HP 2000 SERIES
CONTRIBUTED LIBRARY

TIME-SHARED BASIC/2000
PROGRAM DOCUMENTATION

VOLUME IV

(800) EDUCATION

36000-91004

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HEWLETT hp PACKARD

TIME-SHARED BASIC/2000 CONTRIBUTED LIBRARY HANDBOOK

VOLUME IV

(800) EDUCATION

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36000-91004 6/74 Volume IV

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CLASSIFICATION CODE CATEGORY

(Not all categories have programs. Please refer to the INDEX to HP BASIC Program Library for available programs in HP BASIC)

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102 INFORMATION STORAGE AND RETRIEVAL
103 TABLE HANDLING
104 CHARACTER/SYMBOL MANIPULATION
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106 DUPLICATION
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900 UNCLASSIFIED (VOLUME V)

903 GAMES

GENERAL

Hewlett-Packard is a major designer and manufacturer of electronics for measurement, analysis and computation. HP customers in science, industry, medicine, and education know and appreciate Hewlett-Packard's reputation for technical excellence, quality, and reliability.

Over 170 world-wide offices sell and service the products of 21 manufacturing facilities located in the United States, Europe, and the Far East.

THE HP 2000 CONTRIBUTED LIBRARY

Hewlett-Packard makes available to all users a wide variety of computer programs through the HP 2000 Contributed Library.

Before writing a program for your particular application, scan the list of contributed programs. (A complete Index of contributed programs is available at your local HP sales office). You may be able to use these programs without modification, or as a starting point for developing your own special-purpose software.

The Contributed Library collects, indexes and distributes programs submitted by HP users throughout the world. These programs range from complex data communications packages to educational games, and all are classified according to the functions they perform.

2000 BASIC

Programs written in HP 2000 BASIC are documented in 5 volumes, plus additional user manuals for certain individual programs.

2000 NON-BASIC

Programs written for the HP 2000 series computers in FORTRAN, ALGOL, HP Assembly language, etc. are abstracted in the HP Program Catalog available from your local HP sales office. This catalog contains a number of programs for use with HP Time-Sharing systems, providing conversion capabilities, diagnostics, etc.

NEW ORGANIZATION OF LIBRARY

Because of the rapid growth of library contributions, it has been necessary to place a new emphasis on including only programs of very widespread usefulness. A Program Review Committee screens new submittals to determine this particular feature. Also, a number of programs have been purged from the library, where it was decided that a widespread application did not exist. You may elect to retain the documentation or software for one of these programs; however, HP will not be reprinting or updating them.

The documentation for BASIC Library programs has been completely reprinted and reorganized. There are five volumes available, and programs are arranged alphabetically, by calling NAMe, within each major category.

Volume I	(100) DATA HANDLING (200) TESTING, DEBUGGING AND PROGRAMMING AIDS
Volume II	(300) MATH AND NUMERICAL ANALYSIS (400) PROBABILITY AND STATISTICS (500) SCIENTIFIC AND ENGINEERING APPLICATIONS
Volume III	(600) MANAGEMENT SCIENCES AND OPERATIONS RESEARCH (700) BUSINESS AND MANUFACTURING APPLICATIONS
Volume IV	(800) EDUCATION
Volume V	(900) MISCELLANEOUS (GAMES) **

** Plotting routines previously classified under 904 are now found in Volume I under DATA HANDLING. This leaves Volume V exclusively for GAMES.

ORDERING INFORMATION

Contact your local HP sales office for ordering information of contributed software. Programs are available individually on paper tape, or collectively, on magnetic tape. Documentation is provided in the 5 volumes of BASIC Handbooks, and in some cases additional user manuals and classroom supplementary materials are available. (See list of Supplementary Documentation).

DOCUMENTATION

Volume I	HP 36000-91001	HP BASIC Program Library (100,200)
Volume II	HP 36000-91002	HP BASIC Program Library (300,400,500)
Volume III	HP 36000-91003	HP BASIC Program Library (600,700)
Volume IV	HP 36000-91004	HP BASIC Program Library (800)
Volume V	HP 36000-91005	HP BASIC Program Library (900) (GAMES)

SOFTWARE (HP 2000C'/F MAG TAPE DUMP)

*	HP 36000-10001	HP BASIC Contributed Software (100,200)
*	HP 36000-10002	HP BASIC Contributed Software (300,400,500)
*	HP 36000-10003	HP BASIC Contributed Software (600,700)
*	HP 36000-10004	HP BASIC Contributed Software (800)
*	HP 36000-10005	HP BASIC Contributed Software (900) (GAMES)

* 800 BPI. (1600 BPI mag tapes are also available under separate order number)

SUPPLEMENTARY DOCUMENTATION

FINDIT Users Manual	36250, Option D00
CTC1 Documentation	36210, Option D00
CTC2 Documentation	36211, Option D00
CTC3 Documentation	36212, Option D00
CTC4 Documentation	36213, Option D00
CTC5 Documentation	36214, Option D00
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PILOT Users Manual	5951-5660
COBOL/2000 Primer	5951-5664
IDA	5951-5606
GRAZE (Student Manual)	5951-5653
(Teacher's Guide)	5951-5654
(Classroom Set)	5951-5655
CASE1	5951-5661
CASE2	5951-5662

UPDATES

The BASIC Library will be updated every 6 months. An addendum is printed, containing all new and revised programs in loose-leaf, 3-hole punched format to be easily added to your handbooks. A new Index is also published at this time to announce the release of new addenda and provide a complete updated list of library programs. Additions and revisions are flagged for your reference. Again, contact your local HP sales office to order addenda or a new Index.

SYSTEMS SPECIFICATIONS

Library programs have been collected over a period of years, and some of the earlier programs were written for a "single terminal" BASIC system, or an early version of the HP 2000 series Time-Share systems.

The chart below lists varying system features. In many cases slight modifications in coding will allow a program to RUN on systems other than the one for which it was originally written. The Index listing all Library programs indicates system compatibility for individual programs.

Program Features	2000A	2000B	2000C	2000E	2000C High Speed 2000F
Maximum Program Size	5100 Words	5100 Words	10000 Words	4180 Words	10000 Words
Maximum Number of Files	8	8	16	4	16
Maximum Number of Records/File	128	128	32767	48	32767
Maximum Number of Words/Record	64	64	256	128	256
Programmable Functions					
TIME		X	X	X	X
ENTER		X	X		X
COMMON		X	X	X	X
CHAIN		Chain Name	Chain $Name Statement No	Chain $Name	Chain $Name Statement No
		X	X	X	X
PRINT USING (IMAGE)			X		X
BRK					X
ASSIGN			X		X
RESTARTABLE RND			X	X	X
SPACE			X		X
LINE			X		X

ERRORS IN CONTRIBUTED SOFTWARE

Every HP BASIC Program included in the Contributed Library is checked by HP personnel and verified for accuracy with the sample RUN submitted. However, it is impractical to test programs under all circumstances, and HP does not assume responsibility for errors in contributed software. If you do encounter errors, please report them to the HP Contributed Library on the Error Report form supplied with this publication.

RELATED INFORMATION

An active Educational Users' Group at HP invites inquiries. Also, Hewlett-Packard offers a number of supported programs in Education Administration and Instruction. For more information on these activities, contact the Education Marketing Department, Hewlett-Packard Company, 11000 Wolfe Road, Cupertino, California 95014.

There are a number of manuals and documents relating to HP 2000 series Time-Sharing Systems that may be useful to you:

LANGUAGE MANUALS:

A Guide to HP Educational Basic (02116-91773)
HP BASIC (02116-9077)
2000F: Time-Shared BASIC Programmers' Guide (02000-900

OPERATING SYSTEM MANUALS:

2000F: Time-Shared BASIC Operator's Guide (02000-90074)

EDUCATIONAL APPLICATIONS MANUALS:

2000C/2000F System Operator Instructions for Educational Application (02000-90046)

2000C/2000F Instructional Management Facility and Instructional Dialogue Facility—Proctors Manual (02000-90047

2000C/2000F Mathematics Drill and Practice Program—Proctors Manual (02000-90051)

2000C/2000F Instructional Dialogue Facility—Authors Manual (02000-90055)

2000C/2000F IDF Author's Pocket Guide (02000-90076)

2000C/2000F Mathematics Drill and Practice Program—Teachers Handbook (02000-90052)

COPYFL (02000-90032)

EDCALC (02000-90033)

Integer to String (02000-90035)

Date and Time (02000-90036)

2000C/2000F Introduction to Mathematics Drill and Practice (02000-90050)

2000C/2000F Mathematics Drill and Practice Curriculum Guide (02000-90053)

Course Developers' Manual for IDF-1 and IMF-1 (02000-9006

Upshift (02000-90037)

Character Removal (02000-90038)

Key Word Search (02000-90039)

Downshift (02000-90040)

String Match with "Don't Cares" (02000-90041)

String to Number (02000-90042)

Student Response Analysis (02000-90043)

The preceding publications are available at nominal cost through your local HP sales office.

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CRVLEN	COMPUTES LENGTH OF ANY CURVE	36333
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QUADT	NATURE OF GRAPH OF A 2ND ORDER EQUATION IN TWO VARIABLES	36335A
RATIO	SOLVES PROPORTIONS	36336A
ROOTS2	QUADRATIC EQUATION SOLVER	36625A
SAT	TRIGONOMETRIC SOLUTIONS OF TRIANGLES	36182A
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SYSSOL	SOLVING SYSTEMS OF LINEAR EQUATIONS	36278A
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810 PROGRAMMING AND COMPUTER SCIENCE (EDUCATION)

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PZTUA	:PILOT TUTORIAL	36758B
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PTUD	:PILOT TUTORIAL	36888-18016
PTUE	:PILOT TUTORIAL	36888-18017
PILOTF	:PILOT 73 AUTHOR LANGUAGE FOR THE HP 2000 SERIES SYSTEM	36756B
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STOP	:COMPUTER LITERACY - PSEUDO-MACHINE LANGUAGE	36208B
STPAL	:STOP MACHINE AND ASSEMBLY LANGUAGE SIMULATOR	36765A
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820 ENGINEERING (EDUCATION)

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BASP	:BASIC ANALOG SIMULATION PROGRAM	36888-18022
COMPLX	:CAI IN ALGEBRA OF COMPLEX NUMBERS	36153A
DVDRS	:CAI IN VOLTAGE AND CURRENT DIVIDERS	36156A
EXPNTL	:CAI IN SIMPLE EXPONENTIAL FUNCTIONS OF TIME	36148A
INDMTR	:ANALYSIS OF A BALANCED POLYPHASE INDUCTION MOTOR	36154A
JACOBI	:EIGENVALUES AND EIGENVECTORS OF A REAL SYMMETRIC MATRIX	36167A
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UNITS	:CAI IN INTERPRETATION OF EE UNITS	36157A

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830 ECONOMICS (EDUCATION)

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USECON	TESTING ECONOMIC HYPOTHESES	36588-18031

833 SCIENCE (EDUCATION)

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ATWT	CALCULATES ATOMIC WEIGHT	36613A
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CHARG	MILLIKAN'S OIL-DROP EXPERIMENT	36621A
CHEM	SELF-CORRECTING CHEMISTRY TEST	36295B
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CLIMAT	CLIMATE TEACHING PROGRAM	36760A
CLOUDS	CLOUD FORMATION	36325A
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DECAY1	RADIOACTIVE DECAY GAME	36306A
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EMPIR	CALCULATES EMPIRICAL FORMULAS	36615A
EQUIL1	EQUILIBRIUM SYSTEMS	36308A
EVOLU	NATURAL SELECTION EXPERIMENT	36301A
GAMGN	PROCESS OF GAMETOGENESIS	36302A
GRAZE	GRASSLANDS ECOLOGY SIMULATION	36746A
IONIC	DRILL ON FORMULAS AND CHARGES OF IONS	36260A
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ISOMER	DRILL ON NAMING ALKANES	36261A
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833 SCIENCE (EDUCATION) Continued

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ORG5	:TEACHES NOMENCLATURE OF ALKYL HALIDES AND ALCOHOLS	36888-18011
ORGCHE	:DRILL ON ORGANIC COMPOUND NOMENCLATURE	36646A
PZHYP	:SCIENTIFIC METHOD AND HYPOTHESIS	36759A
PZKEPL	:KEPLER'S 3RD LAW	36779A
PHOSYN	:PHOTOSYNTHESIS EXPERIMENT	36305A
PHOTEL	:PHOTOELECTRIC EFFECT	36317A
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POLUT	:WATER POLLUTION SIMULATION	36639B
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PRCNT	:PERCENT COMPOSITION	36311A
PRJTL	:PROJECTILE MOTION	36631A
REFLCT	:LEAST TIME PRINCIPLE AND LIGHT	36319A
REFLEC	:COMPUTER-AUGMENTED PHYSICS TOPICS	36672A
REFRAC	:COMPUTER-AUGMENTED PHYSICS TOPICS	36669A
SLITS	:YOUNG'S DOUBLE SLIT EXPERIMENT	36351B
SNELL	:SNELL'S LAW	36320A
SPACE	:SPACECRAFT ORBITS	36321A
SPCTRA	:OPTICAL ABSORPTION SPECTRA SIMULATION, 2-SPECIES EQUILIBRIUM MIXTURES	36184A
STERL	:FLY POPULATION CONTROL	36641B
STOICH	:MASS VOLUME	36618A
TITER	:SIMULATES TITRATION OF A BASE BY AN ACID	36888-18006
TRIVIA	:COMMON NAME QUIZ FOR CHEMISTRY STUDENTS	36888-18012
USPOP	:HUMAN POPULATION PROJECTION	36802A
VFIELD	:POTENTIAL FIELD PICTURE	36322A
VLOCTY	:INSTANTANEOUS VELOCITY	36323A
WATER1	:WATER BUDGET PROBLEM CHECK	36326A
WATER2	:WATER BUDGET	36327A
WAVES	:SUM OF TWO WAVES	36324B
MCMAN	:CARDIOVASCULAR SIMULATION	36888-18002

850 FINE ARTS (EDUCATION)

KEYSIG	:GIVES MAJOR SCALES	36258A
MUSIC	:TWELVE TONE COMPOSITION PROGRAM	36888-18028
MUSIC2	:TRIAD SOLVING PROGRAM	36276A
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860 SOCIAL SCIENCE (EDUCATION)

NAME	TITLE	PROGRAM NUMBER
BALANC:	TRADE AND PAYMENT BALANCES	36328A
BANK :	SOLVES FINANCIAL PROBLEMS	36329B
CHARGE:	CHARGE ACCOUNT SIMULATION	36604A
CONSMP:	DEPRESSION/EQUILIBRIUM	36330A
ELECT :	CAMPAIGN STRATEGY AND ELECTIONS	36798A
INQUIR:	SOCIAL SCIENCE INQUIRY PACKAGE	36888-18001
POLICY:	STUDENTS FORMULATE NATIONAL POLICY	36649A
POLSYS:	SIMULATION OF CITY COUNCIL	36640B
PYRMID:	BUILD A PYRAMID	36888-18013
SAP :	SURVEY ANALYSIS PROGRAM	36843A
STOCK :	STOCK MARKET SIMULATION	36331A

870 ENGLISH (EDUCATION)

VOCAB :	CAI IN WORD USAGE	36880A

871 FOREIGN LANGUAGES (EDUCATION)

CARLOS:	COMPUTER-ASSISTED REVIEW LESSONS ON SYNTAX FOR SPANISH II	36175A

880 BUSINESS (EDUCATION)

ATG :	COMPUTER ORIENTED ACCOUNTING - INTERACTIVE VERSION	36888-18032
BNKSIM:	SIMULATES ONE YEAR'S DEPOSIT AND WITHDRAWAL ACTIVITIES OF A SMALL BANK	36713A
GSPMG :	STANFORD PORTFOLIO MANAGEMENT GAME	36502A
LABOR :	LABOR/MANAGEMENT BARGAINING	36233A

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885 EDUCATIONAL ADMINISTRATION

NAME	TITLE	PROGRAM NUMBER
ATTEND	:ABSENTEE LISTING	36202A
AVERG1	:AVERAGES AND CURVES GRADES	36340B
FREQ	:BAR GRAPHS OF GRADES	36341A
GRADE	:TEST GRADE FOR NUMBER OF QUESTIONS MISSED	36342A
ITEM1	:NUMBER FREQUENCIES	36343A
STAT	:STATISTICAL ANALYSIS OF LAB DATA	36344A

HEWLETT-PACKARD SOFTWARE CENTER
DOCUMENTATION FORM FOR CONTRIBUTED BASIC PROGRAMS

TITLE

PROGRAM NAME CLASSIFICATION CODE ☐☐☐

SELECT UP TO FOUR CROSS REFERENCE WORDS FROM CROSS REFERENCE INDEX _____ _____ _____ _____

DESCRIPTION ( ) Program ( ) Subroutine

(Please include the specific application of your program – i.e., how do *you* use it, or recommend its application.)

USER INSTRUCTIONS

If possible, please include 'INSTRUCTIONS' as an option in your program. (Define the inputs requested by the program or subroutine. List the files used, and the data format of each. List the maximum file size. If applicable, include algorithms used.)

NOTE ON SUBROUTINES: The following conventions have been adopted for stand-alone subroutines. Variable names should begin with Z. When more than 10 variables are used, Z, . . . Z9, list the other variable names under Special Considerations. Subroutine line number should begin at 9000.

SYSTEM SPECIFICATIONS

System: ( ) Single Terminal Basic ( ) 2000A ( ) 2000B ( ) 2000C ( ) 2000E ( ) 2000C'/F

Terminal: ( ) Teletype ( ) Mark Sense Card Reader ( ) CRT ( ) Other _____

Note: Does this program use the BRK function? ( ) Yes ( ) No

SPECIAL CONSIDERATIONS

List any special hardware requirements, subroutine variable names not beginning with a 'Z', accuracy limitations, literature references, etc.

CONTRIBUTOR'S NAME AND ORGANIZATION ADDRESS

TO BE PUBLISHED? ( ) yes ( ) no

DISCLAIMER

To the best of my knowledge this contributed program is free of any proprietary information and I hereby agree that HP may reproduce, publish, and use it, and authorize others to do so without liability of any kind.

Signature _____ Date _____

Attach a sample run including input data and resulting TTY output data. Send a paper tape, or whenever possible, please send program on 2000C/F dump tape, ID B500.

Do you use this program for instructional purposes?

What age level are the students?

Please briefly describe the course, and topics within the course.

ERROR REPORT FORM
(HP BASIC CONTRIBUTED)

Comment fully on any software "bugs" in the space provided and enclose any teleprinter output that may be useful in defining the problem. A copy will be forwarded to the contributor. A reply will be returned to the person who submits this report. Send completed report to:

Hewlett-Packard Company
HP Basic Users' Library
11000 Wolfe Road
Cupertino, California 95014

Submitted By

Date

Organization Name

Program Name

Address

Order No.

City, State, Zip

Phone

Has software been modified by user? NO YES (If YES, explain below)

Enclosed References:

TTY LOG LISTING Corrected Tape Corrected LISTING

CONTRIBUTED PROGRAM **BASIC**

ALGIE
36851

TITLE: BASIC ALGEBRA DRILL

DESCRIPTION:

This program provides drill in elementary algebraic equations. Any one of four different types of equations may be chosen and the user may elect to give himself a limited amount of time which he may specify to respond to each problem. A session lasts until the user gets twenty correct answers. A summary is printed at the end of the run.

INSTRUCTIONS:

The program asks for the user's name, type of problem desired, whether the user wishes to time himself and if so how many seconds are to be allowed for answers.

ACKNOWLEDGEMENTS: Bill Jarosz
De Paul University

```
RUN


RUN
ALGIE

THIS IS A COMPUTER-ASSISTED DRILL IN BASIC ALGEBRA.
TO STOP PRACTICE BEFORE A SESSION IS COMPLETE, HOLD THE
CTRL KEY DOWN, HIT THE LETTER C, AND RETURN.
A SESSION LASTS UNTIL YOU GET 20 CORRECT ANSWERS.
ALL ANSWERS ARE POSITIVE OR NEGATIVE INTEGERS.

WHAT'S YOUR NAME?BILL JAROSZ

TYPE 1 FOR PROBLEMS OF THE FORM: 3X=15
     2 FOR PROBLEMS OF THE FORM: 3X+5=20
     3 FOR PROBLEMS OF THE FORM: 2(X+4)=12
     4 FOR PROBLEMS OF THE FORM: 2(X-3)+4(X-7)=-10
WHICH DO YOU WANT?4

DO YOU WANT TO TIME YOURSELF (1=YES,0=NO)?1
HOW MANY SECONDS PER ANSWER?30

2(Y-9)+3(Y-7)= -44      Y=-1
1(J-4)+3(J+1)=  35      J=9
1(Z-6)-4(Z+3)=   6      Z=-8
1(C+1)-3(C+6)=  -9      C=-4
3(Z-6)+5(Z-1)=   9      Z=4
6(X+4)+8(X-9)=  22      X=4
SORRY, TIME'S UP. LET'S TRY ANOTHER PROBLEM.

9(C+4)+8(C+4)= 102      C=2
3(Z-3)-2(Z-1)= -10      Z=-3
1(B-9)+1(B-2)=   1      B=6
1(J-7)+4(J+1)= -18      J=-3
8(K-1)+7(K-1)=-105      K=-6

YOU'RE HALF WAY THROUGH NOW.

3(B-6)+6(B-7)= -33      B=
SORRY, TIME'S UP. LET'S TRY ANOTHER PROBLEM.

5(C-1)-7(C+5)= -28      C=-6
5(Z-8)+5(Z+7)= -75      Z=-7
2(J-7)+7(J-6)=   7      J=
SORRY, TIME'S UP. LET'S TRY ANOTHER PROBLEM.

6(C+8)-9(C-3)=  63      C=
SORRY, TIME'S UP. LET'S TRY ANOTHER PROBLEM.

5(Z+2)-4(Z-6)=  41      Z=7
8(C+2)-7(C+7)= -42      C=75
YOUR ANSWER IS WRONG. TRY IT AGAIN. -75
YOUR ANSWER IS STILL WRONG. LET'S TRY ANOTHER PROBLEM.
8(C-9)+2(C-3)= -58      C=2
1(B-7)+2(B-3)= -28      B=-5
4(U+2)-2(U+5)=  16      U=9
7(X+5)-6(X+6)=   7      X=8
5(W-3)+9(W-6)=-181      W=-8
2(B+1)-1(B+7)=  -4      B=-1
YOUR ANSWER IS WRONG. TRY IT AGAIN. 1
THAT'S RIGHT.

YOU ONLY NEED ONE MORE CORRECT ANSWER.

7(Z+1)+9(Z+9)= 232      Z=9


BILL JAROSZ
YOU TRIED 25 PROBLEMS.
19 WERE CORRECT ON THE FIRST TRY.
 1 WAS CORRECT ON THE SECOND TRY.
 1 WAS NOT ANSWERED CORRECTLY ON EITHER TRY.
YOU GAVE YOURSELF 30 SECONDS TO ANSWER EACH QUESTION.
YOU RAN OUT OF TIME  4 TIMES.
YOUR TOTAL TIME WAS  9 MINUTES AND 45 SECONDS.
DONE
```

CONTRIBUTED PROGRAM **BASIC**

TITLE:

COMPUTER-AUGMENTED CALCULUS TOPICS (PROJECT SOLO)

AREA
36668

DESCRIPTION:

This program uses Euler's method (rectangles) to approximate the area of any specified polynomial of the form

$$Y = AX^3 + BX^2 + CX + D$$

over any specified interval on the X-axis.

INSTRUCTIONS:

The user is asked to input the values of A, B, C, and D in the polynomial. They may take any value, including Ø.

Then the program asks the user to select an interval on the X-axis (lower bound, upper bound), and then specify the number of approximating rectangles to be used.

When the program has printed its resulting approximation to the area under the curve in the interval, the user may select option 1, 2, 3, or 4, which represent:

1. Change the number of approximating rectangles.
2. Change the interval on the X-axis.
3. Input new values of A, B, C, and D.
4. Terminate program run.

SPECIAL CONSIDERATIONS:

This program is one of 7 which accompany the Project Solo Module "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum series.

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Mathematics (Secondary, College); Elem. Computer Science

Student Background Required: Elem. Calculus (can be concurrent), BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

HP Computer Curriculum Project
11000 Wolfe Road
Cupertino, California 95014

ACKNOWLEDGEMENTS:

Project Solo
University of Pittsburgh

```
RUN

RUN
AREA



THIS PROGRAM COMPUTES APPROXIMATIONS TO THE AREA
BOUNDED BY THE X-AXIS AND THE GRAPH OF ANY POLYNOMIAL
FUNCTION OF DEGREE THREE OR LESS OVER AN INTERVAL OF
THE X-AXIS.  THE METHOD USED TO APPROXIMATE THE AREA
IS TO BUILD RECTANGLES WHOSE SUM WILL BE AN APPROXIMATION
TO THE AREA WE ARE TRYING TO FIND.
THE POLYNOMIAL FUNCTION IS OF THE FORM

Y = A*X↑3 + B*X↑2 + C*X + D.

YOU CAN GIVE ANY VALUES (INCLUDING 0) TO A,B,C, AND D.
OK., ASSIGN NUMERICAL VALUES TO A, B, C, AND D.
A=?0
B=?1
C=?0
D=?0
SELECT AN INTERVAL (R,S) ON THE X-AXIS
BY ASSIGNING VALUES TO R AND S.
R=?0
S=?2
HOW MANY RECTANGLES DO YOU WANT TO BUILD ON [R,S]?
N=?4


THE INTERVAL IS [ 0     , 2     ].
THE NUMBER OF RECTANGLES IS  4     .
THE FUNCTION IS
 0     X↑3 +  1     X↑2 +  0     X +  0     .

THE APPROXIMATION TO THE AREA IS ***** 1.75        *****


PLEASE SELECT OPTION 1, 2, 3, OR 4.  YOUR OPTION?1
HOW MANY RECTANGLES DO YOU WANT TO BUILD ON [R,S]?
N=?256


THE INTERVAL IS [ 0     , 2     ].
THE NUMBER OF RECTANGLES IS  256   .
THE FUNCTION IS
 0     X↑3 +  1     X↑2 +  0     X +  0     .

THE APPROXIMATION TO THE AREA IS ***** 2.65106     *****


PLEASE SELECT OPTION 1, 2, 3, OR 4.  YOUR OPTION?2
SELECT AN INTERVAL (R,S) ON THE X-AXIS
BY ASSIGNING VALUES TO R AND S.
R=?-2
S=?2
HOW MANY RECTANGLES DO YOU WANT TO BUILD ON [R,S]?
N=?512


N MUST BE A POSITIVE WHOLE NUMBER
LESS THAN 500.  TRY AGAIN.
HOW MANY RECTANGLES DO YOU WANT TO BUILD ON [R,S]?
N=?256


THE INTERVAL IS [-2     , 2     ].
THE NUMBER OF RECTANGLES IS  256   .
THE FUNCTION IS
 0     X↑3 +  1     X↑2 +  0     X +  0     .

THE APPROXIMATION TO THE AREA IS ***** 5.3335      *****
```

```
PLEASE SELECT OPTION 1, 2, 3, OR 4.  YOUR OPTION?3
OK., ASSIGN NUMERICAL VALUES TO A, B, C, AND D.
A=?5
B=?-3.5
C=?8.111
D=?Ø.Ø1
SELECT AN INTERVAL (R,S) ON THE X-AXIS
BY ASSIGNING VALUES TO R AND S.
R=?-2
S=?2
HOW MANY RECTANGLES DO YOU WANT TO BUILD ON [R,S]?
N=?256


THE INTERVAL IS [-2     , 2     ].
THE NUMBER OF RECTANGLES IS  256  .
THE FUNCTION IS
 5    X↑3 + -3.5        X↑2 +  8.111      X +  .Ø1

THE APPROXIMATION TO THE AREA IS ***** 72.6652     *****


PLEASE SELECT OPTION 1, 2, 3, OR 4.  YOUR OPTION?4

DONE
```

CONTRIBUTED PROGRAM **BASIC**

BASE
36796

TITLE: BASE CONVERTER

DESCRIPTION: Converts a number in any base (1-10) into any base (1-10).

INSTRUCTIONS: User will input a number and its base and then input into what base he would like the number converted. The computer will then print the number in the new base.

SPECIAL CONSIDERATIONS: It will not work in any base higher than base 10.

ACKNOWLEDGEMENTS: Peter Katz
Ravenswood High School

```
RUN

RUN
BASE

THIS PROGRAM IS A BASE CONVERTER
IT CONVERTS A NUMBER IN A BASE 10 OR LESS
INTO A GIVEN BASE (10 OR LESS)

ENTER THE NUMBER?256
ENTER ITS BASE?10
ENTER DESIRED BASE?8

THE NUMBER  256   IN BASE  8     IS  400


ENTER THE NUMBER?64
ENTER ITS BASE?10
ENTER DESIRED BASE?2

THE NUMBER  64    IN BASE  2     IS  1.00000E+06


ENTER THE NUMBER?400
ENTER ITS BASE?8
ENTER DESIRED BASE?10

THE NUMBER  400   IN BASE  10    IS  256


ENTER THE NUMBER?1.00000E+06
ENTER ITS BASE?2
ENTER DESIRED BASE?10

THE NUMBER  1.00000E+06    IN BASE  10    IS  64


ENTER THE NUMBER?10,249
EXTRA INPUT - WARNING ONLY

ENTER ITS BASE?10
ENTER DESIRED BASE?6

THE NUMBER  10    IN BASE  6     IS  14


ENTER THE NUMBER?10249
ENTER ITS BASE?10
ENTER DESIRED BASE?6

THE NUMBER  10249    IN BASE  6     IS  115241.


ENTER THE NUMBER?115241
ENTER ITS BASE?6
ENTER DESIRED BASE?10

THE NUMBER  115241.     IN BASE  10    IS  10249


ENTER THE NUMBER?
DONE
```

CONTRIBUTED PROGRAM **BASIC**

BISQAR
36240

TITLE: SQUARING BINOMIALS

DESCRIPTION:

This program presents the student with a series of five binomials to be squared. He types in the coefficients of the correct answer and is told whether or not he is correct on the problems when he is through the list. The time taken for his response to all five is printed out.

INSTRUCTIONS:

Directions to the student are included on an optional basis within the program. The student is asked to practice squaring binomials of the form $A*X + B$. The answers will be a trinomial of the form $P*X^2 + Q*X + R$. The values of P, Q and R should be typed in, separated by commas.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Algebra I or as a review in Algebra II
Student Background Required: Ability to mentally square a binomial
Application: This program affords a student a chance to hone up his skill in rapidly squaring binomials. In particular it should reinforce the idea of getting the correct middle term and the fact that $(a+b)^2 \neq a^2+b^2$. The time factor provides for a good deal of competition among students.

ACKNOWLEDGEMENTS:

Michael Bolduan
Clackamas High School

RUN

```
RUN
BISQAR

SQUARING BINOMIALS .......
DO YOU WANT DIRECTIONS?YEES--S
YOU ARE GOING TO PRACTICE SQUARING BINOMIALS OF THE FORM
  A*X + B.  IN EACH CASE YOUR ANSWER WILL BE A TRI-
NOMIAL OF THE FORM  P*X↑2 + Q*X + R. WHEN I ASK FOR YOUR
ANSWER, YOU SHOULD TYPE IN THE VALUES OF P,Q,AND R SEPAR-
ATED BY COMMAS. AFTER YOU HAVE TYPED IN 'R' YOU SHOULD HIT
THE 'RETURN' KEY. NOTE THAT YOU ARE ONLY TYPING IN THE
COEFFICIENTS OF THE ANSWER. YOU WILL BE ASKED TO DO FIVE
PROBLEMS AND THEN YOU WILL BE TOLD HOW WELL YOU DID.
NO.  1     :
WHAT IS THE SQUARE OF   3     *X +  1
?9,6,1
NO.  2     :
WHAT IS THE SQUARE OF  -10    *X +  1
?100,-20,1
NO.  3     :
WHAT IS THE SQUARE OF   10    *X +  2
?100,40,4
NO.  4     :
WHAT IS THE SQUARE OF   5     *X +  1
?25,5,1
NO.  5     :
WHAT IS THE SQUARE OF  -9     *X + -9
?81,162,81
YOU GOT  4     OUT OF  5     CORRECT. YOU MISSED THE FOLLOWING:
NO.  4
IT TOOK YOU  2     MINUTES.
CORRECT YOUR ERRORS ON THIS PAPER AND TURN IT IN FOR
CREDIT. MAYBE NEXT TIME YOU WILL GET 100%. BYE!

DONE
```

CADA1I
36205

TITLE: COMPUTER ASSISTED ARITHMETIC DRILL

DESCRIPTION:

These programs give students drill problems in the four operations of arithmetic. All problems have integer answers. All problems of one drill session are of the same operation. The program stores the raw score data from a drill session in a record for up to twenty five students. Record management is accomplished by using a special program designed for this purpose.

INSTRUCTIONS:

To use the program for the first time open a file, (CRE-CADA1F,25). Next RUN CADA1I to format the records of the file. Once the file is set, this program never needs to be used again unless the file is to be obliterated and restarted. When CADA1I is run, there will be no output on the teleprinter.

To use the arithmetic drill program, get CADA1P and type run. The computer will type some preliminary remarks and then ask for a student ID number. Reply with the correct student number if known, otherwise any number less than twenty five will do except zero. Student number zero is reserved for students who do not wish to have a permanent record on file.

The computer will type OPERATION 1=ADDITION, ETC. to which you respond 1, 2, 3, or 4 for addition, subtraction, multiplication, or division respectively.

Next CORRECT PROBLEMS? will be typed. Your response must be a number greater than zero and will determine the number of correct problems your student must get correct on his first attempt to complete his drill.

Finally the computer will ask what is the LARGEST ADDEND? Your answer will determine the largest possible addend in the addition drill. Similar results are obtained for subtraction, multiplication, and division.

Arithmetic drill problems will now appear and answers must be supplied by the student. Commentary will be supplied for incorrect student responses. A student has two chances to answer correctly. Failure to give a correct response after two tries will cause a new problem to be typed.

At the end of the practice a summary of the current practice will be typed and then questions will be asked to which you reply with yes, no, or the student name. When the proper student record has been located and revised, the program will end.

Using a student number of zero will cause the computer to skip the record revising routine of this program.

For management of student records there is a special file management program called CADA1M entitled File Manager for CADA1F.

The management program allows for opening, altering, closing, printing one record, or printing all records. Instructions are conversational. The sample run will show how to open, alter, and close a record.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Arithmetic from grade one
Student Background Required: Knowledge of arithmetic operations.

This program can be used for drill work in the four arithmetic operations. Daily sessions with the computer are best if they are kept fairly short, i.e. ten to twenty problems.

ACKNOWLEDGEMENTS: William H. Jones
Chatham Township High School

RUN

```
CREF-CADA1F,25
GET-CADA1I
RUN
CADA1I


DONE
GET-CADA1P
RUN
CADA1P

THIS PROGRAM IS A CAI-DRILL IN INTEGER ARITHMETIC. TO
STOP PRACTICE BEFORE COMPLETE, HOLD CTRL KEY DOWN AND
DEPRESS THE LETTER C, THEN RETURN. A PERMANENT SUMMARY
OF THIS WORK CAN BE OBTAINED THROUGH MR. JONES.
STUDENT #?3
OPERATION   1=ADDITION, ETC.
?2
CORRECT PROBLEMS?10
LARGEST MINUEND?25
 24   - 23   =?14
YOUR ANSWER IS WRONG, TRY IT AGAIN.
?1
THAT IS BETTER. TRY THIS PROBLEM.
 15   - 10   =?5
 17   - 16   =?1
 23   - 11   =?12
 12   - 7    =?5
 10   - 7    =?3
YOU HAVE ANSWERED HALF OF YOUR PROBLEMS CORRECTLY.
KEEP UP THE GOOD WORK.
 22   - 21   =?1
 18   - 14   =?4
 24   - 17   =?7
 8    - 2    =?6
YOU NEED TO GET ONE MORE PROBLEM CORRECT TO FINISH
YOUR WORK.
 25   - 22   =?3


THIS STUDENT HAS ATTEMPTED  11   PROOBLEMS.
 10   WERE CORRECT ON THE FIRST TRY.
 1    WERE CORRECT ON THE SECOND TRY.
 0    WERE NOT ANSWERED CORRECTLY ON EITHER TRY.


NO RECORD LISTED FOR STUDENT #  3
DO YOU WISH TO OPEN A RECORD?YES
STUDENT NAME?JOHN DOE
JOHN DOE IS THE STUDENT NAME, IS THAT CORRECT?YES


WHEN I FINISH TYPING YOU MAY TEAR OFF THE PAGE AND
GIVE IT TO YOUR TEACHER.



DONE



GET-CADA1M
RUN
CADA1M

1=UPDATE RECORD OF STUDENT, 2=OPEN STUDENT RECORD, 3=ERASE
STUDENT RECORD, 4=PRINT ONE STUDENT RECORD, 5=PRINT ALL
STUDENT RECORDS.
?2
STUDENT NUMBER IS  1      STUDENT NAME IS?JACK SMITH
DO YOU WISH FURTHER MAINTANENCE?YES
?1
STUDENT # ?4
A              0
```

OPERATION	ATTEMPTED	1 ST TRY	2 ND TRY	INCORRECT
ADD.	0	0	0	0
SUB.	0	0	0	0
MULT.	0	0	0	0
DIV.	0	0	0	0

```
HOW SHOULD THE FILE READ
?16,10,5,1,0,0,0,0,0,0,0,0,5,1,1,3
DO YOU WISH FURTHER MAINTANENCE?YES
?4
WHAT IS STUDENT #?
??4
A                0
```

OPERATION	ATTEMPTED	1 ST TRY	2 ND TRY	INCORRECT
ADD.	16	10	5	1
SUB.	0	0	0	0
MULT.	0	0	0	0
DIV.	5	1	1	3

```
DO YOU WISH FURTHER MAINTANENCE?NO

DONE
```

CRVLEN
36333

TITLE: CRVLEN: Computes Length of Any Curve

DESCRIPTION:

This program approximates the length of any curve between two fixed points on the curve, by taking an increasing number of subintervals and computing the sum of the secants involved.

OBJECTIVES:

A. Time saving factor for computations.

B. By typing out successive approximations, the machine displays the manner by which the limit is approached.

C. The attendant discussion focuses attention upon the techniques needed to build up the analytic method for finding the length of a curve.

INSTRUCTIONS:

PRELIMINARY PREPARATION: None.

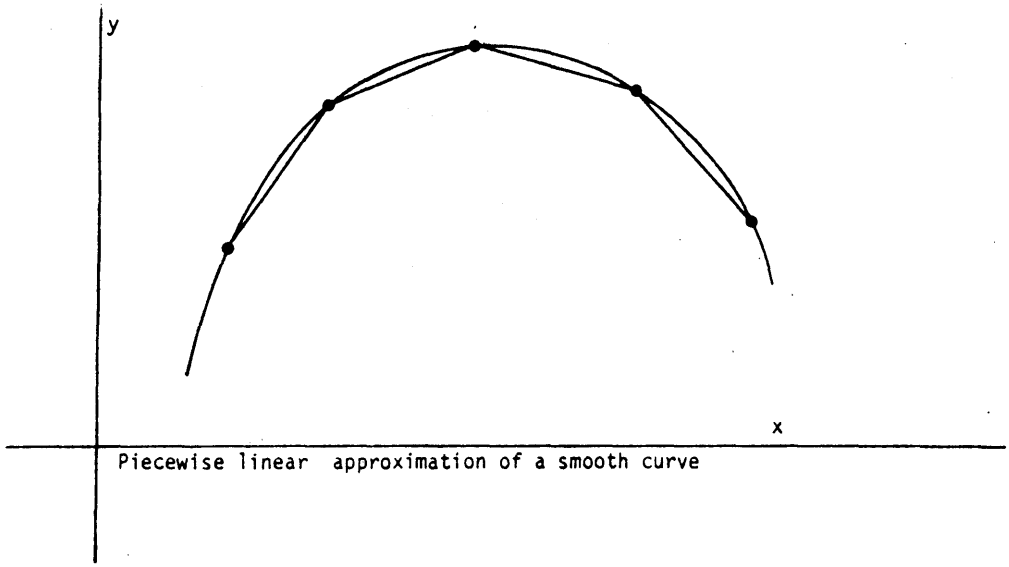
DISCUSSION: See following page.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

INSTRUCTIONS: continued

DISCUSSION:

The operator inserts any function, sets up his own limits, and the computer proceeds to print out several approximations to the actual length a diagram (such as below) should be displayed, indicating the geometric basis for the computations.



Piecewise linear approximation of a smooth curve

```
RUN

RUN
CRVLEN

                    LENGTH OF A CURVE

THIS PROGRAM APPROXIMATES THE LENGTH OF ANY CURVE BETWEEN
TWO POINTS HAVING P AND Q AS THEIR RESPECTIVE ABSCISSAS.
THE PROGRAM DIVIDES THE CURVE INTO INCREASING NUMBERS OF
SUBINTERVALS, JOINS THESE WITH SECANTS AND FINDS THE SUM
OF THESE SECANTS.

TO INPUT THE FUNCTION WHICH YOUR CURVE REPRESENTS, TYPE AS
FOLLOWS AFTER THE PROGRAM STOPS:
(TYPE THE 'RETURN' KEY AFTER EACH LINE INCLUDING 'RUN')

          1 GO TO 200
          300 DEF FNY(X)=....(YOUR FUNCTION OF X)....
          RUN

FOR EXAMPLE, TO USE THE FUNCTION 2*X↑3+3*X↑2-2*X+3
YOU WOULD TYPE:

          1 GO TO 200
          300 DEF FNY(X)=2*X↑3+3*X↑2-2*X+3
          RUN

YOU MIGHT TRY THAT AS YOUR FIRST RUN.

DONE
1  GO TO 200
300 DEF FNY(X)=2*X↑3+3*X↑2-2*X+3
RUN
CRVLEN

WHAT ARE THE ABSCISSAS OF THE END POINTS OF THE INTERVAL
WHOSE LENGTH YOU WANT (SMALLER ONE FIRST:P,Q)?-1,6
```

NUMBER OF SUBINTERVALS	SUM OF SECANT LENGTHS	% CHANGE IN LENGTH
1	525.047	NO PREVIOUS VALUE
2	525.158	.02125
4	529.652	.855745
8	531.017	.257691
16	531.964	.178364
32	532.017	9.82135E-03
64	532.042	4.72664E-03
128	532.049	1.28485E-03
256	532.05	2.06491E-04

*****

WOULD YOU LIKE TO TRY NEW END POINTS (1-YES, 0-NO)?0

TO TRY ANOTHER FUNCTION, RETYPE LINE 300, AND 'RUN'.
SEE INSTRUCTIONS FOR MORE DETAILS. IF YOU ARE FINISHED,
TYPE '1' AND 'RETURN' KEY AFTER THE PROGRAM STOPS.

DONE

CVAREA
36620

TITLE: AREA UNDER CURVE

DESCRIPTION:

By numerical methods, this program evaluates the definite integral of f(x), from x=a to x=b, by four different methods of successive approximation:

I Rectangles (starting with f(a) as height)
II Rectangles (starting with f(a+h) as height)
III Trapezoids
IV Parabolas (Simpson's Rule)

OBJECTIVES:

A. Enhances comprehension of the analytic procedures for finding the area under a curve.

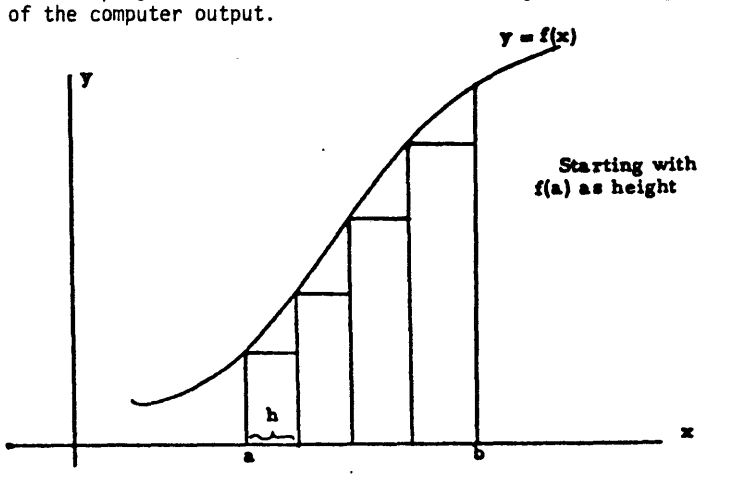
B. Dramatizes the limiting processes involved.

C. Decreases the time needed for lengthy computations.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

Prior to the computer run, diagrams should appear on the board, or on the overhead projector screen to demonstrate the geometric significance of the computer output.



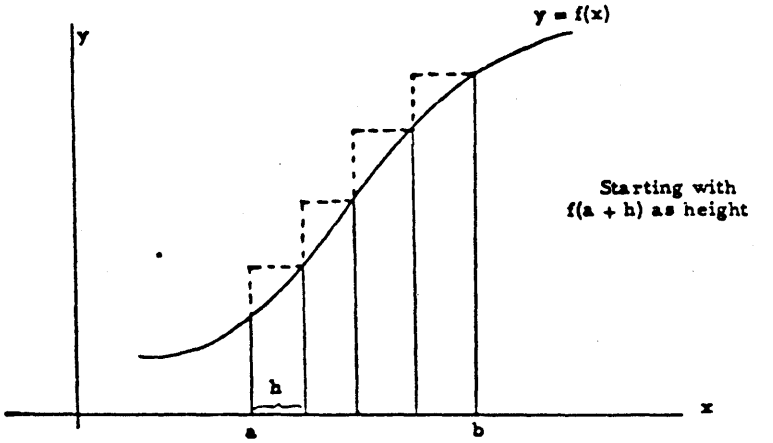
Inscribed Rectangular Approximation

Continued on following page.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

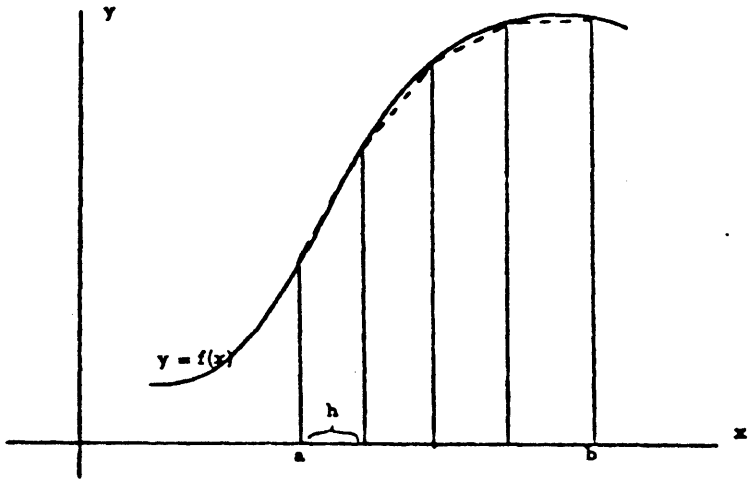
PRELIMINARY PREPARATION: continued



Circumscribed Rectangular Approximation

DISCUSSION:

This program may be run as an introduction to the problem of finding the area under a curve. In some classes, the consideration of Simpson's Rule may be omitted or briefly hinted at. With the more mathematically talented classes, an explanation of this parabolic approximation should precede the running of the program.



Trapezoid Approximation

```
RUN
CVAREA

               AREA UNDER A CURVE - INTEGRATION

     THIS PROGRAM EVALUATES THE DEFINITE INTEGRAL OF F(X)
FROM X=A TO X=B BY FOUR METHODS OF NUMERICAL APPROXIMATION:

                    I RECTANGLES (INITIAL HEIGHT OF F(X))
                   II RECTANGLES (INITIAL HEIGHT OF F(X+H))
                  III TRAPEZOIDS
                   IV PARABOLAS (SIMPSON'S RULE)

AFTER THE PROGRAM STOPS, YOU MAY ENTER YOUR FUNCTION AS FOLLOWS:

             1 GO TO 200
             300 DEF FNY(X)=...(YOUR FUNCTION OF X)...
             RUN

FOR EXAMPLE, TO FIND THE AREA UNDER THE CURVE Y=X↑3 YOU
WOULD TYPE:

             1 GO TO 200
             300 DEF FNY(X)=X↑3
             RUN

YOU MIGHT TRY THAT AS YOUR FIRST RUN.
END EACH LINE, INCLUDING 'RUN', WITH THE 'RETURN' KEY.

DONE


1  GOTO 200
300  DEF FNY(X)=X↑3
RUN
CVAREA

WHAT ARE YOUR VALUES FOR A AND B (SMALLER FIRST:A,B)?1,10

 NUMBER OF      I. SUM OF       II. SUM OF      III. SUM OF     IV. SUM OF
SUBINTERVALS    RECTANGLES      RECTANGLES      TRAPEZOIDS      PARABOLAS
------------    ----------      ----------      -----------     ----------
 2               753.187         5248.69         3000.94         2499.75
 4               1501.17         3748.92         2625.05         2499.75
 8               1969.14         3093.01         2531.07         2499.75
 16              2226.61         2788.55         2507.58         2499.75
 32              2361.22         2642.19         2501.71         2499.75
 64              2430.           2570.48         2500.24         2499.75

NOTE THAT SIMPSON'S RULE (IV) CONVERGES FASTEST.

WOULD YOU LIKE TO TRY NEW VALUES FOR A AND B (1-YES, 0-NO)?0

*****

TO USE A NEW FUNCTION YOU NEED ONLY RETYPE LINE 300
AND 'RUN'.  SEE INSTRUCTIONS FOR MORE DETAILS.
IF YOU ARE FINISHED, TYPE '1' AND THE 'RETURN' KEY.

DONE
```

TITLE: SOLVING SYSTEMS OF COMPLEX LINEAR EQUATIONS

CXSYSS
36262

DESCRIPTION:

This program will solve systems like $AX=V_1$, $AX=V_2$,..$AX=V_s$ where A is an m by n matrix with complex coefficients of the form $a_{ij}+I*(b_{ij}f+1/(c_{ij}f))$, where the a_{ij}, b_{ij}, and c_{ij} are real numbers, and f is a real number that can be varied by the user. The V_j are m-dimensional vectors, with complex components of the form $v_{ij}+I*w_{ij}$ being the i-th component of the j-th vector. X is an n-dimensional vector. The X's will be printed out for each different V_j and each different value of f. The components of each vector X will in general be complex numbers, and will be printed out in both rectangular and polar form. If the system of equations is under-determined, the vectors of the null space will also be printed out. These vectors will be orthonormalized, and their elements will have their rectangular form and the argument of their polar forms printed out.

INSTRUCTIONS:

Enter the above defined data as follows:

8900 DATA m, n, s

8901 DATA a_{11},b_{11},c_{11},a_{12},b_{12},c_{12},...a_{1n},b_{1n},c_{1n},v_{11},w_{11},...v_{1s},w_{1s}

8902 DATA a_{21},b_{21},c_{21},a_{22},b_{22},c_{22},...a_{2n},b_{2n},c_{2n},v_{21},w_{21},...v_{2s},w_{2s}

:

89xx DATA a_{m1},b_{m1},c_{m1},a_{m2},b_{m2},c_{m2},...a_{mn},b_{mn},c_{mn},v_{m1},w_{m1},...v_{ms},w_{ms}

When you run the program you will be asked what frequencies for which you wish the system solved. Enter the values of f, one per line. When you have entered as many values as you wish, type a 999 to end input.

SPECIAL CONSIDERATIONS:

I and J (capitalized) are used interchangeably for the square root of negative one. The maximum values of m and n are ten each, and the maximum value of s is five. These values may be increased by redimensioning in line 10.

ACKNOWLEDGEMENTS:

Phillip Short
Burnsville Senior High School

```
RUN

8900 DATA 2,2,2
8901 DATA 1,3,2,5,6,-1,-1,1,-3,2
8902 DATA 1,1,1,-1,3,1,-2,1,2,-2
RUN
CXSYSS

WHAT FREQUENCIES WOULD YOU LIKE THE SYSTEMS SOLVED FOR?
 : ?1
 : ?2
 : ?4
 : ?999

FREQUENCY =  1

SOLUTIONS

     SYSTEM #  1

-----

-.386785        + .560838     *J  ARG = 2.17455      MOD = .68128
 .314263        + 4.43191E-02    *J  ARG = .140102      MOD = .317372

-----

     SYSTEM #  2

-----

 1.46011        +-.717163     *J  ARG = 5.82663      MOD = 1.62673
-.936342        + .457695     *J  ARG = 2.68693      MOD = 1.04222

-----

**********************************************************************

FREQUENCY =  2

SOLUTIONS

     SYSTEM #  1

-----

-.117966        +-.500021     *J  ARG = 4.4807       MOD = .513748
 1.24792        +-.298069     *J  ARG = 6.04872      MOD = 1.28302

-----

     SYSTEM #  2

-----

 .222502        + .212826     *J  ARG = .763175      MOD = .3079
-.383427        + 2.51306E-02    *J  ARG = 3.07614      MOD = .38425

-----

**********************************************************************

FREQUENCY =  4

SOLUTIONS

     SYSTEM #  1

-----
```

```
-7.55172E-02    +-.211878     *J  ARG = 4.37001      MOD = .224933
 .599648        +-.233392     *J  ARG = 5.91201      MOD = .643467

-----

     SYSTEM #  2

-----

 .114965        + 9.72171E-02   *J  ARG = .701949     MOD = .150559
-.177335        + 2.16664E-02   *J  ARG = 3.02002     MOD = .178654

-----

**********************************************************************


DONE
8900  DATA 2,2,2
8901  DT-ATA 1,1,0,3,5,0,1,-3,3,9
8902  DATA -1,1,0,-5,3,0,3,1,2,1
RUN
CXSYSS

WHAT FREQUENCIES WOULD YOU LIKE THE SYSTEMS SOLVED FOR?
 : ?1
 : 7999


FREQUENCY =  1


VECTOR  1      OF NULL SPACE.


-----

-.942809        +-.235702     *J    ARG = 3.38657
 .235702        + 0     *J           ARG = 0

-----


VECTOR  2      OF NULL SPACE.


-----

-.235701        + .942809     *J    ARG = 1.81577
 0              +-.235702     *J    ARG = 4.71239

-----



SOLUTIONS


     SYSTEM #  1

-----

-5.55554E-02    +-.111111     *J  ARG = 4.24874      MOD = .124226
-.333333        +-.388889     *J  ARG = 4.00376      MOD = .512197

-----

     SYSTEM #  2      IS INCONSISTENT.

-----

**********************************************************************


DONE
```

DERSIN
36663

TITLE: COMPUTER-AUGMENTED CALCULUS TOPICS

DESCRIPTION:

This program estimates the value of the derivative of SIN(X) for input value of X.

INSTRUCTIONS:

The user is asked to input the value of X.

SPECIAL CONSIDERATIONS:

This program is one of 7 which accompany the Project Solo Module "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum Series.

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Mathematics (Secondary, College); Elem. Computer Science

Student Background Required: Calculus (can be concurrent); BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS: Project Solo
University of Pittsburgh

```
RUN

RUN
DERSIN


PROGRAM TO ESTIMATE THE DERIVATIVE OF
SIN(X) FOR ANY VALUE OF X.

WHAT IS X?-1


X = -1     SIN(X) = -.841471

  H                (SIN(X+H)-SIN(X))/H

 .1                .581441
-.1                .497364
 .01               .544488
-.01               .536096
 .001              .540733
-.001              .540018
 .0001             .538826
-.0001             .54121

WHAT IS X?0


X =  0     SIN(X) =  0

  H                (SIN(X+H)-SIN(X))/H

 .1                .998334
-.1                .998334
 .01               .999983
-.01               .999983
 .001              1
-.001              1
 .0001             1.
-.0001             1.

WHAT IS X?1


X =  1     SIN(X) =  .841471

  H                (SIN(X+H)-SIN(X))/H

 .1                .497364
-.1                .581441
 .01               .536084
-.01               .544488
 .001              .540018
-.001              .540733
 .0001             .540018
-.0001             .538826

WHAT IS X?
DONE
```

TITLE:

COMPUTER-AUGMENTED CALCULUS TOPICS

DERTIV
36662

DESCRIPTION:

This program computes a set of approximations to the derivative of a supplied function, for an input value of X, the independent variable.

INSTRUCTIONS:

The function to be studied must be supplied as line 330, in the form:

```
330 LET Y=f(X)
```

During the program run, you will be asked to input a value for X.

SPECIAL CONSIDERATIONS:

This program is one of 7 which accompany the Project Solo Computer Topics entitled "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum Series.

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Mathematics (Secondary, College); Elem. Computer Science

Student Background Required: Elem. Calculus (can be concurrent); BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS:

Project Solo
University of Pittsburgh

```
RUN

330  LET Y=EXP(X)
RUN
DERTIV


THIS PROGRAM WILL COMPUTE A SET OF APPROXIMATIONS
TO THE DERIVATIVE OF ANY FUNCTION F(X) WHICH YOU GIVE
IT FOR ANY VALUE YOU ASSIGN TO THE INDEPENDENT
VARIABLE X, PROVIDED THE FUNCTION HAS A DERIVATIVE
FOR THAT X.

FOR EACH X YOU WILL GET AS OUTPUT THE VALUES OF X
AND F(X), AS WELL AS A SET OF APPROXIMATIONS TO
F'(X) FOR H= .1, -.1, .01, -.01, .001, -.001,
.0001, AND -.0001.


WHAT IS X?0

  H               APPROXIMATION TO F'(X)
 .1               1.05171
-.1               .951624

 .01              1.00501
-.01              .995028

 .001             1.0004
-.001             .999212

 .0001            .998974
-.0001            1.00017


X =  0      Y =  1

WHAT IS X?1

  H               APPROXIMATION TO F'(X)
 .1               2.85884
-.1               2.58678

 .01              2.73194
-.01              2.70472

 .001             2.7194
-.001             2.71702

 .0001            2.7132
-.0001            2.71797


X =  1      Y =  2.71828

WHAT IS X?
DONE
```

TITLE:

COMPUTER-AUGMENTED CALCULUS TOPICS

DERTIV
36662

DESCRIPTION:

This program computes a set of approximations to the derivative of a supplied function, for an input value of X, the independent variable.

INSTRUCTIONS:

The function to be studied must be supplied as line 330, in the form:

```
330 LET Y=f(X)
```

During the program run, you will be asked to input a value for X.

SPECIAL CONSIDERATIONS:

This program is one of 7 which accompany the Project Solo Computer Topics entitled "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum Series.

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Mathematics (Secondary, College); Elem. Computer Science

Student Background Required: Elem. Calculus (can be concurrent); BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

HP Computer Curriculum Project
11000 Wolfe Road
Cupertino, California 95014

ACKNOWLEDGEMENTS:

Project Solo
University of Pittsburgh

```
RUN

330  LET Y=EXP(X)
RUN
DERTIV


THIS PROGRAM WILL COMPUTE A SET OF APPROXIMATIONS
TO THE DERIVATIVE OF ANY FUNCTION F(X) WHICH YOU GIVE
IT FOR ANY VALUE YOU ASSIGN TO THE INDEPENDENT
VARIABLE X, PROVIDED THE FUNCTION HAS A DERIVATIVE
FOR THAT X.

FOR EACH X YOU WILL GET AS OUTPUT THE VALUES OF X
AND F(X), AS WELL AS A SET OF APPROXIMATIONS TO
F'(X) FOR H= .1, -.1, .01, -.01, .001, -.001,
.0001, AND -.0001.


WHAT IS X?0

  H               APPROXIMATION TO F'(X)
 .1              1.05171
-.1              .951624

 .01             1.00501
-.01             .995028

 .001            1.0004
-.001            .999212

 .0001           .998974
-.0001           1.00017


X =  0      Y =  1

WHAT IS X?1

  H               APPROXIMATION TO F'(X)
 .1              2.85884
-.1              2.58678

 .01             2.73194
-.01             2.70472

 .001            2.7194
-.001            2.71702

 .0001           2.7132
-.0001           2.71797


X =  1      Y =  2.71828

WHAT IS X?
DONE
```

TITLE:

DESCAL
DESK CALCULATOR SUBROUTINE 36674

DESCRIPTION:

This routine simulates a desk calculator. It is designed to be appended to an interactive program to give the user the ability to calculate needed values in "direct mode", then return to the interactive program and continue. Access to the subroutine is generally performed through a modification of INPUT statements.

INSTRUCTIONS:

The program requests the user to input: one number for unary operations, two numbers for binary operations, and a three-letter mnemonic code for the operation (e.g., SQR for square root). Return to the main program is achieved with the code EXT for Exit.

See REFLEC (HP 36672) as an example of appending DESCAL to an existing program.

DESCAL may be used alone, or added to a program. DESCAL is written as a subroutine beginning at line 9000 and ending at line 9414. It also includes line 9999 END. Total size is 7000 words.

To run DESCAL as a separate program, type:

```
GET- DESCAL
1 GOSUB 9000
2 STOP
RUN
```

To add DESCAL to an existing program, load your program as you would normally, then make these changes:

a) No line number in your program can be 9000 or greater. Renumber if necessary.

b) The END statement in your program should be changed to STOP.

c) Provide access to DESCAL at the appropriate point(s) in your program by inserting GOSUB 9000 instructions (e.g., new lines).

continued on following page

SPECIAL CONSIDERATIONS:

This program was written to be used with some of the Project Solo Computer Topics , a group of units in the Hewlett Packard Curriculum Series.

Uses string variables X$(3) and Z$(60), dimensioned in the subroutine.

ACKNOWLEDGEMENTS:

People's Computer Company
Menlo Park, California

INSTRUCTIONS continued

Suppose your program contains an interaction like:

```
100  PRINT "GIVE ME YOUR ANSWER"
110  INPUT A
120  (program continues here)
```

You could modify this interaction as follows:

```
100  PRINT "GIVE ME YOUR ANSWER, OR TYPE 9000 FOR DESCAL."
110  INPUT A
112  IF A#9000 THEN 120
114  GOSUB 9000
116  GO TO 100
120  (program continues here)
```

NOTE: 9000 is used as the "flag" in line 112. Any number which is unlike the true answer may be used instead.

d) DESCAL uses the following variables:

Numeric: Z0, Z1, Z2

Subscripted: none

String: X$(3), Z$(60) (Dimensions specified in line 9001)

You should avoid using any of these variable names anywhere else in your program.

When these four modifications have been completed, type

```
APPEND- DESCAL
RUN
```

Functions available

Function	Abbreviation	Result
Exit	EXT	[return]
Clear	CLR	Z1=Z2=0
Exchange	EXC	Z1↔Z2
Addition	ADD	Z1=Z1+Z2
Subtraction	SUB	Z1=Z1-Z2
Multiplication	MUL	Z1=Z1*Z2
Division	DIV	Z1=Z1/Z2
Power	POW	Z1=Z1↑Z2
Hypotenuse of a right triangle	HYP	Z1=SQR(Z1*Z1+Z2*Z2)
Reciprocal	RCP	Z1=1/Z1
Negative	NEG	Z1=-Z1
Exponentiation	EXP	Z1=e↑Z1
Logarithm (natural)	LOG	Z1=Ln(Z1)
Square root	SQR	Z1=SQR(Z1)
Sine	SIN	Z1=SIN(Z1)
Cosine	COS	Z1=COS(Z1)
Tangent	TAN	Z1=TAN(Z1)
Arctangent	ATN	Z1=ATN(Z1)
Radians to degrees	RTD	Z1=Z1*57.2958
Degrees to radians	DTR	Z1=Z1/57.2958

NOTE:

a) To select a function, type the abbreviation of the function.

b) In the Result column above, "=" means "is replaced by".

c) Z1 is the "1st number," and also accumulates the answer.
Z2 is the "2nd number."

```
RUN

1  PRINT "MAIN PROGRAM BEGINS."
2  GOSUB 9000
3  PRINT "MAIN PROGRAM ENDS."
4  STOP

RUN
DESCAL

MAIN PROGRAM BEGINS.
CALCULATOR MODE.
CLEARED TO ZERO
1ST NUMBER?3
FUNCTION?ADD
2ND NUMBER?50
ADD= 53

FUNCTION?MUL
2ND NUMBER?2
MUL= 106

FUNCTION?CLR
CLEARED TO ZERO
1ST NUMBER?144
FUNCTION?SQR
SQR= 12

FUNCTION?DIV
2ND NUMBER?3
DIV= 4

FUNCTION?DIV
2ND NUMBER?0
DIVISION BY ZERO IS UNDEFINED.
DIV= 4

FUNCTION?SIN
SIN=-.756803

FUNCTION?SQR
SQR OF NEGATIVE NUMBER IS UNDEFINED.
SQR=-.756803

FUNCTION?EXC
2ND NUMBER?10
EXC= 10

FUNCTION?NEG
NEG=-10

FUNCTION?EXT
EXIT.
MAIN PROGRAM ENDS.

DONE
```

CONTRIBUTED PROGRAM **BASIC**

DIFFEQ
36159

TITLE: CAI IN SOLUTION OF LINEAR FIRST-ORDER DIFFERENTIAL EQUATIONS

DESCRIPTION: This program solves a set of linear first-order differential equations using the Runge-Kutta-Gill Algorithm.

INSTRUCTIONS: Instructions and a sample run are included within the program.

SPECIAL CONSIDERATIONS: FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Differential equations and engineering courses.

Student Background Required: General knowledge of differential equations.

Intended as a general purpose program.

ACKNOWLEDGEMENTS: Anthony Q. Baxter
University of Virginia

```
RUN


RUN
DIFFEQ

FOURTH ORDER RUNGE-KUTTA-GILL INTEGRATION ALGORITHM
  THE FOLLOWING INFORMATION MUST BE SPECIFIED:
9900 DATA T1,T2,N,H,NP
              WHERE T1=INITIAL TIME
                    T2=FINAL TIME
                    N =NUMBER OF DIFFERENTIAL EQUATIONS
                    H =INTEGRATION STEP SIZE
                    NP=NUMBER OF CALCULATIONS BETWEEN PRINTINGS
                       (PRINTING AT:T1,T1+NP*H,T1+2*NP*H,...,T2)
9901 DATA <INITIAL CONDITIONS>
              (IE. X(T1) FOR 1ST. EQUATION,
                   X(T1) FOR THE 2ND. EQUATION,
                   ETC.)
  THE EQUATIONS WILL BE ENTERED AS FOLLOWS:
8900 LET D(1)=FUNCTION OF (X(1),X(2),...,X(N-1),X(N),T)
8901 LET D(2)=FUNCTION OF (X(1),X(2),...,X(N-1),X(N),T)
89-- ... .... ........ ..  ........................
89-- LET D(N)=FUNCTION OF (X(1),X(2),...,X(N-1),X(N),T)
         WHERE X(1)=SOLUTION TO D(1) AT TIME T,
               X(2)=SOLUTION TO D(2) AT TIME T,
                    ETC.

FOR EXAMPLE TO SOLVE: X'=2/Y
                      Y'=-1/X
                      X(1)=Y(1)=1
                           ON THE INTERVAL [1,3] WITH STEP SIZE .0625
WE NEED ONLY SPECIFY THE FOLLOWING:
1. SPECIFY THE EQUATIONS
     8900 LET D(1)=2/X(2)
     8901 LET D(2)=-1/X(1)
2. INTERVAL, # EQUATIONS, STEP SIZE, AND PRINTING INSTRUCTIONS
     9900 DATA 1,3,  2,  .0625,  8
3. INITIAL CONDITIONS
     9901 DATA 1, 1

DONE
8900 LET D(1)=2/X(2)
8901 LET D(2)=-1/X(1)
9900 DATA 1,3,2,.0625,8
9901 DATA 1,1
RUN
DIFFEQ

FOURTH ORDER RUNGE-KUTTA-GILL INTEGRATION ALGORITHM

SOLUTION ON THE INTERVAL: 1      3            STEP SIZE: .0625
SOLUTION TO BE PRINTED EVERY .5         UNITS

TIME         EQUATION: 1     EQUATION: 2
 1            1               1
 1.5          2.25            .666667
 2            4               .5
 2.5          6.25            .4
 3            9.              .333333

DONE
```

CONTRIBUTED PROGRAM **BASIC**

DIMIS
36277

TITLE: X-Y AXIS SEGMENT PROGRAM

DESCRIPTION:

This program finds the distance, midpoint, and slope of a line on the coordinate X-Y axis. The line is determined by the two endpoints, P1 and P2. The program is useful to users who do not want their answers in decimal form. Fractions are left as fractions but are reduced to lowest terms. Square roots are left as square roots but are rationalized as far as possible.

INSTRUCTIONS:

Run the program and input the coordinates of the two endpoints on the X-Y axis. After solving a problem it will ask for another.

SPECIAL CONSIDERATIONS:

The Aardvarkand Company Writing Team has designed programs to take up an absolute minimum of computer storage and perform a maximum purpose. The team encourages people to send good programs to Aardvark. As a slight encouragement, the team will give anyone who sends a program which is accepted a free "subscription" to the program handbook, and include the contributor as a member of the writing team.

ACKNOWLEDGEMENTS:

John C. Ridges
Aardvark and Company
2130 Bell Court
Lakewood, Colorado 80215

```
RUN

RUN
DIMIS


INPUT P1(X1,Y1) AND P2(X2,Y2)?1,0,1,25
THE DISTANCE IS 25
THE MIDPOINT IS P(+1,+25/2)
THE SLOPE IS UNDEFINED

INPUT P1(X1,Y1) AND P2(X2,Y2)?0,0,3,4
THE DISTANCE IS 5
THE MIDPOINT IS P(+3/2,+2)
THE SLOPE IS +4/3

INPUT P1(X1,Y1) AND P2(X2,Y2)?28,4,93,2
THE DISTANCE IS SQR(4229)
THE MIDPOINT IS P(+121/2,+3)
THE SLOPE IS -2/65

INPUT P1(X1,Y1) AND P2(X2,Y2)?6,3,2,1
THE DISTANCE IS 2*SQR(5)
THE MIDPOINT IS P(+4,+2)
THE SLOPE IS +1/2

INPUT P1(X1,Y1) AND P2(X2,Y2)?
DONE
```

TITLE: SUPER DRILL IN ARITHMETIC FACTS

DRILL
36129

DESCRIPTION:

DRILL provides students 30 seconds of drill in the so-called arithmetic facts. The student initiates the drill in addition, subtraction, multiplication, or division. DRILL scores each response and tallies his total number correct. DRILL then loops and provides students with the option to practice some more.

Since the machine provides a limited response time, the students are encouraged in both speed and accuracy.

All problems resolve to positive whole numbers between Ø and 2Ø.

INSTRUCTIONS:

The student is able to choose his area of drill. Inasmuch as the machine recognizes only the first letter of his response to this choice, "ADDITION," "ADD," or simply "A" are equivalent.

The teacher may alter the time-out factor--the number of seconds allotted by the machine before continuing to the next problem--
--by changing line 9 to some other value for Z. DRILL is initially set for 5 seconds.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES:
Suitable Courses: General Math, Arithmetic

Student Background: 1) to supplement the CAI Drill & Practice Program
2) to supplement typical high school general math class
3) to supplement any elementary school class

ACKNOWLEDGEMENTS: Tim Aaronson
Woodrow Wilson High School/San Francisco

```
RUN
RUN
DRILL

DO YOU WANT DRILL IN ADDITION,SUBTRACTION,
MULTIPLICATION, OR DIVISION (TYPE WHAT YOU WANT)?SUBTRACTIN
C 11 - 9 = 2
C 17 - 8 = 9
C  4 - 3 = 1
C 17 - 8 = 9
C 13 - 7 = 6
C  9 - 4 = 5
C 11 - 6 = 5
C 18 - 9 = 9
X 12 - 4 = 5
C  9 - 3 = 6
C  6 - 1 = 5
C 18 - 9 = 9
C 17 - 8 = 9
C  3 - 1 = 2
C  8 - 4 = 4
C  4 - 3 = 1
C  6 - 5 = 1
C 10 - 2 = 8
C 13 - 5 = 8
C 11 - 5 = 6
C  4 - 1 = 3
C 10 - 3 = 7
C 12 - 5 = 7
C  7 - 5 = 2
C  8 - 3 = 5
C  5 - 3 = 2
C  6 - 1 = 5
C 15 - 7 = 8

YOU GOT 27 CORRECT AND  1 WRONG IN 30 SECONDS OF SUPERDRILL

DO YOU WANT MORE?YES
DO YOU WANT DRILL IN ADDITION,SUBTRACTION,
MULTIPLICATION, OR DIVISION (TYPE WHAT YOU WANT)?DUB
C 24 / 3 = 8
C 36 / 4 = 9
C 18 / 2 = 9
  54 / 6 = X
C  8 / 8 = 1
C  9 / 9 = 1
C  3 / 1 = 3
C  6 / 2 = 3
C 10 / 2 = 5
  49 / 7 = X
C 16 / 8 = 2

YOU GOT  9 CORRECT AND  2 WRONG IN 30 SECONDS OF SUPERDRILL

DO YOU WANT MORE?YES
DO YOU WANT DRILL IN ADDITION,SUBTRACTION,
MULTIPLICATION, OR DIVISION (TYPE WHAT YOU WANT)?M
C  3 X 1 = 3
C  1 X 2 = 2
   6 X 2 = 12X
C  1 X 6 = 6
C  0 X 7 = 0
X  1 X 8 = 1
   7 X 9 = 63X
C  3 X 8 = 24
C  2 X 2 = 4
C  1 X 7 = 7
C  1 X 0 = 0
C  6 X 5 = 30
C  9 X 8 = 72

YOU GOT 10 CORRECT AND  3 WRONG IN 30 SECONDS OF SUPERDRILL

DO YOU WANT MORE?P

.....................................................LATER, MAN

DONE
```

CONTRIBUTED PROGRAM **BASIC**

EXTEND
36253

TITLE: "INFINITE" PRECISION MATH UTILITY PROGRAM

DESCRIPTION: This program does division, exponentiation, finds factorials, and finds prime factors with complete accuracy.

INSTRUCTIONS: Run the program. The instructions are self explanatory.

SPECIAL CONSIDERATIONS: This program can be used on a 2000B system by reducing matrix A to 1800 elements and changing line 1040 to:
1040 L=J1=1800

The Aardvark and Company Writing Team has designed programs to take up an absolute minimum of computer storage and perform a maximum purpose. The team encourages people to send good programs to Aardvark. As a slight encouragement, the team will given anyone who sends a program which is accepted a free "subscription" to the program handbook, and include the contributor as a member of the writing team.

ACKNOWLEDGEMENTS: Aardvark and Company
2130 Bell Court
Lakewood, Colorado 80215

```
RUN


RUN
EXTEND

THE FOLLOWING INSTRUCTIONS CAN BE USED:
FACTORIAL
DIVIDE
FACTOR
EXPONENTIATE
STOP

WHAT IS YOUR INSTRUCTION?FACTORIAL
INPUT FROM, TO AND STEP?1,100,25


 25   FACTORIAL = 15,511,210,043,330,985,984,000,000

 50   FACTORIAL = 30,414,093,201,713,378,043,612,608,166,064,768,844,377
,641,568,960,512,000,000,000,000

 75   FACTORIAL = 24,809,140,811,395,398,091,946,477,116,594,033,660,926
,243,886,570,122,837,795,894,512,655,842,677,572,867,409,443,815,424,000
,000,000,000,000,000,000

 100  FACTORIAL = 93,326,215,443,944,152,681,699,238,856,266,700,490,715
,968,264,381,621,468,592,963,895,217,599,993,229,915,608,941,463,976,156
,518,286,253,697,920,827,223,758,251,185,210,916,864,000,000,000,000,000
,000,000,000

WHAT IS YOUR INSTRUCTION?DIVIDE


INPUT A/B?11,7
HOW MANY DIGIT ACCURACY (MIN. OF 1     )?100

 11   / 7    = 1.571428571428571428571428571428571428571428571428571428571428
714285714285714285714285714285714285714285714285714285714285714285714285

WHAT IS YOUR INSTRUCTION?FACTOR


INPUT NUMBER TO BE FACTORED?1234567890
 2    * 3    * 3    * 5    * 3607    * 3803

WHAT IS YOUR INSTRUCTION?EXPONENTIATE


INPUT THE BASE & EXPONENT?2,24
 2    ↑ 24   = 16,777,216

WHAT IS YOUR INSTRUCTION?STOP

DONE
```

CONTRIBUTED PROGRAM **BASIC**

FUNDTH
36664

TITLE: COMPUTER-AUGMENTED CALCULUS TOPICS

DESCRIPTION:

This program uses the trapezoid method to compute approximations to the definite integral of a specified function, and compares the approximation to g(B)-g(A), where

A is the lower bound
B is the upper bound
g(X) is a primitive of f(X), the specified function.

INSTRUCTIONS:

f(X) and g(X) must be specified as lines 300 and 500 respectively.

During the program run, the user is asked to input A, B, and the number of approximating trapezoids.

When the program has printed the result, the user may select option 1, 2, or 3, which represent:

1. Change the number of approximating trapezoids.
2. Change the values of A and B.
3. Terminate the program.

SPECIAL CONSIDERATIONS:

This program is one of 7 which accompany the Project Solo Module "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum Series.

f(X) must be supplied as line 300 as follows:

```
300  LET Y=f(X)
```

Similarly, g(X) must be supplied as line 500

```
500  LET Z=g(X)
```

before the program is run.

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Mathematics (Secondary, College); Elem. Computer Science

Student Background Required: Calculus (can be concurrent), BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS:

Project Solo
University of Pittsburgh

```
RUN

300  LET Y=SIN(X)
500  LET Z=-COS(X)
RUN
FUNDTH

THIS PROGRAM COMPUTES APPROXIMATIONS TO THE DEFINITE
INTEGRAL OF THE FUNCTION Y=F(X) WHICH YOU SUPPLIED ON
LINE 300, OVER THE INTERVAL (A,B), AND COMPARES THE
APPROXIMATION TO G(B)-G(A), WHERE Z=G(X) IS A
PRIMITIVE OF F(X) SUPPLIED BY YOU ON LINE 500.

WHAT IS A?-3.14159
WHAT IS B?0
HOW MANY SUBINTERVALS ON [A,B]?64
.NTERVAL [-3.14159     , 0      ]. 64    TRAPEZOIDS.

APPROXIMATION TO INTEGRAL IS *******-1.9996      *******

G(B)-G(A) = -1.           -  1.           = -2.           .


TYPE THE CODE?1
HOW MANY SUBINTERVALS ON [A,B]?256
INTERVAL [-3.14159     , 0      ]. 256   TRAPEZOIDS.

APPROXIMATION TO INTEGRAL IS *******-1.99997     *******

G(B)-G(A) = -1.           -  1.           = -2.           .


TYPE THE CODE?2

WHAT IS A?-3.14159
WHAT IS B?3.14159
HOW MANY SUBINTERVALS ON [A,B]?64
INTERVAL [-3.14159     , 3.14159     ]. 64    TRAPEZOIDS.

APPROXIMATION TO INTEGRAL IS *******-2.57787E-06    *******

G(B)-G(A) =  1.           -  1.           =  0      .


TYPE THE CODE?3

DONE
```

GAME
36265

TITLE: CLASSIC MATRIX OF GAME THEORY

DESCRIPTION:

This program accepts as input an n x m matrix, and checks for a minimax solution to the game. If no solution exists it then generates a mixed strategy using linear programming. The game is then played with the computer having columns and paying the value of the chosen matrix element.

INSTRUCTIONS:

The first inputs concern the game matrix - how many rows are there in the matrix followed by how many columns. Then enter the matrix row by row. If the value of the game is positive, it will be subtracted from each of your winnings, and added to the computers'. If it is negative, the player has five seconds after the matrix is printed to type in CAESAR. This action insures that the value of the game,(which is negative) will be subtracted from the players winnings and added to the computers' winnings. The player is now asked how many times he wants to play. For each play he is asked which row he wants to play.

SPECIAL CONSIDERATIONS:

The game matrix can be of dimensions up to 20 by 20.

ACKNOWLEDGEMENTS:

Phillip Short
Burnsville Senior High School

RUN

```
RUN
GAME

     THIS PROGRAM PLAYS THE CLASSIC MATRIX GAME.  SEE S. VAJDA
AN INTRODUCTION TO LINEAR PROGRAMMING AND THE THEORY OF GAMES
OR ANY BOOK ON FINITE MATHEMATICS FOR A DESCRIPTION.


INPUT NUMBER OF YOUR STRATEGIES?4
AND THE NUMBER OF MINE?4


INPUT THE GAME MATRIX ROW BY ROW, YOU HAVE ROW STRATEGIES,
AND RECEIVE PAYOFFS?-1,6,-6,1
??1,3,-2,1
??7,7,7,-15
??1,3,-5,16


HERE IS A COPY OF THE GAME MATRIX.

-1              6              -6              1

 1              3              -2              1

 7              7               7             -15

 1              3              -5              16

YOU PAY ME  .860466     FOR EACH PLAY.

HOW MANY TIMES WILL WE PLAY THE GAME?6


WHAT ROW DO YOU PLAY?4


I CHOSE COLUMN  3     .

PAY-OFF IS -5     .
MY NET GAIN IS  5.86047    UNITS.
YOU HAVE A TOTAL OF -5.86047     POINTS,
I HAVE  5.86047     POINTS.


WHAT ROW DO YOU PLAY?3


I CHOSE COLUMN  3     .

PAY-OFF IS  7     .
YOUR NET GAIN IS  6.13953     UNITS.
YOU HAVE A TOTAL OF  .279068     POINTS,
I HAVE -.279068     POINTS.


WHAT ROW DO YOU PLAY?4


I CHOSE COLUMN  3     .

PAY-OFF IS -5     .
MY NET GAIN IS  5.86047    UNITS.
YOU HAVE A TOTAL OF -5.5814      POINTS,
I HAVE  5.5814      POINTS.


WHAT ROW DO YOU PLAY?2


I CHOSE COLUMN  4     .
```

```
PAY-OFF IS  1      .
YOUR NET GAIN IS  .139534      UNITS.
YOU HAVE A TOTAL OF -5.44186      POINTS,
I HAVE  5.44186      POINTS.


WHAT ROW DO YOU PLAY?4


I CHOSE COLUMN  3      .

PAY-OFF IS -5      .
MY NET GAIN IS  5.86047     UNITS.
YOU HAVE A TOTAL OF -11.3023      POINTS,
I HAVE  11.3023      POINTS.


WHAT ROW DO YOU PLAY?4


I CHOSE COLUMN  4      .

PAY-OFF IS  16     .
YOUR NET GAIN IS  15.1395      UNITS.
YOU HAVE A TOTAL OF  3.8372       POINTS,
I HAVE -3.8372       POINTS.



**********************************************************


YOU WIN BY A TOTAL OF  3.8372       TO -3.8372
GOOD GOING..

DONE
```

GRAPH1
36665

TITLE: COMPUTER-AUGMENTED CALCULUS TOPICS

DESCRIPTION:

This program is designed to provide information to the student about functions. The program prints values of f(X), d(f(x)), and d'(f(x)), given f(X) and X. The student should graph the values and attempt to discover what the nature of f(X) is.

The program contains five different functions, on lines

220, 390, 490, 580, and 680

All functions are in the form Y=f(X).

INSTRUCTIONS:

The user is asked to select one of the five functions by typing 100, 200, 300, 400 or 500, and then entering a value for X.

The program provides five opportunities to see the values of the function, the first derivative, and the second derivative for input values of X. After five values of X have been evaluated, the program asks the user to type 1 or 2, representing:

1. Enough information has been obtained.
2. Not enough information has been obtained; let me try 5 more values of X.

If option 1 is selected, the program will begin again at the beginning.

SPECIAL CONSIDERATIONS:

This program is one of 7 which accompany the Project Solo Module "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum Series.

To change the functions, retype lines 220, 390, 490, 580, and/or 680. Functions are in the form LET Y=f(X).

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Mathematics (Secondary, College); Elem. Computer Science

Student Background Required: Calculus (can be concurrent); BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS: Project Solo
University of Pittsburgh

```
RUN

RUN
GRAPH1


PLEASE TYPE THE CODE NUMBER (100, 200, 300, 400, 500)
OF THE FUNCTION THAT YOU WANT TO WORK WITH.
FUNCTION?100
TYPE A VALUE FOR X.
?-2
 X = -2      Y =  4      D1 = -4      D2 =  2
TYPE A VALUE FOR X.
?-1
 X = -1      Y =  1      D1 = -2      D2 =  2
TYPE A VALUE FOR X.
?0
 X =  0      Y =  0      D1 =  0      D2 =  2
TYPE A VALUE FOR X.
?1
 X =  1      Y =  1      D1 =  2      D2 =  2
TYPE A VALUE FOR X.
?2
 X =  2      Y =  4      D1 =  4      D2 =  2
IF YOU HAVE ENOUGH INFORMATION ABOUT THIS FUNCTION,
TYPE 1; FOR MORE INFORMATION, TYPE 2
?1
TO OBTAIN ANOTHER FUNCTION TYPE ITS CODE NUMBER
(100, 200, 300, 400, OR 500). TO STOP THE PROGRAM,
PRESS CTRL/C, THEN PRESS RETURN.
FUNCTION?400
TYPE A VALUE FOR X
?-10
X = -10     Y =  .544022      D1 = -.839072      D2 = -.544022
TYPE A VALUE FOR X
?-2.5
X = -2.5          Y = -.598472      D1 = -.801144      D2 =  .598472
TYPE A VALUE FOR X
?0
X =  0      Y =  0      D1 =  1.           D2 =  0
TYPE A VALUE FOR X
?2.5
X =  2.5          Y =  .598472      D1 = -.801144      D2 = -.598472
TYPE A VALUE FOR X
?10
X =  10     Y = -.544022      D1 = -.839071      D2 =  .544022
IF YOU HAVE ENOUGH INFORMATION ABOUT THIS FUNCTION,
TYPE 1; FOR MORE INFORMATION, TYPE 2
?1
TO OBTAIN ANOTHER FUNCTION TYPE ITS CODE NUMBER
(100, 200, 300, 400, OR 500). TO STOP THE PROGRAM,
PRESS CTRL/C, THEN PRESS RETURN.
FUNCTION?
DONE
```

TITLE:

COMPUTER-AUGMENTED CALCULUS TOPICS

GRAPH1
36665

DESCRIPTION:

This program is designed to provide information to the student about functions. The program prints values of f(X), d(f(x)), and d'(f(x)), given f(X) and X. The student should graph the values and attempt to discover what the nature of f(X) is.

The program contains five different functions, on lines

220, 390, 490, 580, and 680

All functions are in the form Y=f(X).

INSTRUCTIONS:

The user is asked to select one of the five functions by typing 100, 200, 300, 400 or 500, and then entering a value for X.

The program provides five opportunities to see the values of the function, the first derivative, and the second derivative for input values of X. After five values of X have been evaluated, the program asks the user to type 1 or 2, representing:

1. Enough information has been obtained.
2. Not enough information has been obtained; let me try 5 more values of X.

If option 1 is selected, the program will begin again at the beginning.

SPECIAL CONSIDERATIONS:

This program is one of 7 which accompany tne Project Solo Module "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum Series.

To change the functions, retype lines 220, 390, 490, 580, and/or 680. Functions are in the form LET Y=f(X).

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Mathematics (Secondary, College); Elem. Computer Science

Student Background Required: Calculus (can be concurrent); BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

HP Computer Curriculum Project
11000 Wolfe Road
Cupertino California 95014

ACKNOWLEDGEMENTS:

Project Solo
University of Pittsburgh

RUN

```
RUN
GRAPH1


PLEASE TYPE THE CODE NUMBER (100, 200, 300, 400, 500)
OF THE FUNCTION THAT YOU WANT TO WORK WITH.
FUNCTION?100
TYPE A VALUE FOR X.
?-2
 X = -2      Y =  4      D1 = -4      D2 =  2
TYPE A VALUE FOR X.
?-1
 X = -1      Y =  1      D1 = -2      D2 =  2
TYPE A VALUE FOR X.
?0
 X =  0      Y =  0      D1 =  0      D2 =  2
TYPE A VALUE FOR X.
?1
 X =  1      Y =  1      D1 =  2      D2 =  2
TYPE A VALUE FOR X.
?2
 X =  2      Y =  4      D1 =  4      D2 =  2
IF YOU HAVE ENOUGH INFORMATION ABOUT THIS FUNCTION,
TYPE 1; FOR MORE INFORMATION, TYPE 2
?1
TO OBTAIN ANOTHER FUNCTION TYPE ITS CODE NUMBER
(100, 200, 300, 400, OR 500). TO STOP THE PROGRAM,
PRESS CTRL/C, THEN PRESS RETURN.
FUNCTION?400
TYPE A VALUE FOR X
?-10
X = -10     Y =  .544022      D1 = -.839072      D2 = -.544022
TYPE A VALUE FOR X
?-2.5
X = -2.5          Y = -.598472      D1 = -.801144      D2 =  .598472
TYPE A VALUE FOR X
?0
X =  0      Y =  0      D1 =  1.           D2 =  0
TYPE A VALUE FOR X
?2.5
X =  2.5          Y =  .598472      D1 = -.801144      D2 = -.598472
TYPE A VALUE FOR X
?10
X =  10     Y = -.544022      D1 = -.839071      D2 =  .544022
IF YOU HAVE ENOUGH INFORMATION ABOUT THIS FUNCTION,
TYPE 1; FOR MORE INFORMATION, TYPE 2
?1
TO OBTAIN ANOTHER FUNCTION TYPE ITS CODE NUMBER
(100, 200, 300, 400, OR 500). TO STOP THE PROGRAM,
PRESS CTRL/C, THEN PRESS RETURN.
FUNCTION?
DONE
```

GRAPH2
36666

TITLE: COMPUTER-AUGMENTED CALCULUS TOPICS

DESCRIPTION:

This program is designed to provide information to students about functions. For a selected f(X) and input value of X, the program prints the values of the first and second derivatives of f(X). The student should graph the values and attempt to discover what f(X) is.

INSTRUCTIONS:

The program contains five different functions, on lines 220, 390, 490, 580 and 680. All functions are in the form Y=f(X).

The user is asked to select one of the five functions by typing 100, 200, 300, 400, or 500.

Then the program asks for a value for X, and the user has 5 opportunities to input values of X, and obtain the values of the first and second derivative of the unknown f(X). After five values of X have been evaluated, the program asks for an input of 1 or 2, representing:

1. Enough information has been obtained.
2. Not enough information has been obtained; let me try 5 more values of X.

If option 1 is selected, another function may be selected.

SPECIAL CONSIDERATIONS:

This program is one of 7 which accompany the Project Solo Module "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum Series.

To change the functions, retype lines 220, 390, 490, 580, and/or 680. Functions are in the form LET Y=f(X).

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Mathematics (Secondary, College); Elem. Computer Science

Student Background Required: Calculus (can be concurrent); BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS:

Project Solo
University of Pittsburgh

```
RUN

RUN
GRAPH2



PLEASE TYPE THE CODE NUMBER (100, 200, 300, 400, 500)
OF THE FUNCTION THAT YOU WANT TO WORK WITH.
FUNCTION?200
TYPE A VALUE FOR X.
?-1
 X = -1      D1 = -6      D2 =  2
TYPE A VALUE FOR X.
?0
 X =  0      D1 = -4      D2 =  2
TYPE A VALUE FOR X.
?1
 X =  1      D1 = -2      D2 =  2
TYPE A VALUE FOR X.
?5
 X =  5      D1 =  6      D2 =  2
TYPE A VALUE FOR X.
?100
 X =  100    D1 =  196    D2 =  2
IF YOU HAVE ENOUGH INFORMATION ABOUT THIS FUNCTION,
TYPE 1; FOR MORE INFORMATION, TYPE 2
?1
TO OBTAIN ANOTHER FUNCTION TYPE ITS CODE NUMBER
(100, 200, 300, 400, OR 500). TO STOP THE PROGRAM,
PRESS CTRL/C, THEN PRESS RETURN.
FUNCTION?300
TYPE A VALUE FOR X.
?-1
 X = -1      D1 =  .367879      D2 =  .367879
TYPE A VALUE FOR X.
?0
 X =  0      D1 =  1      D2 =  1
TYPE A VALUE FOR X.
?1
 X =  1      D1 =  2.71828      D2 =  2.71828
TYPE A VALUE FOR X.
?-10
 X = -10     D1 =  4.53999E-05     D2 =  4.53999E-05
TYPE A VALUE FOR X.
?10
 X =  10     D1 =  22026.5      D2 =  22026.5
IF YOU HAVE ENOUGH INFORMATION ABOUT THIS FUNCTION,
TYPE 1; FOR MORE INFORMATION, TYPE 2
?1
TO OBTAIN ANOTHER FUNCTION TYPE ITS CODE NUMBER
(100, 200, 300, 400, OR 500). TO STOP THE PROGRAM,
PRESS CTRL/C, THEN PRESS RETURN.
FUNCTION?
DONE
```

CONTRIBUTED PROGRAM **BASIC**

INTEGR
36667

TITLE: COMPUTER-AUGMENTED CALCULUS TOPICS

DESCRIPTION:

This program computes an approximation to the definite integral of a function over a supplied interval on the X-axis, using the trapezoidal method of approximation.

INSTRUCTIONS:

The desired function is supplied as program line 250, in the form

```
250  LET Y=f(X)
```

During the run, the user is asked to input A and B, which are the lower and upper bounds of the desired interval on the X-axis.

The program then asks the number of approximating trapezoids (N must be greater than Ø).

When the program has printed the resulting approximation, the user is asked to select option 1, 2, or 3 which represent:

1. Change the number of approximating trapezoids.
2. Change A and B.
3. Terminate the program.

SPECIAL CONSIDERATIONS:

This program is one of 7 which accompany the Project Solo Module "Computer-Augmented Calculus Topics" of the Hewlett Packard Curriculum Series.

To change the function, line 250 must be retyped before running the program.

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Mathematics (Secondary, College): Elem. Computer Science

Student Background Required: Calculus (can be concurrent); BASIC

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5611 Computer-Augmented Calculus Topics
HP 5951-5612 Classroom Set (30 books)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS: Project Solo
University of Pittsburgh

```
RUN

250  LET Y=X↑2-2*X
RUN
INTEGR


THIS PROGRAM COMPUTES APPROXIMATIONS TO THE
DEFINITE INTEGRAL OF THE FUNCTION WHICH YOU
SUPPLIED ON LINE 250, OVER AN INTERVAL (A,B).

NOW TYPE A VALUE FOR A?1
TYPE A VALUE OF B?3
HOW MANY SUBINTERVALS DO YOU WANT [A,B] DIVIDED INTO?16


THE INTERVAL IS [ 1     , 3     ].
THE NUMBER OF APPROXIMATING TRAPEZOIDS IS  16

THE APPROXIMATION IS ****** .671875     ******

TYPE THE CHANGE CODE?1
HOW MANY SUBINTERVALS DO YOU WANT [A,B] DIVIDED INTO?256


THE INTERVAL IS [ 1     , 3     ].
THE NUMBER OF APPROXIMATING TRAPEZOIDS IS  256

THE APPROXIMATION IS ****** .666687     ******

TYPE THE CHANGE CODE?2
NOW TYPE A VALUE FOR A?-2
TYPE A VALUE OF B?2
HOW MANY SUBINTERVALS DO YOU WANT [A,B] DIVIDED INTO?32


THE INTERVAL IS [-2     , 2     ].
THE NUMBER OF APPROXIMATING TRAPEZOIDS IS  32

THE APPROXIMATION IS ****** 5.34375     ******

TYPE THE CHANGE CODE?1
HOW MANY SUBINTERVALS DO YOU WANT [A,B] DIVIDED INTO?64


THE INTERVAL IS [-2     , 2     ].
THE NUMBER OF APPROXIMATING TRAPEZOIDS IS  64

THE APPROXIMATION IS ****** 5.33594     ******

TYPE THE CHANGE CODE?3

DONE
```

TITLE:

LIMIT OF (SIN X)/X

LIMSIN
36622

DESCRIPTION:

This program demonstrates that the limit of $\frac{\sin x}{x}$, as x approaches 0, equals 1, provided x is measured in radians. If x is measured in degrees, the limit equals approximately .017.

OBJECTIVES:

A. To demonstrate the manner by which the limit of $\frac{\sin x}{x}$ is approached.

B. To show that degree measure does not yield the same solution as radian measure.

INSTRUCTIONS:

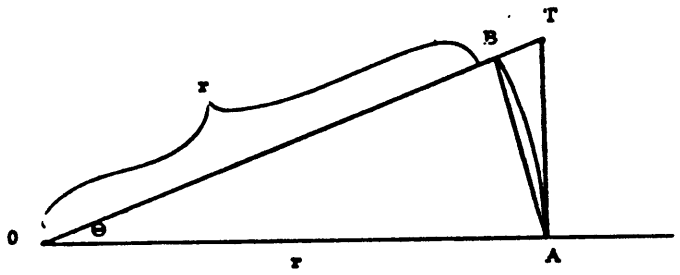
PRELIMINARY PREPARATION:

A. Student - Knowledge of degree vs. radian measure

B. Materials - None

DISCUSSION:

Following the computer type-out, the teacher will use the analytic method to evaluate the limit. Prior to this discussion, the student should be reminded of the area formulas for a triangle and for a sector in terms of the central angle measured in radians. A geometric diagram should be presented showing the sector lying between two triangles.



Here, $\frac{1}{2}r^2 \sin\theta \leq \frac{1}{2}r^2\theta \leq \frac{1}{2}r^2\tan\theta$

Circular Sector with Circumscribed and Inscribed Triangles

The teacher can modify the type-out by inserting: 195 GO TO 300. This decreases the number of lines typed out to the final eleven appearing on the program "run".

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

RUN

RUN
LIMSIN

THIS PROGRAM DEMONSTRATES THAT THE LIMIT OF
F(X) = (SIN X)/X, AS X APPROACHES 0, IS EQUAL TO 1,
PROVIDED X IS MEASURED IN RADIANS.

$$\lim_{X \to 0} \frac{\sin(X)}{X} = 1$$

WHEN X IS IN DEGREES,		WHEN X IS IN RADIANS,	
X IS	F(X) IS	X IS	F(X) IS
90	1.11111E-02	1.5708	.63662
85	1.17199E-02	1.48353	.671504
80	1.23101E-02	1.39626	.705317
75	.012879	1.309	.737913
70	1.34242E-02	1.22173	.769149
65	1.39432E-02	1.13446	.798887
60	1.44338E-02	1.0472	.826994
55	1.48937E-02	.95993	.853345
50	1.53209E-02	.872664	.877823
45	1.57135E-02	.785398	.900317
40	1.60697E-02	.698131	.920726
35	1.63879E-02	.610865	.938958
30	1.66667E-02	.523598	.95493
25	1.69047E-02	.436332	.96857
20	.017101	.349066	.979816
15	1.72546E-02	.261799	.988616
10	1.73648E-02	.174533	.994931
5	1.74311E-02	8.72664E-02	.998731
1	1.74524E-02	1.74533E-02	.999949
.9	1.74526E-02	.015708	.999959
.8	1.74527E-02	1.39626E-02	.999968
.7	1.74528E-02	1.22173E-02	.999975
.6	.017453	.010472	.999982
.5	1.74531E-02	8.72664E-03	.999987
.4	1.74531E-02	6.98131E-03	.999992
.3	1.74532E-02	5.23598E-03	.999996
.2	1.74532E-02	3.49066E-03	.999998
.1	1.74533E-02	1.74533E-03	1.
.09	1.74533E-02	1.57079E-03	1.
.08	1.74533E-02	1.39626E-03	1.
.07	1.74533E-02	1.22173E-03	1.
.06	1.74533E-02	1.04720E-03	1
.05	1.74533E-02	8.72664E-04	1.
.04	1.74533E-02	6.98131E-04	1
.03	1.74533E-02	5.23598E-04	1
.02	1.74533E-02	3.49066E-04	1
.01	1.74533E-02	1.74533E-04	1.

DONE

		LINES
TITLE:	CONVERSATIONAL COMPUTER GENERATED CALCULUS QUIZ	3670C
DESCRIPTION:	Conversational computer generated calculus quiz. Values are random so the program can be used several times by a student.	
INSTRUCTIONS:	Conversational	
ACKNOWLEDGEMENTS:	Babson College Babson Park, Massachusetts	

```
RUN

RUN
LINES

TYPE ANSWER TO EACH QUESTION,THEN PRESS RETURN KEY.
FRACTIONAL VALUES MUST BE ENTERED IN DECIMAL FORM - ONE
              DECIMAL PLACE IS O.K.
GIVEN THE POINTS (-3     , 7     ),AND ( 3     , 10    ),
   WHAT IS THE SLOPE OF THE LINE PASSING THROUGH THESE POINTS?.5
CORRECT
WHAT IS THE SLOPE OF THE STRAIGHT LINE WHOSE EQUATION IS
      Y = -1     X +  2     ?-1
CORRECT
WHAT IS THE SLOPE OF THE LINE WHOSE EQUATION IS
 6     X + -8     Y = -1     ?.7
CORRECT
WHAT IS THE Y-INTERCEPT OF THE ABOVE LINE?.1
CORRECT
THE LINE L HAS EQUATION 9     X + -3     Y =-7
WHAT IS THE VALUE OF X AT WHICH L CROSSES THE X-AXIS?-.7
CORRECT
WHAT IS THE VALUE OF Y AT WHICH L CROSSES THE Y-AXIS?2.3
CORRECT
GIVEN THAT THE POINT P IS ON L AND THAT THE X-COORDINATE
OF P IS-3     , WHAT IS THE Y-COORDINATE OF P?-.6
CORRECT ANSWER IS-6.7
CONSIDER THE STRAIGHT LINE WHOSE EQUATION IS
       Y = 10    X +  2      .
WHAT IS THE SLOPE OF A LINE PASSING THROUGH THE POINT
P ( 4     , 7     )  WHICH IS PERPENDICULAR TO THE
GIVEN LINE?10
CORRECT ANSWER IS-.1

YOU HAVE ANSWERED 6     QUESTIONS CORRECTLY OUT OF A TOTAL OF
 8 QUESTIONS.
YOU SHOULD PRACTICE A LITTLE MORE.  RUN THE PROGRAM AGAIN
EITHER NOW OR AFTER REVIEWING THE MATERIAL.

DONE
```

CONTRIBUTED PROGRAM **BASIC**

LOGIC
36251

TITLE: LOGIC EXAMINATION PROGRAMS (LOGIC1,2,3,4,5)

DESCRIPTION: These programs teach the basics of logic. At the end of each program, the score and percent right is printed. The package consists of five programs, LOGIC1, LOGIC2, LOGIC3, LOGIC4, and LOGIC5.

INSTRUCTIONS: Instructions are contained in the program.

SPECIAL CONSIDERATIONS: The Aardvark and Company Writing Team has designed programs to take up an absolute minimum of computer storage and perform a maximum purpose. The team encourages people to send good programs to Aardvark. As a slight encouragement, the team will give anyone who sends a program which is accepted a free "subscription" to the program handbook, and include the contributor as a member of the writing team.

ACKNOWLEDGEMENTS: Aardvark and Company
2130 Bell Court
Lakewood, Colorado 80215

RUN

```
RUN
LOGIC1


IF PAUL PLAYS THEN THE TEAM WINS.


O.K.--
NOW ASSUME PAUL DOES NOT PLAY.
CAN WE CONCLUDE THE TEAM DOES NOT WIN?NO
CORRECT.

O.K.--
NOW ASSUME THE TEAM DOES NOT WIN.
CAN WE CONCLUDE PAUL DOES NOT PLAY?YES
CORRECT.

O.K.--
NOW ASSUME THE TEAM WINS.
CAN WE CONCLUDE PAUL PLAYS?YES
WRONG, THE CONCLUSION IS INVALID.
YOU DENIED THE ANTECEDENT.

O.K.--
NOW ASSUME PAUL PLAYS.
CAN WE CONCLUDE THE TEAM WINS?YES
CORRECT.


IF ABCD IS A SQUARE THEN IT HAS FOUR RIGHT ANGLES.


O.K.--
NOW ASSUME ABCD IS A SQUARE.
CAN WE CONCLUDE IT HAS FOUR RIGHT ANGLES?YES
CORRECT.

O.K.--
NOW ASSUME IT HAS FOUR RIGHT ANGLES.
CAN WE CONCLUDE ABCD IS A SQUARE?NO
CORRECT.

O.K.--
NOW ASSUME IT HASN'T FOUR RIGHT ANGLES.
CAN WE CONCLUDE ABCD IS NOT A SQUARE?YES
CORRECT.

O.K.--
NOW ASSUME ABCD IS NOT A SQUARE.
CAN WE CONCLUDE IT HASN'T FOUR RIGHT ANGLES?NO
CORRECT.


IF JOE STUDIES THEN HE PASSES THE COURSE.


O.K.--
NOW ASSUME HE PASSES THE COURSE.
CAN WE CONCLUDE JOE STUDIES?YES
WRONG, THE CONCLUSION IS INVALID.
YOU DENIED THE ANTECEDENT.

O.K.--
NOW ASSUME JOE STUDIES.
CAN WE CONCLUDE HE PASSES THE COURSE?YES
CORRECT.

O.K.--
NOW ASSUME JOE DOESN'T STUDY.
CAN WE CONCLUDE HE FAILS THE COURSE?YES
WRONG, THE CONCLUSION IS INVALID.
YOU AFFIRMED THE CONSEQUENT.
```

O.K.--
NOW ASSUME HE FAILS THE COURSE.
CAN WE CONCLUDE JOE DOESN'T STUDY?YES
CORRECT.

IF A MAN IS PRESIDENT THEN HE IS AT LEAST 40.

O.K.--
NOW ASSUME HE IS AT LEAST 40.
CAN WE CONCLUDE A MAN IS PRESIDENT?NO
CORRECT.

O.K.--
NOW ASSUME A MAN IS PRESIDENT.
CAN WE CONCLUDE HE IS AT LEAST 40?YES
CORRECT.

O.K.--
NOW ASSUME A MAN IS NOT PRESIDENT.
CAN WE CONCLUDE HE IS YOUNGER THAN 40?NO
CORRECT.

O.K.--
NOW ASSUME HE IS YOUNGER THAN 40.
CAN WE CONCLUDE A MAN IS NOT PRESIDENT?YES
CORRECT.

IF X AND Y ARE BOTH POSITIVE THEN X*Y>0.

O.K.--
NOW ASSUME X AND Y ARE NOT BOTH POSITIVE.
CAN WE CONCLUDE X*Y<=0?YES
WRONG, THE CONCLUSION IS INVALID.
YOU AFFIRMED THE CONSEQUENT.

O.K.--
NOW ASSUME X AND Y ARE BOTH POSITIVE.
CAN WE CONCLUDE X*Y>0?YES
CORRECT.

O.K.--
NOW ASSUME X*Y>0.
CAN WE CONCLUDE X AND Y ARE BOTH POSITIVE?NO
CORRECT.

O.K.--
NOW ASSUME X*Y<=0.
CAN WE CONCLUDE X AND Y ARE NOT BOTH POSITIVE?YES
CORRECT.

IF THE WEATHER IS WINDY THEN THE BOAT SINKS.

O.K.--
NOW ASSUME THE BOAT SINKS.
CAN WE CONCLUDE THE WEATHER IS WINDY?YES
WRONG, THE CONCLUSION IS INVALID.
YOU DENIED THE ANTECEDENT.

O.K.--
NOW ASSUME THE WEATHER IS WINDY.
CAN WE CONCLUDE THE BOAT SINKS?YES
CORRECT.

O.K.--
NOW ASSUME THE WEATHER IS CALM.
CAN WE CONCLUDE THE BOAT FLOATS?NO
CORRECT.

O.K.--
NOW ASSUME THE BOAT FLOATS.
CAN WE CONCLUDE THE WEATHER IS CALM?YES
CORRECT.

IF YOU RUN THIS PROGRAM THEN YOU LEARN SOMETHING.

O.K.--
NOW ASSUME YOU LEARN SOMETHING.
CAN WE CONCLUDE YOU RUN THIS PROGRAM?NO
CORRECT.

O.K.--
NOW ASSUME YOU RUN THIS PROGRAM.
CAN WE CONCLUDE YOU LEARN SOMETHING?YES
CORRECT.

O.K.--
NOW ASSUME YOU LEARN NOTHING.
CAN WE CONCLUDE YOU DON'T RUN THIS PROGRAM?YES
CORRECT.

O.K.--
NOW ASSUME YOU DON'T RUN THIS PROGRAM.
CAN WE CONCLUDE YOU LEARN NOTHING?NO
CORRECT.

YOU ANSWERED 23 OUT OF 28 QUESTIONS CORRECTLY FOR A
FINAL SCORE OF 82 %.

DONE

IF IT IS A WARM NIGHT OR I AM OVER MY COLD,
THEN I AM GOING TO THE GAME.

O.K. --- NOW ASSUME I AM NOT GOING TO THE GAME.

CAN WE CONCLUDE:
IT IS NOT A WARM NIGHT OR I AM NOT OVER MY COLD?Y
CORRECT.
IT IS NOT A WARM NIGHT AND I AM NOT OVER MY COLD?Y
CORRECT.

IF IT IS A WARM NIGHT AND I AM OVER MY COLD,
THEN I AM GOING TO THE GAME.

O.K. --- NOW ASSUME I AM NOT GOING TO THE GAME.

CAN WE CONCLUDE:
IT IS A WARM NIGHT AND I AM NOT OVER MY COLD?N
CORRECT.
IT IS NOT A WARM NIGHT AND I AM OVER MY COLD?N
CORRECT.

IF JOE ATTENDS CLASS OR HE STUDIES DILIGENTLY,
THEN HE PASSES THE COURSE.

O.K. --- NOW ASSUME HE FAILS THE COURSE.

```
CAN WE CONCLUDE:
     JOE DOES NOT ATTEND CLASS OR HE DOES NOT STUDY DILIGENTLY?Y
CORRECT.
     JOE DOES NOT ATTEND CLASS OR HE STUDIES DILIGENTLY?N
CORRECT.



IF JOE ATTENDS CLASS AND HE STUDIES DILIGENTLY,
THEN HE PASSES THE COURSE.


O.K. --- NOW ASSUME HE FAILS THE COURSE.

CAN WE CONCLUDE:
     JOE ATTENDS CLASS AND HE DOES NOT STUDY DILIGENTLY?N
CORRECT.
     JOE DOES NOT ATTEND CLASS AND HE STUDIES DILIGENTLY?N
CORRECT.



IF GLEEBS ARE SEERY OR MODULS ARE TRUNE,
THEN FLORTZ ARE ARTIFERAKE.


O.K. --- NOW ASSUME FLORTZ ARE NOT ARTIFERAKE.

CAN WE CONCLUDE:
     GLEEBS ARE NOT SEERY?N
WRONG --- GO BACK AND STUDY THE NEGATION OF A DISJUNCTION.
     GLEEBS ARE NOT SEERY AND MODULS ARE NOT TRUNE?N
WRONG --- GO BACK AND STUDY THE NEGATION OF A DISJUNCTION.



IF GLEEBS ARE SEERY AND MODULS ARE TRUNE,
THEN FLORTZ ARE ARTIFERAKE.


O.K. --- NOW ASSUME FLORTZ ARE NOT ARTIFERAKE.

CAN WE CONCLUDE:
     GLEEBS ARE NOT SEERY AND MODULS ARE NOT TRUNE?N
CORRECT.
     GLEEBS ARE NOT SEERY AND MODULS ARE TRUNE?N
CORRECT.



IF EDGAR INHERRITS MONEY OR HE INVESTS WISELY,
THEN HE BECOMES WEALTHY.


O.K. --- NOW ASSUME HE DOES NOT BECOME WEALTHY.

CAN WE CONCLUDE:
     HE DOES NOT INVEST WISELY?Y
CORRECT.
     EDGAR DOES NOT INHERIT MONEY OR HE DOES NOT INVEST WISELY?Y
CORRECT.



IF EDGAR INHERRITS MONEY AND HE INVESTS WISELY,
THEN HE BECOMES WEALTHY.


O.K. --- NOW ASSUME HE DOES NOT BECOME WEALTHY.

CAN WE CONCLUDE:
     EDGAR DOES NOT INHERIT MONEY?N
```

CORRECT.
EDGAR DOES NOT INHERIT MONEY AND HE INVESTS WISELY?N
CORRECT.

YOU ANSWERED 14 OUT OF 16 QUESTIONS CORRECTLY FOR A
FINAL SCORE OF 87 %.

DONE

PI

TITLE: CALCULATES PI 36623

DESCRIPTION:

This program computes the area of a circle and "pi" by using the areas of inscribed and circumscribed regular polygons.

OBJECTIVES:

As an introduction to the limit process and a method for approximating "pi".

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - Students must know how to calculate the area of a circle and a triangle using the formulas: $A = \pi R^2$ and $A = 1/2bh$.

B. Materials - Chalkboard, board compass, and straight edge.

DISCUSSION:

Ask students to find the area of a circle without using the formula. The instructor may suggest to the class to inscribe and/or circumscribe an equilateral triangle. Have students compare the area of their figures to that of the circle. Some students will suggest to increase the number of sides and the instructor should suggest that a regular hexagon be used for convenience of drawing. This can be illustrated on the chalkboard for the class. Another comparison is made between the areas and then the students will observe that to obtain any satisfactory results, the number of sides must increase greatly. At this moment the instructor should introduce this program and explain to the class that the program will increase the number of sides of a regular polygon and compute the area of each new figure. A table is printed giving the areas of both inscribed and circumscribed regular polygons and also the number of sides for each area. The students can readily see that the machine has eliminated the tedious calculations. Now, have the students calculate the area of the circle using the formula and make a comparison of results; thus, the students can observe that the areas of the polygons approach the area of the circle.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

```
RUN


RUN
PI
AREA OF A CIRCLE USING INSCRIBED AND CIRCUMSCRIBED REGULAR POLYGONS.

*****

WHAT IS THE RADIUS OF THE CIRCLE?10

 INSCRIBED       CIRCUMSCRIBED     NUMBER OF     INSCRIBED  CIRCUMSCRIBED
   AREA              AREA            SIDES       % ERROR      % ERROR

  129.904          519.614           3          -58.65          65.4
  259.807          346.41            6          -17.3           10.27
  300.             321.539           12         -4.51           2.35


HOW MANY SIDES DO YOU THINK ARE NEEDED TO APPROXIMATE
THE AREA OF THIS CIRCLE?100

  313.952          314.262           100        -.07            .03

WOULD YOU LIKE TO TRY ANOTHER NUMBER OF SIDES (1-YES, 0-NO)?1
HOW MANY SIDES DO YOU THINK ARE NEEDED TO APPROXIMATE
THE AREA OF THIS CIRCLE?1E6
THAT MANY SIDES IS VALID, BUT NOT NECESSARY FOR A
GOOD APPROXIMATION.  USE 10000 AS THE MAXIMUM NUMBER.
HOW MANY SIDES DO YOU THINK ARE NEEDED TO APPROXIMATE
THE AREA OF THIS CIRCLE?10000

  314.159          314.159           10000      0               0

WOULD YOU LIKE TO TRY ANOTHER NUMBER OF SIDES (1-YES, 0-NO)?0
WOULD YOU LIKE TO TRY ANOTHER RADIUS (1-YES, 0-NO)?1

*****

WHAT IS THE RADIUS OF THE CIRCLE?1000000
ANY RADIUS WILL WORK, BUT USE A NUMBER LESS THAN 1000.
WHAT IS THE RADIUS OF THE CIRCLE?999

 INSCRIBED       CIRCUMSCRIBED     NUMBER OF     INSCRIBED  CIRCUMSCRIBED
   AREA              AREA            SIDES       % ERROR      % ERROR

 1.29644E+06     5.18576E+06         3          -58.65          65.4
 2.59288E+06     3.45717E+06         6          -17.3           10.27
 2.99400E+06     3.20896E+06         12         -4.51           2.35


HOW MANY SIDES DO YOU THINK ARE NEEDED TO APPROXIMATE
THE AREA OF THIS CIRCLE?10000

 3.13531E+06     3.13531E+06         10000      0               0

WOULD YOU LIKE TO TRY ANOTHER NUMBER OF SIDES (1-YES, 0-NO)?0
WOULD YOU LIKE TO TRY ANOTHER RADIUS (1-YES, 0-NO)?0

*****

DONE
```

CONTRIBUTED PROGRAM **BASIC**

POLSUB
36239

TITLE: POLYNOMIAL SUBTRACTION

DESCRIPTION:

This program presents the student with a list of polynomials of degree one through four which are to be subtracted in pairs. The student types in the coefficient of the answer and is then told whether or not he is correct. At the end of the list he is told what percent he got right.

INSTRUCTIONS:

Directions to the student are included in the program on an optional basis. The student is asked to subtract polynomial No. 2 from polynomial No. 1. After each question mark, the coefficients of the answer are typed, starting with the coefficient of the highest degree term and going in descending order. If a coefficient is zero, a zero must be typed in for it.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Algebra I and as a review in Algebra II
Student Background Required: Familiarity with polynomial subtraction
Application: This program is best used as a drill for makeup with those students who have difficulty remembering the rules for subtraction of signed numbers.

ACKNOWLEDGEMENTS:

Michael Bolduan
Clackamas High School

RUN

```
RUN
POLSUB

DO YOU WANT DIRECTIONS?YES
NOW LET'S SUBTRACT SOME POLYNOMIALS. WHEN YOU ARE ASKED FOR
YOUR ANSWER YOU ARE TO SUBTRACT POLYNOMIAL NO. 2 FROM
POLYNOMIAL NO. 1 . AFTER EACH QUESTION MARK YOU ARE TO TYPE IN
THE COEFFICIENTS OF YOUR ANSWER STARTING WITH THE COEFFICIENT
OF THE HIGHEST DEGREE TERM AND GOING IN DESCENDING ORDER.
IF A COEFFICIENT IS ZERO, YOU MUST TYPE IN A ZERO FOR IT.
AFTER EACH COEFFICIENT BE SURE TO HIT THE 'RETURN' KEY.
HERE WE GO. GOOD LUCK!
HOW MANY PROBLEMS DO YOU WANT TO TRY?3
HERE ARE THE POLYNOMIALS:
-3     *X + 30

 41    *X + 0

ANSWER PLEASE.
?38
?30

SORRY, WRONG!
HERE ARE THE POLYNOMIALS:
 8     *X↑ 3     + 0     *X↑ 2     + 7     *X +  28

 34    *X↑ 3     + 0     *X↑ 2     + 0     *X +  5

ANSWER PLEASE.
?-26
?0
?7
?23

RIGHT!
HERE ARE THE POLYNOMIALS:
 1     *X↑ 2     + 44    *X + -9

 1     *X↑ 2     + 22    *X +  4

ANSWER PLEASE.
?0
?22
?-14

SORRY, WRONG!
YOU DID  3     SUBTRACTIONS AND GOT  1     RIGHT. THIS
IS  33.3333     PER CENT CORRECT.
I THINK YOU'D BETTER RE-STUDY THE RULES FOR SUBTRACTION
AND THEN TRY ME AGAIN. I'LL BE WAITING. BYE!

DONE
```

QUADT
36335

TITLE: QUADT: Nature of Graph of $Ax^2+Bxy+Cy^2+Dx+Ey+F=0$

DESCRIPTION:

This program determines the nature of the graph of $Ax^2+Bxy+Cy^2+Dx+Ey+F=0$, after the operator inputs the six constants (A, B, C, D, E, F). Limiting cases, such as point or a line, are separated from the general cases so that the computer type-out gives the exact nature of the graph.

OBJECTIVE:

To permit exploration of the properties of the second-degree equation.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - should have a reasonable knowledge of conic section, second-degree equations in two unknowns, invariant functions of the coefficients under transformations, etc.

B. Materials - An overhead projector along with a transparency of the flow chart would be desirable.

DISCUSSION:

Before running the program, the teacher should discuss the general form of a second-degree equation in two variables, the functions of the coefficients used in the program, and the implications of the flow chart.

The discussion of the flow chart for this program enhances the understanding of the problem.

The type-out serves as a check on students' efforts in identifying second-degree equations.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
QUADT

    THIS PROGRAM DETERMINES THE NATURE OF THE GRAPH OF:
        A*X↑2+B*X*Y+C*Y↑2+D*X+E*Y+F=0
    ENTER YOUR CONSTANTS IN THE ORDER LISTED ABOVE.

?5,8,5,0,0,0
THE GRAPH OF YOUR EQUATION IS A SINGLE POINT.

ANOTHER RUN (1=YES, 0=NO) : ?5,8---1

    ENTER YOUR CONSTANTS IN THE ORDER LISTED ABOVE.

?5,8,5,0,0,36
THERE IS NO REAL LOCUS FOR YOUR EQUATION.

ANOTHER RUN (1=YES, 0=NO) : ?1

    ENTER YOUR CONSTANTS IN THE ORDER LISTED ABOVE.

?0,50-,0,0,0,9
THE GRAPH OF YOUR EQUATION IS A HYPERBOLA.

ANOTHER RUN (1=YES, 0=NO) : ?1

    ENTER YOUR CONSTANTS IN THE ORDER LISTED ABOVE.

?1,0,1,0,-16,-16
THE GRAPH OF YOUR EQUATION IS A CIRCLE.

ANOTHER RUN (1=YES, 0=NO) : ?1

    ENTER YOUR CONSTANTS IN THE ORDER LISTED ABOVE.

?0,0,0,5,-10,6
THE GRAPH OF YOUR EQUATION IS A SINGLE STRAIGHT LINE.

ANOTHER RUN (1=YES, 0=NO) : ?1

    ENTER YOUR CONSTANTS IN THE ORDER LISTED ABOVE.

?1,0,0,6,0,-4
THE GRAPH OF YOUR EQUATION CONSISTS OF 2 PARALLEL LINES.

ANOTHER RUN (1=YES, 0=NO) : ?1

    ENTER YOUR CONSTANTS IN THE ORDER LISTED ABOVE.

?1,0,0,6,1,-4
THE GRAPH OF YOUR EQUATION IS A PARABOLA.

ANOTHER RUN (1=YES, 0=NO) : ?0


DONE
```

RATIO
36336

TITLE: RATIO: Solves Proportions

DESCRIPTION:

This program solves a proportion of the type A/B = C/D. A, B, C, or D can be unknown.

OBJECTIVES:

A. To teach the student(s) the relationships in a proportion.

B. To aid in teaching the solution of proportions.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - no particular preparation necessary

B. Materials - see discussion

DISCUSSION:

The student is given the opportunity to see any number of solutions to proportions. The program then asks a series of questions designed to allow the student to discover that in a proportion, the product of the means equals the product of the extremes. The program can be used either with individual students or with an entire class depending upon the availability of equipment to display the output. The running time varies, depending upon the number of proportions you wish to solve. In 10 to 15 minutes, the program can be run with about 100 proportion problems. Included in this time is a built-in variable pause for observation of the tabulated results. Another value of using this program is that the teacher can easily handle numbers in proportions that heretofore were too difficult.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN
RUN
RATIO

THIS PROGRAM SOLVES FOR THE UNKNOWN IN THE PROPORTION
A/B AS C/D. USE A ZERO AS A DUMMY VALUE FOR THE UNKNOWN.

HOW MANY PROPORTIONS DO YOU WISH TO SOLVE?4
WHAT ARE THE VALUES FOR A,B,C,D?3,4,6,0

                    3    / 4     AS  6    / 8

WHAT ARE THE VALUES FOR A,B,C,D?1,10,5,50
YOU FORGOT TO INPUT A ZERO FOR YOUR
UNKNOWN.  TRY AGAIN.?1,10,0,50

                    1    / 10    AS  5    / 50

WHAT ARE THE VALUES FOR A,B,C,D?5,15,72,0

                    5    / 15    AS  72   / 216

WHAT ARE THE VALUES FOR A,B,C,D?6,0,3,39

                    6    / 78    AS  3    / 39


TAKE A GOOD LOOK AT THE PROPORTIONS.  THE TWO MIDDLE
POSITION NUMBERS ARE CALLED THE 'MEANS', THE TWO
END POSITION NUMBERS ARE CALLED THE 'EXTREMES'.

LOOK AT THE 'MEANS' AND THE 'EXTREMES' -    SEE IF
YOU CAN FIND SOME KIND OF RELATIONSHIP BETWEEN THEM.
WHEN YOU THINK YOU HAVE FOUND A RELATIONSHIP BETWEEN
THE 'MEANS' AND THE 'EXTREMES', TYPE 1 AND HIT THE RETURN KEY.
?1


DID YOU SEE THAT IF YOU MULTIPLY THE 'MEANS'
AND MULTIPLY THE 'EXTREMES', THE PRODUCTS ARE EQUAL?

IN THE LAST PROPORTION  78   X 3    EQUALS 6    X 39
CHECK THE OTHERS, TOO.  WHEN YOU ARE READY TO CONTINUE,
TYPE 1 AND HIT THE RETURN KEY.
?1


IF YOU WISH TO USE THIS PROGRAM AGAIN TYPE 1, IF NOT TYPE 0
?0

DONE
```

ROOTS2
36625

TITLE: QUADRATIC EQUATION SOLVER

DESCRIPTION:

This program describes the nature of the roots of a quadratic equation, and finds the roots whether real or complex.

OBJECTIVES:

A. To familiarize the student with quadratic function.

B. To review and drill exercise... to study the nature of roots.

C. To emphasize that roots of f(x) = 0 are the same as x-intercepts of f(x) = y.

D. To impress the student with geometric interpretation(s) of the nature of roots.

E. To provide "lead-in" material for the introduction of further study of the real number line, the real cartesian plane, complex numbers, quadratic inequalities, etc.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - The teacher can use the program to introduce the students to the quadratic formula, to conclude discussion of the quadratic formula...or both.

B. Materials - None

DISCUSSION:

The program uses the "discriminant" to determine the nature of the roots of the quadratic equation. Regardless of the nature of the roots, the student is asked to graph y = F(x), and to compare his graph with the kind of roots he finds for a specific F(x) = 0. He should be impressed with the picture; and he should understand (ultimately) the reasonableness and validity of the analytic methods presented in class.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN


RUN
ROOTS2

THIS PROGRAM HANDLES ALL THE POSSIBLE CASES OF SOLUTION OFTHE EQUATION :

     A * X ↑ 2  +  B * X  +  C  =  0

TYPE IN YOUR VALUES FOR A, B, AND C : ?1,2,3

DISCRIMINANT IS LESS THAN ZERO, SO ROOTS ARE IMAGINARY.
THEY ARE OF THE FORM :  P+I*Q , P-I*Q , WHERE :
P=-1            Q= 1.41421

                                ***


DO YOU WANT ANOTHER RUN (0 = NO , 1 = YES ) : ?1

TYPE IN YOUR VALUES FOR A, B, AND C : ?1,7,3

DISCRIMINANT IS GREATER THAN ZERO, SO ROOTS ARE REAL.
ROOTS ARE X1 AND X2 .
X1 =-.458619                    X2 =-6.54138

                                ***


DO YOU WANT ANOTHER RUN (0 = NO , 1 = YES ) : ?1

TYPE IN YOUR VALUES FOR A, B, AND C : ?1,6,9

DISCRIMINANT IS EUQAL TO ZERO, SO ROOTS ARE EQUAL. X =-3

                                ***


DO YOU WANT ANOTHER RUN (0 = NO , 1 = YES ) : ?1

TYPE IN YOUR VALUES FOR A, B, AND C : ?2,8,6

DISCRIMINANT IS GREATER THAN ZERO, SO ROOTS ARE REAL.
ROOTS ARE X1 AND X2 .
X1 =-1          X2 =-3

                                ***


DO YOU WANT ANOTHER RUN (0 = NO , 1 = YES ) : ?0

DONE
```

CONTRIBUTED PROGRAM **BASIC**

SAT
36182

TITLE: TRIGONOMETRIC SOLUTIONS OF TRIANGLES

DESCRIPTION:

The program is a compilation of several programs which solve for the remaining parts of a triangle given three parts. The program uses the Law of Sines, the Law of Tangents, and the Half-Angle Formulas. The user must know the given information.

INSTRUCTIONS:

Instructions are included in the program and input is conversational.

SPECIAL CONSIDERATIONS:

If this is used with the Educational system on a single terminal the program is too long unless the matrix package is deleted.

ACKNOWLEDGEMENTS:

Robert Watson/William Smith
Haddonfield Memorial High School

```
RUN
RUN
SAT

THIS PROGRAM WILL SOLVE ANY TRIANGLE GIVEN;
(1)AAS  (2)SSA  (3)SAS  (4)ASA  (5)SSS
WHEN ENTERING ANGLES, ENTER THE DEGREES AND MINUTES
SEPERATED BY A COMMA;I.E. 36,50 FOR 36 DEG50MIN AND 26,0FOR 26 DEGREES.
THE ORDER THE PARTS ARE ENTERED IS IMPORTANT!
PLEASE INPUT THE NUMBER CORRESPONDING TO YOUR PROBLEM.
?3
ENTER THE TWO SIDES AND THE INCLUDED ANGLE. IN THAT ORDER!
?7,9,60,0
THIS IS AN ACUTE TRIANGLE.
                    ANGLES                      SIDES
               DEGREES         MINUTES
A1=             47              47.02          A= 7
B1=             72              12.98          B= 9
C1=             60              0              C= 8.18535
PLEASE INPUT THE NUMBER CORRESPONDING TO YOUR PROBLEM.
?4
INPUT THE TWO ANGLES AND THEN THE INCLUDED SIDE.
?48,31,75,11,284.8
THIS IS AN ACUTE TRIANGLE.
                    ANGLES                      SIDES
               DEGREES         MINUTES
A1=             48              31             A= 256.453
B1=             56              17.99          B= 284.8
C1=             75              11             C= 330.944
PLEASE INPUT THE NUMBER CORRESPONDING TO YOUR PROBLEM.
?2
INPUT THE TWO SIDES AND THEN THE ANGLE OPPOSITE THE SECOND SIDE.
?18.25
??26.43,56,16
THERE IS ONLY ONE TRIANGLE FORMED.
THIS IS AN ACUTE TRIANGLE.
                    ANGLES                      SIDES
               DEGREES         MINUTES
A1=             35              2.8            A= 18.25
B1=             56              16             B= 26.43
C1=             88              41.19          C= 31.7726
PLEASE INPUT THE NUMBER CORRESPONDING TO YOUR PROBLEM.
?5
ENTER THE THREE SIDES!
?2,3,5

DIVIDE BY ZERO - WARNING ONLY  IN LINE 5060

UNDERFLOW - WARNING ONLY IN LINE 5060
THIS IS AN OBTUSE TRIANGLE.
                    ANGLES                      SIDES
               DEGREES         MINUTES
A1=             0               0              A= 2
B1=             0               0              B= 3
C1=             180             0              C= 5
PLEASE INPUT THE NUMBER CORRESPONDING TO YOUR PROBLEM.
?5
ENTER THE THREE SIDES!
?2,3,4
THIS IS AN OBTUSE TRIANGLE.
                    ANGLES                      SIDES
               DEGREES         MINUTES
A1=             28              57.3           A= 2
B1=             46              34.05          B= 3
C1=             104             28.65          C= 4
PLEASE INPUT THE NUMBER CORRESPONDING TO YOUR PROBLEM.
?1
INPUT THE TWO ANGLES AND THEN THE SIDE OPPOSITE THE SECOND SIDE.
?39,46,81,54,36.92
THIS IS AN ACUTE TRIANGLE.
                    ANGLES                      SIDES
               DEGREES         MINUTES
A1=             39              46             A= 23.8543
B1=             81              53.99          B= 36.92
C1=             58              19.99          C= 31.7399
PLEASE INPUT THE NUMBER CORRESPONDING TO YOUR PROBLEM.
?
DONE
```

SETS

TITLE: SETS: Union and Intersection of Sets 36337

DESCRIPTION:

This program finds the intersection and union of any two numerical sets.

OBJECTIVES:

A. To motivate students to find the union and intersection of any two sets.

B. To learn the logic involved in finding the union and intersection.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - no special preparation necessary.

B. Materials - see discussion

DISCUSSION:

This program may be used with individuals, small groups, or class-size groups. The elements of the two sets are entered as per instructions. Incidently, one or both of the sets may be empty. The computer then types back the elements in the union and intersection. The speed with which the computer operates enables the students to see a great many examples, giving them the opportunity to make discoveries about what is the union and what is an intersection of two sets. The teacher may use the flow chart that follows to explain the logic behind finding the union and intersection.

It is suggested that when used with large groups, a supplementary device be used to display output.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
SETS

THIS PROGRAM FINDS THE UNION AND INTERSECTION OF ANY TWO
NUMERICAL SETS.

  HOW MANY ELEMENTS IN THE FIRST SET?5

THESE ARE - (HIT THE RETURN KEY AFTER ENTERING EACH ELEMENT?2
?4
?6
?8
?10

  HOW MANY ELEMENTS IN THE SECOND SET?6

THESE ARE:
?1
?2
?3
?4
?5
?6


THE INTERSECTION CONTAINS  2     4     6
THE UNION CONTAINS 1     2     3     4     5     6     8     10

DO YOU WANT ANOTHDR RUN (1=YES, 0=NO) : ?0

DONE
```

SIPRAC
36238

TITLE: PRACTICE WITH SIGNED NUMBERS

DESCRIPTION:

This program presents the student with a random number of problems dealing with addition, subtraction, or multiplication of signed numbers. The student has a set amount of time in which to answer before the next problem is posed. (As written this time is set to 5 seconds). At the end of his list he is told the number correct, the percent correct, and the problems which he missed.

INSTRUCTIONS:

Instructions are included on an optional basis within the program. The student is asked his "lucky" number and told how many problems will be stated. The time constant is set in line 20 (variable K).

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Algebra I or General Mathematics
Student Background Required: Knowledge of the sign rules for addition, subtraction and multiplication of signed numbers.
Application: This program provides good drill on an individual basis (since each student gets a list of different problems and of different length. The time constant may be adjusted to make this a challenge for even the best students or a success experience for the slower ones.

ACKNOWLEDGEMENTS: Michael Bolduan
Clackamas High School

RUN

```
RUN
SIPRAC

SIGNED NUMBER MANIPULATION PRACTICE .......


DO YOU WANT DIRECTIONS?YES
IN THIS PROGRAM YOU WILL BE PRACTICING ADDITION,SUBTRACTION,
AND MULTIPLICATION OF SIGNED NUMBERS . YOU WILL HAVE
 5    SECONDS AFTER THE PROBLEM IS STATED IN WHICH TO
TYPE IN YOUR ANSWER. (MULTIPLICATION WILL BE SHOWN
BY USING AN 'X'.
WHAT'S YOUR LUCKY NUMBER?8
YOU'LL BE DOING  10   PROBLEMS. GOOD LUCK!!


NO.  1    :      -9    +   14    =5
NO.  2    :       17   X  -19    =
TOO LATE! TRY THE NEXT ONE.
NO.  3    :       8    X   11    =88
NO.  4    :      -8    -   16    =-
TOO LATE! TRY THE NEXT ONE.
NO.  5    :       10   -   8     =2
NO.  6    :      -18   X   12    =6
NO.  7    :       14   +  -4     =10
NO.  8    :      -7    X   14    =
TOO LATE! TRY THE NEXT ONE.
NO.  9    :       19   X   10    =190
NO.  10   :       14   +   0     =14


HERE'S HOW YOU DID:

            YOU GOT  6    RIGHT OUT OF  10
            THIS IS  60   PERCENT.
            YOU MISSED THE FOLLOWING PROBLEMS:

     NO.  2        NO.  4        NO.  6        NO.  8
CORRECT YOUR ERRORS AND TURN IN YOUR PAPER FOR CREDIT.

DONE

GET-SIPRAC
RUN
SIPRAC

SIGNED NUMBER MANIPULATION PRACTICE .......


DO YOU WANT DIRECTIONS?NO
WHAT'S YOUR LUCKY NUMBER?5
YOU'LL BE DOING  5    PROBLEMS. GOOD LUCK!!


NO.  1    :       5    X   8     =40
NO.  2    :      -1    -   19    =
TOO LATE! TRY THE NEXT ONE.
NO.  3    :       19   +   7     =26
NO.  4    :       16   -   18    =-2
NO.  5    :      -1    X   7     =-7


HERE'S HOW YOU DID:

            YOU GOT  4    RIGHT OUT OF  5
            THIS IS  80   PERCENT.
            YOU MISSED THE FOLLOWING PROBLEMS:

     NO.  2
CORRECT YOUR ERRORS AND TURN IN YOUR PAPER FOR CREDIT.

DONE
```

SLOPE
36626

TITLE: FINDS DERIVATIVES

DESCRIPTION:

This program considers a function which is differentiable at x=a, and at all points in the interval [a,a+1]. The value of the derivative at x=a is approximated through secant slopes.

OBJECTIVES:

A. The preliminary discussion of the method whereby the machine solves the problem enhances the students' comprehension of the techniques. These techniques are then used in developing the analytic method for finding the slope of the tangent line.

B. The type-out of successive approximations to the tangent slope clarifies and dramatizes the nature of the limiting processes.

C. Time-saving factor through the elimination of lengthy computations.

INSTRUCTIONS:

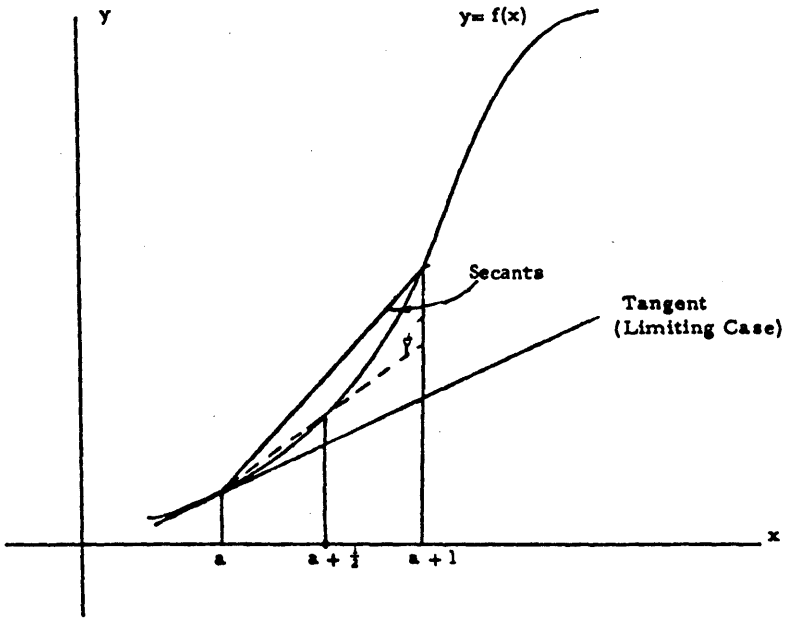
PRELIMINARY PREPARATION:

A. Materials - The diagram below may be shown to the students on a blackboard, or an overhead projector, to explain the computations geometrically.

(continued on following page)

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

Math
SLOPE



DISCUSSION:

The use of the computer and the attendant discussion of the program dramatically introduces the idea of differentiation.

```
RUN


RUN
SLOPE

          SECANT SLOPE OF A CURVE - THE DERIVATIVE

THIS PROGRAM CONSIDERS A FUNCTION OF X (Y=F(X)) WHICH IS
DIFFERENTIABLE AT X=A AND AT ALL POINTS IN THE INTERVAL
(A,A+1).  THE VALUE OF THE DERIVATIVE AT X=A IS
APPROXIMATED THROUGH SECANT SLOPES.

AFTER THE PROGRAM STOPS, TYPE IN THE FOLLOWING:
(END EACH LINE, INCLUDING 'RUN', WITH A 'CARRIAGE RETURN')

          1 GO TO 300
          300 DEF FNY(X)=....(YOUR FUNCTION OF X)....
          RUN

FOR EXAMPLE, TO FIND THE SLOPE OF THE EQUATION Y=X↑3
YOU WOULD TYPE AS FOLLOWS:

          1 GO TO 300
          300 DEF FNY(X)=X↑3
          RUN

YOU MIGHT TRY THAT AS YOUR FIRST RUN.
FOR SUBSEQUENT RUNS, YOU NEED ONLY CHANGE LINE 300 FOR
A NEW FUNCTION, FOLLOWED BY 'RUN'.

DONE

1  GOTO 300
300  DEF FNY(X)=X↑3
RUN
SLOPE

FOR WHAT VALUE OF A IS THE SLOPE TO BE EVALUATED?2

'CHANGE IN X' IS THE DISTANCE FROM 'A', AND 'CHANGE IN Y'
IS THE DISTANCE FROM 'F(A)' UPON WHICH THE SLOPE IS CALCULATED.


CHANGE IN X     CHANGE IN Y     SECANT SLOPE    % CHANGE IN SLOPE
------ -- -     ------ -- -     ------ -----    - ------ -- -----
1/ 1             19              19             NO PREVIOUS VALUE
1/ 2             7.625           15.25           19.7368
1/ 4             3.39062         13.5625         11.0656
1/ 8             1.5957          12.7656         5.87558
1/ 16            .773682         12.3789         3.02938
1/ 32            .38089          12.1885         1.53834
1/ 64            .188969         12.094          .775178
1/ 128           9.41162E-02     12.0469         .389608
1/ 256           4.69666E-02     12.0234         .194553
1/ 512           2.34604E-02     12.0117         9.74659E-02
1/ 1024          1.17245E-02     12.0059         4.87805E-02
1/ 2048          5.86128E-03     12.0039         1.62681E-02

*****

DO YOU WISH TO USE A DIFFERENT VALUE OF X (1-YES, 0-NO)?0
TO CHANGE YOUR FUNCTION SEE THE INSTRUCTIONS.
IF YOU ARE FINISHED, TYPE '1', AND THE 'RETURN' KEY
AFTER THE PROGRAM STOPS.

DONE
```

SQRT
36627

TITLE: FINDS SQUARE ROOT

DESCRIPTION:

This program finds the square root of counting numbers up to five decimal places.

OBJECTIVES:

A. To demonstrate and familiarize the students with square roots.

B. The method utilizes "pinching" $\sqrt{Z}$ between the endpoints of smaller and smaller domains.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - 1) The definition of square root as the inverse operation of squaring; and 2) Drill in estimating square roots to the nearest tenth, hundredth, etc.

B. Materials - None

DISCUSSION:

This program provides an "introduction to", and a "review of" evolution and involution. Limiting the neighborhood of $\sqrt{Z}$ to find successively closer approximations of the square root of a number, demonstrates to the student that he is able to determine the square root to any degree.

The program may be effectively utilized for introducing the limiting process.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

```
RUN


RUN
SQRT

PROGRAM FINDS SQUARE ROOT OF ANY POSITIVE NUMBER
BY 'PINCHING' IT WITHIN A SMALLER AND SMALLER INTERVAL.


WHAT IS THE NUMBER WHOSE SQUARE ROOT YOU SEEK?54

LOWER LIMIT                                    UPPER LIMIT
----- -----                                    ----- -----
 0              < SQ.RT. OF 54    <              54
 5.4            < SQ.RT. OF 54    <              10.8
 7.02           < SQ.RT. OF 54    <              7.56
 7.344          < SQ.RT. OF 54    <              7.398
 7.344          < SQ.RT. OF 54    <              7.3494
 7.34832        < SQ.RT. OF 54    <              7.34886
 7.34843        < SQ.RT. OF 54    <              7.34848
 7.34847        < SQ.RT. OF 54    <              7.34847

APPROXIMATION NOW CORRECT TO AN ACCURACY OF .0001
YOU MAY USE EITHER 7.34847    OR 7.34847    AS THE SQUARE ROOT OF 54


WANT TO TRY ANOTHER NUMBER (1=YES, 0=NO) : ?1


WHAT IS THE NUMBER WHOSE SQUARE ROOT YOU SEEK?39

LOWER LIMIT                                    UPPER LIMIT
----- -----                                    ----- -----
 0              < SQ.RT. OF 39    <              39
 3.9            < SQ.RT. OF 39    <              7.8
 6.24           < SQ.RT. OF 39    <              6.63
 6.24           < SQ.RT. OF 39    <              6.279
 6.2439         < SQ.RT. OF 39    <              6.2478
 6.24468        < SQ.RT. OF 39    <              6.24507
 6.245          < SQ.RT. OF 39    <              6.24503
 6.245          < SQ.RT. OF 39    <              6.245

APPROXIMATION NOW CORRECT TO AN ACCURACY OF .0001
YOU MAY USE EITHER 6.245      OR 6.245      AS THE SQUARE ROOT OF 39


WANT TO TRY ANOTHER NUMBER (1=YES, 0=NO) : ?0

DONE
```

STATAL
36628

TITLE: ARITHMETIC MEAN

DESCRIPTION:

This program finds the average (arithmetic mean), median, and standard deviation of up to one hundred numbers.

OBJECTIVES:

A. To familiarize the student with the concepts of arithmetic mean (average), median, and standard deviation of a group of numbers.

B. To impress him with the speed and accuracy of the computer as a calculating device.

C. To provide teachers with handy means of computing averages.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - "Arithmetic mean", "average", "median", and "standard deviation" must be well-defined.

B. Materials - None

DISCUSSION:

Given N terms, "A(1), A(2),..., A(N-1), A(N)", students will have learned the average of these N terms is "$\frac{A(1)+A(2)+...A(N-1)+A(N)}{N}$".

The program prints out the median value of the user's data when there is an odd number of data values. When there is an even number, the median value printed is the average between the N/2 and the (N+2)/2 terms.

The program serves as an excellent vehicle for drill in division and addition, and helps strengthen the concept of arithmetic mean (average).

This program is useful in demonstrating a simple "loop" routine for students interested in programming.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN


RUN
STATAL

               MEAN, MEDIAN, AND DEVIATION OF A SET OF NUMBERS.

 ENTER YOUR NUMBERS IN DATA STATEMENTS ON LINES
 1000 - 2000.  FOR EXAMPLE, YOU MIGHT TYPE :

               1000 DATA  1,2,3,4  ETC. (YOUR DATA GOES HERE)

 WHEN YOUR DATA HAS BEEN ENTERED,  TYPE :

               1 GO TO 300
               RUN

 THEN RELAX WHILE THE MACHINE GRINDS OUT THE ANSWERS.

 IF A 'SUBSCRIPT ERROR' APPEARS, INCREASE THE SIZE OF THE
 ARRAY IN LINE 295.

 WARNING -- THE NUMBER 9999 IS USED AS AN INTERNAL DATA
 VALUE.  IF THIS VALUE IS ONE OF YOUR DATA VALUES, SIMPLY
 RE-TYPE LINES 999 AND 2001 WITH A COMMON DATA VALUE WHICH
 YOU WILL NOT USE.

DONE

1000  DATA 244,182,112,2,198,10,314,169,18,38
1     GOTO 300
RUN
STATAL


 THESE ARE YOUR NUMBERS :
 244   182   112   2     198   10    314   169   18    38

 THESE ARE YOUR NUMBERS (HIGHEST TO LOWEST) :
 314   244   198   182   169   112   38    18    10    2


 NUMBER OF VALUES IS 10
 SUM OF THE VALUES IS 1287
 THE MEAN VALUE IS 128.7
 THE MEDIAN VALUE IS 140.5
 THE STANDARD DEVIATION IS 209.541


 FOR ANOTHER RUN, RE-ENTER DATA ON LINES
 1000 - 2000, TAKING CARE TO ELIMINATE OLD DATA
 BY TYPING THOSE LINE NUMBERS WHICH YOU DO NOT USE AGAIN;
 THEN TYPE 'RUN'.

DONE
```

TITLE: SURFAC: Area of Surface of Revolution

SURFAC
36338

DESCRIPTION:

This program approximates the area of a surface of revolution, by computing lateral areas of frustrums of cones of revolution.

OBJECTIVES:

A. The saving of time in computations.

B. The speedy demonstration of limiting processes.

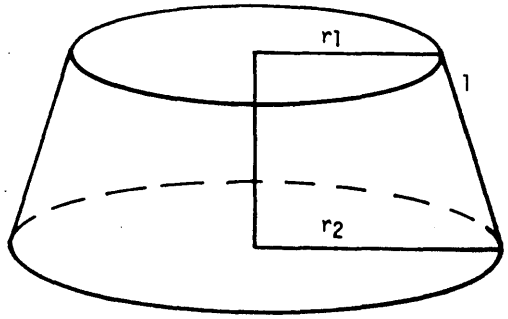
C. The focusing of attention upon those processes needed to develop the analytic approach.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

Before running this program, the lateral area of a frustrum of a cone should be discussed. Many students in the Advanced Placement Program have not taken a course in Solid Geometry and may be unfamiliar with the formula:

$$\text{Lateral Area} = \pi\, l\, (r_1 + r_2)$$



Frustrum of a Cone

Whether or not this formula is derived in class will depend on the amount of time available. Most likely it will merely be stated; students who have not taken Solid Geometry may be asked to look up the derivation on their own.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
SURFAC

                AREA OF A SURFACE OF REVOLUTION

    THIS PROGRAM APPROXIMATES THE AREA OF A SURFACE OF
REVOLUTION BY COMPUTING LATERAL AREAS OF FRUSTUMS OF CONES
OF REVOLUTION.  TYPE IN YOUR FUNCTION OF X (Y=F(X)),
WHOSE GRAPH WILL BE ROTATED ABOUT THE X AXIS, AS FOLLOWS:

       1 GO TO 200
       300 DEF FNY(X)=...(YOUR FUNCTION OF X)...
       RUN

FOR EXAMPLE, TO USE THE FUNCTION Y=X↑2 YOU WOULD TYPE:

       1 GO TO 200
       300 DEF FNY(X)=X↑2
       RUN

YOU MIGHT TRY THAT AS YOUR FIRST RUN.
END EACH LINE, INCLUDING 'RUN', WITH THE 'RETURN' KEY.

DONE
1 GO TO 200
300 DEF FNY(X)=X↑2
RUN
SURFAC

WHAT ARE THE ABSCISSAS OF THE END POINTS OF THE SECTION
TO BE CONSIDERED (SMALLER FIRST: P,Q)?-3,2

NUMBER OF       SUM OF                    % CHANGE
SUBINTERVALS    APPROXIMATING AREAS       IN SUM
------------    -------------------       --------
 1               288.787                     NO PREVIOUS VALUE
 2               324.623                     11.6841
 4               317.682                     2.16125
 8               315.335                     .741601
 16              314.743                     .187694
 32              314.593                     4.76964E-02
 64              314.556                     1.18549E-02
 128             314.546                     3.08522E-03

WOULD YOU LIKE TO TRY NEW END POINTS (1-YES, 0-NO)?0
TO ENTER A NEW FUNCTION YOU NEED ONLY RETYPE LINE
300 AND 'RUN'.  SEE INSTRUCTIONS FOR MORE DETAILS.
IF YOU ARE FINISHED, TYPE '1' AND THE 'RETURN' KEY.

DONE
```

SYSSOL
36278

TITLE: SOLVING SYSTEMS OF LINEAR EQUATIONS

DESCRIPTION:

This program solves systems of linear equations for up to twenty equations in twenty variables. It will solve even over-or underdetermined systems. It employs Gaussian Elimination, and will automatically round the difference of two numbers to zero if six significant digits of accuracy have been lost. Also, if the system is underdetermined, the solution is in the form $X+A_1X_1+A_2X_2\ldots$, where the X_i and X are vectors, and A_1, $A_2\ldots$ are arbitrary constants. The user has the option of having the X_i orthogonalized or orthonormalized.

