TITLE: Regulog II - MULTIPLE REGRESSION 3

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Berkeley, California

DATE:

ABSTRACT:

DISCLAIMER:

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I. General Description

The objective of this program is to compute least squares estimates of the parameters of a multiple regression equation and related statistics for an N_2 by N_1 matrix, X, of N_2 observations on each of N_1 variables, $N_1 \leq 20$. In particular, the following statistics are computed and printed:

$$i, j = 0, 1, 2, \ldots, (N_1-1)$$
$$t = 1, 2, \ldots, N_2$$

(a) ΣX_{it};

(b) $X'X = [(\Sigma X_{it}X_{jt})]$;

(c) Arithmetic means, $\bar{X}_i$;

(d) Standard deviations, S_i;

(e) A square matrix of correlation coefficients, $R = [(r_{ij})]$;

(f) R^{-1};

(g) The constant term of the regression equation, b_o;

(h) A set of (N_1-1) regression coefficients, $b_{o.j}$, each with its associated standard error, and t ratio;

(i) The sum of squared residuals;

(j) The coefficient of multiple determination, R^2 and the coefficient of multiple correlation, R;

(k) Predicted values and residuals.

Provision is made in the data input subroutine: (a) to transform any subset of the variables to logarithms, or (b) to generate up to 15 additional variables by forming squares and/or cross products of the

variables on tape, or (c) to use the data on tape with no transformation. Options (a) or (b) are often used to generate a curvilinear regression surface.

For either option (a) or (b) the transfer control switch is used to control a printing subroutine. If the transfer control switch is down, the transformed variables are printed, if the transfer control switch is up, the transformed variables are not printed.

If the dependent variable has been transformed to logarithms, the program will also compute and print the antilogarithms of predicted values and residuals.

All of the regression statistics are computed from the elements $\bar{X}_i$, S_i, and R^{-1}, where R is a correlation matrix including the dependent variable. The reasons for using the augmented correlation matrix are as follows:

(a) At times, only the correlation matrix is required and the first part of this program can be used for this with no modification necessary.

(b) If any of the variables are highly correlated, the X'X matrix may have an almost vanishing determinant. This kind of difficulty may be spotted as soon as the correlation matrix is printed.

(c) No additional matrix multiplication is required to obtain regression coefficients and/or multiple correlation coefficients.

(d) The variables are treated symmetrically. This program does not contain this feature at present, but it is possible to modify it so that each variable may be regressed on the remaining variables with all of the computations derived from the same $\bar{X}_i$, S_i, and R^{-1}.

(e) Even though the floating point interpretative routine is designed to accommodate numbers of widely varying magnitudes, there may be an advantage in the matrix inversion routine of scaling all the numbers to the same order of magnitude. At least it is somewhat easier to compare the accuracy of matrix inversion if the matrices to be inverted have elements of the same order of magnitude.

A large part of this program is made up of rather short subroutines, making it somewhat easier to analyze and making it convenient to use various subroutines in different ways. The subroutines are located in tracks 32 through 39 and from 4246 to 4611. The control program starts at 4000 and runs to 4245.

A rather liberal use is made of the alphanumeric subroutine, 19.0, and an automatic printing subroutine so that little operator attention is necessary once the problem has started.

II. Storage

A. Program Input Routine, 10.4 — 0000-0263

B. 24.1 and 24.1 Subroutines

(1)	24.1	E.R.F.P.	0300-1363
(2)	11.5	Input	1400-2063
(3)	12.5	Output	2100-2463
(4)	18.2	Logarithm	2819-2863
(5)	17.2	Exponential	2900-3063
(6)	30.0	Matrix Inversion	2500-2731
(7)	19.0	Alphanumeric	3100-3163

C. Regulog Subroutines

(1)	Printing	3200-3234
(2)	Clearing	3235-3249
(3)	Printing square matrix by rows	3250-3305
(4)	Data input and transformation	3306-3422
(5)	Formation of ΣX_i and X'X	3423-3522
(6)	Formation of S_{ij}, $\bar{X}_i$, S_i, R_{ij}	3523-3718
(7)	Regression statistics	3719-3958
(8)	Predicted values and residuals	4246-4449
(9)	Antilogs of predicted values and residuals	4450-4463, 4545-4562
(10)	Binarization of manual printing constants	4500-4544

D. Control Program 4000-4245

E. Constants

(1)	Problem specification	2732-2806
(2)	Other constants, fixed point	2807-2818
		4600-4611
	floating point	6248-6253

F. Temporary Working Locations

(1)	Matrix inversion	6132-6207
(2)	Other	6254-6261
		4626-4635

G. Data and Results

(1)	Data	6132-6207
(2)	Regression coefficients, standard errors, t ratios	4636-4823
(3)	Arithmetic means	4824-4863
(4)	Standard deviations	6208-6247
(5)	X'X, R, R^{-1}	4900-6131

III. Mathematical-Statistical Statement of Procedure

A. Definitions:

N_1 = total number of variables

N_2 = number of observations

$$i, j = 0, 1, 2, \ldots, (N_1 - 1)$$

$$t = 1, 2, \ldots, N_2$$

(1) $$\bar{X}_i = \frac{1}{N_2} \sum_{t=1}^{N_2} X_{it}$$

(2) $$S_{ij} = \frac{1}{N_2} \sum_{t=1}^{N_2} (X_{it} - \bar{X}_i)(X_{jt} - \bar{X}_j) = \frac{1}{N_2^2} \left\{ N_2 \sum_{t=1}^{N_2} X_{it} X_{jt} - \left(\sum_{t=1}^{N_2} X_{it} \right) \left(\sum_{t=1}^{N_2} X_{jt} \right) \right\}$$

if $i = j$, $S_{ij} = S_{ii} = S_i^2$

(3) $$r_{ij} = \frac{S_{ij}}{S_i S_j}$$

B. Statistical Model (The following procedures are based in part on Schultz, Henry, The Theory and Measurement of Demand, The University of Chicago Press, Chicago, 1933, Appendix C.)

$$X_{ot} = B_o + B_{o.1}X_{it} + \cdots + B_{o.N_1-1}X_{(N_1-1),t} + e_t$$

$$t = 1, 2, \ldots, N_2$$

$$\text{Let } E = \underset{(N_2 X 1)}{[(e_t)]}$$

$$\text{Then: } \underset{E}{\not\Sigma} = \varepsilon (E\,E') = \sigma^2 I$$

The objective is to develop least squares estimates of the regression coefficients, estimates of their standard errors, t ratios, and selected interpretive statictics.

C. Computational Formulae

$$\text{Let } P = R^{-1} = [P_{ij}]$$

$$i, j = 1, 2, 3, \ldots, N_1$$

(1) Least squares estimates of regression coefficients

$$b_o = \bar{X}_o - b_{o.1}\bar{X}_1 - \cdots - b_{o.N_1-1}\bar{X}_{N_1-1}$$

$$b_{o.1} = -\frac{S_o}{S_j}\,\frac{P_{12}}{P_{11}}$$

$$b_{O.j} = -\frac{S_o}{S_j}\,\frac{P_{1,\,j+1}}{P_{11}}$$

(2) Standard errors

$$S_{bo.1} = \frac{1}{\sqrt{N_2 - N_1}}\,\frac{S_o}{S_1}\,\frac{1}{P_{11}}\,\sqrt{P_{11}P_{22} - P_{12}^2}$$

$$S_{bo.j} = \frac{1}{\sqrt{N_2 - N_1}}\,\frac{S_o}{S_j}\,\frac{1}{P_{11}}\,\sqrt{P_{11}P_{j+1,j+1} - P_{1,j+1}^2}$$

(3) t ratios

$$t_{o.1} = \frac{b_{o.1}}{S_{bo.1}}$$

$$t_{o.j} = \frac{b_{o.j}}{S_{bo.j}}$$

(4) $$R^2 = \frac{P_{11}^{-1}}{P_{11}}$$

(5) Sum of squared residuals

$$S = N_2 S_o^{\,2}(1-R^2)$$

(6) Predicted values

$$X_o' = Y' = b_o + b_{o.1}X_1 + \cdots + b_{o.N_1-1}X_{N_1-1}$$

(7) Residuals

$$X_o - X_o' = Y - Y'$$

(8) Steps (1) through (7) assume that R^{-1} has already been calculated. This is done in three parts:

(a) Let $X_t = [X_{it}]$ $(N_1 X 1)$

$$X'X = \sum_{t=1}^{N_2} X_t X_t'$$

The data are entered one line at a time, $X_h X_h'$ is computed and added to

$$\sum_{t=1}^{h-1} X_t X_t'$$ to form an (N_1 by N_1) matrix.

(b) The X'X matrix is then transformed to

$$S = [(S_{ij})] \text{ and}$$

(c) to $$R = \left[\left(\frac{S_{ij}}{S_i S_j}\right)\right]$$

IV. Operating Instructions

A. Problem Specification.-- The particular problem is specified by a set of fixed point constants entered as instructions in 2732 on. Examples are given of each of three options: (a) logarithmic transformation, (b) polynomial transformation, or (c) no transformation. The first eight constants have the same meaning for each variation.

(1) The total number of variables including any polynomial terms to be generated, N_1.

(2) $2\ N_1$

(3) N_1^2

(4) $2\ N_1^2$

(5) The total number of observations. Since these constants are entered in the form of instructions, this format should only be used if $N_2 \leq 63$. If N_2 were 147, the program input routine would transform 1 and 47 separately and the result would not be the binary equivalent of 147 at 29. If $N_2 > 63$, it should be entered as a hexadecimal word. One procedure is to convert 147 to its binary equivalent, add two zeros on the right to allow for the spacer bit and the 30th bit, and convert the resulting sequence to hexadecimal.

Example: $N_2 = 147$ at 29

128	64	32	16	8	4	2	1
1	0	0	1	0	0	1	1
(0010)		(0100)				(1100)	
2		4				J	

(6) A specification of the number of columns desired for printing.

(7) A constant expressing the choice of logarithmic transformation, a "1" indicating that at least one variable is to be transformed, a "0" indicating no logarithmic transformation. Any subset or all the data may be transformed.

(8) A similar constant expressing the choice of a polynomial transformation, a "1" indicating at least one polynomial term to be generated, a "0" indicating no polynomial transformation. Options (4) and (5) are mutually exclusive.

(9) For logarithmic transformations the locations from 2740 to 2740 + N_1 must be used as follows: a "1" indicates that the corresponding variable should be transformed, a "0" indicates that the corresponding variable should not be transformed.

(10) For polynomial transformations the locations from 2741 to 2806 are used to specify up to 15 pairs of variables to form product terms. Location 2740 is used to specify the number of such terms to be generated. Following this, all that needs to be filled in are the actual pairs desired. Order is not important. However, the product terms will be generated in the same order as they are listed. Because of the fact that each number requires two locations, the variables should be identified for this purpose by even numbers. Thus, the second variable times the third variable is indicated by Z0002, Z0004.

(11) Certain floating point constants are required. These are inserted just prior to the data and are read in along with the first line of data. These constants are located in 6248-6255 and consist of

(a) "1"

(b) N_2 = number of observations

(c) N_2^2

(d) $N_2 - N_1$ = adjustment for degrees of freedom

(12) Normally, fixed point constants, floating point constants and data will all be on the same tape. If the "stop and transfer to 4000" follows the fixed point constants, the tape is inserted in the tape reader and the usual routine for loading a program is followed: one operation, clear counter, normal and start compute. At the stop and transfer, a start compute is necessary.

Since the data are read one line at a time, they are always preceded by the same code word (80006132) and followed by (exit'). This, of course, is the standard format for 24.1 floating point input. The first variable is treated as the dependent variable.

B. Programmed Stops.-- There are a number of breakpoint 4 stops scattered through the control program primarily to aid debugging the program. During almost all operations, breakpoint 4 should be depressed.

A breakpoint 8 stop follows the computation of R so that if the correlation matrix is all that is wanted, breakpoint 4 only should be depressed.

A breakpoint 4 also follows the subroutine to invert the R matrix and compute a check product.

A stop follows the completion of the regression statistics. In order to compute predicted values, it is necessary to read the data a second time. Consequently, at this point the tape must be placed in the tape reader so that the first line of data will be read as the tape reader is set in motion.

A breakpoint 16 stop follows the subroutine to compute predicted values and residuals. If antilogs of predicted values and residuals are desired, breakpoint 16 may be depressed any time after the data starts through the second time.

SUMMARY

Location	Breakpoint	Reason
4121	0800	Follows R matrix
4245	0000	To replace tape for computing predicted values
4449	1600	Follows predicted values and residuals
4562	0000	Problem finished

Normal operation: breakpoints 4 and 8 depressed.

There are no other programmed stops except those provided for in 24.1, the floating point interpretive routine.

If breakpoints 4 and 8 are depressed, the normal operation would be:

(a) Load fixed point constants.

(b) Start compute.

(c) After R^2 and R are printed, a stop will occur at 4245. After tape is reloaded so that data is just in front of the tape reader, press start compute.

(d) After predicted values, residuals and S are printed, a stop will occur at 4449. If the dependent variable is in logarithms and antilogs are desired, press start compute.

C. Optional Printing. -- If either transformation is used, the transfer control switch is used to control a printing subroutine. If the transfer control switch is down, and one or the other transformation is employed, all of the variables will be printed in their final form. If this option is wanted at all, it would ordinarily be used only once, either during the original read in or during the computation of predicted values and residuals.

D. Alternative Uses. -- (1) As mentioned earliers, the first part of the program may be used to compute means, standard deviations, and the correlation matrix for a set of variables. Only breakpoint 4 should be depressed and the computer will stop on breakpoint 8 located at 4121. (2) In some cases, it is desired to use subsets of the data in separate regression

analyses and then to combine these subsets. In this case, much computing time is saved by adding the various ΣX and the various X'X matrices, writing a short program to load them into the indicated locations modifying the problem specifications and starting at 4050. Breakpoints 4 and 8 should be depressed. After the problem is completed, each separate tape can be run and predicted values, residuals, and sum of squared residuals computed for each subset of the data. The procedure would be to read the instruction constants as though starting the problem, then manually stop and transfer to 4246 to compute predicted values and residuals for the combined regression equation. An example is shown just prior to the program instruction coding sheets of the program instructions required for starting a problem when ΣX and X'X have already been computed. (3) If $\bar{X}_i$, S_i, and R have already been computed, they can be loaded in the proper locations and the problem started at 4052. An example is shown just prior to the program instruction coding sheets of the program instructions required for starting the problem at this point. (4) Providing the variables to be dropped are either at the extreme right of the original set or are polynomial terms, variations of the original problem can be run using the same tape but using appropriately modified instruction constants and floating point constants. Since the floating point constants enter with the first line of data, it is appropriate to copy the first line of data with the new constants, start the problem and, after the first line of data has been read, go into "one op," change tapes and then proceed. The old tape should be marked so that the second line of data is under the tape reader.

