HEWLETT-PACKARD

Decision Analysis (Statistics)

Scientific Software Solutions

SERIES 80

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PROGRAM DESCRIPTION I

Program Title Analysis of Variance and F-Ratio

File Name A N A V A R

Contributor's Name

Company *(if applicable)*

Address

City **State/Country**

Zip Code/Mail Code

Machine Size: **16K** ☒ **32K** ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 5,006

Program Description: The program computes an analysis of variance table and F-ratios for a simple Graeco-Latin square design. The user is required to enter the number of treatments, the Latin assignments by row, the Graeco assignments by row, and the value of the data elements for each treatment.

PROGRAM DESCRIPTION II

Sample Problem

Find the F-ratio and an analysis of variance for the following Graeco-Latin square design:

Number of treatments: 4

Latin assignments-Row 1: 1, 2, 3, 4
-Row 2: 4, 1, 2, 3
-Row 3: 3, 4, 1, 2
-Row 4: 2, 3, 4, 1

Graeco assignments-Row 1: 4, 3, 2, 1
-Row 2: 3, 2, 1, 4
-Row 3: 2, 1, 4, 3
-Row 4: 1, 4, 3, 2

Data-Row 1: 24, 47, 35, 42
-Row 2: 47, 85, 23, 47
-Row 3: 65, 49, 23, 62
-Row 4: 12, 14, 19, 23

SOLUTION:

```
LOAD "ANAVAR".
RUN.
```

Enter input data as prompted.

ITEM	SUM-SQR
ROWS	2940.1875
COLS	1258.1875
TREAT 'L'	39.6875
TREAT 'G'	1564.1875
ERROR	579.6875

ITEM	DEG. FREE.
ROWS	3.0000
COLS	3.0000
TREAT 'L'	3.0000
TREAT 'G'	3.0000
ERROR	3.0000

ITEM	MEAN-SQR
ROWS	980.0625
COLS	419.3958
TREAT 'L'	13.2292
TREAT 'G'	521.3958
ERROR	193.2292

ITEM	F-RATIO
ROWS	5.0720
COLS	2.1705
TREAT 'L'	.0685
TREAT 'G'	2.6983
ERROR	

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PROGRAM DESCRIPTION III

Operating Limits and Warnings Maximum treatment is 10. In order to increase the number of allowable data elements, add a DIM statement for the variables M, N, R, C, T, and G.

Reference(s)

Variables:

Name	Description	Length	Comments
M(,)	Latin assignments		
N(,)	Graeco assignments		
N	Number of treatments		
S	Sum of treatments		
SØ	Sum of squares of treatments		
R( )	Sum of observations in each row		
C( )	Sum of observations in each column		
T( )	Sum of Latin assignments		
G( )	Sum of Graeco assignments		
X	Input treatments		
S3	Used in treatment 'G' computations		
S4	Used in row computations		
S5	Used in column computations		
S6	Used in treatment 'L' computations		
C	Preliminary calculations		
D1,D2	Degrees of freedom		
S7	Error SS		
S8	Used in mean square and f-ratio computations		
K1 - K5	Used in outputting table		
I,J,B3	Internal looping		
X9$	Table headings		

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USER INSTRUCTIONS

STEP	INSTRUCTIONS
1	LOAD "ANAVAR" and press RUN.
2	Enter number of treatments.
3	Enter the Latin assignments, Graeco assignments, and data by row.
4	Results will be displayed.

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PROGRAM LISTING

Listing

```
 10 REM **********
 20 REM * ANAVAR *
 30 REM **********
 40 OPTION BASE 1
 50 DIM M(10,10),N(10,10),Q$[9]
 60 REM
 70 REM ************************
 80 REM * PUT DIMENSIONS HERE *
 90 REM * IF NECESSARY        *
100 REM ************************
110 REM
120 FOR I=1 TO 10
130 FOR J=1 TO 10
140 M(I,J)=0 @ N(I,J)=0
150 NEXT J @ NEXT I
160 CLEAR @ DISP
170 REM ***************
180 REM * DESCRIPTION *
190 REM ***************
200 DISP TAB(12);"STAT16" @ DISP
     @ DISP @ DISP
210 DISP "This program computes
    an"
220 DISP "analysis of variance t
    able"
230 DISP "and F-ratios for a sim
    ple"
240 DISP "Graeco-Latin square de
    sign."
250 DISP @ DISP @ DISP "Press 'E
    NDLINE' to continue";@ INPUT
     Q$@ CLEAR
260 DISP "Enter the number of tr
    eatments";
270 INPUT N
280 DISP @ DISP @ DISP
290 DISP "Values for each treatm
    ent"
300 DISP "Will be entered by row
    s." @ DISP @ DISP @ DISP "Pr
    ess 'ENDLINE' to continue";@
     INPUT Q$@ CLEAR
310 DISP "Enter Latin assignment
    s by row."
320 FOR I=1 TO N
330 DISP "ROW #";I
340 DISP "----------------------
    ----------"
350 FOR J=1 TO N
360 DISP "TREATMENT #";J;
370 INPUT M(I,J)
380 NEXT J
390 CLEAR
400 NEXT I
410 CLEAR
420 DISP "Enter Graeco assignmen
    ts by row."
430 FOR I=1 TO N
440 DISP "ROW #";I
450 DISP "----------------------
    ----------"
```

Comments

Insert dimensions if necessary

Description

Data entry

PROGRAM LISTING

Listing

```
460 FOR J=1 TO N
470 DISP "TREATMENT #";J;
480 INPUT N(I,J)
490 DISP
500 NEXT J
510 CLEAR
520 NEXT I
530 CLEAR
540 S=0 @ S0=0
550 FOR I=1 TO 10
560 R(I)=0 @ C(I)=0 @ T(I)=0 @ G
    (I)=0
570 NEXT I @ DISP "Now enter dat
    a for ..."
580 FOR I=1 TO N
590 DISP "ROW #";I @ DISP "-----
    --------------------------"
600 FOR J=1 TO N
610 DISP "TREATMENT #";J;
620 INPUT X
630 DISP
640 R(I)=R(I)+X @ C(J)=C(J)+X
650 T(M(I,J))=T(M(I,J))+X
660 G(N(I,J))=G(N(I,J))+X
670 S=S+X
680 S0=S0+X*X
690 NEXT J
700 CLEAR
710 NEXT I
720 CLEAR
730 S3=0 @ S4=0 @ S5=0 @ S6=0
740 DISP "WORKING ... Please wai
    t ..."
750 FOR I=1 TO N
760 S4=S4+R(I)^2
770 S5=S5+C(I)^2
780 S6=S6+T(I)^2
790 S3=S3+G(I)^2
800 NEXT I
810 C=S*S/N/N
820 S4=S4/N-C
830 S5=S5/N-C
840 S6=S6/N-C
850 S3=S3/N-C
860 D1=N-1
870 D2=D1*(N-3)
880 S7=S0-C-S4-S5-S6
890 S7=S7-S3
900 S8=S7/D2
910 CLEAR
920 FOR B3=1 TO 3 @ BEEP @ WAIT
    250 @ NEXT B3
930 K1=S4 @ K2=S5 @ K3=S6 @ K4=S
    3 @ K5=S7
940 X9$="SUM-SQR" @ GOSUB 1040
950 K1=D1 @ K2=D1 @ K3=D1 @ K4=D
    1 @ K5=D2
960 X9$="DEG. FREE." @ GOSUB 104
    0
970 K1=S4/D1 @ K2=S5/D1 @ K3=S6/
    D1 @ K4=S3/D1 @ K5=S8
```

Comments

Summations

Calculations
Sum of squares

Degrees of freedom

F-ratio calculation

Output

PROGRAM LISTING

Listing **Comments**

```
980 X9$="MEAN-SQR" @ GOSUB 1040
990 K1=S4/D1/S8 @ K2=S5/D1/S8 @
    K3=S6/D1/S8 @ K4=S3/D1/S8 @
    K5=0
1000 X9$="F-RATIO" @ GOSUB 1040
1010 DISP "END OF EXECUTION"
1020 DISP @ DISP @ DISP @ DISP
1030 STOP
1040 DISP "ITEM";TAB(13);X9$
1050 DISP "----------------------
     -----------"                    Table headings
1060 DISP "ROWS";TAB(12);
1070 DISP USING 1200 ; K1
1080 DISP "COLS";TAB(12);
1090 DISP USING 1200 ; K2
1100 DISP "TREAT 'L'";TAB(12);
1110 DISP USING 1200 ; K3
1120 DISP "TREAT 'G'";TAB(12);
1130 DISP USING 1200 ; K4
1140 DISP "ERROR";TAB(12);
1150 IF X9$="F-RATIO" THEN 1170
1160 DISP USING 1200 ; K5
1170 DISP "----------------------
     -----------"
1180 DISP @ DISP "Press 'ENDLINE
     ' to continue";@ INPUT Q$@
     CLEAR
1190 RETURN
1200 IMAGE MDDDD.DDDD
1210 END
```

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Kruskal-Wallis One-Way Anova

File Name K R U W A L

Contributor's Name

Company *(if applicable)*

Address

City **State/Country**

Zip Code/Mail Code

Machine Size: **16K** ☒ **32K** ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 12,858

Program Description: The Kruskal-Wallis one-way analysis of variance by ranks is an extremely useful non-parametric test for deciding whether K independent samples are from different populations. The Kruskal-Wallis technique tests the null hypothesis that the K samples came from the same population or from identical populations with respect to averages. You must enter data in the form of a table having K columns. Each column represents one set, or sample, from a total of N observations.

PROGRAM DESCRIPTION II

Sample Problem

Test the following samples, using the Kruskal-Wallis technique, to decide whether they are from different populations:

Number of samples: 8

Number of observations per sample are: 10, 8, 10, 8, 6, 4, 6, 4

#1: 2, 2.8, 3.3, 3.2, 4.4, 3.6, 1.9, 3.3, 2.8, 1.1

#2: 3.5, 2.8, 3.2, 3.5, 2.3, 2.4, 2, 1.6

#3: 3.3, 3.6, 2.6, 3.1, 3.2, 3.3, 2.9, 3.4, 3.2, 3.2

#4: 3.2, 3.3, 3.2, 2.9, 3.3, 2.5, 2.6, 2.8

#5: 2.6, 2.6, 2.9, 2, 2, 2.1

#6: 3.1, 2.9, 3.1, 2.5

#7: 2.6, 2.2, 2.2, 2.5, 1.2, 1.2

#8: 2.5, 2.4, 3, 1.5

SOLUTION:

```
LOAD "KRUWAL".
RUN.
```

Enter input data as prompted.

```
RANKED SCORES                                    RANKED SCORES
 1        2        3        4                    5        6        7        8
-------------------------------------------------------------------------------
 8.5      52.5     47.5     41                   23       36       23       18.5
 27.5     27.5     54.5     47.5                 23       31.5     12.5     15.5
 47.5     41       23       41                   31.5     36       12.5     34
 41       52.5     36       31.5                 8.5      18.5     18.5     4
 56       14       41       47.5                 8.5      0        2.5      0
 54.5     15.5     47.5     18.5                 11       0        2.5      0

 6        8.5      31.5     23                   0        0        0        0
 47.5     5        51       27.5                 0        0        0        0
 27.5     0        41       0                    0        0        0        0
 1        0        41       0                    0        0        0        0


NUMBER OF NUMBERS IN COLUMN                      NUMBER OF NUMBERS IN COLUMN
 10       8        10       8                    6        4        6        4

SUM OF NUMBERS IN COLUMN                         SUM OF NUMBERS IN COLUMN
 317      216.5    414      277.5                105.5    122      71.5     72

                The value to be compared with
                Chi-Square is 18.46389411


                Degrees of freedom = 7
```

PROGRAM DESCRIPTION III

Operating Limits and Warnings Maximum number of sample sets is 8. Maximum number of observations for any sample set cannot exceed 39.

Reference(s)

Variables:

Name	Description	Length	Comments
A(,)	Observations		
B(,)	Stores answers		
D( )	Number of numbers in columns, sum of number in columns		
E( )	Ranked scores		
B	Preliminary summation statistic		
T1,T2,T3	Preliminary calculations for H		
K	Number of sample sets (columns)		
O( )	Number of observations for each sample set		
Y	Sample set with the most observations		
X	Temporary storage		
N	Total number of observations		
X3,X7,X8	Counters		
X5	Temporary storage		
X9	Temporary storage for E( )		
H	Number to compare to chi-square		
I1	Counter and index		
I2,X2,X1,X4	Internal looping and index		
I	Internal looping		
Q$	User interaction		

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USER INSTRUCTIONS

STEP	INSTRUCTIONS
1	LOAD "KRUWAL" and press RUN.
2	INITIALIZING is displayed, and takes about 30 seconds.
3	Enter input data as prompted.
4	Results will be displayed.