INSTRUCTIONS:

The program asks if the user wishes printouts (text) in terms of Linear Transformations or Simultaneous equations (LIN or SIM). Since this program will solve at the same time up to five systems with the same coefficient matrix, like:

$$\begin{bmatrix} 1x+2y \\ -1x+3y \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \end{bmatrix} \text{ and } \begin{bmatrix} x+2y \\ -x+3y \end{bmatrix} = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$$

The next input is how many of these systems there are (in this case 2). The next input is the elements of the coefficient matrix and the elements of the constant(s) array, in this case 1, 3, 2, 2 (these are the elements to the right of the equals sign). The program gives the user the option of verifying this input, and also seeing a copy of the reduced matrix.

SPECIAL CONSIDERATIONS:

This program is subject to the same accuracy problems as any using the Gaussian Elimination method.

ACKNOWLEDGEMENTS:

Phillip Short
Burnsville Senior High School

```
RUN


RUN
SYSSOL

DO YOU WANT PRINTOUTS TO BE IN TERMS OF LINEAR TRANSFORMATIONS OR
IN TERMS OF SIMULTANEOUS EQUATIONS?SIM


DO YOU WISH A DESCRIPTION?YES


     THIS PROGRAM SOLVES SYSTEMS OF LINEAR EQUATIONS.  IT CAN
FIND THE SOLUTIONSET OF A GIVEN SET OF COEFFICIENTS WITH UP TO
5 DIFFERENT SETS C. CONSTANT TERMS.  IF THE SOLUTION IS NOT
UNIQUE, IT CONSISTS OF A LINEAR COMBINATION OF ORDERED N-TUPLES
V,W, ETC, ADDED TO A CONSTANT N-TUPLE, THE LATTER OF WHICH DEPENDS
ON THE ABOVE MENTIONED CONSTANT TERMS.  THE V,W, ARE GIVEN
(OUTPUTTED) FIRST, THEN THE CONSTANT N-TUPLES ONE BY ONE.


HOW MANY EQUATIONS ARE THERE?3

HOW MANY VARIABLES?3

HOW MANY SETS OF CONSTANTS?2


INPUT THE COEFFICIENT MATRIX ROW BY ROW?1,2,3,4,4,4,5,6,7

INPUT THE ARRAY OF CONSTANTS ROW BY ROW?2,8,8,31,10,40


DO YOU WANT VERIFICATION OF INPUT?YES


HERE IS A COPY OF THE COEFFICIENT MATRIX.

X      X      X
 1      2      3


 1      2      3

 4      4      4

 5      6      7

HERE IS A COPY OF THE MATRIX OF CONSTANTS.

C      C
 1      2


 2      8

 8      31

 10     40

                  ****************************


DO YOU WISH A COPY OF THE REDUCED MATRIX?YES
```

```
X      X      X
 1      2      3

 1      0     -1

 0      1      2

 0      0      0



C      C
 1      2

 2      7.5

 0      .25

 0      1

DO YOU WISH THE BASIS TO BE ORTHOGONALIZED?NO


THE SOLUTION CONSISTS OF ANY LINEAR COMBINATION OF THE FOLLOWING
N-TUPLES, PLUS THE CONSTANT N-TUPLE, TO BE GIVEN SHORTLY.
[ 1     -2      1     ]


THE CONSTANT N-TUPLE IN SYSTEM 1     IS:

[ 2      0      0     ]


SYSTEM# 2     IS INCONSISTENT.


DONE


RUN
SYSSOL

DO YOU WANT PRINTOUTS TO BE IN TERMS OF LINEAR TRANSFORMATIONS OR
IN TERMS OF SIMULTANEOUS EQUATIONS?LIN


DO YOU WISH A DESCRIPTION?NO


WHAT IS THE DIMENSION OF THE IMAGE SPACE?3

WHAT IS THE DIMENSION OF THE PRE-IMAGE SPACE?3

HOW MANY IMAGE VECTORS?2


INPUT THE TRANSFORMATION MATRIX ROW BY ROW?1,2,3,0,0,0,0,0,0

INPUT THE IMAGE VECTORS, FIRST ALL THE FIRST COMPONENTS,
THEN ALL THE SECOND COMPONENTS, ETC...OK?1,3,0,0,0,1


DO YOU WANT VERIFICATION OF INPUT?NO


                  ******************************
```

```
DO YOU WISH A COPY OF THE REDUCED MATRIX?NO
DO YOU WISH THE BASIS TO BE ORTHOGONALIZED?YES
DO YOU WISH IT ORTHOGONALIZED OR ORTHONORMALIZED?ORTHONORMALIZED

HERE IS A BASIS OF THE NULL SPACE AS SPECIFIED.
[-.894427      .447214      0     ]

+[-.358569     -.717137      .597614     ]

THE PRE-IMAGE VECTOR FOR IMAGE VECTOR 1     IS:

[ .794082     -1.18368E-02     7.65306E-02    ]

IMAGE VECTOR # 2     HAS NO CORRESPONDING PRE-IMAGE.

DONE
```

TENS

TITLE: DRILL IN MULTIPLICATION OF NUMBERS WITH TRAILING ZEROES 36128

DESCRIPTION:

TENS drills students in the multiplication of numbers of the form $A \times 10^n$, e.g. 3000 x 400 =

By affording the student only a few seconds to answer, it encourages him to use a short-cut method.

TENS gives 25 problems and scores the student responses.

INSTRUCTIONS:

The teacher may vary the Time-Out factor by changing the value of Z in line 100.

ACKNOWLEDGEMENTS:

Tim Aaronson
Woodrow Wilson High School / San Francisco

```
RUN

RUN
TENS

C  60    X    5      =  300
X  9000      X    5      =  4500
C  3     X    4000       =  12000
   70    X    9000       =  X
C  3     X    3      =  9
C  7     X    200    =  1400
X  7000      X    4000       =  280000000
C  5000      X    9      =  45000
C  6000      X    8000       =  48000000
C  70    X    500    =  35000
C  2     X    800    =  1600
X  30    X    900    =  21000
C  4000      X    800    =  3200000
C  9000      X    4      =  36000
C  90    X    800    =  72000
C  900   X    60     =  54000
C  6     X    20     =  120
C  600   X    20     =  12000
X  50    X    6      =  3000
C  8     X    4      =  32
C  700   X    400    =  280000
C  50    X    600    =  30000
X  60    X    700    =  43000
C  400   X    600    =  240000
C  3     X    50     =  150

YOU GOT    19    RIGHT AND    6     WRONG

DONE
```

CONTRIBUTED PROGRAM **BASIC**

TRIFAC
36237

TITLE: FACTORING QUADRATIC TRINOMIALS

DESCRIPTION:

This program asks a student for his "lucky" number. It then presents him with a random number of factoring problems based on this number (minimum of 6). When the student has his list he returns to his seat to work out the problems. When he has finished the set he prepares a DATA tape with his answers on it, feeds the tape into the program and RUNs it again. He is then informed of his errors and what percent he worked correctly.

INSTRUCTIONS:

Instructions to the student are included on an optional basis within the program. 25 lines may be used for DATA; it is suggested that one DATA line be used per problem. Data lines are 600 through 625. Enter data as follows: coefficient of trinomial, then coefficients of each factor.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Algebra I or as a review in Algebra II
Student Background Required: Knowledge of trinomial factoring
Application: This program may be used effectively to provide different students with completely different sets of problems (both in length and in content). It may be used with an entire class (average time per student at the terminal is 2-3 minutes) or with individuals for extra practice or makeup work.

ACKNOWLEDGEMENTS: Michael Bolduan
Clackamas High School

RUN

```
RUN
TRIFAC

DO YOU WANT DIRECTIONS?YES
IN THIS PROGRAM YOU'LL BE GIVEN SOME TRINOMIALS
WHICH ARE TO BE FACTORED. IN EACH CASE THE FACTORS
WILL BE TWO BINOMIALS. (WE'LL IGNORE ANY COMMON
FACTORS WHICH MAY APPEAR.) AFTER YOU HAVE YOUR
LIST OF PROBLEMS,RETURN TO YOUR SEAT TO SOLVE THEM
THEN SEE YOUR TEACHER FOR THE WAY TO MAKE A TAPE WITH
YOUR ANSWERS ON IT. WHEN YOU HAVE YOUR TAPE DO
THE FOLLOWING SERIES OF STEPS:


     A)  AT THE ON-LINE TTY TYPE     GET-TRIFAC
     B)  TYPE  TAPE
     C)  PUT YOUR TAPE IN THE READER AND TURN IT ON
     D)  WHEN TAPE IS THROUGH, TYPE    KEY
     E)  TYPE     RUN-600
WHAT'S YOUR LUCKY NUMBER?4


YOU WILL BE DOING  6    PROBLEMS


NO.  1
 21   *X↑2 +  34   *X + -35
NO.  2
 8    *X↑2 +  26   *X +  6
NO.  3
 18   *X↑2 + -39   *X +  20
NO.  4
 25   *X↑2 +  0    *X + -9
NO.  5
 20   *X↑2 +  25   *X +  5
NO.  6
 25   *X↑2 +  0    *X + -1
NOW RETURN TO YOUR SEAT TO WORK ON THESE.

DONE

600  DATA 21,34,-35,7,-5,3,+7
601  DATA 8,26,6,8,2,1,3
602  DATA 18,-39,1-20,3,-4,6,-5
603  DATA 25,0.,-9,5,-3,5,3
6:4 \
604  DATA 20,25,5,4,1,5,5
605  DATA 25,0,-1,5,-1,5,1

RUN-600
TRIFAC

HOW MANY PROBLEMS DID YOU DO?6
NO.  1
 21   *X↑2 +  34   *X + -35
 7    *X + -5    AND 3    *X +  7    ARE CORRECT.
NO.  2
 8    *X↑2 +  26   *X +  6
 8    *X +  2    AND 1    *X +  3    ARE CORRECT.
NO.  3
 18   *X↑2 + -39   *X +  20
 3    *X + -4    AND 6    *X + -5    ARE CORRECT.
NO.  4
 25   *X↑2 +  0    *X + -9
 5    *X + -3    AND 5    *X +  3    ARE CORRECT.
NO.  5
 20   *X↑2 +  25   *X +  5
 4    *X +  1    AND 5    *X +  5    ARE CORRECT.
NO.  6
 25   *X↑2 +  0    *X + -1
 5    *X + -1    AND 5    *X +  1    ARE CORRECT.
YOU GOT  6    RIGHT OUT OF  6    . THIS IS  100   PERCENT.
YOU SURE KNOW HOW TO FACTOR TRINOMIALS! GOOD WORK!

DONE
```

TRUTH

TITLE: TRUTH TABLES FOR BOOLEAN EXPRESSIONS 36602

DESCRIPTION:

This is a program to produce truth tables for Boolean expressions. The expression is analyzed into reverse polish form, and for all possible values of the variables in the expression, a truth value for the expression is computed.

INSTRUCTIONS:

Instructions are provided in the program.

Any single letter may be used as a variable. The Boolean operators are:

priority	symbol	mnemonic	description
1	'	NOT	negation
2	&	AND	conjunction
3	+	OR	disjunction
3	#	XOR	exclusive or
4	>	IF	conditional
5	=	IFF	biconditional

Note that OR and XOR have the same priority, these are evaluated left to right. All operators except NOT are binary operators and are placed between two quantities. Negation is indicated by an apostrophe (prime ?) following the quantity. Parentheses may be used at will to change the order of evaluation. Blanks in the expression are ignored.

SPECIAL CONSIDERATIONS:

Very little syntax checking is done. The program will try to evaluate any expression that is entered. It will only give an error message if it is impossible to evaluate the expression. Thus the user must take care that his expression is correct, otherwise the resultant truth table may not reflect his wishes.

Up to 26 separate variables are allowed. However, this would produce a truth table of 2^{26} = 67,108,864 lines if all 26 variables were used. This table would take about 10 years to print on a conventional teletype! The use of any of the 26 letters is to increase the user's choice of which ones he wishes to use.

Continued on following page.

ACKNOWLEDGEMENTS:

Lawrence E. Turner, Jr.
Pacific Union College

SPECIAL CONSIDERATIONS: continued

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Introductory Programming, Elementary Logic, Boolean Algebra

Student Background Required: Elementary concepts of logic or Boolean Algebra

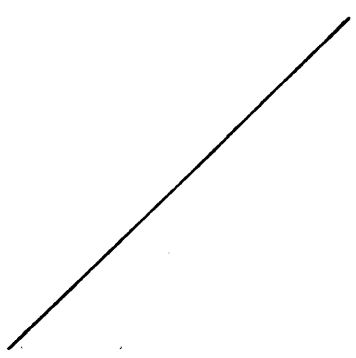
This program was specifically written for a course in introductory programming. One to two lectures are devoted to number systems and the elementary Boolean operators of: NOT, AND, and OR. Applications to circuit analysis and logic problems are illustrated both in the lectures and in the homework assignments. Typically the student would reduce a set of english statements to a Boolean expression and then evaluate the truth table for the result. The text in use is Introduction to Computers and Computer Science, by Richard C. Dorf (Boyd and Fraser Publishing Co., San Francisco, 1972).

In writing the program the operators: XOR, IF, and IFF were added to the above. Thus the program contains the commonly used Boolean operators and is applicable to elementary logic courses.

The program can quickly produce truth tables for very elaborate Boolean expressions, and may be used to reduce the tedious evaluations or as a check on the results. In addition many theorems that two expressions are equal may be easily checked by producing the truth tables for the two expressions and comparing them.

RUN

```
RUN
TRUTH

                TRUTH

'BEAUTY IS TRUTH, TRUTH BEAUTY--THAT IS ALL
   YE KNOW ON EARTH, AND ALL YE NEED TO KNOW.
                                        KEATS

INSTRUCTIONS ?YES

THIS PROGRAM PRODUCES TRUTH TABLES FOR BOOLEAN EXPRESSIONS.
ANY SINGLE LETTER MAY BE USED AS A VARIABLE.
THE BOOLEAN OPERATORS ARE:
 PRIORITY   SYMBOL   MNEMONIC   DESCRIPTION

    1         '        NOT      NEGATION  (UNARY OPERATOR)
    2         &        AND      CONJUNCTION
    3         +         OR      DISJUNCTION
    3         #        XOR      EXCLUSIVE OR
    4         >         IF      CONDITIONAL
    5         =        IFF      BICONDITIONAL

WITHIN A PRIORITY GROUP EVALUATION IS LEFT TO RIGHT.
ALL OPERATORS EXCEPT 'NOT' ARE BINARY AND ARE PLACED BETWEEN VARIABLES.
NEGATION IS INDICATED BY AN APOSTROPHE FOLLOWING THE QUANTITY.
PARENTHESIS MAY BE USED AT WILL TO CHANGE THE ORDER OF EVALUATION.


EXP=?F&B'+(C'+H&F)'


 F&B'+(C'+H&F)'

 F B C H  EXP
-------------

 0 0 0 0   0
 0 0 0 1   0
 0 0 1 0   1
 0 0 1 1   1
 0 1 0 0   0
 0 1 0 1   0
 0 1 1 0   1
 0 1 1 1   1
 1 0 0 0   1
```



```
 1 0 0 1   1
 1 0 1 0   1
 1 0 1 1   1
 1 1 0 0   0
 1 1 0 1   0
 1 1 1 0   1
 1 1 1 1   0


EXP=?
DONE
```

CONTRIBUTED PROGRAM **BASIC**

TITLE: MATHEMATICAL GAME OF TWENTY QUESTIONS

TWQUES
36130

DESCRIPTION:

TWQUES challenges the student to a game of mathematical twenty questions. The student must try to outwit the machine in finding out what number the machine is "thinking of." He communicates his guess by one of three assertions: the number is greater than, less than, or equal to a certain number.

The program encourages students to develop a strategy for narrowing the range of possibilities and enhances his understanding of the number-line.

INSTRUCTIONS:

TWQUES is initially set for a range of 0 to 100, but this may be changed at the discretion of the teacher by altering the value of Z in line 100.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: General Math, Elementary Arithmetic

1. Used to supplement Hewlett-Packard drill and practice program
2. Used to supplenent any arithmetic class

REFERENCES: John Holt's book, HOW CHILDREN FAIL, has a lucid description of the use of this game in a class situation.

ACKNOWLEDGEMENTS:

Tim Aaronson
Woodrow Wilson High School/San Francisco

```
RUN

RUN
TWQUES

    TWENTY QUESTIONS

I'M THINKING OF A NUMBER
BETWEEN  1    AND  100
TRY TO GUESS MY NUMBER!!!!!!!

YOU MAY ASK ME IF MY NUMBER IS
GREATER OR LESS THAN OR EQUAL TO SOME NUMBER

TYPE IN > OR< OR = AND YOUR GUESS

FOR EXAMPLE, IF YOU THINK THAT
MY NUMBER IS GREATER THAN 73, YOU WOULD
TYPE  >73  (THEN HIT THE RETURN KEY)

 UP, UP, AND AWAY.....

YOUR GUESS
>50  NO...  YOU NOW HAVE  19   QUESTIONS LEFT
YOUR GUESS
>25  NO...  YOU NOW HAVE  18   QUESTIONS LEFT
YOUR GUESS
>12  NO...  YOU NOW HAVE  17   QUESTIONS LEFT
YOUR GUESS
>6  YES... YOU NOW HAVE  16   QUESTIONS LEFT
YOUR GUESS
>9  NO...  YOU NOW HAVE  15   QUESTIONS LEFT
YOUR GUESS
=7  !!!!!!!  YOU GOT IT  !!!!!!!
DO YOU WANT ANOTHER TRY?NO
SO LONG, AND THANKS FOR THE GAME

DONE
```

VOLSOL
36339

TITLE: VOLSOL: Volume of Solid of Revolution

DESCRIPTION:

Through the use of cylindrical discs, the program approximates the volume of a solid of revolution generated by rotating about the x-axis the area bounded by y=f(x), the x-axis, and the vertical lines x=a and x=b.

OBJECTIVES:

To help the student understand the analytic procedures and to appreciate the nature of the limiting process.

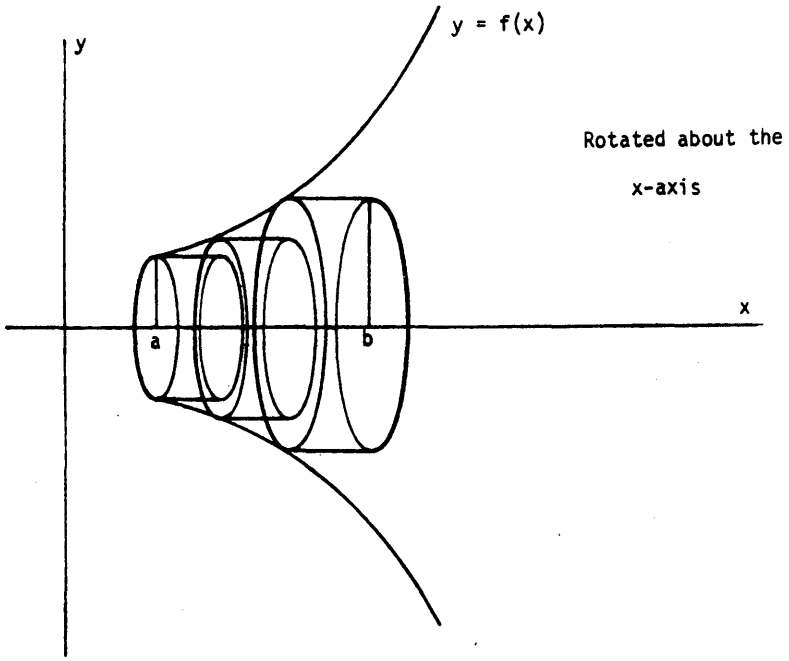
INSTRUCTIONS:

PRELIMINARY PREPARATION:

The class should be reminded of the formula for the volume of a cylinder, and the way in which a cylinder is generated by rotating a rectangle about one of its sides.

DISCUSSION:

It would be desirable to make use of an overhead projector transparency to display the cylindrical discs generated.



Approximation of Volume of Revolution by Cylindrical Discs

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
VOLSOL

                VOLUME OF A SOLID OF REVOLUTION

    THIS PROGRAM USES CYLINDRICAL DISCS TO APPROXIMATE
THE VOLUME OF A SOLID OF REVOLUTION.  THE SOLID IS GENE-
RATED BY ROTATING AB THE X-AXIS THE AREA BOUNDED BY
Y=F(X), THE LINES X=A AND X=B, AND THE X-AXIS.

TO INPUT YOUR FUNCTION OF X (Y=F(X)) TYPE AS FOLLOWS:

          1 GO TO 200
          220 DEF FNY(X)=....(YOUR FUNCTION OF X)....
          RUN

FOR EXAMP, TO USE THE FUNCTION Y=X↑2 YOU WOULD TYPE:

          1 GO TO 200
          220 DEF FNY(X)=X↑2
          RUN

YOU MIGHT TRY THAT AS YOUR FIRST EXAMPLE.
END EACH LINE, INCLUDING 'RUN', WITH THE 'RETURN' KEY.

DONE
1 GO TO 200
220 DEF FNY(X)=X↑2
RUN
VOLSOL

WHAT ARE YOUR VALUES FOR A AND B (SMALLER FIRST: A,B)?0,5

NUMBER OF          SUM OF                  % CHANGE
CYLINDERS      CYLINDER VOLUMES             IN SUM
---------      ----------------             --------
 1              0                 NO PREV. VALUE, OR IT WAS ZERO
 2              306.796           NO PREV. VALUE, OR IT WAS ZERO
 4              939.562                      206.25
 8              1400.95                      49.1071
 16             1669.48                      19.167
 32             1813.29                      8.61439
 64             1887.59                      4.09763
 128            1925.34                      1.99994
 256            1944.37                      .988143
 512            1953.92                      .491114


WOULD YOU LIKE TO TRY YOUR OWN 'NUMBER OF CYLINDERS' (1-YES, 0-NO)?0

*****

WOULD YOU LIKE TO TRY NEW VALUES OF A AND B (1-YES, 0-NO)?0
TO USE A NEW FUNCTION YOU NEED ONLY RETYPE LINE 220 AND
'RUN'.  SEE INSTRUCTIONS FOR MORE DETAILS.
IF YOU ARE FINISHED, TYPE '1' AND THE 'RETURN' KEY.

DONE
```

CONTRIBUTED PROGRAM **BASIC**

TITLE: GENERATES MATH WORKSHEETS

WKSHT
36133

DESCRIPTION:

Program generates a worksheet on basic math operations (addition, subtraction, multiplication, or division) of a specified level of difficulty (determined by the maximum number of digits in each of the two numbers with which the operation is to be performed). Spacing on the worksheet is such that it may be duplicated using ditto masters and run on 8 1/2" x 11" paper.

INSTRUCTIONS:

Teacher will be asked to input four types of information before the worksheet is generated:

1. Type of problem (addition, subtraction, multiplication, or division).
2. Maximum number of digits desired in each number (1,2, or 3).
3. Number of problems on the worksheet (up to 25).
4. Choice of whether answers are to be printed at the bottom of the page for student reference or whether additional blank print lines are to be inserted (so that when the answers are printed on the teletype roll, they will be positioned too low to be included on an 8 1/2" x 11" page, but will be available for teacher reference).

Subtraction problems with negative differences will not be generated.

Division problems involving division by zero will not be generated.

The two numbers with which the operation is to be performed will always be positive integers.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Basic mathematics in junior or senior high school, or mathematics for elementary grades.

This program can be used whenever the teacher wishes to have several sets of problems available that are similar in type and difficulty. This allows for much more individualizing of instruction. The teacher has the option (at the time that he originally generates the worksheets) of making the problem answers available to the students if he wishes to.

ACKNOWLEDGEMENTS:

Donald E. Gettinger
Stillwater Senior High School

```
RUN


RUN
WKSHT

TYPE 1 FOR ADDITION, 2 FOR SUBTRACTION, 3 FOR
MULTIPLICATION AND 4 FOR DIVISION.
?4
TYPE A 1, 2, OR 3 FOR THE NUMBER OF DIGITS DESIRED
IN EACH NUMBER.
HOW MANY DIGITS DO YOU WANT PER NUMBER? 1,2, OR 3?3
HOW MANY PROBLEMS DO YOU WANT ON THIS WORKSHEET?
PLEASE NO MORE THAN 25!
?10
TYPE A 1 IF YOU WANT THE ANSWERS PRINTED AT THE
BOTTOM OF THE WORKSHEET OR A 2 IF ANSWERS ARE TO BE
PRINTED SEPARATELY.  1 OR 2?1


MATH PROBLEMS

 1              621  / 215  = ?

 2              886  / 754  = ?

 3              433  / 81   = ?

 4              193  / 739  = ?

 5              876  / 505  = ?

 6              446  / 331  = ?

 7              912  / 283  = ?

 8              117  / 791  = ?

 9              266  / 283  = ?

 10             388  / 372  = ?


ANSWERS
 1      2.88837                  2      1.17507                  3
 5.34568          4      .261164          7      3.22261          5      1.73465
 6      1.34743                  7      3.22261                  8
 .147914          9      .939929                  10     .88172

DONE
```

CLEARB
36888-18025

TITLE:

CWF SUBPROGRAM

DESCRIPTION:

CLEARB is one of a series of user-written subprograms that extend the capabilities of Hewlett-Packard's licensed instructional product: Course Writing Facility (CWF). For more information about CWF, users should consult the Course Writing Facility Reference Manual, part number 24383-90001.

Sometimes an author would like to fill a buffer full with one repeated character. Perhaps he wishes to clear a buffer with spaces so that he can check buffer contents without interference from previous contents, or perhaps he is building up a buffer using variable length loads. In the latter case, if the buffer has previously been filled with "end of buffer" characters (E^C) there will always be an "eob" at the end of the message in the buffer.

The CWF author can simply invoke this sub-program with a call of the form "fn /clearb".

INSTRUCTIONS:

CALLING FORMAT

fn /clearb/bn,n

bn - a buffer from b0 to b5 (default b0)

n - any character, as well as N^C (line feed), E^C (end of buffer), or O^C (carriage return) (default = spaces).

SAMPLE CALLS

```
fn /clearb
fn /clearb/b2,*
fn /clearb/b4
fn /clearb/b5,E^C
```

The last statement would cause buffer 5 to be filled with end of buffer characters (E^C) in positions 0 through 97.

COURSE FACILITIES AFFECTED

This sub-program fills positions 0 through 97 of any buffer (b0 - b5) with the specified character, and places a carriage return (O^C) and an eob (Ec) into positions 98 and 99.

SPECIAL CONSIDERATIONS:

HP 24383A, Course Writing Facility must be present in the system for this subprogram to RUN.

ACKNOWLEDGEMENTS:

Jutta Kernke
Hewlett Packard

PROGRAMMING AND COMPUTER SCIENCE (EDUCATION) (810)

CONTRIBUTED PROGRAM **BASIC**

CLEARF
36888-18026

TITLE:

CWF SUBPROGRAM

DESCRIPTION:

CLEARF is one of a series of user-written sub-programs that extend the capabilities of Hewlett-Packard's licensed instructional product: Course Writing Facility (CWF). For more information about CWF, users should consult the Course Writing Facility Reference Manual, part number 24383-90001.

When a CWF author invokes this sub-program with a call of the form "fn "fn /clearf", various course facilities can be set to zero (all counters, all the switches, and/or all the parameters) or to blanks (all the buffers) on one operation.

INSTRUCTIONS:

CALLING FORMAT

fn /clearf/n

n - an integer from 1 to 7 such that

1 - counters set to Ø

2 - buffers set to blanks

3 - switches set to Ø

4 - parameters set to Ø

5 - reset counters and switches

6 - reset counters, switches and buffers

7 - reset all four

COURSE FACILITIES AFFECTED

This function resets the facilities as specified

SAMPLE CALL

fn /clearf/6

The above statement would cause all counters and switches to be reset to 0, and all buffers to be filled with blanks.

SPECIAL CONSIDERATIONS:

HP 24383A, Course Writing Facility must be present in the system for this subprogram to run.

ACKNOWLEDGEMENTS:

Jutta Kernke
Hewlett Packard

PROGRAMMING AND COMPUTER SCIENCE (EDUCATION) (810)

CONTRIBUTED PROGRAM **BASIC**

LENGTH
36888-18024

TITLE:

CWF SUBPROGRAM

DESCRIPTION:

LENGTH is one of a series of user-written sub-programs that extend the capabilities of Hewlett-Packard's licensed instructional product: Course Writing Facility (CWF). For more information about CWF, users should consult the Course Writing Facility Reference Manual, part number 24383-90001.

When an author wishes to find the position of the first "end of buffer" character (E^C) in a buffer, he can invoke this sub-program by simply calling fn /length. This function then returns the "eob" position in a counter. If no "end of buffer" character is found, 100 is returned in the counter.

INSTRUCTIONS:

CALLING FORMAT

fn /length/cn/bn

cn - a counter from c0 to c30 (no default)

bn - a buffer from b0 to b5 (default b0)

SAMPLE CALLS

fn /length/c2/b3

fn /length/c1

COURSE FACILITIES AFFECTED

The first statement would return in C2 the position of the first "end of buffer" character in B3. The second statement would return the first "eob" in B0 in C1; since no buffer is specified, the default is B0.

SPECIAL CONSIDERATIONS:

HP 24383A, Course Writing Facility must be present in the system for this subprogram to RUN.

ACKNOWLEDGEMENTS:

Jutta Kernke
Hewlett Packard

Documentation Date 3/75

PROGRAMMING AND COMPUTER SCIENCE (EDUCATION) (810)

CONTRIBUTED PROGRAM **BASIC**

PTUD

TITLE: PILOT TUTORIAL 36888-18016

DESCRIPTION:

This is the fourth program in the PILOT tutorial series. It is written in PILOT to teach the syntax and usage of PILOT.

This portion discusses the DEMAND and the COMPUTE statements.

INSTRUCTIONS:

This program is stored on 3 files named P-TUD1, P-TUD2, P-TUD3 for use on the HP 2000E systems and is stored on 1 file named PTUD for the 2000 series system.

The scratch file should be at least three records.

SPECIAL CONSIDERATIONS:

on 2000E: P-TUD1,48
P-TUD2,48
P-TUD3,48

on 2000 Series System: PTUD,70

ACKNOWLEDGEMENTS:

Lawrence E. Turner
Department of Physics and Computer Science
Pacific Union College

RUN

```
CRE-SCR,5
GET-PILOTF
RUN
PILOTF

NAME OF PILOT PROGRAM ?PTUD
NAME OF SCRATCH FILE  ?SCR


?RUN

                                PILOT


HI!  I AM READY TO GO AGAIN, HOW ABOUT YOU??

CONSIDER THIS SECTION OF A PROGRAM:

   NAME TWO STATES BORDERING ON CALIFORNIA ?OREGON,ARIZONA
   VERY GOOD!

THIS PROGRAM TAKES A TOTAL OF 8 STATEMENTS (INCLUDING A NEGATIVE RETORT
WHICH YOU DID NOT GET SINCE YOU ANSWERED CORRECTLY).  IT ALSO TAKES
INTO ACCOUNT ANY COMBINATION OF THE THREE POSSIBLE STATES!

WHAT STATEMENT IS NECESSARY FOR THIS ?DEMAND
EXCELLENT, I CAN TELL YOU DID YOUR HOMEWORK!
LET'S LOOK AT A LISTING OF THE PROGRAM.

        7000 T:NAME TWO STATES BORDERING ON CALIFORNIA +
        7010 A:
        7020 M:ARIZON,AZ
        7030 M:NEVAD,NV
        7040 M:OREG,OR
        7050 .D:2
        7060 Y:VERY GOOD!
        7070 N:NOPE.

THE HEART OF THIS IS STATEMENT 7050, THE DEMAND STATEMENT.
WHAT DO STATEMENTS 7020, 7030, AND 7040 DO ?MATCH
YES, THEY CHECK FOR THE POSSIBLE CORRECT STATES.  NOW IF STATEMENT 7050
WERE LEFT OUT, THEN WHAT RESPONSE WOULD SET THE MATCH FLAG TO THE 'YES'
STATE ?R-OREGON
EXACTLY!  ONLY 'OREGON' WOULD INITIATE 'VERY GOOD!'.  WHAT THE DEMAND
STATEMENT DOES IS TO CHANGE THE MATCH FLAG TO 'YES' IF TWO OR MORE OF
THE EXECUTED MATCH STATEMENTS SINCE THE LAST EXECUTED ANSWER STATEMENT
HAVE BEEN SUCCESSFUL, OTHERWISE IT IS SET TO 'NO'!
WHAT OTHER PILOT STATEMENTS CAN CHANGE THE MATCH FLAG ?ANSWER
CORRECT, BUT YOU FORGOT ONE.  BOTH THE ANSWER AND THE MATCH CAN ALSO
SET THE MATCH FLAG.
IF STATEMENT 7050 WERE TO READ '7050 .D:1', THEN HOW MANY CORRECT
STATES WOULD HAVE TO BE ENTERED IN ORDER TO GET 'VERY GOOD!' ?1
EXACTLY!  THE INTEGER OBJECT OF THE DEMAND STATEMENT (IN THIS CASE 1)
TELLS HOW MANY EXECUTED MATCH STATEMENTS MUST BE SUCCESSFUL SO THAT THE
'Y' CONDITION STATEMENTS WILL BE EXECUTED.
CONSIDER:

        7050 T:YOU GOT +
        7060 .D:1
        7070 Y:ONE+
        7080 .D:2
        7090 Y:, TWO+
        7100 .D:3
        7110 Y:, THREE+
        7120 .D:1
        7130 Y: OF THEM!
        7140 N:NOT EVEN ONE!
```

TRY IT!

```
   NAME TWO STATES BORDERING ON CALIFORNIA ?OREGON,ARIZONA
   YOU GOT ONE, TWO OF THEM!
```

TRY IT AGAIN!

```
   NAME TWO STATES BORDERING ON CALIFORNIA ?ARIZONA,NEVADA
   YOU GOT ONE, TWO OF THEM!
```

TRY IT AGAIN!

```
   NAME TWO STATES BORDERING ON CALIFORNIA ?ARIZONA,NEVADA,OREGON
   YOU GOT ONE, TWO, THREE OF THEM!
```

ONE MORE TIME.

```
   NAME TWO STATES BORDERING ON CALIFORNIA ?ARIZONA,NEVADA,OREGON
   YOU GOT ONE, TWO, THREE OF THEM!
```

THERE ARE, OF COURSE, MANY VARIATIONS MADE POSSIBLE BY THE DEMAND STATEMENT. CONSIDER:

```
        7050 .D:3
        7060 Y:VERY, VERY GOOD!  YOU GOT ALL THREE!
        7070 JY:*NEXT
        7080 .D:2
        7090 Y:CORRECT!
        7100 JY:*NEXT
        7110 .D:1
        7120 Y:YOU DID GET ONE RIGHT.
        7130 N:YOU DIDN'T EVEN GET ONE!
        7140 *NEXT R:
```

WHY DO YOU THINK THE JUMP STATEMENTS ARE NECESSARY??
?

IF .D:3 IS SATISFIED, SO IS .D:2 AND .D:1!! THUS IF THREE ARE FOUND, THEN YOU MUST BRANCH AROUND THE SECTIONS THAT CHECK FOR TWO AND ONE. NOTE THAT THE DEMAND STATEMENT CHECKS FOR 'AT LEAST'. IT DOES NOT CHECK FOR 'EXACTLY'.
OK, WHAT DO YOU THINK .D:0 SETS THE MATCH FLAG TO ?
??YES
RIGHT ON! SINCE IN ALL CASES AT LEAST ZERO MATCH STATEMENTS HAVE BEEN SATISFIED, .D:0 ALWAYS SETS THE MATCH FLAG TO 'YES'. THIS IS A WAY OF FORCING THE MATCH FLAG IRREGARDLESS OF PREVIOUS MATCHES.
AN EXAMPLE:

```
        3560 T:CAN YOU NAME THE CLOSEST STAR TO THE EARTH +
        3570 A:
        3580 M:YES,OF COURS,RIGHT,CERTAIN,SURE,Y
        3590 Y:OK, WHAT IS IT +
        3600 *STAR AY:
        3610 M:SUN,SOL
        3620 Y:VERY GOOD!
        3630 JY:*NEXT
        3640 T:NO WAY, HERE'S A HINT:  YOU ONLY SEE IT DURING THE DAY.
        3650 T:NOW TRY IT +
        3660 .D:0
        3670 J:*STAR
```

IF STATEMENT 3660 WERE MISSING, WOULD *STAR AY: BE EXECUTED AFTER THE JUMP (J:*STAR) ?NO
THAT'S RIGHT! IN FACT, THERE WOULD BE NO WAY TO GET OUT OF THE LOOP!! ACTUALLY THERE ARE PERHAPS OTHER WAYS OF ACHIEVING THIS SAME RESULT WITHOUT RESORTING TO THE .D:0, BUT AT TIMES IT IS CONVENIENT.
THERE IS ONE FURTHER POINT TO CONSIDER. IF THERE ARE TOO MANY ALTERNATIVES IN A MATCH OBJECT TO FIT ON ONE LINE, THEN HOW DO YOU 'CONTINUE' A MATCH??
?CONDITION
ACTUALLY, BY THE USE OF AN 'N' CONDITION YOU CAN 'CONTINUE' AS LONG AS YOU WISH.
THE QUESTION TO BE ANSWERED IS: DOES THIS AFFECT THE FUNCTION OF THE DEMAND STATEMENT?
WHAT DO YOU THINK ?NO
RIGHT! IT DOES WORK PROPERLY IF YOU THINK OF THE TWO OR MORE STATEMENTS 'CONTINUED' TOGETHER AS A SINGLE MATCH STATEMENT. AT THE MOST THERE WILL BE ONE SUCCESSFUL MATCH AMONG THEM. TO SEE THIS, EXAM:

```
        4070 T:NAME A DIGIT AND A COLOR.
        4080 A:
        4090 M:ZER,ONE,TWO,THRE,FOUR,FIVE
        4100 MN:SIX,SEVEN,EIGHT,NINE
        4110 M:BLUE,RED,GREEN,ORANGE,GREY
        4120 MN:PINK,BLACK,PURPLE,VIOLET
        4130 MN:YELLOW,WHITE,BROWN
        4140 .D:2
        4150 Y:GROOVY!
        4160 N:I GIVE UP!
```

IF 'TWO' IS TYPED IN, HOW MANY SUCCESSFUL MATCH STATEMENTS WILL EXECUTED BEFORE 4140 ?1
CORRECT. ONLY NUMBER 4090 WILL BE SUCCESSFUL, IN FACT 4100 WILL NEVER BE EXECUTED!
NOW WHAT IF 'NINE AND RED' ?2
RIGHT. BOTH 4100 AND 4110 ARE SUCCESSFUL. NUMBER 4090 IS EXECUTED BUT FAILS. 4120 AND 4130 ARE NOT EVEN EXECUTED.
IF 'NOTHING' IS TYPED IN ?0
OK, THEY ALL WILL BE EXECUTED, BUT NONE SUCCESSFULLY.
NOTICE THAT EACH SET OF 'CONTINUED' MATCH STATEMENTS ACTS LIKE ONLY ONE STATEMENT AS FAR AS BOTH THE MATCH FLAG AND THE DEMAND STATEMENT.

WHAT DO YOU THINK IS THE MAXIMUM NUMBER OF SUCCESSFUL MATCHES THAT CAN BE 'DEMANDED' ?99
I GUESS YOU REALLY DID YOUR HOMEWORK! THE LARGEST ALLOWED OBJECT OF A DEMAND STATEMENT IS 99. THUS YOU CAN HAVE UP TO 99 MATCHES TO BE 'DEMANDED'! IT IS RARE THAT YOU WILL EVER NEED THIS MANY FOR A VERY SIMPLE REASON.
WHAT IS THE LONGEST RESPONSE ALLOWED BY PILOT ?72
CLOSE! EXACTLY! UP TO 72 CHARACTERS MAY BE TYPED IN AT ANY TIME. THIS IS THE MOST THAT PILOT CAN CHECK FOR POSSIBLE MATCHES AT ANY ONE TIME.

THAT COMPLETES EVERYTHING THERE IS TO KNOW ABOUT DEMAND! YOU NOW KNOW (OR HAVE BEEN EXPOSED TO) MOST OF THE PILOT LANGUAGE STATEMENTS. YOU CAN CAUSE THE COMPUTER TO PRINT OUR STUFF, ASK QUESTIONS, MATCH THE RESPONSE, MAKE APPROPRIATE COMMENTS, JUMP, AND NOW DEMAND. THERE ARE ONLY THREE MORE THINGS TO KNOW AND YOU WILL BE AN EXPERT! THESE ARE: HOW TO MODIFY THE VALUE OF A NUMERIC VARIABLE, SUBROUTINE JUMPING, AND A MORE POWERFUL MATCH STATEMENT.

LET'S REVIEW WHAT YOU KNOW ABOUT NUMERIC VARIABLES. FIRST HOW MANY DIFFERENT NUMERIC VARIABLES ARE THERE ?26
PRECISELY!
WHAT PILOT STATEMENT(S) CAN MODIFY THE VALUE STORED IN A NUMERIC VARIABLE ?DONT KNOW
SO FAR WE HAVE ONLY DISCUSSED HOW THE ANSWER STATEMENT CAN MODIFY THE VALUE OF A VARIABLE.
WHAT PART OF AN ANSWER STATEMENT ALLOWS THIS ?AFTER THE COLON
BEAUTIFUL! AND WHAT SPECIAL SYMBOL SIGNIFIES A NUMERIC VARIABLE ?#
OF COURSE!
NAME TWO WAYS IN WHICH A NUMERIC VARIABLE MAY BE USED.
?MATCH AND TYPE
WELL, YOU GOT ONE. THE FIRST WAY WE STUDIED WAS TO OUTPUT THE VALUE IN A TYPE STATEMENT. THE SECOND WAS IN A CONDITION. HERE IS A PART OF A PROGRAM TO ILLUSTRATE:

```
        4520 T:WHAT IS YOUR AGE +
        4530 *PLEASE A:#A
        4540 TB:GIMME A NUMBER!
        4550 JB:*PLEASE
        4560 T(A<=0):WHAT?  A NEGATIVE NUMBER!
        4570 T(A>150):A FOSSIL IF I EVER SAW ONE!
        4580 T:ARE YOU REALLY #A YEARS OLD???
```

WHAT DOES THE CONDITION 'B' DO ?DONT KNOW
I ALMOST FEEL LIKE GIVING UP ON YOU! THE STATEMENTS WITH A 'B' CONDITION ARE EXECUTED ONLY IF NO VALID NUMBER WERE ENTERED. IT ALLOWS TESTING OR CHECKING FOR A NUMBER IN THE RESPONSE.
SOMETIMES IT IS DESIRED TO MODIFY THE VALUE OF A NUMERIC VARIABLE OTHER THAN IN AN ANSWER STATEMENT. THERE ARE THREE PILOT STATEMENTS THAT DO THIS. THE FIRST AND MOST POWERFUL IS THE COMPUTE STATEMENT. WHAT DO YOU THINK IS THE INSTRUCTION FOR THE COMPUTE STATEMENT ?.C
AHA, YOU ARE TOO TRICKY! THE INSTRUCTION FOR THE COMPUTE STATEMENT IS SIMPLY A 'C'.
LET'S LOOK AT A FEW EXAMPLE COMPUTE STATEMENTS:

```
7350 C:A=5
8120 CY:B=A+32*X
8320 C(Z>3):S=T*(2+N)
9040 C:H=K
9450 C:N=N+1
```

THE OBJECT OF THE COMPUTE STATEMENT BEGINS WITH WHAT ?CHARACTER
OH MY ACHING HEADS! WILL YOU WAKE UP?? THE FIRST THING IN THE COMPUTE OBJECT IS A NUMERIC VARIABLE. IT IS THE ONE WHOSE VALUE IS TO BE MODIFIED.
WHAT IS THE NUMERIC VARIABLE THAT IS TO BE MODIFIED IN STATEMENT 8320 ABOVE ?S
ALRIGHT, THE VARIABLE S WILL BE MODIFIED WHEN 8320 IS EXECUTED.
WHAT IS THE NEXT ITEM IN ALL COMPUTE STATEMENT AFTER THE LEADING NUMERIC VARIABLE ?=
GOOD. ALL COMPUTE STATEMENTS MUST HAVE AN EQUALS SIGN (=). THE PART TO THE RIGHT OF THE EQUALS SIGN IS VERY GENERALLY TERMED AN ARITHMETIC EXPRESSION OR SIMPLY EXPRESSION.

C:<NUMERIC VARIABLE>=<EXPRESSION>

THIS IS HOW YOU WOULD DIAGRAM A GENERAL COMPUTE STATEMENT. THE '<>' SURROUND A SINGLE SYNTACTICAL PILOT ENTITY. I HAVE LEFT OFF THE STATEMENT NUMBER AND ANY OPTIONAL LABEL OR CONDITION, THEY ARE MOST CERTAINLY ALLOWED. WHERE DOES THE CONDITION GO??
?

•
•
•

TITLE:	PILOT TUTORIAL	PTUE 36888-18017
DESCRIPTION:	This is the fifth and last program in the tutorial series in PILOT to teach the elements of the PILOT language. This program deals with additional usage of the COMPUTE statement, the INTEGER FUNCTION, the RANDOM NUMBER FUNCTION, USE and END, and the extended MATCH.	
INSTRUCTIONS:	This program is stored in 3 files: P-TUE1, P-TUE2, P-TUE3 for the HP 2000E system and on the one file PTUE for the HP 2000E series system. The scratch file should be at least 2 records in length.	
SPECIAL CONSIDERATIONS:	2000E: P-TUE1, 48; P-TUE2, 48; P-TUE3, 48 2000 Series System; PTUE, 70	
ACKNOWLEDGEMENTS:	Lawrence E. Turner, Jr. Department of Physics and Computer Science Pacific Union College	

RUN

```
CRE-SCR,5
GET-PILOTF
RUN
PILOTF

NAME OF PILOT PROGRAM ?PTUE
NAME OF SCRATCH FILE  ?SCR


?RUN

                                PILOT


GREETINGS!  THIS IS THE FINAL PROGRAM IN THIS SERIES.  YOU ARE ALMOST
FINISHED.  ACTUALLY, I HOPE THIS IS JUST A BEGINNING OF YOUR USAGE OF
PILOT!

LAST TIME WE DISCUSSED THE COMPUTE STATEMENT AND AT LEAST ONE EXAMPLE
OF HOW IT COULD BE USED.  DO YOU REMEMBER THAT USE ?YES
VERY GOOD, WHAT IS IT ?
??FORGOT
WELL, WHAT I HAD IN MIND WAS THE USE AS A COUNTER.  AS IN:

          1730 C:M=M+1
          2960 CY:P=P+1
          4110 C(X<17):D=D+1

BESIDES THE COMPUTE STATEMENT, WHAT PILOT STATEMENT CAN MODIFY THE
VALUE OF A NUMERIC VARIABLE ?ANSWER STATEMENT
RIGHT ON!  SO FAR WE HAVE ONLY EXAMINED THE ANSWER STATEMENT.  THIS
ALLOWS A QUESTION WHICH ASKS FOR A NUMERIC RESPONSE.
THE COMPUTE STATEMENT MAY BE USED IN CONJUNCTION WITH THIS TO HELP
EXTRACT THE INTENDED RESPONSE MORE ACCURATELY.  CONSIDER:

        6310 T:HOW MANY DAYS IN ONE WEEK +
        6320 A:#D
        6330 M:SEVEN
        6340 CY:D=7
        6350 T(D=7):EXACTLY!  +
        6360 T(D#7):SORRY, +
        6370 T:THERE ARE SEVEN DAYS IN ONE WEEK.

WHAT IS THE PURPOSE OF STATEMENTS 6330 AND 6340??
?TO ALLOW FOR NUMERIC 7 AND ALPHABETIC SEVEN
RIGHT, THEY CATCH THE RIGHT RESPONSE IF THE PERSON HAPPENED TO TYPE
'SEVEN' INSTEAD OF '7'.  BOTH ARE CORRECT.
LET'S EXECUTE THIS PROGRAM.

   HOW MANY DAYS IN ONE WEEK ?7
   EXACTLY!  THERE ARE SEVEN DAYS IN ONE WEEK.

NOW TRY IT AND ENTER 'SEVEN' SPELLED OUT.

   HOW MANY DAYS IN ONE WEEK ?SEVEN
   EXACTLY!  THERE ARE SEVEN DAYS IN ONE WEEK.

OFTEN ONE ONLY WISHES THAT THE RESPONSE BE CLOSE TO THE CORRECT
ANSWER.  AGAIN THE COMPUTE STATEMENT TO THE RESCUE!

        8400 T:HOW MANY CENTIMETERS IN ONE INCH +
        8410 A:#X

THE CORRECT ANSWER IS 2.54; HOWEVER, TO BE CONSIDERED CORRECT YOU MIGHT
ALLOW ANY NUMBER BETWEEN 2.5 AND 2.58.  THIS WOULD ALLOW ANY RESPONSE
THAT IS WITHIN 0.04 OF THE CORRECT ANSWER TO BE COUNTED.  A VERY SIMPLE
WAY IS TO COMPUTE THE DIFFERENCE BETWEEN THE CORRECT ANSWER AND THE
RESPONSE.
HOW WOULD YOU DO THIS ?C:D=2.54-X
I BELIEVE THAT IS CORRECT!  A COMPUTE STATEMENT THAT LOOKS LIKE THIS
SHOULD DO THE TRICK:
```

```
        8420 C:D=2.54-X
```

IF THE RESPONSE IS: '2.5' WHAT IS STORED IN D ?.04
EXACTLY! D HAS 0.04 STORED IN IT. SINCE 2.5 IS AN ALLOWED 'CORRECT ANSWER', HOW WOULD YOU CAUSE THE APPROPRIATE MESSAGE TO BE TYPED OUT??
?C:←T(D<=0.04):CORRECT!
GOOD. BY USING D IN A CONDITION ON A TYPE STATEMENT YOU CAN PRINT THE CORRECT RETORT. CONSIDER:

```
        8400 T:HOW MANY CENTIMETERS IN ONE INCH +
        8410 A:#X
        8420 C:D=2.54-X
        8440 T(D<=0.04):VERY GOOD!
        8450 T(D>0.04):NOT QUITE.
```

THIS IS COOL FOR GUESSES LESS THAN 2.54, BUT WHAT WOULD BE PRINTED IF '57' WERE ENTERED ?VERY GOOD!
EXACTLY! NOW IS '57' A 'CORRECT RESPONSE' ?NO
OF COURSE NOT, THUS WE HAVE A BUG TO FIX!! WHAT WE REALLY WANT IS THE ABSOLUTE DIFFERENCE FOR D. SO IF D IS LESS THAN ZERO, WE WANT TO CHANGE ITS SIGN. THIS CAN BE DONE WITH ONE PILOT STATEMENT:

```
        8430 C(D<0):
```

WHAT IS THE CORRECT OBJECT ?D=-D
VERY GOOD!
THUS OUR PROGRAM BECOMES:

```
        8400 T:HOW MANY CENTIMETERS IN ONE INCH +
        8410 A:#X
        8420 C:D=2.54-X
        8430 C(D<0):D=-D
        8440 T(D<=0.04):VERY GOOD!
        8450 T(D>0.04):NOT QUITE.
```

EXCEPT FOR INTEGER RESPONSES IT IS BEST TO GO THROUGH SOMETHING LIKE THIS FOR NUMERIC RESPONSES, EVEN FOR SIMPLE DECIMAL NUMBERS. THE COMPUTER CANNOT REPRESENT MOST DECIMALS EXACTLY, HENCE SOMETHING LIKE:
7320 T(X=.1): ... MAY NEVER BE EXECUTED EVEN IF '0.1' HAS BEEN PREVIOUSLY STORED IN X. SOMEWHERE, PERHAPS IN THE SEVENTH DECIMAL PLACE, X MAY DIFFER SLIGHTLY FROM 0.1, AND THE TEST WILL FAIL.

ANOTHER USEFUL WAY TO MODIFY THE VALUE OF A NUMERIC VARIABLE IS TO REPLACE IT WITH THE GREATEST INTEGER LESS THAN OR EQUAL TO THE ORIGINAL NUMBER.
FOR 4.7, WHAT IS THIS INTEGER ?4
RIGHT ON!
HOW ABOUT 0.247 ?0
BEAUTIFUL!
OK, TRY 6.00 ?6
GOOD.
AND -2.7 ?-3
EXCELLENT!
FINALLY, -7.00 ?-7
PERFECT! NOTE THAT FOR POSITIVE NUMBERS THIS GREATEST INTEGER FUNCTION IS EQUIVALENT TO JUST THROWING AWAY ANY DECIMAL PORTION; HOWEVER, THIS SIMPLE-MINDED DESCRIPTION IS NOT ADEQUATE FOR NEGATIVE NUMBERS.
THIS OPERATION IS DIFFICULT, IF NOT IMPOSSIBLE, TO DO WITH THE COMMON ARITHMETIC OPERATORS AS ALLOWED IN THE COMPUTE STATEMENT, YET IT IS SUFFICIENTLY USEFUL TO BE INCLUDED IN THE PILOT LANGUAGE.
A NEW INSTRUCTION IS USED, WHAT DO YOU THINK IT IS ?I
THAT IS A GOOD GUESS, BUT THE INTEGER FUNCTION (REALLY THE GREATEST INTEGER THAT IS LESS THAN OR EQUAL TO) IS DESIGNATED BY THE EXTENDED INSTRUCTION '.I'. EXAMPLES ARE:

```
        3710 .I:X
        4290 .I:S
        6660 .I(X>9):X
```

WHAT ARE THE OBJECTS OF THESE INTEGER FUNCTION STATEMENTS ?NUMERIC VARI
NUMERIC VARIABLES
EXACTLY! THE OBJECT IS A SINGLE NUMERIC VARIABLE. ITS VALUE IMMEDIATELY BEFORE THE EXECUTION OF THE STATEMENT IS REPLACED BY THE GREATEST INTEGER THAT IS LESS THAN OR EQUAL TO IT.
TO SEE A POSSIBLE USE, CONSIDER:

```
        3250 T:THREE IS WHAT PERCENT OF 24 +
        3260 A:#P
        3270 .I:P
        3280 T(P=12):EXCELLENT!
        3290 T(P#12):NOPE.

WHAT IS THE SMALLEST NUMBER FOR WHICH 'EXCELLENT' WILL BE PRINTED ?12
RIGHT ON!
HERE THE CORRECT ANSWER IS 12.5, BUT ANYTHING FROM 12 UP TO (BUT NOT
INCLUDING) 13 IS ACCEPTABLE.  THE .I VERY EASILY SETS UP THE RANGE.
A MORE IMPORTANT USE IS FOR ROUNDING.  THE INTEGER FUNCTION AS GIVEN
DOES NOT ROUND, IT MERELY TRUNCATES.  ROUNDING CAN BE ACHIEVED IN QUITE
A STRAIGHTFORWARD MANNER BY:

        4560 C:X=X+.5
        4570 .I:X

WHAT WILL BE STORED IN X IF IT PREVIOUSLY HAD 4.00 ?4
EXACTLY.
HOW ABOUT 4.6 ?5
COOL!
OK, TRY -2.1 ?-2
RIGHT!
AND WHAT DOES -5.7 BECOME ?-5
MY, MY, NO.  -5.7 + 0.5 IS -5.2 WHICH BECOMES -6.

NOTE THAT THE WAY THE INTEGER FUNCTION IS DEFINED MAKES THE ROUNDING
OPERATION WORK FOR BOTH POSITIVE AND NEGATIVE VALUES.  IF IT SIMPLY
DISCARDED THE DECIMAL PART, THEN THERE WOULD HAVE TO BE SPECIAL TESTS
AND HASSELING TO DO THE ROUNDING.
YOU CAN ROUND TO ANY POINT YOU WISH.  CONSIDER THE FOLLOWING TO ROUND
TO THE NEAREST HUNDRETH (PENNY??):

        7310 C:Q=Q*100+.5
        7320 .I:Q
        7330 C:Q=Q/100

OK, IF Q ORIGINALLY CONTAINS 3.14159, WHAT IS THE NEW VALUE ?
```

•
•
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CONTRIBUTED PROGRAM **BASIC**

TITLE: CWF SUBPROGRAM

STDATA
36888-18027

DESCRIPTION:

STDATA is one of a series of user-written sub-programs that extend the capabilities of Hewlett Packard's licensed instructional product: Course Writing Facility (CWF). For more information about CWF, users should consult the Course Writing Facility Reference Manual, Part no. 24383-90001.

When a CWF author invokes this sub-program with a call of the form "fn /stdata", certain data from the student's record are made available in the CWF buffer, b5. The data include the student's name, number, user group, and date of registration, as well as the time he has spent on the course and the time of his last sign-on. These data may be used directly by the author to print out messages to the student, or to affect the logical flow of the course for each individual student.

INSTRUCTIONS:

CALLING FORMAT

fn /stdata

COURSE FACILITIES AFFECTED

Counter 30 (c30) will contain the student number

Buffer 5 (b5) will contain the following:

Starting position	length	contents
0	9	student number
9	22	student's last name
31	3	user group
34	8	data of registration: MM/DD/YY
42	8	today's date: MM/DD/YY
50	8	time of sign on: hh-mm xx (AM, PM, N, M)
58	13	time on course up to last sign off (hh hrs mm min)
71	22	student's first name

The student's last name will never exceed a maximum of 20 characters and will be filled with blanks to a total of 22 characters; all 22 characters will be filled with blanks for a demo student. The last character in the name is followed by a control E, e.g., SMITHE^{C}. This causes printing to stop at the end of the student's name, for example, "ld b5,71,22/b1" loads 22 characters into b1, but "ty b1" then prints only up to the E^{C}.

Continued on following page.

SPECIAL CONSIDERATIONS:

HP 24383A, Course Writing Facility must be present in the system for this subprogram to RUN.

ACKNOWLEDGEMENTS:

Jutta Kernke
Hewlett Packard

INSTRUCTIONS continued

Similar remarks apply to the student's first name

SAMPLE CALL

```
fn /stdata
ld b5,71,22/bl
ty How are you today,
ty bl
ty ?
```

SAMPLE RUN

```
    .
    .
    .
How are you today, John?
```

CONTRIBUTED PROGRAM **BASIC**

TITLE: MATH CALCULATOR PACKAGE

STOP
36208

DESCRIPTION:

STOP is a hypothetical STOred Program digital computer having a very simple machine language. The STOP program in the TIES Time-Share library simulates STOP, allowing users to write programs in a simple machine language.

The op codes are:

- ØI LOAD - Clears the contents of the accumulator and brings to it the number stored in the location specified by the storage address.
- Ø2 ADD - Adds to the accumulator the number stored in the specified location.
- Ø3 SUBTRACT - Subtracts from the accumulator the number stored in the specified location.
- Ø4 MULTIPLY - Multiplies the number in the accumulator by the number in the specified location.
- Ø5 DIVIDE - Divides the number in the accumulator by the number in the specified location, keeping only the quotient in the accumulator.
- Ø6 STORE - Stores the accumulator contents in the specified location.
- Ø7 PRINT (cr) - Prints the number contained in the specified location and returns the carriage. It will not print a number directly from the accumulator.
- Ø8 BRANCH ON NEGATIVE - If the accumulator is negative, sends control to the specified location and continues execution with the instruction found there.
- Ø9 HALT - Stops execution of a program. The address portion of a halt instruction is ignored by the system. Use any 3 digits.
- 1Ø JUMP - Sends control unconditionally to the specified address and continues execution with the instruction found there.
- 11 PRINT - Prints the number contained in the specified location; does not return the carriage. It will not print a number directly from the accumulator.
- 12 DIVIDE - Divides the number in the accumulator by the number in the specified location, keeping only the remainder in the accumulator.
- 15 BRANCH ON ZERO - If the accumulator is zero, sends control to the specified location and continues execution with the instruction found there.
- 17 PRINT FROM ACCUMULATOR - Prints the number contained in the accumulator. Operand should be ØØØ since no address is referred to.

INSTRUCTIONS: See Attached

SPECIAL CONSIDERATIONS: Statement 20 dimensions Array A at 500 to accomodate the HP 2000E. The array may be re-dimensioned to 1000 to allow HP 2000 Series users to write longer STOP programs.

ACKNOWLEDGEMENTS: TIES
St. Paul, Minnesota

INSTRUCTIONS:

To enter a program in the STOP language:

- After the system prints "BEGIN TYPING IN YOUR PROGRAM AND DATA STATEMENTS.", enter each statement as in the following example:

  ØØ1,Ø12ØØ (carriage return)

  The first three digits are the address where the instruction or datum (Ø12ØØ) will be stored.

- After your program and data are entered, type an E indicating the end of your entries.

- The system will print "TYPE Ø TO RUN, 1 TO EDIT, 2 TO LIST, 3 TO STEP." Typing a 1 at this point allows you to re-enter any statements you wish to correct or to add new statements. You need to terminate your editing by typing an E. (See below for options 2 and 3)

- When you type a Ø to run, you will be asked to enter the starting address of the program. Touching the RETURN button after entering the address will cause the program to be executed.

Other Options

LIST: This will give a list of addresses and their contents. You must be prepared to type on request the beginning and ending addresses of the list you wish printed.

STEP: This will allow you to execute your program one step at a time. You will first enter the starting address as in the RUN option. As each step is executed, the teletype will print the address of the instruction executed and the contents of the accumulator after execution. Typing a 3 and carriage return will cause the system to execute the next instruction in the same manner. Typing a Ø and carriage return will cause the rest of the program to be executed from that point on. Typing a 1 will send control back to the original four-option statement.

SPECIAL CONSIDERATIONS:

An introduction to STOP and its language is found in Computers - Theory and Uses, written by Vincent S. Darnowski and published by the National Science Teachers Association, NEA, 1201 Sixteenth Street N.W., Washington, D.C. 20036. The cost is $24.00 for 30 copies. The book was written as a text for introducing junior high school students to computers and their implications. Students studying this text can enhance their understanding of computers by writing and running machine language programs from any TIES Time-Sharing terminal.

Storage addresses must be integers greater than Ø and less than 1ØØØ. Instructions and data words must be integers between -99999 and 99999 inclusive.

Program or data statements can be corrected by retyping the statement. This can be done at any time during the entering of your program, or at other times when a system message gives you the option. New statements can be added at those same times.

STOP will execute instructions in sequence by address, starting with whatever address you specify and ending when a HALT command is reached. Hence, you must not leave any addresses undefined in the range of your program.

Since a datum and an instruction are each represented by a 5 digit integer, they appear the same to the computer. Therefore, programs and data must be stored in separate areas predetermined by you when you assign storage locations.

RUN

```
RUN
STOP

TYPE AN 'E' TO INDICATE YOU HAVE FINISHED INPUTTING.

BEGIN TYPING IN YOUR   S T O P   PROGRAM.
?001,11100
?002,11100
?003,07100
?004,11100
?005,09000
?100,02345
?E
TYPE 0 TO RUN, 1 TO EDIT, 2 TO LIST, 3 TO STEP.
?2

INPUT THE STARTING AND ENDING ADDRESSES FOR THE LISTING.
?001,005

001,11100
002,11100
003,07100
004,11100
005,09000

TYPE 0 TO RUN, 1 TO EDIT, 2 TO LIST, 3 TO STEP.
?0

INPUT THE STARTING ADDRESS.
?001

 2345     2345    02345
 2345    HALT

TYPE 0 TO RUN, 1 TO EDIT, 2 TO LIST, 3 TO STEP.
?
DONE
RUN
STOP

TYPE AN 'E' TO INDICATE YOU HAVE FINISHED INPUTTING.

BEGIN TYPING IN YOUR   S T O P   PROGRAM.
?001,01401
?002,02402
?003,17000
?004,09000
?401,00003
?402,08632
?
??E
TYPE 0 TO RUN, 1 TO EDIT, 2 TO LIST, 3 TO STEP.
?0

INPUT THE STARTING ADDRESS.
?001

08635
HALT

TYPE 0 TO RUN, 1 TO EDIT, 2 TO LIST, 3 TO STEP.
?
??
DONE
```

STPAL
36765

TITLE: STOP MACHINE AND ASSEMBLY LANGUAGE SIMULATOR

DESCRIPTION:

STPAL consists of 4 programs named STPAL, STPAL1, STPAL2, and STPAL3.

STOP is a hypothetical, electronic, stored-program, sequential, digital computer designed specifically to aid in teaching computer concepts. (It is not difficult to simulate STOP on many existing computer.) The STPAL system consists of a machine language translator and an assembly language translator. The two languages are SML (extended STOP simulated Machine Language) and SAL (STOP simulated Assembly Language).

The STOP system has had two predecessors, the most influential being a similar system developed at Illinois Institute of Technology with Computers - Theory and Uses by Vincent S. Darnowski as an initial impetus in this project. The second more recent influence is An Instructional Manual for CARDIAC by Hagelberger and Fingerman distributed and published by the Bell System for use in the classroom. CARDIAC consists of a cardboard "computer" with a small set of operations. The STOP system and CARDIAC are easily made compatible with HP Time-Sharing BASIC.

INSTRUCTIONS:

The STOP system begins by requesting "PROGRAM FILE NAME ?". The operator responds with the name of the file to be used to store the program or the file containing the program, if a previously written program is to be re-RUN. If the file is not available, STPAL will tell the operator how to open it and halt. It is necessary to type RUN after opening the file and re-enter the file name. The system will then print "TYPE YES IF THIS IS AN ASSEMBLY PROGRAM?". The operator responds with YES or NO. If NO is the response, STPAL types "ENTER MACHINE LANGUAGE STATEMENTS". The operator begins to enter statements according to the SML rules. After the operator enters a statement with a ØØØ address, execution of the machine language program begins.

After a HALT is encountered, the STPAL system asks "DO YOU WISH TO CORRECT THE MACHINE LANGUAGE PROGRAM?". The operator answers YES or NO. If no corrections are to be made, STPAL returns to the PROGRAM FILE NAME? request. The operator enters a new file name to run another program or //STOP to terminate.

continued on following page

ACKNOWLEDGEMENTS: Norman Thompson
TIES

INSTRUCTIONS continued

The machine language version can be corrected by typing in the address and the instruction to go at that address. To end corrections, the operator types a ØØØ address, and the program begins executing as before.

If an assembly language program is indicated, STPAL types:

BEGINNING ASSEMBLY
TYPE Ø FOR NEW PROGRAM, 1 FOR REASSEMBLE OLD PROGRAM?

If an old program, the program statements will be read from the file requested earlier, then compiled and executed. If a new program, STPAL will request assembly statements, write them to the file, then, after an END statement is encountered, compile and execute the program. After execution of either an old or new assembly program, the system will type:

DO YOU WISH TO CORRECT THE MACHINE LANGUAGE PROGRAM?

and the operator should proceed as above.

I. SML - A Machine Language

1. Instruction WORD FORMAT

Each SML instruction is 5 decimal digits long. The first two (high order) digits form the operation code while the low order three digits form the operand. The operation code (op-code) specifies the operation to be performed. (See Section III.) The operand varies in function from operation to operation. The various uses are: a. Location of data; b. Location of next instruction to be executed; c. The data itself; d. Additional information necessary in the instruction execution.

2. Statement Format

SML recognizes two basic types of statements, program statements and comment statements. The comment statement must have an asterisk in column 1. Then the rest of the line will be taken as a comment for documentation purposes. Program statements have the following format:

Cols.	1-3	Address of the computer word to be stored.
Col.	4	Blank
COl.	5	Either blank or a +, -, #, or *.
Col.	6-10	Computer Word
Col.	11-72	Any comment

Blank is the only non-numeric character allowed in Cols. 1-3 and 6-10 inclusive and will be assumed to be zero. A + or - in Col. 5 assumes the computer word is a data word with the associated sign. An * in Col. 5 indicates indirect addressing. A # in Col. 5 indicates that operand (Col. 8-10) is the data itself. This is generally referred to as a literal operand.

3. Instruction Execution

SML instructions are executed in numerical order by location. A branch instruction (or transfer instruction) may alter the normal order of execution. The last statement written must have location ØØØ and contain in the operand portion (Cols. 8-10) the location of the first instruction to be executed.

II. SAL - An Assembly Language

SAL recognizes three basic types of statements: program statements, pseudo-operations, and comment statements.

1. Program Statement

Program statements are translated into equivalent SML statements and stored. They have the following format:

Col.	1	Any control character but generally A^C. (Super script "C" indicates a control character which is done by pressing CTRL and the character simultaneously.)
Col.	2-3	Label field
Cols.	5-7	Operation field
Col.	8	An * or part of operand field
Cols.	9-10	Operand
Cols.	11-72	Any comment

If Col. 1 has an * (asterisk) the entire line is taken as a comment statement. The label field may contain a unique symbolic label of either 1 or 2 alpha-numeric characters. The first character must be alphabetic (A-Z) but the second character may be alphabetic, numeric or blank. The label may not be SQ or TR since these are reserved words used in the linkage to the square root and trig subroutines respectively. The operation field must contain a valid SAL mnemonic operation code. (See Section III.) The operand may contain a symbolic label as defined above. Also the operand may contain a literal 1, 2 or 3 digit right justified number. If this is so, the value used by the instruction is not the content of the location specified but the number itself. (For example, ADD1ØØ would add the number 100 to the content of the accumulator, <u>not</u> the content of location 100.)

INSTRUCTIONS continued

Indirect addressing is indicated by an asterisk in Column 8. When indirect addressing is specified, the operand portion (Col. 9-10 of the assembled SML instruction) is replaced by the operand portion of the location indicated. If indirect addressing is specified by the new effective instruction, another indirect addressing cycle is taken. Indirect addressing may only be specified 10 levels deep.

It should be noted that the four fields of a SAL statement correspond to the four fields of SML statement even to essentially the same columns.

2. Pseudo-operations
Pseudo-operations, unlike normal operations in program statements, are not assembled into SML instructions, but are used to communicate with the assembler. In general, they have the same format as program statements.

a. ORG
The pseudo-operation ORG (origin) sets the location counter at the value of the operand. The operand must be right justified 1-3 digit non negative number in Columns 8-10.

b. END
The pseudo-operation END signals the end of the assembly program execution. An unconditional branch to the location specified by the operand is generated in location ØØØ. The specified location will be the first statement to be executed by the assembled SML program.

c. DS
The pseudo-operation DS (define storage) is used to reserve the number of storage locations specified by the operand. The format of the operand is the same as that for the ORG pseudo-operation.

d. Define constant + and -.
Either the pseudo-operation + or the pseudo-operation - may be used to reserve one location of storage using the signed word content as the defined constant. The sign must appear in Column 5 and the word must be a 5 digit number right justified in Columns 6-10. The define constant may be used for constants in integer range -99,999 to 99,999.

III. The valid SML operation codes and their SAL equivalents are listed below.

OP-CODE	MNEMONIC	FUNCTIONS
00	REA	Allows one number to be read into the location specified by the operand.
01	LOA	Load the accumulator with the word specified by the operand.
02	ADD	Add to the accumulator the word specified by the operand.
03	SUB	Subtract from the accumulator the word specified by the operand.
04	MUL	Multiply the content of the accumulator by the word specified by the operand.
05	DVQ	Divide the content of the accumulator by the word specified by the operand and store the quotient in the accumulator.
06	STO	Store the content of accumulator in the location specified by the operand. (The content of the accumulator is not altered.)
07	PRT	Print the content of the location specified by the operand.[1]
08	BON	Branch to the location specified by the operand if the content of the accumulator is negative.
09	HLT	Halt execution. Control returns to a system command.[2] (Operand is ignored.)
10	UCB	Branch to the location specified by the operand.
11	PSC	Print the word specified by the operand and suppress the carriage return.[1]
12	DVR	Divide the content of the accumulator by the word specified by the operand and store the remainder in the accumulator.
13	NOP	No operation executed. (Operand is ignored)
14	ZAC	Zero the accumulator. (Operand is ignored)
15	BOZ	Branch to the location specified by the operand if the content of the accumulator is zero.
16	BOP	Branch to the location specified by the operand if the content of the accumulator is positive.
17	PAD	Print the content of the accumulator inserting a decimal point the number of places from right specified by the operand.[1,3]
18	BSA	Store the address of the (current) instruction plus one in the location specified by the operand and branch to the address specified by the operand plus one.[4] (Appendix III)
19	RTC	Return the carriage. (Skips a line)
20	SCR	Suppress the carriage.[1] (Operand ignored)
21	SNR	Shift the content of the accumulator right the number of decimal places specified by the operand.
22	SNL	Shift the content of the accumulator left the number of decimal places specified by the operand.
23	RAL	Allows up to 10 numbers to be read into the 10 consecutive locations beginning with the location specified by the operand.[4]

INSTRUCTION continued

OP-CODE	MNEMONIC	FUNCTIONS
24	PCL	Print the number of locations specified by the accumulator beginning with the location specified by the operand.[5]

Notes:

1. The print operations simulate a typewriter with an automatic carriage return (unless the carriage return is suppressed). PRT and PAD must be followed by SCR if so desired while PSC will suppress the automatic carriage return.
2. The system will always respond "TYPE YES IF THIS IS AN ASSEMBLY PROGRAM". If the answer is NO the system will expect a SML program, if YES a SAL program.
3. The PAD (17) operation is used to print a number with a decimal point. For example, to print the value of PI(π) the content of the accumulator must be 31416 and then the operation PAD04 would be written and 3.1416 would be printed.
4. The RAL (23) operation allows up to 70 characters to be read from an input line. The format must be Col. 1 sign, Col. 2-6 numeric, and Col. 7 comma and so on across the line until the number of items desired is included.
5. The PCL (24) operation allows memory to be dumped from ØØ1 by loading the accumulator with the number locations desired and executing PCLØØ.

IV. Subroutines

1. A subroutine is a sub-ordinate part of a computer program written to do some routine or operation. The linkage to a subroutine requires that the location of the subroutine be known; the location of the return address be known; and the location of the fields operated upon be known. In SAL the BSA (18) instruction is used to link to subroutines whether the subroutine is a library (See 2 and 3 below) or programmer created subroutine.

2. Linkage to the library subroutine for the square root is:

```
Col. 2345678910
        BSA SQ
     NU DS ØØ1
     RT DS ØØ1
```

NU must be loaded with the number whose square root is to be found. The square root subroutine will place in RT the root of the absolute value of NU (truncated to two decimal places but multiplied by a factor of 100).

3. Linkage to trigonometric subroutine is as follows:

```
Col. 2345678910
        BSA TR
     AA DS ØØ1
     BB DS ØØ1
```

BB must contain a parameter that indicates the values to be found while AA is the value to be operated upon.

Parameter	Unit of Input	Function	Stored
1	Degrees	SIN	BB
2	Degrees	COS	BB
3	Radians	SIN	BB
4	Radians	COS	BB
5	Degrees	SIN	AA
		COS	BB
6	Radians	SIN	AA
7	Degrees	ARCTAN	BB
8	Radians	ARCTAN	BB

If BB is less than or equal to 6, AA is an angle in degrees or radians. If AA is in degrees, it must be in the range $\pm$180.ØØ and two decimal places are assumed. If AA is in radians, it must be in the range $\pm\overline{3.1416}$ and 4 decimal places are assumed. For these values of BB all results are truncated to 4 decimal places and multiplied by 10,000. Note that BB is always replaced by an answer and for options 5 and 6 both AA and BB are replaced by answers. If BB is 7 or 8, AA must be a number in the range $\pm$99.999 and 3 decimal places are assumed. If the output is in degrees, the results are truncated to two decimal places and multiplied by 100. If the output is in radians, the results are truncated to 4 decimal places and multiplied by 10,000.

```
RUN

RUN
STPAL

PROGRAM FILE NAME?ROBIN
TYPE CRE-ROBIN,2 (RETURN), THEN TYPE RUN

DONE
RUN
STPAL

PROGRAM FILE NAME?PROGFL


TYPE YES IF THIS  IS AN ASSEMBLY PROGRAM
?NO\
NO
ENTER MACHINE LANGUAGE STATEMENTS
?001  \
001 #01001
?002  06020
?003  07020
?004  01020
?005  02020
?006  06020
?007 #03513
?008  08003
?009  09000
?000  10001
BEGINNING EXECUTION



 1
 2
 4
 8
 16
 32
 64
 128
 256
 512
HALT ENCOUNTERED.  EXECUTION COMPLETE.
NUMBER OF STATEMENTS EXECUTED 63
DO YOU WISH TO CORRECT THE MACHINE LANGUAGE PROGRAM?NO

PROGRAM FILE NAME?FILE1


TYPE YES IF THIS  IS AN ASSEMBLY PROGRAM
?YES


BEGINNING ASSEMBLY
TYPE 0 FOR NEW PROGRAM, 1 FOR RE-ASSEMBLE OLD PROGRAM.?1


LOC  OPADD   LAB  OP OPER

001           R  DS 001
002           H  DS 001
003              DS 008
011 +00314    PI +00314
012  23001    GO RAL R
013  01001       LOA R
014  15022       BOZ EX
015  04001       MUL R
016  04002       MUL H
017  04011       MUL PI
018  11001       PSC R
019  11002       PSC H
020  17002       PAD 02
```

```
021  10012        UCB GO
022  09000     EX HLT 00
000  10012        END GO
ASSEMBLY COMPLETE, BEGINNING EXECUTION



INPUT DATA. FORMAT SXXXXX,ETC.
?+00005,+00002
 5     2     157
?+00000
HALT ENCOUNTERED.  EXECUTION COMPLETE.
NUMBER OF STATEMENTS EXECUTED 14
DO YOU WISH TO CORRECT THE MACHINE LANGUAGE PROGRAM?YES
START EDITING.  000 ADDRESS  STILL LAST STATEMENT.
?011 +00031
?020  17001
?000  10012
BEGINNING EXECUTION



INPUT DATA. FORMAT SXXXXX,ETC.
?+00005,+00002
 5     2     155
?+00000
HALT ENCOUNTERED.  EXECUTION COMPLETE.
NUMBER OF STATEMENTS EXECUTED 14
DO YOU WISH TO CORRECT THE MACHINE LANGUAGE PROGRAM?NO
PROGRAM FILE NAME?//STOP

DONE
```

CONTRIBUTED PROGRAM **BASIC**

TITLE: TURING MACHINE — TM 36743

DESCRIPTION:

This package is a complete "Turing Machine" simulator, which may be used in theoretical computer studies.

INSTRUCTIONS:

It is assummed that the user understands Turing Machines at least abstractly. These instructions describe a system designed to give one practical experience in the programming of Turing Machines.

The system consists of 5 programs: TM, TMZNEW, TMZIN, TMZLST and TMZRUN. Three files must be created: TQUIN, 5 records, TTAPE, 2 records, and TWORM, 2 records.

The system is activated by "getting" and "running" a program named TM. The computer will prompt with "TMC?" which stands for Turing Machine Command. The user will type a command as outlined in "COMMANDS". Commands may be entered as a complete word or as a two letter abbreviation. To terminate execution, respond with a C^C in the usual manner.

Anytime the system is running or listing, execution may be terminated by merely depressing the break key. Typing "RUN" will re-activate the system. The system should be terminated only under one of the above conditions. To be more specific, the only commands which should be interrupted are:

LQ RU NR FR

All vital information is stored in the user's disc files so that he may leave and return later.

Error messages and diagnostics are at a minimum. The system is constructed to be "self-recovering". This means that nothing the user types will cause the system to fail. If something invalid happens, the system will either ignore it or type an error message. The standard error message is the word "GOOF" accompanied by bells. This usually happens when an invalid command is entered. Other possible error messages are described under the commands with which they are associated.

continued on following page.

SPECIAL CONSIDERATIONS:

For an excellent introduction to Turing Machines, see Baer*. The notation and design of the present system reflects the more complete treatment given in Minsky*.

*Baer,R. (1972), The Digital Villian. Addison-Wesley.

Minsky,M. (1967), Computation: Finite and Infinite Machines. Prentice-Hall.

ACKNOWLEDGEMENTS:

Ted Park
Pacific Union College

INSTRUCTIONS continued

COMMANDS:

ERASE - ER

PROMPTS

None

DESCRIPTION

This command causes the quintuples to be erased. Upon completion of the operation, the computer responds with "QUINTUPLES ERASED".

ERRORS

None

NEWTAPE - NT

PROMPTS

None

DESCRIPTION

This command causes the tape to be erased. Upon completion of the operations, the computer responds with "TAPE ERASED".

ERRORS

None

TAPE - TA

PROMPTS

"1ST CHARACTER POSITION" -- User is to input a number to indicate where the new information is to begin.

"TMT?" -- (stands for Turing Machine Tape)
User is to input information to be stored on the tape.

DESCRIPTION

This command allows one to enter meaningful information on the tape. When typing-in information, the user may use as many lines as are necessary. The input is terminated by the character "/". If the user types J characters, then J positions of the tape will be overlaid beginning with the position indicated as "1ST CHARACTER POSITION".

ERRORS

Due to the nature of the implementation, the tape has a finite length. If the user specifies a "1ST CHARACTER POSITION" outside the boundary of the tape, the computer will reprompt. If at any time the user inputs more characters than the tape can contain, the computer types "OUT OF STORAGE -- GOOF". Any time an invalid character is encountered "GOOF" is printed. (Valid characters are 0-9, A-Z.) In the case of any error the characters up to the goof are stored on the tape and control is returned to the main program.

QUINTUPLES - QU

PROMPTS

"TMQ?" -- (stands for Turing Machine Quintuple)
The user is to input a valid quintuple or the character "/".

DESCRIPTION

This command allows one to enter quintuples (program steps) into the system and to modify existing quintuples. Quintuples may be entered free-field but must contain exactly 3 or 7 non-blank characters. Character meanings are as follows with allowed values:

1,2	PRESENT STATE	(00-99)
3	PRESENT SYMBOL	(0-9,A-Z,$)
4,5	NEW STATE	(00-99)
6	NEW SYMBOL	(0-9,A-Z,$)
7	TAPE DIRECTION	(L,C,R)

There must be only one quintuple present for each unique pattern of the first three characters. (These three characters are used much like the statement numbers in BASIC.) Typing-in any quintuple will delete any previous quintuple with the same first three characters and enter the new one. Typing only the first three characters will delete the corresponding quintuple if it exists.

In this system, the "halt" command is anything which has the new state equal to the old state and has a tape direction of "center".

Instead of the normal alphanumeric symbols, the "$" may be used as a "present symbol" or a "new symbol". Its meaning is indicated by the following table:

present symbol -- "whatever is on the tape"
new symbol -- "whatever the present symbol was"

CONTRIBUTED PROGRAM **BASIC**™

TITLE: TURING MACHINE 36743

DESCRIPTION:

This package is a complete "Turing Machine" simulator, which may be used in theoretical computer studies.

INSTRUCTIONS:

It is assumed that the user understands Turing Machines at least abstractly. These instructions describe a system designed to give one practical experience in the programming of Turing Machines.

The system consists of 5 programs: TM, TM*NEW, TM*IN, TM*LST and TM*RUN. Three files must be opened: TQUIN, 5 records, TTAPE, 2 records, and TWORM, 2 records.

The system is activated by "getting" and "running" a program named TM. The computer will prompt with "TMC?" which stands for Turing Machine Command. The user will type a command as outlined in "COMMANDS". Commands may be entered as a complete word or as a two letter abbreviation. To terminate execution, respond with a C^C in the usual manner.

Anytime the system is running or listing, execution may be terminated by merely depressing the break key. Typing "RUN" will re-activate the system. The system should be terminated only under one of the above conditions. To be more specific, the only commands which should be interrupted are:

LQ RU NR FR,

All vital information is stored in the user's disc files so that he may leave and return later.

Error messages and diagnostics are at a minimum. The system is constructed to be "self-recovering". This means that nothing the user types will cause the system to fail. If something invalid happens, the system will either ignore it or type an error message. The standard error message is the word "GOOF" accompanied by bells. This usually happens when an invalid command is entered. Other possible error messages are described under the commands with which they are associated.

continued on following page.

SPECIAL CONSIDERATIONS:

For an excellent introduction to Turing Machines, see Baer*. The notation and design of the present system reflects the more complete treatment given in Minsky*.

*Baer,R. (1972), The Digital Villian. Addison-Wesley.

Minsky,M. (1967), Computation: Finite and Infinite Machines. Prentice-Hall.

ACKNOWLEDGEMENTS:

Ted Park
Pacific Union College

INSTRUCTIONS continued

COMMANDS:

ERASE - ER

PROMPTS

None

DESCRIPTION

This command causes the quintuples to be erased. Upon completion of the operation, the computer responds with "QUINTUPLES ERASED".

ERRORS

None

NEWTAPE - NT

PROMPTS

None

DESCRIPTION

This command causes the tape to be erased. Upon completion of the operations, the computer responds with "TAPE ERASED".

ERRORS

None

TAPE - TA

PROMPTS

"1ST CHARACTER POSITION" -- User is to input a number to indicate where the new information is to begin.

"TMT?" -- (stands for Turing Machine Tape)
User is to input information to be stored on the tape.

DESCRIPTION

This command allows one to enter meaningful information on the tape. When typing-in information, the user may use as many lines as are necessary. The input is terminated by the character "/". If the user types J characters, then J positions of the tape will be overlaid beginning with the position indicated as "1ST CHARACTER POSITION".

ERRORS

Due to the nature of the implementation, the tape has a finite length. If the user specifies a "1ST CHARACTER POSITION" outside the boundary of the tape, the computer will reprompt. If at any time the user inputs more characters than the tape can contain, the computer types "OUT OF STORAGE -- GOOF". Any time an invalid character is encountered "GOOF" is printed. (Valid characters are 0-9, A-Z.) In the case of any error the characters up to the goof are stored on the tape and control is returned to the main program.

QUINTUPLES - QU

PROMPTS

"TMQ?" -- (stands for Turing Machine Quintuple)
The user is to input a valid quintuple or the character "/".

DESCRIPTION

This command allows one to enter quintuples (program steps) into the system and to modify existing quintuples. Quintuples may be entered free-field but must contain exactly 3 or 7 non-blank characters. Character meanings are as follows with allowed values:

1,2	PRESENT STATE	(00-99)
3	PRESENT SYMBOL	(0-9,A-Z,$)
4,5	NEW STATE	(00-99)
6	NEW SYMBOL	(0-9,A-Z,$)
7	TAPE DIRECTION	(L,C,R)

There must be only one quintuple present for each unique pattern of the first three characters. (These three characters are used much like the statement numbers in BASIC.) Typing-in any quintuple will delete any previous quintuple with the same first three characters and enter the new one. Typing only the first three characters will delete the corresponding quintuple if it exists.

In this system, the "halt" command is anything which has the new state equal to the old state and has a tape direction of "center".

Instead of the normal alphanumeric symbols, the "$" may be used as a "present symbol" or a "new symbol". Its meaning is indicated by the following table:

present symbol -- "whatever is on the tape"
new symbol -- "whatever the present symbol was"

INSTRUCTIONS continued

When executing the program, the system tries to satisfy all the specific cases first. The $ notation is tried only as a last resort.

ERRORS
Goofs are caused by the following conditions: quintuples not 3 or 7 characters long, any parameter out of range, program space full. The last error also causes the computer to type "OUT OF STORAGE".

LIST TAPE - LT
PROMPTS
"1ST CHARACTER POSITION" -- User must respond with a number indicating where listing is to begin.

"LAST CHARACTER POSITION" -- User must respond with a number indicating where listing is to end.

DESCRIPTION
This command allows the user to look at the contents of the tape. Indicated portion of the tape is printed.

ERRORS
Any number specified which is outside the range of the tape will be ignored and the computer will reprompt.

LIST - LQ
PROMPTS
None

DESCRIPTION
This command allows the user to look at the qunituples (program steps). The quintuples are sorted, then printed.

ERRORS
None

PUNCH - PU
PROMPTS
None

DESCRIPTION
This command is the same as the LIST command except that a leader and trailer are punched. A "/" is also punched as the last quintuple to facilitate future read-in.

It is the responsibility of the user to turn the punch on and off at the appropriate times.

ERRORS
None

RUN - RU
PROMPTS
"INITIAL STATE" -- User must type the state number with which he wishes to start.

"INITIAL TAPE POSITION" -- User must type the tape position where processing is to begin.

DESCRIPTION
This command causes the computer to execute the quintuples with a given tape. The quintuples are executed and a trace is supplied by the computer. Each quintuple is printed with a copy of the tape as it appears after the quintuple has acted. The current tape position is also indicated. The whole tape is not printed; just the indicated character and 10 characters of context on either side.

ERRORS
Control is returned to the main program if a null program or tape is specified. The computer reprompts when invalid numbers are given for "INITIAL STATE" or "INITIAL TAPE POSITION". (Valid range for tape position is from 10 to 10 from the end of the tape.) A goof is generated when a real state-tape configuration finds no counterpart in the list of quintuples or when a tape runs out.

NORUN - NR
PROMPTS
"INITIAL STATE" -- User must type the state number with which he wishes to start.

"INITIAL TAPE POSITION" -- User must type the tape position where processing is to begin.

DESCRIPTION
This command causes the computer to execute the quintuples with a given tape. The quintuples are executed but no trace is given.

INSTRUCTIONS continued

ERRORS

Control is returned to the main program if a null program or tape is specified. The computer reprompts when invalid numbers are given for "INITIAL STATE" or "INITIAL TAPE POSITION". (Valid range for tape position is from 10 to 10 from the end of the tape.) A goof is generated when a real state-tape configuration finds no counterpart in the list of quintuples or when a tape runs out.

MODIFICATIONS:

The maximum number of quintuples and the maximum length of the tape may also be changed. Two procedures for doing the indicated modifications follow:

1. CHANGE NUMBER OF QUINTUPLES
   Change the common statement in each program. Array Q is where the quintuples are stored. There must be 3 entries for each quintuple. (Thus the standard option allows for 100 quintuples.)

   In the mainline, change the variable Q to be the new maximum number allowed.

   File TQUIN will have to be changed. It takes approximately 1 record for each 20 quintuples allowed.

2. CHANGE LENGTH OF TAPE
   Change variable T in the mainline to be one less than the new maximum tape length.

   Files TTAPE and TWORM will have to be changed. It takes 1 record for each 64 characters allowed.

RUN

```
RUN
TM


TMC?ERASE
QUINTUPLES ERASED

TMC?NEWTAPE
TAPE ERASED

TMC?QUINTUPLES
TMQ?Ø1AØ2AL
TMQ?Ø1$Ø1$R
TMQ?Ø2ØØ31L
TMQ?Ø21Ø2ØL
TMQ?Ø2AØ41L
TMQ?Ø3AØ4AL
TMQ?Ø3$Ø3$L
TMQ?Ø4$Ø4$C
TMQ?/

TMC?LIST
Ø1 A  Ø2 A  L
Ø1 $  Ø1 $  R
Ø2 Ø  Ø3 1  L
Ø2 1  Ø2 Ø  L
Ø2 A  Ø4 1  L
Ø3 A  Ø4 A  L
Ø3 $  Ø3 $  L
Ø4 $  Ø4 $  C


TMC?TAPE
1ST CHARACTER POSITION?18
TMT?AA1Ø11AA/

TMC?LISTTAPE
1ST CHARACTER POSITION?1Ø
LAST CHARACTER POSITION?5Ø
........AA1Ø11AA.....................

TMC?RUN
INITIAL STATE?1
INITIAL TAPE POSITION?2Ø

QUINTUPLES---      TAPE------------------
```

```
*** START ***        ........AA 1 Ø11AA..... 2Ø
Ø1 $  Ø1 $  R        .......AA1 Ø 11AA..... 21
Ø1 $  Ø1 $  R        ......AA1Ø 1 1AA...... 22
Ø1 $  Ø1 $  R        .....AA1Ø1 1 AA....... 23
Ø1 $  Ø1 $  R        ....AA1Ø11 A A........ 24
Ø1 A  Ø2 A  L        .....AA1Ø1 1 AA....... 23
Ø2 1  Ø2 Ø  L        ......AA1Ø 1 ØAA...... 22
Ø2 1  Ø2 Ø  L        .......AA1 Ø ØØAA..... 21
Ø2 Ø  Ø3 1  L        ........AA 1 1ØØAA.... 2Ø
Ø3 $  Ø3 $  L        .........A A 11ØØAA... 19
Ø3 A  Ø4 A  L        .......... A A11ØØAA.. 18
Ø4 $  Ø4 $  C        .......... A A11ØØAA.. 18


TMC?
DONE




GET-TM
RUN
TM


TMC?ER
QUINTUPLES ERASED

TMC?NT
TAPE ERASED

TMC?ØØYØØXR  }   MISTAKE - SHOULD HAVE TYPED 'QU'
GOOF

TMC?QU
TMQ?ØØYØØXR
TMQ?ØØ1Ø1XR
TMQ?ØØ$ØØ$R
TMQ?Ø1BØ2BL
TMQ?Ø1XØ11R
TMQ?Ø1YØ11R
TMQ?Ø1$Ø1$R
TMQ?Ø2AØ3AR
TMQ?Ø2$Ø2$L
TMQ?Ø3XØ4YR
TMQ?Ø3$Ø3$R
TMQ?Ø41Ø51R
TMQ?Ø4BØ8BL
TMQ?Ø4$Ø4$R
TMQ?Ø51Ø6XL
TMQ?Ø5XØ7XR
TMQ?Ø5BØ9BL      INPUT QUINTUPLES
TMQ?Ø5$Ø5$R
TMQ?Ø6YØ3YR
TMQ?Ø6$Ø6$L
TMQ?Ø71Ø6XL
TMQ?Ø7BØ8BL
TMQ?Ø7$Ø7$R
TMQ?Ø8AØ8AR
TMQ?Ø8$Ø8$L
TMQ?Ø9Y1ØYL
TMQ?Ø9$Ø9$L
TMQ?1ØA11PC
TMQ?1ØY11NC
TMQ?1Ø$1Ø$L
TMQ?11$11$C
TMQ?/
```

```
TMC?LQ
00 1  01 X  R
00 Y  00 X  R
00 $  00 $  R
01 B  02 B  L
01 X  01 1  R
01 Y  01 1  R
01 $  01 $  R
02 A  03 A  R
02 $  02 $  L
03 X  04 Y  R
03 $  03 $  R
04 1  05 1  R
04 B  08 B  L
04 $  04 $  R
05 1  06 X  L
05 B  09 B  L
05 X  07 X  R
05 $  05 $  R
06 Y  03 Y  R
06 $  06 $  L
07 1  06 X  L
07 B  08 B  L
07 $  07 $  R
08 A  08 A  R
08 $  08 $  L
09 Y  10 Y  L
09 $  09 $  L
10 A  11 P  C
10 Y  11 N  C
10 $  10 $  L
11 $  11 $  C
```

NOTE HOW LISTING IS SORTED

```
TMC?TA
1ST CHARACTER POSITION?20
TMT?A11111B/

TMC?FR
INITIAL STATE?0
INITIAL TAPE POSITION?20
STOP
```

> 5 MINUTES
(OBVIOUSLY ONE OR MORE QUINTUPLES ARE WRONG)

```
RUN
TM*RUN
```

START AGAIN

```
TMC?LT
1ST CHARACTER POSITION?15
LAST CHARACTER POSITION?30
.....A11111B....

TMC?QU
TMQ?08A00AR
TMQ?/
```

CHANGE WRONG QUINTUPLE

```
TMC?LQ
00 1  01 X  R
00 Y  00 X  R
00 $  00 $  R
01 B  02 B  L
01 X  01 1  R
01 Y  01 1  R
01 $  01 $  R
02 A  03 A  R
02 $  02 $  L
03 X  04 Y  R
03 $  03 $  R
04 1  05 1  R
04 B  08 B  L
04 $  04 $  R
05 1  06 X  L
05 B  09 B  L
05 X  07 X  R
05 $  05 $  R
```

```
06 Y  03 Y  R
06 $  06 $  L
07 1  06 X  L
07 B  08 B  L
07 $  07 $  R
08 A  00 A  R   ← NOTE NEW ENTRY
08 $  08 $  L
09 Y  10 Y  L
09 $  09 $  L
10 A  11 P  C
10 Y  11 N  C
10 $  10 $  L
11 $  11 $  C

TMC?FR
INITIAL STATE?0
INITIAL TAPE POSITION?20
                                  ≈ 30 SECONDS
.................PYXXX1B.........................................
                  5 IS PRIME
TMC?NT
TAPE ERASED

TMC?TA
1ST CHARACTER POSITION?30
TMT?A1111B
TMT?/

TMC?FR
INITIAL STATE?0
INITIAL TAPE POSITION?30
                                  ≈ 5 SECONDS
.............................AN1Y1B.................................
                                  4 IS NON-PRIME
TMC?
DONE
```

PROGRAMMING AND COMPUTER SCIENCE (EDUCATION) (310)

CONTRIBUTED PROGRAM **BASIC**

TRAN1
36888-18038

TITLE: GRAPHICS UTILITY PROGRAMS

DESCRIPTION:

There are 3 programs in this project: TRAN1, PLOT1 and PLOT2. These three programs support the publication Computer Graphics: Three Dimensional Projections: Theory, Programs and Examples, by Herbert D. Peckham published by the Hewlett-Packard Computer Curriculum Project, order number 5951-5601, price $5.50.

For further information contact:

Hewlett-Packard Computer-Based Educational Materials
Scientific Press
1629 Channing Avenue
Palo Alto, Ca 84303

INSTRUCTIONS:

User's Instructions are in the publication.

SPECIAL CONSIDERATIONS:

TRAN1 is the general capability program. PLOT1 requires a HP 7200 or 7202 plotter and PLOT2 requires a 4010 or 4012 Tektronix Graphics terminal and the Hewlett-Packard Primary Graphics Software (HP 20311A) See HP sales representative for details.

ACKNOWLEDGEMENTS:

HERB PECKHAM
GAVILAN COLLEGE

CONTRIBUTED PROGRAM **BASIC**

TUTOR
36139

TITLE: TUTOR SERIES BASIC LANGUAGE PROGRAM COURSE

DESCRIPTION:

This series of 25 individual programs (named TUTØ1, TUTØ2 . . . TUT25) provides conversational instructions to a student new to computer programming in the Time-Shared BASIC Language.

INSTRUCTIONS:

"GET" the first program, TUTØ1. Further instructions are included within that program.

Because of the extensive length of the 25 programs, only representative "RUNS" are printed and no listings.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES

Student Background Required: No programming experience is required. However, some knowledge of algebra is needed.

REFERENCES: The student should have available the HP reference manuals to Time-Shared BASIC.

ACKNOWLEDGEMENTS:

```
RUN

RUN
TUT01

WELCOME TO THE HEWLETT-PACKARD T/S SYSTEM. WE WILL
TRY TO TEACH YOU ENOUGH ABOUT THE SYSTEM IN THIS SITTING FOR
YOU TO BE ABLE TO WRITE YOUR OWN COMPUTER PROGRAMS

BEFORE WE CAN WRITE A PROGRAM WE NEED TO REVIEW THE SYMBOLS
AVAILABLE

  (1) +
  (2)  -
  (3)   /
  (4)    *
  (5)     ()
  (6)       ↑

AFTER THE ? BELOW TYPE THE NUMBER OF YOUR ANSWER

WHICH OF THE SYMBOLS IS USED FOR ADDITION?1
GOOD
WHICH SYMBOL IS USED FOR SUBTRACTION?2
RIGHT
WHICH SYMBOL IS USED FOR DIVISION?3
GOOD FOR YOU. NOW, THE NEXT ONE IS TRICKY.
WHICH SYMBOL IS USED FOR MULTIPLICATION?4
VERY GOOD, IF 'X' WERE USED FOR MULTIPLY, IT COULD BE
CONFUSED WITH THE VARIABLE 'X'. LETS PRACTICE A LITTLE:
HOW MUCH IS 2*3?6
SURE
HOW MUCH IS 3*4+7?14
SORRY, LOOK AGAIN
HOW MUCH IS 3*4+7?19
RIGHT YOU ARE
HOW MUCH IS 3*(1+5)/2?9
GOOD
THAT LEAVES ↑ WHICH IS OUR WAY TO INDICATE SQUARES,CUBES
ETC., SUCH AS X↑2 FOR 'X SQUARED' OR X*X, Y↑3 FOR 'Y CUBED
OR Y*Y*Y ETC.
YOU CAN EVEN DEFINE YOUR OWN,BUT THESE WILL BE COVERED
IN ANOTHER LESSON. WE'LL USE SQR(SQUARE ROOT) IN OUR
COMING EXAMPLE TO GIVE YOU THE IDEA. LET'S ASSUME
YOU WANT TO COMPOSE A PROGRAM TO COMPUTE RADIUS VECTORS
(THE SQUARE ROOT OF THE SUM OF THE SQUARES OF THE
THREE COMPONENTS). THIS PROBLEM WILL BE A SEQUENCE OF
STATEMENTS TO TELL THE COMPUTER WHAT TO DO.
DO YOU THINK THE STATEMENTS SHOULD BE NUMBERED:
 (1) CONSECUTIVELY (1,2,3 ETC.)
 (2) INCREMENTALLY (10,20,30 ETC.)
 (3) ANY SEQUENCE FOR IT DOESN'T MATTER
(TYPE NO. OF ANSWER)
?2
RIGHT
LEAVING SPACE BETWEEN NUMBERS PERMITS INSERTIONS LATER.
FOR OUR SAMPLE PROGRAM, LETS FIRST CALL FOR OUR KNOWN
VARIABLES. WE SIMPLY TYPE:

10 INPUT X,Y,Z

10 IS SIMPLY THE FIRST STATEMENT NUMBER. X, Y, AND Z ARE
OUR 'DATA'. NEXT, WE WRITE OUR EQUATION BY TYPING:
20 LET R=SQR(X↑2+Y↑2+Z↑2)

HERE 20 IS THE NEXT STATEMENT NUMBER, 'LET' TELLS THE
COMPUTER THAT AN EQUATION IS COMING, AND 'R' IS OUR
UNKNOWN VARIABLE. NOTE:UNKNOWNS MUST BE ON THE
LEFT OF THE '=' AND KNOWNS ARE ON THE RIGHT. SQR IS
THE SQUARE ROOT FUNCTION MENTIONED EARLIER. THE REST IS
TELETYPE ALGEBRA. FROM THIS POINT ON 'R' CAN BE TREATED AS
A KNOWN IN OTHER EQUATIONS. IN THIS EXAMPLE WE'LL TELL THE
COMPUTER TO PRINT THE VALUE OF 'R' BY TYPING THE STATEMENT

30 PRINT R

WHICH WILL CAUSE THE COMPUTER TO DO JUST THAT. NOW WE ADD
AN 'END' STATEMENT AND THIS IS OUR COMPLETE PROGRAM
```

ACZ1
36152

TITLE: COMPUTER AIDED PRACTICE IN EE AC ANALYSIS

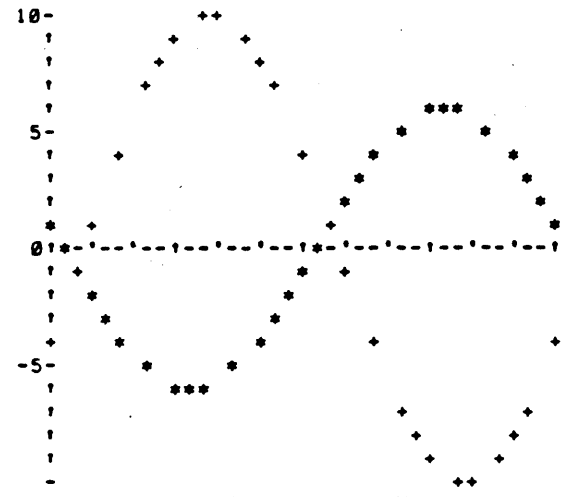
DESCRIPTION: ACZ1 offers computer aided practice in the analysis of single frequency sine waves, complex power, power factor, etc.

INSTRUCTIONS: Instructions are included within the program.

SPECIAL CONSIDERATIONS: FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Any AC analysis course such as Electrical Science

ACKNOWLEDGEMENTS: Dr. Clifford M. Siegel
University of Virginia

```
RUN
NOT
AC-1
COMPUTER AIDED PRACTICE IN ANALYSIS OF SINGLE-FREQUENCY
SINE WAVES, COMPLEX POWER, POWER FACTOR, ETC;
  PREPARED BY C.M. SIEGEL, NOV.24, 1970 (REV. 12/3/70).

LET CURRENT AND P.D. APPEAR AS FOLLOWS:
     P.D. = + + + + + + + +
     CURRENT = * * * * * * * * *
```



```
EXPECTED ANSWERS WILL BE GIVEN IN (  ).
  ALL ANGLES ARE MULTIPLES OF + OR - 5 DEGREES;
  SHOULD BE EXPRESSED IN THE RANGE, -180<ANGLE<=180.

1. WHAT ARE THE POLAR COMPONENTS OF THE
 P.D.  REGARDED AS A SINE FUNCTION?
 MAGNITUDE ?10
CLOSE ENOUGH, ( 10    )

 PHASE (DEGREES) ?-20
TOO FAR WRONG;
-------TRY AGAIN.?-15
TOO FAR WRONG;
(-25    )

2.  CURRENT  REGARDED AS A SINE FUNCTION?
 MAGNITUDE ?6
CLOSE ENOUGH, ( 6     )

 PHASE (DEGREES) ?170
CLOSE ENOUGH, ( 170   )

3.  P.D.  REGARDED AS A COSINE FUNCTION?
 PHASE (DEGREES) ?-115
CLOSE ENOUGH, (-115   )

4.  CURRENT  REGARDED AS A COSINE FUNCTION?
 PHASE (DEGREES) ?8
TOO FAR WRONG;
-------TRY AGAIN.?80
CLOSE ENOUGH, ( 80    )

5. WHAT ARE THE POLAR COMPONENTS OF THE  IMPEDANCE (V/I)?
 MAGNITUDE ?1.67
CLOSE ENOUGH, ( 1.66667     )

 PHASE (DEGREES) ?165
CLOSE ENOUGH, ( 165   )

AND ITS RECTANGULAR COMPONENTS,
R = ?.432
TOO FAR WRONG;
-------TRY AGAIN.?-1.62
CLOSE ENOUGH, (-1.61        )
 AND X = ?.432
CLOSE ENOUGH, ( .430904     )
```

```
6. WHAT ARE THE POLAR COMPONENTS OF THE  ADMITTANCE (I/V)?
 MAGNITUDE ?.6
CLOSE ENOUGH, (  .6          )

 PHASE (DEGREES) ?-165
CLOSE ENOUGH, (-165   )

AND ITS RECTANGULAR COMPONENTS,
G = ?-.58
CLOSE ENOUGH, (-.5796        )

 AND B = ?-.155
CLOSE.ENOUGH, (-.155125      )

AND WHAT ARE THE
7.  POWER FACTOR?.99
YOU ARE NOT FAR OFF;
--------TRY AGAIN.?.97
CLOSE ENOUGH, (  .966        )

8.  VOLT-AMPERES?60
TOO FAR WRONG;
-------TRY AGAIN.?30
CLOSE ENOUGH, (  30    )

9.  AVERAGE POWER?29
TOO FAR WRONG;
-------TRY AGAIN.?-29
CLOSE ENOUGH, (-28.98        )

10.  REACTIVE VOLT-AMPERES (ACCORDING TO V*CONJ I)?7.8
CLOSE ENOUGH, (  7.75627     )

11.  AVERAGE P.D.?0
CLOSE ENOUGH, (  0     )

12.  AVERAGE CURRENT?0
CLOSE ENOUGH, (  0     )

13.  RMS P.D.?7.07
CLOSE ENOUGH, (  7.07        )

14.  RMS CURRENT?4.25
CLOSE ENOUGH, (  4.242       )

15.  MAXIMUM INSTANTANEOUS POWER?-55
TOO FAR WRONG;
-------TRY AGAIN.?-50
TOO FAR WRONG;
(  1.02        )

16.  MINIMUM INSTANTANEOUS POWER?-55
TOO FAR WRONG;
-------TRY AGAIN.?-58
CLOSE ENOUGH, (-58.98        )

RELATIVE TO THE P.D., WHAT ARE THE
     17.  IN-PHASE RMS CURRENT?-5.8
TOO FAR WRONG;
-------TRY AGAIN.?-4.1
CLOSE ENOUGH, (-4.09777      )

     18.  THE REACTIVE (I.E. QUADRATURE) RMS CURRENT?1.1
TOO FAR WRONG;
-------TRY AGAIN.?-1.1
CLOSE ENOUGH, (-1.09674      )

RELATIVE TO THE CURRENT, WHAT ARE THE
     19.  IN-PHASE RMS P.D.?-6.85
CLOSE ENOUGH, (-6.82962      )

     20.  REACTIVE (I.E. QUADRATURE) RMS P.D.?-1.83
TOO FAR WRONG;
-------TRY AGAIN.?1.83
CLOSE ENOUGH, (  1.82789     )


DONE
```

BASP

TITLE: BASIC ANALOG SIMULATION PROGRAM 36888-18022

DESCRIPTION:

BASP utilizes digital techniques to simulate the operation of an analog computer. In essence, it is used to break down descriptions of conventional analog block diagrams into sets of simultaneous first order differential equations. These differential equations are then solved by numerical methods.

INSTRUCTIONS:

The user must first define his problem in terms of an analog block diagram. BASP utilizes twenty four functional block types to facilitate the construction of this block diagram from the problem description. By defining each block in terms of its function, referenced inputs, and associated parameters, the block interconnection structure and system parameters are readily available for program use. The user may then select the desired output format and adjust the run-time parameters for required accuracy.

Order HP 36888-90022, $5 for complete documentation

SPECIAL CONSIDERATIONS:

Some extreme problem cases may require that the user take into account such analog computer characteristics as scaling.

ACKNOWLEDGEMENTS:

Michael A. Van Cleave
University of Louisville

RUN

```
RUN
BASP
```

```
                    BASIC ANALOG SIMULATION PROGRAM
                    -------------------------------


SYSTEM DESCRIPTION:

DEFINE BLOCK FUNCTIONS,BLOCK INTERCONNECTIONS,AND ASSOCIATED PARAMETERS.
HOW MANY BLOCKS IN THE SYSTEM?6
INPUT BLOCK TYPE,INPUTS (1,2,3),AND BLOCK PARAMETERS (1,2)
BE SURE TO ENCLOSE BLOCK TYPE IN QUOTES.

BLOCK NO. 1     ?"MUL",2,5,0,0,0
BLOCK NO. 2     ?"INT",-1,3,0,5,0
BLOCK NO. 3     ?"POT",2,0,0,2,0
BLOCK NO. 4     ?"POT",1,0,0,2,0
BLOCK NO. 5     ?"INT",4,-6,0,2,0
BLOCK NO. 6     ?"POT",5,0,0,8,0
```

SEQUENCE TABLE FOR BASP RUN

BLOCK NO.	BLOCK TYPE	INPUT 1	INPUT 2	INPUT 3
3	POT	2	Ø	Ø
1	MUL	2	5	Ø
2	INT	-1	3	Ø
6	POT	5	Ø	Ø
4	POT	1	Ø	Ø
5	INT	4	-6	Ø

```
DETERMINE OUTPUT FORMAT:

INPUT BLOCK NUMBERS OF OUTPUTS TO BE MONITORED.
(ENTER ZERO AS LAST INPUT IF LESS THAN THREE.)
?2
?5
?0


OUTPUT OPTIONS ARE AS FOLLOWS :
  (1) TABULAR
  (2) TABULAR PLUS GRAPHICAL

WHICH IS YOUR CHOICE?2


DEFINE RUN-TIME PARAMETERS:

INPUT INITIAL AND FINAL VALUES OF THE INDEPENDENT VARIABLE?0,5
ENTER THE INTEGRATION STEP SIZE?.1
```

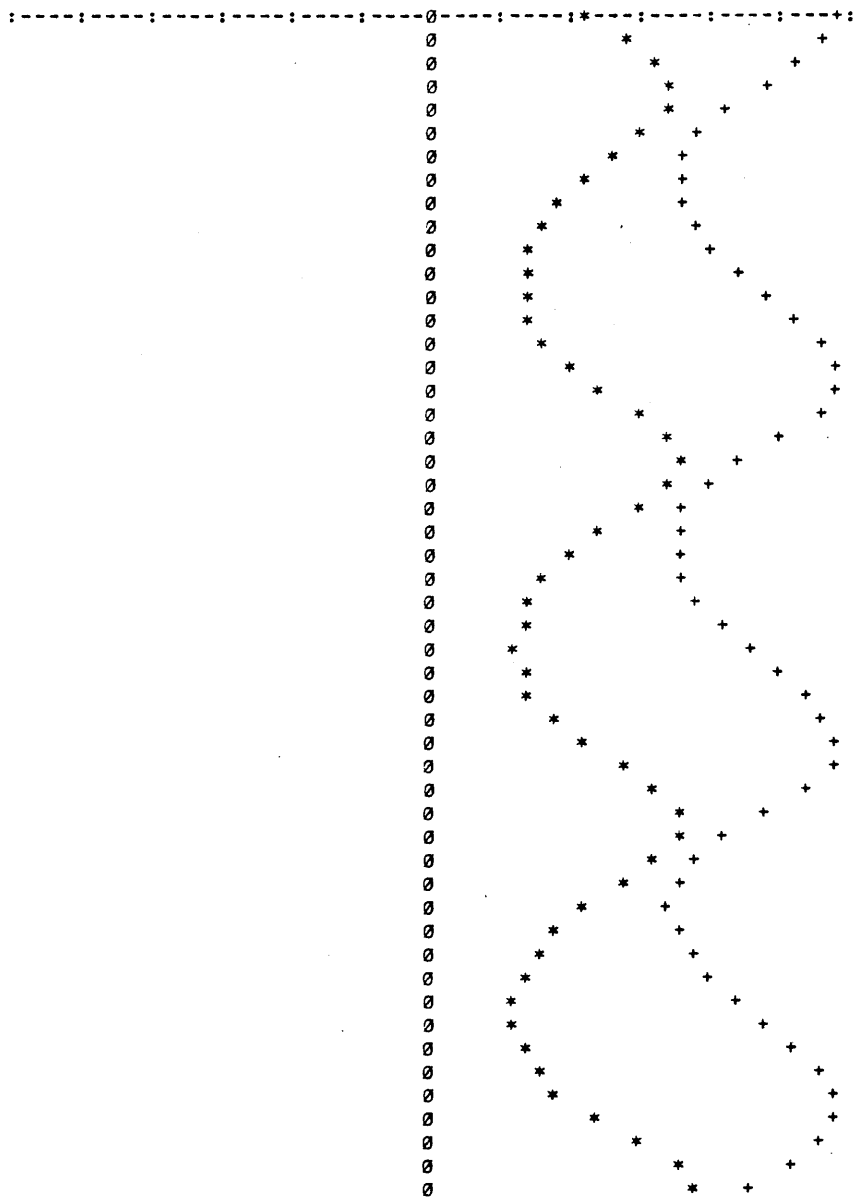
BLOCK OUTPUT TABLE

IND. VAR.	BLOCK NO. 2	BLOCK NO. 5	BLOCK NO. 0
0.00000E+00	+5.00000E+00	+2.00000E+00	+0.00000E+00
1.00000E-01	+4.90000E+00	+2.44000E+00	+0.00000E+00
2.00000E-01	+4.58627E+00	+2.85665E+00	+0.00000E+00
3.00000E-01	+4.13999E+00	+3.08585E+00	+0.00000E+00
4.00000E-01	+3.69891E+00	+3.03085E+00	+0.00000E+00
5.00000E-01	+3.36754E+00	+2.74523E+00	+0.00000E+00
6.00000E-01	+3.18004E+00	+2.35976E+00	+0.00000E+00
7.00000E-01	+3.12701E+00	+1.98194E+00	+0.00000E+00
8.00000E-01	+3.18687E+00	+1.66703E+00	+0.00000E+00
9.00000E-01	+3.33938E+00	+1.43278E+00	+0.00000E+00
1.00000E+00	+3.56757E+00	+1.27954E+00	+0.00000E+00
1.10000E+00	+3.85502E+00	+1.20371E+00	+0.00000E+00
1.20000E+00	+4.18148E+00	+1.20519E+00	+0.00000E+00
1.30000E+00	+4.51716E+00	+1.29123E+00	+0.00000E+00
1.40000E+00	+4.81637E+00	+1.47731E+00	+0.00000E+00
1.50000E+00	+5.01357E+00	+1.78147E+00	+0.00000E+00
1.60000E+00	+5.03182E+00	+2.20268E+00	+0.00000E+00
1.70000E+00	+4.81883E+00	+2.67704E+00	+0.00000E+00
1.80000E+00	+4.40514E+00	+3.04970E+00	+0.00000E+00
1.90000E+00	+3.91829E+00	+3.15437E+00	+0.00000E+00
2.00000E+00	+3.50101E+00	+2.96290E+00	+0.00000E+00
2.10000E+00	+3.22691E+00	+2.59205E+00	+0.00000E+00
2.20000E+00	+3.10235E+00	+2.18039E+00	+0.00000E+00
2.30000E+00	+3.10652E+00	+1.81407E+00	+0.00000E+00
2.40000E+00	+3.21610E+00	+1.52747E+00	+0.00000E+00
2.50000E+00	+3.41199E+00	+1.32634E+00	+0.00000E+00
2.60000E+00	+3.67799E+00	+1.20643E+00	+0.00000E+00
2.70000E+00	+3.99686E+00	+1.16418E+00	+0.00000E+00
2.80000E+00	+4.34505E+00	+1.20232E+00	+0.00000E+00
2.90000E+00	+4.68600E+00	+1.33270E+00	+0.00000E+00
3.00000E+00	+4.96343E+00	+1.57548E+00	+0.00000E+00
3.10000E+00	+5.10008E+00	+1.94790E+00	+0.00000E+00
3.20000E+00	+5.01686E+00	+2.42992E+00	+0.00000E+00
3.30000E+00	+4.68718E+00	+2.91129E+00	+0.00000E+00
3.40000E+00	+4.19428E+00	+3.19745E+00	+0.00000E+00
3.50000E+00	+3.69917E+00	+3.15728E+00	+0.00000E+00
3.60000E+00	+3.32691E+00	+2.84600E+00	+0.00000E+00
3.70000E+00	+3.11570E+00	+2.41935E+00	+0.00000E+00
3.80000E+00	+3.05165E+00	+2.00328E+00	+0.00000E+00
3.90000E+00	+3.10860E+00	+1.65919E+00	+0.00000E+00
4.00000E+00	+3.26390E+00	+1.40420E+00	+0.00000E+00
4.10000E+00	+3.49990E+00	+1.23598E+00	+0.00000E+00
4.20000E+00	+3.80080E+00	+1.14828E+00	+0.00000E+00
4.30000E+00	+4.14774E+00	+1.13914E+00	+0.00000E+00
4.40000E+00	+4.51259E+00	+1.21517E+00	+0.00000E+00
4.50000E+00	+4.85034E+00	+1.39358E+00	+0.00000E+00
4.60000E+00	+5.09243E+00	+1.69870E+00	+0.00000E+00
4.70000E+00	+5.15083E+00	+2.14214E+00	+0.00000E+00
4.80000E+00	+4.95296E+00	+2.67264E+00	+0.00000E+00
4.90000E+00	+4.51335L+00	+3.12455E+00	+0.00000E+00
5.00000E+00	+3.97008E+00	+3.28695E+00	+0.00000E+00

COMPOSITE PLOT OF BLOCK OUTPUTS VERSUS THE INDEPENDENT VARIABLE

LEGEND:

\+ DENOTES THE OUTPUT OF BLOCK NO. 2
* DENOTES THE OUTPUT OF BLOCK NO. 5
SCALE: ONE DIVISION = .171694 UNITS



PROGRAM OPTIONS AT THIS POINT INCLUDE THE FOLLOWING :
  (1) CHANGE RUN-TIME PARAMETERS ONLY AND RUN UNDER
      THE PREVIOUS OUTPUT OPTION.
  (2) CHANGE BLOCK PARAMETERS, RUN-TIME PARAMETERS
      AND OUTPUT FORMAT FOR NEXT RUN.
      NOTE: BLOCK INTERCONNECTIONS MAY NOT BE ALTERED!
  (3) TERMINATE RUN.

WHICH IS YOU CHOICE ?3

DONE

CONTRIBUTED PROGRAM **BASIC**

COMPLX
36153

TITLE: CAI IN ALGEBRA OF COMPLEX NUMBERS

DESCRIPTION:

COMPLX offers computer aided practice in the algebra of complex numbers. Several different types of problems are offered.

INSTRUCTIONS:

Instructions and definitions of the types of problems available are included within the program.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Any course in AC circuit analysis

Student Background Required: Some knowledge of the algebra of complex numbers

ACKNOWLEDGEMENTS:

Dr. Clifford M. Siegel
University of Virginia

```
RUN

RUN
COMPLX


FOR INSTRUCTIONS TYPE 1, OTHERWISE 0.
?1
COMPUTER AIDED PRACTICE IN ALGEBRA OF COMPLEX NUMBERS
AS USED IN A.C. CIRCUITS;  PREPARED BY C.M.SIEGEL
AND E. DIXON, JUNE 30, 1970.  (REV. 12/20/70)
SELECT THE KIND OF PROBLEM FROM THIS LIST.
    1. INTRODUCTION- SLIDE RULE INSTRUCTION, RECTANGULAR
    TO POLAR CONVERSION.
    2.  CONVERT RECTANGULAR TO POLAR
    3. FIND RECIPROCAL
    4.  CONVERT POLAR TO RECTANGULAR FORM
    5.  FIND R,X,G,B
    6.  FIND COMPLEX POWER
    99.  FINISHED
EXPECTED ANSWERS WILL BE SHOWN IN [ ].

WHICH KIND?
?1

FOR Z =  85    , 35
WHAT IS ITS POLAR FORM?
FIND IT VIA THE FOLLOWING STEPS.
FIND THE SHORT-SIDE VALUE ON THE SLIDE RULE D-SCALE.
PUT THE HAIR LINE THERE.  WHAT IS THAT NUMBER?
?35
O.K.

MOVE THE SLIDE(NOT THE HAIR LINE) SO THAT THE
RIGHT* OR LEFT*END OF THE S,T AND ST SCALES LIES OVER
THE LONG SIDE VALUE ON THE D-SCALE. (* THE WRONG
CHOICE OF END WILL NOT LEAVE THE S,T AND ST SCALES
BENEATH THE HAIR LINE.)
WHAT IS THAT NUMBER?
?85
O.K.

OBTAIN THE ANGLE FROM THE READING ON THE T(OR ST) SCALE
BENEATH THE HAIR LINE.
WHAT IS THE ANGLE(DEGREES)?
(SHOW REGARD FOR THE PROPER QUADRANT; CHOSE ANGLE
BETWEEN -180 AND +180)
?24.4
YOU ARE NOT WITHIN  1.11        OR MORE DEGREES
TRY THE ANGLE AGAIN.
?22.4
CORRECT IN  2     TRY(S)
[ 22.3801    ]

MOVE THE SLIDE UNTIL THAT SAME READING (ON THE T SCALE)
APPEARS ON THE S-SCALE# BENEATH THE HAIR LINE
(# IF RATIO, SHORT-SIDE/LONG-SIDE, IS < .1 USE THE ST
SCALE: NO SLIDE MOVEMENT NEEDED.)
ONE END OF THE S,T OR ST SCALES SHOULD NOW LIE
OVER THE HYPOTENUSE-VALUE ON THE D-SCALE
THE MAGNITUDE EQUALS?
?92
CORRECT IN  1     TRY(S)
[ 91.9239    ]


WHICH KIND?
?2

FOR Z =  313   - J 11
WHAT IS ITS POLAR FORM?
WHAT IS THE ANGLE(DEGREES)?
(SHOW REGARD FOR THE PROPER QUADRANT; CHOSE ANGLE
BETWEEN -180 AND +180)
?-19.4
YOU ARE NOT WITHIN  .1          OR MORE DEGREES
```

```
TRY THE ANGLE AGAIN.
?-2
CORRECT IN  2     TRY(S)
[-2.01276    ]
THE MAGNITUDE EQUALS?
?313
CORRECT IN  1     TRY(S)
[ 313.193    ]


WHICH KIND?
?99

DONE
```

CONTRIBUTED PROGRAM **BASIC**

DVDRS
36156

TITLE: CAI IN VOLTAGE AND CURRENT DIVIDERS

DESCRIPTION: DVDRS offers computer aided practice in the analysis of voltage (potential difference) and current dividers.

INSTRUCTIONS: Instructions are included within the program.

SPECIAL CONSIDERATIONS: FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Introductory Engineering courses

Student Background Required: Some knowledge of voltage and current dividers.

ACKNOWLEDGEMENTS: Dr. Clifford M. Siegel and Edward T. Dixon
University of Virginia

```
RUN

RUN
DVDRS


WHAT IS THE TIME OF DAY (HR:MIN)?
?10:42

A PROGRAM FOR COMPUTER AIDED PRACTICE IN ANALYSIS
OF P.D. AND CURRENT DIVIDERS, PREPARED BY
C.M. SIEGEL AND E. DIXON, JULY 2, 1970 (REV. 11/22/70)



WHEN ASKED FOR KIND, YOU SHOULD TYPE
     1. FOR RESISTIVE NETWORKS
     2. FOR R,L,C NETWORKS
     0 TO QUIT

KIND   ?1



FOR   2      RESISTANCES IN  PARALLEL  WITH VALUES AS FOLLOWS:
R 1    = 7830
R 2    = 180

WHAT FRACTION OF THE APPLIED CURRENT PASSES THROUGH  R 1     ?.0224
O.K. IN  1     TRY(S);
  THE EXPECTED ANSWER WAS  2.24719E-02


WHAT IS THE RESISTANCE OF THE COMBINATION?
?180
YOU ARE WITHIN 5 PER CENT; TRY AGAIN  ?179.5
YOU ARE WITHIN 5 PER CENT; TRY AGAIN  ?179
YOU ARE WITHIN 5 PER CENT; TRY AGAIN  ?175
O.K. IN  4     TRY(S);
  THE EXPECTED ANSWER WAS  175.955

KIND   ?2


FOR 2 ADMITTANCES IN PARALLEL WITH VALUES AS FOLLOWS:
(G1,B1)= 1172     ,-5600     MICROMHOS
(G2,B2)= 1286     , 4440     MICROMHOS
WHAT FRACTION (MAG) OF THE APPLIED CURRENT PASSES THROUGH   Y 2
?1.71
O.K. IN  1     TRY(S);
  THE EXPECTED ANSWER WAS  1.70071

WHAT IS THE ASSOCIATED ANGLE   ?99.2
O.K. IN  1     TRY(S);
  THE EXPECTED ANSWER WAS  99.1109

KIND   ?0

DONE
```

CONTRIBUTED PROGRAM **BASIC**

EXPNTL
36148

TITLE: CAI IN SIMPLE EXPONENTIAL FUNCTIONS OF TIME

DESCRIPTION: EXPNTL offers computer aided instruction and practice in the identification of various characteristics of exponential functions of time.

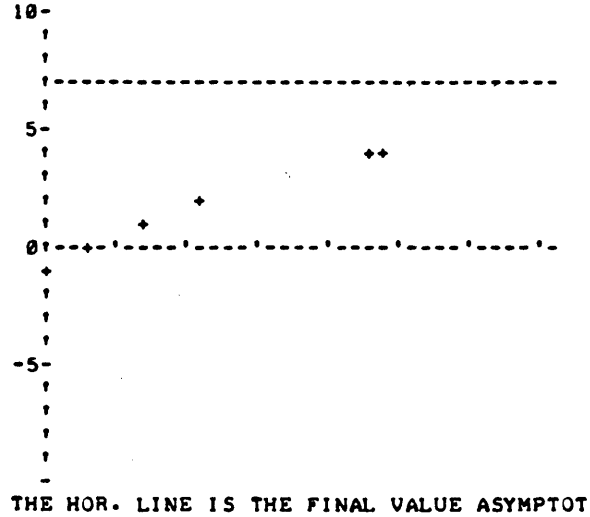
INSTRUCTIONS: Instructions are contained within the program.

SPECIAL CONSIDERATIONS: FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Any Mathematical or Engineering course

Student Background Required: Some knowledge of elementary calculus

ACKNOWLEDGEMENTS: Dr. Clifford M. Siegel
University of Virginia

```
RUN

RUN
EXPNTL

COMPUTER AIDED PRACTICE IN IDENTIFICATION OF SIMPLE
  EXPONENTIAL FUNCTIONS OF TIME;
  PREPARED BY C.M. SIEGEL, DEC. 4, 1970 (REV. 1/3/71).
```




```
THE HOR. LINE IS THE FINAL VALUE ASYMPTOTE.

TEAR THIS OFF FOR MEASURING.

GIVEN THE FUNCTION,  B + A * EXP(-T/T.C.),
  PLOTTED AS ABOVE,
WHAT ARE THE VALUES
  1.  OF B?7
CLOSE ENOUGH, ( 7     )

  2.  OF A?-8
CLOSE ENOUGH, (-8     )

  3.  OF T.C.?15
TOO FAR WRONG;
-------TRY AGAIN.?20
YOU ARE NOT FAR OFF;
( 24    )

DRAW A TANGENT TO THE CURVE AT T=0;
  4.  AT WHAT VALUE OF T DOES THAT TANGENT INTERSECT
      THE FINAL VALUE ASYMPTOTE?24
CLOSE ENOUGH, ( 24    )

  5.  WITH THIS MUCH OF THE ASYMPTOTE AS BASE, FORM
      A RECTANGLE WITH HEIGHT EXTENDING (UP OR DOWN)
      TO THE INITIAL HEIGHT OF THE GIVEN CURVE.
      WHAT IS ITS AREA?192
CLOSE ENOUGH, ( 192   )

  6.  WHAT IS THE AREA ENCLOSED BY THE VERTICAL AXIS,
      THE ASYMPTOTE AND CURVE FOR ALL POSITIVE T?192
CLOSE ENOUGH, ( 192   )

7.  AS A FRACTION OF A, HOW FAR IS THE CURVE FROM ITS
    ASYMPTOTE WHEN T HAS THE VALUE GIVEN BY THE ANSWER
    TO 4, ABOVE?.5
TOO FAR WRONG;
-------TRY AGAIN.?.4
TOO FAR WRONG;
( .368        )

DRAW A TANGENT TO THE CURVE AT T DIFFERENT FROM ZERO.
  8.  HOW MUCH MUST T INCREASE BEYOND THIS FOR THIS
      TANGENT TO REACH THE ASYMPTOTE?10
TOO FAR WRONG;
-------TRY AGAIN.?12
TOO FAR WRONG;
( 24    )
DONE
```

INDMTR
36154

TITLE: ANALYSIS OF A BALANCED POLYPHASE INDUCTION MOTOR

DESCRIPTION:

INDMTR aids in the analysis of a balanced polyphase induction motor. Machine parameters or no load test data must be supplied and the program will calculate the current, efficiency, torque, losses, electrical power in and the mechanical power out as a function of speed.

INSTRUCTIONS:

Instructions are included within the program.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Any course in machinery

Student Background Required: Some knowledge of polyphase induction motors.

ACKNOWLEDGEMENTS:

Dr. Clifford M. Siegel
University of Virginia

```
RUN

RUN
INDMTR

INDMTR: BALANCED POLYPHASE INDUCTION MOTOR ANALYSIS
     PREPARED BY C.M.SIEGEL, DEC. 31, 1969.
IF YOU WANT BRIEFING REMARKS, TYPE 1, OTHERWISE 0.
?1
GIVES CURRENT, EFFICIENCY, TORQUE, LOSSES, ELECTRICAL
POWER IN, AND MECHANICAL POWER OUT AS FUNCTIONS OF SPEED
WHEN MACHINE PARAMETERS OR NO-LOAD TEST DATA ARE GIVEN.

R1 AND R2 ARE STATOR AND ROTOR WINDING RESISTANCES.
X1 AND X2 ARE STATOR AND ROTOR LEAKAGE REACTANCES.
R3 AND X3 ARE MAGNETIZING LOSS RESISTANCE AND MUTUAL REACTANCE.

WHEN YOU SEE THE WORD, CONTINUE?, TYPE 1 FOR AFFIRMATIVE.
TYPING 0 WILL LET YOU RESUBMIT DATA.
BASE SPEED (RPM) MEANS YOUR CHOICE OF 100% VALUE OF ROTOR SPEED.
START(%) AND STOP(%) ARE THE BEGINNING AND END OF THE
     SPEED RANGE OF INTEREST (% OF BASE SPEED)
INCREMENT(%) IS THE SIZE OF INCREMENTS BETWEEN START AND STOP
FOR WHICH ANALYSIS IS WANTED (% OF BASE SPEED)
WHEN YOU ARE ASKED FOR:
BASE SPEED (RPM), START(%), STOP(%), INCREMENT(%)?--
ILLUSTRATION: PUTTING IN
   1800,    80,    100,    2    GIVES MOTOR PERFORMANCE
     FOR THE RANGE 1440 TO 1800 RPM AT 36 RPM INCREMENTS.

ALL ELECTRICAL WATTS, VOLTS, AMPS, ETC ARE PER PHASE.
ALL MECHANICAL HP AND TORQUE ARE TOTAL.

TYPE 1 IF YOU WANT TO PUT IN MACHINE PARAMETERS,
     2 IF YOU WANT TO PUT IN TEST DATA, OR
    99 IF YOU ARE FINISHED.
?1
R1,   R2,   R3,   X1,   X2,   X3?
?.25,  .46, 132,  .655, .655, 18.5

FOR F(CPS) CORRESPONDING TO X1,X2,X3, TYPE VALUES OF
F(CPS), NO. OF PHASES, NO. OF POLES.
?60,3,8

CONTINUE?
?1
OPERATING CONDITIONS:
VOLTS(LINE-TO-NEUTRAL; RMS), F (CPS)?
?254,60

BASE SPEED (RPM), START (%), STOP (%), INCREMENT (%)?
?900,  -40,   160,   20

CONTINUE?
?1
RPM             TORQUE          CURRENT         P.F.            VARS IN
                WATTS IN        H.P. OUT        WATTS LOSS      EFFICIENCY
-360             233.345         180.571         .403982         41955.9
                 18528.7        -15.9943         22505.9        -.214654
-180             263.653         177.78          .433289         40697.2
                 19565.7        -9.0359          21812.6        -.11484
 0               301.586         173.682         .471868         38895.
                 20816.5         0               20816.5         0
 180             348.923         167.255         .52443          36172.2
                 22279.3         11.9582         19305.7         .13347
 360             404.756         156.271         .598665         31794.
                 23762.7         27.7435         16863.8         .290324
 540             452.172         135.358         .705442         24368.
                 24253.7         46.4904         12693.1         .476654
 720             400.405         91.264          .843909         12436.3
                 19562.7         54.8906         5913.24         .697729
 900             0               13.3727         .156488         3354.81
                 531.536         0               531.536         0
 1080           -544.738         103.093        -.763228         16919.2
                -19985.5        -112.015         7868.93         .717498
 1260           -645.239         159.096        -.509473         34772.5
                -20587.9        -154.795         17904.4         .534858
 1440           -552.822         180.666        -.323302         43424.7
                -14836.1        -151.57          22854.4         .393629
```

```
CONTINUE?
?1
OPERATING CONDITIONS:
VOLTS(LINE-TO-NEUTRAL; RMS), F (CPS)?
?254,60

BASE SPEED (RPM), START (%), STOP (%), INCREMENT (%)?
?900, 99, 100, .25

CONTINUE?
?1
RPM             TORQUE          CURRENT         P.F.            VARS IN
                WATTS IN        H.P. OUT        WATTS LOSS      EFFICIENCY
 891             30.2503         15.0489         .478118         3357.22
                 1827.57         5.13184         551.45          .69826
 893.25          22.7526         14.4582         .409798         3349.85
                 1504.93         3.86962         542.687         .639395
 895.5           15.2107         13.9738         .332834         3346.97
                 1181.34         2.59346         536.433         .545912
 897.75          7.6257          13.6083         .247892         3348.61
                 856.837         1.30347         532.708         .378286
 900             0               13.3727         .156488         3354.81
                 531.536         0               531.536         0
CONTINUE?
?0
TYPE 1 IF YOU WANT TO PUT IN MACHINE PARAMETERS,
     2 IF YOU WANT TO PUT IN TEST DATA, OR
    99 IF YOU ARE FINISHED.
?2
BLOCKED-ROTOR QUANTITIES:
TORQUE(FT-LBS), WATTS IN, VOLTS IN, CURRENT IN?
?301.586, 20816.5, 254,,- 173.682

FREQ(CPS), NO. OF PHASES, NO. OF POLES?
?60, 3, 8

NO-LOAD QUANTITIES:
SLIP(RPM), WATTS IN, VOLTS IN, CURRENT IN?
?2.25, 856.837, 254, 13.6083
CONTINUE?
?1
RESULT OF SUCCESSIVE ITERATIONS FOLLOWS:

R1              R2              R3              X1 AND X2       X3
L1-M            M               L1
 .240617         .46332          132.035         .659814         19.3943
 1.74809E-03     5.14449E-02     .053193
 .249809         .458743         131.481         .65468          18.6166
 1.73659E-03     .049382         5.11186E-02
 .249961         .459788         131.932         .655            18.5198
 1.73744E-03     4.91252E-02     5.08627E-02
 .249992         .459966         131.986         .655003         18.5031
 1.73745E-03     .049081         5.08184E-02
 .249997         .459995         131.996         .655005         18.5005
 1.73745E-03     .049074         5.08115E-02

IF YOU WANT TO CONTINUE THE ITERATION, TYPE 2
IF YOU ARE READY FOR CALCULATION OF BEHAVIOR, TYPE 1
?1
OPERATING CONDITIONS:
VOLTS(LINE-TO-NEUTRAL; RMS), F (CPS)?
?254, 60

BASE SPEED (RPM), START (%), STOP (%), INCREMENT (%)?
?900, 80, 100, 5

CONTINUE?
?1
RPM             TORQUE          CURRENT         P.F.            VARS IN
                WATTS IN        H.P. OUT        WATTS LOSS      EFFICIENCY
 720             400.406         91.2646         .843906         12436.5
                 19562.8         54.8907         5913.27         .697728
 765             343.695         74.0015         .874818         9105.93
                 16443.4         50.061          3994.91         .757051
 810             258.621         53.7291         .892922         6144.13
                 12185.9         39.8854         2267.7          .813908
 855             142.781         31.1161         .859069         4045.49
                 6789.65         23.2435         1009.77         .851278
```

```
 900             0               13.3724         .156495         3354.73
                 531.55          0               531.55          0
CONTINUE?
?99
TYPE 1 IF YOU WANT TO PUT IN MACHINE PARAMETERS,
     2 IF YOU WANT TO PUT IN TEST DATA, OR
    99 IF YOU ARE FINISHED.
?99

DONE
```

JACOBI
36167

TITLE: EIGENVALUES AND EIGENVECTORS OF A REAL SYMMETRIC MATRIX

DESCRIPTION: Using the Jacobi rotation method, this program calculates eigenvalues and eigenvectors of a real symmetric matrix.

INSTRUCTIONS: Instructions are included within the program.

SPECIAL CONSIDERATIONS: FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Quantum Mechanics

ACKNOWLEDGEMENTS: Dr. Avery Catlin
University of Virginia

```
RUN

RUN
JACOBI

TYPE 1 IF YOU WANT INSTRUCTIONS, OTHERWISE 0?1
THIS PROGRAM USES THE JACOBI ATION METHOD TO CALCULATE
THE EIGENVALUES AND EIGENVECTORS OF A REAL SYMMETRIC
MATRIX. TYPE RUN AND WHEN ASKED, SUPPLY THE FOLLOWING
INFORMATION:

  1. REQUIRED ACCURACY OF THE EIGENVALUES.
     (NORMALLY 1E-6 FOR THE H-P COMPUTER)

  2. THE ORDER OF THE MATRIX.
     (A SINGLE NUMBER SINCE THE MATRIX MUST BE SQUARE)

  3. THE MATRIX ELEMENTS BY ROW.
     (START AT ROW 1, COLUMN 1 AND SEPARATE THE ELEMENTS
      BY COMMAS. WHEN YOU REACH THE END OF A TYPED LINE,
      PUSH THE RETURN KEY. THE COMPUTER WILL ADVANCE THE
      PAPER AND PRINT ?? IF MORE DATA IS NEEDED.)


NOW TYPE RUN AGAIN.

DONE
RUN
JACOBI

TYPE 1 IF YOU WANT INSTRUCTIONS, OTHERWISE 0?0

WHAT IS REQUIRED RELATIVE ACCURACY OF EIGENVALUES?1E-6

WHAT IS ORDER OF MATRIX?3

WHAT ARE THE MATRIX ELEMENTS?1,2,3,2,2,2,3,2
??5


FINAL THRESHOLD V5= 4.08248E-07

EIGENVALUES

-.945668
 1.0748
 7.87086

EIGENVECTORS

 .870996
-.379706
-.311752

 .163801
 .822692
-.544377

 .463179
 .423085
 .778758


DONE
```

CONTRIBUTED PROGRAM **BASIC**

POLAR
36155

TITLE: PLOTS SINGLE VARIABLE IN POLAR FORM

DESCRIPTION: Plots a function of a single variable in polar form.

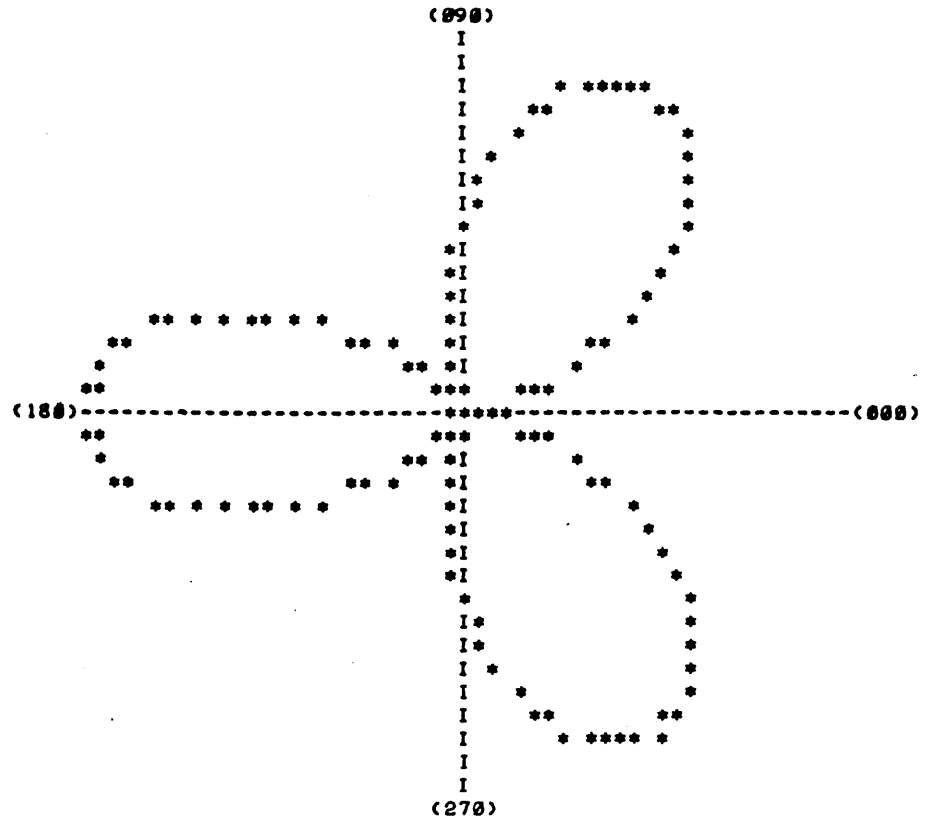
INSTRUCTIONS: Instructions are included within the program.

SPECIAL CONSIDERATIONS:
FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Engineering

Student Background Required: Knowledge of elementary trigonometry and the polar form for plotting functions.

ACKNOWLEDGEMENTS: John H. Fikus
University of Virginia

```
RUN

RUN
POLAR

     THIS PROGRAM PLOTS FUNCTIONS IN POLAR FORM.
  TO USE IT TYPE:

        8900 DEF FNR(0)=<YOUR FUNCTION>
        9900 DATA <INCR>,<RADIUS>,<NUMBER>
        RUN

  WHERE,<INCR> IS THE DESIRED INCREMENT IN DEGREES
  BETWEEN THE POINTS, <RADIUS> IS THE LARGEST VALUE OF
  THE RADIAL DISPLACEMENT FROM THE ORIGIN TO BE PLOTTED
  AND <NUMBER> IS THE NUMBER OF '360 DEGREE' PLOTTING
  SWEEPS DESIRED (FOR MOST PROBLEMS 1 IS SUFFICIENT).
     A GOOD INITIAL CHOICE FOR <INCR> AND <NUMBER> ARE
  '10' AND '1' RESPECTIVELY. FOR <RADIUS> TRY TO CHOOSE
  A VALUE SUCH THAT MOST OF THE FUNCTION WILL FIT ON
  THE PLOTTING FIELD. IN OTHER WORDS IF FNR(0)=SIN(0)
  THEN LET <RADIUS>=1.
     THE USER MAY NEED TO ADJUST THE VALUES OF <INCR>
  <RADIUS> OR <NUMBER> TO OBTAIN THE BEST REPRESENTATION
  OF THE FUNCTION.

DONE
8900 DEF FNR(0)=1-COS(3*0)
9900 DATA 2.5,2,1
RUN
POLAR
```




```
DONE
```

CONTRIBUTED PROGRAM **BASIC**

SOLVER
36149

TITLE: SOLVES COMPLEX SIMULTANEOUS EQUATIONS

DESCRIPTION:

SOLVER solves simultaneous equations having complex coefficients and complex driving functions, where the imaginary part of the root is frequency dependent. SOLVER also plots a graph for the last variable and steps the frequency in 1-2-4-8 decades.

INSTRUCTIONS:

Instructions are included within the program.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Electrical Science I and II

Student Background Required: Engineering college level courses in circuit analysis. No programming knowledge required. Some knowledge of simultaneous equations with complex coefficients.

ACKNOWLEDGEMENTS:

Edward T. Dixon
University of Virginia

```
RUN

RUN
SOLVER

DO YOU WANT INSTRUCTIONS?
?YES
SOLVER SOLVES N SIMULANEOUS EQUATIONS HAVING COMPLEX
COEFFICIENTS AND COMPLEX DRIVING SOURCES, WHERE THE
IMAGINARY PART OF THE ROOT IS FREQUENCY DEPENDANT.
SOLVER ALSO PLOTS A GRAPH FOR THE LAST VARABLE AND
STEPS THE FREQUENCY IN 1-2-4-8 DECADES.
THE FREQUENCY PART MAY CONTAIN A LINEAR PART AND
A INVARSE PART.  THE DATA IS FED AS FOLLOWS:

     9900 DATA <FIRST COEFFICIENT OF FIRST EQUATION>
     9901 DATA <SECOND COEFFICIENT OF FIRST EQUATION>
     99-- ETC.
     99-- DATA <COEFFICIENTS OF DRIVING SOURCE>

FOR EXAMPLE TO SOLVE:

     (3+(2W-1/4W)J)V1+ (-2+(0+1/W)J)V2= 1+2J

     (1+(3W)J)V1 + (1+(2/W)J)V2= -2+0J

NOTE  W STANDS FOR OMEGA
THE DATA STATEMENTS WOULD BE:

     9900 DATA 3,2,-4
     9901 DATA -2,0,1
     9902 DATA 1,3,0
     9903 DATA 1,0,.5
     9904 DATA 1,2,-2,0

THE DATA LINES SHOULD BE NUMBERED FROM 9900
THROUGH 9997
IF NO LINEAR OR INVERSE PARTS OF A COEFFICIENT EXIST
 THEN ENTER ZERO'S

DONE
9900 DATA 3,2,-4
9901 DATA -2,0,1
9902 DATA 1,3,0
9903 DATA 1,0,.5
9904 DATA 1,2,-2,0
RUN
SOLVER

WOULD YOU LIKE TO COMPUTE SOME SPECIFIC VALUES OF F?
?NO
WHAT IS YOUR VALUE FOR F1 AND F2?
?10,40
DO YOU ONLY WANT TO SEE THE GRAPH?
?NO

FREQ    VAR NO     REAL             IMAG              MAG             ANGLE
 10
        1         4.05616E-03     6.12632E-03     7.34740E-03     56.492
        2        -.87292         -.742909         1.14626     -139.601

 20
        1         2.00899E-03     3.02370E-03     3.63026E-03     56.3993
        2        -.873983        -.746486         1.14939     -139.499

 40
        1         9.99637E-04     1.50197E-03     1.80421E-03     56.3542
        2        -.874497        -.748251         1.15092     -139.449

GRAPH FOLLOWS
```

```
FREQ                        VARABLE NO. 2
(TIMES 100)
        ------------------------------------------------------------------
        1.146                1.147                1.149              1.15
        ------------------------------------------------------------------
 .1     *
 .2                                                  *
 .4                                                                      *
        ------------------------------------------------------------------
DONE
```

TITLE:	CAI IN INTERPRETATION OF EE UNITS	UNITS 36157
DESCRIPTION:	UNITS offers computer aided practice in choosing new units to avoid large positive or negative powers of 10.	
INSTRUCTIONS:	Instructions are included within the program.	
SPECIAL CONSIDERATIONS:	FOR INSTRUCTIONAL PURPOSES Suitable Courses: Electrical Engineering at any level.	
ACKNOWLEDGEMENTS:	Dr. Clifford M. Siegel and Edward D. Dixon University of Virginia	

```
RUN

RUN
UNITS



 A PROGRAM FOR COMPUTER AIDED PRACTICE IN CHOOSING
NEW UNITS TO AVOID LARGE - OR + POWERS OF 10;
PREPARED BY C.M. SIEGEL AND E. DIXON, JULY 1,1970

IF AT ANY TIME YOU WANT A NEW SET OF C AND L
UNITS, ANSWER QUESTIONS WITH ANY NEGATIVE NUMBER

(YOU NEED TO KNOW THAT THE SQUARE ROOT OF 10 IS 3.16)



TO SATISFY THE RELATIONS V=ZI, I=YV,
X=OMEGA TIMES L, B=OMEGA TIMES C,
OMEGA =1/SQR(LC), ETC.

