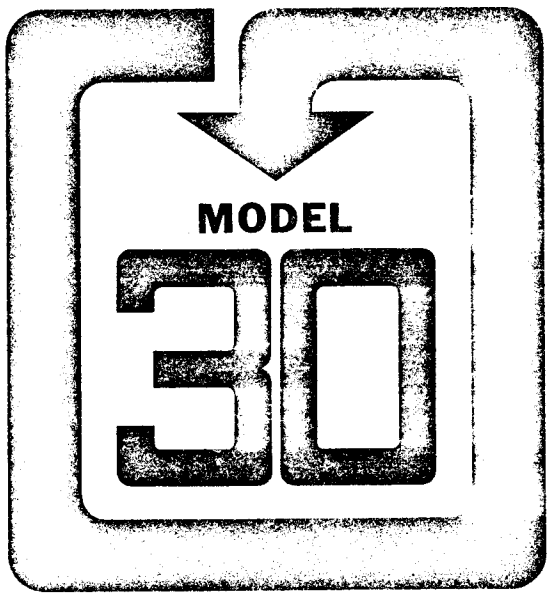


HEWLETT-PACKARD CALCULATOR

9830A STAT PAC

VOLUME 2

Program Listing

File Description

File Number	Description	File Size
1	MLR: Starts program and contains pointers for operations	93
2	MLR: Type Headings	356
3	MLR: Input Data	392
4	MLR: Transformations Program	677
5	MLR: Basic Statistics and Correlation Matrix	575
6	MLR: Load Data from Tape	759
7	MLR: Square Root and Inverse of XX'	429
8	MLR: Print AOV	383
9	MLR: Print Coefficients	428
10	MLR: Print Residuals	783
11	MLR: Durbin-Watson Statistic	744
12	MLR: Correct Data on Tape	247
13-213	MLR: Data Files	.60/file

Introduction

This family of statistical programs for the Model 9830 results from several years' experience in providing statistical solutions to our customers. We have attempted to incorporate all those desirable features and options suggested to us by general statistical practitioners. As a result, the special function keys have been applied to offer a wide choice of problem solutions. The "Special Function" template should illustrate the flexibility of these programs.

This program was written by Bob Kopitzke of Colorado State University, Statistics Laboratory. Additional statistical packages will be developed in the future.

PROGRAM SUBMISSIONS

You are invited to submit statistical programs to us for inclusion in future statistical pacs and our Catalog of Calculator Programs. Details for submitting programs for this catalog are found near the back of this pac. Please use the prepared forms for your program submittal.

Dave Cole
Statistics Applications
Hewlett-Packard Company
Loveland, Colorado

Commentary

In writing the programs for this package, it has been assumed that the user is familiar with the basic keyboard operations of the 9830, and also with some of the elementary programming concepts such as data entry, use of the Special Function Keys (SFK) and defined function utilization.

There are several general comments which are applicable to most of the programs in this package and which should aid the user in running those programs. These comments have been collected in this section for easy reference, and to reduce the length of the operating instructions for the individual programs. It is recommended that the user read this section before running the various programs in this package.

1. SCRATCH A should be executed prior to loading any of the programs for running. This assures that no extraneous program lines or variables are left in the memory from the previous program, which could cause program malfunction.

2. Many of the programs which operate from the Special Function Keys (SFK) require that RUN, START (where START is one of the predefined SFK's) be pressed to initiate program operation. It is the purpose of the START key in these programs to initialize certain variables and to dimension the arrays which the program will use. If START is pressed without previously pressing the RUN key in these programs, ERROR 41 (array or string has not been initialized) will result.

3. Most of the programs require data input at various points throughout the running. When data entry is required, the display will show some indication of the particular data being requested, followed by a question mark. The user should enter the desired number(s) and press EXECUTE. If more than one number is requested, the user may enter the numbers one at a time, pressing EXECUTE after each entry; or he may enter all the numbers at once, separated by commas, and then press EXECUTE. If an error is made in entering the number(s), press CLEAR and enter the numbers again. The program does not accept the input until EXECUTE is pressed.

When entering lists of data (such as x and y values of data points), the program sometimes must do a considerable amount of computation between entries. As a result, the user may enter the points faster than the program can process them. Be sure to wait until the question mark appears in the display before entering the next value.

4. Most of the programs give printed results of the computations that are performed. In many cases, the user can control the format of these results by placing the calculator in the appropriate format mode (FIXED N, FLOAT N, or STANDARD). In addition, by placing the calculator in the PRINT ALL mode, a record of the data entered will also be printed. (Note that some programs already print out data entry. For these programs, the PRINT ALL mode should be OFF.) The user may exercise these options at his own discretion to obtain a printout which suits his needs.

Each of the programs is followed by an example case. There are some items printed in these cases (such as which key is to be pressed next) that will not appear on the printout when the program is run. These are intended to aid the user in running the example case, and the fact that the non-numeric portion of the printout obtained does not identically match the example case should not be cause for concern.

MODEL 30

HEWLETT·PACKARD

HEWLETT·PACKARD

HEWLETT·PACKARD

HEWLETT·PACKARD

MULTIPLE LINEAR REGRESSION

DESCRIPTION:

This program determines a least squares regression of a variable y on a set of k independent variables $x_1, \ldots, x_k$ where $k \leq 12$.

The equation is of the form: $y = b_0 + b_1x_1 + \ldots + b_kx_k$.