PROGRAM LISTING

Listing

```
 10 REM **********
 20 REM * KRUWAL *
 30 REM **********
 40 DIM Q$[9]
 50 DIM A(42,8),B(42,8),D(60),E(
    60)
 60 CLEAR @ DISP TAB(12);"KRUWAL
    " @ DISP @ DISP @ DISP @ DIS
    P
 70 DISP "Do you want instructio
    ns (Y/N)";@ INPUT Q$[1,8]@ C
    LEAR
 80 IF UPC$(Q$[1,1])="N" THEN 29
    0
 90 REM ****************
100 REM * INSTRUCTIONS *
110 REM ****************
120 DISP "         KRUSKAL - WALL
    IS        "
130 DISP "  ONE WAY ANALYSIS OF
    VARIANCE"
140 DISP @ DISP @ DISP "The Krus
    kal-Wallis one way      anal
    ysis of variance by ranks is
    "
150 DISP "an extremely useful no
    n-" @ DISP "parametric test
    for deciding"
160 DISP "whether K independent
    samples   are from different
     populations."
170 DISP @ DISP @ DISP @ DISP "P
    ress 'ENDLINE' to continue";
    @ INPUT Q$@ CLEAR
180 DISP "The Kruskal-Wallis tec
    hnique    tests the null hyp
    othesis that"
190 DISP "the K samples came fro
    m the samepopulation or from
     identical"
200 DISP "populations with respe
    ct to     averages."
210 DISP @ DISP @ DISP @ DISP "P
    ress 'ENDLINE' to continue";
    @ INPUT Q$@ CLEAR
220 DISP "You must enter data in
     the form of a table having
    K columns     (maximum of 8)
    ."
230 DISP @ DISP "Each column rep
    resents one set, or sample,
    from a total of N    observa
    tions."
240 DISP @ DISP "The number of o
    bservations per  sample must
     not exceed 39."
250 DISP @ DISP @ DISP @ DISP "P
    ress 'ENDLINE' to continue";
    @ INPUT Q$@ CLEAR
260 REM ****************
```

Comments

Instructions

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing	Comments
270 REM * INITIALIZATION *	
280 REM **********	Initialization
290 DISP "INITIALIZING"	
300 T=0 @ T1=0 @ T2=0 @ T3=0	
310 FOR I=1 TO 60 @ D(I)=0 @ E(I)=0 @ NEXT I	
320 FOR I=1 TO 42 @ FOR I1=1 TO 8	
330 A(I,I1)=0 @ B(I,I1)=0 @ NEXT I1 @ NEXT I	
340 CLEAR	
350 REM **********	
360 REM * ENTER DATA *	Data entry
370 REM **********	
380 DISP "Enter the number of sample sets";	
390 INPUT K	
400 CLEAR	
410 IF K<=0 OR K>8 THEN 380	
420 I1=1	
430 FOR I=1 TO K	
440 DISP "ENTER NUMBER OF OBSERVATIONS"	
450 DISP "Sample Set #";I	
460 INPUT O(I)	
470 DISP	
480 NEXT I	
490 CLEAR	
500 Y=0	
510 FOR I=1 TO K	
520 X=O(I)	
530 IF X>Y THEN Y=X	
540 NEXT I @ O(K+1)=Y	
550 FOR I=1 TO K	
560 I1=I1+1	
570 DISP "SAMPLE SET #";I	
580 DISP "----------"	
590 FOR I2=1 TO O(I)	
600 DISP "Observation #";I2	
610 INPUT A(I2,I)	
620 I1=I1+1	
630 DISP	
640 NEXT I2	
650 CLEAR	
660 NEXT I	
670 CLEAR	
680 DISP "WORKING ..... Please wait ....."	
690 REM **********	
700 REM * CALCULATIONS *	
710 REM **********	Calculations
720 I1=I1-1	
730 N=I1-K	
740 X3=0	
750 FOR X2=1 TO K	
760 FOR X1=1 TO 40	
770 IF A(X1,X2)=0 THEN 810	
780 X3=X3+1	
790 D(X3)=A(X1,X2)	

PROGRAM LISTING

Listing	Comments
800 NEXT X1	
810 NEXT X2	
820 FOR X4=1 TO N	
830 IF D(X4)>D(X4+1) THEN 860	
840 NEXT X4	
850 GOTO 900	
860 X5=D(X4)	
870 D(X4)=D(X4+1)	
880 D(X4+1)=X5	
890 GOTO 820	
900 FOR X1=1 TO N	
910 D(X1)=D(X1+1)	Ranked scores
920 E(X1)=X1	
930 NEXT X1	
940 D(N+1)=0 @ E(N+1)=0	
950 X7=0	
960 X7=X7+1	
970 IF X7>=N THEN 1090	
980 IF D(X7)=D(X7+1) THEN 1000	
990 GOTO 960	
1000 X8=X7	
1010 X8=X8+1	
1020 IF D(X8)=D(X8+1) THEN 1010	
1030 X9=X7-1+((X8-X7+1)/2+.5)	
1040 FOR J=X7 TO X8	
1050 E(J)=X9	
1060 NEXT J	
1070 X7=X8	
1080 GOTO 960	
1090 FOR X1=1 TO K	
1100 FOR X2=1 TO 40	
1110 IF A(X2,X1)=0 THEN 1170	
1120 FOR X3=1 TO N+1	
1130 IF A(X2,X1)=D(X3) THEN 1150	
1140 NEXT X3	
1150 B(X2,X1)=E(X3)	Answers stored in B
1160 NEXT X2	
1170 NEXT X1	
1180 FOR X1=1 TO K	
1190 FOR X2=1 TO 40	
1200 IF B(X2,X1)=0 THEN 1230	
1210 B(41,X1)=B(41,X1)+B(X2,X1)	
1220 NEXT X2	
1230 NEXT X1	
1240 X=0	
1250 T=0	
1260 X=X+1	
1270 IF X>=N THEN 1420	
1280 IF D(X)=D(X+1) THEN 1260	
1290 FOR X1=1 TO K	
1300 FOR X2=1 TO 40	
1310 IF A(X2,X1)=0 THEN 1340	
1320 IF A(X2,X1)=D(X) THEN 1360	
1330 NEXT X2	
1340 NEXT X1	
1350 GOTO 1380	
1360 GOTO 1390	
1370 GOTO 1330	
1380 IF T=1 THEN 1250	
1390 T1=T^3-T	

PROGRAM LISTING

Listing **Comments**

```
1400 T3=T3+T1
1410 GOTO 1250
1420 IF T3=0 THEN 1450
1430 T2=1-T3/(N^3-N)
1440 GOTO 1460
1450 T2=1-0/(N^3-N)
1460 B=0
1470 FOR J=1 TO K
1480 FOR G=1 TO 40
1490 IF B(G,J)=0 THEN 1510
1500 NEXT G
1510 B(40,J)=G-1
1520 NEXT J
1530 FOR J=1 TO K
1540 B=B+B(41,J)^2/B(40,J)                  Summation statistic
1550 NEXT J
1560 REM ********************
1570 REM * VALUE TO COMPARE *               Number to compare with chi-square
1580 REM * TO CHI-SQUARE    *
1590 REM ********************
1600 H=12/(N*(N+1))*B-3*(N+1)
1610 H=H/T2
1620 FOR B5=1 TO 5 @ BEEP @ WAIT
      500 @ NEXT B5
1630 CLEAR
1640 DISP "Do you wish to see th
     e ranked   scores (Y/N)";
1650 INPUT Q$[1,8]
1660 IF UPC$(Q$[1,1])="N" THEN 2
     230
1670 Z=0
1680 REM ********************
1690 REM * CHECK ARRAY SIZE *              Check array size
1700 REM ********************
1710 IF K<=4 THEN 1750
1720 DISP "Because of the no. of
      samples   and the screen l
     imitations the"
1730 DISP "program can only show
      you the   first four at a
     time, and then  the remaind
     er."
1740 DISP @ DISP @ DISP @ DISP "
     Press 'ENDLINE' to continue
     ";@ INPUT Q$@ CLEAR
1750 CLEAR
1760 FOR J=1 TO K
1770 Z=MAX(Z,B(40,J))
1780 NEXT J
1790 R=MIN(K,4)
1800 R1,R2=1
1810 REM ******************
1820 REM * RANKED SCORES *                 Ranked scores
1830 REM ******************
1840 DISP "RANKED SCORES"
1850 FOR I=R1 TO R
1860 DISP TAB(R2);I;
1870 R2=R2+8
1880 NEXT I
1890 DISP "----------------------
     -----------"
```

PROGRAM LISTING

Listing

```
1900 I=0
1910 FOR X1=1 TO Z
1920 I=I+1
1930 R2=1
1940 FOR X2=R1 TO R
1950 DISP TAB(R2);B(X1,X2);
1960 R2=R2+8
1970 NEXT X2
1980 DISP
1990 REM ******************
2000 REM * CHECK FOR FULL *
2010 REM * SCREEN         *
2020 REM ******************
2030 IF I/6=INT(I/6) THEN GOSUB
     2320
2040 NEXT X1
2050 R2=1
2060 DISP @ DISP "NUMBER OF NUMB
     ERS IN COLUMN"
2070 FOR X2=R1 TO R
2080 DISP TAB(R2);B(40,X2);
2090 R2=R2+8
2100 NEXT X2
2110 DISP @ DISP @ DISP "SUM OF
     NUMBERS IN COLUMN"
2120 R2=1
2130 FOR X2=R1 TO R
2140 DISP TAB(R2);B(41,X2);
2150 R2=R2+8
2160 NEXT X2
2170 GOSUB 2320
2180 IF R=K THEN 2230
2190 R=K
2200 R1=5
2210 R2=1
2220 GOTO 1840
2230 CLEAR @ DISP "The value to
     be compared with   Chi-Squa
     re is";H
2240 DISP @ DISP @ DISP "Degrees
      of freedom =";K-1
2250 DISP @ DISP @ DISP "Do you
     wish to review data (Y/N)";
2260 INPUT Q$[1,8]
2270 CLEAR
2280 IF UPC$(Q$[1,1])="Y" THEN 1
     630
2290 DISP "END OF EXECUTION"
2300 DISP @ DISP @ DISP @ DISP
2310 STOP
2320 DISP @ DISP "Press 'ENDLINE
     ' to continue";@ INPUT Q$@
     CLEAR
2330 RETURN
2340 END
```

Comments

Check for full screen

Number of numbers per column

Sum of numbers per column

Output answer

Degrees of freedom

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Three Factorial Analysis of Variance

File Name A N O V A 3

Contributor's Name

Company *(if applicable)*

Address

City **State/Country**

Zip Code/Mail Code

Machine Size: **16K** ☒ **32K** ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 12,671

Program Description: This program computes an analysis of variance for an experiment with three factors. Each factor may have up to eight levels. The number of observations for each cell must be the same. The printout consists of a table listing sum of squares, mean squares, and F-ratios, for Factor 1, Factor 2, Factor 3, and the various interactions. You must enter the number of levels in each factor and the number of observations in each block, followed by the observations.

PROGRAM DESCRIPTION II

Sample Problem

Factor 1 = 2 Factor 2 = 2
Factor 3 = 3 # observations = 6
Enter data as follows:

$DATA_{1,1,1}$ = 27, 22, 45, 18, 76, 33
$DATA_{1,1,2}$ = 31, 37, 52, 45, 86, 66
$DATA_{1,1,3}$ = 55, 62, 76, 85, 104, 126
$DATA_{1,2,1}$ = 55, 40, 81, 50, 36, 70
$DATA_{1,2,2}$ = 77, 76, 98, 68, 42, 104
$DATA_{1,2,3}$ = 132, 104, 96, 70, 89, 142

$DATA_{2,1,1}$ = 61, 39, 76, 60, 46, 59
$DATA_{2,1,2}$ = 61, 71, 82, 92, 103, 105
$DATA_{2,1,3}$ = 140, 122, 99, 92, 68, 101
$DATA_{2,2,1}$ = 88, 92, 95, 103, 51, 73
$DATA_{2,2,2}$ = 100, 120, 120, 131, 89, 76
$DATA_{2,2,3}$ = 142, 150, 96, 105, 80, 125

SOLUTION:

```
LOAD "ANOVA3".
RUN.
```

Enter input data as prompted.

	SUM OF SQUARES
FACTOR 1	7667.347222
FACTOR 2	23630.027778
FACTOR 3	9730.125
FCT1 x FCT2	136.194443
FCT1 x FCT3	8.680556
FCT2 x FCT3	751.749999
FCT1 x 2 x 3	223.694448
W/GROUP	28769.499998
TOTAL	70917.319444

	MEAN SQUARE
FACTOR 1	7667.347222
FACTOR 2	11815.013889
FACTOR 3	9730.125
FCT1 x FCT2	68.0972215
FCT1 x FCT3	8.680556
FCT2 x FCT3	375.8749995
FCT1 x 2 x 3	111.847224
W/GROUP	479.491666633

	DEGREES OF FREEDOM
FACTOR 1	1
FACTOR 2	2
FACTOR 3	1
FCT1 x FCT2	2
FCT1 x FCT3	1
FCT2 x FCT3	2
FCT1 x 2 x 3	2
W/GROUP	60
TOTAL	71

	F-RATIO
FACTOR 1	15.9905745095
FACTOR 2	24.6407074641
FACTOR 3	20.2925841617
FCT1 x FCT2	.142019614185
FCT1 x FCT3	1.81036639509E-2
FCT2 x FCT3	.783903090828
FCT1 x 2 x 3	.23326208104

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PROGRAM DESCRIPTION III

Operating Limits and Warnings Maximum rows, columns, layers = 8, or maximum of 200 observation cells.

Reference(s)

Variables:

Name	Description	Length	Comments
X(,)	Stores summations for calculations		
L	Number of levels in factor 1 (layers)		
R	Number of levels in factor 2 (rows)		
C	Number of levels in factor 3 (columns)		
N	Number of observations in each block		
C1	SS of x		
K1	Totals squares of sum of x/N		
Z1	Summation calculation for columns		
O1	Summation calculation for rows		
P1	Summation calculation for levels (layers)		
Q1	Summation calculation for rows * columns		
R1	Summation calculation for layers * rows		
S1	Summation calculation for columns * layers		
T1	Calculates rows * columns * layers		
N1	Total number of numbers to be input		

PROGRAM DESCRIPTION III

Variables:

Name	Description	Length	Comments
F,F2	Indices for X(,)		
X	Used to input observations		
C2	Square of total sum/N1		
T	Total SS		
B	Preliminary calculation for T1		
W	Error within groupon (SS)		
D1 - D9	Degrees of freedom		
M1 - M8	Calculations for mean square		
F1 - F7	Calculations for F-ratio		
I,J,K,M	Internal looping and indexing		
Q$	User interaction		

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USER INSTRUCTIONS

STEP	INSTRUCTIONS
1	LOAD "ANOVA3" and press RUN.
2	Enter number of levels for factors 1, 2, and 3.
3	Enter number of observations per cell.
4	Enter data for observations as prompted.
5	Results will be displayed.