E. Manual Printing.--A binarization subroutine is used in conjunction with the printing subroutine to print manually any 24.1 floating point data. The initial address and number of words to be printed are entered manually.

If desired, the column format can be controlled by using a start fill instruction with the program input routine to load k into 3233.

The manual printing subroutine is located in 4500 on. With manual input down on the Flexowriter, press one op, clear counter, normal, and start on the console. Then type .0004500 and depress start compute twice on the Flexowriter. At this point, a carriage return is executed and the letter "i" is printed followed by a space. At this point, type in the initial address and press start compute. A carriage return is executed and the letter "n" is printed followed by a space. At this point, type in the number of words to be printed and press start compute. After the desired number of words is printed, the program automatically loops, prints "i" and is ready for the next sequence.

V. Calling Sequences for Selected Regulog II Subroutines

A. Printing

```
B xxxx        (Initial address)
Y 3212
B xxxx        (k = number of columns)
C 3233
B xxxx        (n = number of words)
C 3234
R 3231
U 3200 or 3202 or 3204
```

The order of the first three pairs is immaterial. The choice of the U command depends on the number of carriage returns desired prior to printing.

B. Clearing

```
B xxxx        (Initial address)
Y 3237
Y 3238
B xxxx        (Number of words)
C 3249
R 3248
U 3235
```

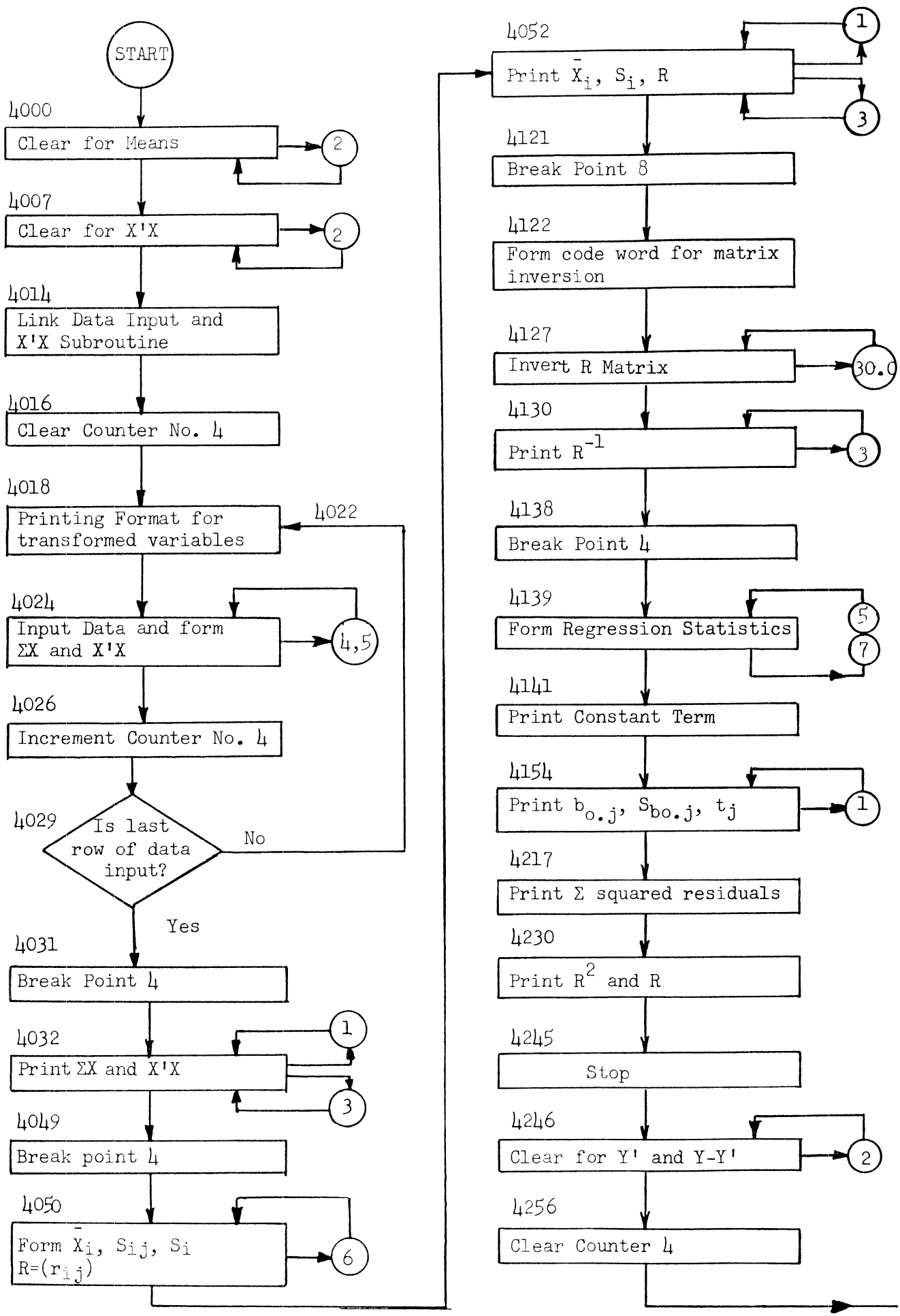
C. Data Input and Transformation

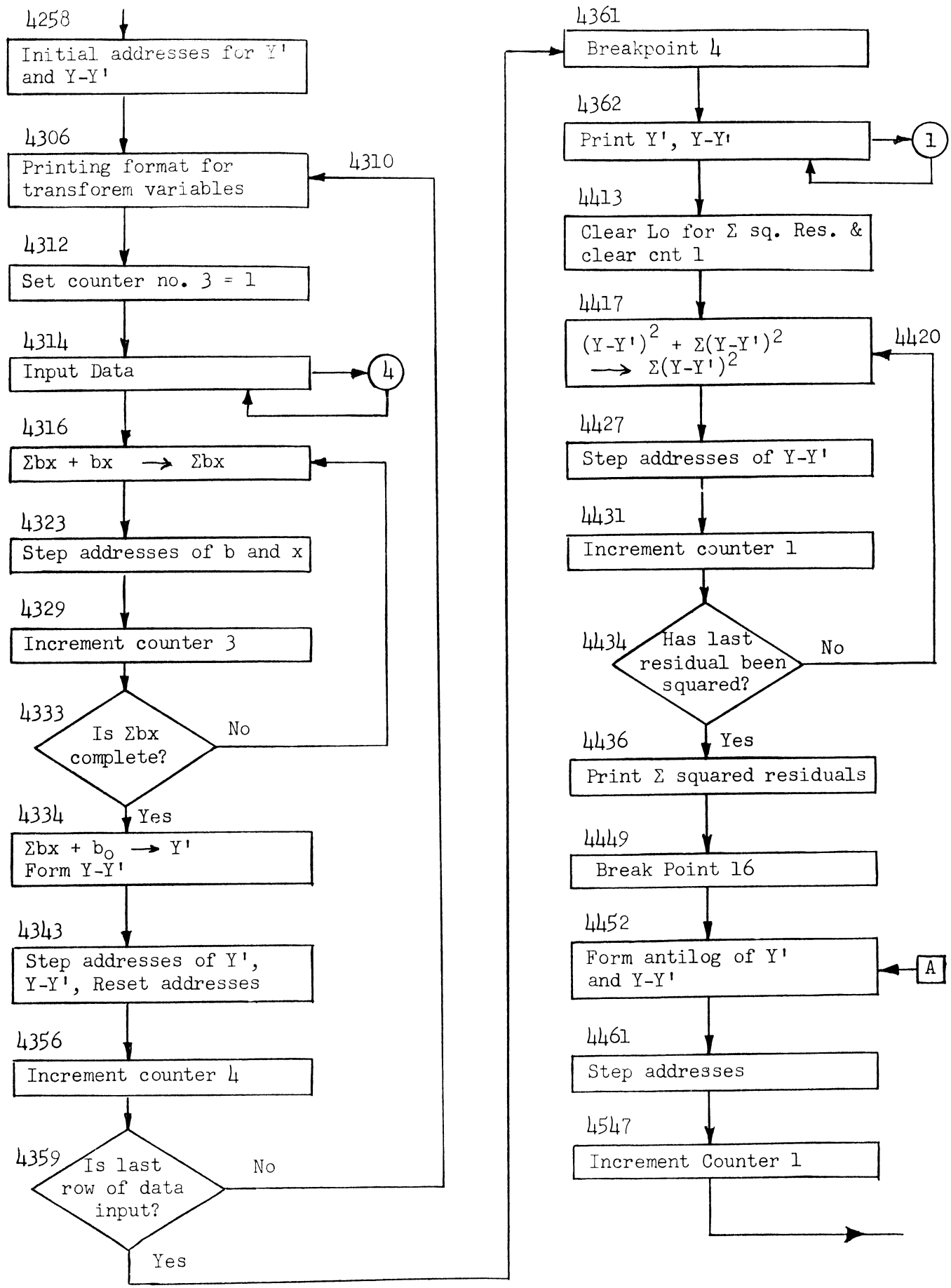
B 2737	(k)	Printing
C 3233		format
B 2732	(N_1)	for
C 3234		transformed
B 2807	(6132)	variables
Y 3212		
R 3422		
U 3306		

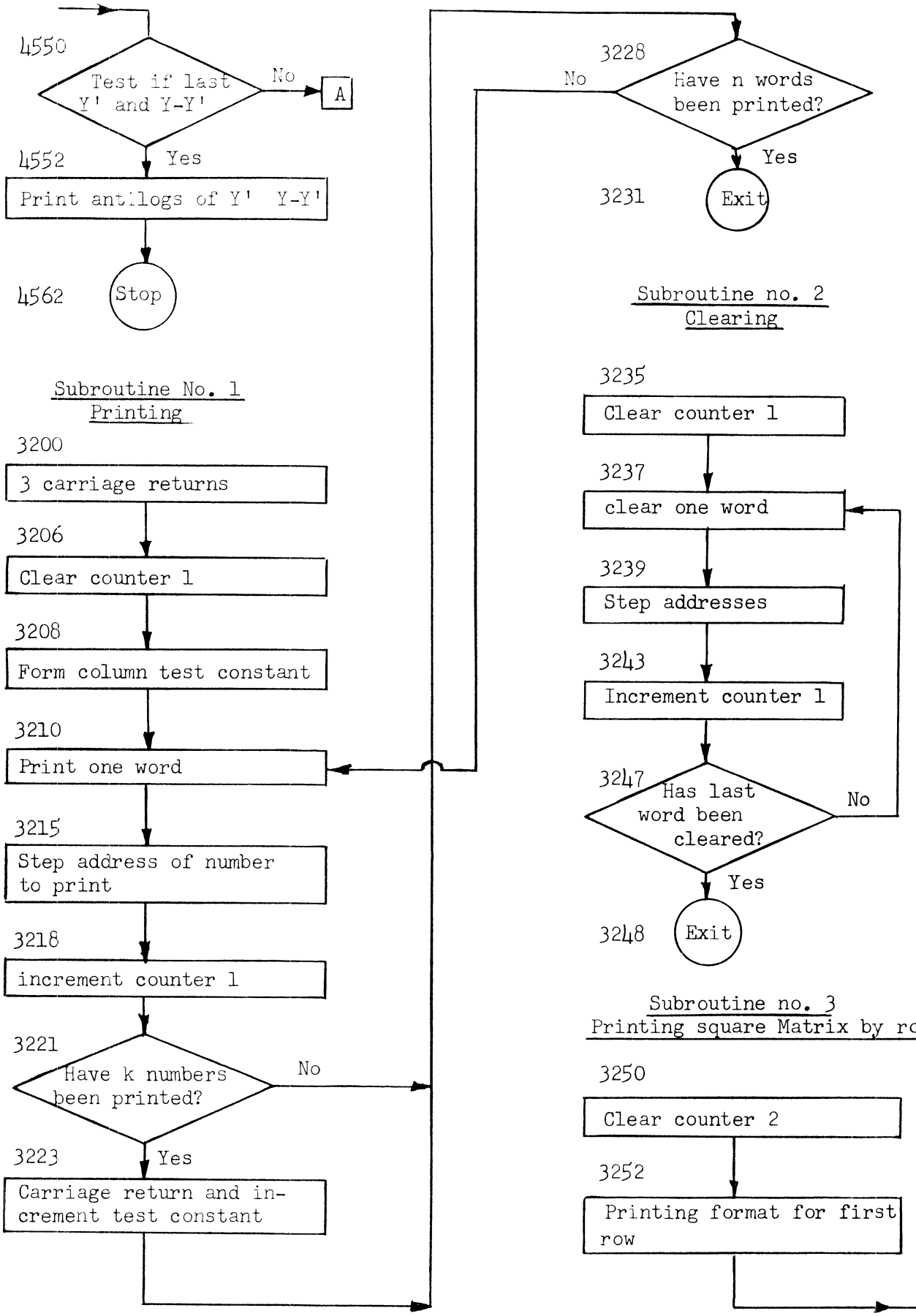
Note: Use last four commands each time since the initial address is modified for each line of data.