The user has the following options:

1. A table of means and variances of all variables may be printed.
2. The correlation matrix may be printed.
3. A complete analysis of variance table may be printed.
4. Regression coefficients are calculated together with estimates of their variances and t-values.
5. Residuals may be calculated and printed.
6. The Durbin-Watson statistic may be calculated and printed.
7. Various transformations may be performed on the input data with all of the above options available for transformed data.
8. Correction options for incorrectly entered data are available.
9. A stepwise procedure for building a model is allowed.

METHODS:

The raw data is entered and stored on tape. At this time, the necessary calculations are performed to allow an analysis on the raw data. In general, when a key is pressed, wait until the display returns before pressing another key.

SPECIAL CONSIDERATIONS:

None

ACKNOWLEDGMENTS:

Robert W. Kopitzke, Hewlett-Packard

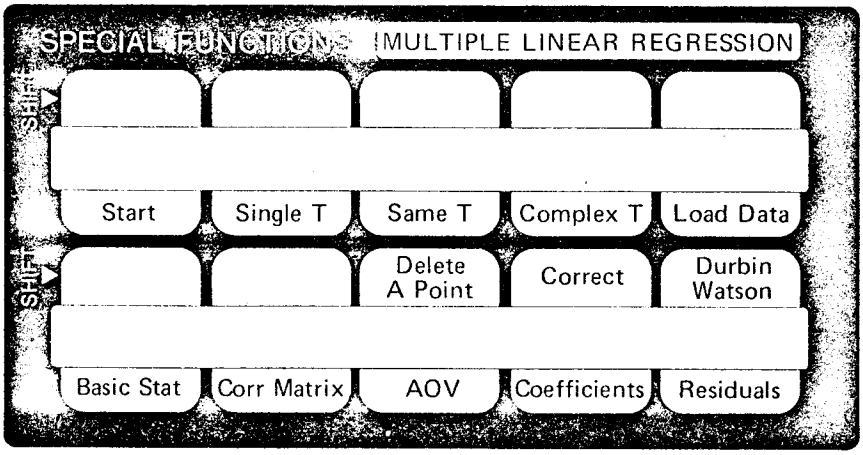
REFERENCES:

Graybill, F. A., An Introduction to Linear Statistical Models, Vol. I (New York: McGraw-Hill Book Company, 1961).

Yamane, T., Statistics, An Introductory Analysis (New York: Harper and Row, 1967), pp. 809 - 813.

SYSTEM SPECIFICATIONS:

9830 (2K or 4K R/W)
9866 Printer or 9861 Typewriter



OPERATION:

1. Type SCRATCH A, press EXECUTE.
2. Type LOADKEY 1, press EXECUTE.
3. Press START [SF Key 0].
4. The display will read, "K = ?". Enter the number of independent variables, press EXECUTE.
5. The display will read, "Y = ?". Enter y of the data set being entered.
6. The display will read, "X(I) = ?". Enter x_i for i = 1,...,k.
7. After x_i is entered, the display will read, "CORRECTIONS?". If there are corrections to this data set, enter 1; otherwise, enter 0, press EXECUTE.

   The display will read, "I = ?". Enter the number of the variable being corrected, press EXECUTE.

   The display will read, "CORRECT VALUE?". Enter the correct value and press EXECUTE. Repeat step 6 as often as required.
8. After all data is entered, the various options described below may be used.
9. To run another case, go to step 2.

SPECIAL FUNCTIONS:

BASIC STAT [SF Key 5]:
Prints means and variances of data.

CORR MATRIX [SF Key 6]:
Prints correlations between variables.

COEFF [SF Key 8]:
Calculates and prints estimates of the regression coefficients with variances and t-values.

AOV [SF Key 7]:
Calculates and prints analysis of variance table with multiple correlation coefficient.

RESID [SF Key 9]:
Calculates and prints residuals for inputted data points. Residuals must immediately follow the calculation of coefficients.

D-W [SF Key 19]:
Calculates and prints the Durbin-Watson test statistic for serial correlation. The Durbin-Watson test should immediately follow the calculation of residuals.

CORRECT [SF Key 18]:
This key allows the operator to correct data sets that have been stored on tape. To use, press CORRECT, then:

1. The display reads, "CORRECT DATA SET #".
2. Enter the number of the data set to be corrected, press EXECUTE.
3. The display reads, "I = ?, CORRECT VALUE?". Enter the number of the variable to be changed, and the correct value. Press EXECUTE.
4. The display reads, "ENT 1 FOR MORE CORRECTIONS?". If it is desired to correct more values on this data set, enter 1, press EXECUTE, go to step 3. Otherwise, enter 0, press EXECUTE, and the correct data is stored on tape. Go to step 1.

(See Note 1 under LOAD DATA [SF Key 4]).

DELETE [SF Key 17]:
This key allows the operator to delete an entire data set from tape. To use, press CORRECT, then:
DELETE
1. The display reads, "DELETE DATA SET #".
2. Enter the number of the data set to be deleted, press EXECUTE. Go to step 1.

(See Note 1 under LOAD DATA [SF Key 4]).

LOAD DATA [SF Key 4]:
This key is the exit key after transformations are specified. When this key is pressed, data from the tape is read and a specified model is fit.

Note 1: The use of the CORRECT [SF Key 18] or DELETE [SF Key 17] only changes data stored on tape and will not correct data stored in memory. To correct data in memory, press LOAD DATA [SF Key 4]. This will call data from the tape and store the data in memory. If it is desired to have a list of the data as stored on tape, press SINGLE [SF Key 1], specify that the data be printed, the total number of variables and when the display reads, "VAR #, T CODE, V, C", press LOAD DATA [SF Key 4].