PROGRAM LISTING

Listing **Comments**

```
 10 REM **********
 20 REM * ANOVA3 *
 30 REM **********
 40 DIM X(9,81),Q$[9]
 50 CLEAR @ DISP TAB(12);"ANOVA3
    " @ DISP @ DISP @ DISP @ DIS
    P
 60 DISP "Do you want instructio
    ns (Y/N)";@ INPUT Q$[1,8]
 70 IF UPC$(Q$[1,1])="N" THEN 27
    0
 80 CLEAR
 90 REM ****************
100 REM * INSTRUCTIONS *                Instructions
110 REM ****************
120 DISP "This program computes
    an"
130 DISP "analysis of variance f
    or an"
140 DISP "experiment with 3 fact
    ors."
150 DISP @ DISP "It will handle
    up to an"
160 DISP "8 x 8 x 8 analysis."
170 DISP @ DISP "The number of o
    bservations for"
180 DISP "each block must be the
     same."
190 DISP @ DISP @ DISP "Press 'E
    NDLINE' to continue";@ INPUT
     Q$
200 CLEAR @ DISP "You are requir
    ed to enter the   following
    data:"
210 DISP @ DISP "1.  Number of l
    evels in Factor 1"
220 DISP "2.  Number of levels i
    n Factor 2"
230 DISP "3.  Number of levels i
    n Factor 3"
240 DISP "4.  Number of observat
    ions in       each block."
250 DISP @ DISP @ DISP
260 DISP @ DISP "Press 'ENDLINE'
     to continue";@ INPUT Q$
270 CLEAR
280 REM **************
290 REM * ENTER DATA *                 Data entry
300 REM **************
310 DISP "Number of levels in Fa
    ctor 1";
320 INPUT L
330 DISP @ DISP "Number of level
    s in Factor 2";
340 INPUT R
350 DISP @ DISP "Number of level
    s in Factor 3";
360 INPUT C
370 CLEAR @ DISP "Number of obse
    rvations";
```

PROGRAM LISTING

Listing	Comments
380 INPUT N	
390 DISP @ DISP @ DISP "You will be entering" @ DISP L*R*C*N;" numbers."	
400 DISP @ DISP "Press 'ENDLINE' to continue";@ INPUT Q$@ CLEAR	
410 REM ******************	
420 REM * INITIALIZATION *	Initialization
430 REM ******************	
440 FOR I=0 TO 9	
450 FOR J=0 TO 81	
460 X(I,J)=0	
470 NEXT J	
480 NEXT I	
490 C1=0 @ K1=0 @ M1=0 @ O1=0 @ P1=0 @ Q1=0 @ R1=0 @ S1=0 @ T1=0	
500 N1=N*R*C*L	
510 F=(C+1)*L	
520 FOR K=0 TO L-1	
530 FOR I=1 TO R	
540 FOR J=1 TO C	
550 F2=K*(C+1)	
560 FOR M=1 TO N	
570 DISP TAB(13);"LEVELS" @ DISP "------------------------------"	
580 DISP "FACTOR 1 FACTOR 2 FACTOR 3"	
590 DISP TAB(3);K+1;TAB(15);I;TAB(27);J	Enter observations
600 DISP @ DISP "ENTER OBSERVATION #";M;	
610 INPUT X	
620 CLEAR	
630 C1=C1+X^2	
640 X(I,F2+J)=X(I,F2+J)+X	
650 NEXT M	
660 X(I,F+J)=X(I,F+J)+X(I,F2+J)	
670 K1=K1+X(I,F2+J)^2/N	
680 NEXT J	
690 NEXT I	
700 NEXT K	
710 REM *****************	
720 REM * CALCULATIONS *	Calculations
730 REM *****************	
740 FOR K=0 TO L	
750 FOR I=1 TO R	
760 FOR J=1 TO C	
770 F2=K*(C+1)	
780 X(R+1,F2+J)=X(R+1,F2+J)+X(I,F2+J)	
790 X(I,F2+C+1)=X(I,F2+C+1)+X(I,F2+J)	
800 X(R+1,F2+C+1)=X(R+1,F2+C+1)+X(I,F2+J)	
810 NEXT J	
820 NEXT I	
830 NEXT K	

PROGRAM LISTING

Listing	Comments
840 FOR K=0 TO L	Summation statistics
850 F2=K*(C+1)	
860 FOR I=1 TO R+1	
870 FOR J=1 TO C+1	
880 NEXT J	
890 NEXT I	
900 NEXT K	
910 C2=X(R+1,F+C+1)^2/N1	
920 T=C1-C2	
930 B=K1-C2	
940 W=T-B	
950 FOR I=1 TO R	
960 M1=M1+X(I,F+C+1)^2/(N1/R)	Columns
970 NEXT I	
980 M1=M1-C2	
990 FOR J=1 TO C	
1000 O1=O1+X(R+1,F+J)^2/(N1/C)	Rows
1010 NEXT J	
1020 O1=O1-C2	
1030 FOR K=0 TO L-1	
1040 F2=K*(C+1)	
1050 P1=P1+X(R+1,F2+C+1)^2/(N1/L)	Layers
1060 NEXT K	
1070 P1=P1-C2	
1080 FOR I=1 TO R	
1090 FOR J=1 TO C	
1100 Q1=Q1+X(I,J+F)^2/(N1/(R*C))	Rows * Columns
1110 NEXT J	
1120 NEXT I	
1130 Q1=Q1-M1-O1-C2	
1140 FOR K=0 TO L-1	
1150 F2=K*(C+1)	
1160 FOR I=1 TO R	
1170 R1=R1+X(I,F2+C+1)^2/(N1/(L*R))	Layers * Rows
1180 NEXT I	
1190 FOR J=1 TO C	
1200 S1=S1+X(R+1,F2+J)^2/(N1/(C*L))	Columns * Layers
1210 NEXT J	
1220 NEXT K	
1230 R1=R1-P1-M1-C2	
1240 S1=S1-O1-P1-C2	
1250 T1=B-M1-O1-P1-Q1-R1-S1	Rows * Layers * Columns
1260 D1=R-1	
1270 D2=C-1	
1280 D3=L-1	
1290 D4=D1*D2	Degrees of freedom
1300 D5=D1*D3	
1310 D6=D2*D3	
1320 D7=D1*D2*D3	
1330 D8=R*C*L*(N-1)	
1340 D9=N1-1	
1350 Z1=M1	Mean square calculations
1360 M1=M1/D1	
1370 M2=O1/D2	
1380 M3=P1/D3	
1390 M4=Q1/D4	
1400 M5=R1/D5	

PROGRAM LISTING

Listing **Comments**

```
1410 M6=S1/D6
1420 M7=T1/D7
1430 M8=W/D8                                  F-ratio calculations
1440 F1=M1/M8
1450 F2=M2/M8
1460 F3=M3/M8
1470 F4=M4/M8
1480 F5=M5/M8
1490 F6=M6/M8
1500 F7=M7/M8
1510 REM ****************                     Source table
1520 REM * SOURCE TABLE *
1530 REM ****************
1540 REM ******************                   SS (Sum of squares)
1550 REM * SUM OF SQUARES *
1560 REM ******************
1570 DISP "                    SUM OF
     SQUARES"
1580 DISP "--------------------
     -----------"
1590 DISP "FACTOR 1";TAB(14);Z1
1600 DISP "FACTOR 2";TAB(14);01
1610 DISP "FACTOR 3";TAB(14);P1
1620 DISP "FCT1 x FCT2";TAB(14);
     Q1
1630 DISP "FCT1 x FCT3";TAB(14);
     R1
1640 DISP "FCT2 x FCT3";TAB(14);
     S1
1650 DISP "FCT1 x 2 x 3";TAB(14)
     ;T1
1660 DISP "W/GROUP";TAB(14);W
1670 DISP "--------------------
     -----------"
1680 DISP "TOTAL";TAB(14);T
1690 DISP @ DISP "Press 'ENDLINE
     ' to continue";@ INPUT Q$@
     CLEAR
1700 REM **********************           Degrees of freedom
1710 REM * DEGREES OF FREEDOM *
1720 REM **********************
1730 DISP "                  DEGREES
     " @ DISP "                 OF
     FREEDOM"
1740 DISP "--------------------
     -----------"
1750 DISP "FACTOR 1";TAB(14);D1
1760 DISP "FACTOR 2";TAB(14);D2
1770 DISP "FACTOR 3";TAB(14);D3
1780 DISP "FCT1 x FCT2";TAB(14);
     D4
1790 DISP "FCT1 x FCT3";TAB(14);
     D5
1800 DISP "FCT2 x FCT3";TAB(14);
     D6
1810 DISP "FCT1 x 2 x 3";TAB(14)
     ;D7
1820 DISP "W/GROUP";TAB(14);D8
1830 DISP "--------------------
     -----------"
```

PROGRAM LISTING

Listing

Comments

```
1840 DISP "TOTAL";TAB(14);D9
1850 DISP @ DISP "Press 'ENDLINE
     ' to continue";@ INPUT Q$@
     CLEAR
1860 REM ***************
1870 REM * MEAN SQUARE *
1880 REM ***************
1890 DISP "                  MEAN SQ
     UARE"
1900 DISP "-------------------
     -----------"
1910 DISP "FACTOR 1";TAB(14);M1
1920 DISP "FACTOR 2";TAB(14);M2
1930 DISP "FACTOR 3";TAB(14);M3
1940 DISP "FCT1 x FCT2";TAB(14);
     M4
1950 DISP "FCT1 x FCT3";TAB(14);
     M5
1960 DISP "FCT2 x FCT3";TAB(14);
     M6
1970 DISP "FCT1 x 2 x 3";TAB(14)
     ;M7
1980 DISP "W/GROUP";TAB(14);M8
1990 DISP @ DISP @ DISP "
     Press 'ENDLINE' to continue
     ";@ INPUT Q$@ CLEAR
2000 REM ************
2010 REM * F-RATIO *
2020 REM ************
2030 DISP "                  F-RATIO
     "
2040 DISP "-------------------
     -----------"
2050 DISP "FACTOR 1";TAB(14);F1
2060 DISP "FACTOR 2";TAB(14);F2
2070 DISP "FACTOR 3";TAB(14);F3
2080 DISP "FCT1 x FCT2";TAB(14);
     F4
2090 DISP "FCT1 x FCT3";TAB(14);
     F5
2100 DISP "FCT2 x FCT3";TAB(14);
     F6
2110 DISP "FCT1 x 2 x 3";TAB(14)
     ;F7
2120 DISP @ DISP @ DISP "Do you
     want to run again (Y/N)";@
     INPUT Q$[1,8]
2130 CLEAR
2140 IF UPC$(Q$[1,1])="Y" THEN 3
     10
2150 DISP "END OF EXECUTION"
2160 DISP @ DISP @ DISP
2170 END
```

Mean square

F-ratio

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Regression/Correlation

File Name R E G C O R

Contributor's Name

Company *(if applicable)*

Address

City **State/Country**

Zip Code/Mail Code

Machine Size: **16K** ☒ **32K** ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 11,693

Program Description: This program performs simple regression and correlation analysis on a series of observations of the values of two variables. The correlation coefficient between the variables is computed, and up to four regression equations are estimated, using the method of least-squares. You must enter the total number of observations, followed by the data that corresponds to each variable.

PROGRAM DESCRIPTION II

Sample Problem

		Variable #1	Variable #2
13 observations --	# 1	1	.3
	# 2	2	.6
	# 3	3	2.3
	# 4	4	4.1
	# 5	5	4.2
	# 6	6	4.3
	# 7	7	4.3
	# 8	8	5.2
	# 9	9	7.2
	#10	10	9.1
	#11	11	11.2
	#12	12	12.4
	#13	13	12.9

SOLUTION:

```
LOAD "REGCOR".
RUN.
```

Enter input data as prompted.

```
AVERAGE VALUE FOR:
---------------------------------
   Variable 1 =        7.000
   Variable 2 =        6.008


STANDARD DEVIATION FOR:
---------------------------------
   Variable 1 =        3.894
   Variable 2 =        4.235


CORRELATION COEFFICIENT BETWEEN
VAR 1 & 2 =                .971



EQUATION 1
---------------------------------
VAR 2=a+b * VAR 1

       a=-1.381E+000
       b=     1.055


   94.189
% OF THE VARIANCE IN VARIABLE 2
EXPLAINED
```

PROGRAM DESCRIPTION II

```
EQUATION 2
--------------------------------
VAR 2=a+b * LOG(VAR 1)

      a=-2.459E+000
      b=     4.881


   77.802
% OF THE VARIANCE IN VARIABLE 2
EXPLAINED


EQUATION 3
--------------------------------
LOG(VAR 2)=a+b * VAR 1

      a=-4.344E-001
      b=      .262

ALTERNATE FORM
--------------------------------
VAR 2=a*b^(VAR 1)

      a=      .648
      b=     1.300


   70.954
% OF THE VARIANCE IN VARIABLE 2
EXPLAINED

EQUATION 4
--------------------------------
LOG(VAR 2)=a+b * LOG(VAR 1)

      a=-1.106E+000
      b=     1.445

ALTERNATE FORM
--------------------------------
VAR 2=a * (VAR 1)^b

      a=      .331
    1.445


   95.835
% OF THE VARIANCE IN VARIABLE 2
EXPLAINED
```

PROGRAM DESCRIPTION III

Operating Limits and Warnings Maximum of 50 variable pairs

Variables:

Name	Description	Length	Comments
A( )	Stores log of variable 1		
B( )	Stores Y		
X( )	Stores variable 1 for computation		
Y( )	Stores variable 2 for computation		
Z(,)	Variables (input)		
N	Stores Z for computations		
A1,A2	Average values for variables 1 and 2		
D1,D2	Standard deviations for variables 1 and 2		
V1,V2	Variances for variables 1 and 2		
C9	Correlation coefficient between variables		
I9	Intercept ('a' part of equation)		
S9	Slope ('b' part of equation)		
P9	Percent of variance		
A9	Stores average value for variable 2		
Z	Total number of observations		
I1	Counter		
S1	Sums A( )		
S2	Sums B( )		
S3	Sums $A( )^2$		
S4	Sums $B( )^2$		
S5	Sums products A * B		
DØ	Divisor for regression line		
E,S8,S7	Preliminary calculations for P9		
I	Internal looping		
Q$,Q	User interaction		

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USER INSTRUCTIONS

STEP	INSTRUCTIONS
1	LOAD "REGCOR" and press RUN.
2	Enter number of observations.
3	Enter variables 1 and 2 until all observations are filled.
4	Results will be displayed.

