-TYPE (APAK)APAK.INF

MAY 1974

CONTENTS

User Program Index 7 contains a list of languages, programs, and subprograms available on the Tymshare TYMCOM-IX system. This list is divided into five sections, each arranged by program type.

SECTION 1

LANGUAGES AND LIBRARY PROGRAMS

The programs in this section are contained in the Tymshare Library and the User Program Library (UPL).

Most Tymshare Library programs are written by Tymshare and are documented in published manuals. Tymshare has committed its applications group to maintaining these programs.

The program names are listed in the first column. Programs with names beginning with a crosshatch (#) are contained in the User Program Library. Most of these programs were written by individuals outside Tymshare and are stored in this library for the convenience of Tymshare users. Tymshare tries to keep these programs in working condition. Users may request the symbolic versions of any of the UPL programs except those few whose program names are underlined.

All of these library programs are called by typing their names in the EXECUTIVE.

All new programs not documented in the previous Program Availability List are denoted by an asterisk (*) following the program name.

The third column of this index indicates the source of documentation according to the following code:

MANUAL	Program has its own manual.
SD	Program is self-documenting. It either asks whether instructions are needed or accepts the command INSTRUCTIONS.
BML	Program is documented in the *Tymshare Business Management Library Reference Manual*, April 1971.
IML	Program is documented in the *Tymshare Information Management Library Reference Manual*, January 1973.
STATLM	Program is documented in the *Tymshare Statistics Library Reference Manual*, September 1971.
EXEC	Program is documented in the *Tymshare EXECUTIVE Reference Manual*, January 1971, and supplementary Systems Bulletins.
CTC	Program is documented in the *Tymshare CTC Datapoint Cursor Program Reference Manual*, March 1970.
LTD.ED	Currently, only rough documentation is available.
TAPE	Program is documented in the *Tymshare Paper Tape Package Reference Manual*, November 1971.

AB #	Program is described in an Applications Bulletin.
LB #	Program is described in a Language Bulletin.
SB #	Program is described in a Systems Bulletin.
FII	Program is documented in the *Tymshare BATCH FORTRAN/FORTRAN II Reference Manual*, March 1972.
FIV	Program is documented in the *Tymshare BATCH FORTRAN IV Reference Manual*, September 1972.

To allow you to use the Tymshare libraries more easily, a standard set of commands has been added to many of the library programs. These programs print a colon (:) when they are called. The user may then type:

CAPABILITIES	Describes capabilities of the program.
INSTRUCTIONS	Describes how to use the program.
HELP	Prints a list of program commands and descriptions.
RUN	Executes the program.
QUIT	Leaves program, returns to EXECUTIVE level.

Programming Languages and Text Editing

ARPAS	Assembly Language	MANUAL
BFORTRAN	BATCH FORTRAN IV	MANUAL
CAL	Conversational Algebraic Language	MANUAL
DCAL	Conversational Algebraic Language (DDI Version)	MANUAL
DDT	Dynamic Debugging Tool for ARPAS	MANUAL
EDITOR	General Text Editing Language	MANUAL
F2C	FORTRAN II Compiler	MANUAL
F2OS	FORTRAN II Operating System	MANUAL
FOS	BATCH FORTRAN II Operating System	MANUAL
FTC	BATCH FORTRAN II Compiler	MANUAL
NARP	New ARPAS	MANUAL
SBASIC	SUPER BASIC	MANUAL
SFORTRAN	SUPER FORTRAN (Conversational FORTRAN IV)	MANUAL
SNOBOL	String-Oriented Symbolic Language	MANUAL
XCAL	Conversational Algebraic Language (extended size DCAL)	MANUAL
XDDT	Dynamic Debugging Tool for NARP	MANUAL

Information Management Library

APPEND	Appends one file to another	IML
CONVERT	Converts an IML data base from one format or type to another	AB #37
CREATE	Creates a data base to be used with other IML programs	IML
DEFINE	Defines description of files for other IML programs	IML
MERGE	Merges two sorted files into one	IML
NOTE*	Prints text to terminal for documenting commands files	IML
PERFORM*	Executes IML SAVE files	IML
PURGE	Purges selected information from a file	IML
REPLACE	Replaces selected information on a file	IML
REPORT	Report generation program	IML
RETRIEVE	Management information retrieval system	MANUAL
SELECT	Selects specified records from a file	IML
SORT	Fast and flexible sorting program	IML
UPDATE	Updates selected information based on specified conditions	IML
VERIFY	Verifies the data in a file used by other IML programs	IML

Business Programs

Property Management

C1APTS	Financial analysis of apartments	MANUAL
C1COND	Financial analysis of projects for sale	MANUAL
C1OFIC	Financial analysis of commercial buildings	MANUAL
C2LUI	Land use intensity (FHA Form 1028,1029)	MANUAL
C2PLAN	Design statistics for land use studies	MANUAL
CPEAP1*	Real estate analysis package	MANUAL

