Programs for the Analysis of Non-normal Data

by J. K. Lindsey

FISHERIES RESEARCH BOARD OF CANADA

TECHNICAL REPORT NO. 275

1971

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Biological Station, Nanaimo, B. C.

September, 1971

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INTRODUCTION

The programs in this Technical Report are designed for use in discovering a suitable distribution when normal theory analysis does not appear to be adequate and for carrying out the analysis for the exponential, Poisson, and binomial distributions for one- and two-way analysis of variance and for a two-factor response surface. If a suitable distribution cannot be discovered, programs are provided for a two parameter transformation of the response to make it follow more closely a normal distribution.

COMPARISON OF PROBABILITY DISTRIBUTIONS

Often a set of frequency data made under one set of response conditions needs to be grouped before goodness of fit tests and comparison of various probability distributions can be carried out. The program CØIS prints out a series of values of the log multinomial likelihood and the log interval width for various intervals. These may be plotted on a grid of equal unit size each way and a 45° line drawn through the points. The points will follow an S shape, curving away from the straight line at the two extremes. Then, the grouping interval to be chosen is the minimum width which still falls on the 45° line.

As an example of the comparison of fit of a number of distributions, the program GAMMA is provided to compare the normal, log normal, two parameter $(y + C_1)^{C_2}$ transformed normal (the two parameters may be estimated from the program PPEI below), exponential, and gamma distributions.

The analyses of these programs are explained with more theoretical detail in Lindsey (MS, 1971a).

TRANSFORMATIONS TO NORMALITY

For a series of frequency observations, as described in the previous section, all taken under one set of response conditions, the program PPE1 estimates the two parameters of the transformation, $(y + C_1)^{C_2}$ to make the data follow more closely a normal distribution.

If observations are available under a number of different response conditions, such as in analysis of variance, with several observations at each set of conditions, the program PPE2 may be used to estimate the same two parameter transformation to normality. In addition, this transformation allows the data to better fulfill the assumption of constant variance.

If observations are available from a regression problem with one to twelve independent variables, the program PPE3 may be used to estimate the same transformation as with PPE2.

ANALYSES USING NON-NORMAL DISTRIBUTIONS

The programs CØEM, CØPM, and CØBM may be used to do one- and two-way analysis of variance assuming that the data come from an exponential, Poisson or binomial distribution, respectively.

The programs ERSL2, PRSL2, and BRSL2 may be used to do an analysis of a two-factor response surface assuming that the data come from an exponential, Poisson, or binomial distribution, respectively, in analogous manner to the program BØX2 for normal theory (Lindsey and Sandnes, 1971).

The program CØBM2 provides a comparison of the analysis of a two-factor response surface using normal theory on binomial data with logit, odds, percent and arcsine transformations and both linear and nonlinear models. All values of power transformations must be supplied.

The analyses of these programs are explained with more theoretical detail in Lindsey (MS, 1971b).

An I x 2 analysis of variance with a binomial distribution which is equivalent to I 2 x 2 contingency tables may be analyzed in more detail for differences within tables, after the use of the program CØBM, by using the program CØCBM. Points of the maximized relative likelihood and on the conditional relative likelihood are listed as well as the exact test of significance for both no interaction and interaction models.

The exact analysis of one 2 x 2 contingency table may also be carried out using CØCBM. For comparison, the program APLIK gives the Chi-squared test for independence on the 2 x 2 table and lists points on the approximate likelihood function assumed when making this test.

The analyses of these programs are explained with more theoretical detail in Lindsey (MS, 1971c).

THE PROGRAMS

These programs were developed for a 16K core IBM 1130 single disk computer using FØRTRAN 1130 (a subset of FØRTRAN IV). The restrictions on numbers of variables are given in the following table:

Program	Number of Cells	Number of Responses per Cell
CØIS	1	800
GAMMA	1	800
PPE1	1	800
PPE2	80	20
PPE3	150	1
CØEM	20	4
ERSL2	30	4
CØPM	20	4
PRSL2	40	4
CØBM	16	4
CØCBM	15 x 2 = 30	1
APLIK	2	1
BRSL2	30	4
CØBM2	30	4

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Gart, J. J. (1970). The comparison of proportions: a review of significance tests, confidence intervals, and adjustments for stratification. Proc. 7th Biometrics Conf., Hanover.

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(MS, 1971b). An analysis of non-normal data. Submitted to Biometrics.

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Lindsey, J. K., and A. M. Sandnes. (1971). Programs for the Analysis of Nonlinear Response Surfaces, Technical Report.