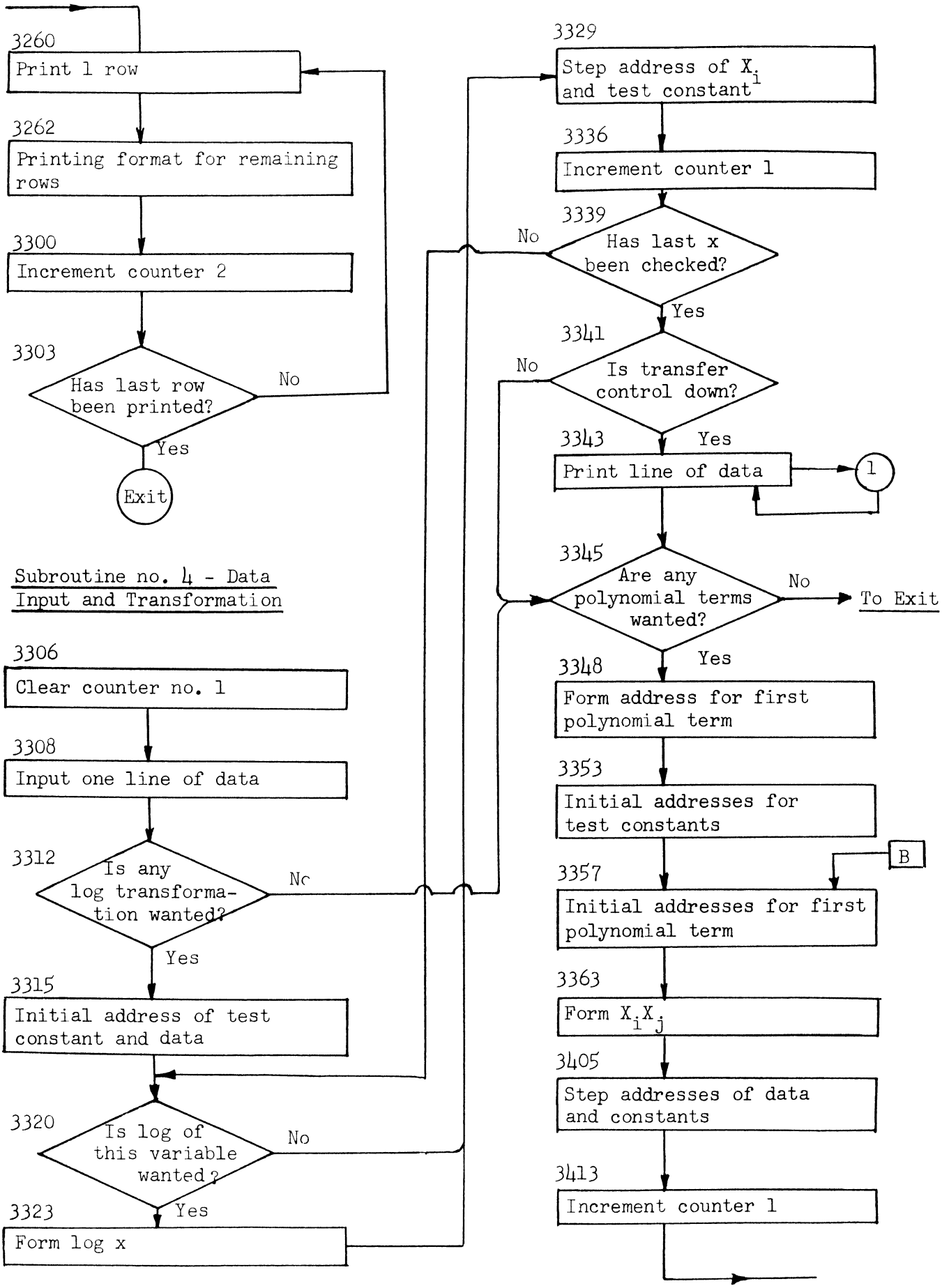
D. The remaining subroutines use only the normal R and U instructions.

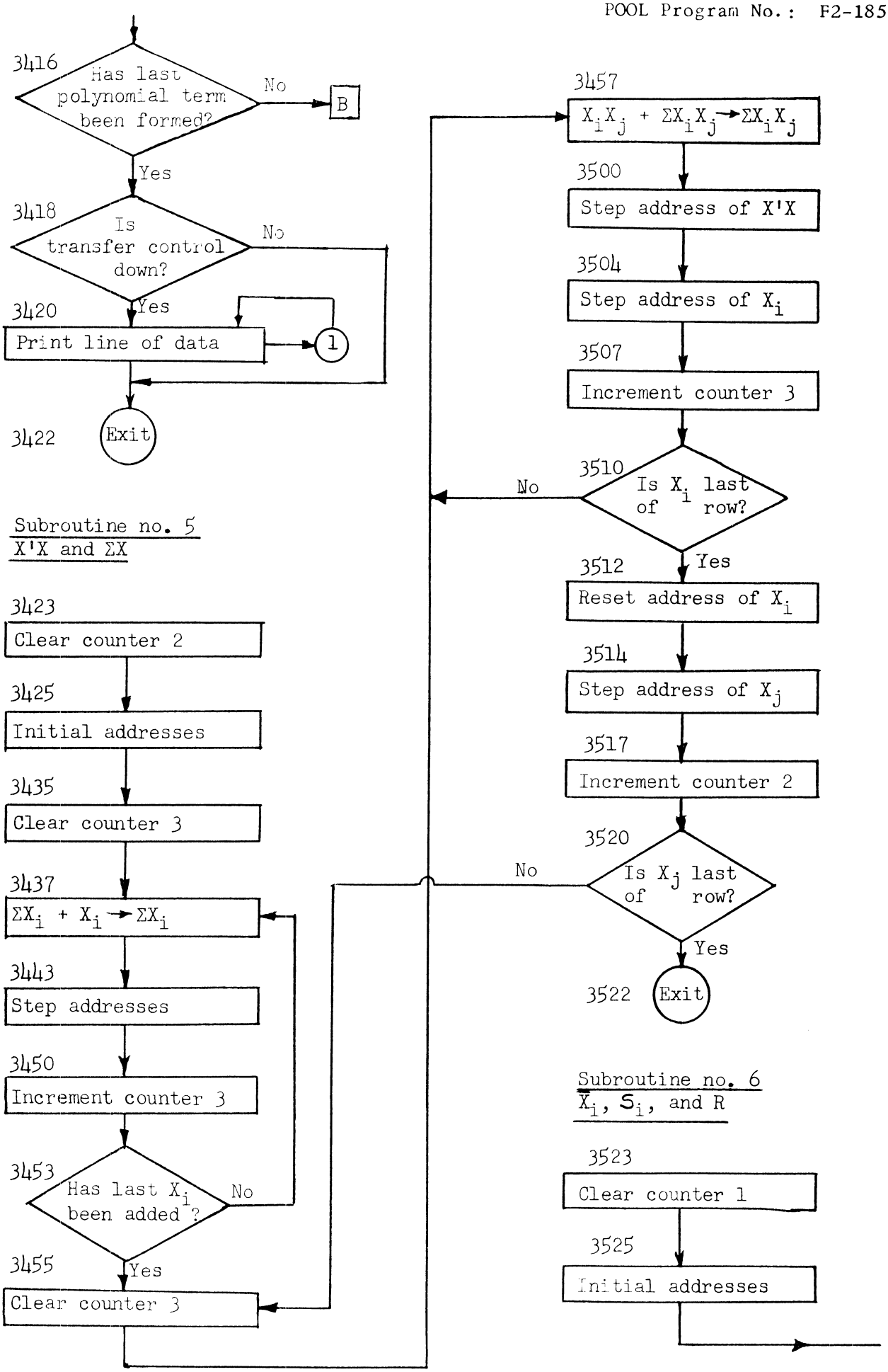
CONTROL PROGRAM

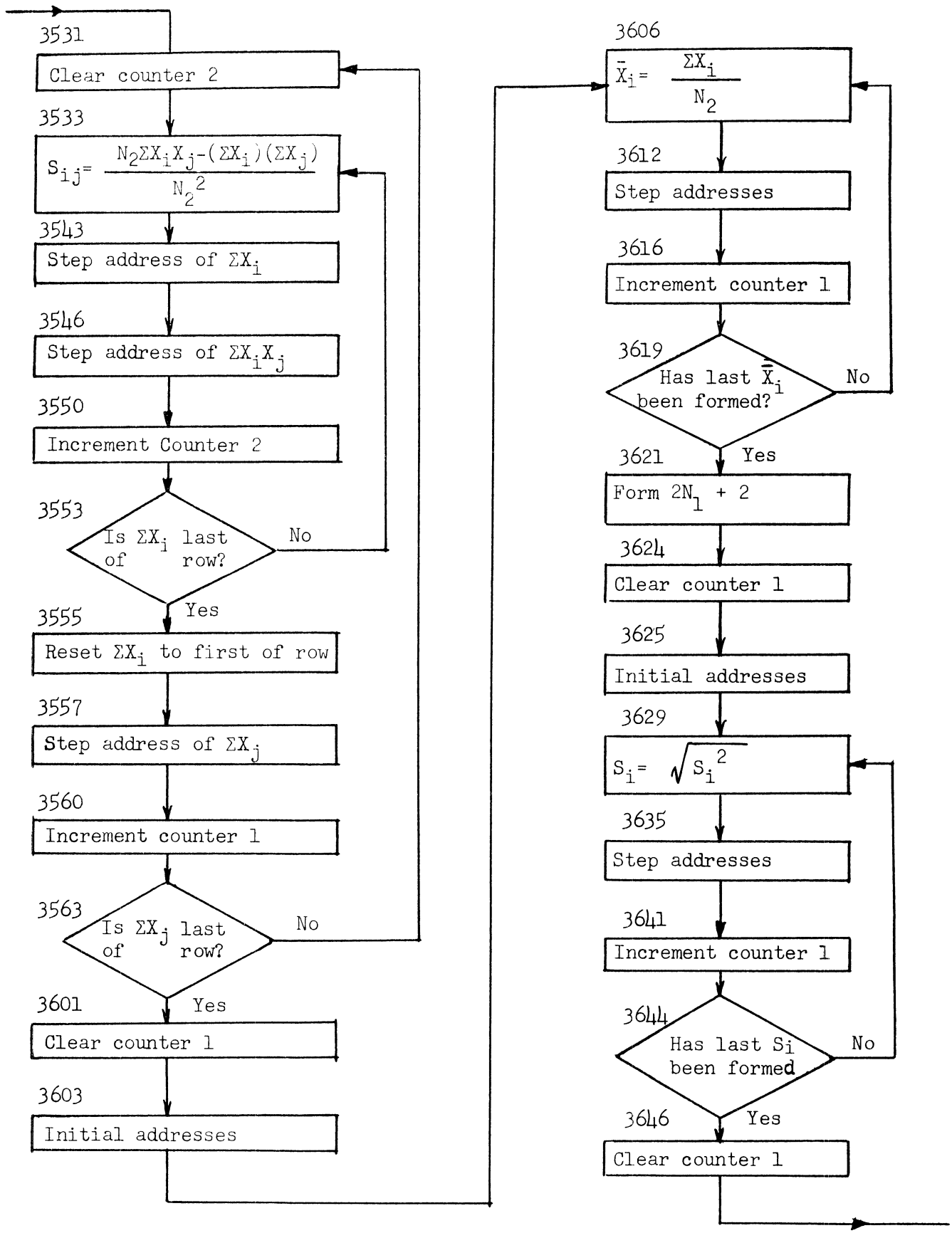


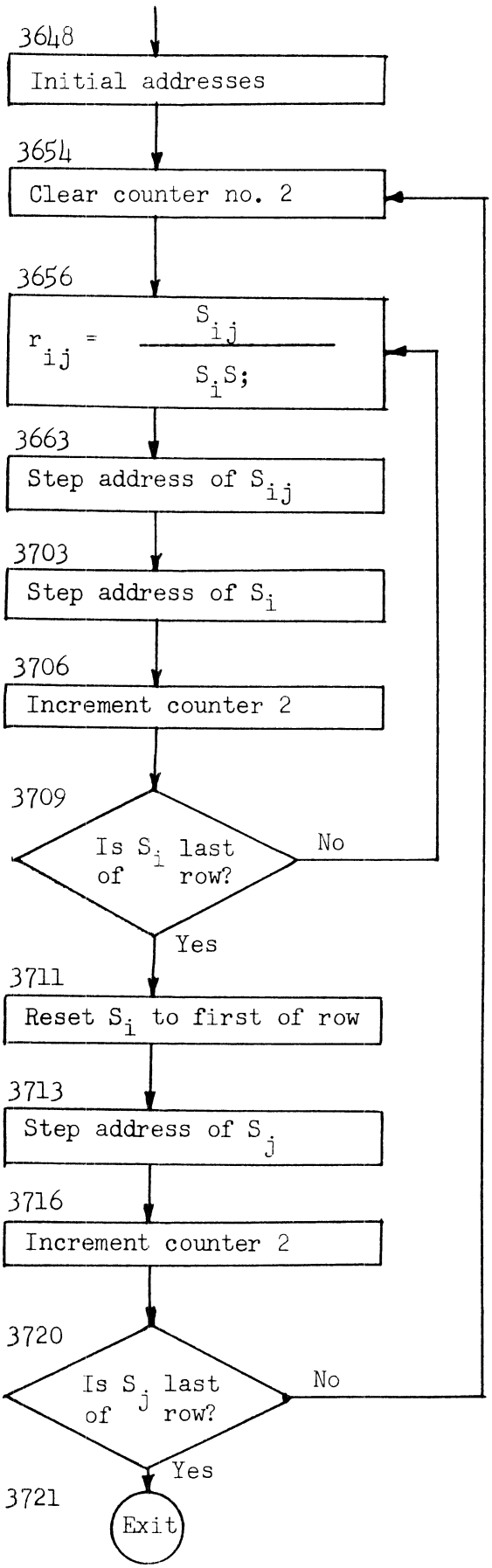

4258
Initial addresses for Y' and Y-Y'
4306
Printing format for transforem variables
4310
4312
Set counter no. 3 = 1
4314
Input Data
4
4316
Σbx + bx → Σbx
4323
Step addresses of b and x
4329
Increment counter 3
4333
Is Σbx complete?
No
Yes
4334
Σbx + b0 → Y'
Form Y-Y'
4343
Step addresses of Y', Y-Y', Reset addresses
4356
Increment counter 4
4359
Is last row of data input?
No
Yes
4361
Breakpoint 4
4362
Print Y', Y-Y'
1
4413
Clear Lo for Σ sq. Res. & clear cnt 1
4417
(Y-Y')2 + Σ(Y-Y')2 → Σ(Y-Y')2
4420
4427
Step addresses of Y-Y'
4431
Increment counter 1
4434
Has last residual been squared?
No
Yes
4436
Print Σ squared residuals
4449
Break Point 16
4452
Form antilog of Y' and Y-Y'
A
4461
Step addresses
4547
Increment Counter 1


4550
Test if last Y' and Y-Y'
No
A
4552
Yes
Print antilogs of Y' Y-Y'
4562
Stop
3228
No
Have n words been printed?
Yes
3231
Exit
Subroutine no. 2
Clearing
3235
Clear counter 1
3237
clear one word
3239
Step addresses
3243
Increment counter 1
3247
Has last word been cleared?
No
Yes
3248
Exit
Subroutine No. 1
Printing
3200
3 carriage returns
3206
Clear counter 1
3208
Form column test constant
3210
Print one word
3215
Step address of number to print
3218
increment counter 1
3221
Have k numbers been printed?
No
3223
Yes
Carriage return and increment test constant
Subroutine no. 3
Printing square Matrix by rows
3250
Clear counter 2
3252
Printing format for first row