Management

C3CPM	Critical path method scheduling	MANUAL
C3CPMF	Critical path method (expanded version)	MANUAL
#CPM1	Critical path method phase 1	BML
#CPM2	Critical path method phase 2	BML
#CPM3	Critical path method phase 3 (used for making revisions)	SD
#CPMI	Instructions for critical path method programs	BML
FASTAB	Fast version of TYMTAB	MANUAL
#INVENTORY	Facilitates inventory bookkeeping	MANUAL
LINPROG	Extended linear programming	MANUAL
#PERT	Performs PERT network analysis	BML
TYMTAB	Powerful report/table generation	MANUAL
USPAVOT	Processes surveys	MANUAL

Finance

#ANNUITY	Calculation of annuities	BML
CASHMGT*	Devises optimal short-term investment/borrowing strategy	MANUAL
C6JOBC	Job cost accounting	MANUAL
#CASHFLOW	Discounted cash flow	BML
#COSTSAVE	Cost of making versus buying a product	BML
#DEPREC	Four method depreciation on investment	BML
FINPAK	Financial analysis package	MANUAL
#FINSTA	Financial statement and report program	SD
#LESSOR	Lease analysis from lessor's point of view	BML
#PORTMGT*	Securities portfolio management system	MANUAL
#PRESVAL	Rate of return on investments given a series of cash flows	BML
RISKAN	Risk analysis program	MANUAL
#STOCKRETRIEVE*	Daily securities prices	MANUAL
TYMKEEP	General ledger accounting	MANUAL

Economics

#FORECAST	Trend analysis forecasting	BML
#TRENDANAL	Forecast based on data with trend and/or seasonal effect	SD
#TRENDFORE	Linear trend forecast	SD

Mortgage

#MORTGAGE	Yearly or monthly mortgage table	BML

Real Estate

RANAL	Investment analysis	MANUAL
REAIA	Investment analysis	MANUAL
REAPA	Project analysis	MANUAL

Statistics Programs

General Statistics and Data Screening

#BINDIS	Binomial probability distribution	STATLM
#DESTAN	Detailed statistical analysis on univariate data	STATLM
GENIE	Statistical analysis	MANUAL
#MANDSD	Mean variance and standard deviation	SD
#STATANAL	Statistical analysis	STATLM
#STATLINK	Creates a STATPAK data file from a RETRIEVE data base	STATLM
STATPAK	Comprehensive statistics package	MANUAL

Confidence Limits

#COLINR	Confidence limits on a linear regression	STATLM
#MEANLIM	Mean, variance, standard deviation, and confidence limits	STATLM
#SIGNIF	Confidence limits on difference between two means	STATLM

Correlation, Regression, and Curve Fitting

#CURFIT	Fitting a curve	STATLM
#CURVES	Fit data to six different curves	SD
#LEAST	Least error line fitting	SD
#LINREG	Simple linear regression	SD
#POLYCURV	Polynomial curve fitting	STATLM
#STEPREG	Multiple regression analysis with step technique to add variables	STATLM

Analysis of Variance

#ONEWAY	Analysis of variance	STATLM

Random Number Generators

#RANDOMINT	Generates list of random numbers	SD

Electrical Engineering

Circuit Design/Synthesis

AC-CODED	AC circuit analysis	MANUAL
ACSEQ	Used with CIRCAC user-defined subroutines	MANUAL
#BODEPLOT	Solution of transfer function of a circuit or network	SD
CIRCAC	AC circuit analysis with built-in transistors	MANUAL
CIRCDC	Nonlinear DC circuit analysis with built-in transistors	MANUAL
DC-CODED	Nonlinear DC analysis with built-in transistors	MANUAL
DCSEQ	Used with CIRCDC user-defined subroutines	MANUAL
ECAP	Electronic circuit analysis (linear AC, DC, and Transient)	MANUAL
FILSYN	Synthesizes equal ripple and maximally flat low, high, and bandpass filters	MANUAL
#NASAP	Linear network analysis by S-plane method	MANUAL
#RCFILT	RC active filter synthesis	SD
SCIRCAC	Used with CIRCAC user-defined subroutines	MANUAL
SCIRCDC	Used with CIRCDC user-defined subroutines	MANUAL

TR-CODED	Transient circuit analysis with nonlinear elements and plotting	MANUAL
#TYMTRAC	Transient circuit analysis with nonlinear elements and semiconductor library	MANUAL
TRAP*	Linear circuit analysis program	MANUAL

Reliability Analysis

RADAC	R.A.D.C. Notebook #2 for Reliability Prediction	MANUAL
RELAN	Reliability Analysis	MANUAL

Logic Design and Analysis

LOGMIN	Logic minimization	MANUAL
LOGSIM	Logic simulation with propagation delays	MANUAL

Microwave Analysis

MICAP	Microwave circuit analysis program	MANUAL
MICLIB	Makes MICAP user-defined subroutines	See MICAP