TRANSFORMATIONS:

There are three types of transformations allowed for user convenience. These are:

1. COMPLEX TRANSFORMATIONS [SF Key 4]:
   This key permits more than one transformation on individual variables. If, for example, it is desired to square input variable 3; multiply by input variable 2; and enter this product as a variable, it would require two transformations and, hence, is complex. For this type of transformation, each variable entering the model must be specified, including the dependent variable which is the highest numbered variable.

2. SINGLE TRANSFORMATIONS [SF Key 1]:
   This key permits, at most, one transformation to be performed on any variable. The highest numbered variable entering is assumed to be the independent variable.

3. SAME FOR ALL [SF Key 2]:
   This key permits the same transformation to be performed on all independent variables.

Note: When the number of variables is asked for, it includes the dependent variable.

Transformations are accomplished by building a matrix with four code numbers entered by the user. These are in sequence:

1. VAR # The number of the variable entering the model.
2. T Transformation code from Table 1 to specify the transformation to be performed.
3. V The variable upon which the transformation is being performed.
4. C Either a variable number or a constant, depending upon the type of transformation desired.

For transforming all independent variables, only codes 2 and 4 are entered; for other transformations, all four codes must be entered. For Single Transformations and Complex Transformations, the display will read, "VAR #, T CODE, V, C", while for Same Transformations, the display will read, "T CODE, C", since only the T CODE and C need be entered.

Repeated Transformations on the Same Variable:

If repeated transformations are to be done on a variable, they must be performed sequentially since, in this case, the variable specified by V is the calculated value from a previous transformation.

Example:

If there are seven independent variables and it is desired to fit a model of the form:

$$y = b_0 + b_1x_1 + b_2(x_1x_2x_6)/x_4 + b_3x_5$$

the transformations required are:

VAR #	T	V	C
1	0	1	0
2	9	2	1
2	9	2	6
2	10	2	4
3	0	5	0

Then transformations will allow the specified model to be fit.

Limitations:

A maximum of 12 independent variables may be entered, and a maximum of a combination of 15 transformations and variables may be entered.

TABLE 1

Transformation Codes:

VAR #	T	V	C	Description:
J	0	V	0	Relabel variable V, entering it as variable J
J	1	V	C	Add constant C to variable V and enter as variable J
J	2	V	C	Multiply variable V by constant C and enter as variable J
J	3	V	C	Divide variable V by constant C and enter as variable J
J	4	V	C	Raise constant C to variable V power and enter as variable J
J	5	V	C	Raise variable V to constant C power
J	6	V	0	Take natural log of variable V and enter as variable J
J	7	V	C	Add variable V and variable C and enter as variable J
J	8	V	C	Subtract variable C from variable V and enter as variable J
J	9	V	C	Multiply variable V by variable C and enter as variable J
J	10	V	C	Divide variable V by variable C and enter as variable J
J	11	V	C	Raise variable V to variable C power and enter as variable J
J	12	V	0	Enter exp(variable V) as variable J
J	13	V	0	Take logarithm to base 10 of variable V and enter as variable J
J	14	0	0	Delete variable J

EXAMPLE

```
    MULTIPLE LINEAR REGRESSION EXAMPLE


      MULTIPLE LINEAR REGRESSION


NUMBER OF IND VAR= 3
DEPENDENT VAR=Y= X( 4    )
   I         Y          X(  1)       X(  2)       X(  3)

   1       3.0000       5.0000       1.0000       8.0000

   2       4.2000       2.0000       1.5000       9.0000

   3       4.5000       1.0000       1.6000       1.0000

   4       6.0000       7.0000       2.0000       4.0000

   5       6.5000       9.0000       2.1000      12.0000

   6       8.4000       4.0000       2.5000       2.0000


VAR          MEAN          VARIANCE
X(  1)       4.6667        9.0667
X(  2)       1.7833        0.2777
X(  3)       6.0000       18.8000
X(  4)       5.4333        3.7147


CORRELATION MATRIX
       1       2       3       4
   1  1.000

   2  0.324   1.000

   3  0.536  -0.254   1.000

   4  0.340   0.987  -0.251   1.000
```

```
MULTIPLE CORRELATION=  0.9756

                AOV

SOURCE  DF       SS            MS              F

TOTAL    5     18.5733
REG      3     18.1203       6.0401       26.6655
 X(  1)  1      2.1475        2.1475        9.4805
 X(  2)  1     15.9647       15.9647       70.4803
 X(  3)  1      0.0081        0.0081        0.0358
RESID    2      0.4530        0.2265


COEFFICIENTS
                B(I)     VARIANCE     TVALUE
B( 0) =      -0.9176
B( 1) =       0.0277       0.0103       0.2734
B( 2) =       3.5326       0.2553       6.9914
B( 3) =      -0.0130       0.0047      -0.1893


RESIDUALS
 I          Y          YHAT           RES
  1       3.0000        2.6493        0.3507
  2       4.2000        4.3195       -0.1195
  3       4.5000        4.7493       -0.2493
  4       6.0000        6.2894       -0.2894
  5       6.5000        6.5938       -0.0938
  6       8.4000        7.9987        0.4013

TRANSFORMATIONS
DEPENDENT VAR=YT=XT( 2    )
X(  1),   14.0000     0.0000     0.0000
X(  1),    0.0000     2.0000     0.0000
X(  3),   14.0000     0.0000     0.0000
X(  2),    0.0000     4.0000     0.0000


  I          YT         XT(  1)
  1       3.0000        1.0000
  2       4.2000        1.5000
  3       4.5000        1.6000
  4       6.0000        2.0000
  5       6.5000        2.1000
  6       8.4000        2.5000
```

```
MULTIPLE CORRELATION=  0.9747

                ANOV

SOURCE  DF       SS             MS              F

TOTAL    5     18.5733
REG      1     18.1034      18.1034     154.0830
 X(  1)   1      18.1034      18.1034      154.0830
RESID    4      0.4700       0.1175


COEFFICIENTS
                B(I)     VARIANCE     TVALUE
B( 0) =     -1.0064
B( 1) =      3.6110       0.0846      12.4130


RESIDUALS
 I          Y          YHAT           RES
  1       3.0000        2.6047        0.3953
  2       4.2000        4.4102       -0.2102
  3       4.5000        4.7713       -0.2713
  4       6.0000        6.2157       -0.2157
  5       6.5000        6.5768       -0.0768
  6       8.4000        8.0212        0.3788

DURBIN-WATSON STATISTIC =    1.2774
```