IF WE USE   1.00000E-07     FARADS AS UNIT OF CAPACITANCE AND
 10     HENRIES AS UNIT OF INDUCTANCE, THEN

THE UNIT OF  OMEGA  WILL BE HOW MANY  RAD/SEC  ?
?1E3
CORRECT

THE UNIT OF  TIME  WILL BE HOW MANY  SECONDS  ?
?1E-3
CORRECT

THE UNIT OF  IMPEDANCE  WILL BE HOW MANY  OHMS  ?
?1E3
WRONG,TRY AGAIN
?1E2
WRONG,TRY AGAIN
?1E4
CORRECT

THE UNIT OF  ADMITTANCE  WILL BE HOW MANY  MHOS  ?
?1E-4
CORRECT

IF, FURTHERMORE, P.D. IS EXPRESSED IN VOLTS,
THE UNIT OF  CURRENT  WILL BE HOW MANY  AMPERES  ?
?1E-4
CORRECT

THE UNIT OF  POWER  WILL BE HOW MANY  WATTS  ?
?1E-4
CORRECT

IF, HOWEVER, CURRENT IS EXPRESSED IN AMPERES,
THE UNIT OF  P.D.  WILL BE HOW MANY  VOLTS  ?
?1E4
CORRECT

THE UNIT OF  POWER  WILL BE HOW MANY  WATTS  ?
?1E4
CORRECT
IF YOU WANT A NEW PROBLEM, TYPE 1, OTHERWISE 0
?0



DONE
```

CIRFLW
36632

TITLE: CIRCULAR FLOW MODEL

DESCRIPTION:

Simulation of the circular flow of goods, services, and money, between business and the consumer in a free enterprise economy without government control.

OBJECTIVES:

A. To explore the effect of personal consumption upon business' demand for productive services from the individual, and upon personal income.

B. To demonstrate that widespread uninvested savings can cause a general drop in income.

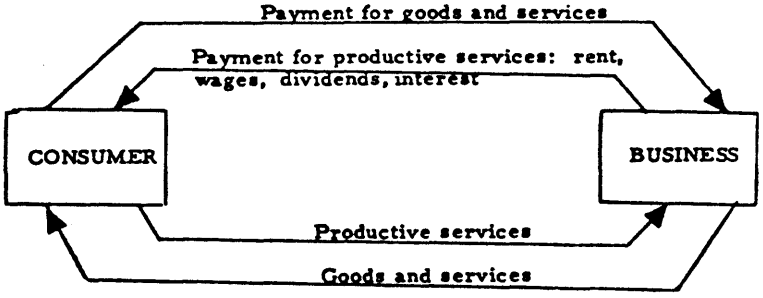
C. To demonstrate how credit buying can raise personal income, in general.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student

1. Terms to define:
   a. propensity to consume
   b. savings
   c. credit
   d. circular flow of goods, services, and money
2. Concepts for explanation or discussion:



CIRCULAR FLOW

Continued on following page.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

INSTRUCTIONS: continued

DISCUSSION:

A. Operational Suggestions

1. Student level - average to above average ability
2. Placement in curriculum - Unit: Economic growth and stability
3. Group size - may be used individually, with small groups, or as a teacher demonstration

B. Follow-up

Suggested classroom activities:

1. Use the circular flow chart to illustrate one or more of the program "run-offs".
2. Discuss the lack of aggregate demand as a cause for recession; and the rise in aggregate demand as a cause for growth or inflation.

```
RUN


RUN
CIRFLW

THE FOLLOWING WILL SIMULATE THE EFFECT ON THE
CIRCULAR FLOW OF GOODS, SERVICES AND MONEY WHEN
ALL THE INDIVIDUALS IN THE ECONOMY SPEND ALL THEIR
INCOME.  IF THE AVERAGE INCOME IS $2,500 AND
EVERY INDIVIDUAL SPENDS 100 PERCENT OF IT,
EACH INCOME WILL BE IN EQUILIBRIUM--THEY WILL
EARN BACK FROM BUSINESS $2500
THE FOLLOWING WILL BE A COMPUTATION OF THE
VALUES IN THE CIRCULAR FLOW

AVERAGE INCOME- 2500


PROPENSITY TO CONSUME IS
100 PERCENT

INDIVIDUAL'S PAYMENTS FOR
GOODS AND SERVICES- 2500

THE VALUE OF GOODS
AND SERVICES- 2500


THE PERCENT OF PRODUCTIVE
SERVICES BUSINESS WANTS
IS 100 PERCENT.


THE RETURN INCOME
TO INDIVIDUAL-2500.

THE ABOVE REPRESENTS THE AVERAGE OF ALL INDIVIDUAL
INCOMES IN THE ECONOMY.  SINCE ALL INDIVIDUALS CONSUMED
100 PERCENT OF THEIR INCOME,THEIR RETURN INCOMEIS
100 PERCENT OF THEIR PREVIOUS INCOME. THIS HAPPENS
BECAUSE BUSINESS NEEDS 100 PERCENT OF THE PREVIOUS
PRODUCTIVE SERVICES TO MEET THE DEMAND.

THE RETURN INCOME TO THE INDIVIDUAL FROM
BUSINESS DEPENDS TO A LARGE EXTENT ON HOW
MUCH ALL INDIVIDUALS SPEND(THEIR PROPENSITY TO
CONSUME).  COMMON SENSE TELLS US THAT IF AN IN-
DIVIDUAL SAVES PART OF HIS INCOME AND INVESTS IT
IN A BANK, HE WILL RAISE HIS INCOME BY MEANS OF
THE INTEREST ON HIS SAVINGS.  BUT IF ALL OR MANY
OF THE INDIVIDUAL CONSUMERS IN THE ECONOMY CUT
THEIR CONSUMPTION, THEN THE OVERALL RETURN INCOME
TO THOSE INDIVIDUALS WILL PROBABLY DROP.
BY CHANGING THE PERCENTAGE OF YOUR PROPENSITY
TO CONSUME YOU CAN CHANGE YOUR INCOME.

A PROPENSITY TO CONSUME OF 100 PERCENT WILL,
IN THIS SIMULATION, GIVE YOU A RETURN INCOME
EQUAL TO YOUR ORIGINAL INCOME.  ANY VALUE
MORE OR LESS THAN 100 PERCENT WILL CHANGE
YOUR RETURN INCOME.

TYPE IN A VALUE FOR THE PROPENSITY TO CONSUME,
A PERCENTAGE MORE OR LESS THAN 100 PERCENT.
PUT IT IN IN DECIMAL FORM (E.G. .75=75 PERCENT)

WHAT IS THE VALUE?.75
BECAUSE YOUR PROPENSITY TO CONSUME IS LESS THAN
YOUR INCOME, YOU ARE SAVING MONEY.  WE WILL ASSUME
THAT YOU DIDN'T PUT IT IN A BANK BUT
RATHER STUFFED IT UNDER YOUR MATTRESS, SO
YOU WON'T RAISE YOUR INCOME WITH INTEREST

INDIVIDUAL'S PAYMENTS FOR
GOODS AND SERVICES- 1875

VALUE OF GOODS AND SERVICES
FROM BUSINESS- 1875

PERCENT OF PRODUCTIVE
SERVICES IN DEMAND- .75
```

```
RETURN INCOME TO IN-
DIVIDUAL- 1875

YOUR RETURN INCOME
HAS DROPPED THE FOLLOWING
PERCENTAGE POINTS FROM
100 PERCENT- 25
IF YOU WISH TO PUT IN ANOTHER PERCENTAGE VALUE
FOR THE PROPENSITY TO CONSUME, TYPE 0
IF YOU WISH TO STOP THE PROGRAM, TYPE 1
?1

DONE
```

GMCR01
36519

TITLE: FISCAL POLICY GAME

DESCRIPTION:

GMCR01 and GMCR02 are economic simulation games which allow the student to manage fiscal policy.

GMCR01 puts the student in the position of managing only fiscal policy for an economy represented by a model in the computer. Each "year" the student has the opportunity to change the level of government expenditures (G) and the level of tax receipts (T). The computer calculates the effects of the policy decisions and reports the following information: Potential NNP (Q), Actual NNP (Y), Consumption (C), Investment (I), Disposable Income (D), the Level of Government Expenditures (G), tax receipts (T) and "achievement score".

The game continues for twenty years. From time to time the computer asks questions which can be answered correctly only on an understanding of the basic model. The computer will occasionally inform the student of changes in economic or political conditions to which he has to react.

The goal throughout GMCR01 is to keep actual NNP (Y) at or near potential NNP (Q); as in most economies, Q grows over time. The student is given a "score" by the computer on the basis of how well he does. The student may wish to consider other policy goals also, e.g., balancing the budget or altering the mix of C and G.

GMCR02 differs from GMCR01 in important respects. It is designed to emphasize the influence of the consumer on the economy as a whole and on the problems of the policy-maker.

Again, the student controls yearly changes in government expenditures and taxes. The effects of yearly policy moves are reported on a quarterly basis so that the economy's reactions can be seen more clearly; that is, after entering changes at the beginning of a year, the computer will print out four quarters of results (at yearly rates) before asking for another set of changes.

INSTRUCTIONS: See Page 2

ACKNOWLEDGEMENTS: Graduate School of Business
Stanford University

INSTRUCTIONS:

These programs may require an hour or more to play carefully. If you think that you may possibly wish to play it in more than one sitting, or may wish to stop to think before continuing, you should create a file to store the data generated by your economy.

If you desire to stop the program during execution, you may do so by typing '9999' when the change in G is requested. Remember to type in the change in T also. You may then logoff and resume GMCR01 in the year that you stop. Instructions for restarting will be given when you stop.

GMCR01: your objectives in the next twenty years are to keep GNP (Y) as close as possible to potential output (Q) in constant dollars, and to determine from the economy's performance the values of certain multipliers and propensities.

You begin the first year with a score of 1000. Each year you lose the absolute value of the difference between Y and Q. You can control Government expenditures (G) and Taxes (T) for each year by typing in values for the changes in G and T as requested. If there is no change type a zero. You will be given all values including investment (I), consumption (C), and disposable income (D).

GMCR02 deals with theories of aggregate consumption. The model generates quarterly observations, but you can change G and T only once a year. When you are requested to do so type in the values for changes in G and T. If there is no change type a zero. Note that the changes in G and T are to be entered on the same line separated by a comma.

Your objectives in the next 15 years are to keep Y as close to Q as possible and to determine from the economy's performance the parameters of the consumption function. You begin the first year with a score of 5000. Each quarter you lose the absolute value of the difference between Y and Q.

RUN

```
RUN
GMCRO1

MCRO1 MAY REQUIRE AN HOUR OR MORE TO PLAY CAREFULLY.
IF YOU THINK THAT YOU MAY POSSIBLY WISH TO PLAY IT
IN MORE THAN ONE SITTING, OR MAY WISH TO STOP TO THINK
BEFORE CONTINUING, YOU SHOULD CREATE A FILE TO STORE
THE DATA GENERATED BY YOUR ECONOMY.

DO YOU WANT THE FLEXIBILITY TO STOP THE GAME AND RETURN
LATER   ?YES

WHEN THE PROGRAM STOPS, TYPE

200 FILES DATA1
CRE-DATA1,1
RUN-200

THE PROGRAM WILL NOW STOP TO ALLOW YOU TO TYPE IN THESE LINES.
TYPE IN THE LINES AFTER THE COMPUTER PRINTS 'DONE'.


DONE
200 FILES DATA1
CRE-DATA1,1
RUN-200
GMCRO1

IF YOU DESIRE TO STOP THIS PROGRAM DURING EXECUTION, YOU MAY
DO SO BY TYPING '9999' WHEN THE CHANGE IN G IS REQUESTED.
REMEMBER TO TYPE IN THE CHANGE IN T ALSO.  YOU MAY THEN
LOGOFF AND RESUME MCRO1 IN THE YEAR THAT YOU STOP.
INSTRUCTIONS FOR RESTARTING WILL BE GIVEN WHEN YOU STOP.

YOUR OBJECTIVES IN THE NEXT TWENTY YEARS ARE TO KEEP GNP (Y)
AS CLOSE AS POSSIBLE TO POTENTIAL OUTPUT (Q) IN CONSTANT DOLLARS,
AND TO DETERMINE FROM THE ECONOMY'S PERFORMANCE THE VALUES OF
CERTAIN MULTIPLIERS AND PROPENSITIES.

YOU BEGIN THE FIRST YEAR WITH A SCORE OF 1000. EACH YEAR YOU
LOSE THE ABSOLUTE VALUE OF THE DIFFERENCE BETWEEN Y AND Q.
YOU CAN CONTROL GOVERNMENT EXPENDITURES (G) AND TAXES (T)
FOR EACH YEAR BY TYPING IN VALUES FOR THE CHANGES IN G AND T
AS REQUESTED. IF THERE IS NO CHANGE TYPE A ZERO.  YOU WILL BE
GIVEN ALL VALUES INCLUDING INVESTMENT (I), CONSUMPTION (C),
AND DISPOSABLE INCOME (D).

WHEN REQUESTED TO DO SO, TYPE IN THE VALUES OF G AND T
SEPARATED BY A COMMA.



TYPE YOUR NAME  -?ANON
ANON            GNP ACCOUNTS     YEAR 0
Q= 610          Y= 600           C= 520          I= 55
D= 550          G= 25            T= 50           SCORE= 1000

CHANGE IN G,T?2,0
CHECK YOUR WORK. ANY CHANGES? (1=YES,0=NO)  ???0

ANON            GNP ACCOUNTS     YEAR 1
Q= 628.3        Y= 620           C= 538          I= 55
D= 570          G= 27            T= 50           SCORE= 991.7

CHANGE IN G,T?
DONE

RUN
GMCRO2

MCRO2 MAY REQUIRE AN HOUR OR MORE TO PLAY CAREFULLY.
IF YOU THINK THAT YOU MAY POSSIBLY WISH TO PLAY IT
IN MORE THAN ONE SITTING, OR MAY WISH TO STOP TO THINK
BEFORE CONTINUING, YOU SHOULD CREATE A FILE TO STORE
THE DATA GENERATED BY YOUR ECONOMY.
```

```
DO YOU WANT THE FLEXIBILITY TO STOP THE GAME AND RETURN
LATER   ?YES

WHEN THE PROGRAM STOPS, TYPE

200 FILES DATA2
CRE-DATA2,1
RUN-200

THE PROGRAM WILL NOW STOP TO ALLOW YOU TO TYPE IN THESE LINES.
TYPE IN THE LINES AFTER THE COMPUTER PRINTS 'DONE'.


DONE
200 FILES DATA2
CRE-DATA2,1
RUN-200
GMCR02

IF YOU DESIRE TO STOP THIS PROGRAM DURING EXECUTION, YOU MAY
DO SO BY TYPING '9999' WHEN THE CHANGE IN G IS REQUESTED.
REMEMBER TO TYPE IN THE CHANGE IN T ALSO.  YOU MAY THEN
LOGOFF AND RESUME MCR02 IN THE YEAR THAT YOU STOP.
INSTRUCTIONS FOR RESTARTING WILL BE GIVEN WHEN YOU STOP.

MCR02 DEALS WITH THEORIES OF AGGREGATE CONSUMPTION. THE
MODEL GENERATES QUARTERLY OBSERVATIONS, BUT YOU CAN CHANGE
G AND T ONLY ONCE A YEAR. WHEN YOU ARE REQUESTED TO DO SO
TYPE IN THE VALUES FOR CHANGES IN G AND T. IF THERE IS
NO CHANGE TYPE A ZERO. NOTE THAT THE CHANGES IN G AND T
ARE TO BE ENTERED ON THE SAME LINE SEPARATED BY A COMMA.

YOUR OBJECTIVES IN THE NEXT 15 YEARS ARE TO KEEP Y AS CLOSE
TO Q AS POSSIBLE AND TO DETERMINE FROM THE ECONOMY'S
PERFORMANCE THE PARAMETERS OF THE CONSUMPTION FUNCTION. YOU
BEGIN THE FIRST YEAR WITH A SCORE OF 5000. EACH QUARTER
YOU LOSE THE ABSOLUTE VALUE OF THE DIFFERENCE BETWEEN Y AND Q.


TYPE YOUR NAME  -?ANON

ANON            GNP ACCOUNTS     QUARTER 0
Q= 610          Y= 600           C= 520          I= 55
D= 550          G= 25            T= 50           SCORE= 5000


CONSUMERS BEHAVIOR IS NOW REPRESENTED BY A FUNCTION OF THE
FORM:  C(T)=A+B*D(T) WHERE T=NUMBER OF THE QUARTER.
ENTER CHANGES IN G,T -?3,0
CHECK YOUR VALUES. CHANGES ? (1=YES, 0=NO) ???0

ANON            GNP ACCOUNTS     QUARTER 1
Q= 616.1        Y= 630           C= 547          I= 55
D= 580          G= 28            T= 50           SCORE= 4986.1

ANON            GNP ACCOUNTS     QUARTER 2
Q= 622.261      Y= 630           C= 547          I= 55
D= 580          G= 28            T= 50           SCORE= 4978.36

ANON            GNP ACCOUNTS     QUARTER 3
Q= 628.484      Y= 630           C= 547          I= 55
D= 580          G= 28            T= 50           SCORE= 4976.84

ANON            GNP ACCOUNTS     QUARTER 4
Q= 634.768      Y= 630           C= 547          I= 55
D= 580          G= 28            T= 50           SCORE= 4972.08


ENTER CHANGES IN G,T -?
DONE
```

GMCRO5

-E: ECONOMIC POLICY GAME 36521

CRIPTION:

GMCRO5 and GMCRO6 simulate the complexities of a dynamic economy and the problems inherent in the use of fiscal and monetary policy to pursue the goals of economic stability and growth.

In GMCRO5 a student will control fiscal policy and monetary policy and will have an eight period history of a hypothetical economy which was generated by a fairly realistic model of the U.S. economy. For succeeding periods the economy will be influenced by past policy decisions. From the ninth period on, each student makes independent policy decisions, thus his economy will run a separate course.

The emphasis in this game is on combining a number of policy tools (government spending, the marginal tax rate, and the money supply) to reach specified national economic goals. The goals are defined by a "welfare function" which expresses mathematically the relative weight the policy maker gives to various economic indicators of well-being. Scoring well in this game requires giving thought to what the welfare function really means in terms of policy.

The computer reports each year's economic data after policy decisions have been decided upon and implemented. In particular, prices and unemployment are reported; their behavior is important to welfare. Since GNP components are stated in "real" (deflated) terms, actual output (Y) cannot exceed potential output (Q). If aggregate demand is excessively great, it is met not by added output, but by inventory decumulation -- and this information is reported.

A student who has played GMCRO5 will have faced many of the problems economists and government policy makers face. In GMCRO6 the student still faces the unemployment-inflation dilemma. However, he must also be aware that the policy tools used to control the domestic economy have significant effects on exports, imports, and international capital flows, i.e., the balance of payments. Should the student now encounter a severe balance of payments deficit he must either deflate his economy or suffer the international consequences specified at the beginning of GMCRO6.

In this model of the economy, exports are dependent upon the level of GNP and upon the inflation rate, imports depend upon disposable income. Capital inflows vary with the domestic interest rate. Again the student should study the economic history before beginning.

No goals are prescribed for the student in GMCRO6. Rather, as policy maker, he must attempt to achieve the economic goals which he considers important. The game continues for twenty "years". Various changes will occur in international relations during this period. They affect exports and imports and, consequently, policy decisions.

TRUCTIONS:

See Page 2

KNOWLEDGEMENTS:

Graduate School of Business
Stanford University

INSTRUCTIONS:

The game is played in three ten-period sessions each having a different welfare function which requires widely differing policies.

For the first ten periods the objective is to maximize a welfare function of the form $W = (C)^{.6}\ (I)^{.2}\ (G)^{.2} - U - (PC)^3$. Note that the inflation rate (PC) is weighted much more heavily than unemployment (U).

For the second ten periods the welfare function is $W = (C)^{.4}\ (I)^{.2}\ (G)^{.4} - U^3 - PC$. Now unemployment is weighted more heavily than inflation.

For the final ten periods the welfare function is $W = Q - U^2 - (PC)^2$. Both unemployment and inflation are weighted equally.

Clues for Good Policy Making

To achieve policy objectives students might find the following guidelines helpful.

1. Interpret the goal. What does it mean to maximize the given welfare function? What variables in the economy should the student be trying to affect by his policy decisions?

2. Formulate ideas about how the economy functions. What factors are likely to be important determinants of the variables that he wants to influence? How will changes in the policy variables influence these target variables?

3. Test ideas against available information contained in the accompanying table. Do these ideas explain most of the economy's behavior in past periods? Do the data suggest alternative explanations as to how the economy functions?

GMCRO5--ECONOMIC DATA FOR PREVIOUS YEARS

Year	Q	Y	C	I	G	TI	T	D	E	M	R	P	PC	U	IN
-7	509.0	500.0	303.5	104.5	92.0	.30	110.0	315.0	75.0	125.6	3.9	1.0	0.0	6.5	0.0
-6	588.4	521.0	313.9	115.1	92.0	.30	116.3	326.5	78.1	135.6	3.3	.997	-0.3	6.3	0.0
-5	608.9	576.4	341.3	128.1	107.0	.30	132.9	357.0	86.5	150.6	3.1	.995	-0.2	4.3	0.0
-4	630.6	583.1	292.2	124.0	167.0	.40	193.2	302.4	87.5	150.6	3.3	1.013	1.8	5.0	0.0
-3	652.2	620.7	335.3	118.4	167.0	.35	177.2	350.3	93.1	150.6	4.0	1.021	0.7	4.1	0.0
-2	673.6	673.6	389.4	117.2	167.0	.30	162.1	410.5	101.0	170.6	4.2	1.042	2.1	2.5	15.5
-1	695.1	692.8	398.9	126.9	167.0	.30	167.8	421.0	103.9	170.6	5.0	1.149	10.3	2.6	0.0
0	717.6	651.6	378.5	106.1	167.0	.30	155.5	398.4	97.7	170.6	4.7	1.214	5.7	5.5	0.0

Definitions

Q = Potential Net National Product
Y = Net National Product
C = Consumption Expenditures
I = Net Private Investment
G = Government Purchases of Goods and Services
TI = Marginal Income Tax Rate
T = Tax Receipts
D = Disposable Personal Income
E = Corporate Retained Earnings
M = Money Supply
R = Rate of Interest (percentage)
P = Index of Price Level
PC = Yearly Rate of Price Change (percentage)
U = Unemployment Rate (percentage)
IN = Inventory Disinvestment
W = Welfare for Current Year
W+ = Sum of Welfare since Year Zero

INSTRUCTIONS: (continued)

GMCRO6 - Economic Data for Previous Years

Year	-7	-6	-5	-4	-3	-2	-1	0
Q	569.0	588.4	608.9	630.6	652.2	673.6	695.1	717.6
Y	500.0	521.0	576.4	583.1	620.7	673.6	692.8	651.6
C	303.5	313.9	341.3	292.2	335.3	389.4	398.9	378.5
I	104.5	115.1	128.1	124.0	118.4	117.2	126.9	106.1
G	92.0	92.0	107.0	167.0	167.0	167.0	167.0	167.0
TI	.30	.30	.30	.40	.35	.30	.30	.30
T	110.0	116.3	132.9	193.2	177.2	162.1	167.8	155.5
D	315.0	326.5	357.0	302.4	350.3	410.5	421.0	398.4
E	75.0	78.1	86.5	87.5	93.1	101.0	103.9	97.7
M	125.6	135.6	150.6	150.6	150.6	170.6	170.6	170.6
R	3.9	3.3	3.1	3.3	4.0	4.2	5.0	4.7
P	1.0	9.997	0.995	1.013	1.021	1.042	1.149	1.214
PC	0.0	-0.3	-0.2	1.8	0.7	2.1	10.3	5.7
U	6.5	6.3	4.3	5.0	4.1	2.5	2.6	5.5
IN	0.0	0.0	0.0	0.0	0.0	15.5	0.0	0.0
EX	40.0	41.3	42.1	36.3	40.3	37.2	12.9	25.9
IM	28.4	29.4	32.1	27.2	31.5	36.9	37.9	35.9
K	-1.2	-2.9	-3.6	-2.9	-1.0	-0.6	0.0	-0.1
BoP	10.4	9.0	6.4	6.2	7.8	-0.3	-25.0	-10.1
BoP+	10.4	19.4	25.8	32.0	39.8	39.5	14.5	4.4

Definitions

Q = Potential Net National Product
Y = Net National Product
C - Consumption Expenditures
I = Net Private Investment
G = Government Purchases of Goods and Services
TI = Marginal Income Tax Rate
T - Tax Receipts
D = Disposable Personal Income
R = Rate of Interest (percentage)
P = Index of Price Level
PC = Yearly Rate of Price Change (percentage)
U = Unemployment Rate (percentage)
IN = Inventory Disinvestment
W = Welfare for Current Year
W+ = Sum of Welfare since Year Zero
EX = Exports
IM = Imports
K = Capital Inflows
BoP = Balance of Payments
BoP+ = Balance of Payments since Year 0

RUN

```
RUN
GMCRO5

MCRO5 MAY REQUIRE AN HOUR OR MORE TO PLAY CAREFULLY.
IF YOU THINK THAT YOU MAY POSSIBLY WISH TO PLAY IT
IN MORE THAN ONE SITTING, OR MAY WISH TO STOP TO THINK
BEFORE CONTINUING, YOU SHOULD CREATE A FILE TO STORE
THE DATA GENERATED BY YOUR ECONOMY.

DO YOU WANT THE FLEXIBILITY TO STOP THE GAME AND RETURN
LATER   ?YES

WHEN THE PROGRAM STOPS, TYPE

200 FILES DATA5
CRE-DATA5,1
RUN-200

THE PROGRAM WILL NOW STOP TO ALLOW YOU TO TYPE IN THESE LINES.
TYPE IN THE LINES AFTER THE COMPUTER PRINTS 'DONE'.


DONE
200 FILES DATA5
CRE-DATA5,1
RUN-200
GMCRO5

IF YOU DESIRE TO STOP THIS PROGRAM DURING EXECUTION,
YOU MAY DO SO BY TYPING '9999' WHEN THE CHANGE IN M IS
REQUESTED.  YOU MAY THEN LOGOFF AND RESUME MCRO5 IN THE
YEAR THAT YOU STOP.  INSTRUCTIONS FOR RESUMING WILL BE
GIVEN WHEN YOU STOP.

MCRO5 DEALS WITH DESIGNING POLICY STRATEGIES TO MEET DIFFERENT
ECONOMIC GOALS. YOU WILL BE GIVEN INFORMATION ON MAJOR ECONOMIC
VARIABLES INCLUDING THE RATE OF UNEMPLOYMENT (U) AND THE RATE OF
INFLATION (PC). YOU SHOULD HAVE STUDIED THE PAST PERFORMANCE OF
THE ECONOMY PRIOR TO THE BEGINNING OF THE GAME. YOU WILL CONTROL
THE MONEY SUPPLY (M). GOVERNMENT EXPENDITURES (G), AND THE
MARGINAL TAX RATE (T1). WHEN YOU ARE REQUESTED TO DO SO TYPE IN
THE CHANGES IN M,G, AND T1. IF THERE IS NO CHANGE A ZERO MUST
BE TYPED.

YOUR OBJECTIVE IN MCRO5 IS TO MAXIMIZE A FUNCTION
WHICH IS DEFINED IN TERMS OF WELFARE (W).

THE NATIONS WELFARE FUNCTION FOR YEARS 1 THROUGH 10 IS

          .6    .2    .2       3
      W=(C   )(I   )(G   )-U-PC

NOTICE THAT CONSUMPTION IS VALUED RATHER HIGHLY, AND INFLATION
IS REGARDED MUCH MORE SERIOUSLY THAN UNEMPLOYMENT. YOU ARE TO
MAXIMIZE THE SUM OF WELFARE (W+) OVER THE NEXT 10 YEARS.

TYPE YOUR NAME   -?ANON

ANON            GNP ACCOUNTS      YEAR 0
Q = 717.645     Y = 651.611     C = 378.547     I = 106.063     G = 167
T1= .3          T = 155.483     D = 398.386     E = 97.7416     M = 170.6
P = 1.21428     R = 4.69452     PC= 5.67608     U = 5.53652     IN= 0
W = 0           W+= 0


ENTER CHANGE IN M -  ?0
ENTER CHANGE IN G -  ?0
ENTER CHANGE IN T1 - ?0
CHECK YOUR WORK. ANY CHANGES ? (1=YES,0=NO).?0

ANON            GNP ACCOUNTS      YEAR 1
Q = 738.808     Y = 651.083     C = 378.286     I = 105.797     G = 167
T1= .3          T = 155.325     D = 398.096     E = 97.6624     M = 170.6
P = 1.21653     R = 4.57059     PC= .185108     U = 6.41838     IN= 0
W = 242.536     W+= 242.536
```

```
ENTER CHANGE IN M -  ?9999
YOUR DATA HAS BEEN STORED IN A FILE DESIGNATED DATA5.
TO RESTART CALL MCR05 AND TYPE

2510 FILES DATA5
RUN-2500

DONE

RUN
GMCR06

MCR06 MAY REQUIRE AN HOUR OR MORE TO PLAY CAREFULLY.
IF YOU THINK THAT YOU MAY POSSIBLY WISH TO PLAY IT
IN MORE THAN ONE SITTING, OR MAY WISH TO STOP TO THINK
BEFORE CONTINUING, YOU SHOULD CREATE A FILE TO STORE
THE DATA GENERATED BY YOUR ECONOMY.

DO YOU WANT THE FLEXIBILITY TO STOP THE GAME AND RETURN
LATER   ?YES

WHEN THE PROGRAM STOPS, TYPE

200 FILES DATA6
RUN-200

THE PROGRAM WILL NOW STOP TO ALLOW YOU TO TYPE IN THESE LINES.
TYPE IN THE LINES AFTER THE COMPUTER PRINTS 'DONE'.


DONE
200 FILES DATA6
RUN-200
GMCR06

IF YOU DESIRE TO STOP THIS PROGRAM DURING EXECUTION,
YOU MAY DO SO BY TYPING '9999' WHEN THE CHANGE IN M IS
REQUESTED.  YOU MAY THEN LOGOFF AND RESUME MCR06 IN THE
YEAR THAT YOU STOP.  INSTRUCTIONS FOR RESUMING WILL BE
GIVEN WHEN YOU STOP.

MCR06 DEALS WITH DESIGNING POLICY STRATEGIES TO MEET
YOUR ECONOMIC GOALS.  YOU WILL BE GIVEN INFORMATION
ON MAJOR ECONOMIC VARIABLES INCLUDING CURRENT EXPORTS (EX),
IMPORTS (IM), AND SHORT TERM CAPITAL INFLOWS (K). THE
BALANCE OF PAYMENTS IN THE CURRENT YEAR (BOP) AND THE
TOTAL DOLLAR CLAIMS ON OTHER NATIONS FROM YEAR -7 (BOP+)
ARE ALSO REPORTED.

YOU MAY SET YOUR OWN OBJECTIVES IN MCR06. NOTE THAT YOU
MUST BE CONCERNED WITH THE BALANCE OF PAYMENTS AND FOREIGN
TRADE IN ADDITION TO UNEMPLOYMENT AND INFLATION.  BE CAREFUL
TO MAKE YOUR OBJECTIVES REALISTIC, FOR SHOULD THE BALANCE
OF PAYMENTS FALL BELOW -20 IN ANY YEAR, ALL MEMBERS OF THE
IMF WILL REVALUE THEIR CURRENCIES UPWARDS.

YOU SHOULD HAVE STUDIED THE PAST PERFORMANCE OF THE ECONOMY
PRIOR TO THE BEGINNING OF THE GAME.  YOU WILL CONTROL THE
MONEY SUPPLY (M), GOVERNMENT EXPENDITURES (G), AND THE
MARGINAL TAX RATE (TI).  WHEN YOU ARE REQUESTED TO DO SO,
TYPE IN THE CHANGES IN M,G, AND TI. IF THERE IS NO CHANGE
A ZERO MUST BE TYPED.


TYPE YOUR NAME   -?ANON

ANON            GNP ACCOUNTS      YEAR 0
Q = 717.645     Y = 651.611     C = 378.547     I = 106.063     G = 167
TI= .3          T = 155.483     D = 398.386     E = 97.7416     M = 170.6
P = 1.21428     R = 4.69452     PC= 5.67608     U = 5.53652     IN= 0
EX= 25.932      IM= 35.856      K = .009        BOP=-10.014
BOP+= 4.45499
```

```
ENTER CHANGE IN M -  ?0
ENTER CHANGE IN G -  ?0
ENTER CHANGE IN T1 - ?0
CHECK YOUR WORK. ANY CHANGES ? (1=YES,0=NO).?0

ANON          GNP ACCOUNTS      YEAR 1
Q = 738.808   Y = 651.083   C = 378.286   I = 105.797   G = 167
T1= .3        T = 155.325   D = 398.096   E = 97.6624   M = 170.6
P = 1.21653   R = 4.57059   PC= .185108   U = 6.41838   IN= 0
EX= 42.4663   IM= 35.8286   K =-.184391   BOP= 6.45334
BOP+= 10.9083


ENTER CHANGE IN M -  ?9999
YOUR DATA HAS BEEN STORED IN A FILE DESIGNATED DATA6.
TO RESTART CALL MCR06 AND TYPE
2510 FILES DATA6
RUN-2500

DONE
```

ECONOMICS (EDUCATION) (830)

CONTRIBUTED PROGRAM **BASIC**

STABIL
36888-18023

TITLE: FEDERAL GOVERNMENT STABILIZATION POLICY

DESCRIPTION:

STABIL is a simulation which explores the process of federal government actions to stabilize the economy. A computer serves as a model of the U.S. economy. This model reports its current state of health by printing out economic indicators. Students act as economic advisors who must implement new stabilization policy by manipulating eight economic policy variables. The objective is to stabilize the economy within eight quarters given an initial condition of excessive expansion or recession.

OBJECTIVES:

Students will learn:

a) to judge the general condition of the economy by analyzing six key economic indicators.

b) the impact of eight different economic policy changes upon the economy

c) about the interrelated nature of economic indicators

d) about the difficulty of "fine-timing" an economy to achieve acceptable levels of unemployment and inflation.

Grade level:

9 - 12

INSTRUCTIONS:

This program is to be used with the following publication: STABIL Economics Simulation (HP 5951-7390)

For further information contact:

Hewlett-Packard Computer-Based Educational Materials
Scientific Press
1629 Channing Avenue
Palo Alto, Ca 94303

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Economics & Social Science, Grades 9-12

ACKNOWLEDGEMENTS: Mike Crook
West Jr. High School

RUN

```
RUN
STABIL

                          *****STABIL*****



ARE YOU STARTING(1), OR CONTINUING ANOTHER GAME(0)?1
DO YOU WANT INSTRUCTIONS?YES
YOUR GOAL IS TO USE THE ECONOMIC TOOLS AVAILABLE
TO ACHIEVE A SITUATION OF CONTROLLED EXPANSION IN
THE ECONOMY WITHIN 8 QUARTERS.  THIS IDEAL SITUATION
WILL BE ACHIEVED WHEN THE ECONOMIC INDICATORS HAVE
THE FOLLOWING VALUES:

                          GNP GROWTH         10%
                          UNEMPLOYMENT RATE   4%
                          INFLATION RATE      4%
                          WAGE GROWTH         6%
                          PROFIT RATE        10%
                          INTEREST RATE       7%

(FOR A VALUE TO BE ACCEPTABLE, IT MUST BE WITHIN
1/2 OF A PERCENT OF THE ABOVE FIGURE).

AT THE PRESENT TIME THE ECONOMY IS
IN A STATE OF RAPID INFLATION AS THE ECONOMIC
INDICATORS CLEARLY SHOW.


                          QUARTER 1
                          ---------
GNP GROWTH:          16          %      TOO FAST
UNEMPLOYMENT RATE:   2           %      TOO LOW?
INFLATION RATE:      12          %      TOO HIGH
WAGE RATE GROWTH:    10          %      TOO HIGH
PROFIT RATE:         15          %      TOO HIGH
INTEREST RATE:       9           %      TOO HIGH
WILL YOU INPUT STABILIZATION DECISIONS NOW(1) OR LATER(0)?1
DO YOU WANT A LISTING OF THE ECONOMIC POLICIES?YES

YOU MAY USE ONE OR SEVERAL OF THE FOLLOWING POLICY
ACTIONS (TOOLS) TO ACHIEVE CONTROLLED EXPANSION.

FISCAL POLICIES
---------------
1.  CHANGE FEDERAL SPENDING -10% OR +10%
2.  CHANGE FEDERAL BUDGET FOR JOB RETRAINING -50% OR +50%
3.  CHANGE FEDERAL TAXES ON INDIVIDUALS -10% OR +10%
4.  CHANGE FEDERAL TAXES ON BUSINESSES -10% OR +10%

MONETARY POLICY
---------------
5.  CHANGE MONEY SUPPLY -10% OR +10%

DISCRETIONARY POLICIES
----------------------
6.  IMPOSE PRICE CONTROLS FOR THIS QUARTER
7.  IMPOSE WAGE CONTROLS FOR THIS QUARTER
8.  IMPOSE PRICE, WAGE, AND INTEREST RATE FREEZE FOR THIS QUARTER
```

Documentation Date 3/75

ECONOMICS (EDUCATION) (830)

CONTRIBUTED PROGRAM **BASIC**

USECON
36888-18031

TITLE: TESTING ECONOMIC HYPOTHESES

DESCRIPTION:

This simulation supports the Hewlett-Packard Computer Curriculum Project publication, Testing Economic Hypotheses, an Economic Policy Model (HP 5951-7378) by Loren J. Dunham. The publication will be available in late spring, 1975. For further information contact:

Hewlett-Packard Computer-Based Educational Materials
Scientific Press
1629 Channing Avenue
Palo Alto, Ca 94303

INSTRUCTIONS:

See publication HP 5951-7378.

ACKNOWLEDGEMENTS:

Loren C. Dunham
Fairmont, Minnesota 56031

RUN

```
RUN
USECON

          THE U.S. ECONOMY: ITS YOUR DECISION!

CONSULT YOUR LAB BOOK FOR DIRECTIONS.  FOR ALL RESPONSES,
YES=1 AND NO=0.
DO YOU WANT TO INPUT INITIAL VALUES?1
IN WHAT YEAR ARE YOU STARTING?1974

               PERSONAL CONSUMPTION     ?550
               PRIVATE INVESTMENT       ?250
               GOVERNMENT SPENDING      ?200
                                        ----------
               ACTUAL GNP                1000

               POTENTIAL GNP            ?850

           ********** INFLATION ALERT! **********

YOU MAY ASSUME A MULTIPLIER OF  2.5

ENTER YOUR POLICY DECISIONS IN BILLIONS OF DOLLARS OR
PERCENTS. BE SURE TO INDICATE DIRECTION OF CHANGE BY A
+ OR -.  (FORMAT FOR PERCENTS: ENTER 2.1% AS 2.1.)

     FISCAL ACTION

GOVERNMENT SPENDING:  ?0
PERSONAL TAXES COLLECTED:  ?0
BUSINESS TAXES COLLECTED:  ?0

     MONETARY ACTION

RESERVE REQUIREMENT (%):  ?1
DISCOUNT RATE (%):  ?1
NET OPEN MARKET PURCHASES:  ?-3

                          **********

                          YEAR:   1975

               PERSONAL CONSUMPTION     544.8
               PRIVATE INVESTMENT       207.1
               GOVERNMENT SPENDING      200
                                        --------
               ACTUAL GNP               952

               POTENTIAL GNP            884

                          **********
DO YOU WANT TO CONTINUE?0

DONE
```

CONTRIBUTED PROGRAM **BASIC**

ALERA
36603

TITLE: PROPAGATION OF ERROR

DESCRIPTION:

This program computes the resultant precision of a quantity computed from imprecise measured quantities.

INSTRUCTIONS:

Instructions are contained in the program.

The program will compute the propagation of error through a series of binary operations. These are the familiar arithmetic operators. The input consists of three possible categories:

1. Commands
   REStore, clears all variables,
   LISt, lists all non-empty variables and their values.

   only the first three characters are needed.

2. Single letter
   This allows entering a value and an absolute precision directly into the given variable.

3. Operation
   The operation is of the form: VoV, where V is any alphabetic character, the accumulator #, or a single digit integer. The absolute precision of the integers is zero. The operator, o, is one of the following:

   + add
   - subtract
   * multiply
   / divide
   ↑ exponentiation
   = store

   In all cases except '=' (store), the result is put into the accumulator, #. This may be used in subsequent operations. If the variable referenced does not have a previously defined value, the program automatically requests a value and absolute precision.

SPECIAL CONSIDERATIONS:

The formulas for the error propagation are based on a geometric sum as described in Introduction to the Theory of Error by Yardley Beers (Addison-Wesley Publishing Co., 1957). Thus the resultant precision is an estimate of the actual precision of the computed quantity assuming that the errors in the measured quantities are independent, rather than an upper limit.

Continued on following page.

ACKNOWLEDGEMENTS:

Lawrence E. Turner, Jr.
Pacific Union College

SPECIAL CONSIDERATIONS: continued

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: General Physics Laboratory

Student Background Required: Discussion of precision and propagation of error.

In most laboratory situations the final result is computed from a set of measurements. It is important for the student to be able to estimate or determine the precision of each measurement. From this the precision of the result may be computed. It is also very important for the student to understand how the error in his initial data affects the result. To determine this, one performs a standard propagation of error analysis. However, this can be quite tedious, especially if the expression involves both sums and multiplies. One has to convert from relative to absolute precision and back.

Most students are so discouraged by the arithmetic in an analysis of error that they lose any benefit from the process. They rebel about doing the proper analysis. It was for this reason that the program was written. The computer is a good tool to do messy arithmetic.

In practice the students are introduced to the concept of error analysis and perform several calculations by hand. Thereafter, it is assumed that they have learned the concept, and the computer is allowed to help do the calculations.

RUN

```
RUN
ALERA

                ALGEBRAIC ERROR ANALYSIS

INSTRUCTIONS, (YES OR NO)?YES


   THIS PROGRAM COMPUTES THE RESULTANT PRECISION OF A QUANTITY.
IT IS RESTRICTED TO A SERIES OF BINARY OPERATIONS OF THE FORM:  VOV
WHERE 'V' IS ANY ALPHABETIC CHARACTER, '#', OR A SINGLE DIGIT INTEGER.
THE ABSOLUTE PRECISION OF THE INTEGERS IS ZERO.

'O' IS ONE OF THE FOLLOWING OPERATORS
     +    ADD
     -    SUBTRACT
     *    MULTIPLY
     /    DIVIDE
     ↑    EXPONENTIATE
     =    STORE

IN ALL CASES EXCEPT '=', THE RESULT IS RETURNED IN '#',
THIS MAY BE USED IN SUBSEQUENT OPERATIONS.

TYPING A SINGLE VARIABLE ALLOWS ENTERING ITS VALUE DIRECTLY
OTHERWISE, THE PROGRAM WILL ASK FOR ALL VALUES NEEDED

THERE ARE TWO COMMANDS:
  RESTORE,  CLEARS ALL VARIABLES
  LIST,     LISTS ALL NON-EMPTY VARIABLES

INITIALIZED


?P
    ENTER:  P, DP  ?3.14159,0
?R↑2
    ENTER:  R, DR  ?12,1

   # =  144              D# =  24               D#/# =  .166667

?P*#

   # =  452.389          D# =  75.3982          D#/# =  .166667

?A=#
    STORED
?4*#

   # =  1809.56          D# =  301.593          D#/# =  .166667

?S=#
    STORED
?LIS

A =  452.389    DA =  75.398
P =  3.14159    DP =  0
R =  12         DR =  1
S =  1809.56    DS =  301.593
#  =  1809.56    D# =  301.593

?
DONE
```

TITLE: DERIVES THE ELECTRONIC CONFIGURATION OF ANY ELEMENT

ATOM
36705

DESCRIPTION:

This program dervies the electronic configuration of any element according to the atomic orbital theory.

INSTRUCTIONS:

Type in the atomic number of the element to be analyzed when required.

ACKNOWLEDGEMENTS:

Babson College
Babson Park, Massachusetts

```
RUN

RUN
ATOM



THIS PROGRAM DERIVES THE ELECTRONIC CONFIGURATION OF ANY
ELEMENT ACCORDING TO THE ATOMIC ORBITAL THEORY.


WHAT IS THE ATOMIC NUMBER OF YOUR ELEMENT?16

THE ELECTRONIC CONFIGURATION IS:
1S 2    2S 2    2P 6    3S 2    3P 4


DO YOU WANT ME TO DO ANOTHER ELEMENT?YES

WHAT IS THE ATOMIC NUMBER OF YOUR ELEMENT?1

THE ELECTRONIC CONFIGURATION IS:
1S 1


DO YOU WANT ME TO DO ANOTHER ELEMENT?YES

WHAT IS THE ATOMIC NUMBER OF YOUR ELEMENT?12

THE ELECTRONIC CONFIGURATION IS:
1S 2    2S 2    2P 6    3S 2


DO YOU WANT ME TO DO ANOTHER ELEMENT?NO

DONE
```

ATWT
36613

TITLE: CALCULATES ATOMIC WEIGHT

DESCRIPTION:

This program will calculate the atomic weight (atomic mass) of an element from the % abundance of each isotope of the element. The % abundance may be found in the chemistry handbook.

OBJECTIVES:

To show that the atomic weight is an average weight and not the weight of any particular atom.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - The student should have an introductory understanding of atomic weight, mass number, and isotopes.

B. Materials - A chemistry handbook from which mass numbers and % abundances may be obtained is necessary.

DISCUSSION:

It is usually difficult to get the point across that the atomic weight is an average weight and not the weight of any particular atom. This point can be made rather easily if the calculations for atomic weight are examined. This program will enable the teacher, in a few minutes during his discussion, to do a large number of calculations. This is particularly impressive when the teacher uses % data that is significant to 5-6 figures, and thus produces an atomic weight as accurate as those given in most tables.

If the teacher is interested in discussing programming with his students, this program is a good one to use. It has the advantage of being short, but still containing a number of interesting programming techniques.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN


RUN
ATWT

 THIS PROGRAM WILL CALCULATE THE ATOMIC WEIGHT (ATOMIC MASS)
 FROM THE PERCENT ABUNDANCE OF EACH ISOTOPE.  PERCENT
 ABUNDANCES MAY BE FOUND IN THE CHEMISTRY HANDBOOK.

 HOW MANY ISOTOPES DOES THE ELEMENT HAVE ?7

 INPUT THE MASS NUMBER AND THE PERCENT ABUNDANCE FOR
 EACH OF THE 7    ISOTOPES.

 ISOTOPE NO. 1      ?196,.15
 ISOTOPE NO. 2      ?198,10
 ISOTOPE NO. 3      ?199,16.9
 ISOTOPE NO. 4      ?200,1-23.1
 ISOTOPE NO. 5      ?201,13.2
 ISOTOPE NO. 6      ?202,29.8
 ISOTOPE NO. 7      ?204,6.8


 ATOMIC WEIGHT (ATOMIC MASS) IS 200.525

 ANOTHER RUN (1=YES, 0=NO) ?0

DONE
```

AVOGA
36614

TITLE: AVOGADRO'S NUMBER

DESCRIPTION:

A class presentation designed to calculate Avogadro's number, by using the molecular weight of a compound and dividing by the combined actual weight of the total numbers of neutrons and protons in a single molecule.

OBJECTIVES:

To show by calculation, the value of Avogadro's number, and to reinforce the concept of Avogadro's hypothesis.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - The student must be familiar with atomic structure, atomic mass, nuclear particles, and isotopes.

B. Materials - None

DISCUSSION:

A. Operational Suggestions

The presentation of this program can be utilized to occupy one forty-five minute teaching period, even though the actual running time is approximately 10 minutes.

B. Suggested Follow-up

The occurrence of built-in error, due to the use of average atomic weights, generally provokes discussion as to the reasons for the error.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN


RUN
AVOGA

IF INSTRUCTIONS DESIRED, TYPE 1,  IF NOT, TYPE 0?1

THIS PROGRAM WILL CALCULATE AVOGADRO'S NUMBER BY USING
ANY PURE GASEOUS ELEMENT OR BINARY COMPOUND.

THIS VALUE WILL BE CALCULATED BY USING THE MASS IN GRAMS
OF THE NEUTRON, WHICH IS : 1.67438E-24
AND THE MASS OF THE PROTON, WHICH IS : 1.67206E-24

YOU MUST SUPPLY THE ATOMIC NUMBER AND THE ATOMIC WEIGHT OF
INPUT EACH ELEMENT USED.  CARRY DIGITS UP TO 6 PLACES IF YOU
WISH.  WHEN THE MACHINE ASKS (?) INPUT THE ATOMIC NUMBER
AND THE ATOMIIC WEIGHT OF THE FIRST ELEMENT, THEN THE
ATOMIC NUMBER AND THE ATOMIC WEIGHT OF THE SECOND IN THE
FORM A,B,C,D.  IF USING SINGLE ELEMENTS, BE SURE TO
PUT IN 0 FOR VALUES C AND D.

               ***************

NOW INPUT THE VALUES FOR YOUR COMPOUND
?6,12.0012,8,15.9994
INPUT THE NUMBER OF ATOMS FOR EACH ELEMENT.
(CO2 WOULD BE 1,2)  :?1,2

*** THE NUMBER OF PARTICLES PER MOLE OF THIS GAS IS 5.97650E+23

WOULD YOU LIKE TO TRY ANOTHER PROBLEM ?
TYPE 1 IF YES, TYPE 0 IF NO  ?1

               ***************

NOW INPUT THE VALUES FOR YOUR COMPOUND
?8,15.994,0,0
INPUT THE NUMBER OF ATOMS FOR EACH ELEMENT.
(CO2 WOULD BE 1,2)  :?2,0

*** THE NUMBER OF PARTICLES PER MOLE OF THIS GAS IS 5.97650E+23

WOULD YOU LIKE TO TRY ANOTHER PROBLEM ?
TYPE 1 IF YES, TYPE 0 IF NO  ?0

DONE
```

BFIELD
36312

TITLE: BFIELD: Magnetic Field Picture

DESCRIPTION:

Student may visualize the effects of current on the magnetic field produced about a single conductor. The student may also explore the fields produced by the current flow in two parallel wires. The current in the two wires may be chosen in the same direction or in opposite directions.

OBJECTIVES:

To acquaint student with the magnetic fields produced by current carrying conductors.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - Prior preparation involving currents and fields.

B. Materials - None

DISCUSSION:

Student may qualitatively explore the effects of currents on the production of magnetic fields by successively increasing or decreasing the current. The resulting magnetic field is printed out showing the relative magnitude of the field in relation to the position of the current.

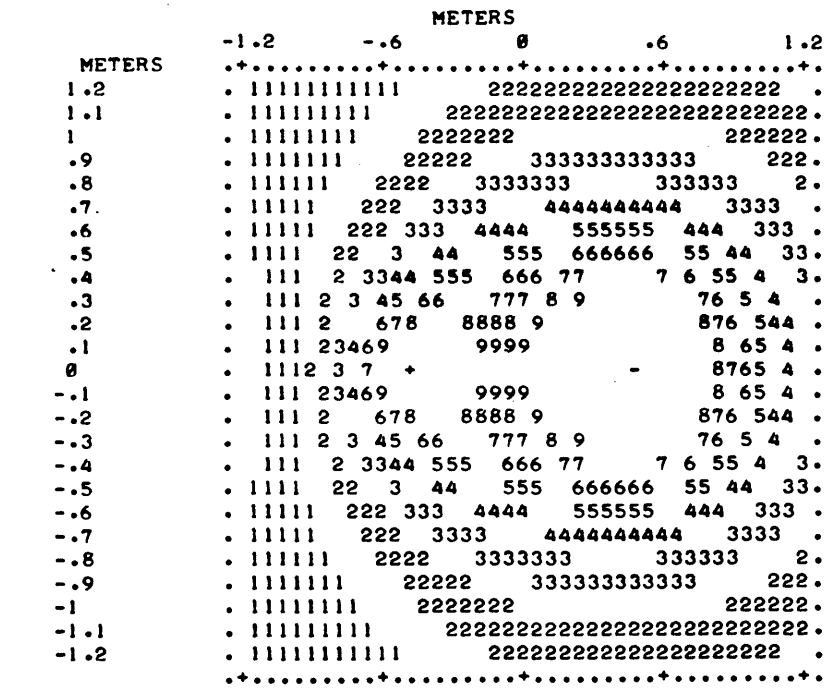
The student may also view the magnetic field due to two currents in the same or opposite direction.

This program may also be used to introduce groups to the field concept. In addition, minor modification of the program will produce a series of plots which will demonstrate an expanding field resulting from an increasing current.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN
RUN
BFIELD

THIS PROGRAM WILL PERMIT YOU TO EXPLORE THE MAGNETIC FIELD
ABOUT A CURRENT DIRECTED INTO THE PAGE AS A FUNCTION OF THE
CURRENT MAGNITUDE.

WHAT WILL BE YOUR INITIAL CURRENT (SELECT POSITIVE VALUES
BETWEEN 1 AND 8 AMPERES).
ENTER YOUR VALUE OF CURRENT?6

THE MAGNITUDE OF THE FIELD DECREASES FROM 9 TO 0.
9 IS THE HIGHEST POSSIBLE FIELD STRENGTH, AND 0
(WHICH MEANS A ZERO FIELD) THE LOWEST.

                              METERS
              -1.2      -.6        0        .6        1.2
   METERS     .+.........+.........+.........+.........+.
  1.2         .        22222222222222222222222        .
  1.1         .      22222222222222222222222222222      .
  1           .    222222222222         222222222222    .
  .9          .  2222222222                 2222222222  .
  .8          . 22222222     3333333333333     22222222 .
  .7          .22222222   333333       333333   22222222.
  .6          .222222    3333  444444444  3333    222222.
  .5          .22222   3333  44   555   44  3333   22222.
  .4          .2222   333  44 55 66666 55 44  333   2222.
  .3          .2222   33  44 5 67 888 76 5 44  33   2222.
  .2          .222   333 44 56  9     9  65 44 333   222.
  .1          .222   33  4 5   9       9   5 4  33   222.
  0           .222   33  4 56 8    +    8 65 4  33   222.
 -.1          .222   33  4 5   9       9   5 4  33   222.
 -.2          .222   333 44 56  9     9  65 44 333   222.
 -.3          .2222   33  44 5 67 888 76 5 44  33   2222.
 -.4          .2222   333  44 55 66666 55 44  333   2222.
 -.5          .22222   3333  44   555   44  3333   22222.
 -.6          .222222    3333  444444444  3333    222222.
 -.7          .22222222   333333       333333   22222222.
 -.8          . 22222222     3333333333333     22222222 .
 -.9          .  2222222222                 2222222222  .
 -1           .    222222222222         222222222222    .
 -1.1         .      22222222222222222222222222222      .
 -1.2         .        22222222222222222222222        .
              .+.........+.........+.........+.........+.


SELECT A DIFFERENT CURRENT.
ENTER YOUR VALUE OF CURRENT?3

                              METERS
              -1.2      -.6        0        .6        1.2
   METERS     .+.........+.........+.........+.........+.
  1.2         .11111111111111111111111111111111111111111.
  1.1         .11111111111111111111111111111111111111111.
  1           .11111111111111111111111111111111111111111.
  .9          .11111111111111111       11111111111111111.
  .8          .1111111111111               1111111111111.
  .7          .1111111111         222         1111111111.
  .6          .111111111     2222222222222     111111111.
  .5          .11111111    222222     222222    11111111.
  .4          .1111111    2222  3333333  2222    1111111.
  .3          .111111    222  33 44444 33  222    111111.
  .2          .11111    222  3 4 56665 4 3  222    11111.
  .1          .11111    222 334 6     6 433 222    11111.
  0           .11111    222 3 45   +   54 3 222    11111.
 -.1          .11111    222 334 6     6 433 222    11111.
 -.2          .11111    222  3 4 56665 4 3  222    11111.
 -.3          .111111    222  33 44444 33  222    111111.
 -.4          .1111111    2222  3333333  2222    1111111.
 -.5          .11111111    222222     222222    11111111.
 -.6          .111111111     2222222222222     111111111.
 -.7          .1111111111         222         1111111111.
 -.8          .1111111111111               1111111111111.
 -.9          .11111111111111111       11111111111111111.
 -1           .11111111111111111111111111111111111111111.
 -1.1         .11111111111111111111111111111111111111111.
 -1.2         .11111111111111111111111111111111111111111.
              .+.........+.........+.........+.........+.
```

```
WOULD YOU LIKE TO TRY TWO DIFFERENT CURRENTS AT THE SAME
TIME (YES=1; NO=0)?1
THE TWO CURRENTS WILL BE SEPARATED BY 1.0 METER. (NOTE: IF
THE CURRENTS ARE TO BE OPPOSITELY DIRECTED, STATE ONE OF THEM
AS A NEGATIVE VALUE).
ENTER THE TWO CURRENTS?4,-8
```




```
WANT TO TRY AGAIN (YES=1; NO=0)?0
WELL I GUESS YOU'RE ALL THROUGH. THANKS-- SEE Y'A

DONE
```

BOHR

TITLE: BOHR: Energy Level Diagram 36313

DESCRIPTION:

The student may choose to have the Lyman, Balmer, or Paschen Series of the hydrogen emission spectrum displayed. He then must decide which energy level transitions are responsible for the lines of the spectrum that he has chosen. If he is successful, an energy-level diagram is presented and he must determine the energies of the photons emitted by the electron as it falls between randomly-selected energy levels.

OBJECTIVES:

To give an increased understanding of the Bohr atom and of how emission spectra are formed.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - The student should have been introduced to the Bohr atom, quantum theory, and ideally, have measured the wavelengths of the bright lines of the hydrogen spectrum.

B. Materials - A piece of paper and a pencil.

DISCUSSION:

After the student selects the series he wishes to see, it is displayed and he tries to discover which quantum level jumps by the electron are responsible for the first two of three lines in the series. If he is successful three times, a statement as to how the lines of that series are formed is printed and he may then elect to try another series or move on to work with the energy-level diagram for hydrogen.

After a brief explanation concerning the energy of a photon emitted during the transition of the electron from a higher to a lower energy level, the student is given a chance to show what he has learned. Energy levels are randomly selected and he must calculate the energy of the emitted photon. If the student is not successful, he gets a further explanation. After six trials the program ends.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
BOHR

YOU MAY VIEW THE 1. LYMAN  2.BALMER  OR 3. PASCHEN
SERIES BY TYPING IN THE NUMBER OF THE SERIES YOU WANT
DISPLAYED, OR TYPE 4 FOR AN ENERGY LEVEL DIAGRAM.

  CHOOSE THE NUMBER OF THE PART YOU WOULD LIKE TO SEE.
?2

 7000      A
 6900      A
 6800      A
 6700      A
 6600      A
 6500      A---------- 6564.7
 6400      A
 6300      A
 6200      A
 6100      A
 6000      A
 5900      A
 5800      A
 5700      A
 5600      A
 5500      A
 5400      A
 5300      A
 5200      A
 5100      A
 5000      A
 4900      A
 4800      A---------- 4862.75
 4700      A
 4600      A
 4500      A
 4400      A
 4300      A---------- 4341.74
 4200      A
 4100      A---------- 4102.94
 4000      A
 3900      A---------- 3971.24
 3800      A---------- 3890.2
 3700      A
 3600      A---------- 3647.06     -----SERIES LIMIT
 3500      A
 3400      A
 3300      A
 3200      A
 3100      A
 3000      A

  ACCORDING TO THE BOHR THEORY EACH OF THESE LINES RESULTS
FROM THE EMISSION OF A PHOTON DURING THE TRANSITION OF THE
ORBITAL ELECTRON OF AN EXCITED HYDROGEN ATOM FROM A HIGHER
ENERGY STATE (ORBIT) TO A LOWER ONE.  IN A PARTICULAR SERIES
THE TRANSITION (JUMP) IS ALWAYS INTO THE SAME LOWER LEVEL
(ORBIT) FROM ANY HIGHER ONE.
  LET'S SEE IF YOU CAN DETERMINE WHICH TWO ORBITS THE ELECTRON
JUMPED BETWEEN TO GIVE THE LINES THAT HAVE BEEN DISPLAYED.
  THE LOWEST ENERGY LEVEL (GROUND STATE) IS NUMBERED ONE.
HIGHER ENERGY LEVELS HAVE HIGHER NUMBERS IN SEQUENCE.


  FOR EXAMPLE: FROM 4 TO 1 ENTER AS 4,1?3,2

GOOD START.  THAT GIVES A WAVELENGTH OF 6564.71
THE NEXT LINE IS FORMED BY WHICH TRANSITION?4,2

BY GEORGE!! I THINK YOU'VE GOT IT!! THE WAVELENGTH IS 4862.75
TRY ONE MORE - THE NEXT ONE.  ENTER NOW.?5,2


  ANY TRANSITION FROM A HIGHER ENERGY LEVEL INTO THE
SECOND ENERGY LEVEL YIELDS A PHOTON OF THE BALMER SERIES.
```

```
IF YOU WOULD LIKE TO TRY ANOTHER SERIES TYPE IN THE NUMBER
OF THAT SERIES.  IF YOU WANT TO GO ON TO A NEW PART OF
THE PROGRAM TYPE 4
WHICH??4


  YOU WILL NOW GET AN ENERGY LEVEL DIAGRAM FOR HYDROGEN.
IT SHOWS THE ENERGY OF THE ELECTRON IN THE VARIOUS ENERGY
LEVELS.  THE DIFFERENCE BETWEEN THE ENERGY OF THE ELECTRON
IN A HIGHER LEVEL AND THAT IN A LOWER LEVEL IS THE ENERGY
OF THE EMITTED PHOTON.   E(PHOTON) = E (HIGHER) - E (LOWER)

        CONTINUUM

N= .....INFINITY..... E=    000000
N= 6       --------------- E= - .370001
N= 5       --------------- E= - .540001
N= 4       --------------- E= - .850001

N= 3       --------------- E= - 1.51



N= 2       --------------- E= - 3.4


N= 1       --------------- E= - 13.6

FIND THE ENERGIES OF THE PHOTONS GIVEN OFF FOR THE
TRANSITIONS GIVEN BELOW.

FROM LEVEL 3      TO LEVEL 1      THE ENERGY OF THE PHOTON IS??-11.09

THE ENERGY OF LEVEL 3      IS-1.51111
THE ENERGY OF LEVEL 1      IS-13.6

THEIR DIFFERENCE = PHOTON ENERGY = 12.0889

FROM LEVEL 4      TO LEVEL 1      THE ENERGY OF THE PHOTON IS??-12.75

GOOD. TRY ANOTHER

FROM LEVEL 3      TO LEVEL 1      THE ENERGY OF THE PHOTON IS??12.09

GOOD. TRY ANOTHER

FROM LEVEL 3      TO LEVEL 2      THE ENERGY OF THE PHOTON IS??1.89

GOOD. TRY ANOTHER

FROM LEVEL 4      TO LEVEL 1      THE ENERGY OF THE PHOTON IS??12.75

GOOD. TRY ANOTHER

FROM LEVEL 2      TO LEVEL 1      THE ENERGY OF THE PHOTON IS??10.2

THANK YOU, AND GOODBYE.

DONE
```

CONTRIBUTED PROGRAM **BASIC**

BOLA
36879

TITLE: NUCLEAR PHYSICS GAME

DESCRIPTION:

BOLA is a physics game which uses a section chart of Nuclides as a playing field. Through bombardment of atomic nuclei, the players (1 or 2) attempt to move through the chart.

INSTRUCTIONS:

User instructions and classroom material are contained in a publication of the Hewlett Packard Curriculum Project entitled: BOLA, A Nuclear Physics Game (HP-5951-7177). For information contact:

Computer Curriculum Project
Hewlett Packard Company
11000 Wolfe Road
Cupertino, CA

ACKNOWLEDGEMENTS: Michael Chester

```
RUN

RUN
BOLA

HOW MANY PLAYERS, 0, 1, OR 2
?0
IS THIS A TEST
?NO

LI      7

WHAT NUCLEAR REACTION
?2
B       10

B 10 IS ONE OF THE MAIN MOBILITY CENTERS OF THIS
GAME.  THERE ARE MANY PLACES YOU CAN GO FROM HERE.
IN PART, THIS REFLECTS THE MANY REACTIONSTHAT HAVE
BEEN CARRIED OUT INVOLVING B 10 BOMBARDMENT.  BE 9
AND N14 ARE SIMILAR STRATEGIC HUBS.

WHAT NUCLEAR REACTION
?5
B       9


SHORT-LIVED ISOTOPE.


BE      8

BE 8 LIVES JUST LONG ENOUGH (10 TO THE MINUS 16
SECONDS) TO FORM A REACTION BRIDGE TO C 12.
THE REACTIONS, OCCURRING IN STELLAR INTERIORS,
ARE: HE 4 + HE 4 = BE 8; THEN, BE 8 + HE 4 = C 12.
WITHOUT THIS BRIDGE THERE WOULD BE NO ELEMENTS
HEAVIER THAN HELIUM IN THE UNIVERSE.  BERYLLIUM 8
WAS THE FLICKERING GATE THAT LED TO SOLID PLANETS
AND CARBON CHAINS AND LIFE IN THE UNIVERSE.

SHORT-LIVED ISOTOPE.


HE      4

HE 4 IS A VERY STABLE ISOTOPE, AND THEREFORE
THE END POINT OF MANY NUCLEAR REACTIONS, AND
THE END POINT OF THIS GAME.


END OF GAME
DO YOU WANT A FINAL DISPLAY
?NO

DONE



RUN
BOLA

HOW MANY PLAYERS, 0, 1, OR 2
?1
IS THIS A TEST
?YES
WHAT Z
?5
WHAT N
?7
B       12

WHAT NUCLEAR REACTION
?0
```

```
C      12

SHORT-LIVED ISOTOPE.


BE      8

SHORT-LIVED ISOTOPE.


HE      4

O 17 NOT INCLUDED IN GAME ROUTE.
YOU WENT TO HELIUM 4 TOO SOON
GAME LOST

END OF GAME
DO YOU WANT A FINAL DISPLAY
?YES

OXYGEN (O)                                  0      0      0      0      0

NITROGEN (N)                                0      0      0      0      0

CARBON (C)                          0       0      1      0      0

BORON (B)                           0       0      0      1

BERYLLIUM (BE)      0       0       1       0

LITHIUM (LI)        0       0       0

HELIUM (HE)         1       0       0


DONE


RUN
BOLA

HOW MANY PLAYERS, 0, 1, OR 2
?2
IS THIS A TEST
?NO

LI      7


PLAYER 1

WHAT NUCLEAR REACTION
?2
B      10


PLAYER 1

WHAT NUCLEAR REACTION
?1
C      13


PLAYER 2

WHAT NUCLEAR REACTION
?9
C      14


PLAYER 2

WHAT NUCLEAR REACTION
?0
```

```
PLAYER 1'S SCORE IN MEV= 1.21
PLAYER 2'S SCORE IN MEV= 8.36
N      14


ISOTOPE COUNT= 5
TRANSITIONS MADE= 4

DO YOU WANT A CHECKLIST DISPLAY
?NO
N      14


PLAYER 1

WHAT NUCLEAR REACTION
?
DONE



RUN
BOLA

HOW MANY PLAYERS, 0, 1, OR 2
?1
IS THIS A TEST
?NO

LI      7

WHAT NUCLEAR REACTION
?2
B      10

WHAT NUCLEAR REACTION
?5
B      9

SHORT-LIVED ISOTOPE.


BE      8

SHORT-LIVED ISOTOPE.


HE      4

O 17 NOT INCLUDED IN GAME ROUTE.
YOU WENT TO HELIUM 4 TOO SOON
GAME LOST

END OF GAME
DO YOU WANT A FINAL DISPLAY
?YES

OXYGEN (O)                              0      0      0      0      0

NITROGEN (N)                            0      0      0      0      0

CARBON (C)                        0     0      0      0      0

BORON (B)                         1     1      0      0

BERYLLIUM (BE)      0      0      1      0

LITHIUM (LI)        0      0      1

HELIUM (HE)         1      0      0


DONE
```

CALORI
36314

TITLE: CALORI: Calorimetry Experiment

DESCRIPTION:

Calorimetry experiments are simulated by the computer permitting the student to enter the mass and temperatures of two quantities of water. The computer calculates and prints out the equilibrium temperature of the mixture. The student must then determine the heat energy, in calories, to be supplied (or removed) from each mass to obtain the equilibrium temperature.

OBJECTIVES:

A. To acquaint the students with conservation of energy concepts involving calorimetry.

B. To determine the equations governing these relationships.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - Must know definitions for calorie and specific heat.

B. Materials - Table of Specific heats

DISCUSSION:

Calorimetry, in its simplest form, is presented as part of a class lesson. The concept of heat energy balance is developed by presenting several examples, with the computer, based on the definition of the "calorie". Specific heat is introduced by a similar approach (replacing the water of the initial examples, with alcohol; specific heat of 6 cal/gm-0°C.)

The program can be modified (with relative ease) to incorporate different materials or combinations of different materials.

When this program was used as an introduction to calorimetry, it was noted that many students were able to determine the equations describing the phenomenon by utilizing the stated results from the computer.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
CALORI

                HEAT AND CALORIMETRY


##########

YOU HAVE TWO BEAKERS OF WATER .
WHAT IS THE MASS (IN GRAMS) AND THE TEMP (IN DEGREES) OF THE
 WATER IN THE FIRST BEAKER?80,50

WHAT IS THE MASS (IN GRAMS) AND THE TEMP (IN DEGREES) OF THE
 WATER IN THE SECOND BEAKER?40,60

THE FINAL TEMPERATURE OF THE MIXTURE IS  53.33       DEGREES.

HOW MANY CALORIES WERE INVOLVED IN CHANGING THE TEMP OF
THE  FIRST  BEAKER FROM  50    TO  53.33       DEGREES?260

YOU'RE CLOSE ENOUGH. THE CORRECT ANSWER IS  266.4       CALORIES.

HOW MANY CALORIES WERE INVOLVED IN CHANGING THE TEMP OF
THE  SECOND  BEAKER FROM  60    TO  53.33       DEGREES?240

YOU'RE MORE THAN 3 PERCENT OFF. YOU SHOULD HAVE SAID
 266.8       CALORIES.


WANT TO TRY AGAIN (1=YES, 0=NO) : ?1
CHOOSE A LIQUID : 0=WATER, 1=ALCOHOL.  WHICH?1


##########

YOU HAVE TWO BEAKERS OF ALCOHOL .
WHAT IS THE MASS (IN GRAMS) AND THE TEMP (IN DEGREES) OF THE
 ALCOHOL IN THE FIRST BEAKER?100,50

WHAT IS THE MASS (IN GRAMS) AND THE TEMP (IN DEGREES) OF THE
 ALCOHOL IN THE SECOND BEAKER?100,70

THE FINAL TEMPERATURE OF THE MIXTURE IS  60    DEGREES.

HOW MANY CALORIES WERE INVOLVED IN CHANGING THE TEMP OF
THE  FIRST  BEAKER FROM  50    TO  60    DEGREES?610

YOU'RE CLOSE ENOUGH. THE CORRECT ANSWER IS  600   CALORIES.

HOW MANY CALORIES WERE INVOLVED IN CHANGING THE TEMP OF
THE  SECOND  BEAKER FROM  70    TO  60    DEGREES?700

YOU'RE MORE THAN 3 PERCENT OFF. YOU SHOULD HAVE SAID
 600   CALORIES.


WANT TO TRY AGAIN (1=YES, 0=NO) : ?0

DONE
```

TITLE: MILLIKAN'S OIL-DROP EXPERIMENT

CHARG
36621

DESCRIPTION:

This simulation of a modern version of the Millikan Oil Drop Experiment is designed to demonstrate to the student the existence of a discrete unit of electrical charge. CHARG (which was originally named CHARGE) was developed by the Huntington II Project at the State University of New York under the direction of Ludwig Braun. This work was partially supported by the National Science Foundation, Grant GW-5883.

INSTRUCTIONS:

The computer will request a new voltage or an option change by printing out " V = X? ", where X is the old voltage. After the question mark, you may either type in a new voltage between -1000 and +1000 volts, type in the old voltage again, or enter one of the following code numbers for an option to be performed.

2000 - to request calculation of charge for a drop with velocity = 0
3000 - to request a new batch of drops
4000 - to end the program

SPECIAL CONSIDERATIONS:

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

Student Workbook	**$ .30**
Teachers Guide	**.30**
Resource Handbook	**.50**

ACKNOWLEDGEMENTS: Huntington II Project
State University of New York

```
RUN

RUN
CHARG

                MILLIKAN OIL DROP EXPERIMENT

INSTRUCTIONS (1=YES, 0=NO)?1

INSTRUCTIONS -- AFTER EACH QUESTION MARK, (V=  ?), YOU MAY:

TYPE IN VOLTAGE BETWEEN -1000 AND 1000 (IN ORDER TO MAKE
THE VELOCITY PRINTED OUT AS CLOSE TO ZERO AS POSSIBLE),
REQUEST CALCULATION OF CHARGE FOR STOPPED DROP (TYPE IN 2000),
REQUEST NEW BATCH OF DROPS (TYPE IN 3000),
OR END THE PROGRAM (TYPE IN 4000).


                NO ELECTRIC FIELD

DROP:            1              2              3              4
                 ---            ---            ---            ---
  VELOCITY
(METERS/SEC)
( X  10↑-6 )
                -29.9          -30.3          -30.5          -30.3

V= 0      ?100
                -10.9          -11.5          -16.4          -30.3

V= 100    ?150
                -1.5           -2.1           -9.3           -30.3

V= 150    ?151
                -1.3           -1.9           -9.2           -30.3

V= 151    ?160
                 .4            -.2            -7.9           -30.3

V= 160    ?158
                 .1            -.6            -8.2           -30.3

V= 158    ?157
                -.1            -.8            -8.4           -30.3

V= 157    ?157.5
                 0             -.7            -8.3           -30.3

V= 157.5        ?2000


CALCULATION FOR WHICH DROP?1

CHARGE ON DROP 1      IS 6.52         X 10↑-19 COULOMBS.

V= 157.5        ?164
                 1.2            .6             -7.4           -30.3

V= 164    ?162
                 .8             .2             -7.7           -30.3

V= 162    ?161
                 .6             0              -7.8           -30.3

V= 161    ?2000


CALCULATION FOR WHICH DROP?2

CHARGE ON DROP 2      IS 6.37         X 10↑-19 COULOMBS.

V= 161    ?200
                 8              7.3            -2.3           -30.3

V= 200    ?225
                 12.8           12              1.2           -30.3
```

```
V= 225   ?220
              11.8          11.1          .5          -30.3
V= 220   ?216
              11.1          10.3          0           -30.3
V= 216   ?2000

CALCULATION FOR WHICH DROP?3
CHARGE ON DROP 3     IS 4.75       X 10↑-19 COULOMBS.
V= 216   ?3000

DROP:          5             6             7             8
              ---           ---           ---           ---
              10.6          -30.3         -.2           .7
V= 216   ?175
              2.9           -30.3         -5.9          -5.1
V= 175   ?165
              1             -30.3         -7.3          -6.5
V= 165   ?160
              .1            -30.3         -8.1          -7.2
V= 160   ?161
              .2            -30.3         -7.9          -7.1
V= 161   ?159
             -.1            -30.3         -8.2          -7.4
V= 159   ?159.5
              0             -30.3         -8.1          -7.3
V= 159.5      ?2000

CALCULATION FOR WHICH DROP?5
CHARGE ON DROP 5     IS 6.43       X 10↑-19 COULOMBS.
V= 159.5      ?220
              11.4          -30.3         .4            1.3
V= 220   ?217
              10.8          -30.3         0             .9
V= 217   ?2000

CALCULATION FOR WHICH DROP?7
CHARGE ON DROP 7     IS 4.73       X 10↑-19 COULOMBS.
V= 217   ?213
              10.1          -30.3         -.6           .3
V= 213   ?211
              9.7           -30.3         -.9           0
V= 211   ?2000


CALCULATION FOR WHICH DROP?8
CHARGE ON DROP 8     IS 128.28     X 10↑-19 COULOMBS.
V= 8     ?4000

DONE
```

CHEM

TITLE: SELF-CORRECTING CHEMISTRY TEST 36295

DESCRIPTION:

This program generates a self-correcting Chemistry test. Ten questions are asked on the ideal gas law, then one mass problem (considered harder than the rest) is asked. This is followed by ten more gas law problems of a different type. The test is scored as follows: full value is given for a correct answer on the first try; if the first answer is within three of the correct answer, the student is given a second try for half value. Each section is valued at ten points. The sectional mark is given after each section, with the total correct out of thirty given at the end.

INSTRUCTIONS:

This program is almost completely self explanatory, therefore no instructions are needed. If any difficulty should arise, the user should be able to modify the program to suit his own particular needs.

SPECIAL CONSIDERATIONS:

This program will run on any 8K or larger HP computer, however if the 8K configuration is used, the matrix package of the BASIC interperter must be deleted. This is because program "CHEM" requires more storage than what is available when the matrix package is retained.

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Chemistry.

Student Background Required: Basic High School Chemistry

ACKNOWLEDGEMENTS:

Paul M. Dunphy
Nova Scotia Eastern Institute of Technology

```
RUN


RUN
CHEM

                          ***CHEM TEST***

THERE ARE 3 PARTS: PART 1 IS ON THE IDEAL GAS LAW,
                   PART 2 IS A MASS PROBLEM, AND PART 3 IS
                   ALSO ON THE IDEAL GAS LAW.

DIRECTIONS: WHEN THE COMPUTER ASKS FOR THE ANSWER, TYPE IT
IN, THEN PUSH 'RETURN'.

USE THE FOLLOWING FORMULA TO CALCULATE THE ANSWERS FOR PARTS
1 AND 3: V2=V1*(P1/P2)*(T2/T1). AT S.T.P.,P1=760 MM HG AND
T1=273 DEGREES KELVIN.
YOUR MARK OUT OF 30 WILL BE GIVEN AT THE END.
VALUES: PART 1---10 QUESTIONS-1 POINT EACH.
        PART 2---1 QUESTION-10 POINTS.
        PART 3---10 QUESTIONS-1 POINT EACH.

                       PART 1
                     ***********
**************************************************************************

 1    .IF A 453  ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.
AND SUBJECTED TO 750  MM HG AND 285   DEGREES KELVIN WHAT WILL
ITS FINAL VOLUME BE
?479
CORRECT------1 POINT
**************************************************************************

 2    .IF A 453  ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.
AND SUBJECTED TO 751  MM HG AND 287   DEGREES KELVIN WHAT WILL
ITS FINAL VOLUME BE
?482
CLOSE, YOU ARE WITHIN 3 MLS, TRY AGAIN.
?481
CORRECT ON YOUR SECOND TRY------1/2 POINT
**************************************************************************

 3    .IF A 454  ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.
AND SUBJECTED TO 754  MM HG AND 295   DEGREES KELVIN WHAT WILL
ITS FINAL VOLUME BE
?494
CORRECT------1 POINT
**************************************************************************

 4    .IF A 457  ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.
AND SUBJECTED TO 757  MM HG AND 298   DEGREES KELVIN WHAT WILL
ITS FINAL VOLUME BE
?500

CORRECT------1 POINT
**************************************************************************

 5    .IF A 461  ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.
AND SUBJECTED TO 760  MM HG AND 299   DEGREES KELVIN WHAT WILL
ITS FINAL VOLUME BE
?504
CORRECT------1 POINT
**************************************************************************

 6    .IF A 470  ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.
AND SUBJECTED TO 762  MM HG AND 305   DEGREES KELVIN WHAT WILL
ITS FINAL VOLUME BE
?523
CORRECT------1 POINT
**************************************************************************

 7    .IF A 470  ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.
AND SUBJECTED TO 770  MM HG AND 313   DEGREES KELVIN WHAT WILL
ITS FINAL VOLUME BE
?531
CORRECT------1 POINT
**************************************************************************
```

```
 8    .IF A 473  ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.
AND SUBJECTED TO 776  MM HG AND 320   DEGREES KELVIN WHAT WILL
ITS FINAL VOLUME BE
?543
CORRECT------1 POINT
**************************************************************************

 9    .IF A 478  ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.
AND SUBJECTED TO 778  MM HG AND 326   DEGREES KELVIN WHAT WILL
ITS FINAL VOLUME BE
?556
CLOSE, YOU ARE WITHIN 3 MLS, TRY AGAIN.
?557
CORRECT ON YOUR SECOND TRY------1/2 POINT
**************************************************************************

 10   .IF A 481  ML SAMPLE OF AN IDEAL GAS IS COLLECTED AT S.T.P.
AND SUBJECTED TO 781  MM HG AND 332   DEGREES KELVIN WHAT WILL
ITS FINAL VOLUME BE
?569
CORRECT------1 POINT
**************************************************************************
                        9    POINTS OUT OF 10
**************************************************************************
YOU HAVE NOW COMPLETED PART 1. IF YOU WISH TO TRY IT
AGAIN WITH THE SAME VALUES, TYPE'2'. IF YOU WANT TO
TRY IT AGAIN WITH DIFFERENT VALUES, TYPE'1'. IF YOU
WANT TO PROCEED WITH THE REST OF THE TEST,TYPE'0'.
IF YOU DON'T WANT TO DO ANY MORE,TYPE'3'.
?0
                     *****END OF PART 1*****

**************************************************************************

                           PART 2
                     ******************
IN THE FOLLOWING REACTION:
NAOH+HCL->NACL+H2O(SODIUM HYDROXIDE +HYDROCHLORIC
ACID YIELDS SODIUM CHLORIDE AND WATER), HOW MUCH
SODIUM HYDROXIDE(IN GRAMS) IS NEEDED TO PRODUCE
470 GRAMS OF SODIUM CHLORIDE?

ATOMIC WEIGHTS: 1. SODIUM=22.98
                2. CHLORINE=35.45
                3. HYDROGEN=1.0079
                4. OXYGEN=15.99

HOW MANY GRAMS
?685
YOU ARE WITHIN 10 GRAMS, TRY AGAIN FOR 1/2 VALUE.
?683
SORRY,YOU ARE WRONG AGAIN, CORRECT ANSWER IS 686   GRAMS

                     *****END OF PART 2*****

**************************************************************************
YOU HAVE NOW COMPLETED PART 2. TO CONTINUE,TYPE'0'.
TO END HERE,TYPE'1'.
?0
**************************************************************************
                           PART 3
                     ******************

THE FOLLOWING TEST IS THE SAME AS IN PART 1
EXCEPT THAT THE GAS IS NOT COLLECTED AT S.T.P

**************************************************************************
 1    .IF A 342  ML SAMPLE OF GAS IS COLLECTED AT 753  MM HG AND
 376  DEGREES KELVIN, THEN SUBJECTDD TO 739  MM HG
AND 230  DEGREES KELVIN
WHAT WILL ITS FINAL VOLUME BE
?213
CORRECT------1 POINT
**************************************************************************
```

```
 2    .IF A 343  ML SAMPLE OF GAS IS COLLECTED AT 760  MM HG AND
 383  DEGREES KELVIN, THEN SUBJECTDD TO 746  MM HG
AND 233  DEGREES KELVIN
WHAT WILL ITS FINAL VOLUME BE
?212
CORRECT------1 POINT
**************************************************************************
 3    .IF A 348  ML SAMPLE OF GAS IS COLLECTED AT 761  MM HG AND
 385  DEGREES KELVIN, THEN SUBJECTDD TO 749  MM HG
AND 233  DEGREES KELVIN
WHAT WILL ITS FINAL VOLUME BE
?213
CORRECT------1 POINT
**************************************************************************
 4    .IF A 350  ML SAMPLE OF GAS IS COLLECTED AT 764  MM HG AND
 385  DEGREES KELVIN, THEN SUBJECTDD TO 757  MM HG
AND 236  DEGREES KELVIN
WHAT WILL ITS FINAL VOLUME BE
?219
CLOSE, YOU ARE WITHIN 3 MLS, TRY AGAIN.
?218
SORRY, YOU ARE WRONG AGAIN, THE CORRECT ANSWER IS 216  MLS.
**************************************************************************
 5    .IF A 350  ML SAMPLE OF GAS IS COLLECTED AT 768  MM HG AND
 393  DEGREES KELVIN, THEN SUBJECTDD TO 765  MM HG
AND 243  DEGREES KELVIN
WHAT WILL ITS FINAL VOLUME BE
?226
WRONG, THE CORRECT ANSWER IS 217  MLS
**************************************************************************
 6    .IF A 359  ML SAMPLE OF GAS IS COLLECTED AT 777  MM HG AND
 402  DEGREES KELVIN, THEN SUBJECTDD TO 774  MM HG
AND 244  DEGREES KELVIN
WHAT WILL ITS FINAL VOLUME BE
?218
CORRECT------1 POINT
**************************************************************************
 7    .IF A 362  ML SAMPLE OF GAS IS COLLECTED AT 778  MM HG AND
 404  DEGREES KELVIN, THEN SUBJECTDD TO 778  MM HG
AND 245  DEGREES KELVIN
WHAT WILL ITS FINAL VOLUME BE
?219
CORRECT------1 POINT
**************************************************************************
 8    .IF A 366  ML SAMPLE OF GAS IS COLLECTED AT 779  MM HG AND
 406  DEGREES KELVIN, THEN SUBJECTDD TO 787  MM HG
AND 252  DEGREES KELVIN
WHAT WILL ITS FINAL VOLUME BE
?224
CORRECT------1 POINT
**************************************************************************
 9    .IF A 373  ML SAMPLE OF GAS IS COLLECTED AT 779  MM HG AND
 407  DEGREES KELVIN, THEN SUBJECTDD TO 791  MM HG
AND 255  DEGREES KELVIN
WHAT WILL ITS FINAL VOLUME BE
?230
CORRECT------1 POINT
**************************************************************************
 10   .IF A 379  ML SAMPLE OF GAS IS COLLECTED AT 781  MM HG AND
 412  DEGREES KELVIN, THEN SUBJECTDD TO 796  MM HG
AND 264  DEGREES KELVIN
WHAT WILL ITS FINAL VOLUME BE
?238
CORRECT------1 POINT

**************************************************************************
                    8    POINTS OUT OF 10
**************************************************************************

                YOUR MARK IS 17   OUT OF 30.

              **********THE END**********

DONE
```

CONTRIBUTED PROGRAM **BASIC**

CHEM1
36878

TITLE: CAI IN CHEMISTRY

DESCRIPTION:

This package includes four programs, CHEM1, CHEM2, INPUT and TEACH. Also included are 3 exercise files, EX1, EX2 and EX3. CHEM1 is a general CAI program which conducts exercises requiring the user to respond with alphanumeric short answers. CHEM2 is similar to CHEM1 except that the response may contain different parts or terms separated by '+'. Each part of the user's response is checked separately. Only one multiple term answer is correct.

INSTRUCTIONS:

Both programs are very similar except for one significant difference. CHEM1 is designed to accept one short answer in response to a question. CHEM2 is designed to accept one answer, but this answer of multiple parts is the only one that is acceptable. For example, in the identification of elements and compounds (CHEM1), the compound HCl may be identified as hydrogen chloride or hydrochloric acid. Both are correct. On the other hand, in chemical reactions there may be many products. (CHEM2)

CH4 + 2O2 --- CO2 +2H2O

The second program (CHEM2) breaks the response into the various parts of the answer: CO2 and 2H2O. Then it compares each against the various parts of the correct answer.

None of the questions and answers are retained in the programs but are saved separately in an Exercise file. The user selects the exercise he wishes to work on when either program is run.

The Exercise File

An exercise may have levels of difficulty (or levels corresponding to different aspects of the same topic). If the exercise is multi-level, the computer will request the user to specify the level he wishes to work on. Afterwards, only questions from that level will be used in the exercise.

In some instances, it is advantageous to be able to interchange the questions and answers. For example, in the identification of elements and compounds, the user is able to specify whether he wants the symbol or the name of the substance to be given as the questions to which he will respond the reverse. This capability is referred to throughout as the 'order option'. If the exercise allows the order option, then the user is requested to specify the order.

CONTINUED ON NEXT PAGE.

SPECIAL CONSIDERATIONS:

When running the program do NOT interrupt the normal course of execution. If you must halt the program type 'STOP' in response to a question in the exercise. The program will then exit in the quickest way possible. The teacher's record is written in the last part of the program, so if you stop it before it reaches that portion of the program, there will be no record of your work.

ACKNOWLEDGEMENTS: J. Glenn Allan
University of Lethbridge
Alberta, Canada

INSTRUCTIONS: Continued.

Any exercise file may contain 128 records which is space for approximately 250 or 300 questions.

Initialization

The initialization routine consists of a series of questions which the computer asks the user. First, the user must give his name and the name of the exercise he wishes to work on. At the beginning of the exercise file, the levels and the order option are specified. If the file is multi-level, the computer requests the level. If the order option is available, it is also asked, Once this information is supplied the exercise is ready to begin.

Main Exercise

If the user fails to respond the correct answer, the computer prints the correct answer and types over the answer until it is illegible. Then the computer selects another question and continues the exercise.

Retest

When all the questions in the main exercise (that level) have been exhausted, the computer automatically begins the retest. The computer searches all the questions to find those that were missed and asks them again. Now the user only has one chance to get the question right.

Finalization

After the retest, the computer calculates the scores on both the main exercise and retest and prints them for the user. It then writes all pertinent information about the user and his performance on a record file for the instructor's use. The program then stops.

The Record File and the Teacher's Program

In the initialization, the user gives information which is stored. The information on the user is listed below:

Users Name
The Exercise
Level
Order (if any)
Date
Time (start and finish)
Elapsed Run Time
Number of Questions in Main Exercise and Retest
Scores on Main Exercise and Retest

There is a record file called REC1 on which this information is stored. This file must be opened by the user.

To start the program type 'RUN' and then wait for instructions. First will come the 'STUDENT INFORMATION'. When the computer types 'YOUR NAME : ?', type your name in the following way. DO NOT USE ANY COMMAS!

EXAMPLE:

If your name happens to be John D. Smith, type your last name first followed by your first and middle initials.

YOUR NAME : ? SMITHJD

The computer will then ask 'TOPIC : ?' to which you must respond the name of the exercise your wish to work on.

There may be an option available to you in respect to which order you want the questions presented. If it is a French vocabulary exercise, you may have to option of having the question be either the English or the French word to which you will respond the other. If such an option is available, the next thing that will appear is the question 'ORDER'. The options will be printed in brackets. You must then type one or the other option. It might appear like this:

ORDER [FRENCH OR ENGLISH] : ? FRENCH

Some exercises may be multi-level. That is, you have the choice of working on different levels of difficulty or, depending on the arrangement of the exercise, on different aspects of the same topic. If this option is available to you, the next line the computer will type will be 'LEVEL -- (1 to 4) --?'. This means that there are four (4) levels in the exercise. You must now select a level number by typing either 1,2,3 or 4. You should not use anything but a whole number. If the levels denote difficulty, the easiest level will be level 1 and the most difficult will be level 4.

INSTRUCTIONS: Continued.

EXAMPLE: LEVEL--(1 to 6)--? 6

With the above example, you have selected the most difficult level.

A list of legal commands which you may use will now be printed for you. These commands can be used at any time during the Main Exercise in response to a question. Here is the list of those commands

WRONG,END,STOP,LEVEL,SCORE,TIME,NUMBER,ORDER,RTIME,REPEAT,IDENT

Each command is explained below:

WRONG

For every question in the Main Exercise you have 3 tries at the correct answer. If a question appears to which you don't have the slightest idea what the answer is, just type 'WRONG'. The remainder of your tries will be skipped. The computer will score you incorrect on the question and immediately proceed to the next question. If there is a chance that you might get the answer don't use this command.

END

If you wish to end the main exercise before you have exhausted all the questions, type 'END'. This will tell the computer that you don't wish to continue in the main exercise routine but wish to start finishing up (RETEST).

The computer will then proceed to retest you on all the questions you missed in the Main Exercise. You have only one chance at each question. At the end of the retest, your score on the Main Exercise as well as your score on the retest will be given.

If you exhaust the questions without typing 'END', the computer will automatically go into the retest.

STOP

A time may arise when you must stop the program immediately during the Main Exercise or the Retest. In response to a question, type 'STOP' and the program will finish up as soon as possible. If you stop the program by some other means, the record of your work will not be written.

LEVEL

Perhaps you are working on a multi-level exercise. You find that the level is either too difficult or too easy. You may change the level during the Main Exercise by typing 'LEVEL' in response to a question. The computer will write your present score on your record and then ask you for your 'NEW LEVEL --?'. Type the number (integer, please) of the new level and the exercise will begin again. If you have incorrectly asked for a level which does not exist, the computer will tell you so and ask you again. If the exercise is not multi-level, the computer will tell you so and the exercise will resume where you left off.

SCORE

If you are curious about your score while you are working on the Main Exercise, type 'SCORE' in response to a question. The computer will give it to you. It will then resume with the next question.

TIME

By typing 'TIME', the computer will tell you the time at which you started the program and the present time. If you don't have a watch, this is one way to find out if you are late to your next class. The computer will then resume with the next question.

NUMBER

The number of questions in the exercise (all levels), the number of questions in the present level, and the number of questions that have been asked to date can be found by typing 'NUMBER' in response to a question. Like above, the computer will then restate the present question.

ORDER

If the order option is available (Remember the French-to-English example?), you may change it in the middle of the Main Exercise just as you can the level by typing 'ORDER'. Your present score will be recorded on your record and then the computer will request the new order. Then the Main Exercise will begin again. If the order option is not available, the computer will state that and resume the Main Exercise where you left off. If you mistype the new order or give an order not allowed, it will ask you to repeat it.

INSTRUCTIONS: Continued.

RTIME

The elapsed running time will be printed for you if you type 'RTIME' in response to a question. This is the amount of time the computer has spend in executing the program. The program takes over a second of run time to get started. The run time required to process your answers will be very small in comparison.

REPEAT

Sometimes the ribbons on these machines get worn. Perhaps you can't read part of the question for one reason or another. You don't have to make a stab in the dark. Type 'REPEAT' and the computer will repeat the question.

IDENT

The program command 'IDENT' can be used in place of a response. The following information will be given:

EXAMPLE:

```
NAME: SMITHJD
TOPIC: ELEMENTS
ORDER: SYMBOL
LEVEL: 3
# OF QUESTIONS ASKED: 12
SCORE: 83%
BEGAN AT 09:39:27
TIME IS 09:45:25
ELAPSED TIME (RUN):  1.568 (to nearest 1/64 or a second)
```

After the IDENT information is given, the program will repeat the present question.

RUN

```
CHEM-EX1,15,64
```

```
GET-INPUT
5 FILES EX1
RUN
INPUT

THIS PROGRAM WRITES THE FILES FOR USE WITH CHEM1 AND CHEM2
MAKE SURE A FILE HAS BEEN OPENED AND DECLARED IN STATEMENT
FIVE OF THIS PROGRAM.
IS THERE ORDER?YES
WHAT IS THE FIRST ITEM?SYMBOL
AND THE SECOND?NAME
HOW MANY LEVELS ARE THERE?4
HOW MANY QUESTIONS IN LEVEL 1     ?25
HOW MANY QUESTIONS IN LEVEL 2     ?25
HOW MANY QUESTIONS IN LEVEL 3     ?25
HOW MANY QUESTIONS IN LEVEL 4     ?26
INPUT TO LEVEL 1
FIRST ITEM
?AG
# ANSWERS?1
# 1     ?SILVER
FIRST ITEM
?AL
# ANSWERS?1
# 1     ?ALUMINUM
FIRST ITEM
?AR
# ANSWERS?1
# 1     ?ARGON
```

```
FIRST ITEM
?AU
# ANSWERS?1
# 1     ?GOLD
FIRST ITEM
?B
# ANSWERS?1
# 1     ?BORON
FIRST ITEM
?BR
# ANSWERS?1
# 1     ?BROMINE
FIRST ITEM
?C
# ANSWERS?1
# 1     ?CARBON
FIRST ITEM
?CA
# ANSWERS?1
# 1     ?CALCIUM
FIRST ITEM
?CL
# ANSWERS?1
# 1     ?CHLORINE
FIRST ITEM
?CU
# ANSWERS?1
# 1     ?COPPER
FIRST ITEM
?F
# ANSWERS?1
# 1     ?FLORINE
FIRST ITEM
?FE
# ANSWERS?1
# 1     ?IRON
FIRST ITEM
?H
# ANSWERS?1
# 1     ?HYDROGEN
FIRST ITEM
?HE
# ANSWERS?1
# 1     ?HELIUM
FIRST ITEM
?HG
# ANSWERS?1
# 1     ?MERCURY
FIRST ITEM
?I
# ANSWERS?1
# 1     ?IODINE
FIRST ITEM
?K
# ANSWERS?1
# 1     ?POTASSIUM
FIRST ITEM
?N
# ANSWERS?1
# 1     ?NITROGEN
FIRST ITEM
?NA
# ANSWERS?1
# 1     ?SODIUM
FIRST ITEM
?NI
# ANSWERS?1
# 1     ?NICKEL
```

```
CRE-REL,15,64
GET-CHEM1
RUN
CHEM1
```

```
GENERAL IDENTIFICATION PROGRAM
------------------------------

     IF YOU WANT INSTRUCTIONS TYPE 'STOP' AFTER THE QUESTION
     MARK AND CONSULT DOCUMENTATION.  OTHERWISE, INPUT 'GO'
     AFTER THE QUESTION MARK?GO


STUDENT INFORMATION
-------------------

YOUR NAME :?SMITHHD
CHOOSE TOPIC 2 OR 3.  WHICH DO YOU WANT?2
ORDER (SYMBOL OR NAME):?SYMBOL
LEVEL -- (1 TO  4    ) --?1
LIST OF COMMANDS:
WRONG--END--STOP--LEVEL--SCORE--TIME--NUMBER--ORDER--RTIME--REPEAT--
IDENT--


MAIN EXERCISE
-------------

QUEST. # 1     :U?CH--URANIUM
QUEST. # 2     :B?BORIUM
 ----- MISSPELLED.
     TRY AGAIN?BORON
QUEST. # 3     :F?FLURO-INE
 ----- MISSPELLED.
     TRY AGAIN?FLORINE
QUEST. # 4     :N?NITROGEN
QUEST. # 5     :CA?CADIUM
     TRY AGAIN?CADMIUM
 ----- MISSPELLED.
     TRY AGAIN?CALCIUM
QUEST. # 6     :I?IODINE
QUEST. # 7     :AG?SILVER
QUEST. # 8     :AU?GOLD
QUEST. # 9     :CL?CLORINE
     TRY AGAIN?CHLORINE
QUEST. # 10    :K?POTASSIUM
QUEST. # 11    :BR?BROMIDE
 ----- MISSPELLED.
     TRY AGAIN?BROMINE
QUEST. # 12    :SI?SILICON
QUEST. # 13    :AR?ARGON
QUEST. # 14    :HE?HELIUM
QUEST. # 15    :C?CARBON
QUEST. # 16    :FE?IRON
QUEST. # 17    :H?HYDROGEN
QUEST. # 18    :AL?ALUMINUM
QUEST. # 19    :HG?MERCURY
QUEST. # 20    :O?OXYGEN
QUEST. # 21    :NA?SODIUM
QUEST. # 22    :NI?NICKEL
QUEST. # 23    :ZN?ZINC
QUEST. # 24    :CU?COPPER
QUEST. # 25    :S?SULPHUR
 ----- MISSPELLED.
     TRY AGAIN?SULFUR
YOU MISSED NO QUESTIONS -- PERFECT SCORE


THE DRILL IS OVER

MAIN DRILL  25    CORRECT OUT OF  25    FOR SCORE OF 100  %

REDRILL:  0     CORRECT OUT OF 0     FOR SCORE OF 100  %

GOODBYE

DONE
```

```
CRE-CHEM,14,64
RUN
CHEM2

GENERAL IDENTIFICATION PROGRAM
------------------------------

     IF YOU WANT INSTRUCTIONS TYPE 'STOP' AFTER THE QUESTION
     MARK AND CONSULT DOCUMENTATION.  OTHERWISE, INPUT 'GO'
     AFTER THE QUESTION MARK?GO


STUDENT INFORMATION
-------------------

YOUR NAME :?JONES,HD
CHOOSE TOPIC 2 OR 3 OR 4.  WHICH DO YOU WANT?4
LEVEL -- (1 TO  4     ) --?1
LIST OF COMMANDS:
WRONG--END--STOP--LEVEL--SCORE--TIME--NUMBER--ORDER--RTIME--REPEAT--
IDENT--


MAIN EXERCISE
-------------

QUEST. # 1     :H2CO + O2?WRONG
CORRECT ANSWER --BBBBBBBBBBBBBBBBBBBBBBBBBB
QUEST. # 2     :CH4 + 2O2?REPEAT
QUEST. # 2     :CH4 + 2O2?LEVEL

NEW LEVEL --?4
LEVEL CHANGED -- NEW BALL GAME


MAIN EXERCISE
-------------

QUEST. # 1     :2NA(S) + 2H2O?SCORE

 0      OUT OF 0
OVERFLOW - WARNING ONLY  IN LINE 1870

OVERFLOW - WARNING ONLY  IN LINE 1870
 1.70141E+38   %

QUEST. # 1     :2NA(S) + 2H2O?TIME

BEGAN AT: 24   MIN. 11   HRS. 105  DAYS.
TIME NOW IS:  27   MIN. 11   HRS. 105  DAYS.

QUEST. # 1     :2NA(S) + 2H2O?NUMBER

TOTAL # OF QUESTIONS : 47
# OF QUESTIONS IN LEVEL  4     :  6
# OF QUESTIONS ASKED : 1

QUEST. # 1     :2NA(S) + 2H2O?ORDER
ORDER CAN'T BE CHANGED -- SORRY
QUEST. # 1     :2NA(S) + 2H2O?RTIME

ELAPSED RUN TIME : 3    MIN.
QUEST. # 1     :2NA(S) + 2H2O?IDENT

NAME : JONES,HD
TOPIC:  4
ORDER : NONE
LEVEL :  4
# OF QUESTIONS ASKED :  1
SCORE : 100
BEGAN AT : 24   MIN. 11   HRS. 105  DAYS.
TIME IS:  27   MIN. 11   HRS. 105  DAYS.
ELAPSED RUN TIME : 3    MIN.
```

```
QUEST. # 1     :2NA(S) + 2H2O?WRONG
CORRECT ANSWER --■■■■■■■■■■■■■■■■■■■■■■■■■■G)
QUEST. # 2     :ZN(S) + 2H+(AQ)?ZN+2(AQ)
     TRY AGAIN?H2(G)
     TRY AGAIN?ZN+2(AQ) + H2(G)
QUEST. # 3     :2NH3(G) + HEAT?N2(G) + 3H2(G)
QUEST. # 4     :N2(G) + O2(G) + HEAT?2NO
QUEST. # 5     :ZN(S) + 2H+(AQ) + 2CL-(AQ)?ZN+2(AQ) + H2(G) + 2CL-(AQ)
QUEST. # 6     :3C(S) + 2FE2O3(S) + HEAT?4FE(S) + 3CO2(G)

RETEST
------

FINISHING UP -- ONLY ONE TRY ON THE FOLLOWING QUESTIONS

QUEST. #  1     : 2NA(S) + 2H2O?2NA+(AQ) + 2O-OH-(AQ) + H2(G)
CORRECT


THE DRILL IS OVER

MAIN DRILL  5      CORRECT OUT OF  6      FOR SCORE OF 83   %

REDRILL:  1      CORRECT OUT OF 1      FOR SCORE OF 100  %

GOODBYE

DONE



GET-TEACH
RUN
TEACH

NAME:           JONES,HD
START TIME:      24    : 11    : 105
END TIME:        26    : 11    : 105
TOPIC:           4
ORDER:          NONE
LEVEL:           1
MAIN DRILL
# OF Q'S:       1
% SCORE          0
NAME:           JONES,HD
START TIME:      24    : 11    : 105
END TIME:        38    : 11    : 105
TOPIC:           4
ORDER:          NONE
LEVEL:           4
MAIN DRILL
# OF Q'S:       6
% SCORE          83
RETEST
# OF Q'S:       1
% SCORE          100



SCORING IS FINISHED.

DONE
```

CONTRIBUTED PROGRAM **BASIC**

CLIMAT
36760

TITLE: CLIMATE TEACHING PROGRAM

DESCRIPTION:

There are 10 programs in this package: CL1Z1, CL1Z2, CL2Z1, CL2Z2, CL3Z1, CL3Z2, CL4Z1, CL5Z1 and CL5z2. They form a series of conversational teaching programs on climate classification, adapted from Dartmouth College's Kiewit Computation Center programs CLIMAT-1 through CLIMAT-5. Programs use temperature and rainfall data from well-known locations in the world and ask the user to give the geographical locations of the stations. Koppen symbols are used extensively.

INSTRUCTIONS:

The programs are completely conversational. The user accesses each of the five main programs (i.e., CL1-1, CL2-1, etc.). Chaining is automatic to the second program of each of the five main programs.

Create file SCRA 10 records long.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES:
Suitable courses: Courses requiring knowledge of climate classification
Student background required: University level Geography

ACKNOWLEDGEMENTS: Harry Lilleniit
University of Lethbridge, Canada

RUN

```
CRE-SCRA,50
GET-CLIMI
RUN
CLIMI

HI, I AM CALLED MISS TELETYPE - WHAT WOULD YOU LIKE ME TO CALL
YOU?PETE
HELLO, PETE! WELCOME TO THE WORLD OF COMPUTER ASSISTED
INSTRUCTION. TOGETHER WE WILL LEARN THE LOGIC OF LOCATING A SET
OF CLIMATE DATA ON THE GLOBE AND ALSO LEARN TO IDENTIFY THE
APPROPIATE KOPPEN SYMBOLS.
IN THE FOLLOWING CLIMATE DATA MONTHLY AVERAGE TEMPERATURES
AND THE MONTHLY AVERAGE RAINFALL FOR A SPECIFIC STATION ARE
GIVEN IN FAHRENHEIT AND INCHES. I WILL ASK A NUMBER OF QUESTIONS
ABOUT THE DATA AND YOU WILL PLEASE ANSWER IN YOUR OWN WORDS.
IF YOU DON'T UNDERSTAND OR NEED HELP - JUST LET ME KNOW.
YOU ARE LIMITED TO A SINGLE LINE FOR EACH ANSWER!!!!

          TEMPERATURE THEN RAINFALL BY MONTHS

  J.,  F.,  M.,  A.,  M.,  J.,  J.,  A.,  S.,  O.,  N.,  D.

  17,  18,  28,  42,  55,  63,  69,  66,  59,  48,  34,  21
 2.6, 2.3, 2.6, 2.3, 3.2, 3.4, 3.5, 3.6, 3.1, 3.1, 2.7, 2.6


         YEARLY AVERAGE TEMP. 43.1 DEGREES F.
         YEARLY RAINFALL TOTAL 35.6 INCHES


STUDY VERY CAREFULLY THE TEMPERATURE RANGE - NOTE THE MONTHS
OF MAXIMUM AND OF MINIMUM READINGS. THIS IS A REAL PLACE.

IN WHICH HEMISPHERE IS THE STATION LOCATED?NORTHERN

GOOD - YOU KNEW BECAUSE JAN. IS COLD WHILE JULY IS QUITE WARM
NOW TELL ME ABOUT THE RELATIVE LATITUDE WITHIN THE N. HEMISPHERE
?60

WHAT I REALLY WANT TO KNOW IS THIS. IS THE STATION IN THE
    POLAR,   MID-LATITUDE  OR EQUATORIAL REGION
?MID-LAT

VERY GOOD, PETE. YOU KNEW BECAUSE OF THE QUITE LARGE TEMP.
RANGE AND WARM SUMMERS - MARKED SEASONALITY.  WITHIN THIS
MID-LATITUDE REGION IS THE STATION CLOSER TO THE POLEWARD OR TO
THE EQUATORIAL INFLUENCE?POLE


PETE, YOU ARE DOING WELL. YOU KNEW BECAUSE WINTERS ARE COLD AND
SUMMERS NOT REALLY HOT.  BY THE WAY, ARE THE TERMS 'SUMMER'
AND 'WINTER' CLEAR IN YOUR MIND? PLEASE WRITE A DEFINITION OF
THE TERM 'SUMMER'
?JUNE,JULY,AUG

A WORKING DEFINITION FOR OUR USE MIGHT BE; 'THAT HALF OF THE
YEAR WHEN THE NOONDAY RAYS OF THE SUN MOST NEARLY APPROACH
THE VERTICAL - OR, MORE ROUGHLY, THE WARMEST HALF OF THE YEAR.

IN CHICAGO, ROME AND SHANGHAI THE SUMMER HALF OF THE YEAR
EXTENDS FROM APRIL THROUGH SEPTEMBER.

IN BUENOS AIRES, JOHANNESBURG AND MELBOURNE SUMMER HALF OF
THE YEAR EXTENDS?OCTOBER THRU MARCH

PERFECT, PETE. I GUESS YOU REALLY DO UNDERSTAND THE TERMS
NOW BACK TO THE ORIGINAL PROBLEM; OUR STATION IS:
     NORTHERN HEMISPHERE
     UPPER MID-LATITUDES

FROM YOUR KNOWLEDGE OF THE WORLD MAP YOU KNOW THAT A LARGE
CONTINENT IS INVOLVED.
     PLEASE COMMENT ON THE RELATIVE LOCATION ON THIS CONTINENT
     OF OUR STATION
?COAST
```

```
 TOUCHE - MARINE INFLUENCE IS INDICATED BY THE RAINFALL PATTERN
HOWEVER, YOU FORGOT TO TELL ME WHICH COAST
?WEST

AT A WEST COAST LOCATION IN THE MID-LATITUDES THE RAINFALL
ALWAYS SHOWS A MARKED CONCENTRATION IN THE WINTER MONTHS
IS THIS THE CASE AT OUR STATION?  TRY AGAIN
?EAST

EXCELLENT, PETE. I ASSUME YOU CHOSE AN EAST COAST LOCATION
BECAUSE OF THE FAIRLY HIGH RAINFALL AND ITS EVEN DISTRIBUTION
FROM SEASON TO SEASON.

AS YOU STUDY THE MAP YOU WILL REALIZE THAT YOU HAVE LIMITED
THE POSSIBLE LOCATION OF OUR STATION TO NORTHEASTERN NORTH
AMERICA OR NORTHEASTERN ASIA.  WHICH OF THESE IS CORRECT
?NORTH AMERICA

I ASSUME THAT YOU CHOSE NORTH AMERICA BECAUSE OF THE LACK OF
MONSOON RHYTHM IN THE RAINFALL PATTERN. IF I'M RIGHT,PETE
YOU ARE DOING BRILLIANTLY.

NOW LET'S TRY GETTING THE CORRECT KOPPEN CLASSIFICATION
FOR THE STATION THE DATA FOR WHICH APPEARED ABOVE
IS THE STATION HUMID OR ARID
?HUMIS-D

HUMID CLIMATES (IN THE KOPPEN SYSTEM) ARE:
   'A' (ALL MONTHS ABOVE 64.4 F.)
   'C' (ALL MONTHS WARMER THAN 26.6 F.)
   'D' (AT LEAST ONE MONTH BELOW 26.6 F.)
   'E' (ALL MONTHS 50 F. OR COLDER)

WHCIH IS THE CORRECT FIRST LETTER IN THIS CASE?D

GOOD - CLEARLY OUR STATION HAS A SEVERE WINTER WITH TEMPS.
WELL BELOW 26.6 DEGREES BUT WITH SUMMER TEMPS. ABOVE 50 F.

SECOND LETTER CHOICES REFER TO THE RAINFALL PATTERN:
       'S' (SUMMER DROUGHT)
       'W' (WINTER DROUGHT)
       'F' (HUMID ALL YEAR WITH NO MARKED DROUGHT)

WHICH OF THESE CHOICES BEST FITS OUR STATION?F

FINE, PETE - YOU CHOSE 'F' BECAUSE OF THE VERY EVEN
DISTRIBUTION OF THE RAINFALL AND THE LACK OF A MARKED DRY SEASON

THIRD LETTER CHOICES REFER TO TEMPERATURE EXTREMES:
THIRD LETTER POSSIBILITIES FOR 'D' CLIMATES ARE:
      'A' (AT LEAST ONE MONTH WARMER THAN 71.6 F.)
      'B' (>3 MONTHS WARMER THAN 50 F. NONE ABOVE 71.6 F.)
      'C' (<4 MONTHS WARMER THAN 50 F.)
      'D' (AT LEAST I MONTH COLDER THAN -36.4 F.)

WHICH OF THESE IS MOST APPROPRIATE?B

EXCELLENT,JULY, THE WARMEST MONTH,IS COOLER THAN 71.6 F. AND
THERE ARE MORE THAN THREE MONTHS WARMER THAN 50 F.

NOW, PETE , YOU KNOW THE CLIMATE IS  'DFB'
   YOU ALSO KNOW THAT THE LOCATION IS:
        NORTHERN HEMISPHERE
        UPPER MID-LATITUDES
        NEAR THE EAST COAST     AND IN
        NORTH AMERICA

NOW, ALL THAT IS LEFT IS TO NAME THE TOWN(OR CITY) AND THE
STATE (OR PROVINCE)!
?NOVA SCOTIA, CANADA

WELL, MY MAP SAYS THAT YOUR GUESS IS NOT BAD - BUT JULY
TEMPS. AT NOVA SCOTIA, CANADA WOULD BE A BIT COOLER
THAN AT OUR STATION.  MOVE SOUTH.
?BOSTON, MASS
```

```
BOSTON, MASS IS SOUTH OF OUR STATION BY ABOUT 150 MILES.
FIND A PLACE FURTHER TO THE NORTH.
?HANOVER, NEW HAMPSHIRE

PERFECT - THAT WASN'T HARD WAS IT!

SO LONG FOR NOW,PETE, PLEASE GIVE ME A CALL AGAIN - SOON

DONE
```

```
GET-CL5Z1
RUN
CL5Z1

HELLO AND WELCOME TO THE 5TH LESSON ON CLIMATOLOGY

YOU KNOW WHO I AM BUT I DON'T KNOW WHO YOU ARE. WHAT MAY
I CALL YOU?PETE

HELLO, PETE. I WILL GIVE YOU SOME INFORMATION AND THEN ASK
A QUESTION OR TWO. YOU RESPOND BRIEFLY AND IN YOUR OWN WORDS.

IN THE FOLLOWING CLIMATE DATA MONTHLY AVERAGE TEMPERATURES
AND THE MONTHLY AVERAGE RAINFALL FOR A SPECIFIC STATION ARE
GIVEN IN FAHRENHEIT AND INCHES.  YOU WILL ANSWER A NUMBER OF
QUESTIONS ABOUT THIS STATION AND OTHER PLACES WITH SIMILAR
RAINFALL AND TEMPERATURE PATTERNS.  IF YOU ARE STUCK ON THE
ANSWER TO A QUESTION, JUST TELL ME OR ASK FOR HELP.


  J.,  F.,  M.,  A.,  M.,  J.,  J.,  A.,  S.,  O.,  N.,  D.

  74,  74,  70,  64,  58,  54,  52,  54,  57,  61,  67,  71
 0.7, 0.8, 1.0, 1.7, 2.7, 3.1, 2.6, 2.4, 2.1, 1.7, 1.1, 0.9


          YEARLY AVERAGE TEMP.  60.5 DEGREES F.
          YEARLY RAINFALL TOTAL 20.8 INCHES

STUDY VERY CAREFULLY THE TEMPERATURE RANGE - NOTE THE MONTH
OF MINIMUM TEMP. AND THE PERIOD OF MAXIMUM TEMP.  NOTE
ALSO THE SEASONAL DISTRIBUTION OF RAINFALL.  THIS IS A REAL
PLACE, AT AN ELEVATION OF LESS THAN 500 FEET.

DO YOU JUDGE THIS STATION TO BE NORTH OR SOUTH OF THE EQUATOR
?SOUTH

RIGHT - BUT THAT WASN'T HARD - NOW GIVE ME THE APPROXIMATE
LATITUDE OF THE STATION.   (PLEASE USE DIGITS ONLY)
?40
YOU ARE IN THE BALL PARK - THE STATION IS INDEED BETWEEN 30
AND 40 SOUTH LAT.  IN THIS CASE IT IS AT ALMOST EXACTLY
35 DEGREES.  PETE, YOU ARE DOING WELL SO FAR.

WHICH OF THE FOLLOWING AMERICAN CITIES IS THE BEST ANALOGUE
TO THE STATION GIVEN ABOVE?
     ATLANTA, EL PASO, OR SANTA BARBARA
?SANTA BARBARA

EXCELLENT, PETE, THIS IS CLEARLY A WEST COAST LOCATION.

NOW, PETE, IF YOU WERE TO TAKE A SWIM IN THE OCEAN AT OUR
STATION YOU WOULD DISCOVER THE WATER TEMPERATURE TO BE
RELATIVELY            (FILL IN AN APPROPIATE WORD)
?WARM
```

```
ONE OF THE CHARACTERISTICS OF THIS CLIMATE TYPE IS THAT THE
ADJACENT OCEAN CURRENT IS COOL. THIS HELPS TO ACCOUNT FOR
THE LOW SUMMER RAINFALL.


NOW, PETE, DURING THE WINTER SEASON (MAY, JUNE, JULY, AUG.)
THE PREVAILING WIND AT OUR STATION IS FROM WHICH DIRECTION
?WEST

YES, FROM WEST, NORTHWEST OR SOUTHWEST.  THIS IS THE QUITE
WELL DEFINED BELT OF THE WESTERLIES.

WITHIN THE WESTERLIES LOCAL LOW PRESSURE CENTERS MIGRATE FROM
WEST TO EAST AND CAUSE PRECIPITATION.  THESE ARE KNOWN AS
?DONT KNOW

A REGION OF LOW ATMOSPHERIC PRESSURE SOMETIMES CALLED A
DEPRESSION IS MORE OFTEN KNOWN AS A (             )?
?HELP

A REGION OF LOW ATMOSPHERIC PRESSURE SOMETIMES CALLED A
DEPRESSION IS MORE OFTEN KNOWN AS A (             )?
?FRONT

IT IS EASY TO SEE THAT YOU, PETE KNOW YOUR CONTROLS

CYCLONIC STORMS ARE IMPORTANT DURING THE WINTER, BUT,
BY CONTRAST, DURING THE SUMMER THE WIND IS LIGHT AND VARIABLE
WITH A COMPONENT PARALLEL TO THE SHORE. THE PATHS OF CYCLONIC
STORMS ARE THEN WELL POLEWARD OF THIS STATION.

NOW PETE , PLEASE TELL ME THE KOPPEN SYMBOLS FOR THIS
STATION    (TYPE 'HELP' IF YOU NEED IT)
?HELP

HINTS - HUMID CLIMATE, QUITE WARM, MARKED SUMMER DROUGHT
TRY THE FIRST LETTER AT LEAST.
?C

'C' IS THE CORRECT FIRST LETTER.
   SECOND LETTER: 'S'(SUMMER DRY), 'W'(WINTER DRY), 'F'(WET)

   THIRD LETTER CHOICES ARE:
      'A' (AT LEAST ONE MONTH ABOVE 71.6 F.)
      'B' (> 3 MONTHS ABOVE 50 F., NONE ABOVE 71.6)
      'C' (< 4 MONTHS ABOVE 50)
    OUR STATION IS 'CSA' - MEDITERRANEAN.


BY FAR THE LARGEST AND MOST SIGNIFICANT AREA OF THIS CLIMATE
IS IN EUROPE WHERE IT EXTENDS FROM LISBON TO BEIRUT AND FROM
CASABLANCA TO MARSEILLE.

PETE, I WOULD LIKE YOU TO DESCRIBE THE NATURAL VEGETATION OF
THE MEDITERRANEAN AREA IN YOUR OWN WORDS.  (YOU MAY USE UP
TO A FULL LINE)
?PALM TREES,DATES,FIGS,BROAD LEAFED TROPICALS

I THINK THAT YOU HAVE NAMED SOME COMMON PLANTS. I WANT A
MORE GENERAL DESCRIPTION OF THE VEGETATION. TRY AGAIN.
?LOW VEGETATIONS-, SUCCULENTS THAT CAN WITHSTAND DROUGHT

YOU HAVE THE RIGHT IDEA. NATURAL VEGETATION IS DROUGHT
RESISTANT; A MIXTURE OF SHORT, WIDELY SPACED TREES, MANY
SHRUBS AND SOME GRASS. OFTEN CALLED CHAPARRAL.

NOW, WITHOUT NAMING CROPS, PLEASE CHARACTERIZE MEDITERRANEAN
AGRICULTURE.  (LIMIT OF 1 LINE)
?AREA IS HILLY, REQUIRES TERRACING, SHORT SEASON


I AM SORRY BUT I DON'T UNDERSTAND YOUR ANSWER. HAVE YOU
MISSPELLED AN IMPT. WORD? PLEAS CHECK AND REPHRASE YOUR
ANSWER.
?WOULD NEED IRRIGATION IN SUMMER
```

NOT BAD - INTENSIVE FARMING WITH WINTER GRAINS,ORCHARDS,
AND VEGETABLES; OFTEN IN TWO STORY COMBINATION, AND WITH
SOME IRRIGATION IS COMMON.

WHAT SPECIFIC CROPS WOULD YOU EXPECT TO FIND IN SUCH AN AREA
?FIGS, DT-ATES, GRAPES

GRAPES, OLIVES, FIGS, WINTER WHEAT, BARLEY, CITRUS,NUTS,
VEGETABLES AND OAK CORK ARE COMMON.PETE YOU ARE RIGHT.

WHAT ARE SOME IMPORTANT CHARACTERISTICS OF ANIMAL HUSBANDRY
IN THIS CLIMATIC REGION
?SMALL FARMS FOR ANIMALS, NOT MUCH GRAZING

I AM SORRY BUT I DON'T UNDERSTAND YOUR ANSWER. HAVE YOU
MISSPELLED AN IMPT. WORD? PLEAS CHECK AND REPHRASE YOUR
ANSWER.
?A FEW GOATS AND SHEEP

GOOD TRY - MANY SHEEP AND GOATS SHARE THE DRY GRASSES OF
OVERGRAZED SLOPES WITH A FEW CATTLE AND DONKEYS.

THE ORIGINAL DATA WAS FOR ADELAIDE, AUSTRALIA.
THE RAINFALL AND TEMPERATURE PATTERNS AT THAT LOCATION ARE
TYPICAL OF ANY OF THE FIVE AREAS OF 'MEDITERRANEAN' CLIMATE
SCATTERED THROUGHOUT THE WORLD.

I HAD FUN - HOPE YOU DID TOO. GOOD BYE,PETE.

DONE

TITLE:

CLOUDS: Cloud Formation

CLOUDS
36325

DESCRIPTION:

This program tests student ability to solve problems related to the formation of cumuliform clouds (i.e. L.C.L., temperature at various altitudes). In Phase I of the program students enter the variables and unknowns of previously assigned problems. The computer checks the students' answers and supplies the correct answers if an error is detected.

When Phase I is completed the computer automatically presents a group of new problems for the student to solve and check at the machine.

OBJECTIVES:

The program attempts to reinforce and apply the following concepts:

A. There is a specific rate at which temperature drops in a rising parcel of unsaturated air.

B. Once air becomes saturated and condensation begins, the lapse rate decreases due to the release of latent heat of vaporization.

C. The base level of a cloud (LCL), and temperatures within it can be calculated from ground level data.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - Students should be familiar with the terms and values of the dry and wet adiabatic lapse rates, normal lapse rate, and the formula for calculating the Lifting-Condensation Level.

B. Materials - Printed sets of problems with the following variables and unknowns:
   1. Air temperature on the ground.
   2. Dew point on the ground.
   3. Temperature at the base of the cloud.
   4. The elevation, in feet, of the base of the cloud (LCL).

Continued on following page.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

DISCUSSION:

This program is designed for average students. Individuals should be permitted to go to the computer to check any problem or groups of problems whenever the machine is free. The teacher in the lesson acts solely as a resource person to help those students unable to arrive at correct responses because of conceptual errors - not mechanical errors.

To speed the lesson, Phase II of the program may be omitted entirely, by procedure 1, or from early runs by procedure 2.

Procedure 1

Erase lines 1560 - 1810, 1760 - 1800, and change line 1520 to read:
If P > 1 then 2060.

Procedure 2

Change line 1520 to read:
If P > 1 then 2060.

When you are ready to use Phase II merely retype line 1520 as originally listed.

```
RUN

RUN
CLOUDS

                CLOUD NINE
                ***** ****

   STRONG CONVECTION CURRENTS ARE CAUSING ADIABATIC
COOLING OF AIR WHERE YOU ARE AND ARE RESPONSIBLE FOR THE
FORMATION OF A CLOUD.  BOTH THE DRY AND THE MOIST ADIABATIC
(AS WELL AS THE NORMAL LAPSE RATES) ARE CONSIDERED IN THIS
PROGRAM.


                LEGEND
                ******
1=THE TEMPERATURE ON THE GROUND
2=THE DEW POINT TEMPERATURE ON THE GROUND
3=THE TEMPERATURE AT THE BASE OF THE CLOUD
4=THE ELEVATION, IN FEET, OF THE CLOUD BASE


CHOOSE ANY TWO OF THE ABOVE VARIABLES AND SELECT VALUES FOR
THEM.  TYPE THEM IN AS:
VARIABLE CODE ,VALUE, VARIABLE CODE ,VALUE...(E.G. 1,50,2,30)

?1,50,2,41

OKAY, TYPE IN YOUR CALCULATED VALUE FOR
THE TEMPERATURE AT THE BASE OF THE CLOUD
FOLLOWED BY A COMMA, AND THEN TYPE IN YOUR VALUE FOR
THE ELEVATION, IN FEET, OF THE CLOUD BASE
?30-9,2000

VERY GOOD.  VERY, VERY GOOD.

DO YOU HAVE ANY OTHER PROBLEMS YOU WOULD LIKE TO TRY?
(1=YES, 0=NO) : ?1

USING THE SAME LEGEND AS BEFORE...
CHOOSE ANY TWO OF THE ABOVE VARIABLES AND SELECT VALUES FOR
THEM.  TYPE THEM IN AS:
VARIABLE CODE ,VALUE, VARIABLE CODE ,VALUE...(E.G. 1,50,2,30)

?1,60,3,25

OKAY, TYPE IN YOUR CALCULATED VALUE FOR
THE DEW POINT TEMPERATURE ON THE GROUND
FOLLOWED BY A COMMA, AND THEN TYPE IN YOUR VALUE FOR
THE ELEVATION, IN FEET, OF THE CLOUD BASE
?30,4000
```

```
IT LOOKS LIKE WE GOOFED SOME PLACE.
LET'S SEE WHAT THE CORRECT VALUES ARE.

 60    DEGREES - THE TEMPERATURE ON THE GROUND
 31.3636     DEGREES - THE DEW POINT TEMPERATURE ON THE GROUND
 25    DEGREES - THE TEMPERATURE AT THE BASE OF THE CLOUD
 6363.64     FEET - THE ELEVATION, IN FEET, OF THE CLOUD BASE

DO YOU HAVE ANY OTHER PROBLEMS YOU WOULD LIKE TO TRY?
(1=YES, 0=NO) : ?0

WELL, BEFORE YOU LEAVE, I HAVE A FEW I'D LIKE YOU TO TRY...
BASED ON YOUR VALUES, THE HEIGHT OF THE CLOUD
(MEASURED FROM THE CLOUD BASE) IS  25454.5      FT.  CAN YOU TELL ME:

WHAT IS THE TEMPERATURE AT EACH OF THESE ALTITUDES:
                1      4455     FT
                2      44545.       FT
                3      19091    FT

THE TEMPERATURE AT  4455      FT. IS -?32.5

SORRY.  YOU WERE DOING GREAT THERE FOR A WHILE.
WELL, BACK TO THE BOOKS.  THE VALUES YOU SHOULD HAVE ARE:

 1     THE TEMPERATURE AT 4455     FEET IS  35.5        DEGREES
 2     THE TEMPERATURE AT 44545.       FEET IS -95.9091     DEGREES
 3     THE TEMPERATURE AT 19091    FEET IS -13.1818     DEGREES

DONE
```

TITLE:

TEMPERATURE SCALE CONVERSION

CONVRT
36685

DESCRIPTION:

This program converts a given temperature in one of the four temperature scales (Centigrade, Fahrenheit, Kelvin, and Rankine) to the equivalent in the others.

INSTRUCTIONS:

Instructions are given in the program. The user enters the numeric value of the temperature followed by a single letter indicating which scale it is in. The program returns the value in all four temperature scales.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Introductory Physics and Astronomy

Student Background Required: None

This program is not extremely complicated. For students in any mathematically oriented physics class it is quite useless. However, for students in a descriptive physics or astronomy who would have a bit of trouble in doing the conversion manually, this program very quickly allows them to get a comparison between the familiar temperature scale of Fahrenheit (at least in the United States) and the temperature scale used in describing the physical world they are studying, i.e., astronomy-Kelvin, low temperature physics-Kelvin, and ordinary temperatures-Centigrade. The input to the program is into a string variable. This allows the input to be quite user adapted. The program has also been used as an example to a computer programing class on the value of using string inputs for numeric quantities.

ACKNOWLEDGEMENTS:

Lawrence E. Turner
Pacific Union College

```
RUN

TEMPERATURE CONVERSION

ENTER TEMPERATURE AND SCALE AS:  37.56 C
USE 'F', 'C', 'K', OR 'R' FOR THE SCALE.

ENTER TEMP ?398 C
T =            F  748.4       C  398         K  671.15      R  1238.07

ENTER TEMP ?0 K
T =            F -459.67      C -273.15      K  0           R  0

ENTER TEMP ?5800 K
T =            F  9980.33     C  5526.85     K  5800        R  10440

ENTER TEMP ?98.6F
T =            F  98.6        C  37          K  310.15      R  558.27

ENTER TEMP ?
DONE
```

DECAY1
36306

TITLE: DECAY1: Radioactive Decay Game

DESCRIPTION:

Radioactive decay is treated pseudo-quantitatively, by permitting the student to determine the approximate number of radioactive particles remaining after various times.

OBJECTIVES:

To induce a "feel" for exponential decay, by repeated exercises.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - Awareness of terms: Half-life, exponential, and radioactivity

B. Materials - none

DISCUSSION:

The concept of radioactive decay is presented in a game format, allowing the student to challenge his own ability in determining (with 5, 10, or 20% error), the number of radioactive "chips" remaining after various times. The number of chips successively decreases with each trial, increasing the level of difficulty as the program runs. In each case, the exact number remaining is given, following the students' entered value.

Individuals or small groups find this program exciting. They enjoy the game approach, at least the first time through it, and seem to be motivated by the opportunity to "break the bank."

This program can be used as an integral part of a class lesson to introduce the concept, or to motivate group discussion and participation concerning the phenomenon.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

```
RUN
RUN
DECAY1

              ---THE NEW CLEA CASINO---

     MR. A. TOM MICK, GENERAL MANAGER OF THE NEW CLEA CASINO,
HAS, AT TIME  T=0,  DISCOVERED  100,000 RADIOACTIVE PLAYING
CHIPS AT HIS TABLE. THEIR HALF-LIFE IS 10 MINUTES. EACH CHIP
TRANSMUTES SPONTANEOUSLY AND COMPLETELY IN A RANDOM FASHION.

     AT VARIOUS TIMES T, AFTER T=0, YOU MUST DETERMINE WITHIN
A CERTAIN PERCENTAGE, HOW MANY CHIPS ARE LEFT.

     TO FURTHER THE INTEREST OF THE GAME, YOU WILL START WITH
$1,000 AND THE HOUSE WITH AN UNSPECIFIED AMOUNT.  HALF THE
MONEY YOU HAVE WILL RIDE ON EACH GUESS YOU TAKE.  LET'S SEE
IF YOU CAN BREAK THE HOUSE BEFORE THE CHIPS RUN OUT.

THE HOUSE OFFERS THE FOLLOWING ODDS:
     2) 2 TO 1 ODDS FOR GUESSING WITHIN 20 PERCENT
     4) 4 TO 1 ODDS FOR GUESSING WITHIN 10 PERCENT
     8) 8 TO 1 ODDS FOR GUESSING WITHIN  5 PERCENT.

ENTER THE NUMBER 2, 4, OR 8 FOR THE ODDS YOU WANT AFTER THE
QUESTION MARK IN THE COLUMN LABELLED ODDS.

YOUR $          HOUSE $         TIME (MIN)      ODDS

 1000            1.00000E+06     4.9             ?8
HOW MANY CHIPS LEFT ?71200
ACTUAL NUMBER LEFT IS  71207.
YOU WON. TRY AGAIN.

 5000            996000.         16.3            ?8
HOW MANY CHIPS LEFT ?342500
ACTUAL NUMBER LEFT IS  32316
TOO BAD, YOU LOST. TRY AGAIN.

 2500            998500.         25.4            ?4
HOW MANY CHIPS LEFT ?18612
ACTUAL NUMBER LEFT IS  17200
YOU WON. TRY AGAIN.

 7500            993500.         32.4            ?3
SORRY PAL, WE DONT OFFER THOSE ODDS.
 7500            993500.         32.4            ?4
HOW MANY CHIPS LEFT ?11180
ACTUAL NUMBER LEFT IS  10589
YOU WON. TRY AGAIN.

 22500           978500.         42.1            ?4
HOW MANY CHIPS LEFT ?6890
ACTUAL NUMBER LEFT IS  5406
TOO BAD, YOU LOST. TRY AGAIN.

 11250           989750.         51.2            ?4
HOW MANY CHIPS LEFT ?2803
ACTUAL NUMBER LEFT IS  2877
YOU WON. TRY AGAIN.

 33750.          967250.         66.5            ?4
HOW MANY CHIPS LEFT ?720
ACTUAL NUMBER LEFT IS  996
TOO BAD, YOU LOST. TRY AGAIN.

 16875           984125.         75.6            ?8
HOW MANY CHIPS LEFT ?500
ACTUAL NUMBER LEFT IS  530
TOO BAD, YOU LOST. TRY AGAIN.

 8437            992563.         87              ?4
HOW MANY CHIPS LEFT ?215
ACTUAL NUMBER LEFT IS  240
TOO BAD, YOU LOST. TRY AGAIN.
```

```
 4218            996782.         90.7          ?2
HOW MANY CHIPS LEFT ?200
ACTUAL NUMBER LEFT IS  186
YOU WON. TRY AGAIN.

 8436            992564.         101.6         ?4
HOW MANY CHIPS LEFT ?95
ACTUAL NUMBER LEFT IS  87
YOU WON. TRY AGAIN.

 25308           975692.         110.9         ?4
HOW MANY CHIPS LEFT ?45
ACTUAL NUMBER LEFT IS  45
YOU WON. TRY AGAIN.

 75924.          925076.         126.4         ?2
HOW MANY CHIPS LEFT ?13
ACTUAL NUMBER LEFT IS  15
YOU WON. TRY AGAIN.

 151848.         849152.         137.4         ?2
HOW MANY CHIPS LEFT ?7
ACTUAL NUMBER LEFT IS  7
YOU CAN BREAK THE HOUSE IF YOU TRY A LONG SHOT.

 303696.         697304.         148.3         ?2
HOW MANY CHIPS LEFT ?3
ACTUAL NUMBER LEFT IS  3
YOU CAN BREAK THE HOUSE IF YOU TRY A LONG SHOT.

 607392.         393608.         159.2         ?2
HOW MANY CHIPS LEFT ?1
ACTUAL NUMBER LEFT IS  1
YOU BROKE THE HOUSE. YOU NEEDED ONLY  16   GUESSES.
CONGRATULATIONS.
YOU MUST KNOW A LOT ABOUT RADIOACTIVITY AND THINGS.
THANKS FOR PLAYING..

------------------------------------------------------------

                                        CHECK NO. 17

                                      DATE: ----------19--

 PAY TO THE ORDER OF--------CASH------$ 1.00100E+06

 THE NEW CLEA CASINO                    A. TOM MICK
                                         GENERAL MANAGER

------------------------------------------------------------

DONT SPEND IT ALL IN ONE PLACE.

DONE
```

DECAY2
36307

TITLE: DECAY2: Nuclear Decay

DESCRIPTION:

This program will do the following:

A. Calculate half-life from 2 readings on a geiger counter, and the time between them.

B. Calculate mass of a radioactive sample remaining after some given amount of time.

C. Prints out a table showing mass or number of particles of a radioactive sample remaining vs. some range of time.

OBJECTIVES:

A. To provide tables and graphs for a better understanding of the exponential decay of a radioactive substance.

B. To provide a calculator for determining the amount of mass of a radioactive sample remaining after some given amount of time.

C. To provide a calculator for half-life experiments.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - The student should have a general introduction to half-life before the use of the program.

B. Materials - none

DISCUSSION:

It is difficult to teach about the exponential (logarithmic) manner by which radioactive elements decay without meaningful illustrations and simulations.

Continued on following page.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

DISCUSSION continued

With this program, a number of interesting possibilities are available. For example, if the initial mass is 100 g and the time is equal to 10 half-lives with an increment equal to the half-life, the student will see the mass decrease to 0.1 g during that time. More important, the example may be generalized to show that for any radioactive sample:

after 1 half-life 50% of the substance remains
after 2 half-life 25% of the substance remains
after 3 half-life 12.5% of the substance remains
after 10 half-life 0.1% of the substance remains

You may also illustrate nuclear decay by using particles instead of mass. Use Avogadro's number of particles with students who feel comfortable with scientific notation. For the others, you may use a number up to 1,000,000 without having exponential numbers print out in the table.

The fact that the teletype unit takes about 8 seconds to type out a line provides you with cute little gimmicks. Set up a run with 8 seconds (or any multiple of 8) and the print-out of the table will keep time with the decay of the sample substance.

Please note that the half-life calculations are not accurate for a small number of particles, thus it is misleading to make runs go to zero mass or zero particles.

```
RUN

RUN
DECAY2

DO YOU WANT INSTRUCTIONS (1=YES, 0=NO) : ?1
  THIS PROGRAM WILL DO THE FOLLOWING:
       CHOICE 1 - CALCULATES HALF-LIFE FROM TWO READINGS
                  ON A GEIGER COUNTER.
       CHOICE 2 - CALCULATES HOW MUCH OF A RADIOACTIVE SAMPLE
                  WILL REMAIN AFTER SOME GIVEN AMOUNT OF TIME
       CHOICE 3 - PRINTS OUT A TABLE SHOWING MASS OF SAMPLE
                   VS. TIME OR NO. OF PARTICLES VS. TIME.
                   (GRAPH OPTIONAL) NOTE: FOR THE TABLE YOU
                   MUST INPUT TOTAL TIME AND TIME INCREMENT.
                    EXAMPLE: IF TOTAL TIME=100 AND TIME
                   INCREMENT=10, THEN TIME IN THE TABLE WILL
                   BE 10,20,30,.....,100.
        CHOICE 4 - END OF PROGRAM

                   NOTE: IN ANY ONE PROBLEM,TIME MUST
                   ALWAYS BE INPUTED IN THE SAME UNITS
                   OF MEASURE (IE: SECS.,MINS.,ETC.)

**********

WHAT IS YOUR CHOICE?1

 WHAT IS THE INITIAL READING ON THE GEIGER COUNTER,
 THE SECOND READING, AND THE TIME BETWEEN READINGS.
?1500,3000,36

INITIAL READING= 1500     SECOND READING 3000     TIME= 36
HALF-LIFE= 35.9976

**********

WHAT IS YOUR CHOICE?2

WHAT IS THE HALF-LIFE, INITIAL MASS OF SAMPLE, AND
TOTAL TIME OF DECAY?18,56,76

HALF-LIFE= 18   INITIAL MASS= 56   TOTAL TIME= 76
MASS OF SAMPLE REMAINING= 3.00095

**********

WHAT IS YOUR CHOICE?3

DO YOU WANT TO WORK WITH PARTICLES OR MASS? (ANSWER 1 FOR
 PARTICLES OR 2 FOR MASS) ?1
```

```
 WHAT IS THE HALF-LIFE, INITIAL NUMBER OF PARTICLES IN THE
 SAMPLE, TOTAL ELAPSED TIME FOR DECAY, AND THE
 INCREMENT OF ELAPSED TIME?10,6.02E23,100,10

HALF-LIFE= 10   INITIAL NO. OF PARTICLES= 6.02000E+23
TOTAL TIME= 100  INCREMENT= 10

 TIME           PARTICLES      PART. LOSS      TOTAL PART. LOSS
 ----           ---------      ----- ----      ----- ----- ----

 0              6.02000E+23     0               0
 10             3.01014E+23     3.00986E+23     3.00986E+23
 20             1.50514E+23     1.50500E+23     4.51486E+23
 30             7.52606E+22     7.52536E+22     5.26739E+23
 40             3.76321E+22     3.76285E+22     5.64368E+23
 50             1.88169E+22     1.88152E+22     5.83183E+23
 60             9.40891E+21     9.40803E+21     5.92591E+23
 70             4.70468E+21     4.70423E+21     5.97295E+23
 80             2.35245E+21     2.35223E+21     5.99648E+23
 90             1.17628E+21     1.17617E+21     6.00824E+23
 100            5.88168E+20     5.88112E+20     6.01412E+23


 DO YOU WANT THE ABOVE DATA GRAPHED? (1-YES, 0-NO)?2-1


                                MASS (OR PARTICLES) REMAINING

                0
 6.02000E+23
TIME            I---------I---------I---------I---------I---------I
 0              I                                                 *
 10             I                        *
 20             I            *
 30             I    *
 40             I *
 50             I*
 60             I*
 70             I*
 80             I*
 90             I*
 100            I*

**********

WHAT IS YOUR CHOICE?3

DO YOU WANT TO WORK WITH PARTICLES OR MASS? (ANSWER 1 FOR
 PARTICLES OR 2 FOR MASS) ?2

 WHAT IS THE HALF-LIFE, INITIAL MASS OF SAMPLE,TOTAL
ELAPSED TIME FOR DECAY, AND THE INCREMENT OF
ELAPSED TIME?15,100,150,15

HALF-LIFE= 15   INITIAL MASS= 100  TOTAL TIME= 150  INCREMENT= 15

TIME            MASS            MASS LOSS       TOTAL MASS LOSS
----            ----            ---- ----       ----- ---- ----

 0              100             0               0
 15             50.0024         49.9976         49.9976
 30             25.0024         25.             74.9976
 45             12.5018         12.5006         87.4982
 60             6.25118         6.25059         93.7488
 75             3.12574         3.12544         96.8743
 90             1.56294         1.5628          98.4371
 105            .781508         .781434         99.2185
 120            .390772         .390735         99.6092
 135            .195395         .195377         99.8046
 150            9.77024E-02     .097693         99.9023


 DO YOU WANT THE ABOVE DATA GRAPHED? (1-YES, 0-NO)?1
```

MASS (OR PARTICLES) REMAINING

```
                0                                                  100
TIME            I---------I---------I---------I---------I---------I
 0              I                                                  *
 15             I                         *
 30             I              *
 45             I     *
 60             I  *
 75             I*
 90             I*
 105            I*
 120            I*
 135            I*
 150            I*
```

****

WHAT IS YOUR CHOICE?4

DONE

CONTRIBUTED PROGRAM **BASIC**

DRAGON
36785

TITLE: SOLAR ECLIPSE SIMULATION

DESCRIPTION:

This program is a simulation of a solar eclipse for a CRT display terminal that has cursor addressing capabilities such as the Hazeltine 2000. First, the sun is drawn in boldface, then the dragon moon eats the sun, a corona appears, and finally the sun reappears.

INSTRUCTIONS:

The User "GET"s the program and executes it. Everything follows automatically.

SPECIAL CONSIDERATIONS:

This program will print garbage if executed on a teletype terminal. It must be used with a terminal with cursor addressing capabilities. This present version uses the subroutine FAZEL (HP 36786) which provides the proper control for a Hazeltine 2000 terminal. Any similar subroutine with the proper entry points designed for a different terminal could easily replace the current one. This would allow the program to be used on any terminal with similar features as the Hazeltine.

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Beginning Astronomy

Student Background Required: None

This program can be used to illustrate to beginning astronomy students the time sequence of events in a solar eclipse. It was written to be more entertaining than educational since the amount of potential learning in this program is probably quite minimal.

This program also makes an interesting demonstration of the capabilities of a terminal with cursor addressing capability.

ACKNOWLEDGEMENTS: Lawrence E. Turner
Pacific Union College

TITLE:

DROS: Genetic Characteristics

DROS
36300

DESCRIPTION:

This program determines the genetic characteristics of the offspring of a pair of Drosophila flies with specified traits. A game approach is used involving the entire class, in which the students can select different genotypes.

OBJECTIVES:

To show the student:

A. The result of MEIOSIS and the effect of random assortment.

B. That various genetic recombinations occur in sex cells and in genotypes of offspring.

C. That if enough trials are run, Mendelian ratios are verified.

D. That he can simulate different genotypic conditions and determine the probability of the phenotypic outcome.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - An understanding of the concepts in the computer program GAMGN, A833-36302 in Volume IV. It is best to use DROS as soon as possible after GAMGN.

B. Materials - Eight containers grouped in two sets of four and labeled A, B, C, D. Designate one of the group of four as male chromosomes, and the other as female. Into each container, place two slips of paper, one marked 1 and the other, 2.

Before beginning the program have a student:

1. Take out one slip of paper from each of the containers of the male group and mark the designation on the chalk board. For instance: A1, B2, C2, D1;
2. Take out one slip from each container of the female group and do the same as with the male group.

Decide what the phenotype would be by discussing it in class.

You will run the program using the information you have on the chalk board. It will give you the correct phenotype. See how the class' answer compares with the computer's.

DISCUSSION: See attached.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

INSTRUCTIONS: continued

DISCUSSION:

A. Operational Suggestions

1. Student level - average
2. This program can be used on a classroom basis.
3. Pitfalls to avoid - See that the students run the program several times and keep a record of each run. This is necessary to show the various possible combinations that can occur, and their frequencies.

B. Follow-up

After the program has been run:

1. Get as many runs as possible so that percentages can be determined for each phenotype of the offspring.
2. a) Determine the total number of offspring. Each run represents 1 offspring. Count them.
   b) Determine the total number of offspring which lived.
   c) Determine each phenotype and show that a ratio exists between dominant and recessive traits. (This should follow typical Mendelian ratios)
3. Elicit from the students:
   a) What was their role in the game? (The students conduct meiosis by randomly selecting the genotype of each gamete.)
   b) (When using a small number of runs) Why did the Mendelian ratios not hold true?

```
RUN

RUN
DROS

THIS PROGRAM IS DESIGNED TO GIVE THE GENETIC RESULTANT TRAITS
OF OFFSPRING WHOSE PARENTAGE WAS DISCUSSED IN PROGRAM 'GAMGN'

ARE YOU READY? HERE WE GO.

FOR THE SPERM CELL, WHAT IS 'A'? (TYPE 1 OR 2)?2
                   WHAT IS 'B'?1
                   WHAT IS 'C'?2
                   WHAT IS 'D'?2
FOR THE EGG CELL, WHAT IS 'A'? (TYPE 1 OR 2)?2
                  WHAT IS 'B'?1
                  WHAT IS 'C'?1
                  WHAT IS 'D'?1
OFFSPRING HAS NORMAL WINGS
AND IS RED EYED.

     LET'S TRY THIS SEVERAL TIMES AND SEE THE RESULTS WE GET
OVER SEVERAL TRIALS. KEEP A RECORD.
SHALL WE TRY AGAIN? IF YES TYPE 1, IF NO TYPE 0.
?1
FOR THE SPERM CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1
                   WHAT IS 'B'?2
                   WHAT IS 'C'?2
                   WHAT IS 'D'?2
FOR THE EGG CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1
                  WHAT IS 'B'?2
                  WHAT IS 'C'?1
                  WHAT IS 'D'?1
OFFSPRING HAS VESTIGIAL WINGS
AND IS WHITE EYED

SHALL WE TRY AGAIN? IF YES TYPE 1, IF NO TYPE 0.
?1
FOR THE SPERM CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1
                   WHAT IS 'B'?2
                   WHAT IS 'C'?2
                   WHAT IS 'D'?2
FOR THE EGG CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1
                  WHAT IS 'B'?2
                  WHAT IS 'C'?1
                  WHAT IS 'D'?2
OFFSPRING HAS VESTIGIAL WINGS
AND IS WHITE EYED
```

```
SHALL WE TRY AGAIN? IF YES TYPE 1, IF NO TYPE 0.
?1
FOR THE SPERM CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1
                    WHAT IS 'B'?1
                    WHAT IS 'C'?2
                    WHAT IS 'D'?2
FOR THE EGG CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1
                  WHAT IS 'B'?2
                  WHAT IS 'C'?1
                  WHAT IS 'D'?2
OFFSPRING HAS VESTIGIAL WINGS
AND IS RED EYED.

SHALL WE TRY AGAIN? IF YES TYPE 1, IF NO TYPE 0.
?1
FOR THE SPERM CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1
                    WHAT IS 'B'?2
                    WHAT IS 'C'?2
                    WHAT IS 'D'?2
FOR THE EGG CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1
                  WHAT IS 'B'?2
                  WHAT IS 'C'?2
                  WHAT IS 'D'?2
OFFSPRING HAS VESTIGIAL WINGS
AND IS WHITE EYED

SHALL WE TRY AGAIN? IF YES TYPE 1, IF NO TYPE 0.
?1
FOR THE SPERM CELL, WHAT IS 'A'? (TYPE 1 OR 2)?2
                    WHAT IS 'B'?1
                    WHAT IS 'C'?1
                    WHAT IS 'D'?1
FOR THE EGG CELL, WHAT IS 'A'? (TYPE 1 OR 2)?1
                  WHAT IS 'B'?1
                  WHAT IS 'C'?1
                  WHAT IS 'D'?1
DEVELOPING EMBRYO HAS DIED DUE TO LETHAL GENE ACTION.

SHALL WE TRY AGAIN? IF YES TYPE 1, IF NO TYPE 0.
?0
     I HOPE THAT I HAVE BEEN OF SOME HELP TO YOU,
AND THAT 6    RUNS PROVIDE ENOUGH INFORMATION.

DONE
```

TITLE:

ELECTRIC FIELD STRENGTH

EFIELD
36629

DESCRIPTION:

The electric-field strength at a point near a fixed charge is calculated and printed. A line of charge is then generated by adding charges to either side of the fixed charge. As each additional charge is added, the new electric-field strength is calculated and selected values are printed.

Similarly, the field strength at a point near a plane of charge is calculated and printed as the plane is generated with the addition of other lines to the previous line of charge.

In both cases, the fields can be seen to approach a limiting value which is then printed for an infinite line and plane.

OBJECTIVES:

A. To show that the electric-field strength approaches limiting values for a line and a plane of charge.

B. To let the student discover how the field strength depends upon the distance from a point to a line of and to a plane of charge.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - A knowledge of Coulomb's law and the vector addition of electric fields.

B. Materials - None

DISCUSSION:

The operator chooses a distance (y) away from a fixed charge (Q_2) at which he wishes to know the field strength. He also chooses the number of charges (N), and their spacing (C), that he wishes to add to each side of the fixed charge to generate a line of charge. After the line has been generated, the operator enters the number of such lines (M) that he wishes to use in building up the plane of charge.

Continued on following page.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

DISCUSSION: continued

Actual values of force are not given, only relative values. When the fixed charge (Q_2) is at a distance Y=1 from the test charge (Q_1), the force is 1 unit. The force may be calculated in Newtons if all distances are in meters, and the program is slightly changed so that Q_1 and Q_2 are in coulombs. If both of these charges were to be taken as single elementary charges, then the following changes should be made:

```
280  LET Q1 = 1.6*E-19
290  LET Q2 = 1.6*E-19
300  LET K  = 9*E9
```

If the spacing (C) is taken as .1 and the number of charges (N) as 1000, then three runs through the program using the distance between the test charge and the fixed charge (y) as 1, 2, and 4 should be sufficient for the relationships to be determined. A casual inspection of the exact values of the field strength for these three distances should yield the following conclusions:

1. The field strength varies inversely with the square of the distance away from a single point charge.
2. The field strength varies inversely with the distance from a line of charge.
3. The field strength remains constant even though the distance from a plane of charge changes.

It should be noted in 2 and 3 above, that the spacing between charges must be small as compared to the distance away from the line or plane of charge, and of course that the line be so long and the plane so broad that any further increase in length or breadth be insignificant.

An interesting bonus to this program is discovered when distances from test charge to plane is decreased to .001, .0001, and .00001. Here it can be seen that the field no longer is constant, but changes as an inverse square law for a single charge because the test charge begins to "see" the fixed charge instead of the whole plane. The "EXACT VALUE ...," is calculated for charges smeared over the whole plane and not in discrete point charges as we have here; hence, the disagreement with actual field values.