Mathematical Methods

LAPLACE	LaPlace transform inversion program (see Fourier analysis under Mathematics Programs, also)	MANUAL

Civil Engineering

Civil and Structural Engineering

C4HEAT	Calculates the heat loss, or heating loads, for buildings	MANUAL
C2PLOT	Plotting program for land use studies	MANUAL

Chemical Engineering

#VIGAS	Gas chromatography analysis of data from VIDAR AUTOLAB	SD

System Simulation

CSMP	Continuous system modeling program	MANUAL

Calculator

#CALCULATOR	Simulates a calculating machine	SD

Graphics/Plotting

ACPLOT	Plots output of AC-CODED	NONE
#CURFITPLOT	Creates plot of #CURFIT data	SD
#EASYDEMO	Plotting demonstration file for #EASYPLOT	NONE
#EASY30	30 cps EASYPLOT for Zeta plotters	NONE
#EASYPLOT	All-purpose plotting on incremental plotter	MANUAL
#EZGRAF	EASYPLOT package for the Typagraf	SD
#PLOTEASY	Conversational front end to write EASYPLOT programs	SD
EASYPLOT	10/30 cps all-purpose plotting for Zeta plotters	NONE

Utility Programs

Tape Conversion

#ASCII	Conversion table – ASCII, external to internal	TAPE
#BCD	Converts 029 punched card file to 026 punch compatibility	SD
BINTAPE	Punches paper tape from or reads tape into a binary file	TAPE
CONFILE	File-to-tape conversion by user-written table	TAPE
CONTAPE	Tape-to-file conversion by user-written table	TAPE
#EBCDIC	Converts BCD 026 punched files to 029 punch compatibility	SD
#FLEXIN	Converts flex coded tape to ASCII and input to disk file	SD
#FLEXOUT	Converts ASCII file to flexowriter code and punches tape	SD
#INTAPE	Tape-to-file code converter	SD
#OUTTAPE	File-to-tape code converter	SD

TABLEMAKER	Creates table for use with the programs CONFILE and CONTAPE	TAPE
TABONE	Conversion table — code number is its position	NONE
TAPE	Punches paper tape from or reads tape into symbolic file	TAPE
#TAPECON	Reads paper tape and writes character numeric equivalent to file and vice versa	SD
TITLE	Punches readable text on paper tape	SD

Format Conversion

#ALIGN	Prints SUPER BASIC or BATCH FORTRAN programs in readable form	SD
#FCONVERT	Conversion of free format FORTRAN IV to card image	SD
#STRIP	Strips trailing blanks and columns 72–80 from cards	SD

Language Conversion

FSB	Optimizes SBASIC programs	MANUAL
#GETYMB	Converts GE BASIC to Tymshare SBASIC	SD
#GETYMF	Converts GE FORTRAN to Tymshare SFORTRAN	SD

Machine Languages

SYMSORT	Sorts and creates file of program labels for ARPAS program	SD

Text Manipulation Programs

FET	File editing tool	NONE
LNED	Line editor	MANUAL

Programming Aids

BFBED	BATCH FORTRAN IV binary editor	MANUAL
BFMACRO	BATCH FORTRAN IV macros for NARP subroutines	MANUAL
F2BED	FORTRAN II binary editor	FII
#GETSSP	Prints symbolics of FORTRAN II subroutines in SPMATH, SPMATR, and SPSTAT	SD
#IOBIN	Binary input/output routine	SD
#LIBLD	BATCH FORTRAN II library builder	FII
MAKEGO	Transforms SFORTRAN link files into GO files	NONE

Debugging Aids

#BINDUMP	Print contents of binary file in ASCII, HEX, or OCTAL	SD
SBIG	SUPER BASIC index generator	LB #5

File Utility Programs

AFD	Automatic file deletion	EXEC
FDM	File directory management — compacts files	SD
NET	Copies a file from one TYMCOM-X system to another	SD
#PRINT	Prints files in various formats	MANUAL
SETS	Sets maximum allowable file size	EXEC
TELECOPY	Copies a file from one computer to another	SD

Security

CIPHER	Enciphers or deciphers a file	EXEC
CHECKSUM	Computes unique file identification number	EXEC
COMPARE	Compares any two files	EXEC
FAILSAFE	Protection from phone disconnects	EXEC
PASSWORD	Changes password	EXEC
SCOMPARE	Compares any two symbolic files and prints all differences	EXEC
SETFAILSAFE	Invokes failsafe feature	EXEC
VALID	Sets up requirement for project code validation	NONE
VERIF	Prints checksums for entire directory	EXEC

Terminal Input/Output

FDX	Puts user in full-duplex mode	EXEC
HDX	Puts user in half-duplex mode	EXEC
TERMINET	Sets system I/O parameters for GE Terminet	NONE