Snedecor, G. W., and W. G. Cochran. (1967). Statistical Methods. Iowa State University Press. 593 + xiv p.

```
// JOB                                                                  COIS0000
// FOR                                                                  COIS0001
*LIST ALL                                                               COIS0002
*EXTENDED PRECISION                                                     COIS0003
*ONE WORD INTEGERS                                                      COIS0004
*IOCS(1403 PRINTER)                                                     COIS0005
*IOCS(2501 READER)                                                      COIS0006
*NAME COIS                                                              COIS0007
C                                                                       COIS0008
C    CALCULATION OF OPTIMUM INTERVAL WIDTH FOR GROUPING FREQUENCY DATA  COIS0009
C                                                                       COIS0010
C    THIS PROGRAM CALCULATES THE MULTINOMIAL LIKELIHOOD FOR VARIOUS     COIS0011
C INTERVAL WIDTHS. IF THE LOG LIKELIHOOD IS PLOTTED VS. LOG INTERVAL    COIS0012
C WIDTH AS PRINTED OUT BY THIS PROGRAM, THE POINT AT WHICH THE CURVE    COIS0013
C BEGINS TO FOLLOW A 45 DEGREE STRAIGHT LINE INDICATES THE OPTIMUM      COIS0014
C INTERVAL WIDTH FOR GROUPING DATA FOR COMPARISON OF PROBABILITY        COIS0015
C DISTRIBUTIONS AS WITH THE PROGRAM GAMMA OR WITH CHI-SQUARED GOODNESS  COIS0016
C OF FIT TESTS.                                                         COIS0017
C                                                                       COIS0018
C   MAKEUP OF DATA DECK                                                 COIS0019
C                                                                       COIS0020
C 1.TITLE CARD - (12A6)                                                 COIS0021
C 2.CONTROL CARD - (I3)                                                 COIS0022
C     I3 - NUMBER OF INTERVALS IN WHICH NON-ZERO OBSERVATIONS FALL      COIS0023
C 3.DATA DECK - OBSERVED VALUES AND NON-ZERO FREQUENCIES IN PAIRS       COIS0024
C               (16F5.0)
C 4.99 IN COLS. 79-80 INDICATES END OF DATA, ANOTHER DATA DECK TO FOLLOWCOIS0025
C   98 IN COLS. 79-80 INDICATES END OF JOB, CALL EXIT AFTER THIS DECK   COIS0026
C 5.REPEAT 1. TO 4. AS REQUIRED                                         COIS0027
C                                                                       COIS0028
      DIMENSION NN(800,2),TITL(12),NN1(800,2)                           COIS0029
   87 FORMAT(78X,I2)                                                    COIS0030
   86 FORMAT(31HOTOTAL NUMBER OF OBSERVATIONS =I5/)                     COIS0031
   85 FORMAT(1H1,12A6)                                                  COIS0032
   84 FORMAT(12A6)                                                      COIS0033
   83 FORMAT(4X8HINTERVAL,3X6HNO. OF,6X3HLOG16X3HLOG/5X4HSIZE,4X9HINTERVALSCOIS0034
     1 3X8HINTERVAL,10X10HLIKELIHOOD)                                   COIS0035
   82 FORMAT(2I9,2E18.7)                                                COIS0036
   81 FORMAT(16I5)                                                      COIS0037
   80 FORMAT(I3)                                                        COIS0038
      L=8                                                               COIS0039
      M=5                                                               COIS0040
   13 READ(L,84)TITL                                                    COIS0041
      WRITE(M,85)TITL                                                   COIS0042
      READ(L,80)N                                                       COIS0043
      READ(L,81)((NN(I,J),J=1,2),I=1,N)                                 COIS0044
      READ(L,87)ID                                                      COIS0045
      DO 12 I=1,N                                                       COIS0046
      DO 12 J=1,2                                                       COIS0047
   12 NN1(I,J)=NN(I,J)                                                  COIS0048
      MM=0                                                              COIS0049
      DO 2 I=1,N                                                        COIS0050
    2 MM=MM+NN(I,2)                                                     COIS0051
      WRITE(M,86)MM                                                     COIS0052
      WRITE(M,83)                                                       COIS0053
      JK=1                                                              COIS0054
```

```
      KL=NN(1,1)                                                        COIS0055
      N1=N                                                              COIS0056
      DO 1 I=1,15                                                       COIS0057
      SLM=-FLOAT(MM)*ALOG(FLOAT(MM))                                    COIS0058
      DO 3 J=1,N1                                                       COIS0059
    3 SLM=SLM+FLOAT(NN1(J,2))*ALOG(FLOAT(NN1(J,2)))                     COIS0060
      SI=FLOAT(MM)*ALOG(FLOAT(JK))                                      COIS0061
      WRITE(M,82)JK,N1,SI,SLM                                           COIS0062
      IF(2**(I-1)-(NN(N,1)-NN(1,1))/4)9,9,10                            COIS0063
    9 JK=2*JK                                                           COIS0064
      KJ=JK+KL-1                                                        COIS0065
      N1=1                                                              COIS0066
      NN1(N1,1)=KJ-JK/2                                                 COIS0067
      NN1(1,2)=NN(1,2)                                                  COIS0068
      DO 4 J=2,N                                                        COIS0069
      IF(NN(J,1)-KJ)5,5,6                                               COIS0070
    5 NN1(N1,2)=NN1(N1,2)+NN(J,2)                                       COIS0071
      GO TO 4                                                           COIS0072
    6 KJ=KJ+JK                                                          COIS0073
      IF(NN(J,1)-KJ)8,8,6                                               COIS0074
    8 N1=N1+1                                                           COIS0075
      NN1(N1,2)=NN(J,2)                                                 COIS0076
      NN1(N1,1)=KJ-JK/2                                                 COIS0077
    4 CONTINUE                                                          COIS0078
    1 CONTINUE                                                          COIS0079
   10 IF(ID-98)11,11,13                                                 COIS0080
   11 CALL EXIT                                                         COIS0081
      END                                                               COIS0082
// DUP                                                                  COIS0083
*DELETE              COIS                                             COIS0084
*STORE      WS  UA  COIS                                             COIS0085
```

```
// JOB                                                                  GAMMA000
// FOR                                                                  GAMMA001
*ONE WORD INTEGERS                                                      GAMMA002
*LIST ALL                                                               GAMMA003
*EXTENDED PRECISION                                                     GAMMA004
*IOCS(2501 READER)                                                      GAMMA005
*IOCS(1403 PRINTER)                                                     GAMMA006
*NAME GAMMA                                                             GAMMA007
C                                                                       GAMMA008
C     THIS PROGRAM COMPARES THE GOODNESS OF FIT OF THE NORMAL,LOG NORMAL,GAMMA009
C  GAMMA, EXPONENTIAL, AND TWO PARAMETER (Y+C1)**C2 TRANSFORMED NORMAL   GAMMA010
C  PROBABILITY DISTRIBUTIONS BY MEANS OF LIKELIHOOD RATIOS, USING THE   GAMMA011
C  MULTINOMIAL DISTRIBUTION AS A BASE. PARAMETER ESTIMATES GIVEN ARE THE GAMMA012
C  MEAN (A1) AND VARIANCE (A2) OF THE LOG NORMAL DISTRIBUTION, THE MEAN GAMMA013
C  (B1) OF THE EXPONENTIAL DISTRIBUTION, THE MEAN (B1) AND VARIANCE (D2) GAMMA014
C  OF THE NORMAL DISTRIBUTION, AND THE TWO PARAMETERS (B1 AND B2) OF THE GAMMA015
C  GAMMA DISTRIBUTION. IF AN INTERVAL WIDTH IS PROVIDED, THE DATA WILL BEGAMMA016
C  GROUPED ACCORDINGLY.                                                 GAMMA017
C                                                                       GAMMA018
C    MAKEUP OF DATA DECK                                                GAMMA019
C                                                                       GAMMA020
C  1.TITLE CARD - (12A6)                                                GAMMA021
C  2.CONTROL CARD - (I3,2F4.0,2X,2F5.3)                                 GAMMA022
C       I3 - NUMBER OF INTERVALS IN WHICH NON-ZERO OBSERVATIONS FALL    GAMMA023
C       F4.0 - UNIT OF MEASUREMENT                                      GAMMA024
C       F4.0 - INTERVAL WIDTH DESIRED                                   GAMMA025
C       2F5.3 - PARAMETERS OF TRANSFORMED NORMAL - C1 AND C2            GAMMA026
C  3.DATA DECK - OBSERVED VALUES AND NON-ZERO FREQUENCIES IN PAIRS      GAMMA027
C            (16F5.0)
C  4.99 IN COLS. 79-80 INDICATES END OF DATA, ANOTHER DATA DECK TO FOLLOWGAMMA028
C    9s IN COLS. 79-80 INDICATES END OF JOB, CALL EXIT AFTER THIS DECK   GAMMA029
C  5.REPEAT 1. TO 4. AS REQUIRED                                        GAMMA030
C                                                                       GAMMA031
      DIMENSION TITL(12),X(800),F(800),CC(2)                            GAMMA032
   91 FORMAT(21HOLOG L(MULTINOMIAL) =E15.7/21HOLOG L(GAMMA)       =2E15.GAMMA033
     17/21HOLOG L(EXPONENTIAL) =2E15.7/21HOLOG L(NORMAL)       =2E15.7/21GAMMA034
     2HOLOG L(LOG NORMAL)  =2E15.7)                                     GAMMA035
   90 FORMAT(1H010(12H  X(I)  F(I))/)                                   GAMMA036
   89 FORMAT(1X20F6.0)                                                  GAMMA037
   88 FORMAT(5HOC1 =F9.3,6H  C2 =F7.3)                                  GAMMA038
   87 FORMAT(31HOTOTAL NUMBER OF OBSERVATIONS =I5/28HOTOTAL NUMBER OF INGAMMA039
     1TERVALS =I5/17HOINTERVAL WIDTH =F4.0)                             GAMMA040
   86 FORMAT(21HOLOG L(MULTINOMIAL) =E15.7/21HOLOG L(GAMMA)       =2E15.GAMMA041
     17/21HOLOG L(EXPONENTIAL) =2E15.7/21HOLOG L(NORMAL)       =2E15.7/21GAMMA042
     2HOLOG L(LOG NORMAL)  =2E15.7/21HOLOG L(TRANS NORMAL)=2E15.7)      GAMMA043
   85 FORMAT(5HOA1 =F12.6,6H  A2 =F12.6,6H  B1 =F12.6,6H  B2 =F12.6,6H  GAMMA044
     1D2 =F12.6)                                                        GAMMA045
   84 FORMAT(78X,I2)                                                    GAMMA046
   83 FORMAT(16F5.0)                                                    GAMMA047
   82 FORMAT(I3,2F4.0,2X,2F5.3)                                         GAMMA048
   81 FORMAT(1H1)12A6)                                                  GAMMA049
   80 FORMAT(12A6)                                                      GAMMA050
      L=8                                                               GAMMA051
      M=5                                                               GAMMA052
    3 READ(L,80)TITL                                                    GAMMA053
```

```
      WRITE(M,81)TITL                                                   GAMMA054
      READ(L,82)J,D,B,CC                                                GAMMA055
      READ(L,83)(X(I),F(I),I=1,J)                                       GAMMA056
      READ(L,84)ID                                                      GAMMA057
      N=0                                                               GAMMA058
      DO 7 I=1,J                                                        GAMMA059
    7 N=N+F(I)                                                          GAMMA060
      A1=0.0                                                            GAMMA061
      B1=0.0                                                            GAMMA062
      C1=0.0                                                            GAMMA063
      C3=0.0                                                            GAMMA064
      DO 1 I=1,J                                                        GAMMA065
      C1=C1+(X(I)+CC(1))**CC(2)*F(I)/FLOAT(N)                           GAMMA066
      C3=C3+ALOG(X(I)+CC(1))*F(I)                                       GAMMA067
      B1=B1+X(I)*F(I)/FLOAT(N)                                          GAMMA068
    1 A1=A1+ALOG(X(I))*F(I)/FLOAT(N)                                    GAMMA069
      A2=0.0                                                            GAMMA070
      C2=0.0                                                            GAMMA071
      D2=0.0                                                            GAMMA072
      DO 2 I=1,J                                                        GAMMA073
      D2=D2+F(I)*(X(I)-B1)**2/FLOAT(N)                                  GAMMA074
      C2=C2+F(I)*((X(I)+CC(1))**CC(2)-C1)**2/FLOAT(N)                   GAMMA075
    2 A2=A2+F(I)*(ALOG(X(I))-A1)**2/FLOAT(N)                            GAMMA076
      B2=(30.0+SQRT(900.0+240.0*(ALOG(B1)-A1)))/120.0/(ALOG(B1)-A1)     GAMMA077
      IF(B2-1.0)5,5,6                                                   GAMMA078
    5 B2=10.0**(-10)+1.0                                                GAMMA079
    6 ALG=FLOAT(N)*(B2*(ALOG(B2/B1))-(B2-0.5)*ALOG(B2-1.0)-ALOG(6.283185GAMMA080
     1)/2.0-1.0-1.0/12.0/(B2-1.0)+(B2-1.0)*A1)                          GAMMA081
      ALLN=-FLOAT(N)*(ALOG(6.283185)+1.0+ALOG(A2)+2.0*A1)/2.0           GAMMA082
      ALE=-FLOAT(N)*(ALOG(B1)+1.0)                                      GAMMA083
      ALT=-FLOAT(N)*(ALOG(6.283185)+1.0+ALOG(C2)-2.0*ALOG(ABS(CC(2))))/2GAMMA084
     1.0+(CC(2)-1.0)*C3                                                 GAMMA085
      ALN=-FLOAT(N)*(ALOG(6.283185)+1.0+ALOG(D2))/2.0                   GAMMA086
      IF(B-1.0)12,12,13                                                 GAMMA087
   13 A=X(1)+B                                                          GAMMA088
      N1=1                                                              GAMMA089
      X(1)=X(1)+B/2.0                                                   GAMMA090
      DO 8 I=2,J                                                        GAMMA091
      IF(X(I)-A)9,9,10                                                  GAMMA092
    9 F(N1)=F(N1)+F(I)                                                  GAMMA093
      GO TO 8                                                           GAMMA094
   10 A=A+B                                                             GAMMA095
      IF(X(I)-A)11,11,10                                                GAMMA096
   11 N1=N1+1                                                           GAMMA097
      F(N1)=F(I)                                                        GAMMA098
      X(N1)=A-B/2                                                       GAMMA099
    8 CONTINUE                                                          GAMMA100
      J=N1                                                              GAMMA101
      GO TO 14                                                          GAMMA102
   12 B=1.0                                                             GAMMA103
   14 C=FLOAT(N)*ALOG(D*B)                                              GAMMA104
      ALG=ALG+C                                                         GAMMA105
      ALN=ALN+C                                                         GAMMA106
      ALE=ALE+C                                                         GAMMA107
      ALT=ALT+C                                                         GAMMA108
      ALLN=ALLN+C                                                       GAMMA109
```

```
      ALM=-FLOAT(N)*ALOG(FLOAT(N))                                          GAMMA110
      DO 15 I=1,J                                                           GAMMA111
   15 ALM=ALM+F(I)*ALOG(F(I))                                               GAMMA112
      ARN=ALN-ALM                                                           GAMMA113
      ARG=ALG-ALM                                                           GAMMA114
      ARE=ALE-ALM                                                           GAMMA115
      ART=ALT-ALM                                                           GAMMA116
      ARLN=ALLN-ALM                                                         GAMMA117
      WRITE(M,87)N,J,B                                                      GAMMA118
      WRITE(M,90)                                                           GAMMA119
      WRITE(M,89)(X(I),F(I),I=1,J)                                          GAMMA120
      WRITE(M,85)A1,A2,B1,B2,D2                                             GAMMA121
      IF(CC(2))16,17,16                                                     GAMMA122
   16 WRITE(M,88)CC                                                         GAMMA123
      WRITE(M,86)ALM,ALG,ARG,ALE,ARE,ALN,ARN,ALLN,ARLN,ALT,ART              GAMMA124
      GO TO 18                                                              GAMMA125
   17 WRITE(M,91)ALM,ALG,ARG,ALE,ARE,ALN,ARN,ALLN,ARLN                      GAMMA126
   18 IF(ID-98)4,4,3                                                        GAMMA127
    4 CALL EXIT                                                             GAMMA128
      END                                                                   GAMMA129
// DUP                                                                      GAMMA130
*DELETE             GAMMA                                                  GAMMA131
*STORE      WS  UA  GAMMA                                                  GAMMA132
```

```
// JOB                                                                  PPE10000
// FOR                                                                  PPE10005
*ONE WORD INTEGERS                                                      PPE10010
*EXTENDED PRECISION                                                     PPE10015
*LIST ALL                                                               PPE10020
*IOCS(1403 PRINTER)                                                     PPE10025
*IOCS(2501 READER)                                                      PPE10030
*IOCS(KEYBOARD)                                                         PPE10035
*IOCS(TYPEWRITER)                                                       PPE10040
*NAME PPE1                                                             PPE10045
C                                                                       PPE10050
C     THIS PROGRAM ESTIMATES THE TWO PARAMETERS OF THE TRANSFORMATION   PPE10055
C (Y+C1)**C2 TO MAKE DATA FOLLOW MORE CLOSELY A NORMAL DISTRIBUTION. ALLPPE10060
C OBSERVATIONS ARE TAKEN UNDER THE SAME RESPONSE CONDITIONS. POINTS ON  PPE10065
C THE TWO MAXIMIZED RELATIVE LIKELIHOOD GRAPHS ARE LISTED AND, IF DATA  PPE10070
C SWITCH 10 IS UP, PLOTTED.                                             PPE10075
C                                                                       PPE10080
C     THE SAME DATA DECK AS FOR COIS AND GAMMA MAY BE USED.             PPE10085
C                                                                       PPE10090
C     IF DATA SWITCH 9 IS UP, 130 POINTS ON THE LIKELIHOOD SURFACE ARE  PPE10095
C PRINTED OUT. THE POINT WITH LARGEST LOG LIKELIHOOD MAY THEN BE TYPED  PPE10100
C IN TO GIVE INITIAL ESTIMATES OF C1 AND C2.                            PPE10105
C                                                                       PPE10110
C   LINK CALLED                                                         PPE10115
C                                                                       PPE10120
C PPPE1 - PLOTS TWO MAXIMIZED RELATIVE LIKELIHOOD GRAPHS                PPE10125
C                                                                       
C   SUBROUTINES CALLED                                                  
C                                                                       
C PPSS1 - CALCULATE POINTS ON LIKELIHOOD SURFACE
C PPES1 - CALCULATES LIKELIHOOD FUNCTION
C MATV2 - INVERTS MATRICES UP TO 2 BY 2
C                                                                       PPE10130
C   MAKEUP OF DATA DECK                                                 PPE10135
C                                                                       PPE10140
C 1.TITLE - (12A6)                                                      PPE10145
C 2.CONTROL CARD - (I3,8X,I2,4F5.3,I3)                                  PPE10150
C       I3 - NUMBER OF INTERVALS IN WHICH NON-ZERO FREQUENCIES FALL     PPE10155
C       I2 - NUMBER OF ITERATIONS ALLOWED                               PPE10160
C       2F5.3 - INITIAL ESTIMATES OF PARAMETERS                         PPE10165
C       2F5.3 - HALF SIZE OF INTERVAL TO BE PLOTTED AROUND EACH MAXIMUM PPE10170
C       I3 - NUMBER OF POINTS ON GRAPHS TO BE CALCULATED                PPE10175
C 3.DATA DECK - OBSERVED VALUES AND NON-ZERO FREQUENCIES IN PAIRS        PPE10180
C               (16F5.0)
C 4.99 IN COLS. 79-80 INDICATES END OF DATA, ANOTHER DATA DECK TO FOLLOWPPE10185
C   98 IN COLS. 79-80 INDICATES END OF JOB, CALL EXIT AFTER THIS DECK   PPE10190
C 5.REPEAT 1. TO 4. AS REQUIRED                                         PPE10195
C                                                                       PPE10200
      DIMENSION Y(800),F(800),S(2),SS(2,2),T(12),I1(2),C1(2),C2(2)      PPE10205
      COMMON TITL(12),R(75,3,2),C(2),A(2),ID,NI                         PPE10210
   96 FORMAT(F6.3)                                                      PPE10215
   95 FORMAT(33HTYPE IN ESTIMATES OF C1,C2 - F6.3)                      PPE10220
   90 FORMAT(1X2F9.4,E14.6,I5,15X,2F9.4,E14.6,I5)                       PPE10225
   89 FORMAT(6OHOPOINTS ON MAXIMIZED RELATIVE LIKELIHOOD GRAPHS OF C1 ANPPE10230
     1D C2//4X2HC17X2HC210X1HR8X4HITER18X2HC17X2HC210X1HR8X4HITER/)      PPE10235
```

```
88 FORMAT(1X20F6.0)                                                    PPE10240
87 FORMAT(1H0I0(12H   X(I)   F(I))/)                                   PPE10245
86 FORMAT(25H0INITIAL ESTIMATES - C1 =F9.4,6H  C2 =F9.4,9H  LOG L =E1PPE10250
  14.6)                                                                PPE10255
85 FORMAT(36H0MAXIMUM LIKELIHOOD ESTIMATES - C1 =F9.4,6H  C2 =F9.4,6XPPE10260
  17HLOG L =E14.6,6X22HNUMBER OF ITERATIONS =I4)                       PPE10265
84 FORMAT(78X,I2)                                                      PPE10270
83 FORMAT(16F5.0)                                                      PPE10275
82 FORMAT(I3,8X,I2,4F5.3,I3)                                           PPE10280
81 FORMAT(1H1I2A6)                                                     PPE10285
80 FORMAT(12A6)                                                        PPE10290
   L=8                                                                 PPE10295
   M=5                                                                 PPE10300
10 READ(L,80)TITL                                                      PPE10305
   READ(L,82)MN,MI,C,A,NI                                              PPE10310
   READ(L,83)(Y(I),F(I),I=1,MN)                                        PPE10315
   READ(L,84)ID                                                        PPE10320
   IF(Y(1)+C(1))23,23,24                                               PPE10325
23 IF(Y(1))40,40,41                                                    PPE10330
41 C(1)=0.0                                                            PPE10335
   GO TO 24                                                            PPE10340
40 C(1)=1.0-Y(1)                                                       PPE10345
24 N=0                                                                 PPE10350
   DO 4 I=1,MN                                                         PPE10355
 4 N=N+F(I)                                                            PPE10360
   CALL DATSW(9,J9)                                                    PPE10365
   GO TO (42,43),J9                                                    PPE10370
42 WRITE(M,81)TITL                                                     PPE10375
   CALL PPSS1(Y,F,N,MN)                                                PPE10380
   WRITE(1,95)                                                         PPE10385
   READ(6,96)C                                                         PPE10390
43 WRITE(M,81)TITL                                                     PPE10395
   WRITE(M,87)                                                         PPE10400
   WRITE(M,88)(Y(I),F(I),I=1,MN)                                       PPE10405
   P=PPES1(Y,F,N,MN,C(1),C(2))                                         PPE10410
   WRITE(M,86)C,P                                                      PPE10415
   DO 2 II=1,MI                                                        PPE10420
   I2=II                                                               PPE10425
   DO 1 I=1,12                                                         PPE10430
 1 T(I)=0.0                                                            PPE10435
   YY=0.0                                                              PPE10440
   DO 5 I=1,MN                                                         PPE10445
 5 YY=YY+(Y(I)+C(1))**C(2)*F(I)/FLOAT(N)                               PPE10450
   DO 3 I=1,MN                                                         PPE10455
   T1=(Y(I)+C(1))**C(2)                                                PPE10460
   T2=(Y(I)+C(1))**(C(2)-1.0)                                          PPE10465
   T3=(Y(I)+C(1))**(C(2)-2.0)                                          PPE10470
   T4=ALOG(Y(I)+C(1))                                                  PPE10475
   T(1)=T(1)+(T1-YY)**2*F(I)                                           PPE10480
   T(2)=T(2)+(T1-YY)*T2*F(I)                                           PPE10485
   T(3)=T(3)+1.0/(Y(I)+C(1))*F(I)                                      PPE10490
   T(4)=T(4)+(T1-YY)*T1*T4*F(I)                                        PPE10495
   T(5)=T(5)+T4*F(I)                                                   PPE10500
   T(6)=T(6)+T3*(T1-YY)*F(I)                                           PPE10505
   T(7)=T(7)+T2*T2*F(I)                                                PPE10510
   T(8)=T(8)+1.0/(Y(I)+C(1))/(Y(I)+C(1))*F(I)                          PPE10515
```

```
      T(9)=T(9)+(T1-YY)*T1*T4*T4*F(I)                                   PPE10520
      T(10)=T(10)+T1*T1*T4*T4*F(I)                                      PPE10525
      T(11)=T(11)+T1*T2*T4*F(I)                                         PPE10530
    3 T(12)=T(12)+(T1-YY)*T2*T4*F(I)                                    PPE10535
      S(1)=-FLOAT(N)*T(2)*C(2)/T(1)+(C(2)-1.0)*T(3)                     PPE10540
      S(2)=-FLOAT(N)*(T(4)/T(1)-1.0/C(2))+T(5)                          PPE10545
      SS(1,1)=-FLOAT(N)*(T(1)*(C(2)*(C(2)-1.0)*T(6)+C(2)*C(2)*T(7))-2.0*PPE10550
     1T(2)*T(2)*C(2)*C(2))/T(1)/T(1)-(C(2)-1.0)*T(8)                    PPE10555
      SS(2,2)=-FLOAT(N)*((T(1)*(T(9)+T(10))-2.0*T(4)*T(4))/T(1)/T(1)+1.0PPE10560
     1/C(2)/C(2))                                                       PPE10565
      SS(1,2)=-FLOAT(N)*(T(1)*(C(2)*T(11)+C(2)*T(12)+T(2))-2.0*C(2)*T(2)PPE10570
     1*T(4))/T(1)/T(1)+T(3)                                             PPE10575
      SS(2,1)=SS(1,2)                                                   PPE10580
      CALL MATV2(SS,2,S,1,DET)                                          PPE10585
      DO 6 I=1,2                                                        PPE10590
    6 C(I)=C(I)-S(I)                                                    PPE10595
      DO 7 I=1,2                                                        PPE10600
      IF(ABS(S(I))-0.0001)7,7,2                                         PPE10605
    7 CONTINUE                                                          PPE10610
      GO TO 8                                                           PPE10615
    2 CONTINUE                                                          PPE10620
    8 P=PPES1(Y,F,N,MN,C(1),C(2))                                       PPE10625
      WRITE(M,85)C,P,I2                                                 PPE10630
      IF(MN/10+NI-42)25,25,26                                           PPE10635
   26 WRITE(M,81)TITL                                                   PPE10640
   25 WRITE(M,89)                                                       PPE10645
      C2(1)=C(2)                                                        PPE10650
      C1(2)=C(1)                                                        PPE10655
      DO 11 J=1,NI                                                      PPE10660
      C1(1)=C(1)-A(1)+(J-1)*2.0*A(1)/FLOAT(NI-1)                        PPE10665
      IF(Y(1)+C1(1))16,16,28                                            PPE10670
   28 DO 14 II=1,MI                                                     PPE10675
      I1(1)=II                                                          PPE10680
      DO 13 I=1,10                                                      PPE10685
   13 T(I)=0.0                                                          PPE10690
      YY=0.0                                                            PPE10695
      DO 15 I=1,MN                                                      PPE10700
   15 YY=YY+(Y(I)+C1(1))**C2(1)*F(I)/FLOAT(N)                           PPE10705
      DO 12 I=1,MN                                                      PPE10710
      T1=(Y(I)+C1(1))**C2(1)                                            PPE10715
      T4=ALOG(Y(I)+C1(1))                                               PPE10720
      T(1)=T(1)+(T1-YY)**2*F(I)                                         PPE10725
      T(4)=T(4)+(T1-YY)*T1*T4*F(I)                                      PPE10730
      T(5)=T(5)+T4*F(I)                                                 PPE10735
      T(9)=T(9)+(T1-YY)*T1*T4*T4*F(I)                                   PPE10740
   12 T(10)=T(10)+T1*T1*T4*T4*F(I)                                      PPE10745
      S(2)=-FLOAT(N)*(T(4)/T(1)-1.0/C2(1))+T(5)                         PPE10750
      SS(2,2)=-FLOAT(N)*((T(1)*(T(9)+T(10))-2.0*T(4)*T(4))/T(1)/T(1)+1.0PPE10755
     1/C2(1)/C2(1))                                                     PPE10760
      C2(1)=C2(1)-S(2)/SS(2,2)                                          PPE10765
      IF(ABS(S(2)/SS(2,2))-0.0001)16,16,14                              PPE10770
   14 CONTINUE                                                          PPE10775
   16 C2(2)=C(2)-A(2)+(J-1)*2.0*A(2)/FLOAT(NI-1)                        PPE10780
      DO 18 II=1,MI                                                     PPE10785
      I1(2)=II                                                          PPE10790
      DO 19 I=1,8                                                       PPE10795
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   19 T(I)=0.0                                                          PPE10800
      YY=0.0                                                            PPE10805
      DO 20 I=1,MN                                                      PPE10810
   20 YY=YY+(Y(I)+C1(2))**C2(2)*F(I)/FLOAT(N)                           PPE10815
      DO 21 I=1,MN                                                      PPE10820
      T1=(Y(I)+C1(2))**C2(2)                                            PPE10825
      T2=(Y(I)+C1(2))**(C2(2)-1.0)                                      PPE10830
      T3=(Y(I)+C1(2))**(C2(2)-2.0)                                      PPE10835
      T(1)=T(1)+(T1-YY)**2*F(I)                                         PPE10840
      T(2)=T(2)+(T1-YY)*T2*F(I)                                         PPE10845
      T(3)=T(3)+1.0/(Y(I)+C1(2))*F(I)                                   PPE10850
      T(6)=T(6)+T3*(T1-YY)*F(I)                                         PPE10855
      T(7)=T(7)+T2*T2*F(I)                                              PPE10860
   21 T(8)=T(8)+1.0/(Y(I)+C1(2))/(Y(I)+C1(2))*F(I)                      PPE10865
      S(1)=-FLOAT(N)*T(2)*C2(2)/T(1)+(C2(2)-1.0)*T(3)                   PPE10870
      SS(1,1)=-FLOAT(N)*(T(1)*(C2(2)+(C2(2)-1.0)*T(6)+C2(2)*C2(2)*T(7))-PPE10875
     12.0*T(2)*T(2)*C2(2)*C2(2))/T(1)/T(1)-(C2(2)-1.0)*T(8)             PPE10880
      C1(2)=C1(2)-S(1)/SS(1,1)                                          PPE10885
      IF(ABS(S(1)/SS(1,1))-0.0001)22,22,18                              PPE10890
   18 CONTINUE                                                          PPE10895
   22 DO 39 I=1,2                                                       PPE10900
      R(J,1,I)=C1(I)                                                    PPE10905
      R(J,2,I)=C2(I)                                                    PPE10910
   39 R(J,3,I)=EXP(PPES1(Y,F,N,MN,C1(I),C2(I))-P)                       PPE10915
      WRITE(M,90)((R(J,K,I),K=1,3),I1(I),I=1,2)                         PPE10920
   11 CONTINUE                                                          PPE10925
      CALL DATSW(10,J10)                                                PPE10930
      GO TO (35,36),J10                                                 PPE10935
   35 CALL LINK(PPPE1)                                                  PPE10940
   36 IF(ID-98)9,9,10                                                   PPE10945
    9 CALL EXIT                                                         PPE10950
      END                                                               PPE10955
// DUP                                                                  PPE10960
*DELETE             PPE1                                               PPE10965
*STORE      WS  UA  PPE1                                               PPE10970

// JOB                                                                  PPPE1000
// FOR                                                                  PPPE1001
*ONE WORD INTEGERS                                                      PPPE1002
*EXTENDED PRECISION                                                     PPPE1003
*LIST ALL                                                               PPPE1004
*IOCS(PLOTTER)                                                          PPPE1005
*NAME PPPE1                                                             PPPE1006
      COMMON TITL(12),R(75,3,2),C(2),A(2),ID,NI                         PPPE1007
   94 FORMAT(24HMAXIMUM LIKELIHOOD RATIO)                               PPPE1008
   93 FORMAT(10HVALUE OF CI1,15H   MAXIMUM AT CI1,2H =F8.4)             PPPE1009
   92 FORMAT(F3.1)                                                      PPPE1010
   91 FORMAT(F8.3)                                                      PPPE1011
   80 FORMAT(12A6)                                                      PPPE1012
      DO 30 J=1,2                                                       PPPE1013
      X4=C(J)-A(J)                                                      PPPE1014
      A3=2.0*A(J)                                                       PPPE1015
      B3=A3/20.                                                         PPPE1016
      C3=X4-A3/50.                                                      PPPE1017
      D3=A3/10.                                                         PPPE1018
      E3=10./A3                                                         PPPE1019
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      F3=X4-B3                                                          PPPE1020
      G3=X4+D3                                                          PPPE1021
      H3=X4+A3*1.3                                                      PPPE1022
      W3=X4-A3/15.                                                      PPPE1023
      Z3=X4-D3                                                          PPPE1024
      CALL SCALE(E3,10.0,X4,0.0)                                        PPPE1025
      CALL EGRID(0,X4,0.0,B3,20)                                        PPPE1026
      CALL EGRID(1,X4,0.0,0.05,20)                                      PPPE1027
      DO 31 I=1,11                                                      PPPE1028
      X1=G3-D3/2.0+D3*FLOAT(I-2)                                        PPPE1029
      XO=G3+D3*FLOAT(I-2)                                               PPPE1030
      CALL ECHAR(X1,-0.02,0.1,0.1,0.0)                                  PPPE1031
   31 WRITE(7,91)XO                                                     PPPE1032
      DO 32 I=1,11                                                      PPPE1033
      X1=-0.1+0.1*FLOAT(I)                                              PPPE1034
      CALL ECHAR(F3,X1,0.1,0.1,0.0)                                     PPPE1035
   32 WRITE(7,92)X1                                                     PPPE1036
      CALL ECHAR(G3,-0.04,0.1,0.1,0.0)                                  PPPE1037
      WRITE(7,93)J,J,C(J)                                               PPPE1038
      CALL ECHAR(W3,0.1,0.1,0.1,1.5709)                                 PPPE1039
      WRITE(7,94)                                                       PPPE1040
      CALL ECHAR(Z3,0.1,0.1,0.1,1.5709)                                 PPPE1041
      WRITE(7,80)TITL                                                   PPPE1042
      CALL EPLOT(-2,X4,0.0)                                             PPPE1043
      DO 33 I=1,NI                                                      PPPE1044
      IF(R(I,3,J)-1.0)33,33,34                                          PPPE1045
   34 R(I,3,J)=1.0                                                      PPPE1046
   33 CALL EPLOT(0,R(I,J,J),R(I,3,J))                                   PPPE1047
      CALL EPLOT(1,H3,0.0)                                              PPPE1048
   30 CONTINUE                                                          PPPE1049
      IF(ID-98)9,9,10                                                   PPPE1050
   10 CALL LINK(PPE1)                                                   PPPE1051
    9 CALL EXIT                                                         PPPE1052
      END                                                               PPPE1053
// DUP                                                                  PPPE1054
*DELETE              PPPE1                                             PPPE1055
*STORE      WS  UA  PPPE1                                             PPPE1056

// JOB                                                                  PPSS1000
// FOR                                                                  PPSS1001
*ONE WORD INTEGERS                                                     PPSS1002
*EXTENDED PRECISION                                                    PPSS1003
*LIST ALL                                                              PPSS1004
      SUBROUTINE PPSS1(Y,F,N,MN)                                        PPSS1005
      DIMENSION Y(200),F(200),P(10),C1(10),C2(10)                       PPSS1006
   85 FORMAT(1X)                                                        PPSS1007
   84 FORMAT(1X10E12.4)                                                 PPSS1008
   83 FORMAT(1X10F12.3)                                                 PPSS1009
   82 FORMAT(27HOC1, C2, AND LOG LIKELIHOOD)                            PPSS1010
      M=5                                                               PPSS1011
      WRITE(M,82)                                                       PPSS1012
      A=(Y(MN)+Y(1))/25.0                                               PPSS1013
      DO 1 I=1,13                                                       PPSS1014
      WRITE(M,85)                                                       PPSS1015
      DO 2 J=1,10                                                       PPSS1016
      C1(J)=(I-1)*A-Y(1)+0.0001                                         PPSS1017
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      C2(J)=(J-6)*0.4+0.2                                          PPSS1018
      P(J)=PPES1(Y,F,N,MN,C1(J),C2(J))                             PPSS1019
    2 CONTINUE                                                     PPSS1020
      WRITE(M,83)C1,C2                                             PPSS1021
      WRITE(M,84)P                                                 PPSS1022
    1 CONTINUE                                                     PPSS1023
      RETURN                                                       PPSS1024
      END                                                          PPSS1025
// DUP                                                           PPSS1026
*DELETE              PPSS1                                       PPSS1027
*STORE       WS  UA  PPSS1                                       PPSS1028

// JOB                                                           PPES1000
// FOR                                                           PPES1001
*ONE WORD INTEGERS                                               PPES1002
*EXTENDED PRECISION                                              PPES1003
*LIST ALL                                                        PPES1004
      FUNCTION PPES1(Y,F,N,MN,C1,C2)                             PPES1005
      DIMENSION Y(200),F(200)                                    PPES1006
      YY=0.0                                                     PPES1007
      DO 2 I=1,MN                                                PPES1008
    2 YY=YY+(Y(I)+C1)**C2*F(I)/FLOAT(N)                          PPES1009
      A=0.0                                                      PPES1010
      B=0.0                                                      PPES1011
      DO 1 I=1,MN                                                PPES1012
      A=A+((Y(I)+C1)**C2-YY)**2*F(I)                             PPES1013
    1 B=B+ALOG(Y(I)+C1)*F(I)                                     PPES1014
      PPES1=-FLOAT(N)*(ALOG(A)/2.0-ALOG(ABS(C2)))+(C2-1.0)*B     PPES1015
      RETURN                                                     PPES1016
      END                                                        PPES1017
// DUP                                                           PPES1018
*DELETE              PPES1                                       PPES1019
*STORE       WS  UA  PPES1                                       PPES1020

// JOB                                                           MATV2000
// FOR                                                           MATV2001
*LIST ALL                                                        MATV2002
*ONE WORD INTEGERS                                               MATV2003
*EXTENDED PRECISION                                              MATV2004
      SUBROUTINE MATV2(A,N,B,M,DETM)                             MATV2005
      DIMENSION IPVOT(2),A(2,2),B(2,1),INDEX(2,2),PIVOT(2)       MATV2006
      EQUIVALENCE (IROW,JROW),(ICLUM,JCLUM),(AMAX,T,SWAP)        MATV2007
      DETM=1.0                                                   MATV2008
      DO 20 J=1,N                                                MATV2009
   20 IPVOT(J)=0                                                 MATV2010
      DO 550 I=1,N                                               MATV2011
      AMAX=0.0                                                   MATV2012
      DO 105 J=1,N                                               MATV2013
      IF(IPVOT(J)-1)60,105,60                                    MATV2014
   60 DO 100 K=1,N                                               MATV2015
      IF(IPVOT(K)-1)80,100,740                                   MATV2016
   80 IF(ABS(AMAX)-ABS(A(J,K)))85,100,100                        MATV2017
   85 IROW=J                                                     MATV2018
      ICLUM=K                                                    MATV2019
      AMAX=A(J,K)                                                MATV2020
  100 CONTINUE                                                   MATV2021
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  105 CONTINUE                                                          MATV2022
      IPVOT(ICLUM)=IPVOT(ICLUM)+1                                       MATV2023
      IF(IROW-ICLUM)140,260,140                                         MATV2024
  140 DETM=-DETM                                                        MATV2025
      DO 200 L=1,N                                                      MATV2026
      SWAP=A(IROW,L)                                                    MATV2027
      A(IROW,L)=A(ICLUM,L)                                              MATV2028
  200 A(ICLUM,L)=SWAP                                                   MATV2029
      IF(M)260,260,210                                                  MATV2030
  210 DO 250 L=1,M                                                      MATV2031
      SWAP=B(IROW,L)                                                    MATV2032
      B(IROW,L)=B(ICLUM,L)                                              MATV2033
  250 B(ICLUM,L)=SWAP                                                   MATV2034
  260 INDEX(I,1)=IROW                                                   MATV2035
      INDEX(I,2)=ICLUM                                                  MATV2036
      PIVOT(I)=A(ICLUM,ICLUM)                                           MATV2037
      DETM=DETM*PIVOT(I)                                                MATV2038
      A(ICLUM,ICLUM)=1.0                                                MATV2039
      DO 350 L=1,N                                                      MATV2040
  350 A(ICLUM,L)=A(ICLUM,L)/PIVOT(I)                                    MATV2041
      IF(M)380,380,360                                                  MATV2042
  360 DO 370 L=1,M                                                      MATV2043
  370 B(ICLUM,L)=B(ICLUM,L)/PIVOT(I)                                    MATV2044
  380 DO 550 L1=1,N                                                     MATV2045
      IF(L1-ICLUM)400,550,400                                           MATV2046
  400 T=A(L1,ICLUM)                                                     MATV2047
      A(L1,ICLUM)=0.0                                                   MATV2048
      DO 450 L=1,N                                                      MATV2049
  450 A(L1,L)=A(L1,L)-A(ICLUM,L)*T                                      MATV2050
      IF(M)550,550,460                                                  MATV2051
  460 DO 500 L=1,M                                                      MATV2052
  500 B(L1,L)=B(L1,L)-B(ICLUM,L)*T                                      MATV2053
  550 CONTINUE                                                          MATV2054
      DO 710 I=1,N                                                      MATV2055
      L=N+1-I                                                           MATV2056
      IF(INDEX(L,1)-INDEX(L,2))630,710,630                              MATV2057
  630 JROW=INDEX(L,1)                                                   MATV2058
      JCLUM=INDEX(L,2)                                                  MATV2059
      DO 705 K=1,N                                                      MATV2060
      SWAP=A(K,JROW)                                                    MATV2061
      A(K,JROW)=A(K,JCLUM)                                              MATV2062
      A(K,JCLUM)=SWAP                                                   MATV2063
  705 CONTINUE                                                          MATV2064
  710 CONTINUE                                                          MATV2065
  740 IF(DETM-0.000001)750,750,760                                      MATV2066
  750 DETM=0.0                                                          MATV2067
  760 RETURN                                                            MATV2068
      END                                                               MATV2069
// DUP                                                                  MATV2070
*DELETE              MATV2                                             MATV2071
*STORE       WS  UA  MATV2                                             MATV2072
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// JOB                                                                  PPE20000
// FOR                                                                  PPE20001
*ONE WORD INTEGERS                                                      PPE20002
*EXTENDED PRECISION                                                     PPE20003
*LIST ALL                                                               PPE20004
*IOCS(1403 PRINTER)                                                     PPE20005
*IOCS(2501 READER)                                                      PPE20006
*IOCS(TYPEWRITER)                                                       PPE20007
*IOCS(KEYBOARD)                                                         PPE20008
*NAME PPE2                                                             PPE20009
C                                                                       PPE20010
C    THIS PROGRAM ESTIMATES THE TWO PARAMETERS OF THE TRANSFORMATION    PPE20011
C (Y+C1)**C2 TO MAKE DATA FOLLOW MORE CLOSELY A NORMAL DISTRIBUTION.    PPE20012
C OBSERVATIONS ARE TAKEN UNDER A NUMBER OF RESPONSE CONDITIONS AS IN    PPE20013
C ANALYSIS OF VARIANCE OR REGRESSION ANALYSIS, WITH EQUAL NUMBERS AND AT PPE20014
C LEAST TWO UNDER EACH CONDITION. POINTS ON THE TWO MAXIMIZED RELATIVE  PPE20015
C LIKELIHOOD GRAPHS ARE LISTED AND, IF DATA SWITCH 10 IS UP, PLOTTED.   PPE20016
C                                                                       PPE20017
C    IF DATA SWITCH 9 IS UP, 130 POINTS ON THE LIKELIHOOD SURFACE ARE   PPE20018
C PRINTED OUT. THE POINT WITH LARGEST LOG LIKELIHOOD MAY THEN BE TYPED  PPE20019
C IN TO GIVE INITIAL ESTIMATES OF C1 AND C2.                            PPE20020
C                                                                       PPE20021
C   LINK CALLED                                                         PPE20022
C                                                                       PPE20023
C PPPE2 - PLOTS TWO MAXIMIZED RELATIVE LIKELIHOOD GRAPHS                PPE20024
C
C   SUBROUTINES CALLED
C
C PPSS2 - CALCULATE POINTS ON LIKELIHOOD SURFACE
C PPES2 - CALCULATES LIKELIHOOD FUNCTION
C MATV2 - INVERTS MATRICES UP TO 2 BY 2
C                                                                       PPE20025
C   REQUIRES SUBROUTINE READB(Y,N1,MN,ID)                               PPE20026
C                                                                       PPE20027
C  STORES Y OBSERVATIONS IN Y(80,20)                                    PPE20028
C  N1 - NUMBER OF RESPONSE CONDITIONS (BLOCKS) - MAXIMUM 80             PPE20029
C  MN - NUMBER OF OBSERVATIONS PER BLOCK - MAXIMUM 20                   PPE20030
C  ID=98 TERMINATION, ID NE 98 - PROCESS NEXT DATA DECK                 PPE20031
C                                                                       PPE20032
C    MAKEUP OF DATA DECK                                                PPE20033
C                                                                       PPE20034
C 1.TITLE CARD - (12A6)                                                 PPE20035
C 2.CONTROL CARD - (4X,I2,4F5.3,I3)                                     PPE20036
C      I2 - NUMBER OF ITERATIONS ALLOWED                                PPE20037
C      2F5.3 - INITIAL ESTIMATES OF PARAMETERS C1 AND C2                PPE20038
C      2F5.3 - HALF SIZE OF INTERVAL TO BE PLOTTED AROUND EACH MAXIMUM  PPE20039
C      I3 - NUMBER OF POINTS ON GRAPHS TO BE CALCULATED                 PPE20040
C 3.DATA DECK - ACCORDING TO SUBROUTINE READB                           PPE20041
C 4.REPEAT 1. TO 3. AS REQUIRED                                         PPE20042
C                                                                       PPE20043
      DIMENSION Y(80,20),YY(80),S(2),SS(2,2),T(12),I1(2),C1(2),C2(2)    PPE20044
      COMMON TITL(12),R(75,3,2),C(2),A(2),ID,NI                         PPE20045
   96 FORMAT(F6.3)                                                      PPE20046
   95 FORMAT(33HTYPE IN ESTIMATES OF C1,C2 - F6.3)                      PPE20047
   90 FORMAT(1X2F9.4,E14.6,I5,15X,2F9.4,E14.6,I5)                       PPE20048
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89 FORMAT(60HOPOINTS ON MAXIMIZED RELATIVE LIKELIHOOD GRAPHS OF C1 ANPPE20049
  1D C2//4X2HC17X2HC210X1HR8X4HITER18X2HC17X2HC210X1HR8X4HITER/)      PPE20050
88 FORMAT(1X13F8.3)                                                  PPE20051
87 FORMAT(17HOOBSERVATION SETS/)                                     PPE20052
86 FORMAT(25HOINITIAL ESTIMATES - C1 =F9.4,6H  C2 =F9.4,9H  LOG L =E1PPE20053
  14.6)                                                              PPE20054
85 FORMAT(36HOMAXIMUM LIKELIHOOD ESTIMATES - C1 =F9.4,6H  C2 =F9.4,6XPPE20055
  17HLOG L =E14.6,6X22HNUMBER OF ITERATIONS =I4)                     PPE20056
82 FORMAT(4X,I2,4F5.3,I3)                                            PPE20057
81 FORMAT(1H1,12A6)                                                  PPE20058
80 FORMAT(12A6)                                                      PPE20059
   L=8                                                               PPE20060
   M=5                                                               PPE20061
10 READ(L,80)TITL                                                    PPE20062
   READ(L,82)MI,C,A,NI                                               PPE20063
   CALL READB(Y,N1,MN,ID)                                            PPE20064
   N=N1*MN                                                           PPE20065
   F=Y(1,1)                                                          PPE20066
   F1=Y(1,1)                                                         PPE20067
   DO 17 I=1,N1                                                      PPE20068
   DO 17 J=1,MN                                                      PPE20069
   IF(Y(I,J)-F)37,44,44                                              PPE20070
37 F=Y(I,J)                                                          PPE20071
44 IF(Y(I,J)-F1)17,17,45                                             PPE20072
45 F1=Y(I,J)                                                         PPE20073
17 CONTINUE                                                          PPE20074
   CALL DATSW(9,J9)                                                  PPE20075
   GO TO (42,43),J9                                                  PPE20076
42 WRITE(M,81)TITL                                                   PPE20077
   CALL PPSS2(Y,F,F1,N1,MN)                                          PPE20078
   WRITE(1,95)                                                       PPE20079
   READ(6,96)C                                                       PPE20080
   GO TO 24                                                          PPE20081
43 IF(F+C(1))23,23,24                                                PPE20082
23 IF(F)40,40,41                                                     PPE20083
41 C(1)=0.0                                                          PPE20084
   GO TO 24                                                          PPE20085
40 C(1)=1.0-F                                                        PPE20086
24 WRITE(M,81)TITL                                                   PPE20087
   WRITE(M,87)                                                       PPE20088
   DO 4 I=1,N1                                                       PPE20089
 4 WRITE(M,88)(Y(I,J),J=1,MN)                                        PPE20090
   P=PPES2(Y,N1,MN,C(1),C(2))                                        PPE20091
   WRITE(M,86)C,P                                                    PPE20092
   DO 2 II=1,MI                                                      PPE20093
   I2=II                                                             PPE20094
   DO 1 I=1,12                                                       PPE20095
 1 T(I)=0.0                                                          PPE20096
   DO 5 I=1,N1                                                       PPE20097
   YY(I)=0.0                                                         PPE20098
   DO 5 J=1,MN                                                       PPE20099
 5 YY(I)=YY(I)+(Y(I,J)+C(1))**C(2)/FLOAT(MN)                         PPE20100
   DO 3 I=1,N1                                                       PPE20101
   DO 3 J=1,MN                                                       PPE20102
   T1=(Y(I,J)+C(1))**C(2)                                            PPE20103
   T2=(Y(I,J)+C(1))**(C(2)-1.0)                                      PPE20104
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      T3=(Y(I,J)+C(1))**(C(2)-2.0)                                      PPE20105
      T4=ALOG(Y(I,J)+C(1))                                              PPE20106
      T(1)=T(1)+(T1-YY(I))**2                                           PPE20107
      T(2)=T(2)+(T1-YY(I))*T2                                           PPE20108
      T(3)=T(3)+1.0/(Y(I,J)+C(1))                                       PPE20109
      T(4)=T(4)+(T1-YY(I))*T1*T4                                        PPE20110
      T(5)=T(5)+T4                                                      PPE20111
      T(6)=T(6)+T3*(T1-YY(I))                                           PPE20112
      T(7)=T(7)+T2*T2                                                   PPE20113
      T(8)=T(8)+1.0/(Y(I,J)+C(1))/(Y(I,J)+C(1))                         PPE20114
      T(9)=T(9)+(T1-YY(I))*T1*T4*T4                                     PPE20115
      T(10)=T(10)+T1*T1*T4*T4                                           PPE20116
      T(11)=T(11)+T1*T2*T4                                              PPE20117
    3 T(12)=T(12)+(T1-YY(I))*T2*T4                                      PPE20118
      S(1)=-FLOAT(N)*T(2)*C(2)/T(1)+(C(2)-1.0)*T(3)                     PPE20119
      S(2)=-FLOAT(N)*(T(4)/T(1)-1.0/C(2))+T(5)                          PPE20120
      SS(1,1)=-FLOAT(N)*(T(1)*(C(2)*(C(2)-1.0)*T(6)+C(2)*C(2)*T(7))-2.0*PPE20121
     1T(2)*T(2)*C(2)*C(2))/T(1)/T(1)-(C(2)-1.0)*T(8)                    PPE20122
      SS(2,2)=-FLOAT(N)*((T(1)*(T(9)+T(10))-2.0*T(4)*T(4))/T(1)/T(1)+1.0PPE20123
     1/C(2)/C(2))                                                       PPE20124
      SS(1,2)=-FLOAT(N)*(T(1)*(C(2)*T(11)+C(2)*T(12)+T(2))-2.0*C(2)*T(2)PPE20125
     1*T(4))/T(1)/T(1)+T(3)                                             PPE20126
      SS(2,1)=SS(1,2)                                                   PPE20127
      CALL MATV2(SS,2,S,1,DET)                                          PPE20128
      DO 6 I=1,2                                                        PPE20129
    6 C(I)=C(I)-S(I)                                                    PPE20130
      DO 7 I=1,2                                                        PPE20131
      IF(ABS(S(I))-0.0001)7,7,2                                         PPE20132
    7 CONTINUE                                                          PPE20133
      GO TO 8                                                           PPE20134
    2 CONTINUE                                                          PPE20135
    8 P=PPES2(Y,N1,MN,C(1),C(2))                                        PPE20136
      WRITE(M,85)C,P,I2                                                 PPE20137
      IF(N1+NI-42)25,25,26                                              PPE20138
   26 WRITE(M,81)TITL                                                   PPE20139
   25 WRITE(M,89)                                                       PPE20140
      C2(1)=C(2)                                                        PPE20141
      C1(2)=C(1)                                                        PPE20142
      DO 11 J=1,NI                                                      PPE20143
      C1(1)=C(1)-A(1)+(J-1)*2.0*A(1)/FLOAT(NI-1)                        PPE20144
      IF(F+C1(1))16,16,28                                               PPE20145
   28 DO 14 II=1,MI                                                     PPE20146
      I1(1)=II                                                          PPE20147
      DO 13 I=1,10                                                      PPE20148
   13 T(I)=0.0                                                          PPE20149
      DO 15 I=1,N1                                                      PPE20150
      YY(I)=0.0                                                         PPE20151
      DO 15 K=1,MN                                                      PPE20152
   15 YY(I)=YY(I)+(Y(I,K)+C1(1))**C2(1)/FLOAT(MN)                       PPE20153
      DO 12 I=1,N1                                                      PPE20154
      DO 12 K=1,MN                                                      PPE20155
      T1=(Y(I,K)+C1(1))**C2(1)                                          PPE20156
      T4=ALOG(Y(I,K)+C1(1))                                             PPE20157
      T(1)=T(1)+(T1-YY(I))**2                                           PPE20158
      T(4)=T(4)+(T1-YY(I))*T1*T4                                        PPE20159
      T(5)=T(5)+T4                                                      PPE20160
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      T(9)=T(9)+(T1-YY(I))*T1*T4*T4                                    PPE20161
   12 T(10)=T(10)+T1*T1*T4*T4                                          PPE20162
      S(2)=-FLOAT(N)*(T(4)/T(1)-1.0/C2(1))+T(5)                        PPE20163
      SS(2,2)=-FLOAT(N)*((T(1)*(T(9)+T(10))-2.0*T(4)*T(4))/T(1)/T(1)+1.0PPE20164
     1/C2(1)/C2(1))                                                    PPE20165
      C2(1)=C2(1)-S(2)/SS(2,2)                                         PPE20166
      IF(ABS(S(2)/SS(2,2))-0.0001)16,16,14                             PPE20167
   14 CONTINUE                                                         PPE20168
   16 C2(2)=C(2)-A(2)+(J-1)*2.0*A(2)/FLOAT(NI-1)                       PPE20169
      DO 18 II=1,M1                                                    PPE20170
      I1(2)=II                                                         PPE20171
      DO 19 I=1,8                                                      PPE20172
   19 T(I)=0.0                                                         PPE20173
      DO 20 I=1,N1                                                     PPE20174
      YY(I)=0.0                                                        PPE20175
      DO 20 K=1,MN                                                     PPE20176
   20 YY(I)=YY(I)+(Y(I,K)+C1(2))**C2(2)/FLOAT(MN)                      PPE20177
      DO 21 I=1,N1                                                     PPE20178
      DO 21 K=1,MN                                                     PPE20179
      T1=(Y(I,K)+C1(2))**C2(2)                                         PPE20180
      T2=(Y(I,K)+C1(2))**(C2(2)-1.0)                                   PPE20181
      T3=(Y(I,K)+C1(2))**(C2(2)-2.0)                                   PPE20182
      T(1)=T(1)+(T1-YY(I))**2                                          PPE20183
      T(2)=T(2)+(T1-YY(I))*T2                                          PPE20184
      T(3)=T(3)+1.0/(Y(I,K)+C1(2))                                     PPE20185
      T(6)=T(6)+T3*(T1-YY(I))                                          PPE20186
      T(7)=T(7)+T2*T2                                                  PPE20187
   21 T(8)=T(8)+1.0/(Y(I,K)+C1(2))/(Y(I,K)+C1(2))                      PPE20188
      S(1)=-FLOAT(N)*T(2)*C2(2)/T(1)+(C2(2)-1.0)*T(3)                  PPE20189
      SS(1,1)=-FLOAT(N)*(T(1)*(C2(2)*(C2(2)-1.0)*T(6)+C2(2)*C2(2)*T(7))-PPE20190
     12.0*T(2)*T(2)*C2(2)*C2(2))/T(1)/T(1)-(C2(2)-1.0)*T(8)            PPE20191
      C1(2)=C1(2)-S(1)/SS(1,1)                                         PPE20192
      IF(ABS(S(1)/SS(1,1))-0.0001)22,22,18                             PPE20193
   18 CONTINUE                                                         PPE20194
   22 DO 39 I=1,2                                                      PPE20195
      R(J,1,I)=C1(I)                                                   PPE20196
      R(J,2,I)=C2(I)                                                   PPE20197
   39 R(J,3,I)=EXP(PPES2(Y,N1,MN,C1(I),C2(I))-P)                       PPE20198
      WRITE(M,90)((R(J,K,I),K=1,3),I1(I),I=1,2)                        PPE20199
   11 CONTINUE                                                         PPE20200
      CALL DATSW(10,J10)                                               PPE20201
      GO TO (35,36),J10                                                PPE20202
   35 CALL LINK(PPPE2)                                                 PPE20203
   36 IF(ID-98)9,9,10                                                  PPE20204
    9 CALL EXIT                                                        PPE20205
      END                                                              PPE20206
// DUP                                                                 PPE20207
*DELETE              PPE2                                            PPE20208
*STORE       WS  UA  PPE2                                            PPE20209

// JOB                                                                 READB000
// FOR                                                                 READB001
*ONE WORD INTEGERS                                                     READB002
*EXTENDED PRECISION                                                    READB003
*LIST ALL                                                             READB004
C                                                                      READB005
```