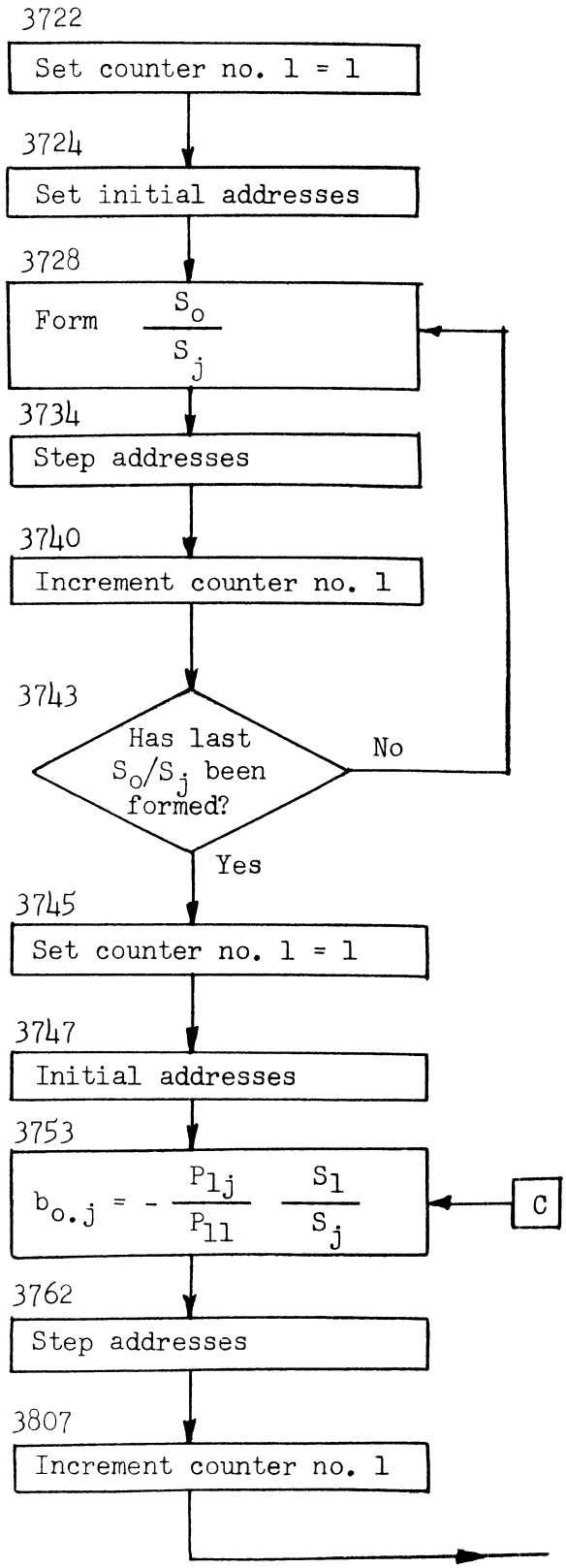

3260
Print 1 row
3262
Printing format for remaining rows
3300
Increment counter 2
3303
Has last row been printed?
No
Yes
Exit
Subroutine no. 4 - Data Input and Transformation
3306
Clear counter no. 1
3308
Input one line of data
3312
Is any log transformation wanted?
No
Yes
3315
Initial address of test constant and data
3320
Is log of this variable wanted?
No
Yes
3323
Form log x
3329
Step address of X_i and test constant
3336
Increment counter 1
3339
Has last x been checked?
No
Yes
3341
Is transfer control down?
No
Yes
3343
Print line of data
1
3345
Are any polynomial terms wanted?
No
To Exit
Yes
3348
Form address for first polynomial term
3353
Initial addresses for test constants
B
3357
Initial addresses for first polynomial term
3363
Form X_iX_j
3405
Step addresses of data and constants
3413
Increment counter 1

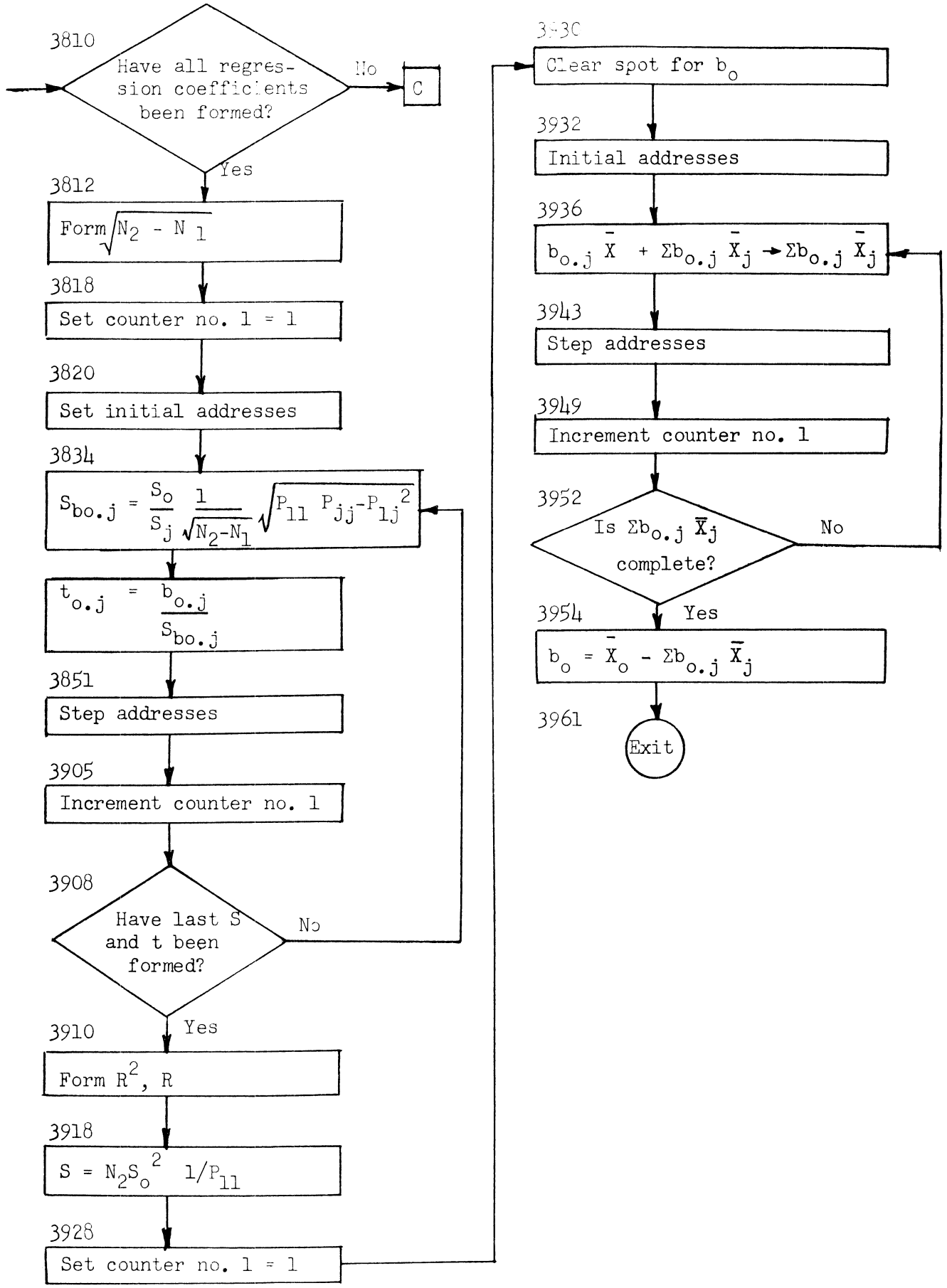

3416
Has last polynomial term been formed?
No
B
Yes
3418
Is transfer control down?
No
Yes
3420
Print line of data
1
3422
Exit
Subroutine no. 5
X'X and ΣX
3423
Clear counter 2
3425
Initial addresses
3435
Clear counter 3
3437
ΣXi + Xi → ΣXi
3443
Step addresses
3450
Increment counter 3
3453
Has last Xi been added?
No
Yes
3455
Clear counter 3
3457
XiXj + ΣXiXj → ΣXiXj
3500
Step address of X'X
3504
Step address of Xi
3507
Increment counter 3
3510
Is Xi last of row?
No
Yes
3512
Reset address of Xi
3514
Step address of Xj
3517
Increment counter 2
3520
Is Xj last of row?
No
Yes
3522
Exit
Subroutine no. 6
X̄i, Si, and R
3523
Clear counter 1
3525
Initial addresses


3531
Clear counter 2
3533
$S_{ij} = \frac{N_2 \Sigma X_i X_j - (\Sigma X_i)(\Sigma X_j)}{N_2^2}$
3543
Step address of ΣX_i
3546
Step address of $\Sigma X_i X_j$
3550
Increment Counter 2
3553
Is ΣX_i last of row?
No
Yes
3555
Reset ΣX_i to first of row
3557
Step address of ΣX_j
3560
Increment counter 1
3563
Is ΣX_j last of row?
No
Yes
3601
Clear counter 1
3603
Initial addresses
3606
$\bar{X}_i = \frac{\Sigma X_i}{N_2}$
3612
Step addresses
3616
Increment counter 1
3619
Has last $\bar{X}_i$ been formed?
No
Yes
3621
Form $2N_1 + 2$
3624
Clear counter 1
3625
Initial addresses
3629
$S_i = \sqrt{S_i^2}$
3635
Step addresses
3641
Increment counter 1
3644
Has last S_i been formed
No
Yes
3646
Clear counter 1

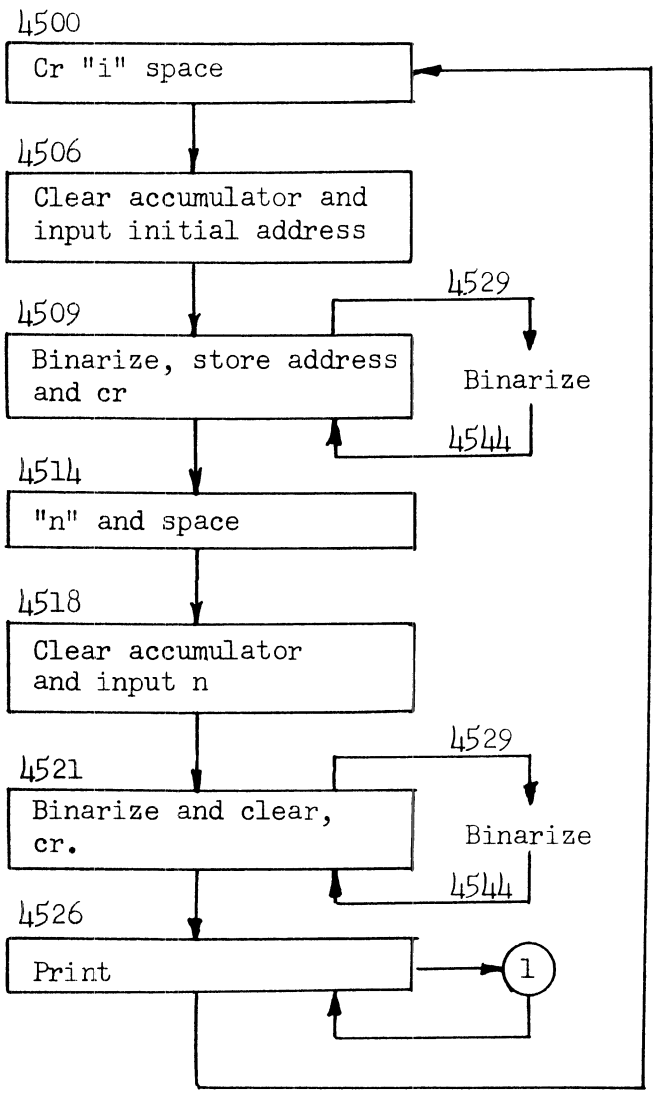


Subroutine No. 7
Form Regression Statistics




3810
Have all regression coefficients been formed?
No
C
Yes
3812
Form $\sqrt{N_2 - N_1}$
3818
Set counter no. 1 = 1
3820
Set initial addresses
3834
$S_{bo.j} = \frac{S_o}{S_j} \frac{1}{\sqrt{N_2-N_1}} \sqrt{P_{11} P_{jj} - P_{1j}^2}$
$t_{o.j} = \frac{b_{o.j}}{S_{bo.j}}$
3851
Step addresses
3905
Increment counter no. 1
3908
Have last S and t been formed?
No
Yes
3910
Form R^2, R
3918
$S = N_2 S_o^2 \; 1/P_{11}$
3928
Set counter no. 1 = 1
3930
Clear spot for b_o
3932
Initial addresses
3936
$b_{o.j} \bar{X} + \Sigma b_{o.j} \bar{X}_j \rightarrow \Sigma b_{o.j} \bar{X}_j$
3943
Step addresses
3949
Increment counter no. 1
3952
Is $\Sigma b_{o.j} \bar{X}_j$ complete?
No
Yes
3954
$b_o = \bar{X}_o - \Sigma b_{o.j} \bar{X}_j$
3961
Exit

Subroutine no. 8
Manual Printing



REGULOG II - MULTIPLE REGRESSION 3

PREPARED FOR:				PAGE OF
LGP-30, RPC-4000 USERS ORGANIZATION - POOL				1 / 1
JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY:	PROGRAM CHECKED BY:	DATE
	F2-185	James N. Boles	POOL Review	
PROBLEM:				TRACK
Regulog II Example: Regression Starting with X'X Matrix				

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
;0000 3233	/						
/0000 0000	/	☒					
		00	Z	00006	/	k	Printing format for ΣX
		01	Z	00006	/	N_1	
;0000 2732	/	02			/		
/0000 0000	/	03	Z	00006	/	☒ N_1	
		04	Z	00012	/	$2N_1$	
		05	Z	00036	/	N_1^2	
,0000 0001	/	06		1200	/	$2N_1^2$	Normal Instruction
		07	Z	00017	/	☒ N_2	Constants
		08	Z	00006	/	k	
		09	Z	00000	/	No log	
		10	Z	00000	/	No polys	
;0000 6132	/	11			/	☒	
/0000 0000	/	12	R	03000	/		
		13	U	03000	/		Load Data
		14	I	00000	/		
		15	E	00000	/	☒	
		16	U	40320	/		
.0000 6132	/	17			/		
8000 6248	/	18	100	00000	/	Fl.pt. "1"	
		19	0	0+08	/	☒	
		20	140	00000	/	N_2	Floating Point
		21	0	0+07	/		Constants
		22	196	00000	/	N_2^2	
		23	0	0+06	/	☒	
		24	800	00000	/	$N_2 - N_1$	
		25	0	0+08	/		
		26	g	roup	/		
8000 4824	/	27			/	☒	ΣX Data
		28			/		
		29	g	roup	/		
8000 4900	/	30			/		X'X by rows data
		31	e	xit	/	☒	

CARRIAGE RETURN

PREPARED FOR: LGP-30, RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY	PROGRAM CHECKED BY:	DATE
	F2 - 185	J. N. Boles	POOL Review	

PROBLEM: Regulog II Example: Regression Starting with Correlation Matrix

TRACK:

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
;0000 4637	'						
/0000 0000	'	☒					
		000	Z	0014	'	$2N_1 + 2$	Constant needed to pick diagonal terms of matrix
;0000 3233	'	001			'		
/0000 0000	'	002	Z	0006	'	k	Printing format for $\bar{X}_i$
		003	Z	0006	'	☒ N_1	
;0000 2732	'	004			'		
/0000 0000	'	005	Z	0006	'	N_1	
		006	Z	0012	'	$2N_1$	
		007	Z	0036	'	☒ N_1^2	Normal Instruction
,0000 0001	'	008		120	'	$2N_1^2$	Constants
		009	Z	0014	'	N_2	
		010	Z	0006	'	k	
		011	Z	0000	'	☒ No logs	
		012	Z	0000	'	No polys	
;0000 6132	'	013			'		
/0000 0000	'	014	R	0300	'		
		015	U	0300	'	☒	Load Data
		016	I	0000	'		
		017	E	0000	'		
		018	U	4052	'		
.0000 6132	'	019			'	☒	
8000 6248	'	020	100	0000	'	Fl. Pt. "1"	
		021	0	0+08	'		
		022	140	0000	'	N_2	
		023	0	0+07	'	☒	Normal floating
		024	196	0000	'	N_2^2	point constants
		025	0	0+06	'		
		026	800	0000	'	$N_2 - N_1$	
		027	0	0+08	'	☒	
		028	group		'		
8000 4824	'	029			'		$\bar{X}_i$
		030			'		
		031	group		'	☒	

DATA PROCESSING DIV. PORT CHESTER, NEW YORK

FORM LP-10

ROYAL McBEE, J13541X

☒ CARRIAGE RETURN

PREPARED FOR: LGP-30, RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY:	PROGRAM CHECKED BY:	DATE
	F2-185	J. N. Boles	POOL Review	

PROBLEM: Regulog II Example: Regression Starting with Correlation Matrix

TRACK

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
8000 6208	'	00			/	}	S_i
		01			/		
		02	Group		/		
8000 4900	'	03			/	☒ }	R Matrix by rows
		04			/		
		05	Exit		/		
		06			/		
		07			/	☒	
		08			/		
		09			/		
		10			/		
		11			/	☒	
		12			/		
		13			/		
		14			/		
		15			/	☒	
		16			/		
		17			/		
		18			/		
		19			/	☒	
		20			/		
		21			/		
		22			/		
		23			/	☒	
		24			/		
		25			/		
		26			/		
		27			/	☒	
		28			/		
		29			/		
		30			/		
		31			/	☒	

PREPARED FOR: LGP-30, RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.	PROGRAM NO	PROGRAM PREPARED BY	PROGRAM CHECKED BY:	DATE
	F2-185	J. N. Boles	POOL Review	

PROBLEM: Regulog II Data Format

TRACK:

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/				/		
	/	☒			/		
8 0 0 0 6 2 4 8	'	32	1 0 0	0 0 0 0	/	00+08'	"1"
		33	8 0 0	0 0 0 0	/	00+08'	N_2
		34	6 4 0	0 0 0 0	/	00+07'	N_2^2
		35	5 0 0	0 0 0 0	/	☒ 00+08'	$N_2 - N_1$
		36		Group	/		
8 0 0 0 6 1 3 2	'	37	3 2 0	0 0 0 0	/	00+07'	
		38	7 4 0	0 0 0 0	/	00+06'	Data
		39	1 0 0	0 0 0 0	/	☒ 00+08'	
		40		Exit	/		
8 0 0 0 6 1 3 2	'	41	3 4 0	0 0 0 0	/	00+07'	
		42	8 0 4	0 0 0 0	/	00+06'	Data
		43	2 0 0	0 0 0 0	/	☒ 00+08'	
		44		Exit	/		
		45			/		
		46			/		
		47			/	☒	
		48			/		
		49			/		
		50			/		
		51			/	☒	
		52			/		
		53			/		
		54			/		
		55			/	☒	
		56			/		
		57			/		
		58			/		
		59			/	☒	
		60			/		
		61			/		
		62			/		
		63			/	☒	

FORM LP-12

☒ CARRIAGE RETURN

PREPARED FOR: LGP-30, RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.

PROGRAM NO.: F2-185

PROGRAM PREPARED BY: J. N. Boles

PROGRAM CHECKED BY: POOL Review

DATE

PROBLEM: Instruction Constants - Log Transformations

TRACK: 27

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
;0000 2732	/				/		
/0000 0000	/	☒			/		
		2732		Z0020	/	N_1 = Total number of variables	
		33		Z0040	/	$2N_1$	
,0000 0002	/	34		640	/	N_1^2 400 at 29	
		35		J80	/	☒ $2N_1$ 800 at 29	
		36		Z0045	/	N_2 = Number of observations	
		37		Z0006	/	k { = N_1 if $N_1 \leq 6$; 6 if $N_1 > 6$ } number of columns	
		38		Z0001	/	Want log transformation	
		39		Z0000	/	☒ Do not want polynomial transf.	
		40		Z0001	/	X_0	
		41		Z0001	/	X_2	1 Indicates want
		42		etc.	/	X_4	log transformation
		43			/	☒ X6	0 Indicates do not
		44			/	X_8	want log transformation
		45			/	X_{10}	
		46			/	X_{12}	Space allocated for up
		47			/	☒ X_{14}	to 20 variables
		48			/	X_{16}	
		49			/	X_{18}	
		50			/	X_{20}	
		51			/	☒ X_{22}	
		52			/	X_{24}	
		53			/	X_{26}	
		54			/	X_{28}	
		55			/	☒ X_{30}	
		56			/	X_{32}	
		57			/	X_{34}	
		58			/	X36	
		59			/	☒ X_{38}	
.0000 4000	/	60			/		
		61			/		
		62			/		
		63			/	☒	

☒ CARRIAGE RETURN

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JOB NO. | PROGRAM NO.: F2-185 | PROGRAM PREPARED BY: J. N. Boles | PROGRAM CHECKED BY: POOL Review | DATE

PROBLEM: Instruction Constants - Polynomial Transformation | TRACK: 27

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
;0002732	/						
/0000000	/	☒					
		32	Z	00020	/	N_1 = Total number of variables	
		33	Z	00040	/	$2N_1$	
,0000002	/	34		6400	/	N_1^2	
		35		J800	/	☒ $2N_1^2$	
		36	Z	00045	/	N_2 = Total number of observations	
		37	Z	00006	/	$k \begin{cases} = N_1 \text{ if } N_1 \leq 6 \\ = 6 \text{ if } N_1 > 6 \end{cases}$ number of columns	
		38	Z	00000	/	No log transformation	
		39	Z	00001	/	☒ Polynomial transformation	
		40	Z	00015	/		
		41	Z	00002	/	X_2^2	
		42	Z	00002	/		Up to 15 second
		43	Z	00004	/	☒ X_4^2	order terms generated
		44	Z	00004	/		
		45	Z	00006	/	X_6^2	
		46	Z	00006	/		
		47	Z	00008	/	☒ X_8^2	
		48	Z	00008	/		
		49	Z	00010	/	X_{10}^2	
		50	Z	00010	/		
		51	Z	00002	/	☒ $X_2 X_4$	
		52	Z	00004	/		
		53	Z	00002	/	$X_2 X_6$	
		54	Z	00006	/		
		55	Z	00002	/	☒ $X_2 X_8$	
		56	Z	00008	/		
		57	Z	00002	/	$X_2 X_{10}$	
		58	Z	00010	/		
		59	Z	00004	/	☒ $X_4 X_6$	
		60	Z	00006	/		
		61	Z	00004	/	$X_4 X_8$	
		62	Z	00008	/		
		63	Z	00004	/	☒ $X_4 X_{10}$	

☒ CARRIAGE RETURN

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DATA PROCESSING DIV. PORT CHESTER, NEW YORK

PREPARED FOR: LGP-30, RPC-4000 USRES ORGANIZATION -POOL

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JOB NO. | PROGRAM NO F2-185 | PROGRAM PREPARED BY J. N. Boles | PROGRAM CHECKED BY: POOL Review | DATE

PROBLEM: Instruction Constants - Polynomial Transformation

TRACK 28

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		2800	Z	0010	/		
		01	Z	0006	/	} X_6 X_8	
		02	Z	0008	/		
		03	Z	0006	/	☒ } X_6 X_{10}	
		04	Z	0010	/		
		05	Z	0008	/	} X_8 X_{10}	
		06	Z	0010	/		
.0004000	'	07			/	☒	
		08			/		
		09			/		
		10			/		
		11			/	☒	
		12			/		
		13			/		
		14			/		
		15			/	☒	
		16			/		
		17			/		
		18			/		
		19			/	☒	
		20			/		
		21			/		
		22			/		
		23			/	☒	
		24			/		
		25			/		
		26			/		
		27			/	☒	
		28			/		
		29			/		
		30			/		
		31			/	☒	

PREPARED FOR: LGP-30, RPC-4000 USERS ORGANIZATION - POOL | PAGE 111 / 33

JOB NO. | PROGRAM NO. F2-185 | PROGRAM PREPARED BY J. N. Boles | PROGRAM CHECKED BY: POOL Review | DATE

PROBLEM: Instruction Constants - No log and no Polynomial Transformation | TRACK 27

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
;0002732	/						
/0000000	/	☒					
		32	Z	0020	/	N_1	
		33	Z	0040	/	$2N_1$	
,0000002	/	34		640	/	N_1^2 = 400	at 29
		35		J80	/	☒ $2N_1^2$ = 800	at 29
		36	Z	0045	/	N_2 = Number of observations	
		37	Z	0006	/	k { = N_1 if $N_1 \leq 6$; = 6 if $N_1 > 6$ }	No. of columns
		38	Z	0000	/	No log transformations	
		39	Z	0000	/	☒ No polynomial transformations	
.0004000	/	40			/		
		41			/		
		42			/		
		43			/	☒	
		44			/		
		45			/		
		46			/		
		47			/	☒	
		48			/		
		49			/		
		50			/		
		51			/	☒	
		52			/		
		53			/		
		54			/		
		55			/	☒	
		56			/		
		57			/		
		58			/		
		59			/	☒	
		60			/		
		61			/		
		62			/		
		63			/	☒	

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☒ CARRIAGE RETURN

PORT CHESTER, NEW YORK

PREPARED FOR: LGP-30, RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.

PROGRAM NO. F2-185

PROGRAM PREPARED BY: J. N. Boles

PROGRAM CHECKED BY: POOL Review

DATE

PROBLEM: Regulog II

TRACK 28

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
↓0002807	/						
/0000000	/	X					
		00			/		
		01			/		
		02			/		
		03			/	X	
		04			/		
		05			/		
		06			/		
		07	Z	6132	/	X	Lo first data word
		08	Z	6134	/		Lo secomd data word
		09	Z	6208	/		Lo first S_i
		10	Z	6210	/		Lo second S_i
		11	Z	0001	/	X	
		12	Z	0002	/		
		13	Z	0003	/		
		14	Z	0004	/		
		15	Z	0005	/	X	
		16	Z	0006	/		
		17	Z	4824	/		Lo first $\bar{X}_i$
		18	Z	4826	/		Lo second $\bar{X}_i$
		19			/	X	
		20			/		
		21			/		
		22			/		
		23			/	X	
		24			/		
		25			/		
		26			/		
		27			/	X	
		28			/		
		29			/		
		30			/		
		31			/	X	

PREPARED FOR: LGP-30, RPC -4000 USERS ORGANIZATION - POOL

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JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY:	PROGRAM CHECKED BY:	DATE
	F2-185	J. N. Boles	POOL Review	

PROBLEM: Regulog II

TRACK 32

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
;0003200	/						
/0000000	/	☒					
		3200	P	1600	/		
		01	Z	00000	/		
		02	P	1600	/		
		03	Z	00000	/	☒	
		04	P	1600	/		
		05	Z	00000	/		
		06	C	4632	/		Clear Counter no. 1
		07	C	4632	/	☒	
		08	B	3233	/		Set up k tester 24.1
		09	C	3232	/		
		10	R	0300	/		Fl.Pt. Int. 24.1
		11	U	0300	/	☒	
		12	8000 B	[ ]	/	Number to print	
		13	P	0000	/		
		14	E	0000	/		
		15	B	3212	/	☒	Step address of number to print
		16	A	2812	/	2 at 29	
		17	Y	3212	/		
		18	B	4632	/	Counter number 1	
		19	A	2811	/	☒ 1 at 29	Increment counter no.1
		20	H	4632	/		
		21	S	3232	/	k tester	Test if k columns
		22	T	3228	/		printed
		23	P	1600	/	☒ c.r.	
		24	Z	00000	/		
		25	B	3232	/	k tester	
		26	A	3233	/		Increment k tester
		27	C	3232	/	☒	
		28	B	4632	/	Counter no. 1	
		29	S	3234	/	n = no. of words	
		30	T	3210	/		
		31	U	[ ]	/	☒ Exit	

☒ CARRIAGE RETURN

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PREPARED FOR: LGP-30, RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY	PROGRAM CHECKED BY:	DATE
	F2-185	J. N. Boles	POOL Review	

PROBLEM: Regulog II

TRACK 32

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		3232	[ ]		/	k tester	
		33	[ ]		/	k	
		34	[ ]		/	n = number	of words
		35	C	4632	/	☒	Clear counter no. 1
		36	C	4632	/		
		37	C	[ ]	/		
		38	C	[ ]	/		
		39	B	3237	/	☒	Step addresses
		40	A	2811	/	1 at 29	
		41	Y	3237	/		
		42	Y	3238	/		
		43	B	4632	/	☒ Counter no.	1
		44	A	2811	/	1 at 29	
		45	H	4632	/		
		46	S	3249	/	n	
		47	T	3237	/	☒	
		48	U	[ ]	/		
		49	[ ]		/	n = number	of words
		50	C	4633	/		Clear counter no. 2
		51	C	4633	/	☒	
		52	B	4600	/	4900	Printing format
		53	Y	3212	/		
		54	B	2737	/	k	
		55	C	3233	/	☒	
		56	B	2732	/	N_1	
		57	C	3234	/		
		58	B	4603	/	3200	Print 3 c.r. before first row
		59	Y	3261	/	☒	
		60	R	3231	/		Print by rows
		61	U	[ ]	/		
		62	B	4604	/	3204	1 c.r.for subsequent rows
		63	Y	3261	/	☒	

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☒ CARRIAGE RETURN

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JOB NO. | PROGRAM NO. F2-185 | PROGRAM PREPARED BY: J.N. Boles | PROGRAM CHECKED BY: POOL Review | DATE

PROBLEM: Regulog II | TRACK 33

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		3300	B	4633	/	Counter no. 2	
		01	A	2811	/	1 at 29	
		02	H	4633	/		
		03	S	2732	/	☒ N_1	
		04	T	3260	/		
		05	U	[ ]	/		
		06	C	4632	/		Clear counter no. 1
		07	C	4632	/	☒	
		08	R	0300	/	}	24.1
		09	U	0300	/		
		10	I	0000	/		
		11	E	0000	/	☒	
		12	B	2738	/		
		13	S	2811	/	1 at 29	
		14	T	3345	/	→	Is any log transformation
		15	B	4605	/	☒ 2740	wanted?
		16	Y	3320	/		
		17	B	2807	/	6132	Lo of X_o
		18	Y	3325	/		
		19	Y	3327	/	☒	
		20	B	[2740]	/		
		21	S	2811	/	1 at 29	
		22	T	3329	/		
		23	R	0300	/	☒ }	
		24	U	0300	/	}	24.1
		25	8000 B	[6132]	/		Form log X_i
		26	N	0000	/		
		27	8000 C	[6132]	/	☒	
		28	E	0000	/		
		29	B	3325	/		
		30	A	2812	/	2 at 29	
		31	Y	3325	/	☒	