TYPE HEADINGS

```
10 DIM A[3,15],B[14],C[105],D[6],E[15],F[15]
15 PRINT
20 PRINT "      MULTIPLE LINEAR REGRESSION"
22 PRINT
24 PRINT
30 FORMAT 4F3.0
40 DISP "K=";
50 INPUT K
55 D[5]=D[6]=0
60 PRINT "NUMBER OF IND VAR="K
70 PRINT "DEPENDENT VAR=Y= X("K+1")"
72 PRINT "    I          Y          ";
80 D[1]=K
85 D[2]=D[1]+1
90 T=-INT(-K/4)
100 FOR I=0 TO T-1
110 P=4*(I<T-1)+(K-4*(T-1))*(I=T-1)
120 FOR J=1 TO P
130 S=4*I+J
140 WRITE (15,30)"X("S")      ",
150 NEXT J
160 PRINT
170 IF I=T-1 THEN 190
180 PRINT TAB22;
190 NEXT I
200 FOR I=1 TO 15
210 A[1,I]=I
211 A[2,I]=F[I]=0
216 A[3,I]=I
220 NEXT I
230 FOR I=1 TO 105
240 C[I]=0
250 NEXT I
260 D[4]=0
262 D[3]=1
270 FOR I=1 TO 14
280 B[I]=E[I]=1
290 NEXT I
295 PRINT
300 LINK 3,10,30
```

FILE 3

INPUT DATA

```
10 LINK 5,10,10
12 LINK 5,10,12
```

```
14 LINK 4,10,30
15 LINK 4,10,180
16 LINK 4,10,16
17 LINK 6,10,190
18 LINK 8,10,30
19 LINK 9,10,30
22 LINK 12,10,22
23 LINK 12,10,23
30 FORMAT F4.0,F12.4
40 FORMAT 4F12.4
50 FIND 13
60 P=0
70 DISP "Y=";
80 INPUT B[K+2]
110 WRITE (15,30)D[3],B[K+2];
120 FOR I=1 TO K
130 DISP "X("I")=";
140 INPUT B[I+1]
160 P=P+1
170 IF ((P=4)+(I=K))=0 THEN 250
180 FOR J=I-P+2 TO I+1
190 WRITE (15,40)B[J];
200 NEXT J
210 PRINT
220 IF I=K THEN 250
230 PRINT TAB16;
240 P=0
250 NEXT I
260 DISP "CORRECTIONS";
270 INPUT X
280 IF X=0 THEN 370
290 DISP "I=";
300 INPUT I
320 DISP "CORRECT VALUE";
330 INPUT B[I+1]
350 WRITE (15,30)"CHANGE X("I") TO"B[I+1]
360 GOTO 260
370 STORE  DATA D[3]+12,B
380 D[3]=D[3]+1
381 R=0
382 FOR L=1 TO D[2]+1
383 FOR P=L TO D[2]+1
384 R=R+1
385 C[R]=C[R]+B[L]*B[P]
386 NEXT P
387 NEXT L
390 PRINT
400 GOTO 60
410 END
```

FILE 4

TRANSFORMATIONS PROG

```
10 LINK 5,10,10
12 LINK 5,10,12
14 GOTO 30
15 GOTO 170
16 GOTO 470
17 GOTO 310
30 FOR I=1 TO 15
40 A[1,I]=0
50 NEXT I
51 PRINT
52 PRINT "TRANSFORMATIONS"
53 D[5]=0
60 DISP "ENT 1 TO PRINT DATA";
70 INPUT D[4]
80 DISP "NUMBER OF VARIABLES";
90 INPUT D[2]
95 PRINT "DEPENDENT VAR=YT=XT("D[2]")"
100 K=1
110 DISP "VAR #,TCODE,C1,C2";
120 INPUT I,A[2,K],A[3,K],F[K]
130 A[1,K]=I
140 WRITE (15,170)"X("I")=",A[2,K],A[3,K],F[K]
150 K=K+1
160 GOTO 110
170 FORMAT F3.0,3F10.4
180 FOR I=1 TO 15
190 A[1,I]=I
200 A[2,I]=0
205 A[3,I]=I
210 NEXT I
211 PRINT
212 PRINT "TRANSFORMATIONS"
213 D[5]=0
220 DISP "ENT 1 TO PRINT DATA";
230 INPUT D[4]
240 DISP "NUMBER OF VARIABLES";
250 INPUT D[2]
255 PRINT "DEPENDENT VAR=YT=XT("D[2]")"
260 DISP "VAR #,TCODE,C1,C2";
270 INPUT I,A[2,I],A[3,I],F[I]
280 WRITE (15,170)"X("I")=","A[2,I],A[3,I],F[I]
290 A[1,I]=I
300 GOTO 260
310 FORMAT 4F3.0
320 IF D[4]=0 THEN 450
```

```
321 PRINT
322 PRINT
330 PRINT "   I          YT        ";
340 T=-INT(-(D[2]-1)/4)
350 FOR I=0 TO T-1
360 P=4*(I<T-1)+(D[2]-1-4*(T-1))*(I=T-1)
370 FOR J=1 TO P
380 S=4*I+J
390 WRITE (15,310)"XT("S")      ";
400 NEXT J
410 PRINT
420 IF I=T-1 THEN 440
430 PRINT TAB22;
440 NEXT I
450 E[1]=1
460 LINK 6,10,190
470 PRINT "TRANSFORM ALL"
480 DISP "ENT 1 TO PRINT DATA";
490 INPUT D[4]
500 DISP "TCODE,C2";
510 INPUT T,C
530 FOR I=1 TO D[2]-1
540 A[1,I]=A[3,I]=I
550 A[2,I]=T
560 F[I]=C
570 NEXT I
580 GOTO 320
590 END
```