This program may be run by an individual student after proper introductory explanation concerning vector addition of electric fields, contributions of the charges being added in the line or lines to the plane. It may also be used as a class demonstration and discussion. When used with a whole class it is best to have a television camera and monitor available for immediate display of print out. A summary table constructed either by the teacher on the board or by students at their desks is useful in analysis of the data.

```
RUN


RUN
EFIELD

THIS PROGRAM WILL CALCULATE THE FORCE ON A TEST CHARGE
THAT IS PLACED SOME DISTANCE, Y, AWAY FROM ANOTHER CHARGE;
A LINE OF CHARGE; AND A PLANE OF CHARGE.
YOU MUST ENTER THE DISTANCE AWAY, Y; THE SPACING DESIRED
BETWEEN CHARGES, C, AND ALSO BETWEEN LINES OF CHARGE THAT
MAKE UP THE PLANE OF CHARGE.
YOU MUST ALSO CHOOSE THE NUMBER OF CHARGES IN THE LINE OF
CHARGE THAT YOU WOULD LIKE TO USE (500 IS A GOOD VALUE IF
YOU USE A SPACING OF .1 FOR C.
JUST SO THE CALCULATIONS DON'T GO TOO FAR I'VE INCLUDED
A STOP THAT DEPENDS UPON THE ANGLE FROM TEST CHARGE TOTHE
LAST CHARGE TO BE CALCULATED.  IF THE ANGLE IS LESS
THAN 2     DEGREES, CALCULATIONS WILL CEASE.

INPUT Y,C,N?1,.1,1000


NO. OF CHGS.
ON EACH SIDE    FORCE
------------    -----
 0               1
 1               2.97
 2               4.86
 3               6.61
 4               8.21
 5               9.65
 6               10.91
 7               12.01
 8               12.96
 9               13.78
 10              14.49
 20              17.98
 30              19
 40              19.42
 50              19.62
 60              19.73
 70              19.8
 80              19.85
 90              19.88
 100             19.9
 200             19.98
 287             19.99
EXCESSIVE COMPUTER TIME WOULD BE REQUIRED TO CALCULATE
THE FORCE FOR ADDITIONAL CHARGES.


THE EXACT VALUE FOR AN INFINITELY LONG LINE OF CHARGE IS 20


NOW ADD ROWS ON EITHER SIDE OF THE LINE OF CHARGE JUST
CALCULATED.  THE SPACING BETWEEN ROWS WILL BE THE SAME AS
THE SPACING BETWEEN THE CHARGES.
ENTER THE NUMBER OF EQUALLY SPACED ROWS YOU WANT ON EACH SIDE
?500


NO. OF LINES
ON EACH SIDE    FORCE
------------    -----
 0               20
 1               59.58
 2               98.02
 3               134.69
 4               169.16
 5               201.14
 6               230.53
 7               257.36
 8               281.73
 9               303.82
 10              323.81
 20              446.55
 30              501.31
 40              531.19
 50              549.8
 60              562.47
 70              571.62
 80              578.55
```

```
 90              583.96
 100             588.3
 200             608.03
 287             614.05
EXCESSIVE COMPUTER TIME WOULD BE REQUIRED TO CALCULATE
THE FORCE FOR ADDITIONAL LINES OF CHARGE.

THE EXACT VALUE FOR AN INFINITE PLANE OF CHARGE IS 628.318

DO YOU WANT ANOTHER RUN (1=YES, 0=NO) : ?0

DONE
```

CONTRIBUTED PROGRAM **BASIC**

EINDIS
36716

TITLE: EINSTEIN DISTORTIONS

DESCRIPTION:

Calculates and tabulates Relativistic Effects on a "twin" who is flying by in a rocket ship, as a function of (percent of speed of light) his velocity (speed). Changes in twin's height, weight, age, color of rocket ship are noted.

INSTRUCTIONS:

The user enters height in inches, weight in pounds, and age in years,

e.g., ? 70,175,37 (carriage return)

User enters twin's speed as % of speed of light,

e.g., ? 99 (cannot enter 100)
(cannot enter 0)
(repeats request for input)

Program always stops - user must use RUN command for additional RUNs.

SPECIAL CONSIDERATIONS:

For Instructional Programs: Science, Physics courses, Introduction to relativity theory.

ACKNOWLEDGEMENTS:

Dr. Robert J. Bennett
Bergen Community College

```
RUN

RUN
EINDIS

ENTER YOUR HEIGHT IN INCHES,YOUR WEIGHT IN LBS.,AND
YOUR AGE IN YEARS.
?70,175,37
YOUR IDENTICAL TWIN FLIES PAST IN A ROCKET SHIP. CHOOSE
HIS SPEED AS A % OF THE SPEED OF LIGHT(BETWEEN 0 AND 100).
?50

FOR A SPEED OF 50   % OF LIGHT,WHICH IS  149.896    MILLION
METERS/SEC AND  329.5      MILLION MPH,

 YOU            TWIN'S APPEARANCE

 70   INCHES        60.6218    INCHES       - LENGTH CONTRACTION
 79.5455    KGMS.   91.8512    KGMS.        - MASS-ENERGY INCREASE
 37   YEARS         32.0429    YEARS        - TIME DILATION
YOUR TWIN IS ALSO TILTED BY  26.5206    DEGREES,DUE TO DEPTH-
OF-FIELD ROTATION

FOR EARTH'S GRAVITY FIELD TO PRODUCE AN EQUIVALENT SPACE-
TIME DISTORTION WOULD REQUIRE THE EARTH'S DIAMETER TO BE
 180.942    MILLION TIMES SMALLER THAN IT IS,OR THE MASS 180.942
MILLION
TIMES BIGGER THAN ACTUAL.

YOUR ANTI-MATTER TWIN COULD BE CREATED BY THE COLLISION OF
2 GAMMA-RAYS EACH HAVING  7.15909     BILLION BILLION JOULES OF
ENERGY,WHICH EQUALS  1883.97    MILLION TONS OF TNT OR
 37.6794     H-BOMBS (PAIR PRODUCTION).

IF YOU FLY OFF IN THE ROCKET'S OPPOSITE DIRECTION AT THE
SAME SPEED, 50    % OF C,YOU BOTH WILL SEPARATE AT
 80    % OF C (RELATIVISTIC VELOCITY ADDITION).

WHEN THE PURPLE ROCKET IS MOVING AWAY, IT APPEARS
RED                    (RED SHIFT)
WHEN THE PURPLE ROCKET IS PASSING YOU, IT APPEARS
BLUE                   (RED SHIFT)
OF COURSE YOU APPEAR THE SAME WAY TO YOUR TWIN; AFTER
ALL, HE IS A RELATIVE !!

DONE



RUN
EINDIS

ENTER YOUR HEIGHT IN INCHES,YOUR WEIGHT IN LBS.,AND
YOUR AGE IN YEARS.
?70,175,37
YOUR IDENTICAL TWIN FLIES PAST IN A ROCKET SHIP. CHOOSE
HIS SPEED AS A % OF THE SPEED OF LIGHT(BETWEEN 0 AND 100).
?100
YOUR IDENTICAL TWIN FLIES PAST IN A ROCKET SHIP. CHOOSE
HIS SPEED AS A % OF THE SPEED OF LIGHT(BETWEEN 0 AND 100).
?99

FOR A SPEED OF 99   % OF LIGHT,WHICH IS  296.794    MILLION
METERS/SEC AND  652.41     MILLION MPH,

 YOU            TWIN'S APPEARANCE

 70   INCHES        9.87471    INCHES       - LENGTH CONTRACTION
 79.5455    KGMS.   563.883    KGMS.        - MASS-ENERGY INCREASE
 37   YEARS         5.21949    YEARS        - TIME DILATION
YOUR TWIN IS ALSO TILTED BY  44.6373    DEGREES,DUE TO DEPTH-
OF-FIELD ROTATION
```

```
FOR EARTH'S GRAVITY FIELD TO PRODUCE AN EQUIVALENT SPACE-
TIME DISTORTION WOULD REQUIRE THE EARTH'S DIAMETER TO BE
 709.365     MILLION TIMES SMALLER THAN IT IS,OR THE MASS 709.365
MILLION
TIMES BIGGER THAN ACTUAL.

YOUR ANTI-MATTER TWIN COULD BE CREATED BY THE COLLISION OF
2 GAMMA-RAYS EACH HAVING  7.15909      BILLION BILLION JOULES OF
ENERGY,WHICH EQUALS  1883.97     MILLION TONS OF TNT OR
 37.6794      H-BOMBS (PAIR PRODUCTION).

IF YOU FLY OFF IN THE ROCKET'S OPPOSITE DIRECTION AT THE
SAME SPEED, 99     % OF C,YOU BOTH WILL SEPARATE AT
 99.9949      % OF C (RELATIVISTIC VELOCITY ADDITION).

WHEN THE PURPLE ROCKET IS MOVING AWAY, IT APPEARS
INVISIBLE-INFRARED!  (LARGE RED SHIFT)
WHEN THE PURPLE ROCKET IS PASSING YOU, IT APPEARS
INVISIBLE-INFRARED!  (LARGE RED SHIFT)
OF COURSE YOU APPEAR THE SAME WAY TO YOUR TWIN; AFTER
ALL, HE IS A RELATIVE !!

DONE
```

TITLE: DRILL ON SYMBOLS FOR CHEMICAL ELEMENTS

ELMENT
36267

DESCRIPTION:

This program provides drill and practice in the naming of chemical symbols for a given chemical element. The user is allotted 5 seconds for a correct response to a given element name. The cycle is repeated ten times followed by a summary of his performance.

INSTRUCTIONS:

User types in his name. He is asked to input the symbols for the elements. Example: CR for CHROMIUM. Five seconds are provided to answer. The cycle repeats ten times.

SPECIAL CONSIDERATIONS:

XØ, which is set in line 2Ø, is how many elements are stored in the DATA statements. NØ, assigned in line 25, assigns the number of problems, and TØ in line 30 sets the time limit for the responses. To add more elements, use DATA statements, with the format

XXXX DATA "ELEMENT", "SYMBOL", "ELEMENT", ETC....

FOR INSTRUCTIONAL PURPOSES:
Suitable Courses: Chemistry

Student Background Required: Knowledge of elements and their symbols.

ACKNOWLEDGEMENTS:

Phillip Short
Burnsville Senior High School

```
RUN


RUN
ELMENT


 NAMING ELEMENTS

WHAT IS YOUR NAME?PHILLIP SHORT

WHAT IS THE SYMBOL FOR LITHIUM ?
LN
NO. YOU ARE WRONG
THE ANSWER IS  LI  .

WHAT IS THE SYMBOL FOR NEON ?
NE
CORRECT!!

WHAT IS THE SYMBOL FOR IRIDIUM ?
IR
CORRECT!!

WHAT IS THE SYMBOL FOR HYDROGEN ?
H
CORRECT!!

WHAT IS THE SYMBOL FOR GERMANIUM ?
GE
CORRECT!!

WHAT IS THE SYMBOL FOR NICKEL ?
NI
CORRECT!!

WHAT IS THE SYMBOL FOR KRYPTON ?
KR
CORRECT!!

WHAT IS THE SYMBOL FOR TIN ?
T
YOU ARE TOO SLOW.
THE ANSWER IS  SN  .

WHAT IS THE SYMBOL FOR BORON ?
B
YOU ARE TOO SLOW.
THE ANSWER IS  B  .

WHAT IS THE SYMBOL FOR BROMINE ?
BR
CORRECT!!

-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-

                                        PHILLIP SHORT

YOU GOT  7    RIGHT.

YOU WERE TOO SLOW  2    TIMES.

YOU WERE WRONG  1    TIMES.

-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-

DONE
```

EMPIR
36615

TITLE: CALCULATES EMPIRICAL FORMULAS

DESCRIPTION:

A classroom demonstration designed to calculate the empirical formulae from atomic mass (atomic weight) and percent composition.

OBJECTIVES:

A. To distinguish between molecular and empirical formulae.

B. To illustrate the law of multiple proportions.

C. To emphasize the unity of the atom when writing chemical formulae.

D. To demonstrate the importance of accurate calculation with empirical formulae problems.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - The student should have some experience in writing chemical formulae and calculating percent composition from chemical formulae. An understanding of significant figures would also add to the value of the lesson.

B. Materials - None

DISCUSSION:

In this program the atomic number is used for identification only and has no part in the actual calculations.

The student generally has difficulty understanding the function of the ratio in calculating empirical formulae. This program is designed to emphasize that function.

The importance of significant figures could also be illustrated. The students' tendency to approximate generally results in numbers of questionable value. In this program, by using a series of calculations for the same compound with figures of progressively greater accuracy, an empirical formulae closer to whole numbers will be obtained.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

```
RUN


RUN
EMPIR

 THIS PROGRAM WILL FIND THE EMPIRICAL FORMULA FOR
ANY COMPOUND CONTAINING UP TO FIVE DIFFERENT ELEMENTS

  WHEN INFORMATION IS REQUESTED, TYPE IN THE ATOMIC
 NUMBER, THE ATOMIC WEIGHT, AND THE PCT COMPOSITION BY
 WEIGHT IN THAT ORDER; FOR EXAMPLE, IN THE COMPOUND S02,
 THE DATA WOULD BE ENTERED AS FOLLOWS:  16,32,50 FOR
 SULFUR AND 8,16,50 FOR OXYGEN.

 HOW MANY ELEMENTS DOES YOUR UNKNOWN COMPOUND CONTAIN?2
 ENTER THE ATOMIC NUMBER, THE ATOMIC WEIGHT, AND THE
 PCT COMPOSITION FOR EACH OF THE ELEMENTS IN YOUR COMPOUND.
 BE SURE TO ENTER ONE SET OF NUMBERS FOR EACH QUESTION MARK.

      1     .  ?26,55.9,69.96
      2     .  ?8,16,30.04

 ATOMIC          PCT.          INITIAL         RATIO*2         RATIO*3
NUMBER          COMP.          RATIO
 26              69.96          1               2               3
 8               30.04          1.5             3               4.5

 TO FIND THE EMPIRICAL FORMULA LOCATE THE FIRST RATIO
 COLUMN IN WHICH ALL OF THE NUMBERS MOST CLOSELY APPROXIMATE
 A WHOLE NUMBER.
IF YOU WOULD LIKE TO TRY AGAIN TYPE 1, IF NOT TYPE 0.?1

 HOW MANY ELEMENTS DOES YOUR UNKNOWN COMPOUND CONTAIN?3
 ENTER THE ATOMIC NUMBER, THE ATOMIC WEIGHT, AND THE
 PCT COMPOSITION FOR EACH OF THE ELEMENTS IN YOUR COMPOUND.
 BE SURE TO ENTER ONE SET OF NUMBERS FOR EACH QUESTION MARK.

      1     .  ?1,1,2
      2     .  ?16,32,32.7
      3     .  ?8,16,65.3

 ATOMIC          PCT.          INITIAL         RATIO*2         RATIO*3
NUMBER          COMP.          RATIO
 1               2              2               3.9             5.9
 16              32.7           1               2               3
 8               65.3           4               8               12

IF YOU WOULD LIKE TO TRY AGAIN TYPE 1, IF NOT TYPE 0.?1

 HOW MANY ELEMENTS DOES YOUR UNKNOWN COMPOUND CONTAIN?1
 THE EMPIRICAL FORMULA FOR A COMPOUND THAT CONTAINS ONLY
 A SINGLE ELEMENT IS STRAIGHTFORWARD.

IF YOU WOULD LIKE TO TRY AGAIN TYPE 1, IF NOT TYPE 0.?0


DONE
```

EQUIL1

TITLE: EQUIL1/EQUIL2: Equilibrium Systems 36308

DESCRIPTION:

This program calculates the effects of concentration changes in the equilibrium systems $2HI \rightleftharpoons H_2 + I_2$ and $PCl_5 \rightleftharpoons PCl_3 + Cl_2$.

OBJECTIVES:

A. To show that an equilibrium system is a dynamic one.

B. To illustrate and reinforce Le Chateliers principle.

C. An exercise in the interpretation of experimental data.

D. The significance of the Equilibrium constants.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - The student should have been made aware of "reversible" reactions, equilibrium systems and Le Chateliers principle.

B. Materials - none

DISCUSSION:

These two programs can be used as classroom demonstrations to illustrate the effect of varying the concentration of one of the products of a system at Equilibrium. The results are given not only as a table, but also graphically, since it was found that students have less trouble recognizing trends when they can be illustrated.

The equilibrium constant can also be changed to show its effect on the equilibrium system.

As always, the teacher should have run the program he wishes to use prior to its classroom presentation since the choice of constants will determine the slope of the curves.

NOTE: The vertical axis (horizontal on the output) is labeled in percent of maximum y value.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
EQUIL1

THIS PROGRAM WILL INVESTIGATE THE EQUILIBRIUM SYSTEM

            2HI = H2 + I2

WHAT IS THE EQUILIBRIUM CONSTANT?.5
WHAT IS THE INITIAL CONCENTRATION OF HI?2

WOULD YOU LIKE THE RESULTS PLOTTED (1), TABULATED (2)
OR BOTH (3) (TYPE THE APPROPRIATE NUMBER)?3
```

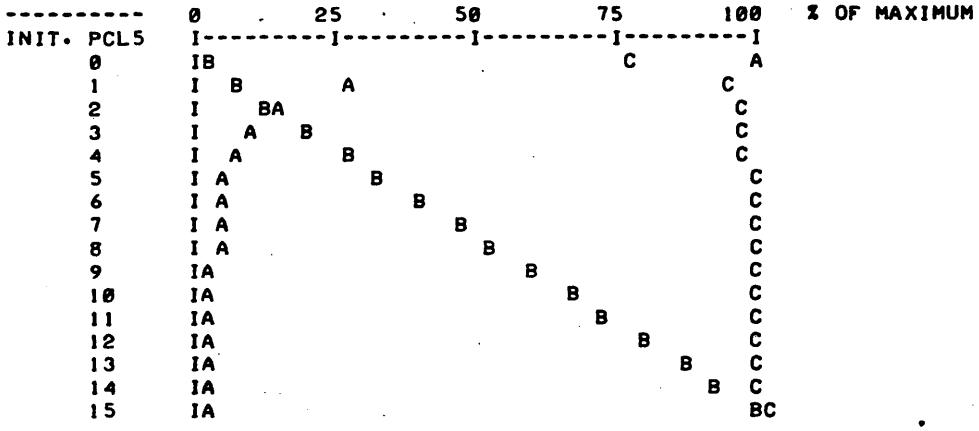
INIT. I2 / INIT. HI	EQUIL. H2 / INIT. HI	EQUIL. I2 / INIT. HI	EQUIL. HI / INIT. HI
0	.292893	.292893	.414214
1	.177124	1.17712	.645751
2	.129171	2.12917	.741658
3	.102084	3.10208	.795832
4	8.45242E-02	4.08452	.830952
5	7.21726E-02	5.07217	.855655
6	6.29959E-02	6.063	.874008
7	5.59025E-02	7.0559	.888195
8	.050252	8.05025	.899496
9	4.56438E-02	9.04564	.908712
10	4.18119E-02	10.0418	.916376
11	3.85761E-02	11.0386	.922848
12	3.58057E-02	12.0358	.928389
13	3.34072E-02	13.0334	.933186
14	.031311	14.0313	.937378
15	2.94628E-02	15.0295	.941074

```
A: (EQUIL. H2)/(INIT. HI)      MAXIMUM IS  .292893
B: (EQUIL. I2)/(INIT. HI)      MAXIMUM IS  15.0295
C: (EQUIL. HI)/(INIT. HI)      MAXIMUM IS  .941074

INIT. I2                  A - B - C
--------  0        25        50        75        100   % OF MAXIMUM
INIT. HI  I---------I---------I---------I---------I
      0    IB                C                    A
      1    I B                    A  C
      2    I    B           A              C
      3    I      B     A                   C
      4    I        BA                     C
      5    I         A  B                  C
      6    I       A      B                C
      7    I      A          B              C
      8    I     A             B           C
      9    I    A                 B         C
      10   I    A                    B      C
      11   I   A                       B    C
      12   I   A                          B C
      13   I   A                            BC
      14   I  A
      15   I  A

*****

WOULD YOU LIKE ANOTHER RUN (1-YES, 0-NO)?0

DONE
```

```
RUN
RUN
EQUIL2

THIS PROGRAM WILL INVESTIGATE THE EQUILIBRIUM SYSTEM

            PCL5 = PCL3 + CL2

WHAT IS THE EQUILIBRIUM CONSTANT?.74
WHAT IS THE INITIAL CONCENTRATION OF PCL5?10

WOULD YOU LIKE THE RESULTS PLOTTED (1), TABULATED (2)
OR BOTH (3) (TYPE THE APPROPRIATE NUMBER)?3
```

INIT. CL2 / INIT. PCL5	EQUIL. PCL3 / INIT. PCL5	EQUIL. CL2 / INIT. PCL5	EQUIL. PCL5 / INIT. PCL5
0	.237534	.237534	.762466
1	.064971	1.06497	.935029
2	3.50864E-02	2.03509	.964914
3	2.38872E-02	3.02389	.976113
4	1.80836E-02	4.01808	.981916
5	1.45426E-02	5.01454	.985457
6	1.21589E-02	6.01216	.987841
7	1.04456E-02	7.01045	.989554
8	9.15527E-03	8.00916	.990845
9	8.14819E-03	9.00815	.991852
10	7.34043E-03	10.0073	.99266
11	6.67858E-03	11.0067	.993321
12	6.12545E-03	12.0061	.993875
13	5.65815E-03	13.0057	.994342
14	5.25570E-03	14.0053	.994744
15	4.90761E-03	15.0049	.995092

```
A: (EQUIL. PCL3)/(INIT. PCL5)      MAXIMUM IS  .237534
B: (EQUIL. CL2)/(INIT. PCL5)       MAXIMUM IS  15.0049
C: (EQUIL. PCL5)/(INIT. PCL5)      MAXIMUM IS  .995092
```




```
*****

WOULD YOU LIKE ANOTHER RUN (1-YES, 0-NO)?0

DONE
```

EVOLU
36301

TITLE: EVOLU: Natural Selection Experiment

DESCRIPTION:

A population of dark and light pepper moths are studied over a period of 30 years. The student selects the year and direction of environmental changes which favors one or the other. The concept of natural selection in evolution is developed.

OBJECTIVES:

To show the student that:

A. The mutation rate within a population for a specific trait can be stable for a period of time, or can change. The success of the progeny exhibiting this variation is dependent upon environmental conditions.

B. Progeny exhibiting an hereditary trait do not necessarily reach maturity, because of the influence of environment.

C. Evolution depends upon mutation, heredity, and environmental pressures.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - An understanding of the following terms: 1) mutation rate, 2) species, 3) environmental change, 4) population.

B. Materials - 1) Specimens showing color variations within any species (optional); and 2) Ditto of the list of assumptions presented in this program (optional). Assumptions are listed below.

DISCUSSION: See following page.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

DISCUSSION:

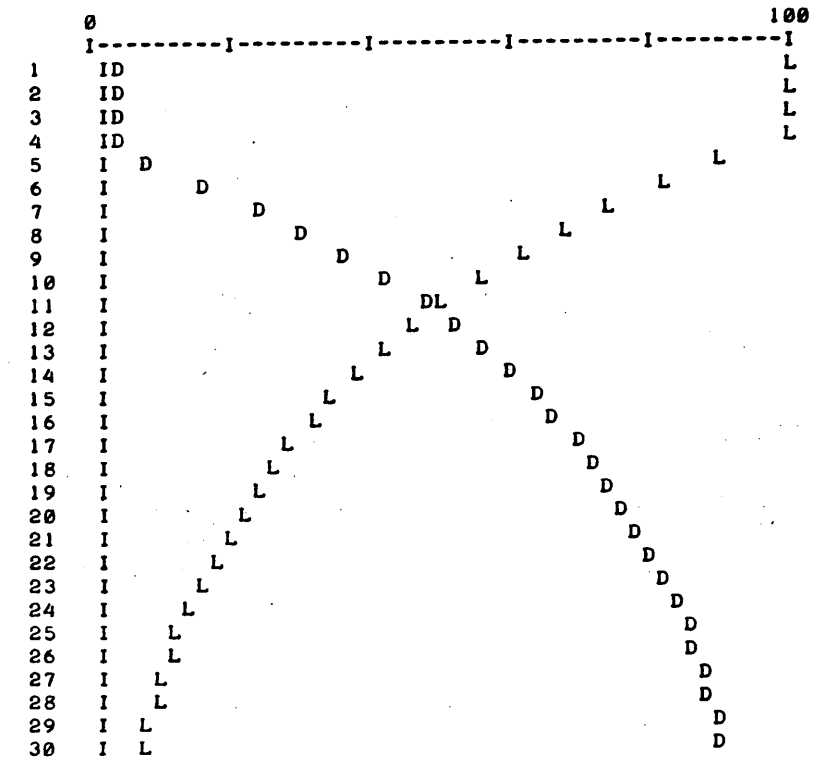
A. Operational Suggestions
   1. Student level - average
   2. Group size - Work in small groups of five or less. Remaining students may be engaged in a related activity.
   3. Assumptions - Prior to running the program, the students should be told to assume the following:
      a) The environment initially favors the light moths.
      b) At first, brown moths are produced, but because of environmental pressures they do not reach maturity.
      c) The total population in the area cannot exceed the initial number of moths, because this is the maximum number of moths the environment can support.
   4. Each group of students should run the program at least two times, varying the environmental pressure; once favoring the dark moths and once favoring the light.
   5. You might have the runs of different groups of students reflect different mutation rates.
   6. Supervision of the number of program runs per group is necessary since they are not automatically cut off.

B. Suggested Follow-up
   These questions may be used to initiate discussion:
   1. Why does the mutation rate remain constant? Does it always remain constant under natural conditions? Explain your reasons.
   2. Assuming constant environmental conditions, how does changing the mutation rate affect the population? Why?
   3. How does changing the mutation rate affect the dark moth population when environmental pressures favor these moths? Why?
   4. What environmental pressures could favor the dark moths? (industrial expansion, predators which favor the light or dark moths) (The classic case of the pepper moths and the industrial revolution in England could be discussed at this point.)
   5. What possible role might pollutants play in altering a mutation rate? What other factors could affect a mutation rate?
   6. Is evolution a slow or fast process? Explain your answer.
   7. Why do a few white moths always remain in the population, even though the environment favors the dark moths?
   8. What is natural selection? What is its role in evolution?
   9. Make a list of all factors important to evolution.

```
RUN

RUN
EVOLU

                EVOLUTION STUDY

WITHIN A LARGE POPULATION OF PEPPER MOTHS, THERE ARE A FEW
INDIVIDUALS WHICH SHOW UP DARKER IN COLOR THAN THE NORMAL
LIGHT COLORED MOTHS BECAUSE OF MUTATIONS.

YOU ARE GOING TO STUDY THIS POPULATION OF PEPPER MOTHS FOR 30
YEARS AND SEE WHAT HAPPENS TO THE NUMBER OF DARK MOTHS WHEN
YOU ALTER ENVIRONMENTAL CONDITIONS.

SELECT A MUTATION RATE VALUE BETWEEN 1 AND 10.  THE
HIGHER THE NUMBER, THE HIGHER THE MUTATION RATE IS, AND THUS
THERE ARE MORE DARK MOTHS IN OUR POPULATION.
?9

HOW MANY LIGHT COLORED MOTHS ARE THERE IN THE AREA?
SELECT A NUMBER BETWEEN 1000 AND 1000000 ?65789

YOU HAVE THE POWER TO CHANGE THE ENVIRONMENT.
AT WHAT POINT IN OUR THIRTY YEAR PERIOD DO YOU WANT
TO IMPLEMENT YOUR POWER? SELECT A YEAR FROM 3 THROUGH 10.
?5

IS THE ENVIRONMENTAL CHANGE GOING TO FAVOR
LIGHT MOTHS (TYPE 1) OR DARK MOTHS (TYPE 2)?2

HOW DO YOU WISH TO SEE THE RESULTS?
1=TABLE ONLY, 2=GRAPH ONLY, 0=BOTH?0

FOR A MUTATION RATE OF 9
```

YEAR	DARK MOTHS	LIGHT MOTHS
1	0	65789.
2	0	65789.
3	0	65789.
4	0	65789.
5	5921	59868.
6	11309	54480.
7	16212	49577.
8	20674	45115.
9	24734	41055.
10	28429	37360.
11	31791	33998.
12	34851.	30938
13	37635.	28154
14	40169.	25620
15	42475.	23314
16	44573.	21216
17	46482.	19307
18	48220.	17569
19	49801.	15988
20	51240.	14549
21	52549.	13240
22	53741.	12048
23	54825.	10964
24	55812.	9977
25	56710.	9079
26	57527.	8262
27	58271.	7518
28	58948.	6841
29	59564.	6225
30	60124.	5665

L=LIGHT MOTHS, D=DARK MOTHS
VALUES GRAPHED AS PERCENTAGE OF POPULATION.



DO YOU WANT TO RUN THIS PROGRAM AGAIN (1=YES,0=NO)?0

DONE

TITLE:

GAMGN: Process of Gametogenesis

GAMGN
36302

DESCRIPTION:

A review of the process of gametogenesis, applying it to the concept of dominant-recessive traits.

OBJECTIVES:

A. To reinforce the meaning of the terms random assortment, meiotic divisions, monoploid, and diploid.

B. To allow the student to make decisions based upon knowledge gained in the program, thus causing the students to think.

C. To review and reinforce both spermatogenesis and oogenesis.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student

1. Students should be familiar with all phases of meiosis.
2. Genetics should have been introduced so that the student understands the implications of gene action, dominance and recessiveness, homologous and non-homologous chromosomes.
3. Programming and machine knowledge. Keep in mind that for this program the students should be given time to try to determine what genetic traits are represented by the chromosome designation shown in the program.

normal wing - red eye	= A1A2, B1B2, C1C2, D1D2
normal wing - white eye	= A1A2, B2B2, C1C2, D1D2
vestigial wing	= A1A1, B1B2, C1C2, D1D2
lethal gene	= A1A2, B1B2, C1C1, D1D2

red eye	= B1B2 or B1B1
white eye	= B2B2 (recessive)
normal wing	= A1A2 or A2A2
vestigial wing	= A1A1 (recessive)
non lethal gene	= C2C2
lethal gene carrier	= C1C2
lethal (dies)	= C1C1 (recessive)

B. Materials - none necessary

Continued on following page.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

DISCUSSION:

A. Operational Suggestions

1. Student level - average to above average ability
2. If the student is confused alert him to the fact that chromosomes are letters and the number following the letter represents genes. Similar letters indicate homologous chromosomes. (see program)
3. Read the program ahead of time to make sure your students are familiar with the terms used in the program.
4. If the students are thrown off the machine see that they review with the teacher the concept of gametogenesis before continuing with the program.
5. Ideally, students should work individually. If this is not possible, then work in groups of 5 or less. Allow one group at a time at the computer while the remaining groups are engaged in a related activity.

B. Suggested Follow-up

To maximize the value of this program, it is strongly suggested that the teacher:

1. Elicit from the students:

   What are the gene locations for the various genetic traits (eye color, wing normalcy, lethality)? Which is recessive? Which is dominant? Why is there no chance that the offspring will have the exact chromosomal composition of the father?

2. Ask the following questions, based on the information given, as lead-ins to discussion or as a homework assignment.

   (a) What is a polar body? How does the formation of polar bodies increase the survival chance of the egg cell?
   (b) How is random assortment responsible for genetic trait variations?
   (c) Why is it possible for all offspring to have the same traits without variations?

ARTICULATION INTO NEXT AREA TO BE COVERED:

This program can lead directly into the topic of genetics. A second program, DROS A833-36300, appearing in the manual, should follow. It demonstrates, with a game, the random recombinations of the chromosomes in offspring, showing all possible combinations and, if repeated often enough, Mendelian ratios.

```
RUN

RUN
GAMGN

THE FOLLOWING DIAGRAMS ARE REPRESENTATIONS OF PRIMARY SEX
CELLS. CHROMOSOMES ARE REPRESENTED BY LETTERS.

PRIMARY SPERMATOCYTE          PRIMARY OOCYTE
     ----------                    ----------
     ( A1 A2  )                    ( A3 A4  )
     (        )                    (        )
     ( B1 B2  )                    ( B3 B4  )
     ----------                    ----------

BY TYPING IN A NUMBER,WHAT IS THE DIPLOID NUMBER OF
CHROMOSOMES FOR THIS ORGANISM?4

SO YOU SEE THAT A1 + A2, FOR EXAMPLE, ARE PAIRS OF HOMOLOGOUS
CHROMOSOMES. IT IS ESSENTIAL THAT AFTER FERTILIZATION, IF THE
DIPLOID CONDITION IS TO BE RETAINED THAT WE HAVE SOME MEANS OF
PLACING ONLY ONE A AND ONE B CHROMOSOME IN THE SPERM AND ONLY
ONE A AND ONE B CHROMOSOME IN THE EGG. THIS INVOLVES MEIOSIS.

LOOK AT THE PRIMARY SPERMATOCYTE ABOVE.
DURING THE FIRST STAGE OF MEIOSIS, THE MALE SEX CELL
SHOULD APPEAR AS IT IS IN ONE OF THE FOLLOWING DIAGRAMS.

     1              2              3              4              5
----------     ----------     ----------     ----------     ----------
( A1A1   )     ( A1  A2 )     (    A   )     ( A1 A2  )     (        )
(  A2A2  )     (        )     (        )     (        )     (        )
( B1B1   )     (        )     (        )     (        )     (        )
(  B2B2  )     ( B1  B2 )     (    B   )     (        )     ( B1 B2  )
----------     ----------     ----------     ----------     ----------
```

```
WHICH DIAGRAM MOST CLOSELY REPRESENTS THIS MEIOTIC STAGE ?1

O.K., NOW WE CAN MOVE ALONG. MEIOTIC DIVISION OCCURS AND
WE GET TWO SECONDARY SPERMATOCYTES FROM EACH PRIMARY
SPERMATOCYTE AND ONE SECONDARY OOCYTE FROM EACH PRIMARY
OOCYTE. EACH SPERMATOCYTE CONTAINS THE FOLLOWING CHROMOSOMES:
A1 A2, B1 B2.     EACH OOCYTE HAS  A3 A4, B3 B4.

THE REASON WHY ONLY ONE OOCYTE IS PRODUCED IS:

     1)THE OOCYTE DOES NOT UNDERGO DIVISION.
     2)THE OOCYTE DIVIDES AFTER FERTILIZATION.
     3)A POLAR BODY IS FORMED.
     4)THERE IS AN ERROR IN THE COMPUTER.

WHICH NUMBER WOULD REPRESENT THE CORRECT ANSWER?3

CORRECT.      NOW LET'S MOVE TO THE FINAL STAGE IN WHICH
WE WILL END UP WITH 4 MONOPLOID(HAPLOID) SPERM--1)A1B1
2)A2B2  3)A1B2  4)A2B1  AND ONE OVUM--1)A3B3 OR  2)A4B4
OR  3)A3B4  OR  4)A4B3

WHAT IS THE POSSIBILITY THAT THE OFFSPRING WILL HAVE
THE SAME CHROMOSOMAL COMPOSITION AS THE FATHER?
PRINT ONE OF THE FOLLOWING NUMBERS.
     1)50 CHANCE   2)NO CHANCE   3)100 CHANCE
     4)YOU CAN'T TELL FROM THE INFORMATION GIVEN
?2
GOOD THINKING.
I HOPE YOU HAVE A FAIRLY GOOD IDEA OF SEVERAL PRINCIPLES
INVOLVED, PARTICULARLY RANDOM ASSORTMENT.

NOW LET'S SEE IF WE CAN USE THESE IDEAS TO DETERMINE WHAT
OCCURS IN A POPULATION. WE WILL USE AS OUR ORGANISM THE FRUIT
FLY, DROSOPHILA, WHICH HAS 8 AS THE DIPLOID NUMBER OF
CHROMOSOMES.  THE FOLLOWING WILL REPRESENT CERTAIN CONDITIONS
IN FRUIT FLIES :

NORMAL WING-RED EYE=A1A2, B1B2, C1C2, D1D2
NORMAL WING-WHITE EYE=A1A2, B2B2, C1C2, D1D2
VESTIGIAL WING=A1A1, B1B2, C1C2, D1D2
LETHAL GENE=A1A2, B1B2, C1C1, D1D2

SUPPOSE WE CROSS THE NORMAL RED EYED WITH THE NORMAL
EYED FRUIT FLY. WHAT COULD THE OFFSPRING LOOK LIKE? LOOK AT
THE GENOTYPES CAREFULLY AND SEE IF YOU CAN PICK OUT THE
DIFFERENT GENE COMBINATIONS. THEN MAKE ALL POSSIBLE CROSSES.
AT A LATER DATE, WE WILL SEE HOW I, THE COMPUTER, CAN
SOLVE THIS PROBLEM FOR YOU.
BUT FIRST, TAKE THIS SHEET BACK TO YOUR SEATS AND WORK ON IT.

DONE
```

TITLE: GENETICS SIMULATION

GENE1
36642

DESCRIPTION:

GENE1 is a simulation of the inheritance of genetic traits demonstrating the statistical nature of the Mendelian Laws.

GENE1 was developed by the Huntington II Project at the Polytechnic Institute of Brooklyn under the direction of L. Braun. This work was partially supported by the National Science Foundation, Grant GW-5883.

INSTRUCTIONS:

The user specifies the dominant and recessive traits to be studied. The user is then asked to enter the genotypes of the female parent and the male parent (the genotype of each parent is entered on 2 separate lines). After specifying the number of offspring to be studied, the simulation takes place and a detailed report of the offspring may be generated.

SPECIAL CONSIDERATIONS:

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

Student Workbook	**$ .30**
Teachers Guide	**.30**
Resource Handbook	**.50**

ACKNOWLEDGEMENTS:

Huntington II Project
State University of New York

RUN

```
RUN
GENE1

WHAT ARE THE TWO TRAITS TO BE STUDIED?
DOMINANT TRAIT?BROWN
RECESSIVE TRAIT?BLUE

******

GENOTYPE OF FEMALE PARENT?BROWN
??BLUE

GENOTYPE OF MALE PARENT?BLUE
??BLE-UE


HOW MANY OFFSPRING DO YOU WANT TO STUDY?25

DETAILED REPORT (YES OR NO)?YES


OFFSPRING NO.  ------GENOTYPE------          PHENOTYPE
               GENE 1          GENE 2
================================================
 1             BROWN           BLUE            BROWN
 2             BROWN           BLUE            BROWN
 3             BROWN           BLUE            BROWN
 4             BLUE            BLUE            BLUE
 5             BROWN           BLUE            BROWN
 6             BLUE            BLUE            BLUE
 7             BLUE            BLUE            BLUE
 8             BLUE            BLUE            BLUE
 9             BROWN           BLUE            BROWN
 10            BROWN           BLUE            BROWN
 11            BROWN           BLUE            BROWN
 12            BLUE            BLUE            BLUE
 13            BROWN           BLUE            BROWN
 14            BROWN           BLUE            BROWN
 15            BROWN           BLUE            BROWN
 16            BROWN           BLUE            BROWN
 17            BROWN           BLUE            BROWN
 18            BLUE            BLUE            BLUE
 19            BROWN           BLUE            BROWN
 20            BROWN           BLUE            BROWN
 21            BROWN           BLUE            BROWN
 22            BLUE            BLUE            BLUE
 23            BROWN           BLUE            BROWN
 24            BLUE            BLUE            BLUE
 25            BROWN           BLUE            BROWN

************

GENOTYPE RATIO     0 : 2.125      : 1
PHENOTYPE RATIO    2.125      : 1

############

WANT ANOTHER RUN (YES OR NO)?YES

******

GENOTYPE OF FEMALE PARENT?BROWN
??BLUE

GENOTYPE OF MALE PARENT?BROWN
??BLUE


HOW MANY OFFSPRING DO YOU WANT TO STUDY?15

DETAILED REPORT (YES OR NO)?YES
```

OFFSPRING NO.	------GENOTYPE------		PHENOTYPE
	GENE 1	GENE 2	
1	BLUE	BLUE	BLUE
2	BLUE	BROWN	BROWN
3	BROWN	BLUE	BROWN
4	BROWN	BLUE	BROWN
5	BROWN	BROWN	BROWN
6	BROWN	BROWN	BROWN
7	BLUE	BLUE	BLUE
8	BLUE	BLUE	BLUE
9	BROWN	BROWN	BROWN
10	BROWN	BROWN	BROWN
11	BROWN	BROWN	BROWN
12	BLUE	BROWN	BROWN
13	BROWN	BROWN	BROWN
14	BLUE	BLUE	BLUE
15	BROWN	BLUE	BROWN

****

GENOTYPE RATIO 1 : .833333 : .666667
PHENOTYPE RATIO 2.75 : 1

##########

WANT ANOTHER RUN (YES OR NO)??

******

GENOTYPE OF FEMALE PARENT?BROWN
??BLUE

GENOTYPE OF MALE PARENT?BROWN
??BLUE

HOW MANY OFFSPRING DO YOU WANT TO STUDY?15

DETAILED REPORT (YES OR NO)?NO

****

GENOTYPE RATIO 1 : 1.6 : .4
PHENOTYPE RATIO 6.5 : 1

##########

WANT ANOTHER RUN (YES OR NO)?NO

DONE

TITLE:

GRASSLANDS ECOLOGY SIMULATION

GRAZE
36746

DESCRIPTION:

This program deals with the ecology of a grasslands region and allows the student to vary animal population in order to attain an ecological balance. The populations of cattle, songbirds, hawks, rodents and grasshoppers are considered. The user is referred to the supplementary materials that describe detailed operation of the program in the curriculum material listed below.

INSTRUCTIONS:

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5653	Student Manual
HP 5951-5654	Teacher's Guide
HP 5951-5655	Classroom Set (30 Student Manuals and 1 Teacher's Guide)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Course(s): General Science, Biology, Environmental Studies

Student Background Required: None (Grades 7-12)

ACKNOWLEDGEMENTS: Michael Chester/Irv Brenner

```
RUN

WHAT'S YOUR NAME?IRV BRENNER

HOW MANY CATTLE?300
HOW MANY SONGBIRDS?5000
HOW MANY HAWKS?5

YEAR  CATTLE  SONGBIRDS  HAWKS  RODENTS/ACRE  G'HOPPERS/ACRE
 0.0    300       5000    5.0           200           10000
 0.5    288       5273    5.0           306           14528
 1.0    276       5691    5.6           478            9251
 1.5    277       5503    6.0           455           12134
 2.0    291       3998    5.7           419            9541

YOUR SCORE IS 60.7

COMPLETE SUMMARY?NO

15.0    295       4856    12.2          195            9867

HOW MANY CATTLE?0

DONE


RUN
GRAZE

WHAT'S YOUR NAME?IRV BRENNER

HOW MANY CATTLE?400
HOW MANY SONGBIRDS?8000
HOW MANY HAWKS?10

YEAR  CATTLE  SONGBIRDS  HAWKS  RODENTS/ACRE  G'HOPPERS/ACRE
 0.0    400       8000   10.0           200           10000
 0.5    440       7313    9.5           243           11183
 1.0    402       6038   10.3           254           10786
 1.5    421       5370   11.0           252           12884
 2.0    435       5538   12.6           225           10615

YOUR SCORE IS 90.8

COMPLETE SUMMARY?YES

 2.5    420       5275   11.9           210           13103
 3.0    420       5495   13.4           211           10247
 3.5    431       5796   12.5           212           11959
 4.0    392       5334   13.6           184           11008
 4.5    383       5472   13.7           206           11810
 5.0    396       5780   12.7           201           11164
 5.5    386       5417   12.8           184           13996
 6.0    377       5363   13.1           174           10133
 6.5    409       5203   11.8           200           13472
 7.0    377       4791   12.1           218           10150
 7.5    411       4993   14.4           217           13109
 8.0    365       4888   11.8           188           10685
 8.5    398       4736   11.0           239           13850
 9.0    425       5601   12.0           229            9225
 9.5    396       5698   12.4           192           14088
10.0    366       5215   12.4           204           11106
10.5    364       5532   13.3           201           13478
11.0    363       5103   12.1           219           10396
11.5    377       5637   14.1           199           14167
12.0    369       4982   11.5           210            9731
12.5    411       5265   11.7           202           12752
13.0    381       5234   12.3           219           10959
13.5    436       4970   15.0           184           14175
14.0    374       5561   12.2           198           10268
14.5    366       5474   12.3           233           12946
15.0    361       5467   13.2           218            9913

HOW MANY CATTLE?0

DONE
```

HZLIFE
36134

TITLE: HALF-LIFE SIMULATION

DESCRIPTION:

The program simulates the decay of 1000 radioactive nucleii by simulating the tossing of 1000 20-sided dice. One side of each dice is assumed to be marked, so that if that side is up after the toss, the nucleus that it represents is considered to have decayed. After each toss, those dice which have decayed are removed from the experiment, since they cannot decay a second time. Output includes a table of number of toss, number of decays, number remaining, a graph of decays as a function of time, a table of number of toss, number of decays, logarithm of number of decays, a graph of logarithm of decays as a function of time, and calculation of decay constant using least squares, plus a calculation of the percent error of this calculation.

INSTRUCTIONS:

Answer any questions either Yes or No.

Total execution time if the entire program is run will be about 12 minutes.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Physics, Physical Science, General Science, Chemistry.

Student Background Required: Appropriate to study of radioactive decay and/or half-life in typical junior or senior high school.

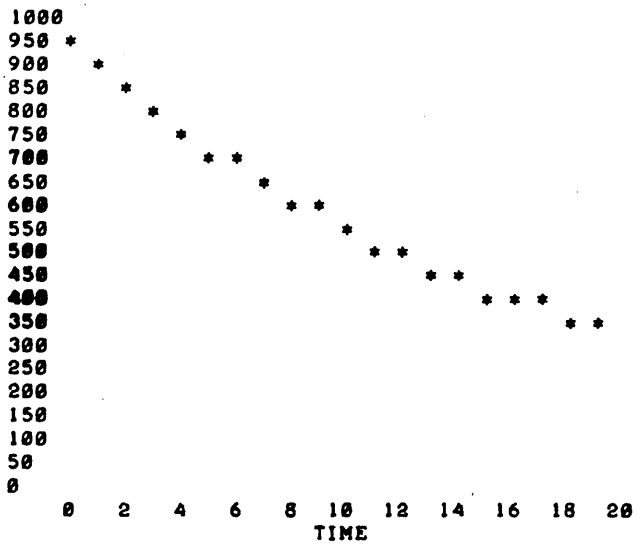
The program could be used to supplement or replace laboratory experiments in the courses noted. Teachers may wish to omit the logarithum and decay constant portions for junior high or for general science classes.

ACKNOWLEDGEMENTS: Donald E. Gettinger
Stillwater Senior High School

RUN

```
RUN
HZLIFE

DO YOU NEED EXPLANATION?NO
IT WILL TAKE ABOUT 3 MINUTES TO TOSS THE DICE
20 PIMES BEFORE ANY FURTHER PRINTING WILL OCCUR.

NO. OF TOSS     NO OF DECAYS    NO. REMAINING
-----------     ------------    -------------
 1               50              950
 2               49              901
 3               44              857
 4               43              814
 5               40              774
 6               37              737
 7               36              701
 8               36              665
 9               33              632
 10              29              603
 11              29              574
 12              28              546
 13              28              518
 14              25              493
 15              24              469
 16              23              446
 17              22              424
 18              21              403
 19              20              383
 20              19              364


DECAYS AS A FUNCTION OF TIME (TOSSES)

 75
 72
 69
 66
 63
 60
 57
 54
 51
 48  * *
 45
 42      * *
 39          *
 36            * * *
 33                *
 30
 27                  * * * *
 24                        * *
 21                            * * *
 18                                * *
 15
 12
 9
 6
 3
 0
     0   2   4   6   8  10  12  14  16  18  20
                    TIME

NOTE:TIME=0 IS TOSS NO. 1, TIME=1 IS TOSS NO. 2, ETC.
```

NUMBER REMAINING AS A FUNCTION OF TIME (TOSSES)

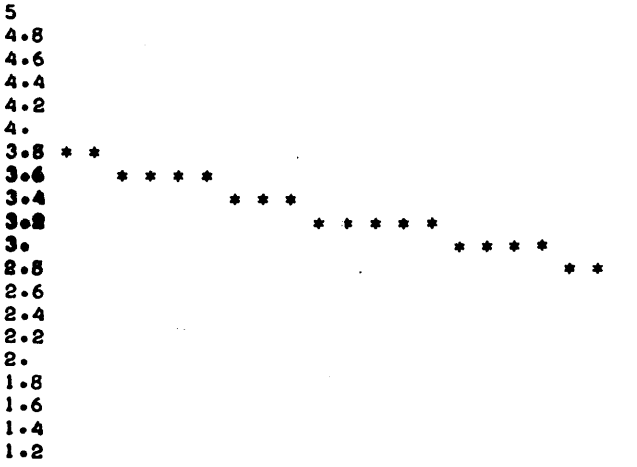


NOTE:TIME=0 IS TOSS NO. 1, TIME=1 IS TOSS NO. 2, ETC.

DO YOU WISH TO HAVE TABLE OF LN OF DECAYS, GRAPH
OF LN DECAYS VS. TIME, AND DECAY CONSTANT?YES

NO. OF TOSS	NO. OF DECAYS	LN OF NO. OF DECAYS
1	50	3.91202
2	49	3.89182
3	44	3.78419
4	43	3.7612
5	40	3.68888
6	37	3.61092
7	36	3.58352
8	36	3.58352
9	33	3.49651
10	29	3.3673
11	29	3.3673
12	28	3.3322
13	28	3.3322
14	25	3.21888
15	24	3.17805
16	23	3.13549
17	22	3.09104
18	21	3.04452
19	20	2.99573
20	19	2.94444

LN OF DECAYS AS A FUNCTION OF TIME (TOSSES)



```
 1.
 .800003
 .600003
 .400003
 .200003
 2.80142E-06
    0   2   4   6   8  10  12  14  16  18  20
                      TIME

NOTE:TIME=0 IS TOSS NO. 1, TIME=1 IS TOSS NO. 2, ETC.


SLOPE OF THE LINE JUST PLOTTED IS -5.09096E-02
THIS SLOPE IS THE DECAY CONSTANT
ACCEPTED VALUE FOR THE DECAY CONSTANT IS -0.05000
PER CENT ERROR IN DECAY CONSTANT IS  1.81913

DONE
```

TITLE: DRILL ON FORMULAS AND CHARGES OF IONS

IONIC
36260

DESCRIPTION:

This program randomly generates a total of 10 ions. The student is given five seconds to input the formula, and five seconds to input the charge. If he is too slow, or incorrect, the correct answer is printed. A summary is given at the end of the drill.

INSTRUCTIONS:

The user is asked to input his name. The program prompts the student to give the correct answers on formulas and charges.

SPECIAL CONSIDERATIONS:

The value of TO set in line 5 governs the amount of time given to respond, N in line 30 governs how many ions are stored in the DATA lines, AO controls how many ions are given as questions, and is set in line 32. Any of these can be changed by altering the appropriate line. Use the DATA statements (lines 88-1010) as a model for adding more ions, if desired.

FOR INSTRUCTIONAL PURPOSES:
Suitable Courses: Chemistry

Student Background Required: Knowledge of ions, their formulas and charges.

ACKNOWLEDGEMENTS:

Phillip Short
Burnsville Senior High School

RUN

```
RUN
IONIC

WHAT IS YOUR NAME?PHILLIP SHORT

                    IONS AND THEIR CHARGES.

WHAT IS THE FORMULA OF THE NICKEL ION?
NI
RIGHT!!
WHAT IS THE CHARGE ON THE NICKEL ION?
2
CORRECT!!

WHAT IS THE FORMULA OF THE CUPROUS ION?
CU
RIGHT!!
WHAT IS THE CHARGE ON THE CUPROUS ION?
1
CORRECT!!

WHAT IS THE FORMULA OF THE MERCUROUS ION?
HG
RIGHT!!
WHAT IS THE CHARGE ON THE MERCUROUS ION?
1
CORRECT!!

WHAT IS THE FORMULA OF THE BARIUM ION?
BA
RIGHT!!
WHAT IS THE CHARGE ON THE BARIUM ION?
2
CORRECT!!

WHAT IS THE FORMULA OF THE IODIDE ION?
I
RIGHT!!
WHAT IS THE CHARGE ON THE IODIDE ION?
-1
CORRECT!!

WHAT IS THE FORMULA OF THE CHROMATE ION?

TOO SLOW!!
THE ANSWER IS CRO4 !!!!
MAYBE YOU KNOW ITS CHARGE...
WHAT IS THE CHARGE ON THE CHROMATE ION?
-2
CORRECT!!

WHAT IS THE FORMULA OF THE LITHIUM ION?
LI
RIGHT!!
WHAT IS THE CHARGE ON THE LITHIUM ION?
1
CORRECT!!

WHAT IS THE FORMULA OF THE CARBONATE ION?
CO3
RIGHT!!
WHAT IS THE CHARGE ON THE CARBONATE ION?
-2
CORRECT!!

WHAT IS THE FORMULA OF THE NITRATE ION?
NO
TOO SLOW!!
THE ANSWER IS NO3 !!!!
MAYBE YOU KNOW ITS CHARGE...
WHAT IS THE CHARGE ON THE NITRATE ION?
-1
CORRECT!!
```

```
WHAT IS THE FORMULA OF THE MAGNESIUM ION?
MG
RIGHT!!
WHAT IS THE CHARGE ON THE MAGNESIUM ION?
2
CORRECT!!

-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=

                                        PHILLIP SHORT

YOU GOT BOTH PARTS RIGHT FOR  8     IONS.

YOU GOT  ONE PART  RIGHT FOR  2     IONS.

YOU GOT BOTH PARTS WRONG FOR  0    IONS.

-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=-=

DONE
```

CONTRIBUTED PROGRAM **BASIC**

IONIC1
36266

TITLE: DRILL ON FORMULAS OF IONIC COMPOUNDS

DESCRIPTION:

This program randomly selects a positive and negative ion, and asks the user for the chemical formula of the simplest resulting compound.

INSTRUCTIONS:

Conventions used in formula input.

1. If there is more than one molecule of an ion, the number of molecules of this ion follows the ion's formula.
2. Put parenthesis around the formula if the ion is multiatomic and it occurs more than once in the compound.
3. The cation is given first, then the negative ion. (anion)
4. Give the simplest form of the compound.

   i.e. give H_4O_2 as H_2O.

   but leave $Cu_2\ C_2O_4$ as is.

Ten pairs of ions are given. The response time is 15 seconds to input the name of each compound.

SPECIAL CONSIDERATIONS:

23 common cations and 18 common anions are stored in the data lines at the end of the program. The cations are given first, the anions last. The format used is name, formula, charge. If the user adds any more, change lines 40 and 70 to the appropriate values, and change the dimensions of matrices A and C, if necessary. To add more multiatomic cations, add the line(s) after 400 that read the same as 400 except they have the formula of the added multiatomic cation(s) in the quotes. To add multiatomic anions which have only two letters (like OH) add lines after 530 paralleling the construction of 530. If a user wants the question to give the formula of the ions, change the A$ and C$ in line 700 to B$ and D$. Line 30 controls how many problems are given. To vary the time given to respond, change line 710 to ENTER n, Z, G$, where n is an integer between 1 and 255.

For INSTRUCTIONAL PURPOSES
Suitable Courses: Chemistry

Student Background Required: Memorization of ion names, formulas, charges, and of how to combine them to get compounds.

ACKNOWLEDGEMENTS:

Phillip Short
Burnsville Senior High School

RUN

```
RUN
IONIC1

IONIC BONDS

WHAT IS THE COMPOUND FORMED FROM SODIUM AND HYDROXIDE .
NAOH
 THAT IS  CORRECT... VERY GOOD!!!!!
 YOU HAVE ANSWERED 1      CORRECTLY OUT OF 1     .



WHAT IS THE COMPOUND FORMED FROM LITHIUM AND PERMANGANATE .

 TOO SLOW!!! THE ANSWER IS LIMNO4.
 YOU HAVE ANSWERED 1      CORRECTLY OUT OF 2     .


WHAT IS THE COMPOUND FORMED FROM MERCURIC AND PHOSPHATE .
HG
 TOO SLOW!!! THE ANSWER IS HG3(PO4)2.
 YOU HAVE ANSWERED 1      CORRECTLY OUT OF 3     .



WHAT IS THE COMPOUND FORMED FROM CALCIUM AND IODIDE .
CA14
NO THE ANSWER IS CAI2.
 YOU HAVE ANSWERED 1      CORRECTLY OUT OF 4     .



WHAT IS THE COMPOUND FORMED FROM HYDROGEN AND CHLORIDE .
HOCL
NO THE ANSWER IS HCL.
 YOU HAVE ANSWERED 1      CORRECTLY OUT OF 5     .



WHAT IS THE COMPOUND FORMED FROM STANNOUS AND DICHROMATE .
STCH2
NO THE ANSWER IS SNCR207.
 YOU HAVE ANSWERED 1      CORRECTLY OUT OF 6     .



WHAT IS THE COMPOUND FORMED FROM CHROMOUS AND FLUORIDE .
CRFLØ3
NO THE ANSWER IS CRF2.
 YOU HAVE ANSWERED 1      CORRECTLY OUT OF 7     .



WHAT IS THE COMPOUND FORMED FROM MERCUROUS AND NITRATE .
HGNØ3
NO THE ANSWER IS HGNO3.
 YOU HAVE ANSWERED 1      CORRECTLY OUT OF 8     .

AGCH3COO
 THAT IS  CORRECT... VERY GOOD!!!!!
 YOU HAVE ANSWERED 2      CORRECTLY OUT O



WHAT IS THE COMPOUND FORMED FROM LEAD AND CARBONATE .
PB(CO2)2
NO THE ANSWER IS PBCO3.
 YOU HAVE ANSWERED 1      CORRECTLY OUT OF 9     .

 YOU WERE WRONG  6     TIMES.
 YOU WERE TOO SLOW  2      TIMES.

DONE

WHAT IS THE COMPOUND FORMED FROM SILVER AND ACETATE .
```

ISOMER
36261

TITLE: DRILL ON NAMING ALKANES

DESCRIPTION:

This program generates names of up to ten alkanes randomly, and prints out representations of them on the teletype, then names them. The number of alkanes (of lengths up to ten carbons in the main chain) is controllable (via input), as is the total number of carbons in the alkyl side chains (by altering a line). In a given run there are no duplications.

INSTRUCTIONS:

The only input required is the number of hydrocarbons to be printed. One file, (ISO-1), is required. It should have a length of about 512 words, or eight records on the HP 2000B. This file serves as a temporary storage for strings used in naming the alkanes. If the name of the first two alkanes are 2,3-dimethylpentane and 3,4-dimethyl-5,6-diethyl-4,5-dibutyldecane respectively the strings stored in the file will be "2,3-DIMETHYLPENTANE", "3,4-DIMETHYL", "5,6-DIETHYL", "-4,5-DIBUTYLDECANEN".

SPECIAL CONSIDERATIONS:

The length of the larges number of carbon atoms in all the side chains may be altered by changing line 9 to 9 LET MO=n, where n is this number. This is just an upper limit, not a lower, and the actual number is limited also by the number (randomly-generated) of carbons in the main chain.

FOR INSTRUCTIONAL PURPOSES

Suitable Courses: Organic Chemistry

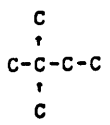
Student Background Required: Knowledge of how to name simple alkanes (with side chains). This program is written with the intention that the student run the program and take the output back to his desk. He conceals the answers from his view, and names the chemicals, checking his answers when he is done.

ACKNOWLEDGEMENTS:

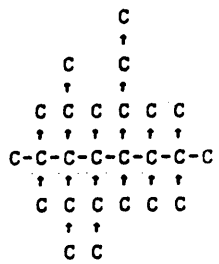
Phillip Short
Burnsville Senior High School

```
RUN

RUN
ISOMER
                ALKANES WITH SIMPLE ALKYL SIDECHAINS

HOW MANY HYDROCARBONS DO YOU WANT PRINTED?5
```

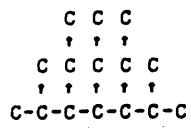
(1)



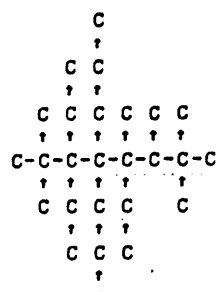
(2)



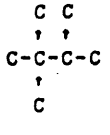
(3)



(4)



(5)



```
( 1 )   2,2-DIMETHYLBUTANE

( 2 )   2,2,4,5,6,6,7,7-OCTAMETHYL-3,3,4-TRIETHYL-5-PROPYLOCTANE

( 3 )   2,6-DIMETHYL-3,4,5-TRIETHYLHEPTANE

( 4 )   2,2,5,6,7,7-HEXAMETHYL-3,3,5-TRIETHYL-4,4-DIPROPYLOCTANE

( 5 )   2,2,3-TRIMETHYLBUTANE

**********************************************************************

DONE
```

KINERV
36315

TITLE: KINERV: Review of Kinematics

DESCRIPTION:

Questions are asked concerning the motion of a ball thrown vertically upwards at various velocities. Neglecting air resistance, the student is to determine such quantities as 1) maximum obtainable height; 2) time of flight; and 3) the height reached at different times.

OBJECTIVES:

To develop and review basic skills in solving projectile motion problems.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - previous classroom instruction and a working knowledge of algebra.

B. Materials - none

DISCUSSION:

The student is presented with various problems concerning the motion of the ball. In each case, the initial velocity V_0 of the ball is given. There are five basic questions asked:

1. Determine maximum height reached;
2. Find the height after t seconds;
3. Find the velocity when the ball is at height h;
4. Determine the time of flight; and
5. Find the velocity after t seconds.

The quantities V_0, h, and t are randomly determined for each question asked and the correct answers are given following the student response.

The program is designed to serve as a review of typical motion problems discussed in class and to aid in overcoming student "uncertainty" in the solution of numerical problems.

The program may be modified to cover other areas of review by entering new questions in place of those presently offered (see listing).

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN
RUN
KINERV

                ---REVIEW OF KINEMATICS---

     A BALL IS THROWN STRAIGHT UP AT VARIOUS VELOCITIES.
AIR FRICTION IS NEGLIGIBLE. THE UPWARD DIRECTION IS TAKEN
AS POSITIVE, AND THE DOWNWARD DIRECTION AS NEGATIVE.

THE LOCAL ACCELERATION DUE TO GRAVITY IS -10 METERS/SECOND/SEC

ALL VALUES ARE IN M.K.S. METRIC UNITS.

     FOR VARIOUS THROWING SPEEDS, YOU MUST ANSWER CERTAIN
QUESTIONS ABOUT THE BALL IN FLIGHT.


 1     . THE UPWARD THROWING SPEED IS  15     METERS/SECOND.
WHAT IS THE VELOCITY AFTER  1.9          SECONDS OF FLIGHT?-4
YOU'RE CORRECT WITHIN 5 PERCENT. THE CORRECT ANSWER IS -4


 2     . THE UPWARD THROWING SPEED IS  38     METERS/SECOND.
HOW HIGH ABOVE THE GROUND WILL THE BALL GO?28
YOU'RE OFF MORE THAN 5 PERCENT. THE CORRECT ANSWER IS  72.2


 3     . THE UPWARD THROWING SPEED IS  30     METERS/SECOND.
HOW LONG WILL IT TAKE THE BALL TO RETURN TO THE GROUND?6.0
YOU'RE CORRECT WITHIN 5 PERCENT. THE CORRECT ANSWER IS  6


 4     . THE UPWARD THROWING SPEED IS  22     METERS/SECOND.
WHAT IS THE VELOCITY WHEN IT REACHES A HEIGHT OF  12.2
METERS ABOVE THE GROUND ?16
YOU'RE CORRECT WITHIN 5 PERCENT. THE CORRECT ANSWER IS  15.4919


 5     . THE UPWARD THROWING SPEED IS  17     METERS/SECOND.
WHAT IS THE VELOCITY AFTER  2.2          SECONDS OF FLIGHT?-4
YOU'RE OFF MORE THAN 5 PERCENT. THE CORRECT ANSWER IS -5.


OUT OF  5      QUESTIONS, YOU GOT  3      RIGHT.
DON'T YOU KNOW ANYTHING ABOUT THROWING THINGS UP???

WANT TO TRY ANOTHER 5 PROBLEMS (1=YES, 0=NO) : ?0

DONE
```

TITLE:

KINET

KINET: Kinetic Reaction 36309

DESCRIPTION:

A class room presentation designed to calculate equilibrium concentrations and graph the progress (concentration vs. time) from initiation to equilibrium for the general reaction $A \rightleftharpoons P$.

OBJECTIVES:

A. An understanding of Equilibrium

B. The significance of the magnitude of the Equilibrium constant.

C. The relationship of the rate constant to the point of equilibrium.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student

1. The distinction between initial and equilibrium concentration should be made very clear.

2. The meaning of the terms "Rate constant" and "Equilibrium constant".

B. Materials - none

DISCUSSION:

To insure the success of this program in a teaching situation, the teacher should run the program prior to its use in the classroom. This is necessary to insure that the choice of constants illustrates the point to be made and the amount of classroom time be kept to a minimum.

By varying the equilibrium constant it is possible to move the point of equilibrium on the concentration axis, and show the relative concentrations of product and reactant as a function of the value of the equilibrium constant.

The effect of different rate constants on the time it takes to attain equilibrium can also be shown. The point at which the two curves approach a straight line is the point of equilibrium (if the two curves intersect a dot is used as the point).

In this program, time is plotted in ten equal steps from initiation of the reaction to equilibrium. The time to attain equilibrium is different depending on the constant used. It should be pointed out that while the point of equilibrium on the graph may appear to be at the same spot, the units of time are changing, thus the point on the graph is different.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN.
KINET

  FOR THE EQUILIBRIUM PROBLEMS YOU ARE ABOUT TO DO, THE
  DATA MAY BE PRESENTED IN THE FOLLOWING MANNER:
     (INDICATE YOUR CHOICE BY NUMBER)

           CHOICE 1 = TABLE OF DATA
           CHOICE 2 = GRAPH OF DATA
           CHOICE 3 = TABLE AND GRAPH OF DATA
           CHOICE 4 = END PROGRAM

 WHAT IS YOUR CHOICE?3

 LET F = THE FORWARD RATE CONSTANT
 LET K = THE EQUILIBRIUM CONSTANT FOR THE REACTION A =P
 TYPE IN THE CONSTANTS F AND K IN THAT ORDER.
?5,1

              ******************************

 LET A1 = ORIGINAL CONCENTRATION (  A
 LET A = PERCENT CONCENTRATION OF A  (A/A1*100)
 LET P = PERCENT CONCENTRATION OF P  (P/A1*100)

 TIME            A              P
 ----            ---            ---
 0               100            0
 .05             80.3265        19.6735
 .1              68.394         31.606
 .15             61.1565        38.8435
 .2              56.7668        43.2332
 .25             54.1043        45.8958
 .3              52.4893        47.5107
 .35             51.5099        48.4901
 .4              50.9158        49.0842
 .45             50.5555        49.4445
 .5              50.3369        49.6631

                  PERCENT CONCENTRATION OF A(*) AND P(+)

               0         25         50         75         100
  TIME         I---------I---------I---------I---------I
 0             I+                                      *
 .05           I      +                          *
 .1            I          +                  *
 .15           I              +          *
 .2            I               +       *
 .25           I                +     *
 .3            I                 + *
 .35           I                 + *
 .4            I                  .
 .45           I                  .
 .5            I                  .

 WHAT IS YOUR CHOICE?2

 LET F = THE FORWARD RATE CONSTANT
 LET K = THE EQUILIBRIUM CONSTANT FOR THE REACTION A =P
 TYPE IN THE CONSTANTS F AND K IN THAT ORDER.
?5,0.1

              ******************************
```

```
                    PERCENT CONCENTRATION OF A(*) AND P(+)

                   0         25         50         75         100
    TIME           I---------I---------I---------I---------I
    0              I+                                       *
    .05            I +                                    *
    .1             I  +                                   *
    .15            I  +                                   *
    .2             I  +                                   *
    .25            I  +                                   *
    .3             I  +                                   *
    .35            I  +                                   *
    .4             I  +                                   *
    .45            I  +                                   *
    .5             I  +                                   *

    WHAT IS YOUR CHOICE?0
    YOUR CHOICE MUST BE A NUMBER BETWEEN 1 AND 4, TRY AGAIN.

    WHAT IS YOUR CHOICE?4

DONE
```

LANDIN
36670

TITLE: COMPUTER-AUGMENTED PHYSICS TOPICS (NEWTON)

DESCRIPTION:

This program, written by a high school student at Project Solo, calculates the stopping distance for a simulated aircraft landing on an airfield or aircraft carrier. Two types of output are available:

1. A listing of landing distances for progressively large aircraft mass and landing speed.
2. A single calculation for one value each of mass and speed.

INSTRUCTIONS:

The program asks the user to choose the type of output (see above).

If option 1 has been chosen, the user enters:

a. Landing speeds - smallest value, greatest value, step size
b. Mass - smallest value, greatest value, step size
c. Runway - length and width

continued on following page

SPECIAL CONSIDERATIONS:

This program accompanies the Project Solo Module "Computer-Augmented Physics Topics" of the Hewlett Packard Curriculum Series.

This program is a sample answer to a student problem presented in Computer-Augmented Physics Topics, a Physics module from the Project Solo Series.

Information on actual aircraft (lines 500-590) may need to be updated from time to time, and as desired by the teacher.

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Physics

Student Background Required: Newtonian laws of motion (concurrent)

This is a sample solution to a problem for the student. It may be desired to provide access to this program only after the student has attacked the problem in his or her own way.

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5648 Computer-Augmented Physics Topics (student text)
HP 5951-5649 Computer-Augmented Physics Topics (problem solutions)
HP 5951-5650 Computer-Augmented Physics Topics (classroom set - 30 student books and 1 problem solutions)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS:

Project Solo
University of Pittsburgh

Instructions - continued

d. Braking strength of the retaining barrier

e. A value determining the accuracy (roundoff) of the calculations.

If option 2 has been chosen, the user enters:

a. Mass and landing speed (one value for each)

followed by c., d., and e. as given above.

The program contains information on the range of mass and landing speed in representative civilian aircraft, which the student can request.

RUN

```
PLEASE USE THE METRIC SYSTEM THROUGHOUT.
WOULD YOU LIKE SOME ACTUAL FIGURES FOR
AIRCRAFT CARRIERS (0=NO, 1=YES)?
?1
ON AN AIRCRAFT CARRIER, THE RUNOUT DISTANCE IS
ABOUT 305 METERS.
THE MASS AND LANDING SPEED OF REAL AIRPLANES RANGE
FROM ABOUT 419 KG AND 72.5 KM/HR FOR THE BOWERS
FLY BABY 1-A, TO ABOUT 157,500 KG AND 230 KM/HR FOR
THE LONG-RANGE RUSSIAN AIRLINER, ILYUSHIN 11-62.
THE MASS OF THE BOEING 747-21 IS ABOUT 236,815 KG.

DO YOU WANT A LISTING WITH PROGRESSIVELY LARGER
MASS AND SPEED (0=NO, 1=YES)?
?1
INPUT THE SMALLEST AND GREATEST VALUE OF THE LANDING
SPEEDS AND THE STEP SIZE IN KM/HR.
?80,240,40
NOW, DO THE SAME FOR THE AIRPLANE'S MASS IN KG.
?400,4400,400
INPUT THE RUNOUT DISTANCE AND THE RUNWAY WIDTH
IN METERS.
?1000,200
INPUT THE BRAKING STRENGTH (NEGATIVE) IN NEWTONS.
?-5000
MY CALCULATIONS ARE ACCURATE TO THE NEAREST N METERS.
INPUT A VALUE FOR N.
?10
 400  KG
        80   KM/HR
           LANDING DISTANCE = 70   M
        120  KM/HR
           LANDING DISTANCE = 100  M
        160  KM/HR
           LANDING DISTANCE = 140  M
        200  KM/HR
           LANDING DISTANCE = 170  M
        240  KM/HR
           LANDING DISTANCE = 210  M
 800  KG
        80   KM/HR
           LANDING DISTANCE = 100  M
        120  KM/HR
           LANDING DISTANCE = 150  M
        160  KM/HR
           LANDING DISTANCE = 200  M
        200  KM/HR
           LANDING DISTANCE = 260  M
        240  KM/HR
           LANDING DISTANCE = 330  M
 1200    KG
        80   KM/HR
           LANDING DISTANCE = 120  M
        120  KM/HR
           LANDING DISTANCE = 180  M
        160  KM/HR
           LANDING DISTANCE = 250  M
        200  KM/HR
           LANDING DISTANCE = 330  M
        240  KM/HR
           LANDING DISTANCE = 430  M
```

```
1600    KG
       80   KM/HR
          LANDING DISTANCE = 140  M
       120  KM/HR
          LANDING DISTANCE = 210  M
       160  KM/HR
          LANDING DISTANCE = 300  M
       200  KM/HR
          LANDING DISTANCE = 400  M
       240  KM/HR
          LANDING DISTANCE = 520  M
2000    KG
       80   KM/HR
          LANDING DISTANCE = 150  M
       120  KM/HR
          LANDING DISTANCE = 240  M
       160  KM/HR
          LANDING DISTANCE = 350  M
       200  KM/HR
          LANDING DISTANCE = 470  M
       240  KM/HR
          LANDING DISTANCE = 620  M
2400    KG
       80   KM/HR
          LANDING DISTANCE = 170  M
       120  KM/HR
          LANDING DISTANCE = 270  M
       160  KM/HR
          LANDING DISTANCE = 390  M
       200  KM/HR
          LANDING DISTANCE = 540  M
       240  KM/HR
          LANDING DISTANCE = 710  M
2800    KG
       80   KM/HR
          LANDING DISTANCE = 190  M
       120  KM/HR
          LANDING DISTANCE = 300  M
       160  KM/HR
          LANDING DISTANCE = 440  M
       200  KM/HR
          LANDING DISTANCE = 600  M
       240  KM/HR
          LANDING DISTANCE = 800  M
3200    KG
       80   KM/HR
          LANDING DISTANCE = 200  M
       120  KM/HR
          LANDING DISTANCE = 330  M
       160  KM/HR
          LANDING DISTANCE = 480  M
       200  KM/HR
          LANDING DISTANCE = 670  M
       240  KM/HR
          LANDING DISTANCE = 890  M
3600    KG
       80   KM/HR
          LANDING DISTANCE = 210  M
       120  KM/HR
          LANDING DISTANCE = 350  M
       160  KM/HR
          LANDING DISTANCE = 520  M
       200  KM/HR
          LANDING DISTANCE = 730  M
       240  KM/HR
          LANDING DISTANCE = 980  M
4000    KG
       80   KM/HR
          LANDING DISTANCE = 230  M
       120  KM/HR
          LANDING DISTANCE = 380  M
       160  KM/HR
          LANDING DISTANCE = 570  M
       200  KM/HR
          LANDING DISTANCE = 800  M
       240  KM/HR
THE PLANE COULD NOT BE STOPPED IN 1000    METERS.
4400    KG
```

```
        80   KM/HR
           LANDING DISTANCE = 240  M
        120  KM/HR
           LANDING DISTANCE = 400  M
        160  KM/HR
           LANDING DISTANCE = 610  M
        200  KM/HR
           LANDING DISTANCE = 860  M
        240  KM/HR
THE PLANE COULD NOT BE STOPPED IN 1000    METERS.
WELL, I'M FINALLY FINISHED NOW.  GOODBYE !

DONE



RUN
LANDIN

PLEASE USE THE METRIC SYSTEM THROUGHOUT.
WOULD YOU LIKE SOME ACTUAL FIGURES FOR
AIRCRAFT CARRIERS (0=NO, 1=YES)?
?0

DO YOU WANT A LISTING WITH PROGRESSIVELY LARGER
MASS AND SPEED (0=NO, 1=YES)?
?0
INPUT THE MASS IN KG, AND THE LANDING SPEED IN KM/HR.
?157500,230
INPUT THE RUNOUT DISTANCE AND THE RUNWAY WIDTH
IN METERS.
?1000,250
INPUT THE BRAKING STRENGTH (NEGATIVE) IN NEWTONS.
?-5000
MY CALCULATIONS ARE ACCURATE TO THE NEAREST N METERS.
INPUT A VALUE FOR N.
?10
THE PLANE COULD NOT BE STOPPED IN 1000    METERS.
LIKE TO TRY AGAIN, WITH DIFFERENT VALUES (0=NO, 1=YES)
?1
INPUT THE MASS IN KG, AND THE LANDING SPEED IN KM/HR.
?157500,230
INPUT THE RUNOUT DISTANCE AND THE RUNWAY WIDTH
IN METERS.
?7500,250
INPUT THE BRAKING STRENGTH (NEGATIVE) IN NEWTONS.
?-10000
MY CALCULATIONS ARE ACCURATE TO THE NEAREST N METERS.
INPUT A VALUE FOR N.
?50
THE PLANE COULD NOT BE STOPPED IN 7500    METERS.
LIKE TO TRY AGAIN, WITH DIFFERENT VALUES (0=NO, 1=YES)
?1
INPUT THE MASS IN KG, AND THE LANDING SPEED IN KM/HR.
?150000,230
INPUT THE RUNOUT DISTANCE AND THE RUNWAY WIDTH
IN METERS.
?5000,200
INPUT THE BRAKING STRENGTH (NEGATIVE) IN NEWTONS.
?-100000
MY CALCULATIONS ARE ACCURATE TO THE NEAREST N METERS.
INPUT A VALUE FOR N.
?100
THE PLANE WAS SUCCESSFULLY STOPPED.
ITS LANDING DISTANCE WAS 1800    M
LIKE TO TRY AGAIN, WITH DIFFERENT VALUES (0=NO, 1=YES)
?0

DONE
```

LENSES
36630

TITLE: SOLVES LENS PROBLEMS

DESCRIPTION:

The focal length, object distance, image distance, image size, or object size, may be calculated if sufficient information is entered by the student.

OBJECTIVES:

A. To solve for focal length of a lens from laboratory data.

B. To check image position and size from lab data.

C. To solve lens problems.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - Data from a lens experiment.

B. Materials - None

DISCUSSION:

If this program is used in conjunction with a lens laboratory, the student may check his calculations of focal length.

He may also check his image size and position from known object size and position.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN


RUN
LENSES
THIS PROGRAM MAY BE USED TO SOLVE LENS PROBLEMS.
IN THE ORDER GIVEN ENTER THE VALUES FOR THE FOLLOWING:
FOCAL LENGTH, OBJECT DISTANCE, IMAGE DISTANCE, OBJECT
SIZE, IMAGE SIZE.  INPUT 0 (ZERO) FOR UNKNOWN VALUES.
EVERY TIME THE COMPUTER ASKS 'READY?', ENTER 1 IF YOU HAVE
MORE PROBLEMS TO DO, OR 0 TO END THE PROGRAM.

*** READY ?1
WHAT ARE YOUR VALUES FOR F, P, Q, O, I?1,2,3,4,5
YOUR Q IS NOT CORRECT FOR THE F AND P YOU HAVE ENTERED
NOTE CHANGED Q.  THE PERCENT ERROR ON YOUR Q IS:
 50    PERCENT.
YOUR I IS NOT CORRECT FOR THE O YOU HAVE ENTERED
NOTE CHANGED I.  THE PERCENT ERROR ON YOUR I IS:
 25    PERCENT.
F= 1            P= 2            Q= 2            O= 4            I= 4

*** READY ?1
WHAT ARE YOUR VALUES FOR F, P, Q, O, I?1,2,2.04,4,3.9
YOUR Q IS CORRECT TO WITHIN  2.          %
NOTE CORRECTED Q.
YOUR I IS CORRECT TO WITHIN  2.5         %
NOTE CORRECTED I.
F= 1            P= 2            Q= 2            O= 4            I= 4

*** READY ?1
WHAT ARE YOUR VALUES FOR F, P, Q, O, I?0,5,8,4,4
YOUR I IS NOT CORRECT FOR THE O YOU HAVE ENTERED
NOTE CHANGED I.  THE PERCENT ERROR ON YOUR I IS:
 37.5         PERCENT.
F= 3.07692      P= 5            Q= 8            O= 4            I= 6.4

*** READY ?1
WHAT ARE YOUR VALUES FOR F, P, Q, O, I?46,53,0,34,32
YOUR I IS NOT CORRECT FOR THE O YOU HAVE ENTERED
NOTE CHANGED I.  THE PERCENT ERROR ON YOUR I IS:
 85.6777      PERCENT.
F= 46           P= 53           Q= 348.286      O= 34           I= 223.429

*** READY ?1
WHAT ARE YOUR VALUES FOR F, P, Q, O, I?4857,2,6,0,0
YOUR Q IS NOT CORRECT FOR THE F AND P YOU HAVE ENTERED
NOTE CHANGED Q.  THE PERCENT ERROR ON YOUR Q IS:
 399.876      PERCENT.
F= 4857         P= 2            Q=-2.00082


*** READY ?0
DONE
```

LOCKEY
36624

TITLE: LOCK & KEY MODEL OF ENZYME ACTION

DESCRIPTION:

This exercise allows the user to conduct a simulated experiment in competitive inhibition of the enzyme acetylcholinesterase.

INSTRUCTIONS:

The goal in this experiment is to determine which inhibitor chemical is most effective. In the computer simulation you can control: (1) amount of acetylocholine, (2) type of inhibitor chemical, and (3) amount of inhibitor.

Before running the program, the user should map out the experimental design and enter it on a Computer Input Sheet. Output may be in either table or graph form. The table prints out the amount of acetylchline remaining at the end of each tenth of a minute and the total acetic acid produced up to that time. The graph yields a plot of the amount of acetic acid produced versus the time (in tenths of a minute) since the onset of the reaction, with the amount of acetic acid produced (in millimoles) printed next to the appropriate point.

SPECIAL CONSIDERATIONS:

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

Student Workbook	$ .30
Teachers Guide	.30
Resource Handbook	.50

ACKNOWLEDGEMENTS:

Huntington II Project
State University of New York

```
RUN

RUN
LOCKEY

LOCKEY- A COMPETITIVE INHIBITION STUDY OF THE ENZYME
ACETYLCHOLINESTERASE FEATURING THE LOCK AND KEY HYPOTHESIS

DO YOU WISH INSTRUCTIONS? (1=YES, 0=NO)?1

  YOU ARE CONDUCTING AN INVESTIGATION OF THE ENZYME
 ACETYLCHOLINESTERASE.  FROM THE NAME YOU CAN TELL
 THAT THIS ENZYME WORKS ON THE CHEMICAL ACETYLCHOLINE.
 IT BREAKS ACETYLCHOLINE INTO ACETIC ACID AND CHOLINE.

  WE WANT TO INVESTIGATE WHICH INHIBITOR IS THE MOST
 EFFECTIVE IN SLOWING THE NORMAL ACTION OF THE ENZYME.
 THIS WILL GIVE US VALUABLE INFORMATION ON ITS ACTION.

      THE CODE FOR THE INHIBITORS IS:

         1= AMMONIUM
         2= DIMETHYLAMINE        BE SURE TO CONSULT
         3= METHYLAMINE          THE IMPORTANT STRUCTURAL
         4= PROSTIGMINE          FORMULAE LISTED IN THE
         5= TRIMETHYLAMINE       INFORMATION PACKET
         0= NO INHIBITOR

 IN THIS STUDY YOU CAN CONTROL:
       THE AMOUNT OF ACETYLCHOLINE
       THE TYPE OF INHIBITOR
       AND THE AMOUNT OF INHIBITOR

BY COMPARING THE STRUCTURE OF ACETYLCHOLINE WITH
THE STRUCTURE OF THE FIVE INHIBITORS YOU SHOULD
BE ABLE TO MAKE A HYPOTHESIS AS TO WHICH OF THE
FIVE INHIBITORS WILL BE THE MOST EFFECTIVE

   REMEMBER: INCLUDE YOUR KNOWLEDGE OF THE
   LOCK AND KEY MODEL OF ENZYME ACTION.

**********************************************************

AMOUNT OF ACETYLCHOLINE - FROM 0 TO 3 MILLIMOLES?2
TYPE OF INHIBITOR - USE CODE FROM 0 TO 5?0
DATA FORMAT: 1=TABLE, 2=GRAPH   TYPE NUMBER OF CHOICE?1


MINUTES      ACETYLCHOLINE   TOTAL ACETIC
ELAPSED      REMAINING       ACID PRODUCED
-------      ------------    -------------
 0               2               0
 .1              1.72            .28
 .2              1.43            .57
 .3              1.15            .85
 .4              .88             1.12
 .5              .61             1.39
 .6              .36             1.64
 .7              .14             1.86
 .8              .02             1.98
 .9              0               2
 THE REACTION HAS RUN TO COMPLETION

CONCENTRATION OF INHIBITIOR REMAINING: 0    MILLIMOLES

ANOTHER EXPERIMENT? (1=YES, 0=NO)?1

**********************************************************

AMOUNT OF ACETYLCHOLINE - FROM 0 TO 3 MILLIMOLES?2
TYPE OF INHIBITOR - USE CODE FROM 0 TO 5?1
AMOUNT OF INHIBITOR IN MILLIMOLES?100
DATA FORMAT: 1=TABLE, 2=GRAPH?1
```

```
MINUTES      ACETYLCHOLINE   TOTAL ACETIC
ELAPSED      REMAINING       ACID PRODUCED
-------      ------------    -------------
 0               2               0
 .1              1.72            .28
 .2              1.44            .56
 .3              1.16            .84
 .4              .88             1.12
 .5              .62             1.38
 .6              .37             1.63
 .7              .16             1.84
 .8              .03             1.97
 .9              0               2
 THE REACTION HAS RUN TO COMPLETION

CONCENTRATION OF INHIBITIOR REMAINING: 100  MILLIMOLES

ANOTHER EXPERIMENT? (1=YES, 0=NO)?1

**********************************************************

AMOUNT OF ACETYLCHOLINE - FROM 0 TO 3 MILLIMOLES?2
TYPE OF INHIBITOR - USE CODE FROM 0 TO 5?2
AMOUNT OF INHIBITOR IN MILLIMOLES?100
DATA FORMAT: 1=TABLE, 2=GRAPH?2

MIN.         MILLIMOLES ACETIC ACID PRODUCED
      0                          1                          2
      I....I....I....I....I....I....I....I....I....I....I....I
 0    I* 0
 .1        I* .23
 .2        I     * .46
 .3        I           * .68
 .4        I                 * .89
 .5        I                       * 1.09
 .6        I                             * 1.27
 .7        I                                   * 1.44
 .8        I                                         * 1.58
 .9        I                                               * 1.71
 1    I                                                     * 1.8
 1.1       I                                                  * 1.87
 1.2       I                                                    * 1.92
 1.3       I                                                      * 1.95
 1.4       I                                                      * 1.97
 1.5       I                                                        * 1.98
 1.6       I                                                        * 1.99
 1.7       I                                                        * 2
 THE REACTION HAS RUN TO COMPLETION

CONCENTRATION OF INHIBITIOR REMAINING: 100  MILLIMOLES

ANOTHER EXPERIMENT? (1=YES, 0=NO)?1

**********************************************************

AMOUNT OF ACETYLCHOLINE - FROM 0 TO 3 MILLIMOLES?2
TYPE OF INHIBITOR - USE CODE FROM 0 TO 5?3

AMOUNT OF INHIBITOR IN MILLIMOLES?100
DATA FORMAT: 1=TABLE, 2=GRAPH?2

MIN.         MILLIMOLES ACETIC ACID PRODUCED
      0                          1                          2
      I....I....I....I....I....I....I....I....I....I....I....I
 0    I* 0
 .1        I* .27
 .2        I      * .54
 .3        I            * .81
 .4        I                  * 1.07
 .5        I                        * 1.32
 .6        I                              * 1.55
 .7        I                                    * 1.75
 .8        I                                          * 1.9
 .9        I                                            * 1.98
 1    I                                                  * 2
 THE REACTION HAS RUN TO COMPLETION
```

```
CONCENTRATION OF INHIBITIOR REMAINING: 100  MILLIMOLES

ANOTHER EXPERIMENT? (1=YES, 0=NO)?1

**********************************************************

AMOUNT OF ACETYLCHOLINE - FROM 0 TO 3 MILLIMOLES?2
TYPE OF INHIBITOR - USE CODE FROM 0 TO 5?4
AMOUNT OF INHIBITOR IN MILLIMOLES?100
DATA FORMAT: 1=TABLE, 2=GRAPH?2

MIN.          MILLIMOLES ACETIC ACID PRODUCED
      0                          1                          2
      I....I....I....I....I....I....I....I....I....I....I....I
 0    I* 0
 .1           I* 0
 .2           I* 0
 .3           I* 0
 .4           I* 0
 .5           I* .01
 .6           I* .01
 .7           I* .01
 .8           I* .01
 .9           I* .01
 1    I* .01
 1.1          I* .01
 1.2          I* .01
 1.3          I* .01
 1.4          I* .01
 1.5          I* .02
 1.6          I* .02
 1.7          I* .02
 1.8          I* .02
 1.9          I* .02
 2    I* .02
DO YOU WANT TO CONTINUE THE ASSAY? (1=YES, 0=NO)?0

CONCENTRATION OF INHIBITIOR REMAINING: 100  MILLIMOLES

ANOTHER EXPERIMENT? (1=YES, 0=NO)?1

**********************************************************

AMOUNT OF ACETYLCHOLINE - FROM 0 TO 3 MILLIMOLES?2
TYPE OF INHIBITOR - USE CODE FROM 0 TO 5?5
AMOUNT OF INHIBITOR IN MILLIMOLES?100
DATA FORMAT: 1=TABLE, 2=GRAPH?2
```

```
MIN.          MILLIMOLES ACETIC ACID PRODUCED
      0                           1                           2
      I....I....I....I....I....I....I....I....I....I....I....I
 0    I* 0
 .1         I* .11
 .2         I* .21
 .3         I * .31
 .4         I   * .4
 .5         I     * .49
 .6         I        * .58
 .7         I          * .66
 .8         I            * .74
 .9         I              * .82
 1    I                    * .89
 1.1        I                * .96
 1.2        I                  * 1.03
 1.3        I                   * 1.09
 1.4        I                     * 1.15
 1.5        I                      * 1.21
 1.6        I                        * 1.26
 1.7        I                         * 1.31
 1.8        I                          * 1.36
 1.9        I                           * 1.4
 2    I                                 * 1.45
DO YOU WANT TO CONTINUE THE ASSAY? (1=YES, 0=NO)?1
 2.1        I                           * 1.48
 2.2        I                            * 1.52
 2.3        I                             * 1.56
 2.4        I                              * 1.59
 2.5        I                              * 1.62
 2.6        I                               * 1.65
 2.7        I                                * 1.67
 2.8        I                                * 1.7
 2.9        I                                 * 1.72
 3    I                                       * 1.74
DO YOU WANT TO CONTINUE THE ASSAY? (1=YES, 0=NO)?0

CONCENTRATION OF INHIBITIOR REMAINING: 100  MILLIMOLES

ANOTHER EXPERIMENT? (1=YES, 0=NO)?0




DONE
```

TITLE:

MALAR
MALARIA ERADICATION PROGRAM 36797

DESCRIPTION:

The MALAR unit provides a context within which to explore the economic, biological, political, and ecological ramifications of a classic example of a serious health problem. Often the problems of public health are viewed only as medical ones, when in fact they are also very much economic, political, and even ecological. A unit of study such as that suggested by MALAR can be of great assistance in helping students learn about, and gain an appreciation of these other factors related to health problems.

Many school programs are beginning to recognize the importance of the study of health at all levels and in the broad sense of the term. A unit like MALAR provides a novel, interesting core for a related unit of study. Since MALAR treats a classic health problem, it provides a springboard to considerations of other health problems.

At a more specific level, MALAR helps a student to learn something about epidemiology and the health problem of malaria. He can determine basic principlies of dealing with an epidemic disease. The computer program allows the student to become the decision-maker in a situation involving public health, and requires him to balance economic considerations with biological and medical ones. Using the computer simulation, the student has an opportunity to explore a public health situation from new perspectives and at the same time to develop some important inquiry and problem-solving skills.

INSTRUCTIONS:

This program simulates the attack phase of a malaria eradication plan. It allows the user to attempt to eradicate malaria from a given area within five years. The user can try to do this with or without a budget limitation.

SPECIAL CONSIDERATIONS:

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

Student Workbook	**$ .30**
Teachers Guide	**.30**
Resource Handbook	**.50**

ACKNOWLEDGEMENTS:

Huntington II Project
State University of New York

```
RUN

RUN
MALAR

DO YOU REQUIRE INSTRUCTIONS FOR MALAR (1=YES, 0=NO)?1
CURRENT CONDITIONS:
      APPROX. POP. OF AREA:100000
      APPROX. NO. ILL WITH MALARIA:25000
      APPROX. NO. DEATHS/YR DUE TO MALARIA:1000

TO CORRECT THIS SITUATION YOU CAN:
      ISOLATE THOSE ILL IN QUARANTINE HOSPITALS
      ADMINISTER DRUGS TO THOSE ILL
      APPLY PESTICIDES TO KILL MOSQUITOES
      GIVE PREVENTIVE DRUGS TO THOSE STILL HEALTHY

THESE ARE THE APPROX. COSTS:
      FIELD HOSPITAL OF 20 BEDS: $2000 PER YEAR
      DRUG TREATMENT FOR ILL: $2 PER PERSON FOR 1 YR.
      FULL ANTI-MOSQUITO SPRAY:$ 75000 FOR 1 YEAR
          WHEN USING DDT, OTHER SPRAYS HIGHER COST
      PREVENTIVE DRUG EFFECTIVE 1 YR.:72 CENTS PER PERSON

CONSULT YO UR STUDENT MANUAL FOR FURTHER INFORMATION
YOU MAY USE MALAR EITHER WITH A BUDGET (VERSION 1)
OR WITHOUT A BUDGET (VERSION 2). VERSION NUMBER?2

YOUR OBJECTIVE IS TO MINIMIZE MALARIA FOR THE NEXT
FIVE YEARS.

------------------------------------------------   (HOSPITALS)

HOW MANY FIELD HOSPITALS DO YOU INTEND TO USE?200

FOR THIS TREATMENT:
INDICATE YEARS TO BE USED BY TYPING, AFTER THE YEAR,
1=YES OR 0=NO
YEAR 1     ?1
YEAR 2     ?1
YEAR 3     ?1
YEAR 4     ?1
YEAR 5     ?1
COST OF THIS TREATMENT: $ 2.00000E+06
TOTAL MONEY ALREADY ALLOCATED FOR  5      YEARS $ 2.00000E+06

------------------------------------------------   (DRUGS FOR SICK)

HOW MANY FULL TREATMENTS OF DRUGS
FOR THE ILL, SHOULD BE ORDERED PER YEAR?1000

FOR THIS TREATMENT:
YEAR 1     ?1
YEAR 2     ?1
YEAR 3     ?1
YEAR 4     ?1
YEAR 5     ?1
COST OF THIS TREATMENT: $ 10000
TOTAL MONEY ALREADY ALLOCATED FOR  5      YEARS $ 2.01000E+06

------------------------------------------------   (MOSQUITOES)

WHAT PERCENTAGE OF MOSQUITOES DO YOU WANT TO ELIMINATE?0

------------------------------------------------   (PREVENTIVE DRUGS)

HOW MANY DOSES OF PREVENTIVE DRUGS, FOR THOSE
HEALTHY, DO YOU WANT TO ORDER PER YEAR?1000

FOR THIS TREATMENT:
YEAR 1     ?1
YEAR 2     ?1
YEAR 3     ?1
YEAR 4     ?1
YEAR 5     ?1
COST OF THIS TREATMENT: $ 3600
TOTAL MONEY ALREADY ALLOCATED FOR  5      YEARS $ 2.01360E+06
```

```
USING YOUR PLAN:
YEAR            NO. SICK        NO. DEATHS DUE TO MALARIA
----            --------        -------------------------
 0               24963           981
 1               23658           905
 2               23721           935
 3               23761           955
 4               23586           869
 5               23625           888

OVER YOUR  5     YEAR TREATMENT PROGRAM
 4552     DEATHS DUE TO MALARIA HAVE BEEN RECORDED

DO YOU WISH AN EVALUATION (1=YES, 0=NO)?0

DO YOU WANT TO (1) TAKE THE NEXT FIVE YEARS
OR (2) START OVER  OR (3) END. TYPE NUMBER?3

DONE


RUN
MALAR

DO YOU REQUIRE INSTRUCTIONS FOR MALAR (1=YES, 0=NO)?0
YOU MAY USE MALAR EITHER WITH A BUDGET (VERSION 1)
OR WITHOUT A BUDGET (VERSION 2). VERSION NUMBER?2

YOUR OBJECTIVE IS TO MINIMIZE MALARIA FOR THE NEXT
FIVE YEARS.

-------------------------------------------------   (HOSPITALS)

HOW MANY FIELD HOSPITALS DO YOU INTEND TO USE?200

FOR THIS TREATMENT:
INDICATE YEARS TO BE USED BY TYPING, AFTER THE YEAR,
1=YES OR 0=NO
YEAR 1     ?1
YEAR 2     ?1
YEAR 3     ?1
YEAR 4     ?0
YEAR 5     ?0
COST OF THIS TREATMENT: $ 1.20000E+06
TOTAL MONEY ALREADY ALLOCATED FOR  5     YEARS $ 1.20000E+06

-------------------------------------------------   (DRUGS FOR SICK)

HOW MANY FULL TREATMENTS OF DRUGS
FOR THE ILL, SHOULD BE ORDERED PER YEAR?1000

FOR THIS TREATMENT:
YEAR 1.    ?1
YEAR 2     ?1
YEAR 3     ?1
YEAR 4     ?0
YEAR 5     ?0
COST OF THIS TREATMENT: $ 6000
TOTAL MONEY ALREADY ALLOCATED FOR  5     YEARS $ 1.20600E+06

-------------------------------------------------   (MOSQUITOES)

WHAT PERCENTAGE OF MOSQUITOES DO YOU WANT TO ELIMINATE?60
WHAT PESTICIDE WILL YOU USE
1=DDT       2=MALATHION      3=PROPOXUR
?1

FOR THIS TREATMENT:
YEAR 1     ?1
YEAR 2     ?1
YEAR 3     ?1
YEAR 4     ?0
YEAR 5     ?0
COST OF THIS TREATMENT: $ 135000.
TOTAL MONEY ALREADY ALLOCATED FOR  5     YEARS $ 1.34100E+06

-------------------------------------------------   (PREVENTIVE DRUGS)
```

```
HOW MANY DOSES OF PREVENTIVE DRUGS, FOR THOSE
HEALTHY, DO YOU WANT TO ORDER PER YEAR ? 1000
FOR THIS TREATMENT:
YEAR 1    ?1
YEAR 2    ?1
YEAR 3    ?1
YEAR 4    ?0
YEAR 5    ?0
COST OF THIS TREATMENT: $ 2160
TOTAL MONEY ALREADY ALLOCATED FOR  5     YEARS $ 1.34316E+06


USING YOUR PLAN:
YEAR           NO. SICK       NO. DEATHS DUE TO MALARIA
----           --------       -------------------------
 0              24963          981
 1              11730          433
 2              11793          455
 3              11833          469
 4              24900          949
 5              24939          969

OVER YOUR  5     YEAR TREATMENT PROGRAM
 3275     DEATHS DUE TO MALARIA HAVE BEEN RECORDED

DO YOU WISH AN EVALUATION (1=YES, 0=NO)?0

DO YOU WANT TO (1) TAKE THE NEXT FIVE YEARS
OR (2) START OVER  OR (3) END. TYPE NUMBER?3

DONE


RUN
MALAR

DO YOU REQUIRE INSTRUCTIONS FOR MALAR (1=YES, 0=NO)?0
YOU MAY USE MALAR EITHER WITH A BUDGET (VERSION 1)
OR WITHOUT A BUDGET (VERSION 2). VERSION NUMBER?1

YOUR OBJECTIVE IS TO MINIMIZE MALARIA FOR THE NEXT
5 YEARS, WITH A TOTAL FUND OF  500   THOUSAND DOLLARS

-------------------------------------------------  (HOSPITALS)

HOW MANY FIELD HOSPITALS DO YOU INTEND TO USE?0

-------------------------------------------------  (DRUGS FOR SICK)

HOW MANY FULL TREATMENTS OF DRUGS
FOR THE ILL, SHOULD BE ORDERED PER YEAR?7500

FOR THIS TREATMENT:
INDICATE YEARS TO BE USED BY TYPING, AFTER THE YEAR,
1=YES OR 0=NO
YEAR 1    ?1
YEAR 2    ?1
YEAR 3    ?1
YEAR 4    ?1
YEAR 5    ?1
COST OF THIS TREATMENT: $ 75000.
THIS LEAVES A BALANCE OF  425000.     DOLLARS

-------------------------------------------------  (MOSQUITOES)

WHAT PERCENTAGE OF MOSQUITOES DO YOU WANT TO ELIMINATE?100
WHAT PESTICIDE WILL YOU USE
1=DDT       2=MALATHION       3=PROPOXUR
?3

FOR THIS TREATMENT:
YEAR 1    ?1
YEAR 2    ?1
YEAR 3    ?1
YEAR 4    ?1
YEAR 5    ?1
COST OF THIS TREATMENT: $ 3.18750E+06
```

```
YOUR LAST ITEM OVERSPENT YOUR BUDGET
RESET THIS EXPENDITURE SO IT'S WITHIN THE $ 425000.      REMAINING
WHAT PERCENTAGE OF MOSQUITOES DO YOU WANT TO ELIMINATE?100
WHAT PESTICIDE WILL YOU USE
1=DDT       2=MALATHION       3=PROPOXUR
?1

FOR THIS TREATMENT:
YEAR 1     ?1
YEAR 2     ?1
YEAR 3     ?1
YEAR 4     ?1
YEAR 5     ?1
COST OF THIS TREATMENT: $ 375000.
THIS LEAVES A BALANCE OF  50000.       DOLLARS

------------------------------------------------   (PREVENTIVE DRUGS)

HOW MANY DOSES OF PREVENTIVE DRUGS, FOR THOSE
HEALTHY, DO YOU WANT TO ORDER PER YEAR?12000

FOR THIS TREATMENT:
YEAR 1     ?1
YEAR 2     ?1
YEAR 3     ?1
YEAR 4     ?1
YEAR 5     ?1
COST OF THIS TREATMENT: $ 43200.
THIS LEAVES A BALANCE OF  6800      DOLLARS


USING YOUR PLAN:
YEAR            NO. SICK        NO. DEATHS DUE TO MALARIA
----            --------        -------------------------
 0               25047           1024
 1               700             8
 2               706             9
 3               694             6
 4               691             5
 5               703             8

OVER YOUR  5      YEAR TREATMENT PROGRAM
 36     DEATHS DUE TO MALARIA HAVE BEEN RECORDED

DO YOU WISH AN EVALUATION (1=YES, 0=NO)?1


TOTAL COST  493200.      DOLLARS
PROGRAM         COST            YEARS           EFFECTIVENESS (PCT.)
-------         ----            -----           --------------------
DRUG TREAT       75000.          5               85
MOSQ SPRAY       375000.         5               80
PREVENT DRUG     43200.          5               7.2

SURPLUS ORDERING:
 14205     TREATMENTS OF DRUGS FOR SICK UNUSED
OF THESE  6505      DOSES ARE STILL USABLE

DO YOU WANT TO (1) TAKE THE NEXT FIVE YEARS
OR (2) START OVER  OR (3) END. TYPE NUMBER?3

DONE
```

MASSD
36310

TITLE: MASSD: Mass Defect

DESCRIPTION:

A classroom presentation that could be used to calculate mass defect, and give the answer in terms of usable energy (kw-hr. of electricity).

OBJECTIVES:

A. To calculate and explain mass defect.

B. To introduce the concept of binding energy.

C. Conversion of mass to energy. (atomic power)

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - The student should have an understanding of nuclear particles, and the law of conservation of mass and energy.

B. Materials - The teacher should make available a table of isotopes that lists the actual mass. (Handbook of Chemistry and Physics, Chemical Rubber Company)

DISCUSSION:

It should be noted that the masses used here include the electrons. The very small difference which would be obtained if the bare nuclear mass were known is negligible for the purpose of this calculation.

Time permitting, it would be beneficial to have the student investigate the conversion of atomic mass units (AMU) to calories and kilowatt-hours in order to recognize the significance of the units and the magnitude of the numbers involved.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
MASSD

   THIS PROGRAM IS DESIGNED TO INVESTIGATE MASS DEFECT

   WHICH OF THE ELEMENTS WOULD YOU LIKE TO CONSIDER?
 REMEMBER WE ARE DEALING WITH A SINGLE ATOM, THEREFORE
 IN ADDITION TO THE ATOMIC NUMBER WE ARE GOING TO NEED THE
 ACTUAL MASS (IN AMU) AND THE MASS NUMBER OF THE ISOTOPE
 YOU WANT TO WORK WITH.

 WHEN THE MACHINE TYPES A QUESTION MARK (?) TYPE IN
 YOUR ANSWER THEN HIT RETURN KEY. USE NUMBERS OF UP TO
 SIX SIGNIFICANT FIGURES. ROUND IF NECESSARY TO 6 DIGITS.
IN THE VALUES FOR MASS DEFECT.


 THE ATOMIC NUMBER IS ?8
 THE ACTUAL MASS IS ?15.9949
 THE MASS NUMBER IS ?16

 THE SUM OF THE MASS OF THE 8     PROTONS ANL THE 8     NEUTRONS
 PLUS THE WEIGHT OF THE 8     ELECTRONS IS THE CALCULLATED
 MASS.

  CALCULATED MASS   -   ACTUAL MASS   =   MASS DEFECT
      16.132                       -     15.9949          =      .1371

 THE MASS DEFECT IN TERMS OF ENERGY IS THE EQUIVALENT OF
 2936     X 10↑9 CAL. PER MOLE OF THIS SUBSTANCE,
OR 184   X 10↑9 CAL. PER GRAM.

 IF WE DIVIDE THIS BINDING ENERGY BY THE NUMBER OF
 PARTICLES IN THE NUCLEUS, WE GET A RATIO KNOWN AS THE
 BINDING ENERGY PER NUCLEON, WHICH IS A MEASURE OF THE
 STABILITY OF THE NUCLEUS.  THE MORE 'BINDING'
 PER NUCLEON, THE MORE STABLE IS THE NUCLEUS.
 THE BINDING ENERGY PER NUCLEON IS : 1.27674E-05    ERGS. PER NUCLEON, OR
3.04712E-13    CAL. PER NUC.,
 WHICH IS MORE COMMONLY EXPRESSED AS 800   MEV.

 THE AMOUNT OF ENERGY (BINDING ENERGY) CONTAINED IN ONE
 GRAM OF THIS SUBSTANCE WOULD BE SUFFICIENT TO SUPPLY ALL
 THE ELECTRICAL NEEDS IN AN AVERAGE ONE FAMILY HOUSE USING
 15 KW-HRS. PER DAY FOR A PERIOD OF 14245    DAYS OR
 39    YEARS.

 IF YOU WOULD LIKE TO RUN ANOTHER PROBLEM TYPE IN 1,
 IF NOT TYPE IN 0.
?0

                **************

DONE
```

MEMBR
36611

TITLE: DIFFUSION EXPERIMENT

DESCRIPTION:

This program simulates an experiment on diffusion. Membrane charateristics are "observed" by the student, and means of transport across membranes identified.

OBJECTIVES:

A. To provide background for understanding of transport of materials across living membranes.

B. To evaluate and reinforce an understanding of conditions under which diffusion, osmosis, and active transport take place.

C. To help in the understanding of solution concentrations.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - exposed to the meaning of diffusion, osmosis, active transport, and semipermeable; should understand the need for energy expenditure in active transport; and have observed or performed the iodine test for starch.

B. Materials - a prepared ditto of questions to be answered by students as a homework assignment or for classroom discussion.

DISCUSSION:

A. Operational Suggestions
   1. Student level - this program has been effective with average and above average students.
   2. An incorrect answer results in the students being instructed to return to their seats, correct their answer, and give a reason for its correctness. A correct answer is immediately reinforced.

Continued on following page.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

DISCUSSION: continued

3. The class is grouped. A maximum of 5 per group is recommended. The groups sequentially run the program until completion, or they are sent away from the machine by an incorrect answer. The other groups may be engaged in performance of the same experiment being "done" by the computer, or in a related activity. Interruption of an actual experiment, as a group goes to the computer, should not affect the results.
4. When the program is to be used with more than one class, it is suggested that the data line in the program (see list) be changed. Since this is a simple change to make, it can be made between groups within a class. This prevents their memorization and/or transmission to other groups and classes. Examples follow:

```
     140  DATA10,11,12,13,14 may be changed to:
     140  DATA1,2,3,4,5
or   140  DATA4,2,6,9,1
or   140  DATA20,30,40,50,60
```

Any combination of numbers may be inserted. There must be a total of five, however, since the student is asked to respond to five questions.

It has been found that extensive discussion preceeds the answering of each question on the computer, and in the writing of the rationalizations. This is certainly desirable.

B. Suggested Follow-up

Questions which may be used for discussion, or given as a homework assignment:

1. What happens to the concentration of water within the membrane as the glucose diffuses out? Why?
2. What observations indicated that the iodine has moved into the "cell"?
3. Why couldn't the same observations be made outside of the membrane?
4. What changes in observations would you expect if the cellophane had not been permeable?
5. Can materials diffuse through a semipermeable membrane in both directions at the same time?
6. What is meant by equilibrium?
7. Under what conditions is a cell in complete equilibrium with its environment? (When it is dead.)

```
RUN

RUN
MEMBR

                    CELL MEMBRANES

     AN IMPORTANT FUNCTION OF CELL MEMBRANES IS TO CONTROL
THE PASSAGE OF MATERIAL INTO AND OUT OF CELLS. THIS PROGRAM
GOES INTO THE MEANS BY WHICH THIS PROCESS TAKES PLACE.

     IN THIS EXPERIMENT A STARCH AND GLUCOSE SOLUTION WAS
PLACED WITHIN A PIECE OF CELLOPHANE TUBING. CELLOPHANE IS
POROUS ENOUGH TO PERMIT THE PASSAGE OF SOME SMALLER MOLECULES
THROUGH IT. THEREFORE, A CLOSED OFF PIECE OF TUBING CAN
REPRESENT A CELL.

     AFTER THE STARCH AND GLUCOSE SOLUTION WAS PLACED INTO THE
TUBING, THE END WAS TIED OFF AND THE 'CELL' PLACED IN A BEAKER
OF WATER TO WHICH A FEW DROPS OF IODINE HAD BEEN ADDED.

     LET  10    REPRESENT THE OUTSIDE OF THE MEMBRANE
     LET  11    REPRESENT THE INSIDE OF THE MEMBRANE

WHERE IS THE CONCENTRATION OF GLUCOSE THE GREATEST?11

THAT IS CORRECT. WHERE IS THE CONCENTRATION OF STARCH THE
GREATEST?11

RIGHT.  WHERE IS THE CONCENTRATION OF IODINE THE GREATEST?10

WOW!  WHAT A SUPERIOR MIND YOU HAVE, OR IS IT JUST LUCKY
GUESSING? WHERE IS THE CONCENTRATION OF WATER THE GREATEST?10

YES.  IF THE MEMBRANE WERE THE OUTER LIMITS OF A LIVING
CELL, WHICH OF THE PROCESSES BELOW WOULD ACCOUNT FOR THE MOVE-
MENT OF GLUCOSE OUT OF THE CELL?

     LET OSMOSIS =  12
     LET ACTIVE TRANSPORT =  13
     LET DIFFUSION =  14
?14

CORRECT.  THE GLUCOSE DIFFUSED FROM AN AREA OF HIGHER
CONCENTRATION TO ONE OF LOWER CONCENTRATION. WHICH PROCESS
WOULD ACCOUNT FOR THE MOVEMENT OF THE WATER OUT OF THE CELL?13

RIGHT.  THE CONCENTRATION OF WATER IS GREATER OUTSIDE OF THE
CELL THAN INSIDE. ACTIVE TRANSPORT WOULD ACCOUNT FOR MOVE-
MENT AGAINST DIFFUSION. WHICH PROCESS WOULD EXPLAIN THE
TRANSPORT OF WATER INTO THE CELL?12

YES, OSMOSIS IS DIFFUSION OF WATER THROUGH A SEMIPERMEABLE
MEMBRANE. IF THE IODINE OUTSIDE OF THE CELL HAD TURNED BLACK,
WHAT PROCESS WOULD HAVE CAUSED IT?13

YES.  SINCE STARCH MOLECULES ARE RELATIVELY LARGE, THE CELL
WOULD HAVE TO EXPEND ENERGY TO MOVE THEM ACROSS THE
MEMBRANE, EVEN WHEN THE STARCH CONCENTRATION IS GREATER
INSIDE THE CELL.

CONGRATULATIONS.  YOU HAVE SCORED 100. KEEP UP THE GOOD WORK.

          ***          END OF PROGRAM          ***

DONE
```

TITLE:

MKS1

COMPUTER-AUGMENTED PHYSICS TOPICS (MKS UNITS) 36671

DESCRIPTION:

This program provides practice in converting from English units to MKS units of physical measurement. The student is asked to answer questions, and perform one conversion calculation, using Desk Calculator mode if desired.

INSTRUCTIONS:

To access the calculator mode, the student types 999999 in answer to question(s) requiring calculation. For all other questions, factual data (self-explanatory) is requested, and the program calculates the conversions.

See DESCAL (HP 36674) in Volume IV for instructions for using the Calculator Mode.

APPEND - DESCAL before RUNning program.

SPECIAL CONSIDERATIONS:

This program accompanies the Project Solo Module "Computer-Augmented Physics Topics" of the Hewlett Packard Curriculum Series.

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Physics (Secondary level)

Student Background Required: MKS units of measurements (may be concurrent)

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5648 Computer-Augmented Physics Topics (student text)
HP 5951-5649 Computer-Augmented Physics Topics (problem solutions)
HP 5951-5650 Computer-Augmented Physics Topics (classroom set - 30 student books and 1 problem solutions)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS:

Project Solo
University of Pittsburgh

```
RUN


APPEND-DESCAL
RUN
MKS1

IN THIS LESSON YOU WILL GAIN SOME FAMILIARITY
WITH THE MKS SYSTEM OF UNITS.
TO USE THE CALCULATOR MODE (LATER ON) TYPE 999999.

WHAT IS YOUR WEIGHT IN POUNDS?125
THEREFORE YOUR WEIGHT IS  556.818    NEWTONS.
YOUR MASS IS  56.8182     KILOGRAMS.
WHILE I'M STILL BEING PERSONAL,
HOW LONG DOES IT TAKE YOU TO GET TO SCHOOL?
GIVE YOUR TIME IN MINUTES.
?25
THAT IS  1500    SECONDS.
WELL, I GUESS THAT ISN'T TOO BAD!
NOW LET'S CONSIDER DISTANCES
HOW FAR DO YOU LIVE FROM SCHOOL?
ALLOW 10 BLOCKS PER MILE AND PRINT YOUR
ANSWER IN BLOCKS!
?35
THAT IS A DISTANCE OF  5632.7     METERS!
YOUR AVERAGE SPEED ON THE WAY TO SCHOOL IS  3.75514    M/SEC.
HOW DO YOU GET TO SCHOOL?
INDICATE BY 1 FOR WALKING, 2 FOR BUS, 3 FOR CAR, 4 FOR BICYCLE
AND 5 FOR OTHER?3
THE SPEED LIMIT IN THE CITY IS 25 MPH.
WHAT IS THIS SPEED EXPRESSED IN METERS PER SECOND?
?999999
CALCULATOR MODE.
CLEARED TO ZERO
1ST NUMBER?25
FUNCTION?MUL
2ND NUMBER?5280
MUL= 132000.

FUNCTION?DIV
2ND NUMBER?3600
DIV= 36.6667

FUNCTION?DIV
2ND NUMBER?3.281
DIV= 11.1755

FUNCTION?EXT
EXIT.
?11.1755
YOU HAVE JUST CALCULATED WHAT YOUR MAXIMUM
SPEED SHOULD HAVE BEEN.  DO YOU EXCEED
ANY SPEED LIMITS (1=YES, 0=NO)?0
RIGHT! HOPE YOU HAD A GOOD TIME WITH THIS LITTLE
PROGRAM. YOU HAVE COOPERATED TO THE FULLEST (I THINK).
TRY THE NEXT LESSON (MKS2).
PEACE AND FAREWELL.

DONE
```

MKS2

TITLE: COMPUTER-AUGMENTED PHYSICS TOPICS (MKS UNITS) 36673

DESCRIPTION:

This program follows MKS1 in learning sequence, and provides further practice in conversion from English units to MKS units of physical measurement, using the Desk Calculator mode if desired.

INSTRUCTIONS:

There are two kinds of problems in this tutorial:

1. Convert mass in Kg. to weight in Newtons.

2. Convert distance in miles to distance in meters.

The student may attempt as many of each kind as he or she desires. To access the Calculator mode (which allows the student to perform the necessary calculations, then return to the INPUT (answer) line in the program), the student enters 999999 as the answer.

See DESCAL (HP 36674) in Volume IV for instructions in using the calculator mode.

APPEND - DESCAL before RUNning the program.

SPECIAL CONSIDERATIONS:

This program accompanies the Project Solo Module "Computer-Augmented Physics Topics" of the Hewlett Packard Curriculum Series.

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Physics (secondary)

Student Background Required: MKS units of measurement (may be concurrent)

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5648 Computer-Augmented Physics Topics (student text)
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HP 5951-5650 Computer-Augmented Physics Topics (classroom set - 30 student books and 1 problem solutions)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS: Project Solo
University of Pittsburgh

RUN

```
APPEND-DESCAL
RUN
MKS2

AND SO WE CONTINUE WITH THE MKS SYSTEM OF UNITS.
REMEMBER-- 999999 FOR CALCULATOR MODE.
IF A CAR HAS A MASS OF 1000 KILOGRAMS, WHAT IS ITS
WEIGHT IN NEWTONS?9800
VERY GOOD.
NOW TRY THIS ONE.  WHAT IS THE WEIGHT OF AN OBJECT
WHICH HAS A MASS OF  7085    KILOGRAMS?
?999999
CALCULATOR MODE.
CLEARED TO ZERO
1ST NUMBER?7085
FUNCTION?MUL
2ND NUMBER?9.8
MUL= 69433.

FUNCTION?EXT
EXIT.
?69433.
GOOD. SOON YOU'LL BE AN EXPERT.
WOULD YOU LIKE TO TRY ANOTHER CONVERSION OF MASS
TO WEIGHT? (1=YES, 0=NO)?0
OK, THEN, TRY SOME DISTANCES:
HOW MANY METERS ARE THERE IN A MILE?
?999999
CALCULATOR MODE.
CLEARED TO ZERO
1ST NUMBER?5280
FUNCTION?DIV
2ND NUMBER?3.281
DIV= 1609.27

FUNCTION?EXT
EXIT.
HOW MANY METERS ARE THERE IN A MILE?
?1609.27
O.K. YOU ARE GETTING THE IDEA.  GO TO THE DESK CALCULATOR MODE
AND CALCULATE EACH OF THE FOLLOWING DISTANCES IN METERS
 6700     MILES
 8000     MILES
 4400     MILES
 7200     MILES
CALCULATOR MODE.
CLEARED TO ZERO
1ST NUMBER?6700
FUNCTION?MUL
2ND NUMBER?1609.27
MUL= 1.07821E+07

FUNCTION?CLR
CLEARED TO ZERO
1ST NUMBER?8000
FUNCTION?MUL
2ND NUMBER?1609.27
MUL= 1.28742E+07

FUNCTION?CLR
CLEARED TO ZERO
1ST NUMBER?4400
FUNCTION?MUL
2ND NUMBER?1609.27
MUL= 7.08079E+06

FUNCTION?CLR
CLEARED TO ZERO
1ST NUMBER?7200
FUNCTION?MUL
2ND NUMBER?1609.27
MUL= 1.15867E+07

FUNCTION?EXT
EXIT.
```

```
INPUT YOUR FOUR ANSWERS:
?1.07821E+07,1.28742E+07,7.08079E+06,1.15867E+07
CONGRATULATIONS! SEE YOU LATER.

DONE
```

MOLAR
36616

TITLE: ACID-BASE TITRATION

DESCRIPTION:

This program will calculate molarity by using data obtained from an acid-base titration.

OBJECTIVES:

To provide the teacher and the student with a molarity calculator to be used where either finds it applicable.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - This program can be used with students who have had no preliminary preparation or those with extensive preparation.

B. Materials - None

DISCUSSION:

It should be noted that normality is no longer in the New York State syllabus. It thus becomes necessary to teach titration calculations in the molarity systems by way of moles of H^+ reacted vs. moles of OH^- reacted, a much preferred method. This program does just that.

This program may be used in lab, as check on homework problems, and for tutorial work.

The teacher may also wish to show the logic of programs in general by using this very elementary program. The teacher need only take the list and explain it line by line to enhance the students' understanding. The equation used to solve the problems is:

Moles H^+ = Moles OH^-

$(M_A)(V_A)(n) = (M)(V_B)(n)$

V = volume in liters
n = subscript of the H^+ or OH^-

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN


GET-MOLAR
RUN
MOLAR

THIS PROGRAM IS DESIGNED TO CALCULATE THE UNKNOWN MOLARITY
IN AN ACID-BASE TITRATION.


 WHAT IS THE SUBSCRIPT OF THE H+ IN THE ACID FORMULA,
 AND THE SUBSCRIPT OF THE OH- IN THE BASE FORMULA?2,1

 HC  MANY ML OF ACID, AND HOW MANY ML OF BASE
 WERE USED?19.7,10.0

 IS THE KNOWN MOLARITY FOR THE ACID OR THE BASE?
 ANSWER 1 FOR ACID OR 2 FOR BASE?1

 WHAT IS THE MOLARITY OF THE ACID?5.5


 ANSWER: THE BASE IS  21.67       M.


 DO YOU WANT TO WORK ANOTHER PROBLEM?  ANSWER 1 FOR YES
 OR 0 FOR NO?1

 ***************


 WHAT IS THE SUBSCRIPT OF THE H+ IN THE ACID FORMULA,
 AND THE SUBSCRIPT OF THE OH- IN THE BASE FORMULA?3,1

 HOW MANY ML OF ACID, AND HOW MANY ML OF BASE
 WERE USED?0,29.3

 IS THE KNOWN MOLARITY FOR THE ACID OR THE BASE?
 ANSWER 1 FOR ACID OR 2 FOR BASE?1

 WHAT IS THE MOLARITY OF THE ACID?2.0


 ANSWER: THE BASE IS  0     M.


 DO YOU WANT TO WORK ANOTHER PROBLEM?  ANSWER 1 FOR YES
 OR 0 FOR NO?1

 ***************


 WHAT IS THE SUBSCRIPT OF THE H+ IN THE ACID FORMULA,
 AND THE SUBSCRIPT OF THE OH- IN THE BASE FORMULA?2,1

 HOW MANY ML OF ACID, AND HOW MANY ML OF BASE
 WERE USED?15.0,24.7

 IS THE KNOWN MOLARITY FOR THE ACID OR THE BASE?
 ANSWER 1 FOR ACID OR 2 FOR BASE?2

 WHAT IS THE MOLARITY OF THE BASE?1.5


 ANSWER: THE ACID IS  1.24        M.


 DO YOU WANT TO WORK ANOTHER PROBLEM?  ANSWER 1 FOR YES
 OR 0 FOR NO?0

 ***************

DONE
BYE
051 MINUTES OF TERMINAL TIME
```

NEWTN2
36316

TITLE: NEWTN2: Newtons 2nd Law

DESCRIPTION:

A problematic situation is presented to the student which requires repeated applications of Newton's 2nd law. By selecting various angles and forces, the operator can observe the resulting motion produced. To successfully complete the program, the student must complete a specified displacement within ten attempts.

OBJECTIVES:

To aid in the development of skills in applying the equations of motion.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - An awareness of Newton's 2nd law is required. In addition, some familiarity of force components (resolution of vectors) is necessary.

B. Materials - Graph paper is helpful to students with below-to-average ability.

DISCUSSION:

A. Operational Suggestions

This program was designed for operation by individual students or small groups, but the program may be used with a class as a "lead-in" demonstration of forces and vectors. The presentation is also helpful in describing two dimensional motion under the influence of a constant external force.

When executed by small groups of average students, it has been noted that programs of this type stimulate discussions and involvement for those participating.

B. Suggested Follow-up

The student is confronted with a situation which requires that he overcome a given force (the wind), in moving a boat across a channel 10 Km. wide. The magnitude of the force produced by the wind on the boat varies with each "run", but the direction of the vector is always southwest, i.e. 45 deg. with respect to the direction EAST. The student may vary his paddling force (limited to values less than 200 Newtons), and direction at intervals during his displacement. After each choice of variables, he is given his position, as well as the resulting speed and direction of the boat. A certificate is presented for successful completion of the task.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
NEWTN2

HINT: GRAPH PAPER IS HELPFUL IN RUNNING THIS PROGRAM.

                F'  MA  SPEED,...
                ----------------

YOU'RE TRYING TO ESCAPE FROM DEVIL'S ISLAND ON A SMALL BOAT.
DEVIL'S ISLAND IS LOCATED AT COORDINATES (0,0).
TO SUCCEED, YOU MUST REACH A CHANNEL 50 METERS WIDE AND
10000 METERS DUE EAST, AT ABOUT (10000,0).

IN ADDITION, YOU MUST GET THERE IN FIVE MINUTES OR LESS OR
SUFFER RECAPTURE ---  (HEH,HEH,HEH--)

WHAT DO YOU WEIGH (IN POUNDS)?170

YOUR SITUATHON IS AS FOLLOWS:

THE WIND IS BLOWING FROM THE NORTHE@ST (45 DEGREES) EXERTING
A FORCE OF 120  NEWTONS ON YOUR BOAT. YOU MAY PADDLE WITH
ANY FORCE IN THE EASTWARD DIRECTION (ZERO DEGREES IS EAST)
TO ACCELERATE YOUR BOAT ACROSS THE BAY AND THUS
REACH THE OPPOSITE SHORE (AND FREEDOM).
(NOTE: THE MASS OF THE BOAT WITH YOU ABOARD IS 177  KILOGRAMS).

WITH WHAT FORCE (IN NEWTONS) AND DIRECTION (IN DEGREES) WILL
YOU PADDLE?150,25
T= .5          X= 127         Y=-57          V(X)= 8        V(Y)=-4

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?0
T= 1           X= 507         Y=-229         V(X)= 17       V(Y)=-8

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?1

WITH WHAT FORCE (IN NEWTONS) AND DIRECTION (IN DEGREES) WILL
YOU PADDLE?150,15
T= 1.5         X= 1163        Y=-577         V(X)= 27       V(Y)=-16

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?1

WITH WHAT FORCE (IN NEWTONS) AND DIRECTION (IN DEGREES) WILL
YOU PADDLE?150,8
T= 2           X= 2128        Y=-1211        V(X)= 37       V(Y)=-27

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?0
T= 2.5         X= 3410        Y=-2176        V(X)= 48       V(Y)=-38

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?0
T= 3           X= 5011        Y=-3472        V(X)= 59       V(Y)=-49

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?1

WITH WHAT FORCE (IN NEWTONS) AND DIRECTION (IN DEGREES) WILL
YOU PADDLE?150,3
T= 3.5         X= 6932        Y=-5132        V(X)= 69       V(Y)=-62

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?1

WITH WHAT FORCE (IN NEWTONS) AND DIRECTION (IN DEGREES) WILL
YOU PADDLE?150,30
T= 4           X= 9126        Y=-7018        V(X)= 77       V(Y)=-64

WANT TO CHANGE FORCE OR DIRECTION (1=YES, 0=NO) : ?1

WITH WHAT FORCE (IN NEWTONS) AND DIRECTION (IN DEGREES) WILL
YOU PADDLE?150,25
T= 4.5         X= 11559       Y=-8990        V(X)= 85       V(Y)=-68
YOU HAVE REACHED THE OPPOSITE SHORE,
BUT ARE-8990    METERS OFF COURSE.
ALL THAT WORK FOR NOTHING!
YOU'RE LOST IN THE SWAMPS FOREVER;  GOODBYE.

SEE IF YOU CAN IMPROVE YOUR ABILITY LATER.

DONE
```

NZYM2
36304

TITLE: NZYM2: Enzyme Reaction Rate

DESCRIPTION:

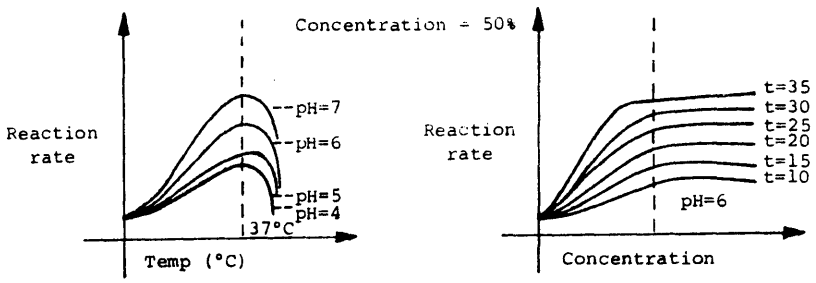
An extension of NZYMC A833-36303 which permits the student to examine the effect on reaction rate with continuous changes in environmental factors.

OBJECTIVES:

In addition to reinforcing the concept that reaction rate is governed by pH, temperature, and enzyme concentration; the program can be used to:

A. Introduce the idea of controlled experimentation where two factors are kept constant and a third is permitted to vary.

B. Develop the idea of plotting experimental data to generate a family of curves as illustrated below.



INSTRUCTIONS: See following page.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - Same as NZYMC. It might also be helpful if the student has been exposed previously to an actual experimental demonstration in which the change of reaction rate with one or more factors is visually displayed. The rate of bubble formation when one of the reactant products is a gas for example, might serve as one practical illustration of variation of reaction rate with temperature.

B. Materials - none

DISCUSSION:

A. Operational Suggestions

1. Average students should work as part of a group; above-average students could be permitted to work alone.
2. For group effort activity, it would be instructive to use three different groups, each of which holds a different factor constant while the other two factors are allowed to vary.

B. Suggested Follow-up

1. Each group should be required to plot their data, on a board, if possible, so the whole class can see the results. Families of curves should be discussed.
2. Equivalent points on each data set should be compared; e.g. is reaction rate the same when pH is 4, temperature is 25°C and concentration is 50%, regardless of which factor is held constant and the others allowed to vary?
3. Introduce the concepts of interpolation between curves and again check comparable points on each set.
4. Indicate that the maximum reaction rate obtained is the same regardless of the technique used to reach maximum.

```
RUN

RUN
NZYM2

THIS PROGRAM WILL ENABLE YOU TO SEE THE EFFECTS ON THE RATE OF
REACTION WITHIN A SYSTEM CONTROLLED BY ENZYMES.  THE
REACTION RATE WILL VARY AS THE ENVIRONMENTAL CONDITIONS
VARY.  THESE CONDITIONS, PH, CONCENTRATION OF ENZYMES,
AND TEMPERATURE, IN A NATURAL SITUATION ARE NEVER CONSTANT.
LET'S SEE WHAT CONTROLS THIS RATE IN THESE SYSTEMS.

THE FOLLOWING ARE THE LIMITS WITHIN WHICH EACH OF OUR
ENVIRONMENTAL CONDITIONS CAN VARY.
               1)PH----------BETWEEN 4 AND 10
               2)ENZ. CONC.--BETWEEN 10 AND 100 PERCENT
               3)TEMP.-------BETWEEN 5 AND 47 DEGREES C.

I AM GOING TO PRINT A '?'.  YOU MUST THEN TYPE A NUMBER FOR PH,
CONC., AND TEMP. (IN THAT ORDER), WHICH FALLS WITHIN EACH
LIMIT STATED (SEE ABOVE.)
?4,10,5
PH             CONC.          TEMP.          REACTION RATE
--             -----          -----          -------- ----
 4              10             5              .05

NOTE THE REACTION RATE WITH THE THREE VALUES WHICH YOU
SELECTED TO PROVIDE A BASIS FOR JUDGEMENT OF REACTION
RATE, CHOOSE ANOTHER SET OF VALUES FOR PH, CONC., AND
TEMP.  (SEE LIMITS ABOVE).

?7,10,5
PH             CONC.          TEMP.          REACTION RATE
--             -----          -----          -------- ----
 7              10             5              4.5
IS THE RESULT A HIGHER OR LOWER REACTION RATE?  IS THE HIGHEST
VALUE OBTAINED A MAXIMUM VALUE?  DO YOU WANT TO TRY ANOTHER
SET OF VALUES (TYPE '1') OR WOULD YOU PREFER A MORE ORGANIZED
APPROACH TO DETERMINE MAXIMUM REACTION RATE (TYPE '2')
?2
```

```
WE ARE NOW GOING TO PERFORM AN EXPERIMENT IN WHICH YOU ARE
TO TYPE IN THE VALUES FOR PH, CONC. AND TEMP. AS YOU DID
BEFORE. HOWEVER,NOW YOU ABE GOING TO BE ABLE TO CHOOSE THE
FACTOR WHICH WILL VARY. THE OTHER TWO FACTORS WILL REMAIN
CONSTANT. (USE DIFFERENT NUMERICAL VALUES FOR EACH FACTOR.)
TO OBTAIN THE MOST SIGNIFICANT DATA, START THE EXPERIMENT
USING LOW NUMERICAL VALUES FOR EACH FACTOR.

I AM GOING TO PRINT A '?'. YOU MUST THEN TYPE A NUMBER FOR PH,
CONC., AND TEMP. (IN THAT ORDER), WHICH FALLS WITHIN EACH
LIMIT STATED (SEE ABOVE.)
?2
??20,5
AT LEAST ONE OF THE VARIABLES DOES NOT LIE WITHIN THE
PRESCRIBED LIMITS. SEE LIMITS ABOVE AND TRY AGAIN.
?4,20,5
TYPE THE NUMBER WHICH IS TO BE VARIED.
?20
PH              CONC.           TEMP.           REACTION RATE
--              -----           -----           -------- ----
 4               20              5               .1
 4               30              5               .13
 4               40              5               .16
 4               50              5               .17
 4               60              5               .19
 4               70              5               .19
 4               80              5               .2
 4               90              5               .2
 4               100             5               .2
YOU NOW HAVE A SET OF VALUES FOR REACTION RATE AS ONE OF
THE GOVERNING FACTORS IS VARIED AND THE OTHER TWO ARE HELD
CONSTANT. DOES THE REACTION RATE HAVE A MAXIMUM VALUE?
IS THIS THE MAXIMUM POSSIBLE REACTION RATE? TO DETERMINE THIS,
USE THE SAME INITIAL VALUE FOR THE VARYING FACTOR, BUT THIS
TIME TYPE IN DIFFERENT VALUES FOR THE CONSTANT FACTORS.

IF YOU WANT ANOTHER SET OF VALUES FOR REACTION RATE,TYPE '1'
IF YOU ARE SATISFIED THAT YOU KNOW THE VALUES FOR EACH FACTOR'S
MAXIMUM REACTION RATE THEN TYPE '2'.
?2

DONE
```

TITLE:

NZYMC: Enzymatic Reaction Rates

NZYMC
36303

DESCRIPTION:

This program covers enzymatic reaction rates, and conveys the idea that enzyme reactions are dependent upon environmental factors such as pH, temperature, and the concentration of the enzymes. A simulated experimental situation is created, whereby the student works with one parameter at a time and can vary the degree of the enzyme reactivity.

OBJECTIVES:

The program presents the students with the following concepts:

A. Enzymatic reaction rates are dependent upon environmental factors; (these include pH, temperature, concentration of enzymes, and substrate)

B. The value of graphing to help in the interpretation of data;

C. The meaning of the term "limiting factor";

D. Different enzymes may vary in degree of reactivity and thereby affect reaction rates;

E. Enzymes are not used up, but can take part in additional reactions.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - The student should have some understanding of these terms: pH, substrate, enzyme, and chemical reaction. He should know that there is a substrate-enzyme interaction, and that enzymes act as catalytic agents, therefore, more than one reaction can take place with one molecule of the enzyme over a period of time.

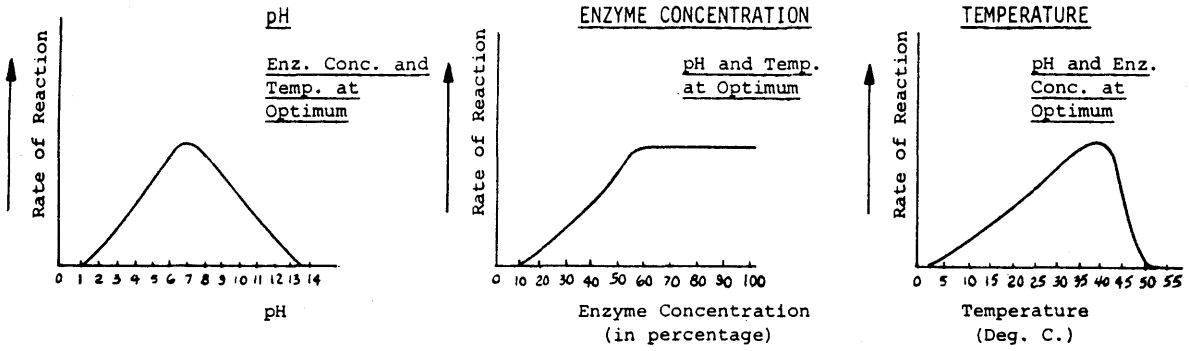
B. Materials - graph paper, transparencies of the following plots, and one of the three together for simultaneous viewing. (optional)

Continued on following page.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

RATES OF ACTIVITY WHEN VARYING



DISCUSSION:

A. Operational Suggestions
   1. Student level - Average to above average ability
   2. The student should use all three limiting factors presented in the computer program.
   3. Students' graphs should be checked before proceeding with the follow-up question.
   4. Students work in groups of 5 or less. Allow one group at a time at the computer while the remaining groups are engaged in a related activity. For Example: Food testing with hydrogen peroxide for catalase activity.

B. Suggested Follow-up
   To maximize the value of this program, it is strongly suggested that the teacher:
   1. Elicit from the students:
      What represents maximum and minimum reaction rate for pH, temperature, and enzyme concentration? (Use appropriate transparencies or chalkboard)
   2. Ask the following questions, based on the plotted graphs, as lead-ins to discussion or as a homework assignment.
      (a) At what point do most reactions take place with regard to pH, enzyme concentration, and temperature? (This and subsequent questions are intended to bring up the ideas of optimal pH, temperature, and enzyme concentration.)
      (b) Why is death caused when pH rises or falls beyond a certain point in a system?
      (c) Why does the concentration of enzymes reach a point and then no increase in reactions take place?
      (d) What is normal body temperature? What relationship is there between reaction rate and body temperature? High fever? Freezing temperature? (Note: 40 deg. C. is 104 deg. F., which is higher than normal.)
      (e) Suppose the pH of a system is 7, enzyme concentration is 90, and temperature is 0 degrees. What is the reaction rate? Why? *
      (f) Suppose the temperature is 37 deg. C., enzyme concentration is 30, and pH is 14. What is the reaction rate? Why? *
      (g) What is meant by limiting factors?

* Student must examine all three graphs before reaching a conclusion.

```
RUN
RUN
NZYMC

     THIS PROGRAM IS DESIGNED TO SHOW THAT ENZYME ACTION IS
RELATED TO CERTAIN LIMITING FACTORS. THESE FACTORS INCLUDE PH,
THE CONCENTRATION OF ENZYMES, AND TEMPERATURE. IN THIS PROGRAM
WE ASSUME THAT TWO OF THE THREE FACTORS ARE CONSTANTS AND
WILL CHANGE ONLY ONE AT A TIME. WE ALSO ASSUME THAT EACH
FACTOR WORKS INDEPENDENTLY, ALTHOUGH THIS IS NOT TRUE IN
NATURE.

     YOU HAVE A CHOICE OF THE FOLLOWING LIMITING FACTORS:

1)PH          2)CONCENTRATION OF ENZYMES          3)TEMPERATURE

WHICH NUMBER DO YOU WISH ?1

*** PH ***

HOW REACTIVE AN ENZYME ARE YOU WORKING WITH? USE A VALUE OF
FROM 1 (NOT VERY REACTIVE) TO 10 (VERY REACTIVE). ?7.5

PH VALUE        REACTION RATE  0         50         100        150        200
--------        -------------  I---------I---------I---------I---------I
 1               0             I*
 2               11.25         I*
 3               30            I   *
 4               56.25         I       *
 5               90            I           *
 6               138.75        I                   *
 7               157.5         I                       *
 8               138.75        I                   *
 9               90            I           *
 10              56.25         I       *
 11              30            I   *
 12              11.25         I*
 13              3.75          I*
 14              0             I*

DO YOU WISH ANOTHER RUN? IF YES, PRINT 1; IF NO, PRINT 0. ?1

     YOU HAVE A CHOICE OF THE FOLLOWING LIMITING FACTORS:

1)PH          2)CONCENTRATION OF ENZYMES          3)TEMPERATURE

WHICH NUMBER DO YOU WISH ?2

*** CONCENTRATION OF ENZYMES ***
HERE WE MUST ASSUME THAT THE SUBSTRATE IS ALWAYS SUFFICIENT.

HOW REACTIVE AN ENZYME ARE YOU WORKING WITH? USE A VALUE OF
FROM 1 (NOT VERY REACTIVE) TO 10 (VERY REACTIVE). ?7.5

ENZYME CONC.    REACTION RATE  0         50         100        150        200
------------    -------------  I---------I---------I---------I---------I
 10              0             I*
 20              33.75         I   *
 30              67.5          I       *
 40              101.25        I           *
 50              135           I               *
 60              157.5         I                   *
 70              157.5         I                   *
 80              157.5         I                   *
 90              157.5         I                   *
 100             157.5         I                   *

DO YOU WISH ANOTHER RUN? IF YES, PRINT 1; IF NO, PRINT 0. ?1

     YOU HAVE A CHOICE OF THE FOLLOWING LIMITING FACTORS:

1)PH          2)CONCENTRATION OF ENZYMES          3)TEMPERATURE

WHICH NUMBER DO YOU WISH ?3
```

```
*** TEMPERATURE ***

HOW REACTIVE AN ENZYME ARE YOU WORKING WITH? USE A VALUE OF
FROM 1 (NOT VERY REACTIVE) TO 10 (VERY REACTIVE). ?7.5

DEGREES C.      REACTION RATE  0         50         100        150        200
----------      -------------  I---------I---------I---------I---------I
 0               0             I*
 5               11.25         I*
 10              22.5          I *
 15              41.25         I     *
 20              63.75         I          *
 25              86.25         I               *
 30              112.5         I                    *
 35              146.25        I                         *
 40              127.5         I                       *
 45              37.5          I    *
 50              0             I*

DO YOU WISH ANOTHER RUN? IF YES, PRINT 1; IF NO, PRINT 0. ?0

STUDY THE GRAPHS AND TABLES, AND TRY TO FIGURE
OUT WHAT'S HAPPENING HERE.

DONE
```

ORBIT
36121

TITLE: INTEGRATES EQUATIONS OF MOTION

DESCRIPTION:

This program integrates the equations of motion for an object moving under the influence of a force that varies as $\frac{1}{r^n}$.

INSTRUCTIONS:

Initial conditions are put in the DATA statement in line 1410. The data is in the order in which it occurs:

(a) Exponent N in the force law
(b) Initial X position
(c) Initial Y position
(d) Initial X velocity
(e) Initial Y velocity
(f) Computing time increment
(g) Time limit

Typical values are shown in the listing. The program gives relative information only. It is intended to show the shapes of orbits.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Any Physics courses, high school level up.

Student Background Required: The program can be used by high school physics students without becoming involved in the mathematical description. College physics students would probably be interested in the method used.

The program should be used to teach students about two dimensional motion under various force laws. Certainly inverse square law (n=2) examples should be studied. Let the students experiment with other exponents.

If a plotter is available, the program can be easily modified to produce a graphic output.

ACKNOWLEDGEMENTS: Herbert D. Peckham
Gavilan Junior College

```
RUN

RUN
ORBIT

 1                0                1
 .995004          9.98334E-02      1
 .980067          .198669          1
 .955336          .29552           1
 .921061          .389418          1.
 .877583          .479425          1.
 .825336          .564642          1.
 .764842          .644217          1.
 .696707          .717356          1.
 .62161           .783326          1.
 .540302          .84147           1.
 .453596          .891207          .999999
 .362358          .932038          .999999
 .267499          .963557          .999999
 .169967          .985449          .999999
 .070737          .997494          .999999
-2.91997E-02      .999572          .999999
-.128845          .991663          .999999
-.227202          .973846          .999998
-.32329           .946298          .999998
-.416147          .909295          .999998
-.504846          .863207          .999998
-.588501          .808494          .999998
-.666276          .745702          .999998
-.737394          .67546           .999998
-.801143          .598468          .999997
-.856888          .515497          .999997
-.904071          .427375          .999997
-.942221          .334983          .999997
-.970956          .239244          .999997
-.98999           .141114          .999997
-.999132          4.15747E-02      .999997
-.998291         -5.83803E-02      .999997
-.987476          -.157752         .999997
-.966793          -.255547         .999997
-.936451          -.35079          .999997
-.896752          -.442527         .999997
-.848093          -.529842         .999997
-.790959          -.611863         .999997
-.725923          -.687771         .999997
-.653634          -.756807         .999997

DONE
```

TITLE:

TEACHES STRAIGHT ALKANE NOMENCLATURE AND NAMING OF ORGANIC ALKANES

ORG1
36826

DESCRIPTION:

There are 2 programs in this package: ORG1 and ORG2. ORG1 teaches a student how to recognize a hydrocarbon, find carbon to hydrogen ratio, and name straight chain alkanes of up to 20 carbons in length. ORG2 is a sequel to ORG1, and teaches a student how to name branched chain alkanes of up to 20 carbons. Should be followed by ISOMER (HP 36261) for practice drill.

INSTRUCTIONS:

Program is inter-active. Just GET and RUN program.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES.

Suitable Courses: Advanced or organic chemistry.

Student Background Required: Knowledge of chemical symbols, pre-algebra.

ACKNOWLEDGEMENTS:

Richard C. Adams
Pleasant Hill High School

```
RUN

RUN
ORG1

THIS IS A PROGRAM FOR TEACHING YOU HOW TO NAME ORGANIC
CHEMICALS OF VARIOUS TYPES.  NOW SINCE I'VE TOLD YOU
WHAT THIS PROGRAM IS ABOUT, WHAT IS YOUR NAME?
?RICHARD
HELLO, RICHARD.  LET'S GET STARTED THEN.

CARBON COMPOUNDS MAKE UP QUITE A LARGE PART OF OUR WORLD.
I (A COMPUTER) AM NOT MADE OF CARBON BUT YOU ARE, RICHARD.
THE CHEMISTRY OF CARBON COMPOUNDS IS CALLED 'ORGANIC CHEMISTRY'.
ONE FACET OF THIS LARGE AREA OF STUDY IS 'HYDROCARBONS.'
HYDROCARBONS ARE CHEMICAL COMPOUNDS WHICH CONTAIN CARBON
AND HYDROGEN ATOMS ONLY.
WHICH OF THE COMPOUNDS BELOW DO YOU THINK IS A HYDROCARBON?
(USE THE NUMBER OF YOUR CHOICE)

     1.            2.            3.


   H H H         H H H H       H H   H
  HC-C-C-OH     HC-C-C-C-H    HC-C-O-CH
   H H H         H H H H       H H   H


?1
NO THAT'S NOT CORRECT.  TRY AGAIN.    REMEMBER,
HYDROCARBONS ARE CHEMICAL COMPOUNDS WHICH CONTAIN CARBON
AND HYDROGEN ATOMS ONLY.
WHICH OF THE COMPOUNDS BELOW DO YOU THINK IS A HYDROCARBON?
(USE THE NUMBER OF YOUR CHOICE)

?2
THAT'S THE ONE.  YOU SAW THE OTHER TWO HAD OXYGEN IN THEM.
HOW MANY CARBONS ARE THERE IN #1, #2, & #3?4,4,4
NO, THAT'S NOT RIGHT.  YOU MISSED #1 #3 COUNT AGAIN!
HOW MANY CARBONS ARE THERE IN #1, #2, & #3?4,4,3
NO, THAT'S NOT RIGHT.  YOU MISSED #1 COUNT AGAIN!
HOW MANY CARBONS ARE THERE IN #1, #2, & #3?3,4,3
THAT'S RIGHT.  GOOD FOR YOU, RICHARD!

A CERTAIN CLASS OF HYDROCARBONS IS CALLED
'THE ALKANE FAMILY.'  THEY ALL HAVE A CERTAIN RATIO OF
CARBON TO HYDROGEN SUCH THAT IF THERE ARE 'N' CARBONS,
THERE WILL BE 2N+2 HYDROGENS.
HOW MANY HYDROGENS WOULD AN ALKANE OF 1     CARBONS HAVE?6
NO, THAT'S NOT RIGHT. TRY AGAIN. REMEMBER: HYDROGENS=2N+2
HOW MANY HYDROGENS WOULD AN ALKANE OF 1     CARBONS HAVE?4
THAT'S THE ANSWER. LET'S DO ANOTHER ONE.    NOW
HOW MANY HYDROGENS WOULD AN ALKANE OF 3     CARBONS HAVE?8
THAT'S THE ANSWER. LET'S DO ANOTHER ONE.    NOW
HOW MANY HYDROGENS WOULD AN ALKANE OF 4     CARBONS HAVE?10
THAT'S THE ANSWER. LET'S DO ANOTHER ONE.    NOW
HOW MANY HYDROGENS WOULD AN ALKANE OF 4     CARBONS HAVE?10
THAT'S THE ANSWER.
NOW YOU SHOULD LEARN HOW TO NAME HYDROCARBONS.
ALL THE ALKANES END IN '-ANE.'  THE PREFIXES ARE AS FOLLOWS:

 FOR ONE CARBON THE PREFIX IS'METH-'
     TWO                      'ETH-'
    THREE                     'PROP-'
     FOUR                     'BUT-'
     FIVE                     'PENT-'
     SIX                      'HEX-'

FOR EXAMPLE
      H                  H H
     HCH IS METHANE AND  HC-CH
      H                  H H

                  . IS ETHANE.
```

```
WHAT DO YOU THINK THIS COMPOUND IS:
          H H H H
         HC-C-C-CH
          H H H H

   1. PROPANE?   2. BUTANE?   3. PENTANE?
(TYPE NUMBER OF YOUR ANSWER)?3
PENTANE HAS FIVE CARBONS.  TRY AGAIN.
(TYPE NUMBER OF YOUR ANSWER)?1
PROPANE HAS THREE CARBONS.  COUNT AGAIN.
(TYPE NUMBER OF YOUR ANSWER)?2
RIGHT!  BUTANE HAS FOUR CARBONS.

HERE ARE SOME MORE NAMES FOR NUMBERS OF CARBONS.
MOST OF THEM ARE GREEK SO THEY'RE A LITTLE WEIRD.

  7 HEPT   10 DEC     13 TRISKEDEC   16 HEXADEC
  8 OCT    11 UNDEC   14 TETRADEC    ............
  9 NON    12 DODEC   15 PENTADEC    20 EICOS

HOW MANY CARBONS DO YOU THINK THERE ARE IN
HEPTADECANE, OCTADECANE, AND NONADECANE? (USE COMMAS)?16,17,18

THAT'S NOT RIGHT.  BUT HERE'S A CLUE*  'OCTADECANE'
HAS 18 CARBONS.  TRY AGAIN.