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☒ CARRIAGE RETURN

ROYAL McBEE J13541X

PORT CHESTER, NEW YORK

PREPARED FOR: LGP-30, RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY	PROGRAM CHECKED BY:	DATE
	F2-185	J. N. Boles	POOL Review	

PROBLEM: Regulog II

TRACK 33

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		3332	Y	3327	/		
		33	B	3320	/		
		34	A	2811	/	1 at 29	
		35	Y	3320	/	☒	
		36	B	4632	/	Counter no.1	
		37	A	2811	/	1 at 29	
		38	H	4632	/		
		39	S	2732	/	☒ N_1	
		40	T	3320	/		
		41	T	3343	/		Transfer Control
		800 42	U	3345	/		
		43	R	3231	/	☒ }	Print
		44	U	3204	/		
		45	B	2739	/		
		46	S	2811	/	1 at 29	
		47	T	3422	/	☒ →	No polynomial terms wanted
		48	B	2733	/	2 N_1	
		49	S	2740	/	N_3 = No. of variables generated	
		50	S	2740	/	N_3	
		51	A	2807	/	☒ 6132	
		52	Y	3403	/	6132 + 2	(N_1 - N_3)
		53	B	4606	/	2741	
		54	Y	3357	/		
		55	A	2811	/	☒ 1 at 29	
		56	Y	3360	/		
		57	B	[2741]	/		
		58	A	2807	/	6132	
		59	Y	3401	/	☒	
		60	B	[2742]	/		
		61	A	2807	/	6132	
		62	Y	3402	/		
		63	R	0300	/	☒	

☒ CARRIAGE RETURN

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ROYAL M-BEE J13581X

Royal McBee Corporation
DATA PROCESSING DIV.
PORT CHESTER, NEW YORK

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JOB NO. | PROGRAM NO. F2-185 | PROGRAM PREPARED BY: J. N. Boles | PROGRAM CHECKED BY: POOL Review | DATE

PROBLEM: Regulog II | TRACK 34

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		3400	U	0300	/		24.1
		01	800 P	[6132]	/	X_i	
		02	800 M	[6132]	/	X_j	
		03	800 C	[6132]	/	☒ X_i X_j	
		04	E	0000	/		
		05	B	3357	/		Step addresses of constants
		06	A	2812	/	2 at 29	
		07	Y	3357	/	☒	
		08	A	2811	/	1 at 29	
		09	Y	3360	/		
		10	B	3403	/		Step address of X_i X_j
		11	A	2812	/	☒ 2 at 29	
		12	Y	3403	/		
		13	B	4632	/	Counter no.1	
		14	A	2811	/	1 at 29	
		15	H	4632	/	☒	
		16	S	2740	/	N_3 = No. of	variables generated
		17	T	3357	/		
		18	800 T	3420	/		
		19	U	3422	/	☒	
		20	R	3231	/		
		21	U	3204	/		Print
		22	U	0000	/		Exit
		23	C	4633	/	☒	Clear counter no. 2
		24	C	4633	/		
		25	B	2817	/	4824	Lo $\bar{X}_o$, ΣX_o
		26	Y	3439	/		
		27	Y	3441	/	☒	
		28	B	2807	/	6132	Lo of X_o
		29	Y	3440	/		
		30	Y	3459	/		
		31	Y	3460	/	☒	

DATA PROCESSING DIV. PORT CHESTER, NEW YORK

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ROYAL McBEE, J13541X

☒ CARRIAGE RETURN

PREPARED FOR

LGP-30, RPC-4000 USERS ORGANIZATION -POOL

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JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY	PROGRAM CHECKED BY	DATE
	F2-185	J.N. Boles	POOL Review	

PROBLEM: Regulog II

TRACK 34

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		3432	B	4600	/	xz4900	Lo Of X'X
		33	Y	3461	/		
		34	Y	3462	/		
		35	C	4634	/	☒	Clear Counter No. 3
		36	C	4634	/		
		37	R	0300	/		Fl.Pt. Int. 24.2
		38	U	0300	/		
		39	800 B	[ ]	/	☒ ΣX_i	
		40	800 A	[ ]	/	$\Sigma X_i + X_i$	Form ΣX_i
		41	800 C	[ ]	/	ΣX_i	
		42	E	0000	/		
		43	B	3439	/	☒	Step Addresses
		44	A	2812	/	2 at 29	
		45	Y	3439	/		
		46	Y	3441	/		
		47	B	3440	/	☒	
		48	A	2812	/	2 at 29	
		49	Y	3440	/		
		50	B	4634	/		
		51	A	2811	/	☒ 1 at 29	Increment Counter No. 4
		52	H	4634	/		
		53	S	2732	/		
		54	T	3437	/		
		55	C	4634	/	☒	Clear Counter No. 3
		56	C	4634	/		
		57	R	0300	/		Fl.Pt. Int. 24.2
		58	U	0300	/		
		59	800 P	[ ]	/	☒	
		60	800 M	[ ]	/		Form X'X
		61	800 A	[ ]	/		
		62	800 C	[ ]	/		
		63	E	0000	/	☒	

☒ CARRIAGE RETURN

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PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.

PROGRAM NO. F2-185

PROGRAM PREPARED BY: J.N. Boles

PROGRAM CHECKED BY: POOL Review

DATE

PROBLEM: Regulog II

TRACK 35

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		3500	B	3461	/		Step X'X
		01	A	28122	/	2 at 29	addresses
		02	Y	34611	/		
		03	Y	34622	/	☒	
		04	B	3459	/		Step P
		05	A	28122	/	2 at 29	multiplier
		06	Y	3459	/		
		07	B	46334	/	☒	Increment
		08	A	28111	/	1 at 29	counter no. 3
		09	H	46334	/		
		10	S	27322	/	N_1	
		11	T	34557	/	☒	
		12	B	28072	/	6132	Reset P
		13	Y	3459	/		multiplier
		14	B	34600	/		Step M
		15	A	28122	/	☒	multiplier
		16	Y	34600	/		
		17	B	46333	/	Counter 2	Increment
		18	A	28111	/	1 at 29	counter 2
		19	H	46333	/	☒	
		20	S	27322	/	N_1	
		21	T	34555	/		
		22	U	00000	/		Exit
		23	C	46322	/	☒	Clear
		24	C	46322	/		counter no. 1
		25	B	28117	/	4824	Lo $\bar{X}_o$, ΣX_o
		26	Y	35335	/		
		27	Y	35336	/	☒	
		28	B	46000	/	4900	Lo X'X
		29	Y	35338	/		
		30	Y	35411	/		
		31	C	46333	/	☒	

DATA PROCESSING DIV. PORT CHESTER, NEW YORK

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ROYAL McBEE J13541X

☒ CARRIAGE RETURN

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.:

PROGRAM NO.: F2-185

PROGRAM PREPARED BY: J.N. Boles

PROGRAM CHECKED BY: POOL Review

DATE:

PROBLEM: Regulog II

TRACK: 35

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		3532	C	4633	/		Clear counter 2
		33	R	0300	/		24.1
		34	U	0300	/		
		35	800 P	[4824]	/	☒ ΣX_i	Form S_{ij}
		36	800 M	[4824]	/	ΣX_j	
		37	Y	0000	/	$-(\Sigma X_i)(\Sigma X_j)$	
		38	800 P	[4900]	/	$\Sigma X_i X_j$	
		39	800 N	[6250]	/	☒ N_2	
		40	800 D	[6252]	/	N_2^2	
		41	800 C	[4900]	/	S_{ij}	
		42	E	0000	/		
		43	B	3535	/	☒	Step P
		44	A	2812	/	2 at 29	multiplier
		45	Y	3535	/		
		46	B	3538	/		Step addresses
		47	A	2812	/	☒ 2 at 29	of S_{ij}
		48	Y	3538	/		
		49	Y	3541	/		
		50	B	4633	/		Increment
		51	A	2811	/	☒ 1 at 29	counter 2
		52	H	4633	/		
		53	S	2732	/	N_1	
		54	T	3533	/		
		55	B	2817	/	☒ 4824	Reset P
		56	Y	3535	/		multiplier
		57	B	3536	/		Step M
		58	A	2812	/	2 at 29	multiplier
		59	Y	3536	/	☒	
		60	B	4632	/		Increment
		61	A	2811	/	1 at 29	counter 1
		62	H	4632	/		
		63	S	2732	/	☒ N1	

☒ CARRIAGE RETURN

Royal McBee Corporation
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PORT CHESTER, NEW YORK

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PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL | PAGE 11 / 33

JOB NO. | PROGRAM NO. F2-185 | PROGRAM PREPARED BY: J.N. Boles | PROGRAM CHECKED BY: POOL Review | DATE

PROBLEM: Regulog II | TRACK 36

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		3600	T	3531	/		
		01	C	4632	/		} Clear
		02	C	4632	/		} counter 1
		03	B	2817	/	☒ 4824	
		04	Y	3608	/		
		05	Y	3610	/		
		06	R	0300	/		} 24.1
		07	U	0300	/	☒	}
		08	800 B	[4824]	/	ΣX_i	
		09	800 D	6250	/	N2	Form $\bar{X}_i$
		10	800 C	[4824]	/	$\bar{X}$	
		11	E	0000	/	☒	
		12	B	3608	/		} Step addresses
		13	A	2812	/	2 at 29	} of $\bar{X}_i$
		14	Y	3608	/		}
		15	Y	3610	/	☒	}
		16	B	4632	/	Counter 1	} Increment
		17	A	2811	/	1 at 29	} counter no. 1
		18	H	4632	/		}
		19	S	2732	/	☒ N_1	
		20	T	3606	/		
		21	B	2733	/	2 N_1 at 29	
		22	A	2812	/	2 at 29	
		23	C	4631	/	☒ 2 N_1 + 2 at 29	
		24	C	4632	/	Clear counter 1	
		25	B	4600	/	4900	
		26	Y	3631	/		
		27	B	2809	/	☒ 6208	
		28	Y	3633	/		
		29	R	0300	/		} 24.1
		30	U	0300	/		}
		31	800 B	[4900]	/	☒ S_i^2	

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☒ CARRIAGE RETURN

ROYAL McBEE, J13541X

PORT CHESTER, NEW YORK

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY	PROGRAM CHECKED BY:	DATE
	F2-185	J.N. Boles	POOL Review	

PROBLEM: Regulog II

TRACK 36

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		36 32	R	0000	/	$\sqrt{S_i^2}$	Form S_i
		33	800C	6208	/	S_i	
		34	E	0000	/		
		35	B	3631	/	☒	
		36	A	4631	/	$2N_1 + 2$	
		37	Y	3631	/		
		38	B	3633	/		
		39	A	2812	/	☒ 2 at 29	
		40	Y	3633	/		
		41	B	4632	/	Counter 1	
		42	A	2811	/	1 at 29	
		43	H	4632	/	☒	
		44	S	2732	/	N_1	
		45	T	3629	/		
		46	C	4632	/		Clear counter 1
		47	C	4632	/	☒	
		48	B	2809	/	6208	
		49	Y	3659	/		
		50	Y	3660	/		
		51	B	4600	/	☒ 4900	
		52	Y	3658	/		
		53	Y	3661	/		
		54	C	4633	/		clear counter 2
		55	C	4633	/	☒	
		56	R	0300	/		} 24.1
		57	U	0300	/		}
		58	800B	[4900]	/		
		59	800D	[6208]	/	☒	Form r_{ij}
		60	800D	[6208]	/		
		61	800C	[4900]	/		
		62	E	0000	/		
		63	B	3658	/	☒	

☒ CARRIAGE RETURN

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JOB NO. | PROGRAM NO. F2-185 | PROGRAM PREPARED BY: J.N. Boles | PROGRAM CHECKED BY: POOL Review | DATE

PROBLEM: Regulog II | TRACK 37

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		3700	A	2812	/	2 at 29	Step addresses of r_{ij}
		01	Y	3658	/		
		02	Y	3661	/		
		03	B	3659	/	☒ 2 at 29	Step address of first D
		04	A	2812	/		
		05	Y	3659	/		
		06	B	4633	/		Increment counter
		07	A	2811	/	☒	
		08	H	4633	/		
		09	S	2732	/	N_1	
		10	T	3656	/		
		11	B	2809	/	☒ 6208	Reset first D
		12	Y	3659	/		
		13	B	3660	/		Step address of 2nd D
		14	A	2812	/		
		15	Y	3660	/	☒	
		16	B	4632	/		Increment counter 1
		17	A	2811	/	1 at 29	
		18	H	4632	/		
		19	S	2732	/	☒ N_1	
		20	T	3654	/		
		21	U	[0000]	/		Exit
		22	B	2811	/	1 at 29	Set counter 1 = 1
		23	C	4632	/	☒	
		24	B	2810	/	6210	Lo of S_2
		25	Y	3731	/		
		26	B	2807	/	6132	
		27	Y	3732	/	☒	
		28	R	0300	/		24.1
		29	U	0300	/		
		30	8000 B	6208	/	S_o	
		31	8000 D	[6210]	/	☒ S_j	Form S_o/S_j

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JOB NO.	PROGRAM NO	PROGRAM PREPARED BY	PROGRAM CHECKED BY	DATE
	F2-185	J.N. Boles	POOL Review	

PROBLEM: Regulog II

TRACK 37

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		37 32	8 0 0 C	[6 1 3 2]	/		
		33	E	0 0 0 0	/		
		34	B	3 7 3 1	/		
		35	A	2 8 1 2	/	☒ 2 at 29	
		36	Y	3 7 3 1	/		
		37	B	3 7 3 2	/		
		38	A	2 8 1 2	/	2 at 29	
		39	Y	3 7 3 2	/	☒	
		40	B	4 6 3 2	/	counter 1	
		41	A	2 8 1 1	/	1 at 29	
		42	H	4 6 3 2	/		
		43	S	2 7 3 2	/	☒ N_1	
		44	T	3 7 2 8	/		
		45	B	2 8 1 1	/	1 at 29	Set counter 1 = 1
		46	C	4 6 3 2	/		
		47	B	4 6 0 1	/	☒ 4902	Lo P_{12}
		48	Y	3 7 5 5	/		
		49	B	2 8 0 7	/	6132	Lo S_1/S_2
		50	Y	3 7 5 9	/		
		51	B	4 6 0 2	/	☒ 4636	Lo $b_{o.2}$
		52	Y	3 7 6 0	/		
		53	R	0 3 0 0	/		} 24.1
		54	U	0 3 0 0	/		
		55	8 0 0 B	[4 9 0 2]	/	☒ P_{1j}	
		56	8 0 0 D	4 9 0 0	/	P_{11}	
		57	Y	0 0 0 0	/	$-P_{1j}/P_{11}$	} Form $b_{o.j}$
		58	U	0 0 0 0	/		
		59	8 0 0 M	[6 1 3 2]	/	☒ $S1/S_j$	
		60	8 0 0 C	[4 6 3 6]	/	$b_{o.j}$	
		61	E	0 0 0 0	/		
		62	B	3 7 5 5	/		
		63	A	2 8 1 2	/	☒ 2 at 29	

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☒ CARRIAGE RETURN

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JOB NO.