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C     THIS IS A SAMPLE READ SUBROUTINE FOR PPE2                                  READB006
C     THIS SUBROUTINE READS THE DATA DECK FROM BOX2 OR BOX3, LEAVING OUT READB007
C THE CARDS FOR FACTOR POINTS                                                    READB008
C                                                                                READB009
      SUBROUTINE READB(Y,N1,MN,ID)                                               READB010
      DIMENSION Y(80,20)                                                         READB011
   82 FORMAT(78X,I2)                                                             READB012
   81 FORMAT(13F6.3)                                                             READB013
   80 FORMAT(1X,2I2)                                                             READB014
      L=8                                                                        READB015
      READ(L,80)N1,MN                                                            READB016
      DO 1 I=1,N1                                                                READB017
    1 READ(L,81)(Y(I,J),J=1,MN)                                                  READB018
      READ(L,82)ID                                                               READB019
      RETURN                                                                     READB020
      END                                                                        READB021
// DUP                                                                           READB022
*DELETE              READB                                                       READB023
*STORE       WS  UA  READB                                                       READB024
// JOB                                                                           PPPE2000
// FOR                                                                           PPPE2001
*ONE WORD INTEGERS                                                               PPPE2002
*EXTENDED PRECISION                                                             PPPE2003
*LIST ALL                                                                       PPPE2004
*IOCS(PLOTTER)                                                                  PPPE2005
*NAME PPPE2                                                                     PPPE2006
      COMMON TITL(12),R(75,3,2),C(2),A(2),ID,NI                                  PPPE2007
   94 FORMAT(24HMAXIMUM LIKELIHOOD RATIO)                                        PPPE2008
   93 FORMAT(10HVALUE OF CI1,15H   MAXIMUM AT CI1,2H =F8.4)                      PPPE2009
   92 FORMAT(F3.1)                                                               PPPE2010
   91 FORMAT(F8.3)                                                               PPPE2011
   80 FORMAT(12A6)                                                               PPPE2012
      DO 30 J=1,2                                                                PPPE2013
      X4=C(J)-A(J)                                                               PPPE2014
      A3=2.0*A(J)                                                                PPPE2015
      B3=A3/20.                                                                  PPPE2016
      C3=X4-A3/50.                                                               PPPE2017
      D3=A3/10.                                                                  PPPE2018
      E3=10./A3                                                                  PPPE2019
      F3=X4-B3                                                                   PPPE2020
      G3=X4+D3                                                                   PPPE2021
      H3=X4+A3*1.3                                                               PPPE2022
      W3=X4-A3/15.                                                               PPPE2023
      Z3=X4-D3                                                                   PPPE2024
      CALL SCALE(E3,10.0,X4,0.0)                                                 PPPE2025
      CALL EGRID(0,X4,0.0,B3,20)                                                 PPPE2026
      CALL EGRID(1,X4,0.0,0.05,20)                                               PPPE2027
      DO 31 I=1,11                                                               PPPE2028
      X1=G3-D3/2.0+D3*FLOAT(I-2)                                                 PPPE2029
      XO=G3+D3*FLOAT(I-2)                                                        PPPE2030
      CALL ECHAR(X1,-0.02,0.1,0.1,0.0)                                           PPPE2031
   31 WRITE(7,91)XO                                                              PPPE2032
      DO 32 I=1,11                                                               PPPE2033
      X1=-0.1+0.1*FLOAT(I)                                                       PPPE2034
      CALL ECHAR(F3,X1,0.1,0.1,0.0)                                              PPPE2035
   32 WRITE(7,92)X1                                                              PPPE2036
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      CALL ECHAR(G3,-0.04,0.1,0.1,0.0)                                  PPPE2037
      WRITE(7,93)J,J,C(J)                                               PPPE2038
      CALL ECHAR(W3,0.1,0.1,0.1,1.5709)                                 PPPE2039
      WRITE(7,94)                                                       PPPE2040
      CALL ECHAR(Z3,0.1,0.1,0.1,1.5709)                                 PPPE2041
      WRITE(7,80)TITL                                                   PPPE2042
      CALL EPLOT(-2,X4,0.0)                                             PPPE2043
      DO 33 I=1,NI                                                      PPPE2044
      IF(R(I,3,J)-1.0)33,33,34                                          PPPE2045
   34 R(I,3,J)=1.0                                                      PPPE2046
   33 CALL EPLOT(0,R(I,J,J),R(I,3,J))                                   PPPE2047
      CALL EPLOT(1,H3,0.0)                                              PPPE2048
   30 CONTINUE                                                          PPPE2049
      IF(ID-98)9,9,10                                                   PPPE2050
   10 CALL LINK(PPE2)                                                   PPPE2051
    9 CALL EXIT                                                         PPPE2052
      END                                                               PPPE2053
// DUP                                                                  PPPE2054
*DELETE              PPPE2                                             PPPE2055
*STORE       WS  UA  PPPE2                                             PPPE2056

// JOB                                                                  PPSS2000
// FOR                                                                  PPSS2001
*ONE WORD INTEGERS                                                     PPSS2002
*EXTENDED PRECISION                                                    PPSS2003
*LIST ALL                                                              PPSS2004
      SUBROUTINE PPSS2(Y,F,F1,N1,MN)                                    PPSS2005
      DIMENSION Y(40,13),P(10),C1(10),C2(10)                            PPSS2006
   85 FORMAT(1X)                                                        PPSS2007
   84 FORMAT(1X10E12.4)                                                 PPSS2008
   83 FORMAT(1X10F12.3)                                                 PPSS2009
   82 FORMAT(27HOC1, C2, AND LOG LIKELIHOOD)                            PPSS2010
      M=5                                                               PPSS2011
      WRITE(M,82)                                                       PPSS2012
      A=(F+F1)/25.0                                                     PPSS2013
      DO 1 I=1,13                                                       PPSS2014
      WRITE(M,85)                                                       PPSS2015
      DO 2 J=1,10                                                       PPSS2016
      C1(J)=(I-1)*A-F+0.0001                                            PPSS2017
      C2(J)=(J-6)*0.4+0.2                                               PPSS2018
      P(J)=PPES2(Y,N1,MN,C1(J),C2(J))                                   PPSS2019
    2 CONTINUE                                                          PPSS2020
      WRITE(M,83)C1,C2                                                  PPSS2021
      WRITE(M,84)P                                                      PPSS2022
    1 CONTINUE                                                          PPSS2023
      RETURN                                                            PPSS2024
      END                                                               PPSS2025
// DUP                                                                  PPSS2026
*DELETE              PPSS2                                             PPSS2027
*STORE       WS  UA  PPSS2                                             PPSS2028

// JOB                                                                  PPES2000
// FOR                                                                  PPES2001
*ONE WORD INTEGERS                                                     PPES2002
*EXTENDED PRECISION                                                    PPES2003
*LIST ALL                                                              PPES2004
```

```
      FUNCTION PPES2(Y,N1,MN,C1,C2)                                    PPES2005
      DIMENSION Y(40,13),YY(40)                                        PPES2006
      N=N1*MN                                                          PPES2007
      DO 2 I=1,N1                                                      PPES2008
      YY(I)=0.0                                                        PPES2009
      DO 2 J=1,MN                                                      PPES2010
    2 YY(I)=YY(I)+(Y(I,J)+C1)**C2/FLOAT(MN)                            PPES2011
      A=0.0                                                            PPES2012
      B=0.0                                                            PPES2013
      DO 1 I=1,N1                                                      PPES2014
      DO 1 J=1,MN                                                      PPES2015
      A=A+((Y(I,J)+C1)**C2-YY(I))**2                                   PPES2016
    1 B=B+ALOG(Y(I,J)+C1)                                              PPES2017
      PPES2=-FLOAT(N)*(ALOG(A)/2.0-ALOG(ABS(C2)))+(C2-1.0)*B           PPES2018
      RETURN                                                           PPES2019
      END                                                              PPES2020
// DUP                                                                 PPES2021
*DELETE              PPES2                                            PPES2022
*STORE       WS  UA  PPES2                                            PPES2023

// JOB                                                                 MATV2000
// FOR                                                                 MATV2001
*LIST ALL                                                            MATV2002
*ONE WORD INTEGERS                                                   MATV2003
*EXTENDED PRECISION                                                  MATV2004
      SUBROUTINE MATV2(A,N,B,M,DETM)                                   MATV2005
      DIMENSION IPVOT(2),A(2,2),B(2,1),INDEX(2,2),PIVOT(2)             MATV2006
      EQUIVALENCE (IROW,JROW),(ICLUM,JCLUM),(AMAX,T,SWAP)              MATV2007
      DETM=1.0                                                         MATV2008
      DO 20 J=1,N                                                      MATV2009
   20 IPVOT(J)=0                                                       MATV2010
      DO 550 I=1,N                                                     MATV2011
      AMAX=0.0                                                         MATV2012
      DO 105 J=1,N                                                     MATV2013
      IF(IPVOT(J)-1)60,105,60                                          MATV2014
   60 DO 100 K=1,N                                                     MATV2015
      IF(IPVOT(K)-1)80,100,740                                         MATV2016
   80 IF(ABS(AMAX)-ABS(A(J,K)))85,100,100                              MATV2017
   85 IROW=J                                                           MATV2018
      ICLUM=K                                                          MATV2019
      AMAX=A(J,K)                                                      MATV2020
  100 CONTINUE                                                         MATV2021
  105 CONTINUE                                                         MATV2022
      IPVOT(ICLUM)=IPVOT(ICLUM)+1                                      MATV2023
      IF(IROW-ICLUM)140,260,140                                        MATV2024
  140 DETM=-DETM                                                       MATV2025
      DO 200 L=1,N                                                     MATV2026
      SWAP=A(IROW,L)                                                   MATV2027
      A(IROW,L)=A(ICLUM,L)                                             MATV2028
  200 A(ICLUM,L)=SWAP                                                  MATV2029
      IF(M)260,260,210                                                 MATV2030
  210 DO 250 L=1,M                                                     MATV2031
      SWAP=B(IROW,L)                                                   MATV2032
      B(IROW,L)=B(ICLUM,L)                                             MATV2033
  250 B(ICLUM,L)=SWAP                                                  MATV2034
  260 INDEX(I,1)=IROW                                                  MATV2035
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```
      INDEX(I,2)=ICLUM                                              MATV2036
      PIVOT(I)=A(ICLUM,ICLUM)                                       MATV2037
      DETM=DETM*PIVOT(I)                                            MATV2038
      A(ICLUM,ICLUM)=1.0                                            MATV2039
      DO 350 L=1,N                                                  MATV2040
  350 A(ICLUM,L)=A(ICLUM,L)/PIVOT(I)                                MATV2041
      IF(M)380,380,360                                              MATV2042
  360 DO 370 L=1,M                                                  MATV2043
  370 B(ICLUM,L)=B(ICLUM,L)/PIVOT(I)                                MATV2044
  380 DO 550 L1=1,N                                                 MATV2045
      IF(L1-ICLUM)400,550,400                                       MATV2046
  400 T=A(L1,ICLUM)                                                 MATV2047
      A(L1,ICLUM)=0.0                                               MATV2048
      DO 450 L=1,N                                                  MATV2049
  450 A(L1,L)=A(L1,L)-A(ICLUM,L)*T                                  MATV2050
      IF(M)550,550,460                                              MATV2051
  460 DO 500 L=1,M                                                  MATV2052
  500 B(L1,L)=B(L1,L)-B(ICLUM,L)*T                                  MATV2053
  550 CONTINUE                                                      MATV2054
      DO 710 I=1,N                                                  MATV2055
      L=N+1-I                                                       MATV2056
      IF(INDEX(L,1)-INDEX(L,2))630,710,630                          MATV2057
  630 JROW=INDEX(L,1)                                               MATV2058
      JCLUM=INDEX(L,2)                                              MATV2059
      DO 705 K=1,N                                                  MATV2060
      SWAP=A(K,JROW)                                                MATV2061
      A(K,JROW)=A(K,JCLUM)                                          MATV2062
      A(K,JCLUM)=SWAP                                               MATV2063
  705 CONTINUE                                                      MATV2064
  710 CONTINUE                                                      MATV2065
  740 IF(DETM-0.000001)750,750,760                                  MATV2066
  750 DETM=0.0                                                      MATV2067
  760 RETURN                                                        MATV2068
      END                                                           MATV2069
// DUP                                                            MATV2070
*DELETE              MATV2                                        MATV2071
*STORE       WS  UA  MATV2                                        MATV2072
```