PROGRAM LISTING

Listing **Comments**

```
 10 REM **********
 20 REM * REGCOR *
 30 REM **********
 40 DIM A(50),B(50),X(50),Y(50),
    Z(50,2),Q$[9]
 50 CLEAR @ DISP TAB(12);"REGCOR
    " @ DISP @ DISP @ DISP @ DIS
    P
 60 DISP "Do you want instructio
    ns (Y/N)";@ INPUT Q$[1,8]@ C
    LEAR
 70 IF UPC$(Q$[1,1])="N" THEN 45
    0
 80 REM ***************
 90 REM * INSTRUCTIONS *
100 REM ***************
110 DISP "Regression/Correlation
     performs simple analyses on
     a series of"
120 DISP "observations of the va
    lues of   two variables." @
    DISP
130 DISP "The correlation coeffi
    cient"
140 DISP "between the variables
    is" @ DISP "computed, and up
     to four"
150 DISP "regression equations a
    re" @ DISP "estimated using
    the method of   least-square
    s."
160 DISP @ DISP @ DISP "Press 'E
    NDLINE' to continue";@ INPUT
     Q$@ CLEAR
170 DISP "The four equations are
    :" @ DISP
180 DISP "  1. Variable 2=a+b (v
    ar1)" @ DISP @ DISP "  2. Va
    riable 2=a+b (natural"
190 DISP "                    lo
    g of var1)"
200 DISP @ DISP "  3. Natural lo
    g of var2=a+b"
210 DISP "
    (var1)"
220 DISP @ DISP "  4. Natural lo
    g of var2=a+b"
230 DISP "       (natural log of
     var1)"
240 DISP @ DISP @ DISP "Press 'E
    NDLINE' to continue";@ INPUT
     Q$@ CLEAR
250 DISP "If any observation con
    tains a   negative or zero v
    alue of one"
260 DISP "of the variables, the
    equations using the natural
    log of that"
270 DISP "variable are not estim
    ated."
```

Instructions

PROGRAM LISTING

Listing **Comments**

```
280 DISP @ DISP @ DISP @ DISP @
    DISP "Press 'ENDLINE' to con
    tinue";@ INPUT Q$@ CLEAR
290 DISP "Coefficients for each
    equation  are chosen to mini
    mize the"
300 DISP "deviations of the actu
    al values of the quantity to
     the left"
310 DISP "of the equal sign from
     the      estimated values."
320 DISP @ DISP "However, the ex
    tent to which theequation fi
    ts the data is"
330 DISP "indicated by the perce
    ntage of  the variation in v
    ariable 2"
340 DISP "that is explained by t
    he" @ DISP "equation."
350 DISP @ DISP "Press 'ENDLINE'
     to continue";@ INPUT Q$@ CL
    EAR
360 DISP "Equations 3 and 4 are
    presented both in the form a
    lready"
370 DISP "given and in alternate
     forms in which variable 2 i
    s the"
380 DISP "dependent variable."
390 DISP @ DISP "The program als
    o gives the      average val
    ue and standard"
400 DISP "deviation of values fo
    r each    variable."
410 DISP @ DISP @ DISP "Press 'E
    NDLINE' to continue";@ INPUT
     Q$@ CLEAR
420 REM ***************
430 REM * LOAD ARRAY *                Enter observations
440 REM ***************
450 GOSUB 2430
460 CLEAR
470 REM ******************
480 REM * REGRESS VAR2 *
490 REM * ON VAR1       *            Regress Variable 2 on Variable 1
500 REM ******************
510 FOR I=1 TO N
520 A(I)=X(I)
530 B(I)=Y(I)
540 NEXT I
550 GOSUB 2650
560 REM ************************
570 REM * OUTPUT AVERAGE &   *
580 REM * STANDARD DEVIATION *      Output
590 REM ************************
600 CLEAR @ DISP "AVERAGE VALUE
    FOR:"
610 DISP "----------------------
    ----------"
620 DISP "   Variable 1 =";
```

PROGRAM LISTING

Listing

```
630 DISP TAB(18);@ DISP USING 78
    0 ; A1
640 DISP "   Variable 2 =";
650 DISP TAB(18);@ DISP USING 78
    0 ; A2
660 DISP @ DISP @ DISP @ DISP "P
    ress 'ENDLINE' to continue";
    @ INPUT Q$@ CLEAR
670 DISP "STANDARD DEVIATION FOR
    :"
680 DISP "----------------------
    ----------"
690 DISP "   Variable 1 =";
700 DISP TAB(18);@ DISP USING 78
    0 ; D1
710 DISP "   Variable 2 =";
720 DISP TAB(18);@ DISP USING 78
    0 ; D2
730 DISP @ DISP @ DISP @ DISP "P
    ress 'ENDLINE' to continue";
    @ INPUT Q$@ CLEAR
740 DISP "CORRELATION COEFFICIEN
    T BETWEEN"
750 DISP "VAR 1 & 2 =";
760 DISP TAB(18);@ DISP USING 78
    0 ; C9
770 DISP @ DISP @ DISP @ DISP "P
    ress 'ENDLINE' to continue";
    @ INPUT Q$@ CLEAR
780 IMAGE MDDDD.DDD
790 IMAGE MD.DDDE
800 A9=A2
810 CLEAR
820 DISP "EQUATION 1"
830 DISP "----------------------
    ----------"
840 DISP "VAR 2=a+b * VAR 1" @ D
    ISP
850 DISP "      a=";
860 IF I9=0 THEN DISP I9;@ GOTO
    910
870 IF I9>9999 OR I9<.0001 THEN
    900
880 DISP USING 780 ; I9
890 GOTO 910
900 DISP USING 790 ; I9
910 DISP "      b=";
920 IF S9=0 THEN DISP S9;@ GOTO
    970
930 IF S9>9999 OR S9<.0001 THEN
    920
940 DISP USING 780 ; S9
950 GOTO 970
960 DISP USING 790 ; S9
970 DISP @ DISP
980 IF P9=0 THEN DISP P9;@ GOTO
    1030
990 IF P9>9999 OR P9<.0001 THEN
    1020
1000 DISP USING 780 ; P9
```

Comments

Averages

Standard deviations

Correlation coefficient

Equation 1

PROGRAM LISTING

Listing **Comments**

```
1010 GOTO 1030
1020 DISP USING 790 ; P9
1030 DISP "% OF THE VARIANCE IN
     VARIABLE 2 EXPLAINED"
1040 DISP @ DISP @ DISP @ DISP "
     Press 'ENDLINE' to continue
     ";@ INPUT Q$@ CLEAR
1050 REM ********************
1060 REM * REGRESS VAR2 ON *
1070 REM * LOG OF VAR1     *
1080 REM ********************
1090 FOR I=1 TO N
1100 IF X(I)<=0 THEN 1370
1110 A(I)=LOG(X(I))
1120 NEXT I
1130 GOSUB 2650
1140 DISP "EQUATION 2"
1150 DISP "----------------------
     -----------"
1160 DISP "VAR 2=a+b * LOG(VAR 1
     )" @ DISP
1170 DISP "       a=";
1180 IF I9=0 THEN DISP I9 @ GOTO
      1230
1190 IF I9>9999 OR I9<.0001 THEN
      1220
1200 DISP USING 780 ; I9
1210 GOTO 1230
1220 DISP USING 790 ; I9
1230 DISP "       b=";
1240 IF S9=0 THEN DISP S9;@ GOTO
      1290
1250 IF S9>9999 OR S9<.0001 THEN
      1280
1260 DISP USING 780 ; S9
1270 GOTO 1290
1280 DISP USING 790 ; S9
1290 DISP @ DISP
1300 IF P9=0 THEN DISP P9;@ GOTO
      1350
1310 IF P9>9999 OR P9<.0001 THEN
      1340
1320 DISP USING 780 ; P9
1330 GOTO 1350
1340 DISP USING 790 ; P9
1350 DISP "% OF THE VARIANCE IN
     VARIABLE 2 EXPLAINED"
1360 DISP @ DISP @ DISP @ DISP "
     Press 'ENDLINE' to continue
     ";@ INPUT Q$@ CLEAR
1370 REM ********************
1380 REM * REGRESS LOG OF *
1390 REM * VAR 2 ON VAR 1 *
1400 REM ********************
1410 FOR I=1 TO N
1420 A(I)=X(I)
1430 IF Y(I)<=0 THEN 450
1440 B(I)=LOG(Y(I))
1450 NEXT I
1460 GOSUB 2650
```

Regress Variable 2 on Variable 1

Equation 2

Regress LOG (Variable 2) on Variable 1

PROGRAM LISTING

Listing **Comments**

```
1470 GOSUB 3220
1480 DISP "EQUATION 3"
1490 DISP "----------------------
     ----------"
1500 DISP "LOG(VAR 2)=a+b * VAR
     1" @ DISP
1510 DISP "       a=";
1520 IF I9=0 THEN DISP I9;@ GOTO
      1570
1530 IF I9>9999 OR I9<.0001 THEN
      1560
1540 DISP USING 780 ; I9
1550 GOTO 1570
1560 DISP USING 790 ; I9
1570 DISP "       b=";
1580 IF S9=0 THEN DISP S9;@ GOTO
      1630
1590 IF S9>9999 OR S9<.0001 THEN
      1620
1600 DISP USING 780 ; S9
1610 GOTO 1630
1620 DISP USING 790 ; S9
1630 DISP @ DISP @ DISP @ DISP @
      DISP @ DISP "Press 'ENDLIN
     E' to continue";@ INPUT Q$@
      CLEAR
1640 DISP "ALTERNATE FORM" @ DIS
     P "----------------------
     --------"
1650 DISP "VAR 2=a*b^(VAR 1)" @
     DISP
1660 DISP "       a=";
1670 IF EXP(I9)=0 THEN DISP EXP(
     I9);@ GOTO 1720
1680 IF EXP(I9)>9999 OR EXP(I9)<
     .0001 THEN 1710
1690 DISP USING 780 ; EXP(I9)
1700 GOTO 1720
1710 DISP USING 790 ; EXP(I9)
1720 DISP "       b=";
1730 IF EXP(S9)=0 THEN DISP EXP(
     S9);@ GOTO 1780
1740 IF EXP(S9)>9999 OR EXP(S9)<
     .0001 THEN 1770
1750 DISP USING 780 ; EXP(S9)
1760 GOTO 1780
1770 DISP USING 790 ; EXP(S9)
1780 DISP @ DISP
1790 IF P9=0 THEN DISP P9;@ GOTO
      1840
1800 IF P9>9999 OR P9<.0001 THEN
      1830
1810 DISP USING 780 ; P9
1820 GOTO 1840
1830 DISP USING 790 ; P9
1840 DISP "% OF THE VARIANCE IN
     VARIABLE 2 EXPLAINED"
1850 DISP @ DISP @ DISP @ DISP "
     Press 'ENDLINE' to continue
     ";@ INPUT Q$@ CLEAR
```

Equation 3

Alternate to equation 3

PROGRAM LISTING

Listing **Comments**

```
1860 REM ******************
1870 REM * REGRESS LOG OF *
1880 REM * VAR2 ON LOG OF *
1890 REM * VAR1           *
1900 REM ******************
1910 FOR I=1 TO N
1920 IF A(I)<=0 THEN 450
1930 A(I)=LOG(X(I))
1940 NEXT I
1950 GOSUB 2650
1960 GOSUB 3220
1970 DISP "EQUATION 4"
1980 DISP "----------------------
     -----------"
1990 DISP "LOG(VAR 2)=a+b * LOG(
     VAR 1)" @ DISP
2000 DISP "       a=";
2010 IF I9=0 THEN DISP I9;@ GOTO
      2060
2020 IF I9>9999 OR I9<.0001 THEN
      2050
2030 DISP USING 780 ; I9
2040 GOTO 2060
2050 DISP USING 790 ; I9
2060 DISP "       b=";
2070 IF S9=0 THEN DISP S9;@ GOTO
      2120
2080 IF S9>9999 OR S9<.0001 THEN
      2110
2090 DISP USING 780 ; S9
2100 GOTO 2120
2110 DISP USING 790 ; S9
2120 DISP @ DISP @ DISP @ DISP @
      DISP "Press 'ENDLINE' to c
     ontinue";@ INPUT Q$@ CLEAR
2130 DISP "ALTERNATE FORM"
2140 DISP "----------------------
     -----------"
2150 DISP "VAR 2=a * (VAR 1)^b"
     @ DISP
2160 DISP "       a=";
2170 IF EXP(I9)=0 THEN DISP EXP(
     I9);@ GOTO 2230
2180 IF EXP(I9)>9999 OR EXP(I9)<
     .0001 THEN 2210
2190 DISP USING 780 ; EXP(I9)
2200 GOTO 2230
2210 DISP USING 790 ; EXP(I9)
2220 DISP "       b=";
2230 IF S9=0 THEN DISP S9;@ GOTO
      2290
2240 IF S9=0 THEN DISP S9;@ GOTO
      2290
2250 IF S9>9999 OR S9<.0001 THEN
      2280
2260 DISP USING 780 ; S9
2270 GOTO 2290
2280 DISP USING 790 ; S9
2290 DISP @ DISP
2300 IF P9=0 THEN DISP P9;@ GOTO
      2350
```

Regress LOG (Variable 2) on LOG (Variable 1)

Equation 4

Alternate to equation 4

PROGRAM LISTING

Listing

```
2310 IF P9>9999 OR P9<.0001 THEN
      2340
2320 DISP USING 780 ; P9
2330 GOTO 2350
2340 DISP USING 790 ; P9
2350 DISP "% OF THE VARIANCE IN
     VARIABLE 2 EXPLAINED"
2360 DISP @ DISP @ DISP @ DISP "
     Press 'ENDLINE' to continue
     ";@ INPUT Q$@ CLEAR
2370 DISP "Do you want to run ag
     ain (Y/N)";@ INPUT Q$[1,8]
2380 CLEAR
2390 IF UPC$(Q$[1,1])="Y" THEN 4
     50
2400 DISP "END OF EXECUTION"
2410 DISP @ DISP @ DISP @ DISP
2420 STOP
2430 REM **************
2440 REM * ENTER DATA *
2450 REM **************
2460 CLEAR @ DISP "What is the t
     otal number of     observat
     ions";
2470 I1=1
2480 INPUT Z
2490 IF Z<=0 THEN 2460
2500 FOR I=1 TO Z*2 STEP 2
2510 CLEAR @ DISP "OBSERVATION
     # ";I1
2520 DISP "--------------------
     -----------"
2530 DISP "Variable # 1";
2540 INPUT Z(I1,1)
2550 DISP "Variable # 2";
2560 INPUT Z(I1,2)
2570 I1=I1+1
2580 NEXT I
2590 FOR I=1 TO Z
2600 X(I)=Z(I,1)
2610 Y(I)=Z(I,2)
2620 NEXT I
2630 N=Z
2640 RETURN
2650 REM ********************
2660 REM * REGRESS N VALUES *
2670 REM * OF B(I) ON A(I)  *
2680 REM ********************
2690 REM COMPUTE SUMS
2700 S1=0 @ S2=0 @ S3=0 @ S4=0 @
      S5=0
2710 FOR I=1 TO N
2720 S1=S1+A(I)
2730 S2=S2+B(I)
2740 S3=S3+A(I)^2
2750 S4=S4+B(I)^2
2760 S5=S5+A(I)*B(I)
2770 NEXT I
2780 REM ********************
2790 REM * COMPUTE AVERAGE *
```