User Information and Assistance

BATCH	Requests jobs to be done by computer center	MANUAL
COPYBATCH	Used with BATCH. Transfers user's file to operator's file directory	MANUAL
NAMES	Types all user names in account	EXEC
NONAME	User validation program	SD
OFF	Turns off selected features	SD
ON	Turns on selected features	SD
POSTMAN	Prints mail information	EXEC
PREMIUM	Lists royalty program premium charges	SD

SUMMARY	Disk storage summary	EXEC
TYMUSE	Accounting data regarding use of Tymshare system	MANUAL
WHY	Further explains some system error messages	EXEC

Demonstration Programs

#BATNUM	The battle of numbers	SD
#BLACKJACK	Computer deals BLACKJACK	SD
#BOTTLE	Jug and Bottle game	SD
#CARDTRICK	Performs a card trick	SD
#DICE	Game of DICE	SD
#FOOTBALL	Game of FOOTBALL	SD
#GOLF	Game of GOLF	SD
#GOMOKU	Game of GOMOKU	SD
#KENO	Game of KENO	SD
#NIM	Game of NIM	SD
#POKER	Computer deals draw POKER	SD
#QUBIC	Three-dimensional TIC-TAC-TOE	SD
#ROULETTE	Game of ROULETTE	SD
#SLOT	Game of SLOT MACHINE	SD

Remote Peripheral Access

PRINTER	General-purpose printer program	MANUAL

SECTION 2

BATCH FORTRAN LIBRARY ROUTINES

A number of library functions and subroutines are available in BATCH FORTRAN II. Standard library functions – SIN, COS, etc. – are stored on a file named *LIB. The compiled functions and subroutines described in this section are on the following files:

*FSUBR	General subroutines.
#EXL2	Additional general subroutines. (#EXL4 contains a similar library for BFORTRAN4.)
#SPSTAT	Statistical subroutines.
#SPMATR	Matrix subroutines.
#SPMATH	Mathematical subroutines.

In addition, Tymshare offers BATCH FORTRAN II subroutines to control incremental plotters. The Zeta plotter routines are on the file *ZLIB, and the routines for CalComp and similar plotters are on the file *PLIB.

All BATCH FORTRAN II subroutines are documented in the *Tymshare BATCH FORTRAN/ FORTRAN II Reference Manual*. These subroutines are used in BATCH FORTRAN II in a CALL statement. The user's main program is compiled in FTC. The user calls FOS, enters the name of his compiled main program, and then enters the name of the required subroutine files.

Symbolics for the BATCH FORTRAN II subroutines on the files #SPSTAT, #SPMATR, and #SPMATH can be obtained by typing #GETSSP in the EXECUTIVE. For example:

```
-#GETSSP↵
WHAT ROUTINE DO YOU WISH? subroutine name↵
NAME YOUR FILE? file name↵
***SSP PROGRAM subroutine name IS WRITTEN ON FILE file name***
```

These symbolics can be used in SUPER FORTRAN with only minor changes. The procedure used is as follows:

1. The user writes the symbolics of the subroutine on a file using the program #GETSSP.
2. He strips off the trailing blanks with the #STRIP program.
3. He enters the program into SUPER FORTRAN with the COPY command.

In BATCH FORTRAN II, continuation of a statement to the next line is indicated by a character in column 6. In SUPER FORTRAN, the continued lines are separated by Line Feeds rather than by Carriage Returns. Therefore, all continued lines in the subroutine need a Line Feed instead of a Carriage Return, and the character in column 6 must be removed. The JOIN command in EDITOR may be used to join two lines with a Line Feed between them.

Statistics Programs

General Statistics and Data Screening

Totals, means, standard deviations, minima, and maxima	TALLY	#SPSTAT
Selections of observations within bounds	BOUND	#SPSTAT
Subset selection from observation matrix	SUBST	#SPSTAT
Detection of missing data	ABSNT	#SPSTAT
Tabulation of data in one variable	TAB1	#SPSTAT
Tabulation of data in two variables	TAB2	#SPSTAT
Building subset matrix	SUBMX	#SPSTAT
First four moments	MOMEN	#SPSTAT
Test on population means	TTSTT	#SPSTAT

Correlation, Regression, and Curve Fitting

Data generation	GDATA	#SPSTAT
Multiple regression and correlation	MULTR	#SPSTAT
Rearrangement of intercorrelations	ORDER	#SPSTAT
Means, standard deviations, and correlations	CORRE	#SPSTAT
Canonical correlations	CANOR	#SPSTAT

Analysis of Variance

Data storage allocation	AVDAT	#SPSTAT
Sigma and del operations	AVCAL	#SPSTAT
Mean square operation	MEANQ	#SPSTAT

Discriminant Analysis

Means and dispersion matrix	DMATX	#SPSTAT
Discriminant functions	DISCR	#SPSTAT

Factor Analysis

Cumulative percentage of eigenvalues	TRACE	#SPSTAT
Factor loading	LOAD	#SPSTAT
Varimax rotation	VARMX	#SPSTAT