FILE 5

BASIC STATISTICS AND CORRELATION MATRIX

```
10 D=0
11 GOTO 30
12 D=1
13 GOTO 30
14 LINK 4,10,30
15 LINK 4,10,170
16 LINK 4,10,16
17 LINK 6,10,190
18 LINK 8,10,30
19 LINK 9,10,30
22 LINK 12,10,22
23 LINK 12,10,23
30 FORMAT F3.0,2F12.4
31 FORMAT F7.0
40 FOR I=1 TO D[2]
50 E[I]=C[I*(D[2]+1-(I-1)/2)+1]
```

```
60 E[I]=(E[I]-(C[I+1]↑2)/C[1])/(C[1]-1)
70 B[I]=C[I+1]/C[1]
80 NEXT I
90 IF D=1 THEN 135
95 PRINT
100 PRINT "VAR          MEAN         VARIANCE"
110 FOR I=1 TO D[2]
120 WRITE (15,30)"X("I")"B[I],E[I]
125 NEXT I
128 DISP "DONE";
130 STOP
135 PRINT
138 PRINT
140 PRINT "CORRELATION MATRIX"
145 T=-INT(-D[2]/7)
150 FOR I=0 TO T-1
160 P=7*(I<T-1)+(D[2]-7*(T-1))*(I=T-1)
170 FOR J=1 TO P
180 S=7*I+J
190 WRITE (15,31)S;
200 NEXT J
210 PRINT
220 IF I=T-1 THEN 250
230 PRINT TAB3;
240 NEXT I
245 PRINT
250 FORMAT F4.0
260 FORMAT 7F7.3
270 P=0
280 FOR I=1 TO D[2]
290 WRITE (15,250)I;
300 FOR J=1 TO I
310 B[J]=C[J*(D[2]-(J-1)/2)+1+I]
320 B[J]=(B[J]-C[I+1]*C[J+1]/C[1])/(C[1]-1)
330 B[J]=B[J]/SQR(E[I]*E[J])
340 P=P+1
350 IF ((P=7)+(J=I))=0 THEN 430
360 FOR L=J-P+1 TO J
370 WRITE (15,260)B[L],
380 NEXT L
390 P=0
400 PRINT
410 IF J=I THEN 430
420 PRINT TAB7;
430 NEXT J
435 PRINT
440 NEXT I
442 PRINT
444 PRINT
450 GOTO 128
```