```
// JOB                                                                  PPE30000
// FOR                                                                  PPE30001
*ONE WORD INTEGERS                                                      PPE30002
*EXTENDED PRECISION                                                     PPE30003
*LIST ALL                                                               PPE30004
*IOCS(1403 PRINTER)                                                     PPE30005
*IOCS(2501 READER)                                                      PPE30006
*IOCS(TYPEWRITER)                                                       PPE30007
*IOCS(KEYBOARD)                                                         PPE30008
*NAME PPE3                                                              PPE30009
C                                                                       PPE30010
C     THIS PROGRAM ESTIMATES THE TWO PARAMATERS OF THE TRANSFORMATION   PPE30011
C (Y+C1)**C2 TO MAKE DATA FOLLOW MORE CLOSELY A NORMAL DISTRIBUTION. A  PPE30012
C REGRESSION EQUATION WITH 1 TO 12 INDEPENDENT VARIABLES IS FITTED AS   PPE30013
C WITH MREG1. POINTS ON THE TWO MAXIMIZED RELATIVE LIKELIHOOD GRAPHS ARPPE30014
C LISTED AND, IF DATA SWITCH 10 IS UP, PLOTTED.                         PPE30015
C                                                                       PPE30016
C     IF DATA SWITCH 9 IS UP, 130 POINTS ON THE LIKELIHOOD SURFACE ARE  PPE30017
C PRINTED OUT. THE POINT WITH LARGEST LOG LIKELIHOOD MAY THEN BE TYPED  PPE30018
C IN TO GIVE INITIAL ESTIMATES OF C1 AND C2.                            PPE30019
C                                                                       PPE30020
C    LINK CALLED                                                        PPE30021
C                                                                       PPE30022
C PPPE3 - PLOTS TWO MAXIMIZED RELATIVE LIKELIHOOD GRAPHS                PPE30023
C
C    SUBROUTINES CALLED
C
C PPSS3 - CALCULATE POINTS ON LIKELIHOOD SURFACE
C PPES3 - CALCULATES LIKELIHOOD FUNCTION
C PPLR3 - CALCULATES REGRESSION EQUATION
C MATV  - INVERTS MATRICES UP TO 12 BY 12
C                                                                       PPE30024
C    REQUIRES SUBROUTINE READA(X,Y,N,M1,K,ID) - SAME AS FOR MREG1       PPE30025
C                                                                       PPE30026
C   STORES Y AND X OBSERVATIONS IN Y(150) AND X(150,12)                 PPE30027
C   N - NUMBER OF OBSERVATIONS                                          PPE30028
C   M1 - NUMBER OF INDEPENDENT VARIABLES                                PPE30029
C   K - DUMMY PARAMETER - USED IN MREG1                                 PPE30030
C   ID=98 TERMINATION, ID NE 98 - PROCESS NEXT DATA DECK                PPE30031
C                                                                       PPE30032
C    MAKEUP OF DATA DECK                                                PPE30033
C 1.TITLE CARD -(12A6)                                                  PPE30034
C 2.CONTROL CARD - (4X,I2,4F5.3,I3)                                     PPE30035
C       I2 - NUMBER OF ITERATIONS ALLOWED                               PPE30036
C       2F5.3 - INITIAL ESTIMATES OF PARAMETERS C1 AND C2               PPE30037
C       2F5.3 - HALF SIZE OF INTERVAL TO BE PLOTTED AROUND EACH MAXIMUM PPE30038
C       I3 - NUMBER OF POINTS ON GRAPHS TO BE CALCULATED                PPE30039
C 3.DATA - ACCORDING TO SUBROUTINE READA                                PPE30040
C       MAXIMUM NUMBER OF OBSERVATIONS - 150                            PPE30041
C       MAXIMUM NUMBER OF INDEPENDENT VARIATES - 12                     PPE30042
C 4.REPEAT 1. TO 3. AS REQUIRED                                         PPE30043
C                                                                       PPE30044
      COMMON YY(150),TITL(12),R(75,3,2),C(2),A(2),ID,NI,N,Y(150),X(150,1PPE30045
     12),SS(12,12),S(12),T(12),M,F,MI,P                                 PPE30046
   96 FORMAT(F6.3)                                                      PPE30047
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95 FORMAT(33HTYPE IN ESTIMATES OF C1,C2 - F6.3)                          PPE30048
88 FORMAT(1X13F9.3)                                                      PPE30049
87 FORMAT(1H05X1HY12(6X1HX12))                                           PPE30050
86 FORMAT(25HOINITIAL ESTIMATES - C1 =F9.4,6H  C2 =F9.4,9H  LOG L =E1PPE30051
  14.6)                                                                  PPE30052
85 FORMAT(36HOMAXIMUM LIKELIHOOD ESTIMATES - C1 =F9.4,6H  C2 =F9.4,6XPPE30053
  17HLOG L =E14.6,6X22HNUMBER OF ITERATIONS =I4)                         PPE30054
82 FORMAT(4X,I2,4F5.3,I3)                                                PPE30055
81 FORMAT(1H1112A6)                                                      PPE30056
90 FORMAT(12A6)                                                          PPE30057
   L=8                                                                   PPE30058
   M=5                                                                   PPE30059
   READ(L,80)TITL                                                        PPE30060
   READ(L,82)MI,C,A,NI                                                   PPE30061
   CALL READA(X,Y,N,M1,J,ID)                                             PPE30062
   F=Y(1)                                                                PPE30063
   F1=Y(1)                                                               PPE30064
   DO 17 I=1,N                                                           PPE30065
   IF(Y(I)-F)37,44,44                                                    PPE30066
37 F=Y(I)                                                                PPE30067
44 IF(Y(I)-F1)17,17,45                                                   PPE30068
45 F1=Y(I)                                                               PPE30069
17 CONTINUE                                                              PPE30070
   CALL DATSW(9,J9)                                                      PPE30071
   GO TO (42,43),J9                                                      PPE30072
42 WRITE(M,81)TITL                                                       PPE30073
   CALL PPSS3(Y,X,F,F1,N,M1)                                             PPE30074
   WRITE(1,95)                                                           PPE30075
   READ(6,96)C                                                           PPE30076
   GO TO 24                                                              PPE30077
43 IF(F+C(1))23,23,24                                                    PPE30078
23 IF(F)40,40,41                                                         PPE30079
41 C(1)=0.0                                                              PPE30080
   GO TO 24                                                              PPE30081
40 C(1)=1.0-F                                                            PPE30082
24 WRITE(M,81)TITL                                                       PPE30083
   WRITE(M,87)(I,I=1,12)                                                 PPE30084
   DO 4 I=1,N                                                            PPE30085
 4 WRITE(M,88)Y(I),(X(I,J),J=1,M1)                                       PPE30086
   P=PPES3(Y,X,N,M1,C(1),C(2))                                           PPE30087
   WRITE(M,86)C,P                                                        PPE30088
   DO 2 II=1,MI                                                          PPE30089
   I2=II                                                                 PPE30090
   DO 1 I=1,12                                                           PPE30091
 1 T(I)=0.0                                                              PPE30092
   CALL PPLR3(Y,X,C(1),C(2),N,M1)                                        PPE30093
   DO 3 I=1,N                                                            PPE30094
   T1=(Y(I)+C(1))**C(2)                                                  PPE30095
   T2=(Y(I)+C(1))**(C(2)-1.0)                                            PPE30096
   T3=(Y(I)+C(1))**(C(2)-2.0)                                            PPE30097
   T4=ALOG(Y(I)+C(1))                                                    PPE30098
   T(1)=T(1)+(T1-YY(I))**2                                               PPE30099
   T(2)=T(2)+(T1-YY(I))*T2                                               PPE30100
   T(3)=T(3)+1.0/(Y(I)+C(1))                                             PPE30101
   T(4)=T(4)+(T1-YY(I))*T1*T4                                            PPE30102
   T(5)=T(5)+T4                                                          PPE30103
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      T(6)=T(6)+T3*(T1-YY(I))                                          PPE30104
      T(7)=T(7)+T2*T2                                                  PPE30105
      T(8)=T(8)+1.0/(Y(I)+C(1))/(Y(I)+C(1))                            PPE30106
      T(9)=T(9)+(T1-YY(I))*T1*T4*T4                                    PPE30107
      T(10)=T(10)+T1*T1*T4*T4                                          PPE30108
      T(11)=T(11)+T1*T2*T4                                             PPE30109
    3 T(12)=T(12)+(T1-YY(I))*T2*T4                                     PPE30110
      S(1)=-FLOAT(N)*T(2)*C(2)/T(1)+(C(2)-1.0)*T(3)                    PPE30111
      S(2)=-FLOAT(N)*(T(4)/T(1)-1.0/C(2))+T(5)                         PPE30112
      SS(1,1)=-FLOAT(N)*(T(1)*(C(2)*(C(2)-1.0)*T(6)+C(2)*C(2)*T(7))-2.0*PPE30113
     1T(2)*T(2)*C(2)*C(2))/T(1)/T(1)-(C(2)-1.0)*T(8)                   PPE30114
      SS(2,2)=-FLOAT(N)*((T(1)*(T(9)+T(10))-2.0*T(4)*T(4))/T(1)/T(1)+1.0PPE30115
     1/C(2)/C(2))                                                      PPE30116
      SS(1,2)=-FLOAT(N)*(T(1)*(C(2)*T(11)+C(2)*T(12)+T(2))-2.0*C(2)*T(2)PPE30117
     1*T(4))/T(1)/T(1)+T(3)                                            PPE30118
      SS(2,1)=SS(1,2)                                                  PPE30119
      CALL MATV(SS,2,S,1,DET)                                          PPE30120
      DO 6 I=1,2                                                       PPE30121
    6 C(I)=C(I)-S(I)                                                   PPE30122
      DO 7 I=1,2                                                       PPE30123
      IF(ABS(S(I))-0.0001)7,7,2                                        PPE30124
    7 CONTINUE                                                         PPE30125
      GO TO 8                                                          PPE30126
    2 CONTINUE                                                         PPE30127
    8 P=PPES3(Y,X,N,M1,C(1),C(2))                                      PPE30128
      WRITE(M,85)C,P,I2                                                PPE30129
      CALL LINK(PPPE3)                                                 PPE30130
      END                                                              PPE30131
// DUP                                                                 PPE30132
*DELETE              PPE3                                            PPE30133
*STORE       WS  UA  PPE3                                            PPE30134

// JOB                                                                 PPPE3000
// FOR                                                                 PPPE3001
*ONE WORD INTEGERS                                                     PPPE3002
*EXTENDED PRECISION                                                    PPPE3003
*LIST ALL                                                              PPPE3004
*IOCS(PLOTTER)                                                         PPPE3005
*IOCS(1403 PRINTER)                                                    PPPE3006
*NAME PPPE3                                                            PPPE3007
      DIMENSION I1(2),C1(2),C2(2)                                      PPPE3008
      COMMON YY(150),TITL(12),R(75,3,2),C(2),A(2),ID,NI,N,Y(150),X(150,1PPPE3009
     12),SS(12,12),S(12),T(12),M,F,MI,P                                PPPE3010
   94 FORMAT(24HMAXIMUM LIKELIHOOD RATIO)                              PPPE3011
   93 FORMAT(10HVALUE OF CI1,15H   MAXIMUM AT CI1,2H =F8.4)            PPPE3012
   92 FORMAT(F3.1)                                                     PPPE3013
   91 FORMAT(F8.3)                                                     PPPE3014
   90 FORMAT(1X2F9.4,E14.6,I5,15X,2F9.4,E14.6,I5)                      PPPE3015
   89 FORMAT(60HOPOINTS ON MAXIMIZED RELATIVE LIKELIHOOD GRAPHS OF C1 ANPPPE3016
     1D C2//4X2HC117X2HC210X1HR8X4HITER18X2HC117X2HC210X1HR8X4HITER/)   PPPE3017
   81 FORMAT(1H112A6)                                                  PPPE3018
   80 FORMAT(12A6)                                                     PPPE3019
      IF(N+NI-42)25,25,26                                              PPPE3020
   26 WRITE(M,81)TITL                                                  PPPE3021
   25 WRITE(M,89)                                                      PPPE3022
      C2(1)=C(2)                                                       PPPE3023
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      C1(2)=C(1)                                                        PPPE3024
      DO 11 J=1,NI                                                      PPPE3025
      C1(1)=C(1)-A(1)+(J-1)*2.0*A(1)/FLOAT(NI-1)                        PPPE3026
      IF(F+C1(1))16,16,28                                               PPPE3027
   28 DO 14 II=1,MI                                                     PPPE3028
      I1(1)=II                                                          PPPE3029
      DO 13 I=1,10                                                      PPPE3030
   13 T(I)=0.0                                                          PPPE3031
      CALL PPLR3(Y,X,C1(1),C2(1),N,M1)                                  PPPE3032
      DO 12 I=1,N                                                       PPPE3033
      T1=(Y(I)+C1(1))**C2(1)                                            PPPE3034
      T4=ALOG(Y(I)+C1(1))                                               PPPE3035
      T(1)=T(1)+(T1-YY(I))**2                                           PPPE3036
      T(4)=T(4)+(T1-YY(I))*T1*T4                                        PPPE3037
      T(5)=T(5)+T4                                                      PPPE3038
      T(9)=T(9)+(T1-YY(I))*T1*T4*T4                                     PPPE3039
   12 T(10)=T(10)+T1*T1*T4*T4                                           PPPE3040
      S(2)=-FLOAT(N)*(T(4)/T(1)-1.0/C2(1))+T(5)                         PPPE3041
      SS(2,2)=-FLOAT(N)*((T(1)*(T(9)+T(10))-2.0*T(4)*T(4))/T(1)/T(1)+1.0PPPE3042
     1/C2(1)/C2(1))                                                     PPPE3043
      C2(1)=C2(1)-S(2)/SS(2,2)                                          PPPE3044
      IF(ABS(S(2)/SS(2,2))-0.0001)16,16,14                              PPPE3045
   14 CONTINUE                                                          PPPE3046
   16 C2(2)=C(2)-A(2)+(J-1)*2.0*A(2)/FLOAT(NI-1)                        PPPE3047
      DO 18 II=1,MI                                                     PPPE3048
      I1(2)=II                                                          PPPE3049
      DO 19 I=1,8                                                       PPPE3050
   19 T(I)=0.0                                                          PPPE3051
      CALL PPLR3(Y,X,C1(2),C2(2),N,M1)                                  PPPE3052
      DO 21 I=1,N                                                       PPPE3053
      T1=(Y(I)+C1(2))**C2(2)                                            PPPE3054
      T2=(Y(I)+C1(2))**(C2(2)-1.0)                                      PPPE3055
      T3=(Y(I)+C1(2))**(C2(2)-2.0)                                      PPPE3056
      T(1)=T(1)+(T1-YY(I))**2                                           PPPE3057
      T(2)=T(2)+(T1-YY(I))*T2                                           PPPE3058
      T(3)=T(3)+1.0/(Y(I)+C1(2))                                        PPPE3059
      T(6)=T(6)+T3*(T1-YY(I))                                           PPPE3060
      T(7)=T(7)+T2*T2                                                   PPPE3061
   21 T(8)=T(8)+1.0/(Y(I)+C1(2))/(Y(I)+C1(2))                           PPPE3062
      S(1)=-FLOAT(N)*T(2)*C2(2)/T(1)+(C2(2)-1.0)*T(3)                   PPPE3063
      SS(1,1)=-FLOAT(N)*(T(1)*(C2(2)*(C2(2)-1.0)*T(6)+C2(2)*C2(2)*T(7))-PPPE3064
     12.0*T(2)*T(2)*C2(2)*C2(2))/T(1)/T(1)-(C2(2)-1.0)*T(8)             PPPE3065
      C1(2)=C1(2)-S(1)/SS(1,1)                                          PPPE3066
      IF(ABS(S(1)/SS(1,1))-0.0001)22,22,18                              PPPE3067
   18 CONTINUE                                                          PPPE3068
   22 DO 39 I=1,2                                                       PPPE3069
      R(J,1,I)=C1(I)                                                    PPPE3070
      R(J,2,I)=C2(I)                                                    PPPE3071
   39 R(J,3,I)=EXP(PPES3(Y,X,N,M1,C1(I),C2(I))-P)                       PPPE3072
      WRITE(M,90)((R(J,K,I),K=1,3),I1(I),I=1,2)                         PPPE3073
   11 CONTINUE                                                          PPPE3074
      CALL DATSW(10,J10)                                                PPPE3075
      GO TO (35,36),J10                                                 PPPE3076
   35 DO 30 J=1,2                                                       PPPE3077
      X4=C(J)-A(J)                                                      PPPE3078
      A3=2.0*A(J)                                                       PPPE3079
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      B3=A3/20.                                                          PPPE3080
      C3=X4-A3/50.                                                       PPPE3081
      D3=A3/10.                                                          PPPE3082
      E3=10./A3                                                          PPPE3083
      F3=X4-B3                                                           PPPE3084
      G3=X4+D3                                                           PPPE3085
      H3=X4+A3*1.3                                                       PPPE3086
      W3=X4-A3/15.                                                       PPPE3087
      Z3=X4-D3                                                           PPPE3088
      CALL SCALE(E3,10.0,X4,0.0)                                         PPPE3089
      CALL EGRID(0,X4,0.0,B3,20)                                         PPPE3090
      CALL EGRID(1,X4,0.0,0.05,20)                                       PPPE3091
      DO 31 I=1,11                                                       PPPE3092
      X1=G3-D3/2.0+D3*FLOAT(I-2)                                         PPPE3093
      XO=G3+D3*FLOAT(I-2)                                                PPPE3094
      CALL ECHAR(X1,-0.02,0.1,0.1,0.0)                                   PPPE3095
   31 WRITE(7,91)XO                                                      PPPE3096
      DO 32 I=1,11                                                       PPPE3097
      X1=-0.1+0.1*FLOAT(I)                                               PPPE3098
      CALL ECHAR(F3,X1,0.1,0.1,0.0)                                      PPPE3099
   32 WRITE(7,92)X1                                                      PPPE3100
      CALL ECHAR(G3,-0.04,0.1,0.1,0.0)                                   PPPE3101
      WRITE(7,93)J,J,C(J)                                                PPPE3102
      CALL ECHAR(W3,0.1,0.1,0.1,1.5709)                                  PPPE3103
      WRITE(7,94)                                                        PPPE3104
      CALL ECHAR(Z3,0.1,0.1,0.1,1.5709)                                  PPPE3105
      WRITE(7,80)TITL                                                    PPPE3106
      CALL EPLOT(-2,X4,0.0)                                              PPPE3107
      DO 33 I=1,NI                                                       PPPE3108
      IF(R(I,3,J)-1.0)33,33,34                                           PPPE3109
   34 R(I,3,J)=1.0                                                       PPPE3110
   33 CALL EPLOT(0,R(I,J,J),R(I,3,J))                                    PPPE3111
      CALL EPLOT(1,H3,0.0)                                               PPPE3112
   30 CONTINUE                                                           PPPE3113
   36 IF(ID-98)9,9,10                                                    PPPE3114
   10 CALL LINK(PPE3)                                                    PPPE3115
    9 CALL EXIT                                                          PPPE3116
      END                                                                PPPE3117
// DUP                                                                   PPPE3118
*DELETE              PPPE3                                              PPPE3119
*STORE      WS  UA  PPPE3                                               PPPE3120

// JOB                                                                   READA000
// FOR                                                                   READA001
*ONE WORD INTEGERS                                                       READA002
*EXTENDED PRECISION                                                     READA003
*LIST ALL                                                               READA004
C                                                                        READA005
C   THIS IS A SAMPLE READ SUBROUTINE FOR MREG1 AND PPE3                  READA006
C   THIS SUBROUTINE READS THE DATA FOR A THREE FACTOR RESPONSE SURFACE    READA007
C   WITH THE SAME DATA DECK AS BOX3                                      READA008
C                                                                        READA009
      SUBROUTINE READA(X,Y,N,M,K1,ID)                                    READA010
      DIMENSION Y(150),X(150,12),Y1(10),AA(4)                            READA011
   84 FORMAT(16F5.3)                                                     READA012
   83 FORMAT(1X,2I2,5F5.3)                                               READA013
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   82 FORMAT(78X,I2)                                                    READA014
   81 FORMAT(10F6.3)                                                    READA015
      K1=1                                                              READA016
      M=9                                                               READA017
      L=8                                                               READA018
      READ(L,83)N,IREP,CONST,AA                                         READA019
      READ(L,84)((X(I,J),J=1,3),I=1,N)                                  READA020
      DO 1 I=1,N                                                        READA021
      READ(L,81)(Y1(J),J=1,IREP)                                        READA022
      Y(I)=0.0                                                          READA023
      DO 1 J=1,IREP                                                     READA024
    1 Y(I)=Y(I)+(Y1(J)+CONST)**AA(4)/IREP                               READA025
      READ(L,82)ID                                                      READA026
      DO 2 I=1,N                                                        READA027
      X(I,1)=X(I,1)**AA(1)                                              READA028
      X(I,2)=X(I,2)**AA(2)                                              READA029
      X(I,3)=X(I,3)**AA(3)                                              READA030
      X(I,4)=X(I,1)*X(I,1)                                              READA031
      X(I,5)=X(I,2)*X(I,2)                                              READA032
      X(I,6)=X(I,3)*X(I,3)                                              READA033
      X(I,7)=X(I,1)*X(I,2)                                              READA034
      X(I,8)=X(I,1)*X(I,3)                                              READA035
      X(I,9)=X(I,2)*X(I,3)                                              READA036
    2 CONTINUE                                                          READA037
      RETURN                                                            READA038
      END                                                               READA039
// DUP                                                                  READA040
*DELETE              READA                                             READA041
*STORE       WS  UA  READA                                             READA042

// JOB                                                                  PPSS3000
// FOR                                                                  PPSS3001
*ONE WORD INTEGERS                                                      PPSS3002
*EXTENDED PRECISION                                                     PPSS3003
*LIST ALL                                                               PPSS3004
      SUBROUTINE PPSS3(Y,X,F,F1,N,M1)                                   PPSS3005
      DIMENSION Y(100),X(100,12),C1(10),C2(10),P(10)                    PPSS3006
      COMMON YY(100)                                                    PPSS3007
   85 FORMAT(1X)                                                        PPSS3008
   84 FORMAT(1X10E12.4)                                                 PPSS3009
   83 FORMAT(1X10F12.3)                                                 PPSS3010
   82 FORMAT(27HOC1, C2, AND LOG LIKELIHOOD)                            PPSS3011
      M=5                                                               PPSS3012
      WRITE(M,82)                                                       PPSS3013
      A=(F+F1)/25.0                                                     PPSS3014
      DO 1 I=1,13                                                       PPSS3015
      WRITE(M,85)                                                       PPSS3016
      DO 2 J=1,10                                                       PPSS3017
      C1(J)=(I-1)*A-F+0.0001                                            PPSS3018
      C2(J)=(J-6)*0.4+0.2                                               PPSS3019
      P(J)=PPES3(Y,X,N,M1,C1(J),C2(J))                                  PPSS3020
    2 CONTINUE                                                          PPSS3021
      WRITE(M,83)C1,C2                                                  PPSS3022
      WRITE(M,84)P                                                      PPSS3023
    1 CONTINUE                                                          PPSS3024
      RETURN                                                            PPSS3025
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      END                                                          PPSS3026
// DUP                                                           PPSS3027
*DELETE            PPSS3                                        PPSS3028
*STORE      WS  UA  PPSS3                                        PPSS3029