Time Series

Autocovariances	AUTO	#SPSTAT
Cross covariances	CROSS	#SPSTAT
Application of filter coefficients	SMO	#SPSTAT
Triple exponential smoothing	EXSMO	#SPSTAT

Special Statistical Routines

Spearman rank correlation	SRANK	#SPSTAT
Kendall rank correlation	KRANK	#SPSTAT
Chi-square test for a contingency table	CHISQ	#SPSTAT
Cochran Q-test	QTEST	#SPSTAT
Rank observations	RANK	#SPSTAT
Calculation of ties in ranked observations	TIE	#SPSTAT
Friedman two-way analysis of variance	TWOAV	#SPSTAT
Mann-Whitney U-test	UTEST	#SPSTAT
Kendall coefficient of concordance	WTEST	#SPSTAT
Gaussian normal probability integral function	PROBIN	*FSUBR
Gaussian normal probability ordinate function	GAUSS	*FSUBR

Random Number Generators

Uniform random numbers	RANDU	#SPSTAT
Normal random numbers	GAUSS	#SPSTAT

Mathematics Programs

Matrices

Matrix addition subroutine	RMADD	*FSUBR
Matrix subtraction subroutine	RMSUB	*FSUBR
Matrix multiplication subroutine	RMMUL	*FSUBR
Matrix transposition subroutine	RMTRA	*FSUBR
Matrix inversion and rank calculation subroutine	RMINV	*FSUBR
Matrix inversion and determinant calculation subroutine	INVERT	*FSUBR
Determinant evaluation function	DETERM	*FSUBR
Addition of two general matrices	GMADD	#SPMATR
Subtraction of two general matrices	GMSUB	#SPMATR
Product of two general matrices	GMPRD	#SPMATR
Transposition of a general matrix	GMTRA	#SPMATR

Transposition of the product of two general matrices	GTPRD	#SPMATR
Addition of two matrices	MADD	#SPMATR
Subtraction of two matrices	MSUB	#SPMATR
Row into column matrix product	MPRD	#SPMATR
Matrix transposition	MTRA	#SPMATR
Transposition of a product	TPRD	#SPMATR
Transposition of a product of a matrix by itself	MATA	#SPMATH
Addition of a scalar to a matrix	SADD	#SPMATR
Subtraction of a scalar from a matrix	SSUB	#SPMATR
Matrix multiplied by a scalar	SMPY	#SPMATR
Matrix divided by a scalar	SDIV	#SPMATR
Matrix clear and add scalar	SCLA	#SPMATR
Replace diagonal with scalar	DCLA	#SPMATR
Addition of row of one matrix to row of another matrix	RADD	#SPMATR
Addition of column of one matrix to column of another matrix	CADD	#SPMATR
Scalar multiply one row and add to another row	SRMA	#SPMATR
Scalar multiply one column and add to another column	SCMA	#SPMATR
Interchange two rows	RINT	#SPMATR
Interchange two columns	CINT	#SPMATR
Sum the rows of a matrix	RSUM	#SPMATR
Sum the columns of a matrix	CSUM	#SPMATR
Tabulation of the rows of a matrix	RTAB	#SPMATR
Tabulation of the columns of a matrix	CTAB	#SPMATR
Sort of matrix rows	RSRT	#SPMATR
Sort of matrix columns	CSRT	#SPMATR
Partition a matrix by rows	RCUT	#SPMATR
Partition a matrix by columns	CCUT	#SPMATR
Adjoin two matrices by rows	RTIE	#SPMATR
Adjoin two matrices by columns	CTIE	#SPMATR
Copy a matrix	MCPY	#SPMATR
Copy submatrix from given matrix	XCPY	#SPMATR
Copy row of matrix into vector	RCPY	#SPMATR
Copy column of matrix into vector	CCPY	#SPMATR
Copy diagonal of matrix into vector	DCPY	#SPMATR
Storage conversion	MSTR	#SPMATR
Matrix transformation by a function	MFUN	#SPMATR
Reciprocal function for MFUN	RECP	#SPMATR
Location in compressed stored matrix	LOC	#SPMATR
Vector storage double dimensioned storage conversion	ARRAY	#SPMATR
Matrix inversion	MINV	#SPMATR
Real matrix inversion	MINV2	#SPMATR
Eigenvalues and eigenvectors of a real symmetric matrix	EIGEN	#SPMATR
Eigenvalues and eigenvectors of a special nonsymmetric matrix	NROOT	#SPSTAT

Fourier Analysis

Fourier analysis of a given function	FORIF	#SPMATH
Fourier analysis of a tabulated function	FORIT	#SPMATH

Integration

Definite integral evaluation	INTEGR	*FSUBR
Integral of tabulated function by quadrature	QATR	#SPMATH
Integral of given function by Simpson's rule	QSF	#SPMATH
Double integration by Simpson's rule	SIMPDBL	*FSUBR