HOW MANY CARBONS DO YOU THINK THERE ARE IN
HEPTADECANE, OCTADECANE, AND NONADECANE? (USE COMMAS)?17,18,19
THAT'S RIGHT, RICHARD.


WHEN YOU'RE READY FOR THE
NEXT LESSON, TYPE 'GET-ORG2'.

DONE



GET-ORG2
RUN
ORG2

HELLO! OTIS HERE AGAIN.  THIS IS THE SECOND PROGRAM IN
THE SERIES ON ORGANIC CHEMISTRY.  IF YOU HAVEN'T DONE SO
ALREADY, GET-ORG1.  BY THE WAY, WHO IS THIS?RICHARD
OH, IT'S YOU AGAIN, RICHARD.  HAVEN'T GIVEN UP YET, I SEE.

ONE THING I DIDN'T TALK ABOUT LAST TIME IS 'WHAT IF ALL THE
CARBONS AREN'T IN A STRAIGHT LINE?' (I COULD TELL THAT
QUESTION WAS BOTHERING YOU, RICHARD).
     COMPOUNDS WHICH HAVE THE SAME NUMBERS OF ELEMENTS
BUT IN A DIFFERENT ARRANGEMENT ARE CALLED 'ISOMERS'.  FOR
EXAMPLE, HERE ARE THREE ISOMERS OF PENTANE:

       H          H
      HCH        HCH
   H H I H      H I H      H H H H H
  HC-C-C-CH    HC-C-CH    HC-C-C-C-CH
   H H H H      H I H      H H H H H
                 HCH
                  H

HOW MANY CARBONS DOES EACH ONE HAVE (ONE ANSWER)?3
COUNT AGAIN, RICHARD.
HOW MANY CARBONS DOES EACH ONE HAVE (ONE ANSWER)?
??6
COUNT AGAIN, RICHARD.
HOW MANY CARBONS DOES EACH ONE HAVE (ONE ANSWER)?1
COUNT AGAIN, RICHARD.
WELL, YOU'VE HAD 3 TRIES.  THERE ARE 5 IN EACH ONE.
NOW, HOW MANY HYDROGENS?13
COUNT AGAIN.
NOW, HOW MANY HYDROGENS?15
COUNT AGAIN.
NOW, HOW MANY HYDROGENS?11
COUNT AGAIN.
GEE, RICHARD, THAT'S THE SECOND ONE IN A ROW YOU'VE MISSED.
THERE ARE 12 HYDROGENS IN EACH AND EVERY ONE.
```

```
NOW, HOW DO WE NAME SUCH THINGS?  FIRST OFF,    H
A GROUP CONTAINING ONE CARBON IS CALLED A      HC-
'METHYL' GROUP.  ONE WITH TWO CARBONS IS        H
 H H
HC-C-  CALLED AN 'ETHYL GROUP.  ONE WITH
 H H  THREE IS CALLED 'PROPYL' AND SO ON, USING THOSE
      GREEK NAMES  I SHOWED YOU IN 'ORG1'.
     WHAT WOULD YOU CALL THIS GROUP?

    H H H H H
   HC-C-C-C-C-
    H H H H H

?PENTANE
THAT'S CLOSE BUT SIDE GROUPS END IN '-YL'.  TRY AGAIN.
     WHAT WOULD YOU CALL THIS GROUP?
?PENTYL
RIGHT YOU ARE, RICHARD!

IN ORGANIC CHEMISTRY YOU HAVE TO NUMBER YOUR CARBONS IN
THE LONGEST,CONTINUOUS CHAIN AND THEN USE THOSE NUMBERS TO
TELL WHERE A SIDE GROUP IS.  I'LL GIVE YOU AN EXAMPLE IN A
MOMENT BUT I'M GETTING TIRED OF TYPING ALL THOSE HYDROGENS
SO I'M GOING TO LEAVE THEM OFF FROM NOW ON.  THE STRUCTURES
WILL BE EASIER TO SEE ANYWAY.  FOR EXAMPLE:

     C
     I
   C-C-C-C-C-C-C

IS CALLED  2-METHYL HEPTANE  BECAUSE THERE ARE SEVEN
CARBONS ('HEPTANE') IN THE MAIN CHAIN AND THEN ON THE SECOND
CARBON ('2-') THERE IS A 'METHYL GROUP.  .OK.  WHICH
END DO YOU NUMBER FROM?---THE ONE WHICH GIVES YOU THE LOWEST
NUMBER FOR THE MOST COMPLICATED GROUP.   CAUTION*****>>>

             C      (THIS IS ALSO
             I       CALLED
   C-C-C-C-C-C-C       2-METHYL HEPTANE)

(IT'S JUST THE SAME MOLECULE FROM THE OTHER SIDE)

       C
       I          NOW WHAT WOULD YOU CALL THIS?
   C-C-C-C-C-C

?4-METHYL HEXANE
YOU NUMBERED FROM THE WRONG END.  COUNT AGAIN.
?3-METHYLHEXANE
NO, THAT'S NOT IT.  COUNT THE CARBONS IN THE MAIN CHAIN
AND THEN WHERE THE METHYL GROUP IS.  NOW WHAT'S THAT
NAME AGAIN??3-METHYL HEXANE
THAT'S THE ANSWER.  SAY, RICHARD, YOU'VE BEEN WATCHING!


SOMETIMES YOU CAN HAVE MORE THAN ONE OF A CERTAIN GROUP.
IF THAT HAPPENS, YOU HAVE TO TELL HOW MANY THERE ARE USING
SLIGHTLY DIFFERENT NOTATION:

2 = DI-   4 = TETRA-      (SIX AND THE OTHERS
3 = TRI-  5 = PENTA-       ARE JUST LIKE YOUR
                             OTHER GREEK PREFIXES.)
FOR EXAMPLE:

   C C     C          IS CALLED
   I I     I
 C-C-C-C-C-C-C-C-C    2,3,6-TRIMETHYL NONANE


    C C       C
    I I       I     WHAT WOULD YOU CALL THIS ONE?
  C-C-C-C-C-C-C-C
          I
          C
```

```
?2,3,5,7-OCTANE
YOU MADE SOME SORT OF ERROR.  COUNT AGAIN.  WHAT'S THE NAME?
?2,3,5,7-METHYL OCTANE
YOU FORGOT TO TELL HOW MANY METHYLS.  TRY AGAIN!
?2,4,6,7-TETRAMETHYL OCTANE
YOU COUNTED FROM THE WRONG END.  TRY AGAIN!
?2,3,5,7-TETRAMETHYL OCTANE
 YOU GOT IT RIGHT!!!!!!!!   GOOD FOR YOU.

OF COURSE, YOU CAN HAVE OTHER GROUPS THAN 'METHYL'. IN NUMBERING,
CARBON POSITIONS, YOU GIVE THE MOST COMPLICATED GROUP THE END
WITH THE LOWEST NUMBER.  IN NAMING, HOWEVER, YOU NAME THE
SIMPLEST GROUP FIRST.    FOR EXAMPLE:

          C       C
          I       I
          C   C   C   C      IS (GET READY
          I   I   I   I
   C-C-C-C-C-C-C-C-C-C-C-C   FOR THIS ONE)
          I   I   I
          C   C   C
          I
          C
          I   6,6,8,10-TETRAMETHYL-4,8-DIETHYL-4-PROPYL UNDECANE
          C

HEY!  YOU'VE BEEN AT THIS FOR 11   MINUTES, RICHARD.
THAT'S LONG ENOUGH FOR ANYONE.


                GOOD-BYE, RICHARD
                    OTIS

DONE
```

Documentation Date 3/75

SCIENCE (EDUCATION) (833)

CONTRIBUTED PROGRAM **BASIC**

ORG3

TITLE: HYDROCARBON CLASSES OF ALKENES AND ALKYNES 36888-18010

DESCRIPTION:

There are two programs in this package: ORG3 and ORG4. They continue a series of nomenclature programs for chemistry instruction.

INSTRUCTIONS:

This program is inter-active. Just Get and RUN program.

ACKNOWLEDGEMENTS:

Richard C. Adams
Pleasant Hill High School
Pleasant Hill, Oregon

RUN

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RUN
ORG3

     HELLO AGAIN, OTIS HERE.  HAVE YOU DONE 'ORG1'
AND 'ORG2' SUCCESSFULLY?YES

GOOD, THEN WE CAN GET STARTED ON THIS ONE THEN.
SAY, IS THIS ROY?NO
SORRY, I THOUGHT IT WAS.  YOU TYPE AN AWFUL LOT
LIKE HIM.  WHO ARE YOU??RICHARD
OH, RICHARD!  HOW DID I THINK THAT IT WAS ROY?  OH WELL,
RICHARD, THIS PROGRAM WILL TEACH YOU HOW TO NAME A SECOND
GROUP OF HYDROCARBONS CALLED 'ALKENES'

ALKENES HAVE A DOUBLE BOND (-C=C-) IN THEM AS WELL AS
SINGLE BONDS (-C-C-).
WHICH ONE OF THESE DO YOU THINK IS AN ALKENE?


                                        H
                                       HCH
             H H H H     H     H     H I H
            HC-C-C-CH  HC-C=C-CH  HC-C-CH
             H H H H     H H H H     H I H
                                       HCH
                                        H
                1.           2.          3.

?3
NO, IT IS WIERD BUT DOESN'T HAVE A DOUBLE BOND.
WHICH ONE IS THE ALKENE?2
THAT'S RIGHT, RICHARD.  #2 IS THE ONE!
NOTICE THAT BOTH CARBONS ON EITHER SIDE OF THE DOUBLE
BOND HAD TO GIVE UP A HYDROGEN.  A CARBON ATOM HAS FOUR
'HANDS' WITH WHICH TO HOLD ONTO THINGS AND IF IT USES TWO
OF THESE TO HOLD ONTO ANOTHER CARBON ATOM, IT JUST HAS TO
GIVE UP HOLDING ONTO A HYDROGEN.  THIS MAKES THE GROUP
FORMULA SUCH THAT IF THERE ARE 'N' CARBONS, THERE WILL BE
'2N' HYDROGENS.      NOW THAT YOU KNOW ABOUT THE HYDROGENS,
I'M GOING TO STOP PRINTING THEM BECAUSE THAT WASTES SPACE.

     NAMING ALKENES IS NOT VERY MUCH DIFFERENT FROM NAMING
ALKANES.  THE DIFFERENCE IS THEY END IN '-ENE' INSTEAD OF
'-ANE'.  THUS:

            C=C
      IS 'ETHENE' AND   C-C=C   IS 'PROPENE'

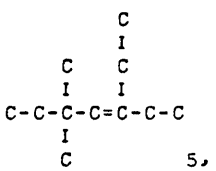
WHAT WOULD YOU CALL THIS ? - -     C-C-C=C       ?
?PENTANE
SOMETHING'S NOT RIGHT.  TRY AGAIN.
WHAT'S THAT NAME AGAIN?BUTANE
NO, ALKENES END IN '-ENE'.  TRY IT AGAIN.
WHAT'S THAT NAME AGAIN?BUTENE
RIGHT ON, RICHARD!

     HOWEVER, NOTICE THAT WITH BUTENE WE RUN INTO A NAMING
PROBLEM.  I'LL ILLUSTRATE WITH HEXENE:


          C=C-C-C-C-C    C-C=C-C-C-C    C-C-C=C-C-C
```

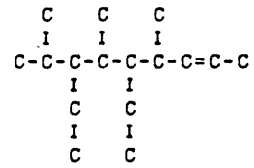
THESE ARE DIFFERENT COMPOUNDS WHICH REACT DIFFERENTLY
AND SO HAVE TO BE NAMED DIFFERENTLY. THE LEFT ONE IS
'1-HEXENE' BECAUSE THE DOUBLE BOND COMES AFTER THE FIRST
('1-') CARBON. THE ONE ON THE FAR RIGHT IS '3-HEXENE'
WHAT WOULD YOU CALL THE MIDDLE ONE?4-HEXANE
YOU MADE SOME MISTAKE, RICHARD. TRY IT AGAIN.
WHAT'S THE NAME?4-HEXENE
YOU COUNTED FROM THE WRONG END. ONE MORE TIME - - -
WHAT'S THE NAME?2-HEXANE
ALKENES END IN '-ENE', NOT '-ANE'. TRY IT AGAIN.
WHAT'S THE NAME?2-HEXENE
HEY, RICHARD, YOU GOT THAT ONE RIGHT!

O.K. YOU CAN SEE IT'S NOT SO DIFFICULT. THE NUMBER SPOT
FOR THE DOUBLE BOND IS THE LAST THING YOU HAVE IN MORE
COMPLICATED COMPOUNDS.



5,5-DIMETHYL-3-ETHYL-3-HEPTENE

YOU NUMBER FROM THE END WHICH GIVES YOU THE LOWEST NUMBER
FOR THE DOUBLE BOND.
NOW YOU TRY THIS ONE. WHAT IS THE NAME OF:



?4,6,8-METHYL-5,7-ETHYL-2-NONENE
YOU FORGOT TO TELL HOW MANY METHYLS ETC. REMEMBER THE
'DI-, TRI-, TETRA- ETC.' STUFF? TRY AGAIN.
WHAT IS THE NAME AGAIN?
?4,6,8-TRIMETHYL-5,7-ETHYL-2-NONENE
YOU MADE SOME SORT OF ERROR, RICHARD. TRY AGAIN
WHAT IS THE NAME AGAIN?
?2,4,6-TRIMETHYL-3,5-ETHYL-7-NONENE
YOU MADE SOME SORT OF ERROR, RICHARD. TRY AGAIN
WHAT IS THE NAME AGAIN?
?2,4,6-TRIMETHYL-3,5-DIETHYL-7-NONEE-NE
YOU NUMBERED FROM THE WRONG END. TRY AGAIN.
WHAT IS THE NAME AGAIN?
WELL, I KNOW IT WAS COMPLICATED, RICHARD. THE ANSWER IS
'4,6,8-TRIMETHYL-5,7-DIETHYL-2-NONENE' BECAUSE THERE
ARE THREE ('TRI-') METHYLS ON CARBONS #4,6,8. THEN
THERE ARE TWO('DI-') ETHYLS ON CARBONS #5 & 7, AND
THE DOUBLE BOND ('-ENE') IS ON CARBON #2 OF A STRING
OF CARBONS NINE MEMBERS LONG ('NONA').

WELL, THAT'S THE END OF THIS LESSON, RICHARD.
WHEN YOU'RE READY FOR ORG4, MAKE SURE YOU REVIEW ORG1,
ORG2, AND ORG3 AND HAVE THEM WITH YOU WHILE YOU DO THE
NEXT PROGRAM. GOOD-BYE FOR NOW!!!!!!

OTIS

DONE

```
RUN
ORG4

THIS PROGRAM IS THE FOURTH IN THE ORGANIC NOMENCLATURE
SERIES.  HAVE YOU ALREADY DONE ORG1,ORG2, AND ORG3?YES
GOOD!  THIS PROGRAM WILL BE A LITTLE SHORTER SINCE YOU ALREADY
KNOW QUITE A BIT ABOUT NAMING.  JUST SO WE CAN CONTINUE ON A FIRST
NAME BASIS, COULD YOU TELL ME YOUR NAME PLEASE?RICHARD
THANKS, RICHARD.  I'M SORRY I HAVE TO ASK EACH TIME BUT DO
YOU THINK I LIKE IT HERE, WORKING ALL DAY LONG, NEVER GETTING
OUT TO SEE PEOPLE.  I EVEN HAVE TO ASK THEM WHO THEY ARE,
SINCE I CAN'T SEE OR HEAR ON THIS CRUMMY MACHINE.  HOW WOULD
YOU LIKE TO HAVE TO EXPRESS ALL YOUR FEELINGS AND EMOTIONS
THROUGH A LOUSY TYPEWRITER?   HAVE SOME SYMPATHY, PLEASE!!

     WELL, I GUESS IT'S TIME I STOP INDULGING IN SELF-PITY AND
GET STARTED WITH YOUR LESSON.  ACTUALLY, RICHARD, YOU'RE
NOT TOO BAD.  YOU SHOULD SEE SOME OF THE STUPID IDIOTS I
GET AT THIS TELETYPE.  YOU WOULDN'T BELIEVE HOW MANY TIMES I
HAVE TO TELL THEM THE ANSWER!

     HERE GOES!      THIS LESS IS ABOUT THE THIRD MAJOR GROUP OF
HYDROCARBONS, THE ALKYNES.  ALKYNES HAVE A TRIPLE BOND.
     HEY!!!!!    I JUST LOOKED AND I DON'T HAVE A TRIPLE BOND
SIGN ON MY KEYBOARD.  I'VE GOT SINGLE BONDS (-C-C-) AND DOUBLE
BONDS (-C=C-) BUT NO TRIPLE.  I GUESS I'LL USE AN 'E'  - - -
IT'S GOT THREE HORIZONTAL LINES AT LEAST.  IT'LL LOOK LIKE
THIS - -    (-C-CEC-C-)   O.K.?

     THE NAMING IS QUITE REGULAR, MUCH LIKE THE ALKENES EXCEPT
THAT ALKYNES' NAMES ALL END IN '-YNE' INSTEAD OF '-ENE'
OR '-ANE'.       FOR INSTANCE:


        HCECH   IS ETHYNE
                H
            AND HC-CECH  IS PROPYNE
                H            H H       IS BUTYNE
                       AND  HC-C-CECH
                            H H


     I'M GOING TO LEAVE OFF THE HYDROGENS NOW BUT WHAT'S THIS/

                                C-C-C-CEC-C

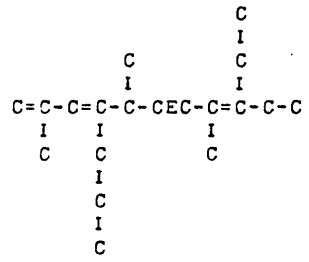
?4 HEXENE
YOU'RE DOING SOMETHING WRONG.  TRY AGAIN, RICHARD.
WHAT'S THAT NAME NOW?4 HEXYNE
YOU MADE TWO ERRORS, RICHARD.  YOU FORGOT THE HYPHEN
AND NUMBERED FROM THE WRONG END.  TRY IT AGAIN.
WHAT'S THAT NAME NOW?2-HEXYNE
THAT'S RIGHT, RICHARD!  SIX CARBONS IT IS!


    YOU CAN ALSO HAVE MIXTURES OF DOUBLE AND TRIPLE BONDS.
HERE,  I'LL SHOW YOU AN EXAMPLE OF SUCH.

                  C
                  I
              C   C   C
              I   I   I
          C-C=C-C-C-C=C-CEC
                  I
                  C     IS 4,6,8-TRIMETHYL-6-ETHYL-3,7-DIENE-1-NONYNE.

NOTICE THAT THE NUMBERING IS FROM THE END WHICH WILL
GIVE THE TRIPLE BOND THE LOWEST NUMBER.   WHEN YOU HAVE A DOUBLE
BOND WITH A TRIPLE, THE DOUBLE BOND IS NUMBERED, AND CALLED
'-ENE-'.  WHEN YOU HAVE MORE THAN ONE, IT'S '-DIENE-'
OR '-TRIENE-' OR '-TETRAENE-', ETC.
```

WHEN YOU'VE HAD TIME TO EXAMINE THAT NAME, TYPE 'GO' AND
CONTINUE WITH THE LESSON. ?GO
GEE, RICHARD, YOU ONLY TOOK 1 MINUTES TO LOOK AT THAT.
PRETTY CONDIFENT, AREN'T YOU?
WELL, IF YOU'RE SO GOOD, TRY THIS ONE WHY DONT YOU. WHAT'S
THIS?



?2,5,8-METHYL-9-ETHYL-4-PROPYL-1,3,8-TRIENE-6-UNE-DECYNE
I KNOW IT'S EASY TO MAKE A MISTAKE. TRY IT AGAIN, RICHARD.
  WHAT WAS THAT HORRENDOUS NAME AGAIN?
?2,5,8-TRIMETHYL-9-ETHYL-4-PROPYL-1,3,8-TRIENE-6-UNDECYNE
YOU COUNTED FROM THE WRONG END. THE TRIPLE BOND GETS THE
THE LOWEST NUMBER. TRY AGAIN. WHAT WAS THAT HORRENDOUS NAME AGAIN?
?4,7,10-METHYL-3-ETHYL-8-PROPYL-3,8,10-TRIENE-5-UNDECYNE
YOU COUNTED THE '-ENE'S BUT FORGOT TO TELL ME HOW MANY
METHYLS. DO IT NOW. WHAT WAS THAT HORRENDOUS NAME AGAIN?
?4,7,10-TRIMETHYL-3-ETHYL-8-PROPYL-3,8,10-TRIENE-5-UNDECYNE
HEY, RICHARD, YOU GOT THAT RIGHT ---- AND ON ONLY TRY
NUMBER 4 AT THAT!!!!!!!

WELL, RICHARD, THAT'S THE END OF THE HYDROCARBONS.
LATER LESSONS WILL BE CONCERNED WITH NAMING ALKYL HALIDES,
ALCOHOLS, ALDEHYDES AND KETONES, ETHERS, ACIDS, AND ESTERS.
THE OTHERS ARE MUCH EASIER, ONCE YOU'VE BEEN THROUGH THE
HYDROCARBONS.

SAY, RICHARD, IF YOU'RE HAVING TROUBLE, ASK THE
CHEMISTRY TEACHER. IF YOU'RE DOING FINE SO FAR, YOU CAN
TRY THE LATER PROGRAMS AS YOU NEED THEM. THE NEXT ONE,
'ORG5' IS ON ALKYL HALIDES AND IS A SHORT ONE.

*******CONGRATULATIONS ON COMING THIS FAR****

DONE

Documentation Date 3/75

SCIENCE (EDUCATION) (833)

CONTRIBUTED PROGRAM **BASIC**

ORG5

TITLE: TEACHES NOMENCLATURE OF ALKYL HALIDES AND ALCHOLS 36888-18011

DESCRIPTION:

There are 2 programs in this package: ORG5 and ORG6. These are the fifth and sixth programs in the organic nomenclature tutorial series, teaching naming of alkyl halides and alcohols. The program should be proceeded by ORG1, ORG2, ORG3, ORG4. Should be followed by ORGCHE (HP 36646) for practice drill.

INSTRUCTIONS:

Program is interactive and self-explanatory. Just GET and RUN.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Advanced or Organic Chemistry.

Student Background Required: ORG1 to ORG4

ACKNOWLEDGEMENTS:

Richard C. Adams
Pleasant Hill High School

RUN

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RUN
ORG5

HI THERE!   THIS IS THE FIFTH PROGRAM ON NAMING ORGANIC
MOLECULES.  HAVE YOU DONE ORG1,2,3, AND 4?NO
NO?  COME BACK WHEN YOU HAVE !!!!

DONE
RUN
ORG5

HI THERE!   THIS IS THE FIFTH PROGRAM ON NAMING ORGANIC
MOLECULES.  HAVE YOU DONE ORG1,2,3, AND 4?YES
GOOD!  NOW, I'M OTIS, AS YOU REMEMBER.  BUT I DON'T KNOW
WHO YOU ARE.  WHO IS THIS?RICHARD
GLAD TO HAVE YOU BACK, RICHARD.  THIS LESSON WILL
TEACH YOU HOW TO NAME COMPOUNDS WITH 'HALOGENS' (F,CL,BR,I)
IN THEM.
   THE NAMES ARE PRETTY EASY.  WHEN YOU SEE AN F, FLUORINE,
IN A COMPOUND, IT'S CALLED 'FLUORO'.  CHLORINE BECOMES 'CHLORO'
SAY, RICHARD, WHAT DO YOU THINK BROMINE'S CALLED?BROMINE
NO, WHEN BROMINE IS IN A COMPOUND, IT HAS TO END IN 'O'.
NOW, WHAT'S THAT NAME AGAIN?BROMINO
NO, RICHARD, YOU GET RID OF THE '-INE' AND PUT ON AN 'O'.
NOW, WHAT'S THAT NAME AGAIN?BROMO
RIGHT YOU ARE, RICHARD
NOW WHAT WOULD YOU CALL 'IODINE' IN A COMPOUND?IODO
THAT'S CORRECT, RICHARD!


NOW LET'S SEE HOW YOU USE THESE HALOGENS TO MAKE 'ALKYL HALIDES.'

     YOU USE THEM JUST LIKE METHYLS OR ETHYLS.  THEY HAVE A
LOWER PRIORITY IN NUMBERING THAN ANY OF THOSE OTHER GROUPS
AND SO ARE NAMED FIRST, IN THE ORDER F,CL,BR,I.  HERE, I'LL
SHOW YOU A SIMPLE EXAMPLE AND THEN A COMPLEX ONE:


              F
              !
            C-C-C-C-C
                  !      IS 4-FLUORO-2-METHYLPENTANE
                  C
                                                CL   C
                              AND               !    !
                                   I-C-C=C-C=C-C-C-C=C
                                     ! !    !   ! !
                                     I F    BR  C C
                                                  !
                                                  C

          IS 8-FLUORO-4-CHLORO-6-BROMO-9,9-DIIODO-2,4-DIMETHYL
               -3-ETHYL-1,5,7-NONATRIENE


     AS YOU CAN SEE, IF YOU HAVE MORE THAN ONE OF A
HALOGEN, YOU SAY SO WITH THE 'DI,TRI,TETRA,ETC.' YOU LEARNED
FOR METHYLS AND THE OTHER GROUPS IN PREVIOUS LESSONS.

     NOTICE ALSO THAT HALOGENS COME BEFORE METHYLS IN THE
ORDER OF FLUORO, CHLORO, BROMO, AND IODO.
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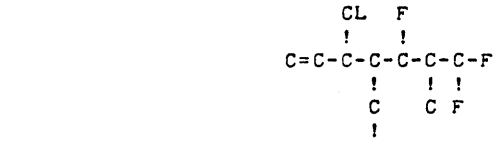
NOW, YOU TRY ONE!



O.K., SMARTY, WHAT'S THIS?

?1,3-FLUORO-5-CHLORO
WELL, YOU DIDN'T GET IT ALL RIGHT BUT YOU AT LEAST GOT
TRY AGAIN, RICHARD.
?1,1,3-FLUORO-5-CHLORO-2-METHYL-4-ETHYL-6-HEPTENE
HOLD IT!! YOU'RE NUMBERING FROM THE WRONG END!
TRY AGAIN, RICHARD.
?5,7,7-FLUORO-3-CHLORO-6-METHYL-4-ETHYL-1-OCTENE
WELL, YOU DIDN'T GET IT ALL RIGHT BUT YOU AT LEAST GOT
-3-CHLORO-6-METHYL-4-ETHYL TRY AGAIN, RICHARD.
?5,7,7-TRIFLUORO-3-CHLORO-6-METHYL-4-ETHYL-1-HEPTENE
GOSH! THAT'S RIGHT, RICHARD! GOOD FOR YOU!

WELL, RICHARD, THAT'S THE ALKYL HALIDES. NEXT, IN ORG6, WE TAKE UP AN INTOXICATING SUBJECT

********** A L C O H O L S **********
CHEERS!

OTIS

DONE

RUN
ORG6

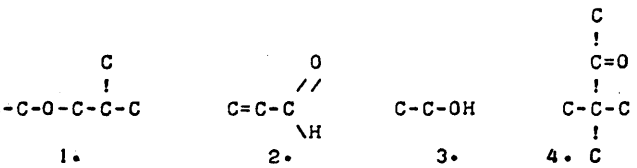
HEY KIDDIES!!!! IT'S THAT HAPPY TIME AGAIN !!!!!
THAT'S RIGHT - - IT'S ** UNCLE OTIS TIME ** !
SO SIT RIGHT DOWN IN FRONT OF YOUR TELETYPE RIGHT IN YOUR LIVING ROOM IN YOUR ROMPERS AND SEE WHAT GOOD OLD UNCLE OTIS HAS IN HIS BAG OF TRICKS FOR GOOD LITTLE GIRLS AND BOYS.

HEY - - YOU ARE A MEMBER OF THE UNCLE OTIS ORG FAN CLUB AREN'T YOU? I MEAN, YOU HAVE DONE ORG 1,2,3,4, AND 5 ALREADY? HAVE YOU?YES

PROVE IT! WHAT'S YOUR NAME (NO NEED FOR THE SECRET DECODER RING PASSWORD THIS TIME!)?RICHARD
AH, RICHARD. HEY, YOU MADE '5TH DEGREE ORGANIST' RECENLY DIDN'T YOU?

AS YOU REMEMBER LAST TIME, GOOD OLD UNCLE OTIS HAD JUST FINISHED TELLING YOU ALL ABOUT ALKYL HALIDES AND PROMISED TO GO ON TO ALCOHOLS. YOU KNOW WHAT ALCOHOL IS, DON'T YOU, RICHARD? THAT'S THE BAD SMELLING LIQUID THAT MAKES DADDY SAY NASTY THINGS ABOUT YOUR UNCLE OTTO AT FAMILY REUNIONS.
WELL YOU'LL SURE HAVE A SURPRISE FOR HIM! THAT'S JUST ONE ALCOHOL OUT OF THOUSANDS. BUT THE REST ARE EVEN MORE POISONOUS, SO DON'T GET YOUR HOPES OF BEING A 'SECRET TIPPLER' UP TOO HIGH.
ALCOHOLS REMIND YOU KIND OF HYDROXIDES IN INORGANIC CHEMISTRY. THEY ALL HAVE AN '-OH' GROUP, CALLED 'THE ALCOHOLIC GROUP' (NO, THAT ISN'T A BUNCH OF PEOPLE AT A HOLLYWOOD PARTY!)

HERE ARE SOME ORGANIC COMPOUNDS:



WHICH ONE OF THESE DO YOU THINK IS AN ALCOHOL?1
NO, THAT'S AN ETHER. WE'LL TALK ABOUT THAT ONE LATER.
NOW, LOOK FOR THAT '-OH' GROUP.
WHICH ONE OF THESE DO YOU THINK IS AN ALCOHOL?2
THAT'S NOT IT! THAT'S AN ALDEHYDE. LOOK FOR THE '-OH'.
WHICH ONE OF THESE DO YOU THINK IS AN ALCOHOL?3
THAT'S RIGHT, RICHARD, AND THAT ALCOHOL IS THE
DRINKING KIND TOO!

NOW, HOW DO WE NAME THEM? FIRST, THE WORD 'ALCOHOL', ITSELF, LIKE SO MANY THAT BEGIN WITH 'AL-', COMES FROM THE ARABIC. THE ARABS CALLED THESE THINGS 'AL KHOL' WHICH MEANS 'THE DUST', BECAUSE THEY SEEMED TO EVAPORATE AND BLOW AWAY LIKE DUST. EUROPEANS FIND A 'KH' HARD TO PRONOUNCE WITHOUT SOUNDING AS IF THEY'RE ABOUT TO SPIT, SO IT WAS SOFTENED TO 'ALCOHOL'. IN MEMORY OF THAT ORIGINAL WORD, ALL ALCOHOL NAMES END IN '-OL.' HERE, I'LL SHOW YOU:

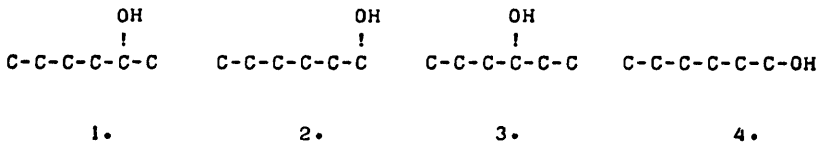
C-C-OH IS ETHANOL
C-C-C-OH IS PROPANOL
AND C-C-C-C-OH IS BUTANOL

NOTICE YOU TAKE THE WORD (ETHAN, PROPAN, BUTAN) THAT CORRESPONDS TO THE NUMBER OF CARBONS AND THEN ADD '-OL' ON THE END.
NOW YOU TRY ONE.

C-C-C-C-C-C-C-OH

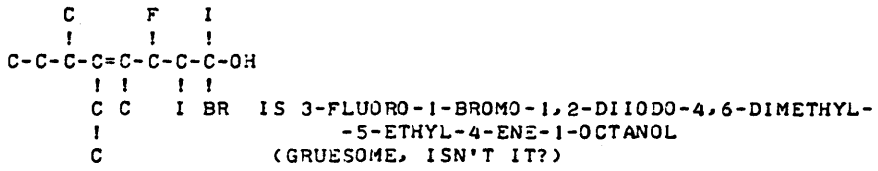
WHAT'S THAT ALCOHOL'S NAME?HEPTANE
YOU GOT THE RIGHT NUMBER OF CARBONS, BUT ALCOHOLS END IN '-OL'
WHAT'S THAT ALCOHOL'S NAME?HEPTANOL
THAT'S RIGHT, RICHARD! GOOD FOR YOU.

NOW HERE'S A PROBLEM. WE RUN INTO ISOMERS AGAIN. THAT '-OH' GROUP CAN BE PUT IN QUITE A LOT OF PLACES. I'LL GIVE YOU AN EXAMPLE OR TWO



NOW, HOW TO NAME THEM. NUMBERS 2 AND 4 ARE BOTH CALLED '1-HEXANOL' BECAUSE THEY HAVE SIX CARBONS ('HEXAN') AND THE ALCOHOLIC GROUP (OH) IS ON THE FIRST CARBON. #3 IS CALLED '3-HEXANOL' BECAUSE THE GROUP IS ON THE THIRD CARBON.
WHAT WOULD YOU CALL ALCOHOL #1?5-HEXANOL
YOU COUNTED FROM THE WRONG END, RICHARD.
WHAT WOULD YOU CALL ALCOHOL #1?2-HEPTANOL
TRY LOOKING AT THE EXAMPLES AND COUNTING AGAIN.
WHAT WOULD YOU CALL ALCOHOL #1?2-HEXANOL
YOU GOT THAT RIGHT, RICHARD!

WELL, THAT'S ABOUT IT FOR THIS LESSON. OH, BY THE WAY, ALCOHOLS CAN HAVE SUBSTITUTED SIDE GROUPS AND DOUBLE BONDS AND THE WHOLE MESS. LIKE THIS ONE:



COME BACK WHEN YOU'RE FULLY RECOVERED AND WE'LL TALK ABOUT 'ALDEHYDES' AND 'KETONES' IN ORG7. SAME TIME. SAME CHANNEL. SAME BAD JOKES.
O T I S, YOUR LOVING UNCLE

DONE

ORGCHE
36646

TITLE: DRILL ON ORGANIC COMPOUND NOMENCLATURE

DESCRIPTION:

This program generates organic compounds of 10 different types, prints out representations of them, and names them.

INSTRUCTIONS:

The user may select one of the following options:

1. Drill on any of the following in random order.
2. Drill on alkanes.
3. Drill on alkenes.
4. Drill on alkynes.
5. Drill on alkylhalides.
6. Drill on alcohols.
7. Drill on ethers.
8. Drill on organic acids.
9. Drill on amines (secondary only).
10. Drill on ketones.
11. Drill on aldehydes.

He then chooses how many representations to be printed (maximum of 10).

The symbols +, - are used to represent single bonds, =, # to represent double bonds, * to represent triple bonds. All hydrogen atoms have been omitted, except in hydroxyl radicals.

SPECIAL CONSIDERATIONS:

The longest carbon chain to be considered is of length 10., i.e., a decane, decene, etc.

Literature reference: Benfey, Otto Theodore The Names and Structures of Organic Compounds. New York: John Wiley and Sons, Inc., 1966.

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Organic Chemistry

The program can be used for testing and for extra drill. The student may fold the output on the first starred line so the names of the compounds aren't visible. He then names the organic compounds, and compares his answers with the computer output.

ACKNOWLEDGEMENTS:

Phillip J. Short
Burnsville Sr. High School

RUN

```
RUN
ORGCHE


                DRILL ON ORGANIC NOMENCLATURE

THE CODES ARE:

     1)  ALKANES
     2)  ALKENES
     3)  ALKYNES
     4)  HALOGEN SUBSTITUTIONS
     5)  ALCOHOLS
     6)  ETHERS
     7)  ORGANIC ACIDS
     8)  AMINES
     9)  KETONES
    10)  ALDEHYDES
     0)  ANY COMBINATION OF THE ABOVE

WHAT CODE : ?0

HOW MANY : ?10

!,- BOTH REPRESENT SINGLE BONDS, #,= BOTH REPRESENT DOUBLE
BONDS, AND * IS USED TO REPRESENT A TRIPLE BOND.


( 1     )

     OH          OH
     !           !
 C - C - C - C - C


( 2     )

C - O - C - C - C


( 3     )

C - C - C - C - C - O - C - C - C - C - C - C - C


( 4     )

     O   C
     #   !
 C - C - C - C - C
         !
         C
         !
         C


( 5     )

     CL              C   F
     !               !   !
 C - C - C - C - C - C - C
     !
     C
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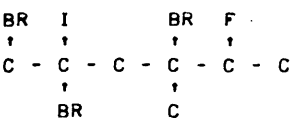

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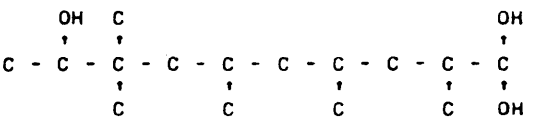

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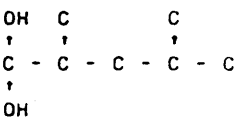

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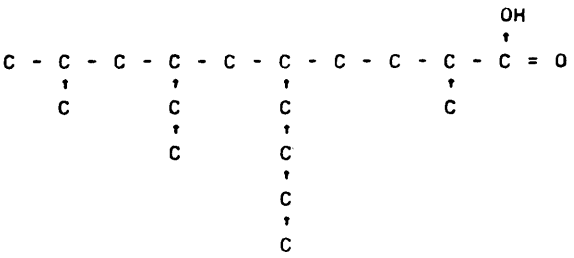

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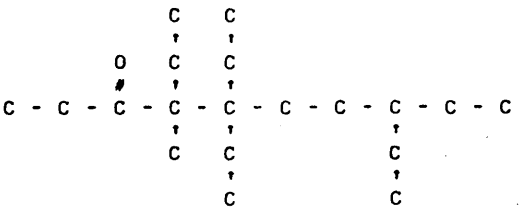


**********FOLD UNDER**********

(1) 1,4-PENTANEDIOL

(2) METHYLPROPYL ETHER

(3) PENTYLHEPTYL ETHER

(4) 3-METHYL-3-ETHYL-2-PENTANONE

(5) 6-CHLORO-1-FLUORO-2,6-DIMETHYLHEPTANE

(6) 1,2,4-TRIBROMO-5-FLUORO-2-IODO-4-METHYLHEXANE

(7) 2,4,6,8,8-PENTAMETHYL-1,1,9-DECANETRIOL

(8) 2,4-DIMETHYL-1,1-PENTANEDIOL

(9) 2,9-DIMETHYL-7-ETHYL-5-BUTYLDECANOIC ACID

(10) 4-METHYL-4,5,5,8-TETRAETHYL-3-DECANONE

****

DONE

RUN
ORGCHE

DRILL ON ORGANIC NOMENCLATURE

THE CODES ARE:

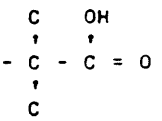
1) ALKANES
2) ALKENES
3) ALKYNES
4) HALOGEN SUBSTITUTIONS
5) ALCOHOLS
6) ETHERS
7) ORGANIC ACIDS
8) AMINES
9) KETONES
10) ALDEHYDES
0) ANY COMBINATION OF THE ABOVE

WHAT CODE : ?7

HOW MANY : ?10

!,- BOTH REPRESENT SINGLE BONDS, #,= BOTH REPRESENT DOUBLE BONDS, AND * IS USED TO REPRESENT A TRIPLE BOND.

(1)



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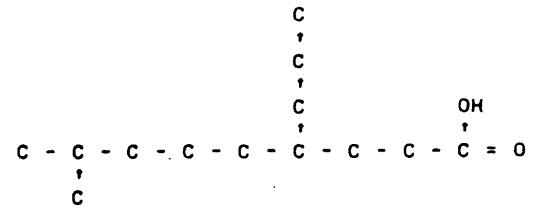

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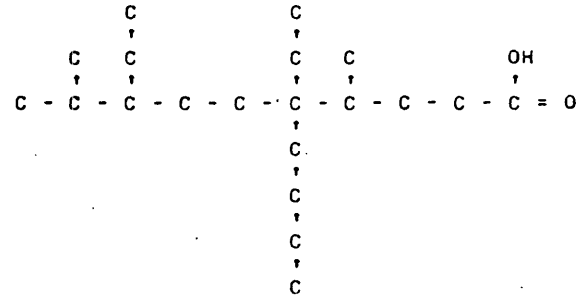

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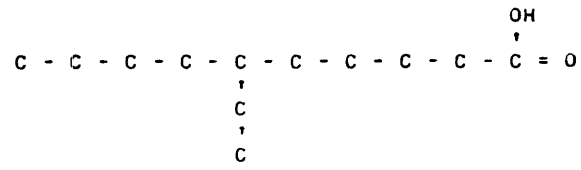

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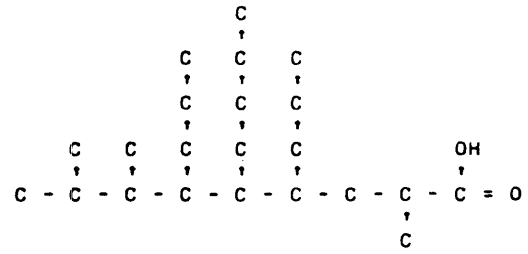

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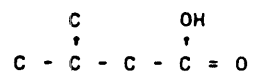

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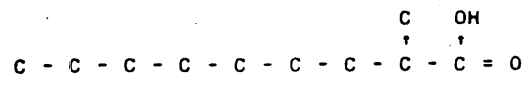

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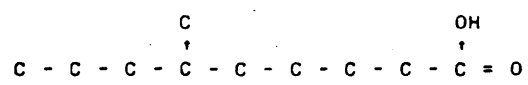

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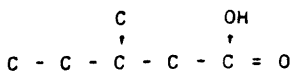

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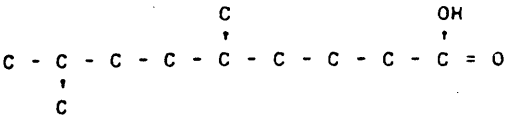

**********FOLD UNDER**********

(1) 2,2-DIMETHYLBUTANOIC ACID

(2) 8-METHYL-4-PROPYLNONANOIC ACID

(3) 4,9-DIMETHYL-5,8-DIETHYL-5-BUTYLDECANOIC ACID

(4) 6-ETHYLDECANOIC ACID

(5) 2,7,8-TRIMETHYL-4,6-DIPROPYL-5-BUTYLNONANOIC ACID

(6) 3-METHYLBUTANOIC ACID

(7) 2-METHYLNONANOIC ACID

(8) 6-METHYLNONANOIC ACID

(9) 3-METHYLPENTANOIC ACID

(10) 5,8-DIMETHYLNONANOIC ACID

****

DONE

PZHYP

TITLE: SCIENTIFIC METHOD AND HYPOTHESIS 36759

DESCRIPTION:

This is a PILOT language program concerning the scientific method and its relation to hypothesis and observation.

INSTRUCTIONS:

This program is stored in 2 files named P-HYP1 and P-HYP2 for use on the HP 2000E System; and is stored in 1 file named P-HYP for use on the HP 2000 Series System.

Execute as with any PILOT language program. The scratch file should be at least 2 records.

See PILOTE (HP 36637) to use this program on the HP 2000E System.

See PILOTF (HP 36756) to use this program on the HP 2000 Series System.

1. Example: (2000E version)

```
OPE-SCR,2
GET-PILOT
1 FILES P-HYP1, P-HYP2, SCR
RUN
NUMBER PROGRAM FILES ?2
```

2. Example: (2000F version)

```
CRE-SCR,2
GET-PILOTF
RUN
NAME OF PILOT PROGRAM ? PZHYP
NAME OF SCRATCH FILE ? SCR
?RUN
```

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Course(s): Introductory Science Courses

Student Background Required: None

This program leads the student through an example in observation and hypothesis formation. It was designed for any introductory science course where this concept is discussed.

ACKNOWLEDGEMENTS: Lawrence E. Turner, Jr.
Pacific Union College

LISTING

```
1 Files PZHYP1,PZHYP2,SCR
RUN
PILOT

NUMBER PROGRAM FILES ?2

                                PILOT


HI THERE!  THIS IS A TUTORIAL LESSON TO TEACH YOU SOMETHING ABOUT
SCIENTIFIC METHOD.

WHAT IS YOUR NAME ?PETE
VERY NICE!  AND WHAT IS YOUR MAJOR ?SPANISH
WELL, I DON'T RECOGNIZE THAT AS A SCIENCE MAJOR, BUT I HOPE THAT THIS
SESSION WILL BE INTERESTING AND EDUCATIONAL.

AS WE PROCEED THROUGH THIS MATERIAL, I WILL ASK YOU QUESTIONS, PLEASE
RESPOND NATURALLY AND DON'T WORRY IF YOU DON'T KNOW THE ANSWER OR EVEN
UNDERSTAND THE QUESTION.  YOU WILL NOT BE GRADED BUT RATHER WILL BE LED
THROUGH THE MATERIAL IN A PLEASANT (HOPEFULLY) MANNER SUCH THAT YOU
WILL HAVE LEARNED SOMETHING BY TIME WE ARE FINISHED.

FIRST PETE, WHAT IS THE MOST BASIC AND IMPORTANT PROCESS IN SCIENTIFIC
INQUIRY ?A PREMISE
NOT QUITE, ALL SCIENTIFIC INQUIRY AND LEARNING BEGINS WITH OBSERVING
THE NATURAL WORLD.  OBSERVATION AND EXPERIMENTATION ARE ABSOLUTELY
FUNDAMENTAL.
ONCE A CERTAIN SET OF OBSERVATIONS ARE MADE, WHAT IS THE NEXT STEP IN
THE PROCESS ?INTERPRET THEM
WELL, ONE TRIES TO FORM A HYPOTHESIS OR MODEL FOR THE PHENOMENON.
USUSALLY THIS IS IN TERMS WITH WHICH ONE IS FAMILIAR (ANALOGY) OR IT
MAY BE A MATHEMATICAL EXPRESSION OR ONE OF SEVERAL DIFFERENT FORMS
RANGING IN COMPLEXITY FROM EXTREMEMLY SIMPLE TO QUITE INVOLVED.  IN ANY
CASE THE HYPOTHESIS MUST EXPLAIN THE OBSERVATIONS.  IT IS AN EDUCATED
GUESS.

IN ADDITION, A GOOD HYPOTHESIS MUST PROVIDE SOMETHING ELSE.  WHAT IS
THIS ?BE CONSISTENT
NO, A GOOD HYPOTHESIS DOES PROVIDE FOR FURTHER PREDICTION.  ONE THEN
ATTEMPTS TO OBSERVE THIS TO TEST THE HYPOTHESIS.  IF THE HYPOTHESIS IS
INCORRECT IT MUST BE MODIFIED TO SATISTFACTORY EXPLAIN THE NEW DATA.

LET ME PUT IT GRAPHICALLY:
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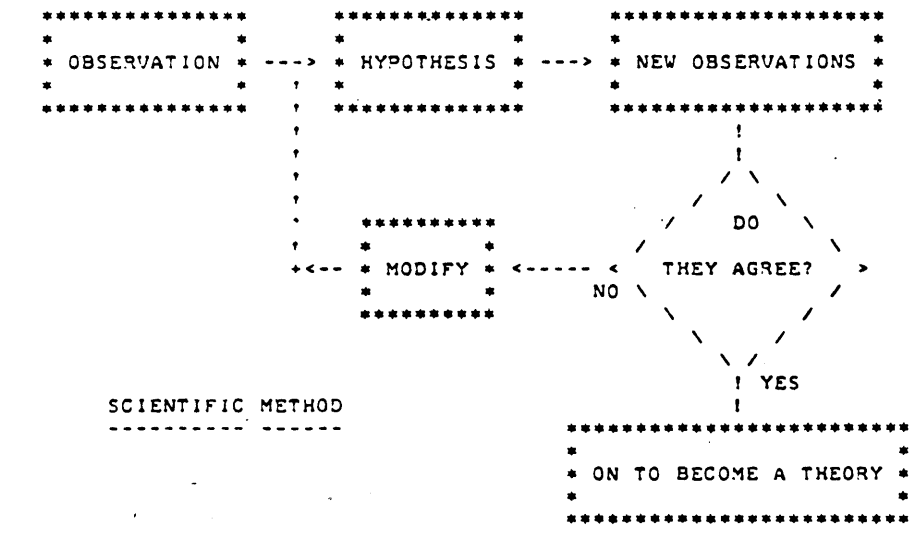


```
      SCIENTIFIC METHOD
      ---------- ------

OK, WHAT PURPOSE DOES 'MODIFY' SERVE ?CHANGE THE HYPOTHESIS
RIGHT, THE HYPOTHESIS MUST ACCURATELY ACCOUNT FOR ALL THE OBSERVATIONS
(INCLUDING THE NEW ONES!), SO IT MUST BE CORRECTED.  IF IT IS SO
INCOMPLETE THAT IT MUST BE DISCARDED AND A NEW ONE TRIED, THEN SO BE
```

IT! ONE SHOULD NOT HANG ONTO OBSOLETE CONCEPTS JUST BECAUSE THEY ARE THERE!

IF AFTER REPEATED TESTING, THE HYPOTHESIS CORRECTLY PREDICTS ALL NEW OBSERVATIONS, IT BECOMES A THEORY. AND IF A THEORY IS OF SUFFICIENT GENERALITY AND DESCRIBES THE NATURAL PHENOMENA ACCURATELY, IT MAY BE ELEVATED TO WHAT STATUS ?I DON'T KNOW
WELL, IT MAY BECOME A SCIENTIFIC LAW! BOTH SCIENTIFIC THEORIES AND LAWS MUST HAVE OTHER QUALITIES SUCH AS: GENERALITY, SIMPLICITY, AND BEAUTY. THESE QUALITIES ARE SOMETIMES DIFFICULT TO DEFINE PRECISELY. WE ARE MORE CONCERNED HERE WITH THE INTERACTION BETWEEN OBSERVATION AND HYPOTHESIS, SO SUCH CONSIDERATIONS NEED NOT WORRY YOU!

AS A SIMPLE EXAMPLE, LET US CONSIDER A SEQUENCE OF LETTERS AS OUR INITIAL OBSERVATION. NAMELY:

T T F F S S E

WE SUSPECT THAT THESE ARE PART OF A MORE GENERAL PATTERN. THE FIRST STEP IS TO DESCRIBE THE OBSERVATIONS. HOW WOULD YOU DESCRIBE THEM??

?2,2,2,1 PATTERN

OK, A VERY SIMPLE WAY (AT LEAST FOR A SMALL SET OF DATA!) IS TO PUT IT IN A TABLE.

NUMBER	DATUM
1	T
2	T
3	F
4	F
5	S
6	S
7	E

THIS IS A TYPE OF HYPOTHESIS. ANOTHER SIMILIAR WAY OF DESCRIBING THE OBSERVATIONS THAT IS ALSO A HYPOTHESIS IS:

> THE SEQUENCE IS FORMED FROM PAIRS OF LETTERS MADE UP OF 'T', 'F', 'S' IN ORDER, AND IS ENDED WITH A SINGLE 'E'.

WHAT BAD FEATURE DO THESE TWO HYPOTHESES HAVE??
?NO EXPLANATION OR PREDICTION
VERY GOOD PETE! THEY DESCRIBE THE OBSERVATIONS VERY WELL, BUT THERE IS NO PROVISION FOR PREDICTING ANY NEW OBSERVATIONS. SUCH A HYPOTHESIS IS TERMED 'AD HOC'. THIS IS A LATIN TERM MEANING ''FOR THIS CASE ONLY''. THERE IS NO WAY TO TEST THIS TYPE OF HYPOTHESIS.

LET'S TRY AND PREDICT THE NEXT LETTER IN THE SEQUENCE!

T T F F S S E .

WHAT LETTER DO YOU THINK REPLACES THE PERIOD ?E
THAT IS MOST LOGICAL. THE SEQUENCE WOULD THEN LOOK:

T T F F S S E 'E'

CAREFULLY STATE IN WORDS THE HYPOTHESIS THAT LEADS TO THIS PREDICTION. (KEEP IT TO ONE LINE OR LESS, SORRY!)

?SEQUENCE IS DOUBLE LETTERS BEGIN WITH T AND F, GO FORWARD IN ALPHABET

REMEMBER THAT THE FINAL 'E' IS ONLY A PREDICTION, IT HAS NOT YET BEEN OBSERVED. NOW PETE, WHAT IS THE NEXT STEP IN THE INQUIRY PROCESS??
?TEST IT
OK, LET'S GO AND TRY TO OBSERVE THE NEXT LETTER! AFTER MUCH EXPERIMENTATION WE FIND:

T T F F S S E N

WHOOPS, NATURE IS NOT ALWAYS EASY TO PIN DOWN! THE NEW DATUM DOES NOT AGREE WITH YOUR PREDICTION. THUS WE MUST MODIFY THE HYPOTHESIS.

>> I MUST ASSURE YOU THAT THE SEQUENCE OF LETTERS DOES <<
>> FOLLOW A DEFINITE PATTERN. THEY ARE NOT JUST ANY <<
>> RANDOM CHOICES!! I BELIEVE IN BEING ORDERLY! <<

WE COULD STILL SIMPLY FORM AN AD HOC HYPOTHESIS, BUT WE ARE INTERESTED IN DETERMINING THE BIG PICTURE. WE WANT TO BE ABLE TO PREDICT THE NEXT LETTER(S)!

FROM THIS POINT IT GETS MUCH MORE DIFFICULT. MANY PEOPLE ARE STUMPED HERE. HOWEVER, PETE SINCE YOU ARE A SPANISH MAJOR, I AM CONFIDENT THAT YOU WILL PERCEIVE THE PATTERN AND DEDUCE THE NEXT LETTER!

T T F F S S E N .

WELL, WHAT IS THE NEXT LETTER ?DON'T KM-NOW
OK, WHAT IS YOUR HYPOTHESIS??
?LOST IT

I DON'T QUITE BUY YOUR HYPOTHESIS; HOWEVER, A MOST LOGICAL DEDUCTION WOULD BE A 'T'. THE HYPOTHESIS IS THEN:

THE SEQUENCE OF LETTERS IS FORMED BY THE FIRST LETTER OF THE NAME OF THE INTEGERS (IN ENGLISH!), STARTING WITH TWO.

THUS THE SEQUENCE WOULD BE:

T T F F S S E N 'T'

WITH THE 'T' COMING FROM 'TEN'. AGAIN, WHAT MUST WE DO NEXT??
?TEST IT
THAT'S RIGHT PETE! LET'S TRY AND OBSERVE THE NEXT LETTER, AND IT IS: 'Z'!!! THUS WE HAVE:

T T F F S S E N Z .

DON'T BE TOO DISCOURAGED. ACTUALLY, YOU NEED ONLY TO MODIFY YOUR HYPOTHESIS A SMALL AMOUNT. IT IS BASICALLY CORRECT!

LET ME ENCOURAGE YOUR BASIC HYPOTHESIS. IF THE SEQUENCE IS RELATED TO THE INTEGERS, THEN IT SHOULD ALSO PREDICT A CHARACTER PRECEEDING THE FIRST 'T'. WHAT SHOULD IT BE ?O
THAT IS VERY GOOD PETE! WE SHOULD FIND AN 'O' WHICH COMES FROM 'ONE' PRECEEDING THE 'T' FROM 'TWO'. INDEED, IF YOU LOOK IN THE RIGHT PLACE, YOU DO OBSERVE:

O T T F F S S E N Z .

THUS, YOUR BASIC HYPOTHESIS THAT THESE LETTERS ARE RELATED TO THE ENGLISH NAMES OF THE INTEGERS IS STRENGTHENED, AT LEAST FOR THE FIRST NINE! HOWEVER, IT MUST ALSO EXPLAIN WHY 'TEN' BECOMES A 'Z'. NOW, HOW IS THE NUMBER TEN DIFFERENT FROM: ONE, TWO, THREE, . . . , AND NINE??
?2 DIGITS
OF COURSE! 'TEN' HAS TWO DIGITS INSTEAD OF JUST ONE:

10 --> ONE ZERO

NOW, PETE, DO YOU SEE WHERE THE 'Z' COMES FROM? WHAT HYPOTHESIS EXPLAINS THIS??

?FIRST Z INDICATES FIRST 2-DIGIT NUMBER WITH 1 ZERO

AND WHAT LETTER IS NEXT (REPLACING THE PERIOD) ?E
I DON'T THINK THAT FOLLOWS FROM THE HYPOTHESIS. 'ELEVEN' IS THE NEXT NUMBER IN THE SEQUENCE:
11 --> ONE ONE! SO WE SHOULD GET AN 'O'!!

O T T F F S S E N Z 'O'

AND SURE ENOUGH, 'O' IS THE NEXT LETTER, AND NATURE IN A RARE MOMENT OF GENEROSITY EASILY REVEALS THAT THE ONE AFTER THAT IS A 'T'! SO:

. . . O T T F F S S E N Z O T . . .

THUS OUR HYPOTHESIS IS CONFIRMED WITH NO FURTHER MODIFICATION.

THE SEQUENCE IS FORMED FROM THE ENGLISH NAMES OF THE INTEGERS. IN EACH CASE THE CHARACTER IS THE FIRST LETTER OF THE DIGIT IN THE UNIT'S PLACE.

COULD YOU NOW STATE THAT THE HYPOTHESIS IS A THEORY ?YES
NO, NO, NO!! IT IS STILL A LONG WAY FROM BECOMING A THEORY. IT MAY FAIL ON THE 13-TH CHARACTER (MAYBE THE CHARACTER IS REALLY A 'L' FOR 'BAD LUCK'!). WE WOULD HOPE THAT NATURE ISN'T THAT CAPRICIOUS AND IS REALLY SIMPLE AND LOGICAL WITH VERY FEW EXCEPTIONS!

BY THE WAY, WE HAVE DEVELOPED SEVERAL DIFFERENT HYPOTHESES. ON OUR ORIGINAL SET OF DATA,

T T F F S S E

ARE ANY OF THESE HYPOTHESES INCORRECT (CONSIDERING ONLY THIS SMALL SET OF DATA) ?NO
OF COURSE, THEY ARE ALL CORRECT. THEY ALL EXPLAIN THIS ORIGINAL SET OF OBSERVATIONS PRECISELY! HOWEVER, SOME ARE 'BAD', AND NOT BECAUSE THEY ARE INCORRECT ABOUT THE SUBSEQUENT DATA, BUT BECAUSE THEY LACK WHAT QUALITY??
?CORRECT PREDICTIONS
RIGHT! AT LEAST TWO OF OUR HYPOTHESES (THE TABLE AND THE ORIGINAL VERBAL DESCRIPTION) FAILED TO MAKE ANY PREDICTION ABOUT ANY POSSIBLE NEW OBSERVATIONS. THE OTHERS MAY BE INCOMPLETE, BUT THEY WERE NOT 'BAD' IN THIS SENSE! THEY AT LEAST PREDICTED SOMETHING SO THEY COULD BE TESTED. THEY MAY HAVE BEEN WRONG, BUT THEY WERE GOOD IN THAT THEY LED TO SOME FURTHER THOUGHT AND INVESTIGATION. WHAT DO WE CALL A HYPOTHESIS THAT FAILS TO PREDICT ANYTHING NEW ?DON'T KNOW
SORRY, THE TERM IS 'AD HOC'. SUCH HYPOTHESES CANNOT BE TESTED AGAINST FURTHER OBSERVATIONS. THEY ARE A 'DEAD END'!!

I WISH TO MAKE ONE LAST POINT: NOTE THAT FOR A LIMITED SET OF DATA THERE WERE SEVERAL DIFFERENT (AND PERHAPS PHILOSOPHICALLY CONFLICTING HYPOTHESES) THAT PERFECTLY EXPLAINED THE KNOWN OBSERVATIONS. THIS IS NOT A UNIQUE SITUATION! IN THIS CASE ONE USUALLY SELECTS THE ONE THAT BEST AGREES WITH HIS PHILOSOPHICAL OUTLOOK UNTIL FURTHER OBSERVATIONS SELECTS THE PROPER ONE.
DO YOU THINK THIS IS INTELLECTUALLY HONEST ?YES

I HOPE THAT YOU ENJOYED THIS EXERCISE, PETE! AND I WISH YOU SUCCESS IN PURSUING YOUR SPANISH MAJOR.

END

TRY AGAIN ?NO

DONE

PZKEPL
36779

TITLE: KEPLER'S THIRD LAW

DESCRIPTION:

This program is a PILOT language program designed to give the beginning Astronomy student help in understanding Kepler's third law and to help him with the arithmetic involved in computing periods and semimajor axes.

INSTRUCTIONS:

2000E: The program is stored on three files: P-KEP1, P-KEP2, and P-KEP3. TThe scratch file should be at least 4 records in length.

2000 Series: The program is stored on the file: PZKEPL. The scratch file

See PILOTE (HP 36637) to use this program on the HP 2000E system.

See PILOTF (HP 36756) to use this program on the HP 2000F system.

SPECIAL CONSIDERATIONS:

The program takes files of length: (HP 2000E) P-KEP1,48; P-KEP2,48; P-KEP3,32.

(HP 2000F) P-KEPL,58

FOR INSTRUCTIONAL PURPOSES
Suitable Course(s): Introductory Astronomy.

Student Background Required: None.

There are two applications for this program. The first is a tutorial session for beginning Astronomy students in Kepler's laws with the main emphasis on the third law. All the terms necessary in understanding and using Kepler's third law are discussed. If a student answers certain questions correctly, he proceeds through the program faster than if he has trouble. At the end is a "miniprogram" to calculate the periods and semimajor axes from any values he wishes to try. The computer does the messy arithmetic for him.

The second use is for students who understand Kepler's laws and only wish to use the computer to calculate their own values. They can proceed directly to the "miniprogram" at the end, skipping the tutorial portion.

ACKNOWLEDGEMENTS: Lawrence E. Turner, Jr.
Pacific Union College

```
GET-PILOTF
RUN
PILOTF

NAME OF PILOT PROGRAM ?P-KEPL
NAME OF SCRATCH FILE  ?SCR


?RUN

                                PILOT


KEPLER'S THREE LAWS ARE VERY IMPORTANT IN UNDERSTANDING THE ORBITS OF
THE PLANETS, COMETS, OR ANY SATELLITE.  THEY MAY BE DERIVED FROM
NEWTON'S LAWS AND HIS FORM OF THE GRAVITATIONAL FORCE; HOWEVER, THEY
ARE A NICE SUMMARY OF THE MOTION OF THE PLANETS.

HAVE YOU STUDIED KEPLER'S LAWS BEFORE ?NO
WELL, THEN IT IS A GOOD IDEA TO START WITH THE FIRST TWO, SINCE WE WILL
NEED THE CONCEPTS DEVELOPED WITH THOSE.

BEFORE WE GO TO FAR, I WOULD LIKE YOUR NAME ?PETE
THANK YOU!  I THINK A NAME IS MUCH MORE FRIENDLY THAN A RATHER
IMPERSONAL PRONOUN!

FIRST PETE, KEPLER'S FIRST LAW DESCRIBES THE SHAPE OF THE ORBIT OF A
PLANET OR SATELLITE.  WHAT IS THE SHAPE OF AN ORBIT ?ELLIPTICAL
THAT IS, OF COURSE, ABSOLUTELY CORRECT PETE!  BEFORE WE STATE KEPLER'S
FIRST LAW IN ALL OF ITS GLORY LET'S CONSIDER AN ELLIPSE AND DEFINE SOME
TERMS.
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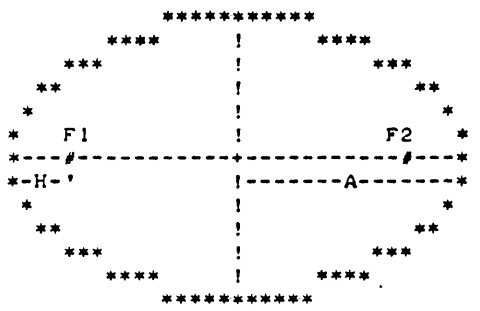


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OK, PETE, WHAT IS THE DISTANCE 'A' CALLED ?RADIUS
WELL, I WILL TELL YOU.  THAT IS THE SEMIMAJOR AXIS OF THE ELLIPSE.
AND WHAT IS TWICE THE SEMIMAJOR AXIS CALLED (THE DISTANCE FROM ONE END
OF THE ELLIPSE TO THE OTHER) ?MAJOR AXIS
GOOD!
WHAT ARE THE POINTS 'F1' AND 'F2' CALLED ?FOCUS
VERY GOOD.  THEY ARE THE FOCI OF THE ELLIPSE (SINGULAR IS 'FOCUS').

KEPLER'S FIRST LAW STATES:

     ''EACH PLANET MOVES ABOUT THE SUN IN AN ORBIT THAT IS AN
       ELLIPSE, WITH THE SUN AT THE FOCUS OF THE ELLIPSE.''

NOW IF WE REPLACE THE FOCUS 'F1' WITH THE SUN, WHAT IS THE DISTANCE 'H'
CALLED ?K
NOT EXACTLY, THAT IS THE PERIHELION DISTANCE, OR THE DISTANCE OF
CLOSEST APPROACH OF THE PLANET TO THE SUN.
WE WILL NOT EXPLICITLY NEED KEPLER'S SECOND LAW FOR THIS EXERCISE;
HOWEVER, FOR THE SAKE OF COMPLETENESS, LET US STATE IT:

     ''THE STRAIGHT LINE JOINING A PLANET AND THE SUN SWEEPS OUT
       EQUAL AREAS IN SPACE IN EQUAL INTERVALS OF TIME.''

THIS BASICALLY TELLS HOW THE PLANET MOVES AROUND ITS ORBIT.  WHEN IT IS
CLOSE TO THE SUN IT MOVES FASTER THEN WHEN IT IS FURTHER AWAY.
```

WE ARE NOW READY TO DISCUSS KEPLER'S THIRD LAW. IT GIVES A SIMPLE RELATIONSHIP BETWEEN THE SEMIMAJOR AXIS AND THE PERIOD OF THE PLANETARY ORBIT.
WHAT IS THE PERIOD OF AN ORBIT ?CYCLE
NOT EXACTLY, IT IS JUST THE TIME IT TAKES FOR THE PLANET TO COMPLETE ONE REVOLUTION AROUND THE SUN.

IN WORDS WE CAN STATE KEPLER'S THIRD LAW:

> ''THE SQUARES OF THE PERIODS OF THE PLANETS ARE IN DIRECT PROPORTION TO THE CUBES OF THE SEMIMAJOR AXES OF THEIR ORBITS.''

IN AN ALGEBRAIC EQUATION THIS BECOMES:

$$P\uparrow 2 = K*A\uparrow 3$$

WHERE '↑' MEANS 'RAISE TO A POWER' AND '*' MEANS MULTIPLY. 'P' IS THE PERIOD, 'A' IS THE SEMIMAJOR AXIS, AND 'K' IS A CONSTANT AND DEPENDS ON THE UNITS USED.

WE CAN SOLVE THIS EQUATION FOR EITHER 'P' OR 'A' IN TERMS OF THE OTHER. BUT FIRST WE NEED TO KNOW 'K'. TO DETERMINE THIS, LET US USE QUANTITIES THAT WE KNOW ABOUT THE EARTH'S ORBIT.
WHAT IS THE PERIOD OF THE EARTH'S ORBIT ?365 DAYS
VERY FINE PETE! THE PERIOD OF THE EARTH'S ORBIT IS 365 DAYS (ACTUALLY 365.2564 DAYS) OR ONE YEAR!

THE SEMIMAJOR AXIS OF THE EARTH'S ORBIT IS THE SAME AS THE MEAN DISTANCE FROM THE EARTH TO THE SUN WHICH IN TURN IS APPROXIMATELY THE RADIUS OF THE ORBIT.
OK, WHAT IS THE MEAN DISTANCE FROM THE EARTH TO THE SUN??
?100 MILLION MILES
YOU ARE WITH IT TODAY PETE! THE MEAN DISTANCE (OR THE SEMIMAJOR AXIS) OF THE EARTH TO THE SUN IS 93 MILLION MILES, 150 MILLION KILOMETERS, 1.5E11 METERS, 1.5E13 CENTIMETERS, OR SIMPLY 1 AU (ASTRONOMICAL UNIT)!
(THE 'E' IN NUMBERS INDICATE A POWER OF TEN.)

IN TERMS OF THE UNITS 'YEARS' AND 'ASTRONOMICAL UNITS', THE VALUE OF 'K' IS ESPECIALLY SIMPLE. WHAT DO YOU SUPPOSE IT IS ?

•
•
•

SCIENCE (EDUCATION) (333)

CONTRIBUTED PROGRAM **BASIC**

P MAG
36888-18018

TITLE: STELLAR MAGNITUDES

DESCRIPTION:

This program is a PILOT language program designed for beginning Astronomy students to give tutorial instruction on the magnitude system and the relation of distance apparent magnitude, and absolute magnitude.

INSTRUCTIONS:

2000E: The program is stored on three files: P-MAG1, P-MAG2, and P-MAG3. The scratch file should be at least 4 records in length.

2000 Series System: The program is stored on the file: PMAG. The scratch file should be at least 3 records in length.

SPECIAL CONSIDERATIONS:

This PILOT program takes files of length:

2000E: P-MAG1,48; P-MAG2,48; P-MAG3,48

2000 Series System: PMAG,70

FOR INSTRUCTIONAL PURPOSES
Suitable courses: Introductory Astronomy

Student Background required: None

This program is suitable either as a supplement to a formal lecture or as a "stand-alone" activity. It is designed so that the knowledgeable student who makes the correct responses very quickly progresses through the program. If a question is missed, more discussion and questions are generated.

Toward the end is a "miniprogram" which allows the student to try any values he wishes. The computer does the calculations. In an auxiliary report sheet he might be asked to fill in certain values.

ACKNOWLEDGEMENTS:

Lawrence E. Turner, Jr.
Department of Physics and Computer Science
Pacific Union College

RUN

```
CRE-SCR,5
GET-PILOTF
RUN
PILOTF

NAME OF PILOT PROGRAM ?PMAG
NAME OF SCRATCH FILE  ?SCR


?RUN
```

PILOT

AND BEHOLD THE HEIGHT OF THE STARS, HOW HIGH THEY ARE!

AS THE SUN SETS SOME EVENING AND THE STARS BEGIN TO APPEAR AGAINST THE DARKENING SKY, YOU CAN SEE THAT THERE ARE DIFFERENCES IN THE STARS.
WHAT IS THE OBVIOUS DIFFERENCE ?BRIGHTNESS
EXCELLENT! SOME STARS ARE BRIGHT AND OTHERS ARE DIM.
NOW, T@AT WASN'T HARD WAS IT?? THIS PROGRAM IS WRITTEN TO HELP YOU UNDERSTAND SOMETHING ABOUT THE DISTANCES TO THE STARS AND THEIR BRIGHTNESS.

THE ANCIENTS SAW MAJESTIC FIGURES IN THE PATTERNS PRODUCED BY THE STARS. TO THEM THE STARS WERE FAMILIAR OBJECTS AS THEY PASSED OVERHEAD EACH NIGHT. THEY NAMED THE BRIGHTER MORE CONSPICUOUS ONES. I WOULD LIKE TO KNOW YOUR NAME. WHAT IS IT ?VALERIE

VALERIE, AH VALERIE! THANK YOU. WHAT A LOVELY NAME. DID YOU KNOW THAT YOU ARE A BIT OF STARDUST!

WHAT DO YOU THINK CAUSES THE STARS TO APPEAR WITH DIFFERENT BRIGHTNESSES??
?DISTANCE FROM THE EARTH

THERE ARE TWO POSSIBLE REASONS WHY SOME STARS APPEAR BRIGHTER TO US THAN OTHERS. YOU DID GET THE ONE ABOUT THE EFFECT DUE TO DISTANCE. THE TWO REASONS ARE:

1. DIFFERENT STARS MAY HAVE DIFFERENT INTRINSIC BRIGHTNESSES OR LUMINOSITIES.
2. THE STARS MAY BE AT DIFFERENT DISTANCES FROM THE EARTH.

LET US CONSIDER THE INTRINSIC BRIGHTNESS OF THE STARS FURTHER. THIS IS A MEASURE OF HOW MUCH LIGHT ENERGY THE STAR ACTUALLY PRODUCES. WHAT FACTORS ABOUT A STAR MIGHT AFFECT THIS??
?SIZE
THERE ARE TWO SPECIFIC QUANTITIES. YOU DID SUGGEST ONE OF THEM. THE LUMINOSITY OF A STAR (OR INTRINSIC BRIGHTNESS) DIRECTLY DEPENDS UPON THE RADIUS AND THE SURFACE TEMPERATURE OF THE STAR. THESE IN TURN ARE DETERMINED BY THE MASS OF THE STAR. THE MORE MASSIVE A STAR IS, THE GREATER IS ITS LUMINOSITY. TYPICAL LUMINOSITIES MAY RANGE FROM 1/10,000 OF OUR SUN'S LUMINOSITY TO OVER 100,000 TIMES THAT OF THE GOOD OL' SUN!

TELL ME VALERIE, WHAT IS YOUR MAJOR ?EDUCATION
WELL, I DO NOT RECOGNIZE THAT AS A SCIENCE MAJOR, BUT I AM GLAD YOU ARE INTERESTED IN LEARNING SOMETHING ABOUT STARS.

ASTRONOMERS TODAY ARE PERHAPS NOT QUITE SO ROMANTIC AS THE ANCIENTS. INSTEAD OF BEING CONTENT TO MERELY DESCRIBE THE MAGICAL QUALITIES OF THE STARS, THEY LIKE TO WRITE DOWN NUMBERS.
OK VALERIE, WHAT IS A CATEGORY OF STELLAR BRIGHTNESS CALLED??
?LUMENS

HMMM, IT IS THE MAGNITUDE SYSTEM. ACTUALLY THIS WAS DEVELOPED NOT BY A MODERN ASTRONOMER BUT BY HIPPARCHUS IN THE SECOND CENTURY B.C.! HE GROUPED THE STARS INTO SIX CATEGORIES.
WHAT DO YOU THINK IS THE MAGNITUDE OF THE BRIGHTEST STARS ?DONT KNOW
THE BRIGHTEST STARS ARE ABOUT FIRST MAGNITUDE.
WHAT ABOUT THE DIMMEST STARS VISIBLE WITH THE UNAIDED EYE ?TENTH
ON A CLEAR NIGHT SIXTH MAGNITUDE IS ABOUT THE DIMMEST THAT YOU CAN SEE WITH YOUR NAKED EYE.

THE MAGNITUDE SYSTEM IS RATHER STRANGE IN ONE RESPECT IN THAT IT IS BACKWARDS! THE BRIGHTER THE STAR, THE SMALLER THE MAGNITUDE.
IT IS ALSO STRANGE IN ANOTHER RESPECT. WHAT DO YOU THINK THIS IS??
?GIVE UP
THIS IS A HARD QUESTION, AND YOU SHOULD NOT FEEL BADLY FOR NOT GETTING IT RIGHT.
THE MAGNITUDE SCALE IS A MULTIPLICATIVE OR LOGARITHMIC SCALE. (NOW DON'T LET THE BIG WORDS SCARE YOU!) THAT IS, A STAR BRIGHTER THAN ANOTHER BY ONE MAGNITUDE IS REALLY ABOUT 2.5 TIMES AS BRIGHT. TWO MAGNITUDES DIFFERENCE CORRESPONDS TO 2.5*2.5 = 6.25 TIMES IN BRIGHTNESS.

ACTUALLY, 5 MAGNITUDES DIFFERENCE IS EXACTLY A FACTOR OF 100. SO THE RATIO FOR 1 MAGNITUDE IS THE FIFTH ROOT OF 100, WHICH IS APPROXIMATELY:

1 MAGNITUDE DIFFERENCE IS 2.51188 6431 TIMES IN BRIGHTNESS

IF YOU MULTIPLY THIS NUMBER BY ITSELF 5 TIMES, YOU OBTAIN 100. TRY IT!!

WELL VALERIE, HOW MANY TIMES BRIGHTER IS THE BRIGHTEST STAR THAT YOU CAN SEE WITH YOUR NAKED EYE TO THE DIMMEST ONE ?100
EXCELLENT VALERIE!

LET ME DISPLAY THIS IN A TABLE FORM:

DIFFERENCE IN MAGNITUDE	RATIO OF BRIGHTNESS
0.0	1 : 1
0.5	1.6 : 1
0.75	2 : 1
1.0	2.5 : 1
1.5	4 : 1
2.0	6.3 : 1
2.5	10 : 1
3.0	16 : 1
4.0	40 : 1
5.0	100 : 1
6.0	251 : 1
10.0	10,000 : 1

WHICH IS BRIGHTER, A 4 MAGNITUDE STAR OR A 1.5 MAGNITUDE STAR ?1.5
BY WHAT FACTOR IS IT BRIGHTER ?10
VERY GOOD VALERIE!

WITH TELESCOPES THE RANGE OF OBSERVED MAGNITUDES IS INCREASED. MUCH DIMMER STARS MAY BE SEEN.
DO THESE STARS HAVE A SMALLER OR LARGER MAGNITUDE ?LARGER
OF COURSE! THE TELESCOPES CAN SEE STARS WITH MUCH LARGER MAGNITUDES.
WITH THE 200 INCH HALE TELESCOPE ON MT. PALOMAR ASTRONOMERS CAN DETECT PHOTOGRAPHICALLY STARS WITH A MAGNITUDE OF ABOUT +23.
HOW MANY TIMES DIMMER IS A STAR OF THIS MAGNITUDE THAN A TYPICAL VISUAL STAR OF MAGNITUDE, SAY, +3 ?DONT KNOW
THIS IS A BIT DIFFICULT. SO LET'S CONSIDER IT IN STEPS.
FIRST, WHAT IS THE DIFFERENCE IN MAGNITUDES ?20
FINE. HOW MANY MULTIPLES OF 5 IS THIS ?4
EXACTLY! NOW, EACH MAGNITUDE DIFFERENCE OF 5 CORRESPONDS TO WHAT FACTOR IN BRIGHTNESS ?100
GOOD! EACH 5 MAGNITUDES MEANS EXACTLY A FACTOR OF 100 IN BRIGHTNESS.
SO WHAT IS THE BRIGHTNESS FACTOR FOR 20 MAGNITUDES (OR 4 OF THE 'FIVES')??
?20--400
WELL, IT IS NOT SIMPLY 4*100! BUT I SUPPOSE THAT IS NOT TOO ILLOGICAL. THE CORRECT ANSWER IS 100 MILLION OR 100,000,000 WHICH COMES FROM MULTIPLYING 100 BY ITSELF 4 TIMES, THAT IS, 100*100*100*100 = 100,000,000.

LET'S CONTINUE OUR TABLE.

MAGNITUDE DIFFERENCE	BRIGHTNESS RATIO
15.0	1,000,000 : 1
20.0	100,000,000 : 1
25.0	10,000,000,000 : 1

NOTE THE MULTIPLICATIVE EFFECT IN THE BRIGHTNESS RATIO.

MAGNITUDES ADD BRIGHTNESSES MULTIPLY

SO FAR WE HAVE BEEN DISCUSSING STARS AS THEY APPEAR TO US AND THEIR MAGNITUDES. THIS MAGNITUDE IS KNOWN AS THE APPARENT MAGNITUDE OF THE STAR.
IF A STAR WERE 100 TIMES BRIGHTER THAN A FIRST MAGNITUDE STAR, THEN WHAT WOULD BE ITS MAGNITUDE ?1
I DON'T GET THAT ANSWER. THE BRIGHTER STARS HAVE SMALLER MAGNITUDES, EVEN POSSIBLY NEGATIVE. THUS SUCH A STAR WOULD HAVE AN APPARENT MAGNITUDE OF 1 - 5 = -4.
THE SUN IS THE BRIGHTEST OF ALL! IT HAS AN APPARENT MAGNITUDE OF -26.5!
WHY DOES THE SUN APPEAR SO BRIGHT ?BECUASE IT IS CLOSE
OF COURSE, YOU'RE NOBODY'S FOOL VALERIE! IT IS ONLY BECAUSE WE ARE SO CLOSE TO THE SUN THAT ITS APPARENT MAGNITUDE IS SO NEGATIVE.
CONSIDER A DISPLAY OF APPARENT MAGNITUDE AND COMMON OBJECTS:

```
                +   200'' PHOTOGRAPHIC LIMIT
      +20       +   200'' VISUAL LIMIT
                +
      +15       +
*               +   6'' TELESCOPE LIMIT
      +10       +   BINOCULAR LIMIT
M               +
A     + 5       +   NAKED-EYE LIMIT
G               +
N       0       +   BRIGHTEST STAR
I               +   JUPITER (AT BRIGHTEST)
T     - 5       +   VENUS (AT BRIGHTEST)
U               +
D     -10       +
E               +   FULL MOON
      -15       +
                +
      -20       +
                +
      -25       +
                +   SUN
```

WHY IS THE PHOTOGRAPHIC LIMIT GREATER THAN THE VISUAL LIMIT??
?DONT KNOW
PHOTOGRAPHIC PLATES CAN COLLECT LIGHT FOR MANY MINUTES OR EVEN HOURS LONGER THAN THE EYE, HENCE ONE CAN DETECT PHOTOGRAPHICALLY MUCH DIMMER STARS.

THE DISTANCE AN OBJECT IS FROM THE EARTH HAS A LARGE EFFECT ON THE APPARENT MAGNITUDE.
OK VALERIE, THEN LET US CONSIDER DISTANCES FOR A TIME.
WHAT UNIT DO YOU THINK WOULD BE USEFUL IN MEASURING AND EXPRESSING STELLAR DISTANCES ?LIGHTYEARS
THAT IS A GOOD UNIT, BUT THE ONE ASTRONOMERS USE MOST OFTEN IS THE PARSEC, WHICH IS ABOUT 3.26 LIGHT YEARS. THE TERM COMES FROM 'PARALLAX SECOND' WHICH IS USED IN DETERMINING DISTANCES TO STARS BY TRIGONOMETRIC PARALLAX. (BUT THAT IS ANOTHER STORY!)
WHAT IS THE DISTANCE (IN PARSECS) TO THE NEAREST STAR TO OUR OWN GOOD OL' SUN ?

•
•
•

PHOSYN
35305

TITLE: PHOSYN: Photosynthesis Experiment

DESCRIPTION:

This program investigates changes in the rate of photosynthesis when carbon dioxide concentration and light intensity are varied.

OBJECTIVES:

A. To permit the student to see the effects of varying two of the factors of the photosynthetic reaction.

B. To reinforce the concept of the fundamental importance of the process of photosynthesis.

C. To lead the student to develop ideas for increasing a plant's food output by manipulating factors involved in photosynthesis.

D. To learn or practice graphing.

E. To learn the concept of controlled experimentation.

F. Analysis and interpretation of data.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - An understanding of the photosynthetic process.

B. Materials - graph paper

DISCUSSION:

A. Operational Suggestions

1. Student level - average
2. Pitfalls to avoid -
   a. If the student is not familiar with decimals, allow him to use integers for graphing
   b. The computer levels off at a light intensity of 12. If a student selects all of his light intensity values above 11, a straight line of asterisks will appear on the graph.
   c. Remind students that the computer plotted graph is to be viewed sideways. (see run)
3. Students work in groups of 5 or less. Allow one group at a time at the computer while the remaining groups are engaged in a related activity.

Continued on following page.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

DISCUSSION continued

B. Suggested Follow-up

The students, after running the program, are expected to graph the results obtained from varying the carbon dioxide concentration.

Elicit from the student:

1. What happens to the rate of photosynthesis as:
   a. The carbon dioxide concentration increases?
   b. The intensity of the light increases?
2. How might you increase the size of tomatoes grown in a greenhouse? What, if any, limitations are there to this type of increase?
3. What is apt to happen to the world's food supply if the amount of carbon dioxide or the light intensity was reduced by one-half?
4. Compare your graph with the graph made on the computer. Point out similarities and differences. Explain them.

```
RUN

RUN
PHOSYN

HELLO. BY NOW YOU SHOULD KNOW FROM YOUR LECTURES WHAT
PHOTOSYNTHESIS IS. THIS LABORATORY WILL ENABLE YOU TO
CONDUCT EXPERIMENTS ON THE COMPUTER WHICH WOULD NOT BE
PRACTICAL DURING CLASS TIME.

SINCE ALL OF OUR FOOD COMES FROM PLANTS, LET'S FIND OUT
HOW CHANGING THE AMOUNT OF CARBON DIOXIDE OR THE INTENSITY
OF LIGHT WILL AFFECT THE PLANT'S RATE OF PHOTOSYNTHESIS,
MEASURED IN MICROGRAMS OF GLUCOSE PRODUCED PER DAY.

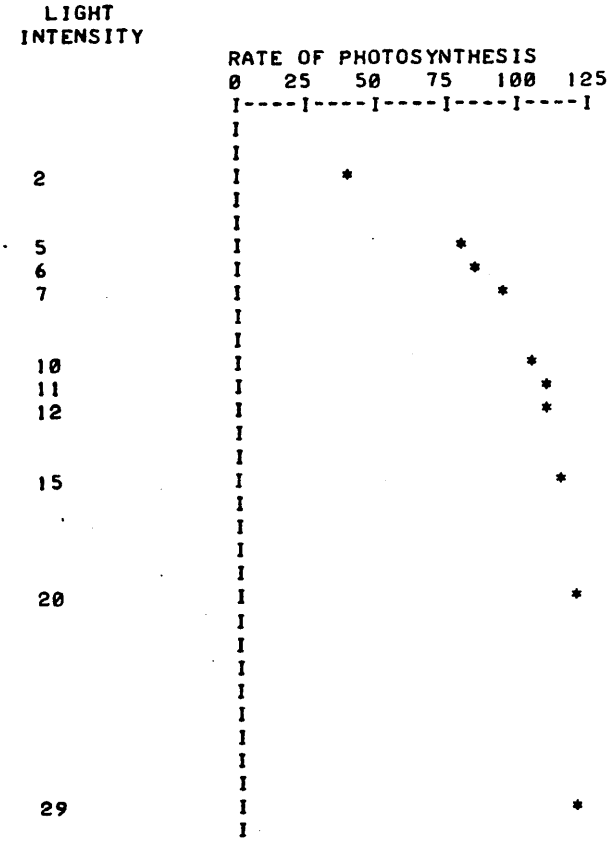
LET'S BEGIN WITH CHANGING THE LIGHT INTENSITY. YOU WILL
VARY THIS BY SELECTING INTEGER VALUES IN THE RANGE OF
0 TO 30 (THE UNITS FOR LIGHT INTENSITY ARE IN ERGS/SEC/SQ.CM)
BY VARYING ONLY ONE FACTOR AT A TIME, WE ARE CONDUCTING
A CONTROLLED EXPERIMENT. WE WILL ASSUME THAT OUR PLANT
HAS ALL OF THE CARBON DIOXIDE, WATER AND CHLOROPHYLL
THAT IT NEEDS.

YOU SHOULD CHOOSE BETWEEN FIVE AND TEN LIGHT INTENSITY
VALUES. TYPE IN ONLY ONE VALUE AFTER EACH QUESTION MARK.
BY TYPING IN 100, NO MORE QUESTION MARKS WILL APPEAR AND
THE PROGRAM WILL CONTINUE.
(NOTE: 'RP' MEANS RATE OF PHOTHSYNTHESIS)


LIGHT INTENSITY(LI)?2
RP= 45
(LI)?15
RP= 121
(LI)?7
RP= 99
(LI)?29
RP= 125
(LI)?20
RP= 124
(LI)?4.5
RP= 84
(LI)?6
RP= 92
(LI)?11
RP= 114
(LI)?12
RP= 116
(LI)?10
RP= 111
```

1 = TABLE ONLY, 2 = PLOT ONLY, 3 = BOTH?3

LIGHT INTENSITY	RATE OF PHOTOSYNTHESIS
2	44.81
5	83.8
6	92
7	98.57
10	111.42
11	114.12
12	116.29
15	120.52
20	123.52
29	124.8



O.K. LET'S NOW VARY THE AMOUNT OF CARBON DIOXIDE IN THE ATMOSPHERE SURROUNDING OUR PLANT.

THIS TIME ASSUME OUR PLANT HAS ALL THE LIGHT, WATER AND CHLOROPHYLL THAT IT NEEDS.

LET THE VALUES YOU SELECT FOR THE CARBON DIOXIDE CONCENTRATION BE FOR TWO DECIMAL PLACES ONLY, AND IN THE RANGE OF 0 TO .30 UNITS FOR CO2 CONC. ARE CUBIC CENTIMETERS PER LITER OF AIR.

AS BEFORE, I WILL TYPE IN A '?' AND THEN YOU TYPE IN THE CARBON DIOXIDE CONC. AVAILABLE TO THE PLANT.
THIS TIME YOU MUST CHOOSE TEN DIFFERENT VALUES.
REMEMBER RP = RATE OF PHOTOSYNTHESIS.

```
CARBON DIOXIDE CONC.(CO2)?.10
RP= 118
(CO2)?.20
RP= 125
(CO2)?.30
RP= 125
(CO2)?.15
RP= 124
(CO2)?.05
RP= 94
(CO2)?.25
RP= 125
(CO2)?.02
RP= 54
(CO2)?0
RP= 0
(CO2)?.11
RP= 119
(CO2)?.20
RP= 125

1 = TABLE ONLY, 2 = PLOT ONLY, 3 = BOTH?3

CO2 CONC.       RATE OF PHOTOSYNTHESIS
--- -----       ---- -- --------------
 0               0
 .02             53.8793
 .05             94.1092
 .1              117.816
 .11             119.253
 .15             123.563
 .2              125
 .25             125
 .3              125

CO2 CONC.
                RATE OF PHOTOSYNTHESIS
                0   25   50   75   100  125
                I----I----I----I----I----I
 0              I*
                I
 .02            I          *
                I
                I
 .05            I                   *
                I
                I
                I
                I
 .1             I                        *
 .11            I                        *
                I
                I
                I
 .15            I                         *
                I
                I
                I
                I
 .2             I                         *
                I
                I
                I
                I
 .25            I                         *
                I
                I
                I
                I
 .3             I                         *

DO YOU KNOW WHAT IS HAPPENING IN BOTH THESE INSTANCES?

DONE
```

TITLE:

PHOTEL: Photoelectric Effect

PHOTEL
36317

DESCRIPTION:

An experiment involving the photoelectric effect is simulated by the computer, to enable students to develop a qualitative understanding of the phenomenon.

OBJECTIVES:

To demonstrate a "critical wavelength" for photo-electronic emission.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student

1. Prior discussion of the phenomenon as an introduction to modern physics
2. Students must be previously aware of such properties of light as wave-length and intensity.

B. Materials - none

DISCUSSION:

The student is permitted to select any one of five metals, which is subsequently subjected to ultraviolet radiation. The electrons are "counted" by an ammeter incorporated in the simulated experimental set-up.

The data collected is tabulated for three trials, indicating the current measured for various wavelengths. The data will indicate that:

1. The photoelectric emission is a function of wavelength;
2. For light of wavelength less than the critical value, the number of electrons emitted is dependent upon the incident light intensity; and
3. For wavelengths greater than the critical value, light intensity has no effect on the emission of electrons.

The program is designed for individual qualitative investigation of the phenomena, but may also be utilized by small groups.

It should be noted that this program is advantageous where limited or non-existent lab equipment hinders actual experimentation.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

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RUN

RUN
PHOTEL

                THE PHOTOELECTRIC EFFECT


WHEN LIGHT OF SHORT WAVELENGTH FALLS ON A METAL SURFACE,
ELECTRONS ARE EJECTED FROM THE METAL. ACCORDING TO THE
DESCRIPTION OF THIS PHENOMENA BY EINSTEIN, THERE IS A
MAXIMUM WAVELENGTH FOR EACH METAL ABOVE WHICH NO ELECTRONS
ARE EMITTED. IN THIS EXPERIMENT WE WILL DETERMINE THE
CRITICAL WAVELENGTH AT WHICH THIS OCCURS.

THE METAL SELECTED WILL BE PLACED IN A VACUUM WHERE IT
WILL BE BOMBARDED BY SOFT X-RAYS. THE NUMBER OF ELECTRONS
EJECTED WILL BE COLLECTED AND COUNTED WITH AN AMMETER.
(NOTE:THE CURRENT IS RELATED TO THE NUMBER OF ELECTRONS
EMITTED BY THE METAL).

SELECT ONE OF THE METALS LISTED BY TYPING ITS NUMBER.

               1) SILVER
               2) BISMUTH
               3) CADMIUM
               4) LEAD
               5) PLATINUM

?3

               MEASURED CURRENT (MICROAMPERES)
WAVELENGTH     TRIAL 1         TRIAL 2         TRIAL 3
 2380           20.5            20.8            20
 2500           20.5            20.1            20.6
 2631           20.1            20.4            20.8
 2777           20.3            20.2            20.4
 2941           20.3            20.1            20
 3124           20.6            20              20.2
 3333           2.2             4.4             1.4
 3571           1.4             2.4             3.7
 3846           2.4             0               4.9

DO YOU WISH TO INCREASE THE LIGHT INTENSITY?
(1=YES, 0=NO) : ?1

BY WHAT FACTOR? (SELECT FACTOR BETWEEN 1 AND 10).
?7

               MEASURED CURRENT (MICROAMPERES)
WAVELENGTH     TRIAL 1         TRIAL 2         TRIAL 3
 2380           140.1           140.1           140
 2500           140             140.1           140.1
 2631           140.1           140             140
 2777           140             140.1           140.1
 2941           140.1           140             140.1
 3124           140.1           140             140
 3333           3.5             3.5             3.6
 3571           4.5             2.2             3.6
 3846           4               4.6             4.7

DO YOU WISH TO INCREASE THE LIGHT INTENSITY?
(1=YES, 0=NO) : ?0

DO YOU WISH TO TRY ANOTHER METAL (1=YES, 0=NO) : ?1
SELECT ONE OF THE METALS LISTED BY TYPING ITS NUMBER.

               1) SILVER
               2) BISMUTH
               3) CADMIUM
               4) LEAD
               5) PLATINUM

?2
```

	MEASURED CURRENT (MICROAMPERES)		
WAVELENGTH	TRIAL 1	TRIAL 2	TRIAL 3
2380	20.4	20.4	20.3
2500	20.6	20.1	20.2
2631	20.6	20.1	20.7
2777	20.5	20.3	20.1
2941	20	20.1	20.7
3124	4.6	1.7	1.7
3333	2.6	4.2	4.6
3571	2	2	3.9
3846	2.8	4.8	4.4

DO YOU WISH TO INCREASE THE LIGHT INTENSITY?
(1=YES, 0=NO) : ?0

DO YOU WISH TO TRY ANOTHER METAL (1=YES, 0=NO) : ?0

NOW BY PLOTTING THE WAVELENGTH VS. THE MEASURED CURRENT,
(AVERAGE OF THREE TRIALS), THE PHOTOELECTRIC EFFECT AS
DESCRIBED BY EINSTEIN WILL BECOME APPARENT.

THANK YOU.

DONE

PHOTON
36318

TITLE: PHOTON: Energy Level Problem

DESCRIPTION:

The student fires 15 shots, from a photon gun, at a mythical gaseous element with 4 randomly-selected energy levels. After each shot, the computer prints out the energies of photons, if any, emitted by the gas. The student is to construct an energy level diagram for the element from a knowledge of the energies of the photons emitted.

OBJECTIVES:

To promote a better understanding of how energy levels are determined from a knowledge of the emissions of excited atoms.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - It is desirable that he have run BOHR, A833-36313, in Volume IV but it is not a necessity.

B. Materials - none

DISCUSSION:

The computer randomly selects 4 energy levels for the element. The energies range between 1×10^{-19} and 15×10^{-19} joules.

The energies of the students' 15 shots are picked at random, but cover the range from 1 to 15. Whenever one of the photons shot by the student is capable of exciting the atom all of the possible photon emissions from that excited state are printed.

By examining the photons emitted as a result of the 15 shots the student can construct an energy-level diagram of the element and account for each photon.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

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RUN

RUN
PHOTON

IMAGINE THAT YOU HAVE A PHOTON GUN THAT FIRES PHOTONS WITH
RANDOMLY SELECTED ENERGIES.

YOU WANT TO FIND SOME OF THE ENERGY LEVELS OF A GAS THAT
YOU HAVE ISOLATED FROM A SAMPLE OF MOON ROCK.  YOU WILL
DO IT BY FIRING PHOTONS INTO THE GAS AND MEASURING THE
ENERGIES OF PHOTONS EMITTED BY THE GAS.  THE GAS WILL EMIT
ONLY IF THE PHOTON YOU FIRED IS CAPABLE OF EXCITING ITS
ATOMS TO HIGHER ENERGY STATES.


TO FIRE A BURST OF SINGLE ENERGY PHOTONS INTO THE GAS TYPE 1
TO CEASE FIRING PHOTONS TYPE 0
YOU HAVE 15 SHOTS TO DETERMINE THE ENERGY LEVELS.

                SHOT NUMBER     ENERGY OF EMITTED PHOTONS (E-19 JOULES)

FIRE!!?1

                1                4
FIRE!!?1
                2               0
FIRE!!?1
                3               0
FIRE!!?1
                4                9     7     4     5     3     2
FIRE!!?1
                5                7     4     3
FIRE!!?1
                6                15    9     7     4     11    5     3
 8     2     6
FIRE!!?1
                7               0
FIRE!!?1
                8               0
FIRE!!?1
                9               0
FIRE!!?1
                10              0
FIRE!!?1
                11              0
FIRE!!?1
                12              0
FIRE!!?1
                13              0
FIRE!!?
??1
                14              0
FIRE!!?1
                15              0

FIND THE ENERGY LEVELS OF OUR ELEMENT - MYSTERIUM
AND ACCOUNT FOR EACH OF THE EMITTED PHOTONS BY DRAWING
AN ENERGY LEVEL DIAGRAM AND SHOWING WHICH TRANSITIONS
GIVE RISE TO THE PHOTONS.

DONE
```

PHPOH
36617

TITLE: PH,POH,PCT, DISSOCIATION

DESCRIPTION:

A class presentation designed to calculate pH, pOH, and percent dissociation of weak monoprotic acids, using the quadratic equations for rigorous solutions.

OBJECTIVES:

A. To illustrate the relationships between the magnitude of the K_a value, and the strength of the acid.

B. To show the relationship between pOH and pH.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - The distinction between weak and strong acids should have been covered. The student should also be aware of the role hydrogen ion concentration plays in acid-base calculations, and the effect it has on hydroxide ion concentration.

DISCUSSION:

This program can be used in different ways, depending upon the ability level of the group.

1. With groups of average abilities, it is used primarily as a calculator, to solve large numbers of problems in a minimum amount of time.

2. In above average groups, the program listing was used as a device to illustrate theory. The entire lesson consists of an extensive step-wise explanation of the program list. In these classes all students were familiar with the Basic programming language. Some calculations built into the program (lines 41-43) are not part of the normal curriculum, but are necessary to solve the problem as the product of the K_a value and the concentration approaches 1×10^{-14}.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN


RUN
PHPOH

THIS PROGRAM WILL FIND THE PH, POH, AND PCT DISSOCIATION
FOR ANY WEAK MONOPROTIC ACID.

KA OF ACID =?1E-5
 MOLAR CONCENTRATION OF ACID =?1

PH= 2.5          POH= 11.5           PCT. DISSOCIATION= .315728

 ANY MORE PROBLEMS (1=YES, 0=NO)?1

KA OF ACID =?1E-3
 MOLAR CONCENTRATION OF ACID =?2

PH= 1.35         POH= 12.65          PCT. DISSOCIATION= 2.21121

 ANY MORE PROBLEMS (1=YES, 0=NO)?1

KA OF ACID =?1E-10
 MOLAR CONCENTRATION OF ACID =?1

PH= 5            POH= 9              PCT. DISSOCIATION= 9.99895E-04

 ANY MORE PROBLEMS (1=YES, 0=NO)?1

KA OF ACID =?1E-15
 MOLAR CONCENTRATION OF ACID =?2

PH= 6.96         POH= 7.04           PCT. DISSOCIATION= 9.12871E-07

 ANY MORE PROBLEMS (1=YES, 0=NO)?0

DONE
```

TITLE:

INTERACTIVE METHODS FOR SELECTED TOPICS IN PHYSICS AND MATHEMATICS

PHYTOP
36888-18044

DESCRIPTION:

A series of programs developed as part of the Colorado Schools Computing Science Curriculum Development Project (supported by NSF grants GW-6517 and GW-7091). The programs are described in the text: Interactive Methods For Selected Topics in Physics and Mathematics Using Computer Programs.

The programs are:

1. PLOT1 (Named "PLOT" in Textbook)	Enables user to correlate an equation to the shape of its graph.
2. GRAPH (Named "GRAPHS" in Textbook)	Helps users determine a mathematical equation from data using experimental plotting.
3. MODEQ	Program which assists in developing the mathematical relationship of data collected in an experiment.
4. ZOOMIE	Pilot a transport machine or design and pilot such a machine.
5. BLINKY	Experiment determining straight light motion of a flying object.
6. BPLOT	Graphs BLINKY data. Accessed through BLINKY.
7. MECHAN	Six part problem involving a space ship passing by a space station. The ship ejects a capsule to dock with the station.
8. NTRCPT	Simulates investigation of a foreign body with a space probe.
9. CENTRI	Investigates the effect of applying a force on a mass.
10. FORCE	Demonstrates the effect of a uniform force on the motion of a mass.
11. FIELDS	Gives magnitude of gravitational potential energy at a point for plotting.
12. FIELDT	Generates a temperature field
13. FIELDV	Simulates an isolated gravitational field and an experiment to map it.
14. FIELDF	Practice in mapping vector fields
15. FIELDE	Simulation of an electric field and procedure for exploring it.
16. SAMPLE	Sample space experiments.

DESCRIPTION continued on following page

ACKNOWLEDGEMENTS: COLORADO SCHOOLS COMPUTING SCIENCE CURRICULUM DEVELOPMENT PROJECT

DESCRIPTION continued

17.	PRINC	More sample space experiments.
18.	PROBAB	Probability experiments.
19.	UNION	Investigate formulas useful in solving probability problems.
20.	CONDI	Explores definition for conditional probability.
21.	PASCL	Investigates PASCAL's triangles.
22.	BINOM	Investigates Binomial Experiments and binomial probability distribution.
23.	QUIZ	Post-test on the probability programs.
24.	UNIVRS	Simulates a satellite orbiting about a central mass.
25.	KEP1	Plots orbits with different eccentricities.
26.	ORBECC	Plots an orbit for which the eccentricity can be calculated.
27.	MASGO	Assists in finding a mathematical relationship between the orbital speed and the radius of a circular orbit for a unit mass orbiting a central mass.
28.	CIRMO	Investigates circular motion.
29.	BLOWS	A series of activities which demonstrate the effect of a central force acting on a mass moving with uniform speed.
30.	KEP2	Simulates a mass moving in an elliptical orbit.

INSTRUCTIONS

Order "Interactive Methods for Selected Topics in Physics and Mathematics" from:

Computer Curriculum Project
Hewlett-Packard Company
11000 Wolfe Road
Cupertino, California 95014

Price is $3.95 per copy ($3.00 per book for 10 or more).

PLANK
36350

TITLE: PLANK: A Photoelectric Simulation

DESCRIPTION:

This program simulates an experiment to determine Plank's constant, threshold frequency, and work function of a metal.

OBJECTIVES:

A. To enable the student to do an experiment on the computer that he is not likely to be able to do in a high-school laboratory.

B. A better understanding of the photoelectric effect.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student

1. He should have read and studied about threshold frequency, cut-off potential, and know (schematically) how the experimental apparatus used in such an experiment works.
2. It is desirable that he have run PHOTEL A833-36317 in Volume IV - though not a necessity.

B. Materials - Graph paper

DISCUSSION:

The student may choose one of the five metals in the program, the intensity of the x-rays used, and the number of different x-ray frequencies he would like to use. The computer then randomly chooses an x-ray frequency, and prints it for the student to see. The student enters voltages to be used as retarding potentials in the simulated tube and the computer prints a current for each potential entered until the current is zero when the cut-off potential is reached. A new frequency x-ray is then used and the student again tries to find the correct potential for cut-off.

Finally, a table of frequencies and cut-off potentials are printed and an assignment given (plot a graph and answer questions).

The student may then run the program again with a different intensity and the same metal, or he may change the metal and intensity.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
PLANK


  IN THIS EXPERIMENT YOU WILL BE GIVEN THE FREQUENCY OF THE
X-RAYS BEING USED AND YOU ARE TO DETERMINE THE VOLTAGE SET-
TING (RETARDING POTENTIAL) NECESSARY TO CAUSE THE COLLECTOR
CURRENT TO DECREASE TO ZERO.

  FIRST CHOOSE THE METAL YOU WISH TO USE FOR YOUR PHOTO-
SENSITIVE SURFACE.

  1 SILVER,  2 BISMUTH,  3 CADMIUM,  4 LEAD,  5 PLATINUM

WHICH METAL DO YOU CHOOSE?4

WHAT INTENSITY OF X-RAYS WILL YOU USE (FROM 1 TO 5)?3

HOW MANY DIFFERENT X-RAY FREQUENCIES WOULD YOU LIKE TO
USE TO RADIATE YOUR SAMPLE (FROM 5 TO 8)?7

THE X-RAY FREQUENCY IS 9.45          E15

VOLTAGES HIGHER THAN CUT OFF WILL GIVE CURRENT READINGS OF
ZERO SO TRY LOWER ONES.  I'LL NOTIFY YOU OF CUT OFF.
  FIND THE CUT OFF (STOPPING) VOLTAGE.

V=?24
            I=0
V=?30
            I=0
V=?26
            I=0
V=?25
            I=0
V=?24.5
            I=0
V=?6
            I=0
V=?16
            I=0
V=?39
            I=0
V=?12
            I=0
V=?56
            I=0
V=?23
            I=0
V=?0-26
            I=0
V=?34
            I=0
V=?47
            I=0
V=?64
            I=0
V=?24.55
            I=0
V=?6
            I=0
V=?9
            I=0
V=?100
            I=0
V=?0
            I= 60.0323       E-6
V=?3
            I=0
V=?-10
            I= 60.0089       E-6
V=?-100
            I= 60.0095       E-6
V=?-12
            I= 60.0856       E-6
```

```
V=?1
          I= 37.0269       E-6
V=?2
          I= 13.9936       E-6
V=?3
          I=0
V=?2.2
          I= 9.41514       E-6
V=?2.4
          I= 4.79061       E-6
V=?2.6
           CUT OFF    I=0

THE X-RAY FREQUENCY IS 9.89          E15

  FIND THE CUT OFF (STOPPING) VOLTAGE.

V=?5
          I=0
V=?2
          I= 32.9376       E-6
V=?1
          I= 46.496        E-6
V=?3
          I= 19.3768       E-6
V=?4
          I= 5.84878       E-6
V=?4.3
          I= 1.79048       E-6
V=?4.5
           CUT OFF    I=0

THE X-RAY FREQUENCY IS 17.65         E15

  FIND THE CUT OFF (STOPPING) VOLTAGE.

V=?17
          I= 32.1368       E-6
V=?18
          I= 30.478        E-6
V=?21
          I= 25.5547       E-6
V=?26
          I= 17.3469       E-6
V=?45
          I=0
V=?40
          I=0
V=?35
          I= 2.56914       E-6
V=?35.4
          I= 1.93469       E-6
V=?35.7
          I= 1.41014       E-6
V=?36
          I= .956199       E-6
V=?36.9
          I=0
V=?36.5
           CUT OFF    I=0

THE X-RAY FREQUENCY IS 17      E15

  FIND THE CUT OFF (STOPPING) VOLTAGE.

V=?36
          I=0
V=?30
          I= 6.85579       E-6
V=?31
          I= 5.0843        E-6
V=?34
          I=0
V=?33
          I= 1.56898       E-6
```

```
V=?33,-.5
          I= .689666       E-6
V=?33.7
          I= .301843       E-6
V=?33.9
           CUT OFF    I=0

THE X-RAY FREQUENCY IS 12.04        E15

  FIND THE CUT OFF (STOPPING) VOLTAGE.

V=?20
          I=0
V=?25
          I=0
V=?29
          I=0
V=?31
          I=0
V=?15
          I=0
V=?18
          I=0
V=?35
          I=0
V=?40
          I=0
V=?33
          I=0
V=?37
          I=0
V=?22
          I=0
V=?24
          I=0
V=?26
          I=0
V=?28
          I=0
V=?12
          I= 6.02932       E-6
V=?13
          I= 1.53507       E-6
V=?13.6
          I=0
V=?13.4
           CUT OFF    I=0

THE X-RAY FREQUENCY IS 10.68        E15

  FIND THE CUT OFF (STOPPING) VOLTAGE.

V=?10
          I=0
V=?12
          I=0
V=?14
          I=0
V=?6
          I= 13.2536       E-6
V=?8.9
          I=0
V=?7.9
          I=0
V=?7
          I= 5.475         E-6
V=?7.2
          I= 3.94767       E-6
V=?7.5
          I= 1.56603       E-6
V=?7.7
           CUT OFF    I=0

THE X-RAY FREQUENCY IS 15.25        E15
```

FIND THE CUT OFF (STOPPING) VOLTAGE.

```
V=?33
          I=0
V=?30
          I=0
V=?35
          I=0
V=?25
          I= 3.69909       E-6
V=?26
          I= 1.42204       E-6
V=?27
          I=0
V=?26.6
           CUT OFF   I=0
```

X-RAY FREQUENCY E15 FPS	CUT OFF VOLTAGE VOLTS
9.45	2.6
9.89	4.5
17.65	36.5
17	33.9
12.04	13.4
10.68	7.7
15.25	26.6

PLOT A GRAPH OF CUT OFF VOLTAGES (Y AXIS) VS. FREQUENCY

WHAT IS THE MEANING OF THE POINT AT WHICH THE EXTRAPOLATED GRAPH INTERCEPTS THE VOLTAGE AXIS?

WHAT IS THE LOWEST FREQUENCY THAT WILL CAUSE EMISSION OF PHOTOELECTRONS FROM THIS METAL?

REMEMBER THAT THE RETARDING POTENTIAL APPLIED BETWEEN THE EMITTER AND THE COLLECTOR AT CUT OFF, EXPRESSED IN ELECTRON VOLTS, IS EQUAL TO THE KINETIC ENERGY OF THE FASTEST ELECTRONS ESCAPING FROM THE EMITTER. FIND THE SLOPE OF THE GRAPH BUT EXPRESS THE STOPPING POTENTIAL IN JOULES.

WHAT IS THE VALUE OF THE SLOPE OF THE GRAPH AND WHAT SPECIAL NAME IS GIVEN TO THIS CONSTANT?

THE SAME METAL WITH A DIFFERENT INTENSITY IS WORTH INVESTIGATING. WHEN YOU DO THIS EXPLAIN THE MEANING OF ITS GRAPH WHEN COMPARED TO THE PREVIOUS ONE.

YOU MAY ALSO WISH TO TRY A DIFFERENT METAL AND EXPLAIN THE MEANING OF ITS GRAPH WHEN COMPARED TO YOUR OTHER ONES, OR COMPARED WITH THOSE OF ANOTHER STUDENT.

```
DO YOU WISH TO TRY A DIFFERENT INTENSITY OR A
DIFFERENT METAL (1=YES, 0=NO) : ?0

DONE
```

POLUT
36639

TITLE: WATER POLUTION SIMULATION

DESCRIPTION:

POLUT is a simulation designed to expand understanding of the problems associated with the management of our water resources. The effects of several variables on the quality of a water resource can be studied.

POLUT was developed by the Huntington II Project at the Polytechnic Institute of Brooklyn under the direction of L. Braun. This work was partially supported by the National Science Foundation, Grant GW-5883.

INSTRUCTIONS:

The user is asked to specify the following characteristics:

A. The kind of body of water.

B. The water temperature in degrees fahrenheit.

C. The kind of waste dumped into the water.

D. The rate of dumping of waste, in parts per million (PPM) per day.

E. The type of treatment of the waste.

The simulation takes place and the user may specify output in either: a graph, a table, or both.

SPECIAL CONSIDERATIONS:

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

Student Workbook	$ .30
Teachers Guide	.30
Resource Handbook	.50

ACKNOWLEDGEMENTS: Huntington II Project
State University of New York

RUN

```
RUN
POLUT

                WATER POLLUTION STUDY

INSTRUCTIONS (1=YES, 0=NO)?1


IN THIS STUDY YOU CAN SPECIFY THE FOLLOWING CHARACTERISTICS:

A. THE KIND OF BODY OF WATER:
   1. LARGE POND
   2. LARGE LAKE
   3.  LOW-MOVING RIVER
   4. FAST-MOVING RIVER

B. THE WATER TEMPERATURE IN DEGREES FAHRENHEIT:

C. THE KIND OF WASTE DUMPED INTO THE WATER:
   1. INDUSTRIAL
   2. SEWAGE

D. THE RATE OF DUMPING OF WASTE, IN PARTS PER MILLION (PPM)/DAY.

E. THE TYPE OF TREATMENT OF THE WASTE:
   0. NONE
   1. PRIMARY (SEDIMENTATION OR PASSAGE THROUGH FINE
               SCREENS TO REMOVE GROSS SOLIDS)
   2. SECONDARY (SAND FILTERS OR THE ACTIVATED SLUDGE
                 METHOD TO REMOVE DISSOLVED AND COLLOIDAL
                 ORGANIC MATTER)


**********

BODY OF WATER?4
WATER TEMPERATURE?60
KIND OF WASTE?1
DUMPING RATE?10
TYPE OF TREATMENT?0


DO YOU WANT: A GRAPH(1), A TABLE(2), OR BOTH(3)?1



      0...OXYGEN-SCALE....5...OXYGEN-SCALE...10...OXYGEN-SCALE...15
      0..WASTE.10..SCALE.20..WASTE.30..SCALE.40..WASTE.50..SCALE.60
DAY    I---------I---------I---------I---------I---------I---------I
 0     I   W                                     O
 1     I             W                       O
 2     I                     W             O
 3     I                           W     O
 4     I                                WO
 5     I                                0  W
 6     I                               0      W
 7     I                              0         W
 8     I                             0           W
 9     I                             0             W
 10    I                             0             W
 11    I                            0               W
 12    I                            0                 W
 13    I                            0                 W
 14    I                            0                   W
 15    I                            0                   W
 16    I                            0                   W
 17    I                            0                   W
 18    I                            0                   W

THE WASTE CONTENT AND OXYGEN CONTENT WILL REMAIN AT
THESE LEVELS UNTIL ONE OF THE VARIABLES CHANGES.
```

```
ANOTHER RUN (1=YES, 0=NO)?1

**********

BODY OF WATER?3
WATER TEMPERATURE?60
KIND OF WASTE?1
DUMPING RATE?10
TYPE OF TREATMENT?0

DO YOU WANT: A GRAPH(1), A TABLE(2), OR BOTH(3)?1


AFTER DAY 3      THE FISH BEGIN TO DIE, BECAUSE
THE OXYGEN CONTENT OF THE WATER DROPPED BELOW 5 PPM.


        0...OXYGEN-SCALE....5...OXYGEN-SCALE...10...OXYGEN-SCALE...15
        0..WASTE.10..SCALE.20..WASTE.30..SCALE.40..WASTE.50..SCALE.60
DAY     I---------I---------I---------I---------I---------I---------I
 0      I   W                                 O
 1      I             W                   O
 2      I                     W       O
 3      I                        0 W
 4      I                     0         W
 5      I                  0              W
 6      I               0                    W
 7      I             0                        W
 8      I            0                          W
 9      I           0                            W
 10     I          0                             W
 11     I          0                              W
 12     I         0                                W
 13     I         0                                W
 14     I        0                                  W
 15     I        0                                  W
 16     I        0                                  W
 17     I        0                                  W
 18     I        0                                  W

THE WASTE CONTENT AND OXYGEN CONTENT WILL REMAIN AT
THESE LEVELS UNTIL ONE OF THE VARIABLES CHANGES.


ANOTHER RUN (1=YES, 0=NO)?0

DONE
```

TITLE:

POPULATION GROWTH

POP
36844

DESCRIPTION:

The POP SERIES programs are designed to allow a student with little mathematical background to explore various simple mathematical models of population growth. Student exercises revolve about studies of the growth of a gypsy-moth population. The gypsy moth was chosen as the primary animal for investigation because of its current ecological interest as an important species with few natural enemies and because its population meets the assumptions of the models presented in the POP SERIES.

The following models are explored in the POP SERIES.

POP1 - simple exponential growth
(population explosion)

POP2 - logistic model
(environmental limiting factor)

POP3 - logistic model with a low-density modification

Each of these programs is general enough so that it can be used to model other plant and animal populations.

INSTRUCTIONS:

See Special Considerations

SPECIAL CONSIDERATIONS:

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

Student Workbook	$ .30
Teachers Guide	.30
Resource Handbook	.50

ACKNOWLEDGEMENTS:

Huntington II Project
State University of New York

RUN

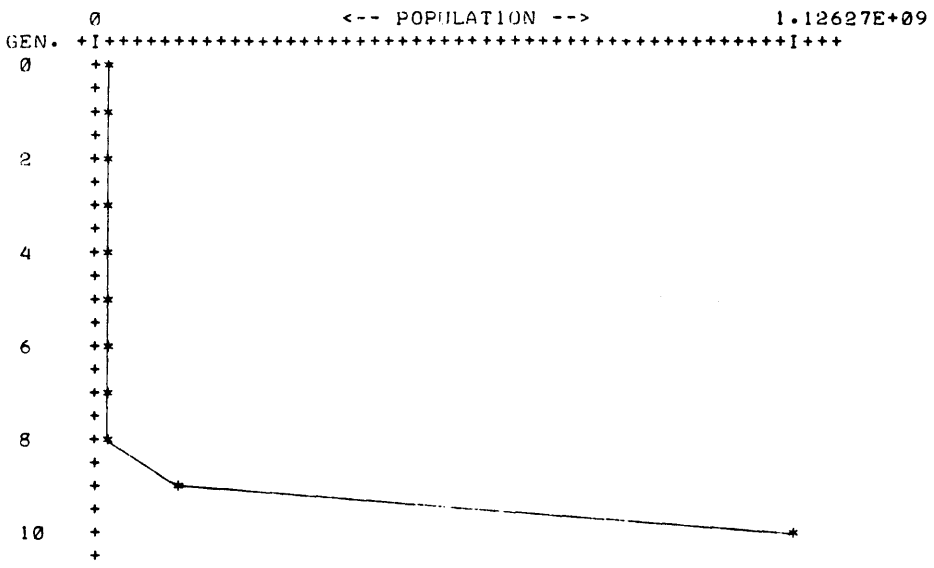
```
RUN
POP

                POPULATION GROWTH SIMULATION

WHICH POPULATION MODEL? (1, 2, OR 3). TYPE IN NUMBER?1


P(0)=?2
REPRO RATE=?7.5
TIME UNIT PER GENERATION?1
NO. OF GENERATIONS?10
OUTPUT DESIRED: 1=TABLE, 2=GRAPH, 3=BOTH?3

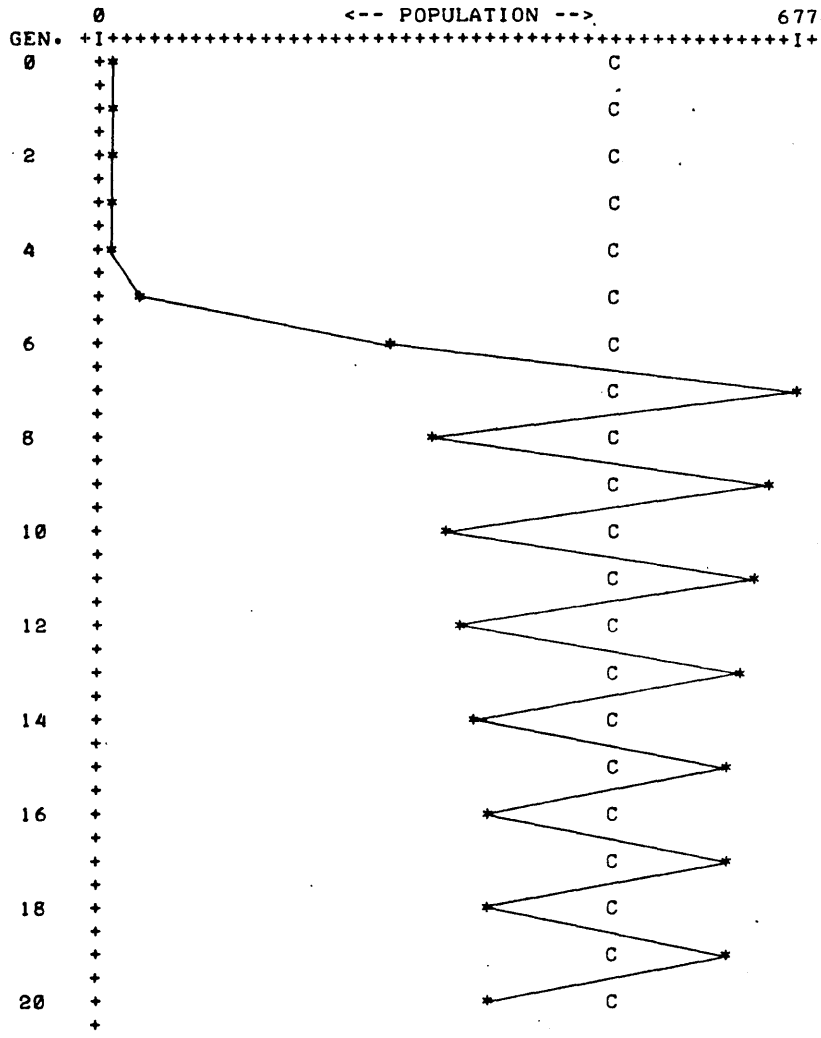
GEN.            TIME            POP.
------          ------          ------
 0               0               2
 1               1               15
 2               2               113
 3               3               844
 4               4               6328
 5               5               47461.
 6               6               355957.
 7               7               2.66968E+06
 8               8               2.00226E+07
 9               9               1.50169E+08
 10              10              1.12627E+09
```




```
ANOTHER RUN? (YES=1, NO=0)?1

WHICH POPULATION MODEL? (1, 2, OR 3). TYPE IN NUMBER?2


P(0)=?2
REPRO RATE=?7.5
TIME UNIT PER GENERATION?1
CARRYING CAPACITY?500000
NO. OF GENERATIONS?20
OUTPUT DESIRED: 1=TABLE, 2=GRAPH, 3=BOTH?2
```

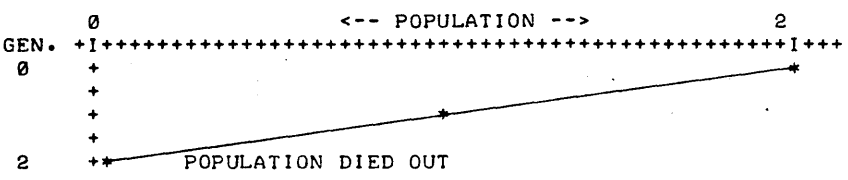



```
ANOTHER RUN? (YES=1, NO=0)?1

WHICH POPULATION MODEL? (1, 2, OR 3). TYPE IN NUMBER?3


P(0)=?2
REPRO RATE=?7.5
TIME UNIT PER GENERATION?1
CARRYING CAPACITY?500000
AT WHAT PO P. DO LOW DENSITY EFFECTS FIRST BEGIN?100
NO. OF GENERATIONS?10
OUTPUT DESIRED: 1=TABLE, 2=GRAPH, 3=BOTH?3

GEN.          TIME          POP.
------        ------        ------
 0             0             2
 1             1             1
 2             2             0            POPULATION DIED OUT
```




```
ANOTHER RUN? (YES=1, NO=0)?1

WHICH POPULATION MODEL? (1, 2, OR 3). TYPE IN NUMBER?3
```

```
P(0)=?5
REPRO RATE=?7.5
TIME UNIT PER GENERATION?1
CARRYING CAPACITY?500000
AT WHAT PO P. DO LOW DENSITY EFFECTS FIRST BEGIN?100
NO. OF GENERATIONS?10
OUTPUT DESIRED: 1=TABLE, 2=GRAPH, 3=BOTH?1

GEN.          TIME          POP.
------        ------        ------
 0             0             5
 1             1             5
 2             2             5
 3             3             5
 4             4             5
 5             5             5
 6             6             5
 7             7             5
 8             8             5
 9             9             5
 10            10            5

ANOTHER RUN? (YES=1, NO=0)?1

WHICH POPULATION MODEL? (1, 2, OR 3). TYPE IN NUMBER?3


P(0)=?6
REPRO RATE=?7.5
TIME UNIT PER GENERATION?1
CARRYING CAPACITY?500000
AT WHAT PO P. DO LOW DENSITY EFFECTS FIRST BEGIN?100
NO. OF GENERATIONS?10
OUTPUT DESIRED: 1=TABLE, 2=GRAPH, 3=BOTH?1

GEN.          TIME          POP.
------        ------        ------
 0             0             6
 1             1             7
 2             2             10
 3             3             19
 4             4             62
 5             5             393
 6             6             2943
 7             7             21812
 8             8             149825.
 9             9             614375.
 10            10            387493.

ANOTHER RUN? (YES=1, NO=0)?0




DONE
```

PRCNT
36311

TITLE: PRCNT: Percent Composition

DESCRIPTION:

This program is designed to calculate the percent composition (by weight) of a compound that may contain up to 5 elements. The program also contains a detailed sample calculation which is optional.

OBJECTIVES:

A. For the students who are familiar with percentage, this program may be used as a self-teaching device to show how this concept applies to a chemical situation.

B. The program may be used as a calculator to:

1) Illustrate the Law of Multiple Proportions
2) Illustrate the Law of Definite Proportions
3) Work out percent water of hydration, percent sulfate, nitrate, etc. (see discussion)
4) Check homework problems, class problems, lab problems, etc.

C. The program may be used as a tutorial device for students having difficulty.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - The student should at least have an understanding of the concept of percentage. The teacher may also wish to discuss how this concept applies to chemical compounds.

B. Materials - none.

DISCUSSION:

This program makes it possible for the teacher to spend very little time in class on percent composition and still have the student receive ample instruction and drill on the topic. This is possible since the program may be used in a number of situations such as teaching, self-teaching, and tutorial.

It should be brought to the students' attention that % water of hydration, % sulfate, % nitrate, etc., may be calculated by treating the groups of atoms as a single element when entering data.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
PRCNT

     THIS PROGRAM IS DESIGNED TO CALCULATE THE PERCENT
COMPOSITION BY WEIGHT OF A COMPOUND THAT MAY CONTAIN
FROM 2 TO 5 ELEMENTS.

 DO YOU WANT TO SEE A SAMPLE CALCULATION?
ANSWER 1 FOR YES OR 0 (ZERO) FOR NO?1

EXAMPLE :   THE PERCENT COMPOSITION OF SULFURIC ACID

LET W1 = ATOMIC WEIGHT OF HYDROGEN
 LET A1 = THE NO. OF HYDROGEN ATOMS IN THE FORMULA
LET W2 = THE ATOMIC WEIGHT OF SULFUR
 LET A2 = THE NO. OF SULFUR ATOMS IN THE FORMULA
LET W3 = THE ATOMIC WEIGHT OF OXYGEN
 LET A3 = THE NO. OF OXYGEN ATOMS IN THE FORMULA

 Y= FORMULA WEIGHT OF SULFURIC ACID
 Y= (W1*A1) + (W2*A2) + (W3*A3)
 Y= (1.008*2) + (32.064*1) + (15.999*4)
 Y= 98.076

PERCENT H = (W1*A1/Y)*100
PERCENT H = (1.008*2/98.076)*100
PERCENT H = 2.005

PERCENT S = (W2*A2/Y)*100
PERCENT S = (32.064*1/98.076)*100
PERCENT S = 32.693

PERCENT O = (W3*A3/Y)*100
PERCENT O = (15.999*4/98.076)*100
PERCENT O = 65.2514

 DO YOU WANT TO DO A PROBLEM ?
ANSWER 1 FOR YES OR 0 (ZERO) FOR NO?1

 WHAT IS THE NUMBER OF ELEMENTS IN THE FORMULA?3
 TYPE (THE ATOMIC WEIGHT,NO. OF ATOMS) FOR EACH ELEMENT,
 ONE ELEMENT TO A LINE.
?12.011,12
?1.008,22
?15.999,11
                ******************************

FORMULA WEIGHT = 342.297

ATOMIC WEIGHT  NO. OF ATOMS   PERCENT COMPOSITION
 12.011          12             42.1073
 1.008           22             6.47858
 15.999          11             51.4141

                ******************************

 DO YOU WANT TO DO ANOTHER PROBLEM?
ANSWER 1 FOR YES OR 0 (ZERO) FOR NO?0

DONE
```

PRJTL
36631

TITLE: PROJECTILE MOTION

DESCRIPTION:

By entering the firing angle and initial speed, the computer calculates the coordinates, vertical and horizontal velocities, and speed of a projectile for equal time intervals.

OBJECTIVES:

To show the independence of the horizontal and vertical velocities of a projectile, and to facilitate the plotting of its path by eliminating tedious calculations.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - Knowledge of motion at constant velocity and at constant acceleration; and the vector nature of velocity and acceleration.

B. Materials - graph paper

DISCUSSION:

The student enters an angle and an initial speed of a projectile. A table of time, X and Y coordinates, horizontal and vertical velocities, and speed of the projectile is printed.

The student may then plot a graph of the position of the projectile, and draw vectors at each coordinate point to show the vertical and horizontal components of its velocity.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
PRJTL

SUPPOSE YOU ARE GOING TO FIRE A PROJECTILE INTO THE AIR.
IF YOU ENTER A VALUE FOR ANGLE OF ELEVATION AND INITIAL
VELOCITY, THE RANGE AND HEIGHT WILL BE EVALUATED.  ENTER
YOUR INFORMATION IN THE FORM A,V AFTER THE QUESTION MARK.
(REMEMBER, THE ANGLE IS IN DEGREES AND THE INITIAL
VELOCITY IS IN METERS/SECOND.)


WHAT ARE YOUR VALUES?30,200


THE TOTAL FLIGHT TIME WAS 20.3943    SECONDS
THE RANGE WAS 3532.4     METERS
THE MAXIMUM HEIGHT WAS 509.858    METERS

BECAUSE THERE IS NO FRICTION, THE HORIZONTAL VELOCITY IS
CONSTANT.  HORIZONTAL VELOCITY = 173.205

   THE FOLLOWING ARE POINTS ON THE CURVE AT VARIOUS TIME INTERVALS:


                                                VERTICAL
 TIME            X-COORD         Y-COORD        VELOCITY        SPEED
 ----            -------         -------        --------        -----
 0               0               0              100.            200
 1.85403         321.127         168.548        81.8181         191.557
 3.70806         642.254         303.386        63.6363         184.525
 5.56209         963.382         404.515        45.4545         179.07
 7.41611         1284.51         471.934        27.2727         175.339
 9.27014         1605.64         505.644        9.09091         173.444
 11.1242         1926.76         505.643       -9.0909          173.444
 12.9782         2247.89         471.934       -27.2727         175.339
 14.8322         2569.02         404.514       -45.4545         179.07
 16.6863         2890.14         303.385       -63.6363         184.525
 18.5403         3211.27         168.547       -81.8181         191.557
 20.3943         3532.4          0             -99.9999         200

THE ANGLE AT WHICH YOU FIRED THE PROJECTILE DOES NOT
YIELD THE MAXIMUM RANGE.  WHAT ANGLE DOES?45

45 DEGREES GIVES THE MAXIMUM RANGE OF 4077.65

WOULD YOU LIKE ANOTHER RUN WITH DIFFERENT A AND V?
(1=YES, 0=NO) : ?0

DONE
```

REFLCT
36319

TITLE: REFLCT: Least Time Principle and Light

DESCRIPTION:

An analogy is given for a light-ray reflected from a plane surface to demonstrate the "least-time" principle and its relationship to the reflection laws of light.

OBJECTIVES:

To demonstrate the consequences of the "least-time" principle.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - Should be familiar with the reflection laws of light.

B. Materials - graph paper.

DISCUSSION:

Given points P_1 and P_2 and the line l, the student can vary the point P_3 to note the effects on angles P and Q and their relationship to the time required to traverse the path $P_1P_3P_2$.

The program is presented as a game in which a horse (lightray) must complete a journey within a specified time. The student is limited to seven choices of P_3 to complete the task. After a successful journey, the student may vary the point P_2 to further establish the principle of least time.

This program has been extremely helpful in developing the least-time concept and its relationship to the laws of reflection.

It is applicable to a classroom situation as well as small study groups.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN
RUN
REFLCT

YOU ARE CAMPING OUT WEST IN COORDINATE NATIONAL PARK ON
ORDINATE MOUNTAIN, LOCATED 10 MILES NORTH OF THE
DESERTED TOWN OF ORIGIN, WHICH IS CONVENIENTLY LOCATED
AT (0,0) ON THE LOCAL MAP.

A CALAMITY STRIKES!  THE NEAREST HELP IS AT THE
BAR 30:30 RANCH, LOCATED AT COORDINATES (30,30).
TO GET THERE, YOU MUST RIDE AN OLD HORSE
(NAMED LIGHTRAY)  WHO :
               A) WILL ONLY WALK 5 MILES PER HOUR
               B) WILL CEASE TO WALK (AND EXIST) AFTER 10 HOURS
               C) MUST HAVE A DRINK OF WATER SOMEWHERE ALONG THE
               ABSCISSA RIVER, WHICH (IF YOU HAVEN'T GUESSED) RUNS
               ALONG THE ABSCISSA IN COORDINATE PARK

HERE IS YOUR PROBLEM:  YOU MUST PICK A SPOT
(FROM 0 TO 30) ALONG THE ABSCISSA RIVER DURING THE
TRIP TO GIVE LIGHTRAY A DRINK, AND STILL MAKE IT TO
THE BAR 30:30 WITHIN THE TIME ALLOWED.  LIGHTRAY, USING
HORSE SENSE, KNOWS ALL THE ANGLES, SO WE WILL GIVE
THEM TO YOU, TOO.

WHERE WILL LIGHTRAY STOP FOR A DRINK?7

ANGLE APPROACHING RIVER IS 55   DEGREES.
ANGLE LEAVING RIVER IS 53   DEGREES.

WHERE WILL LIGHTRAY STOP FOR A DRINK?.25

ANGLE APPROACHING RIVER IS 89   DEGREES.
ANGLE LEAVING RIVER IS 45   DEGREES.
HEY - THIS TRIP TAKES LONGER!
YOU HAVE A DEAD HORSE ON YOUR HANDS.  TRY AGAIN.

WHERE WILL LIGHTRAY STOP FOR A DRINK?6

ANGLE APPROACHING RIVER IS 59   DEGREES.
ANGLE LEAVING RIVER IS 51   DEGREES.
WELL, YOU ARE CLOSER THAN LAST TIME.
KEEP AN EYE ON THOSE ANGLES, THOUGH.
LET'S GO BACK FOR ANOTHER HORSE.

WHERE WILL LIGHTRAY STOP FOR A DRINK?8

ANGLE APPROACHING RIVER IS 51   DEGREES.
ANGLE LEAVING RIVER IS 54   DEGREES.
WELL, YOU ARE CLOSER THAN LAST TIME.
KEEP AN EYE ON THOSE ANGLES, THOUGH.
LET'S GO BACK FOR ANOTHER HORSE.

WHERE WILL LIGHTRAY STOP FOR A DRINK?7.4

ANGLE APPROACHING RIVER IS 53   DEGREES.
ANGLE LEAVING RIVER IS 53   DEGREES.
NICE WORK.  YOU MADE IT.
THE TRIP TOOK ABOUT 10.0001     HOURS.
YOU CAN SEE THAT USING HORSE SENSE, LIGHTRAY KNOWS THAT
THE ANGLES HAVE TO BE EQUAL OF REFLECTION FOR A
MINIMUM TIME TRIP.

IF YOU WANT TO MOVE THE RANCH, TYPE 1
IF YOU WANT TO SEE SOMETHING ELSE, TYPE 2
IF YOU WANT TO QUIT, TYPE 3
?2
TIME FOR AN ACTUAL LIGHTRAY TO COMPLETE THE TRIP IS:
 2.75455E-04    SECONDS.

               THANK YOU FOR PLAYING.

DONE
```

CONTRIBUTED PROGRAM **BASIC**

REFLEC
36672

TITLE: COMPUTER-AUGMENTED PHYSICS TOPICS (OPTICS)

DESCRIPTION:

This program provides practice in using the formulas for images formed by mirrors with circular surfaces, as given in the module, Computer-Augmented Physics Topics (Optics, Part 3) of the Hewlett Packard Curriculum Series. Some algebraic tranformation of the given formulas may be necessary for calculating the answers.

This program uses Calculator Mode as a student option in answering questions.

INSTRUCTIONS:

Problems are of two general types:

1. Given focal length, object height, and object distance, calculate image distance and image height.

2. Given image distance and object distance, calculate focal length.

In either case, the student is also asked to specify whether the image formed is real or virtual.

To enter Calculator mode (before entering answer), the student types 999999 as the answer.

APPEND - DESCAL before RUNning the program.

See DESCAL (HP 36674) in Volume IV for instructions in using the calculator mode.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Physics (secondary)

Student Background Required: Algebra, formulas for circular mirrors (concurrent)

The curriculum material listed below is available for classroom implementation of this program.

HP 5951-5648 Computer-Augmented Physics Topics (student text)
HP 5951-5649 Computer-Augmented Physics Topics (problem solutions)
HP 5951-5650 Computer-Augmented Physics Topics (classroom set - 30 student books and 1 problem solutions)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

ACKNOWLEDGEMENTS: Project Solo
University of Pittsburgh

```
RUN

APPEND-DESCAL
REFLEC
RUN



THIS PROGRAM WILL DEAL WITH THE PHYSICS OF CURVED MIRRORS.
THE FORMULAS WHICH YOU WILL NEED MAY BE FOUND IN THE MODULE.
REMEMBER -- TYPE 999999 FOR CALCULATOR MODE.


THE FOCAL LENGTH OF A CURVED MIRROR IS FOUND TO BE 6.6        CM.
AN OBJECT  1.4        CM HIGH IS PLACED  5.3        CM AWAY FROM
THE MIRROR. TYPE IN THE IMAGE DISTANCE FROM THE MIRROR IN CM.
DISTANCE=?999999
CALCULATOR MODE.
CLEARED TO ZERO
1ST NUMBER?5.3
FUNCTION?RCP
RCP= .188679

FUNCTION?CLR
CLEARED TO ZERO
1ST NUMBER?6.6
FUNCTION?RCP
RCP= .151515

FUNCTION?SUB
2ND NUMBER?.188679
SUB=-3.71639E-02

FUNCTION?RCP
RCP=-26.9079

FUNCTION?EXT
EXIT.
DISTANCE=?-26.91
GOOD FOR YOU.
NOW TYPE IN THE HEIGHT OF THE IMAGE (HI) IN CM.
HEIGHT=?999999
CALCULATOR MODE.
CLEARED TO ZERO
1ST NUMBER?1.4
FUNCTION?MUL
2ND NUMBER?-26.9079
MUL=-37.6711

FUNCTION?DIV
2ND NUMBER?5.3
DIV=-7.10775

FUNCTION?EXT
EXIT.
HEIGHT=?-7.10775
GOOD. YOU'RE RIGHT.
IS THE IMAGE REAL OR VIRTUAL (1=REAL, 0=VIRTUAL)?0
RIGHT ON!

DO YOU WANT TO TRY ANOTHER PROBLEM LIKE THIS ONE
(0=NO, 1=YES)?0

OK, THEN, HOW ABOUT THIS ONE?


THE IMAGE OF AN OBJECT PLACED 4.74        CM AWAY FROM A CURVED
MIRROR IS FOUND TO BE LOCATED  6.17        CM AWAY FROM THE
MIRROR.  INPUT THE FOCAL LENGTH OF THE MIRROR.
FOCAL LENGTH = ?999999
CALCULATOR MODE.
CLEARED TO ZERO
1ST NUMBER?4.74
FUNCTION?ADD
2ND NUMBER?6.17
ADD= 10.91
```

```
FUNCTION?CLR
CLEARED TO ZERO
1ST NUMBER?4.74
FUNCTION?MUL
2ND NUMBER?6.17
MUL= 29.2458

FUNCTION?DIV
2ND NUMBER?10.91
DIV= 2.68064

FUNCTION?EXT
EXIT.
FOCAL LENGTH = ?2.681
RIGHT.. GOOD
IS THE IMAGE REAL OR VIRTUAL (1=REAL, 0=VIRTUAL)?1
RIGHT ON!

DO YOU WANT TO TRY ANOTHER PROBLEM LIKE THIS ONE
(0=NO, 1=YES)?0
SO LONG, THEN.  TRY THE NEXT PROGRAM, REFRAC.
AU REVOIR

DONE
```

TITLE: COMPUTER-AUGMENTED PHYSICS TOPICS (OPTICS) REFRAC 36669

DESCRIPTION:

This program provides practice in using the formulas for refraction through plane surfaces and thin lenses given in the module, Computer-Augmented Physics Topics of the Hewlett Packard Curriculum Series.

The program uses Calculator Mode as a student option in answering questions.

INSTRUCTIONS:

There are two types of problems:

1. Given the angle of incidence and the angle of refraction (in degrees) of light incident on a plane surface, calculate the index of refraction, and identify the material from a table of indices of refraction given in the module.

2. Given the two radii of the opposing surfaces of a thin lens, and the index of refraction of the material of the lens, calculate the focal length.

To enter the Calculator Mode while answering a question, the student types 999999 as the answer.

SPECIAL CONSIDERATIONS:

Complete instructions for the Calculator Mode are given in a separate module. Examples of its use in this program are given in the curriculum material listed below.

HP 5951-5648 Computer-Augmented Physics Topics (student text)
HP 5951-5649 Computer-Augmented Physics Topics (problem solutions)
HP 5951-5650 Computer-Augmented Physics Topics (classroom set - 30 student books and 1 problem solutions)

For ordering information of curriculum material, contact:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Physics (optics)

Student Background Required: Algebra, Snell's law, "lensmaker's formula" (concurrent)

ACKNOWLEDGEMENTS: Project Solo
University of Pittsburgh

```
RUN

APPEND-DESCAL
RUN
REFRAC



THIS PROGRAM WILL DEAL WITH REFRACTION AND THE PHYSICS OF
THIN LENSES.
THE FORMULAS THAT YOU WILL NEED MAY BE FOUND IN THE MODULE.
REMEMBER--999999 FOR CALCULATOR MODE.

LIGHT TRAVELING THROUGH A VACUUM (N1=1) IS INCIDENT
ON AN OBJECT AT AN ANGLE OF 23.88      DEGREES, AND IS
REFRACTED TO AN ANGLE OF 11.11      DEGREES.
WHAT IS THE INDEX OF REFRACTION (N2) OF THE MATERIAL?
N2 = ?999999
CALCULATOR MODE.
CLEARED TO ZERO
1ST NUMBER?11.11
FUNCTION?DTR
DTR= .193986

FUNCTION?SIN
SIN= .192693

FUNCTION?CLR
CLEARED TO ZERO
1ST NUMBER?23.88
FUNCTION?DTR
DTR= .416785

FUNCTION?SIN
SIN= .404822

FUNCTION?DIV
2ND NUMBER?.192693
DIV= 2.10087

FUNCTION?EXT
EXIT.
N2 = ?2.10
EXCELLENT- YOU'RE RIGHT

REFER TO THE MODULE. TYPE IN THE NUMBER OF THE MATERIAL.
?10
RIGHT YOU ARE.

WOULD YOU LIKE TO TRY ANOTHER LIKE THIS (1=YES, 0=NO)?0
USING THE 'LENSMAKER'S FORMULA,' CALCULATE THE FOCAL
LENGTH OF A THIN LENS MADE FROM GLASS. (N=1.5), IF THE
RADII OF THE OPPOSING SURFACES ARE 2     AND 3.5        CM.
FOCAL LENGTH (CM) = ?999999
CALCULATOR MODE.
CLEARED TO ZERO
1ST NUMBER?3.5
FUNCTION?RCP
RCP= .285714

FUNCTION?ADD
2ND NUMBER?.5
ADD= .785714

FUNCTION?MUL
2ND NUMBER?.5
MUL= .392857

FUNCTION?RCP
RCP= 2.54545

FUNCTION?EXT
EXIT.
FOCAL LENGTH (CM) = ?2.55
GOOD YOU ARE CORRECT
```

```
HOW ABOUT ANOTHER ONE LIKE THIS (0=NO, 1=YES)?
?0
OK, NOW TRY YOUR HAND AT WRITING A PROGRAM TO COMPLETE
THE TABLE IN PART 3 OF THE MODULE.

DONE
```

SLITS
36351

TITLE: SLITS: Youngs Double Slit Experiment

DESCRIPTION:

Young's Double Slit Experiment is simulated by the computer to permit greater exploration of the influence of wavelength and slit-separation on the interference pattern. (This is a plotting program.)

OBJECTIVES:

To determine, qualitatively, the effects of slip-separation, inter-screen spacing distance (d) and wavelength (w), in altering the location of the maxima and minima of the intensity bands of light.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - An instruction sheet is helpful in leading the student through a logical approach. It is also recommended that students understand the superposition of waves before executing this program.

B. Materials - none.

DISCUSSION:

A. Operational Suggestions

1. The objectives of this program are best accomplished with small groups (3 to 4 students) to permit discussion and development of ideas concerning the relationships involved.
2. The program has worked well with highly-motivated students and has often led into detailed discussions of related topics. However, it has been found to be relatively ineffectual with poorly-motivated students.

B. Suggested Follow-up

This program permits the exploration of the parameters involved in double-slit interference patterns without the requirement of extensive equipment and/or set-ups. It is recommended that this simulated experiment be employed after the student has familiarized himself with the normal lab experiment.

To enhance the operation of this program, it is further recommended that an instruction sheet (see attachment) be constructed to enable efficient exploration of this phenomenon. By varying the slit-senaration (d), the student can observe the effects by noting the relative separations between adjacent maxima. In a similar manner, changes effectuated by the various wavelengths can also be noted.

ACKNOWLEDGEMENTS: Huntington Project
State University of New York

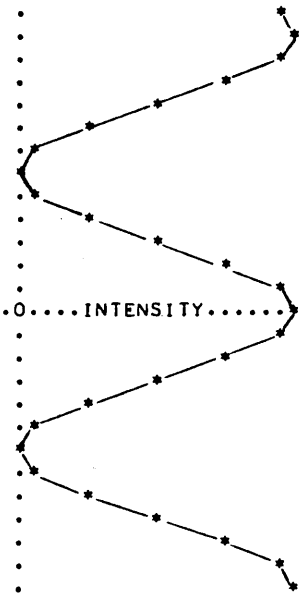
```
RUN

RUN
SLITS

                YOUNG'S DOUBLE SLIT EXPERIMENT

L = 2     METERS     W = 6000     ANGSTROMS     D = .5          MILLIMETERS

DISTANCE (MM'S FROM CENTER)
          -.26          .
          -.24          .
          -.22          .
          -.2           .
          -.18          .
          -.16          .
          -.14          .
          -.12          .
          -.1           .
          -.08          .
          -.06          .
          -.04          .
          -.02          .
....................0....INTENSITY.....
           .02          .
           .04          .
           .06          .
           .08          .
           .            .
           .12          .
           .14          .
           .16          .
           .18          .
           .2           .
           .22          .
           .24          .
```



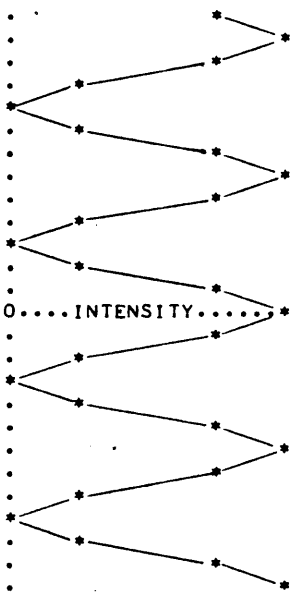
```
ABOVE IS AN ILLUSTRATIVE RUN WITH PRE-DETERMINED
VALUES FOR WAVELENGTH (W), DISTANCE BETWEEN SLITS
AND SCREEN (L), AND SLIT SEPARATION - CENTER TO
CENTER (D).  NOW YOU MAY VARY THESE PARAMETERS,
ONE AT A TIME.

*****

WHAT IS THE NEW SLIT SEPARATION (D) IN MILLIMETERS?1


L = 2     METERS     W = 6000     ANGSTROMS     D = 1     MILLIMETERS

DISTANCE (MM'S FROM CENTER)
          -.26          .
          -.24          .
          -.22          .
          -.2           .
          -.18          .
          -.16          .
          -.14          .
          -.12          .
          -.1           .
          -.08          .
          -.06          .
          -.04          .
          -.02          .
....................0....INTENSITY.....
           .02          .
           .04          .
           .06          .
           .08          .
           .1           .
           .12          .
           .14          .
           .16          .
           .18          .
           .2           .
           .22          .
           .24          .
```



```
WOULD YOU LIKE TO TRY ANOTHER VALUE OF D (1-YES, 0-NO)?1
WHAT IS THE NEW SLIT SEPARATION (D) IN MILLIMETERS?.25

L = 2     METERS     W = 6000     ANGSTROMS     D = .25          MILLIMETERS

DISTANCE (MM'S FROM CENTER)
          -.26          *
          -.24          *
          -.22          *
          -.2           .*
          -.18          . *
          -.16          .  *
          -.14          .   *
          -.12          .    *
          -.1           .     *
          -.08          .      *
          -.06          .       *
          -.04          .        *
          -.02          .         *
....................0....INTENSITY.....*
           .02          .         *
           .04          .        *
           .06          .       *
           .08          .      *
           .1           .     *
           .12          .    *
           .14          .   *
           .16          .  *
           .18          . *
           .2           .*
           .22          *
           .24          *

WOULD YOU LIKE TO TRY ANOTHER VALUE OF D (1-YES, 0-NO)?0

*****

WHAT IS THE NEW WAVELENGTH (W) IN ANGSTROMS?3000

L = 2     METERS     W = 3000     ANGSTROMS     D = .5           MILLIMETERS

DISTANCE (MM'S FROM CENTER)
          -.26          .                    *
          -.24          .                   * *
          -.22          .                  *   *
          -.2           .                 *     *
          -.18          *                *       *
          -.16          .               *         *
          -.14          .              *           *
          -.12          .             *             *
          -.1           .            *               *
          -.08          .           *                 *
          -.06          *          *                   *
          -.04          .         *                     *
          -.02          .        *                       *
....................0....INTENSITY.....*
           .02          .         *                     *
           .04          .          *                   *
           .06          *           *                 *
           .08          .            *               *
           .1           .             *             *
           .12          .              *           *
           .14          .               *         *
           .16          .                *       *
           .18          *                 *     *
           .2           .                  *   *
           .22          .                   * *
           .24          .                    *

WOULD YOU LIKE TO TRY ANOTHER VALUE OF W (1-YES, 0-NO)?1
WHAT IS THE NEW WAVELENGTH (W) IN ANGSTROMS?15000
A WAVELENGTH OF  15000    IS INFRARED LIGHT AND NOT VISIBLE.
THE INTERFERENCE PATTERN WILL BE VISIBLE USING DETECTORS
ONLY.  TRY ANOTHER WAVELENGTH.
```

```
WHAT IS THE NEW WAVELENGTH (W) IN ANGSTROMS?6900

L = 2     METERS     W = 6900     ANGSTROMS     D = .5          MILLIMETERS

DISTANCE (MM'S FROM CENTER)
          -.26          .
          -.24          .
          -.22          .
          -.2           .
          -.18          .
          -.16          .
          -.14          .
          -.12          .
          -.1           .
          -.08          .
          -.06          .
          -.04          .
          -.02          .
.....................0....INTENSITY.....
           .02          .
           .04          .
           .06          .
           .08          .
           .1           .
           .12          .
           .14          .
           .16          .
           .18          .
           .2           .
           .22          .
           .24          .