Comments

Routine to enter data

Routine to Regress N values of B(I) on A(I)

Averages

PROGRAM LISTING

Listing	Comments
2800 REM **********	
2810 A1=S1/N	
2820 A2=S2/N	
2830 REM **********	
2840 REM * COMPUTE VARIANCES *	Variances
2850 REM **********	
2860 V1=(S3-N*A1^2)/(N-1)	
2870 V2=(S4-N*A2^2)/(N-1)	
2880 REM **********	
2890 REM * STANDARD DEVIATION *	Standard deviations
2900 REM **********	
2910 D1=SQR(V1)	
2920 D2=SQR(V2)	
2930 REM **********	
2940 REM * DIVISOR FOR *	Divisor for regression line
2950 REM * REGRESSION LINE *	
2960 REM **********	
2970 D0=N*S3-S1^2	
2980 IF D0#0 THEN 3050	
2990 DISP "Note: Division by ze ro"	
3000 DISP @ DISP "Do you wish to try again or continue"	
3010 DISP "(1=CONTINUE, 2=AGAIN) ";@ INPUT Q@ IF Q=2 THEN 50	
3020 REM **********	
3030 REM * INTERCEPT & SLOPE *	Intercept ('a')
3040 REM **********	Slope ('b')
3050 I9=(S2*S3-S1*S5)/D0	
3060 S9=(N*S5-S1*S2)/D0	
3070 REM **********	
3080 REM * % OF VARIANCE *	Percent of variance explained
3090 REM * EXPLAINED *	
3100 REM **********	
3110 P9=S9^2*V1/V2	
3120 REM **********	
3130 REM * CORR. COEFFICIENT *	Correlation coefficient
3140 REM **********	
3150 IF S9<0 THEN 3190	
3160 C9=SQR(P9)	
3170 P9=100*P9	
3180 GOTO 3210	
3190 C9=SQR(P9)*(-1)	
3200 P9=100*P9	
3210 RETURN	
3220 REM **********	
3230 REM * % OF VARIANCE IN *	
3240 REM * VAR 2 EXPLAINED *	Percent of variance in Variable 2 explained
3250 REM **********	
3260 S8=0 @ S7=0	
3270 FOR I=1 TO N	
3280 E=EXP(I9+S9*A(I))	
3290 S8=S8+(Y(I)-E)^2	
3300 S7=S7+(Y(I)-A9)^2	
3310 NEXT I	
3320 P9=100*(1-S8/S7)	
3330 RETURN	
3340 END	

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Analysis of Covariance

File Name A N C O V

Contributor's Name

Company *(if applicable)*

Address

City **State/Country**

Zip Code/Mail Code

Machine Size: **16K** ☒ **32K** ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 6,216

Program Description: This program computes an analysis of covariance table, F-ratio, and adjusted means for groups of unequal size. It computes the difference between two or more groups of any size that were not matched groups before the beginning of the experimental period. You must enter the number of groups (blocks), the number of observations (treatments) per group, and the observations.

PROGRAM DESCRIPTION II

Sample Problem

Group 1	--	3 observations	x=4,y=6 x=8,y=9 x=14,y=11
Group 2	--	4 observations	x=5,y=5 x=7,y=7 x=12,y=13 x=9,y=12
Group 3	--	5 observations	x=10,y=13 x=8,y=12 x=11,y=16 x=4,y=9 x=7,y=11
Group 4	--	6 observations	x=11,y=11 x=12,y=17 x=8,y=10 x=10,y=13 x=7,y=9 x=10,y=11

SOLUTION:

```
LOAD "ANCOV".
RUN.

Enter input data as prompted.

                BETWEEN   WITHIN  TOTAL
                 GROUPS   GROUPS  ERROR
-------------------------------------------
DEG. OF
FREEDOM=  3          14        17

SUM SQRS
OF X=     8.86       124.75    133.61

SUM XY=   4.08       106.08    110.17

SUM SQRS
OF Y=     39.45      125.05    164.5

                BETWEEN   WITHIN  TOTAL
                 GROUPS   GROUPS  ERROR
-------------------------------------------
ADJ SS Y= 38.82    34.84     73.66

ADJ DF=   3        13        16

MEAN SQR= 12.94    2.68      4.6


F-ratio = 4.83

MEAN ADJ Y( 1 )= 8.71
MEAN ADJ Y( 2 )= 9.65
MEAN ADJ Y( 3 )= 12.81
MEAN ADJ Y( 4 )= 11.03
```

PROGRAM DESCRIPTION III

Operating Limits and Warnings Total of 75 observations can be entered. Large values make table difficult to read due to screen size limitations.

Reference(s) Statistical Methods, by Geroge W. Snedecor, pp. 318-320

Variables:

Name	Description	Length	Comments
Z( )	X,Y observations		
X( )	Sum of X's for each group		
Y( )	Sum of Y's for each group		
C( )	Sum of XY's for each group		
X2	SS of X		
Y2	SS of Y		
C	Sum of XY		
N	Total number of observations		
M1	Total sum of X's		
M2	Total sum of Y's		
B1	Error between groups (SS of X)		
B2	Error between groups (Sum of SY)		
B3	Error between groups (SS of Y)		
D1	Error SS of Y		
E1	Error sum of products XY		

PROGRAM DESCRIPTION III

Variables:

Name	Description	Length	Comments
A	Estimated regression coefficient		
G	Number of groups (blocks)		
N( )	Number of observations (treatments) per group		
I1	Index for calculations		
P2	Sum of squares of X for each group		
S,Y	Observation being computed on		
E	Error of squares of X		
D	Error of products XY		
F	Used in adjusting size of answers in output		
T1	Total error for sum of squares of X		
T3	Total error for sum of squares of Y		
T2	Total error for sum of XY		
J1	Error within groups: SS of X		
J3	Error within groups: SS of Y		
J2	Error within groups: Sum of XY		
A2	Total error (adjusted SS of Y)		
A1	Error within groups (adjusted SS of Y)		
A3	Error between groups (adjusted SS of Y)		
I,I2,J	Internal looping		
Q$	User interaction		

SERIES 80 USERS' LIBRARY

USER INSTRUCTIONS

STEP	INSTRUCTIONS
1	LOAD "ANCOV" and press RUN.
2	Enter the number of groups.
3	Enter number of observations in each group.
4	Enter data for X and Y for each observation.
5	Results will be displayed.

PROGRAM LISTING

Listing **Comments**

```
 10 REM *********
 20 REM * ANCOV *
 30 REM *********
 40 DIM Q$[9],Z(150)
 50 CLEAR @ DISP TAB(12);"ANCOV"
     @ DISP @ DISP
 60 DISP @ DISP @ DISP "Do you n
    eed instructions (Y/N)";@ IN
    PUT Q$[1,8]@ CLEAR
 70 IF UPC$(Q$[1,1])="N" THEN 34
    0
 80 REM ****************
 90 REM * INSTRUCTIONS *
100 REM ****************
110 DISP "This program computes
    an an-"
120 DISP "alysis of covariance t
    able, F-"
130 DISP "ratio and adjusted mea
    ns for    groups of unequal
    size."
140 DISP
150 DISP "It computes the differ
    ence"
160 DISP "between two or more gr
    oups of"
170 DISP "any size that were not
     matched"
180 DISP "groups before the begi
    nning of"
190 DISP "the experimental perio
    d."
200 DISP @ DISP "Press 'ENDLINE'
     to continue";@ INPUT Q$@ CL
    EAR
210 DISP "1.  Enter the number o
    f groups"
220 DISP "    (or blocks)."
230 DISP
240 DISP "2.  Enter the number o
    f observ-"
250 DISP "    ations (or treatme
    nts) per"
260 DISP "    group."
270 DISP
280 DISP "3.  Enter the observat
    ions."
290 DISP @ DISP @ DISP "Press 'E
    NDLINE' to begin        ente
    ring data";@ INPUT Q$@ CLEAR
300 DISP
310 REM ******************
320 REM * INITIALIZATION *
330 REM ******************
340 FOR I=1 TO 9
350 X(I)=0 @ Y(I)=0 @ C(I)=0
360 NEXT I
370 X2=0 @ Y2=0 @ C=0 @ N=0 @ M1
    =0
380 M2=0 @ B1=0 @ B2=0 @ B3=0
```

Instructions

Initialization

PROGRAM LISTING

Listing

```
390 D1=0 @ E1=0
400 REM **************
410 REM * ENTER DATA *
420 REM **************
430 DISP "     ANALYSIS OF COVAR
    IANCE     "
440 DISP @ DISP
450 DISP "Enter the number of gr
    oups";
460 INPUT G
470 CLEAR
480 DISP "Enter number of observ
    ations."
490 FOR I=1 TO G
500 DISP
510 DISP "Group #";I;
520 INPUT N(I)
530 NEXT I
540 CLEAR
550 DISP "Enter data for each gr
    oup."
560 DISP "----------------------
    ----------"
570 I1=1
580 FOR I=1 TO G
590 DISP "GROUP #";I;
600 DISP
610 FOR I2=1 TO N(I)
620 DISP "Observation #";I2
630 DISP "X= ";@ INPUT Z(I1)@ I1
    =I1+1
640 DISP "Y= ";@ INPUT Z(I1)@ I1
    =I1+1
650 NEXT I2
660 CLEAR
670 NEXT I
680 REM ***************
690 REM * CALCULATIONS *
700 REM ***************
710 I1=1
720 FOR I=1 TO G
730 P2=0
740 FOR J=1 TO N(I)
750 X=Z(I1)
760 Y=Z(I1+1)
770 X(I)=X(I)+X
780 Y(I)=Y(I)+Y
790 C(I)=C(I)+X*Y
800 X2=X2+X^2
810 Y2=Y2+Y^2
820 C=C+X*Y
830 P2=P2+X^2
840 I1=I1+2
850 NEXT J
860 N=N+N(I)
870 M1=M1+X(I)
880 M2=M2+Y(I)
890 B1=B1+X(I)^2/N(I)
900 B2=B2+X(I)*Y(I)/N(I)
910 B3=B3+Y(I)^2/N(I)
```

Comments

Data entry

Calculations

Summations for each group

Summations for all groups

PROGRAM LISTING

Listing | Comments

```
920 E=C(I)-X(I)*Y(I)/N(I)
930 D=P2-X(I)^2/N(I)
940 D1=D1+D
950 E1=E1+E
960 NEXT I
970 T1=X2-M1^2/N
980 B1=B1-M1^2/N
990 J1=T1-B1
1000 T3=Y2-M2^2/N
1010 B3=B3-M2^2/N
1020 J3=T3-B3
1030 T2=C-M1*M2/N
1040 B2=B2-M1*M2/N
1050 J2=T2-B2
1060 A2=T3-T2^2/T1
1070 A1=J3-J2^2/J1
1080 A3=A2-A1
1090 REM ******************
1100 REM * ADJUST SIZE OF *
1110 REM * ANSWERS        *
1120 REM ******************
1130 F=1000
1140 IF ABS(INT(X2))>9999 OR ABS
     (INT(Y2))>9999 THEN F=1
1150 IF ABS(INT(X2))>999 OR ABS(
     INT(Y2))>999 THEN F=10
1160 IF ABS(INT(X2))>99 OR ABS(I
     NT(Y2))>99 THEN F=100
1170 DEF FNI(Q) = INT(Q*F+.5)/F
1180 REM ******************
1190 REM * SOLUTION TABLE *
1200 REM ******************
1210 CLEAR
1220 DISP "          BETWEEN  WIT
     HIN TOTAL"
1230 DISP "           GROUPS  GRO
     UPS ERROR"
1240 DISP "--------------------
     -----------"
1250 DISP "DEG. OF"
1260 DISP "FREEDOM=";
1270 DISP TAB(9);FNI(G-1);TAB(17
     );FNI(N-G);TAB(25);FNI(N-1)
1280 DISP
1290 DISP "SUM SQRS"
1300 DISP "OF X=";
1310 DISP TAB(9);FNI(B1);TAB(17)
     ;FNI(J1);TAB(25);FNI(T1)
1320 DISP
1330 DISP "SUM XY=";
1340 DISP TAB(9);FNI(B2);TAB(17)
     ;FNI(J2);TAB(25);FNI(T2)
1350 DISP
1360 DISP "SUM SQRS"
1370 DISP "OF Y=";
1380 DISP TAB(9);FNI(B3);TAB(17)
     ;FNI(J3);TAB(25);FNI(T3)
1390 GOSUB 1650
1400 DISP "          BETWEEN  WIT
     HIN TOTAL"
```

Adjust size of answers to fit screen

Solution table

PROGRAM LISTING

Listing

Comments

```
1410 DISP "           GROUPS  GRO
     UPS ERROR"
1420 DISP "----------------------
     -----------"
1430 DISP "ADJ SS Y=";
1440 DISP TAB(10);FNI(A3);TAB(17
     );FNI(A1);TAB(25);FNI(A2)
1450 DISP
1460 DISP "ADJ DF=";
1470 DISP TAB(10);FNI(G-1);TAB(1
     7);FNI(N-G-1);TAB(25);FNI(N
     -2)
1480 DISP
1490 DISP "MEAN SQR=";
1500 DISP TAB(10);FNI(A3/(G-1));
     TAB(17);FNI(A1/(N-G-1));TAB
     (25);FNI(A2/(N-2))
1510 GOSUB 1650
1520 DISP "F-ratio =";FNI(A3/(G-
     1)/(A1/(N-G-1)))
1530 DISP
1540 A=E1/D1
1550 FOR I=1 TO G
1560 DISP "MEAN ADJ Y(";FNI(I);"
     )=";FNI(Y(I)/N(I)-A*(X(I)/N
     (I)-M1/N))
1570 IF I/6#INT(I/6) AND I#G THE
     N 1590
1580 DISP @ DISP "Press 'ENDLINE
     ' to continue";@ INPUT Q$@
     CLEAR
1590 NEXT I
1600 DISP @ DISP "Do you wish to
      run again (Y/N)";@ INPUT Q
     $[1,8]
1610 CLEAR
1620 IF UPC$(Q$[1,1])="Y" THEN 4
     30
1630 DISP "END OF EXECUTION" @ D
     ISP @ DISP @ DISP @ DISP
1640 STOP
1650 DISP @ DISP "Press 'ENDLINE
     ' to continue";@ INPUT Q$
1660 CLEAR
1670 RETURN
1680 END
```

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Basic Statistics

File Name B A S I C S

Contributor's Name

Company *(if applicable)*

Address

City **State/Country**

Zip Code/Mail Code

Machine Size: **16K** ☒ **32K** ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 5,973

Program Description: This program will find the mean, standard deviation, sample variance, estimated true variance, and standard error of the mean for individual or grouped data sets. You must enter the values for individual data, and the values and their frequencies for grouped data.