FILE 6

LOAD DATA FROM TAPE

```
10 LINK 5,10,10
12 LINK 5,10,12
14 LINK 4,10,14
15 LINK 4,10,15
16 LINK 4,10,16
18 LINK 8,10,30
19 LINK 9,10,30
22 LINK 12,10,22
23 LINK 12,10,23
40 FORMAT F3.0,F12.4
50 FORMAT 4F12.4
60 IF D[4]=0 THEN 180
70 WRITE (15,40)K,E[D[2]+1];
80 T=-INT(-(D[2]-1)/4)
90 FOR I=0 TO T-1
100 P=4*(I<T-1)+(D[2]-1-4*(T-1))*(I=T-1)
110 FOR J=1 TO P
120 WRITE (15,50)E[4*I+J+1];
130 NEXT J
140 PRINT
150 IF I=T-1 THEN 170
160 PRINT TAB16;
170 NEXT I
180 GOTO 480
190 E[1]=1
192 D[5]=0
195 FOR J=1 TO 105
200 C[J]=0
210 NEXT J
220 FOR K=1 TO D[3]-1
230 LOAD  DATA 12+K,B
235 D[6]=0
240 IF B[1]=0 THEN 540
250 FOR J=1 TO 13
260 B[J]=B[J+1]
270 NEXT J
280 J=0
290 FOR L=1 TO D[2]
295 J=J+1
300 X=0
310 V=A[1,J]
320 IF A[2,J]=14 THEN 562
330 GOTO 580
340 IF V#A[1,J+1] THEN 400
350 X=1
360 T=B[V]
```

```
370 B[V]=S
380 J=J+1
390 GOTO 320
400 IF X=0 THEN 430
420 B[V]=T
430 E[V+1-D[6]]=S
450 X=0
460 NEXT L
470 GOTO 40
480 FOR P=1 TO D[2]+1
490 FOR L=P TO D[2]+1
500 X=X+1
510 C[X]=E[P]*E[L]+C[X]
520 NEXT L
530 NEXT P
540 NEXT K
550 DISP "ALL DATA IN";
560 STOP
562 D[6]=D[6]+1
564 GOTO 295
580 R=A[3,J]
590 T=F[J]
600 IF A[2,J]>7 THEN 620
610 GOTO A[2,J]+1 OF 630,650,670,690,710,730,750
620 GOTO A[2,J]-6 OF 770,790,810,830,850,870,890
630 S=B[R]
640 GOTO 340
650 S=B[R]+T
660 GOTO 340
670 S=B[R]*T
680 GOTO 340
690 S=B[R]/T
700 GOTO 340
710 S=T↑B[R]
720 GOTO 340
730 S=B[R]↑T
740 GOTO 340
750 S=LOGB[R]
760 GOTO 340
770 S=B[R]+B[T]
780 GOTO 340
790 S=B[R]-B[T]
800 GOTO 340
810 S=B[T]*B[R]
820 GOTO 340
830 S=B[R]/B[T]
840 GOTO 340
850 S=B[R]↑B[T]
860 GOTO 340
870 S=EXP(B[R])
```

```
880 GOTO 340
890 S=LGT(B[R])
900 GOTO 340

    FILE 7

    SQUARE ROOT AND INVERSE OF XX'


10 GOTO 30
20 GOTO 30
30 P=1
40 FOR J=1 TO D[2]
50 C[P]=SQR(C[P])
60 FOR I=1 TO D[2]-J+1
70 C[P+I]=C[P+I]/C[P]
80 NEXT I
90 R=P+I
100 S=R
110 FOR L=1 TO D[2]-J
120 P=P+1
130 FOR M=1 TO D[2]+2-J-L
140 C[R+M-1]=C[R+M-1]-C[P]*C[P+M-1]
150 NEXT M
160 R=R+M-1
170 NEXT L
180 P=S
190 NEXT J
200 T=(D[2]+1)*(D[2]+2)/2
210 FOR I=1 TO D[2]-1
220 T=T-1-I
230 C[T]=1/C[T]
240 FOR J=1 TO D[2]-I
250 P=D[2]+1-I-J
260 P=P+(D[2]+1-(P-1)/2)-I
270 R=P-J
280 S=0
290 U=I+J+1
300 V=P
310 FOR K=1 TO J
320 V=V+U-K
330 S=S-C[R+K]*C[V]
340 NEXT K
350 C[P]=S/C[R]
360 NEXT J
370 NEXT I
380 C[1]=1/C[1]
390 R=0
400 FOR I=1 TO D[2]
410 E[I]=C[I*(D[2]+1-(I-1)/2)]↑2
420 R=R+E[I]
```

```
430 NEXT I
440 T0=C[(D[2]+1)*(D[2]+2)/2]
450 D=(1/C[1])↑2
460 S=(T0-R)/(D-D[2])
470 IF D[5]=2 THEN 490
480 LINK 9,10,30
490 LINK 8,10,30

     FILE 8

     PRINT AOV

10 GOTO 60
14 LINK 4,10,30
15 LINK 4,10,170
16 LINK 4,10,16
18 GOTO 30
19 LINK 9,10,30
20 LINK 9,10,19
21 LINK 9,10,19
22 LINK 12,10,22
23 LINK 12,10,23
30 IF D[5]>0 THEN 60
40 D[5]=2
50 LINK 7,10,10
60 R=0
70 FORMAT F3.0,3F12.4
71 FORMAT F8.4
80 FOR I=1 TO D[2]
90 E[I]=C[I*(D[2]+1-(I-1)/2)]↑2
100 R=R+E[I]
110 NEXT I
130 T0=T0-E[1]
140 R=R-E[1]
141 PRINT
142 PRINT
150 WRITE (15,71)"MULTIPLE CORRELATION="R/T0
160 PRINT
170 PRINT
180 PRINT TAB16,"AOV"
182 PRINT
184 PRINT
190 PRINT "SOURCE  DF     ` SS","MS"," F"
195 PRINT
210 WRITE (15,70)"TOTAL  "D-1,T0
220 R0=R/(D[2]-1)
240 WRITE (15,70)"REG    "D[2]-1,R,R0,R0/S
250 FOR I=2 TO D[2]
260 WRITE (15,70)" X("I-1")   1"E[I],E[I],E[I]/S
```

```
270 NEXT I
280 WRITE (15,70)"RESID  "D-D[2],T0-R,S
290 PRINT
300 PRINT
310 DISP "DONE";
320 STOP
```