WOULD YOU LIKE TO TRY ANOTHER VALUE OF W (1-YES, 0-NO)?0

*****

WHAT IS THE NEW DISTANCE FROM SLITS TO SCREEN (L) IN METERS?5

L = 5     METERS     W = 6000     ANGSTROMS     D = .5          MILLIMETERS

DISTANCE (MM'S FROM CENTER)
          -.26          .
          -.24          .
          -.22          .
          -.2           .
          -.18          .
          -.16          .
          -.14          .
          -.12          .
          -.1           .
          -.08          .
          -.06          .
          -.04          .
          -.02          .
.....................0....INTENSITY.....
           .02          .
           .04          .
           .06          .
           .08          .
           .1           .
           .12          .
           .14          .
           .16          .
           .18          .
           .2           .
           .22          .
           .24          .

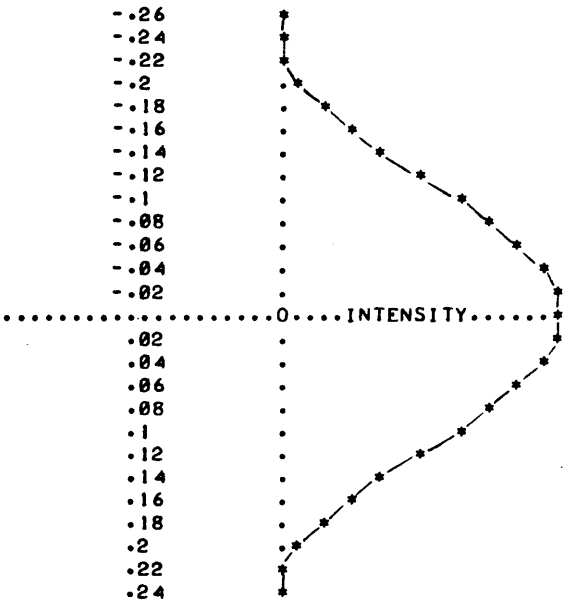
WOULD YOU LIKE TO TRY ANOTHER VALUE OF L (1-YES, 0-NO)?0

*****
```

```
YOU WILL NOW BE GIVEN A LIGHT SOURCE OF UNKNOWN
WAVELENGTH.  YOU WILL SPECIFY THE SLIT SEPARATION (D),
AND THE DISTANCE FROM SLITS TO SCREEN (L).
WHAT IS THE NEW SLIT SEPARATION (D) IN MILLIMETERS?.5
WHAT IS THE NEW DISTANCE FROM SLITS TO SCREEN (L) IN METERS?4

L = 4    METERS    W = ? ANGSTROMS    D = .5         MILLIMETERS

DISTANCE (MM'S FROM CENTER)
```




```
WOULD YOU LIKE A PLOT FOR OTHER VALUES OF D AND L (1-YES, 0-NO)?0
WHAT DO YOU THINK THE UNKNOWN WAVELENGTH (W) IS?6000
PRETTY GOOD!  THE WAVELENGTH WAS  6000     ANGSTROMS.
WOULD YOU LIKE TO TRY ANOTHER UNKNOWN WAVELENGTH(1-YES, 0-NO)?0

*****

WOULD YOU LIKE A PLOT WITH YOUR OWN VALUES FOR WAVELENGTH
 (W), SLIT SEPARATION (D), AND DISTANCE FROM SLITS TO
SCREEN (L) (1-YES, 0-NO)?1
WHAT IS THE NEW WAVELENGTH (W) IN ANGSTROMS?5500
WHAT IS THE NEW SLIT SEPARATION (D) IN MILLIMETERS?.75
WHAT IS THE NEW DISTANCE FROM SLITS TO SCREEN (L) IN METERS?3

L = 3    METERS    W = 5500    ANGSTROMS    D = .75        MILLIMETERS
```

```
DISTANCE (MM'S FROM CENTER)
          -.26          .
          -.24          .
          -.22          .
          -.2           .
          -.18          .
          -.16          .
          -.14          .
          -.12          .
          -.1           .
          -.08          .
          -.06          .
          -.04          .
          -.02          .
....................0....INTE. SITY.....*
           .02          .
           .04          .
           .06          .
           .08          .
           .1           .
           .12          .
           .14          .
           .16          .
           .18          .
           .2           .
           .22          .
           .24          .
```

ANOTHER ONE (1-YES, 0-NO)
?0

****

HOPE YOU HAD FUN!

DONE

SNELL
36320

TITLE:

SNELL: Snell's Law

DESCRIPTION:

Snell's law is presented pictorially by plotting the path of a light ray as it crosses a boundary separating two different media.

OBJECTIVES:

To permit students to "see" the refraction of light, including the case when the critical angle is exceeded and reflection occurs.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - The terms associated with Snell's law, such as refraction, media, normals, etc., must be presented prior to the running of this program.

B. Materials - No additional supplies or materials are necessary.

DISCUSSION:

Snell's law can be investigated independently by students by altering the angle of incidence, and/or the indices of refraction. The pictorial presentation is especially beneficial to students with reading problems, since the concepts implied by the mathematical relationships are presented hueristically.

In addition, the critical angle may be approached and exceeded, in the special case where n_2 (second medium) is less than n_1 (initial medium).

Queries are included as part of the program to reinforce the concepts.

The program is well suited for small groups or individuals, but may be utilized for large group presentation without program modification.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

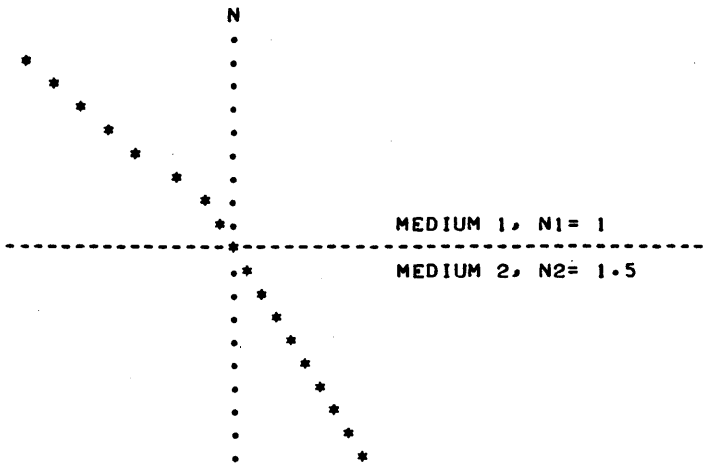
RUN
SNELL

               ---REFRACTION OF LIGHT---

     THIS PROGRAM WILL HELP YOU VISUALIZE THE REFRACTION
OF LIGHT #S IT CROSSES A BOUNDARY SEPARATING TWO DIFFERENT
MEDIA.

THE DIAGRAM BELOW SHOWS LIGHT INCIDENT TO THE BOUNDARY AT
45 DEGREES.  THE INDICES OF REFRACTION ARE  N1=1.0 AND
N2=1.5  RESPECTIVELY.

```



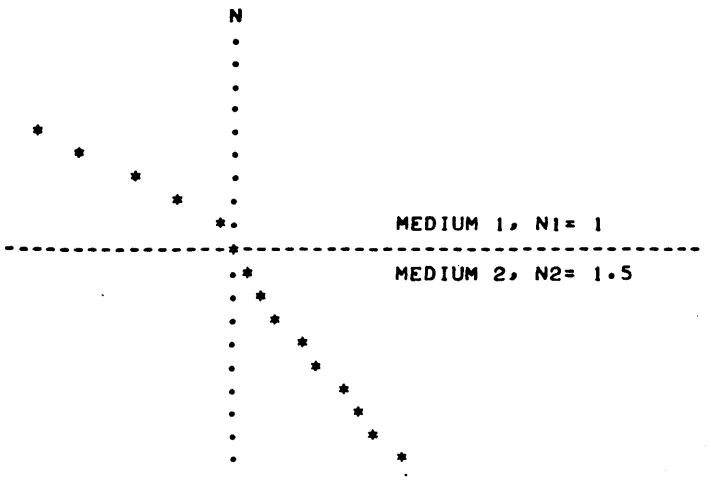

```
WHAT DO YOU THINK THE ANGLE OF REFRACTION IS?30
YOU ARE WITHIN 10 PERCENT.
THE ANGLE OF REFRACTION, A2= 28.126

DO YOU WANT TO CONTINUE (1=YES, 0=NO) : ?1

     NOW YOU CAN CHANGE THE INCIDENT ANGLE. THE REFRACTIVE
INDICDS WILL REMAIN AS  N1=1.0  AND  N2=1.5 .

REMEMBER, ONLY POSITIVE ANGLES BETWEEN 0 AND 90 DEGREES ARE
PERMISSIBLE  ENTRIES.
SO, WHAT ANGLE DO YOU WANT?60

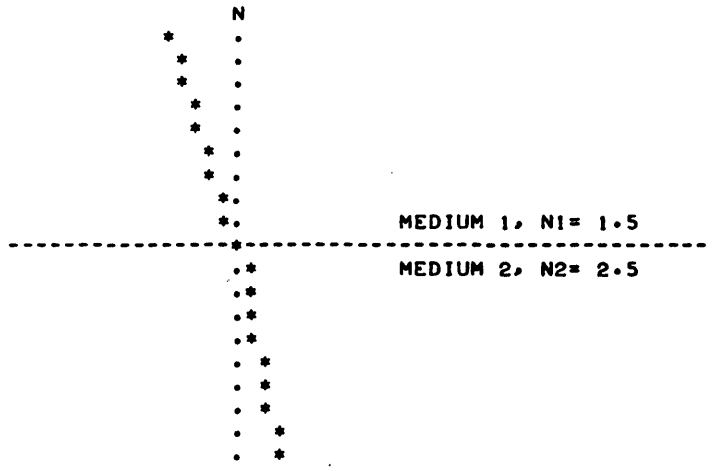
```




```
WHAT DO YOU THINK THE ANGLE OF REFRACTION IS?35
YOU ARE WITHIN 10 PERCENT.
THE ANGLE OF REFRACTION, A2= 35.264

DO YOU WANT TO CONTINUE (1=YES, 0=NO) : ?1
```

```
    NOW SPECIFY NEW VALUES FOR  N1, N2, AND ANGLE 1.
SEPARATE WITH COMMAS.  OKAY, WHAT VALUES?1.5,2.5,15
```




```
WHAT DO YOU THINK THE ANGLE OF REFRACTION IS?9
YOU ARE WITHIN 10 PERCENT.
THE ANGLE OF REFRACTION, A2= 8.934

DO YOU WANT TO CONTINUE (1=YES, 0=NO) : ?0

DONE
```

SPACE
36321

TITLE: SPACE: Spacecraft Orbits

DESCRIPTION:

The effects of speed on orbital motion can be demonstrated by incrementally altering the tangential velocity of an orbitting spacecraft. Limiting cases are included, i.e. exceeding the escape velocity and/or crashing into the earth.

OBJECTIVES:

To demonstrate the effects of speed on orbital motion.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - Student should be familiar with circular motion, central forces, and have some knowledge of conic sections.

B. Materials - None

DISCUSSION:

Orbital motion is described in terms of the eccentricity (E) of the orbit, the period (T), and the maximum and minimum tangential velocities. The student selects the initial apogee and perigee (in miles) to define the orbit.

After describing the initial orbit the limiting changes required to produce circular and parabolic orbits are given, as well as the changes required to produce an orbit that will be tangent to the earth's surface.

The speed at the apogee and perigee is given and the student may alter either of these values (+ or -) incrementally. The new orbit will again be described in terms of E, T, and the velocities.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
SPACE

                    SPACECRAFT ORBITS

WHAT IS THE MINIMUM AND MAXIMUM ALTITUDE OF THE SPACECRAFT
ABOVE THE SURFACE OF THE EARTH IN MILES?150,230

THE ECCENTRICITY OF THE ORBIT IS 9.64088E-03

THE VELOCITY AT THE PERIGEE IS  25593.4     FEET/SECOND.

THE VELOCITY AT THE APOGEE IS  25104.6     FEET/SECOND.

THE PERIOD OF THE ORBIT IS  90.5043     MINUTES.

ADDING A VELOCITY INCREMENT TO THE PERIGEE
OF  10427.9     FT/SEC WOULD RESULT IN A
PARABOLIC ORBIT-- CAUSING THE SPACECRAFT TO FLY OFF INTO SPACE.

A CHANGE OF -122.488     FT/SEC WOULD PRODUCE A
CIRCULAR ORBIT. HOWEVER, A VELOCITY INCREMENT
OF -360.375     FT/SEC WOULD PRODUCE AN ORBIT
THAT WOULD BE TANGENT TO THE EARTH'S SURFACE.

ADDING A VELOCITY INCREMENT TO THE APOGEE
OF  10571.      FT/SEC WOULD RESULT IN A
PARABOLIC ORBIT-- CAUSING THE SPACECRAFT TO FLY OFF INTO SPACE.

A CHANGE OF  121.895     FT/SEC WOULD PRODUCE A
CIRCULAR ORBIT. HOWEVER, A VELOCITY INCREMENT
OF -236.695     FT/SEC WOULD PRODUCE AN ORBIT
THAT WOULD BE TANGENT TO THE EARTH'S SURFACE.


DO YOU WANT TO ADD A VELOCITY INCREMENT AT THE
PERIGEE(TYPE 1) OR AT THE APOGEE(TYPE 2)     ?1

WHAT VELOCITY INCREMENT IS TO BE ADDED?-250

THE NEW ORBIT IS ELLIPTICAL
 WITH AN EBCENTRICITY OF 9.98735E-03

THE POINT WHERE THE VELOCITY INCREMENT WAS ADDED
CORRESPONDS TO THE APOGEE OF THE NEW ORBIT
THE PERIGEE OF THE NEW ORBIT IN MILES IS 68.7358

 THE VELOCITY AT THE PERIGEE IS  25854.7     FT/SEC.

THE PERIOD OF THE NEW ORBIT IS  87.8788     MINUTES.

*****

BASED ON YOUR ORIGINAL ALTITUDES OF  150   AND  230   MILES
WOULD YOU LIKE TO TRY DIFFERENT VELOCITY INCREMENTS
(1-YES, 0-N0)?0

WOULD YOU LIKE TO RUN THE PROGRAM AGAIN (1-YES, 0-NO)?0

*****


DONE
```

SPCTRA
36184

TITLE: OPTICAL ABSORPTION SPECTRA SIMULATION, 2-SPECIES EQUILIBRIUM MIXTURES

DESCRIPTION:

This program computes and plots simulated optical absorption spectra for up to five equilibrium mixtures of a system of two interconvertible chemical species. The output resembles the recorder output of an infrared, visible, or ultraviolet spectrophotometer.

The program simply assigns a Gaussian curve to each of the two species. The two curves have their maxima separated by an arbitrary amount (variable D1 in the program) and are assigned arbitrary relative amplitudes (variable C1 in the program). The composite spectrum is taken to be the sum of the two curves, with each weighted by the mole fraction of the respective species. The mole fractions of one species (species 'A') are input by the student at execution time.

The program can produce as many as five superimposed spectra, in which case the "isosbestic point" is quite evident. Each spectrum is plotted using an identifying digit as the plotting character.

INSTRUCTIONS:

At execution time, the student inputs:

1. The number of spectra to be run (1-5)
2. The mole fraction (concentration) of species 'A' for each spectrum.

SPECIAL CONSIDERATIONS:

The relative spacing (λ max) and relative amplitudes (extinction coefficients) of the two absorption peaks can be changed by changing the respective data in line 210. This might necessitate a change in the plot scaling data in lines 102 and 112.

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Analytical Chemistry, Physical Chemistry

Student Background Required: Students should be acquainted with theory and operation of an optical spectrometer, as well as with the concept of chemical equilibrium.

This program is used to supplement laboratory experiments involving spectra of equilibrium mixtures in solution, such as the determination of the pK of an acid-base indicator. The program can be used before or after the actual experiment to give students a better feel for the idealized spectra of such systems. Program parameters (D1 and C1) can be adjusted by the instructor to make the simulated spectra more closely resemble those of the system being studied.

The phenomenon of the isosbestic point (the common intersection of all the spectra generated when the total concentration of the chemical species is kept constant) is very easily discussed in terms of this program. Examination of the simple model used (line 280) shows that this special point arises because one curve is weighted by M while the other is weighted by 1-M. Such weighting leads to the common intersection which is the isosbestic point. The M, 1-M coefficients exactly correspond, of course, to the mole fraction relationship which exists in an equilibrium mixture of two interconvertible species.

ACKNOWLEDGEMENTS: Leonard Jay Soltzberg
Simmons College

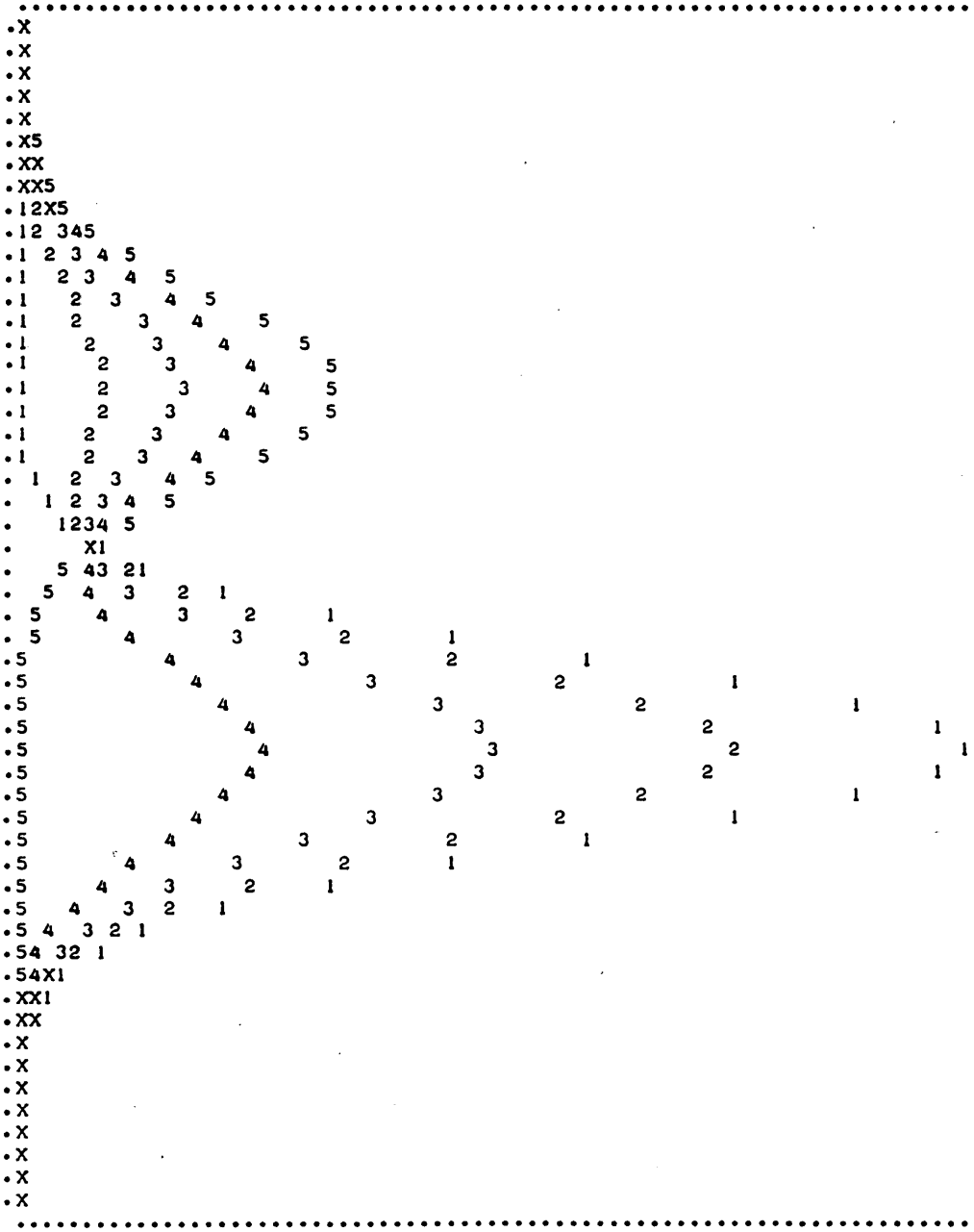
RUN

```
RUN
SPCTRA

NUMBER OF SPECTRA (5 MAX.)?5

ENTER MOLE FRACTION OF COMPONENT 'A' FOR EACH SPECTRUM

SPECTRUM #              MOLE FRACTION OF 'A'
 1                       ?0.00
 2                       ?0.25
 3                       ?0.50
 4                       ?0.75
 5                       ?1.00
```



```
DONE
```

TITLE: FLY POPULATION CONTROL

STERL
36641

DESCRIPTION:

This program is a simulation designed to make possible any investigation of the effectiveness of two very different methods of pest control: 1) the use of pesticides, and 2) the release of sterile males.

STERL was developed by the Huntington II Project at the Polytechnic Institute of Brooklyn under the direction of L. Braun. This work was partially supported by the National Science Foundation, Grant GW-5383.

INSTRUCTIONS:

The user's goal is to destroy the fly population in a given area by choosing the methods of control. The program prompts appropriate response to indicate the type of control desired, and the simulation takes place.

SPECIAL CONSIDERATIONS:

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

Student Workbook	**$ .30**
Teachers Guide	**.30**
Resource Handbook	**.50**

ACKNOWLEDGEMENTS: Huntington II Project
State University of New York

```
RUN


RUN
STERL

                CONTROL OF SCREW-WORM FLY POPULATION

INSTRUCTIONS (1=YES, 0=NO)?1

YOUR GOAL WILL BE TO ELIMINATE THE ONE MILLION MALE
FLIES NOW IN YOUR 10000 SQUARE MILE AREA, THUS DESTROYING
THE TOTAL FLY POPULATION.  YOU MAY USE A PESTICIDE,
RELEASE STERILE MALE FLIES, OR BOTH.  INDICATE THE TYPE
OF CONTROL PROGRAM YOU WANT BY TYPING IN THE APPROPRIATE
RESPONSES TO THE FOLLOWING QUESTIONS:

'PESTICIDE?'
  0= NO PESTICIDES.
  1= PESTICIDES ON SPECIFIED DAYS.  INDICATE
     THESE DAYS BY TYPING A DAY NUMBER (BETWEEN 1 AND 75)
     NEXT TO EACH '?' THAT APPEARS; TYPE 0 WHEN FINISHED.

'STERILE FLIES?'
  0= NO STERILE FLIES.
  1= STERILE FLIES WILL BE RELEASED.  COMPUTER WILL
     ASK 'HOW OFTEN?'  TYPE 1=DAILY OR 2=CERTAIN DAYS
  IF 1, SPECIFY NUMBER OF FLIES EACH DAY (UP TO 1000000),
        THE FIRST DAY OF THE PERIOD, AND THE LAST DAY
        (BETWEEN 1 AND 75 DAYS).
  IF 2, FOR EACH DAY SELECTED, SPECIFY THE DAY NUMBER
        (BETWEEN 1 AND 75) AND THE NUMBER OF STERILE FLIES
        (UP TO 1000000).  USE A NEW LINE FOR EACH DAY.
        TYPE 0,0 WHEN FINISHED.

**********

PESTICIDE (1=YES, 0=NO)?1
WHICH DAYS
?1
?11
?21
?31
?41
?51
?61
?71
?0

STERILE FLIES (1=YES, 0=NO)?1
HOW OFTEN (1=DAILY, 2=SELECTED DAYS)?2
DAY, NUMBER OF FLIES
?2,1000000
?3,1000000
?4,1000000
?12,1000000
?13,1000000
?14,1000000
?22,1000000
?23,1000000
?24,1000000
?0,0
```

MILLIONS OF NORMAL ADULT MALE FLIES

```
          0         .2         .4         .6         .8         1
DAY       I---------I---------I---------I---------I---------I
 0        I                                                  *  1.00000E+06
 1        I      *  100000.
 2        I                          *  449489.
 3        I                       *  393439.
 4        I                    *  334594.
 5        I                   *  318814.
 6        I                           *  450118.
 7        I                              *  544413.
 8        I                                 *  615256.
 9        I                                    *  670304.
10        I                                      *  714209.
11        I     *  74996.
12        I                          *  435154.
13        I                       *  385717.
14        I                *  250520.
15        I             *  175145.
16        I              *  195974.
17        I              *  206759.
18        I               *  212442.
19        I               *  216854.
20        I               *  220481.
21        I  *  22402
22        I             *  182296.
23        I           *  164261.
24        I       *  93343.
25        I     *  83207.
26        I        *  115190.
27        I         *  134580.
28        I         *  146128.
29        I          *  157303.
30        I          *  169204.
31        I  *  18288
32        I                   *  278245.
33        I                         *  417323.
34        I                            *  460778.
35        I                               *  519622.
36        I                                  *  564348.
37        I                                     *  593302.
38        I                                      *  614001.
39        I                                       *  631237.
40        I                                       *  648231.
41        I    *  66531.
42        I          *  181276.
43        I              *  260112.
44        I                 *  322424.
45        I                      *  398735.
46        I                         *  476509.
47        I                            *  545846.
48        I                               *  607354.
49        I                                  *  646326.
50        I                                     *  691699.
51        I     *  74036.
52        I                                                  *  1.00000E+06
53        I                                                  *  1.00000E+06
54        I                                                  *  999637.
55        I                                                  *  1.00000E+06
56        I                                                  *  1.00000E+06
57        I                                                  *  1.00000E+06
58        I                                                  *  1.00000E+06
59        I                                                  *  1.00000E+06
60        I                                                  *  1.00000E+06
61        I      *  99999.
62        I                         *  443562.
63        I                               *  596412.
64        I                                  *  636960.
65        I                                     *  675094.
66        I                                      *  707673.
67        I                                        *  734624.
68        I                                         *  756652.
69        I                                      *  710685.
70        I                                      *  723414.
71        I     *  74181.
72        I                                                  *  999999.
73        I                                                  *  1.00000E+06
74        I                                                  *  999760.
```

```
 75   I                                                        *  1.00000E+06
       I---------I---------I---------I---------I---------I
```

COST OF FLY CONTROL: $ 890000.

ANOTHER RUN (1=YES, 0=NO)?0

DONE

STOICH
36618

TITLE: MASS VOLUME

DESCRIPTION:

This program solves mass-mass, mass-volume, and volume-volume problems. The input may be in grams and/or moles and the output will be in grams, moles and/or liters.

OBJECTIVES:

To provide the teacher and the student with a stoichiometry calculator to be used where either finds it applicable.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - The student must have an introduction to stoichiometry.

B. Materials - None

DISCUSSION:

Some of the situations where this program is useful:

A. In Class
   1. Enables teacher to cover a large number of problems without using time to do calculations.
   2. Can be used in conjunction with a problem exercise in class so teacher can go around and give individual help.

B. Outside of Class
   1. Tutorial Work.
   2. Students can check homework problems during study periods or after school.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
STOICH

 DO YOU WISH TO SKIP THE INSTRUCTIONS? 1 FOR YES ,0 FOR NO?0
THIS PROGRAM IS DESIGNED TO SOLVE:
       1. MASS-MASS PROBLEMS
       2. MASS-VOLUME PROBLEMS
       3. VOLUME-VOLUME PROBLEMS

SOME GENERAL INSTRUCTIONS FOR USING THE PROGRAM WILL
BE HELPFUL AT THIS TIME.
     1. IF TWO PIECES OF DATA ARE REQUESTED, BE SURE TO
        GIVE THEM IN THE ORDER REQUESTED AND SEPARATE
        THEM WITH A COMMA.
     2. THE BALANCED EQUATION IS THE FIRST THING
        NEEDED WITH EACH TYPE OF PROBLEM SO HAVE IT PREPARED.
     3. THE FORMULA WEIGHTS ARE NEEDED NEXT SO HAVE THEM
        PREPARED.


PICK THE TYPE OF CALCULATION YOU DESIRE BY ANSWERING THE
FOLLOWING QUESTION WITH A 1,2, OR 3:
             1 FOR MASS-MASS CALCULATIONS
             2 FOR MASS-VOLUME CALCULATIONS
             3 FOR VOLUME-VOLUME CALCULATIONS

WHAT IS THE NUMBER OF YOUR CHOICE?1
               ***************

 PROVIDE THE FOLLOWING DATA FOR THIS MASS-MASS PROBLEM:

HOW MANY MOLES OF KNOWN COMPOUND AND UNKNOWN COMPOUND
ARE SHOWN IN THE BALANCED CHEMICAL EQUATION?1,1
WHAT IS THE FORMULA WEIGHT OF THE KNOWN COMPOUND
 AND THE UNKNOWN COMPOUND ?100,56
 WHAT MASS, IN GRAMS, OF THE KNOWN COMPOUND IS INVOLVED
 IN THE CHEMICAL REACTION?  IF THIS INFORMATION IS AVAILABLE
 IN MOLES ANSWER ZERO (0) AND WAIT FOR THE NEXT QUESTION?50.0
 ANSWERS: ..................  .5          MOLES OF UNKN. CPD.
          ..................  28     GRAMS OF UNKN. CPD.

               ***************

DO YOU WISH TO SOLVE ANOTHER PROBLEM?  ANSWER 1 FOR M-M,
 2 FOR M-V, 3 FOR V-V, AND ZERO (0) TO END THE PROGRAM.?2

               ***************

 PROVIDE THE FOLLOWING DATA FOR THIS MASS-VOLUME PROBLEM:

 HOW MANY MOLES OF KNOWN COMPOUND AND UNKNOWN COMPOUND
 ARE SHOWN IN THE BALANCED EQUATION?2,2
WHAT IS THE FORMULA WEIGHT OF THE KNOWN COMPOUND AND THE
 UNKNOWN COMPOUND?18,2
 WHAT MASS, IN GRAMS, OF THE KNOWN COMPOUND IS INVOLVED
 IN THE CHEMICAL REACTION? IF ONLY VOLUME IS KNOWN
 ANSWER ZERO (0) AND WAIT FOR THE NEXT QUESTION?20.0
ANSWERS: ............................. 1.11111    MOLES OF UNKN. GAS
         ............................. 24.8889     LITERS OF UNKN. GAS

               ***************

DO YOU WISH TO SOLVE ANOTHER PROBLEM?  ANSWER 1 FOR M-M,
 2 FOR M-V, 3 FOR V-V, AND ZERO (0) TO END THE PROGRAM.?3

               ***************

PROVIDE THE FOLLOWING DATA FOR THIS VOLUME-VOLUME PROBLEM:

HOW MANY MOLES KNOWN GAS AND UNKNOWN GAS ARE SHOWN
 IN THE BALANCED EQUATION?1.3,3
 WHAT IS THE VOLUME IN LITERS OF THE KNOWN GAS INVOLVED
 IN THE CHEMICAL REACTION? (VOLUME MUST BE AT STP.)?146
ANSWER: ............................. 336.923    LITERS OF UNKN. GAS

               ***************
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```
DO YOU WISH TO SOLVE ANOTHER PROBLEM?  ANSWER 1 FOR M-M,
 2 FOR M-V, 3 FOR V-V, AND ZERO (0) TO END THE PROGRAM.?1

               **************

 PROVIDE THE FOLLOWING DATA FOR THIS MASS-MASS PROBLEM:

HOW MANY MOLES OF KNOWN COMPOUND AND UNKNOWN COMPOUND
ARE SHOWN IN THE BALANCED CHEMICAL EQUATION?1,1
WHAT IS THE FORMULA WEIGHT OF THE KNOWN COMPOUND
 AND THE UNKNOWN COMPOUND ?56,74
 WHAT MASS, IN GRAMS, OF THE KNOWN COMPOUND IS INVOLVED
 IN THE CHEMICAL REACTION?  IF THIS INFORMATION IS AVAILABLE
 IN MOLES ANSWER ZERO (0) AND WAIT FOR THE NEXT QUESTION?0
 HOW MANY MOLES OF KNOWN COMPOUND WERE INVOLVED IN
 THE CHEMICAL REACTION?2.9
 ANSWERS: ..................  2.9          MOLES OF UNKN. CPD.
          ..................  214.6        GRAMS OF UNKN. CPD.

               **************

DO YOU WISH TO SOLVE ANOTHER PROBLEM?  ANSWER 1 FOR M-M,
 2 FOR M-V, 3 FOR V-V, AND ZERO (0) TO END THE PROGRAM.?2

               **************

 PROVIDE THE FOLLOWING DATA FOR THIS MASS-VOLUME PROBLEM:

 HOW MANY MOLES OF KNOWN COMPOUND AND UNKNOWN COMPOUND
 ARE SHOWN IN THE BALANCED EQUATION?1,2
WHAT IS THE FORMULA WEIGHT OF THE KNOWN COMPOUND AND THE
 UNKNOWN COMPOUND?2,23
 WHAT MASS, IN GRAMS, OF THE KNOWN COMPOUND IS INVOLVED
 IN THE CHEMICAL REACTION? IF ONLY VOLUME IS KNOWN
 ANSWER ZERO (0) AND WAIT FOR THE NEXT QUESTION?0
 WHAT IS THE VOLUME, IN LITERS, OF THE KNOWN GAS
INVOLVED IN THE CHEMICAL REACTION? (VOLUME MUST BE AT STP)?212
 ANSWERS:..................  18.9286      MOLES OF UNKN. CPD.
          ..................  435.357      GRAMS OF UNKN. CPD.

               **************

DO YOU WISH TO SOLVE ANOTHER PROBLEM?  ANSWER 1 FOR M-M,
 2 FOR M-V, 3 FOR V-V, AND ZERO (0) TO END THE PROGRAM.?0

               **************


DONE
```

TITER
36888-18006

TITLE: SIMULATES TITRATION OF A BASE BY AN ACID

DESCRIPTION:

This program simulates a titration with clues to neutralization progress by color and hints on addition amounts. Has facility for proper end point, small overrun, and gross overshooting of endpoint.

INSTRUCTIONS:

Program is interactive and self-explanatory. Just GET and RUN.

SPECIAL CONSIDERATIONS:

For instructional purposes:
Suitable Courses: First year chemistry

Student background required: Algebra, Descriptive Chemistry.

ACKNOWLEDGEMENTS:

Richard C. Adams
Pleasant Hill High School
Pleasant Hill, Oregon 97401

RUN

```
RUN
TITER

WELL, HERE YOU ARE - THE ONE WHO DIDN'T GET TO TITRATE
THE BASE WITH THE ACID.  YOU MISSED OUT ON ALL THE FUN
OF SPILLING ACID ON YOURSELF AND BREAKING A BURETTE ($12.95) OR
MAYBE JUST A PIPETTE ($4.95).  ANYWAY, YOU'RE GOING TO GET
TO HAVE  SOME  OF THAT FUN AND DO AN ELECTRONIC TITRATION.
YOU JUST HAVE TO TELL ME WHAT STRENGTH ACID YOU WANT TO USE
(SOMEWHERE LESS THAN 1 MOLAR IS NICE) AND HOW MUCH BASE
YOU WANT TO TITRATE.  WE'LL BE USING A RED INDICATOR,
PHENOLPHTHALEIN  (FEE NO THAY LEE IN) WHICH IS A PRETTY REDDISH-
MAGENTA COLOR IN BASE, SO YOU'LL BE SHOOTING FOR A CLEAR
SOLUTION AT NEUTRALITY.       LET'S GET STARTED!

WHAT MOLARITY OF ACID DO YOU WANT TO USE??.2
FINE.  NOW, HOW MANY MILLILITERS OF BASE DO YOU WANT TO USE?5
O.K.  START OFF WITH A VOLUME OF ACID (IN MILLILITERS) AND
I'LL TRY TO TELL YOU HOW THE COLOR'S COMING ALONG.
ML?1
YOU'VE HARDLY ADDED ANY AT ALL!  DO MORE NEXT TIME.
YOU'VE ADDED 1     ML OF ACID SO FAR.
ML?3
BOY!  THAT'S NOT VERY MUCH EVEN YET.  I DIDN'T SEE ANY COLOR
CHANGE.  TRY MORE NEXT TIME.  REALLY!
YOU'VE ADDED 4     ML OF ACID SO FAR.
ML?3
THAT'S STILL NOT VERY GOOD.
YOU'VE ADDED 7     ML OF ACID SO FAR.
ML?2
HEY!  IT CLEARED IN ONE SPOT JUST FOR A SECOND!
YOU'VE ADDED 9     ML OF ACID SO FAR.
ML?3
HEY!  IT CLEARED IN ONE SPOT JUST FOR A SECOND!
YOU'VE ADDED 12    ML OF ACID SO FAR.
ML?3
THE CLEARING LASTED A LITTLE LONGER THIS TIME!
YOU'VE ADDED 15    ML OF ACID SO FAR.
ML?2
THE CLEAR AREA KEEPS GETTING A LITTLE LARGER BEFORE IT TURNS
BACK TO ALL RED.  KEEP GOING!
YOU'VE ADDED 17    ML OF ACID SO FAR.
ML?1
YOU'RE GAINING ON IT.  YOU'D BETTER NOT ADD TOO MUCH AT A
TIME - - YOU'RE 85% THERE NOW!
YOU'VE ADDED 18    ML OF ACID SO FAR.
ML?1
THE COLOR'S BEGINNING TO FADE NOW!
YOU'VE ADDED 19    ML OF ACID SO FAR.
ML?1
THAT'S IT   IT'S CLEAR!!!  CONGRATULATIONS!!!!
O.K., YOU HAD 5     ML OF BASE AND YOU ADDED 20
ML OF YOUR ACID, WHICH WAS .2          MOLAR.  SO 20
TIMES .2          HAS TO EQUAL 5     TIMES THE BASE'S MOLARITY.
I GET .8          FOR THE MOLARITY OF THE BASE.

THANKS FOR TITRATING WITH ME   - HE SAID ACIDLY

DONE
```

TRIVIA
36888-18012

TITLE:

TRIVIAL OR COMMON NAME QUIZ FOR CHEMISTRY STUDENTS

DESCRIPTION:

This program is a simple drill on the common names of selected familiar substances. It includes the formula and chemical names as well. The student is asked between 10 and 16 questions at a time after which his wrong responses are reviewed and the correct answers are given. There are six types of questions that are asked - each of which is asked once in a random order for the first six questions presented. From the seventh question on they are chosen at random, being slightly biased toward the two types involving the common name and the chemical name (#2 & #5).

The six types of questions are:

1. Give common name ask formula
2. Give common name ask chemical name
3. Give formula ask common name
4. Give formula ask chemical name
5. Give chemical name ask common name
6. Give chemical name ask formula

For any questions that are answered incorrectly, the correct answers are written onto a file and read back as a study list at the end of the session. The option to go through the drill again is then offered (with different questions and order).

INSTRUCTIONS:

The program requires string inputs depending upon the question asked. If the correct answer is not known to a question the user may type A ? or simply return (or anything else for that matter), and the program will continue with the next question. All responses are timed input.

There is one file used by this program called TRIVIF. It is a one record file, or the first record of a file. The information is written onto it three strings at a time.

SPECIAL CONSIDERATIONS:

The Data Base is easily changed. Simply add Data Statements and increase the value of N accordingly (line #900). If it is desired to use two records of the file or to increase the number of questions asked before the review is given, change the test of W0 in line # 1070 to - 1070 if W0>510 then 1170 -. The program was designed to use only the first record of a semipermanent student record file as a scratch pad, and so will not overflow into the second record, thereby protecting the contents of the file beginning with record two. This feature is transparent whether used or not.

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Basic Chemistry

ACKNOWLEDGEMENTS:

John R. Wilson
Contra Costa Community College

RUN

```
OPE-TRIVIF,1
RUN
TRIVIA

INSTRUCTIONS FOR THIS TRIVIAL NAME QUIZ:
   ALWAYS PUT PARENTHESIS () AROUND THE FOLLOWING -     H2O
                                                        SO4
                                                         OH
THIS IS IMPORTANT IN ORDER FOR ME TO UNDERSTAND YOUR FORMULAS.


IF YOU DON'T KNOW THE ANSWER, TYPE  ?  OR PRESS  RETURN .

 1      WHAT IS THE COMMON NAME OF
                    CALCIUM CARBONATE?:CA;COT\
CALCITE
   YES! ALSO THE FORMULA IS CACO3.


 2      WHAT IS THE COMMON NAME OF
                    NA(OH)?:SALT
NO, IT IS CALLED LYE.


 3      WHAT IS THE FORMULA OF
                    MAGNESIUM SULFATE HEPTAHYDRATE?:MG(SO4)2(H20)
NO, THE CORRECT ANSWER IS MG(SO4)7(H2O).


 4      WHAT IS THE CHEMICAL NAME OF
                    NAHCO3?:SODIUM BICARBONATE
   YES! ALSO THE COMMON NAME IS BAKING SODA.


 5      WHAT IS THE FORMULA OF
                    VINEGAR?:HC2H302
NO, THE CORRECT ANSWER IS HC2H302.


 6      WHAT IS THE CHEMICAL NAME OF
                    QUICKSILVER?:MERCURY
   YES! ALSO THE FORMULA IS HG.


 7      WHAT IS THE COMMON NAME OF
                    NA2(B407)10(H20)?:BORAX
   YES! ALSO THE CHEMICAL NAME IS SODIUM TETRABORATE DECAHYDRATE.


 8      WHAT IS THE CHEMICAL NAME OF
                    AL203?:ALUMINUM OXIDE
   YES! ALSO THE COMMON NAME IS ALUMINA.


 9      WHAT IS THE CHEMICAL NAME OF
                    PBO?:LEAD OXIDE
  YES, BUT IT IS MORE CORRECT TO SAY LEAD(II) OXIDE.


 10     WHAT IS THE COMMON NAME OF
                    POTASSIUM HYDROGEN TARTRATE?:CREAM OF TARTAR
   YES! ALSO THE FORMULA IS KHC4H406.

=================================================================
  YOU GOT          RIGHT.
            3      WRONG.
            0      TO SLOW.

     STUDY LIST:
LYE = NA(OH) = SODIUM HYDROXIDE
EPSOM SALTS = MG(SO4)7(H2O) = MAGNESIUM SULFATE HEPTAHYDRATE
VINEGAR = HC2H302 = ACETIC ACID
=================================================================
 I WILL WAIT  24     SECONDS FOR YOU TO STUDY THIS LIST...
   PRESS  CR  IF YOU DON'T WANT TO WAIT.
DO YOU WANT TO CONTINUE THIS DRILL ?NO
DONE
```

USPOP
36802

TITLE:

HUMAN POPULATION PROJECTION

DESCRIPTION:

USPOP is a highly flexible human population model. The student can investigate the effects of fertility, age of mother at birth of child, sex ratio of the offspring and age-dependent mortality on population size and structure. Through use of 1970 census data, held in DATA statements, the student need enter only a few of the required inputs.

If the student or teacher wishes to model situations other than that collected in the DATA statements, all or some of the required inputs may have to be changed.

INSTRUCTIONS:

USPOP uses simulation techniques as a stimulus to learning in the teaching of many key demographic concepts involving population growth and age distribution. Students play the role of demographers projecting future population trends. The STUDENT MANUAL (See "SPECIAL CONSIDERATIONS") leads the student through a series of five investigations, each involving a single concept. The following concepts are explored:

INVESTIGATION #1: Effect of fertility on population growth. Fertility is seen to have a major impact on population growth.

INVESTIGATION #2: Effect of time of birth of first child on the population-growth rate. Surprisingly, delaying the birth of the first child can slow population growth, even if the total number of offspring remains constant.

INVESTIGATION #3: Effect of reducing infant mortality. Reducing infant mortality to the lowest level realistically possible is seen to have only a minor impact on future population size.

INVESTIGATIONS #4 and #5: Exploration of factors affecting age distribution in a population. Again fertility is seen as the major factor. Mortality is important, but it has only a secondary effect on age distribution in the population.

SPECIAL CONSIDERATIONS:

The Huntington II Project recommends that for use of this program in the classrooms it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts, 01754.

Student Workbook	$.30
Teachers Guide	$.30
Resource Handbook	$.50

ACKNOWLEDGEMENTS:

Huntington II Project
State University of New York

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RUN

RUN
USPOP

DO YOU WANT REPORTS 1) EVERY 5 YEAR INTERVAL
OR 2) SELECTED YEARS?1

YEAR AT START OF PROJECTION?1970

DO YOU ASSUME STANDARD FERTILITY (1=YES,0=NO)?1
WILL FERTILITY (1) STAY AT 2.45        OR (2) CHANGE SLOWLY
TO A NEW LEVEL?1

DO YOU ASSUME STANDARD BIRTH DISTRIBUTION (1=YES,0=NO)?0
PCT. FERTILITY OCCURING IN FEMALES AGES:
 10   - 14   ?30
 15   - 19   ?40
 20   - 24   ?30
 25   - 29   ?0
 30   - 34   ?0
 35   - 39   ?0
 40   - 44   ?0
 45 AND OLDER?0

DO YOU ASSUME STANDARD SEX RATIO (1=YES,0=NO)?1

DO YOU ASSUME STANDARD MORTALITY (1=YES,0=NO)?1

DO YOU ASSUME STANDARD POPULATION (1=YES,0=NO)?1

REPORT:1)SHORT 2)LONG 3)GRAPH 4)CHANGE ASSUMPTIONS 5)END?1

YEAR 1970      POP=  204.8      MILLION      FERTILITY 2.45

REPORT:?1

YEAR 1975      POP=  218.8      MILLION      FERTILITY 2.45

REPORT:?1

YEAR 1980      POP=  233.6      MILLION      FERTILITY 2.45

REPORT:?1

YEAR 1985      POP=  247  MILLION            FERTILITY 2.45

REPORT:?1

YEAR 1990      POP=  260.3      MILLION      FERTILITY 2.45

REPORT:?1

YEAR 1995      POP=  274.9      MILLION      FERTILITY 2.45

REPORT:?1

YEAR 2000      POP=  291  MILLION            FERTILITY 2.45

REPORT:?5

ANOTHER PROJECTION (1=YES, 0=NO)?0

DONE

RUN
USPOP

DO YOU WANT REPORTS 1) EVERY 5 YEAR INTERVAL
OR 2) SELECTED YEARS?2

YEAR AT START OF PROJECTION?1975

DO YOU ASSUME STANDARD FERTILITY (1=YES,0=NO)?0
FERTILITY IN 1975    ?2.06
WILL FERTILITY (1) STAY AT 2.06        OR (2) CHANGE SLOWLY
TO A NEW LEVEL?2
WHAT FERTILITY WILL BE STABLE?1
HOW MANY DECADES UNTIL FERTILITY REACHES 1    ?3.5
```

```
DO YOU ASSUME STANDARD BIRTH DISTRIBUTION (1=YES,0=NO)?0
PCT. FERTILITY OCCURING IN FEMALES AGES:
 10    - 14    ?.5
 15    - 19    ?20
 20    - 24    ?40
 25    - 29    ?20
 30    - 34    ?10
 35    - 39    ?5
 40    - 44    ?4.5
 45 AND OLDER?0

DO YOU ASSUME STANDARD SEX RATIO (1=YES,0=NO)?0
PERCENT FEMALE BIRTHS?30

DO YOU ASSUME STANDARD MORTALITY (1=YES,0=NO)?0
CHANGE IN MORTALITY OCCURING IN FEMALES
GROUPS (FROM AGE, TO AGE)?0,4
GROUP           CURRENT         NEW VALUE
                DEATH/1000
 0     - 4       17.8            ?10
CHANGE IN MORTALITY OCCURING IN MALES
GROUPS (FROM AGE, TO AGE)?0,4
GROUP           CURRENT         NEW VALUE
                DEATH/1000
 0     - 4       22.5            ?14

DO YOU ASSUME STANDARD POPULATION (1=YES,0=NO)?0
CHANGE IN FEMALE POPULATION
GROUPS (FROM AGE, TO AGE)?0,0
CHANGE IN MALE POPULATION
GROUPS (FROM AGE, TO AGE)?15,34
GROUP           CURRENT         NEW VALUE
          POPULATION MILLIONS
 15    - 19      9.8             ?8
 20    - 24      8.6             ?4.3
 25    - 29      6.8             ?3.4
 30    - 34      5.7             ?2.8

REPORT:1)SHORT 2)LONG 3)GRAPH 4)CHANGE ASSUMPTIONS 5)END?2

YEAR 1975       POP=  192.4       MILLION       FERTILITY 2.06
 AGES     FEMALES <-MILLIONS-> MALES             PCT. TOTAL
 0     - 4       8.4             8.7             8.9
 5     - 9       9.7             10.1            10.3
 10    - 14      10.2            10.5            10.8
 15    - 19      9.4             8               9
 20    - 24      8.5             4.3             6.6
 25    - 29      6.9             3.4             5.3
 30    - 34      5.8             2.8             4.4
 35    - 39      5.7             5.5             5.8
 40    - 44      6.1             5.8             6.1
 45    - 49      6.2             5.9             6.3
 50    - 54      5.7             5.3             5.7
 55    - 59      5.2             4.7             5.1
 60    - 64      4.6             4               4.5
 65    - 69      3.7             3               3.5
 70    - 74      3.2             2.3             2.9
 75 AND OVER     4.6             2.9             3.9
YEAR FOR NEXT REPORT?1985

REPORT:?1

YEAR 1985       POP=  206.5       MILLION       FERTILITY 1.75714
YEAR FOR NEXT REPORT?1995

REPORT:?1

YEAR 1995       POP=  217.4       MILLION       FERTILITY 1.45429
YEAR FOR NEXT REPORT?2005

REPORT:?1

YEAR 2005       POP=  215.8       MILLION       FERTILITY 1.15143
YEAR FOR NEXT REPORT?2015

REPORT:?2
```

```
YEAR 2015      POP=  205.8       MILLION       FERTILITY 1.
 AGES     FEMALES <-MILLIONS-> MALES            PCT. TOTAL
 0     - 4      1.6               3.8           2.6
 5     - 9      2                 4.5           3.2
 10    - 14     2.7               5.9           4.2
 15    - 19     3.7               8.3           5.8
 20    - 24     4.7               10.3          7.3
 25    - 29     5.3               11.3          8
 30    - 34     5.4               11.4          8.2
 35    - 39     5.2               10.9          7.8
 40    - 44     8.8               8.8           8.6
 45    - 49     9.9               9.7           9.5
 50    - 54     10                9.7           9.5
 55    - 59     8.9               6.9           7.7
 60    - 64     7.6               3.4           5.4
 65    - 69     5.7               2.3           3.9
 70    - 74     4.2               1.4           2.7
 75 AND OVER    5.6               4.1           4.7
YEAR FOR NEXT REPORT?2025

REPORT:?1

YEAR 2025      POP=  189.3       MILLION       FERTILITY 1.
YEAR FOR NEXT REPORT?2035

REPORT:?1

YEAR 2035      POP=  165.7       MILLION       FERTILITY 1.
YEAR FOR NEXT REPORT?2045

REPORT:?1

YEAR 2045      POP=  138.1       MILLION       FERTILITY 1.
YEAR FOR NEXT REPORT?2055

REPORT:?1

YEAR 2055      POP=  113  MILLION              FERTILITY 1.
YEAR FOR NEXT REPORT?2300

REPORT:?2

YEAR 2300      POP=  27.9        MILLION       FERTILITY 1.
 AGES     FEMALES <-MILLIONS-> MALES            PCT. TOTAL
 0     - 4      .2                .4            2.5
 5     - 9      .3                .6            3.3
 10    - 14     .4                .7            4.1
 15    - 19     .5                .8            5
 20    - 24     .6                .9            5.7
 25    - 29     .7                1             6.5
 30    - 34     .8                1.1           7.3
 35    - 39     .9                1.1           7.5
 40    - 44     .9                1.1           7.6
 45    - 49     .9                1.1           7.7
 50    - 54     .9                1.1           7.6
 55    - 59     .9                1.1           7.5
 60    - 64     .9                1             7.1
 65    - 69     .8                .8            6.3
 70    - 74     .7                .6            5.2
 75 AND OVER    1.3               .9            8.3
YEAR FOR NEXT REPORT?3000

REPORT:?5

ANOTHER PROJECTION (1=YES, 0=NO)?0

DONE
```

VFIELD
36322

TITLE: VFIELD: Potential Field Picture

DESCRIPTION:

This program plots a picture of the relative potential field strengths of regions surrounding two point charges.

OBJECTIVES:

To give the student a feel for how the electric potential field is altered by changing the positions of two point charges.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - The concept of electric potential for a point charge should be understood, as well as equipotential lines and potential hills or swells.

B. Materials - none needed

DISCUSSION:

One run of this program requires much time, so it is not advised for use with a whole class. Individual students or small groups will derive the greatest benefit, or, alternatively, the teacher may make several runs before class and display the resulting plots during a class discussion.

The coordinate plane occupied by the charges is 30 x 30.

NOTE: The numbers in the plots indicate relative field strengths.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
VFIELD

THIS PROGRAM PLOTS A PICTURE OF THE RELATIVE ELECTRICAL
POTENTIAL FIELD STRENGTHS IN THE REGION SURROUNDING TWO
POINT CHARGES.  THE CHARGES ARE IN A COORDINATE PLANE
30 BY 30.  THE CHARGES MAY HAVE ANY VALUE WHOSE
MAGNITUDE IS LESS THAN 10   , AND MAY BE ANYWHERE BETWEEN
0 AND 30 ON THE X AND Y AXES.
THE MAGNITUDE OF THE FIELD DECREASES FROM 9 TO 1, 0, A TO J
THAT IS, 9 TO 1 IS A POSITIVE POTENTIAL, 0 IS ROUGHLY 0,
AND A=-1, B=-2, ... J=-9. (THERE IS NO 'I'.)

WHAT VALUES OF CHARGES DO YOU WISH TO STUDY?
TO STUDY ONLY ONE CHARGE, MAKE THE SECOND CHARGE 0.
ENTER TWO VALUES OF CHARGE : ?10,-3.5
WHERE SHALL THE FIRST CHARGE BE LOCATED?15,15
WHERE SHALL THE SECOND CHARGE BE LOCATED?15,25


          *0         6         12        18        24        30*
          *I---------I---------I---------I---------I---------I*
    30    *               000000000000000000000               *
    29    *               000000000000000000000               *
    28    *                000000  AAA  000000                *
    27    *                00000 AABBBAA 00000                *
    26    *      111        000 A CDEDC A 000        111      *
    25    * 1111111111111   000 ABD - DBA 000   1111111111111 *
    24    *1111111111111111   00 ABDEDBA 00   1111111111111111*
    23    *1111111111111111111  00 AAA 00  1111111111111111111*
    22    *1111111111111111111111     1111111111111111111111*
    21    *111111111111111                     111111111111111*
    20    *111111111111   2222222       2222222   111111111111*
    19    *1111111111   22222 333  444  333 22222   1111111111*
    18    *111111111   2222 33 4455 6 5544 33 2222   111111111*
    17    *11111111   2222 33 45  89998  54 33 2222   11111111*
    16    *11111111  2222  3 4  79     97  4 3  2222  11111111*
    15    *1111111   2222 33 4568   +   8654 33 2222   1111111*
    14    *1111111   2222 33 45679     97654 33 2222   1111111*
    13    *1111111   2222  334456789 987654433  2222   1111111*
    12    *1111111   22222 33 4455666665544 33 22222   1111111*
    11    *11111111   22222 333 444   444 333 22222   11111111*
    10    *11111111    22222  3333     3333  22222    11111111*
    9     *111111111    222222  333333333  222222    111111111*
    8     *1111111111    22222222       22222222    1111111111*
    7     *11111111111     2222222222222222222     11111111111*
    6     *1111111111111     222222222222222     1111111111111*
    5     *111111111111111          2          111111111111111*
    4     *111111111111111111                 11111111111111111*
    3     *1111111111111111111111111111111111111111111111111*
    2     *1111111111111111111111111111111111111111111111111*
    1     *1111111111111111111111111111111111111111111111111*
    0     *1111111111111111111111111111111111111111111111111*
          *I---------I---------I---------I---------I---------I*


DO YOU WISH TO VIEW ANOTHER PLOT (1=YES, 0=NO) : ?0


DONE
```

VLOCTY
36323

TITLE: VLOCTY: Instantaneous Velocity

DESCRIPTION:

A graph of distance vs. time is plotted for a body accelerating at 1m/sec/sec. The average velocity is found for a point on the graph several times using V average $=(d_2 - d_1)/(T_2 - T_1)$ as $(T_2 - T_1)$ gets smaller and smaller.

The program prints the instantaneous velocity at the points and allows the student to change some of the parameters involved.

OBJECTIVES:

To aid the student in understanding the meaning of instantaneous velocity and taking a limit.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - should know the definitions of average and instantaneous velocity

B. Materials - none

DISCUSSION:

A good tutorial program or teaching aid. Student should realize that the slope of the line drawn between the points d1, T1, and d2, T2 is the average velocity. As the second point is made to approach the first, the slope of this line approaches the value of the slope of the tangent line drawn to the first point - which is called the instantaneous velocity.

The student may then change the acceleration, time at which he wants to know the average speed, and the time interval, delta T.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN
RUN
VLOCTY

          AVERAGE AND INSTANTANEOUS VELOCITY

THIS PROGRAM CONSIDERS DISTANCE AS A FUNCTION OF TIME,
D=F(T).  IT WILL CALCULATE THE AVERAGE VELOCITY DURING
THE TIME INTERVAL T1,T2 BY EVALUATING D AT THOSE TIMES
GIVING D1 AND D2.  THE RESULT OF (D2-D1)/(T2-T1) YIELDS
THE AVERAGE VELOCITY.  AS T2 IS BROUGHT CLOSER AND CLOSER
TO T1 THE RESULTANT AVERAGE VELOCITY WILL APROACH THE
INSTANTANEOUS VELOCITY AT T1.

AFTER THE PROGRAM STOPS, TYPE IN THE FOLLOWING:
(END EACH LINE, INCLUDING 'RUN', WITH THE 'RETURN' KEY)

          1 GO TO 300
          300 DEF FND(T)=....(YOUR FUNCTION OF TIME)....
          RUN

FOR EXAMPLE, TO USE THE EQUATION D=A*T*T WITH A=1
YOU WOULD TYPE AS FOLLOWS:

          1 GO TO 300
          300 DEF FND(T)=1*T*T
          RUN

YOU MIGHT TRY THAT AS YOUR FIRST RUN.
FOR SUBSEQUENT RUNS, YOU NEED ONLY CHANGE LINE 300 FOR
A NEW FUNCTION, FOLLOWED BY 'RUN'.

DONE


1 GO TO 300
300 DEF FND(T)=1*T*T
RUN
VLOCTY


*****

WHAT ARE YOUR VALUES OF T1 AND T2 (SMALLER FIRST: T1,T2)?5,50

THE DISTANCE TRAVELED DURING THE INTERVAL IS  2475
THE AVERAGE VELOCITY IS  55

WOULD YOU LIKE TO CHANGE T2 (1-YES, 0-NO)?1
WHAT IS YOU NEW VALUE FOR T2 (T2 MUST BE GREATER THAN T1)?105

THE DISTANCE TRAVELED DURING THE INTERVAL IS  11000
THE AVERAGE VELOCITY IS  110

WOULD YOU LIKE TO CHANGE T2 (1-YES, 0-NO)?0

NOW WATCH THE AVERAGE VELOCITY AS T2 APPROACHES T1.

 T1 =  5                        D1 =  25

 T2             T2-T1          D2             D2-D1
 (D2-D1)/(T2-T1)
 --             -----          --             -----
 ---------------
 105            100            11025          11000          110
 55             50             3025           3000           60
 30             25             900            875            35
 17.5           12.5           306.25         281.25         22.5
 11.25          6.25           126.562        101.562        16.25
 8.125          3.125          66.0156        41.0156        13.125
 6.5625         1.5625         43.0664        18.0664        11.5625
 5.78125        .78125         33.4229        8.42285        10.7812
 5.39062        .390625        29.0588        4.05884        10.3906
 5.19531        .195312        26.9913        1.99127        10.1953
 5.09766        9.76562E-02    25.9861        .986099        10.0977
 5.04883        4.88281E-02    25.4907        .490665        10.0488
```

```
 T2             T2-T1          D2             D2-D1
 (D2-D1)/(T2-T1)
 --             -----          --             -----
 ---------------
 5.02441        2.44141E-02    25.2447        .244736        10.0244
 5.01221        .012207        25.1222        .122219        10.0122
 5.0061         6.10352E-03    25.0611        6.10733E-02    10.0063
 5.00305        3.05176E-03    25.0305        3.05252E-02    10.0025
 5.00153        1.52588E-03    25.0153        1.52626E-02    10.0025
 5.00076        7.62939E-04    25.0076        7.62939E-03    10
```

NOTE THAT THE AVERAGE VELOCITY CHANGES VERY LITTLE
AS T2 APPROACHES T1. T2 CAN NEVER EQUAL T1 SINCE
(D2-D1)/(T2-T1) WOULD THEN RESULT IN A DIVISION BY ZERO.

*****

WOULD YOU LIKE TO TRY DIFFERENT VALUES OF T1 AND T2
(1-YES, 0-NO)?0
TO CHANGE YOUR FUNCTION SEE THE INSTRUCTIONS.
IF YOU ARE FINISHED, TYPE '1', AND THE 'RETURN' KEY
AFTER THE PROGRAM STOPS.

DONE

WATER1
36326

TITLE: WATER1: Water Budget Problem Check

DESCRIPTION:

This is a tutorial program which takes a student through the step-by-step calculations of a water budget, checks the correctness of his responses, and indicates the location of his errors. In difficult parts of the budget instructions, clues are given before the student is asked to re-calculate his work.

OBJECTIVES:

This program is designed to:

A. Enable students to "visualize" an areas' climate in terms of its moisture patterns of usage, storage, recharge, and deficit.

B. Illustrate the relationship of deficit and surplus in light of growing seasons for crops, watering of lawns, the need for irrigation, and the occurrence of floods.

C. Develop the skills necessary for the successful completion of a water budget.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - Students should understand the following terms: potential evapotranspiration, actual evapotranspiration, deficit, and surplus. The concept of a change in value of a number (-ST or 'delta'-ST) should also have been covered.

B. Materials - Ditto sheets containing water budget tables should be available for each class member. A sample table follows:

Continued on following page.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

WATER BUDGET

FOR:_____

Progress code no.		J	F	M	A	M	J	J	A	S	O	N	D
P													
PE													
P-PE													
ST													
Δ ST													
AE													
D													
S													

A set of water budget graphs should also be available if the teacher wishes to have his classes complete the graph in addition to the water budget. See: Investigating the Earth, Teacher's Guide, Part I. P. 402 of the Earth Science Curriculum Project.

DISCUSSION:

This program is applicable to individual or small group (5 or less) instruction, and is designed for average students.

The progress code number assigned to the student indicates to the program the extent to which the student has progressed through the program. These numbers should be chosen according to the following table:

Progress Code #	Stage of Calculation of Water Budget
0-10	Introductory information
11-20	Student is ready for "P-PE" section of program
21-30	ready for "ST" section of program
31-40	ready for "-ST" section of program
41-50	ready for "A.E." section of program
51-60	ready for "D" section of program
61-70	ready for "S" section of program

Each student may work on a different water budget by entering a unique set of data in lines 43 and 44. Line 42 also may be changed to indicate the region whose water budget is under study.

This program should be used in conjunction with program WATER2 A833-36327.

```
RUN

RUN
WATER1

WHAT IS YOUR PROGRESS CODE NUMBER?5

WATER BUDGET FOR RUTLAND,VT.:
=============================================
P:
 57      48      63      74      80      90      86      86      92      94
 88      56
PE:
 0        0       0       28      75      114     133     114     78      41
 8        0
NOW, RETURN TO YOUR SEATS AND SEPARATELY WORK OUT YOUR VALUES
    FOR:  'P-PE'    AND 'STORAGE'.
RETURN ONLY AFTER YOUR TEACHER HAS CHECKED YOUR WORK AND GIVEN
     YOU A NEW PROGRESS CODE NUMBER!

DONE
```

TITLE:

WATER2: Water Budget

WATER2
36327

DESCRIPTION:

This program prints out a completed water budget. It may be used by a teacher to quickly calculate a series of water budgets he plans to use or it may be employed with more advanced students to check out an entire budget in one run.

OBJECTIVES:

A. To free teachers from the time-consuming task of calculating a number of practice water budgets.

B. To allow students a rapid means of verifying budgets they have been assigned for practice and drill.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - Students should be completely familiar with the concepts of evapotranspiration, water surplus, water storage, and water deficit.

B. Materials - A ditto of water budget tables as shown below:

WATER BUDGET
FOR:_____

	J	F	M	A	M	J	J	A	S	O	N	D
P												
PE												
P-PE												
ST												
ΔST												
AE												
D												
S												

Continued on following page.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

DISCUSSION:

To place a particular water budget in the program:

1. Call up the program by name.

2. Type the precipitation data on line 120, the P.E. data on line 130 and the title of the budget on line 110.

   example:

```
110 PRINT "Water Budget for N.Y., N.Y.:"
120 DATA 89, 86, 98, 86, 84, 85, 113, 88, 88, 82, 85
130 DATA 12, 40, 86, 125, 149, 132, 94, 55, 22, 2
```

3. Type "RUN"

The complete water budget will print out. (Check the value for P and PE to make sure you have typed them in correctly.)

To add other budgets repeat steps 2 and 3 until all budgets have been completed.

Additional P and PE data for other regions can be found in Investigating the Earth, Teacher's Guide, Part I, pages 392-397.

This program may be used in conjunction with WATER1 A833-36326.

```
RUN
110  PRINT "WATER BUDGET FOR ANCHORAGE,ALASKA:"
120  DATA 22,18,13,10,12,22,48,68,66,47,25,23
130  DATA 0,0,0,18,71,104,115,105,65,21,0,0
RUN
WATER2

WATER BUDGET FOR ANCHORAGE,ALASKA:
============================================================

P:
 22      18      13      10      12      22      48      68      66      47
 25      23
PE:
 0       0       0       18      71      104     115     105     65      21
 0       0
P-PE:
 22      18      13      -8      -59     -82     -67     -37     1       26
 25      23
DELTA-ST:
 22      3       0       -8      -59     -33     0       0       1
 26      25      23
STORAGE-(ST):
 97      100     100     92      33      0       0       0       1       27
 52      75
AE:
 0       0       0       18      71      55      48      68      65      21
  0       0
D:
 0       0       0       0       0       49      67      37      0
 0       0       0
SURPLUS:
 0       15      13      0       0       0       0       0       0
 0       0       0

TOTAL P =       374
TOTAL PE =      499
P/PE = .749499

DONE
```

WAVES
36324

TITLE:

WAVES: Sum of Two Waves

DESCRIPTION:

This program finds the sum of two waves: one predetermined by the program, and the other determined by the student. There are options of either displaying both waves and their sum, or just their sum.

OBJECTIVES:

To enable the student to study, independently, the effect of changes in wavelength, amplitude, and phase on the superposition pattern formed by two waves.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - Some experience with "SLINKY" wave superposition: knowledge of phase, amplitude, and wave length.

B. Materials - none

DISCUSSION:

The student controlled wave ("B") may have wavelengths ranging from 2 to 8, though only a wave length of 4 may be fully displayed. Its amplitude can be varied between 5 and 11, and its phase can be any decimal part of a wavelength.

The fixed wave ("A") has a wavelength of 4, and an amplitude of 10.

The display consists of both waves, side by side, and their superposition, or just their superposition.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

RUN

```
RUN
WAVES

                WAVES AND THEIR SUPERPOSITION
DO YOU NEED INSTRUCTIONS (1=YES, 0=NO) : ?1

IN THIS PROGRAM YOU MAY OBSERVE THE EFFECTS OF
CHANGING WAVELENGTH, AMPLITUDE, AND PHASE ON TWO
WAVES AND ON THEIR SUM (OR SUPERPOSITION).

WAVE 'A' IS FIXED.  ITS WAVELENGTH IS 4, ITS AMPLITUDE
IS 10, AND ITS PHASE IS 0.

WAVE 'B' MAY BE CHANGED BY YOU.  FOR BEST RESULTS :
                WAVELENGTH (L) BETWEEN 2 AND 4
                AMPLITUDE (A) BETWEEN 5 AND 10
                PHASE (P) BETWEEN 0 AND 1
                (FOR EXAMPLE, .5 PHASE = 1/2 WAVELENGTH

IT IS EASIEST TO SEE THE EFFECTS OF CHANGES IN EACH
PARAMETER IF YOU HOLD TWO CONSTANT AND VARY THE OTHER,
ALTHOUGH ALL THREE MAY BE VARIED AT ONCE.

WHAT IS YOUR CHOICE OF WAVELENGTH, AMPLITUDE, AND PHASE?2,10,0

NOTATION:       A = 'A' WAVE
                B = 'B' WAVE
                S = SUPERPOSITION WAVE

 X (CM.)            -20       -10        0        +10       +20
                -I----I---------I---------I---------I---------I----I
    0           -                         ABS
    .2          -                            A  B  S
    .4          -                               A   B     S
    .6          -                                 A B       S
    .8          -                               B   A     S
    1           -                         B         AS
    1.2         -                  B         S     A
    1.4         -              B       S         A
    1.6         -              B     S         A
    1.8         -                  B  S     A
    2           -                         ABS
    2.2         -                     A     S  B
    2.4         -                  A         S     B
    2.6         -                A         S       B
    2.8         -              A     S         B
    3           -              AS        B
    3.2         -        S     A   B
    3.4         -      S       B A
    3.6         -        S     B   A
    3.8         -               S  B  A
    4           -                         ABS
                -I----I---------I---------I---------I---------I----I

WANT TO TRY ANOTHER SET OF VALUES (1=YES, 0=NO) : ?0

DONE
```

HEALTH SCIENCES (EDUCATION) (835)

CONTRIBUTED PROGRAM **BASIC**

MCMAN
36888-18002

TITLE: CARDIOVASCULAR SIMULATION

DESCRIPTION:

MCMAN is an interactive model used in teaching basic principles of hemodynamics. It was developed by the Department of Clinical Epidemiology and Biostatistics of McMaster University, Hamilton, Ontario, Canada and is employed in the instruction of first year medical students in the problem-oriented curriculum of that instruction. MCMAN is a 2000 Series BASIC language version of the HP 3000 FORTRAN program MCMAN.

The model is a synthetic person who has a heart inside a chest, systemic arteries and arterioles, a capillary bed, and veins collecting blood from the capillary bed and returning it to the heart. "MCMAN" thus has a complete systemic circulatory system, and when the heart is working it will circulate blood. To speed up computation, the heart is treated as a single chamber filling the right atrium and pumping blood out into the aorta. The pulmonary circulation is regarded as simply a parallel path, and not (as in life) in series with the systemic circulation. However, this makes the model unrealistic only when one side of the heart is able to pump much less than the other (e.g. because of valve disease). "MCMAN" cannot therefore simulate the effects of valve lesions but it can simulate most types of generalized heart disease. "MCMAN" also possesses synthetic baroreceptors similar in operation to those which are normally situated at the bifurcation of the common carotid artery and at the aortic arch. These act in such a way as to stabilize blood pressure.

The performance of the heart can be described by a starling curve relating effective cardiac input pressure to cardiac output. The pressure drop between the systemic arteries and the systemic capillary bed can be derived from the cardiac output and the mean value of arterial resistance; and the right atrial pressure (input pressure of the heart) can be derived from the capillary pressure, the mean venous resistance, and the cardiac output. About 80% of the blood is contained on the low-pressure side of the circulation, and the mean systemic pressure at which it is contained depends on the blood volume and on the capacitance of the low pressure circulation.

All these relationships can be expressed as a series of simultaneous equations, and for a given blood volume, systemic arterial resistance, venous resistance, circulatory capacitance, and cardiac performance characteristics, there is only one solution which satisfies all the equations. The computer is programmed to find this solution in an interactive manner. In addition, the performance of the simulated circulation in the course of time can be determined by solving the appropriate equations at suitably short simulated time intervals, and then allowing a simulated arterial baroreceptor feed-back loop to operate with a realistic time constant, appropriately modifying the values of arterial resistance, circulatory capacitance, and cardiac function.

This mathematical model is presented in the form of a teaching display which puts out on a teleprinter or CRT a 1 min record of systemic arterial pressure and pulse rate appropriate to a normal human subject. At the end of each simulated minute of recording, the current values for cardiac output, mean capillary pressure, and right atrial pressure, together with other values, are put out in numerical form. Operation of the model then ceases and the terminal user is invited to make changes in fixed arterial and/or venous resistance (simulating the effects of vasoconstrictor or vasodilator drugs), in cardiac contractility

Continued on following page.

ACKNOWLEDGEMENTS: Dept. of Clinical Epidemiology and Biostatistics
McMaster University Medical School

DESCRIPTION continued

(simulating the effects of myocardial infarction, or digitalis), in intrathoracic pressure (which can be raised to simulate positive pressure ventilation), in pericardial restriction of cardiac filling (to simulate pericardial tamponade) or in blood volume (to simulate haemorrhage or transfusion). In addition, the setting of the arterial baroreceptor feed-back loop can be altered to that appropriate to a hypertensive subject, or the baroreceptor loop can be permanently interrupted to simulate the effect of cutting the buffer nerves. Combinations of any of these changes can be made and studied, and graphs of blood pressure and other variables made over successive simulated minutes of observation.

The example shown is of an actual run. After the preamble the program produces a vertical graph of arterial blood pressure from its simulated subject (in the span of X's the right-most X represents systolic and the left-most X represents diastolic pressure, approximately). At the end of the initialization period the operating values for BP, right atrial pressure, mean capillary pressure, cardiac output, stroke volume, heart rate, arterial resistance, venous resistance (in each case the total resistance in the systemic circuit), and finally cardiac contractility (the slope of the Starling function curve relating cardiac output to filling pressure) are given. Note, incidentally, that the vertical line of dots on the graph represent heart rate approximately, but the heart rate at the end of each run is accurately given as a number.

Then follows a list of the working values of variable which you can change: the basic mean values of arterial and venous resistance as percentages of normal (you could simulate a pressor drug by increasing 1 and a depressor drug by decreasing 1, and an arterial and venous vasodilator drug, e.g. nitroglycerine, by decreasing both 1 and 2 in proportion); the basic contractile function of the heart (remember that this is modified continuously by vagal and sympathetic influences and circulating adrealine, so even if you reduced this to, say, a nominal 30% of normal, to simulate a patient with a very bad heart, the actual contractility would be kept partly restored by sympathetic action); the intra-thoracic pressure (normally averaged at -2 mm Hg, but you can change this and see how very sensitive the circulation is to small changes, which greatly influence venous return); 'limiting cardiac input pressure' (factor 5) - this is the effective filling pressure above which no further increase in output can be obtained: pericardiacal tamponade may be simulated by making this some small figure, e.g. 3 mm Hg, indicating that up to 3 mm filling pressure the heart will pump normally, but at filling pressures above this no further output can be obtained); blood volume, in ml (you can simulate a 1000 cc haemorrhage by making this 4000). In the example shown factors 1 and 2 were greatly reduced, simulating the effects of nitroglycerine.

INSTRUCTIONS

To interact with the model respond to the questions as follows:

1. When asked "DO YOU WANT TO CONTINUE?",

   type YES if you wish to proceed with another 60 second simulation period; type NO if you wish to discontinue using the model.

2. When asked "DO YOU WANT A PLOT?",

   type YES if you want a graphical display of heart rate and blood pressure over time; type NO if you wish to proceed directly to the calculated values of the simulation.

3. When asked "DO YOU WANT TO CHANGE ANY OF THESE FACTORS?"

   you are being given the opportunity to alter the 6 basic variables of the systemic circulation; type YES if you wish to make changes before the next simulation, type NO if you wish to proceed "as is" or move to altering the blood pressure stabilizing system.

4. When asked "CHANGE FACTOR (1...6 OR Ø TO QUIT)?"

   type any of the digits Ø, 1, 2, 3, 4, 5, 6, where Ø means "no more changes to be made", 2 means "a change is to be made to venous resistance", etc.

5. When asked: "FACTOR X?", (where X is any digit 1 thru 6),

   type the new value for that factor. For example, each of factors 1, 2, and 3 are stated in percent of normal; your response of 50 would mean "reset the variable to behave at 50% of normal functioning." Likewise, 150 would mean "50% greater than normal", etc. Do not use the character "%"; do not enter whole percents as decimal fractions. Factors 4 and 5 are pressures stated in millimeters of mercury (HG), Factor 6 is volume stated in milliliters. Do not input these units of measure (i.e. the letters "MM HG" or "ML") as part of the numeric value you give the model.

Continued on following page.

INSTRUCTIONS continued

6. When asked "DO YOU WANT TO CUT THE BUFFER NERVES.....?"

   type YES if you wish to put the blood pressure stabilizing system completely out of action; type NO if you wish to reset baraceptor sensitivity.

7. When asked "DO YOU WANT TO RESET BAROCEPTER SENSITIVITY.....?",

   type YES if you wish to simulate the barocepter sensitivity of a hypertensive patient, type NO if you do not.

RUN

```
RUN
MCMAN

MCMAN WAS DEVELOPED AND IS CURRENTLY USED IN THE MEDICAL
CURRICULUM AT MCMASTER UNIVERSITY, HEALTH SCIENCES CENTRE,
HAMILTON, ONTARIO, CANADA.

NEITHER HEWLETT-PACKARD NOR MCMASTER UNIVERSITY ASSUME
ANY RESPONSIBILITY FOR THE OPERATION AND CORRECTNESS OF THIS MODEL

DO YOU WANT TO CONTINUE?YES

DO YOU WANT A PLOT?YES

(XXX) SYSTOLIC/DIASTOLIC PRESSURES - MM HG   (.) HEART RATE - BEATS/MIN
TIME 0   20   40   60   80   100  120  140  160  180  200  220  240  260
SECS .    .    .    .    .    .    .    .    .    .    .    .    .    .
-28                      .XXXXXXXXXXXX
-26                      .XXXXXXXXXX
-24                       .XXXXXXXXXX
-22                      .XXXXXXXXXX
-20                      X.XXXXXXXXXX
-18                     .  XXXXXXXXXX
-16                      .XXXXXXXXXX
-14                      .XXXXXXXXXX
-12                      X.XXXXXXXXXX
-10                      .XXXXXXXXXX
-8                        .XXXXXXXXXX
-6                       .XXXXXXXXXX
-4                       .XXXXXXXXXX
-2                       .XXXXXXXXXX
 0                       .XXXXXXXXXX

ARTERIAL (AORTIC) PRESSURE
SYSTOLIC=129.5   DIASTOLIC= 82.9   MEAN=     98.5 MM HG
CENTRAL VENOUS (RIGHT ATRIAL) PRESSURE=      1.6 MM HG
MEAN CAPILLARY PRESSURE=     13.1 MM HG
CARDIAC OUTPUT=     5.2 L/MIN
STROKE VOLUME=     64.2 ML/BEAT     HEART RATE= 80.9 BEATS/MIN
ARTERIAL RESISTANCE=     16.5       VENOUS RESISTANCE=     2.2 MM HG/L/MIN
CARDIAC CONTRACTILITY=     1.4 L/MIN/MM HG

FINAL VALUES FOR THIS RUN WERE:
1. ARTERIAL RESISTANCE= 100 % OF NORMAL
2. VENOUS RESISTANCE= 100 % OF NORMAL
3. CARDIAC CONTRACTILITY= 100 % OF NORMAL
4. MEAN INTRATHORACIC PRESSURE=  -2.0 MM HG
5. LIMITING CARDIAC INPUT PRESSURE=      8.0 MM HG
6. BLOOD VOLUME= 5000 ML

DO YOU WANT TO CHANGE ANY OF THESE FACTORS?YES
CHANGE FACTOR (1..6 OR 0 TO QUIT)?1
FACTOR 1?40
CHANGE FACTOR (1..6 OR 0 TO QUIT)?2
FACTOR 2?40
CHANGE FACTOR (1..6 OR 0 TO QUIT)?0


1=  40, 2=  40, 3= 100, 4=  -2, 5=   8, 6=5000
DO YOU WANT A PLOT?YES
```

```
(XXX) SYSTOLIC/DIASTOLIC PRESSURES - MM HG   (.) HEART RATE - BEATS/MIN
TIME 0    20    40    60    80    100   120   140   160   180   200   220   240   250
SECS .    .     .     .     .     .     .     .     .     .     .     .     .     .
 2                        .           XXXXXXXXXXXXXXXXXX
 4                 XXXXXXXXX.XXX
 6                 XXXXXXXX.XXX
 8                XXXXXXXX.XXXX
 10               XXXXXXXXXX.XX
 12                XXXXXXXXXX.XXX
 14                 XXXXXXXXXX.XX
 16                  XXXXXXXXXXX.X
 18                  XXXXXXXXXXXX.
 20                   XXXXXXXXXX.
 22                   XXXXXXXXXXXXX .
 24                    XXXXXXXXXXXXX.
 26                    XXXXXXXXXXXXX .
 28                     XXXXXXXXXXXX  .
 30                     XXXXXXXXXXXXX  .
 32                     XXXXXXXXXXXX   .
 34                      XXXXXXXXXXXX   .
 36                      XXXXXXXXXXXXX  .
 38                      XXXXXXXXXXXX    .
 40                      XXXXXXXXXXXXX  .
 42                      XXXXXXXXXXXXX .
 44                      XXXXXXXXXXXX  .
 46                      XXXXXXXXXXXXXX .
 48                      XXXXXXXXXXXXX .
 50                      XXXXXXXXXXXXX .
 52                      XXXXXXXXXXXXX.
 54                     XXXXXXXXXXXXX .
 56                     XXXXXXXXXXXXX .
 58                     XXXXXXXXXXXXX .
 60                     XXXXXXXXXXXXX .

>>> MY HEART IS POUNDING
ARTERIAL (AORTIC) PRESSURE
SYSTOLIC=115.6   DIASTOLIC= 68.9   MEAN=     84.5 MM HG
CENTRAL VENOUS (RIGHT ATRIAL) PRESSURE=      3.2 MM HG
MEAN CAPILLARY PRESSURE=     12.2 MM HG
CARDIAC OUTPUT=    10.2 L/MIN
STROKE VOLUME=     81.9 ML/BEAT      HEART RATE=124.4 BEATS/MIN
ARTERIAL RESISTANCE=      7.4        VENOUS RESISTANCE=     0.9 MM HG/L/MIN
CARDIAC CONTRACTILITY=     2.0 L/MIN/MM HG

FINAL VALUES FOR THIS RUN WERE:
1. ARTERIAL RESISTANCE=  40 % OF NORMAL
2. VENOUS RESISTANCE=  40 % OF NORMAL
3. CARDIAC CONTRACTILITY= 100 % OF NORMAL
4. MEAN INTRATHORACIC PRESSURE=  -2.0 MM HG
5. LIMITING CARDIAC INPUT PRESSURE=      8.0 MM HG
6. BLOOD VOLUME= 5000 ML

DO YOU WANT TO CHANGE ANY OF THESE FACTORS?NO
DO YOU WANT TO CHANGE THE OPERATION OF THE SYSTEMIC
ARTERIAL BAROCEPTORS?YES
DO YOU WANT TO CUT THE BUFFER NERVES AND PUT THE B.P.
STABILIZING SYSTEM PERMANENTLY OUT OF ACTION?YES


YOU HAVE CUT THE BUFFER NERVES
DO YOU WANT A PLOT?YES
```

```
(XXX) SYSTOLIC/DIASTOLIC PRESSURES - MM HG   (.) HEART RATE - BEATS/MIN
TIME 0    20    40    60    80    100   120   140   160   180   200   220   240   260
SECS .     .     .     .     .     .     .     .     .     .     .     .     .     .
 62                    XXXXXXXXXXXX .
 64                     XXXXXXXXXXXX  .
 66                     XXXXXXXXXXXX .
 68                     XXXXXXXXXXXX .
 70                     XXXXXXXXXXXX  .
 72                      XXXXXXXXXXXX    .
 74                      XXXXXXXXXXXX    .
 76                      XXXXXXXXXXXX     .
 78                       XXXXXXXXXXXX    .
 80                       XXXXXXXXXXXX      .
 82                       XXXXXXXXXXXX     .
 84                       XXXXXXXXXXXX       .
 86                       XXXXXXXXXXXX     .
 88                        XXXXXXXXXXXX      .
 90                        XXXXXXXXXXXXX       .
 92                       XXXXXXXXXXXX        .
 94                        XXXXXXXXXXXX       .
 96                        XXXXXXXXXXXX       .
 98                        XXXXXXXXXXXXX      .
 100                       XXXXXXXXXXXXX       .
 102                        XXXXXXXXXXXX       .
 104                        XXXXXXXXXXXX      .
 106                       XXXXXXXXXXXX        .
 108                        XXXXXXXXXXXX      .
 110                        XXXXXXXXXXX           .
 112                        XXXXXXXXXXXXX      .
 114                        XXXXXXXXXXXXX       .
 116                        XXXXXXXXXXXX       .
 118                       XXXXXXXXXXXX         .
 120                        XXXXXXXXXXXX        .

>>> MY HEART IS POUNDING
ARTERIAL (AORTIC) PRESSURE
SYSTOLIC=135.1   DIASTOLIC= 86.9   MEAN=   103.0 MM HG
CENTRAL VENOUS (RIGHT ATRIAL) PRESSURE=     2.8 MM HG
MEAN CAPILLARY PRESSURE=    13.0 MM HG
CARDIAC OUTPUT=   11.6 L/MIN
STROKE VOLUME=    68.7 ML/BEAT     HEART RATE=168.8 BEATS/MIN
ARTERIAL RESISTANCE=     8.0       VENOUS RESISTANCE=    0.9 MM HG/L/MIN
CARDIAC CONTRACTILITY=    2.4 L/MIN/MM HG

FINAL VALUES FOR THIS RUN WERE:
1. ARTERIAL RESISTANCE=  40 % OF NORMAL
2. VENOUS RESISTANCE=  40 % OF NORMAL
3. CARDIAC CONTRACTILITY= 100 % OF NORMAL
4. MEAN INTRATHORACIC PRESSURE=  -2.0 MM HG
5. LIMITING CARDIAC INPUT PRESSURE=     8.0 MM HG
6. BLOOD VOLUME= 5000 ML

DO YOU WANT TO CHANGE ANY OF THESE FACTORS?NO
DO YOU WANT TO CONTINUE?NO

DONE
```

CONTRIBUTED PROGRAM **BASIC**

KEYSIG
36258

TITLE: GIVES MAJOR SCALES

DESCRIPTION:

This program prints out the major scale of any musical key that is requested or all of them at once. They are printed on a staff with keysignature, and at the bottom of each measure abbreviation of the key is printed.

INSTRUCTIONS:

To get all of the major scales printed, just type "ALL" at the question mark. To get one or more of the scales just type the letter of that scale (A through G). Then type an "N" if it is natural, an "S" if it is sharp, or an "F" if it is flat. You may continue this procedure on the same line for up to 36 keys. There is no need to separate the keys by any type of character.

SPECIAL CONSIDERATIONS:

The Aardvark and Company Writing Team has designed programs to take up an absolute minimum of computer storage and perform a maximum purpose. The team encourages people to send good programs to Aardvark. As a slight encouragement, the team will give anyone who sends a program which is accepted a free "subscription" to the program handbook, and include the contributor as a member of the writing team.

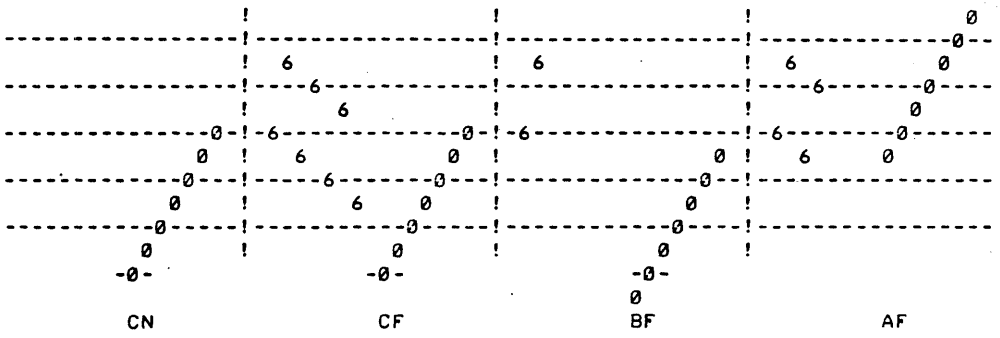
ACKNOWLEDGEMENTS:

Aardvark and Company
2130 Bell Court
Lakewood, Colorado 80215

RUN

```
RUN
KEYSIG

?CNCFBFAF
```



MUSIC

TITLE: TWELVE TONE COMPOSITION PROGRAM 36888-18028

DESCRIPTION:

The program produces simple 12 tone compositions. Values given to various elements of the composition (pitch, time value, etc.) are determined by random processes. The user interacts with the program by assigning probabilities to the random elements. MUSIC is designed primarily to illustrate how random elements and probabilities may be used in composition and how a computer may be used to aid in the selection of random elements.

INSTRUCTIONS:

Order 36888-90028, $5.00 for complete documentation.

SPECIAL CONSIDERATIONS:

The program uses four data files, each 4 records long, to store intermediate results. These files are named V1, V2, V3, V4 in statement 320 of the program. This statement may have to be changed under certain circumstances. See section "Data Files" p. 15 of the manual for more details. In any case the four files must exit on a read-write basis in order for the program to run.

```
CRE-V1,4
CRE-V2,4
CRE-V3,4
CRE-V4,4
```

The program is used as part of a third year course in electronic music for composition majors. It presupposes some knowledge of twelve tone composition technique.

ACKNOWLEDGEMENTS:

Bill Jarosz and Joann Preston
De Paul University

RUN

```
RUN
MUSIC

TWELVE - TONE COMPOSITION PROGRAM  11/28/72 VERSION


NO. OF MEASURES (16 MAX.)?6
TIME SIGNATURE=X/4, (X=9 MAX.)?3
NO. OF VOICES (4 MAX.)?2
CHOOSE PROBABILITIES FOR OCTAVES (1=YES,0=NO)?0
CHOOSE PROBABILITIES FOR TIME VALUES (1=YES,0=NO)?0
CHOOSE PROBABILITIES FROM 0 TO 1 FOR REST IN VOICE(S)
VOICE 1    ?0
VOICE 2    ?0
INPUT YOUR OWN 12-TONE ROW (1=YES,0=NO)?0


12 TONE ROW
C               C#              B               D
F               G               A               D#
A#              G#              E               F#

 EACH NOTE PRINTOUT SHOWS NOTES, OCTAVES, NO. OF BEATS


VOICE 1
C 1 .5          B 3 4           A 1 3.5         G#3 3
E 2 2           C 2 3           B 1 2


VOICE 2
C#2 .5          D 3 1           F 3 2           G 2 2.5
D#1 1.5         A#2 3.5         F#1 2.5         C#3 3
D 1 .5          F 1 1

DONE


320 FILES HIGH,MID10,MID12,LOW
OPE-HIGH,2
OPE-MID10,2
OPE-MID12,2
OPE-LOW,2
5000 DATA 0,0,1,0,0,1,0,0,1
5010 DATA 0,1,0,0,.9,.1,0,.9,.1
5020 DATA .1,.9,0,.1,.9,0,0,1,0
5030 DATA 1,0,0,1,0,0,1,0,0
RUN
MUSIC

TWELVE - TONE COMPOSITION PROGRAM  11/28/72 VERSION


NO. OF MEASURES (16 MAX.)?8
TIME SIGNATURE=X/4, (X=9 MAX.)?4
NO. OF VOICES (4 MAX.)?4
CHOOSE PROBABILITIES FOR OCTAVES (1=YES,0=NO)?1
CHOOSE PROBABILITIES FOR TIME VALUES (1=YES,0=NO)?0
CHOOSE PROBABILITIES FROM 0 TO 1 FOR REST IN VOICE(S)
VOICE 1    ?.1
VOICE 2    ?.1
VOICE 3    ?.1
VOICE 4    ?.1
INPUT YOUR OWN 12-TONE ROW (1=YES,0=NO)?0


12 TONE ROW
D#              A               A#              E
D               B               F#              G
F               C#              C               G#

 EACH NOTE PRINTOUT SHOWS NOTES, OCTAVES, NO. OF BEATS
```

```
VOICE 1
D#3 1.5         D 3 1           F#3 2.5         C#3 .5
C 3 .5          D#3 2.5         B 3 1.5         F 3 .5
C#3 1.5         G#3 1           A#3 1           D 3 1
B 3 2           F 3 .5          C 3 2.5         A#3 3.5
F 3 4           R   2           B 3 2           F 3 .5


VOICE 2
A 2 3.5         G 3 2.5         A 2 1           A#2 1
R   1.5         G 2 2.5         D#2 4           G 2 2.5
D#2 1.5         R   1.5         D 2 2.5         C 2 2
D#2 2.5         D 2 3.5

VOICE 3
A#2 3.5         F 2 2           R   1.5         E 2 4
C 2 4           F#2 4           A 2 2           E 2 1.5
G 2 1           C#2 1.5         G#1 1.5         A#2 2.5
R   2           G 2 1

VOICE 4
E 1 1.5         B 1 4           G#1 1.5         D 1 1.5
F#1 3           R   1           A 1 .5          E 1 4
C#1 1           G#1 3.5         B 1 .5          F#1 2.5
R   1.5         A 1 1.5         E 1 2           F#1 2.5

DONE
```

CONTRIBUTED PROGRAM **BASIC**

MUSIC2
36276

TITLE: TRIAD SOLVING PROGRAM

DESCRIPTION: This program prints major, minor, diminished, or augmented triads on a staff.

INSTRUCTIONS: The instructions are self-explanatory. However, concerning the output "6" is the symbol for a flat, and "#" is the symbol for a sharp.

SPECIAL CONSIDERATIONS: The Aardvark and Company Writing Team has designed programs to take up an absolute minimum of computer storage and perform a maximum purpose. The team encourages people to send good programs to Aardvark. As a slight encouragement, the team will give anyone who sends a program which is accepted a free "subscription" to the program handbook, and include the contributor as a member of the writing team.

ACKNOWLEDGEMENTS: John C. Ridges
Aardvark and Company
2130 Bell Court
Lakewood, Colorado 80215

```
RUN


RUN
MUSIC2

THIS PROGRAM PRINTS TRIADS ON A STAFF.
M=MAJOR  N=MINOR  A=AUGMENTED  D=DIMINISHED
N=NATURAL  F=FLAT  S=SHARP
EACH TRIAD HAS 3 LETTERS  EXAMPLE:
AFA=A FLAT AUGMENTED
THE NUMBER OF TRIADS MUST BE BETWEEN 1  AND 30
EXAMPLE:  AFNDNMGSD
WHAT TRIADS DO YOU WANT?AFAAFNDNMGSD



-------------------------
    0   60
--------------------0----
    0   60
--------------------0----
   60   60    0
------------------#0----
              #0
-------------------------
               0



DONE
```

CONTRIBUTED PROGRAM **BASIC**

MUSIC5
36259

TITLE: FINDS DOMINANT SEVENTHS

DESCRIPTION: This program finds the dominant sevenths of any key.

INSTRUCTIONS: Run the program. Input the keys you want (without commas) and it will print out the sevenths.

SPECIAL CONSIDERATIONS: The Aardvark and Company Writing Team has designed programs to take up an absolute minimum of computer storage and perform a maximum purpose. The team encourages people to send good programs to Aardvark. As a slight encouragement, the team will give anyone who sends a program which is accepted a free "subscription" to the program handbook, and include the contributor as a member of the writing team.

ACKNOWLEDGEMENTS: Aardvark and Company
2130 Bell Court
Lakewood, Colorado 80215

RUN

```
RUN
MUSIC5

FINDS DOMINATE SEVENTHS.
'X'=DOUBLE SHARP, 'S'=SHARP, 'N'=NATURAL,
'F'=FLAT, AND 'D'=DOUBLE FLAT.

'M'=MAJOR, 'A'=AEOLIAN MINOR, AND 'H'=HARMONIC MINOR.

INPUT KEY?CSMANAAFH

CSM
THE V7 OF I   IS GS BS DS FS
THE V7 OF II  IS AS CX ES GS
THE V7 OF III IS BS DX FX AS
THE V7 OF IV  IS CS ES GS BN
THE V7 OF V   IS DS FX AS CS
THE V7 OF VI  IS ES GX BS DS
THE V7 OF VII IS FS AS CS EN

ANA
THE V7 OF I   IS EN GS BN DN
THE V7 OF II  IS FN AN CN EF
THE V7 OF III IS GN BN DN FN
THE V7 OF IV  IS AN CS EN GN
THE V7 OF V   IS BN DS FS AN
THE V7 OF VI  IS CN EN GN BF
THE V7 OF VII IS DN FS AN CN

AFH
THE V7 OF I   IS EF GN BN DF
THE V7 OF II  IS FF AF CF ED
THE V7 OF III IS GN BS DN FN
THE V7 OF IV  IS AF CN EF GF
THE V7 OF V   IS BN DN FN AF
THE V7 OF VI  IS CF EF GF BF
THE V7 OF VII IS DF FN AF CF

DONE
```

BALANC
36328

TITLE:

BALANC: Trade and Payment Balances

DESCRIPTION:

This program demonstrates the distinction between "balance of trade" and "balance of payments." Also shown are the components that make up the "balance of payments" account, and their individual impacts.

OBJECTIVES:

A. To emphasize the important distinction between "Balance of Trade", and "Balance of Payments".

B. To demonstrate the impact of any specific foreign expenditure on our "Balance of Payments".

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student must obtain data for components of balance of payments for a given year and country.

B. Discussion of the concepts "balance of trade" and "balance of payments", would be helpful but are not necessary.

DISCUSSION:

A. Student level - average

B. Curriculum location - advanced economics: Unit on U. S. Economy in the world.

C. This program may be used either as a group exercise, or for individual study.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
BALANC

THERE'S A DISTINCTION BETWEEN TRADE BALANCE AND
BALANCE OF PAYMENTS.

TRADE BALANCE = EXPORTS-IMPORTS.

BALANCE OF PAYMENTS= ALL OVERSEAS EXCHANGES+
ALL OVERSEAS EXPENDITURES.

WHEN INFORMATION IS REQUESTED, INPUT VALUES IN
MILLIONS OF DOLLARS (E.G. 6 = 6 MILLION DOLLARS)

A.
INPUT A FIGURE FIRST FOR ALL MILITARY AID, THEN
FOR ALL OTHER AID TO OTHER NATIONS.
?12,13

B.
INPUT A FIGURE FIRST FOR EXPORTS, THEN FOR IMPORTS.
?256,23

C.
INPUT A FIGURE FIRST FOR FOREIGNERS TRAVELING IN
YOUR COUNTRY, THEN FOR YOUR COUNTRYMEN TRAVELING
ABROAD.
?254,56

D.
INPUT A FIGURE FIRST FOR INCOME FROM FOREIGN INVEST-
MENTS, THEN FOR FOREIGN INVESTMENT ITSELF.
?259,21


A. FOREIGN AID =                25

B. BALANCE OF TRADE =           233

C. TRAVEL BALANCE =             198

D. INVESTMENT BALANCE =         238

----------                     ----------

BALANCE OF PAYMENTS =           644

(REMEMBER, IF A MINUS FIGURE APPEARS ABOVE,YOUR
COUNTRY HAS A DEFICIT IN ITS BALANCE OF PAYMENTS)

HOPE YOU UNDERSTAND THE DISTINCTION BETWEEN THE
BALANCE OF TRADE AND THE BALANCE OF PAYMENTS
BETTER NOW.

DONE
```

BANK

TITLE: BANK: Solves Financial Problems 36329

DESCRIPTION:

This program solves financial problems concerning installment buying, long-term loans, and savings accounts. The program gives you a choice of these three types of problems, and asks for the information needed to do said problems.

OBJECTIVES:

A. This program aids students in learning the terms used in certain financial problems.

B. Student will hopefully be motivated to learn the mathematical logic behind the solution of these problems.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - A review of decimals and fractions would be helpful.

B. Materials - A terminal, and a means by which to display the output to an entire class (e.g. overhead projector, closed circuit TV, etc.)

DISCUSSION:

A type of problem may be demonstrated through the use of the computer, then the mathematical logic behind the solution of the problem may be developed through the use of a flow chart similar to the one that follows.

Terminology may be taught when the computer asks for input (see sample run).

Since the execution time of one run is extremely short, many more problems may be demonstrated. Depending upon the ability of the class or student, a variety of relationships may be discovered.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
BANK

                    FINANCIAL PROBLEMS
THIS PROGRAM SOLVES THREE TYPES OF PROBLEMS:

     (1) INTEREST ON INSTALLMENT BUYING
     (2) PAYMENTS ON LONG TERM LOAN
     (3) BALANCE OF A SAVINGS ACCOUNT

WHICH PROBLEM WOULD YOU LIKE TO WORK WITH (TYPE 1, 2 OR 3)?1

*****

THIS SECTION WILL DETERMINE THE ACTUAL INTEREST YOU PAY
WHEN YOU PURCHASE SOMETHING ON CREDIT.

WHAT IS THE CASH PRICE OF THE ARTICLE ($)?88.99
          DOWN PAYMENT ($)?10
          NUMBER OF PAYMENTS EXCLUDING THE DOWN PAYMENT?18
          NUMBER OF PAYMENTS PER MONTH?1
          AMOUNT PER PAYMENT ($)?4.85


THE RATE OF INTEREST CHARGED WAS 5.69         PERCENT.


*****

WOULD YOU LIKE TO RUN THE PROGRAM AGAIN (1-YES, 0-NO)?1
WHICH PROBLEM WOULD YOU LIKE TO WORK WITH (TYPE 1, 2 OR 3)?2

*****

THIS SECTION WILL DETERMINE PAYMENTS FOR A LONG TERM LOAN.

WHAT IS THE AMOUNT BORROWED ($)?3000
          INTEREST CHARGED (%)?8
          INTERVAL BETWEEN PAYMENTS (MONTHS)?1
          TERM OF THE LOAN (YEARS)?2

DO YOU WISH TO SEE THE TOTALS ONLY - INSTEAD OF THE ENTIRE
TABLE - (1-YES, 0-NO)?0

          OUTSTANDING
          PRINCIPAL AT
          BEGINNING          INTEREST DUE AT     PRINCIPAL
PERIOD    OF PERIOD          END OF PERIOD       REPAID AT
                                                 END OF PERIOD

 1          3000               20                 115.68
 2          2884.32            19.23              116.45
 3          2767.87            18.45              117.23
 4          2650.64            17.67              118.01
 5          2532.63            16.88              118.8
 6          2413.83            16.09              119.59
 7          2294.24            15.29              120.39
 8          2173.85            14.49              121.19
 9          2052.66            13.68              122
 10         1930.66            12.87              122.81
 11         1807.85            12.05              123.63
 12         1684.22            11.23              124.45
 13         1559.77            10.4               125.28
 14         1434.49            9.56               126.12
 15         1308.37            8.72               126.96
 16         1181.41            7.88               127.8
 17         1053.61            7.02               128.66
 18         924.95             6.17               129.51
 19         795.44             5.3                130.38
 20         665.06             4.43               131.25
 21         533.81             3.56               132.12
 22         401.69             2.68               133
 23         268.69             1.79               133.89
 24         134.8              .9                 134.78
                               ----------         ----------
TOTALS                         256.34             3000
```

```
YOUR MONTHLY PAYMENT IS $ 135.68       AND TOTALS $ 3256.34


*****

WOULD YOU LIKE TO RUN THE PROGRAM AGAIN (1-YES, 0-NO)?1
WHICH PROBLEM WOULD YOU LIKE TO WORK WITH (TYPE 1, 2 OR 3)?3

*****

THIS SECTION CALCULATES THE BALANCE OF A SAVINGS ACCOUNT
IN WHICH DEPOSITS ARE MADE REGULARLY.

WHAT IS THE AMOUNT DEPOSITED PER INTEREST PERIOD ($)?10000
HOW OFTEN IS THE INTEREST COMPOUNDED (MONTHS)?3
WHAT IS THE RATE OF INTEREST PAID (%)?5
FOR HOW LONG WILL YOU DEPOSIT MONEY (YEARS)?5


THE BALANCE OF YOUR ACCOUNT AFTER  5    YEARS WILL BE $ 238450.


*****

WOULD YOU LIKE TO RUN THE PROGRAM AGAIN (1-YES, 0-NO)?0

DONE
```

TITLE: CHARGE ACCOUNT SIMULATION

CHARGE
36604

DESCRIPTION:

CHARGE is a simulation game based on the external reality of using charge accounts.

With built-in roles stating set financial conditions, CHARGE provides opportunity to purchase goods and services during a simulated twelve-month period and to add to or begin a Savings Account. The computer assigns positive and negative unexpected events. The program gives experience in fitting income to life style by requiring wise use of credit, adjustments between savings and expenditures, figuring monthly finance charges, and absorbing penalties for unwise use of money.

INSTRUCTIONS:

Before beginning the game each student should be provided with:

1. Set of rules
2. Role Sheet
3. Item Selection Sheets (4)

The game can be played most effectively with groups of ten or fewer. After the instructional session a group of ten students will be able to complete a one-year run in less than two hours.

Copyright to the instructional materials is held by Paul S. Amidon & Associates, Inc. Complete documentation, including Teacher Guide and Student Worksheets may be obtained for $15.00 from: Paul S. Amidon & Associates, Inc., 5408 Chicago Avenue South, Minneapolis, Minnesota.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Because of the various skills and judgments inherent in the game, it easily fits into such disciplines from Grades 9 through 12 as Business Mathematics, General Mathematics, General Business, Home and Family Living, and Social Studies sections dealing with management of personal income.

ACKNOWLEDGEMENTS: Paul S. Amidon and Associates
Minneapolis, Minnesota

```
RUN


RUN
CHARGE

PLEASE ENTER ROLE NUMBER,COMMA, AND MONTH.?1,1
FIRST OF ALL, HOW MANY ITEMS(INCLUDING SAVINGS) THIS MONTH?4
CHOICE 1     --?9,10.20
CHOICE 2     --?26,15.00
CHOICE 3     --?42,22.41
CHOICE 4     --?40,47.39
----UNEXPECTED EVENTS----
YOU DAMAGED EQUIPMENT AT WORK WHICH YOU HAD TO REPLACE
AT A COST OF $19.

THANK YOU FOR SHOPPING COMPU.
YOUR TOTAL POINTS THIS MONTH WERE 10


PLEASE ENTER ROLE NUMBER,COMMA, AND MONTH.?1,2
FIRST OF ALL, HOW MANY ITEMS(INCLUDING SAVINGS) THIS MONTH?4
CHOICE 1     --?9,10.20
CHOICE 2     --?12,22.50
CHOICE 3     --?42,22.41
CHOICE 4     --?40,39.89
----UNEXPECTED EVENTS----
NO GOODIES OR BADDIES THIS MONTH.

THANK YOU FOR SHOPPING COMPU.
YOUR TOTAL POINTS THIS MONTH WERE 11


PLEASE ENTER ROLE NUMBER,COMMA, AND MONTH.?1,3
FIRST OF ALL, HOW MANY ITEMS(INCLUDING SAVINGS) THIS MONTH?5
CHOICE 1     --?9,10.20
CHOICE 2     --?32,9.86
CHOICE 3     --?37,32.50
CHOICE 4     --?42,22.41
CHOICE 5     --?40,20.03
----UNEXPECTED EVENTS----
YOUR SHARE OF YOUR MOTHER'S BIRTHDAY PRESENT WAS $10.

THANK YOU FOR SHOPPING COMPU.
YOUR TOTAL POINTS THIS MONTH WERE 8


PLEASE ENTER ROLE NUMBER,COMMA, AND MONTH.?1,4
FIRST OF ALL, HOW MANY ITEMS(INCLUDING SAVINGS) THIS MONTH?5
CHOICE 1     --?15,22.95
CHOICE 2     --?32,9.86
CHOICE 3     --?33,25.88
CHOICE 4     --?42,22.41
CHOICE 5     --?40,13.90
----UNEXPECTED EVENTS----
THINGS DULL THIS MONTH. NO UNEXPECTED EVENTS.

THANK YOU FOR SHOPPING COMPU.
YOUR TOTAL POINTS THIS MONTH WERE 9


PLEASE ENTER ROLE NUMBER,COMMA, AND MONTH.?1,5
FIRST OF ALL, HOW MANY ITEMS(INCLUDING SAVINGS) THIS MONTH?4
CHOICE 1     --?32,9.86
CHOICE 2     --?33,25.88
CHOICE 3     --?42,22.41
CHOICE 4     --?40,36.85
----UNEXPECTED EVENTS----
YOU LOST YOUR WALLET. IT HAD $23 IN IT.

THANK YOU FOR SHOPPING COMPU.
YOUR TOTAL POINTS THIS MONTH WERE 9
```

```
PLEASE ENTER ROLE NUMBER,COMMA, AND MONTH.?1,6
FIRST OF ALL, HOW MANY ITEMS(INCLUDING SAVINGS) THIS MONTH?3
CHOICE 1     --?33,25.88
CHOICE 2     --?42,22.41
CHOICE 3     --?40,46.71
----UNEXPECTED EVENTS----
NO GOODIES OR BADDIES THIS MONTH.

THANK YOU FOR SHOPPING COMPU.
YOUR TOTAL POINTS THIS MONTH WERE 9

PLEASE ENTER ROLE NUMBER,COMMA, AND MONTH.?1,7
FIRST OF ALL, HOW MANY ITEMS(INCLUDING SAVINGS) THIS MONTH?2
CHOICE 1     --?33,25.88
CHOICE 2     --?40,69.12
----UNEXPECTED EVENTS----
NO GOODIES OR BADDIES THIS MONTH.

THANK YOU FOR SHOPPING COMPU.
YOUR TOTAL POINTS THIS MONTH WERE 11

PLEASE ENTER ROLE NUMBER,COMMA, AND MONTH.?0,8---1,8
FIRST OF ALL, HOW MANY ITEMS(INCLUDING SAVINGS) THIS MONTH?4
CHOICE 1     --?22,5.56
CHOICE 2     --?23,19.96
CHOICE 3     --?33,25.88
CHOICE 4     --?40,43.60
----UNEXPECTED EVENTS----
YOU LOST YOUR CREDIT CARD AND DIDN'T KNOW ABOUT THE LOSS
UNTIL YOU WANTED TO USE IT. YOU DON'T HAVE INSURANCE
AGAINST LOSS OF CREDIT CARDS. YOUR CARD HAS BEEN USED BY
SOMEONE TO MAKE PURCHASES OF $10 AND $15. YOU MUST PAY $25.

THANK YOU FOR SHOPPING COMPU.
YOUR TOTAL POINTS THIS MONTH WERE 9

PLEASE ENTER ROLE NUMBER,COMMA, AND MONTH.?1,9
FIRST OF ALL, HOW MANY ITEMS(INCLUDING SAVINGS) THIS MONTH?2
CHOICE 1     --?33,25.88
CHOICE 2     --?40,69.12
----UNEXPECTED EVENTS----
BUSINESS GOOD THIS MONTH. YOUR BOSS GAVE YOU A $35 BONUS.

THANK YOU FOR SHOPPING COMPU.
YOUR TOTAL POINTS THIS MONTH WERE 11
```

TITLE: CONSMP: Depression/Equilibrium

CONSMP
36330

DESCRIPTION:

This program simulates economic depression and equilibrium as effects of consumption.

OBJECTIVES:

A. Depression or recession results when consumption drops below the capacity to produce.

B. Equilibrium results when consumption equals the capacity to produce.

C. One cause for "over-production" is a time'lag in discovering a drop in consumption.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - terms to define and explain:

1. Depression
2. Recession
3. Equilibrium
4. Under-consumption
5. Overproduction
6. Investment
7. Savings
8. GNP
9. Productive Services

B. Materials - Introduce this program with the Circular Flow model of goods, services and money.

DISCUSSION:

A. Operational Suggestions

1. Student level - above average
2. Curriculum location - advanced economics unit on economic growth and stability.

B. Suggested Follow-up

Discussion topics:
1. Consider possible causes for a drop in consumption.
2. With advanced students, discuss the (Keynesian) concept of "equilibrium at less than full employment."

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

RUN
CONSMP

THIS PROGRAM SIMULATES THE EFFECTS OF CONSUMPTION ON THE
GNP. IT PRINTS OUT THE VALUES FOR THE COMPONENTS OF THE
CIRCULAR FLOW MODEL OF GOODS, SERVICES AND MONEY.

ASSUME GNP IS 100 BILLION.
TYPE IN A VALUE FOR PROPENSITY TO CONSUME.
MAKE THE VALUE BETWEEN 0 AND .75
?.69
IF STARTING ,TYPE 100(GNP);IF NOT
STARTING,TYPE VALUE OF RETURN GNP.
?100


ORIGINAL GNP- 100

PROPENSITY TO
CONSUME- .69

CONSUMPTION- 69

VALUE- 69

SAVINGS- 31

INVESTMENT BY PERIODS:
1-3MONTHS 5
4-6MONTHS 4.925
7-9MONTHS 4.85
10-12MONTHS 4.775
END OF 12TH MONTH 4.7
TOTAL FOR YEAR 24.25

OVER-INVESTMENT

LABOR:
1-3MONTHS- .15
4-6MONTHS- .147
7-9MONTHS- .144
10-12MONTHS- .141
END OF 12MONTH- .138
TOTAL FOR YEAR- .72

GNP:
1-3MONTHS- 14.8
4-6MONTHS- 14.785
7-9MONTHS- 14.77
10-12MONTHS- 14.755
END OF 12 MONTH- 14.74
TOTAL FOR YEAR- 93.25

RECESSION
INVENTORY OVERPRODUCED- 22.75
TYPE DECIMAL VALUE FOR PROPENSITY TO
CONSUME
?.50
IF STARTING ,TYPE 100(GNP);IF NOT
STARTING,TYPE VALUE OF RETURN GNP.
?70

ORIGINAL GNP- 100

PROPENSITY TO
CONSUME- .5

CONSUMPTION- 35

VALUE- 35

SAVINGS- 35
```

```
GNP- 37.25
TYPE DECIMAL VALUE FOR PROPENSITY TO
CONSUME
?
DONE
```

CONTRIBUTED PROGRAM **BASIC**

TITLE: CAMPAIGN STRATEGY AND ELECTIONS — ELECT 36798

DESCRIPTION:

The ELECT package contains three separate simulation programs, focusing on campaign decision making and electoral politics. ELECT1 and ELECT2 focus on the study of campaign strategy in 14 American presidential elections of the past. ELECT3 is a role-playing game which can be used in the classroom to simulate a campaign and election. In the case of all simulations, the computer simulates the behavior of the electorate as it decides which candidate to support.

INSTRUCTIONS:

ELECT1 and ELECT2

The computer programs ELECT1 and ELECT2 contain simulated voter attitudes for each of 14 past presidential elections. (The elections of 1828, 1840, 1844, 1868, 1876, 1884, 1896, 1920, 1928, 1932, 1948, 1952, 1960, and 1968 have been included.) Information about voter attitudes toward the candidates, the parties, and the issues is stored for each of these elections. The basic question facing the students using ELECT1-2 is how each candidate should allocate his political resources among the three areas of voter attitudes. In other words, how much emphasis should the candidate place on his image, on the party, and on the issues. Once these strategies have been determined, they are entered and the computer then indicates how the election would have turned out if these student-developed strategies had, in fact, been adopted by the candidates. It then gives the actual election results so that students can compare the two and attempt to explain the differences. For each election, a brief description of the political climate of the country prior to the election has been included to help students make their strategy decision. Also included is a brief explanation of how the election actually turned out and why.

ELECT3

ELECT3 is based on the same model as is ELECT1 and ELECT2. That is, the program simulates voter-attitudes toward candidates, parties and issues. ELECT3 has been designed as a role-playing game which can be used in the classroom to simulate a campaign and election. Students playing the roles of campaign managers, media specialists, candidates, speechwriters, etc. make decisions which change the attitudes of the electorate. The class may be divided into two camps, each representing a candidate and his campaign staff. The basic objective of the campaign is to use resources in such a way as to increase the candidate's chances of winning on election day. The campaign is conceived of as a series of actions taking place along a time continuum that begins several months before the election and culminates in the aggregate decision of the voters on the day of the election. Each group is given periodic poll results and information regarding the success of their campaign strategies to aid them in planning future campaign strategy.

Continued on the next page.

SPECIAL CONSIDERATIONS:

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

Student Workbook	$.30	Resource Handbook	$.50
Teachers Guide	$.30		

ACKNOWLEDGEMENTS: Huntington II Project
State University of New York

INSTRUCTIONS: Continued.

Attempts to reach and change the attitudes of voters within the electorate is hampered by message and media distortion. Finally, a turnout rate, which can be influenced by the candidates, helps to determine the final outcome of the election.

```
RUN

RUN
ELECT1

                              ELECT1

                HISTORICAL ELECTIONS - 19TH CENTURY

NEED INSTRUCTIONS?YES


YOUR GOAL WILL BE TO CHOOSE THE OPTIMUM STRATEGY FOR
CANDIDATES IN AN HISTORICAL ELECTION.  EACH CANDIDATE'S
STRATEGY VECTOR CONSISTS OF 3 NUMBERS.  THE FIRST REPRESENTS
THE AMOUNT OF EMPHASIS TO BE PLACED ON THE CANDIDATE'S
IMAGE, THE SECOND REPRESENTS THE AMOUNT OF EMPHASIS ON PARTY
AFFILIATION, AND THE THIRD IS THE AMOUNT OF EMPHASIS ON
CAMPAIGN ISSUES.  EACH OF THESE NUMBERS IS BETWEEN 10 AND 80,
WITH A HIGHER NUMBER REPRESENTING MORE EMPHASIS.  THE TOTAL
OF EACH STRATEGY VECTOR MUST EQUAL 100!

THE COMPUTER WILL FIRST ASK 'ELECTION YEAR?'
CHOOSE THE YEAR FROM THE FOLLOWING LIST:
  1828  1840  1844  1868  1876  1884  1896

ELECTION YEAR?1868

              ELECTION OF 1868

CANDIDATE       PARTY
SEYMOUR        DEMOCRAT
GRANT          REPUBLICAN

SEYMOUR - STRATEGY (3 NUMBERS, 10 <= I <= 80, TOTAL = 100)?50,20,30
GRANT - STRATEGY (3 NUMBERS, 10 <= I <= 80, TOTAL = 100)?20,50,30


THE RESULT OF YOUR STRATEGY IS:
SEYMOUR         47.5         %
GRANT           52.5         %

THE VOTE FOR THE TWO MAJOR CANDIDATES IN THE ACTUAL ELECTION WAS:
SEYMOUR         47.3         %
GRANT           52.7         %


ANOTHER RUN?NO

DONE




GET-ELECT2
RUN
ELECT2

                              ELECT2

                HISTORICAL ELECTIONS - 20TH CENTURY

NEED INSTRUCTIONS?YES
```

```
YOUR GOAL WILL BE TO CHOOSE THE OPTIMUM STRATEGY FOR
CANDIDATES IN AN HISTORICAL ELECTION.  EACH CANDIDATE'S
STRATEGY VECTOR CONSISTS OF 3 NUMBERS.  THE FIRST REPRESENTS
THE AMOUNT OF EMPHASIS TO BE PLACED ON THE CANDIDATE'S
IMAGE, THE SECOND REPRESENTS THE AMOUNT OF EMPHASIS ON PARTY
AFFILIATION, AND THE THIRD IS THE AMOUNT OF EMPHASIS ON
CAMPAIGN ISSUES.  EACH OF THESE NUMBERS IS BETWEEN 10 AND 80,
WITH A HIGHER NUMBER REPRESENTING MORE EMPHASIS.  THE TOTAL
OF EACH STRATEGY VECTOR MUST EQUAL 100!

THE COMPUTER WILL FIRST ASK 'ELECTION YEAR?'
CHOOSE THE YEAR FROM THE FOLLOWING LIST:
  1920  1928  1932  1948  1952  1960  1968

ELECTION YEAR?1948

              ELECTION OF 1948

CANDIDATE       PARTY
TRUMAN          DEMOCRAT
DEWEY           REPUBLICAN

TRUMAN - STRATEGY (3 NUMBERS, 10 <= I <= 80, TOTAL = 100)?20,50,30
DEWEY - STRATEGY (3 NUMBERS, 10 <= I <= 80, TOTAL = 100)?30,40,30


THE RESULT OF YOUR STRATEGY IS:
TRUMAN          55     %
DEWEY           45     %

THE VOTE FOR THE TWO MAJOR CANDIDATES IN THE ACTUAL ELECTION WAS:
TRUMAN          52.4         %
DEWEY           47.6         %


ANOTHER RUN?NO

DONE



GET-ELECT3


RUN
ELECT3

PER?1
RES UNITS R,D?300,300
INPUT FACTORS (1=YES, 0=NO)?0
INPUT MATRIX (1=YES, 0=NO)?0

MEDIA DISTORTION: R -  6     PC   D -  4     PC

ALLOC RESOURCES - MIN. 20 PC FOR EACH AREA - TO
IMAGE, PARTY, AND ISSUES

ALLOC. R (MAX = 300   )?140,60,100
ALLOC. D (MAX = 300   )?60,140,100

TO HELP IMAGE -
STRESS EXP, ABIL, OR PERS
  R - HAS 140    UNITS - ALLOC.?40,50,50
NO EQUAL ALLOCATIONS! ALLOC.?40,49,51
  D - HAS 60     UNITS - ALLOC.?10,30,20
NO ALLOC < 20 PC! ALLOC.?12,30,18
TO PUBLICIZE ISSUES -
STRESS ECO, DOMEST, OR FOR POL
  R - HAS 100    UNITS - ALLOC.?30,31,39
  D - HAS 100    UNITS - ALLOC.?39,30,31

UPDATE -
TURNOUT:  47     PC
IMPROVING IMAGE:
 R IS NOT AND  D IS
STRESSING RIGHT ISSUE:
 R IS NOT AND  D IS
```

```
D HAS A DECIDED ADVANTAGE IN IMAGE
D HAS A SLIGHT ADVANTAGE WITH ISSUES

 D HAS CHOSEN CORRECT ISSUE AND IMAGE
 AND THIS SHOULD HELP HIM

TURNOUT HINDERS R

THE LATEST POLL SHOWS D LEADING WITH 52.3         PC OF THE VOTE
AND HIS OPPONENT WITH 47.6         PC

FAC 1.22         3.23         1      2      1      1      3.15         4.22
 .475          .06           .04
CTRS 0      1      0      1
MAT:
CELL 1      --  1
CELL 2      --  3
CELL 3      --  2
CELL 4      --  3
CELL 5      --  3
CELL 6      --  4
CELL 7      --  3
CELL 8      --  4
CELL 9      --  2

DONE


RUN
ELECT3

PER?2
RES UNITS R,D?350,310
INPUT FACTORS (1=YES, 0=NO)?1
FAC?1.22,3.23,1,2,1,1,3.15,4.22,.475,.06,.04
CTRS?0,1,0,1
INPUT MATRIX (1=YES, 0=NO)?1
CELL 1      --- ?1
CELL 2      --- ?3
CELL 3      --- ?2
CELL 4      --- ?3
CELL 5      --- ?3
CELL 6      --- ?4
CELL 7      --- ?3
CELL 8      --- ?4
CELL 9      --- ?2

MEDIA DISTORTION: R -  6      PC    D -  4      PC

ALLOC RESOURCES - MIN. 20 PC FOR EACH AREA - TO
IMAGE, PARTY, AND ISSUES

ALLOC. R (MAX = 350    )?150,100,100
ALLOC. D (MAX = 310    )?70,130,110

TO HELP IMAGE -
STRESS EXP, ABIL, OR PERS
  R - HAS 150    UNITS - ALLOC.?30,40,80
  D - HAS 70     UNITS - ALLOC.?30,25,15
TO PUBLICIZE ISSUES -
STRESS ECO, DOMEST, OR FOR POL
  R - HAS 100    UNITS - ALLOC.?50,30,20
  D - HAS 110    UNITS - ALLOC.?29,50,31

UPDATE -
TURNOUT:  50     PC
IMPROVING IMAGE:
 R IS NOT AND  D IS NOT
STRESSING RIGHT ISSUE:
 R IS AND  D IS NOT

D HAS A DECIDED ADVANTAGE IN IMAGE
NO ONE HAS ADVANTAGE WITH ISSUES

TURNOUT HAS NO EFFECT
```

```
THE LATEST POLL SHOWS D LEADING WITH 51.2         PC OF THE VOTE
AND HIS OPPONENT WITH 48.7         PC

FAC .98          2.99          1      2      1      1      3.85          3.98
 .5           .06           .04
CTRS 0      0      1      0
MAT:
CELL 1      --  1
CELL 2      --  3
CELL 3      --  2
CELL 4      --  3
CELL 5      --  3
CELL 6      --  4
CELL 7      --  3
CELL 8      --  4
CELL 9      --  3

DONE
```

Documentation Date 3/75

SOCIAL SCIENCE (EDUCATION) (860)

CONTRIBUTED PROGRAM **BASIC**

TITLE:

SOCIAL·SCIENCE INQUIRY PACKAGE

INQUIR
36888-18001

DESCRIPTION:

There are 2 programs in this package: INQUIR and INQUIRH. INQUIR is a social science data analysis package which allows the user to create and modify data files and perform a number of statistics on that data including frequencies, both means and standard deviations, crosstabs with chi square, degrees of freedom and gamma. Data can be recoded and statistics done on subpopulations as well.

INSTRUCTIONS:

Order HP 5951-7389 INQUIR Reference Manual.

This package is the software package for the following curriculum packages to be published by Hewlett-Packard's Computer Curriculum Project.

Title

Political Awareness - HP 5951-7382 by Jim Hessler

Analyzing Crime - HP 5951-7380 by Justin Green

INQUIR Reference Manual - HP 5951-7389, by Don Holznagel

For further information contact:

Hewlett-Packard Computer-Based
Educational Materials
Scientific Press
1629 Channing Avenue
Palo Alto, Calif. 94303

ACKNOWLEDGEMENTS:

Don Holznagel
Dan Klassen

CONTRIBUTED PROGRAM **BASIC**

TITLE: STUDENTS FORMULATE NATIONAL POLICY

POLICY
36649

DESCRIPTION:

POLICY is a simulation of the interest group process. Specifically, it focuses attention on the impact these interest groups have on the kind of public policy the government enacts.

INSTRUCTIONS:

Players of this simulation become members of one of six interest groups: Business, Labor, Civil Rights, Military, Internationalists and Nationalists. Each group has a set of goals which reflects the interests of similar groups in real life. The object of the game for each group is to maximize its own set of goals. This is accomplished by organizing support for policies so as to secure their adoption, and by opposing the adoption of policies which are unfavorable to their group. Each interest group has a certain number of "influence points" which it can use to support or oppose proposals. Policies are considered "adopted by government" when they have accumulated a predetermined number of positive influence points and "rejected by the government" when they have accumulated a predetermined number of negative influence points.

SPECIAL CONSIDERATIONS:

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

Student Workbook	$ .30
Teachers Guide	.30
Resource Handbook	.50

ACKNOWLEDGEMENTS: Huntington II Project
State University of New York

```
RUN

RUN
POLICY

HOW MANY PERIODS?3

INITIAL AMOUNTS:

INDICATOR       CURRENTLY       INCREASE        PCT. INC.
 101             976.5
 102             197
 103             80
 104             18.2
 105             3
 106             82
 107             54
 108             3
 109             140
 110             4.5
 111             25
 112             8.2
 113             30
 114             116.3
 115             142
 116             5568
 117             20
 118             0

TAPE?(1=YES,0=NO)?0

BUSINESS

TOTAL POINTS REMAINING :  100
MAXIMUM MINUS POINTS   :  50
INPUT POLICY NO.,POINTS

?4,40
?3,20
?15,0
TOTAL POINTS REMAINING :  40
MAXIMUM MINUS POINTS   :  40
INPUT POLICY NO.,POINTS

?6,-20
?14,6
?15,0
TOTAL POINTS REMAINING :  14
MAXIMUM MINUS POINTS   :  14
INPUT POLICY NO.,POINTS

?7,10
?8,-20
TOTAL POINTS REMAINING :  4
MAXIMUM MINUS POINTS   :  4
INPUT POLICY NO.,POINTS

?0,0

LABOR

TOTAL POINTS REMAINING :  100
MAXIMUM MINUS POINTS   :  50
INPUT POLICY NO.,POINTS

?4,60
?4,1
?15,0
TOTAL POINTS REMAINING :  39
MAXIMUM MINUS POINTS   :  39
INPUT POLICY NO.,POINTS

?7,39
```

```
CIVIL RIGHTS

TOTAL POINTS REMAINING :  100
MAXIMUM MINUS POINTS   :  50
INPUT POLICY NO.,POINTS.

?9,100

MILITARY

TOTAL POINTS REMAINING :  100
MAXIMUM MINUS POINTS   :  50
INPUT POLICY NO.,POINTS

?14,-50
?12,-3
TOTAL POINTS REMAINING :  50
MAXIMUM MINUS POINTS   :  0
INPUT POLICY NO.,POINTS

?12,50

NATIONALISTS

TOTAL POINTS REMAINING :  100
MAXIMUM MINUS POINTS   :  50
INPUT POLICY NO.,POINTS

?14,100

INTERNATIONALISTS

TOTAL POINTS REMAINING :  100
MAXIMUM MINUS POINTS   :  50
INPUT POLICY NO.,POINTS

?11,94
?15,0
TOTAL POINTS REMAINING :  6
MAXIMUM MINUS POINTS   :  6
INPUT POLICY NO.,POINTS

?0,0

PASSED :  4


END OF PERIOD 1

INDICATOR       CURRENTLY       INCREASE        PCT. INC.
 101             1015.56         39.05           3.99
 102             201             4               2.03
 103             81              1               1.25
 104             18.01           -.19            -1.05
 105             2.7             -.31            -10.34
 106             82              0               0
 107             54              0               0
 108             3.03            .03             1
 109             140             0               0
 110             4.5             0               0
 111             24.75           -.25            -1
 112             10.2            2               24.39
 113             33              3               10
 114             120.95          4.65            3.99
 115             156.19          14.19           9.99
 116             6570.24         1002.24         18
 117             20              0               0
 118             0               0               0


TAPE?(1=YES,0=NO)?0

BUSINESS
```

```
TOTAL POINTS REMAINING :  100
MAXIMUM MINUS POINTS   :  50
INPUT POLICY NO.,POINTS

?13,100

LABOR

TOTAL POINTS REMAINING :  100
MAXIMUM MINUS POINTS   :  50
INPUT POLICY NO.,POINTS

?13,20
?0,0

CIVIL RIGHTS

TOTAL POINTS REMAINING :  100
MAXIMUM MINUS POINTS   :  50
INPUT POLICY NO.,POINTS

?5,100

MILITARY

TOTAL POINTS REMAINING :  100
MAXIMUM MINUS POINTS   :  50
INPUT POLICY NO.,POINTS

?5,100

NATIONALISTS

TOTAL POINTS REMAINING :  100
MAXIMUM MINUS POINTS   :  50
INPUT POLICY NO.,POINTS

?5,-40
?15,0
TOTAL POINTS REMAINING :  60
MAXIMUM MINUS POINTS   :  10
INPUT POLICY NO.,POINTS

?0,0

INTERNATIONALISTS

TOTAL POINTS REMAINING :  100
MAXIMUM MINUS POINTS   :  50
INPUT POLICY NO.,POINTS

?0,0

PASSED :  5     13


END OF PERIOD 2

INDICATOR       CURRENTLY       INCREASE        PCT. INC.
 101             1037.56         22              2.16
 102             204             3               1.49
 103             80.19           -.81            -1
 104             17.83           -.19            -1.06
 105             2.42            -.27            -10
 106             88              6               7.31
 107             58              4               7.4
 108             3.06            .03             .99
 109             140             0               0
 110             4.39            -.11            -2.45
 111             24.7            -.05            -.21
 112             9.2             -1              -9.81
 113             30              -3              -9.1
 114             116.95          -4              -3.31
 115             171.81          15.61           9.99
 116             6520.24         -50             -.77
 117             20              0               0
 118             0               0               0
```

```
TAPE?(1=YES,0=NO)?1

310DATA 1037.56    , 204   , 80.19       , 17.8378    , 2.43        , 88
315DATA 58   , 3.0603     , 140  , 4.4          , 24.7        , 9.2
320DATA 30   , 116.952    , 171.82      , 6520.24    , 20   , 0


DONE
```

TITLE: SIMULATION OF CITY COUNCIL

POLSYS
36640

DESCRIPTION:

This program is a simulation attempting to duplicate the processes which individuals and groups undergo when they attempt to influence "City Hall".

POLSYS was developed by the Huntington II Project at the Polytechnic Institute of Brooklyn under the direction of L. Braun. This work was partially supported by the National Science Foundation, Grant GW-5883.

INSTRUCTIONS:

The users assume the role of citizens engaged in political activity. An issue is presented, and the teams enter values for publicity (PBU), knowledge (KU), and support (SU) according to the roles played. The strategy used by the teams is evaluated and decisions made.

SPECIAL CONSIDERATIONS:

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

Student Workbook	**$ .30**
Teachers Guide	**.30**
Resource Handbook	**.50**

ACKNOWLEDGEMENTS: Huntington II Project
State University of New York

```
RUN


RUN
POLSYS

ENTER ISSUE NUMBER ?1
ENTER ROUND?1


TEAM 1 (PRO)
TOTAL RES.,PUBLICITY(PBU),SUPPORT(SU),KNOWLEDGE(KU)?820,310,57


TEAM 2 (CON)
TOTAL RES.,PUBLICITY(PBU),SUPPORT(SU),KNOWLEDGE(KU)?680,400,53


TEAM 1 (PRO)
REMAINING RESOURCES (PBU,SU,KU)
 820   310   57

 PBU RES. TO BE USED?220

 PBU  X  PBU ?50
 PBU  X  SU ?14
 PBU  X  KU ?10

 SU RES. TO BE USED?150

 SU  X  PBU ?250
 SU  X  SU ?50
 SU  X  KU ?25

 KU RES. TO BE USED?30

 KU  X  PBU ?100
 KU  X  SU ?20
 KU  X  KU ?10


TEAM 2 (CON)
REMAINING RESOURCES (PBU,SU,KU)
 680   400   53

 PBU RES. TO BE USED?250

 PBU  X  PBU ?100
 PBU  X  SU ?20
 PBU  X  KU ?5

 SU RES. TO BE USED?170

 SU  X  PBU ?250
 SU  X  SU ?20
 SU  X  KU ?50

 KU RES. TO BE USED?23

 KU  X  PBU ?130
 KU  X  SU ?10
 KU  X  KU ?5


CITY COUNCIL WILL CONSIDER DEMAND.
PROCEED TO ROUND 2
STRATEGY QUALITY POINTS=-60
ANOTHER RUN(YES=1,NO=0)?0
RES. GROUP 1      RES. GROUP 2
 600   160   27        430   230   30
END OF ROUND  1

DONE
```

SOCIAL SCIENCE (EDUCATION) (860)

CONTRIBUTED PROGRAM **BASIC**

PYRMID
36888-18013

TITLE: BUILD A PYRAMID

DESCRIPTION:

The purpose of this game is to build as high a pyramid as possible with the available amount of money. The pyramid should be completed in 8 years.

INSTRUCTIONS:

The following conventions should be observed:

- The height of a pyramid should neither be smaller than 15 metres nor exceed 200 metres
- The number of slaves should not be smaller than 1000
- The work time of slaves shouldn't exceed 20 hours/day
- The maximum of 9 pyramids can be built within one run

ACKNOWLEDGEMENTS: Hannu Kurki-Suonio
Helsinki, Finland

RUN

```
RUN
PYRMID

PYRAMID-- HANNU KURKI-SUONIO, HELSINKI, FINLAND

  IT IS YEAR 2710 B.C. YOU ARE RULING THE ANCIENT EGYPT AFTER
THE DEATH OF YOUR PREDECESSOR THE LATE PHARAOH KHAFRA. AN OR-
ACLE HAS PREDICTED THAT YOU WILL DEPART THIS LIFE IN EIGHT
YEARS AND THEREFORE YOU ARE BOUND TO START BUILDING YOUR PYR-
AMID DIRECTLY.

YOU'VE GOT 40000.      GOLD RINGS
HOW MANY METRES HIGH DO YOU WISH TO BUILD YOUR PYRAMID ?40
HOW MANY SLAVES DO YOU ACQUIRE ?20000
HOW MANY OF THEM DO YOU APPOINT TO FOREMEN ?700
HOW MANY SLAVES TO THE QUARRY                ?3500
HOW MANY TO CARRY STONES                     ?4000
THERE ARE 11800    SLAVES LEFT AS BUILDING LABOUR
YOU'VE STILL GOT 15977    GOLD RINGS
HOW MUCH FOR TOOLS ETC.?5000
HOW MANY HOURS MUST THE SLAVES WORK DAILY ?12
HOW MUCH WILL YOU SPEND ON FOOD NEXT YEAR ?10000


YOUR PYRAMID BECAME COMPLETED IN 1     YEARS
YOUR PYRAMID HAS NOW 40516.      STONES AND 40    METRES OF HEIGHT
YOUR SUCCESSOR WILL INHERIT THE REMAINING 977  GOLD RINGS

PYRAMID OF PHARAOH MENKAURA 1          .           40    METRES
                                     *I*
                                   *  I  *
                                 *    I    *
                               *      I      *
                             *        I        *
                           *          I          *
                          ..          I          ..
                               ..     I     ..
                                   ..I ..

DOES YOUR SUCCESSOR WANT TO BUILD A PYRAMID (1 OR 0) ?1

########


YOU'VE GOT 40977.      GOLD RINGS
HOW MANY METRES HIGH DO YOU WISH TO BUILD YOUR PYRAMID ?89
HOW MANY SLAVES DO YOU ACQUIRE ?19000
HOW MANY OF THEM DO YOU APPOINT TO FOREMEN ?1000
HOW MANY SLAVES TO THE QUARRY                ?5200
HOW MANY TO CARRY STONES                     ?5400
THERE ARE 7400     SLAVES LEFT AS BUILDING LABOUR
YOU'VE STILL GOT 17682    GOLD RINGS
HOW MUCH FOR TOOLS ETC.?4000
HOW MANY HOURS MUST THE SLAVES WORK DAILY ?12
HOW MUCH WILL YOU SPEND ON FOOD NEXT YEAR ?5000


 1     YEAR

 102261.     STONES              9     METRES

SLAVES STARVED          3210
SLAVES DIED OF OVERWORK 585
SLAVES ESCAPED          0

YOU HAVE NOW 14205    WORKERS AND 8682     GOLD RINGS

ANY CHANGES TO WORKING CONDITIONS (1 OR 0) ?0


 2     YEAR

 164741.     STONES              17    METRES

SLAVES STARVED          205
SLAVES DIED OF OVERWORK 554
SLAVES ESCAPED          0
```

```
YOU HAVE NOW 13446   WORKERS AND 3682    GOLD RINGS

ANY CHANGES TO WORKING CONDITIONS (1 OR 0) ?1
HOW MUCH DO YOU WANT TO INCREASE THE NUMBER OF FOREMEN ?0
HOW MANY HOURS MUST THE SLAVES WORK DAILY ?8
HOW MUCH WILL YOU SPEND ON FOOD NEXT YEAR ?2800


 3    YEAR

 190875.    STONES              20   METRES

SLAVES STARVED          3246
SLAVES DIED OF OVERWORK 0
SLAVES ESCAPED          0

YOU HAVE NOW 10200   WORKERS AND 882  GOLD RINGS

ANY CHANGES TO WORKING CONDITIONS (1 OR 0) ?1
HOW MUCH DO YOU WANT TO INCREASE THE NUMBER OF FOREMEN ?0
HOW MANY HOURS MUST THE SLAVES WORK DAILY ?9
HOW MUCH WILL YOU SPEND ON FOOD NEXT YEAR ?800


 4    YEAR

 201148.    STONES              22   METRES

SLAVES STARVED          8457
SLAVES DIED OF OVERWORK 0
SLAVES ESCAPED          0

YOU HAVE NOW 1743    WORKERS AND 82   GOLD RINGS

ANY CHANGES TO WORKING CONDITIONS (1 OR 0) ?1
HOW MUCH DO YOU WANT TO INCREASE THE NUMBER OF FOREMEN ?0
HOW MANY HOURS MUST THE SLAVES WORK DAILY ?10
HOW MUCH WILL YOU SPEND ON FOOD NEXT YEAR ?80

ALL WORKERS DIED OF STARVATION
YOUR PYRAMID HAS NOW 201148.    STONES AND 22   METRES OF HEIGHT
YOUR SUCCESSOR WILL INHERIT THE REMAINING 2    GOLD RINGS


DOES YOUR SUCCESSOR WANT TO BUILD A PYRAMID (1 OR 0) ?0

########

THERE ARE 2    PYRAMIDS ON THE SEPULCHER AREA

PYRAMID OF MENKAURA 1     , 40   M
PYRAMID OF MENKAURA 2     , 22   M

DONE
```

SAP

TITLE: SURVEY ANALYSIS PROGRAM 36843

DESCRIPTION:

The sample survey is one of the most valuable tools used by the social scientist to learn more about the world around him. Americans are constantly being exposed to the results of survey research. The Gallup and Harris polls continually report the popularity of public figures, and advertising bombards individuals with the results of one survey or another. In order to be able to critically evaluate the results of such surveys, or in order to undertake similar studies of one's own, it is necessary for a person to understand the elements of survey design, sampling procedures, and statistical analysis of results. It is also important to have a sense of the nature and limitations of generalizations that are based on sample survey data. One effective means by which students can achieve such an understanding is actual participation in a survey research project from start to finish. This unit is designed to facilitate such an experience, both for the teacher and the student.

INSTRUCTIONS:

What the Program Will Do

After you have entered your data, you can have the computer do several things with it. The computer will:

1. Compute the mean and standard deviation for any variable. (With OPTIONS 1 through 5 you have a Recode Option.)
2. Construct a table of observed frequencies for any two variables, compute chi square, degrees of freedom (df), and allow the user to calculate the correlation coefficient gamma if desired.
3. Construct a table of observed frequencies by row percentages for any two variables.
4. Construct a table of observed frequencies by column percentages for any two variables.
5. Construct a table of expected frequencies for any two variables.
6. Stop the program.

SPECIAL CONSIDERATIONS:

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

Student Workbook	**$ .30**
Teachers Guide	**.30**
Resource Handbook	**.50**

ACKNOWLEDGEMENTS:

Huntington II Project
State University of New York

```
RUN

RUN
SAP

                SURVEY ANALYSIS PROGRAM

HOW MANY VARIABLES?3

OPTION ?1

VARIABLE?1
NUMBER OF VALUES TO BE RECODED FOR VARIABLE  1    ?0

RANGE OF VAR.  1    ?1,4

VALUE  NO.
    1     24
    2     24
    3     24
    4     24
TOTAL  96

MEAN =  2.5
S.D. =  1.1


OPTION ?2

VARIABLES ?1,2
NUMBER OF VALUES TO BE RECODED FOR VARIABLE  1    ?0

NUMBER OF VALUES TO BE RECODED FOR VARIABLE  2    ?0

RANGE OF VAR.  1    ?1,4
RANGE OF VAR.  2    ?1,2


OBSERVED FREQUENCIES
(ROW: VAR.  1    , COLUMN: VAR.  2    )

      1     2    TOTALS

 1    11    13    24

 2    13    11    24

 3    14    10    24

 4    10    14    24

TOTALS

     48    48     96

CHI SQUARE=  1.7          DF=  3
CALCULATE GAMMA(1=YES, 0=NO)?1
GAMMA =  .03


OPTION ?1

VARIABLE?2
NUMBER OF VALUES TO BE RECODED FOR VARIABLE  2    ?0

RANGE OF VAR.  2    ?1,2

VALUE  NO.
    1     48
    2     48
TOTAL  96

MEAN =  1.5
S.D. =  .5
```

```
OPTION ?1

VARIABLE?3
NUMBER OF VALUES TO BE RECODED FOR VARIABLE  3    ?0

RANGE OF VAR.  3    ?1,2

VALUE  NO.
    1      51
    2      45
TOTAL  96

MEAN =  1.5
S.D. =  .5


OPTION ?2

VARIABLES ?1,3
NUMBER OF VALUES TO BE RECODED FOR VARIABLE  1    ?0

NUMBER OF VALUES TO BE RECODED FOR VARIABLE  3    ?0

RANGE OF VAR.  1    ?1,4
RANGE OF VAR.  3    ?1,2


OBSERVED FREQUENCIES
(ROW: VAR.  1    , COLUMN: VAR.  3    )

      1     2    TOTALS

 1    11    13    24

 2    13    11    24

 3    13    11    24

 4    14    10    24

TOTALS

     51    45    96

CHI SQUARE=  .8          DF=  3
CALCULATE GAMMA(1=YES, 0=NO)?1
GAMMA = -.13


OPTION ?3

VARIABLES ?2,3
NUMBER OF VALUES TO BE RECODED FOR VARIABLE  2    ?0

NUMBER OF VALUES TO BE RECODED FOR VARIABLE  3    ?0

RANGE OF VAR.  2    ?1,2
RANGE OF VAR.  3    ?1,2


OBSERVED FREQUENCIES BY ROW PERCENTAGES
(ROW: VAR.  2    , COLUMN: VAR.  3    )

      1     2    TOTALS

 1    72.9        27.1        100

 2    33.3        66.7        100


OPTION ?4
```

```
VARIABLES ?2,3
NUMBER OF VALUES TO BE RECODED FOR VARIABLE  2     ?0

NUMBER OF VALUES TO BE RECODED FOR VARIABLE  3     ?0

RANGE OF VAR.  2     ?1,2
RANGE OF VAR.  3     ?1,2


OBSERVED FREQUENCIES BY COLUMN PERCENTAGES
(ROW: VAR.  2     , COLUMN: VAR.  3     )

      1     2

 1     68.6         28.9

 2     31.4         71.1

TOTALS

    100   100


OPTION ?5

VARIABLES ?2,3
NUMBER OF VALUES TO BE RECODED FOR VARIABLE  2     ?0

NUMBER OF VALUES TO BE RECODED FOR VARIABLE  3     ?0

RANGE OF VAR.  2     ?1,2
RANGE OF VAR.  3     ?12


EXPECTED FREQUENCIES
(ROW: VAR.  2     , COLUMN: VAR.  3     )

      1     2    TOTALS

 1     25.5         22.5         48

 2     25.5         22.5         48

TOTALS

     51    45     96


OPTION ?1

VARIABLE?1
NUMBER OF VALUES TO BE RECODED FOR VARIABLE  1     ?2
RECODED NEW VALUE?1
        OLD VALUE?1
        OLD VALUE?2
NUMBER OF VALUES TO BE RECODED FOR VARIABLE  1     ?1-2
RECODED NEW VALUE?2
        OLD VALUE?3
        OLD VALUE?4
NUMBER OF VALUES TO BE RECODED FOR VARIABLE  1     ?0

RANGE OF VAR.  1     ?1,2

VALUE  NO.
    1     48
    2     48
TOTAL  96

MEAN =  1.5
S.D. =  .5
```

```
OPTION ?1

VARIABLE?1
NUMBER OF VALUES TO BE RECODED FOR VARIABLE  1    ?3
RECODED NEW VALUE?1
        OLD VALUE?1
        OLD VALUE?2
        OLD VALUE?3
NUMBER OF VALUES TO BE RECODED FOR VARIABLE  1    ?1
RECODED NEW VALUE?2
        OLD VALUE?4
NUMBER OF VALUES TO BE RECODED FOR VARIABLE  1    ?0

RANGE OF VAR.  1    ?1,2

VALUE  NO.
    1      72
    2      24
TOTAL  96

MEAN =  1.3
S.D. =  .4


OPTION ?6


DONE
```

TITLE:

STOCK: Stock Market Simulation

STOCK
36331

DESCRIPTION:

This program simulates the stock market. Each student is given $10,000 with which he may buy and/or sell shares in five fictitious issues.

OBJECTIVES:

A. To give the student a simple understanding of the operations of the stock market.
B. To motivate the student to reinforce his basic arithmetic skills.
C. To give an example of the use of everyday mathematics and economics in everyday life.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

A. Student - no special preparation

B. Materials - possibly graph paper

DISCUSSION:

This program can be used as a good motivation device in the teaching of basic stock-market concepts, and the basic mathematical skills involved. The computer starts each student with $10,000, and allows him to buy and/or sell shares. Precautionary tests are included for the student who tries to purchase more shares than he has money for, or to sell more shares than he actually owns. The program continues for as many trading days as the student desires.

The stock values rise and fall on a semi-random basis. On each trading day all stocks undergo a small random price change, a trend change (based on a random trend), and the possibility--on a random basis--of a large price change. The structure of the formula is:

new price=old price + (trend x old price) + (small random price change) + (possible large price change)

The trend is a random number between -.1 and +.1. It remains constant for a random number of days, at which time the trend is changed randomly. The trend affects all stocks equally, and attempts to simulate general market trends. The small random change ranges between -3 and +3 points. It occurs every day to every stock. The possible large price change is either +10 or -10 points. The + and - changes each occur at random day intervals, and to random stocks. That is, there may be no large change on some trading days, only a +10 change on others, a -10 change on still others, and both large and small changes on others. In all large-change cases, the change affects only one random stock when it occurs.

Because of the random generation of stock values and their fluctuations, the program does not exactly simulate the real market. It does, however, provide a simplified view of what does happen, and familiarizes the student with the basic functions involved. This should be explained to the students, along with some real causes of stock-market fluctuations.

Graph paper might be used to plot the daily stock values and the exchange average. In this way, the trend will become evident.