PROGRAM NO. F2-185

PROGRAM PREPARED BY: J.N. Boles

PROGRAM CHECKED BY: POOL Review

DATE

PROBLEM: Regulog II

TRACK 38

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		3800	Y	3755	/		
		01	B	3759	/		Step address of
		02	A	2812	/	2 at 29	S_1/S_j
		03	Y	3759	/	☒	
		04	B	3760	/		
		05	A	2816	/	6 at 29	
		06	Y	3760	/		
		07	B	4632	/	☒ counter 1	Increment counter 1
		08	A	2811	/	1 at 29	
		09	H	4632	/		
		10	S	2732	/	N_1	
		11	T	3753	/	☒	
		12	R	0300	/		24.1
		13	U	0300	/		
		14	800B	6254	/	$N_2 - N_1$	
		15	R	0000	/	☒	
		16	800C	6260	/	$\sqrt{N_2 - N_1}$	
		17	E	0000	/		
		18	B	2811	/	1 at 29	Set counter 1 = 1
		19	C	4632	/	☒	
		20	B	4602	/	4636	Lo $b_{0.2}$
		21	Y	3847	/		
		22	A	2812	/	2 at 29	
		23	Y	3846	/	☒ 4638	
		24	Y	3848	/	4638	
		25	A	2812	/	2 at 29	
		26	Y	3849	/	4640	
		27	B	4601	/	☒ 4902	
		28	Y	3836	/		
		29	Y	3837	/		
		30	A	2733	/	2 N_1	
		31	Y	3840	/	☒ $4900 + 2(N_1 + 1)$	

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☒ CARRIAGE RETURN

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY	PROGRAM CHECKED BY	DATE
	F2-185	J.N. Boles	POOL Review	

PROBLEM: Regulog II

TRACK 38

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		3832	B	2807	/	6132	
		33	Y	3844	/		
		34	R	0300	/		24.1
		35	U	0300	/	☒	24.1
		36	800P	[4902]	/	P_{1j}	Form $S_{bo.j}$
		37	800M	[4902]	/	P_{1j}^2	Form $S_{bo.j}$
		38	Y	0000	/		Form $S_{bo.j}$
		39	800P	4900	/	☒ P_{11}	Form $S_{bo.j}$
		40	800N	[4900]	/	P_{jj}	Form $S_{bo.j}$
		41	R	0000	/	$\sqrt{P_{11} P_{jj} - P_{1j}^2}$	Form $S_{bo.j}$
		42	800D	4900	/		Form $S_{bo.j}$
		43	U	0000	/	☒	Form $S_{bo.j}$
		44	800M	[6132]	/	S_o/S_j	Form $S_{bo.j}$
		45	800D	6260	/	$\sqrt{N_1 - N_2}$	Form $S_{bo.j}$
		46	800C	[4638]	/	$S_{bo.j}$	Form $S_{bo.j}$
		47	800B	[4636]	/	☒ $b_{o.j}$	Form $t_{o.j}$
		48	800D	[4638]	/	$S_{bo.j}$	Form $t_{o.j}$
		49	800C	[4640]	/	$t_{o.j}$	Form $t_{o.j}$
		50	E	0000	/		
		51	B	3836	/	☒	Step address of P_{ij}
		52	A	2812	/		Step address of P_{ij}
		53	Y	3836	/		Step address of P_{ij}
		54	Y	3837	/		Step address of P_{ij}
		55	B	3840	/	☒	Step address of P_{jj}
		56	A	4631	/	$2N_1 + 2$	Step address of P_{jj}
		57	Y	3840	/		Step address of P_{jj}
		58	B	3844	/		Step address of S_o/S_j
		59	A	2812	/	☒ 2 at 29	Step address of S_o/S_j
		60	Y	3844	/		Step address of S_o/S_j
		61	B	3847	/		
		62	A	2816	/	6 at 29	
		63	Y	3847	/	☒	

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY:	PROGRAM CHECKED BY:	DATE
	F2-185	J.N. Boles	POOL Review	

PROBLEM: Regulog II

TRACK 39

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		3900	A	2812	/	2 at 29	} Step address
		01	Y	3846	/		of $S_{bo.j}$
		02	Y	3848	/		
		03	A	2812	/	☒ 2 at 29	} Step address
		04	Y	3849	/		of $t_{o.j}$
		05	B	4632	/		
		06	A	2811	/	1 at 29	
		07	H	4632	/	☒	
		08	S	2732	/	N_1	
		09	T	3834	/		
		10	R	0300	/		
		11	U	0300	/	☒	
		12	800 B	4900	/	P_{11}	} Form R^2, R
		13	800 S	6248	/	flt. pt. "1"	
		14	800 D	4900	/	P_{11}-1/P_{11}	
		15	800 H	4626	/	☒	
		16	R	0000	/		
		17	800 C	4628	/		
		18	800 B	6248	/	flt. pt. "1"	
		19	800 D	4900	/	☒ 1/P_{11}	
		20	U	0000	/		
		21	800 M	6208	/	S_o	} Form S =
		22	U	0000	/		
		23	800 M	6208	/	☒ S_o	Σ Sq. Res
		24	U	0000	/		
		25	800 M	6250	/	N_2	
		26	800 C	6256	/		
		27	E	0000	/	☒	
		28	B	2811	/	1 at 29	} Set counter 1 = 1
		29	C	4632	/		
		30	C	6258	/		} Clear spot for b_o
		31	C	6259	/	☒	

DATA PROCESSING DIV. PORT CHESTER, NEW YORK

FORM LP-10

☒ CARRIAGE RETURN

ROYAL McBEE J13541X

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY	PROGRAM CHECKED BY:	DATE
	F2-185	J.N. Boles	POOL Review	

PROBLEM: Regulog II

TRACK 39

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		3932	B	2818	/	4826	Lo $\bar{X}_2$
		33	Y	3938	/		
		34	B	4602	/	4636	Lo $b_{o.2}$
		35	Y	3939	/	☒	
		36	R	0300	/		} 24.1
		37	U	0300	/		
		38	800 P	[4826]	/	$\bar{X}_j$	
		39	800 M	[4636]	/	☒ $b_{o.j}$	
		40	800 A	6258	/		
		41	800 C	6258	/		
		42	E	0000	/		
		43	B	3938	/	☒	
		44	A	2812	/	2 at 29	
		45	Y	3938	/		
		46	B	3939	/		
		47	A	2816	/	☒ 6 at 29	
		48	Y	3939	/		
		49	B	4632	/		
		50	A	2811	/	1 at 29	
		51	H	4632	/	☒	
		52	S	2732	/	N_1	
		53	T	3936	/		
		54	R	0300	/		} 24.1
		55	U	0300	/	☒	
		56	800 B	6258	/	$\Sigma b_{o.j}\bar{X}_j$	
		57	Y	0000	/		
		58	800 A	4824	/	$\bar{X}_o$	
		59	800 C	6258	/	☒ b_o	
		60	E	0000	/		
		61	U	0000	/		Exit
		62			/		
		63			/	☒	

☒ CARRIAGE RETURN

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL | PAGE 19 OF 33

JOB NO. | PROGRAM NO. F2-185 | PROGRAM PREPARED BY: J.N. Boles | PROGRAM CHECKED BY: POOL Review | DATE

PROBLEM: Regulog II | TRACK 40

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
;0000 4000	/						
/0000 0000	/	☒					
		4000	B	2817	/	4824	} Clear spot for means
		0001	Y	3237	/		
		0002	Y	3238	/		
		0003	B	2733	/	☒ $2N_1$	
		0004	C	3249	/		
		0005	R	3248	/	Clear	
		0006	U	3235	/		
		0007	B	4600	/	☒ 4900	
		0008	Y	3237	/		
		0009	Y	3238	/		} Clear
		0010	B	2735	/	$2N_1 2$	spot
		0011	C	3249	/	☒	for X'X
		0012	R	3248	/	} clear	
		0013	U	3235	/		
		0014	B	4607	/	3423	} Link data input
		0015	Y	3422	/	☒	& X'X Subroutines
		0016	C	4635	/		} clear counter no. 4
		0017	C	4635	/		
		0018	B	2737	/	k	
		0019	C	3233	/	☒	
		0020	B	2732	/	N_1	Printing
		0021	C	3234	/		format for
		0022	B	2807	/	6132	transformed
		0023	Y	3212	/	☒	variables.
		0024	R	3522	/		} Input data and
		0025	U	3306	/		form X'X and ΣX
		0026	B	4635	/	counter 4	} increment
		0027	A	2811	/	☒ 1 at 29	counter 4
		0028	H	4635	/		
		0029	S	2736	/	N_2	
		0030	T	4022	/		
		0031	Z	0400	/	☒	Stop

☒ CARRIAGE RETURN

FORM LP-10

ROYAL McBEE, J13641X

PORT CHESTER, NEW YORK

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		4032	B	2817	/	4824	
		33	Y	3212	/		
		34	R	3100	/		} Alphanumeric
		35	U	3100	/	☒	
,0000 0003	/	36	2020	2030	/		
		37	1044	064A	/		ΣX
		38	08VQ	0000	/		
		39	R	3231	/	☒	} print ΣX_i
		40	U	3200	/		
		41	R	3100	/		} alphanumeric
		42	U	3100	/		
,0000 0004	/	43	2020	3010	/	☒	
		44	4A40	4A06	/		X'X matrix
		45	3F72	5F1F	/		
		46	224A	08VQ	/		
		47	R	3305	/	☒	} print X'X by rows
		48	U	3250	/		
		49	Z	0400	/		Stop
		50	R	3721	/		} Compute $\bar{X}_i$, S_{ij}
		51	U	3523	/	☒	S_i, $R = [r_{ij}]$
		52	B	2817	/	4824	} Printing address
		53	Y	3212	/		for $\bar{X}_i$
		54	R	3100	/		} alphanumeric
		55	U	3100	/	☒	
,0000 0006	/	56	2020	2030	/		
		57	1072	1F22	/		arithmetic means
		58	5F62	3F4F	/		
		59	5F22	6F06	/	☒	
		60	3F4F	7232	/		
		61	7F08	VQ00	/		
		62	R	3231	/		
		63	U	3200	/	☒	

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY	PROGRAM CHECKED BY:	DATE
	F2-185	J.N. Boles	POOL Review	

PROBLEM: Regulog II

TRACK 41

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	X					
		4100	B	2809	/	6208	} Printing address
		01	Y	3212	/		} for S_i
		02	R	3100	/		} Alphanumeric
		03	U	3100	/	X	}
,0000 0007	1	04	2020	2030	/		
		05	107F	5F72	/		
		06	322F	721F	/		Standard
		07	2F06	2F4F	/	X	Deirations
		08	3A22	725F	/		
		09	2246	327F	/		
		10	08VQ	0000	/		
		11	R	3231	/	X	} Print S_i
		12	U	3200	/		}
		13	R	3100	/		} Alphanumeric
		14	U	3100	/		}
,0000 0004	1	15	2020	2030	/	X	
		16	101F	063F	/		R Matrix
		17	725F	1F22	/		
		18	4A08	VQ00	/		
		19	R	3305	/	X	} Print R Matrix
		20	U	3250	/		} by rows
		21	Z	0800	/		Stop
		22	B	2732	/	N_1 at 29	}
		23	N	4608	/	X 1 at 17	} Form codeword
		24	C	4129	/	N_1 at 15	} for 30.0
		25	B	4600	/	4900	}
		26	Y	4129	/		}
		27	R	2514	/	X	} Invert R
		28	U	2500	/		} Matrix
		29	(	)	/	Codeword for 30.0	
		30	R	3100	/		} Alphanumeric
		31	U	3100	/	X	}

FORM LP-10

ROYAL McBEE J13541X

X CARRIAGE RETURN

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JOB NO. | PROGRAM NO. F2-185 | PROGRAM PREPARED BY J.N. Boles | PROGRAM CHECKED BY POOL Review | DATE

PROBLEM: Regulog II | TRACK 41

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
,000 0004	'	412	2020	2030	/		
		413	101F	0622	/		R Inverse
		414	323A	4F1F	/		
		415	7F4F	08VQ	/	☒	
		416	R	3305	/		} Print R^{-1}
		417	U	3250	/		} by rows
		418	Z	0400	/		Stop
		419	R	3961	/	☒	} Compute
		420	U	3722	/		} Regression statistics
		421	R	3100	/		} alphanumeric
		422	U	3100	/		}
,000 0006	'	423	2020	2010	/	☒	
		424	6F46	327F	/		
		425	5F72	325F	/		
		426	065f	4F1F	/		
		427	3F06	1608	/	☒	
		428	VQ00	0000	/		
		429	R	0300	/		} 24.1
		430	U	0300	/		}
		431	800B	6258	/	☒ b_o	
		432	P	0000	/		
		433	E	0000	/		
		434	B	2733	/	$2N_1$	
		435	A	2732	/	☒ N_1	} Printing
		436	S	2813	/	3 at 29	} format
		437	C	3234	/	$3N_1 - 3$	} for $b_{o.j}$,
		438	B	2813	/	3 at 29	
		439	C	3233	/	☒ k	} $S_{bo.j}$,
		440	B	4602	/	4636	
		441	Y	3212	/		} t_j
		442	R	3100	/		} alphanumeric
		443	U	3100	/	☒	}

☒ CARRIAGE RETURN

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL | PAGE 23 / 33

JOB NO. | PROGRAM NO. F2-185 | PROGRAM PREPARED BY: J.N. Boles | PROGRAM CHECKED BY: POOL Review | DATE

PROBLEM: Regulog II | TRACK 42

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
,0000 0015	'	4200	2020	2010	/		Regression
		01	061F	4F5J	/		coefficient
		02	1F4F	7F7F	/		
		03	2246	3230	/	☒	
		04	7F5F	7232	/		
		05	2F72	1F2F	/		Standard errors
		06	3006	065F	/		
		07	206F	464F	/	☒	
		08	5454	226F	/		
		09	224F	325F	/		
		10	7F30	064F	/		T ratios
		11	1F1F	461F	/	☒	
		12	7F30	1F72	/		
		13	5F22	467F	/		
		14	08VQ	0000	/		
		15		R 3231	/	☒	} Print
		16		U 3200	/		}
		17		R 3100	/		} Alphanumeric
		18		U 3100	/		}
,0000 0006	'	19	2020	2010	/	☒	
		20	4406	7f74	/		
		21	5272	1f4f	/		Σ Squared
		22	2f06	1f4f	/		Res =
		23	7f06	1608	/	☒	
		24	06VQ	0000	/		
		25		R 0300	/		} 24.1
		26		U 0300	/		}
		27	800B	6256	/	☒ S	
		28		P 0000	/		
		29		E 0000	/		
		30		R 3100	/		} Alphanumeric
		31		U 3100	/	☒	}