PROGRAM DESCRIPTION II

Sample Problem

GROUPED SAMPLE

x-value	freq.
5	1
3	4
6	7
2	11

INDIVIDUAL SAMPLE

1, 5, 4, 2,
6, 7, 4, 7

SOLUTION:

```
LOAD "BASICS".
RUN.

Enter input data as prompted.
```

FOR INDIVIDUAL DATA

```
     1                5
     4                2
     6                7
     4                7

NUMBER OF VALUES  =       8.0000
ARITHMETIC MEAN   =       4.5000
STAND. DEVIATION  =       2.2039
SAMPLE VARIANCE   =       4.2500
EST. TRUE VARIANCE=       4.8571
ST. ERROR MEAN    =        .7792
```

FOR GROUPED DATA SET

```
VALUE                FREQUENCY

 5                   1
 3                   4
 6                   7
 2                   11

NUMBER OF VALUES  =      23.0000
ARITHMETIC MEAN   =       3.5217
STAND. DEVIATION  =       1.8058
SAMPLE VARIANCE   =       3.1191
EST. TRUE VARIANCE=       3.2609
ST. ERROR MEAN    =        .3765
```

PROGRAM DESCRIPTION III

Operating Limits and Warnings Maximum data input: Individual--300, Group--150

Variables:

Name	Description	Length	Comments
A( )	Observations and frequencies		
S1	Sum of observations		
S2	Sum of SS of observations		
Q	Number of inputs (grouped data)		
N	Number of values		
Z	Used for counting and tabbing		
X	Temporary storage for A( )		
M	Frequencies (grouped data)		
Z1	Counter		
A	Arithmetic mean		
V	Sample variance		
V1	Estimated true variance		
V2	Preliminary calculation for standard error		
V3	Standard error of the mean		
D	Standard deviation		
Q	Choice of individual or grouped input		
P1	Counter and index		
P	Internal looping		
A$	Input values (changed to numeric)		
Q$	User interaction		

SERIES 80 USERS' LIBRARY

USER INSTRUCTIONS

STEP	INSTRUCTIONS
1	LOAD "BASICS" and press RUN.
2	Enter data as prompted.
3	Results will be displayed.

PROGRAM LISTING

Listing

```
 10 REM **********
 20 REM * BASICS *
 30 REM **********
 40 DIM A(300),Q$[9],A$[15]
 50 CLEAR @ DISP TAB(12);"BASICS
    " @ DISP @ DISP @ DISP @ DIS
    P
 60 DISP "Do you want instructio
    ns (Y/N)";
 70 INPUT Q$[1,8]
 80 IF UPC$(Q$[1,1])="Y" THEN 81
    0 ELSE GOTO 900
 90 REM ******************
100 REM * TABLE OF INPUT *
110 REM ******************
120 S1,S2=0
130 IF A(1)<>0 THEN 360
140 CLEAR
150 REM ****************
160 REM * GROUPED DATA *
170 REM ****************
180 DISP "       FOR GROUPED DATA
     SET"
190 DISP "----------------------
    ----------"
200 Q=A(2)
210 N=0
220 Z=1
230 DISP "VALUE";TAB(18);"FREQUE
    NCY" @ DISP
240 FOR P=2+1 TO Q STEP 2
250 Z=Z+1
260 X=A(P) @ M=A(P+1)
270 N=N+M @ S1=S1+M*X
280 S2=S2+M*X*X
290 DISP X;TAB(17);M
300 IF P#Q AND P#Q-1 AND Z/6#INT
    (Z/6) THEN 340
310 DISP @ DISP "Press 'ENDLINE'
     to continue";@ INPUT Q$@ CL
    EAR
320 IF P=Q OR P=Q-1 THEN 350
330 DISP "VALUE";TAB(18);"FREQUE
    NCY"
340 NEXT P
350 GOTO 610
360 CLEAR
370 REM ******************
380 REM * INDIVIDUAL DATA *
390 REM ******************
400 DISP "       FOR INDIVIDUAL D
    ATA"
410 DISP "----------------------
    ----------"
420 N=A(1)
430 Z=5
440 Z1=0
450 FOR P=2 TO N+1
460 Z1=Z1+1
470 X=A(P)
```

Comments

Input table

Grouped data

Individual data

PROGRAM LISTING

Listing | Comments

```
480 S1=S1+X
490 S2=S2+X*X
500 DISP TAB(Z);X;
510 IF Z=5 THEN Z=18 @ GOTO 540
520 Z=5
530 DISP
540 IF Z1#14 AND P#N+1 THEN 570
550 DISP @ DISP "Press 'ENDLINE'
     to continue";@ INPUT Q$@ CL
    EAR
560 Z1=0
570 NEXT P
580 REM ****************
590 REM * CALCULATIONS *
600 REM ****************
610 A=S1/N                                  Calculations
620 V=(S2-A*S1)/N
630 V1=V*N/(N-1)
640 V2=V1/N
650 V3=SQR(V2)
660 D=SQR(V1)
670 IMAGE MDDDDDD.DDDD
680 REM ************
690 REM * SOLUTION *
700 REM ************
710 DISP "NUMBER OF VALUES  =";@            Solution
     DISP USING 670 ; N
720 DISP @ DISP "ARITHMETIC MEAN
       =";@ DISP USING 670 ; A
730 DISP @ DISP "STAND. DEVIATIO
    N  =";@ DISP USING 670 ; D
740 DISP @ DISP "SAMPLE VARIANCE
       =";@ DISP USING 670 ; V
750 DISP @ DISP "EST. TRUE VARIA
    NCE=";@ DISP USING 670 ; V1
760 DISP @ DISP "ST. ERROR MEAN
       =";@ DISP USING 670 ; V3
770 DISP @ DISP "Do you want to
    run again (Y/N)";
780 INPUT Q$[1,8]
790 IF UPC$(Q$[1,1])="Y" THEN 90
    0
800 GOTO 1300
810 REM ****************
820 REM * INSTRUCTIONS *
830 REM ****************
840 CLEAR @ DISP "This program c            Instructions
    alculates the"
850 DISP "mean, standard deviati
    on, and  sample variance fo
    r each of"
860 DISP "several sets of indivi
    dual      values or frequenc
    y dist-       ributions."
870 DISP @ DISP @ DISP "The prog
    ram allows you to choosebetw
    een 'INDIVIDUAL' or "
880 DISP "'GROUPED' data." @ DIS
    P @ DISP @ DISP "Press 'ENDL
    INE' to continue";@ INPUT Q$
```

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

```
890 CLEAR
900 REM ***************
910 REM * ENTER DATA *
920 REM ***************
930 CLEAR @ DISP "Do you wish to
     work with grouped or individ
    ual values." @ DISP
940 DISP "1=GROUPED   2=INDIVIDU
    AL ";@ INPUT Q
950 IF Q#1 AND Q#2 THEN CLEAR @
    GOTO 940
960 ON Q GOTO 970,1160
970 REM ****************
980 REM * GROUPED DATA *
990 REM ****************
1000 A(1)=0 @ P1=3 @ CLEAR
1010 DISP "        GROUPED DATA I
     NPUT"
1020 DISP "----------------------
     -----------"
1030 DISP "Type 'E' to end data
     entry" @ DISP @ DISP "Enter
      value";
1040 DISP
1050 INPUT A$[1,14]
1060 IF UPC$(A$[1,1])="E" THEN 1
     140
1070 A(P1)=VAL(A$)
1080 P1=P1+1
1090 DISP @ DISP
1100 DISP "Frequency of value";
1110 INPUT A(P1)
1120 P1=P1+1
1130 CLEAR @ GOTO 1030
1140 P1=P1-1 @ A(2)=P1
1150 GOTO 120
1160 REM ******************
1170 REM * INDIVIDUAL DATA *
1180 REM ******************
1190 P1=2 @ CLEAR
1200 DISP "      INDIVIDUAL DATA
     INPUT" @ DISP "------------
     --------------------"
1210 DISP "Type 'E' to end data
     entry" @ DISP @ DISP "ENTER
      VALUE";
1220 DISP
1230 INPUT A$[1,14]
1240 IF UPC$(A$[1,1])="E" THEN 1
     280
1250 A(P1)=VAL(A$)
1260 P1=P1+1
1270 CLEAR @ GOTO 1210
1280 P1=P1-2 @ A(1)=P1
1290 GOTO 120
1300 CLEAR @ DISP "END OF EXECUT
     ION"
1310 DISP @ DISP @ DISP @ DISP
1320 END
```

Comments

Data entry

Grouped data

Individual data

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Confidence Limits

File Name B I C O N F

Contributor's Name

Company *(if applicable)*

Address

City **State/Country**

Zip Code/Mail Code

Machine Size: **16K** ☒ **32K** ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 2,591

Program Description: Determines the confidence limits for a population based on the exact binomial distribution. You must enter the number of successes, the sample size, and the confidence coefficient as a percent. For some sets of data, the program takes a few minutes to run. It will beep when the answers have been computed.

PROGRAM DESCRIPTION II

Sample Problem

A polling agency makes a sample of 200 voters in a certain city and it is found that 110 of these people intend to vote for Candidate A. Therefore, the best estimate that can be made from this sample is that 55 percent of the entire population intends to vote for Candidate A.

If the agency wants to publish a prediction, with a 95% chance that they will be correct that the actual percentage of the entire population will be within certain bounds, what limits should they choose.

Successes = 110 Sample size = 200 Confidence coefficient (%) = 95

SOLUTION:

LOAD "BICONF".
RUN.

Enter input data as prompted.

```
The best estimate of population
proportion (%) is: 55


The 95 % confidence limits
on the population proportion are

     Lower = 47.8249

     Upper = 62.0247
```

PROGRAM DESCRIPTION III

Variables:

Name	Description	Length	Comments
Q	Proportion of failures		
CØ	Conversion for confidence coefficient		
GØ	Standard deviation		
X	Preliminary calculation for log function		
X1	Sums logs		
QØ	Proportion of failures		
P1	Preliminary calculation for confidence interval statistic		
P2	Upper limit calculation for confidence interval		
T	Final limit for summation routine		
Y	Number of successes		
J	Increment for testing size of Z statistic		
Z	Standard normal percentage point		
L	Lower confidence limit		
U	Upper confidence limit		
G	Standard deviation		
S	Initial limit for summation routine		
F	Exponential calculation		
F1	Preliminary calculation for exponential function		
N	Sample size		
C	Confidence coefficient		
PØ	Proportion of successes		
P	Temporary storage for limits		
B5,I	Internal looping		
Q$	User interaction		

SERIES 80 USERS' LIBRARY

USER INSTRUCTIONS

STEP	INSTRUCTIONS
1	LOAD "BICONF" and press RUN.
2	Enter the number of 'successes'.
3	Enter the size of the sample.
4	Enter the confidence coefficient in % (not decimal).
5	Results will be displayed.

PROGRAM LISTING

Listing **Comments**

```
 10 REM **********
 20 REM * BICONF *
 30 REM **********
 40 DIM Q$[9]
 50 CLEAR
 60 REM ****************
 70 REM * INSTRUCTIONS *
 80 REM ****************
 90 DISP TAB(12);"BICONF" @ DISP
    @ DISP
100 DISP "This program determine
    s the     confidence limits
    for a pop-"
110 DISP "ulation based on the e
    xact      binomial distribut
    ion."
120 DISP @ DISP "You must enter
    the number of     successes,
    the sample size, and"
130 DISP "the confidence coeffic
    ient as a percent."
140 DISP @ DISP "Press 'ENDLINE'
     to continue";@ INPUT Q$@ CL
    EAR
150 DEF FNA(V) = .0001*INT(.5+10
    00000*V)
160 CLEAR
170 REM ***************
180 REM * ENTER DATA *
190 REM ***************
200 DISP "Number of successes";
210 INPUT Y
220 DISP
230 DISP "Sample size";
240 INPUT N
250 DISP
260 DISP "Confidence coefficient
    ";
270 INPUT C
280 CLEAR
290 DISP "WORKING ... Please wai
    t ..."
300 REM ****************
310 REM * CALCULATIONS *
320 REM ****************
330 P0=Y/N
340 Q0=1-P0
350 G0=6*SQR(P0*Q0/N)
360 P1=P0-G0
370 IF P1>0 THEN 390
380 P1=0
390 P1=.1*INT(10*P1)
400 P2=P0+G0
410 IF P2<1 THEN 430
420 P2=1
430 P2=1-.1*INT(10-10*P2)
440 C0=.005*(100-C)
450 P=P1
460 T=Y-1
470 J=0
```