ACKNOWLEDGEMENTS:

Huntington Project
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RUN

RUN
STOCK

                    THE STOCK MARKET
DO YOU WANT THE INSTRUCTIONS (YES-TYPE 1, NO-TYPE 0)?1


THIS PROGRAM PLAYS THE STOCK MARKET.  YOU WILL BE GIVEN
$10,000 AND MAY BUY OR SELL STOCKS.  THE STOCK PRICES WILL
BE GENERATED RANDOMLY AND THEREFORE THIS MODEL DOES NOT
REPRESENT EXACTLY WHAT HAPPENS ON THE EXCHANGE.  A TABLE
OF AVAILABLE STOCKS, THEIR PRICES, AND THE NUMBER OF SHARES
IN YOUR PORTFOLIO WILL BE PRINTED.  FOLLOWING THIS, THE
INITIALS OF EACH STOCK WILL BE PRINTED WITH A QUESTION
MARK.  HERE YOU INDICATE A TRANSACTION.  TO BUY A STOCK
TYPE +NNN, TO SELL A STOCK TYPE -NNN, WHERE NNN IS THE
NUMBER OF SHARES.  A BROKERAGE FEE OF 1% WILL BE CHARGED
ON ALL TRANSACTIONS.  NOTE THAT IF A STOCK'S VALUE DROPS
TO ZERO IT MAY REBOUND TO A POSITIVE VALUE AGAIN.  YOU
HAVE $10,000 TO INVEST.  USE INTEGERS FOR ALL YOUR INPUTS.
(NOTE:  TO GET A 'FEEL' FOR THE MARKET RUN FOR AT LEAST
10 DAYS)
-----GOOD LUCK!-----


STOCK                          INITIALS        PRICE/SHARE
INT. BALLISTIC MISSILES          IBM            94.5
RED CROSS OF AMERICA             RCA            79.5
LICHTENSTEIN, BUMRAP & JOKE      LBJ            152.25
AMERICAN BANKRUPT CO.            ABC            137.75
CENSURED BOOKS STORE             CBS            98

NEW YORK STOCK EXCHANGE AVERAGE:  112.4

TOTAL STOCK ASSETS ARE    $ 0
TOTAL CASH ASSETS ARE     $ 10000
TOTAL ASSETS ARE          $ 10000

WHAT IS YOUR TRANSACTION IN
IBM?+10
RCA?+15
LBJ?+5
ABC?+5
CBS?+10


**********  END OF DAY'S TRADING


STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             100             10              1000            5.5
RCA             85.25           15              1278.75         5.75
LBJ             157.25          5               786.25          5
ABC             141             5               705             3.25
CBS             103.5           10              1035            5.5


NEW YORK STOCK EXCHANGE AVERAGE:  117.4          NET CHANGE:  5

TOTAL STOCK ASSETS ARE    $ 4805
TOTAL CASH ASSETS ARE     $ 5386.82
TOTAL ASSETS ARE          $ 10191.8

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?-10
RCA?+5
LBJ?-5
ABC?0
CBS?0


**********  END OF DAY'S TRADING
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STOCK	PRICE/SHARE	HOLDINGS	VALUE	NET CHANGE
IBM	106.25	0	0	6.25
RCA	91	20	1820	5.75
LBJ	162.5	0	0	5.25
ABC	145.25	5	726.25	4.25
CBS	105.75	10	1057.5	2.25

NEW YORK STOCK EXCHANGE AVERAGE: 122.15 NET CHANGE: 4.75

TOTAL STOCK ASSETS ARE $ 3603.75
TOTAL CASH ASSETS ARE $ 6724.69
TOTAL ASSETS ARE $ 10328.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?+5
LBJ?+10
ABC?0
CBS?+10

********** END OF DAY'S TRADING

STOCK	PRICE/SHARE	HOLDINGS	VALUE	NET CHANGE
IBM	107.25	0	0	1
RCA	92.5	25	2312.5	1.5
LBJ	170	10	1700	7.5
ABC	149.5	5	747.5	4.25
CBS	113	20	2260	7.25

NEW YORK STOCK EXCHANGE AVERAGE: 126.45 NET CHANGE: 4.3

TOTAL STOCK ASSETS ARE $ 7020
TOTAL CASH ASSETS ARE $ 3555.81
TOTAL ASSETS ARE $ 10575.8

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0

********** END OF DAY'S TRADING

STOCK	PRICE/SHARE	HOLDINGS	VALUE	NET CHANGE
IBM	109.25	0	0	2
RCA	97	25	2425	4.5
LBJ	178.25	10	1782.5	8.25
ABC	167.75	5	838.75	18.25
CBS	114.5	20	2290	1.5

NEW YORK STOCK EXCHANGE AVERAGE: 133.35 NET CHANGE: 6.9

TOTAL STOCK ASSETS ARE $ 7336.25
TOTAL CASH ASSETS ARE $ 3555.81
TOTAL ASSETS ARE $ 10892.1

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?+5
LBJ?0
ABC?+5
CBS?0

********** END OF DAY'S TRADING

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STOCK           PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM              111.25          0               0               2
RCA              99              30              2970            2
LBJ              184.75          10              1847.5          6.5
ABC              170.75          10              1707.5          3
CBS              106.75          20              2135           -7.75


NEW YORK STOCK EXCHANGE AVERAGE:  134.5          NET CHANGE:  1.15

TOTAL STOCK ASSETS ARE    $ 8660
TOTAL CASH ASSETS ARE     $ 2218.82
TOTAL ASSETS ARE          $ 10878.8

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?-20


**********  END OF DAY'S TRADING

STOCK           PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM              118.75          0               0               7.5
RCA              101.75          30              3052.5          2.75
LBJ              195             10              1950            10.25
ABC              166.25          10              1662.5         -4.5
CBS              113.5           0               0               6.75

NEW YORK STOCK EXCHANGE AVERAGE:  139.05         NET CHANGE:  4.55

TOTAL STOCK ASSETS ARE    $ 6665
TOTAL CASH ASSETS ARE     $ 4332.47
TOTAL ASSETS ARE          $ 10997.5

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?+5
RCA?0
LBJ?0
ABC?0
CBS?0


**********  END OF DAY'S TRADING

STOCK           PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM              122.25          5               611.25          3.5
RCA              117             30              3510            15.25
LBJ              206.25          10              2062.5          11.25
ABC              172.25          10              1722.5          6
CBS              121.25          0               0               7.75


NEW YORK STOCK EXCHANGE AVERAGE:  147.8          NET CHANGE:  8.75

TOTAL STOCK ASSETS ARE    $ 7906.25
TOTAL CASH ASSETS ARE     $ 3732.78
TOTAL ASSETS ARE          $ 11639.

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?-20
LBJ?0
ABC?0
CBS?+10


**********  END OF DAY'S TRADING
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STOCK           PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM              130.75          5               653.75          8.5
RCA              120.5           10              1205            3.5
LBJ              215.75          10              2157.5          9.5
ABC              184             10              1840            11.75
CBS              128.75          10              1287.5          7.5


NEW YORK STOCK EXCHANGE AVERAGE:  155.95        NET CHANGE:  8.15

TOTAL STOCK ASSETS ARE    $ 7143.75
TOTAL CASH ASSETS ARE     $ 4824.75
TOTAL ASSETS ARE          $ 11968.5

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0

**********  END OF DAY'S TRADING

STOCK           PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM              138.5           5               692.5           7.75
RCA              127             10              1270            6.5
LBJ              227             10              2270            11.25
ABC              194.75          10              1947.5          10.75
CBS              137.5           10              1375            8.75

NEW YORK STOCK EXCHANGE AVERAGE:  164.95        NET CHANGE:  9

TOTAL STOCK ASSETS ARE    $ 7555
TOTAL CASH ASSETS ARE     $ 4824.75
TOTAL ASSETS ARE          $ 12379.7

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0

**********  END OF DAY'S TRADING

STOCK           PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM              145.75          5               728.75          7.25
RCA              145             10              1450            18
LBJ              241.75          10              2417.5          14.75
ABC              205.25          10              2052.5          10.5
CBS              146.25          10              1462.5          8.75


NEW YORK STOCK EXCHANGE AVERAGE:  176.8         NET CHANGE:  11.85

TOTAL STOCK ASSETS ARE    $ 8111.25
TOTAL CASH ASSETS ARE     $ 4824.75
TOTAL ASSETS ARE          $ 12936

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0

**********  END OF DAY'S TRADING
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STOCK           PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM              150.75          5               753.75          5
RCA              149             10              1490            4
LBJ              241.75          10              2417.5          0
ABC              212.75          10              2127.5          7.5
CBS              150.25          10              1502.5          4


NEW YORK STOCK EXCHANGE AVERAGE:  180.9          NET CHANGE:  4.1

TOTAL STOCK ASSETS ARE    $ 8291.25
TOTAL CASH ASSETS ARE     $ 4824.75
TOTAL ASSETS ARE          $ 13116

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?-10
ABC?0
CBS?0


**********  END OF DAY'S TRADING


STOCK           PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM              155.5           5               777.5           4.75
RCA              151             10              1510            2
LBJ              249.25          0               0               7.5
ABC              217.5           10              2175            4.75
CBS              157.25          10              1572.5          7


NEW YORK STOCK EXCHANGE AVERAGE:  186.1          NET CHANGE:  5.2

TOTAL STOCK ASSETS ARE    $ 6035
TOTAL CASH ASSETS ARE     $ 7218.07
TOTAL ASSETS ARE          $ 13253.1

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?-10


**********  END OF DAY'S TRADING


STOCK           PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM              157.5           5               787.5           2
RCA              156.75          10              1567.5          5.75
LBJ              256.25          0               0               7
ABC              217             10              2170            -.5
CBS              159             0               0               1.75


NEW YORK STOCK EXCHANGE AVERAGE:  189.3          NET CHANGE:  3.2

TOTAL STOCK ASSETS ARE    $ 4525
TOTAL CASH ASSETS ARE     $ 8774.84
TOTAL ASSETS ARE          $ 13299.8

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?+5
ABC?0
CBS?0


**********  END OF DAY'S TRADING
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STOCK           PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM              160.75          5               803.75          3.25
RCA              160.5           10              1605            3.75
LBJ              263             5               1315            6.75
ABC              235.25          10              2352.5          18.25
CBS              165.75          0               0               6.75


NEW YORK STOCK EXCHANGE AVERAGE:  197.05        NET CHANGE:  7.75

TOTAL STOCK ASSETS ARE    $ 6076.25
TOTAL CASH ASSETS ARE     $ 7480.78
TOTAL ASSETS ARE          $ 13557.

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?-10
CBS?0

**********  END OF DAY'S TRADING

STOCK           PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM              163.25          5               816.25          2.5
RCA              166             10              1660            5.5
LBJ              267.5           5               1337.5          4.5
ABC              242             0               0               6.75
CBS              167.25          0               0               1.5


NEW YORK STOCK EXCHANGE AVERAGE:  201.2         NET CHANGE:  4.15

TOTAL STOCK ASSETS ARE    $ 3813.75
TOTAL CASH ASSETS ARE     $ 9809.75
TOTAL ASSETS ARE          $ 13623.5

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0

**********  END OF DAY'S TRADING

STOCK           PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM              169.75          5               848.75          6.5
RCA              172             10              1720            6
LBJ              274.75          5               1373.75         7.25
ABC              246.25          0               0               4.25
CBS              170.25          0               0               3


NEW YORK STOCK EXCHANGE AVERAGE:  206.6         NET CHANGE:  5.4

TOTAL STOCK ASSETS ARE    $ 3942.5
TOTAL CASH ASSETS ARE     $ 9809.75
TOTAL ASSETS ARE          $ 13752.2

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?+5
ABC?0
CBS?0

**********  END OF DAY'S TRADING
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STOCK	PRICE/SHARE	HOLDINGS	VALUE	NET CHANGE
IBM	173.75	5	868.75	4
RCA	185	10	1850	13
LBJ	283.25	10	2832.5	8.5
ABC	252.5	0	0	6.25
CBS	173.5	0	0	3.25

NEW YORK STOCK EXCHANGE AVERAGE: 213.6 NET CHANGE: 7

TOTAL STOCK ASSETS ARE $ 5551.25
TOTAL CASH ASSETS ARE $ 8422.26
TOTAL ASSETS ARE $ 13973.5

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?+5
LBJ?0
ABC?0
CBS?0

********** END OF DAY'S TRADING

STOCK	PRICE/SHARE	HOLDINGS	VALUE	NET CHANGE
IBM	170.5	5	852.5	-3.25
RCA	169.75	15	2546.25	-15.25
LBJ	255.5	10	2555	-27.75
ABC	229.75	0	0	-22.75
CBS	148.75	0	0	-24.75

NEW YORK STOCK EXCHANGE AVERAGE: 194.85 NET CHANGE: -18.75

TOTAL STOCK ASSETS ARE $ 5953.75
TOTAL CASH ASSETS ARE $ 7488.01
TOTAL ASSETS ARE $ 13441.8

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0

********** END OF DAY'S TRADING

STOCK	PRICE/SHARE	HOLDINGS	VALUE	NET CHANGE
IBM	153.75	5	768.75	-16.75
RCA	156.75	15	2351.25	-13
LBJ	234.25	10	2342.5	-21.25
ABC	217.75	0	0	-12
CBS	133	0	0	-15.75

NEW YORK STOCK EXCHANGE AVERAGE: 179.1 NET CHANGE: -15.75

TOTAL STOCK ASSETS ARE $ 5462.5
TOTAL CASH ASSETS ARE $ 7488.01
TOTAL ASSETS ARE $ 12950.5

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?-5
RCA?-15
LBJ?-10
ABC?0
CBS?0

********** END OF DAY'S TRADING

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STOCK          PRICE/SHARE    HOLDINGS       VALUE          NET CHANGE
IBM             143            0              0             -10.75
RCA             139.25         0              0             -17.5
LBJ             215.25         0              0             -19
ABC             200            0              0             -17.75
CBS             121.5          0              0             -11.5


NEW YORK STOCK EXCHANGE AVERAGE:  163.8          NET CHANGE: -15.3

TOTAL STOCK ASSETS ARE    $ 0
TOTAL CASH ASSETS ARE     $ 12895.9
TOTAL ASSETS ARE          $ 12895.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0

**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE    HOLDINGS       VALUE          NET CHANGE
IBM             127.75         0              0             -15.25
RCA             123.75         0              0             -15.5
LBJ             195.75         0              0             -19.5
ABC             182.75         0              0             -17.25
CBS             110.25         0              0             -11.25


NEW YORK STOCK EXCHANGE AVERAGE:  148.05         NET CHANGE: -15.75

TOTAL STOCK ASSETS ARE    $ 0
TOTAL CASH ASSETS ARE     $ 12895.9
TOTAL ASSETS ARE          $ 12895.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0

**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE    HOLDINGS       VALUE          NET CHANGE
IBM             104.75         0              0             -23
RCA             114.25         0              0             -9.5
LBJ             176.5          0              0             -19.25
ABC             167.75         0              0             -15
CBS             103            0              0             -7.25


NEW YORK STOCK EXCHANGE AVERAGE:  133.25         NET CHANGE: -14.8

TOTAL STOCK ASSETS ARE    $ 0
TOTAL CASH ASSETS ARE     $ 12895.9
TOTAL ASSETS ARE          $ 12895.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0

**********  END OF DAY'S TRADING
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STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             93.25           0               0              -11.5
RCA             104.75          0               0              -9.5
LBJ             163             0               0              -13.5
ABC             160.5           0               0              -7.25
CBS             93.5            0               0              -9.5


NEW YORK STOCK EXCHANGE AVERAGE:  123     NET CHANGE: -10.25

TOTAL STOCK ASSETS ARE    $ 0
TOTAL CASH ASSETS ARE     $ 12895.9
TOTAL ASSETS ARE          $ 12895.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0


**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             87              0               0              -6.25
RCA             97              0               0              -7.75
LBJ             147             0               0              -16
ABC             156.25          0               0              -4.25
CBS             87.75           0               0              -5.75


NEW YORK STOCK EXCHANGE AVERAGE:  115     NET CHANGE: -8

TOTAL STOCK ASSETS ARE    $ 0
TOTAL CASH ASSETS ARE     $ 12895.9
TOTAL ASSETS ARE          $ 12895.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0


**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             84.25           0               0              -2.75
RCA             94.25           0               0              -2.75
LBJ             148.75          0               0               1.75
ABC             157.25          0               0               1
CBS             84.75           0               0              -3


NEW YORK STOCK EXCHANGE AVERAGE:  113.85      NET CHANGE: -1.15

TOTAL STOCK ASSETS ARE    $ 0
TOTAL CASH ASSETS ARE     $ 12895.9
TOTAL ASSETS ARE          $ 12895.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?10
RCA?10
LBJ?10
ABC?10
CBS?10


**********  END OF DAY'S TRADING
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STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             84.75           10              847.5           .5
RCA             93              10              930             -1.25
LBJ             149.5           10              1495            .75
ABC             155.75          10              1557.5          -1.5
CBS             86.25           10              862.5           1.5


NEW YORK STOCK EXCHANGE AVERAGE:  113.85        NET CHANGE:  0

TOTAL STOCK ASSETS ARE    $ 5692.5
TOTAL CASH ASSETS ARE     $ 7146.45
TOTAL ASSETS ARE          $ 12838.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0


**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             84.75           10              847.5           0
RCA             89              10              890             -4
LBJ             137.5           10              1375            -12
ABC             151.25          10              1512.5          -4.5
CBS             86              10              860             -.25

NEW YORK STOCK EXCHANGE AVERAGE:  109.7         NET CHANGE: -4.15

TOTAL STOCK ASSETS ARE    $ 5485
TOTAL CASH ASSETS ARE     $ 7146.45
TOTAL ASSETS ARE          $ 12631.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?
??1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0


**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             84.75           10              847.5           0
RCA             88.25           10              882.5           -.75
LBJ             135.5           10              1355            -2
ABC             148.5           10              1485            -2.75
CBS             84              10              840             -2

NEW YORK STOCK EXCHANGE AVERAGE:  108.2         NET CHANGE: -1.5

TOTAL STOCK ASSETS ARE    $ 5410
TOTAL CASH ASSETS ARE     $ 7146.45
TOTAL ASSETS ARE          $ 12556.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0


**********  END OF DAY'S TRADING
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STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             85.5            10              855             .75
RCA             89              10              890             .75
LBJ             134.25          10              1342.5          -1.25
ABC             157.25          10              1572.5          8.75
CBS             86.5            10              865             2.5


NEW YORK STOCK EXCHANGE AVERAGE:  110.5          NET CHANGE:  2.3

TOTAL STOCK ASSETS ARE    $ 5525
TOTAL CASH ASSETS ARE     $ 7146.45
TOTAL ASSETS ARE          $ 12671.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0


**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             86.75           10              867.5           1.25
RCA             89              10              890             0
LBJ             129.25          10              1292.5          -5
ABC             156.5           10              1565            -.75
CBS             84.5            10              845             -2


NEW YORK STOCK EXCHANGE AVERAGE:  109.2          NET CHANGE: -1.3

TOTAL STOCK ASSETS ARE    $ 5460
TOTAL CASH ASSETS ARE     $ 7146.45
TOTAL ASSETS ARE          $ 12606.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0


**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             87.5            10              875             .75
RCA             79.5            10              795             -9.5
LBJ             129             10              1290            -.25
ABC             157.75          10              1577.5          1.25
CBS             81.75           10              817.5           -2.75


NEW YORK STOCK EXCHANGE AVERAGE:  107.1          NET CHANGE: -2.1

TOTAL STOCK ASSETS ARE    $ 5355
TOTAL CASH ASSETS ARE     $ 7146.45
TOTAL ASSETS ARE          $ 12501.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0


**********  END OF DAY'S TRADING
```

```
STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             86.25           10              862.5           -1.25
RCA             80              10              800              .5
LBJ             128.25          10              1282.5          -.75
ABC             145.75          10              1457.5          -12
CBS             81.25           10              812.5           -.5


NEW YORK STOCK EXCHANGE AVERAGE:  104.3         NET CHANGE: -2.8

TOTAL STOCK ASSETS ARE    $ 5215
TOTAL CASH ASSETS ARE     $ 7146.45
TOTAL ASSETS ARE          $ 12361.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0


**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             83.25           10              832.5           -3
RCA             79.75           10              797.5           -.25
LBJ             136             10              1360             7.75
ABC             145.25          10              1452.5          -.5
CBS             80              10              800             -1.25

NEW YORK STOCK EXCHANGE AVERAGE:  104.85        NET CHANGE:  .55

TOTAL STOCK ASSETS ARE    $ 5242.5
TOTAL CASH ASSETS ARE     $ 7146.45
TOTAL ASSETS ARE          $ 12388.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0


**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             82.75           10              827.5           -.5
RCA             79.25           10              792.5           -.5
LBJ             134.25          10              1342.5          -1.75
ABC             144.25          10              1442.5          -1
CBS             79.75           10              797.5           -.25

NEW YORK STOCK EXCHANGE AVERAGE:  104.05        NET CHANGE: -.8

TOTAL STOCK ASSETS ARE    $ 5202.5
TOTAL CASH ASSETS ARE     $ 7146.45
TOTAL ASSETS ARE          $ 12348.9

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?GJ,¶L0\
0
CBS?0


**********  END OF DAY'S TRADING
```

```
STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             79.5            10              795             -3.25
RCA             78.75           10              787.5           -.5
LBJ             127.5           10              1275            -6.75
ABC             138.25          10              1382.5          -6
CBS             78              10              780             -1.75


NEW YORK STOCK EXCHANGE AVERAGE:  100.4          NET CHANGE: -3.65

TOTAL STOCK ASSETS ARE    $ 5020
TOTAL CASH ASSETS ARE     $ 7146.45
TOTAL ASSETS ARE          $ 12166.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?1
WHAT IS YOUR TRANSACTION IN
IBM?0
RCA?0
LBJ?0
ABC?0
CBS?0


**********  END OF DAY'S TRADING

STOCK          PRICE/SHARE     HOLDINGS        VALUE           NET CHANGE
IBM             75              10              750             -4.5
RCA             72.75           10              727.5           -6
LBJ             118.5           10              1185            -9
ABC             134.75          10              1347.5          -3.5
CBS             64              10              640             -14


NEW YORK STOCK EXCHANGE AVERAGE:  93       NET CHANGE: -7.4

TOTAL STOCK ASSETS ARE    $ 4650
TOTAL CASH ASSETS ARE     $ 7146.45
TOTAL ASSETS ARE          $ 11796.4

DO YOU WISH TO CONTINUE (YES-TYPE 1, NO-TYPE 0)?0
HOPE YOU HAD FUN!!

DONE
```

TITLE: AUTO PURCHASE AND MAINTENANCE SIMULATION — WHEELS 36187

DESCRIPTION:

WHEELS simulation model is designed to provide students with a simulated experience in purchasing and maintaining a car successfully for one year. It may be used with an entire class, as an individual student assignment, or an out-of-class activity. Experiences include the purchase of a car, the selection of a method of financing, the choice of insurance, and a provision for tracking expenses. The computer randomly assigns accidents, major repairs, unexpected events and calculates expenses.

INSTRUCTIONS:

Hewlett-Packard does not have documentation for this package but users instructions are contained in literature distributed by Paul S. Amidon & Associates, Inc., 5408 Chicago Avenue South, Minneapolis, Minnesota.

It is distributed in two packages:

1	teacher's manual
3	sets of student roles
35	participant manuals
	Activity sheet tablet

Sample Set . . .

1	teacher's manual
1	set of student roles
1	participant manual
	Activity sheet tablet

SPECIAL CONSIDERATIONS:

Copyright to the instructional materials are held by Paul S. Amidon & Associates, Inc.

INSTRUCTIONAL PURPOSES

The program is useful in High school business courses, economics classes, or individual assignment.

No student background required.

The program is very effective for teaching private budgeting, installment purchasing or monetary responsibility.

A teacher would utilize the materials and programs as a class unit or as an activity for individual students to do in conjunction with class activity.

ACKNOWLEDGEMENTS: Paul S. Amidon & Associates, Inc.

RUN

```
RUN
WHEELS

CODE?  A^C U^C T^C O^C
TYPE MONTH NUMBER 1-12?1
WELCOME TO THE QUICKIE COMPUTER CAR CHOOSING PARLOR
**************************************************

SO YOU WANT TO BUY A CAR. WELL, MAYBE I CAN HELP YOU TO
MAKE A GOOD CHOICE.
DO YOU NEED INSTRUCTIONS? TYPE 1 FOR YES, 0 FOR NO.?1
YOU SHOULD HAVE BEEN GIVEN A ROLE NUMBER
FROM 1 TO 15 AND ALSO A CAR DESCRIPTION
SHEET. WHEN I ASK YOU, ENTER YOUR ROLE
NUMBER FOLLOWED BY A COMMA AND THEN THE
CAR NUMBER OF YOUR CHOICE.
ENTER ROLE NUMBER, COMMA AND CAR CHOICE NOW. ?8,21

ROLE NUMBER 8     CAR NUMBER 21
REPORT FOR MONTH NUMBER 1

YOU DROVE 997  MILES THIS MONTH.
RUNNING EXPENSES (GAS, OIL, WEAR, ETC.) AMOUNT TO $ 72

MAJOR REPAIRS REPORT
***** ******* ******
NO MAJOR REPAIRS THIS MONTH.

ACCIDENT REPORT
******** ******
NO ACCIDENTS.THANK GOODNESS.

UNEXPECTED EVENTS
********** ******
YOU HAVE ENCOUNTERED EVENT NUMBER..... 29
CHECK TO SEE WHAT HAPPENED.

TRY HARDER NEXT MONTH. GOOD-BYE FOR NOW.



TYPE MONTH NUMBER 1-12?2
ENTER ROLE NUMBER, COMMA AND CAR CHOICE NOW. ?8,21

ROLE NUMBER 8     CAR NUMBER 21
REPORT FOR MONTH NUMBER 2

YOU DROVE 970  MILES THIS MONTH.
RUNNING EXPENSES (GAS, OIL, WEAR, ETC.) AMOUNT TO $ 70

MAJOR REPAIRS REPORT
***** ******* ******
NOTHING NEEDS FIXING. THINGS O.K. THIS MONTH.

ACCIDENT REPORT
******** ******
NO ACCIDENTS.THANK GOODNESS.

UNEXPECTED EVENTS
********** ******
YOU HAVE ENCOUNTERED EVENT NUMBER..... 8
CHECK TO SEE WHAT HAPPENED.

TRY HARDER NEXT MONTH. GOOD-BYE FOR NOW.
```

```
TYPE MONTH NUMBER 1-12?3
ENTER ROLE NUMBER, COMMA AND CAR CHOICE NOW. ?8,21

ROLE NUMBER 8     CAR NUMBER 21
REPORT FOR MONTH NUMBER 3

YOU DROVE 830  MILES THIS MONTH.
RUNNING EXPENSES (GAS, OIL, WEAR, ETC.) AMOUNT TO $ 60

MAJOR REPAIRS REPORT
***** ******* ******
TRANSMISSION ON BUM. BILL AMOUNTS TO $ 182

ACCIDENT REPORT
******** ******
IT MUST BE YOUR CAREFUL DRIVING OR LUCK. NO ACCIDENTS.

UNEXPECTED EVENTS
********** ******
NONE THIS MONTH

TRY HARDER NEXT MONTH. GOOD-BYE FOR NOW.
```

```
TYPE MONTH NUMBER 1-12?4
ENTER ROLE NUMBER, COMMA AND CAR CHOICE NOW. ?8,21

ROLE NUMBER 8     CAR NUMBER 21
REPORT FOR MONTH NUMBER 4

YOU DROVE 835  MILES THIS MONTH.
RUNNING EXPENSES (GAS, OIL, WEAR, ETC.) AMOUNT TO $ 60

MAJOR REPAIRS REPORT
***** ******* ******
NO MAJOR REPAIRS THIS MONTH.

ACCIDENT REPORT
******** ******
YOU HAD AN ACCIDENT WITH DAMAGE $ 126
YOUR INSURANCE RATE GOES UP 25 PER CENT

UNEXPECTED EVENTS
********** ******
YOU HAVE ENCOUNTERED EVENT NUMBER..................... 8
CHECK TO SEE WHAT HAPPENED.

TRY HARDER NEXT MONTH. GOOD-BYE FOR NOW.
```

```
TYPE MONTH NUMBER 1-12?
DONE
```

Documentation Date 3/75

HISTORY (EDUCATION) (863)

CONTRIBUTED PROGRAM **BASIC**

TITLE:

TIME SERIES ANALYSIS GROWTH & DEVELOPMENT OF U.S. 1790-1860 36888-18033
TSAP

DESCRIPTION:

There are 4 programs and 1 file in this package: TSAP, TSAP1, TSAP2, TSAP3 and TSAPF.

These programs, all accessed through TSAP, allow students to do time series analysis of a data base (TSAPF) which contains information on all the states of the U.S.

INSTRUCTIONS:

The program was written to support the publication, The Growth and Development of the United States, 1790-1860 by John G. Kolp published by the Hewlett-Packard Computer Curriculum Project, (HP 5951-7381)

For further information contact:

Hewlett-Packard Computer-Based Educational Materials
Scientific Press
1629 Channing Avenue
Palo Alto, Calif. 94303

The publication is needed for complete user instruction.

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: High School and College American History Courses.

ACKNOWLEDGEMENTS:

John G. Kolp
University of Iowa

RUN

```
RUN
TSAP

TIME SERIES ANALYSIS PACKAGE

DO YOU NEED INSTRUCTIONS?YES
THIS PROGRAM ALLOWS YOU TO RETRIEVE AND/OR
ANALIZE DATA CONCERNING THE U.S. FOR THE PERIOD
1790 THRU 1860.  THE DATA IS STORED INTERNALLY IN THE
COMPUTER.
LET'S IMAGINE THE FILE LOOKS LIKE THE FOLLOWING OUTLINE:

I. US DATA
   A. STATE (STATE)
     1. GEORGIA
   B. YEARS (YEARS)
     1. 1790
   C. TOTAL POPULATION (TOTPOP)
     1. 55 (IN 100 THOUSANDS)
   D. NUMBER OF SLAVES (SLAVES)
     1. 550 (IN 10 THOUSANDS)
   E. NUMBER OF FREE BLACKS (BLACKS)
     1. 66 (IN THOUSANDS)
   F. PERCENTAGE OF POPULATION FOREIGN BORN (FORBOR)
     1. 0 (1850-1860 ONLY)
   G. PERCENTAGE POPULATION LIVING IN URBAN AREAS (URBAN)
     1. 10
   H. AVERAGE ACRES PER FARM (FARMS)
     1. 0 (1850-1860 ONLY)
   I. LAND SALES-PREVIOUS DECADE (LAND)
     1. 0 (1820-1860 ONLY)
   J. MILES OF RAILROAD (RAILS)
     1. 0 (1850-1860 ONLY)
   K. VALUE OF MANUFACTURING (MANFT)
     1. 0 (1810,1840,1850,1860)
   L. VALUE OF IMPORTS (IMPORT)
   M. VALUE OF EXPORTS (EXPORT)
   N. PERCENT OF US TOBACCO PRODUCTION (TOBAC)
   O. PERCENT OF US COTTON PRODUCTION (COTTON)
   P. PERCENT OF US CORN PRODUCTION (CORN)
   Q. SECTION OF COUNTRY (SECTN)
      1. NORTH
      2. SOUTH

THIS PARTICULAR OUTLINE REPRESENTS ONE RECORD - GEORGIA
IN THE YEAR 1790.  THERE ARE RECORDS FOR GEORGIA FOR THE
YEARS 1790 THRU 1860, AS WELL AS RECORDS ON OTHER STATES
FOR THE SAME YEARS.  THIS COLLECTION OF RECORDS MAKES UP
A FILE.
STATE, YEAR, SLAVES ARE WHAT IS KNOWN AS VARIABLES.
INSTEAD OF ALWAYS HAVING TO SPELL THEM OUT SUCH AS
'TOTAL POPULATION' , I'LL MAKE IT EASY FOR YOU. YOU
CAN REFERENCE A VARIABLE BY USING 'TOTPOP' OR 'MANFT'.
THESE VARIABLE NAMES ARE INCLUDED IN THE PARENTHSES IN THE
ABOVE LIST.  SO, WHENEVER YOU ARE ASKED FOR THE NAME
OF A VARIABLE, BE SURE TO RESPOND WITH ONE OF THOSE
LISTED ABOVE.


'DATA SELECTION CRITERION' ALLOWS YOU TO 'PINPOINT' THE
DATA YOU WISH TO ANALYZE.  YOU HAVE THE CHOICE OF
SELECTING A PARTICULAR STATE, YEAR, OR SECTION OF THE
COUNTRY.
STATE=NEWJERSEY, YEARS=1820, SECTN=1ARE EXAMPLES OF HOW TO
ENTER YOUR DATA SELECTIONS.  IF YOU WISH TO ANALYZE THE
ENTIRE FILE, SIMPLY TYPE IN NONE AS THE DATA SELECTION
CRITERION.

WE CAN ALSO PERFORM ONE 'MULTIPLE CRITERION' SELECTION.
YOU CAN SELECT ON SECTN AND YEARS IN ONE STATEMENT.
BUT IT MUST READ SECTN=? AND YEARS=???? IN PRECISELY
THAT ORDER AND FORMAT.
NOW I'LL LIST THE AVAILABLE COMMANDS.
THEY ARE:
                                        RETRIEVE
                                        PLOT
                                        CORRELATE
                                        MEAN
                                    AND QUIT TO STOP

COMMAND?QUIT

DONE
```

CONTRIBUTED PROGRAM **BASIC**

TITLE: CAI IN WORD USAGE

VOCAB
36880

DESCRIPTION:

This package contains 4 CAI programs in English word usage. FLASH assists in word recollection and spelling; GROOT is a drill in the use of greek roots; PREFIX is a drill in the use of prefixes; and VOCAB assists in the learning of synonyms.

INSTRUCTIONS:

FLASH

A word is read from the DATA list, is printed and is blacked out immediately after which the user must type in that word. The program is ready to run with 19 words. Present DATA statements run from statement 500 through to statement 540 in steps of 10. More words may be added between statements 540 and 9000. Each word consists of one string in a DATA statement consisting of that word.

GROOT

A list of greek roots is given after which a word or phrase is printed. The user is called upon to enter the greek root which is defined by that word or phrase. The program is ready to run with 20 greek roots. Present DATA statements run from statement 460 through to 510 in steps of 10. More greek roots may be added between statements 510 and 9000. Each prefix consists of two strings in DATA statements. The first string is the greek root and the second is the word or phrase which corresponds to or defines that greek root. For example,

```
460  DATA"ASTRON","STAR"
```

PREFIX

A list of prefixes is given after which a word or phrase is printed. The user is called upon to enter the prefix which is defined by that word or phrase.

Continued on next page.

SPECIAL CONSIDERATIONS:

New data for each of the 4 programs may be added or existing data modified. There are two things to note: as long as the words (or prefixes or sentences) are added or deleted in the correct manner the program will automatically compute the number of words (or prefexes or sentences) and hence the user can use as many as he wishes; also a randomness feature has been incorporated so that the order in which the words are printed out will vary from run to run.

ACKNOWLEDGEMENTS: University of Lethbridge
Alberta, Canada

INSTRUCTIONS: Continued.

The program is ready to run with 18 prefixes. Present DATA statements run from statement 480 through to 550 in steps of 10. More prefixes may be added between statements 550 and 9000. Each prefix consists of two strings in DATA statements. The first string is the prefix and the second is the word or phrase which corresponds to or defines that prefix. For example,

```
480 DATA"PRE-","BEFORE"
```

VOCAB

The sentence is given with one word marked. Then a list of words follows from which the user is required to pick a synonym to the marked word. The program is ready to run with 15 sentences. Present DATA statements run from statement 350 through to statement 790 in steps of 10. More sentences may be added between statements 790 and 9000. Each question consists of 3 strings and a number in DATA statements. The first two strings are the sentence (there must be two), the third string is the list of answers and the number is the number of the correct answer. For example,

```
350 DATA"WHEN THE NEWS CAME/RADIANT/"
360 DATA"FACES REPLACED GLOOMY ONES"
370 DATA"1 FROWNING 2 OVERHEATED 3 LONG 4 SHINING", 4
```

RUN

```
RUN
FLASH



WELCOME TO THE PROGRAM CALLED 'FLASH'.  THIS PROGRAM IS DESIGNED
TO HELP WITH THE RECALL OF WORDS.  A WORD WILL BE TYPED AND YOU
WILL BE CALLED UPON TO TYPE BACK THAT WORD.


READY....

■■■■■■■■■■■■■■■
WHAT WAS THE WORD?PRINCIPAL
CORRECT
■■■■■■■■■■■■■■■
WHAT WAS THE WORD?IRRITATING
CORRECT
■■■■■■■■■■■■■■■
WHAT WAS THE WORD?AFFECT
CORRECT
■■■■■■■■■■■■■■■
WHAT WAS THE WORD?ELICIT
CORRECT
■■■■■■■■■■■■■■■
WHAT WAS THE WORD?CONTEMPTIBLE
CORRECT
■■■■■■■■■■■■■■■
WHAT WAS THE WORD?IMMIGRANT
CORRECT
■■■■■■■■■■■■■■■
WHAT WAS THE WORD?IMPLIED
CORRECT
■■■■■■■■■■■■■■■
WHAT WAS THE WORD?COMPLIMENTS
INCORRECT ... THE CORRECT ANSWER IS: COMPLEMENTS
■■■■■■■■■■■■■■■
WHAT WAS THE WORD?FEASIBLE
CORRECT
```

WHAT WAS THE WORD?STATIONERY
CORRECT
WHAT WAS THE WORD?VENAL
CORRECT
WHAT WAS THE WORD?VOCATION
CORRECT
WHAT WAS THE WORD?CREDIBLE
CORRECT
WHAT WAS THE WORD?ADVISED
CORRECT
WHAT WAS THE WORD?INGENIOUS
CORRECT
WHAT WAS THE WORD?EXCEEDINGLY
CORRECT
WHAT WAS THE WORD?ORDNANCE

INCORRECT ... THE CORRECT ANSWER IS: ORDINANCE
WHAT WAS THE WORD?UNINTERESTED
CORRECT
WHAT WAS THE WORD?COUNSEL
CORRECT
WHAT WAS THE WORD?PRACTICABLE
CORRECT
OUT OF 20 YOU GOT 18 CORRECT.
THAT IS 90 PERCENT.

YOU GOT COMPLEMENTS INCORRECT.
YOU GOT ORDINANCE INCORRECT.

DONE

GET-GROOT
RUN
GROOT

HI, I'M GLAD YOU LIKE THIS WAY OF LEARNING, TOO
WHAT IS YOUR NAME ??SAM
THESE GREEK ROOTS ARE FOUND IN MANY SCIENTIFIC TERMS.
YOU WILL BE ASKED TO GIVE A ONE WORD MEANING FOR EACH
ROOT. 10 POINTS FOR EACH CORRECT ANSWER. THE COMPUTER
WILL KEEP SCORE. GOOD LUCK, SAM

ASTRON
AUTOS
BIOS
CHRONOS
DECA
DEMOS
GE
GRAPHO
LITHOS
METRON
MONOS
ORTHOS
PHILOS
PHONE
POLYS
SCOPOS
TELE
THERMA
ZOON
ANTHROPOS

```
WHICH PREFIX MEANS HEAT
?THERMA
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS WRITE
?PHILOS
SORRY, YOU MISSED THAT ONE, SAM, THE RIGHT ANSWER IS, GRAPHO

WHICH PREFIX MEANS TIME
?CHRONOS
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS MEASURE
?METRON
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS LIFE
?BIOS
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS ANIMAL
?ZOON
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS SELF
?AUTOS
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS MANY
?POLYS
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS STAR
?ASTRON
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS PEOPLE
?ANTHROPOS
SORRY, YOU MISSED THAT ONE, SAM, THE RIGHT ANSWER IS, DEMOS

WHICH PREFIX MEANS TEN
?DECA
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS STONE
?GE
SORRY, YOU MISSED THAT ONE, SAM, THE RIGHT ANSWER IS, LITHOS

WHICH PREFIX MEANS ONE
?MONOS
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS SOUND
?PHONE
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS EARTH
?GE
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS FAR
?TELE
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS MAN
?PHILOS
SORRY, YOU MISSED THAT ONE, SAM, THE RIGHT ANSWER IS, ANTHROPOS

WHICH PREFIX MEANS WATCHER
?SCOPOS
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS RIGHT
?ORTHOS
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
WHICH PREFIX MEANS LOVING
?PHILOS
VERY GOOD, YOUR ANSWER IS CORRECT, SAM
YOUR SCORE IS  16    OUT OF  20    CORRECT OR  80   %.

DONE
```

```
GET-PREFIX
RUN
PREFIX

HI,I'M GLAD YOU LIKE THIS WAY OF LEARNING,TOO.
DID YOU KNOW THAT THE PREFIXES THAT YOU WILL LEARN IN
THIS PROGRAM WILL GIVE YOU KEYS TO UNLOCK THE MEANINGS
OF OVER 14,000 COMMONLY USED WORDS?
WHAT IS YOUR FIRST NAME?
?KIMBERLY
IN THIS PROGRAM YOU WILL BE ASKED TO GIVE A ONE WORD
MEANING FOR EACH PREFIX THAT YOU ARE ASKED TO
DEFINE. YOU WILL RECEIVE 10 POINTS FOR EACH
CORRECT ANSWER. THE COMPUTER WILL KEEP SCORE.
       GOOD LUCK,KIMBERLY


                      PRE-
                      DE-
                      MONO-
                      INTER-
                      UN-
                      RE-
                      TRANS-
                      PRO-
                      NON-
                      EPI-
                      MIS-
                      OB-
                      EX-
                      DIS-
                      IN-
                      COM-
                      SUB-
                      AD-
WHICH PREFIX MEANS AGAIN OR BACK
?RE
SORRY, YOU MISSED THAT ONE, KIMBERLY, THE RIGHT ANSWER IS, RE-
WHICH PREFIX MEANS  UPON OR OVER
?COM-
SORRY, YOU MISSED THAT ONE, KIMBERLY, THE RIGHT ANSWER IS, EPI-
WHICH PREFIX MEANS  DOWN
?DE-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
WHICH PREFIX MEANS  TOGETHER OR WITH
?COM-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
WHICH PREFIX MEANS BETWEEN
?INTER-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
WHICH PREFIX MEANS APART OR NOT
?NON-
SORRY, YOU MISSED THAT ONE, KIMBERLY, THE RIGHT ANSWER IS, DIS-
WHICH PREFIX MEANS NOT OR ABSENSE OF SOMETHING
?NON-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
WHICH PREFIX MEANS ACROSS OR BEHIND
?TRANS-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
WHICH PREFIX MEANS  BEHING OR AGAINST
?OB-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
WHICH PREFIX MEANS NOT OR INTENSIFIES A VERB
?UN-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
WHICH PREFIX MEANS BEFORE
?PRE-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
WHICH PREFIX MEANS  OUT
?EX-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
WHICH PREFIX MEANS ONE
?MONO-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
WHICH PREFIX MEANS  WRONG
?MIS-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
```

```
WHICH PREFIX MEANS  UNDER
?SUB-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
WHICH PREFIX MEANS INTO OR NOT
?IN-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
WHICH PREFIX MEANS IN FAVOR OF OR FORWARD
?PRO-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
WHICH PREFIX MEANS  TO OR TOWARD
?AD-
VERY GOOD, YOUR ANSWER IS CORRECT, KIMBERLY
YOUR SCORE IS 15   OUT OF 18   WHICH IS 83.3333    %.
YOU COULD PRACTICE A LITTLE MORE KIMBERLY

DONE



GET-VOCAB
RUN
VOCAB

IN THIS EXCERCISE YOU WILL FIRST BE GIVEN A SENTENCE WITH
ONE OF THE WORDS SEPARATED FROM THE REST BY / MARKS. AFTER
THAT YOU WILL BE GIVEN FOUR WORDS. YOU ARE TO TYPE IN THE
NUMBER OF THE WORD THAT IS NEAREST IN MEANING TO THE WORD
IN THE SENTENCE.
A NEW SET OF SENTENCES WAS ENTERED INTO THE COMPUTER ON
TUESDAY JULY 22, 1969



WHEN THE NEWS CAME / RADIANT /
FACES REPLACED GLOOMY ONES.
1 FROWNING 2 OVERHEATED 3 LONG 4 SHINING
?4
CORRECT

/ COMPASSION / FOR THE LESS FORTUNATE IS
ONE MARK OF A GENTLEMAN.
1 ENVY 2 DISLIKE 3 SYMPATHY 4 SCORN
?3
CORRECT

SINCE THEY ALREADY OWNED TWO TELEVISION SETS, THE
SET THEY WON WAS / SUPERFLUOUS /.
1 WELCOME 2 MORE THAN NEEDED 3 SUPERIOR 4 ESPECIALLY NEEDED
?2
CORRECT

SHE POSSESSED MANY QUALITIES / REQUISITE /
FOR LEADERSHIP.
1 USELESS 2 HARMFUL 3 NOT IMPORTANT 4 NECESSARY
?4
CORRECT

 THE / PLAINTIVE / BARKING OF A HOMELESS
DOG MADE THE CHILDREN UNHAPPY/
1 STACCATO 2 LOUD 3 HIGH-PITCHED 4 MOURNFUL
?4
CORRECT

HE WAS SO / VOLUBLE / THAT HIS SPEECH
RAN BEYOND THE ALLOTTED TIME.
1 TALKATIVE 2 BRIEF 3 INTERESTING 4 UPSET
?1
CORRECT
```

```
IN THE WINTER SHE WAS ENERGETIC, BUT IN
AUGUST SHE WAS / INDOLENT/ .
1 OVERHEATED 2 LAZY 3 EAGER 4 DEPRESSED
?2
CORRECT

WHEN THE SENATOR MISPLACED HIS SPEECH, HE
HAD TO / IMPROVISE / HIS TALK.
1 CANCEL 2 CUT SHORT 3 MAKE UP ON SPUR OF THE MOMENT
?3
CORRECT

HIS REASONING WAS SO / FALLACIOUS /
THAT HIS CONCLUSIONS WERE ALWAYS WRONG.
1 UNSOUND 2 UNINTERESTING 3 ACUTE 4 SKILLFUL
?1
CORRECT

THE ECONOMIC INDEPENDENCE THEY NOW ENJOY IS
THE RESULT OF A LIFE OF / FRUGALITY /.
1 WASTE 2 THRIFT 3 ENJOYMENT 4 PURPOSE
?2
CORRECT

DRIVING SUCH A BIG CAR GIVES HIM A CHANCE
TO BE / PRETENTIOUS /.
1 SHOWY 2 SPEEDY 3 HUMBLE 4 PRACTICAL
?1
CORRECT

BEING HUMAN, WE MAY
BE / FALLIBLE / IN OUR JUDGMENTS.
1 CORRECT 2 SUPERNATURAL 3 LIKELY TO ERR 4 FAIR
?3
CORRECT

 HE HAD BECOME SO / OBESE / THAT HE COULD NOT
BEND DOWN TO TIE HIS SHOES.
1 LAZY 2 STIFF 3 FAT 4 TALL
?3
CORRECT

MEMBERS OF THE BASEBALL TEAM CARRIED SO MUCH/IMPEDIMENTA /WITH
THEM THAT WE THOUGHT THEY WERE GOING FOR A MONTH TOUR.
1 MONEY 2 CORRESPONDENCE 3 FOOD 4 BAGGAGE
?4
CORRECT

EVEN BEFORE HE RECEIVED NEWS OF THE ACCIDENT, HE HAD A
/PREMONITION/THAT SOMETHING WOULD HAPPEN.
1 PROMISE 2 HOPE 3 FOREWARNING 4 LETTER
?3
CORRECT

YOU GOT  15    OUT OF  15    FOR  100   %.
CONGRATULATIONS, YOU GOT THEM ALL CORRECT.

DONE
```

TITLE: COMPUTER-ASSISTED REVIEW LESSONS ON SYNTAX FOR SPANISH II

CARLOS
36175

DESCRIPTION:

CARLOS (Computer-Assisted Review Lessons On Syntax) was conceived and developed at Dartmouth College by Dr. Robert C. Turner under an NSF grant during the school year 1967-1968, and was updated during the spring of 1970 at Dartmouth College. The data base was implemented on the HP 2000C in March 1971. These are written grammar drill lessons for Spanish II. Ideally a student may use CARLOS any time in the school year for the preparation of an assignment, for extra curricular review, for final examination, or for review during higher-level Spanish Courses where he is expected to have already mastered the material. The student may repeatedly write the same drills until he has mastered the materials without needing to feel that he is bothering his instructor with "stupid mistakes", which may occur because of a shallow or too distant background. Any mistakes the student makes are entirely private and, of course, are instantly corrected for him.

INSTRUCTIONS:

1. GET-$CARLOS
2. RUN
3. The user will answer the questions which are presented to him on the terminal.

SPECIAL CONSIDERATIONS:

Turner, Ronald C., CARLOS: CAI in Spanish at Dartmouth College, Dartmouth College, Hanover, N.H., 1968

The data base is contained in the file, CAR1, on the system library. It contains a directory and 15 lessons.

ACKNOWLEDGEMENTS:

Richard E. McIntire
Hewlett-Packard/Data Systems

ATG

TITLE: COMPUTER ORIENTED ACCOUNTING - INTERACTIVE VERSION 36888-18032

DESCRIPTION:

To be used in high school accounting I or bookkeeping courses.

Topics: Complete Accounting Cycle
Payroll
Bank Reconcilliation
Declining Balance

There are 6 programs in this package: ATG, ATGE, ATGIB, ATGM, ATGM1, ATGW.

INSTRUCTIONS:

Programs are self prompting so that the user can be helped by answering the questions presented to him.

To be used in conjunction with COMPUTER ORIENTED ACCOUNTING by Wilbur Pillsbury, a workbook published by South-Western Publishing Co. Available from South-Western Publishing Co.
5101 Madison Road
Cincinnati, Ohio 45227

Student Book $5
Teacher's Book $3.75 for 5 or more.

Teacher's books are free to instructors who adopt the text for use in their classes.

Originally, the programs were written for a FORTRAN IV speaking computer which uses punched cards as the input medium. To bring the benefits of Computer Oriented Acounting to as many people as possible on the secondary level, the BASIC language, interactive version was written. It is identical to the original in its purpose, problems and the book used. The student would use the workbook by Dr. Pillsbury just as before, but all transactions are entered via the terminal keyboard directly into the computer's memory, instead of keypunching cards.

To be truly interactive, the transaction data must be checked for errors as it is entered. Totals must be compared for errors in balancing as they are created, and appropriate correction capability available if and when they are needed. Moreover, should the student desire to use the same data in more than one exercise (as is the case in Chapters 7, 9 and 13), it should be available to him without his having to re-enter it. Each of these capabilities has been made readily and easily available to the student in this interactive version.

In a typical program, the student responds to questions which the computer asks him, giving his name, the chapter number, problem number and date. Transaction entries are made by giving an account number (odd-debit, even-credit) and the amount of the transaction. The student is asked to check the data after each transaction. If he sees a mistake he can correct it immediately. Once the data entry is complete, the computer relists it

Description continued on following page.

ACKNOWLEDGEMENTS: Lawrence G. Page
Central Technical High School

INSTRUCTIONS continued

in journal form. If there are adjusting or closing entries, the student is asked to enter them and they, in turn, are checked and listed. Totals of the debit and credit sides of the journal are checked for balance, and in problems 1-3 of Chapters 4-9 and all problems in Chapter 13, the exact values required are checked. Since problem 4 in each of Chapters 4-9 uses student designed data, a check is only made to see if the totals balance.

Usually the computer then asks if the student is ready for the T accounts to be listed. The student types 'GO". Finally, the same "GO" response is requested for either a worksheet, balance sheet, trial balance, income statement, or post closing trial balance, depending upon the problem and chapter. As before, the totals are checked for balance and exactness. Should they not balance, or the totals not agree with those listed in the computer's memory for that problem, the computer asks the student if he would like to correct them. This is a painless procedure because the computer simply relists the original transaction data, one entry at a time, and asks if it is correct. When all necessary corrections have been made, the Computer re-runs the data.

When the problem is complete, the student can either stop, reuse his data in another problem, or do a completely new problem.

Problems in Chapter 3 are checked for balance only. Chapters 10-12 have extensive error checking for problems 1 and 2 and only limited checking for problem 3.

RUN

```
RUN
ATG

ATG ? SELECTION PROGRAM
PLEASE TELL ME WHICH PROGRAM NUMBER (3-13) YOU WISH TO USE ?3
THANKYOU, YOU WILL BE USING PROGRAM ATG 3

IS THIS A SECOND RUN FOR YOUR TRANSACTION DATA (Y/N) ?N


COMPUTER ORIENTED ACCOUNTING

STUDENT NAME PLEASE ?LARRY PAGE
DATE PLEASE ?OCTOBER 12,1974
EXERCISE X-X PLEASE ?3-1

TRANSACTION DATA

COMPANY NAME ?HARRISON RADIO AND TV SALES
DATE OF ACCOUNTING PERIOD ?AUGUST 31, 1974

CASH ?4050
SUPPLIES ?810
TELEVISIONS ?4400
RADIOS ?2740
BOWMAN RADIO CO. ?3560
CAPITAL ?8440


STUDENT NAME - LARRY PAGE
EXERCISE - 3-1
DATE - OCTOBER 12,1974

                    HARRISON RADIO AND TV SALES

                         BALANCE SHEET

                       AUGUST 31, 1974

        ASSETS                              LIABILITIES

CASH                 4050          BOWMAN RADIO CO.      3560

SUPPLIES             810

TELEVISION           4400                    CAPITAL

RADIOS               2740          CAPITAL               8440
                    -------                              -------
TOTAL ASSETS         12000         TOTAL LIAB. & CAP.    12000
                    -------                              -------
                    -------                              -------
```

```
ATG ? SELECTION PROGRAM
PLEASE TELL ME WHICH PROGRAM NUMBER (3-13) YOU WISH TO USE ?4
THANKYOU, YOU WILL BE USING PROGRAM ATG 4

IS THIS A SECOND RUN FOR YOUR TRANSACTION DATA (Y/N) ?N


COMPUTER ORIENTED ACCOUNTING

STUDENT NAME PLEASE ?LARRY PAGE
DATE PLEASE ?OCTOBER 12, 1974
EXERCISE X-X PLEASE ?4-1

TRANSACTION DATA

COMPANY NAME ?ALLISON'S BICYCLE REPAIR
DATE OF ACCOUNTING PERIOD ?SEPTEMBER 30, 1974
WHICH PROBLEM IS THIS ?1
HOW MANY TRANSACTION ENTRIES DO YOU HAVE ?10

DEBIT ENTRY #  1
ACCOUNT NUMBER ?1
AMOUNT ?5600

ACCOUNT #  1    NAME - CASH     AMOUNT =  5600
ARE THEY CORRECT (Y/N) ?Y

CREDIT ENTRY #  1
ACCOUNT NUMBER ?34
AMOUNT ?5600

ACCOUNT #  34   NAME - CAPITAL     AMOUNT =  5600
ARE THEY CORRECT (Y/N) ?Y

DEBIT ENTRY #  2
ACCOUNT NUMBER ?325
***** ERROR - ACCOUNT NUMBER IS GREATER THAN 80 *****
ACCOUNT NUMBER ?9
AMOUNT ?325

ACCOUNT #  9    NAME - SUPPLIES    AMOUNT =  325
ARE THEY CORRECT (Y/N) ?Y

CREDIT ENTRY #  2
ACCOUNT NUMBER ?2
AMOUNT ?326

ACCOUNT #  2    NAME - CASH     AMOUNT =  326
ARE THEY CORRECT (Y/N) ?Y
***** ERROR - DEBIT AND CREDIT AMOUNTS ARE NOT EQUAL TO EACH OTHER *****

DEBIT ENTRY #  2
ACCOUNT NUMBER ?9
AMOUNT ?325

ACCOUNT #  9    NAME - SUPPLIES    AMOUNT =  325
ARE THEY CORRECT (Y/N) ?Y

CREDIT ENTRY #  2
ACCOUNT NUMBER ?2
AMOUNT ?325

ACCOUNT #  2    NAME - CASH     AMOUNT =  325
ARE THEY CORRECT (Y/N) ?Y

DEBIT ENTRY #  3
ACCOUNT NUMBER ?15
AMOUNT ?100

ACCOUNT #  15   NAME - EQUIPMENT    AMOUNT =  100
ARE THEY CORRECT (Y/N) ?N
LET'S TRY AGAIN !
ACCOUNT NUMBER ?15
AMOUNT ?1000
```

```
ACCOUNT #  15   NAME - EQUIPMENT     AMOUNT =  1000
ARE THEY CORRECT (Y/N) ?Y

CREDIT ENTRY #  3
ACCOUNT NUMBER ?28
AMOUNT ?1000

ACCOUNT #  28   NAME - ACCOUNTS PAYABLE     AMOUNT =  1000
ARE THEY CORRECT (Y/N) ?Y

DEBIT ENTRY #  4
ACCOUNT NUMBER ?1
AMOUNT ?100

ACCOUNT #  1    NAME - CASH     AMOUNT =  100
ARE THEY CORRECT (Y/N) ?Y

CREDIT ENTRY #  4
ACCOUNT NUMBER ?16
AMOUNT ?100

ACCOUNT #  16   NAME - EQUIPMENT     AMOUNT =  100
ARE THEY CORRECT (Y/N) ?Y

DEBIT ENTRY #  5
ACCOUNT NUMBER ?15
AMOUNT ?1200

ACCOUNT #  15   NAME - EQUIPMENT     AMOUNT =  1200
ARE THEY CORRECT (Y/N) ?Y

CREDIT ENTRY #  5
ACCOUNT NUMBER ?2
AMOUNT ?1200

ACCOUNT #  2    NAME - CASH     AMOUNT =  1200
ARE THEY CORRECT (Y/N) ?Y


STUDENT NAME - LARRY PAGE
EXERCISE - 4-1
DATE - OCTOBER 12, 1974
```

ALLISON'S BICYCLE REPAIR

JOURNAL OF FINANCIAL TRANSACTIONS

SEPTEMBER 30, 1974

NAME OF ACCOUNT	DEBIT	CREDIT
CASH	5600	
CAPITAL		5600
SUPPLIES	325	
CASH		325
EQUIPMENT	1000	
ACCOUNTS PAYABLE		1000
CASH	100	
EQUIPMENT		100
EQUIPMENT	1200	
CASH		1200
TOTALS FOR THIS DATE	8225	8225

```
##### YOUR JOURNAL BALANCES #####

WHEN YOU ARE READY FOR THE 'T ACCOUNTS', TYPE GO ?GO
```

ALLISON'S BICYCLE REPAIR

DEBITS AND CREDITS BY ACCOUNT

SEPTEMBER 30, 1974

CASH

5600	I	
100	I	
	I	325
	I	1200

SUPPLIES

325	I	

EQUIPMENT

1000	I	
1200	I	
	I	100

ACCOUNTS PAYABLE

	I	1000

CAPITAL

	I	5600

WHEN YOU ARE READY FOR THE BALANCE SHEET, TYPE GO ?GO

ALLISON'S BICYCLE REPAIR

BALANCE SHEET

SEPTEMBER 30, 1974

ASSETS

CASH	4175
SUPPLIES	325
EQUIPMENT	2100
TOTAL	6600

LIABILITIES

ACCOUNTS PAYABLE	1000
TOTAL	1000

CAPITAL

CAPITAL	5600
TOTAL	5600
TOTAL LIABILITIES AND CAPITAL	6600

```
##### CONGRATLATIONS - PROBLEM #  1      IS TOTALLY CORRECT #####

DO YOU WISH TO PROCESS ANOTHER SET OF DATA (Y/N) ?Y
ATG ? SELECTION PROGRAM
PLEASE TELL ME WHICH PROGRAM NUMBER (3-13) YOU WISH TO USE ?11
THANKYOU, YOU WILL BE USING PROGRAM PAY11


COMPUTER ORIENTED ACCOUNTING

STUDENT NAME PLEASE ?LARRY PAGE
DATE PLEASE ?OCTOBER 12, 1974
EXERCISE X-X PLEASE ?6-1

TRANSACTION DATA

COMPANY NAME ?MOORE'S HARDWARE STORE
DATE OF ACCOUNTING PERIOD ?MARCH 7, 1974
WHICH PROBLEM IS THIS ?1

HOW MANY EMPLOYEES DO YOU HAVE ?8

EMPLOYEE # ?1
# EXEMPTIONS ?0
# HOURS ?38
RATE ?2.15
INSURANCE ?1.10
# BONDS ?0

EMPLOYEE # ?2
# EXEMPTIONS ?1
# HOURS ?41
RATE ?2.40
INSURANCE ?.9
# BONDS ?1

EMPLOYEE # ?3
# EXEMPTIONS ?1
# HOURS ?40
RATE ?1.95
INSURANCE ?1.15
# BONDS ?0

EMPLOYEE # ?4
# EXEMPTIONS ?2
# HOURS ?35
RATE ?3
INSURANCE ?.8
# BONDS ?2

EMPLOYEE # ?5
# EXEMPTIONS ?0
# HOURS ?40
RATE ?2.6
INSURANCE ?.65
# BONDS ?0

EMPLOYEE # ?6
# EXEMPTIONS ?3
# HOURS ?44
RATE ?2.75
INSURANCE ?1
# BONDS ?1

EMPLOYEE # ?7
# EXEMPTIONS ?1
# HOURS ?40
RATE ?3.25
INSURANCE ?.70
# BONDS ?1

EMPLOYEE # ?8
# EXEMPTIONS ?2
# HOURS ?40
RATE ?4.5
INSURANCE ?1.2
# BONDS ?2
```

STUDENT NAME - LARRY PAGE
EXERCISE - 6-1
DATE - OCTOBER 12, 1974

MOORE'S HARDWARE STORE
PAYROLL REGISTER
FOR WEEK ENDING MARCH 7, 1974

EMP. NO.	NO. OF EXEM.	NO. OF HOURS	PAY RATE	TOTAL EARNINGS	TOTAL DED.	NET PAY
1	0	38	2.15	81.7	17.28	64.42
2	1	41	2.4	99.6	22.36	77.24
3	1	40	1.95	78	14.57	63.43
4	2	35	3	105	25.06	79.94
5	0	40	2.6	104	21.24	82.76
6	3	44	2.75	126.5	23.75	102.75
7	1	40	3.25	130	28.17	101.83
8	2	40	4.5	180	40.31	139.69
TOTALS				904.8	192.74	712.06

TYPE GO FOR DEDUCTION REGISTER ?GO

	DEDUCTIONS				
EMP. NO.	INCOME TAX	FICA TAX	INSUR.	BONDS	TOTAL
1	11.44	4.74	1.1	0	17.28
2	11.93	5.78	.9	3.75	22.36
3	8.9	4.52	1.15	0	14.57
4	10.67	6.09	.8	7.5	25.06
5	14.56	6.03	.65	0	21.24
6	11.66	7.34	1	3.75	23.75
7	16.18	7.54	.7	3.75	28.17
8	21.17	10.44	1.2	7.5	40.31
TOTALS	106.51	52.48	7.5	26.25	192.74

***** VERY GOOD - YOUR TOTALS MATCH MINE *****

DO YOU WISH TO
1 - DO ANOTHER PROBLEM FROM THIS CHAPTER
2 - DO A PROBLEM FROM ANOTHER CHAPTER
3 - STOP NOW
?3

DONE

BNKSIM

TITLE: SIMULATES ONE YEAR'S DEPOSIT AND WITHDRAWAL ACTIVITIES OF A SMALL BANK 36713

DESCRIPTION:

This program simulates one year's deposit and withdrawal activities of a small bank. It is assumed that the probability for deposits and withdrawals are normally distributed.

INSTRUCTIONS:

In this program you have a choice of the type of simulation to be run. By entering a 1 all balances will be started at $100. In this manner the user can easily see the effects on the account balances from month to month. By entering a 2 larger random numbers are set for beginning balances.

In addition, the user must also select values for the following:

- the number of customers used in the simulation
- the yearly interest rate (in decimal form)
- the probability of a customer entering the bank during one month. The bank is open 20 days per month, thus 2 days of of 20 would be a probability of .10.
- the standard deviation of the transactions in dollars
- the probability that a withdrawal is made when a customer enters the bank.

These questions are all asked at the beginning of the program's execution.

A maximum of 50 customers may be used in the simulation.

ACKNOWLEDGEMENTS: Babson College
Babson Park, Massachusetts

```
RUN

RUN
BNKSIM

TYPE 'RUN-9100' FOR INSTRUCTIONS

IN THIS PROGRAM YOU HAVE YOUR CHOICE OF THE TYPE OF DATA TO USE.
BY ENTERING THE NUMBER  1  ,THE COMPUTER WILL BEGIN ALL
BALANCES AT $100. IN THIS MANNER THE USER CAN SEE THE
EFFECTS MUCH EASIER ON THE ACCOUNT BALANCES FROM MONTH TO MONTH.

BY ENTERING THE NUMBER  2  , THE COMPUTER WILL SELECT LARGER
RANDOM NUMBERS FOR BEGINNING BALANCES.

WHICH TYPE DO YOU WANT TO USE?2
HOW MANY CUSTOMERS DO YOU WISH TO USE IN THIS SIMULATION(LIMIT--
--50-- FOR STORAGE PURPOSES)?10

WHAT IS THE YEARLY INTEREST OF THIS BANK(IN DECIMAL FORM)?0.05

WHAT IS THE PROBABILITY OF A CUSTOMER ENTERING THE BANK DURING
ONE MONTH?  THE BANK IS OPEN 20 DAYS PER MONTH.(E.G.,2 DAYS OUT
OF 20 = .10 PROBABILITY)?0.10

WHAT IS THE MEAN TRANSACTION FOR EACH PERSON ENTERING--IN
DOLLARS--ASSUMING ALL DEPOSITS AND WITHDRAWALS HAVE THE SAME
MEAN?100

WHAT IS THE STANDARD DEVIATION--IN DOLLARS?15

WHAT IS THE PROBABILITY THAT, WHEN A  CUSTOMER ENTERS THE
BANK, HE WILL WITHDRAW MONEY?0.50


**PROBLEM: TO SIMULATE BANK ACTIVITIES USING 10     CUSTOMERS,
WITH THE BANK HAVING A .05          YEARLY RATE.
P(WITHDRAWAL/ENTRY INTO BANK) IS .5          WITH THE MEAN TRANSACTION
BEING $ 100   AND THE STANDARD DEVIATION BEING $ 15


$ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $


          THE NUMBERS TO BE USED AS BEGINNING BALANCES FOR THE
                              ACCOUNTS ARE


CUSTOMER        BLNCE                   CUSTOMER        BALANCE
 1              629.432                    6              796.617
 2              325.555                    7              1040.25
 3              429.078                    8              189.469
 4              406.689                    9              196.894
 5              637.845                    10             745.32

TOTAL BEGINNING BALANCES 5397.15

                                MONTH 1
CUSTOMER        BALANCE                 CUSTOMER        BALANCE
 1              949.58                     6              726.47
 2              24.88                      7              1035.97
 3              396.45                     8              269.51
 4              406.69                     9              209.14
 5              637.85                     10             742.78

TOTAL 5399.32

                                MONTH 2
CUSTOMER        BALANCE                 CUSTOMER        BALANCE
 1              1161.38                    6              524.7
 2              113.98                     7              1007.39
 3              543.94                     8              474.74
 4              299.68                     9              293.99
 5              637.85                     10             831.97

TOTAL 5889.62
```

QUARTER 1

CUSTOMER	BALANCE	INTEREST
1	1289.93	7.8679
2	0	0
3	645.31	4.95567
4	303.43	3.74604
5	679.93	7.14532
6	647.71	6.55871
7	878.69	10.848
8	380.46	2.36836
9	305.81	2.46117
10	642.53	7.93248

TOTAL IN BANK 5773.81
TOTAL CUMULATIVE INTEREST 53.8836

MONTH 4

CUSTOMER	BALANCE	CUSTOMER	BALANCE
1	1289.93	6	960.08
2	0	7	787.13
3	413.24	8	380.46
4	204.12	9	486.65
5	679.93	10	539.63

TOTAL 5741.17

MONTH 5

CUSTOMER	BALANCE	CUSTOMER	BALANCE
1	1192.65	6	752.53
2	91.53	7	699.73
3	610.31	8	380.46
4	90.57	9	783.44
5	755.72	10	736.84

TOTAL 6093.76

QUARTER 2

CUSTOMER	BALANCE	INTEREST
1	1321.59	14.9081
2	78.7	0
3	512.37	5.16553
4	126.71	1.13211
5	864.88	8.49914
6	664.01	7.04137
7	603.9	7.4556
8	282.29	3.48507
9	761.07	3.82261
10	707.87	6.74539

TOTAL IN BANK 5923.39
TOTAL CUMULATIVE INTEREST 112.139

MONTH 7

CUSTOMER	BALANCE	CUSTOMER	BALANCE
1	1022	6	953.9
2	78.7	7	369.5
3	405.49	8	269.66
4	398.83	9	856.74
5	901.81	10	510.66

TOTAL 5767.3

MONTH 8

CUSTOMER	BALANCE	CUSTOMER	BALANCE
1	925.63	6	1026.08
2	388.39	7	369.5
3	368.57	8	359.22
4	596.51	9	976.52
5	940.46	10	510.66

TOTAL 6461.55

QUARTER 3

CUSTOMER	BALANCE	INTEREST
1	937.04	11.4125
2	279.59	0
3	502.71	3.39219
4	483.6	1.58393
5	949.36	8.89901
6	828.02	8.3001
7	694.61	4.6188
8	559.76	3.37072
9	890.04	9.51334
10	619.98	6.3833

TOTAL IN BANK 6744.71
TOTAL CUMULATIVE INTEREST 169.612

MONTH 10

CUSTOMER	BALANCE	CUSTOMER	BALANCE
1	1149.56	6	848.08
2	363.85	7	686.82
3	617.42	8	683.33
4	483.6	9	890.04
5	772.15	10	715.23

TOTAL 7210.1

MONTH 11

CUSTOMER	BALANCE	CUSTOMER	BALANCE
1	1264.51	6	1321.69
2	556.98	7	584.64
3	650.09	8	678.07
4	483.6	9	889.63
5	877.34	10	690.63

TOTAL 7997.18

QUARTER 4

CUSTOMER	BALANCE	INTEREST
1	1441.84	11.713
2	555.34	3.49487
3	626.3	6.28392
4	543.37	5.19864
5	886.33	9.49642
6	1453.22	10.3502
7	607.74	6.19956
8	775.65	6.99701
9	791.48	8.70058
10	798.11	7.74975

TOTAL IN BANK 8479.37
TOTAL CUMULATIVE INTEREST 245.796

THE FINAL ACCOUNT BALANCES FOR THE YEAR ARE

CUSTOMER	BALANCE	CUSTOMER	BALANCE
1	1441.84	6	1453.22
2	555.34	7	607.74
3	626.3	8	775.65
4	543.37	9	791.48
5	886.33	10	798.11

TOTAL 8479.37

DONE

TITLE:

CASES IN COMPUTER AND MODEL ASSISTED MARKETING: PLANNING

CASE1
36790

DESCRIPTION:

There are five programs in this package: ADBUDG, NIK1, NIK2, PLAN and MAXIMA.

ADBUDG presents Castle Coffee Company cases. Castle's share of market had slipped badly during the past decade, although brand share had recently stabilized. A major concern of the advertising manager was the fact that the increased advertising budget he had obtained the previous year had been cut back in mid year because of management's dissatisfaction with the results. In addition, it seemed vital to begin to increase Castle's share so as not to lose distribution.

The Advertising Manager of Castle Coffee is now faced with the problem of preparing and justifying an advertising budget for the coming fiscal year.

After the painful experience of the previous year's advertising budget cutback, the Advertising Manager is contemplating the use of an abridged version of J.D.C. Little, "Models and Managers: The Concept of a Decision Calculus," Management Science: Applications, (April 1970.) The case provides some baseline judgements from Castle's Advertising Manager and presents the ADBUDG II model and Little's concept of a "decision calculus".

Continued on following page.

INSTRUCTIONS:

Complete instructions for use of this material is found in "Cases in Computer and Model Assisted Marketing: Vol. I Planning, by George S. Day, Gerald J. Eskin, David B. Montgomery and Charles B. Weinberg. For information write:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Business School Marketing Courses

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

DESCRIPTION continued

NIK1 Nikoll Electronics, a multi-divisional producer of electronic equipment, has developed a relatively simple competitive bidding model which provides their management with a tool to examine the likelihood of winning and the expected payoffs from alternative bids in bidding situations. The model allows for intangibles as well as competitive advantage (disadvantage).

An opportunity to use the model in a concrete bidding situation occurs when Nikoll has the opportunity to bid on several options on a large oscillator contract. The contract is quite important to Nikoll since it represents a substantial amount of business and the opportunity to gain and hold leadership for this type of product.

NIK2 In this case the Nikoll Electronics Company modifies its bidding model to better reflect the oscillator bidding situation. The revised model considers the fact that competitor's bids on various options might be related. The model also considers the impact of winning various options on overhead billing arrangements on government contracts.

PLAN The case presents a situation in which a computer based macro planning model was proposed as a way of doing strategic planning for two lines of grocery products. From a product point of view the case can be considered a life cycle problem where one product has matured while the other still has growth potential. The implications of this become clear as the model is used to "optimize" sales and profits. From a technical point of view the case raises issues concerning appropriate factors to consider in the planning process and how to represent these in a quantitative way. The model uses "response coefficients" to deal with the "best" strategy question. This raises the issue of sources of information (i.e., experiments, use of historical data, marketing information systems, etc.).

MAXIMA Maxim Case

General Foods must develop a marketing plan for a new product - freeze dried coffee. Based on an extensive set of data on consumer and product research, decisions on product positioning, advertising, price, promotion, etc. must be made. Alternatively, General Foods can decide to stop development of the project if it does not appear to be sufficiently profitable.

MAXIMA is a computer program designed to help the marketing decision maker analyze the profit potential of a number of alternative new product marketing programs. It is a decision-making aid that compares alternatives based on net present value. The program is in two parts. The first section uses a simple 3-equation model (the Ayer model, discussed in H.J. Claycamp and L.E. Liddy, "Prediction of New Product Performance: An Analytical Approach", Journal of Marketing Research, November 1969) to predict the first year market share as a function of the marketing mix. The second section uses this, plus cost data, to prepare profit-and-loss and cash-flow statements. Sub models help to perform sensitivity analysis on the marketing programs.

TITLE:

CASES IN COMPUTER AND MODEL ASSISTED MARKETING: CASE2
DATA ANALYSIS 36841

DESCRIPTION:

There are 8 programs and 1 file in this package: FALLON, FALFIL (file), NEWA, NEWB, NEWC1, NEWC2, NEWD, HINB1 and HINB2.

FALLON
FALFIL
(FILE)

The Fallon Company programs present 2 cases. The (A) case presents sales and advertising expenditure data for thirty-eight geographic areas. The problem is how to extract from this data information on the responsiveness of the market to advertising expenditures. The (B) case presents a special purpose regression program for analyzing this problem. (Note: An instructor could use any canned regression program for this assignment.) This is an excellent case to use to introduce regression. The authors would recommend that it be used prior to the Newfood (B) assignment in order to prepare the students to make a better analysis of that case. The (B) case includes a brief technical appendix on regression analysis.

NEWFOOD. The Newfood series covers an integrated series of problems encountered in the early planning, test marketing, and the final planning prior to national introduction of a new specialty product. The (A) case considers the issue of whether or not to test market at all. The (B) and (C) cases present some actual test market results that require analysis and interpretation. In (B) outcomes of a controlled experiment (involving price, location and advertising level) are presented. In (C) summaries of consumer panel data are presented that should aid in forecasting eventual sales levels. The (D) case is an integrative exercise requiring use of the research information (from the (B) and (C) cases) and prior knowledge (from the (A) case). This information should be exploited to develop a final plan for the national introduction of the product.

Continued on following page.

INSTRUCTIONS:

Complete instructions for use of this material is found in "Cases in Computer and Model Assisted Marketing: Vol. II Data Analysis", by Professors Gerald J. Eskin and David B. Montgomery. For information write:

Hewlett-Packard Computer Curriculum Project
Scientific Press
1629 Channing Ave.
Palo Alto, California 94303

SPECIAL CONSIDERATIONS:

FOR INSTRUCTIONAL PURPOSES
Suitable Courses: Business School Marketing Courses

ACKNOWLEDGEMENTS:

Graduate School of Business
Stanford University

DESCRIPTION continued

NEWA Part I is a problem statement and Part II gives a solution and related computer program. The situation involves a new product pre test market situation in which a GO-NOGO decision is required or alternatively a decision to test market can be made. This raises the value of information question. Part I provides material to set up a formal decision analysis model. Many issues arise from the process including:

- whose priors to use
- appropriateness of the expected value criteria
- length of planning process and discounting
- can the problem be "completely" modeled

In the Part II case the actual solution used is presented. It involves many simplifying assumptions and is only a partial solution. This leads to discussion of the role of simplifying assumptions and partial solution and the usefulness of complex models. With the computer program many of the key assumptions can be tested for sensitivity.

NEWB Outcomes of a controlled store audit experiment involving a factorial arrangement of price (3 levels), advertising (2 levels) and location within store (2 levels) are given and a number of regression runs on the data is provided to aid in interpretation. A computer program to perform further regression analysis is provided.

The case provides an opportunity to use correlation and regression to help understand data as opposed to the more usual forecasting use. Using these techniques it is possible to see to what extent the experiment is out of control, ways of adjusting for this and the magnitude of various experimental effects.

The case raises many other issues such as:

- appropriate measures of advertising inputs
- treatment of experimental effects over time
- role of interactions
- the use of dummy variables
- specification errors in regression models.

NEWC1 Part I presents various summary measures that come out of consumer panel data and sets up the problem of forecasting new product sales for products that may have a short life cycle.

NEWC2 Part II presents several forecasting techniques, resulting forecasts, and computer programs for this purpose. One model is a simulation model to assess uncertainty in a sales forecast based on component uncertainty in variables such as Trial and Repeat. The second model is a dynamic micro forecasting model based on time between purchase and repurchase rate data.

NEWD Here a translation must be made from the various test situations to a national introduction. All previously developed knowledge about the product must be integrated into a general plan. A planning model is presented and the student is encouraged to reuse previously introduced programs to reevaluate the situation based on new environmental information.

HINB1 The (A) case describes a situation in which a cake manufacturer who has just introduced a new product some 6 months ago is faced with new competitive entries that are similar but not the same as his product. The firm must decide if it should compete directly by introducing a product like the competitive one and/or dropping its previous entry which is doing only moderately well. These decisions must be made before share data are available on the market performance of the competitive products. The only available market research data involve protocols obtained from group interviews covering consumer needs in the cake mix area.

HINB2 The case provides an opportunity for students to construct flow charts of probable consumer behaviour as a first step in understanding need segments in this market. The (B) case discusses the forecasting technique used to estimate the size of these segments. It involves the use of a micro behavioral simulation model. A flow chart, trace runs, computer program, forecasts and some validation data are included.

TITLE: STANFORD PORTFOLIO MANAGEMENT GAME

GSPMG
36502

DESCRIPTION:

The Stanford Portfolio Management System is made up of a set of programs and files for use on the Graduate School of Business' Hewlett-Packard 2000C computer. It allows students in the second-year MBA course on Investments to make transactions with an "automated broker" and manage portfolios. The system is an outgrowth of earlier work reported in Technical Report No. 4, "Stanford Portfolio Management Game," by John G. McDonald and Donald C. Baron. The present version differs somewhat from the one described in that report, but the basic philosophy is the same.

GSPMG consists of 7 programs: GBRKR, GQUOTE, GPMS1, GPMS2, GPMS3, GPMS4, GPMS5.

INSTRUCTIONS:

The use of this program is described in GSB #13, "The Stanford Portfolio Management System" by William F. Sharpe, which comprises this documentation.

Accounts Utilized

Three accounts are normally utilized for the system. All programs are maintained in the public library (account A000) and referenced by preceding the program name with a dollar sign. Some of the programs contain a mask for encoding and decoding information written on file ACCTS (see below). These programs are protected -- they may be used but not listed. This makes it impossible for a user to alter the contents of file ACCTS directly; he must use the authorized programs.

The prices and dividends for securities covered in the system are maintained on file SPRDIV. This is usually maintained in account C100 (the course library account). The instructor's assistant typically updates the file once each day during the quarter. The file may be read (but not written) from any account between C101 and C199 by preceding the name with an asterisk.

Instructions continued on next page.

SPECIAL CONSIDERATIONS:

The specific documentation listed here which references account numbers etc., has been left intact to provide a model for other users. Attempts to generalize this material would lose the integrity of the contributor's scheme.

ACKNOWLEDGEMENTS: Graduate School of Business
Stanford University

Students in the course generally enter transactions, get reports, etc., using the instructor's course account. This will be an account with a number between C101 and C199 assigned to the instructor for such use. Students are expected to use the account only for this purpose. The composition of each team's portfolio is maintained on a file named ACCTS in this account. Students access this file and alter it with program $GBRKR. The instructor's assistant may also access the file using programs of his own or those maintained in the public library to prepare summary reports, etc.

FILE ACCTS

The composition of each team's portfolio is maintained on this file. Team 1's portfolio is on records 1 and 2, team 2's portfolio on records 3 and 4, etc. For each team, the following information is stored (in the order shown):

password
time of last update
  - year
  - day
  - hour
  - minute
amount of cash
for each security covered
  - number of shares held (positive if long, negative if short)

Before students may use the system, the instructor's assistant must OPEN this file, then initialize the information with program $GPMS2. The initialization process includes the assignment of a password for each team. Subsequently, no student can access or alter a team's portfolio unless he gives the precise password entered earlier by the instructor's assistant.

File ACCTS is read and written through a mask, so every piece of information must be encoded and decoded. The mask is entered via the initialization of variable M$ in programs $GBRKR and $GPMS2, both of which are protected and hence cannot be listed by the user. The mask must also be entered by the user of program $GPMS5.

FILE SPRDIV

This file, usually maintained on account C100, includes current data on all securities considered "eligible" for the portfolio management system. For each eligible security, the file contains:

- the ticker symbol (in a coded format)
- the price per share
- the most recent dividend paid per share
- the time at which the most recent dividend was posted to the file

In addition, the file includes:

- the number of eligible securities
- the time the information on the file was last updated

Each security's ticker symbol is coded into a numeric equivalent. The symbol is first converted to a four-character symbol (with trailing blanks to the right, as needed). Each character is converted to a numeric equivalent with "A" = 1, "B" = 2 ... "Z" = 26, and blank = 27. Let S_1 represent the numeric equivalent of the first (left-most) character, S_2 the equivalent of the second, etc. Then the code for the entire ticker symbol is:

$$S_1*30^3 + S_2*30^2 + S_3*30 + S_4$$

This coding procedure (and/or an inverse decoding procedure) is used in other programs in the Portfolio Management System.

The time at which a dividend was posted to the file is also entered in coded form. Letting T_3 = the year (71 = 1971), T_2 = the day of the year, T_1 = the hour of the day, and T_0 = the minute of the hour, the code is:

$$[(T_3 - 71)*365] + [T_1/24] + [T_0/(24*60)]$$

This expresses time as the number of days since the beginning of 1971. A similar procedure is used in other programs in the system.

The format of the file is as follows:

- year of last update
- day of last update
- hour of last update
- minute of last update
- number of securities on eligible list

For each security:

- code for ticker symbol
- price per share
- most recent dividend per share
- code for time when last dividend posted

Before any other programs are used, this file must be CREATED, then initialized using program GPMS1.

PROGRAM GBRKR

This program is used to enter transactions for a team's account and to obtain reports on its status. The account is maintained in file ACCTS in the instructor's course account. Security prices and dividends are obtained by the program from file SPRDIV in the course library (account C100). Program $GBRKR is protected so the user is unable to alter the contents of file ACCTS except via this program.

The program begins by asking:

TEAM NUMBER?

The user responds with the appropriate number.

The program then asks:

PASSWORD?

The user must give the exact password entered previously by the instructor for his team. If there is any discrepancy, the program terminates. Otherwise, the program continues by asking:

DO YOU WANT TO ENTER A TRANSACTION, GET A REPORT, OR QUIT?

The user responds with:

T (or TRANSACTION)

R (or REPORT)

Q (or QUIT)

The REPORT option provides a portfolio status report as of the moment of inquiry. After a summary of the cash position, etc., the program asks:

HOLDINGS?

If a list of holdings is desired, the user responds YES (or simply Y). If not, he responds NO (or simply N).

If the TRANSACTION option is selected, the program asks:

STOCK?

The user responds with the ticker symbol of the security in question. The program next asks:

BUY OR SELL?

The user responds with B (or BUY) or S (or SELL), depending on the desired action. The program then asks:

NUMBER OF SHARES?

And the user responds with the number desired.

If the transaction is allowed, the program will indicate the brokerage fee in dollars, then ask:

O.K.?

If the transaction is acceptable, the user responds Y (or YES), the the program will indicate:

CONFIRMED

If the transaction is not acceptable, the user responds N (or NO), and the program will indicate:

REQUEST CANCELLED

If the QUIT option is selected, the program will terminate after updating the ACCTS file.

PROCEDURES

The program maintains an up-to-the-minute valuation of the user's account. All long positions (positive holdings) are valued at the current market prices on file SPRDIV; the total is reported as LONG POSITION AT MARKET. Similarly, all short positions (negative holdings) are valued at current market prices and the total reported as SHORT POSITION AT MARKET. The figure reported for CASH ON HAND indicates liquid interest-earning assets if the value is positive; if the value is negative, it indicates debt owed to the broker. NET WORTH is calculated as follows:

NET WORTH = CASH ON HAND + LONG POSITION AT MARKET - SHORT POSITION AT MARKET

The status of the account depends on its current margin, calculated as follows:

$$\text{CURRENT MARGIN} = \frac{\text{NET WORTH}}{\text{LONG POSITION AT MARKET} + \text{SHORT POSITION AT MARKET}}$$

Whenever the current margin for the account exceeds .70, any type of transaction is allowed unless it will reduce the current margin to a value below .70. In the latter case, a message will be printed and the transaction request will be denied by the program.

Whenever the current margin for the account falls below .70, the account is restricted. Only transactions that will increase the current margin are allowed. Any transaction not meeting this requirement is rejected by the program.

The program adds interest to the amount of cash on hand at an annual rate of 6%, compounded continuously. If the cash on hand is positive, it will be increased. If the cash on hand is negative, its absolute value will be increased (i.e., the amount of debt will be increased). For purpose of interest calculations, the cash on hand is reduced by the value of the short positions (e.g., no interest is paid on the proceeds from a short sale). The program automatically adds interest any time the user requests a report -- (i.e., the appropriate amount to cover the time period since the last report is added).

Dividends are also added to or subtracted from the account. When the user requests the first report since a dividend was posted to the SPRDIV file, the program automatically (1) adds dividends to his cash position for long positions and (2) subtracts them for short positions.

Brokerage charges are those charged by the New York Stock Exchange in April, 1972. A sample run follows.

```
GET-GBRKR
RUN
GBRKR

TEAM NUMBER?1
PASSWORD?BUY LOW, SELL HIGH
DO YOU WANT TO ENTER A TRANSACTION, GET A REPORT,  OR QUIT?T
STOCK?IBM
BUY OR SELL?BUY
NUMBER OF SHARES?200
BROKERAGE FEE IS  130
O.K.?Y
CONFIRMED.

DO YOU WANT TO ENTER A TRANSACTION, GET A REPORT,  OR QUIT?R
```

```
                    PORTFOLIO STATUS REPORT
                     AUG 21    1972    12: 1 A.M.


CASH ON HAND:                      31160.02
LONG POSITION AT MARKET:           69000.00
SHORT POSITION AT MARKET:              0.00
NET WORTH:                        100160.03
CURRENT MARGIN:                        1.452


HOLDINGS?Y

STOCK     SHARES          L/S       PRICE      TOTAL VALUE
-----     ------          ---       -----      -----------
IBM          200          LONG      345.000        69000.00


DO YOU WANT TO ENTER A TRANSACTION, GET A REPORT, OR QUIT?Q

DONE
```

PROGRAM GQUOTE

This program may be used to obtain a quotation from the list of security prices maintained on file SPRDIV on account C100.

The user may type the ticker symbol for the stock in which he is interested. The program then prints its current price as listed on file SPRDIV. If the symbol is not on the eligible list, an appropriate message is printed. In either event, the user is then asked for another symbol.

At any time, the user may respond to the request SYMBOL? with DONE. This will cause termination of the program.

At any time, the user may respond to the request SYMBOL? with ALL. The program will list the ticker symbol and current price of every security on the eligible list, then terminate.

A sample run follows.

```
RUN
GQUOTE

WHEN ASKED, TYPE TICKER SYMBOL, 'ALL' OR 'DONE'.
SYMBOL?WFG
PRICE:       45.750

SYMBOL?ALL

T           46.250
GM          37.000
HWP         77.000
IBM        345.000
WFG         45.750

DONE
```

PROGRAM $GPMS1

This program is used to set up file SPRDIV in account C100 for use in the Stanford Portfolio Management System. The user first indicates the number of securities on the "eligible" list, then their ticker symbols (preferably, but not necessarily, in alphabetic order). After each symbol is input, the program reprints the information and then asks "OK?". If the reply is Y, the program will continue. If the reply is N, the program will ask for the symbol again.

When all symbols have been input and verified, the program will set up file SPRDIV in the format described above. For each security, price, dividend and time of entry of the last dividend will be set to zero. Any previous contents of the file will be lost.

Before this program is run, file SPRDIV must be opened. The number of records must be at least:

$$\frac{5 + 4N}{128}$$

where N = the number of eligible securities, and the formula is assumed to be rounded up to the nearest integer.

Limitations imposed by file ACCTS require:

$$N < 251 + \frac{P}{4}$$

Where P = length of the longest team password.

A sample run follows.

```
RUN
GPMS1

NUMBER OF SECURITIES ON THE ELIGIBLE LIST?5
TICKER SYMBOLS --
 1     ?T
T
OK?Y
 2     ?GN
GN
OK?N
 2     ?GM
GM
OK?Y
 3     ?HWP
HWP
OK?Y
 4     ?IBM
IBM
OK?Y
 5     ?WFG
WFG
OK?Y

DONE
```

PROGRAM GPMS2

This program is used by the instructor's assistant to open the accounts of the teams. Before the program is run, a file named ACCTS should be opened with twice as many records as there are teams. The program will request the password for each team, terminating when the user responds YES to the inquiry "DONE?". This program cannot be run before GPMS1.

A sample run follows.

```
GET-GPMS2
RUN
GPMS2

DONE?N
TEAM  1      -- PASSWORD?BUY LOW, SELL HIGH

DONE?N
TEAM  2      -- PASSWORD?EFFICIENT MARKET

DONE?Y

DONE
```

PROGRAM GPMS3

This program is used to update the dividends in file SPRDIV. It can only be used in the account in which file SPRDIV is maintained (usually account C100). Dividends are normally posted within a day of the time at which the stock goes ex-dividend. In general, the dividend should be entered at the same time as the last price prior to the ex-dividend price is entered.

The program asks for the ticker symbol(s) of securities for which dividends are to be entered. The Portfolio Management System does not provide for stock dividends or splits. The recommended procedure is to assume that any stock dividend or split is converted into cash. In other words, the market value is simply entered as a cash dividend.

When all changes have been entered, the data are entered into file SPRDIV. Both the dividend and the time at which it was entered into the file are recorded. This latter information is used when portfolios are updated to be certain that dividends are credited only once to an account.

```
GET-GPMS3
RUN
GPMS3

SYMBOL OR 'DONE'?IBM
DIVIDEND?1.45
SYMBOL OR 'DONE'?DONE

DONE
```

PROGRAM GPMS4

This program, used to update file SPRDIV, must be used on the account on which SPRDIV is stored (usually account C100). The file is normally updated daily, using closing prices posted as soon as possible after the market has closed.

The user may enter prices for selected securities by indicating the ticker symbol of each. If this option is chosen, the program prints the old price and requests the new one. At any time, the user may respond to the request for a ticker symbol with ALL. The program will then proceed through the eligible list in order, giving each ticker symbol and the old price, and requesting the new one.

When the user is finished, he should respond DONE when the program requests a ticker symbol. The revised information will then be entered on file SPRDIV and the program will terminate.

A sample run follows.

```
RUN
GPMS4


TICKER SYMBOL (OR 'ALL' OR 'DONE')?WFG
OLD PRICE Ø
NEW PRICE?45.5

TICKER SYMBOL (OR 'ALL' OR 'DONE')?ALL
T     Ø
PRICE?46.25

GM    Ø
PRICE?37

HWP   Ø
PRICE?77

IBM   Ø
PRICE?345

WFG   45.5
PRICE?45.75


TICKER SYMBOL (OR 'ALL' OR 'DONE')?DONE

DONE
```

PROGRAM GPMS5

This program is used by the instructor to obtain a summary of the teams' current holdings. The program must be run in the account containing file ACCTS (usually the instructor's course account).

The program begins by asking:

CODE FOR FILE?

The user must respond with the code used to read and write file ACCTS. This is the code used in protected programs $GBRKR and $GPMS1. If the correct code is not given, the program will not operate correctly.

The program will then ask for the number of teams for which accounts exist on file ACCTS. It will then summarize and print the number of shares long and short for each stock. Only those stocks with non-zero positions will be shown.

A sample run follows.

```
GET-GPMS5
RUN
GPMS5

CODE FOR FILE?X3MLB/
NUMBER OF TEAMS?2


SECURITY  LONG   SHORT
--------  ----   -----
  IBM     2ØØ      Ø

DONE
```

LABOR
36233

TITLE: LABOR/MANAGEMENT BARGAINING

DESCRIPTION:

This interactive collective bargaining simulation can be played by one or more groups for several periods. Each group of students will consist of two teams; one team will play the role of management and the other the role of labor. Each team will make decisions on a set of issues and will try to reach an agreement. If no agreement is reached, new decisions are inputted the following week. The computer has the following roles:

- create an economic environment
- play the role of arbitrator, if arbitration is requested by any one team

INSTRUCTIONS:

The data statement in line 30 contains 4 values

```
30 DATA W5, C3, A, B
```

where: W5 tells the computer if the simulation is to work continuously (W5=0) or if it is to stop and a subsequent period be played later(W5=5).

C3 is the number of copies of the printout desired.

A, B must be between 0 and 9. Low values will generate a poor profit and high inflation environment; higher values will generate a better environment.

Currently the simulation is set up such that:
W5=5: the run stops at the end of each period and data are saved.
C3=1: 1 copy is required
A=5:
B=7:

See following pages for a detailed discussion of the theory and additional user procedures.

SPECIAL CONSIDERATIONS:

The only restriction to the number of firms that can play the game is the size of the file STRIKE. 2 sectors are needed per firm. This file must be opened by the user prior to the running of the simulation.

ACKNOWLEDGEMENTS: Francois P. Carlhian
Babson College

DESCRIPTION OF THE ENVIRONMENT

In a hypothetical firm, the labor-management contract is expiring. Labor is dissatisfied with its terms and all efforts made towards Management to improve it have failed. Management claims that the contract is fair and does not want to modify it. Because of the stubborn position of Management, Labor has decided to go on strike.

Management and Labor are provided information concerning:

- the firm
- the last Labor-Management contract
- the economic environment

I. Information Concerning the Firm:

- profit increase: This is the percentage representing profit increase in the firm since the establishment of the last contract. Profit means net profit after taxes.
- productivity increase: Expressed in percent, this figure represents the increase of output per manhour. This productivity is mainly due to new equipment and machinery.
- last wage increase: Amount of hourly wage increase when the last contract was established.
- employment level: The firm's employment when the strike starts. A certain proportion of workers will quit during the strike.
- inventory level: Expressed in dollars, it is the amount of finished goods inventory ready for shipment and stored in warehouses which are not affected by the strike.
- strike fund: Labor has cash reserves which will be utilized to help the workers. It has been decided that every worker on strike will receive $8 a week.
- last year's sales: Value of last year's gross sales expressed in millions of dollars.
- last year's profit: Net profit made after taxes in previous year.
- profit per worker: Dollar value of the net profit divided by the number of workers.

II. Information Concerning the Last Contract:

The Labor-Management contract consists of 9 issues:

- duration: in months
- wage rate: hourly wage rate in dollars
- guaranteed overtime: number of hours a week that a worker can work with an overtime wage rate
- vacation days per year: number of paid vacation days a year
- regular hours a week: number of hours a week worked at regular pay. It is used to compute the week's pay.
- days of sick leave: number of days that a worker is allowed to take (with pay) for sick leave
- bonus and insurance: the firm is paying $250 per year for medical insurance for each worker, and gives a cash bonus every year at Christmas
- number of paid holidays: number of legal holidays: Christmas, Labor Day, Thanksgiving, etc. which are paid
- overtime wage rate: hourly wage rate for overtime

III. General Information on the Economic Environment

- Consumer Price Index Increase (in percent)
- Average Wage Increase in Industry (in percent)
- Rate of Unemployment in Industry (in percent)
- Productivity Increase in Industry (in percent)

In addition to creating an environment, the computer will compute and print out the dollar amount representing the fringe benefits. The two teams are also informed that in view of the coming strike, it has been decided at the last meeting of the board of directors that the company would support an increase of the workers' payroll. The dollar amount indicated is the maximum amount of gross payroll and fringe benefits increase that Management will accept without bargaining at any point of time during the strike. This decision has been made at the top echelon by the board of directors and Management has to enforce it.

DECISIONS AND RESULTS

Once the environment has been described, Management and Labor must reach decisions on the 9 issues involved in the contract. Then the two teams' decisions are typed in and the result of the contract proposal is printed out.

First provided is the cost of the proposed contract due to Labor's conditions and the cost of the proposed contract due to Management's offer. This cost is stated per worker. Therefore, the computer prints out the gross payroll increase, the fringe benefits' increase, and the total increase.

With the help of these figures, the two teams can see how far apart they are, and in which area they should concentrate their efforts in order to reach an agreement.

Then the two teams are given information on the current situation:

- current union membership: Some union members are sometimes not willing to go along with the strike or are not willing to take a loss of income, and quit both their job and the union. Therefore, there is a slow erosion of the union membership that the union leaders must be aware of. If the erosion is too high the Labor will be obliged to give up the strike.
- current strike fund: Labor's strike fund is utilized to distribute $8 a week to each striking worker. This is not a great deal of money, but it helps and has an important psychological effect.
- inventory level: The per worker dollar figure of the current level of inventory is provided. This gives an indication of how long Management can go without any losses in sales.
- unfilled orders: Per dollar figures of losses in sales due to unfilled orders. This dollar figure can go quite high very quickly.
- Management expected cost of one more week of strike: This is the per worker basic cost of the strike for Management. This figure includes all fixed costs, expected cost of rehiring, wasted material, etc.

The overall goal for Labor and Management is to obtain the best deal at the least cost. This is difficult and competition between different groups or "firms" can show large differences. Starting at the second week, the computer will ask if one of the two teams desires arbitration. If this is the case, the computer will act as arbitrator and will decide the final contract. The use of an arbitrator will allow the negotiators to get out of a deadlock or to stop simulation. It is important to note that most of the parameters provided will influence the results of a set of decisions and they should be weighted carefully before a new contract is proposed.

The simulation is designed in such a way that the role of the computer is minimized. Its main function, besides providing an economic environment, is to compute the dollar value of the cost of proposed new contracts. Hence, the user can visualize the dollar impact of his decisions.

If no agreement is reached in a short period of time, pressure to end the strike is put on both Management and Labor. Losses due to unfilled orders and direct cost of the strike will force management to seek a settlement after a few weeks. On the other hand, union membership losses and an empty strike fund will force Labor to a settlement. Of course, the best way to end the strike is through a direct agreement between the two parties involved. The two teams are given the maximum opportunity to settle the strike without the computer's interference. But, if a deadlock develops during the negotiations, or if the strike goes on for too long, the computer will take over and play the role of outside pressure: Board of Directors, strike fund, treasurer, etc. In addition, starting in week 2, there will be an option for either of the two teams to call for arbitration. The rule is that if either Labor or Management wants arbitration, the other party has to submit and accept arbitration. If this is the case the computer

will play the role of arbitrator and will issue the final contract. Because the arbitrator's decision is final, both parties have to accept it, and the simulation is ended.

INSTRUCTIONS FOR USING LABOR

Teacher's Instructions:

Prior to running the simulation, the instructor has to choose a few parameters.

There are two options on how to use the simulation. The first one is to have the simulation go on continuously up to the time an agreement is reached. The second option allows users to play 1 period at a time. The computer retains the necessary data and players can input their decisions for the current period at a later time.

The second parameter to be decided is the number of printout copies desired. There is no limit on that number.

The last thing is to choose the economic environment. It is based on two numbers between 0 and 9. If the values of those numbers are high (e.g., 8 and 9) there will be a good economic environment. On the other hand, if those values are low, they will generate a bad environment -- high inflation, poor profit, low wages, etc.

Those values are to be inserted in line 30 of the program by typing:

```
30 DATA 5,1,5,7
```

Then type:

```
RUN
```

to start the simulation.

5 means that the option chosen is to have the computer stop at the end of each period, saving the data. The user will come back later to play a subsequent period. In order to get the other option of having the simulation go on continuously, the value should be a zero.

1, the second piece of data, indicates that the user wants only 1 copy of the printout.

5 and 7, the third and fourth pieces of data, are the two values that will generate the economic environment.

Student's Instructions:

During the course of the simulation, the computer will ask:

```
ENTER FIRM NUMBER?
```

The firm number identifying the team must be entered.

Then the computer will require the entering of Labor's 9 decisions and Management's 9 decisions on the contract's 9 issues. The first 9 pieces of data (concerning Labor) should be entered separated by commas (see example). The second set of 9 pieces of data must also be entered separated by commas.

If the operator types the wrong information, and if the error is caught before the computer is through typing the results for the period, the simulation can be stopped by pressing the BREAK key. By typing RUN again, the simulation will start at the current period and will give the operator a chance to enter the right data.

HOW TO SET UP THE GAME

The LABOR simulation, written in BASIC consists of one paper tape 4700 words long. After the tape is loaded on the computer a file called STRIKE must be opened by typing:

```
OPEN-STRIKE,20
```

20 is the number of sectors in the file. Each firm needs 2 sectors; therefore, in the above example, up to 10 teams can use the simulation simultaneously.

```
RUN
RUN
LABOR

ENTER FIRM NUMBER?1



            COLLECTIVE BARGINING SIMULATION
            -------------------------------
:::::FIRM 1     :::::COPY # 1


THE LAST LABOR MANAGEMENT CONTRACT IS EXPIRING TONIGHT
 THE UNION IS EXTREMELY DISSATISFIED WITH IT AND HAS DECIDED
TO GO ON
         S
          T
           R
            I
             K
              E



*** INFORMATION CONCERNING :
-----------------------------

THE FIRM (SINCE LAST CONTRACT)        THE LAST CONTRACT

PROFIT INCREASE          % 3          DURATION (MONTHS)          12
PRODUCTIVITY INCREASE    % 5.25       WAGE RATE                $ 2.23
LAST WAGE INCREASE       $ .14        GUARANTEED OVERTIME         3
EMPLOYEMENT LEVEL          328        VACATION DAYS PER YEAR     10
INVENTORY LEVEL          $ 182000.    REGULAR HOURS/WEEK         42
STRIKE FUND              $ 13120      DAYS OF SICK LEAVE          6
LAST YEAR SALES  MILLIONS$ 8          BONUS AND INSURANCE      $ 407
LAST YEAR PROFIT         $ 745500.    # OF PAID HOLIDAYS          3
RATIO: PROFIT /WORKER    $ 2272       OVERTIME WAGE RATE       $ 3.35


GENERAL INFORMATION
-------------------

CONSUMER PRICE INDEX INCREASE                    % 3.75
AVERAGE WAGE INCREASE IN INDUSTRY                % 4.2
RATE OF UNEMPLOYEMENT IN INDUSTRY                % 4.25
PRODUCTIVITY INCREASE IN INDUSTRY                % 4.8


COST OF THE OLD CONTRACT -PER WORKER- :
---------------------------------------

GROSS PAYROLL                $ 9258
FRINGE BENEFITS              $ 1078

TOTAL.............           $ 10336


IN VIEW OF THE COMING STRIKE, IT WAS DECIDED AT THE LAST
MEETING OF THE BOARD OF DIRECTORS THAT THE COMPANY COULD  SUPPORT
AN INCREASE IN THE WORKERS' PAYROLL.
DUE TO THE RELATIVELY IMPORTANT INFLATION RATE,
THE MAXIMUN DOLLAR AMOUNT PROPOSED -PER WORKER-PER YEAR- IS: $ 388



DONE
```

```
RUN
LABOR

ENTER FIRM NUMBER?1



***CONTRACT PROPOSAL: WEEK 1
.....................................................
INPUT LABOR ' S 9 DECISIONS?12,2.4,5,14,40,6,500,7,3.6
INPUT MANAGEMENT 9 DECISIONS?12,2.3,4,10,42,6,450,3,3.45
.....................................................



*****FIRM 1     COPY # 1        WEEK  1



*****BARGINING : CONTRACT PROPOSAL
     ----------------------------

COST OF THE NEW CONTRACT DUE TO LABOR'S CONDITIONS -PER WORKER- :


GROSS PAYROLL INCREASE          $ 560
FRINGE BENEFITS INCREASE        $ 587

TOTAL.............              $ 1147


COST OF THE NEW CONTRACT DUE TO MANAGEMENT'S OFFER -PER WORKER- :


GROSS PAYROLL INCREASE          $ 145
FRINGE BENEFITS INCREASE        $ 228

TOTAL.............              $ 373



***INFORMATION ON THE CURRENT SITUATION :
-----------------------------------------

CURRENT UNION MEMBERSHIP         296            DOWN 10   %
CURRENT STRIKE FUND    ($)       10752          DOWN 18   %

INVENTORY LEVEL -PER WORKER-   $ 35
UNFILLED ORDERS PER WORKER     $ 0

MANAGEMENT EXPECTED COST OF ONE MORE WEEK OF STRIKE       $ 43

THE STRIKE HAS BEEN ON FOR  1    WEEK

                            LABOR            MANAGEMENT

DURATION (MONTHS)             12               12            ***AGREEMENT
WAGE RATE                     2.4              2.3
GUARANTEED OVERTIME           5                4
VACATION DAYS/YEAR            14               10
REGULAR HOURS/WEEK            40               42
DAYS OF RELIEF/YEAR           6                6             ***AGREEMENT
YEARLY BONUS                  500              450
PAID HOLIDAYS                 7                3
OVERTIME RATE                 3.6              3.45



DONE
```

```
RUN
LABOR

ENTER FIRM NUMBER?1



***CONTRACT PROPOSAL: WEEK 2
.....................................................
   ....ARBITRATION ANYONE...?NO
INPUT LABOR ' S 9 DECISIONS?12,2.38,4,12,40,6,480,7,3.6
INPUT MANAGEMENT 9 DECISIONS?12,2.33,5,10,42,6,460,4,3.45
.....................................................



*****FIRM 1     COPY # 1        WEEK  2



*****BARGINING : CONTRACT PROPOSAL
     ------------------------------

COST OF THE NEW CONTRACT DUE TO LABOR'S CONDITIONS -PER WORKER- :


GROSS PAYROLL INCREASE          $ 522
FRINGE BENEFITS INCREASE        $ 366

TOTAL.............              $ 888


COST OF THE NEW CONTRACT DUE TO MANAGEMENT'S OFFER -PER WORKER- :


GROSS PAYROLL INCREASE          $ 206
FRINGE BENEFITS INCREASE        $ 422

TOTAL.............              $ 628



***INFORMATION ON THE CURRENT SITUATION :
-----------------------------------------

CURRENT UNION MEMBERSHIP          264           DOWN 20   %
CURRENT STRIKE FUND   ($)         8640          DOWN 34   %

INVENTORY LEVEL -PER WORKER-   $ 0
UNFILLED ORDERS PER WORKER     $ 486

MANAGEMENT EXPECTED COST OF ONE MORE WEEK OF STRIKE       $ 43

THE STRIKE HAS BEEN ON FOR  2    WEEKS

                            LABOR            MANAGEMENT

DURATION (MONTHS)             12               12            ***AGREEMENT
WAGE RATE                     2.38             2.33
GUARANTEED OVERTIME           5                5             ***AGREEMENT
VACATION DAYS/YEAR            12               10
REGULAR HOURS/WEEK            40               42
DAYS OF RELIEF/YEAR           6                6             ***AGREEMENT
YEARLY BONUS                  480              460
PAID HOLIDAYS                 7                4
OVERTIME RATE                 3.6              3.45



DONE
```

```
RUN
LABOR

ENTER FIRM NUMBER?1



***CONTRACT PROPOSAL: WEEK 3
.....................................................................
   ....ARBITRATION ANYONE...?NO
INPUT LABOR ' S 9 DECISIONS?12,2.38,5,12,40,6,480,7,3.57
INPUT MANAGEMENT 9 DECISIONS?12,2.33,5,10,42,6,460,4,3.50
.....................................................................



*****FIRM 1     COPY # 1        WEEK  3



*****BARGINING : CONTRACT PROPOSAL
     ------------------------------

COST OF THE NEW CONTRACT DUE TO LABOR'S CONDITIONS -PER WORKER- :


GROSS PAYROLL INCREASE          $ 522
FRINGE BENEFITS INCREASE        $ 533

TOTAL.............              $ 1055


COST OF THE NEW CONTRACT DUE TO MANAGEMENT'S OFFER -PER WORKER- :


GROSS PAYROLL INCREASE          $ 206
FRINGE BENEFITS INCREASE        $ 434

TOTAL.............              $ 640



***INFORMATION ON THE CURRENT SITUATION :
-----------------------------------------

CURRENT UNION MEMBERSHIP         232            DOWN 29    %
CURRENT STRIKE FUND   ($)        6784           DOWN 48    %

INVENTORY LEVEL -PER WORKER-  $ 0
UNFILLED ORDERS PER WORKER    $ 1006

MANAGEMENT EXPECTED COST OF ONE MORE WEEK OF STRIKE       $ 43

THE STRIKE HAS BEEN ON FOR  3    WEEKS

                            LABOR            MANAGEMENT

DURATION (MONTHS)             12               12            ***AGREEMENT
WAGE RATE                     2.38             2.33
GUARANTEED OVERTIME           5                5             ***AGREEMENT
VACATION DAYS/YEAR            12               10
REGULAR HOURS/WEEK            40               42
DAYS OF RELIEF/YEAR           6                6             ***AGREEMENT
YEARLY BONUS                  480              460
PAID HOLIDAYS                 7                4
OVERTIME RATE                 3.57             3.5



DONE
```

```
RUN
LABOR

ENTER FIRM NUMBER?1




***CONTRACT PROPOSAL: WEEK 4
..........................................................
   ....ARBITRATION ANYONE...?YES


ARBITRATION IS REQUIRED BY ONE PARTY......


THE ARBITRATOR
DECISIONS ARE FINAL AND MUST BE ACCEPTED BY BOTH PARTIES...
                    THE NEW CONTRACT IS
                    ********************

DURATION (MONTHS)                12
WAGE RATE                        2.35
GUARANTEED OVERTIME              5
VACATION DAYS/YEAR               10
REGULAR HOURS/WEEK               42
DAYS OF RELIEF/YEAR              6
YEARLY BONUS                     464
PAID HOLIDAYS                    4
OVERTIME RATE                    3.53

GROSS PAYROLL INCREASE          $ 248
FRINGE BENEFITS INCREASE        $ 446

TOTAL.............              $ 694


THE STRIKE IS ENDED AFTER 4     WEEKS. CONGRATULATIONS !!!



THE STRIKE HAS BEEN EXPENSIVE!
IT HAS COST MANAGEMENT $ 43011.      AND $ 330022.     IN UNFILLEDORDERS
LABOR HAS PAID $ 6336     AND HAS SUFFERED
 29    % OF MEMBERSHIP LOSSES....

DONE
```

TITLE: TWO COMPANIES IN ONE-PRODUCT COMPETITION

MARKET 36619

DESCRIPTION:

This computer game allows two people or two groups to play the roles of two companies who are competing for the market for a particular product: for example, racing bicycles. At the start of the game, the computer informs the players of the fixed and the variable production costs involved in marketing the product and the number of items that will be sold, with no advertising, at a specific price. The computer then assigns to each company initial values for inventory (stock on hand), cash on hand, and total assets.

INSTRUCTIONS:

Each player is allowed to make marketing decisions quarterly and can specify the production level, the advertising budget, and the unit price of the product for his company. After these decisions have been made for a given quarter, the computer reports the results of these decisions by way of a marketing summary. For each company the report lists:

a) profit
b) percentage share of the market
c) cash on hand
d) number of units sold
e) number of units in stock (inventory)
f) total assets

Players make their decisions for the following quarter on the basis of these reports.

If the demand for one company's product turns out to be larger than the total of the production level and inventory (as of the start of a quarter), the company will sell out its stock. Any additional sales that could have been made will not be given to the other company by the computer.

The companies are penalized for overproduction. An inventory charge at the rate of 5% per quarter will be made for stock on hand at the end of a quarter. That is, 5% of the total value of the inventory (based on variable production cost) will be deducted from the company's cash on hand.

continued on following page

SPECIAL CONSIDERATIONS:

The Huntington II Project recommends that for use of this program in the classroom it is necessary to obtain the following publications from Program Library, Digital Equipment Corporation, Maynard, Massachusetts 01754.

Student Workbook	**$ .30**
Teachers Guide	**.30**
Resource Handbook	**.50**

ACKNOWLEDGEMENTS: Huntington II Project
State University of New York

INSTRUCTIONS continued

It is possible for a company to have a negative value for cash on hand. This means that the company must go into debt for this amount, and an additional 5% charge will be made on the debt.

From time to time throughout the game, events will occur which will necessitate a change in strategy. In such cases, try to consider all consequences of the occurrence before deciding on a new strategy.

The game ends when one company goes bankrupt or accumulates 12 million dollars in total assets.

```
RUN

RUN
MARKET

DO YOU WANT INSTRUCTIONS(TYPE 1 FOR YES, 0 FOR NO)?0

ARE YOU BEGINNING THE GAME OR CONTINUING
(TYPE 1 FOR BEGINNING, 2 FOR CONTINUING)?1


FIXED PRODUCTION COST=$ 250000.     / QUARTER
VARIABLE PRODUCTION COST=$ 20   /UNIT
WITH NO ADVERTISING AND A SELLING PRICE OF $50/UNIT
A COMPANY WILL SELL  25000    UNITS (PRINTED AS  25    )
WAREHOUSE  CHARGE FOR INVENTORY= 5     PER CENT
INTEREST CHARGE ON BORROWED MONEY= 5     PER CENT


UNITS AND DOLLARS BELOW ARE IN THOUSANDS


QUARTER  0

PROFIT  MARKET SHARE  CASH ON HAND  NUMBER SOLD  INVENTORY  ASSETS
 0        0             5000          0            100        7000
 0        0             5000          0            100        7000


COMPANY  1
PRODUCTION LEVEL?25
ADVERTISING BUDGET?0
UNIT PRICE?50


COMPANY  2
PRODUCTION LEVEL?25
ADVERTISING BUDGET?0
UNIT PRICE?50


QUARTER  1

PROFIT  MARKET SHARE  CASH ON HAND  NUMBER SOLD  INVENTORY  ASSETS
 400      50            5400          25           100        7400
 400      50            5400          25           100        7400



COMPANY  1
PRODUCTION LEVEL?0
ADVERTISING BUDGET?0
UNIT PRICE?50


COMPANY  2
PRODUCTION LEVEL?0
ADVERTISING BUDGET?0
UNIT PRICE?50


QUARTER  2
```

```
PROFIT   MARKET SHARE   CASH ON HAND   NUMBER SOLD   INVENTORY   ASSETS
 425        50             6325           25           75         7825
 425        50             6325           25           75         7825


COMPANY  1
PRODUCTION LEVEL?10
ADVERTISING BUDGET?500
UNIT PRICE?55

COMPANY  2
PRODUCTION LEVEL?10
ADVERTISING BUDGET?0
UNIT PRICE?50

QUARTER  3

PROFIT   MARKET SHARE   CASH ON HAND   NUMBER SOLD   INVENTORY   ASSETS
 785        64.28          7810           45           40         8610
 440        35.71          7065           25           60         8265


COMPANY  1
PRODUCTION LEVEL?45
ADVERTISING BUDGET?500
UNIT PRICE?55

COMPANY  2
PRODUCTION LEVEL?25
ADVERTISING BUDGET?300
UNIT PRICE?50

QUARTER  4

PROFIT   MARKET SHARE   CASH ON HAND   NUMBER SOLD   INVENTORY   ASSETS
 641        50.61          8371           41           44         9251
 605        49.38          7970           40           45         8870

NEW LABOR CONTRACT - VARIABLE PRODUCTION COST NOW= $ 21    /UNIT


COMPANY  1
PRODUCTION LEVEL?40
ADVERTISING BUDGET?400
UNIT PRICE?53

COMPANY  2
PRODUCTION LEVEL?40
ADVERTISING BUDGET?350
UNIT PRICE?50

QUARTER  5

PROFIT   MARKET SHARE   CASH ON HAND   NUMBER SOLD   INVENTORY   ASSETS
 660        48.8           9008           41           43         9911
 647        51.19          8635           43           42         9517


COMPANY  1
PRODUCTION LEVEL?70
ADVERTISING BUDGET?250
UNIT PRICE?53
```

```
COMPANY  2
PRODUCTION LEVEL?50
ADVERTISING BUDGET?325
UNIT PRICE?50

QUARTER  6

PROFIT  MARKET SHARE  CASH ON HAND  NUMBER SOLD  INVENTORY  ASSETS
 505      44.15          8757          34           79        10416
 620      55.84          9108          43           49        10137


COMPANY  1
PRODUCTION LEVEL?40
ADVERTISING BUDGET?300
UNIT PRICE?53

COMPANY  2
PRODUCTION LEVEL?45
ADVERTISING BUDGET?400
UNIT PRICE?51

QUARTER  7

PROFIT  MARKET SHARE  CASH ON HAND  NUMBER SOLD  INVENTORY  ASSETS
 514      45             9187          36           83        10930
 617      55             9704          44           50        10754

A TRANSPORTATION STRIKE HAS OCCURED, AND YOU ARE UNABLE TO
MOVE YOUR GOODS TO THE DISTRIBUTORS. NEGOTIATIONS HAVE
BEGUN, BUT HOPE OF A SETTLEMENT LOOKS DIM.


COMPANY  1
PRODUCTION LEVEL?40
ADVERTISING BUDGET?300
UNIT PRICE?55

COMPANY  2
PRODUCTION LEVEL?45
ADVERTISING BUDGET?370
UNIT PRICE?53

QUARTER  8

PROFIT  MARKET SHARE  CASH ON HAND  NUMBER SOLD  INVENTORY  ASSETS
-680      0             7667          0           123        10250
-720      0             8039          0           95         10034

COMPANY  2    HAS BEEN THE VICTIM OF EMBEZZLEMENT BY THE
VICE PRESIDENT OF THE COMPANY. YOUR CASH ON HAND IS NOW $ 7839

NEW LABOR CONTRACT - VARIABLE PRODUCTION COST NOW= $ 23   /UNIT
TRANSPORTATION STRIKE SETTLED. NORMAL DELIVERIES RESUMED


COMPANY  1
PRODUCTION LEVEL?70
ADVERTISING BUDGET?300
UNIT PRICE?60

COMPANY  2
PRODUCTION LEVEL?70
ADVERTISING BUDGET?300
UNIT PRICE?58
```

```
QUARTER  9

PROFIT  MARKET SHARE  CASH ON HAND  NUMBER SOLD  INVENTORY  ASSETS
 580       48.33          7058          29          164       10830
 370       51.66          7322          31          134       10404

THE PRESIDENT HAS JUST IMPOSED A WAGE-PRICE FREEZE ON THE
ECONOMY, AND YOU MAY NOT RAISE THE PRICE OF YOUR PRODUCT
OVER THE NEXT 2 QUARTERS.



COMPANY  1
PRODUCTION LEVEL?70
ADVERTISING BUDGET?300
UNIT PRICE?60


COMPANY  2
PRODUCTION LEVEL?60
ADVERTISING BUDGET?350
UNIT PRICE?58


QUARTER  10

PROFIT  MARKET SHARE  CASH ON HAND  NUMBER SOLD  INVENTORY  ASSETS
 249       46.66          6341          28          206       11079
 333       53.33          7011          32          162       10737



COMPANY  1
PRODUCTION LEVEL?80
ADVERTISING BUDGET?300
UNIT PRICE?60


COMPANY  2
PRODUCTION LEVEL?60
ADVERTISING BUDGET?300
UNIT PRICE?58


QUARTER  11

PROFIT  MARKET SHARE  CASH ON HAND  NUMBER SOLD  INVENTORY  ASSETS
 227       48.33          5395          29          257       11306
 315       51.66          6659          31          191       11052

THE WAGE-PRICE FREEZE HAS ENDED



COMPANY  1
PRODUCTION LEVEL?80
ADVERTISING BUDGET?300
UNIT PRICE?62


COMPANY  2
PRODUCTION LEVEL?65
ADVERTISING BUDGET?300
UNIT PRICE?60


QUARTER  12

PROFIT  MARKET SHARE  CASH ON HAND  NUMBER SOLD  INVENTORY  ASSETS
 146       48.21          4322          27          310       11452
 261       51.78          6092          29.         227       11313

NEW LABOR CONTRACT - VARIABLE PRODUCTION COST NOW= $ 26   /UNIT
```

```
COMPANY  1
PRODUCTION LEVEL?80
ADVERTISING BUDGET?300
UNIT PRICE?65


COMPANY  2
PRODUCTION LEVEL?0
ADVERTISING BUDGET?300
UNIT PRICE?60


QUARTER  13

PROFIT  MARKET SHARE  CASH ON HAND  NUMBER SOLD  INVENTORY  ASSETS
 840      45.28         2776          24           366        12292

              ********************
COMPANY  1     YOU HAVE REACHED  12    MILLION AND WON
              ********************

 859      54.71         7024          29           198        12172

DO YOU WANT TO PLAY AGAIN(TYPE 1 FOR YES, 0 FOR NO)?0

DONE
```

MRKSIM
36199

TITLE: MARKETING SIMULATION

DESCRIPTION:

Multi-teams, multiperiod marketing simulation, MRKSIM is a package consisting of the following programs:

MARK : (inputs data)
BARKSI : (performs computations)
BARKPI : (prints out results)
ANNUAL : (prints annual reports)
MASK : (prints English headings)

and two parameter files PARAM and HISTRY

MARKSIM has been adapted in BASIC to fit the original MARKSIM, A Marketing Decision Simulation, by Greenlaw and Kniffin, International Textbook.

INSTRUCTIONS:

The following files have to be opened on the user's catalog.

MPRINT : 8 sectors
DECIS : 10 sectors
INDY#1 : 4 sectors
INDY#2 : 4 sectors
INDY#3 : 4 sectors
USER : 1 sector

Two additional files, PARAM and HISTRY are provided as part of the program package.

The game can be run by two classes at the same time. Each one is identified by a user number which is either 1 or 2. Each class consists of a maximum of 3 industries and 3 firms. Each industry is independent from the others and is an independent unit.

The program MARK is provided so that the printing time of the game is minimized.

ACKNOWLEDGEMENTS: Francois P. Carlhian
Babson College

The following are excerpts from the book, MARKSIM, A Marketing Decision Simulation by Greenlaw and Kniffin, International Textbook.

An exciting new educational technique designed to provide business students with greater insight into and skills in dealing with managerial problems is business simulation, or business gaming, as it is often called. A business simulation is a sequential decision-making problem structured around a model of a business operation in which participants assume the role of managing a simulated firm. One purpose of this text is to prepare the reader for assuming such a managerial role in MARKSIM--a computerized marketing management simulation.

THE MARKSIM LEARNING EXPERIENCE

MARKSIM was created to provide the student with a planned learning experience in dealing with marketing management problems. Aiding him in gaining such experience are:

1. His instructor, who will be available for guidance when necessary,
2. This text, which will focus attention on numerous concepts, ideas, and analytical tools relative to marketing management, and their application to the simulation.
3. The MARKSIM model which is programmed on an electronic computer. This computer program provides a dynamic simulated marketing decision-making environment, from which operating data are fed back to participants periodically.

More specifically, the procedure followed in assuming the role of marketing manager in the simulation is as follows:

1. Participants familiarize themselves with the simulated environment in which they are to manage by studying the materials presented later in this text and perhaps also by discussing these materials in class.
2. They are next given an opportunity to analyze available data on their past operations and to make a set of decisions for the first period in which they will manage their firms.
3. When firm decisions are due for this period, they are handed in to the instructor or someone designated by him as a simulation administrator.
4. Then each firm's operating results for the period are calculated and printed out by the computer system, and this information is returned to its management.
5. This cycle of decision making, calculation, and feedback of results is repeated for a number of periods of play.

```
OPEN-MPRINT,8
OPEN-DECIS,10
OPEN-INDY#1,4
OPEN-INDY#2,4
OPEN-INDY#3,4
OPEN-USER,4
GET-MARK
RUN
MARK

****************     MARKSIM          *****************
LAST FOR INSTRUCTIONS

ENTER USER NUMBER
?1
ENTER INDUSTRY # AND PERIOD #:
?2,1
ENTER DECISIONS FOR FIRM # 1      (12 DATA)
?500000,300000,55,145,50000,30000,0,1,1,1,1,1
ENTER DECISIONS FOR FIRM # 2      (12 DATA)
?500000,300000,55,145,50000,30000,0,1,1,1,1,1
ENTER DECISIONS FOR FIRM # 3      (12 DATA)
?500000,300000,55,145,50000,30000,0,1,1,1,1,1
ENTER THE NAMES OF THE THREE FIRMS.ONE ON EACH LINE
?THE BES ONES INC.
?THE ASSOCIATES
?THE BULLIES


========GET AND RUN BARKSI============

DONE



RUN

RUN
BARKSI

COMPUTATIONS COMPLETED  : GET AND RUN BARKPI

DONE



RUN

GET-BARKPI
RUN
BARKPI

***
M A R K S I M

THE BES ONES INC.

INDUSTRY # 2    FIRM # 1    PERIOD # 1

------------------------------
       $   5.75443E+06
```

```
2.75000E+06
385866.          (ADD INCREASE IN INV.)
         -3.13587E+06
         ---------


 131275.
 150000.
 153804.
 50815.
 213098.
 300000.
 500000.
 50000.
 0
 500000.
          -2.04899E+06
          ---------
       $   569574.
-------------------------------
$   5.95544E+06
    2.63913E+06
   ----------
$   8.59458E+06
    0
   ---------
$   8.59458E+06
-------------------------------
 1.50000E+06
 900000.
MARKET 1*MARKET 2*MARKET 3
 30511      8628       5184
 145000.      41000.       34000.
 33         33         33

 145
 145
 145
-------------------------------

 30511      8628       5184
 44323.
 45000.      AT $ 55
 53187.2     AT $ 55


 26255
 26255
$ 108.75
$ 2.85522E+06
 27000     AT $ 55
 31505.9     AT $ 55


 26255
 26255
$ 108.75
$ 2.85522E+06
 35000.      AT $ 55


 30761
 30761
$ 94.25
$ 2.89921E+06
 30000
 50000.
 20000     AT $ 55
 9239.17     AT $ 55

---------------------------

*** TEAR HERE***
```

```
***
M A R K S I M

THE ASSOCIATES

INDUSTRY # 2    FIRM # 2    PERIOD # 1

-------------------------------
       $   5.75443E+06

 2.75000E+06
 385866.          (ADD INCREASE IN INV.)
          -3.13587E+06
          ---------


 131275.
 150000.
 153804.
 50815.
 213098.
 300000.
 500000.
 50000.
 0
 500000.
          -2.04899E+06
          ---------
       $   569574.
-------------------------------
$   5.95544E+06
    2.63913E+06
   ----------
$   8.59458E+06
    0
   ---------
$   8.59458E+06
-------------------------------
 1.50000E+06
 900000.
MARKET 1*MARKET 2*MARKET 3
 30511      8628       5184
 145000.      41000.       34000.
 33         33         33

 145
 145
 145
-------------------------------

 30511      8628       5184
 44323.
 45000.      AT $ 55
 53187.2     AT $ 55


 26255
 26255
$ 108.75
$ 2.85522E+06
 27000     AT $ 55
 31505.9     AT $ 55


 26255
 26255
$ 108.75
$ 2.85522E+06
 35000.      AT $ 55


 30761
 30761
$ 94.25
$ 2.89921E+06
 30000
 50000.
```

```
 20000     AT $ 55
 9239.17     AT $ 55

----------------------------

*** TEAR HERE***



***
M A R K S I M

THE BULLIES

INDUSTRY # 2     FIRM # 3     PERIOD # 1

--------------------------------
       $    5.75443E+06

 2.75000E+06
 385866.            (ADD INCREASE IN INV.)
          -3.13587E+06
          ---------


 131275.
 150000.
 153804.
 50815.
 213098.
 300000.
 500000.
 50000.
 0
 500000.
          -2.04899E+06
          ---------
       $    569574.
------------------------------
$    5.95544E+06
     2.63913E+06
    ----------
$    8.59458E+06
     0
    ---------
$    8.59458E+06
--------------------------------
 1.50000E+06
 900000.
MARKET 1*MARKET 2*MARKET 3
 30511      8628       5184
 145000.      41000.       34000.
 33         33         33

 145
 145
 145
--------------------------------

 30511      8628       5184
 44323.
 45000.      AT $ 55
 53187.2     AT $ 55


 26255
 26255
$ 108.75
$ 2.85522E+06
 27000     AT $ 55
 31505.9     AT $ 55


 26255
 26255
$ 108.75
$ 2.85522E+06
```

```
 35000.      AT $ 55


 30761
 30761
$ 94.25
$ 2.89921E+06
 30000
 50000.
 20000     AT $ 55
 9239.17     AT $ 55

----------------------------

*** TEAR HERE***


DONE


RUN


GET-ANNUAL
RUN
ANNUAL

 TYPE IN USER NUMBER
?1
ENTER INDUSTRY # AND LATEST PERIOD #
?2,1
----------


  ANNUAL REPORT FOR INDUSTRY#  2

   AS OF PERIOD  1


FIRMS:       THE BES ONES INC.    THE ASSOCIATES        THE BULLIES


CUMULATIVE RETAIL SALES
   SINCE PERIOD  0      44323.              44323.              44323.
  SINCE START
    OF GAME           44323.              44323.              44323.


CUMULATIVE NET PROFIT
   SINCE PERIOD  0      569574.             569574.             569574.
  SINCE START
    OF GAME           569574.             569574.             569574.


COMPARATIVE BALANCE SHEETS


ASSETS
  CASH                5.95544E+06         5.95544E+06         5.95544E+06
  INVENTORY           2.63913E+06         2.63913E+06         2.63913E+06
                      ==========          ==========          ==========
  TOTAL ASSETS        8.59458E+06         8.59458E+06         8.59458E+06
```

```
LIABILITIES
  DEBTS                0                    0                    0

CAPITAL
  OWNER'S
  INVESTMENT
                   8.59458E+06          8.59458E+06          8.59458E+06

-----------


DONE


 RUN

 GET-MASK
 RUN
 MASK

 ----------------------------------------


                                        ***
 MARKSIM

 A MARKETING SIMULATION


 INCOME STATEMENT-----------------------
 COMPANY SALES.........................

      COST OF PRODUCTION.................
      CHANGE IN INVENTORY VALUE..........
      COST OF GOODS SOLD.................

 GROSS PROFIT..........................

 OPERATING AND ADMINISTRATIVE EXPENSES..:
      TRANSPORTATION TO RETAILERS........
      TRANSPORTATION TO DISTR CENTERS....
      TRANSPORTATION TO WHOLESALERS......
      INVENTORY COSTS AT FACTORY.........
      INVENTORY COSTS AT DISTR CENTERS...
      ADVERTISING ALLOWANCES TO RETAILERS
      NATIONAL ADVERTISING EXPENDITURES..
      MARKETING RESEARCH.................
```

```
     INTEREST CHARGES.....
     FIXED EXPENSES.....
     LESS TOTAL O+A EXPENSES.....

NET PROFIT.....
FINANCIAL STATEMENT----------
ENDING CASH BALANCE.....
ENDING INVENTORY VALUE.....

TOTAL ASSETS.....
LESS DEBTS.....

OWNER'S INVESTMENT.....
MARKETING RESEARCH----------
TOTAL INDUSTRY NATIONAL ADVERTISING.....
TOTAL INDUSTRY ALLOWANCES TO RETAIL.....
POTENTIALS:
     FOR COMPANY DURING THIS PERIOD....
     FOR INDUSTRY TWO PERIODS HENCE.....
SHARE OF MARKET (IN PERCENT).....
PRICES OF COMPETITORS:
     FIRM #1.....
     FIRM #2.....
     FIRM #3.....
SALES INFORMATION----------
RETAILERS:
     RETAIL SALES IN UNITS.....
     TOTAL RETAIL SALES IN UNITS.....
     BEGINNING INVENTORY.....
     ENDING INVENTORY.....

WHOLESALERS:
     ORDERS FROM RETAILERS IN UNITS.....
     DELIVERIES TO RETAILERS.....
     SELLING PRICE TO RETAILERS.....
     RECEIPTS FROM RETAILERS.....
     BEGINNING INVENTORY.....
     ENDING INVENTORY.....

DISTRIBUTION CENTERS:
     ORDERS FROM RETAILERS IN UNITS.....
     DELIVERIES TO RETAILERS.....
     SELLING PRICE TO RETAILERS.....
     COMPANY SALES TO RETAILERS.....
     BEGINNING INVENTORY.....
     ENDING INVENTORY.....

FACTORY WAREHOUSE:
     ORDERS FROM WHOLESALERS IN UNITS...
     DELIVERIES TO WHOLESALERS.....
     SELLING PRICE TO WHOLESALERS.....
     COMPANY SALES TO WHOLESALERS.....
     SHIPMENTS TO DISTR CENTERS.....
     PRODUCTION THIS PERIOD.....
     BEGINNING INVENTORY.....
     ENDING INVENTORY.....


----------

DONE
```

CONTRIBUTED PROGRAM **BASIC**

SETUPC
36209

TITLE: MANAGEMENT SIMULATION GAME (For 2000C)

DESCRIPTION:

This program allows three teams to act as business executives making periodic high level decisions for their firms.

A realistic business practice operating over a period of several years can be simulated in one day. Each team alternately makes decisions about their company and allows the computer to carry out interactions among the teams and to produce quarterly reports based on the strategies of all three teams.

The product is not specifically defined, therefore, the decisions made by the management teams must be based on general business principles and not on knowledge concerning a particular product. Naturally, some simplifications have been made to reduce a real-life business situation to one which is workable on a time-share system with young students. One of these is the requirement that each quarterly operation be financed from cash on hand.

Each team of participants may assume that it has been called in to take over the management of a company which has strong possibilities but which is not in very good financial position at the present time. As play progresses the participants should acquire a feel for the market and an understanding of their competitors which should further aid in their decision making. Each team may want to keep brief notes of the reasoning behind their decisions so these different strategies may be discussed later.

INSTRUCTIONS:

See Page 2

SPECIAL CONSIDERATIONS:

There are two tapes to this package -- SETUPC, and MANAGC.

ACKNOWLEDGEMENTS: TIES
St. Paul, Minnesota

MANAGEMENT SIMULATION GAME FOR THE HP 2000C

INTRODUCTION

Management Simulation allows a group to be divided into three subgroups acting as teams of business executives making periodic high level decisions for their firms.

A realistic business practice operating over a period of several years can be simulated in one day. Each team alternately makes decisions about their company and allows the computer to carry out interactions among the teams and to produce quarterly reports based on the strategies of all three teams.

The product is not specifically defined, therefore, the decisions made by the management teams must be based on general business principles and not on knowledge concerning a particular product. Naturally, some simplifications have been made to reduce a real-life business situation to one which is workable on a time-share system with young students. One of these is the requirement that each quarterly operation be financed from cash on hand.

Each team of participants may assume that it has been called in to take over the management of a company which has strong possibilities but which is not in very good financial position at the present time. As play progresses, the participants should acquire a feel for the market and an understanding of their competitors which should further aid in their decision making. Each team may want to keep brief notes of the reasoning behind their decisions so these different strategies may be discussed later.

GEOGRAPHICAL BREAKDOWN OF THE MARKET

The market is divided geographically into four areas. Any firm may sell its product in any area. Area 1 is the home area of firm 1, area 2 is the home area of firm 2, and area 3 is the home area of firm 3. Area 4 is an open market. Each firm has an advantage in its own area, in that there is no transportation charge applied to the units it sells there. Transportation charges are applied to units sold in competitors' areas, but a smaller transportation charge is applied to units sold in area 4. These charges are included in the unit delivered cost shown on each firm's confidential report.

INITIAL REPORT

At the start of play each team will be given a report showing the economic condition of their company.

AREA DECISIONS

After studying the initial report, each team makes a set of decisions. For each marketing area, it must decide the unit selling price and the amount of money to be spent on advertising. These have a direct and immediate effect on the amount of business each firm will get in each area.

The potential market in each area will vary as a function of selling price, amount spent on research, and the total marketing expenditure. There are no seasonal cycles built into this model.

PLANT DECISIONS

In addition to the area decisions, a set of plant decisions must be made. Each management team must decide how much money to spend on production, research, and plant improvement.

Plant manufacturing capacity may be increased at a cost of $20,000 for each 1,000 units. The new unit capacity can be calculated by dividing the plant value by $20. If a plant is operated at less than full capacity, a penalty of higher unit cost is automatically assessed.

Research and development funds are applied over many periods. In this model they will yield a return greater than their cost in the long run. This is true of these funds only up to a reasonable percentage of sales income. R & D will help increase the potential market and decrease production costs.

CONFIDENTIAL REPORT

Sales Analysis

Orders - The total number of orders received by your firm in the areas indicated during the period covered by the report.

Shipments - The total number of units sold by your firm in the areas indicated for the period covered. If this figure is less than orders, your firm may be underproducing.

Marketing - The total amount your firm decided to spend on marketing in each area during the previous period.

Revenue - The total amount of money your firm received for the shipments it had in each of the areas.

Delivered Unit Cost - The unit cost of production plus the cost of delivering the units to the area.

PRODUCTION REPORT

Profit and Loss

Current Income - The total amount of cash received from the sale of units.

Cost of Goods Sold - The production cost of the units sold. The cost of unsold units appears as inventory in the Cash Flow-Financial Analysis section.

Transportation - The cost of transporting units sold. This charge is $1.00 per unit in area 4, and $2.00 per unit in a competitors area.

Marketing - The amount your firm decided to spend on marketing and advertising during the report period.

Research - The amount your firm decided to spend on research.

Depreciation - Computed at the rate of 2% during each period.

Net Profit - The difference between sales income and total expense.

Taxes - Computed at the rate of 50% of profit before taxes.

Profit after Taxes - Net profit less taxes.

Cash Flow-Financial Analysis

Receipts - The total amount of cash taken in from the sale of units during the report period.

Disbursements - The total amount of cash spent by your firm during the report period.

Net Flow - Receipts less disbursements.

New Balance - The amount of cash your firm now has with which to conduct business during the next period.

Cash - The new cash balance.

Inventory - The production costs of the units remaining unsold from the previous periods.

Plant Value - The current value of your plant. To determine plant capacity for the coming period, divide this value by $20.00.

Total Assets - The total value of all your assets.

Disbursement Allocation ($ Value)

Transportation - See production report

Marketing - See production report

Research - See production report

Plant Improvement - The amount your firm decided to spend this period.

Production Cost - The amount your firm allocated for production this period.

Taxes - See production report

Inventory Allocation (No. of Items)

Beginning - Inventory from previous periods.

Produced - Number of items produced this period.

Shipped - Number of items shipped this period.

Balance - Number of items to be carried to next period as inventory.

Unit Cost - Inventory value divided by balance.

COMPANY STATUS

All companies begin with the same production capacities, assets, and cash balance. These amounts are:

CASH	$7,602
INVENTORY VALUE	$2,509 71 @ $34.34
PLANT VALUE	$5,200
TOTAL ASSETS	$15,311
PRODUCTION CAPACITY	260 units

GENERAL OPERATING INSTRUCTIONS FOR THE MANAG GAME ON HP 2000C

The MANAG simulation is divided into two routines which are described below:

SETUPC - This routine is called and executed at the beginning of the game to initialize the program values for all the groups running the simulation.

MANAGC - This routine allows the three teams of a group to input their values for the unit selling price and advertising in each area and the amounts for production allocation, research and development and plant improvement. After these values are inputted, MANAG will perform the simulation, print out the confidential quarterly report and save the results.

SPECIFIC INSTRUCTIONS FOR RUNNING THE MANAGC GAME

Commands printed below entirely in uppercase are entered by the system user on the remote terminal. Lowercase statements are responses by the computer.

A. To initialize the program values for each group of three teams playing the simulation, it is necessary to use the system command OPEN-GAMEi,1 where i is the game number, an integer 1-10. There must be one such OPEN command for each group of three teams playing the simulation (limit 10).

1. GET-SETUPC

2. OPEN-GAMEi,1 i=1,2,3,...10

(If you get the message DUPLICATE ENTRY, use the next sequential integer unless you are starting the game over and want to reinitialize that game. In that case, proceed to STEP 3 below.)

3. RUN
4. setupc
5. game number?

   (You should enter the integer used for i in the OPEN command given in STEP 2.)

6. done

Repeat Steps 1-6 for each game (set of three teams) to be initialized.

B. To run MANAGC for the first and all succeeding quarters:

1. GET-MANAGC
2. RUN
3. managc
4. game number? (Enter the game number for the group of three teams.)
5. for firm 1 enter area selling prices.?60,60,60,60
6. enter area advertising expenditures.?150,100,100,100
7. enter production, r and d, and plant improvement.?5000,500,500
8. enter firm 2 data using three lines as above.
9. ?60,60,60,60
10. ?100,150,100,100
11. ?5100,400,600
12. enter firm 3 data using three lines as above.
13. ?60,60,60,60
14. ?100,100,150,100
15. ?5200,500,300
16. do you want quarterly report printed?

    If yes, the computer then prints the Confidential Report for all three firms.

    (4-16 The question mark is a response from the computer. The data typed following the question mark is entered from WORK SHEETS.)

17. done

Typical Work Sheets for One Firm

WORK SHEET

FIRST QUARTER
TEAM #1

PART A

CASH	$7,602
PRODUCTION ALLOCATION	6,000
SUB TOTAL	1,602
RESEARCH & DEVELOPMENT	500
SUB TOTAL	1,102
PLANT IMPROVEMENT	100
SUB TOTAL	1,002
ADVERTISING EXPENDITURE	450
CASH ON HAND	552

PART B

	4 REGIONS			
	1	2	3	4
UNIT SELLING PRICE	$60	$60	$60	$60
ADVERTISING DISTRIBUTED BY AREA	$150	$100	$100	$100

PART C - REPEAT FIGURES FROM PART A

PRODUCTION ALLOCATION	$6,000
RESEARCH & DEVELOPMENT	500
PLANT IMPROVEMENT	100

WORK SHEET

SECOND QUARTER
TEAM # 1

PART A

CASH	$9,698
PRODUCTION ALLOCATION	4,000
SUB TOTAL	5,698
RESEARCH & DEVELOPMENT	3,000
SUB TOTAL	2,698
PLANT IMPROVEMENT	100
SUB TOTAL	2,598
ADVERTISING EXPENDITURE	540
CASH ON HAND	2,058

PART B

	4 REGIONS			
	1	2	3	4
UNIT SELLING PRICE	$55	$55	$55	$54
ADVERTISING DISTRIBUTED BY AREA	$150	$190	$50	$150

PART C - REPEAT FIGURES FROM PART A

PRODUCTION ALLOCATION	$4,000
RESEARCH & DEVELOPMENT	3,000
PLANT IMPROVEMENT	100

WORK SHEET

THIRD-QUARTER
TEAM # 1

PART A

CASH	$11,547
PRODUCTION ALLOCATION	6,000
SUB TOTAL	5,547
RESEARCH & DEVELOPMENT	2,000
SUB TOTAL	3,547
PLANT IMPROVEMENT	450
SUB TOTAL	3,097
ADVERTISING EXPENDITURE	513
CASH ON HAND	2,584

PART B

	4 REGIONS			
	1	2	3	4
UNIT SELLING PRICE	$55	$54	$56	$54
ADVERTISING DISTRIBUTED BY AREA	$150	$111	$127	$137

PART C - REPEAT FIGURES FROM PART A

PRODUCTION ALLOCATION	$6,000
RESEARCH & DEVELOPMENT	2,000
PLANT IMPROVEMENT	450

```
RUN

OPEN-GAM1,1
RUN
SETUPC

GAME NUMBER?1

DONE


GET-MANAGC
RUN
MANAGC

GAME NUMBER?1
FOR FIRM 1     ENTER AREA SELLING PRICES.?60,60,60,60
ENTER AREA ADVERTISING EXPENDITURES.?150,100,100,100
ENTER PRODUCTION, R AND D, AND PLANT IMPROVEMENT.?5000,500,500
ENTER FIRM  2     DATA USING THREE LINES AS ABOVE.
?60,60,60,60
?100,150,100,100
?5100,400,600
ENTER FIRM  3     DATA USING THREE LINES AS ABOVE.
?60,60,60,60
?100,100,150,100
?5200,500,300
DO YOU WANT QUARTERLY REPORT PRINTED?YES


FIRM 1        PERIOD 1


SALES ANALYSIS

AREA                      1         2         3         4       TOTAL

ORDERS                   41        30        30        73         174
SHIPMENTS                41        30        30        73         174
MARKETING               150       100       100       100         450
REVENUE                2460      1800      1800      4380       10440
DLVRD UNIT COST($)    36.67     38.67     38.67     37.67


PROFIT AND LOSS                          CASH FLOW  FINANCIAL ANALYSIS

CURRENT INCOME          10440            RECEIPTS              10440
COST OF GDS SLD          6381            DISBURSEMENTS          8049
TRANSPORTATION            193            NET FLOW               2391
MARKETING                 450            NEW BALANCE            9993
RESEARCH                  500
DEPRECIATION              104            CASH                   9993
NET PROFIT               2812            INVENTORY VALUE        1128
TAXES                    1406            PLANT VALUE            5596
PROFIT AFTER TAXES       1406            TOTAL ASSETS          16717


DISBURSEMENT ALLOCATION($VALUE)          INVENTORY ALLOCATION(NO. ITEMS)

TRANSPORTATION            193            BEGINNING              71
MARKETING                 450            PRODUCED              133
RESEARCH                  500            SHIPPED               174
PLANT IMPROVEMENT         500            BALANCE                30
PRODUCTION COST          5000
TAXES                    1406               UNIT COST($)      37.59
TOTAL                    8049
```

FIRM 2 PERIOD 1

SALES ANALYSIS

AREA	1	2	3	4	TOTAL
ORDERS	29	40	29	71	169
SHIPMENTS	29	40	29	71	169
MARKETING	100	150	100	100	450
REVENUE	1740	2400	1740	4260	10140
DLVRD UNIT COST($)	38.43	36.43	38.43	37.43	

PROFIT AND LOSS		CASH FLOW FINANCIAL ANALYSIS	
CURRENT INCOME	10140	RECEIPTS	10140
COST OF GDS SLD	6157	DISBURSEMENTS	8158
TRANSPORTATION	187	NET FLOW	1982
MARKETING	450	NEW BALANCE	9584
RESEARCH	400		
DEPRECIATION	104	CASH	9584
NET PROFIT	2842	INVENTORY VALUE	1452
TAXES	1421	PLANT VALUE	5696
PROFIT AFTER TAXES	1421	TOTAL ASSETS	16732

DISBURSEMENT ALLOCATION($VALUE)		INVENTORY ALLOCATION(NO. ITEMS)	
TRANSPORTATION	187	BEGINNING	71
MARKETING	450	PRODUCED	137
RESEARCH	400	SHIPPED	169
PLANT IMPROVEMENT	600	BALANCE	39
PRODUCTION COST	5100		
TAXES	1421	UNIT COST($)	37.23
TOTAL	8158		

FIRM 3 PERIOD 1

SALES ANALYSIS

AREA	1	2	3	4	TOTAL
ORDERS	30	30	41	73	174
SHIPMENTS	30	30	41	73	174
MARKETING	100	100	150	100	450
REVENUE	1800	1800	2460	4380	10440
DLVRD UNIT COST($)	38.25	38.25	36.25	37.25	

PROFIT AND LOSS		CASH FLOW FINANCIAL ANALYSIS	
CURRENT INCOME	10440	RECEIPTS	10440
COST OF GDS SLD	6308	DISBURSEMENTS	8086
TRANSPORTATION	193	NET FLOW	2354
MARKETING	450	NEW BALANCE	9956
RESEARCH	500		
DEPRECIATION	104	CASH	9956
NET PROFIT	2885	INVENTORY VALUE	1401
TAXES	1443	PLANT VALUE	5396
PROFIT AFTER TAXES	1443	TOTAL ASSETS	16754

DISBURSEMENT ALLOCATION($VALUE)		INVENTORY ALLOCATION(NO. ITEMS)	
TRANSPORTATION	193	BEGINNING	71
MARKETING	450	PRODUCED	141
RESEARCH	500	SHIPPED	174
PLANT IMPROVEMENT	300	BALANCE	38
PRODUCTION COST	5200		
TAXES	1443	UNIT COST($)	36.88
TOTAL	8086		

DONE

TITLE: STAT: Statistical Analysis of Lab Data

STAT
36344

DESCRIPTION:

This program treats class sets of laboratory data statistically. Aside from a table of experimental values with errors and percent errors, the teacher has a choice of experimental value distribution with bar graph, ranking by percent error, ranking by experimental value, mean deviation, and standard deviation.

OBJECTIVES:

A. To make percent error in experiments more meaningful.

B. To increase competitive spirit in the laboratory due to ranking portion of statistical analysis.

C. To provide a basis for further discussion of laboratory data and techniques.

INSTRUCTIONS:

PRELIMINARY PREPARATION:

This program is not generally for student use.

DISCUSSION:

Often a teacher is forced to work with some arbitrary percent error scale for marking purposes. With a statistical analysis of the laboratory results, a realistic scale can easily be developed.

Also, it is often desirable to discuss the class results but without a statistical analysis this usually turns out to be rather shallow. The analysis can now be obtained in the few minutes it takes the students to clean their equipment and put it away.

It may be helpful to discuss a few of the ways in which the teacher can input data. First, the teacher may simply call up the program and then either he or his students can input the data as the experiments are finished. Next, with the teletype unit on local, a tape can be made and the analysis can be made at any convenient time. With tapes a teacher can do a statistical analysis of his classes separately or as a group as long as each student gets a different student number. The program conversationally requests input.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN
RUN
STAT

 THIS PROGRAM WILL DO THE FOLLOWING:
     1. PRINT OUT A TABLE OF EXPERIMENTAL VALUES, ERRORS,
        AND PERCENT ERRORS INCLUDING AVERAGES FOR ALL.
     2. GIVE YOU A CHOICE OF ALL OF THE FOLLOWING:
           CHOICE 1 - EXPERIMENTAL VALUE DISTRIBUTION
                      INCLUDING A BAR GRAPH
           CHOICE 2 - RANKING BY PERCENT ERROR
           CHOICE 3 - RANKING BY EXPERIMENTAL VALUE
           CHOICE 4 - OTHER INFORMATION
           CHOICE 5 - ALL OF THE ABOVE CHOICES
           CHOICE 6 - ENDS PROGRAM
                 INSTRUCTIONS
 1. LINES 100 TO 159 HAVE BEEN RESERVED FOR DATA.
 2. NOTE: THE FIRST DATA LINE MUST ALWAYS BE NO. 100
          AND LINE 101 MUST ALWAYS BE USED.
 3. THERE IS ROOM FOR DATA FOR A MAXIMUM OF 50 STUDENTS.
 4. INPUT SHOULD BE IN THE FORM:
    100 DATA STUDENT NO., VALUE, STUDENT NO., VALUE, ETC.,
 5. STUDENT NUMBERS MUST RANGE FROM 1-50.
 6. OLD DATA IS ERASED BY INPUTING NEW DATA WITH THE SAME
    LINE NUMBERS DURING SUBSEQUENT RUNS.
 7. IF THE FIRST RUN REQUIRES DATA LINES 100-110 AND THE
    SECOND RUN REQUIRES LINES 100-109, LINE 110 IS TYPED
    IN TO ERASE OLD DATA IN THAT LINE.
 8. NEVER TYPE SAVE DURING THE RUN OF ANY PART OF THIS
    PROGRAM.


DONE
100  DATA 1,37,-.8,2,38.6,3,39.7,4,37.9,5,38,6,40.6,7,41,-.8,8,37.6,9
101  DATA 39.5,10,40.1,11,39.8,12,39.4,13,35.4,14,33.9,15,42,16,39.6
102  DATA 17,38.7,18,37,-.6,19,38.5,20,40.1
RUN
STAT

WHAT IS THE TOTAL NO. OF STUDENTS AND THE CALC. VALUE?20,39

DATA LISTED BY STUDENT NUMBER
---- ------ -- ------- ------

 STUDENT NO.    VALUE          ERROR          PERCENT ERROR

 1               37.8          -1.2            3.07692
 2               38.6          -.400002        1.02564
 3               39.7           .699997        1.79486
 4               37.9          -1.1            2.82051
 5               38            -1              2.5641
 6               40.6           1.6            4.10256
 7               41.8           2.8            7.1795
 8               37.6          -1.4            3.58975
 9               39.5           .5             1.28205
 10              40.1           1.1            2.82051
 11              39.8           .800003        2.05129
 12              39.4           .400002        1.02564
 13              35.4          -3.6            9.23077
 14              33.9          -5.1            13.0769
 15              42             3              7.69231
 16              39.6           .599998        1.53846
 17              38.7          -.300003        .769239
 18              37.6          -1.4            3.58975
 19              38.5          -.5             1.28205
 20              40.1           1.1            2.82051

THE ARITHMETIC MEAN (AVERAGE) IS     38.83
THE AVERAGE ERROR (ABSOLUTE) IS      1.43
THE AVERAGE PERCENT ERROR IS         3.66667


 DO YOU DESIRE ADDITIONAL INFORMATION ? IF SO, TYPE
 IN THE NUMBER OF YOUR CHOICE.?5

FOR THE DISTRIBUTION, WHAT LOWER LIMIT, UPPER LIMIT,
AND STEP DO YOU DESIRE ?35,42.5,.5
```

EXPERIMENTAL VALUE DISTRIBUTION

FROM	TO LESS THAN	NO.	BAR GRAPH
0	35	1	*
35	35.5	1	*
35.5	36	0	
36	36.5	0	
36.5	37	0	
37	37.5	0	
37.5	38	4	****
38	38.5	1	*
38.5	39	3	***
39	39.5	1	*
39.5	40	4	****
40	40.5	2	**
40.5	41	1	*
41	41.5	0	
41.5	42	1	*
42	42.5	1	*
42.5	INFINITY	0	

RANKING BY PERCENT ERROR

RANK	STUDENT NO.	PERCENT ERROR
1	17	.769239
2	2	1.02564
3	12	1.02564
4	9	1.28205
5	19	1.28205
6	16	1.53846
7	3	1.79486
8	11	2.05129
9	5	2.5641
10	4	2.82051
11	10	2.82051
12	20	2.82051
13	1	3.07692
14	8	3.58975
15	18	3.58975
16	6	4.10256
17	7	7.1795
18	15	7.69231
19	13	9.23077
20	14	13.0769

RANKING BY EXPERIMENTAL VALUE

RANK	STUDENT NO.	EXPER. VALUE
1	14	33.9
2	13	35.4
3	8	37.6
4	18	37.6
5	1	37.8
6	4	37.9
7	5	38
8	19	38.5
9	2	38.6
10	17	38.7
11	12	39.4
12	9	39.5
13	16	39.6
14	3	39.7
15	11	39.8
16	10	40.1
17	20	40.1
18	6	40.6
19	7	41.8
20	15	42

```
OTHER INFORMATION
----- -----------

THE MEDIAN VALUE IS    38.7
THE LOWEST VALUE IS    33.9
THE HIGHEST VALUE IS   42
THE MEAN DEVIATION (AVERAGE DEVIATION) IS .130003
THE STANDARD DEVIATION IS 1.87776
 THIS CONCLUDES THE RUN.

DONE
```

CONTRIBUTED PROGRAM **BASIC**

ATTEND
36202

TITLE: ABSENTEE LISTINGS

DESCRIPTION:

This program provides a listing of absentees in alphabetical order, according to the first three letters of the last name (most efficient method). The list is divided into three groups, according to each student's class (10, 11, or 12). Calculations are also made to determine total absentees and percent attendance. The completed output is then suitable for use as a daily bulletin of high school attendance. Asterisks designate change of alphabetical character in last name.