// JOB                                                           PPES3000
// FOR                                                           PPES3001
*ONE WORD INTEGERS                                               PPES3002
*EXTENDED PRECISION                                              PPES3003
*LIST ALL                                                        PPES3004
      FUNCTION PPES3(Y,X,N,M1,C1,C2)                             PPES3005
      DIMENSION Y(100),X(100,12)                                 PPES3006
      COMMON YY(100)                                             PPES3007
      CALL PPLR3(Y,X,C1,C2,N,M1)                                 PPES3008
      A=0.0                                                      PPES3009
      B=0.0                                                      PPES3010
      DO 1 I=1,N                                                 PPES3011
      A=A+((Y(I)+C1)**C2-YY(I))**2                               PPES3012
    1 B=B+ALOG(Y(I)+C1)                                          PPES3013
      PPES3=-FLOAT(N)*(ALOG(A)/2.0-ALOG(ABS(C2)))+(C2-1.0)*B     PPES3014
      RETURN                                                     PPES3015
      END                                                        PPES3016
// DUP                                                           PPES3017
*DELETE            PPES3                                        PPES3018
*STORE      WS  UA  PPES3                                        PPES3019

// JOB                                                           PPLR3000
// FOR                                                           PPLR3001
*ONE WORD INTEGERS                                               PPLR3002
*EXTENDED PRECISION                                              PPLR3003
*LIST ALL                                                        PPLR3004
      SUBROUTINE PPLR3(Y,X,C1,C2,N,M1)                           PPLR3005
      DIMENSION XX(12),Y(100),X(100,12),SS(12,12),S(12)          PPLR3006
      COMMON YY(100)                                             PPLR3007
      YY1=0.0                                                    PPLR3008
      DO 4 J=1,M1                                                PPLR3009
      XX(J)=0.0                                                  PPLR3010
      S(J)=0.0                                                   PPLR3011
      DO 4 K=1,M1                                                PPLR3012
    4 SS(J,K)=0.0                                                PPLR3013
      DO 1 I=1,N                                                 PPLR3014
      YY1=YY1+(Y(I)+C1)**C2/FLOAT(N)                             PPLR3015
      DO 1 J=1,M1                                                PPLR3016
    1 XX(J)=XX(J)+X(I,J)/FLOAT(N)                                PPLR3017
      DO 2 I=1,N                                                 PPLR3018
      A=(Y(I)+C1)**C2                                            PPLR3019
      DO 2 J=1,M1                                                PPLR3020
      S(J)=S(J)+(A-YY1)*(X(I,J)-XX(J))                           PPLR3021
      DO 2 K=1,M1                                                PPLR3022
    2 SS(J,K)=SS(J,K)+(X(I,J)-XX(J))*(X(I,K)-XX(K))              PPLR3023
      IF(M1-1)5,5,6                                              PPLR3024
    5 S(1)=S(1)/SS(1,1)                                          PPLR3025
      GO TO 7                                                    PPLR3026
    6 CALL MATV(SS,M1,S,1,DET)                                   PPLR3027
    7 DO 3 I=1,N                                                 PPLR3028
      YY(I)=YY1                                                  PPLR3029
```

```
      DO 3 J=1,M1                                                    PPLR3030
    3 YY(I)=YY(I)+S(J)*(X(I,J)-XX(J))                                PPLR3031
      RETURN                                                         PPLR3032
      END                                                            PPLR3033
// DUP                                                               PPLR3034
*DELETE              PPLR3                                          PPLR3035
*STORE       WS  UA  PPLR3                                          PPLR3036

// JOB                                                               MATV0000
// FOR                                                               MATV0001
*LIST ALL                                                            MATV0002
*ONE WORD INTEGERS                                                   MATV0003
*EXTENDED PRECISION                                                  MATV0004
      SUBROUTINE MATV(A,N,B,M,DETM)                                  MATV0005
      DIMENSION A(12,12),B(12,1),PIVOT(12),IPVOT(12),INDEX(12,12)    MATV0006
      EQUIVALENCE (IROW,JROW),(ICLUM,JCLUM),(AMAX,T,SWAP)            MATV0007
      DETM=1.0                                                       MATV0008
      DO 20 J=1,N                                                    MATV0009
   20 IPVOT(J)=0                                                     MATV0010
      DO 550 I=1,N                                                   MATV0011
      AMAX=0.0                                                       MATV0012
      DO 105 J=1,N                                                   MATV0013
      IF(IPVOT(J)-1)60,105,60                                        MATV0014
   60 DO 100 K=1,N                                                   MATV0015
      IF(IPVOT(K)-1)80,100,740                                       MATV0016
   80 IF(ABS(AMAX)-ABS(A(J,K)))85,100,100                            MATV0017
   85 IROW=J                                                         MATV0018
      ICLUM=K                                                        MATV0019
      AMAX=A(J,K)                                                    MATV0020
  100 CONTINUE                                                       MATV0021
  105 CONTINUE                                                       MATV0022
      IPVOT(ICLUM)=IPVOT(ICLUM)+1                                    MATV0023
      IF(IROW-ICLUM)140,260,140                                      MATV0024
  140 DETM=-DETM                                                     MATV0025
      DO 200 L=1,N                                                   MATV0026
      SWAP=A(IROW,L)                                                 MATV0027
      A(IROW,L)=A(ICLUM,L)                                           MATV0028
  200 A(ICLUM,L)=SWAP                                                MATV0029
      IF(M)260,260,210                                               MATV0030
  210 DO 250 L=1,M                                                   MATV0031
      SWAP=B(IROW,L)                                                 MATV0032
      B(IROW,L)=B(ICLUM,L)                                           MATV0033
  250 B(ICLUM,L)=SWAP                                                MATV0034
  260 INDEX(I,1)=IROW                                                MATV0035
      INDEX(I,2)=ICLUM                                               MATV0036
      PIVOT(I)=A(ICLUM,ICLUM)                                        MATV0037
      DETM=DETM*PIVOT(I)                                             MATV0038
      A(ICLUM,ICLUM)=1.0                                             MATV0039
      DO 350 L=1,N                                                   MATV0040
  350 A(ICLUM,L)=A(ICLUM,L)/PIVOT(I)                                 MATV0041
      IF(M)380,380,360                                               MATV0042
  360 DO 370 L=1,M                                                   MATV0043
  370 B(ICLUM,L)=B(ICLUM,L)/PIVOT(I)                                 MATV0044
  380 DO 550 L1=1,N                                                  MATV0045
      IF(L1-ICLUM)400,550,400                                        MATV0046
  400 T=A(L1,ICLUM)                                                  MATV0047
```

```
      A(L1,ICLUM)=0.0                                                   MATV0048
      DO 450 L=1,N                                                      MATV0049
  450 A(L1,L)=A(L1,L)-A(ICLUM,L)*T                                      MATV0050
      IF(M)550,550,460                                                  MATV0051
  460 DO 500 L=1,M                                                      MATV0052
  500 B(L1,L)=B(L1,L)-B(ICLUM,L)*T                                      MATV0053
  550 CONTINUE                                                          MATV0054
      DO 710 I=1,N                                                      MATV0055
      L=N+1-I                                                           MATV0056
      IF(INDEX(L,1)-INDEX(L,2))630,710,630                              MATV0057
  630 JROW=INDEX(L,1)                                                   MATV0058
      JCLUM=INDEX(L,2)                                                  MATV0059
      DO 705 K=1,N                                                      MATV0060
      SWAP=A(K,JROW)                                                    MATV0061
      A(K,JROW)=A(K,JCLUM)                                              MATV0062
      A(K,JCLUM)=SWAP                                                   MATV0063
  705 CONTINUE                                                          MATV0064
  710 CONTINUE                                                          MATV0065
  740 IF(DETM-0.000001)750,750,760                                      MATV0066
  750 DETM=0.0                                                          MATV0067
  760 RETURN                                                            MATV0068
      END                                                               MATV0069
// DUP                                                                  MATV0070
*DELETE              MATV                                              MATV0071
*STORE       WS  UA  MATV                                              MATV0072
```

```
// JOB                                                                  COEM0000
// FOR                                                                  COEM0001
*ONE WORD INTEGERS                                                      COEM0002
*LIST ALL                                                               COEM0003
*EXTENDED PRECISION                                                     COEM0004
*IOCS(2501 READER)                                                      COEM0005
*IOCS(1403 PRINTER)                                                     COEM0006
*NAME COEM                                                              COEM0007
C                                                                       COEM0008
C    ONE AND TWO WAY ANALYSIS OF VARIANCE USING THE EXPONENTIAL         COEM0009
C DISTRIBUTION
C                                                                       COEM0010
C      THIS PROGRAM ANALYZES ONE- AND TWO-WAY FACTORIAL EXPERIMENTS WITH COEM0011
C A MAXIMUM OF TWENTY BLOCKS AND FOUR OBSERVATIONS PER BLOCK, USING AN  COEM0012
C EXPONENTIAL PROBABILITY DISTRIBUTION. FOR COMPARISON, NORMAL THEORY   COEM0013
C LINEAR, POWER TRANSFORMED, AND LOG MODELS ARE ALSO ANALYZED, WITH     COEM0014
C EITHER NO INTERACTION OR INTERACTION MATHEMATICAL MODELS, DEPENDING ONCOEM0015
C THE NUMBER OF OBSERVATIONS PER BLOCK. OPTIONS ALLOW PRINTOUT OF       COEM0016
C EXPECTED VALUES EITHER IN ORIGINAL OR TRANSFORMED UNITS WITH          COEM0017
C DEVIATIONS.
C                                                                       COEM0018
C      NUMBER OF ROWS (A) MUST BE GREATER THAN OR EQUAL TO NUMBER OF    COEM0019
C COLUMNS
C                                                                       COEM0020
C    SUBROUTINES CALLED                                                 COEM0021
C                                                                       COEM0022
C   CLE    - CALCULATES EXPONENTIAL LIKELIHOOD                         COEM0023
C   CLIE   - CALCULATES MAXIMUM LIKELIHOOD ESTIMATES OF PARAMETERS     COEM0024
C   MATVK  - INVERTS MATRICES UP TO 31 BY 31                           COEM0025
C                                                                       COEM0026
C    MAKEUP OF DATA DECK                                                COEM0027
C                                                                       COEM0028
C 1.TITLE CARD (12A6)                                                   COEM0029
C 2.CONTROL CARD (I1,4I2,2F5.3,I3)                                      COEM0030
C      I1 - OPTION - 0 - NOTHING                                        COEM0031
C                    1 - PRINT EXPECTED VALUES IN ORIGINAL UNITS WITH   COEM0032
C                        DEVIATIONS                                     COEM0033
C                    2 - PRINT EXPECTED VALUES IN TRANSFORMED UNITS WITH COEM0034
C                        DEVIATIONS                                     COEM0035
C      I2 - NUMBER OF BLOCKS                                            COEM0036
C      I2 - NUMBER OF OBSERVATIONS PER BLOCK                            COEM0037
C      I2 - NUMBER OF TREATMENT LEVELS IN DIRECTION A (NUMBER OF ROWS)  COEM0038
C      I2 - NUMBER OF TREATMENT LEVELS IN DIRECTION B (NUMBER OF COLUMNS)COEM0039
C      F5.3 - POWER TRANSFORMATION                                      COEM0040
C      F5.3 - UNIT OF MEASUREMENT                                       COEM0041
C      I3 - NUMBER OF ITERATIONS ALLOWED                                COEM0042
C 3.DATA - SETS OF OBSERVATIONS FOR EACH BLOCK - ONE SET PER CARD -     COEM0043
C      PROCEED DOWN COLUMNS (4F6.3)                                     COEM0044
C 4.99 IN COLS. 79-80 INDICATES END OF DATA, ANOTHER DATA DECK TO FOLLOWCOEM0045
C    98 IN COLS. 79-80 INDICATES END OF JOB, CALL EXIT AFTER THIS DECK  COEM0046
C 5.REPEAT 1. TO 4. AS REQUIRED                                         COEM0047
C                                                                       COEM0048
      DIMENSION R( 80),S( 80),TL(7,5),RS(7,5),B2(5),Y1(4),X(8),X1(8)    COEM0049
      COMMON T(20),TA(10),TB(4),T1(10),T2(4),S1(20,3),TOT,N,N1,MA,MB,NI,COEM0050
     1TITL(12)                                                          COEM0051
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187 FORMAT(15HONO INTERACTION33X11HINTERACTION/)                          COEM0052
186 FORMAT(19HOORIGINAL VARIABLES)                                       COEM0053
185 FORMAT(22HOTRANSFORMED VARIABLES)                                    COEM0054
184 FORMAT(15HONO INTERACTION/)                                          COEM0055
183 FORMAT(8E12.4)                                                       COEM0056
182 FORMAT(51HOEXPECTED VALUES AND DEVIATIONS - EXP. Y/PAR. MODEL)       COEM0057
181 FORMAT(51HOEXPECTED VALUES AND DEVIATIONS - EXP. Y*PAR. MODEL)       COEM0058
180 FORMAT(50HOEXPECTED VALUES AND DEVIATIONS - LOG NORMAL MODEL)        COEM0059
 99 FORMAT(60HOEXPECTED VALUES AND DEVIATIONS - TRANS. NORMAL MODEL -    COEM0060
   1C = F7.4)                                                            COEM0061
 98 FORMAT(53HOEXPECTED VALUES AND DEVIATIONS - LINEAR NORMAL MODEL)     COEM0062
 97 FORMAT(1X)                                                           COEM0063
 96 FORMAT(33HOINCORRECT NUMBER OF OBSERVATIONS)                         COEM0064
 95 FORMAT(1X,4F11.2)                                                    COEM0065
 94 FORMAT(6HOLOG R17X13HLINEAR NORMAL1X13HTRANS. NORMAL2X10HLOG NORMA   COEM0066
   1L3X11HEXP. Y*PAR.3X11HEXP. Y/PAR.)                                  COEM0067
 92 FORMAT(19HOVARIABLES OBSERVED/)                                      COEM0068
 91 FORMAT(23H MULTINOMIAL LIKELIHOODE13.6)                              COEM0069
 90 FORMAT(6HOLOG R17X13HLINEAR NORMAL1X13HTRANS. NORMAL2X10HLOG NORMA   COEM0070
   1L2(3X11HEXP. Y*PAR.3X11HEXP. Y/PAR.))                               COEM0071
 89 FORMAT(38X4HC = F7.4)                                                COEM0072
 88 FORMAT(11HOTREATMENTS11X7E14.6)                                      COEM0073
 87 FORMAT(12H TREATMENT A1OX7E14.6)                                     COEM0074
 86 FORMAT(12H TREATMENT B1OX7E14.6)                                     COEM0075
 85 FORMAT(12H INTERACTION1OX5E14.6)                                     COEM0076
 93 FORMAT(12H INTERACTION8OX2E14.6)                                     COEM0077
 84 FORMAT(21H LACK OF FIT OF MODEL1X7E14.6)                             COEM0078
 83 FORMAT(I1,4I2,2F5.3,I3)                                              COEM0079
 82 FORMAT(1H112A6)                                                      COEM0080
 81 FORMAT(4F6.3,54X,I2)                                                 COEM0081
 80 FORMAT(12A6)                                                         COEM0082
    L=8                                                                  COEM0083
    M=5                                                                  COEM0084
 20 READ(L,80)TITL                                                       COEM0085
    READ(L,83)NJ,N1,IREP,MA,MB,A1,D,NI                                   COEM0086
    NJ=NJ+1                                                              COEM0087
    N=N1*IREP                                                            COEM0088
    I=0                                                                  COEM0089
 22 I=I+1                                                                COEM0090
    READ(L,81)Y1,ID                                                      COEM0091
    IF(ID-98)27,23,23                                                    COEM0092
 27 DO 29 J=1,IREP                                                       COEM0093
    K=(J-1)*N1+I                                                         COEM0094
 29 R(K)=Y1(J)                                                           COEM0095
    GO TO 22                                                             COEM0096
 23 N2=I-1                                                               COEM0097
    IF(N1-N2)2,4,2                                                       COEM0098
  2 WRITE(M,96)                                                          COEM0099
  6 CALL EXIT                                                            COEM0100
  4 Y=0.0                                                                COEM0101
    DO 14 I=1,N                                                          COEM0102
 14 Y=Y+ALOG(R(I))/FLOAT(N)                                              COEM0103
    Y=EXP(Y)                                                             COEM0104
    D=N*ALOG(D)                                                          COEM0105
    E=-FLOAT(N)*(ALOG(6.283185/FLOAT(N))+1.0)/2.0                        COEM0106
    SLM=-N*ALOG(FLOAT(IREP))                                             COEM0107
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```
      DO 10 KK=1,5                                                    COEM0108
      DO 13 I=1,N                                                     COEM0109
      GO TO (1,12,5,1,1),KK                                           COEM0110
    1 S(I)=R(I)                                                       COEM0111
      GO TO 13                                                        COEM0112
   12 S(I)=(R(I)**(A1)-1.0)/A1/Y**(A1-1.0)                            COEM0113
      GO TO 13                                                        COEM0114
    5 S(I)=ALOG(R(I))*Y                                               COEM0115
   13 CONTINUE                                                        COEM0116
      TOT=0.0                                                         COEM0117
      DO 18 I=1,N1                                                    COEM0118
      T(I)=0.0                                                        COEM0119
      DO 18 J=1,IREP                                                  COEM0120
      K=(J-1)*N1+I                                                    COEM0121
      TOT=TOT+S(K)/FLOAT(N)                                           COEM0122
   18 T(I)=T(I)+S(K)/FLOAT(IREP)                                      COEM0123
      B2(2)=TOT                                                       COEM0124
      GO TO (44,44,44,36,44),KK                                       COEM0125
   36 TOT=0.0                                                         COEM0126
      DO 35 I=1,N1                                                    COEM0127
      T(I)=1.0/T(I)                                                   COEM0128
   35 TOT=TOT+T(I)/FLOAT(N1)                                          COEM0129
      B2(2)=1.0/B2(2)                                                 COEM0130
   44 DO 21 I=1,MB                                                    COEM0131
      T2(I)=0.0                                                       COEM0132
   21 TB(I)=0.0                                                       COEM0133
      DO 19 I=1,MA                                                    COEM0134
      T1(I)=0.0                                                       COEM0135
      TA(I)=0.0                                                       COEM0136
      DO 19 J=1,MB                                                    COEM0137
      K=(J-1)*MA+I                                                    COEM0138
      GO TO (34,34,34,3,34),KK                                        COEM0139
    3 T1(I)=T1(I)+1.0/T(K)/FLOAT(MB)                                  COEM0140
      T2(J)=T2(J)+1.0/T(K)/FLOAT(MA)                                  COEM0141
   34 TA(I)=TA(I)+T(K)/FLOAT(MB)                                      COEM0142
   19 TB(J)=TB(J)+T(K)/FLOAT(MA)                                      COEM0143
      GO TO (53,53,53,54,54),KK                                       COEM0144
   54 IF(IREP-1)52,52,76                                              COEM0145
   52 DO 55 I=1,5                                                     COEM0146
   55 TL(KK+2,I)=0.0                                                  COEM0147
   76 IF(MB-1)74,53,74                                                COEM0148
   74 CALL CLIE(KK-3)                                                 COEM0149
      GO TO 73                                                        COEM0150
   53 DO 75 I1=1,MA                                                   COEM0151
      DO 75 J1=1,MB                                                   COEM0152
      I=(J1-1)*MA+I1                                                  COEM0153
      S1(I,1)=T(I)-TA(I1)+TOT                                         COEM0154
      S1(I,2)=T(I)-TB(J1)+TOT                                         COEM0155
   75 S1(I,3)=TA(I1)+TB(J1)-TOT                                       COEM0156
   73 GO TO (7,38,38),NJ                                              COEM0157
   38 IF(KK-2)66,67,66                                                COEM0158
   67 IF(A1-1.0)66,7,66                                               COEM0159
   66 GO TO (7,116,116),NJ                                            COEM0160
  116 DO 79 I=1,8                                                     COEM0161
      X1(I)=0.0                                                       COEM0162
   79 X(I)=0.0                                                        COEM0163
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      GO TO (101,100,101,100,101),KK                                    COEM0164
  100 IF(MA*(IREP+2)-21)68,68,101                                       COEM0165
  101 WRITE(M,82)TITL                                                   COEM0166
      GO TO (7,114,115),NJ                                              COEM0167
  114 WRITE(M,185)                                                      COEM0168
      GO TO 68                                                          COEM0169
  115 WRITE(M,186)                                                      COEM0170
   68 GO TO (43,51,63,64,65),KK                                         COEM0171
   43 WRITE(M,98)                                                       COEM0172
      GO TO 70                                                          COEM0173
   51 WRITE(M,99)A1                                                     COEM0174
      GO TO 70                                                          COEM0175
   63 WRITE(M,180)                                                      COEM0176
      GO TO 70                                                          COEM0177
   64 WRITE(M,181)                                                      COEM0178
      GO TO 70                                                          COEM0179
   65 WRITE(M,182)                                                      COEM0180
   70 IF(IREP-1)107,107,108                                             COEM0181
  107 WRITE(M,184)                                                      COEM0182
      IJK=MB                                                            COEM0183
      GO TO 104                                                         COEM0184
  108 WRITE(M,187)                                                      COEM0185
      IJK=MB+4                                                          COEM0186
  104 DO 71 I=1,MA                                                      COEM0187
      DO 78 J=1,MB                                                      COEM0188
      II=(J-1)*MA+I                                                     COEM0189
      X(J)=S1(II,3)                                                     COEM0190
      IF(KK-4)110,102,110                                               COEM0191
  102 IF(X(J))120,119,120                                               COEM0192
  119 X(J)=10.0**30                                                     COEM0193
      GO TO 121                                                         COEM0194
  120 X(J)=1.0/X(J)                                                     COEM0195
  110 GO TO (7,121,111),NJ                                              COEM0196
  111 GO TO (121,112,113,121,121),KK                                    COEM0197
  112 X(J)=(A1*Y**(A1-1.0)*X(J)+1.0)**(1.0/A1)                          COEM0198
      GO TO 121                                                         COEM0199
  113 X(J)=EXP(X(J)/Y)                                                  COEM0200
  121 IF(IREP-1)78,78,122                                               COEM0201
  122 X(J+4)=T(II)                                                      COEM0202
      IF(KK-4)123,124,123                                               COEM0203
  124 IF(X(J+4))125,126,125                                             COEM0204
  126 X(J+4)=10.0**30                                                   COEM0205
      GO TO 78                                                          COEM0206
  125 X(J+4)=1.0/X(J+4)                                                 COEM0207
  123 GO TO (7,78,127),NJ                                               COEM0208
  127 GO TO (78,128,129,78,78),KK                                       COEM0209
  128 X(J+4)=(A1*Y**(A1-1.0)*X(J+4)+1.0)**(1.0/A1)                      COEM0210
      GO TO 78                                                          COEM0211
  129 X(J+4)=EXP(X(J+4)/Y)                                              COEM0212
   78 CONTINUE                                                          COEM0213
      WRITE(M,183)(X(J),J=1,IJK)                                        COEM0214
      DO 72 K1=1,IREP                                                   COEM0215
      DO 77 J=1,MB                                                      COEM0216
      K=(K1-1)*N1+(J-1)*MA+I                                            COEM0217
      GO TO (7,117,118),NJ                                              COEM0218
  117 X1(J)=S(K)                                                        COEM0219
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      GO TO 106                                                         COEM0220
  118 X1(J)=R(K)                                                        COEM0221
  106 IF(IREP-1)105,105,103                                             COEM0222
  103 X1(J+4)=X1(J)-X(J+4)                                              COEM0223
  105 X1(J)=X1(J)-X(J)                                                  COEM0224
   77 CONTINUE                                                          COEM0225
   72 WRITE(M,183)(X1(J),J=1,IJK)                                       COEM0226
   71 WRITE(M,97)                                                       COEM0227
    7 DO 37 I=1,5                                                       COEM0228
   37 TL(KK,I)=0.0                                                      COEM0229
      DO 26 I1=1,MA                                                     COEM0230
      DO 26 J1=1,MB                                                     COEM0231
      I=(J1-1)*MA+I1                                                    COEM0232
      DO 26 J=1,IREP                                                    COEM0233
      K=(J-1)*N1+I                                                      COEM0234
      IF(IREP-1)56,56,28                                                COEM0235
   56 GO TO (8,8,8,28,28),KK                                            COEM0236
   28 B2(1)=T(I)                                                        COEM0237
      B2(3)=S1(I,1)                                                     COEM0238
      B2(4)=S1(I,2)                                                     COEM0239
      B2(5)=S1(I,3)                                                     COEM0240
      IF(IREP-1)57,57,9                                                 COEM0241
   57 DO 58 I2=1,5                                                      COEM0242
   58 TL(KK+2,I2)=TL(KK+2,I2)+CLE(S(K),B2(I2),KK)                       COEM0243
    8 B2(1)=S1(I,3)                                                     COEM0244
      B2(5)=T(I)                                                        COEM0245
      GO TO (45,45,45,46,45),KK                                         COEM0246
   46 B2(3)=1.0/T2(J1)                                                  COEM0247
      B2(4)=1.0/T1(I1)                                                  COEM0248
      GO TO 9                                                           COEM0249
   45 B2(3)=TB(J1)                                                      COEM0250
      B2(4)=TA(I1)                                                      COEM0251
    9 DO 26 K1=1,5                                                      COEM0252
   26 TL(KK,K1)=TL(KK,K1)+CLE(S(K),B2(K1),KK)                           COEM0253
      GO TO (31,31,31,32,32),KK                                         COEM0254
   31 DO 39 I=1,4                                                       COEM0255
      IF(TL(KK,I))39,39,47                                              COEM0256
   47 TL(KK,I)=-N*ALOG(TL(KK,I))/2.0                                    COEM0257
   39 CONTINUE                                                          COEM0258
      IF(IREP-1)32,32,33                                                COEM0259
   33 IF(TL(KK,5))32,32,48                                              COEM0260
   48 TL(KK,5)=-N*ALOG(TL(KK,5))/2.0                                    COEM0261
   32 DO 40 I=2,5                                                       COEM0262
   40 RS(KK,I-1)=TL(KK,I)-TL(KK,1)                                      COEM0263
      GO TO (16,16,16,17,17),KK                                         COEM0264
   16 RS(KK,5)=TL(KK,1)-SLM*D+E                                         COEM0265
      GO TO 10                                                          COEM0266
   17 RS(KK,5)=TL(KK,1)-SLM*D                                           COEM0267
      IF(IREP-1)50,50,10                                                COEM0268
   50 DO 60 I=2,5                                                       COEM0269
   60 RS(KK+2,I-1)=TL(KK+2,I)-TL(KK+2,1)                                COEM0270
      RS(KK+2,5)=TL(KK+2,1)-SLM*D                                       COEM0271
   10 CONTINUE                                                          COEM0272
      WRITE(M,82)TITL                                                   COEM0273
      WRITE(M,92)                                                       COEM0274
      DO 30 I=1,MA                                                      COEM0275
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      DO 24 K1=1,IREP                                                  COEM0276
      DO 25 J=1,MB                                                     COEM0277
      K=(K1-1)*N1+(J-1)*MA+I                                           COEM0278
   25 TB(J)=R(K)                                                       COEM0279
   24 WRITE(M,95)(TB(J),J=1,MB)                                        COEM0280
   30 WRITE(M,97)                                                      COEM0281
      IJ=5                                                             COEM0282
      IF(IREP-1)61,61,59                                               COEM0283
   61 IJ=7                                                             COEM0284
      WRITE(M,90)                                                      COEM0285
      GO TO 62                                                         COEM0286
   59 WRITE(M,94)                                                      COEM0287
   62 WRITE(M,89)A1                                                    COEM0288
      WRITE(M,88)(RS(I,1),I=1,IJ)                                      COEM0289
      WRITE(M,87)(RS(I,2),I=1,IJ)                                      COEM0290
      WRITE(M,86)(RS(I,3),I=1,IJ)                                      COEM0291
      IF(IREP-1)41,41,42                                               COEM0292
   41 WRITE(M,93)(RS(I,4),I=6,7)                                       COEM0293
      GO TO 49                                                         COEM0294
   42 WRITE(M,85)(RS(I,4),I=1,5)                                       COEM0295
   49 WRITE(M,84)(RS(I,5),I=1,IJ)                                      COEM0296
      WRITE(M,91)SLM                                                   COEM0297
      IF(ID-98)6,6,20                                                  COEM0298
      END                                                              COEM0299
// DUP                                                                 COEM0300
*DELETE              COEM                                             COEM0301
*STORE       WS  UA  COEM                                             COEM0302