Differential Equations

Runge-Kutta integral solution of differential equations	RK	*FSUBR
Solution of differential equations by Runge-Kutta-Gill method	RKINIT	*FSUBR
Solution of differential equations by Runge-Kutta-Gill method	RKSTEP	*FSUBR
Integration of first-order differential equation by Runge-Kutta-Gill method	RK1	#SPMATH
Tabulated integral of first-order differential equation by Runge-Kutta-Gill method	RK2	#SPMATH
Tabulated integral of a system of six first-order differential equations	RKGS	#SPMATH

Linear Equations

Solution of simultaneous linear algebraic equations	SIMQ	#SPMATR

Nonlinear Equations

Refining estimate of root by Wegstein's iteration	RTWI	#SPMATH
Determining root within a range by Mueller's iteration	RTMI	#SPMATH
Refining estimate of root by Newton's iteration	RTNI	#SPMATH

Polynomials

Real and complex roots of a real polynomial	POLRT	#SPMATH
Addition of polynomials	PADD	#SPMATH
Subtraction of polynomials	PSUB	#SPMATH
Multiplication of polynomials	PMPY	#SPMATH
Division of polynomials	PDIV	#SPMATH
Replacing one polynomial by another	PCLA	#SPMATH

Multiplication by constant and addition to another polynomial	PADDM	#SPMATH
Value of a polynomial	PVAL	#SPMATH
Substitution of variable of polynomial by another polynomial	PVSUB	#SPMATH
Evaluation of polynomial and its first derivative	PILD	#SPMATH
Derivative of a polynomial	PDER	#SPMATH
Integral of a polynomial	PINT	#SPMATH
Quadratic synthetic division of a polynomial	PQSD	#SPMATH
Complete linear synthetic division	PCLD	#SPMATH
Greatest common divisor of two polynomials	PGCD	#SPMATH
Normalization of a coefficient vector of a polynomial	PNORM	#SPMATH

Special Functions

Bessel function subroutine	BESSEL	*FSUBR
Bessel calculation subroutine	BESJY	*FSUBR
J Bessel function	BESJ	#SPMATH
Y Bessel function	BESY	#SPMATH
I Bessel function	BESI	#SPMATH
K Bessel function	BESK	#SPMATH
Elliptic integral of the first kind	CEL1	#SPMATH
Elliptic integral of the second kind	CEL2	#SPMATH
Exponential integral	EXPI	#SPMATH
Sine cosine integral	SICI	#SPMATH
Fresnel integrals	CS	#SPMATH
Hyperbolic sine function	HSIN	*FSUBR
Hyperbolic sine function	HSIN	#EXL2
Hyperbolic cosine function	HCOS	*FSUBR
Hyperbolic cosine function	HCOS	#EXL2
Hyperbolic tangent function	HTAN	*FSUBR
Complex sine function	CSIN	#EXL2
Complex cosine function	CCOS	#EXL2
Gamma function	GAMMA	#SPMATH
Legendre polynomial	LEP	#SPMATH
Legendre polynomial function	P	*FSUBR
LaGrange interpolation subroutine	INTERPOL	*FSUBR
Performs logical AND between two integers	IAND	#EXL2
Performs logical EXCLUSIVE-OR between two integers	IEOR	#EXL2
Performs logical OR between two integers	IOR	#EXL2
Complex multiplication for BATCH FORTRAN II	CMULT	#EXL2
Complex division for BATCH FORTRAN II	CDIV	#EXL2
Complex absolute value for BATCH FORTRAN II	CABS	#EXL2

Complex exponential function for BATCH FORTRAN II	CEXP	#EXL2
Complex logarithm function for BATCH FORTRAN II	CLOG	#EXL2
Complex square root for BATCH FORTRAN II	CSQRT	#EXL2

Utility Programs

Block data input or output	BLKIO	#EXL2
Opens a file using a name in an array of A3 integers	OPEN	#EXL2
Opens a file whose name is stored in array	AOPEN	#EXL2
Deletes a file during program execution	ADLETE	#EXL2
Clears the terminal input buffer	CIB	#EXL2
Closes a command file which called the program in which it is used	CLCOM	#EXL2
Gets the system COM file number for use in the FORTRAN program that called it	COM	#EXL2
Interrupts on an Alt Mode and transfers to a predefined instruction	ESCAPE	#EXL2
Cancels the effect of Escape and returns Escape control to BATCH FORTRAN II	ESCRES	#EXL2
Packs three characters into one word when they were input into an A1 or 1H format	PACK	#EXL2
Exits to EXECUTIVE but leaves all files open; on CONTINUE, control is returned to call	QUIT	#EXL2
Reformats a floating point word into an alpha array and inserts commas	RFMT	#EXL2
Fast algorithm to sort a floating point array	SORT	#EXL2
Allows BATCH FORTRAN II to read SFORTRAN or SBASIC binary files	SWITCH	#EXL2
Test input buffer for input waiting	TEL	#EXL2
Unpacks a three-character A3 integer into three A1 integer words	UNPACK	#EXL2
Numeric free form input routine	VALUE	#EXL2
Executes any user status BRS	BRS	#EXL2
Defines an array in terms of string pointers	STRP	#EXL2
Stores an integer in a decimal location in core	STORE	#EXL2
Permits user-controlled interrupts	ALTMODE	#EXL2
COMMON swapping subroutine	COMSWAP	#EXL2
Return to EXECUTIVE from FOS	DISMISS	#EXL2
Suppresses the echo during terminal input	ECHOFF	#EXL2
Returns Teletype input to normal echo mode	ECHON	#EXL2
Creates pause in program execution	WAIT	#EXL2
Reads TS page	RDTSP	#EXL2