FILE 9

PRINT COEFFICIENTS

```
10 GOTO 60
14 LINK 4,10,30
15 LINK 4,10,170
16 LINK 4,10,16
18 LINK 8,10,30
19 GOTO 30
20 LINK 10,10,30
21 LINK 10,10,30
22 LINK 12,10,22
23 LINK 12,10,23
30 IF D[5]>0 THEN 60
40 D[5]=1
50 LINK 7,10,30
60 T=0
70 FOR I=1 TO D[2]
80 B[I]=0
90 FOR J=1 TO D[2]-I+1
100 R=(I+J-1)*(D[2]+1-(I+J-2)/2)
110 B[I]=B[I]+C[T+J]*C[R]
120 NEXT J
130 T=T+J
140 NEXT I
150 T=0
160 FOR I=1 TO D[2]
170 E[I]=0
180 FOR J=1 TO D[2]-I+1
190 E[I]=E[I]+C[T+J]↑2
200 NEXT J
210 T=T+J
220 NEXT I
230 FORMAT F12.4
240 FORMAT F2.0,3F12.4
245 FORMAT F3.0,2F12.4
250 PRINT
260 PRINT
270 PRINT "COEFFICIENTS"
280 PRINT TAB15,"B(I)";"    VARIANCE";"    TVALUE"
290 WRITE (15,230)"B( 0) =",B[1]
```

```
300 FOR I=1 TO D[2]-1
310 T=E[I+1]*S
311 IF T#0 THEN 320
312 WRITE (15,245)"B("I")="B[I+1],T
313 GOTO 330
320 WRITE (15,240)"B("I") ="B[I+1],T,B[I+1]/SQRT
330 NEXT I
340 D[5]=1
365 DISP "DONE";
370 END

     FILE.10

     PRINT RECIDUALS

10 LINK 5,10,10
14 LINK 4,10,30
15 LINK 4,10,180
19 LINK 9,10,30
20 GOTO 30
21 LINK 11,10,30
22 LINK 12,10,22
23 LINK 12,10,23
30 FORMAT F3.0,3F12.4
31 IF D[5]=1 THEN 40
32 DISP "GET COEFFICIENTS";
33 STOP
40 PRINT
50 PRINT
60 PRINT "RESIDUALS"
70 PRINT " I          Y","     YHAT","    RES"
72 FOR J=1 TO D[2]
74 C[J]=B[J]
76 NEXT J
80 FOR I=D[2]+1 TO 105
90 C[I]=0
100 NEXT I
110 D=0
120 E[1]=1
130 FOR K=1 TO D[3]-1
135 D[6]=0
140 LOAD  DATA 12+K,B
150 IF B[1]=0 THEN 450
160 D=D+1
170 FOR J=1 TO 13
180 B[J]=B[J+1]
190 NEXT J
200 J=0
210 FOR M=1 TO D[2]
```

LISTING

```
215 J=J+1
220 X=0
230 V=A[1,J]
240 IF A[2,J]=14 THEN 502
250 GOTO 510
260 IF V#A[1,J+1] THEN 320
270 X=1
280 T=B[V]
290 B[V]=S
300 J=J+1
310 GOTO 240
320 IF X=0 THEN 340
330 B[V]=T
340 E[V+1-D[6]]=S
360 X=0
370 NEXT M
380 Y=C[1]
390 FOR I=2 TO D[2]+1
400 C[D[2]+I-1]=C[D[2]+I-1]+E[I]
410 Y=Y+C[I]*E[I]
420 NEXT I
430 Y=Y-C[D[2]+1]*E[D[2]+1]
440 WRITE (15,30)K,E[D[2]+1],Y,E[D[2]+1]-Y
450 NEXT K
460 FOR I=2 TO D[2]+1
470 C[D[2]+I-1]=C[D[2]+I-1]/D
480 NEXT I
485 D[5]=3
490 DISP "DONE";
500 STOP
502 D[6]=D[6]+1
504 GOTO 215
510 R=A[3,J]
520 T=F[J]
530 IF A[2,J]>7 THEN 550
540 GOTO A[2,J]+1 OF 560,580,600,620,640,660,680
550 GOTO A[2,J]-6 OF 700,720,740,760,780,800,820
560 S=B[R]
570 GOTO 260
580 S=B[R]+T
590 GOTO 260
600 S=B[R]*T
610 GOTO 260
620 S=B[R]/T
630 GOTO 260
640 S=T↑B[R]
650 GOTO 260
660 S=B[R]↑T
670 GOTO 260
680 S=LOGB[R]
```

```
690 GOTO 260
700 S=B[R]+B[T]
710 GOTO 260
720 S=B[R]-B[T]
730 GOTO 260
740 S=B[T]*B[R]
750 GOTO 260
760 S=B[R]/B[T]
770 GOTO 260
780 S=B[R]↑B[T]
790 GOTO 260
800 S=EXP(B[R])
810 GOTO 260
820 S=LGT(B[R])
830 GOTO 260
```

FILE 11

DURBIN-WATSON STATISTIC

```
10 LINK 5,10,10
14 LINK 4,10,30
15 LINK 4,10,180
19 LINK 9,10,30
20 LINK 10,10,30
21 GOTO 30
22 LINK 12,10,22
23 LINK 12,10,23
30 FORMAT F3.0,F12.4
40 FORMAT F10.4
41 IF D[5]=3 THEN 50
42 DISP "GET RESIDUALS";
43 STOP
50 Y=U=0
60 E[1]=1
70 PRINT
80 PRINT
90 FOR K=1 TO D[3]-1
95 D[6]=0
100 LOAD  DATA 12+K,B
110 IF B[1]=0 THEN 470
120 FOR J=1 TO 13
130 B[J]=B[J+1]
140 NEXT J
150 J=0
160 FOR M=1 TO D[2]
165 J=J+1
170 X=0
180 V=A[1,J]
190 IF A[2,J]=14 THEN 492
```

```
200 GOTO 500
210 IF V#A[1,J+1] THEN 270
220 X=1
230 T=B[V]
240 B[V]=S
250 J=J+1
260 GOTO 190
270 IF X=0 THEN 290
280 B[V]=T
290 E[V+1-D[6]]=S
310 X=0
320 NEXT M
330 Z=W=0
340 FOR I=2 TO D[2]
350 Z=(E[I]-C[D[2]+I-1])*C[I]+Z
360 W=(E[I]-C[2*D[2]+I-1])*C[I]+W
370 NEXT I
380 Z=E[I]-C[D[2]+I-1]-Z
390 W=E[I]-C[2*D[2]+I-1]-W
400 Y=Y+Z↑2
410 U=U+W↑2
420 IF K>1 THEN 440
430 U=0
440 FOR I=2 TO D[2]+1
450 C[2*D[2]+I-1]=E[I]
460 NEXT I
470 NEXT K
480 WRITE (15,40)"DURBIN-WATSON STATISTIC ="U/Y
485 DISP "DONE";
490 STOP
492 D[6]=D[6]+1
494 GOTO 165
500 R=A[3,J]
510 T=F[J]
520 IF A[2,J]>7 THEN 540
530 GOTO A[2,J]+1 OF 550,570,590,610,630,650,670
540 GOTO A[2,J]-6 OF 690,710,730,750,770,790,810
550 S=B[R]
560 GOTO 210
570 S=B[R]+T
580 GOTO 210
590 S=B[R]*T
600 GOTO 210
610 S=B[R]/T
620 GOTO 210
630 S=T↑B[R]
640 GOTO 210
650 S=B[R]↑T
660 GOTO 210
670 S=LOGB[R]
```

```
680 GOTO 210
690 S=B[R]+B[T]
700 GOTO 210
710 S=B[R]-B[T]
720 GOTO 210
730 S=B[T]*B[R]
740 GOTO 210
750 S=B[R]/B[T]
760 GOTO 210
770 S=B[R]↑B[T]
780 GOTO 210
790 S=EXP(B[R])
800 GOTO 210
810 S=LGT(B[R])
820 GOTO 210
```