// JOB                                                                 CLE 0000
// FOR                                                                 CLE 0001
*ONE WORD INTEGERS                                                     CLE 0002
*LIST ALL                                                             CLE 0003
*EXTENDED PRECISION                                                   CLE 0004
      FUNCTION CLE(X,Z,I)                                              CLE 0005
      Y=Z                                                              CLE 0006
      GO TO (1,1,1,7,7),I                                              CLE 0007
    1 IF(X-Y)5,6,5                                                     CLE 0008
    6 CLE=0.0                                                          CLE 0009
      GO TO 4                                                          CLE 0010
    5 CLE=(X-Y)**2                                                     CLE 0011
      GO TO 4                                                          CLE 0012
    7 IF(Y)8,8,9                                                       CLE 0013
    8 Y=10.0**(-10)                                                    CLE 0014
    9 GO TO (4,4,4,2,3),I                                              CLE 0015
    2 CLE=ALOG(Y)-X*Y                                                  CLE 0016
      GO TO 4                                                          CLE 0017
    3 CLE=-ALOG(Y)-X/Y                                                 CLE 0018
    4 RETURN                                                           CLE 0019
      END                                                              CLE 0020
// DUP                                                                 CLE 0021
*DELETE              CLE                                              CLE 0022
*STORE       WS  UA  CLE                                              CLE 0023

// JOB                                                                 CLIE0000
// FOR                                                                 CLIE0001
*ONE WORD INTEGERS                                                     CLIE0002
```

```
*LIST ALL                                                                    CLIE0003
*EXTENDED PRECISION                                                          CLIE0004
      SUBROUTINE CLIE(IJ)                                                    CLIE0005
      DIMENSION S5(31,31),S(31),S2(31)                                       CLIE0006
      COMMON T(20),TA(10),TB(4),T1(10),T2(4),S1(20,3),TOT,N,N1,MA,MB,NI,CLIE0007
     1TITL(12)                                                               CLIE0008
   92 FORMAT(1H1/12A6)                                                       CLIE0009
   91 FORMAT(32HONO CONVERGENCE - PARAMETERS ARE/)                           CLIE0010
   90 FORMAT(11E12.5)                                                        CLIE0011
      M=5                                                                    CLIE0012
      JI=1                                                                   CLIE0013
      DO 25 KK=1,2                                                           CLIE0014
      GO TO (4,5),KK                                                         CLIE0015
    4 M1=MA                                                                  CLIE0016
      M2=N1+MA+1                                                             CLIE0017
      M3=MB                                                                  CLIE0018
      GO TO 8                                                                CLIE0019
    5 M1=MB                                                                  CLIE0020
      M2=N1+MB+1                                                             CLIE0021
      M3=MA                                                                  CLIE0022
    8 S2(M2)=TOT                                                             CLIE0023
      DO 1 I=1,N1                                                            CLIE0024
    1 S2(I)=T(I)                                                             CLIE0025
      DO 2 I=1,M1                                                            CLIE0026
      II=I+N1                                                                CLIE0027
    2 S2(II)=0.0                                                             CLIE0028
      DO 27 JK=1,NI                                                          CLIE0029
      DO 10 I=1,M2                                                           CLIE0030
      S(I)=0.0                                                               CLIE0031
      DO 10 J=1,M2                                                           CLIE0032
   10 SS(I,J)=0.0                                                            CLIE0033
      DO 17 I1=1,MA                                                          CLIE0034
      DO 17 J1=1,MB                                                          CLIE0035
      I=(J1-1)*MA+I1                                                         CLIE0036
      GO TO (12,13),KK                                                       CLIE0037
   12 K=I1+N1                                                                CLIE0038
      GO TO 22                                                               CLIE0039
   13 K=J1+N1                                                                CLIE0040
   22 GO TO (51,52),IJ                                                       CLIE0041
   51 S(I)=S2(K)-1.0/T(I)+1.0/S2(I)                                          CLIE0042
      SS(I,I)=-1.0/S2(I)/S2(I)                                               CLIE0043
      GO TO 53                                                               CLIE0044
   52 S(I)=S2(K)+(T(I)-S2(I))/S2(I)                                          CLIE0045
      SS(I,I)=(S2(I)-2.0*T(I))/S2(I)**2                                      CLIE0046
   53 SS(K,I)=1.0                                                            CLIE0047
   17 SS(I,K)=1.0                                                            CLIE0048
      DO 21 I=1,M1                                                           CLIE0049
      II=I+N1                                                                CLIE0050
      S(M2)=S(M2)-FLOAT(M3)*S2(II)                                           CLIE0051
      SS(II,M2)=-FLOAT(M3)                                                   CLIE0052
   21 SS(M2,II)=-FLOAT(M3)                                                   CLIE0053
      GO TO (28,29),KK                                                       CLIE0054
   28 DO 30 I=1,MA                                                           CLIE0055
      II=I+N1                                                                CLIE0056
      S(II)=-FLOAT(M3)*S2(M2)                                                CLIE0057
      DO 30 J=1,MB                                                           CLIE0058
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      K=(J-1)*MA+I                                                      CLIE0059
   30 S(II)=S(II)+S2(K)                                                 CLIE0060
      GO TO 31                                                          CLIE0061
   29 DO 26 J=1,MB                                                      CLIE0062
      JJ=J+N1                                                           CLIE0063
      S(JJ)=-FLOAT(M3)*S2(M2)                                           CLIE0064
      DO 26 I=1,MA                                                      CLIE0065
      K=(J-1)*MA+I                                                      CLIE0066
   26 S(JJ)=S(JJ)+S2(K)                                                 CLIE0067
   31 CALL MATVK(SS,M2,S,1,DET)                                         CLIE0068
      DO 23 I=1,M2                                                      CLIE0069
   23 S2(I)=S2(I)-S(I)                                                  CLIE0070
      DO 24 I=1,M2                                                      CLIE0071
      IF(ABS(S(I)/S2(I))-0.0001)24,24,27                                CLIE0072
   24 CONTINUE                                                          CLIE0073
      GO TO 7                                                           CLIE0074
   27 CONTINUE                                                          CLIE0075
      GO TO (15,16),JI                                                  CLIE0076
   15 WRITE(M,92)TITL                                                   CLIE0077
      JI=2                                                              CLIE0078
   16 WRITE(M,91)                                                       CLIE0079
      WRITE(M,90)(S2(I),I=1,M2)                                         CLIE0080
    7 DO 25 I=1,N1                                                      CLIE0081
   25 S1(I,KK)=S2(I)                                                    CLIE0082
      M1=MA+1                                                           CLIE0083
      M2=MA+MB+1                                                        CLIE0084
      M3=MA+MB+3                                                        CLIE0085
      S2(1)=TOT                                                         CLIE0086
      DO 34 I=1,MA                                                      CLIE0087
   34 S2(I+1)=TA(I)-TOT                                                 CLIE0088
      DO 35 J=1,MB                                                      CLIE0089
      JJ=J+M1                                                           CLIE0090
   35 S2(JJ)=TB(J)-TOT                                                  CLIE0091
      S2(M2+1)=0.0                                                      CLIE0092
      S2(M3)=0.0                                                        CLIE0093
      GO TO (65,36),IJ                                                  CLIE0094
   65 TOT1=0.0                                                          CLIE0095
      DO 64 I=1,N1                                                      CLIE0096
   64 TOT1=TOT1+1.0/T(I)                                                CLIE0097
      DO 36 JK=1,NI                                                     CLIE0098
      DO 43 I=1,M3                                                      CLIE0099
      S(I)=0.0                                                          CLIE0100
      DO 43 J=1,M3                                                      CLIE0101
   43 SS(I,J)=0.0                                                       CLIE0102
      GO TO (44,45),IJ                                                  CLIE0103
   44 S(1)=-TOT1                                                        CLIE0104
   45 DO 38 I=1,MA                                                      CLIE0105
      S(M2+1)=S(M2+1)+S2(I+1)                                           CLIE0106
      SS(M2+1,I+1)=1.0                                                  CLIE0107
      SS(I+1,M2+1)=SS(M2+1,I+1)                                         CLIE0108
      GO TO (56,57),IJ                                                  CLIE0109
   56 S(I+1)=-FLOAT(MB)*T1(I)+S2(M2+1)                                  CLIE0110
      GO TO 3                                                           CLIE0111
   57 S(I+1)=S2(M2+1)                                                   CLIE0112
    3 DO 39 J=1,MB                                                      CLIE0113
      K=(J-1)*MA+I                                                      CLIE0114
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      JJ=J+M1                                                          CLIE0115
      A=S2(1)+S2(I+1)+S2(JJ)                                           CLIE0116
      IF(A)18,19,18                                                    CLIE0117
   18 GO TO (60,61),IJ                                                 CLIE0118
   60 SS(1,I+1)=SS(1,I+1)-1.0/A/A                                      CLIE0119
      SS(I+1,I+1)=SS(I+1,I+1)-1.0/A/A                                  CLIE0120
      SS(I+1,JJ)=-1.0/A/A                                              CLIE0121
      S(I+1)=S(I+1)+1.0/A                                              CLIE0122
      SS(1,1)=SS(1,1)-1.0/A/A                                          CLIE0123
      S(1)=S(1)+1.0/A                                                  CLIE0124
      GO TO 39                                                         CLIE0125
   61 SS(1,I+1)=SS(1,I+1)+(A-2.0*T(K))/A/A/A                           CLIE0126
      SS(I+1,I+1)=SS(I+1,I+1)+(A-2.0*T(K))/A/A/A                       CLIE0127
      SS(I+1,JJ)=(A-2.0*T(K))/A/A/A                                    CLIE0128
      S(I+1)=S(I+1)+(T(K)-A)/A/A                                       CLIE0129
      SS(1,1)=SS(1,1)+(A-2.0*T(K))/A/A/A                               CLIE0130
      S(1)=S(1)+(T(K)-A)/A/A                                           CLIE0131
   39 SS(JJ,I+1)=SS(I+1,JJ)                                            CLIE0132
   38 SS(I+1,1)=SS(1,I+1)                                              CLIE0133
      DO 40 J=1,MB                                                     CLIE0134
      JJ=J+M1                                                          CLIE0135
      S(M3)=S(M3)+S2(JJ)                                               CLIE0136
      SS(M3,JJ)=1.0                                                    CLIE0137
      SS(JJ,M3)=SS(M3,JJ)                                              CLIE0138
      GO TO (58,59),IJ                                                 CLIE0139
   58 S(JJ)=-FLOAT(MA)*T2(J)+S2(M3)                                    CLIE0140
      GO TO 6                                                          CLIE0141
   59 S(JJ)=S2(M3)                                                     CLIE0142
    6 DO 41 I=1,MA                                                     CLIE0143
      K=(J-1)*MA+I                                                     CLIE0144
      A=S2(1)+S2(I+1)+S2(JJ)                                           CLIE0145
      GO TO (62,63),IJ                                                 CLIE0146
   62 SS(1,JJ)=SS(1,JJ)-1.0/A/A                                        CLIE0147
      SS(JJ,JJ)=SS(JJ,JJ)-1.0/A/A                                      CLIE0148
      S(JJ)=S(JJ)+1.0/A                                                CLIE0149
      GO TO 41                                                         CLIE0150
   63 SS(1,JJ)=SS(1,JJ)+(A-2.0*T(K))/A/A/A                             CLIE0151
      SS(JJ,JJ)=SS(JJ,JJ)+(A-2.0*T(K))/A/A/A                           CLIE0152
      S(JJ)=S(JJ)+(T(K)-A)/A/A                                         CLIE0153
   41 CONTINUE                                                         CLIE0154
   40 SS(JJ,1)=SS(1,JJ)                                                CLIE0155
      CALL MATVK(SS,M3,S,1,DET)                                        CLIE0156
      DO 48 I=1,M3                                                     CLIE0157
   48 S2(I)=S2(I)-S(I)                                                 CLIE0158
      DO 49 I=1,M2                                                     CLIE0159
      IF(ABS(S(I)/S2(I))-0.0001)49,49,36                               CLIE0160
   49 CONTINUE                                                         CLIE0161
      GO TO 9                                                          CLIE0162
   36 CONTINUE                                                         CLIE0163
   19 GO TO (11,14),JI                                                 CLIE0164
   11 WRITE(M,92)TITL                                                  CLIE0165
   14 WRITE(M,91)                                                      CLIE0166
      WRITE(M,90)(S2(I),I=1,M3)                                        CLIE0167
    9 DO 50 I=1,MA                                                     CLIE0168
      DO 50 J=1,MB                                                     CLIE0169
      JJ=J+M1                                                          CLIE0170
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      K=(J-1)*MA+I                                                    CLIE0171
   50 S1(K,3)=S2(1)+S2(I+1)+S2(JJ)                                    CLIE0172
      RETURN                                                          CLIE0173
      END                                                             CLIE0174
// DUP                                                              CLIE0175
*DELETE              CLIE                                           CLIE0176
*STORE       WS  UA  CLIE                                           CLIE0177

// JOB                                                              MATVK000
// FOR                                                              MATVK001
*ONE WORD INTEGERS                                                  MATVK002
*LIST ALL                                                           MATVK003
*EXTENDED PRECISION                                                 MATVK004
      SUBROUTINE MATVK(A,N,B,M,DETM)                                MATVK005
      DIMENSION A(31,31),B(31),PIVOT(31),IPVOT(31),INDEX(31,31)     MATVK006
      EQUIVALENCE (IROW,JROW),(ICLUM,JCLUM),(AMAX,T,SWAP)           MATVK007
      DO 20 J=1,N                                                   MATVK008
      DETM=1.0                                                      MATVK009
   20 IPVOT(J)=0                                                    MATVK010
      DO 550 I=1,N                                                  MATVK011
      AMAX=0.0                                                      MATVK012
      DO 105 J=1,N                                                  MATVK013
      IF(IPVOT(J)-1)60,105,60                                       MATVK014
   60 DO 100 K=1,N                                                  MATVK015
      IF(IPVOT(K)-1)80,100,740                                      MATVK016
   80 IF(ABS(AMAX)-ABS(A(J,K)))85,100,100                           MATVK017
   85 IROW=J                                                        MATVK018
      ICLUM=K                                                       MATVK019
      AMAX=A(J,K)                                                   MATVK020
  100 CONTINUE                                                      MATVK021
  105 CONTINUE                                                      MATVK022
      IPVOT(ICLUM)=IPVOT(ICLUM)+1                                   MATVK023
      IF(IROW-ICLUM)140,260,140                                     MATVK024
  140 DETM=-DETM                                                    MATVK025
      DO 200 L=1,N                                                  MATVK026
      SWAP=A(IROW,L)                                                MATVK027
      A(IROW,L)=A(ICLUM,L)                                          MATVK028
  200 A(ICLUM,L)=SWAP                                               MATVK029
      IF(M)260,260,210                                              MATVK030
  210 SWAP=B(IROW)                                                  MATVK031
      B(IROW)=B(ICLUM)                                              MATVK032
      B(ICLUM)=SWAP                                                 MATVK033
  260 INDEX(I,1)=IROW                                               MATVK034
      INDEX(I,2)=ICLUM                                              MATVK035
      PIVOT(I)=A(ICLUM,ICLUM)                                       MATVK036
      DETM=DETM*PIVOT(I)                                            MATVK037
      A(ICLUM,ICLUM)=1.0                                            MATVK038
      DO 350 L=1,N                                                  MATVK039
  350 A(ICLUM,L)=A(ICLUM,L)/PIVOT(I)                                MATVK040
      IF(M)380,380,360                                              MATVK041
  360 B(ICLUM)=B(ICLUM)/PIVOT(I)                                    MATVK042
  380 DO 550 L1=1,N                                                 MATVK043
      IF(L1-ICLUM)400,550,400                                       MATVK044
  400 T=A(L1,ICLUM)                                                 MATVK045
      A(L1,ICLUM)=0.0                                               MATVK046
      DO 450 L=1,N                                                  MATVK047
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  450 A(L1,L)=A(L1,L)-A(ICLUM,L)*T                                  MATVK048
      IF(M)550,550,460                                              MATVK049
  460 B(L1)=B(L1)-B(ICLUM)*T                                        MATVK050
  550 CONTINUE                                                      MATVK051
      DO 710 I=1,N                                                  MATVK052
      L=N+1-I                                                       MATVK053
      IF(INDEX(L,1)-INDEX(L,2))630,710,630                          MATVK054
  630 JROW=INDEX(L,1)                                               MATVK055
      JCLUM=INDEX(L,2)                                              MATVK056
      DO 705 K=1,N                                                  MATVK057
      SWAP=A(K,JROW)                                                MATVK058
      A(K,JROW)=A(K,JCLUM)                                          MATVK059
      A(K,JCLUM)=SWAP                                               MATVK060
  705 CONTINUE                                                      MATVK061
  710 CONTINUE                                                      MATVK062
  740 IF(DETM-0.000001)750,750,760                                  MATVK063
  750 DETM=0.0                                                      MATVK064
  760 RETURN                                                        MATVK065
      END                                                           MATVK066
// DUP                                                            MATVK067
*DELETE              MATVK                                        MATVK068
*STORE       WS  UA  MATVK                                        MATVK069
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// JOB                                                                  ERSL2000
// FOR                                                                  ERSL2001
*ONE WORD INTEGERS                                                      ERSL2002
*LIST ALL                                                               ERSL2003
*EXTENDED PRECISION                                                     ERSL2004
*IOCS(2501 READER)                                                      ERSL2005
*IOCS(1403 PRINTER)                                                     ERSL2006
*NAME ERSL2                                                             ERSL2007
C                                                                       ERSL2008
C     RESPONSE SURFACE ANALYSIS USING THE EXPONENTIAL DISTRIBUTION      ERSL2009
C                                                                       ERSL2010
C     THIS PROGRAM ANALYZES DATA SIMILAR TO THAT FOR BOX2 BUT ASSUMING ANERSL2011
C EXPONENTIAL PROBABILITY DISTRIBUTION WITH NO TRANSFORMATION PARAMETERSERSL2012
C ESTIMATED. THE CORRESPONDING NORMAL THEORY ANOVA IS ALSO PRINTED OUT. ERSL2013
C IF POWER TRANSFORMATIONS OF THE INDEPENDENT VARIABLES ARE SUPPLIED.   ERSL2014
C THE COMPLETE ANALYSIS IS DONE FOR BOTH LINEAR AND NONLINEAR MODELS AS ERSL2015
C IN BOX2.                                                              ERSL2016
C                                                                       ERSL2017
C   LINK CALLED                                                         ERSL2018
C                                                                       ERSL2019
C  EEIG2 - PERFORMS CANONICAL ANALYSIS                                  ERSL2020
C                                                                       ERSL2021
C    SUBROUTINES CALLED                                                 ERSL2022
C                                                                       ERSL2023
C  EORT2 - CALCULATES NORMAL ORTHOGONAL POLYNOMIALS                     ERSL2024
C  ELE2  - CALCULATES MAXIMUM LIKELIHOOD ESTIMATES OF THE COEFFICIENT   ERSL2025
C PARAMETERS USING LEAST SQUARES INITIAL ESTIMATES                      ERSL2026
C  MATV  - INVERTS MATRICES UP TO 12 BY 12                             ERSL2027
C  CLFE  - CALCULATES EXPONENTIAL LIKELIHOOD FOR GIVEN PARAMETER VALUES ERSL2028
C  ELOF  - CALCULATES NON-REGRESSION ENTRIES IN ANOVA TABLE E.G. LACK OFERSL2029
C FIT                                                                   ERSL2030
C  CAN2  - DIAGONALIZES MATRICES                                        ERSL2031
C  JACOB - CALCULATES EIGENVALUES AND VECTORS OF DIAGONAL MATRICES      ERSL2032
C  CERS2 - CALCULATES POINTS ON RESPONSE SURFACE CONTOURS               ERSL2033
C                                                                       ERSL2034
C    MAKEUP OF DATA DECK                                                ERSL2035
C                                                                       ERSL2036
C 1.TITLE CARD - (12A6)                                                 ERSL2037
C 2.CONTROL CARD - (I1,2I2,F8.6,3F5.3,I3)                               ERSL2038
C       I1 - OPTION - 0 - NOTHING                                       ERSL2039
C                     1 - PRINT ITERATED VALUES OF COEFFICIENT PARAMETERS ERSL2040
C       I2 - NUMBER OF TREATMENT COMBINATIONS - MAXIMUM 30               ERSL2041
C       I2 - NUMBER OF OBSERVATION SETS - MAXIMUM 4                      ERSL2042
C       F8.6 - CONVERGENCE CRITERION                                     ERSL2043
C       2F5.3 - POWER TRANSFORMATIONS OF INDEPENDENT VARIABLES - IF BLANK,ERSL2044
C             OMITS THIS ANALYSIS                                       ERSL2045
C       I3 - NUMBER OF ITERATIONS ALLOWED                               ERSL2046
C 3.TREATMENT COMBINATIONS IN PAIRS (16F5.3)                            ERSL2047
C 4.DATA - SETS OF OBSERVATIONS FOR EACH TREATMENT COMBINATION          ERSL2048
C     ONE SET PER CARD (4F6.3)                                          ERSL2049
C 5.99 IN COLS. 79-80 INDICATES END OF DATA, ANOTHER DECK TO FOLLOW     ERSL2050
C   98 IN COLS. 79-80 INDICATES END OF JOB - CALL EXIT AFTER THIS DECK  ERSL2051
C 6.CONTROL CARD (12F6.2)                                               ERSL2052
C       10F6.2 - 10 CONTOUR LEVELS IN UNITS OF DEPENDENT VARIABLE, 5 BELOWERSL2053
C              AND 5 ABOVE THE CENTRE                                   ERSL2054
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C     2F6.2 - 2 FACTOR LIMITS IN UNITS OF INDEPENDENT VARIABLES                ERSL2055
C 7.REPEAT 1. TO 6. AS REQUIRED                                               ERSL2056
C                                                                              ERSL2057
      DIMENSION Y1(4),BB(6),SSY5(6),I5(6),X1(2),SSYN5(6),B(6)                  ERSL2058
      COMMON R(120),W( 30,6,2),T(6),B4(6,2),N,IREP,TITL(12),ID,XX(7),SD(ERSL2059
     15),A3(2),D,X( 30,6),MN,NI,G(9)                                          ERSL2060
     96 FORMAT(36HOB(J) COEFFICIENTS IN ORIGINAL UNITS//6E15.6)                ERSL2061
     95 FORMAT(1X2F8.3,4F12.2)                                                 ERSL2062
     90 FORMAT(21HO*** VARIABLES FITTED//4X2HX16X2HX27X4(8HOBS. SETI2,2X))ERSL2063
     89 FORMAT(54HOPOWER TRANSFORMATIONS OF INDEPENDENT VARIABLES - A1 =F8ERSL2064
       1.4,6H  A2 =F8.4)                                                       ERSL2065
     88 FORMAT(18HOB(J) COEFFICIENTS/1HO6E15.6/17HOLOG LIKELIHOOD =E15.6) ERSL2066
     87 FORMAT(27HOANALYSIS OF VARIANCE TABLE/9HO  SOURCE10X7HLOG MLR9X8HLERSL2067
       1OG R(N))                                                               ERSL2068
     85 FORMAT(66HOINCORRECT NUMBER OF OBSERVATION SETS - SKIPPING TO NEXTERSL2069
       1 DATA DECK)                                                            ERSL2070
     84 FORMAT(16F5.3)                                                         ERSL2071
     83 FORMAT(I1,2I2,F8.6,3F5.3,I3)                                           ERSL2072
     82 FORMAT(1H1I2A6)                                                        ERSL2073
     81 FORMAT(4F6.3,54X,I2)                                                   ERSL2074
     80 FORMAT(12A6)                                                           ERSL2075
     77 FORMAT(13H TREATMENTS  2E16.6)                                         ERSL2076
     93 FORMAT(13H REGRESSION  2E16.6)                                         ERSL2077
     76 FORMAT(13H   LINEAR    2E16.6)                                         ERSL2078
     75 FORMAT(13H    X1 LINEAR 2E16.6)                                        ERSL2079
     74 FORMAT(13H    X2 LINEAR 2E16.6)                                        ERSL2080
     73 FORMAT(13H   QUADRATIC  2E16.6)                                        ERSL2081
     72 FORMAT(13H    X1 QUAD.  2E16.6)                                        ERSL2082
     78 FORMAT(13H    X2 QUAD.  2E16.6)                                        ERSL2083
     79 FORMAT(13H   X1 * X2    2E16.6)                                        ERSL2084
     92 FORMAT(13H LACK OF FIT 2E16.6)                                         ERSL2085
     97 FORMAT(13H FIT OF MODEL2E16.6)                                         ERSL2086
        L=8                                                                    ERSL2087
        M=5                                                                    ERSL2088
      7 READ(L,80)TITL                                                         ERSL2089
        DO 55 I=1,120                                                          ERSL2090
     55 R(I)=0.0                                                               ERSL2091
        READ(L,83)MN,N1,IREP,D,A3,E,NI                                         ERSL2092
        N=N1*IREP                                                              ERSL2093
        READ(L,84)((W(I,J,1),J=2,3),I=1,N1)                                    ERSL2094
        DO 3 I=1,N1                                                            ERSL2095
        W(I,1,1)=1.0                                                           ERSL2096
        W(I,4,1)=W(I,2,1)*W(I,2,1)                                             ERSL2097
        W(I,5,1)=W(I,3,1)*W(I,3,1)                                             ERSL2098
      3 W(I,6,1)=W(I,3,1)*W(I,2,1)                                             ERSL2099
        I=0                                                                    ERSL2100
     22 I=I+1                                                                  ERSL2101
        READ(L,81)Y1,ID                                                        ERSL2102
        IF(ID-98)9,23,23                                                       ERSL2103
      9 DO 24 J=1,IREP                                                         ERSL2104
        K=(J-1)*N1+I                                                           ERSL2105
     24 R(K)=Y1(J)                                                             ERSL2106
        DO 29 J=1,6                                                            ERSL2107
     29 X(I,J)=W(I,J,1)                                                        ERSL2108
        GO TO 22                                                               ERSL2109
     23 N2=I-1                                                                 ERSL2110
```