SECTION 3

FORTRAN II LIBRARY ROUTINES

The following subroutines are used with F2OS and F2C. The routines NSWAP, OVERLAY, and COMSWAP each include a number of associated routines. All routines are documented in the *Tymshare BATCH FORTRAN/FORTRAN II Reference Manual.*

CalComp plotter routine	AXIS	*FLP
CalComp plotter routine	NUMBER	*FLP
CalComp plotter routine	LINE	*FLP
CalComp plotter routine	SCALE	*FLP
CalComp plotter routine	SYMBOL	*FLP
CalComp plotter routine	PLT	*FLP
Uniform random number generator	RANDU	*FL2
Gaussian random number generator	GAUSS	*FL2
Simpson's rule integration	SMPSN	*FL2
Polynomial evaluation	PVAL	*FL2
Arctangent function	ATAN	*FL2
Arctangent function	ATAN	*FL3
Gamma function	GAMMA	*FL2
Matrix inversion and determinant computation	MINV	*FL2
Runge-Kutta integration of first-order differential equation	RUNGK	*FL2
Integration of tabular function	QUADR	*FL2
Eigenvalues and eigenvectors	EIGEN	*FL2
Integration by Gaussian quadrature	GAUQUA	*FL3
Error function	ERFN	*FL3
Bessel function	BESSEL	*FL3
Complex addition	CADD	*FL3
Complex subtraction	CSUB	*FL3
Complex multiplication	CMUL	*FL3
Complex division	CDIV	*FL3
Polar to rectangular form	CRECT	*FL3
Rectangular to polar form	CPOLAR	*FL3
Complex number to real power	CPOWER	*FL3
Absolute value of a complex number	CABS	*FL3
Roots of a polynomial	POLRT	*FL3
Roots of simultaneous equations	SIMQ	*FL3
Roots of simultaneous equations	SIMQ	*FL4
Least squares fit to a polynomial	LSQF	*FL4
Newton's method for finding the root of a nonlinear equation	RTNI	*FL4

Obtaining the date and the time	TIME	*FL1
Subroutine for entering the name of an input/output file during program execution	OPEN	*FL5
Comparing floating point quantities	IF	*FL1
Comparing floating point quantities	IFF	*FL2
Fourier analysis of a given function in tabular form	FORTB	*FL4
Copying files in a FORTRAN program	COPY	*FL1
Fourier analysis of a given function	FOURFN	*FL4
Second-order ordinary differential equations	RUNG2	*FL4
Routines for doing program overlays	— — —	*OVERLAY
Routines for doing program overlays	— — —	*NSWAP
Routines for doing COMMON swapping	— — —	*COMSWAP
File identification as to type	FILEID	*FL5
Opening a file whose name is stored in an array	AOPEN	*FL5
Stopping computation for specified time	WAIT	*FL5
Accepting a line in A format with editing	EDCEPT	*FL5
Control of Escapes	ESCAPE	*FL5
Reading binary paper tapes in FORTRAN	RTBIN	*FL5
Reading binary paper tapes in FORTRAN	INIRTB	*FL5
Reading binary paper tapes in FORTRAN	ICTRTB	*FL5
Inputting one character at a time	ONECHR	*FL5
Fast Fourier transform	FOURT	*FL4
Fast Fourier transform	FOUR2	*FL4
Fast Fourier transform	FOUR1	*FL4
Random file processing routines	— — —	*FL5
Prereads next character in a file	NEXTC	*FL5
Prereads next character in a file	NXTCHR	*FL5
Allows execution of user status BRS	BRS	*FL5
Causes return to EXECUTIVE level	EXIT	*FL1
Turns ACCEPT bell signal on or off	BELL	*FL1
Compares floating point Hollerith data	COMPAR	*FL1
Returns core address of specified variable	LOCF	*FL1
Lists missing routines during F2OS loading	— — —	*LIBEND

SECTION 4

BATCH FORTRAN IV LIBRARY ROUTINES

The basic BATCH FORTRAN IV functions are contained on the file *BFL. Additional subroutines, contained on the files *BFL1 and *BFL2, are listed in the following tables. These routines are documented in the *Tymshare BATCH FORTRAN IV Reference Manual.*