Instructions

Data entry

Calculations

Standard deviation

PROGRAM LISTING

Listing **Comments**

```
480 J=J-1
490 IF J=-7 THEN 550
500 P=P+10^J
510 GOSUB 930
520 IF 1-Z<C0 THEN 500
530 P=P-10^J
540 GOTO 480
550 L=P
560 P=P2
570 T=Y
580 J=0
590 J=J-1
600 IF J=-7 THEN 660
610 P=P-10^J
620 GOSUB 930
630 IF Z<C0 THEN 610
640 P=P+10^J
650 GOTO 590
660 U=P
670 FOR B5=1 TO 5 @ BEEP @ WAIT
    125 @ NEXT B5
680 CLEAR
690 REM ************
700 REM * SOLUTION *
710 REM ************
720 DISP "The best estimate of p
    opulation proportion (%) is:
    ";
730 DISP FNA(Y/N)
740 DISP @ DISP
750 DISP "The";C;"% confidence l
    imits"
760 DISP "on the population prop
    ortion are"
770 DISP @ DISP TAB(5);"Lower ="
    ;
780 DISP FNA(L)
790 DISP @ DISP TAB(5);"Upper ="
    ;
800 DISP FNA(U)
810 DISP @ DISP @ DISP "Do you w
    ish to run again (Y/N)";
820 INPUT Q$[1,8]
830 CLEAR
840 IF UPC$(Q$[1,1])="Y" THEN 16
    0
850 DISP "END OF EXECUTION"
860 DISP @ DISP @ DISP @ DISP
870 STOP
880 REM ********************
890 REM * ROUTINE TO FIND *
900 REM * STANDARD NORMAL *
910 REM * % POINTS (Z).   *
920 REM ********************
930 Q=1-P
940 G=6*SQR(P*Q*N)
950 S=INT(N*P-G)
960 IF S>0 THEN 1010
970 S=0
980 X=1
```

Determine lower confidence limit

Determine upper confidence limit

Solution

Subroutine to determine standard normal percentage points (Z)

PROGRAM LISTING

Listing	Comments
990 X1=LOG(X)	
1000 GOTO 1060	
1010 X=P*N/S	
1020 X1=LOG(X)	
1030 FOR I=1 TO S-1	
1040 X1=X1+LOG(P)+LOG(N-I)-LOG(S -I)	
1050 NEXT I	
1060 F1=X1+(N-S)*LOG(Q)	
1070 F=EXP(F1)	
1080 Z=F	
1090 FOR I=S+1 TO T	
1100 F=F*P*(N-I+1)/(Q*I)	
1110 Z=Z+F	Z determined
1120 NEXT I	
1130 RETURN	
1140 END	

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Correlation Coefficient

File Name C O R R E L

Contributor's Name

Company *(if applicable)*

Address

City **State/Country**

Zip Code/Mail Code

Machine Size: **16K** ☒ **32K** ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 3,666

Program Description: This program computes the correlation coefficient for two sets of data having an equal number of elements in each set. You must enter the number of data elements in each set (i.e., the number of X,Y pairs) and then the X and Y values.

PROGRAM DESCRIPTION II

Sample Problem

Data Set #	X	Y
1	1	5
2	2	3
3	3	0
4	4	-5
5	5	-11

SOLUTION:

```
LOAD "CORREL".
RUN.

Enter input data as prompted.


    THE CORRELATION
    COEFFICIENT =          -.9782
```

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION III

Operating Limits and Warnings Maximum number of data sets must not exceed 100.

Reference(s)

Variables:

Name	Description	Length	Comments
A	Number of data pairs		
X(I)	First value		
Y(I)	Second value		
D	Numerator for correlation coefficient		
B	Denominator for correlation coefficient		
S1	Sum of X's		
S2	Sum of Y's		
S3	Sum of products XY		
S4	SS X (Sum of squares of X)		
S5	SS Y (Sum of squares of Y)		
I	Internal looping		
Q$	User interaction		

SERIES 80 USERS' LIBRARY

USER INSTRUCTIONS

STEP	INSTRUCTIONS
1	LOAD "CORREL" and press RUN.
2	Enter number of data sets.
3	Enter X and Y until all sets are entered.
4	Results will be displayed.

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing **Comments**

```
 10 REM **********
 20 REM * CORREL *
 30 REM **********
 40 DIM X(100),Y(100),Q$[9]
 50 CLEAR
 60 DISP TAB(12);"CORREL" @ DISP
     @ DISP @ DISP
 70 REM ****************                Instructions
 80 REM * INSTRUCTIONS *
 90 REM ****************
100 DISP "This program computes
    the cor-  relation coefficie
    nt for two"
110 DISP "sets of data having an
     equal    number of elements
     in each set."
120 DISP @ DISP "You must enter
    the number of    data elemen
    ts in each set"
130 DISP "(i.e., the number of X
    , Y pairs)"
140 DISP "and then the X and Y v
    alues." @ DISP @ DISP "Press
     'ENDLINE' to continue";
150 INPUT Q$
160 CLEAR
170 REM ***************              Data entry
180 REM * ENTER DATA *
190 REM ***************
200 DISP "Number of data element
    s" @ DISP "(maximum of 100)"
    ;
210 INPUT A
220 IF A>100 OR A<=0 THEN 160
230 CLEAR
240 DISP "ENTER EACH SET OF DATA
    " @ DISP "-----------------
    --------------"
250 FOR I=1 TO A
260 DISP "Set #";I
270 DISP "X =";
280 INPUT X(I)
290 DISP
300 DISP "Y =";
310 INPUT Y(I)
320 DISP @ DISP
330 NEXT I
340 REM ****************             Calculations
350 REM * CALCULATIONS *
360 REM ****************
370 S1,S2,S3,S4,S5=0
380 FOR I=1 TO A                     Summations
390 S1=S1+X(I)
400 S2=S2+Y(I)
410 S3=S3+X(I)*Y(I)
420 S4=S4+X(I)*X(I)
430 S5=S5+Y(I)*Y(I)
440 NEXT I
450 CLEAR @ DISP @ DISP
460 REM **********
```

PROGRAM LISTING

Listing

```
470 REM * OUTPUT *
480 REM **********
490 DISP "THE CORRELATION"
500 DISP "COEFFICIENT = ";
510 D=A*S3-S1*S2
520 B=SQR((A*S4-S1^2)*(A*S5-S2^2
    ))
530 IMAGE MDDDDDDD.DDDD
540 DISP USING 530 ; D/B
550 DISP @ DISP
560 DISP "Do you wish to see the
     data      pairs (Y/N)";
570 INPUT Q$[1,8]
580 IF UPC$(Q$[1,8])="N" THEN 71
    0
590 CLEAR
600 REM **********************
610 REM * TABLE OF X,Y PAIRS *
620 REM **********************
630 DISP TAB(2);"X";TAB(16);"Y"
    @ DISP "--------------------
    ------------"
640 FOR I=1 TO A
650 DISP TAB(1);X(I);TAB(15);Y(I
    )
660 IF A<=10 THEN 700
670 IF I/8#INT(I/8) OR I=A THEN
    700
680 DISP @ DISP "Press 'ENDLINE'
     to continue";@ INPUT Q$@ CL
    EAR
690 DISP TAB(2);"X";TAB(16);"Y"
    @ DISP "--------------------
    ------------"
700 NEXT I
710 DISP "Do you wish to run aga
    in (Y/N)";@ INPUT Q$[1,8]
720 CLEAR
730 IF UPC$(Q$[1,1])="Y" THEN 16
    0
740 DISP "END OF EXECUTION"
750 DISP @ DISP @ DISP @ DISP
760 END
```

Comments

Output

Table of X,Y pairs

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Pooled Mean and Standard Deviation

File Name P M S D E V

Contributor's Name

Company *(if applicable)*

Address

City **State/Country**

Zip Code/Mail Code

Machine Size: **16K** ☒ **32K** ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 2,268

Program Description: This program calculates the pooled mean and standard deviation for up to 30 groups using the mean and standard deviation of the individual groups as input. All data is entered while the program is running.

PROGRAM DESCRIPTION II

Sample Problem

Group #	# of Cases	Mean	Std. Dev.
1	20	32.5	5.67
2	15	28.6	4.98
3	22	33.8	5.42
4	25	29.1	5.11
5	18	30.7	4.88

SOLUTION:

```
LOAD "PMSDEV".
RUN.

Enter input data as prompted.

     TOTAL CASES          100.0000
     POOLED MEAN           31.0270
     POOLED STD. DEV.       5.2380
```

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION III

Operating Limits and Warnings Number of groups cannot exceed 50.

Reference(s)

Variables:

Name	Description	Length	Comments
N1	Number of groups		
N(I)	Number of cases		
A(I)	Mean		
S(I)	Standard deviation		
T	Total cases		
G	Pooled mean		
H	Pooled standard deviation		
I	Internal looping		
Q$	User interaction		

SERIES 80 USERS' LIBRARY

USER INSTRUCTIONS

STEP	INSTRUCTIONS
1	LOAD "PMSDEV" and press RUN.
2	Enter number of groups.
3	Enter number of cases, mean, and standard deviation until complete.
4	Results will be displayed.

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing **Comments**

```
 10 REM **********
 20 REM * PMSDEV *
 30 REM **********
 40 DIM A(30),S(30),N(30),Q$[9]
 50 CLEAR
 60 DISP "          POOLED MEAN &
    "
 70 DISP "       STANDARD DEVIAT
    ION"
 80 DISP @ DISP @ DISP @ DISP @
    DISP
 90 DISP "Do you want instructio
    ns (Y/N)";@ INPUT Q$[1,8]@ C
    LEAR
100 IF UPC$(Q$[1,1])="Y" THEN 44
    0
110 T,G,H=0
120 CLEAR                                  Data entry
130 DISP "Number of groups (30 m
    aximum)";
140 INPUT N1
150 CLEAR
160 DISP "For each group enter t
    he follow-ing data:"
170 DISP "=====================
    ==========="
180 FOR I=1 TO N1
190 DISP "GROUP #";I @ DISP "---
    -------"
200 DISP "Number of cases";
210 INPUT N(I)
220 DISP "Mean";
230 INPUT A(I)
240 DISP "Standard deviation";
250 INPUT S(I)
260 CLEAR                                  Calculations
270 T=T+N(I)
280 G=G+A(I)*N(I)
290 H=H+S(I)*S(I)*(N(I)-1)
300 NEXT I
310 G=G/T
320 H=SQR(H/(T-N1))
330 IMAGE MDDDD.DDDD                       Output
340 DISP "TOTAL CASES      ";
350 DISP USING 330 ; T
360 DISP "POOLED MEAN      ";
370 DISP USING 330 ; G
380 DISP "POOLED STD. DEV.";
390 DISP USING 330 ; H
400 DISP @ DISP @ DISP @ DISP @
    DISP
410 DISP "Do you want to run aga
    in (Y/N)";@ INPUT Q$[1,8]@ C
    LEAR
420 IF UPC$(Q$[1,1])="Y" THEN 13
    0
430 GOTO 560
440 CLEAR
450 DISP "All data is entered wh
    ile the   program is running
    ."
```

PROGRAM LISTING

Listing

```
460 DISP
470 DISP "You are required to en
    ter the   number of groups,
    followed by"
480 DISP "the number of cases, t
    he mean,  and the standard d
    eviation for  each group."
490 DISP
500 DISP "When all data has been
     entered, the total number o
    f cases, the"
510 DISP "pooled mean, and the s
    tandard   deviation will be
    displayed."
520 DISP
530 DISP "Press 'ENDLINE' to con
    tinue";@ INPUT Q$
540 CLEAR
550 GOTO 110
560 CLEAR
570 DISP "END OF EXECUTION"
580 DISP @ DISP @ DISP @ DISP
590 END
```

Comments

Instructions

SERIES 80 USERS' LIBRARY

PROGRAM DESCRIPTION I

Program Title Least Squares Fit, Multiples Y's Per X

File Name M U L T X

Contributor's Name

Company *(if applicable)*

Address

City **State/Country**

Zip Code/Mail Code

Machine Size: **16K** ☒ **32K** ☐

Peripherals Required: none

ROMs Required: none

Number of Bytes: 13,399

Program Description: This program does a least-squares fit for groups having multiple Y's per X. It gives the standard error estimates for each of the following curves:

1. Y=A+(B*X)
2. Y=A*EXP(B*X)
3. Y=A*(X^B)
4. Y=A+(B/X)
5. Y=1/(A+B*X)
6. Y=X/(A+B*X)
7. Y=A+B*LOG(X)

PROGRAM DESCRIPTION II

Sample Problem

Do a least-squares fit for curves 4 and 7 using the following data:

Number of groups: 4

Group #1: X = 60 Y = 110, 135, 120

Group #2: X = 62 Y = 120, 140, 130, 135

Group #3: X = 64 Y = 150, 145

Group #4: X = 70 Y = 170, 185, 160

SOLUTION:

```
LOAD "MULTX".
RUN.
```

Enter input data as prompted.

Curve #4

```
For curve type: 4. Y=A+(B/X)

INDEX OF
DETERMINATION = .8279

A =  477.5912

B = -21371.1432


For curve type: 4. Y=A+(B/X)

REGRESSION =   9.52

INTERCEPT (A)= 48.5

SLOPE (B) =    3080.79


4. Y=A+(B/X)

is a HYPERBOLIC function.  The
result of a least-squares
fit of its linear transform
(sorted in order of ascending
values of X) are in the table to
follow.
```

PROGRAM DESCRIPTION II

X	Y	Y-CALC	% DIFFER
60	110	121.41	-9.3
60	135	121.41	11.1
60	120	121.41	-1.1
62	120	132.9	-9.7
62	140	132.9	5.3
62	130	132.9	-2.1

X	Y	Y-CALC	$ DIFFER
62	135	132.9	1.5
64	150	143.67	4.4
64	145	143.67	.9
70	170	172.29	-1.3
70	185	172.29	7.3
70	160	172.29	-7.1

Curve #7

For curve type: 7. Y=A+B*LOG(X)

INDEX OF
DETERMINATION = .8265

A = -1222.1258

B = 328.2633
For curve type: 7. Y=A+B*LOG(X)

REGRESSION = 9.56

INTERCEPT (A)= 197.62

SLOPE (B) = 47.56
7. Y=A+B*LOG(X)

is a LOGARITHMIC function. The result of a least-squares fit of its linear transform (sorted in order of ascending values of X) are in the table to follow.