FILE 12

CORRECT DATA ON TAPE

```
10 LINK 5,10,10
12 LINK 5,10,12
14 LINK 4,10,30
15 LINK 4,10,15
16 LINK 4,10,16
17 LINK 4,10,320
22 GOTO 30
23 GOTO 140
30 DISP "CORRECT DATA SET #";
32 FORMAT F2.0,F12.4
40 INPUT T
50 LOAD  DATA 12+T,B
60 DISP "I=?,CORRECT VALUE";
70 INPUT I,B[I+1]
84 PRINT "ON DATA SET"T
86 WRITE (15,32)"  CHANGE X("I") TO"B[I+1]
90 DISP "ENT 1 FOR MORE CORRECTIONS";
100 INPUT X
110 IF X=1 THEN 60
120 STORE  DATA 12+T,B
130 GOTO 30
140 DISP "DELETE DATA SET#";
150 INPUT T
155 PRINT "DELETE DATA SET"T
160 LOAD  DATA 12+T,B
170 B[1]=0
180 STORE  DATA 12+T,B
190 GOTO 140
```

PROGRAM SUBMITTAL INSTRUCTIONS AND FORMS

Program Submittal Instructions

Hewlett-Packard maintains a library of calculator programs available to HP users. New contributed programs are solicited to increase the number of programs available to you and other users.

Each program you submit will be evaluated for possible publication in the HP Keyboard or a program library, or inclusion in the HP Calculator Program Catalog.

Entries in the Calculator Program Catalog are of two types — supported programs from Hewlett-Packard and programs contributed by users. HP compiles but does not test or maintain contributed programs. Maintenance of these programs is the responsibility of the person submitting the program, since he is the most knowledgeable about his entry. Each program will bear either an original date or a revised date indicating a revision or correction.

Contributed programs should be typewritten and completely documented so that other users are able to easily understand and operate them. Most user questions can be obviated by having a person unfamiliar with your program read it and try the numerical example before submitting it. Completion of the Program Submittal Form and inclusion of the listed material and recorded mag cards or cassette will help insure adequately documented, publishable programs. The magnetic cards or cassette can be returned on request. Submittal and user instruction forms are found on the next few pages. Contact the HP sales office in your area if you need additional submittal forms.

Programs may be withdrawn from the Calculator Program Catalog by writing to Hewlett-Packard, and stating the reason for withdrawal, such as when the program is replaced with a redesigned version. Address all correspondence to:

Hewlett-Packard Company
Calculator Products Division
P. O. Box 301
Loveland, Colorado 80537

Attention: Applications Services

Program Submittal Form

Hewlett-Packard Company
Calculator Products Division

1. Initial Submission ☐ Revision ☐

2. Equipment required: _____

3. Program Title: _____

4. Program Description and Application: _____

_____

_____

_____

5. Contributor's Name: _____

Organization: _____ Title: _____

Address: _____

_____

Telephone: _____

6. Do you want your name to appear in the catalog?..... yes ☐ no ☐

7. Do you want your organization's name to appear in the catalog?.. yes ☐ no ☐

8. May an HP customer contact you directly?.....yes ☐ no ☐

9. Check (✓) to be sure each item below is included.

☐ Program introduction, including equations solved and text reference.
☐ User instructions.
☐ Numeric input/output example, including sample plot or printer tape if applicable.
☐ Program listing (including program steps and step codes if applicable).
☐ Recorded magnetic cards or cassette.

Shall we return original recorded cards/cassette ☐ or blank cards/cassette ☐ ?

10. Acknowledgement and Agreement

To the best of my knowledge, this contributed program is free of any proprietary information belonging to any person or organization. I am making this program available to Hewlett-Packard, and I agree that HP may reproduce, publish, and use it, and authorize others to do so without obligation or liability of any kind.

_____ _____

(Signature) (Date)

HEWLETT-PACKARD MODEL 30 STAT PAC

VOLUME 2

Part No. 09830-70825

Printed in U.S.A.
10721M

Scan Copyright ©
The Museum of HP Calculators
www.hpmuseum.org

Original content used with permission.

Thank you for supporting the Museum of HP Calculators by purchasing this Scan!

Please to not make copies of this scan or make it available on file sharing services.