*BFL1 — Mathematics and Statistics

Least squares fit to a polynomial	LSQF
Matrix inversion and determinant calculation	MINV
Eigenvalues and eigenvectors	EIGEN
Root of a nonlinear equation	RTNI
Simultaneous equations	SIMQ
Roots of a polynomial	POLRT
Polynomial evaluation	PVAL
Second-order ordinary differential equation	RUNG2
Fourier analysis of a function	FOURFN
Fourier analysis of a tabulated function	FOURTB
Fourier transform	FOURT
Fourier transform	FOUR1
Fourier transform	FOUR2
Bessel function	BESSEL
Gamma function	GAMMA
Error function	ERFN
Random number generator	RANDU
Random number generator	GAUSS
Floating point quantities comparison	IFF
Simpson's rule integration	SMPSN
Integration of tabular values	QUADR
Gaussian quadrature	GAUQUA
Runge-Kutta integration	RUNGK

*BFL2 – Utility

CalComp plotter subroutine	AXIS
CalComp plotter subroutine	NUMBER
CalComp plotter subroutine	LINE
CalComp plotter subroutine	SCALE
CalComp plotter subroutine	SYMBOL
CalComp plotter subroutine	PLOTS
CalComp plotter subroutine	WHERE
CalComp plotter subroutine	OFFSET
CalComp plotter subroutine	PLOT
CalComp plotter subroutine	FACTOR
Multiple sort	MSORT
Fast sort	SORT
Temporary computation halt	WAIT
Single character input	ONECHR
Edited text input	EDCEPT
File type determination	FILEID
Date and time	TIME
File copying during execution	COPY
Binary tape input	RTBIN
Binary tape input	INTRTB
Binary tape input	ICTRTB

#XBFL

Many other useful subroutines have been written and are stored on file #XBFL. Preliminary documentation is available through your Account Representative. The routines are described below.

Strings

Converts integer to string, and vice versa	CONV
Places current date and time in a string	DATIM
Converts lower case alphabetic characters to upper case	UC
Strips off trailing blanks in a string	STRIP
Reverses the characters of a string	REV
Given a string, replaces one substring with another	REPLAC

Files

Gets file name from file directory	GFNAME
Computes checksum of a file	CHECKSUM
Renames a file	RENAME
Deletes a file whose name is stored in an array	IADEL

Input/Output

Gets the next character (no restrictions) from a file	GETNC
Gets terminal characteristics	GETTC
Sets terminal characteristics	SETTC
Turns off (or on) the normal echoing of characters	ECHO
Changes manner in which system handles lower case	LOCASE
Halts execution until output buffer is empty	OUTBUF
Clears output buffer	CLOB
Checks input buffer for characters	CHIB
Clears input buffer	CLIB
Turns eight-level output on or off (normal)	L8OUT

Others

Sets a value into a word, at specified bit locations	SETBIT
Gets a number (specified by bit range) from within an integer word	GETBIT
Gets current total CPU time	CPU
Reads internal system clock	CLTICK
Halts execution for specified amount of time	WAIT
Gets user status and universal user number	STATUS
Enables execution of any user-status BRS	BRS

SECTION 5

EXTENDED CAL FUNCTION LIBRARY

The Extended CAL function library contains XCAL and DCAL programs developed to solve common computational problems. To use these programs, the user loads the appropriate file into his program. Thereafter, the library functions are used like ordinary user-defined functions with the arguments enclosed in square brackets.

For further information about these programs, refer to the *Tymshare Extended CAL Reference Manual.*

Statistics

Calculates mean of a sample	MEAN	#STATPAK
Calculates variance of a sample	VAR	#STATPAK
Calculates standard deviation	SIGMA	#STATPAK
Calculates estimated population variance	EPV	#STATPAK
Least squares fit to a polynomial	LSF	#LSF

Mathematics

Inverse of a matrix	INV	#MATINV
Computes the value of a determinant	DET	#DET
Finds the real or complex roots of a quadratic equation	QUAD	#QUAD
Solves a system of linear equations	LQS	#LQS
Evaluates a definite integral by Simpson's rule	INT	#INT
Calculates factorial of N	FACT	#FPC
Calculates permutations of N things taken R at a time	PERM	#FPC
Calculates combinations of N things taken R at a time	COMB	#FPC
Arctangent function	ATN	#ATN
Arcsine function	A8	#CATAN
Arctangent function	A9	#CATAN
Bessel function of the first kind	JNB	#DBESSEL
Bessel function of the second kind	YNB	#DBESSEL
Modified Bessel function of the first kind	INB	#DBESSEL
Modified Bessel function of the second kind	KNB	#DBESSEL
Computes value of a Bessel function	J	#BESSELCAL

Plotting

Plots graphs on terminal	DPLOT	#DPLOT