X	Y	Y-CALC	% DIFFER
60	110	121.9	-9.7
60	135	121.9	10.7
60	120	121.9	-1.5
62	120	132.66	-9.5
62	140	132.66	5.5
62	130	132.66	-2

X	Y	Y-CALC	$ DIFFER
62	135	132.66	1.7
64	150	143.08	4.8
64	145	143.08	1.3
70	170	172.5	-1.4
70	185	172.5	7.2
70	160	172.5	-7.2

PROGRAM DESCRIPTION III

Operating Limits and Warnings

Variables:

Name	Description	Length	Comments
X( )	Stores X values		
Y( )	Stores Y values		
U( )	Stores necessary format of X's for computations		
V( )	Stores necessary format of Y's for computations		
A( )	'A' - least squares curve fit		
B( )	'B' - least squares curve fit		
C( )	Indices of determination		
S( )	Sums X and Y and squares of X and Y and products XY		
F( )	Indicates lack of fit		
T(,)	Standard Error Estimates		
Q	Counter		
N	Number of different X values or groups		
M	Number of elements per group		
X	Common X value per group		
Y	Y-values		
P,Z	Temporary storage		
B,A,S1,S2	Preliminary calculations for indices of determination and standard error estimates		
D	Difference between actual Y and calculated Y		
I,J,I1,K	Internal looping		
Q$	User interaction		

SERIES 80 USERS' LIBRARY

USER INSTRUCTIONS

STEP	INSTRUCTIONS
1	LOAD "MULTX" and press RUN.
2	Enter number of groups.
3	Enter number of elements in each group, the common X value, and the Y values until completed.
4	Results will be displayed.

SERIES 80 USERS' LIBRARY

PROGRAM LISTING

Listing

```
 10 REM *********
 20 REM * MULTX *
 30 REM *********
 40 DIM X(200),Y(200),U(200),V(2
    00),A(7),B(7),C(7),S(6),F(7)
    ,T(7,3)
 50 CLEAR
 60 Q=0
 70 DISP TAB(12);"MULTX" @ DISP
    @ DISP @ DISP @ DISP @ DISP
 80 DISP "Do you need instructio
    ns (Y/N)";@ INPUT Q$[1,8]@ C
    LEAR
 90 IF UPC$(Q$[1,1])="Y" THEN GO
    SUB 2460
100 DISP "Enter the number of di
    fferent X values or groups";
110 INPUT N
120 CLEAR
130 FOR I=1 TO N
140 DISP "No. of elements in gro
    up ";I;
150 INPUT M
160 DISP @ DISP "What is the com
    mon X ";
170 INPUT X
180 CLEAR
190 DISP "ENTER VALUES FOR GROUP
     ";I @ DISP "---------------
    -----------------"
200 FOR J=1 TO M
210 DISP "Y #";J;
220 INPUT Y
230 Q=Q+1
240 X(Q)=X
250 Y(Q)=Y
260 NEXT J
270 CLEAR
280 NEXT I
290 CLEAR
300 N=Q
310 FOR I=1 TO 7 @ F(I)=1 @ NEXT
     I
320 DEF FNI(Q) = INT(Q*100+.5)/1
    00
330 DEF FNJ(Q) = INT(Q*10000+.5)
    /10000
340 DISP "    LEAST-SQUARES CURV
    E FIT" @ DISP "==============
    ==================="
350 FOR I=1 TO 7
360 DISP "For curve type: ";
370 FOR I1=1 TO 6 @ S(I1)=0 @ NE
    XT I1
380 GOSUB 1660
390 IF (I-5)*(I-6)=0 THEN 550
400 IF (I-2)*(I-3)=0 THEN 480
410 FOR J=1 TO N
420 V(J)=Y(J)
430 GOSUB 1430
```

Comments

Data entry

Display curve types

PROGRAM LISTING

Listing	Comments

```
440 NEXT J
450 IF I=1 THEN 650
460 IF I=7 THEN 700
470 GOTO 760
480 FOR J=1 TO N
490 IF Y(J)<=0 THEN 620
500 V(J)=LOG(Y(J))
510 GOSUB 1430
520 NEXT J
530 IF I=3 THEN 700
540 GOTO 650
550 FOR J=1 TO N
560 IF Y(J)=0 THEN 620
570 V(J)=1/Y(J)
580 GOSUB 1430
590 NEXT J
600 IF I=6 THEN 760
610 GOTO 650
620 DISP "CAN'T FIT"                    No fit
630 F(I)=0
640 GOTO 860
650 FOR J=1 TO N
660 U(J)=X(J)
670 GOSUB 1460
680 NEXT J
690 GOTO 810
700 FOR J=1 TO N
710 IF X(J)<=0 THEN 620
720 U(J)=LOG(X(J))
730 GOSUB 1460
740 NEXT J
750 GOTO 810
760 FOR J=1 TO N
770 IF X(J)=0 THEN 620
780 U(J)=1/X(J)
790 GOSUB 1460
800 NEXT J
810 GOSUB 2130
820 DISP @ DISP "INDEX OF" @ DIS        Display index of determination
    P "DETERMINATION =";FNJ(C(I)
    )
830 DISP @ DISP "A =";TAB(5);FNJ
    (A(I))
840 DISP @ DISP "B =";TAB(5);FNJ
    (B(I))
850 DISP @ DISP @ DISP "Press 'E
    NDLINE' to continue";@ INPUT
     Q$@ CLEAR
860 NEXT I
870 DISP
880 DISP
890 DISP "    STANDARD ERROR EST        Standard Error Estimates
    IMATES" @ DISP "------------
    --------------------"
900 FOR I=1 TO 7
910 DISP "For curve type: ";
920 GOSUB 1660
930 IF F(I)=1 THEN 960
940 DISP @ DISP "COULD NOT BE FI
    T."
```

PROGRAM LISTING

Listing

```
950 GOTO 1000
960 DISP @ DISP "REGRESSION =";T
    AB(15);FNI(T(I,1))
970 DISP @ DISP "INTERCEPT (A)="
    ;TAB(15);FNI(T(I,2))
980 DISP @ DISP "SLOPE (B) =";TA
    B(15);FNI(T(I,3))
990 DISP @ DISP @ DISP @ DISP "P
    ress 'ENDLINE' to continue";
    @ INPUT Q$@ CLEAR
1000 NEXT I
1010 REM
1020 DISP "Enter curve type numb
     er (1-7)   for details."
1030 DISP @ DISP "Type zero (0)
     to end program."
1040 DISP @ DISP @ DISP "CURVE T
     YPE";
1050 INPUT I
1060 CLEAR
1070 IF I=0 THEN 2710
1080 GOSUB 1510
1090 IF F(I)=1 THEN 1130
1100 GOSUB 1660
1110 DISP "COULD NOT BE FIT"
1120 GOTO 1010
1130 GOSUB 1870
1140 IF (I-1)*(I-5)*(I-6)#0 THEN
      1240
1150 FOR J=1 TO N
1160 Y=A(I)+B(I)*X(I)
1170 IF I=1 THEN 1210
1180 Y=1/Y
1190 IF I=5 THEN 1210
1200 Y=X(J)*Y
1210 GOSUB 2350
1220 NEXT J
1230 GOTO 1010
1240 FOR J=1 TO N
1250 IF I=2 THEN 1340
1260 IF I=3 THEN 1320
1270 IF I=4 THEN 1300
1280 Y=A(7)+B(7)*LOG(X(J))
1290 GOTO 1350
1300 Y=A(4)+B(4)/X(J)
1310 GOTO 1350
1320 Y=A(3)*X(J)^B(3)
1330 GOTO 1350
1340 Y=A(2)*EXP(B(2)*X(J))
1350 GOSUB 2350
1360 IF J#N AND J/6#INT(J/6) THE
     N 1410
1370 DISP @ DISP @ DISP "Press '
     ENDLINE' to continue";@ INP
     UT Q$@ CLEAR
1380 IF J=N THEN 1410
1390 DISP "X      Y      Y-CALC
        $ DIFFER"
1400 DISP "----------------------
     -----------"
```

Comments

Output

Get details for each curve

PROGRAM LISTING

Listing

```
1410 NEXT J
1420 GOTO 1010
1430 S(5)=S(5)+V(J)^2
1440 S(3)=S(3)+V(J)
1450 RETURN
1460 S(1)=S(1)+U(J)
1470 S(2)=S(2)+U(J)^2
1480 IF I>1 THEN 1490
1490 S(4)=S(4)+U(J)*V(J)
1500 RETURN
1510 FOR K=1 TO N-1
1520 M=K
1530 FOR J=K+1 TO N
1540 IF X(M)<=X(J) THEN 1560
1550 M=J
1560 NEXT J
1570 IF M=K THEN 1640
1580 P=X(M)
1590 Q=Y(M)
1600 X(M)=X(K)
1610 Y(M)=Y(K)
1620 Y(K)=Q
1630 X(K)=P
1640 NEXT K
1650 RETURN
1660 K=I
1670 IF K=1 THEN 1850
1680 IF K=2 THEN 1830
1690 IF K=3 THEN 1810
1700 IF K=4 THEN 1790
1710 IF K=5 THEN 1770
1720 IF K=6 THEN 1750
1730 DISP "7. Y=A+B*LOG(X)"
1740 RETURN
1750 DISP "6. Y=X/(A+B*X) "
1760 RETURN
1770 DISP "5. Y=1/(A+B*X) "
1780 RETURN
1790 DISP "4. Y=A+(B/X)   "
1800 RETURN
1810 DISP "3. Y=A*(X^B)   "
1820 RETURN
1830 DISP "2. Y=A*EXP(B*X)"
1840 RETURN
1850 DISP "1. Y=A+(B*X)   "
1860 RETURN
1870 DISP "  "
1880 GOSUB 1660
1890 DISP @ DISP "is a";
1900 IF K=1 THEN 1960
1910 IF K=2 THEN 1980
1920 IF K=3 THEN 2000
1930 IF K=7 THEN 2020
1940 DISP " HYPERBOLIC";
1950 GOTO 2030
1960 DISP " LINEAR";
1970 GOTO 2030
1980 DISP "n EXPONENTIAL";
1990 GOTO 2030
2000 DISP " POWER";
```

Comments

Display curve types and definitions

PROGRAM LISTING

Listing

```
2010 GOTO 2030
2020 DISP " LOGARITHMIC";
2030 DISP " function.  The"
2040 IF K#1 THEN 2070
2050 DISP "results (sorted in or
     der of     ascending values
      of X) are in   the table t
     o follow."
2060 GOTO 2090
2070 DISP "result of a least-squ
     ares       fit of its linea
     r transform"
2080 DISP "(sorted in order of a
     scending   values of X) are
      in the table tofollow."
2090 DISP @ DISP @ DISP "Press '
     ENDLINE' to continue";@ INP
     UT Q$@ CLEAR
2100 DISP "X      Y      Y-CALC
        % DIFFER"
2110 DISP "----------------------
     -----------"
2120 RETURN
2130 B=(N*S(4)-S(1)*S(3))/(N*S(2
     )-S(1)^2)
2140 A=(S(3)-B*S(1))/N
2150 S1=S(5)-S(3)^2/N
2160 S2=B^2*(S(2)-S(1)^2/N)
2170 C(I)=S2/S1
2180 T(I,1)=SQR((S1-S2)/(N-2))
2190 T(I,2)=T(I,1)*SQR(S(2)/(N*(
     S(2)-S(1)^2/N)))
2200 T(I,3)=T(I,1)/SQR(S(2)-S(1)
     ^2/N)
2210 IF (I-1)*(I-4)*(I-5)*(I-7)=
     0 THEN 2320
2220 IF (I-2)*(I-3)=0 THEN 2290
2230 A(6)=B
2240 B(6)=A
2250 Z=T(6,2)
2260 T(6,2)=T(6,3)
2270 T(6,3)=Z
2280 RETURN
2290 A(I)=EXP(A)
2300 T(I,2)=EXP(T(I,2))
2310 GOTO 2330
2320 A(I)=A
2330 B(I)=B
2340 RETURN
2350 DISP FNI(X(J));TAB(5);FNI(Y
     (J));TAB(12);FNI(Y);TAB(22)
     ;
2360 D=Y(J)-Y
2370 D=.1*SGN(D)*INT(1000*ABS(D/
     Y))
2380 IF D<0 THEN 2430
2390 IF D>0 THEN 2420
2400 DISP "    0"
2410 RETURN
2420 DISP TAB(26);
```

Comments

Print table

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PROGRAM LISTING

Listing

```
2430 DISP FNI(D)
2440 RETURN
2450 STOP
2460 REM ****************
2470 REM * INSTRUCTIONS *
2480 REM ****************
2490 DISP "       LEAST-SQUARES
     FIT" @ DISP "       MULTIPL
     E Y'S PER X"
2500 DISP @ DISP "This program d
     oes a least-      squares f
     it for groups having"
2510 DISP "more than one Y per X
     "
2520 DISP @ DISP "It gives the S
     tandard Error     Estimates
      for each of the curvesto f
     ollow."
2530 DISP @ DISP @ DISP "Press '
     ENDLINE' to continue";@ INP
     UT Q$@ CLEAR
2540 DISP "CURVE TYPES:" @ DISP
     @ DISP
2550 DISP "  1.  Y=A+(B*X)"
2560 DISP "  2.  Y=A*EXP(B*X)"
2570 DISP "  3.  Y=A*(X^B)"
2580 DISP "  4.  Y=A+(B/X)"
2590 DISP "  5.  Y=1/(A+B*X)"
2600 DISP "  6.  Y=X/(A+B*X)"
2610 DISP "  7.  Y=A+B*LOG(X)"
2620 DISP @ DISP @ DISP "Press '
     ENDLINE' to continue";@ INP
     UT Q$@ CLEAR
2630 DISP "You are required to e
     nter the   following data:"
      @ DISP
2640 DISP "  -  number of differ
     ent X"
2650 DISP "     values or groups
     "
2660 DISP @ DISP "  -  number of
      elements in each      grou
     p."
2670 DISP @ DISP "  -  the commo
     n X value."
2680 DISP @ DISP "  -  the Y val
     ues."
2690 DISP @ DISP "Press 'ENDLINE
     ' to continue";@ INPUT Q$@
     CLEAR
2700 RETURN
2710 CLEAR
2720 DISP "END OF EXECUTION"
2730 DISP @ DISP @ DISP @ DISP @
      DISP
2740 END
```

Comments

Instructions

DECISION ANALYSIS (STATISTICS)

ANALYSIS OF VARIANCE AND F-RATIO
KRUSKAL-WALLIS ONE-WAY ANOVA
THREE FACTORIAL ANALYSIS OF VARIANCE
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POOLED MEAN AND STANDARD DEVIATION
LEAST SQUARES FIT, MULTIPLE Y'S PER X

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