```
      IF(N1-N2)2,4,2                                                    ERSL2111
    2 WRITE(M,85)                                                       ERSL2112
      IF(ID-98)7,6,7                                                    ERSL2113
    6 CALL EXIT                                                         ERSL2114
    4 N=N1*IREP                                                         ERSL2115
      WRITE(M,82)TITL                                                   ERSL2116
      WRITE(M,90)(I,I=1,4)                                              ERSL2117
      DO 54 I=1,N1                                                      ERSL2118
      DO 19 J=1,2                                                       ERSL2119
   19 X1(J)=X(I,J+1)                                                    ERSL2120
      N2=N1+I                                                           ERSL2121
      N3=N1*2+I                                                         ERSL2122
      N4=N1*3+I                                                         ERSL2123
   54 WRITE(M,95)X1(1),X1(2),R(I),R(N2),R(N3),R(N4)                     ERSL2124
      DO 14 KK=1,2                                                      ERSL2125
      CALL EORT2(X,1,KK)                                                ERSL2126
      DO 5 JJ=1,6                                                       ERSL2127
      T(JJ)=0.0                                                         ERSL2128
      DO 5 II=1,N1                                                      ERSL2129
      DO 5 K1=1,IREP                                                    ERSL2130
      K=(K1-1)*N1+II                                                    ERSL2131
    5 T(JJ)=T(JJ)+R(K)*X(II,JJ)                                         ERSL2132
      IF(MN)12,13,12                                                    ERSL2133
   12 WRITE(M,82)TITL                                                   ERSL2134
      GO TO (13,15),KK                                                  ERSL2135
   15 WRITE(M,89)A3                                                     ERSL2136
   13 CALL ELE2(B,I5,0,SN)                                              ERSL2137
      DO 10 I=1,6                                                       ERSL2138
   10 B4(I,KK)=B(I)                                                     ERSL2139
      S=CLFE(B)                                                         ERSL2140
      WRITE(M,88)B,S                                                    ERSL2141
      DO 1 I=2,6                                                        ERSL2142
      I5(1)=I                                                           ERSL2143
      CALL ELE2(BB,I5,1,SSYN5(I))                                       ERSL2144
      SSYN5(I)=SSYN5(I)-SN                                              ERSL2145
    1 SSY5(I)=CLFE(BB)-S                                                ERSL2146
      I5(1)=2                                                           ERSL2147
      I5(2)=3                                                           ERSL2148
      CALL ELE2(BB,I5,2,SSN4)                                           ERSL2149
      SSN4=SSN4-SN                                                      ERSL2150
      SS4=CLFE(BB)-S                                                    ERSL2151
      I5(1)=4                                                           ERSL2152
      I5(2)=5                                                           ERSL2153
      CALL ELE2(BB,I5,2,SSN5)                                           ERSL2154
      SSN5=SSN5-SN                                                      ERSL2155
      SS5=CLFE(BB)-S                                                    ERSL2156
      DO 11 I=2,6                                                       ERSL2157
   11 I5(I-1)=I                                                         ERSL2158
      CALL ELE2(BB,I5,5,SSN3)                                           ERSL2159
      SSN3=SSN3-SN                                                      ERSL2160
      SS3=CLFE(BB)-S                                                    ERSL2161
      BB(1)=B(1)                                                        ERSL2162
      DO 27 I=1,5                                                       ERSL2163
      BB(I+1)=B(I+1)/SD(I)                                              ERSL2164
   27 BB(1)=BB(1)-B(I+1)*XX(I)/SD(I)                                    ERSL2165
      BB(6)=BB(6)/SD(1)/SD(2)                                           ERSL2166
```

```
      BB(2)=BB(2)-BB(4)*XX(6)-BB(6)*XX(2)                                    ERSL2167
      BB(3)=BB(3)-BB(5)*XX(7)-BB(6)*XX(1)                                    ERSL2168
      BB(1)=BB(1)+BB(4)*XX(1)*XX(6)+BB(5)*XX(2)*XX(7)+BB(6)*XX(1)*XX(2)      ERSL2169
      WRITE(M,96)BB                                                          ERSL2170
      DO 28 I=1,6                                                            ERSL2171
      B4(I,KK)=BB(I)                                                         ERSL2172
   28 B(I)=BB(I)                                                             ERSL2173
      F=FLOAT(N)*ALOG(FLOAT(IREP)*E)                                         ERSL2174
      SS2=ELOF(2,KK)                                                         ERSL2175
      SS6=ELOF(1,KK)                                                         ERSL2176
      SS8=ELOF(4,KK)+F                                                       ERSL2177
      IF(IREP-1)26,26,25                                                     ERSL2178
   25 SSN=ELOF(3,KK)                                                         ERSL2179
      SSN2=SN-SSN                                                            ERSL2180
      SSN6=SSN3+SSN2                                                         ERSL2181
      SSN8=SSN                                                               ERSL2182
      GO TO 36                                                               ERSL2183
   26 SSN8=SN                                                                ERSL2184
   36 SSN8=-FLOAT(N)*(ALOG(6.2831853/FLOAT(N))+1.0)/2.0+SSN8+F               ERSL2185
      DO 37 I=1,N                                                            ERSL2186
   37 SSN8=SSN8-2.0*ALOG(R(I))                                               ERSL2187
      WRITE(M,82)TITL                                                        ERSL2188
      GO TO (30,32),KK                                                       ERSL2189
   32 WRITE(M,89)A3                                                          ERSL2190
   30 WRITE(M,87)                                                            ERSL2191
      IF(IREP-1)8,8,20                                                       ERSL2192
   20 WRITE(M,77)SS6,SSN6                                                    ERSL2193
      GO TO 31                                                               ERSL2194
    8 WRITE(M,77)SS6                                                         ERSL2195
   31 WRITE(M,93)SS3,SSN3                                                    ERSL2196
      WRITE(M,76)SS4,SSN4                                                    ERSL2197
      WRITE(M,75)SSY5(2),SSYN5(2)                                            ERSL2198
      WRITE(M,74)SSY5(3),SSYN5(3)                                            ERSL2199
      WRITE(M,73)SS5,SSN5                                                    ERSL2200
      WRITE(M,72)SSY5(4),SSYN5(4)                                            ERSL2201
      WRITE(M,78)SSY5(5),SSYN5(5)                                            ERSL2202
      WRITE(M,79)SSY5(6),SSYN5(6)                                            ERSL2203
      IF(IREP-1)33,33,34                                                     ERSL2204
   34 WRITE(M,92)SS2,SSN2                                                    ERSL2205
      GO TO 35                                                               ERSL2206
   33 WRITE(M,92)SS2                                                         ERSL2207
   35 WRITE(M,97)SS8,SSN8                                                    ERSL2208
      GO TO (18,17),KK                                                       ERSL2209
   18 IF(A3(1))16,17,16                                                      ERSL2210
   16 DO 14 I=1,N1                                                           ERSL2211
      W(I,1,2)=1.0                                                           ERSL2212
      W(I,2,2)=W(I,2,1)**A3(1)                                               ERSL2213
      W(I,3,2)=W(I,3,1)**A3(2)                                               ERSL2214
      W(I,4,2)=W(I,2,2)*W(I,2,2)                                             ERSL2215
      W(I,5,2)=W(I,3,2)*W(I,3,2)                                             ERSL2216
      W(I,6,2)=W(I,3,2)*W(I,2,2)                                             ERSL2217
      DO 14 J=1,6                                                            ERSL2218
   14 X(I,J)=W(I,J,2)                                                        ERSL2219
   17 CALL LINK(EEIG2)                                                       ERSL2220
      END                                                                    ERSL2221
// DUP                                                                       ERSL2222
```

```
*DELETE              ERSL2                                              ERSL2223
*STORE      WS  UA   ERSL2                                              ERSL2224

// JOB                                                                   EORT2000
// FOR                                                                   EORT2001
*ONE WORD INTEGERS                                                       EORT2002
*LIST ALL                                                               EORT2003
*EXTENDED PRECISION                                                     EORT2004
      SUBROUTINE EORT2(X,L6,KK)                                         EORT2005
      DIMENSION W( 30,6),X( 30,6),SSX2(5,5)                             EORT2006
      COMMON R(120),Z( 30,6,2),T(6),B(12),N,IREP,TITL(12),ID,X5(7),S5(5)EORT2007
     1,A3(2)                                                            EORT2008
   85 FORMAT(54HOPOWER TRANSFORMATIONS OF INDEPENDENT VARIABLES - A1 =F8EORT2009
     1.4,6H  A2 =F8.4)                                                  EORT2010
   84 FORMAT(5F15.5)                                                    EORT2011
   83 FORMAT(21HOCROSS PRODUCT MATRIX)                                  EORT2012
   82 FORMAT(30HONORMAL ORTHOGONAL POLYNOMIALS//10X2HX113X2HX211X5HX1*X1EORT2013
     110X5HX2*X210X5HX1*X2)                                             EORT2014
   81 FORMAT(1H112A6)                                                   EORT2015
      M=5                                                               EORT2016
      N1=N/IREP                                                         EORT2017
      DO 14 J=2,3                                                       EORT2018
      X5(J-1)=0.0                                                       EORT2019
      DO 14 I=1,N1                                                      EORT2020
   14 X5(J-1)=X5(J-1)+X(I,J)/N1                                         EORT2021
      DO 15 J=2,3                                                       EORT2022
      S5(J-1)=0.0                                                       EORT2023
      DO 15 I=1,N1                                                      EORT2024
   15 S5(J-1)=S5(J-1)+(X(I,J)-X5(J-1))**2                               EORT2025
      DO 1 J=2,3                                                        EORT2026
      S5(J-1)=SQRT(S5(J-1))                                             EORT2027
      DO 1 I=1,N1                                                       EORT2028
      W(I,1)=1.0                                                        EORT2029
    1 W(I,J)=(X(I,J)-X5(J-1))/S5(J-1)                                   EORT2030
      GO TO (7,8),L6                                                    EORT2031
    7 DO 2 J=2,3                                                        EORT2032
      X5(J+1)=0.0                                                       EORT2033
      X5(J+4)=0.0                                                       EORT2034
      DO 2 I=1,N1                                                       EORT2035
      X5(J+1)=X5(J+1)+X(I,J+2)/N1                                       EORT2036
    2 X5(J+4)=X5(J+4)+X(I,J+2)*(X(I,J)-X5(J-1))/S5(J-1)/S5(J-1)         EORT2037
      X5(5)=0.0                                                         EORT2038
      DO 3 I=1,N1                                                       EORT2039
      W(I,6)=W(I,2)*W(I,3)                                              EORT2040
      X5(5)=X5(5)+W(I,6)/N1                                             EORT2041
      DO 3 J=4,5                                                        EORT2042
    3 W(I,J)=X(I,J)-X5(J-1)-(X(I,J-2)-X5(J-3))*X5(J+2)                  EORT2043
      DO 4 J=4,5                                                        EORT2044
      S5(J-1)=0.0                                                       EORT2045
      DO 4 I=1,N1                                                       EORT2046
    4 S5(J-1)=S5(J-1)+W(I,J)*W(I,J)                                     EORT2047
      S5(3)=SQRT(S5(3))                                                 EORT2048
      S5(4)=SQRT(S5(4))                                                 EORT2049
      S5(5)=0.0                                                         EORT2050
      DO 5 I=1,N1                                                       EORT2051
      S5(5)=S5(5)+(W(I,6)-X5(5))**2                                     EORT2052
```

```
      DO 5 J=4,5                                                        EORT2053
    5 W(I,J)=W(I,J)/S5(J-1)                                             EORT2054
      S5(5)=SQRT(S5(5))                                                 EORT2055
    8 DO 16 I=1,N1                                                      EORT2056
   16 W(I,6)=(W(I,6)-X5(5))/S5(5)                                       EORT2057
      GO TO (9,10),L6                                                   EORT2058
   10 DO 12 I=1,N1                                                      EORT2059
      X(I,4)=W(I,6)                                                     EORT2060
      DO 12 J=1,3                                                       EORT2061
   12 X(I,J)=W(I,J)                                                     EORT2062
      GO TO 11                                                          EORT2063
    9 DO 6 I=1,N1                                                       EORT2064
      DO 6 J=1,6                                                        EORT2065
    6 X(I,J)=W(I,J)                                                     EORT2066
      WRITE(M,81)TITL                                                   EORT2067
      GO TO (13,17),KK                                                  EORT2068
   17 WRITE(M,85)A3                                                     EORT2069
   13 WRITE(M,82)                                                       EORT2070
      WRITE(M,84)((X(I,J),J=2,6),I=1,N1)                                EORT2071
      WRITE(M,83)                                                       EORT2072
      DO 18 I=1,5                                                       EORT2073
      DO 18 J=1,5                                                       EORT2074
      SSX2(I,J)=0.0                                                     EORT2075
      DO 18 K=1,N1                                                      EORT2076
   18 SSX2(I,J)=SSX2(I,J)+X(K,I+1)*X(K,J+1)                             EORT2077
      WRITE(M,84)((SSX2(I,J),J=1,5),I=1,5)                              EORT2078
   11 RETURN                                                            EORT2079
      END                                                               EORT2080
// DUP                                                                  EORT2081
*DELETE              EORT2                                             EORT2082
*STORE       WS  UA  EORT2                                             EORT2083

// JOB                                                                  ELE20000
// FOR                                                                  ELE20001
*ONE WORD INTEGERS                                                      ELE20002
*LIST ALL                                                               ELE20003
*EXTENDED PRECISION                                                     ELE20004
      SUBROUTINE ELE2(B,I5,J3,SS)                                       ELE20005
      DIMENSION A(12,12),C(12),B(6),I5(6)                               ELE20006
      COMMON R(120),Z(360),T(6),ZZ(12),N,IREP,TT(12),ID,S(14),DD,X( 30,6ELE20007
     1),MN,NI                                                           ELE20008
   81 FORMAT(39HONO CONVERGENCE - B(J) COEFFICIENTS ARE //6E15.6)       ELE20009
   80 FORMAT(6E15.6,I8,E15.6)                                           ELE20010
      M=5                                                               ELE20011
      N1=N/IREP                                                         ELE20012
      J4=J3+1                                                           ELE20013
      J6=6-J3                                                           ELE20014
      DO 16 I=J4,6                                                      ELE20015
   16 I5(I)=0                                                           ELE20016
      DO 4 I=1,6                                                        ELE20017
      C(I)=0.0                                                          ELE20018
      DO 4 J=1,6                                                        ELE20019
    4 A(I,J)=0.0                                                        ELE20020
      DO 13 I=1,N1                                                      ELE20021
      Y1=0.0                                                            ELE20022
      DO 14 J=1,IREP                                                    ELE20023
```

```
      K=(J-1)*N1+I                                                    ELE20024
   14 Y1=Y1+1.0/R(K)/FLOAT(IREP)                                      ELE20025
      IJ=1                                                            ELE20026
      DO 38 KK=1,6                                                    ELE20027
      IF(KK-I5(IJ))28,29,28                                           ELE20028
   29 IJ=IJ+1                                                         ELE20029
      GO TO 38                                                        ELE20030
   28 K1=KK-IJ+1                                                      ELE20031
      C(K1)=C(K1)+Y1*X(I,KK)                                          ELE20032
      JI=1                                                            ELE20033
      DO 37 II=1,6                                                    ELE20034
      IF(II-I5(JI))30,31,30                                           ELE20035
   31 JI=JI+1                                                         ELE20036
      GO TO 37                                                        ELE20037
   30 I1=II-JI+1                                                      ELE20038
      A(K1,I1)=A(K1,I1)+X(I,KK)*X(I,II)                               ELE20039
   37 CONTINUE                                                        ELE20040
   38 CONTINUE                                                        ELE20041
   13 CONTINUE                                                        ELE20042
      CALL MATV(A,J6,C,1,DET)                                         ELE20043
      J=1                                                             ELE20044
      DO 39 I=1,6                                                     ELE20045
      IF(I-I5(J))40,41,40                                             ELE20046
   41 J=J+1                                                           ELE20047
      B(I)=0.0                                                        ELE20048
      GO TO 39                                                        ELE20049
   40 I1=I-J+1                                                        ELE20050
      B(I)=C(I1)                                                      ELE20051
   39 CONTINUE                                                        ELE20052
      SS=0.0                                                          ELE20053
      DO 43 I=1,N1                                                    ELE20054
      DO 43 J=1,IREP                                                  ELE20055
      K=(J-1)*N1+I                                                    ELE20056
      U=1.0/R(K)                                                      ELE20057
      DO 44 J1=1,6                                                    ELE20058
   44 U=U-B(J1)*X(I,J1)                                               ELE20059
   43 SS=SS+U*U                                                       ELE20060
      SS=-ALOG(SS)*FLOAT(N)/2.0                                       ELE20061
      DO 6 J5=1,NI                                                    ELE20062
      J=1                                                             ELE20063
      DO 12 KK=1,6                                                    ELE20064
      IF(KK-I5(J))5,11,5                                              ELE20065
   11 J=J+1                                                           ELE20066
      GO TO 12                                                        ELE20067
    5 K1=KK-J+1                                                       ELE20068
      C(K1)=-T(KK)                                                    ELE20069
      K=1                                                             ELE20070
      DO 34 I=1,6                                                     ELE20071
      IF(I-I5(K))15,19,15                                             ELE20072
   19 K=K+1                                                           ELE20073
      GO TO 34                                                        ELE20074
   15 I1=I-K+1                                                        ELE20075
      A(I1,K1)=0.0                                                    ELE20076
   34 CONTINUE                                                        ELE20077
   12 CONTINUE                                                        ELE20078
      DO 1 I=1,N1                                                     ELE20079
```