FORM LP-10

☒ CARRIAGE RETURN

ROYAL McBEE, J13541X

DATA PROCESSING DIV. PORT CHESTER, NEW YORK

PREPARED FOR: LGP-30 RPC-40000 USERS ORGANIZATION - POOL

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JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY	PROGRAM CHECKED BY	DATE
	F2-185	J.N. Boles	POOL Review	

PROBLEM: Regulog II

TRACK 42

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/				/		
	/	☒			/		
,000 0006	1	42 32	2020	2010	/		
		33	0606	1F06	/		R Squares
		34	7f74	5272	/		
		35	1f4f	2f30	/	☒	R
		36	0606	061f	/		
		37	2020	08VQ	/		
		38	R	0300	/		} 24.1
		39	U	0300	/	☒	
		40	800B	4626	/	R^2	
		41	P	0000	/		
		42	R	0000	/		
		43	P	0000	/	☒	
		44	E	0000	/		
		45	Z	0000	/		Stop
		46	B	4600	/	4900	
		47	Y	3237	/	☒	Clear
		48	Y	3238	/		spot for
		49	B	2736	/	N_2	
		50	A	2736	/	N_2	Y' and
		51	H	4630	/	☒ $2N_2$	Y-Y'
		52	A	4630	/	$2N_2$	
		53	C	3249	/	$4N_2$	
		54	R	3248	/	} Clear	
		55	U	3235	/	☒	
		56	C	4635	/		} Clear
		57	C	4635	/		} counter 4
		58	B	2808	/	6134	
		59	Y	4318	/	☒	
		60	B	4602	/	4636	
		61	Y	4319	/		
		62	B	4600	/	4900	
		63	Y	4320	/	☒	

Royal McBee Corporation
DATA PROCESSING DIV.
PORT CHESTER, NEW YORK

FORM LP-12

☒ CARRIAGE RETURN

JOB NO. | PROGRAM NO. F2-185 | PROGRAM PREPARED BY: J.N. Boles | PROGRAM CHECKED BY: POOL Review | DATE

PROBLEM: Regulog II | TRACK 43

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		4300	Y	4321	/		
		01	Y	4336	/		
		02	Y	4338	/		
		03	Y	4340	/	☒	
		04	A	2812	/	2 at 29	
		05	Y	4341	/		
		06	B	2737	/	k	Printing
		07	C	3233	/	☒	format
		08	B	2732	/	N_1	for
		09	C	3234	/		transformed
		10	B	2807	/	6132	variables
		11	Y	3212	/	☒	
		12	B	2811	/	1 at 29	Set counter no. 3
		13	C	4634	/		= 1
		14	R	3422	/		Input
		15	U	3306	/	☒	Data
		16	R	0300	/		24.1
		17	U	0300	/		
		18	800 P	[6134]	/	X_j	
		19	800 M	[4636]	/	☒ $b_{o.j}$	
		20	800 A	[4900]	/	$\Sigma b_{o.j} X_j$	Form $\sum_{j=1}^{N_1-1} b_{o.j} X_j$
		21	800 C	[4900]	/		
		22	E	0000	/		
		23	B	4318	/	☒	
		24	A	2812	/	2 at 29	
		25	Y	4318	/		
		26	B	4319	/		
		27	A	2816	/	☒ 6 at 29	
		28	Y	4319	/		
		29	B	4634	/	counter 3	
		30	A	2811	/	1 at 29	
		31	H	4634	/	☒	

☒ CARRIAGE RETURN

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.:

PROGRAM NO.: F2-185

PROGRAM PREPARED BY: J.N. Boles

PROGRAM CHECKED BY: POOL Review

DATE:

PROBLEM: Regulog II

TRACK: 43

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		4312	S	2732	/	N_1	
		313	T	4316	/		
		314	R	0300	/		} 24.1
		315	U	0300	/	☒	}
		316	800 B	[4900]	/	$\Sigma b_{o,j} X_j$	
		317	800 A	6258	/	b_o	
		318	800 C	[4900]	/	Y'	
		319	800 B	6132	/	☒ $X_o = Y$	
		320	800 S	[4900]	/	Y'	
		321	800 C	[4902]	/	Y - Y'	
		322	E	0000	/		
		323	B	4340	/	☒	
		324	A	2814	/	4 at 29	
		325	Y	4340	/		
		326	Y	4338	/		
		327	Y	4336	/	☒	
		328	Y	4320	/		
		329	Y	4321	/		
		330	A	2812	/	2 at 29	
		331	Y	4341	/	☒	
		332	B	2808	/	6134	
		333	Y	4318	/		
		334	B	4602	/	4636	
		335	Y	4319	/	☒	
		336	B	4635	/	counter 4	
		337	A	2811	/	1 at 29	
		338	H	4635	/		
		339	S	2736	/	☒ N_2	
		340	T	4310	/		
		341	Z	0400	/		Stop
		342	B	4600	/	4900	
		343	Y	3212	/	☒	
						☒ CARRIAGE RETURN	

FORM LP-12

ROYAL M-BEE J115418

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		4400	B	4630	/	$2N_2$	} Printing
		01	C	3234	/		} format
		02	B	2812	/	2 at 29	}
		03	C	3233	/	☒	}
		04	R	3100	/		} alphanumeric
		05	U	3100	/		}
,0000 0005	/	06	2020	2010	/		
		07	0606	1240	/	☒	
		08	3006	1206	/		Y'
		09	0800A	1006	/		Y-Y'
		10	1240	08VQ	/		
		11	R	3231	/	☒	} Print
		12	U	3200	/		}
		13	C	6256	/		} Clear spot for
		14	C	6256	/		} Σ Sq. Res
		15	C	6257	/	☒	}
		16	C	4632	/		Clear counter 1
		17	B	4601	/	4902	
		18	Y	4422	/		
		19	Y	4423	/	☒	
		20	R	0300	/		} 24.1
		21	U	0300	/		}
		22	800P	[4902]	/	Y-Y'	
		23	800M	[4902]	/	☒ $(Y-Y')^2$	Form
		24	800A	6256	/		Σ $(Y-Y')^2$
		25	800C	6256	/		
		26	E	0000	/		
		27	B	4422	/	☒	
		28	A	2814	/	4 at 29	
		29	Y	4422	/		
		30	Y	4423	/		
		31	B	4632	/	☒ counter 1	

☒ CARRIAGE RETURN

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL

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JOB NO. | PROGRAM NO. F2-185 | PROGRAM PREPARED BY J.N. Boles | PROGRAM CHECKED BY: POOL Review | DATE

PROBLEM: Regulog II | TRACK 44

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/				/		
	/	☒					
		4432	A	2811	/	1 at 29	
		33	H	4632	/		
		34	S	2736	/	N_2	
		35	T	4420	/	☒	
		36	R	3100	/		} alphanumeric
		37	U	3100	/		
,000 0006	1	38	2020	2010	/		
		39	4406	7F74	/	☒	
		40	5272	1F4F	/		
		41	2F06	1F4F	/		
		42	7F06	1608	/		
		43	06VQ	0000	/	☒	
		44	R	0300	/		} 24.1
		45	U	0300	/		
		46	800B	6256	/	S	
		47	P	0000	/	☒	
		48	E	0000	/		
		49	Z	1600	/		Stop
		50	C	4632	/		} clear
		51	C	4632	/	☒	} counter 1
		52	B	4600	/	4900	
		53	Y	4457	/		
		54	Y	4459	/		
		55	R	0300	/	☒	} 24.1
		56	U	0300	/		
		57	800B	[4900]	/		
		58	H	0000	/		antilogs
		59	800C	[4900]	/	☒	
		60	E	0000	/		
		61	B	4457	/		
		62	A	2812	/	2 at 29	
		63	U	4545	/	☒	

☒ CARRIAGE RETURN

FORM LP-12

ROYAL MCBEE J13541X

Royal McBee Corporation
DATA PROCESSING DIV.
PORT CHESTER, NEW YORK

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL | PAGE 29 / 33

JOB NO. | PROGRAM NO. F2-185 | PROGRAM PREPARED BY: J.N. Boles | PROGRAM CHECKED BY: POOL Review | DATE

PROBLEM: Regulog II - - Manual Printing Subroutine | TRACK 45

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		4500	P	1600	/	c.r.	
		01	Z	0000	/		
		02	P	1700	/	"i"	
		03	Z	0000	/	☒	
		04	P	0300	/	space	
		05	Z	0000	/		
		06	P	0000	/	Prepare to	read
		07	C	4544	/	☒ temporary	
		08	I	0000	/		
		09	R	4538	/		} Binarize
		10	U	4529	/		}
		11	P	1600	/	☒	
		12	Y	3212	/	Initial address	
		13	Z	0000	/		
		14	P	2500	/	"n"	
		15	Z	0000	/	☒	
		16	P	0300	/	space	
		17	Z	0000	/		
		18	P	0000	/	Prepare to	read
		19	C	4544	/	☒ temporary	
		20	I	0000	/		
		21	R	4538	/		} Binarize
		22	U	4529	/		}
		23	P	1600	/	☒	
		24	C	3234	/	No. of words	
		25	Z	0000	/		
		26	R	3231	/		} Print
		27	U	3200	/	☒	}
		28	U	4500	/		
		29	N	4543	/		
		30	H	4544	/		
		31	E	4539	/	☒	

☒ CARRIAGE RETURN

FORM LP-10

ROYAL MCBEE J13541X

DATA PROCESSING DIV. PORT CHESTER, NEW YORK

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY	PROGRAM CHECKED BY:	DATE
	F2-185	J.N. Boles	POOL Review	

PROBLEM: Regulog II

TRACK 45

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	'						
	'	X					
		4532	M	4541	'		
		33	A	4544	'		
		34	H	4544	'		
		35	E	4540	'	X	
		36	M	4542	'		
		37	A	4544	'		
		38	U	[0000]	'		
,0000004	'	39	3	J3J0	'	X	
		40	3	WJ00	'		
		41	K000	0000	'		
		42	F000	0000	'		
		43	Z	0001	'	X	
		44	(	)	'		
		45	Y	4457	'		
		46	Y	4459	'		
		47	B	4632	'	X	counter 1
		48	A	2811	'		1 at 29
		49	H	4632	'		
		50	S	4630	'	$2N_2$	
		51	T	4455	'	X	
		52	R	3100	'		} Alphanumeric
		53	U	3100	'		
,0000004	'	54	2020	2010	'		
		55	7232	5F22	'	X	
		56	0J46	5J7F	'		
		57	08VQ	0000	'		
		58	B	4600	'	4900	
		59	Y	3212	'	X	
		60	R	3231	'		} Print
		61	U	3200	'		
		62	Z	0000	'		Stop
		63			'	X	

X CARRIAGE RETURN

FORM LP-12

ROYAL MCBEE J13541X

Royal McBee Corporation
DATA PROCESSING DIV.
PORT CHESTER, NEW YORK

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL | PAGE 31 / 33

JOB NO. | PROGRAM NO F2-185 | PROGRAM PREPARED BY: J.N. Boles | PROGRAM CHECKED BY: POOL Review | DATE

PROBLEM: Regulog II | TRACK 46

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		4600	Z	4900	/		1st word of X'X, R, R^{-1}
		01	Z	4902	/		2nd " " " " "
		02	Z	4636	/		1st regression coeff.
		03	Z	3200	/	☒	
		04	Z	3204	/		
		05	Z	2740	/		
		06	Z	2741	/		
		07	Z	3423	/	☒	
,0000 0001	'	08		4000	/		1 at 17
		09	Z	6258	/		
		10	Z	6256	/		
		11	Z	4626	/	☒	
		12			/		
		13			/		
		14			/		
		15			/	☒	
		16			/		
		17			/		
		18			/		
		19			/	☒	
		20			/		
		21			/		
		22			/		
		23			/	☒	
		24			/		
		25			/		
		26	(	R^2	) /		
		27	(		) /	☒	
		28	(	R	) /		
		29	(		) /		
		30	(	$2N_2$	) /		
		31	(	2N1 + 2	) /	☒	

FORM LP-10

☒ CARRIAGE RETURN

ROYAL McBEE J13641X

DATA PROCESSING DIV. PORT CHESTER, NEW YORK

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.	PROGRAM NO.	PROGRAM PREPARED BY	PROGRAM CHECKED BY:	DATE
	F2-185	J.N. Boles	POOL Review	

PROBLEM: Regulog II

TRACK 46

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		4632	( )		/	no. 1	} counter registers
		33	( )		/	no. 2	
		34	( )		/	no. 3	
		35	( )		/	☒ no. 4	
		36			/	Regression coefficients, standard	
		37			/	errors, T ratios	
		38			/		
		39			/	☒	
		40			/		
		41			/		
		42			/		
		43			/	☒	
		44			/		
		45			/		
		46			/		
		47			/	☒	
		48			/		
		49			/		
		50			/		
		51			/	☒	
		52			/		
		53			/		
		54			/		
		55			/	☒	
		56			/		
		57			/		
		58			/		
		59			/	☒	
		60			/		
		61			/		
		62			/		
		63			/	☒	

☒ CARRIAGE RETURN

Royal McBee Corporation
DATA PROCESSING DIV.
PORT CHESTER, NEW YORK

FORM LP-12

ROYAL MCBEE J13541K

PREPARED FOR: LGP-30 RPC-4000 USERS ORGANIZATION - POOL

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JOB NO.

PROGRAM NO. F2-185

PROGRAM PREPARED BY J.N. Boles

PROGRAM CHECKED BY POOL Review

DATE

PROBLEM: Regulog II

TRACK 62

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	/						
	/	☒					
		62 312			/		
		313			/		
		314			/		
		315			/	☒	
		316			/		
		317			/		
		318			/		
		319			/	☒	
		320			/		
		321			/		
		322			/		
		323			/	☒	
		324			/		
		325			/		
		326			/		
		327			/	☒	
		328	(	1)	/		Floating Point
		329	(	)	/		Constants
		330	(	N2)	/		
		331	(	)	/	☒	
		332	(	N_2^2)	/		
		333	(	)	/		
		334	(	N2-N1)	/		
		335	(	)	/	☒	
		336	(	S)	/		
		337	(	)	/		
		338	(	b_ϕ)	/		
		339	(	)	/	☒	
		340	(	$\sqrt{N2-N1}$)	/		
		341	(	)	/		
		342			/		
		343			/	☒	