INSTRUCTIONS:

See page 2.

SPECIAL CONSIDERATIONS:

Care must be exercised to insure sufficient storage for each record, as a file overflow will result in program termination. In all cases, the specific file in which the deficiency has occurred will be indicated by the program. That file should be killed and opened again.

ACKNOWLEDGEMENTS: William R. Hudson
Butler Senior High School/Butler, Pennsylvania

INSTRUCTIONS

Files "ATTEN1," "ATTEN2," "ATTEN3," and "ATTEN4," must be opened before each run and killed afterwards. "ATTEN1" - "ATTEN3" accomodates the number of absentees in classes 10, 11 and 12, respectively (5 names per record). For example, if there are 90 absentees in a class, there must be at least 19 records for that corresponding file [1+INT(N/5)].

Since the files will be killed immediately after the run of the program, the number of records opened is of no consequence as far as cost is concerned. Therefore, files should always be opened larger than necessary.

File "ATTEN4" is used as a buffer file. It must be opened (1 record per entry) to the number of students in the largest class.

Absentees should be entered on paper tape (to conserve terminal time) and should be punched as follows:

LAST NAME, FIRST NAME, GRADE [x-off, return, linefeed]

where:

the name of the student is entered as indicated and may occupy 20 positions,

grade is the class of the student being entered. If omitted, an appropriate error message will be issued.

Name and grade need not be separated; however, any character other than a blank will be accepted as part of the name. If data is not entered on tape, a return is the only needed character to end each line.

Example:

SMITH, JOHN 12 [return]

After the last absentee has been entered, type "END" at the next input (to signify end of data). Each class will then be alphabetized and recorded. Respond with "YES" or "NO" upon request of "CORRECTIONS?". If "YES" the entry numbers of absentees to be omitted will be requested (entry numbers are assigned sequentially during input). If "NO" is typed, the program will continue.

At the input for "TOTAL ATTENDANCE?", enter the number of students in attendance (the number of students present when there are no absentees). At the next input ("NUMBER OF LINES PER PAGE?"), enter the number of lines to be printed on a single page (57 for a standard sheet).

Execution of the program will not continue until the return key is depressed (allowing time for the placement of a stencil or other duplicating forms, in the teletype).

The return key must again be depressed after the printing of the given number of lines. If the printing form is not changed, printing will be continued at the point at which it was previously halted. For additional executions, RUN-930.

RUN

```
RUN
ATTEND


ENTER ABSENTEES AS FOLLOWS:
LAST NAME, FIRST - GRADE
TYPE 'END' AT FINAL DATA REQUEST


ABSENTEES  ********************* GR
ENTRY     1?KRIESS,DONNA 10
ENTRY     2?
            MIZERAK,PATRICE 12
ENTRY     3?
            KELLANDER,LORETTA 11
ENTRY     4?
            FREELING,DONNA 11
ENTRY     5?
            KALP,DEB 12
ENTRY     6?
            JAFFE,JOEL 12
ENTRY     7?
            LEYLAND,MIKE 12
ENTRY     8?
            KENNEDY,PAULA 12
ENTRY     9?
            SCOTT,VALENTINA 12
ENTRY    10?
            BOSHO,PAM 12
ENTRY    11?
            NANNI,DEB 10
ENTRY    12?
            FREDERICK,AMY 12
ENTRY    13?
            TOMASOVICH,RICK 11
ENTRY    14?
            O'BRIEN,CINDY 11
ENTRY    15?
            BARBER,JACK 12
ENTRY    16?
            ENGLISH,JOHN 12
ENTRY    17?
            GREEN,A-MARTIN 11
ENTRY    18?
            MORRISON,ALBY 11
ENTRY    19?
            SWIDZINSKI,ROD 11
ENTRY    20?
            BOUCH,MARY 11
ENTRY    21?
            LANCASTER,JANE 11
ENTRY    22?
            SCHEDLER,LINDA 12
ENTRY    23?
            STEFFANAUER,KAREN 11
ENTRY    24?
            BUREAU,CHUCK 11
ENTRY    25?
            BLOOM,LARRY 12
ENTRY    26?
            HENDERSHOT,CHUCK 2

INPUT ERROR
RE-TYPE ENTRY

ENTRY    26?
            HENDERSHOT,CHUCK 12
ENTRY    27?
            GIBBS,CATHY 12
ENTRY    28?
            SMALLWOOD,BEV 12
ENTRY    29?
            MCKAIN,LARRY 10
ENTRY    30?
            ORTH,RON 10
```

```
ENTRY   31?
           COGLEY,BOB 12
ENTRY   32?
           GAMBLE,RAY 12
ENTRY   33?
           HEITZER,KEN 11
ENTRY   34?
           OLEXSAK,DAVE 11
ENTRY   35?
           LEUTHARDT,VICKI 12
ENTRY   36?
           ZALIPONI,ROD 12
ENTRY   37?
           BIEDENBACH,PAUL 10
ENTRY   38?
           TURNER,TOM 10
ENTRY   39?
           PATTEN,PAT 10
ENTRY   40?
           SCOTT,HAROLD 11
ENTRY   41?
           BITTNER,WM. 10
ENTRY   42?
           HOCKENBERRY,ROBT 10
ENTRY   43?
           ZITZMAN,AL 12
ENTRY   44?
           PROTZMAN,S-DWIGHT 10
ENTRY   45?
           SWIDZINSKI,DALE 11
ENTRY   46?
           ZARNICK,DAVE 12
ENTRY   47?
           OTT,LUTHER 11
ENTRY   48?
           PALACE,CHUCK 11
ENTRY   49?
           SHEPPECK,JERRY 11
ENTRY   50?
           GREEN,JULIE 12
ENTRY   51?
           LESLIE,SALLY 12
ENTRY   52?
           BAUMGART,CAROL 10
ENTRY   53?
           DALLAS,KAREN 10
ENTRY   54?
           CRILEY,RON 12
ENTRY   55?
           GALL,DIANNA 12
ENTRY   56?
           DUNKLE,LISS -A 11
ENTRY   57?
           WEIGLE,PAT 11
ENTRY   58?
           LAMBERT,KAREN 10
ENTRY   59?
           URAM,GARY 12
ENTRY   60?
           MCCOMMON,DAVE 10
ENTRY   61?
           FALLECKER,ROSE 10
ENTRY   62?
           GRAHAM,DEB 10
ENTRY   63?
           GAUDINO,SABRINA 10
ENTRY   64?
           BIEDENBACH,ROGER 11
ENTRY   65?
           CINGOLANI,ROBT 12
ENTRY   66?
           YURKOVICH,GEO. 11
ENTRY   67?
           K-MAUST,KEITH 12
ENTRY   68?
           GRAY,PATTY 11
ENTRY   69?
           KENNEDY,L-TOM 11
```

```
ENTRY   70?
           MILLER,GEO. 11
ENTRY   71?
           CRAIG,RANDY 11
ENTRY   72?
           HUTCHISON,KEITH 11
ENTRY   73?
           MATSON,JIM 11
ENTRY   74?
           HAINER,FRANK 12
ENTRY   75?
           BARBE,

INPUT ERROR
RE-TYPE ENTRY

ENTRY   75?
           BARBER,JEFF 10
ENTRY   76?
           REOTT,ROD 10
ENTRY   77?
           SMITH,RANDY 10
ENTRY   78?
           WAHLER,RONNIE 10
ENTRY   79?
           BAYER,SCOTT 10
ENTRY   80?END


CLASS 10 RECORDED
CLASS 11 RECORDED
CLASS 12 RECORDED
DATA RECORDED

CORRECTIONS?YES

ENTER NUMBER OF ABSENTEE TO BE OMITTED
TYPE ZERO AT FINAL DATA REQUEST


ENTRY NUMBER?35
ENTRY NUMBER?54
ENTRY NUMBER?ZERO
??0


TOTAL ATTENDANCE?2400
NUMBER OF LINES PER PAGE?100

RETURN KEY MUST BE DEPRESSED TO CONTINUE EXCECUTION
```

ATTENDANCE BULLETIN
7/19/72

GRADE 10:	GRADE 11:	GRADE 12:
*BARBER,JEFF	*BIEDENBACH,ROGER	*BARBER,JACK
BAUMGART,CAROL	BOUCH,MARY	BLOOM,LARRY
BAYER,SCOTT	BUREAU,CHUCK	BOSHO,PAM
BIEDENBACH,PAUL	*CRAIG,RANDY	*CINGOLANI,ROBT
BITTNER,WM.	*DUNKLE,LISSA	COGLEY,BOB
*DALLAS,KAREN	*FREELING,DONNA	*ENGLISH,JOHN
*FALLECKER,ROSE	*GRAY,PATTY	*FREDERICK,AMY
*GAUDINO,SABRINA	GREEN,MARTIN	*GALL,DIANNA
GRAHAM,DEB	*HEITZER,KEN	GAMBLE,RAY
*HOCKENBERRY,ROBT	HUTCHISON,KEITH	GIBBS,CATHY
*KRIESS,DONNA	*KELLANDER,LORETTA	GREEN,JULIE
*LAMBERT,KAREN	KENNEDY,TOM	*HAINER,FRANK
*MCCOMMON,DAVE	*LANCASTER,JANE	HENDERSHOT,CHUCK
MCKAIN,LARRY	*MATSON,JIM	*JAFFE,JOEL
*NANNI,DEB	MILLER,GEO.	*KALP,DEB
*ORTH,RON	MORRISON,ALBY	KENNEDY,PAULA
*PATTEN,PAT	*OLEXSAK,DAVE	*LESLIE,SALLY
PROTZMAN,DWIGHT	OTT,LUTHER	LEYLAND,MIKE
*REOTT,ROD	O'BRIEN,CINDY	*MAUST,KEITH
*SMITH,RANDY	*PALACE,CHUCK	MIZERAK,PATRICE
*TURNER,TOM	*SCOTT,HAROLD	*SCHEDLER,LINDA
*WAHLER,RONNIE	SHEPPECK,JERRY	SCOTT,VALENTINA
	STEFFANAUER,KAREN	SMALLWOOD,BEV
	SWIDZINSKI,DALE	*URAM,GARY
	SWIDZINSKI,ROD	*ZALIPONI,ROD
	*TOMASOVICH,RICK	ZARNICK,DAVE
	*WEIGLE,PAT	ZITZMAN,AL
	*YURKOVICH,GEO.	

TOTAL ABSENTEES 77
PERCENT ATTENDANCE 96.79%

DONE

CONTRIBUTED PROGRAM **BASIC**

AVERG1
36340

TITLE: AVERG1: Averages and Curves Grades

DESCRIPTION: This program will average any number of grades. A passing grade must be inputted by the teacher, and the computer will list the numerical value of the curve and the respected adjusted grades based on the computed averages and the passing grade.

INSTRUCTIONS: Enter grades as DATA in lines 600-700.

SPECIAL CONSIDERATIONS: Curving is valid only if the original grade distribution showed a Bell Curve.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN
600  DATA 65,78,76,48,65,78,82,69,71,56,90,67,59,60,70,74,62,57,66
601  DATA 64,63,65,59,60,56,48,66
RUN
AVERG1

PASSING GRADE FOR THIS TEST IS ?70

THE AVERAGE OF ALL GRADES ENTERED IS 65.7037

THE AVERAGE FALLS BELOW THE PASSING GRADE BY 4      POINTS.
(ROUNDED TO NEAREST WHOLE NUMBER.)

ADJUSTED GRADE = ORIGINAL GRADE + 4

STUDENT          ORIGINAL         ADJUSTED
NUMBER            GRADE            GRADE
=======          ========         ========
 1                65               69
 2                78               82
 3                76               80
 4                48               52
 5                65               69
 6                78               82
 7                82               86
 8                69               73
 9                71               75
 10               56               60
 11               90               94
 12               67               71
 13               59               63
 14               60               64
 15               70               74
 16               74               78
 17               62               66
 18               57               61
 19               66               70
 20               64               68
 21               63               67
 22               65               69
 23               59               63
 24               60               64
 25               56               60
 26               48               52
 27               66               70

DONE
```

BASKET
36605

TITLE: BASKETBALL STATISTICS

DESCRIPTION:

This program maintains individual and team statistics for varsity and junior varsity basketball teams. Data items input are offensive rebounds, defensive rebounds, losses (losses of the ball by bad passes, fumbles, allowing the ball to be stolen or being tied up and losing the jump), violations (rule violations other than fouls which result in the loss of the ball), gains (individually forcing losses or violations on opponents), assists, fouls, field goals attempted, field goals made, free throws attempted and free throws made. Output consists of a chart divided into Floor Play and Shooting categories which contains individual totals, games played and shooting and scoring averages. Team information consists of totals and averages on all items input.

INSTRUCTIONS:

Open files VARS and JRVAR with one record each and file NAMES with two records. Enter a zero matrix (21 x 6) in VARS and JRVAR. A program named PROG is provided to enter the zero matrix. Just GET-PROG and RUN to initialize the files. Enter the names of up to 21 varsity players in numerical order in the first record of NAMES and the same information for the junior varsity in the second record. Maximum name length is nine characters.

Two statements must be altered as follows: 80 R = number of varsity players and 110 R = number of junior varsity players.

The argument of the TAB function and the school name in statement 890 should be changed. The formula for the argument is:

If the number of characters in the name string is odd, then the argument is - 36 $\frac{\text{number of characters} + 1}{2}$

If the number of characters in the name string is even, then the argument is - 36 $\frac{\text{number of characters}}{2}$

continued on following page

SPECIAL CONSIDERATIONS:

In order that all data for one team may be stored in a file of one record, the data which is output from a matrix as large as 21 x 13 is compressed into a 21 x 6 matrix. Of the thirteen items for each player, the rebounding and shooting may each total up to 999 (three digits) and other items up to 99 for a total of 32 digits. These are stored in five six-digit numbers and one two-digit number.

ACKNOWLEDGEMENTS:

Richard Bach
North Eugene High School

INSTRUCTIONS continued

On execution, first input required is the number of players for whom data is to be entered, number of games played to date and team identification (varsity or junior varsity).

Next input is player data consisting of the uniform number followed by the eleven items listed above (in the description of the program) in the order given. Players are entered separately and in order of uniform number.

On the season's first execution, enter data for all players, including those who have not yet played. For them, enter the negative of the uniform number (to avoid counting a game played) and eleven zeroes. The question GAMES? will be typed when a negative uniform number is entered. Enter a zero on first execution.

Errors in data can be corrected after the error appears in a complete printout. To correct for any number or players, execute the program, indicating the number of players for whom corrections are needed. Then enter the negative of the player number followed by zeroes or positive or negative numbers as needed to correct. When GAMES? is typed enter the number required to correct the number of games played.

To get a printout without entering player data, enter zero for the number of players.

```
RUN

10  FILES NAMES
20  PRINT #1,1;"WOODRUFF","LEWMAN","AINGE DAV","HATFIELD","JACKSON"
30  PRINT #1;"COOLEY","SCHNEIDER","GOHL","MCCONNELL","ROSHAU","HANEKE"
40  PRINT #1;"NEEDS","AINGE DOU","BURGE"
50  END
RUN
MISSING OR PROTECTED FILE
OPE-NAMES,2
RUN


DONE


OPE-VARS,1
OPE-JRVAR,1
GET-PROG


RUN
PROG


DONE


GET-BASKET
RUN
BASKET

ENTER # OF MEN PLAYING, GAME #, TEAM (VARSITY OR JV)
?14,1,V
ENTER #, OFF RB, DEF RB, LOSS, VIOL, GAIN, ASST, FOULS, FGA, FG, FTA, FT
?12,1,1,0,0,0,2,2,2,1,2,0
?-13,0,0,0,0,0,0,0,0,0,0,0
GAMES?0
?14,0,1,1,1,1,2,3,6,2,2,2
?20,0,0,0,0,0,0,0,2,2,0,0,0
?22,0,1,1,1,1,3,3,5,3,4,4
?24,1,1,0,0,0,1,1,2,0,0,0
?-26,0,0,0,0,0,0,0,0,0,0,0
GAMES?0
?-28,0,0,0,0,0,0,0,0,0,0,0
GAMES?0
?-30,0,0,0,0,0,0,0,0,0,0,0
GAMES?0
?32,3,4,2,1,1,4,2,12,9,0,0
?3--36,0,0,0,0,0,0,0,0,0,0,0
GAMES?0
?-40,0,0,0,0,0,0,0,0,0,0,0
GAMES?0
?50,4,6,1,0,1,2,0,12,8,1,1
?52,3,5,2,1,1,2,2,12,4,5,4
```

NORTH EUGENE HIGH SCHOOL
VARSITY BASKETBALL STATISTICS
THROUGH 1 GAMES

FLOOR PLAY

PLAYER NAME	NO.	OFF REB	DEF REB	LOSS	VIOL	GAIN	ASST	FOULS	GAMES PLAYED
WOODRUFF	12	1	1	0	0	0	2	2	1
LEWMAN	13	0	0	0	0	0	0	0	0
AINGE DAV	14	0	1	1	1	1	2	3	1
HATFIELD	20	0	0	0	0	0	0	2	1
JACKSON	22	0	1	1	1	1	3	3	1
COOLEY	24	1	1	0	0	0	1	1	1
SCHNEIDER	26	0	0	0	0	0	0	0	0
GOHL	28	0	0	0	0	0	0	0	0
MCCONNELL	30	0	0	0	0	0	0	0	0
ROSHAU	32	3	4	2	1	1	4	2	1
HANEKE	36	0	0	0	0	0	0	0	0
NEEDS	40	0	0	0	0	0	0	0	0
AINGE DOU	50	4	6	1	0	1	2	0	1
BURGE	52	3	5	2	1	1	2	2	1
TEAM TOTALS		12	19	7	4	5	16	15	
TEAM AVERAGES		12.0	19.0	7.0	4.0	5.0	16.0	15.0	

SHOOTING

PLAYER NAME	NO.	F G ATT	FLD GLS	FLD GL AVERAGE	F T ATT	FR THR	FR THR AVERAGE	POINT TOTAL	POINT AVERAGE
WOODRUFF	12	2	1	0.500	2	0	0.000	2	2.0
LEWMAN	13	0	0	0.000	0	0	0.000	0	0.0
AINGE DAV	14	6	2	0.333	2	2	1.000	6	6.0
HATFIELD	20	2	0	0.000	0	0	0.000	0	0.0
JACKSON	22	5	3	0.600	4	4	1.000	10	10.0
COOLEY	24	2	0	0.000	0	0	0.000	0	0.0
SCHNEIDER	26	0	0	0.000	0	0	0.000	0	0.0
GOHL	28	0	0	0.000	0	0	0.000	0	0.0
MCCONNELL	30	0	0	0.000	0	0	0.000	0	0.0
ROSHAU	32	12	9	0.750	0	0	0.000	18	18.0
HANEKE	36	0	0	0.000	0	0	0.000	0	0.0
NEEDS	40	0	0	0.000	0	0	0.000	0	0.0
AINGE DOU	50	12	8	0.667	1	1	1.000	17	17.0
BURGE	52	12	4	0.333	5	4	0.800	12	12.0
TEAM TOTALS		53	27		14	11		65	
TEAM AVERAGES		53.0	27.0	0.509	14.0	11.0	0.786		65.0

DONE

RUN
BASKET

```
ENTER # OF MEN PLAYING, GAME #, TEAM (VARSITY OR JV)
?8,2,V
ENTER #, OFF RB, DEF RB, LOSS, VIOL, GAIN, ASST, FOULS, FGA, FG, FTA, FT
?13,1,1,0,0,0,2,2,2,1,2,0
?14,0,0,1,1,1,2,3,5,2,2,1
?20,0,0,0,0,0,2,2,0,0,0,0
?30,1,1,0,0,0,1,1,2,0,0,0
?36,3,4,2,1,1,4,2,12,8,0,0
?40,4,6,1,0,1,2,0,12,8,1,1
?50,3,5,2,1,1,2,2,12,4,5,4
?52,4,6,1,0,1,2,0,12,8,2,1
```

NORTH EUGENE HIGH SCHOOL
VARSITY BASKETBALL STATISTICS
THROUGH 2 GAMES

FLOOR PLAY

PLAYER NAME	NO.	OFF REB	DEF REB	LOSS	VIOL	GAIN	ASST	FOULS	GAMES PLAYED
WOODRUFF	12	1	1	0	0	0	2	2	1
LEWMAN	13	1	1	0	0	0	2	2	1
AINGE DAV	14	0	1	2	2	2	4	6	2
HATFIELD	20	0	0	0	0	0	2	4	2
JACKSON	22	0	1	1	1	1	3	3	1
COOLEY	24	1	1	0	0	0	1	1	1
SCHNEIDER	26	0	0	0	0	0	0	0	0
GOHL	28	0	0	0	0	0	0	0	0
MCCONNELL	30	1	1	0	0	0	1	1	1
ROSHAU	32	3	4	2	1	1	4	2	1
HANEKE	36	3	4	2	1	1	4	2	1
NEEDS	40	4	6	1	0	1	2	0	1
AINGE DOU	50	7	11	3	1	2	4	2	2
BURGE	52	7	11	3	1	2	4	2	2
TEAM TOTALS		28	42	14	7	10	33	27	
TEAM AVERAGES		14.0	21.0	7.0	3.5	5.0	16.5	13.5	

SHOOTING

PLAYER NAME	NO.	F G ATT	FLD GLS	FLD GL AVERAGE	F T ATT	FR THR	FR THR AVERAGE	POINT TOTAL	POINT AVERAGE
WOODRUFF	12	2	1	0.500	2	0	0.000	2	2.0
LEWMAN	13	2	1	0.500	2	0	0.000	2	2.0
AINGE DAV	14	11	4	0.364	4	3	0.750	11	5.5
HATFIELD	20	2	0	0.000	0	0	0.000	0	0.0
JACKSON	22	5	3	0.600	4	4	1.000	10	10.0
COOLEY	24	2	0	0.000	0	0	0.000	0	0.0
SCHNEIDER	26	0	0	0.000	0	0	0.000	0	0.0
GOHL	28	0	0	0.000	0	0	0.000	0	0.0
MCCONNELL	30	2	0	0.000	0	0	0.000	0	0.0
ROSHAU	32	12	9	0.750	0	0	0.000	18	18.0
HANEKE	36	12	8	0.667	0	0	0.000	16	16.0
NEEDS	40	12	8	0.667	1	1	1.000	17	17.0
AINGE DOU	50	24	12	0.500	6	5	0.833	29	14.5
BURGE	52	24	12	0.500	7	5	0.714	29	14.5
TEAM TOTALS		110	58		26	18		134	
TEAM AVERAGES		55.0	29.0	0.527	13.0	9.0	0.692		67.0

DONE

TITLE: COLLEGE REGISTRATION DEMO — COLREG 36282

DESCRIPTION:

COLREG is a comprehensive demo package that illustrates the feasibility of an on-line, multi-terminal college registration. The package consists of 10 programs: CLEAR, FILE, PREREG, REPS, AVAIL, REG, SOFAR, GRAD, CLASS, and COPY.

INSTRUCTIONS:

It is estimated that 1 million characters are needed for each 1,000 students. This estimate is for student and course information only and does not account for program storage.

The operation here assumes that the college registrar will manually plan a list of available courses and associated instructors. This list is entered into the system as well as sent to all students. The students then plan their individual programs at home and then at registration day they enter their programs into the system on one of 32 terminals. This system then checks for validity, class conflict, etc. as students enter their courses. Upon successful completion, the student is given an on-the-spot report of his program. In addition, class reports for the instructors can be obtained at the end of registration.

During the year the individual instructors may enter grades for his students and provide reports for all student grades.

The time per student at registration seems to be about 5 minutes, so a 32 terminal system could handle 384 students/hour.

Continued on following page.

SPECIAL CONSIDERATIONS:

1. Maximum number of students - 32
2. Maximum number of courses one student can take - 9
3. Maximum number of credits a student may take - 17
4. Maximum number of courses available - 9
5. Maximum number of sections within a course - 6
6. Maximum number of hours per week a section may have - 5
7. Sections must be scheduled at same start time and length on each available day.
8. Two programs that write on files may not run simultaneously.
9. No deletes are provided for students, courses, or sections.
10. May not change the original quota for any section.

ACKNOWLEDGEMENTS: George Tibaldi/Dave Denman
HP, Eastern Sales Region

INSTRUCTIONS: continued

NAME OF PROGRAM	FUNCTION
CLEAR	Clears student and course files
FILE	To enter available courses and sections
PREREG	To enter student names and addresses. Prior to registration (if required)
REPS	Lists students' name and addresses
AVAIL	Lists courses and sections available
REG	To register students (can be used to list any students programs)
SOFAR	To list courses, sections and students registered SOFAR
GRAD	To enter midterm or final grades
CLASS	To provide a class report for each instructor
COPY	Restores (copies) two back-up files to student and course

1. OPEN-STUDNT, 128
   OPEN-COURSE, 128
   OPEN-WORK, 3
   OPEN-WORK1, 10
   OPEN-WORK2, 10
2. RUN "CLEAR" to clean student and course file
3. RUN "FILE" to enter an available curriculum
4. RUN "AVAIL" to get a report of all courses and sections entered with "FILE"
5. May RUN "PREREG" to enter names and addresses of students. This saves time at actual registration ("REG") in that names, etc. are already entered.
6. RUN "REG" to enter courses for students. This student should use this program with a copy of the report from "AVAIL" in his hand.
7. May RUN "SOFAR" at any time to see the number of students enrolled SOFAR
8. May RUN "CLASS" at any time to see the actual students enrolled in each class. This program thus provides class reports for all courses to be given to each instructor
9. At midterm and final time, each instructor would run "GRAD" to enter the grades for his students
10. After all midterm or final grades are entered, run "CLASS" again to see entered grades
11. RUN "REPS" at any time to see students in file

The following list of programs may be run at any time with out altering any files since they read only:

REPS, AVAIL, SOFAR, CLASS or REG (with just typing "END" in response to "COURSE-SEC")

For demo purposes, the following procedures are useful:

A. RUN "CLEAR"

B. RUN "FILE" for 7 courses and 3 to 4 sections per course

C. RUN "PREREG" for about 10 students

D. Using a file copy program, ("COPY") save both student and course files. In this way this state can easily be recreated from back-up files (CSAVE and SSAVE).

The file copy program, COPY, included in this program package has been set up to perform these steps. user may just RUN COPY to restore the state. The sample RUNs which follow illustrate the building of the files rather than using COPY which has already set up the files.

```
RUN

GET-CLEAR
RUN
CLEAR                          CLEARS STUDENT AND COURSE FILE

DONE

GET-REPS
RUN
REPS                           FILES ARE EMPTY

ALL OR STUDENT # ?
?ALL

NOT IN FILES

DONE

GET-PREREG
RUN
PREREG

RESPOND WITH ANSWER OR END

STUDENT #??229-56-5036
LAST NAME??BANISCH
FIRST NAME??JIM
MIDDLE INITIAL??Z
PHONE??265-7000
SEX??M
CITY??C-KING OF PRUSSIA
STATE??PENNSYLVANIA
BAD INPUT, RETYPE FROM ITEM 1                PREREGISTER STUDENTS
??PENN.
STREET ADDRESS??1021 EIGHTH ST.
STUDENT #??149-24:686
LAST NAME??FRANK
FIRST NAME??LEE
MIDDLE INITIAL??Z
PHONE??667-4000
SEX??M
CITY??CHERRY HILL
STATE??NEW JERSEY
BAD INPUT, RETYPE FROM ITEM 1
??N.J.
STREET ADDRESS??1060 N. KINGS HIGHWAY
STUDENT #??136-26-1841
LAST NAME??BOLCIK
FIRST NAME??BOB
MIDDLE INITIAL??Z
PHONE??948-6370
SEX??M
CITY??ROCKVILLE
STATE??MD.
STREET ADDRESS??2 CHOKE CHERRY LANE
STUDENT #??065-32:2709
LAST NAME??TIBALDI
FIRST NAME??GEORGE
MIDDLE INITIAL??A
PHONE??265-5000
SEX??M
CITY??PARAMUS
STATE??N.J.
STREET ADDRESS??120 W. CENTURY RD.
STUDENT #??012-28-2705
LAST NAME??KELLEY
FIRST NAME??KEN
```

```
MIDDLE INITIAL??Z
PHONE??948-6370
SEX??M
CITY??ROCKVILLE
STATE??MD.
STREET ADDRESS??2 CHOKE CHERRY LANE
STUDENT #??END

DONE



GET-REPS
RUN
REPS

ALL OR STUDENT # ?
?ALL
229-56-5036 BANISCH JIM Z
1021 EIGHTH ST.  KING OF PRUSSIA,PENN.
265-7000      SEX M

                                                    LISTS ALL STUDENTS PREREGISTERED

149-24:686 FRANK LEE Z
1060 N. KINGS HIGHWAY  CHERRY HILL,N.J.
667-4000      SEX M


136-26-1841 BOLCIK BOB Z
2 CHOKE CHERRY LANE  ROCKVILLE,MD.
948-6370      SEX M


065-32:2709 TIBALDI GEORGE A
120 W. CENTURY RD.  PARAMUS,N.J.
265-5000      SEX M


012-28-2705 KELLEY KEN Z
2 CHOKE CHERRY LANE  ROCKVILLE,MD.
948-6370      SEX M


END OF FILE

DONE



GET-FILE
RUN
FILE

TITLE ?ENG1                                   ENTER COURSES
CREDITS ?3
SECTIONS ?3



SECTION # ?2
START TIME ?10
LENGTH ?1
TIMES/WEEK ?3
DAY  1     ?1
DAY  2     ?3
DAY  3     ?5
INSTRUCTOR ?SMITH
QUOTA ?5
```

```
SECTION # ?1
START TIME ?9
LENGTH ?1
TIMES/WEEK ?3
DAY  1     ?1
DAY  2     ?4
DAY  3     ?5
INSTRUCTOR ?DRAPER
QUOTA ?4



SECTION # ?3
START TIME ?3
LENGTH ?1
TIMES/WEEK ?3
DAY  1     ?1
DAY  2     ?3
DAY  3     ?5
INSTRUCTOR ?BROWN
QUOTA ?4
DONE??NO
TITLE ?HIST1
CREDITS ?3
SECTIONS ?4



SECTION # ?1
START TIME ?9
LENGTH ?1
TIMES/WEEK ?3
DAY  1     ?1
DAY  2     ?3
DAY  3     ?5
INSTRUCTOR ?WATTS
QUOTA ?4



SECTION # ?2
START TIME ?11
LENGTH ?1
TIMES/WEEK ?3
DAY  1     ?1
DAY  2     ?3
DAY  3     ?5
INSTRUCTOR ?WATTS
QUOTA ?4



SECTION # ?3
START TIME ?1
LENGTH ?1
TIMES/WEEK ?3
DAY  1     ?1
DAY  2     ?4
DAY  3     ?5
INSTRUCTOR ?DRAPER
QUOTA ?3
```

```
SECTION # ?4
START TIME ?4
LENGTH ?1
TIMES/WEEK ?3
DAY  1     ?1
DAY  2     ?3
DAY  3     ?5
INSTRUCTOR ?MARK
QUOTA ?3
DONE??NO
TITLE ?EC01
CREDITS ?3
SECTIONS ?4



SECTION # ?1
START TIME ?10
LENGTH ?1
TIMES/WEEK ?3
DAY  1     ?1
DAY  2     ?3
DAY  3     ?5
INSTRUCTOR ?I-HARRIS
QUOTA ?3



SECTION # ?2
START TIME ?11
LENGTH ?1
TIMES/WEEK ?3
DAY  1     ?1
DAY  2     ?2
DAY  3     ?5
INSTRUCTOR ?MARTIN
QUOTA ?4



SECTION # ?3
START TIME ?3
LENGTH ?1
TIMES/WEEK ?3
DAY  1     ?1
DAY  2     ?3
DAY  3     ?5
INSTRUCTOR ?HARRIS
QUOTA ?3



SECTION # ?4
START TIME ?4
LENGTH ?1
TIMES/WEEK ?3
DAY  1     ?2
DAY  2     ?3
DAY  3     ?5
INSTRUCTOR ?BONNER
QUOTA ?4
DONE??NO
TITLE ?BI01
CREDITS ?4
SECTIONS ?4
```

```
SECTION # ?1
START TIME ?9
LENGTH ?4
TIMES/WEEK ?1
DAY  1    ?2
INSTRUCTOR ?MC CLEAN
QUOTA ?4



SECTION # ?2
START TIME ?9
LENGTH ?4
TIMES/WEEK ?1
DAY  1    ?4
INSTRUCTOR ?MARIN
QUOTA ?3



SECTION # ?3
START TIME ?1
LENGTH ?4
TIMES/WEEK ?1
DAY  1    ?4
INSTRUCTOR ?KNOPP
QUOTA ?4



SECTION # ?4
START TIME ?1
LENGTH ?4
TIMES/WEEK ?1
DAY  1    ?5
INSTRUCTOR ?MC CLEAN
QUOTA ?4
DONE??NO
TITLE ?CHEM1
CREDITS ?4
SECTIONS ?3



SECTION # ?1
START TIME ?9
LENGTH ?4
TIMES/WEEK ?1
DAY  1    ?2
INSTRUCTOR ?TOTIE
QUOTA ?4



SECTION # ?2
START TIME ?9
LENGTH ?4
TIMES/WEEK ?1
DAY  1    ?4
INSTRUCTOR ?MATHEWS
QUOTA ?3
```

```
SECTION # ?3
START TIME ?1
LENGTH ?4
TIMES/WEEK ?1
DAY  1    ?3
INSTRUCTOR ?TOTIE
QUOTA ?4
DONE??NO
TITLE ?CHEM1
DUPLICATE COURSE NAME
SECTION ADDITION (Y OR N) ?N
TITLE ?PHY1
CREDITS ?4
SECTIONS ?4


SECTION # ?1
START TIME ?9
LENGTH ?4
TIMES/WEEK ?1
DAY  1    ?1
INSTRUCTOR ?KING
QUOTA ?4


SECTION # ?2
START TIME ?9
LENGTH ?4
TIMES/WEEK ?1
DAY  1    ?2
INSTRUCTOR ?FULLER
QUOTA ?3


SECTION # ?3
START TIME ?9
LENGTH ?4
TIMES/WEEK ?1
DAY  1    ?4
INSTRUCTOR ?KING
QUOTA ?4


SECTION # ?4
START TIME ?1
LENGTH ?4
TIMES/WEEK ?1
DAY  1    ?4
INSTRUCTOR ?FOSTER
QUOTA ?4
DONE??NO
TITLE ?PHYED1
CREDITS ?3
SECTIONS ?4


SECTION # ?1
START TIME ?9
LENGTH ?2
TIMES/WEEK ?2
DAY  1    ?2
DAY  2    ?4
INSTRUCTOR ?PARRISH
QUOTA ?5
```

```
SECTION # ?2
START TIME ?9
LENGTH ?2
TIMES/WEEK ?2
DAY  1    ?1
DAY  2    ?3
INSTRUCTOR ?PEREIRA
QUOTA ?5



SECTION # ?3
START TIME ?2
LENGTH ?2
TIMES/WEEK ?2
DAY  1    ?4
DAY  2    ?5
INSTRUCTOR ?MEYER
QUOTA ?5



SECTION # ?4
START TIME ?1
LENGTH ?2
TIMES/WEEK ?2
DAY  1    ?1
DAY  2    ?2
INSTRUCTOR ?MACKENZIE
QUOTA ?5
DONE??YES

DONE
```

```
GET-AVAIL
RUN
AVAIL                                PRINTS OUT LIST OF ENTERED COURSES

COURSE       SEC   CRDS   INSTRUCTOR          TIME

ENG1          2      3    SMITH               10-11MOWDFR
ENG1          1      3    DRAPER              9-10MOTHFR
ENG1          3      3    BROWN               3-4MOWDFR

HIST1         1      3    WATTS               9-10MOWDFR
HIST1         2      3    WATTS               11-12MOWDFR
HIST1         3      3    DRAPER              1-2MOTHFR
HIST1         4      3    MARK                4-5MOWDFR

EC01          1      3    HARRIS              10-11MOWDFR
EC01          2      3    MARTIN              11-12MOTUFR
EC01          3      3    HARRIS              3-4MOWDFR
EC01          4      3    BONNER              4-5TUWDFR

BI01          1      4    MC CLEAN            9-1TU
BI01          2      4    MARIN               9-1TH
BI01          3      4    KNOPP               1-5TH
BI01          4      4    MC CLEAN            1-5FR

CHEM1         1      4    TOTIE               9-1TU
CHEM1         2      4    MATHEWS             9-1TH
CHEM1         3      4    TOTIE               1-5WD

PHY1          1      4    KING                9-1MO
PHY1          2      4    FULLER              9-1TU
PHY1          3      4    KING                9-1TH
PHY1          4      4    FOSTER              1-5TH
```

```
PHYED1        1      3     PARRISH                  9-11TUTH
PHYED1        2      3     PEREIRA                  9-11MOWD
PHYED1        3      3     MEYER                    2-4THFR
PHYED1        4      3     MACKENZIE                1-3MOTU


DONE



GET-REG
RUN
REG

RESPOND WITH ANSWER OR END


STUDENT # ??229-56-5036
                                        REGISTRATION OF A STUDENT WHO HAD PREREGISTERED
COURSE-SECTION
?HIST1-3
CREDITS ENTERED SOFAR=  3

COURSE-SECTION
?ENG1-1
CREDITS ENTERED SOFAR=  6

COURSE-SECTION
?HIST-1
COURSE OR SECTION NON EXISTENT
                                        STUDENT PICKS COURSES FROM "AVAIL" PRINTOUT
COURSE-SECTION
?HIST1-1
ALREADY HAVE HIST1

COURSE-SECTION
?ECO1-1
COURSE OR SECTION NON EXISTENT

COURSE-SECTION
?EC01-1
CREDITS ENTERED SOFAR=  9

COURSE-SECTION
?CHEM1-3
CREDITS ENTERED SOFAR=  13

COURSE-SECTION
?PHYED1-2
TIME CONFLICT WITH ENG1

COURSE-SECTION
?PHYED1-1
TIME CONFLICT WITH ENG1

COURSE-SECTION
?PHYED1-4
TIME CONFLICT WITH HIST1

COURSE-SECTION
?PHYED1-3
CREDITS ENTERED SOFAR=  16

COURSE-SECTION
?END
```

```
229-56-5036  BANISCH  JIM Z                    STUDENT'S PROGRAM OF CLASSES

COURSE        SEC   CRDS   INSTRUCTOR              TIME

HIST1          3      3    DRAPER                  1-2MOTHFR
ENG1           1      3    DRAPER                  9-10MOTHFR
EC01           1      3    HARRIS                  10-11MOWDFR
CHEM1          3      4    TOTIE                   1-5WD
PHYED1         3      3    MEYER                   2-4THFR

TOTAL CREDITS=  16


STUDENT # ??END

DONE



GET-FILE
RUN
FILE

TITLE ?PHYED1
DUPLICATE COURSE NAME
SECTION ADDITION (Y OR N) ?Y
SECTION # ?8
START TIME ?1                          ADDS A NEW SECTION OF PHYS.ED. BECAUSE OF NEED
LENGTH ?2                              EVIDENT ON REGISTRATION DAY
TIMES/WEEK ?2
DAY  1     ?3
DAY  2     ?4
INSTRUCTOR ?PIXLER
QUOTA ?2
DONE??YES

DONE



GET-FILE
RUN
FILE

TITLE ?MATH1
CREDITS ?3
SECTIONS ?2

                                       ENTERS A NEW COURSE WITH 2 SECTIONS


SECTION # ?1
START TIME ?9
LENGTH ?1
TIMES/WEEK ?3
DAY  1     ?1
DAY  2     ?3
DAY  3     ?4
INSTRUCTOR ?GOODMAN
QUOTA ?5



SECTION # ?2
START TIME ?11
LENGTH ?1
TIMES/WEEK ?3
DAY  1     ?1
DAY  2     ?3
DAY  3     ?5
INSTRUCTOR ?BLAIR
QUOTA ?5
DONE??YES

DONE
```

```
GET-SOFAR
RUN
SOFAR
```

DURING REGISTRATION PROCESS WE CAN SEE THE ACTIVITY SO FAR

COURSE	SEC	CRDS	INSTRUCTOR	QUOTA	SOFAR
ENG1	2	3	SMITH	5	0
ENG1	1	3	DRAPER	4	1
ENG1	3	3	BROWN	4	0
HIST1	1	3	WATTS	4	0
HIST1	2	3	WATTS	4	0
HIST1	3	3	DRAPER	3	1
HIST1	4	3	MARK	3	0
EC01	1	3	HARRIS	3	1
EC01	2	3	MARTIN	4	0
EC01	3	3	HARRIS	3	0
EC01	4	3	BONNER	4	0
BI01	1	4	MC CLEAN	4	0
BI01	2	4	MARIN	3	0
BI01	3	4	KNOPP	4	0
BI01	4	4	MC CLEAN	4	0
CHEM1	1	4	TOTIE	4	0
CHEM1	2	4	MATHEWS	3	0
CHEM1	3	4	TOTIE	4	1
PHY1	1	4	KING	4	0
PHY1	2	4	FULLER	3	0
PHY1	3	4	KING	4	0
PHY1	4	4	FOSTER	4	0
PHYED1	1	3	PARRISH	5	0
PHYED1	2	3	PEREIRA	5	0
PHYED1	3	3	MEYER	5	1
PHYED1	4	3	MACKENZIE	5	0
PHYED1	8	3	PIXLER	2	0
MATH1	1	3	GOODMAN	5	0
MATH1	2	3	BLAIR	5	0

```
TOTAL REGISTERED SOFAR = 5
```

NOTE NEW COURSES WE ADDED

NUMBER OF SEATS, NOT STUDENTS

```
DONE
```

```
GET-REG
RUN
REG

RESPOND WITH ANSWER OR END

STUDENT # ??111-22-3333
LAST NAME??STAUBER
FIRST NAME??LEE
MIDDLE INITIAL??Z
PHONE??345-6980
SEX??M
CITY??CA.
STATE??CA.
STREET ADDRESS??123 FORBES ST.

COURSE-SECTION
?MATH1-2
CREDITS ENTERED SOFAR=  3

COURSE-SECTION
?PHYED1-8
CREDITS ENTERED SOFAR=  6
```

REGISTERS A STUDENT WHOSE NAME WAS NOT PREREGISTERED

```
COURSE-SECTION
?HIST1-3
TIME CONFLICT WITH PHYED1

COURSE-SECTION
?ENG1-1
CREDITS ENTERED SOFAR=  9

COURSE-SECTION
?END


111-22-3333  STAUBER  LEE Z

COURSE        SEC  CRDS  INSTRUCTOR            TIME

MATH1         2     3    BLAIR                11-12MOWDFR
PHYED1        8     3    PIXLER               1-3WDTH
ENG1          1     3    DRAPER               9-10MOTHFR

TOTAL CREDITS=  9


STUDENT # ??END

DONE
```

```
GET-CLASS                       AFTER REGISTRATION, 'CLASS' PROVIDES TEACHER WITH
RUN                             ENROLLMENT IN HIS OWN CLASS
CLASS

ALL,COURSE, OR COURSE-SECTION ?
?ENG1-1


ENG1-1  CR= 3      9-10MOTHFR  DRAPER  COUNT= 2

STUDENT #       NAME                                          MT   F

229-56-5036     BANISCH  JIM  Z
111-22-3333     STAUBER  LEE  Z


DONE
```

```
GET-GRADE
RUN
GRADE

ENTER COURSE TITLE?ENG1
ENTER SECTION#?1
MID-TERM OR FINAL (M OR F)?M        THE TEACHER MAY ENTER GRADES FOR HIS CLASS
ENTER MARK FOR JIM BANISCH?F
ENTER MARK FOR LEE STAUBER?A

DONE
```

```
GET-CA-LASS
RUN
CLASS

ALL, COURSE, OR COURSE-SECTION ?
?ENG1-1
```

RUN 'CLASS' AGAIN TO SHOW ENROLLMENT AND GRADES

```
ENG1-1  CR= 3      9-10MOTHFR  DRAPER  COUNT= 2

STUDENT #       NAME                                          MT   F

229-56-5036     BANISCH  JIM  Z                               F
111-22-3333     STAUBER  LEE  Z                               A


DONE
```

FREQ
36341

TITLE: FREQ: Bar Graphs of Grades

DESCRIPTION: This program prints a frequency distribution (bar graphs) of grades, for a single test for one or more classes, or for several tests for one student.

INSTRUCTIONS: Place grades in data lines 600-700.

SPECIAL CONSIDERATIONS: Accepts up to 150 grades.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN
600   DATA 25,30,35,40,45,50,55,60,65,70,75,80,85,90,95,100
601   DATA 35,40,4,550----5,50,55,60,65,70,75,80,85,90,95
602   DATA 50,55,60,65,70,75,80,85
603   DATA 90,55,7-60,65,70,75,80,85
604   DATA 60,75,65,70,80,85
605   DATA 65,70,75,80
606   DATA 65,70,75,80
607   DATA 70,75
RUN
FREQ

          GRADE FREQUENCY DISTRIBUTION (BAR GRAPH)
          ----------------------------------------

GRADE            1    5    10    15    20    25    30
-----           I+----+----+----+----+----+----+
 0              I
 5              I
 10             I
 15             I
 20             I
 25             IX
 30             IX
 35             IXX
 40             IXX
 45             IXX
 50             IXXX
 55             IXXXX
 60             IXXXXX
 65             IXXXXXXX
 70             IXXXXXXXX
 75             IXXXXXXXX
 80             IXXXXXXX
 85             IXXXXX
 90             IXXX
 95             IXX
 100            IX

DONE
```

CONTRIBUTED PROGRAM **BASIC**

GMARKS
36518

TITLE: GSB GRADING AND EDITING PROGRAM

DESCRIPTION:

GMARKS is a grading program which allows the user to enter up to 20 grades per student for a quarter, weight these grades, and compute the final quarter grade. The program conforms to the H+,P+,P,P- and U grading system adopted by the faculty of Stanford University in the Spring of 1971. At the completion of the program a table of the frequencies for each grade is printed and the user is given the option of scaling his grades by one of two methods. The program can be used iteratively until the distribution of grades is satisfactory, and the final grades and distribution can be printed.

Because it is possible that typing errors will occur while grades are entered into the grading program GMARKS, the companion program GMEDIT can be used to edit the file containing all of the grades for a class.

INSTRUCTIONS:

In order to use this program, each user must open a file called GRADES. The format should be as follows:

OPEN-GRADES,n where n is the size of the file.

To determine the file size use the following formula:

$$\text{Integer}\left(\frac{\text{number of grades X number of students}}{128}\right) + 1$$

The program first requests the user to enter the number of grades per student. This number must be less than or equal to 20. Next, the user is asked to enter the raw weights for each grade. For example, if there are four grades and the user enters weights of 2, 4, 1 and 1, the program will calculate percentage weights of .25, .50, .125 and .125 respectively as the factor to be multiplied by each grade to arrive at a weighted average for each student.

(continued on Page 2)

ACKNOWLEDGEMENTS: Graduate School of Business
Stanford University

INSTRUCTIONS: (continued)

The user is offered the option to read a set of grades stored on the disk during an earlier session with the program. This allows grades to be saved, modified and recalculated if desired. (Even though the program offers the option to enter either letter or numeric grades, letter grades are converted to their numeric equivalents and only numeric grades are stored on the disk.)

Next the user is asked whether he is entering letter grades or numeric equivalents. If letter grades are entered the various grades correspond to points as follows:

H	1.0
P+	.5
P	0
P-	-.3
U	-1.0

The user is offered the option to see each calculated average as it is computed. This should probably be done for the original entry of the grades. If the user is computing grades which have already been entered on the disk, the program will proceed with execution. If the user is entering the grades for the first time, then he will be requested to enter each student number followed by a carriage return. A student number 999 indicates that all grades have been entered. After the student number has been checked and accepted by the program, the grades are entered on the next line separated by commas. The student numbers must be in sequence beginning with 1. To have a missing grade dropped from the computation and the weights rescaled, a 9 should be entered for numeric grades or a Z for letter grades.

There are several possible errors which may occur during the entry of grades. If an error is noted while the line is being typed, the use of the escape key will enable the user to reenter that line. If errors in grades are noted after all of the grades have been entered, another program, GMEDIT, can be used to update or correct the grades which have been saved on the disk. If the program detects an error in student numbers it will not continue until the correct student number has been entered. It is also possible, particularly with letter grades, that an incorrect grade will be entered. This will most likely result from an error in typing or from the omission of a comma. If such a condition is detected the program will ask for the line to be reentered. The same is true if an insufficient number of grades is entered.

At the completion of computing all of the grades the program will print out a table showing for each grade the absolute number in the class who received it, the percentage who received it, the cumulative percentage receiving that high a grade or higher and the percentage of students receiving each letter grade H, P and U.

At this point the user is given the option to scale the grades using two methods. First, he may add a positive or negative constant to each grade. Second, he may enter new break points from which the averages are calculated. The original break points are shown in the following table.

	Average Between	Grade
	.75	H
.749	.25	P+
.249	-.15	P
-.151	-.65	P-
-.651	-1.0	U

The numbers in the second column of the table above are used as the original break points for grades. For example, if a student has an average of .75 or above he receives an H. If he has a .25 or above, but less than .75 he receives a P+ and so on. Thus, by manipulating the break points it is possible to radically change the distribution of grades.

An easy method to experimentally alter the distribution is to enter new break points and run the program again without exercising the option to list each student. This will result in all of the grades being calculated and only a new table of grade distributions being printed. This new table can be examined and the process continued iteratively. When the user is satisfied with the distribution, he should enter a scaling factor of 0 and have each student's grade listed. On this final grading run all students and their grades, the frequency table and the break points are printed.

Finally to terminate the program a scaling factor of 99 is entered.

INSTRUCTIONS: (continued)

If errors in grades have been entered, GMEDIT may be used to update or correct the grades as follows.

The program first asks the user to enter the number of grades for each student. This number should be the same as that originally used to place the grades on the file. Next, the student numbers to be modified should be entered in sequence from low to high. That is, if student numbers 2, 4 and 8 require changes in their grades, they should be entered in that order. To complete this stage of the program a student number of 999 should be entered.

After each student number is entered, his old grades will be printed and the user will be requested to enter a grade number and a change. For example, if a student had grades of -.2, 1.0, .3 and -.5 and it was desired to change the 1 to a .5 the user should type

```
2,.5
```

When all of the modifications for this student have been completed, the user should enter a 99,0 to signify the completion of the changes.

It is possible in this process that a student number will be entered in the wrong order. The program will indicate the offending student number and print the present place in the file. If a correction is inadvertently omitted, the editing run should continue and a separate run can be made later to correct the omission.

At the end of correcting existing grades, that is, when a student number of 999 has been entered, new students may be added. At the completion of entering grades for each new student, the user is asked if another student is to be added to the file. If the answer is yes, the program prints the student number which has been assigned to the new student and requests that the grades be entered. All of the grades are entered on one line. If no further students are to be added, then the program is finished.

In order to run the program, type the following:

```
CRE-SCRTCH,n    where n is the same number used in creating the file GRADES
                (or larger to compensate for new students)
```

At the end of the program

```
PUR-SCRTCH
```

RUN

```
RUN
GMARKS

GSB GRADING PROGRAM. PLEASE ANSWER ALL QUESTIONS Y FOR
YES, N FOR NO.  ALWAYS USE A CARRIAGE RETURN AFTER
ENTERING DATA. USE ESC KEY FOR ERROR. DO YOU WANT INSTRUCTIONS?
?Y
THE PROGRAM ACCEPTS THE NUMBER OF GRADES FOR THE STUDENTS
AND WEIGHTS TO BE MULTIPLIED BY EACH GRADE.  THEN EACH
STUDENT NUMBER IS ENTERED IN ORDER FOLLOWED BY HIS GRADES
ON EACH ASSIGNMENT (EITHER NUMERICAL OR LETTER GRADES).
IF LETTER GRADES ARE USED, H IS A +1 AND U A -1. A STUDENT
NUMBER OF 999 ENDS THE INPUT. THE GRADES ARE SAVED
AND THE PROGRAM CAN READ THEM FROM A PRIOR ENTRY RUN.
A DISTRIBUTION IS PRINTED AND GRADES MAY BE SCALED BY
ADDING A CONSTANT OR ENTERING NEW BREAKPOINTS.

HOW MANY GRADES ARE THERE (20 MAX).?
?4
WHAT ARE THE RAW WEIGHTS FOR EACH GRADE?
?2,2,4,2
NORMALIZED WEIGHTS ARE:
 .2          .2          .4          .2
DO YOU WANT TO READ OLD GRADES FROM DISK?
?N
ARE YOU ENTERING LETTER GRADES?
?N
DO YOU WANT TO SEE EACH GRADE?
?Y
ENTER EACH STUDENT NO. FOLLOWED BY CR. NO=999 FOR LAST STUDENT.
ENTER GRADES ON NEXT LINE SEPARATED BY COMMAS, FOLLOWED BY CR
FOR MISSING GRADE, ENTER 9,GRADE IGNORED & WEIGHTS RECALCULATED
?1
?0,.5,1.,.2
STN 1      .545        P+
?2
?-1.,0,-.2,-.3
STN 2     -.335        P-
?3
?1,1,1,1
STN 3     1.005        H
?4
?-1,-1,-1,-1
STN 4     -.995        U
?5
?0,0,0,0
STN 5      .005        P
?6
?.1,.1,.1,1
STN 6      .285        P+
?7
?.4,-.5,9,-1
STN 7     -.361667     P-
?8
?0,-.2,-.1,.3
STN 8     -.015        P
?9
?-1,.3,0,9
STN 9     -.17         P-
?10
?.2,.2,-.1,-.3
STN 10    -.015        P
?9999
ERROR IN STUDENT NUMBERS: 11    9999
?999
GRADE            NO     %    CUM%    %LETTER
H                1      10     10      10
P+               2      20     30
P                3      30     60
P-               3      30     90      80
U                1      10    100      10
```

```
IF YOU WANT TO SCALE GRADES, ENTER SCALING FACTOR.  FOR
NEW BREAKPOINTS ENTER 9, TO STOP ENTER 99. SCALING BEGINS
AT ORIGINAL GRADES EACH TIME.
?9
ENTER NEW BREAKPOINTS.
H
?.56
P+
?.33
P
?-.1
P-
?-.4
U
?-.2
DO YOU WANT TO SEE EACH GRADE?
?N
GRADE            NO     %    CUM%    %LETTER
H                4      40     40     40
P+               1      10     50
P                4      40     90
P-               1      10    100     60
U                0       0    100     0
IF YOU WANT TO SCALE GRADES, ENTER SCALING FACTOR.  FOR
NEW BREAKPOINTS ENTER 9, TO STOP ENTER 99. SCALING BEGINS
AT ORIGINAL GRADES EACH TIME.
?0
DO YOU WANT TO SEE EACH GRADE?
?Y
STN 1      .545        P+
STN 2     -.335        H
STN 3     1.005        H
STN 4     -.995        H
STN 5      .005        P
STN 6      .285        P
STN 7     -.361667     H
STN 8     -.015        P
STN 9     -.17         P-
STN 10    -.015        P
GRADE            NO     %    CUM%    %LETTER
H                4      40     40     40
P+               1      10     50
P                4      40     90
P-               1      10    100     60
U                0       0    100     0
IF YOU WANT TO SCALE GRADES, ENTER SCALING FACTOR.  FOR
NEW BREAKPOINTS ENTER 9, TO STOP ENTER 99. SCALING BEGINS
AT ORIGINAL GRADES EACH TIME.
?99
BREAKPOINTS USED FOR GRADING:
H  .56
P+ .33
P -.1
P--.4
U -.2

DONE
```

```
RUN
GMEDIT

GSB EDIT PROGRAM FOR GRADING DATA.OPEN FILE SCRTCH AND KILL AT END.
EACH STUDENT NO. MUST BE ENTERED IN SEQUENCE FROM LOWEST TO HIGHEST.
SPECIFY EACH STUDENT NO. TO BE CHANGED AS REQUESTED.  THEN ENTER
GRADE NO AND CORRECT GRADE.  WHEN DONE FOR THIS STUDENT ENTER
GRADE NO OF 99 AND GRADE OF 0.  ENTER STN NO OF 999 WHEN DONE
MODIFYING. YOU CAN THEN ADD NEW STUDENTS AT THE END.
ENTER NUMBER OF GRADES
?4
ENTER FIRST STUDENT NO TO BE CHANGED.  ENTER 999 WHEN NO MORE CHANGES.
?3
OLD GRADES:
 1     1     1     1
ENTER EACH GRADE NO. & CHANGE SEPARATED BY , (ONE PAIR/LINE).
?2,0
?4,-1
?99,0
NEXT STN NO.
?6
OLD GRADES:
 .1          .1          .1          1
GRADE,CHANGE
?2,-.5
?4,-.3
?99,0
NEXT STN NO.
?999
DO YOU WANT TO ADD ANY STUDENTS?
?Y
ENTER 4    GRADES FOR STUDENT 11
?.5,.6,-.1,9
ANOTHER STUDENT (Y OR N)?
?Y
ENTER 4    GRADES FOR STUDENT 12
?-1,.3,.6,0
ANOTHER STUDENT (Y OR N)?
?N
GRADES UPDATED. KILL FILE SCRTCH.

DONE
```

GPAC
36636

TITLE: GRADE PACKAGE

DESCRIPTION:

GPAC is a system of 12 programs written for an HP 2000E system to store and handle accumulative records of points given throughout a normal term's work. In addition, several options are available to combine, manipulate, and display the data in one of several convenient formats. To the user GPAC appears to be one large program with two entry points, one for initialization and the other for subsequent use of the package.

INSTRUCTIONS:

The user has the option of selecting the number of bins to be used, their headings, the method by which the raw totals are combined to produce a "score" for the student, and the various weights to be used in combining the raw totals. These parameters may be modified at will by the user.

The possible options that are available to the user, besides the modification options, are those that allow: entering new information into the accumulative arrays, listing by class student number, sorting on any bin or the combined score and listing in descending order, producing a teletype histogram of any bin or the combined score, computing the z-score or t-score of any bin or the score, or producing a short summary for each student so that each can know his precise standing in the class at any time.

GENERAL CONSIDERATIONS

GPAC is adaptable for a class with up to 140 students. These may be assigned any arbitrary positive integers as class student numbers. A further constraint is that there is a maximum range of 140 in the student numbers. If a student drops, his student number may be deleted and thereafter that student number is ignored. Thus it is possible to generate a range greater than the maximum even with a class of considerably less. It is suggested that this range be chosen in the interval 1 to 999.

continued on following page.

SPECIAL CONSIDERATIONS:

The following general constraints hold for GPAC: up to six separate "bins" for storing the accumulative raw totals and a maximum of 140 students in the class. GPAC has been used to help grading procedures for several different classes in at least five different departments at Pacific Union College. Not only is the teacher's time reduced at the end of the term, but the students are able to see their progress on a regular basis throughout the term. While it is possible for a teacher to prepare listings and histograms at regular intervals, the process is time consuming. GPAC was written to make it possible for such displays to be prepared without increasing the teacher's time.

In addition to regular class grades, GPAC has also been used to accumulate the user's time usage of the terminals. This information is accumulated at the end of each month, listed, sorted, and histograms made.

ACKNOWLEDGEMENTS: Lawrence E. Turner, Jr.
Pacific Union College

INSTRUCTIONS continued

It should be noted that for listings and sorts, close to the entire line of 72 characters is printed. This takes about seven seconds to print on a teletype terminal, hence a class of 100 would take about twelve minutes to produce a listing on the teletype.

Up to six bins are allowed to accumulated separate totals. These may be entitled by any heading of less than six characters. The user is cautioned that these may be any combination except: HELP, SCORE, RETURN, DUMP. These four are used for special system keys.

Once the user has decided upon what quantities are to be accumulated, the next consideration is how these are to be combined to produce the student's "score". There are two possible methods. In both methods the score is essentially a weighted percentage of the total possible.

The first method (mode = 1) is called constant weights and S_n, the score for the nth student, is given by:

$$S_n = \left[\frac{T_{1n}W_1 + T_{2n}W_2 + \ldots}{T_{1N}W_1 + T_{2N}W_2 + \ldots} \right] \times 100$$

$$= F \sum_{k=1}^{b} T_{kn}W_k$$

where T_{kn} is the accumulated raw score of the kth bin for student number n, T_{kn} is the total possible for kth bin, W_k is a constant weight set by the user, b is the number of bins, and F is a normalizing factor which is the same for all students and is such that if a student did perfectly, that is, earned the maximum possible points, his score S_n would be 100.0.

The second method (mode = 2) is termed constant proportionality factors. Here S_n is given by:

$$S_n = \left[\frac{T_{1n}}{T_{1N}} P_1 + \frac{T_{2n}}{T_{2N}} P_2 + \ldots \right] \times \frac{100}{P_1 + P_2 + \ldots}$$

$$= F \sum_{k=1}^{b} T_{kn}P_k T_{kN}^{-1}; \quad \text{all } k,\ T_{kN} \neq 0$$

where P_k is the constant proportionality factor set by the user. The sum is only over those bins with a non-zero T_{kN}. Note that F has same function as used for constant weights but in general will have a different numerical value. In both cases

$$0.0 \leq S_n \leq 100.00$$

The choice of these two modes of operation depends on how the user usually computes grades.

The first method, constant weights, is useful when the user has decided previously on the total possible points available for each item. Consider the example of two exams where the first is to count equally with the second. This can easily be achieved by making the same total possible on each test and the weights equal, or alternately by deciding beforehand what the total possible will be and then adjusting the weights so that the product $T_{kn}W_k$ is the same for both.

The second method, constant proportionality factors, may be used if the total possible is unknown a priori. Here each bin is weighted relative to the total possible for that bin. Thus, in the example above, merely by selecting the P_k's to be equal, each test would count equally regardless of the total possible on the individual tests.

The constant proportionality factors will give the same result at the end of the term as does the constants weights in the case where the user has previously determined the total possible. They may differ at intermediate times since points are not accumulated continuously at the same rate but in rather large discreet amounts.

INSTRUCTIONS continued

Thus in the case where the user has carefully planned the course and knows the total possible for each category at the beginning, he has the option of either method. At the end of the term the results will be identical. However, for the teacher who does not know just how many points will be possible, it is best to use the second method of constant proportionality factors.

For both these cases the actual values of W_k or P_k are unimportant. Only the relative values are involved. It should be possible to find a set of integers that have the proper relative values. Thus, these are to be selected from the set of positive integers.

For simplification the accumulative points are also carried as integers. If the user is accustomed to using fractional points, it is quite easy to multiply each point by a simple factor, and correspondingly reduce the weight or proportionality factor by the same amount.

INITIALIZATION

The user must have access to a terminal and a user ID and password. He must also have disc storage of 14 sectors. For each different class there must be a different user library, that is, a different ID and password. Alternately the user must declare auxilary files and transfer information from them before using GPAC and transfer the information back at the end of a session.

GPAC should be made available from the system library. Assuming the user has previously determined what raw points to store, how he wants to combine them assigned student numbers, and has completed other advanced planning, the procedure to initialize GPAC is as follows.

1. Open the disc storage file.

   OPEN-CLSFIL,14

2. GET and RUN GPAC1

GPAC1, initialization portion of GPAC, will execute and will ask for various items:

CLASS TITLE: This can be any alphanumeric string up to 30 characters long, and will be used as a label for all subsequent output.

NUMBER OF BINS: Up to six bins are allowed.

HEADING: One for each bin, up to 6 characters each. These will be used to identify the bins from this point on. Embedded blanks are significant, trailing blanks are not. The headings must obviously be unique, and they must not be one of the following: HELP, SCORE, RETURN, or DUMP.

MODE: M = 1, constant weights.
M = 2, constant proportionality factors.

FACTORS: One for each bin, either constant weights or constant proportionality factors depending on mode selected previously. They must be integers.

MINIMUM S.N.: This is an integer greater than zero, and allows numbering the students in a class consecutively from a number other than 1; as an example, numbering a class with integers 101 thru 190.

LARGEST S.N.: Again this is an integer which corresponds to the largest S.N. used. Note that it is possible to add students with higher S.N. than this. This may be done later in the MODIFICATION section. For all student numbers within this range from minimum to largest and all useable bins, a zero will be placed. If there are gaps in the student number range, i.e., students which have dropped, these can be deleted in the MODIFICATION section.

A GPAC STATUS CHECK follows, giving the class parameters. The program automatically chains to the COMMAND section. It is at this point that any further modifications may be made.

GPAC MAIN PROGRAM

The initialization sequence is to be used only once. Thereafter, the user accesses and RUNs the main program, GPAC, which will retrieve the necessary data from the disc and chain to the COMMAND section.

COMMAND SECTION

All branches are determined here and eventually return to this section.

Upon printing COMMAND ? the computer requests an alphanumeric response, to determine what action to take. Typing HELP will obtain a listing and a brief explanation of the possible choices available. STOP results in a controlled exit from GPAC. For any COMMAND, typing the first three characters will result in the correct branch.

INSTRUCTIONS continued

The list of possible commands is:

CHEck
HELp
HISto
LISt
MODify
OUT
SORt
STAt
STOp
UPDate

STATUS CHECK SECTION

Entry command: CHEck

This section gives a display of the class parameters. It is accessed automatically after INITIALIZATION or upon return from the MODIFICATION section. It may be directly accessed from COMMAND by the above response. After execution it returns automatically to the COMMAND section.

HISTOGRAM SECTION

Entry command: HISto

This section produces a teletype histogram of any of the used bins or the SCORE. The request KEY ? selects the appropriate bin or the score. The entire heading must be used. The response of HELP will produce a listing of acceptable keys. The response RETURN causes the program to return to the COMMAND section.

The limits of the histogram are entered as three numbers separated by commas for the lower limit, the upper limit, and the interval size respectively.

The histogram produced gives the class title, the date that the disc file was last changed, and the heading of the bin being produced. The TOTAL number is the actual number plotted in the histogram. Hyphens are printed at the top and bottom for those histograms less than one page in length. These are located 11 inches apart for convenient separation into page size.

If a particular datum is equal to the limit of an interval, it is included in the lower interval, that is the interval contains all those points that are described by:

$$L \cdot T_{kn} \_ U$$

where L and U are the lower and upper limits of the interval respectively.

LIST SECTION

Entry command: LISt

This section produces a teletype listing of the accumulated raw points and the SCORE for each student. The listing is in order of increasing student numbers. Any inactive student numbers, that is, student numbers that have been previously deleted in the MODIFICATION section, are ignored.

The total possible for each bin is given, along with the mean and the standard deviation for each bin and the SCORE.

Hyphens separate the output into page size sheets. The class title and the date the files were last changed are also given.

The program automatically returns to the COMMAND section.

MODIFICATION SECTION

Entry command: MODify

There are times when one wishes to change certain class parameters or add or delete a student. This is done in the MODIFICATION section.

The process is controlled by the MOD OPTION. A response of HELP produces a listing of the options. The possible options are:

ADD
DELete
HELp
PARam
RETurn

INSTRUCTIONS continued

ADD and DELETE add and drop a student respectively. In the case of a drop, that student number is ignored in all subsequent output. Checks are made to insure that only allowed drops and adds are processed.

The PARAM option allows modification of the class parameters originally entered in the INITIALIZATION program. The choice of which class parameter to be modified is selected by the ITEM ? request. The ITEMS that may be modified are:

FACtor
HELp
KILl
MODe
NAMe
NEW
RETurn
SWItch
TITle

HELP obtains a listing of items. RETURN, both for the MOD OPTION and the ITEM requests, produces a branch to the COMMAND section.

FACTOR, MODE, NAME, and TITLE provide changing the proportionality or weights (depending on the mode), the mode, the headings of the bins, or the class title respectively.

NEW allows adding a bin, if less than 6 are presently in use. SWITCH allows two bins to be interchanged so that the left to right order as printed in lists or sorts is altered. The contents of the bins are left unchanged.

KILL provides for removal of unwanted bins. If the bin is empty, that is, if the total possible for that bin is zero, the bin is removed without further consideration. If the total possible is non-zero, the disposition of the contents is requested. This may be any other bin. In this case, the contents of the bin to be removed is simply added to the other bin directly, then the first bin is removed. Or if the contents are unwanted a disposition of DUMP results in the bin immediately being deleted. A disposition to the same bin will result in no action and return to the ITEM request.

Note that to obtain histograms, z-scores, etc., for a given set of points in the case that normally they are carried as a total, for example, if all exams are added together in one bin, but it is desired to obtain a histogram separately for the one just entered, a possible procedure is to add a temporary bin, enter the information into it, display it at will, then KILL that bin with a destination of the bin holding the totals.

The disc is automatically updated upon exit from this section.

OUT SECTION

Entry command: OUT

In order to allow the individual student to know his total points and class standing, a short summary may be provided by the OUT section. These are printed with hyphens between so that they may be separated conveniently and given to the students.

The program requests the minimum and maximum student numbers for which a summary is desired. Inactive student numbers are ignored, and return to COMMAND is automatic.

The user should note that it takes of the order of 45 seconds to produce each student's summary, hence for a class of 100 it would take approximately 1 hour.

In combination with a posted histogram of the SCORE, the student could very nicely determine his class standing. This way a student would only know what his particular totals and SCORE was.

Another method would be to post a listing of the totals and the SCORE. Here, of course, a student could know how another specific student was doing by knowing his student number.

SORT SECTION

Entry command: SORt

This section produces a listing of the accumulated points and the SCORE for each student. The listing is in order of descending values for any KEY. These are any bin or the SCORE. The response HELP produces a listing of possible keys. The response RETURN causes the program to return to COMMAND.

The bin that is being sorted on is underlined. The total possible, the mean, and the standard deviation for each bin and the score are also printed. Inactivated student numbers are ignored.

Hyphens separate the output into page size sheets.

INSTRUCTIONS continued

STAT SORT SECTION

Entry command: STAt

This section sorts and produces a sorted listing of any bin or the SCORE. The possible options are:

HELp
RETurn
SCAle
STAndard

HELP and RETURN produce a listing of the options, and return to the COMMAND section respectively.

The response of STANDARD prints an ordinary z-score. For t-scores one may use the option: SCALE. The base (i.e., the value which the mean will take) and the scaling factor are requested. The program also requests if letter grades are desired. If so, the t-score criteria for grade assignments are also requested.

Note that the z-scores numerically are t-scores with a base of zero and a scaling factor of one.

The total possible, mean, and standard deviation for the bin are also printed. Inactivated student numbers are ignored.

Hyphens separate the output into page size sheets.

UPDATE SECTION

Entry command: UPDate

The UPDATE section allows the user to enter new information. Control within this section is determined by OPTIONS. A list is as follows:

HELp
INCre
RETurn
SINgle

As previously used, HELP produces a listing of options and RETURN chains back to the COMMAND section. Only the first three characters of the options need to be entered.

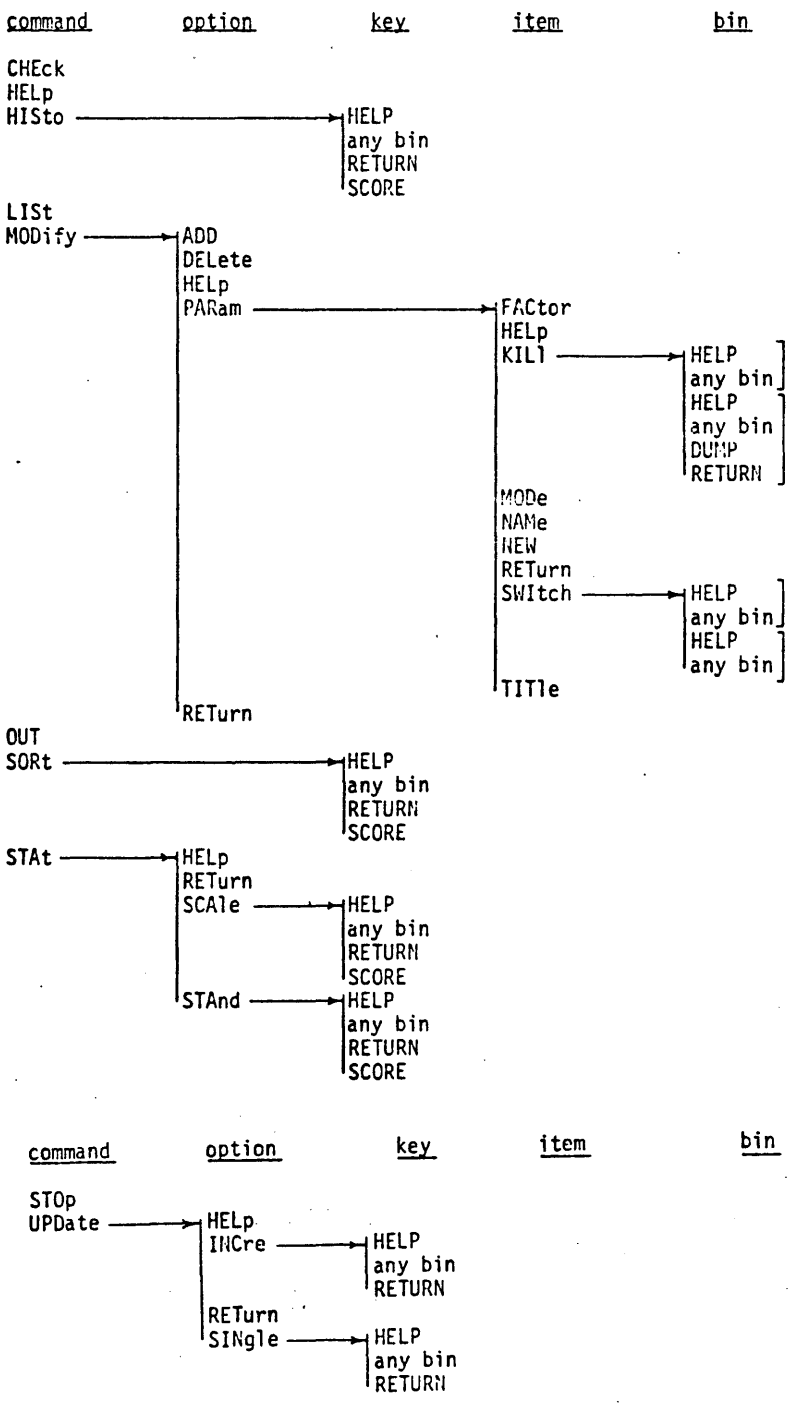
The INCREMENT option allows automatic incrementing through the range of active student numbers, hence the user need only enter the individual item after each request. The TOTAL is the total possible and is entered as the last datum. The bin is selected by the KEY request. Both keys of SCORE and RETURN result in branching to the OPTION request.

The SINGLE option allows entering a certain datum into a given student array. A student number of -1 will return to the OPTION request. The total possible, T_{KN}, is defined to be student number zero. Note that the entry is added directly to the student's raw total. Hence, if points need to be subtracted, enter a negative number. The bin is selected by the KEY request and the raw totals are printed before and after the datum is entered. Thus the SINGLE option may be used to correct an error made in previous updates.

It is important to note that during execution of the UPDATE section the new information is only entered into the arrays in core. It is not until the return to the COMMAND section that the disc is updated. Hence stopping the program during execution of this section before a RETURN, may result in the loss of the new information. It may be possible to recover just by typing RUN (return) but any other teletype entry may destroy the information in the arrays. If in doubt, restart the package from GPAC MAIN PROGRAM and reenter the new data.

INSTRUCTIONS continued

SUMMARY OF GPAC CONTROL



```
RUN

RUN
GPACI


               GPAC-INITIALIZATION

ENTER CLASS TITLE ?ELEMENTARY GPAC

ENTER NUMBER OF BINS DESIRED, (MAX OF 6) ?2

FOR EACH BIN ENTER HEADING, (MAX OF 6 CHAR).

BIN  1        ?HW
BIN  2        ?TEST1

MODE OPTIONS:  CONSTANT WEIGHTS       (M = 1),
               CONSTANT PROP. FACTORS (M = 2).

 ENTER MODE:  M = ?2

ENTER PROPORTIONALITY FACTORS

HW         ?20
TEST1      ?15

ENTER:  MINIMUM STUDENT NUMBER ?101
ENTER: LARGEST STUDENT NUMBER ?124


-


               GPAC STATUS CHECK

                  27 MAY 73

TITLE:  ELEMENTARY GPAC

NUMBER OF BINS IN USE:   2

HEADINGS:            HW          TEST1

P FACTORS:           20           15
 POSSIBLE:            0            0


STUDENT NUMBER BASE:   100
LARGEST STUDENT NUMBER:   124
NUMBER OF STUDENTS IN CLASS:   24


DATE FILES LAST UPDATED:  27 MAY 73




COMMAND ?HELP

               GPAC CONTROL COMMANDS

CHECK:   PRINT OUT CLASS PARAMETERS AND OTHER CLASS INFORMATION.
HELP:    OBTAIN A LISTING OF ALL COMMANDS.
HISTO:   MAKE A TTY HISTOGRAM OF ANY USEABLE BIN OR THE SCORE.
LIST:    LIST THE STUDENT'S RAW TOTAL BY S.N.
MODIFY:  CHANGE THE USEABLE BINS AND OTHER CLASS PARAMETERS.
OUT:     OBTAIN A SHORT INDIVIDUAL SUMMARY GIVING THE RAW TOTALS
         AND THE TOTAL POSSIBLE FOR EACH STUDENT.
SORT:    SORT AND LIST IN DECREASING ORDER ALL RAW TOTALS AND
         THE SCORE,  THE KEY FOR THE SORT MAY BE ANY USEABLE BIN.
STAT:    COMPUTES THE Z-SCORE AND SORTS FOR ANY USEABLE BIN OR THE
         SCORE.
STOP:    PERFORMS A NORMAL EXIT FROM GPAC.
UPDATE:  ALLOWS ENTERING OF NEW DATA INTO THE ARRAYS.
```

```
COMMAND ?MOD

                MODIFICATION SECTION

  MOD OPTION ?DEL

ENTER S.N. TO BE DELETED ?108
STUDENT NUMBER  108   IS DELETED

  MOD OPTION ?DEL

ENTER S.N. TO BE DELETED ?82
OUT OF RANGE,  MIN =  101  MAX =  124  I =  82

  MOD OPTION ?DEL

ENTER S.N. TO BE DELETED ?109
STUDENT NUMBER  109   IS DELETED

  MOD OPTION ?DEL

ENTER S.N. TO BE DELETED ?117
STUDENT NUMBER  117   IS DELETED

  MOD OPTION ?122

INVALID OPTION

ADD:     ACTIVATE A STUDENT
DELETE:  INACTIVATE A STUDENT
HELP:    OBTAIN A LISTING OF OPTIONS
PARAM:   MODIFY THE CLASS PARAMETERS
RETURN:  RETURN TO COMMAND


  MOD OPTION ?DEL

ENTER S.N. TO BE DELETED ?122
STUDENT NUMBER  122   IS DELETED

  MOD OPTION ?DEL

ENTER S.N. TO BE DELETED ?107
STUDENT NUMBER  107   IS DELETED

  MOD OPTION ?RET


COMMAND ?UPD


  UPD OPTION ?INC


   KEY ?HW


 S.N.    HW

 101     ?37
 102     ?21
 103     ?28
 104     ?38
 105     ?43
 106     ?49
 110     ?41
 111     ?25
 112     ?33
 113     ?31
 114     ?41
 115     ?0
 116     ?29
 118     ?38
 119     ?46
 120     ?42
 121     ?37
 123     ?45
 124     ?40
TOTAL    ?50
```

```
  KEY ?TEST1

 S.N.    TEST1

 101     ?86
 102     ?96
 103     ?103
 104     ?73
 105     ?87
 106     ?100
 110     ?98
 111     ?85
 112     ?75
 113     ?49
 114     ?85
 115     ?62
 116     ?91
 118     ?101
 119     ?93
 120     ?86
 121     ?79
 123     ?78
 124     ?83
TOTAL    ?110

  KEY ?RET

INVALID KEY,   POSSIBLE KEYS ARE:
 HELP    HW          TEST1       SCORE       RETURN

  KEY ?RETURN

  UPD OPTION ?RET

COMMAND ?LIS
```

-

ELEMENTARY GPAC 27 MAY 73

S.N.	HW	TEST1	SCORE
101	37	86	75.8
102	21	96	61.4
103	28	103	72.1
104	38	73	71.9
105	43	87	83.0
106	49	100	95.0
110	41	98	85.0
111	25	85	61.7
112	33	75	66.9
113	31	49	54.5
114	41	85	80.0
115	0	62	24.2
116	29	91	68.6
118	38	101	82.8
119	46	93	88.8
120	42	86	81.5
121	37	79	73.1
123	45	78	81.8
124	40	83	78.1
POSSIBLE	50	110	
AVERAGE	34.9	84.7	73.0
DEVIATION	11.3	13.7	15.6

```
COMMAND ?SORT

                SORT SECTION

   KEY ?HW

-

                ELEMENTARY GPAC                    27 MAY 73

        S.N.          HW          TEST1         SCORE
                      ----

 1      106           49          100           95.0
 2      119           46           93           88.8
 3      123           45           78           81.8
 4      105           43           87           83.0
 5      120           42           86           81.5
 6      110           41           98           85.0
 7      114           41           85           80.0
 8      124           40           83           78.1
 9      104           38           73           71.9
10      118           38          101           82.8
11      101           37           86           75.8
12      121           37           79           73.1
13      112           33           75           66.9
14      113           31           49           54.5
15      116           29           91           68.6
16      103           28          103           72.1
17      111           25           85           61.7
18      102           21           96           61.4
19      115            0           62           24.2

POSSIBLE              50          110
AVERAGE             34.9         84.7           73.0
DEVIATION           11.3         13.7           15.6

-

   KEY ?SCORE

-

                ELEMENTARY GPAC                    27 MAY 73

        S.N.          HW          TEST1         SCORE
                                                ----

 1      106           49          100           95.0
 2      119           46           93           88.8
 3      110           41           98           85.0
 4      105           43           87           83.0
 5      118           38          101           82.8
 6      123           45           78           81.8
 7      120           42           86           81.5
 8      114           41           85           80.0
 9      124           40           83           78.1
10      101           37           86           75.8
11      121           37           79           73.1
12      103           28          103           72.1
13      104           38           73           71.9
14      116           29           91           68.6
15      112           33           75           66.9
16      111           25           85           61.7
17      102           21           96           61.4
18      113           31           49           54.5
19      115            0           62           24.2

POSSIBLE              50          110
AVERAGE             34.9         84.7           73.0
DEVIATION           11.3         13.7           15.6
```

-

KEY ?RETURN

COMMAND ?HIS

HISTOGRAM SECTION

KEY ?SCORE

ENTER: MIN, MAX, INC ?0,100,2

-

HISTOGRAM 27 MAY 73

ELEMENTARY GPAC SCORE

INTERVAL	NUM	I++++I++++I++++I++++I++++I++++I++++I++++I++++I++++I++++I
98.0 - 100.0	0	+
96.0 - 98.0	0	+
94.0 - 96.0	1	+*
92.0 - 94.0	0	+
90.0 - 92.0	0	+
88.0 - 90.0	1	+*
86.0 - 88.0	0	+
84.0 - 86.0	1	+*
82.0 - 84.0	2	+**
80.0 - 82.0	2	+**
78.0 - 80.0	2	+**
76.0 - 78.0	0	+
74.0 - 76.0	1	+*
72.0 - 74.0	2	+**
70.0 - 72.0	1	+*
68.0 - 70.0	1	+*
66.0 - 68.0	1	+*
64.0 - 66.0	0	+
62.0 - 64.0	0	+
60.0 - 62.0	2	+**
58.0 - 60.0	0	+
56.0 - 58.0	0	+
54.0 - 56.0	1	+*
52.0 - 54.0	0	+
50.0 - 52.0	0	+
48.0 - 50.0	0	+
46.0 - 48.0	0	+
44.0 - 46.0	0	+
42.0 - 44.0	0	+
40.0 - 42.0	0	+
38.0 - 40.0	0	+
36.0 - 38.0	0	+
34.0 - 36.0	0	+
32.0 - 34.0	0	+
30.0 - 32.0	0	+
28.0 - 30.0	0	+
26.0 - 28.0	0	+
24.0 - 26.0	1	+*
22.0 - 24.0	0	+
20.0 - 22.0	0	+
18.0 - 20.0	0	+
16.0 - 18.0	0	+
14.0 - 16.0	0	+
12.0 - 14.0	0	+
10.0 - 12.0	0	+
8.0 - 10.0	0	+
6.0 - 8.0	0	+
4.0 - 6.0	0	+
2.0 - 4.0	0	+
0.0 - 2.0	0	+
		I++++I++++I++++I++++I++++I++++I++++I++++I++++I++++I++++I
TOTAL	19	

-

KEY ?RETURN

COMMAND ?OUT

OUT SECTION

ENTER SMALLEST AND LARGEST S.N. DESIRED ?106,111

-

ELEMENTARY GPAC 27 MAY 73 STUDENT 106

	HW	TEST1	SCORE
P FACTORS	20	15	
STUDENT TOTALS	49	100	95.0
POSSIBLE	50	110	

-

ELEMENTARY GPAC 27 MAY 73 STUDENT 110

	HW	TEST1	SCORE
P FACTORS	20	15	
STUDENT TOTALS	41	98	85.0
POSSIBLE	50	110	

-

ELEMENTARY GPAC 27 MAY 73 STUDENT 111

	HW	TEST1	SCORE
P FACTORS	20	15	
STUDENT TOTALS	25	85	61.7
POSSIBLE	50	110	

-

END OUT SECTION

COMMAND ?STAT

STAT SORT SECTION

STAT OPTION ?SCALE

KEY ?SCORE

```
BASE AND SCALE FACTOR ?0,1
DO YOU WISH GRADES ?YES
LOWER LIMITS FOR D,C,B,A ?-1.5,-.5,+.5,1.5

-

                ELEMENTARY GPAC                    27 MAY 73

      S.N.          SCORE     T-SCORE  GRADE    B,S:  0      1

 1     106           95.0       1.4      B
 2     119           88.8       1.0      B
 3     110           85.0       0.8      B
 4     105           83.0       0.6      B
 5     118           82.8       0.6      B
 6     123           81.8       0.6      B
 7     120           81.5       0.5      B
 8     114           80.0       0.5      C
 9     124           78.1       0.3      C
 10    101           75.8       0.2      C
 11    121           73.1       0.0      C
 12    103           72.1      -0.1      C
 13    104           71.9      -0.1      C
 14    116           68.6      -0.3      C
 15    112           66.9      -0.4      C
 16    111           61.7      -0.7      D
 17    102           61.4      -0.7      D
 18    113           54.5      -1.2      D
 19    115           24.2      -3.1      F

POSSIBLE           100.0
AVERAGE             73.0
DEVIATION           15.6


-

  STAT OPTION ?RETURN

COMMAND ?CHE

-

                GPAC STATUS CHECK

                  27 MAY 73

TITLE:  ELEMENTARY GPAC

NUMBER OF BINS IN USE:   2

HEADINGS:            HW          TEST1

P FACTORS:           20           15
 POSSIBLE:           50          110


STUDENT NUMBER BASE:   100
LARGEST STUDENT NUMBER:   124
NUMBER OF STUDENTS IN CLASS:   19

INACTIVE S.N.:  107   108   109   117   122


DATE FILES LAST UPDATED:  27 MAY 73




COMMAND ?UPD
```

```
  UPD OPTION ?SIN

ENTER:  S.N. ?115

   KEY ?HW

 115                      0          62
ENTER DATUM ?38
 115                     38          62

ENTER:  S.N. ?-1

  UPD OPTION ?RET

COMMAND ?MOD

               MODIFICATION SECTION

  MOD OPTION ?HELP

ADD:     ACTIVATE A STUDENT
DELETE:  INACTIVATE A STUDENT
HELP:    OBTAIN A LISTING OF OPTIONS
PARAM:   MODIFY THE CLASS PARAMETERS
RETURN:  RETURN TO COMMAND

  MOD OPTION ?PAR

   ITEM ?HELP

FACTOR:  WEIGHTS OR P. FACTORS
HELP:    LIST OF ITEMS
KILL:    REMOVE A BIN
MODE:    CHANGE MODE
NAME:    CHANGE BIN NAMES
NEW:     ADD A NEW BIN
RETURN:  RETURN TO COMMAND
SWITCH:  EXCHANGE TWO BINS
TITLE:   CHANGE TITLE

   ITEM ?NEW

BIN TITLE: ?TEST 2
P. FACTOR: ?15

   ITEM ?RETURN

-

               GPAC STATUS CHECK

                  27 MAY 73

TITLE:  ELEMENTARY GPAC

NUMBER OF BINS IN USE:   3

HEADINGS:          HW         TEST1       TEST 2

P FACTORS:         20          15          15
 POSSIBLE:         50         110           0


STUDENT NUMBER BASE:   100
LARGEST STUDENT NUMBER:   124
NUMBER OF STUDENTS IN CLASS:   19

INACTIVE S.N.:  107   108   109   117   122


DATE FILES LAST UPDATED:  27 MAY 73
```

```
COMMAND ?LIS

-
```

ELEMENTARY GPAC 27 MAY 73

S.N.	HW	TEST1	TEST 2	SCORE
101	37	86	0	75.8
102	21	96	0	61.4
103	28	103	0	72.1
104	38	73	0	71.9
105	43	87	0	83.0
106	49	100	0	95.0
110	41	98	0	85.0
111	25	85	0	61.7
112	33	75	0	66.9
113	31	49	0	54.5
114	41	85	0	80.0
115	38	62	0	67.6
116	29	91	0	68.6
118	38	101	0	82.8
119	46	93	0	88.8
120	42	86	0	81.5
121	37	79	0	73.1
123	45	78	0	81.8
124	40	83	0	78.1
POSSIBLE	50	110	0	
AVERAGE	36.9	84.7	0.0	75.2
DEVIATION	7.4	13.7	0.0	10.3

```
-

COMMAND ?STA

              STAT SORT SECTION

  STAT OPTION ?SCA

    KEY ?SCORE

BASE AND SCALE FACTOR ?0,1
DO YOU WISH GRADES ?YES
LOWER LIMITS FOR D,C,B,A ?-1.5,-.5,.5,1.5

-
```

ELEMENTARY GPAC 27 MAY 73

B,S: 0 1

	S.N.	SCORE	T-SCORE	GRADE
1	106	95.0	1.9	A
2	119	88.8	1.3	B
3	110	85.0	1.0	B
4	105	83.0	0.8	B
5	118	82.8	0.7	B
6	123	81.8	0.6	B
7	120	81.5	0.6	B
8	114	80.0	0.5	C
9	124	78.1	0.3	C
10	101	75.8	0.1	C
11	121	73.1	-0.2	C
12	103	72.1	-0.3	C
13	104	71.9	-0.3	C
14	116	68.6	-0.6	D
15	115	67.6	-0.7	D
16	112	66.9	-0.8	D
17	111	61.7	-1.3	D
18	102	61.4	-1.3	D
19	113	54.5	-2.0	F

```
POSSIBLE              100.0
AVERAGE                75.2
DEVIATION              10.3


-

  STAT OPTION ?RETURN

COMMAND ?STOP

                GPAC EXIT

DONE
```

CONTRIBUTED PROGRAM **BASIC**

TITLE: GRADE: Test Grade for Number of Questions Missed — GRADE 36342

DESCRIPTION:

This program is useful in determining the grade of an examination consisting of any number of questions. The user inputs the number of questions on the test and the output consists of a general table giving the number of questions missed with the corresponding percentage grade based on 100% and the number of questions correct.

INSTRUCTIONS:

User is requested to input the number of questions on the test.

ACKNOWLEDGEMENTS: Huntington Project
Polytechnic Institute of Brooklyn

```
RUN
RUN
GRADE

NUMBER OF QUESTIONS IN THIS TEST IS ?15

NUMBER                          NUMBER
WRONG          GRADE            RIGHT
------         -----            ------
 0               100              15
 1               93               14
 2               87               13
 3               80               12
 4               73               11
.....................................
 5               67               10
 6               60               9
 7               53               8
 8               47               7
 9               40               6
.....................................
 10              33               5
 11              27               4
 12              20               3
 13              13               2
 14              7                1
.....................................
 15              0                0

DONE
```

TITLE:

ITEM: SCORES MULTIPLE CHOICE TESTS

ITEM
36888-18007

DESCRIPTION:

This program scores multiple choice tests with a maximum of 50 items in the test. Simultaneously an analysis of each item takes place and in the ITEM ANALYSIS section the response frequencies for responses A,B,C,D,E and O (omit) are printed for each item, together with an analysis of the candidates who answered correctly into four groups (upper, middle upper, middle lower and lower) depending on scores for the test as a whole. For example, from item No. 1, of the 18 candidates answering correctly, 6 were in the upper 27% of candidates, 4 lay between the 50th and 72nd percentile inclusive, 5 lay between the 28th and 50th percentiles and 3 were in the lower 27%. The groups are of unequal size so as to conform to the demands of the Kuder-Richardson formula 20 which is used to give a measure of the reliability of the list as a whole.

The facility of each item is printed together with the INDEX of discrimination. The analysis for each item is sufficient for an experienced user to establish the validity of each item, the effectiveness of distractions, etc.

The user is given the opportunity to have the scores standardized onto any mean and standard deviation of his choice. The mean, variance and standard deviation of the number of items correct is printed before the user is given the chance to standardize marks. Standardized scores are printed in ascending order. The identification of students is numerical on order of entry of raw responses.

Specification of statistical techniques used:

N = Number of candidates

K = Number of items in the test

N_H = Number of candidates from upper group who answered the item correctly

N_L = Number of candidates from lower group who answered the item correctly.

J = Number of candidates in the upper 27% group.

Reliability for whole test

$$R = \frac{K}{K-1}\left\{1 - \frac{2J\Sigma(N_H + N_L) - \Sigma(N_H + N_L)^2}{0.667\left[\Sigma(N_H - N_L)\right]^2}\right.$$

Facility for an item $F = \frac{\text{No of correct responses}}{N}$

Discrimination $D = \frac{N_H - N_L}{J}$

INSTRUCTIONS:

See following page.

SPECIAL CONSIDERATIONS:

See following page.

ACKNOWLEDGEMENTS:

John R. Tilbury
Arnold & Carlton College

INSTRUCTIONS:

Prepare data statements or data tape.

This should contain strings of candidate responses. Each string must contain the number of letter characters - (A,B,C,D,E or O). The first string must be the string of correct responses.

If using DATA statements, each candidate's responses string may utilize an individual DATA statement, or may be packed several response strings to a single data statement. No sentinel string or indicator is necessary.

Data statements should be numbered starting with a sequence number greater than 158Ø.

If using DATA statements, this must be terminated with an END statement.

CRE-STDT,48: STDT may be opened to more than 48 records if more than 48 students
CRE-STDT (candidates) are involved.

RUN

Program requests number of candidates and number of items.

The rest of the running procedure is straightforward.

If analysis of individual items is not required at some times but is required at others, the user may care to insert the following statements:

```
1ØØ1  PRINT "IS ITEM ANALYSIS REQUIRED";
1ØØ2  INPUT C$
1ØØ3  IF C$ = "NO" THEN 158Ø
```

Storing the program in a user's private library will thus give the user the choice of using the program to mark lists and standardize scores but not to have items analyzed for validity. This is, however, not the way the program is intended to be used.

SPECIAL CONSIDERATIONS:

This program is only of use to persons experienced in the construction and validation of objective tests. The analysis provided by this program must be interpreted in the context of the uses to which the test is being put and should not be taken as absolute evidence that the test is valid & reliable under all conditions, etc.

RUN

```
CRE-STDT, 48
GET-ITEM


 159Ø  DATA "ABAEDCEACB"
 16ØØ  DATA "ABADDCEABA"
 161Ø  DATA "ABAEDCEACB"
 162Ø  DATA "ABBCDBEBAA"
 163Ø  DATA "ABABDCEACO"
 164Ø  DATA "ABEDDAEBCA"
 165Ø  DATA "OBAADCEACC"
 166Ø  DATA "ABDBDEEBAB"
 167Ø  DATA "ABACDOACDA"
 168Ø  DATA "AOCDDCEACC"
 169Ø  DATA "CAAADAEBCD"
 17ØØ  DATA "ABOBDBEAAE"
 171Ø  DATA "ABABDCEACB"
 172Ø  DATA "ABBDDEEBBD"
 173Ø  DATA "OEAAOOBBOC"
 174Ø  DATA "ABCBDCEAEA"
 175Ø  DATA "EBACDAEACB"
 176Ø  DATA "ABDDDBEBCA"
 177Ø  DATA "CBAADOBBBA"
 178Ø  DATA "ABEBDCEACB"
 179Ø  DATA "ADACDAEBAB"
 18ØØ  DATA "EBODDBEBCA"
 181Ø  DATA "ABAEDCEACO"
 182Ø  DATA "CBBBDAEBOB"
 183Ø  DATA "ABACDBEACB"
 184Ø  DATA "ABCDDOEBCB"
```

```
RUN
ITEM

ENTER NUMBER OF STUDENTS INVOLVED IN TEST?25
 HOW MANY ITEMS IN THE TEST?10
STDT.NO.       RIGHT/WRONG/OMIT              SCORE
 1               7     3     0                .7
 2               10    0     0                1
 3               4     6     0                .4
 4               8     1     1                .8
 5               5     5     0                .5
 6               7     2     1                .7
 7               5     5     0                .5
 8               4     5     1                .4
 9               6     3     1                .6
 10              4     6     0                .4
 11              5     4     1                .5
 12              9     1     0                .9
 13              4     6     0                .4
 14              1     5     4                .1
 15              6     4     0                .6
 16              7     3     0                .7
 17              5     5     0                .5
 18              3     6     1                .3
 19              8     2     0                .8
 20              5     5     0                .5
 21              4     5     1                .4
 22              9     0     1                .9
 23              4     5     1                .4
 24              8     2     0                .8
 25              6     3     1                .6


LOWER GROUP OF 7    WITH NUMBER OF ITEMS CORRECT
 14     1
 18     3
 3      4
 8      4
 10     4
 13     4
 21     4


TOP GROUP WITH NUMBER OF ITEMS CORRECT
 16     7
 4      8
 19     8
 24     8
 12     9
 22     9
 2      10
MEAN= 5.76        VARIANCE= 4.42239     STD. DEV.= 2.10295


DO YOU WANT STANDARDISED SCORES?YES
ENTER MEAN AND STANDARD DEVIATION ONTO WHICH YOU
WISH THE RESULTS TO BE STANDARDISED?50,15
```

NO.	SCORE
14	16
18	30
3	37
8	37
10	37
13	37
21	37
23	37
5	44
7	44
11	44
17	44
20	44
9	51
15	51
25	51
1	58
6	58
16	58
4	65
19	65
24	65
12	73
22	73
2	80

ITEM ANALYSIS
QUESTION NO. 1 ANSWER A
RESPONSE FREQUENCIES 18 0 3 0 2 2
UPPER= 6 MIDDLE UPPER= 4 MIDDLE LOWER= 5 LOWER= 3
FACILITY= .72 DISCRIMINATION= .428571

QUESTION NO. 2 ANSWER B
RESPONSE FREQUENCIES 1 21 0 1 1 1
UPPER= 7 MIDDLE UPPER= 4 MIDDLE LOWER= 5 LOWER= 5
FACILITY= .84 DISCRIMINATION= .285714

QUESTION NO. 3 ANSWER A
RESPONSE FREQUENCIES 13 3 3 2 2 2
UPPER= 6 MIDDLE UPPER= 2 MIDDLE LOWER= 1 LOWER= 4
FACILITY= .52 DISCRIMINATION= .285714

QUESTION NO. 4 ANSWER E
RESPONSE FREQUENCIES 4 7 5 7 2 0
UPPER= 2 MIDDLE UPPER= 0 MIDDLE LOWER= 0 LOWER= 0
FACILITY= .08 DISCRIMINATION= .285714

QUESTION NO. 5 ANSWER D
RESPONSE FREQUENCIES 0 0 0 24 0 1
UPPER= 7 MIDDLE UPPER= 5 MIDDLE LOWER= 6 LOWER= 6
FACILITY= .96 DISCRIMINATION= .142857

```
QUESTION NO. 6    ANSWER C
RESPONSE FREQUENCIES 5     5     9     0     2     4
UPPER= 5    MIDDLE UPPER= 4    MIDDLE LOWER= 0    LOWER= 0
FACILITY= .36        DISCRIMINATION= .714286



QUESTION NO. 7    ANSWER E
RESPONSE FREQUENCIES 1     2     0     0     22    0
UPPER= 7    MIDDLE UPPER= 5    MIDDLE LOWER= 6    LOWER= 4
FACILITY= .88        DISCRIMINATION= .428571



QUESTION NO. 8    ANSWER A
RESPONSE FREQUENCIES 12    12    1     0     0     0
UPPER= 7    MIDDLE UPPER= 4    MIDDLE LOWER= 1    LOWER= 0
FACILITY= .48        DISCRIMINATION= 1



QUESTION NO. 9    ANSWER C
RESPONSE FREQUENCIES 4     3     14    1     1     2
UPPER= 7    MIDDLE UPPER= 3    MIDDLE LOWER= 2    LOWER= 2
FACILITY= .56        DISCRIMINATION= .714286



QUESTION NO. 10   ANSWER B
RESPONSE FREQUENCIES 8     9     3     2     1     2
UPPER= 5    MIDDLE UPPER= 1    MIDDLE LOWER= 3    LOWER= 0
FACILITY= .36        DISCRIMINATION= .714286



RELIABILITY  KR(20)  = .505211

DONE
```

ITEM1
36343

TITLE:

ITEM1: Number Frequencies

DESCRIPTION:

This program counts and prints the number of times questions are missed on a test.

INSTRUCTIONS:

Starting on line 600, enter the test numbers missed in any order. Last data line should be no higher than 700.

ACKNOWLEDGEMENTS:

Huntington Project
Polytechnic Institute of Brooklyn

```
RUN

600  DATA 1,2,3,4,5,2,3,5,6,7,8,9,10,7,8,9,11,13,14,15,10,13,15,10
RUN
ITEM1

                ITEM ANALYSIS
                -------------

NUMBER OF QUESTIONS IN THE TEST IS?15

QUESTION            NUMBER OF TIMES MISSED
--------            ----------------------
   1                          1
   2                          2
   3                          2
   4                          1
   5                          2
   6                          1
   7                          2
   8                          2
   9                          2
   10                         3
   11                         1
   12                         0
   13                         2
   14                         1
   15                         2

DONE
```

SALSIM
A720-36072A

TITLE: SALARY SCHEDULE COST SIMULATOR

DESCRIPTION:

This program computes the total cost, average salary per teacher, cost of training and experience increments, and various other related costs for a proposed salary schedule. Output also includes optional reproduction of personnel matrix with marginal totals and average number of years teaching experience.

INSTRUCTIONS:

This program requires two files to be opened (ML0005 and ML0017).

In preparing the data tapes type all figures for step 1 in the first data statement, type all figures for step 2 in the next data statement, etc. (Steps and lanes are defined as follows:)

	LANE		
STEP	7000= 7400 7800 ⋮	7200	7400 . . .

The question "what number do you want to multiply your schedule by?" allows two options.

Option 1 — To multiply the entire schedule by a percentage increase. (Example: Type in 1.03 to multiply the entire schedule. by 3%, 1.05 to multiply by 5%, etc.)

Option 2 — To use an index instead of a proposed schedule. If you want to use an index in place of the proposed schedule just follow the same format for preparing the data tape substituting indices for actual salaries.

Because two sets of data are appended to the program it is important that they are numbered correctly.

The "PERMAT" tape (personnel matrix) must be numbered from 4000 to 6900.

The "PROSCH" tape (proposed schedule) must be numbered from 7000 to 9900.

Because these two tapes are appended you must also include an "end"statement (9999 end) either on the end of the "PROSCH" tape or by itself after the two tapes have been appended.

Both the proposed schedule and the personnel matrix may not exceed 15 steps and 14 lanes. Both the proposed schedule and the personnel matrix must have the same Number of steps and lanes.

SPECIAL CONSIDERATIONS:

See attached copy for additional information.

ACKNOWLEDGEMENTS:

TIES
St. Paul, Minnesota 55113

SALSIM

(SALary schedule cost SIMulator)

Purpose

To compute the total and related cost for a proposed salary schedule.

Input

1. A copy of the proposed salary schedule.
2. A personnel matrix for your district (number of teachers in each salary category).

Output

1. Optional -- A step-by-lane reproduction of the personnel matrix with marginal totals and the average number of years teaching experience.
2. A cost matrix showing the cost in each category with step and lane marginal totals.
3. The total cost of the proposed schedule.
4. The cost if all teachers were placed on step one.
5. The cost of experience increments.
6. The cost if all teachers were placed in lane one.
7. The cost of training increments.
8. The ratio of cost of experience increments to the cost of training increments. (A number greater than 1 means that more money is being spent on experience than on training. A number equal to 1 means that money being spent on experience is equal to money being spent on training. A number less than 1 means that more money is being spent on training than on experience).
9. The average salary for teachers .

Options

There is now a question within the program that asks WHAT NUMBER DO YOU WANT TO MULTIPLY YOUR SCHEDULE BY? This question gives you two options.

1. To multiply your whole schedule by a percentage increase. (Example: Type in 1.03, when the question is asked, to multiply your whole schedule by 3%, 1.05 to multiply by 5%, etc.)
2. To use an index instead of a proposed schedule. When using an index in place of the proposed schedule follow FORMAT B IN SECTION I UNDER OFF-LINE PROCEDURE. When the above question is asked type in the BA base figure you want to multiply your index by. (Type in 7500 to multiply the entire schedule by $7500, 8000 to multiply by $8000, etc.)
3. Type in a 1 if you do not want to multiply your proposed schedule (i.e. if you do not want to take advantage of these options.)

Restrictions

Both the proposed schedule and the personnel matrix may not exceed 15 steps and 14 lanes. Both the proposed schedule and the personnel matrix must have the same number of steps and the same number of lanes.

PRELIMINARY OFF-LINE PROCEDURE FOR RUNNING ALL SALARY PROGRAMS

The following two sections I and II, are instructions for preparing tapes off-line.

To run SALSIM follow sections I and II.

I. Proposed Schedule - PROPS1

You must type a tape of your proposed schedule using the following format.

Type each step of your proposed schedule in one data statement.

NOTE: DATA STATEMENTS FOR THIS FILE MUST BEGIN AT STATEMENT NUMBER 7000 AND CONTINUE AT ANY INTERVAL TO 9000. THE LAST STATEMENT MUST BE A 9999 END.

Format A

```
7000 DATA 7500, 7700, 7900, 8100, 8400, 8600, 8800
7100 DATA 7900, 8100, 8300, 8500, 8900, 9100, 9300
7200 DATA 8300, 8500, 8700, 8900, 9400, 9600, 9800
  .    .
  .    .
  .    .
8700 DATA 10900, 11300, 11700, 12100, 13500, 14500, 15800
9999 END
```

If you want to use an index in place of the proposed schedule you must follow the format below.

Format B

```
7000 DATA 1,1.05, 1.1, 1.15, 1.2, 1.25, 1.3
7100 DATA 1.06, 1.12, 1.18, 1.24, 1.3, 1.36, 1.42
7200 DATA 1.12, 1.19, 1.26, 1.33, 1.4, 1.47, 1.54
  .    .
  .    .
  .    .
8700 DATA 1.87, 1.98, 2.09, 2.2, 2.31, 2.42, 2.53
9999 END
```

II. Personnel Matrix - PERMAT

You must type a tape of your personnel matrix using the following format. Type each step of your personnel matrix in one data statement.
NOTE: DATA STATEMENTS FOR THIS FILE MUST BEGIN AT STATEMENT NUMBER 5000 AND CONTINUE AT ANY INTERVAL TO 6900.

```
5000 DATA 10, 4, 2, 0, 3, 0, 0
5100 DATA  5, 6, 3, 1, 2, 0, 0
5200 DATA  6, 3, 6, 4, 7, 1, 0
  .    .
  .    .
  .    .
6700 DATA  4, 7, 12, 16, 8, 5, 3
```

PRELIMINARY ON-LINE PROCEDURE FOR RUNNING SALARY PROGRAMS

1. Call the H/P Time Sharing System.
2. When you hear a high-pitched tone, place phone in coupler.
3. Type in any number (0-9) and hit carriage return.
4. When computer asks you to log in, type in your appropriate district user ID, hit carriage return, and wait for READY message.
5. The first time you run SALSIM you must type in the following two statement.

   OPE-ML0005,5
   OPE-ML0017,7

   You need never type in these statements again. (In fact it would be best if you took a pen and crossed out this step after you have done it.)

6. If you have never run SALSIM, proceed to step 7, otherwise type in KIL-PROPS1 and hit carriage return.
7. Type in TAPE, hit carriage return and begin reading in the proposed schedule tape.
8. When the tape has been read in, type in NAM-PROPS1 and hit carriage return.
9. Type in SAV and hit carriage return.
10. Type in SCR and hit carriage return.
11. If you have never run SALSIM, proceed to step 12, otherwise type in KIL-PERMAT and hit carriage return.
12. Type in TAPE, hit carriage return, and begin reading in personnel matrix tape.
13. When tape has been read in, type in NAM-PERMAT and hit carriage return.
14. Type in SAV and hit carriage return.
15. Type in SCR and hit carriage return.

PROCEDURE FOR RUNNING - SALSIM

1. Type in GET-PERMAT and hit carriage return.
2. Type in APP-PROPS1 and hit carriage return.
3. Type in RUN and hit carriage return.

The computer will ask you to PLEASE TYPE IN THE NUMBER OF STEPS THEN THE NUMBER OF LANES SEPARATED BY A COMMA. When you have responded the computer will print DONE.

4. Type in GET-SALSIM and hit carriage return.
5. Type in RUN and hit carriage return.

The computer will now ask the following questions:

PLEASE TYPE IN THE NUMBER OF STEPS THEN THE NUMBER OF LANES SEPARATED BY A COMMA.

WHAT NUMBER DO YOU WANT TO MULTIPLY YOUR SCHEDULE BY? IF YOU DO NOT WANT TO MULTIPLY YOUR SCHEDULE TYPE IN A 1.

PLEASE ENTER YOUR LANE HEADINGS. MAXIMUM HEADING LENGTH IS 7 CHARACTERS. PLEASE TYPE ONLY ONE LANE HEADING AFTER EACH QUESTION MARK THAT FOLLOWS.
EXAMPLE:

? BA
? BA + 30
? MA
? MA + 30
? PH.D.

DO YOU WISH TO ADVANCE ALL TEACHERS ONE STEP FOR PROJECTED COST COMPUTATIONS? (TYPE 1 FOR NO, 2 FOR YES).

DO YOU WANT A PRINTOUT OF THE PERSONNEL MATRIX? (TYPE 1 FOR YES, 2 FOR NO).

When the program has finished running it will print DONE. If you want to run the program again type in RUN and hit carriage return. If you want to run one of the other programs go to the respective PROCEDURE FOR RUNNING section for that program. If you are done running programs type in BYE and hit carriage return.

RUN

SAMPLE OUTPUT - SALSIM

DO YOU WISH TO ADVANCE ALL TEACHERS ONE STEP FOR PROJECTED COST COMPUTATIONS?
(TYPE 1 FOR YES, 2 FOR NO)
?1

*****PERSONNEL MATRIX (TRAINING BY EXPERIENCE)*****

LANE 1 LANE 6	LANE 2 LANE 7	LANE 3 LANE 8	LANE 4 LANE 9	LANE 5
0 0	60 0	8 0	5 0	0 73
0 0	57 1	12 0	3 0	1 74
0 0	29 0	9 0	0 0	0 38
0 1	17 1	6 0	1 0	1 27
0 3	12 1	2 0	0 1	0 19
0 1	15 1	2 1	2 0	1 23
0 0	6 0	4 0	1 0	0 11
1 2	0 1	9 0	6 1	1 21
2 2	0 0	8 0	7 0	0 19
1 1	3 0	0 1	0 0	1 7
1 5	11 7	6 7	9 4	0 50
5 15	210 12	66 9	34 6	5 362

THE AVERAGE STEP (ROW) ATTAINED BY YOUR CURRENT STAFF IS 4.73

SAMPLE OUTPUT - SALSIM

$$$

*****COST BY CATEGORY FOR THE PROPOSED SALARY SCHEDULE*****

LESS	BA	BA+15	BA+30	BA+45
$ 0	$ 0	$ 0	$ 0	$ 0
$ 0	$ 498000	$ 69600	$ 45500	$ 0
$ 0	$ 501600	$ 110400	$ 28800	$ 10000
$ 0	$ 269700	$ 87300	$ 0	$ 0
$ 0	$ 166600	$ 61200	$ 10600	$ 11000
$ 0	$ 123600	$ 21400	$ 0	$ 0
$ 0	$ 163500	$ 22600	$ 23400	$ 12100
$ 0	$ 69000	$ 47600	$ 12300	$ 0
$ 9900	$ 0	$ 112500	$ 77400	$ 13300
$ 21000	$ 0	$ 105600	$ 95200	$ 0
$ 22400	$ 189000	$ 83400	$ 128700	$ 14700
$ 53300	$ 1981000	$ 721600	$ 421900	$ 61100

$$$

SAMPLE OUTPUT - SALSIM

$$

*****COST BY CATEGORY FOR THE PROPOSED SALARY SCHEDULE(CONT)*****

MA	MA+15	MA+30	MA+45	TOTAL
$ 0	$ 0	$ 0	$ 0	$ 0
$ 0	$ 0	$ 0	$ 0	$ 613100
$ 0	$ 10800	$ 0	$ 0	$ 661600
$ 0	$ 0	$ 0	$ 0	$ 357000
$ 11400	$ 11800	$ 0	$ 0	$ 272600
$ 35700	$ 12300	$ 0	$ 13100	$206100
$ 12500	$ 12900	$ 13300	$ 0	$ 260300
$ 0	$ 0	$ 0	$ 0	$ 128900
$ 27600	$ 14200	$ 0	$ 15000	$ 269908
$ 29000	$ 0	$ 0	$ 0	$ 250800
$ 91200	$ 109200	$ 128000	$ 65600	$ 832200
$ 207400	$ 171200	$ 141300	$ 93700	$ 3852500

$$

SAMPLE OUTPUT - SALSIM

THE TOTAL COST FOR THE PROPOSED SALARY SCHEDULE IS $ 3852500

THE TOTAL COST FOR THIS SALARY SCHEDULE WOULD BE $ 2958600
IF ALL TEACHERS WERE PLACED ON STEP 1

THE COST OF THE EXPERIENCE INCREMENTS FOR THIS SCHEDULE IS $ 893900

THE TOTAL COST FOR THIS SALARY SCHEDULE WOULD BE $ 2746000
IF ALL TEACHERS WERE PLACED IN LANE 1

THE COST OF TRAINING INCREMENTS FOR THIS SCHEDULE IS $ 1106500

THE RATIO OF THE COST OF EXPERIENCE INCREMENTS TO THE COST OF
TRAINING INCREMENTS IS .81

THE AVERAGE SALARY PER TEACHER FOR THE PROPOSED SALARY SCHEDULE IS
$ 10642.3

CONTRIBUTED PROGRAM **BASIC**

SGFMS
36832

TITLE: STUDENT GRADE FILE MANAGEMENT SYSTEM

DESCRIPTION:

The process of maintaining grade records for large classes can be a complex and time-consuming task for an instructor. If daily grades are given, the amount of record keeping that an instructor must do increases greatly.

The concept of feedback also enters into the process. Once a student is evaluated, the student should be informed of the results as soon as possible. Not only should the numeric results be made available, but the student should be told why he received a particular grade so that the situation becomes a learning experience, thus allowing him to learn from his mistakes, thereby reducing their frequency.

INSTRUCTIONS:

This package includes three computer programs:

STUDENT GRADE FILE MANAGEMENT SYSTEM PROGRAM (SGFMS)
STUDENT STATUS REPORT PROGRAM (SSRP) and
CRITERIA OCCURRENCE REPORT PROGRAM (CORP)

SETTING UP SGFMS

Two files must be opened: FILEA and FILEB. The size of these files should be calculated as follows:

Size of FILEA - max. # of students to be registered on the system + 1.

Size of FILEB + max. # of criteria to be stored onto the system. (99 Max.)

The files are created using the create command, e.g.,

CRE-FILEA, 100 (Creates FILEA to 100 blocks) (99 Students)
CRE-FILEB, 20 (Creates FILEB to 20 blocks)

Procedure

1. Create two files: FILEA and FILEB of the proper size.
2. Get and run SGFMS.
3. Invoke the SYS command. Use the reset option.
4. Invoke the CLE command.
5. Invoke the REG command and register students on the system.
6. Invoke the STA command and get a list of the student names and passwords placed on the system using the NAM print.
7. Use the ALT command to correct any misspelled student names.
8. Invoke the STA command again and get a new list of names in a triple spaced format which may be cut up and distributed to the students.

Continued On Next Page.

ACKNOWLEDGEMENTS: The Ohio State University
College of Pharmacy

INSTRUCTIONS: Continued.

9. Invoke the CRI command and enter the criteria onto the system.

The system is now ready for use.

The objectives of the SGFMS are:

1. Allow an instructor to store and retrieve a student's name and grades on a teletypewriter or CRT.

2. Three grade types are to be accepted:

   Exam, Quiz and Criteria-based grades (daily grades).

3. The daily grades must be criteria-based. The criteria on which the daily grades are based should be placed within the record.

4. The mode of grade input must be efficient, and contain appropriate checks to insure that input errors are not made.

5. The instructor should have the ability to extract reports of:

   a. An individual student's record.
   b. The records of the entire class.
   c. A report which summarizes a student's work.
   d. Any particular test or quiz for the entire class.
   e. A list of names of students currently registered on the system.

6. The system must store a list of criteria on a direct access device on which a student's daily grades must be based.

7. The criteria files should be completely flexible in terms of status reports and input of criteria into the files, and addition of the criteria into a student's record.

8. System security provisions must be established.

9. The system must be easy to set up and maintain.

The SGFMS is designed to allow flexibility in maintaining student records and criteria records. Once the user has accessed and started the SGFMS running, he is prompted for a command. The instructor types a command which directs the system to perform certain operations. The commands presently on the system are:

ALT	(ALTer) Changes a student name or password.
CLE	(CLEar) Clears the student record file.
CRI	(CRIterion) Initiates the criteria file maintenance commands.
DRO	(DROp) Drops a student record from the system.
END	(END) Terminates a system or subsystem.
HEL	(HELp) Prints a list of system commands and their actions.
INP	(INPut) Allows user to input grade into student's records.
REG	(REGistration) Registers students on the system.
STA	(STAtus) Prints reports on file contents.
SYS	(SYStem) Sets system's parameter previous to registration.
UPD	(UPDate) Corrects an erroneous student record.

NOTICE that the commands use the first three letters of a base word.

Description of SGFMS Commands

ALT

The purpose of the ALTER command is to change the student name or password.

INSTRUCTIONS: Continued.

CRI

The purpose of the CRI command is to initiate the CRITERIA MAINTENANCE control section.

(The following commands are not to be confused with the main control section commands.)

There are four CRITERIA MAINTENANCE COMMANDS:

CLE (CLEar)
END (END)
INP (INPut)
PRI (PRInt)

CLE - The purpose of the CLE command is to clear the contents of the criterion files.

END - The END command terminates the CRITERION MAINTENANCE MODE.

INP - The purpose of the INP command is to place or update criteria in the criterion files.

PRI - The purpose of PRI is to print selected criteria stored on the system.

CLE

The purpose of the CLE command is to clear the student record file. The user responds to the TYPE COMMAND prompt with the command "CLE".

The CLE command is protected by a password. The password of the sample RUN program is $R_cU_cN_c$. The system will then type: TYPE C TO CLEAR OR X TO ABORT.

The user may type the letter "C" to clear the student files, or he may type the letter X to prevent a clear from being performed. Once the file is cleared, the system will type: CLEAR COMPLETED
TYPE COMMAND?

DROP

Sometimes it is desirable to eliminate a student record from the system; this task is accomplished through use of the DROP command. Once a student record has been dropped, no more grades may be placed in the record.

END

This command terminates the SGFMS program.

HELP

A list of system commands and their actions may be obtained by responding to the TYPE COMMAND? prompt with HELP.

HELP may be used in response to the SELECT REPORT TYPE? of the STATUS command. If HELP is typed, the system will respond with a list of status reports and their contents.

INP

The purpose of this command is to input student grades. The input routine has three modes: CBG (Criteria Based Grade), Q, E.

The CBG mods allows the instructor to enter criteria-based grades (CBG) on student records, e.g.,

Once the INP command is invoked the user must specify the number of the exercise for which he wishes to place CBG's. Once he specifies the exercise number all of the following inputs will be entered for that particular exercise. Until the user respecifies a new exercise number, the dialogue is as follows:

```
TYPE COMMAND?  INP
SELECT INPUT MODS:  CBG, Q, OR E?  CBG
EXERCISE # 5
ALL INPUTS WILL BE PLACED IN EXERCISE #5
STUDENT NUMBER? 010
JOHN SMITH
GRD,GR1?  9,4          See Explanation Below
GR2?  0
STUDENT NUMBER?
```

INSTRUCTIONS: Continued.

The first system prompt "STUDENT NUMBER?" calls for the student number.

If a valid student number is entered, the system will immediately respond with the student's name and then prompt for the grade and first criterion #, e.g.,

```
STUDENT NUMBER?  10
JOHN SMITH
GRD,CR1?  9,4
```

In the previous example, the user typed in "Student Number 10". The system replied with the name "JOHN SMITH". Then the system prompted for the grade and a first criteria number, separated by a comma. The "9" in the previous example is the grade and "4" is the number of a criterion which will be inserted into JOHN SMITH's record.

The system will then prompt for two more criteria numbers, e.g.,

```
CR2?  5
CR3?  10
```

The system will accept a maximum of three criteria numbers and a minimum of one. If the instructor does not wish to add the 2nd and 3rd criteria to the student record, e.g.,

```
STUDENT NUMBER?  10
JOHN SMITH
GRAD, CR1?  8,4
CR2?  0 - a zero prevents any additional criteria being placed into the record.
```

In the previous example, only one criterion, #4, was added to JOHN SMITH's record.

If the instructor should wish to specify a new exercise number, he should enter a STUDENT NUMBER of zero. This will cause the EXERCISE #? prompt to be printed. (See example below.)

To terminate the INP of CBG's a zero must be entered to the STUDENT NUMBER? and the EXERCISE #? prompt. (See below.)

```
TYPE COMMAND?  INP
SELECT INPUT MODE:  CBG, Q, OR E?  CBG
EXERCISE #? 5
ALL INPUTS WILL BE PLACED IN EXERCISE 5.

STUDENT NUMBER?  11
JACK HAMILTON
GRD, CR1?  8,2
CR2?  3
CR3?  0

STUDENT NUMBER?  0

EXERCISE #? 6
ALL INPUTS WILL BE PLACED IN EXERCISE 6

STUDENT NUMBER?  27
TONI JAMES
GRD, CR1?  10,1
CR2?  0

STUDENT NUMBER? 0
EXERCISE #? 0
TYPE COMMAND?
```

The Q or E inputs allow the instructor to enter quiz or exam grades. Both the input modes are identical. The quizzes and exam grades should be entered into the system in the same order that the quizzes or exams are taken. That is, the grades of the third quiz should not be entered into the system before the grades of the fourth quiz.

To terminate the input of quiz or exam grade, a zero should be entered to the STUDENT NUMBER? prompt.

```
STUDENT NUMBER?  10
JOHN SMITH
QUIZ? 90
STUDENT NUMBER? 0
TYPE COMMAND?
```

In the previous example, a quiz grade of 90 was added to JOHN SMITH's record.

INSTRUCTIONS: Continued.

UPD

The UPD command allows the instructor to correct an erroneous student record, e.g.,

```
STUDENT NUMBER?  10
JOHN SMITH
DISPLAY CBG, Q, E, OR Y?  E
EXAM GRADES
G1 - 10 G2 - 0 G3 - 0 G4 - 0
UPDATE:  CBG, Q, E, OR X? E
EXAM #,GRD?
? 1, 95
TYPE COMMAND?
```

The previous sequence changed JOHN SMITH's first exam grade from a 10 to a 95. If an "X" is typed for the prompt:

```
DISPLAY; CBG, Q, E, OR X?
```

The "X" will prevent the student's record from being displayed.

```
UPDATE; CBG, Q, E, OR X?
```

The reply of an "X" to this prompt will result in no update being made.

REG

The REG command places the student's name into the student record file; routine also generates the student password which is used in SSRP, e.g.,

```
TYPE COMMAND?  REG

REGISTRATION
TYPE END TO TERMINATE REGISTRATION
TYPE NAME 1
? JOHN SMITH
TYPE NAME 2
? BETTY WILLIS
TYPE NAME 3
? END
TYPE COMMAND?
```

The previous example set up records on the system for John Smith and Betty Willis.

STA

The STA command permits reports to be obtained from the system. There are five types of records which may be obtained.

GRD - This report summarizes student grades. The following information is printed for each student registered:

Student name and # of CBG's stored.
CBG average.
# of quiz grades stored.
Quiz grade average.
# of exam grades stored.
Exam grade average.

DMP - This report dumps any quiz or exam onto the printer. The report includes the student name and number.

NAM - NAM reports the student #, student name and password. All students registered on the system are printed. This report may be single or triple-spaced. The triple spaced form may be cut apart and distributed to the respective students at the beginning of the quarter.

RAN - The RAN report dumps the entire contents of the student's records. All the records may be printed over a range of student numbers.

STU - The STU report displays a particular student's record.

INSTRUCTIONS: Continued.

SYS

The SYS command is used to set up the SGFMS system. It is used to inform the SGFMS system of the size of the student record and criteria files.

SGFMS FOR THE PROGRAMMER

Expanding SGFMS Files

A. Student Grade File (FILEA)

The student grade file cannot be enlarged unless the SGFMS program is programmed to do so. One way of avoiding this difficulty is to allow enough blocks of disc storage space to allow for additional records. (Each student record requires one block of space.)

B. Criteria File (FILEB)

The criteria may be expanded if it is found after the initial system setup that additional criteria are needed. Use the following procedure to expand the criteria file:

1. Open a temporary file equal to the size of the old file.
2. GET and RUN the HP utility program $COPYFL; copy FILEB into the temporary file.
3. KIL-FILEB, reopen it to the appropriate size.
4. Run $COPYFL copy the temporary file into the new FILEB.
5. GET and RUN the SGFMS.
6. Invoke the SYS command and RESET the space parameters.
7. Invoke the CRI command and INPUT the additional criteria.

System Grade Capacity

VERSION B of SGFMS can store for each student a maximum of:

40 criteria-based grades
120 criteria numbers, (3 per criteria based grade)
10 quiz grades
10 exam grades

System Record Capacity

STUDENT RECORD FILE -- within disc space limitations.
CRITERIA FILE -- 1 to 99 records.

Criteria Number Storage

The INP command allows that user to store up to three criteria numbers to describe each daily grade. These criteria are stored in array C (see SGFMS file structure). To conserve space all three criteria numbers are placed in one numeric word of storage. For example, if the criteria describing a particular grade were 5, 7, and 16 these criteria would be stored as: 160705.

A special program must be written to decode this number so the criteria number can be extracted. (The criteria number is a disc address used to retrieve the criteria from the criteria file.)

SGFMS program statements 7840-8060 will decode the criteria code; read and print the appropriate criteria from the criteria file.

SGFMS File Structure

It is often desirable to read the SGFMS files for the purpose of extracting information not contained in the SGFMS or CORP reports. For example, an instructor may find it desirable to run a statistical analysis on data stored in SGFMS files.

INSTRUCTIONS: Continued.

SGFMS File Structure

BLOCK 1

N4	L8	C9	Y$(25)	

WHERE:

N4 = number of registered students
L8 = size of student grade file (FILEA) in blocks
C9 = size of criteria file (FILEB) in blocks
Y$ = course name

BLOCK 2 AND ALL SUBSEQUENT BLOCKS

D$(25)	Z$(4)	B(40)	C(40)	Q(10)	P(10)	

WHERE:

D$ = student name
Z$ = password
B = CBG
C = criteria numbers
Q = quiz grades
P = exam grades

INSTRUCTIONS: Continued.

STUDENT STATUS REPORT PROGRAM (SSRP)

The purpose of SSRP is to provide the student with the ability to recall his own grade record, that has been set up the STUDENT GRADE FILE MANAGEMENT SYSTEM (SGFMS).

When the students are registered using SGFMS, a student number and four-letter password is inserted into the student's record. This number and four-letter password is required for a student to print his grade record using SSRP. (To obtain a list of registered students and passwords, use the NAM print of the STA command.)

Use of SSRP

The user types the underlined commands:

GET-$SSRP
RUN
SSRP
STUDENT STATUS REPORT PROGRAM
TYPE YOUR NUMBER?1
PASSWORD? ZAKL
ANN ALBERS
SELECT PRINT: RX,PE,TS, ALL OR STOP?

COMMAND	RESULTING ACTION
RX	Prescription grades are printed (Criteria based grade).
PE	Practical exam grades are printed (Quiz grades).
TS	Test grades are printed (exam grades).
ALL	All of the above.
STOP	Terminates the SSRP

Once the print command is typed, the system will respond with the appropriate information.

In addition, the SSRP computes the criteria based grade and quiz average for the entire class and for the individual student.

Each individual exam is averaged for the individual student as well as for the class. This capability gives the student a means of judging his standing in relation to the rest of the class.

If the student selects the RX, PE, or TS print, the SSRP program must be terminated manually. This is done by typing the word "STOP"

CRITERIA OCCURRENCE REPORT PROGRAM (CORP)

The purpose of CORP is to provide an analysis of criteria occurrence. CORP analyzes the daily grade criteria that are stored by the STUDENT GRADE FILE MANAGEMENT SYSTEM (SGFMS).

CORP enables the instructor to obtain three types of reports:

1. A report which counts the criteria of each student for a specified exercise.

   (E.g., criteria counts for exercise #5.)

2. A report which summarizes the criteria occurrence within a particular student's record.

   (E.g., criteria counts for John Doe.)

3. A report which counts the criteria in all student's records.

   (E.g., total criteria count for all exercises.)

The benefits of such an analysis are of extreme importance to the instructor. By counting the criteria which have occurred for a particular exercise (Report 1), the instructor can immediately determine which criteria are being missed most frequently. This should allow adjustments to be made in the instructional emphasis of the course.

By counting criteria occurrence within a particular student's record (Report 2), the instructor can determine if a student is not grasping concepts which have resulted in excessive occurrence of a particular criteria within the student's record.

INSTRUCTIONS: Continued.

Use of Corp

The user types the underlined commands:

GET-CORP
RUN
PASSWORD? Gc Oc
CRITERIA OCCURRENCE REPORT PROGRAM
PRINT REPORT BY PUPIL, BY EXERCISE, OR SUMMARY?

If the criteria count is obtained according to EXERCISE, there are 2 options available:

1. The print may be obtained for one individual exercise.

2. The print may be started on a particular exercise and stopped at a particular exercise; that is, a range of individual exercises may be printed.

RUN

CRE-FILEA,100
CRE-FILEB,20

GET-SGFMS
RUN
SGFMS

STUDENT GRADE FILE MANAGEMENT SYSTEM
PASSWORD? GcOc
HELP AVAILABLE

USE OF THE SYS, CLE AND REG COMMANDS

TYPE COMMAND?SYS
SYSTEMS CONFIGURATION
DISPLAY OR RESET PARAMETERS?
?RESET
COURSE NAME?PHARMACEUTICS 887
NUMBER OF BLOCKS ALLOCATED FOR FILEA (GRADE FILE)?83
NUMBER OF BLOCKS ALLOCATED FOR FILEB (CRITERIA FILE)?15

```
TYPE COMMAND?CLE
STUDENT RECORD FILE CLEAR
AUTHORIZATION?
TYPE  C  TO CLEAR OR  A  TO ABORT
?C
CLEAR COMPLETED

TYPE COMMAND?REG
REGISTRATION
IF YOU MAKE AN ERROR IN TYPING A STUDENT NAME,
YOU MAY CORRECT IT BY USE OF THE ALT  (ALTER) COMMAND.

TYPE  END  TO TERMINATE REGISTRATION
RECORD LENGTH  --   101        WORDS
TYPE NAME 1
?SUSAN ALDERN-MAN
TYPE NAME 2
?ARKWRIGHT G. AMBERG
TYPE NAME 3
?ROBERT BARBER
TYPE NAME 4
?LISA BLOCHER
TYPE NAME 5
?GEORGE CLARK
TYPE NAME 6
?ALBERT CROFT
TYPE NAME 7
?JOHN EPPICH
TYPE NAME 8
?JON FAUST
TYPE NAME 9
?PATRICIA HOBBS
TYPE NAME 10
?END

TYPE COMMAND?STA                          STATUS COMMAND       (NAME PRINT)
STATUS REPORTS
HELP AVAILABLE
SELECT REPORT:  DMP, GRD, NAM, RAN, STU?NAM
SINGLE OR TRIPLE SPACE REPORT?SINGLE



REGISTERED STUDENTS   PHARMACEUTICS 887


  1   SUSAN ALDERMAN                BIAI
  2   ARKWRIGHT G. AMBERG           DOPR
  3   ROBERT BARBER                 ICYW
  4   LISA BLOCHER                  TDYY
  5   GEORGE CLARK                  GDTB
  6   ALBERT CROFT                  UREF
  7   JOHN EPPICH                   NDJT
  8   JON FAUST                     TOEX
  9   PATRICIA HOBBS                RSFH



TYPE COMMAND?ALT
STUDENT NUMBER?4                  USE OF THE ALTER AND DROP COMMANDS
LISA BLOCHER   TDYY
ALTER NAME OR PASSWORD?PASSWORD
PASSWORD?TDSY

TYPE COMMAND?DRO
STUDENT NUMBER?8
DROP JON FAUST?YES
STUDENT DROPPED
```

```
TYPE COMMAND?CRI                          CRITERIA MAINTENANCE COMMANDS
CRITERIA MAINTANCE
SELECT: CLE, END, INP, PRI
TYPE CRITERIA COMMAND?CLE
CLEAR CRITERIA FILES
TYPE  C  TO CLEAR FILES OR  X  TO ABORT
?C
CLEAR COMPLETED
TYPE CRITERIA COMMAND?INP
INPUT  (SET C#=0 TO TERMINATE ROUTINE)
SYSTEM WILL ACCEPT  15    CRITERIA

C#?1

CRITERION:
?CONGRATULATIONS!! YOU MADE NO ERRORS

C#?2

CRITERION:
?PACKAGING OR LABELING ERROR

C#?3

CRITERION:
?TYPING OR SPELLING L-ERROR ON LABEL

C#?0
TYPE CRITERIA COMMAND?PRI
SELECT PRINT:  RANGE OR SELECT
?RANGE
LOWER LIMIT?1
UPPER LIMIT  (MAX IS  15      ?3




 1   CONGRATULATIONS!! YOU MADE NO ERRORS
 2   PACKAGING OR LABELING ERROR
 3   TYPING OR SPELLING ERROR ON LABEL


                                                    HELP COMMAND

TYPE CRITERIA COMMAND?END

TYPE COMMAND?HELP
ALT  ---  ALTER:  ALTERS STUDENT NAME OR PASSWORD
CLE  ---  CLEAR:  ERASES STUDENT NAMES AND THEIR GRADE RECORDS
CRI  ---  CRITERIA:  INVOLKES THE CRITERIA FILE
          MAINTAINANCE SUBSYSTEM
DRO  ---  DROP:  DROPS A REGISTERED STUDENT
END  ---  TERMINATES A SYSTEM OR SUBSYSTEM
INP  ---  INPUT:  USED TO INPUT STUDENT'S GRADES
REG  ---  REGISTRATION:  PLACES THE STUDENT NAMES AND
          PASSWORDS ON THE SYSTEM
STA  ---  STATUS:  PRINTS STATUS REPORTS
SYS  ---  SYSTEM:  USED IN INITIALIZING THE SYSTEM
UPD  ---  UPDATE:  PERMITS THE CORRECTION OF A STUDENT RECORD

TYPE COMMAND?INP
SELECT INPUT MODE:  CBG, Q, OR E?CBG              INPUT OF CBG'S
EXERCISE #?5
ALL INPUTS WILL BE PLACED IN EXERCISE # 5



STUDENT NUMBER?090---9
PATRICIA HOBBS
GRD,CR1?
?9,4
CR2?0
```

```
STUDENT NUMBER?3
ROBERT BARBER
GRD,CR1?
?8,2
CR2?3
CR3?0

STUDENT NUMBER?0
EXERCISE #?6
ALL INPUTS WILL BE PLACED IN EXERCISE # 6




STUDENT NUMBER?5
GEORGE CLARK
GRD,CR1?
?10,1
CR2?0

STUDENT NUMBER?0
EXERCISE #?0

TYPE COMMAND?UPD
RECORD UPDATE                                    UPDATE COMMAND
AUTHORIZATION?
SET STUDENT NUMBER = 0 TO TERMINATE UPD
TYPE  X  TO BYPASS
STUDENT NUMBER?1
SUSAN ALDERMAN
DISPLAY:  CBG, Q, E, OR X?CBG
NO CBG'S STORED
UPDATE:  CBG, Q, E, OR X?CBG
EX#,CBG,CR1?5,8,3
CR2?4
CR3?0
STUDENT NUMBER?9
PATRICIA HOBBS
DISPLAY:  CBG, Q, E, OR X?CBG
CBG'S
EX #  5 --   9
UPDATE:  CBG, Q, E, OR X?E
EXAM#,GRD?
?2,88
STUDENT NUMBER?0

TYPE COMMAND?END

DONE
```

SRP

TITLE: SRP: STUDENT RESPONSE PRINT 36888-18008

DESCRIPTION:

The Student Response Print (SRP) is a program designed to read response files which are written by the Hewlett-Packard IDF program IDSF (Instructional Dialogue Student Facility), and print the responses in two formats:

A. Standard Response Print

The standard response print lists the responses for each student by section number.

B. Response Frequency Count

The Response Frequency Count print eliminates all duplicate responses and prints only unique responses and their associated frequency of occurrence by section number.

INSTRUCTIONS:

The SRP uses one disc file (SKR2) as a scratch file. The SKR2 file is routinely created as part of the IDF system. If the SKR2 file has not been created it should be opened in the following manner:

```
CRE-SKR2,32
```

SRP contains a variety of features which are designed to increase the program's flexibility and usefulness.

A. "Batch" Processing Feature

The user often must dump a number of response files. This can be a time consuming task if the number of sections are small, and if there are many files to dump, since the user must "baby sit" the computer terminal, dumping one file, then the next, etc. The SRP allows the user to enter from one to twelve filenames to be dumped, the SRP will dump the files in a continuous fashion.

B. Remove Blanks Option

IDSF answer checking is often performed after removal of embedded blanks from student answers, but the student answers are written into the response file without blanks removed. With the REMOVE BLANKS option, the user can print the responses without blanks, thus making the responses appear as they appear to the answer checking section of IDSF. If blanks are removed, the user can readily determine if this answer checking is working properly by comparing the print to the appropriate section.

C. Frequency Counts of //CALC, //HINT, and //STOP

Since it is often useful to determine the student use of CAI facilities, such as the calculator, the SRP does frequency counts of the 3 major IDF aids: //CALC, //HINT, and //STOP.

Continued on following page.

ACKNOWLEDGEMENTS:

Verl Dennis and Daniel Krautheim
Office of Educational Development
The Ohio State University

INSTRUCTIONS continued.

D. Selective Section Dumps

If only one response filename is entered into the SRP, the program allows the user to selectively dump responses of any given section or sections.

E. Response File Protection

The user must enter the code $R_C U_C N_C$ before the program will permit a user to dump a response file/s.

RUN

```
RUN

SRP

IDF STUDENT RESPONSE PRINT    ***  OED VERSION B
CODE? RUNC
ENTER RESPONSE FILE LIST, ONE PER LINE,  TERMINATE WITH 'END'
FILE # 1     ?FRANCR
FILE # 2     ?END
CORRECTIONS?N


REMOVE BLANKS?Y

SELECT:  A. STD RESPONSE PRINT    B. RESPONSE FREQ COUNT?A
THERE ARE  6     SECTIONS IN FRANCR
START SRP AT SECTION #?1
STOP SRP AT SECTION #?6
------

FEB   5, 1975      RESP FILE ASSOCIATED WITH LESSONFILE: FRANC

SECTION # 1        FRANCR       STUDENT RESPONSE PRINT


   S#            RESPONSE
 ====       ========================================

 1010       POMPIDOU
 1011       DESTANE
 1011       POMPDIOU
 1012       POMPIDOU
 1013       POMPIDOU
 1014       POMPIDOU
 1015       DESTANG
 1015       DEGAULLE
 1015       PICKARD
 1016       POMPIDOU
 1017       POMPDIOU
 1018       POMPIDOU
 1019       DESTANG
 1019       DEGALLE
 1019       LEGRANGE

NUMBER OF STUDENTS STOPPING IN THIS SECTION --  0
NUMBER OF //HINTS REQUESTED --  3
NUMBER OF //CALCS USED      --  0
```

FEB 5, 1975 RESP FILE ASSOCIATED WITH LESSONFILE: FRANC

SECTION # 2 FRANCR STUDENT RESPONSE PRINT

S#	RESPONSE
1010	DEGAULLE
1011	DEGAULLE
1012	DEGAULL
1013	DEGAULLE
1014	DEGALL
1015	DEGAULLE
1016	DEGAULLE
1017	DEGAULLE
1018	DEGAULLE
1019	DEGALL

NUMBER OF STUDENTS STOPPING IN THIS SECTION -- 0
NUMBER OF //HINTS REQUESTED -- 2
NUMBER OF //CALCS USED -- 0

FEB 5, 1975 RESP FILE ASSOCIATED WITH LESSONFILE: FRANC

SECTION # 3 FRANCR STUDENT RESPONSE PRINT

S#	RESPONSE
1010	ROMANCATHOLIC
1011	CATHOLIC
1012	ROMANCATHOLIC
1013	JEWISH
1013	CATHOLIC
1014	CATHOLIC
1015	ROMANCATHOLIC
1016	CATHOLIC
1017	CATHOLIC
1018	ROMANCATHOLIC
1019	JEWISH
1019	ITALIAN
1019	

NUMBER OF STUDENTS STOPPING IN THIS SECTION -- 0
NUMBER OF //HINTS REQUESTED -- 4
NUMBER OF //CALCS USED -- 0

FEB 5, 1975 RESP FILE ASSOCIATED WITH LESSONFILE: FRANC

SECTION # 4 FRANCR STUDENT RESPONSE PRINT

S#	RESPONSE
1010	ALPS
1011	ALPS
1012	ALPS
1013	ALPS
1014	ALPS
1015	ALPS
1016	ALPS
1017	ALPS
1018	ALPS
1019	ALPS

NUMBER OF STUDENTS STOPPING IN THIS SECTION -- 0
NUMBER OF //HINTS REQUESTED -- 1
NUMBER OF //CALCS USED -- 0

```
------

FEB   5, 1975      RESP FILE ASSOCIATED WITH LESSONFILE: FRANC

SECTION # 5        FRANCR       STUDENT RESPONSE PRINT


   S#           RESPONSE
 ====       ========================================

 1010       SEINE
 1011       GARONNE
 1012       THESEINE
 1013       LOIRE
 1014       RHONE
 1015       SEINE
 1016       GARONNE
 1017       //RHONE
 1017       RHONE
 1018       RHONE
 1019       GARDEN

NUMBER OF STUDENTS STOPPING IN THIS SECTION --  0
NUMBER OF //HINTS REQUESTED --  2
NUMBER OF //CALCS USED      --  0

------

FEB   5, 1975      RESP FILE ASSOCIATED WITH LESSONFILE: FRANC

SECTION # 6        FRANCR       STUDENT RESPONSE PRINT


   S#           RESPONSE
 ====       ========================================

 1010       NO
 1011       NO
 1012       NO
 1013       NO
 1014       NO
 1015       NO
 1016       NO
 1017       NO
 1018       NO
 1019       NEVER
 1019       NO

NUMBER OF STUDENTS STOPPING IN THIS SECTION --  0
NUMBER OF //HINTS REQUESTED --  0
NUMBER OF //CALCS USED      --  0



GET-$SRP
RUN
SRP

IDF STUDENT RESPONSE PRINT    ***  OED VERSION 8
CODE? RETURN
ENTER RESPONSE FILE LIST, ONE PER LINE,  TERMINATE WITH 'END'
FILE # 1     ?FRANCR
FILE # 2     ?END
CORRECTIONS?N


REMOVE BLANKS?Y

SELECT:  A. STD RESPONSE PRINT    B. RESPONSE FREQ COUNT?B
THERE ARE  6     SECTIONS IN FRANCR
START SRP AT SECTION #?5
STOP SRP AT SECTION #?6
------
```

```
FEB   5, 1975      RESP FILE ASSOCIATED WITH LESSONFILE: FRANC

SECTION # 5         FRANCR     RESPONSE FREQUENCY COUNT-


 FREQ              RESPONSE
 ====  ==============================================

  2     SEINE
  2     GARONNE
  1     THESEINE
  1     LOIRE
  3     RHONE
  1     //RHONE
  1     GARDEN

NUMBER OF //STOPS      --  0
NUMBER OF //HINTS      --  2
NUMBER OF //CALCS      --  0



------

FEB   5, 1975      RESP FILE ASSOCIATED WITH LESSONFILE: FRANC

SECTION # 6         FRANCR     RESPONSE FREQUENCY COUNT


 FREQ              RESPONSE
 ====  ==============================================

  10    NO
  1     NEVER

NUMBER OF //STOPS      --  0
NUMBER OF //HINTS      --  0
NUMBER OF //CALCS      --  0



------

DONE
```

TESTGD
36888-18041

TITLE: MULTIPLE-CHOICE TEST GRADER

DESCRIPTION:

This program is used to score multiple choice tests of up to 40 questions in length. Output includes an alphabetical list of the students with a listing of the answers they had incorrect. Correct responses are listed as "." except every fifth is a ",", double marked answers are listed as ":" and blanks are " ". On the next line is the number of correct answers, the number of incorrect, and the percentage of the maximum. An item analysis of answers completes the report.

INSTRUCTIONS:

Both the students' responses and the answer key must be marked on 40 column mark sense cards. A file TEST must be opened to at least (N+4)/3 records in length where N is the number of students, 140 maximum. The card deck must be made up of alternating "NAME=name-of-student" cards and the corresponding response card. The first card must be "NAME=KEY", followed by the correct answer card, and then the pairs of student cards, not necessarily in alphabetical order. The deck must end with an "END" card.

Upon running TESTGD the computer will ask for the number of questions and then will start reading the cards. If the card reader is not ready at the start, push the READY button. If the card reader drops the ready status, you may have to start over.

If for some reason the program is interrupted after the END card has been read, there are two re-start options: After giving the number of questions, "SORT" will restart the program at the sorting phase and "PRINT" will re-start the program at the printing phase.

Equipment required is: TSB/2000E system, hard-copy terminal, and HP 7260A Optical Mark Reader with the image option.

SPECIAL CONSIDERATIONS:

Leaving the first column blank will mix up the answers to questions 36-40. Marking rows 12 and 2 or 4 and 8 in the same column will falsify any questions after that one.

ACKNOWLEDGEMENTS:

Lary R. Smith
Livonia Public Schools