```
      D=0.0                                                          ELE20080
      J=1                                                            ELE20081
      DO 2 JJ=1,6                                                    ELE20082
      IF(JJ-I5(J))20,21,20                                           ELE20083
   21 J=J+1                                                          ELE20084
      GO TO 2                                                        ELE20085
   20 D=D+B(JJ)*X(I,JJ)                                              ELE20086
    2 CONTINUE                                                       ELE20087
      IJ=1                                                           ELE20088
      DO 1 KK=1,6                                                    ELE20089
      IF(KK-I5(IJ))22,23,22                                          ELE20090
   23 IJ=IJ+1                                                        ELE20091
      GO TO 1                                                        ELE20092
   22 K1=KK-IJ+1                                                     ELE20093
      JI=1                                                           ELE20094
      DO 32 II=1,6                                                   ELE20095
      IF(II-I5(JI))24,25,24                                          ELE20096
   25 JI=JI+1                                                        ELE20097
      GO TO 32                                                       ELE20098
   24 I1=II-JI+1                                                     ELE20099
      A(K1,I1)=A(K1,I1)-X(I,KK)*X(I,II)/D/D*IREP                     ELE20100
   32 CONTINUE                                                       ELE20101
      C(K1)=C(K1)+X(I,KK)/D*IREP                                     ELE20102
    1 CONTINUE                                                       ELE20103
      CALL MATV(A,J6,C,1,DET)                                        ELE20104
      J=1                                                            ELE20105
      DO 9 I=1,6                                                     ELE20106
      IF(I-I5(J))17,18,17                                            ELE20107
   18 J=J+1                                                          ELE20108
      C(I)=0.0                                                       ELE20109
      GO TO 9                                                        ELE20110
   17 I1=I-J+1                                                       ELE20111
      IF(ABS(C(I1))-0.1*ABS(B(I)))26,26,27                           ELE20112
   27 C(I1)=0.1*C(I1)                                                ELE20113
   26 B(I)=B(I)-C(I1)                                                ELE20114
    9 CONTINUE                                                       ELE20115
      IF(MN)46,47,46                                                 ELE20116
   46 S1=CLFP(B)                                                     ELE20117
      WRITE(M,80)B,J5,S1                                             ELE20118
   47 J=1                                                            ELE20119
      DO 7 I=1,6                                                     ELE20120
      IF(I-I5(J))35,36,35                                            ELE20121
   36 J=J+1                                                          ELE20122
      GO TO 7                                                        ELE20123
   35 I1=I-J+1                                                       ELE20124
      IF(ABS(C(I1)/B(I))-DD)7,7,6                                    ELE20125
    7 CONTINUE                                                       ELE20126
      GO TO 8                                                        ELE20127
    6 CONTINUE                                                       ELE20128
      WRITE(M,81)B                                                   ELE20129
    8 RETURN                                                         ELE20130
      END                                                            ELE20131
// DUP                                                               ELE20132
*DELETE              ELE2                                           ELE20133
*STORE      WS  UA  ELE2                                            ELE20134
```

```
// JOB                                                                    MATV0000
// FOR                                                                    MATV0001
*ONE WORD INTEGERS                                                        MATV0002
*LIST ALL                                                                 MATV0003
*EXTENDED PRECISION                                                       MATV0004
      SUBROUTINE MATV(A,N,B,M,DETM)                                       MATV0005
      DIMENSION A(12,12),B(12,1),PIVOT(12),IPVOT(12),INDEX(12,12)         MATV0006
      EQUIVALENCE (IROW,JROW),(ICLUM,JCLUM),(AMAX,T,SWAP)                 MATV0007
      DETM=1.0                                                            MATV0008
      DO 20 J=1,N                                                         MATV0009
   20 IPVOT(J)=0                                                          MATV0010
      DO 550 I=1,N                                                        MATV0011
      AMAX=0.0                                                            MATV0012
      DO 105 J=1,N                                                        MATV0013
      IF(IPVOT(J)-1)60,105,60                                             MATV0014
   60 DO 100 K=1,N                                                        MATV0015
      IF(IPVOT(K)-1)80,100,740                                            MATV0016
   80 IF(ABS(AMAX)-ABS(A(J,K)))85,100,100                                 MATV0017
   85 IROW=J                                                              MATV0018
      ICLUM=K                                                             MATV0019
      AMAX=A(J,K)                                                         MATV0020
  100 CONTINUE                                                            MATV0021
  105 CONTINUE                                                            MATV0022
      IPVOT(ICLUM)=IPVOT(ICLUM)+1                                         MATV0023
      IF(IROW-ICLUM)140,260,140                                           MATV0024
  140 DETM=-DETM                                                          MATV0025
      DO 200 L=1,N                                                        MATV0026
      SWAP=A(IROW,L)                                                      MATV0027
      A(IROW,L)=A(ICLUM,L)                                                MATV0028
  200 A(ICLUM,L)=SWAP                                                     MATV0029
      IF(M)260,260,210                                                    MATV0030
  210 DO 250 L=1,M                                                        MATV0031
      SWAP=B(IROW,L)                                                      MATV0032
      B(IROW,L)=B(ICLUM,L)                                                MATV0033
  250 B(ICLUM,L)=SWAP                                                     MATV0034
  260 INDEX(I,1)=IROW                                                     MATV0035
      INDEX(I,2)=ICLUM                                                    MATV0036
      PIVOT(I)=A(ICLUM,ICLUM)                                             MATV0037
      DETM=DETM*PIVOT(I)                                                  MATV0038
      A(ICLUM,ICLUM)=1.0                                                  MATV0039
      DO 350 L=1,N                                                        MATV0040
  350 A(ICLUM,L)=A(ICLUM,L)/PIVOT(I)                                      MATV0041
      IF(M)380,380,360                                                    MATV0042
  360 DO 370 L=1,M                                                        MATV0043
  370 B(ICLUM,L)=B(ICLUM,L)/PIVOT(I)                                      MATV0044
  380 DO 550 L1=1,N                                                       MATV0045
      IF(L1-ICLUM)400,550,400                                             MATV0046
  400 T=A(L1,ICLUM)                                                       MATV0047
      A(L1,ICLUM)=0.0                                                     MATV0048
      DO 450 L=1,N                                                        MATV0049
  450 A(L1,L)=A(L1,L)-A(ICLUM,L)*T                                        MATV0050
      IF(M)550,550,460                                                    MATV0051
  460 DO 500 L=1,M                                                        MATV0052
  500 B(L1,L)=B(L1,L)-B(ICLUM,L)*T                                        MATV0053
  550 CONTINUE                                                            MATV0054
      DO 710 I=1,N                                                        MATV0055
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```
      L=N+1-I                                                          MATV0056
      IF(INDEX(L,1)-INDEX(L,2))630,710,630                             MATV0057
  630 JROW=INDEX(L,1)                                                  MATV0058
      JCLUM=INDEX(L,2)                                                 MATV0059
      DO 705 K=1,N                                                     MATV0060
      SWAP=A(K,JROW)                                                   MATV0061
      A(K,JROW)=A(K,JCLUM)                                             MATV0062
      A(K,JCLUM)=SWAP                                                  MATV0063
  705 CONTINUE                                                         MATV0064
  710 CONTINUE                                                         MATV0065
  740 IF(DETM-0.000001)750,750,760                                     MATV0066
  750 DETM=0.0                                                         MATV0067
  760 RETURN                                                           MATV0068
      END                                                              MATV0069
// DUP                                                                 MATV0070
*DELETE              MATV                                            MATV0071
*STORE       WS  UA  MATV                                            MATV0072

// JOB                                                                 CLFE0000
// FOR                                                                 CLFE0001
*ONE WORD INTEGERS                                                     CLFE0002
*LIST ALL                                                            CLFE0003
*EXTENDED PRECISION                                                  CLFE0004
      FUNCTION CLFE(B)                                                 CLFE0005
      DIMENSION B(6)                                                   CLFE0006
      COMMON R(120),Z(360),T(6),ZZ(12),N,IREP,TT(12),ID,S(14),D,X( 30,6)CLFE0007
      N1=N/IREP                                                        CLFE0008
      A=0.0                                                            CLFE0009
      DO 1 J=1,6                                                       CLFE0010
    1 A=A-B(J)*T(J)                                                    CLFE0011
      DO 2 I=1,N1                                                      CLFE0012
      DO 2 J=1,IREP                                                    CLFE0013
      C=0.0                                                            CLFE0014
      DO 3 JJ=1,6                                                      CLFE0015
    3 C=C+B(JJ)*X(I,JJ)                                                CLFE0016
      IF(C)5,5,2                                                       CLFE0017
    5 A=-10.0**300                                                     CLFE0018
      GO TO 4                                                          CLFE0019
    2 A=A+ALOG(C)                                                      CLFE0020
    4 CLFE=A                                                           CLFE0021
      RETURN                                                           CLFE0022
      END                                                              CLFE0023
// DUP                                                                 CLFE0024
*DELETE              CLFE                                            CLFE0025
*STORE       WS  UA  CLFE                                            CLFE0026

// JOB                                                                 ELOF0000
// FOR                                                                 ELOF0001
*ONE WORD INTEGERS                                                     ELOF0002
*LIST ALL                                                            ELOF0003
*EXTENDED PRECISION                                                  ELOF0004
      FUNCTION ELOF(IJ,KK)                                             ELOF0005
      COMMON R(120),X( 30,6,2),T(6),B1(6,2),N,IR,TT(12),ID,S(14)       ELOF0006
      N1=N/IR                                                          ELOF0007
      GO TO (8,9,9,9),IJ                                               ELOF0008
    8 B=0.0                                                            ELOF0009
```

```
      DO 5 K=1,N                                                    ELOF0010
    5 B=B+R(K)/N                                                    ELOF0011
      B=1.0/B                                                       ELOF0012
    9 ELOF=0.0                                                      ELOF0013
      DO 1 I=1,N1                                                   ELOF0014
      A=0.0                                                         ELOF0015
      DO 2 J=1,IR                                                   ELOF0016
      K=(J-1)*N1+I                                                  ELOF0017
      GO TO (15,15,14,15),IJ                                        ELOF0018
   15 A=A+R(K)/IR                                                   ELOF0019
      GO TO 2                                                       ELOF0020
   14 A=A+1.0/R(K)/FLOAT(IR)                                        ELOF0021
    2 CONTINUE                                                      ELOF0022
      GO TO (17,17,6,17),IJ                                         ELOF0023
   17 IF(A)10,10,11                                                 ELOF0024
   10 A=10.0**(-10)                                                 ELOF0025
   11 A=1.0/A                                                       ELOF0026
      GO TO (6,7,6,6),IJ                                            ELOF0027
    7 B=0.0                                                         ELOF0028
      DO 3 J=1,6                                                    ELOF0029
    3 B=B+X(I,J,KK)*B1(J,KK)                                        ELOF0030
    6 DO 4 J=1,IR                                                   ELOF0031
      K=(J-1)*N1+I                                                  ELOF0032
      GO TO (12,12,13,16),IJ                                        ELOF0033
   13 ELOF=ELOF+(A-1.0/R(K))**2                                     ELOF0034
      GO TO 4                                                       ELOF0035
   12 ELOF=ELOF+ALOG(B/A)-R(K)*(B-A)                                ELOF0036
      GO TO 4                                                       ELOF0037
   16 ELOF=ELOF+ALOG(A)-R(K)*A                                      ELOF0038
    4 CONTINUE                                                      ELOF0039
    1 CONTINUE                                                      ELOF0040
      GO TO (18,18,20,18),IJ                                        ELOF0041
   20 ELOF=-ALOG(ELOF)*FLOAT(N)/2.0                                 ELOF0042
   18 RETURN                                                        ELOF0043
      END                                                           ELOF0044
// DUP                                                              ELOF0045
*DELETE              ELOF                                          ELOF0046
*STORE       WS  UA  ELOF                                          ELOF0047
// JOB                                                              CAN20000
// FOR                                                              CAN20001
*ONE WORD INTEGERS                                                  CAN20002
*LIST ALL                                                          CAN20003
*EXTENDED PRECISION                                                CAN20004
      SUBROUTINE CAN2(AA,AMBDA,N)                                   CAN20005
      DIMENSION AA(2,2),AMBDA(2),E(4),D(4)                          CAN20006
   80 FORMAT(4X,I2,5X,E15.6,5X,3E15.6)                              CAN20007
      M=5                                                           CAN20008
      NQ=+1                                                         CAN20009
      K=1                                                           CAN20010
      DO 1 I=1,N                                                    CAN20011
      DO 1 J=1,I                                                    CAN20012
      E(K)=AA(I,J)                                                  CAN20013
    1 K=K+1                                                         CAN20014
      CALL JACO2(E,D,AMBDA,N,NQ)                                    CAN20015
      K=1                                                           CAN20016
      DO 2 I=1,N                                                    CAN20017
```

```
      DO 2 J=1,N                                                    CAN20018
      AA(I,J)=D(K)                                                  CAN20019
    2 K=K+1                                                         CAN20020
      DO 3 I=1,N                                                    CAN20021
    3 WRITE(M,80)I,AMBDA(I),(AA(I,J),J=1,N)                         CAN20022
      RETURN                                                        CAN20023
      END                                                           CAN20024
// DUP                                                              CAN20025
*DELETE              CAN2                                         CAN20026
*STORE       WS  UA  CAN2                                         CAN20027

// JOB                                                              JAC02000
// FOR                                                              JAC02001
*ONE WORD INTEGERS                                                  JAC02002
*LIST ALL                                                           JAC02003
*EXTENDED PRECISION                                                 JAC02004
      SUBROUTINE JACO2(A,B,C,NAA,NQ)                                JAC02005
      DIMENSION A(4),B(4),C(2)                                      JAC02006
  901 FORMAT(25H EIGENVALUE NOT CONVERGED  )                        JAC02007
      M=5                                                           JAC02008
      LOOPC=0                                                       JAC02009
      NA=NAA                                                        JAC02010
      NN=(NA*(NA+1))/2                                              JAC02011
      IF (NQ) 120,100,100                                           JAC02012
  100 K=1                                                           JAC02013
      DO 115 I=1,NA                                                 JAC02014
      DO 115 J=1,NA                                                 JAC02015
      IF(I-J)105,110,105                                            JAC02016
  105 B(K)=0.                                                       JAC02017
      GO TO 115                                                     JAC02018
  110 B(K)=1.                                                       JAC02019
  115 K=K+1                                                         JAC02020
  120 SUM=0.                                                        JAC02021
      IF(NA-1)325,310,125                                           JAC02022
  125 K=1                                                           JAC02023
      AMAX=0.                                                       JAC02024
      DO 155 I=1,NA                                                 JAC02025
      DO 150 J=1,I                                                  JAC02026
      IF(I-J)135,145,135                                            JAC02027
  135 IF(ABS(A(K))-AMAX)145,145,140                                 JAC02028
  140 AMAX=ABS(A(K))                                                JAC02029
  145 TERM=A(K)*A(K)                                                JAC02030
      SUM=SUM+TERM+TERM                                             JAC02031
  150 K=K+1                                                         JAC02032
  155 SUM=SUM-TERM                                                  JAC02033
      SUM=SQRT(SUM)                                                 JAC02034
      THRES=SUM/SQRT(FLOAT(NA))                                     JAC02035
      THRSH=THRES*1.0E-08                                           JAC02036
      IF(THRSH-AMAX)165,310,310                                     JAC02037
  165 THRES=AMAX/3.                                                 JAC02038
      IF(THRES-THRSH)175,180,180                                    JAC02039
  175 THRES=THRSH                                                   JAC02040
  180 K=2                                                           JAC02041
      N=0                                                           JAC02042
      JD=1                                                          JAC02043
      DO 270 J=2,NA                                                 JAC02044
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```
      JD=JD+J                                                    JACO2045
      JJ=J-1                                                     JACO2046
      ID=0                                                       JACO2047
      DO 265 I=1,JJ                                              JACO2048
      ID=ID+I                                                    JACO2049
      IF(ABS(A(K))-THRES)265,265,195                             JACO2050
  195 N=N+1                                                      JACO2051
      ALPHA=(A(JD)-A(ID))/(2.*A(K))                              JACO2052
      BETA=1./(1.+ALPHA*ALPHA)                                   JACO2053
      ROOT=1.0+ABS(ALPHA)* SQRT(BETA)                            JACO2054
      IF(ALPHA)205,200,200                                       JACO2055
  200 SSQ=0.5*BETA/ROOT                                          JACO2056
      CSQ=0.5*ROOT                                               JACO2057
      GO TO 210                                                  JACO2058
  205 CSQ=0.5*BETA/ROOT                                          JACO2059
      SSQ=0.5*ROOT                                               JACO2060
  210 CC=SQRT(CSQ)                                               JACO2061
      S=-SQRT(SSQ)                                               JACO2062
      TWOSC=CC*S*2.                                              JACO2063
      TEMPA=CSQ*A(ID)+TWOSC*A(K)+SSQ*A(JD)                       JACO2064
      A(JD)=CSQ*A(JD)-TWOSC*A(K)+SSQ*A(ID)                       JACO2065
      A(ID)=TEMPA                                                JACO2066
      A(K)=0.                                                    JACO2067
      KA=JD-J                                                    JACO2068
      KB=ID-I                                                    JACO2069
      KC=NA*(I-1)                                                JACO2070
      KD=NA*(J-1)                                                JACO2071
      DO 260 L=1,NA                                              JACO2072
      KC=KC+1                                                    JACO2073
      KD=KD+1                                                    JACO2074
      TEMPA=CC*B(KC)+S*B(KD)                                     JACO2075
      B(KD)=-S*B(KC)+CC*B(KD)                                    JACO2076
      B(KC)=TEMPA                                                JACO2077
      IF(I-L)230,220,245                                         JACO2078
  220 KB=KB+1                                                    JACO2079
  225 KA=KA+1                                                    JACO2080
      GO TO 260                                                  JACO2081
  230 KB=KB+L-1                                                  JACO2082
      IF(J-L)240,225,250                                         JACO2083
  240 KA=KA+L-1                                                  JACO2084
      GO TO 255                                                  JACO2085
  245 KB=KB+1                                                    JACO2086
  250 KA=KA+1                                                    JACO2087
  255 TEMPA=CC*A(KB)+S*A(KA)                                     JACO2088
      A(KA)=-S*A(KB)+CC*A(KA)                                    JACO2089
      A(KB)=TEMPA                                                JACO2090
  260 CONTINUE                                                   JACO2091
  265 K=K+1                                                      JACO2092
  270 K=K+1                                                      JACO2093
      LOOPC=LOOPC+1                                              JACO2094
      IF(LOOPC-50)275,305,305                                    JACO2095
  275 IF(N-NN/8)280,280,180                                      JACO2096
  280 IF(THRES-THRSH)285,300,285                                 JACO2097
  285 THRES=THRSH/3.                                             JACO2098
      IF(THRES-THRSH)295,180,180                                 JACO2099
  295 THRES=THRSH                                                JACO2100
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```
      GO TO 180                                                          JACO2101
  300 IF(N)180,310,180                                                   JACO2102
  305 WRITE(M,901)                                                       JACO2103
  310 LL=0                                                               JACO2104
      DO 320 L=1,NA                                                      JACO2105
      LL=LL+L                                                            JACO2106
  320 C(L)=A(LL)                                                         JACO2107
  325 RETURN                                                             JACO2108
      END                                                                JACO2109
// DUP                                                                   JACO2110
*DELETE              JACO2                                              JACO2111
*STORE       WS  UA  JACO2                                              JACO2112

// JOB                                                                   EEIG2000
// FOR                                                                   EEIG2001
*ONE WORD INTEGERS                                                       EEIG2002
*LIST ALL                                                               EEIG2003
*EXTENDED PRECISION                                                     EEIG2004
*IOCS(1403 PRINTER)                                                     EEIG2005
*IOCS(2501 READER)                                                      EEIG2006
*NAME EEIG2                                                             EEIG2007
      DIMENSION BA(12,12),Z(2),S(2),A3(2),COE(6),V(6)                   EEIG2008
      COMMON R(120),X( 30,6,2),T(6),B(6,2),NS,NREPS,TITL(12),ID,XX(7),SDEEIG2009
     1(5),A4(2),XY(181),MN,NI,YS,V1(2),ALAMD(2),PREP(2,2)               EEIG2010
   89 FORMAT(1HO,8X,12HEIGEN VALUES,10X,21HEIGEN VECTORS AS ROWS/)      EEIG2011
   88 FORMAT(1HOE11.4,3H=YS3X)                                          EEIG2012
   87 FORMAT(1HO,2(E11.4,2H=XI1,1HS))                                   EEIG2013
   86 FORMAT(I4,3F10.3,4F15.3)                                          EEIG2014
   85 FORMAT(1HO,1X,18HTABLE OF RESIDUALS)                              EEIG2015
   82 FORMAT(1H1I2A6)                                                   EEIG2016
   81 FORMAT(1HO,3X,5H1/Y -,E15.6,3H = ,2(2H +,E15.6,2H Z,I1,3H SQ),/,) EEIG2017
   80 FORMAT(1HO,7X,5HY EST5X5HY OBS6X4HDEVN12X11HVALUES OF Z18X13HFACTOEEIG2018
     1R LEVELS/)                                                        EEIG2019
   79 FORMAT(54HOPOWER TRANSFORMATIONS OF INDEPENDENT VARIABLES - A1 =F8EEIG2020
     1.4,6H  A2 =F8.4)                                                  EEIG2021
   77 FORMAT(29HO  CENTRE OF RESPONSE SURFACE  ,/,)                     EEIG2022
   78 FORMAT( 52HO CANONICAL REGRESSION   (Z ARE CANONICAL VARIABLES),/)EEIG2023
      M=5                                                               EEIG2024
      NI=NS/NREPS                                                       EEIG2025
      DO 9 KK=1,2                                                       EEIG2026
      WRITE(M,82)TITL                                                   EEIG2027
      DO 5 I=1,2                                                        EEIG2028
      GO TO (7,8),KK                                                    EEIG2029
    7 A3(I)=1.0                                                         EEIG2030
      GO TO 5                                                           EEIG2031
    8 A3(I)=A4(I)                                                       EEIG2032
    5 CONTINUE                                                          EEIG2033
      GO TO (1,2),KK                                                    EEIG2034
    2 WRITE(M,79)A3                                                     EEIG2035
    1 DO 29 J=1,4                                                       EEIG2036
      COE(J)=B(J,KK)                                                    EEIG2037
   29 V(J)=COE(J)                                                       EEIG2038
      COE(5)=B(6,KK)                                                    EEIG2039
      COE(6)=B(5,KK)                                                    EEIG2040
      V(5)=COE(5)                                                       EEIG2041
      V(6)=COE(6)                                                       EEIG2042
```

```
      NFAK=2                                                        EEIG2043
      KP=NFAK+2                                                     EEIG2044
      DO 32 I=1,NFAK                                                EEIG2045
      DO 32 J=1,I                                                   EEIG2046
      IF(I-J)31,30,31                                               EEIG2047
   30 PREP(I,J)=V(KP)                                               EEIG2048
      GO TO 32                                                      EEIG2049
   31 PREP(I,J)=V(KP)*0.5                                           EEIG2050
      PREP(J,I)=PREP(I,J)                                           EEIG2051
   32 KP=KP+1                                                       EEIG2052
      DO 33 I=1,NFAK                                                EEIG2053
   33 V(I)=-V(I+1)*0.500                                            EEIG2054
      DO 34 I=1,NFAK                                                EEIG2055
      DO 34 J=1,NFAK                                                EEIG2056
   34 BA(I,J)=PREP(I,J)                                             EEIG2057
      WRITE(M,77)                                                   EEIG2058
      CALL MATV(BA,NFAK,V,1,DET)                                    EEIG2059
      YS=COE(1)                                                     EEIG2060
      DO 44 I=1,NFAK                                                EEIG2061
   44 YS=YS+0.5*V(I)*COE(I+1)                                       EEIG2062
      YS1=1.0/YS                                                    EEIG2063
      I1=1                                                          EEIG2064
      I2=2                                                          EEIG2065
      DO 3 I=1,2                                                    EEIG2066
      M1=V(I)/ABS(V(I))                                             EEIG2067
    3 S(I)=ABS(V(I))**(1.0/A3(I))*M1                                EEIG2068
      WRITE(M,87)(S(I),I,I=1,NFAK)                                  EEIG2069
      WRITE(M,88)YS1                                                EEIG2070
      WRITE(M,89)                                                   EEIG2071
      CALL CAN2(PREP,ALAMD,NFAK)                                    EEIG2072
      WRITE(M,78)                                                   EEIG2073
      WRITE(M,81)YS,(ALAMD(J),J,J=1,NFAK)                           EEIG2074
      WRITE(M,85)                                                   EEIG2075
      WRITE(M,80)                                                   EEIG2076
      DO 18 J=1,N1                                                  EEIG2077
      YPRED=YS                                                      EEIG2078
      RD=0.0                                                        EEIG2079
      DO 16 I=1,NFAK                                                EEIG2080
      Z(I)=0.0                                                      EEIG2081
      DO 16 L2=1,NFAK                                               EEIG2082
   16 Z(I)=Z(I)+(X(J,L2+1,KK)-V(L2))*PREP(I,L2)                     EEIG2083
      DO 17 L1=1,NFAK                                               EEIG2084
   17 YPRED=YPRED+(Z(L1)**2)*ALAMD(L1)                              EEIG2085
      YPRED=1.0/YPRED                                               EEIG2086
      DO 6 K=1,NREPS                                                EEIG2087
      K1=(K-1)*N1+J                                                 EEIG2088
    6 RD=RD+R(K1)/NREPS                                             EEIG2089
      DEV=RD-YPRED                                                  EEIG2090
      DO 4 II=1,2                                                   EEIG2091
    4 S(II)=X(J,II+1,KK)**(1.0/A3(II))                              EEIG2092
   18 WRITE(M,86)J,YPRED,RD,DEV,(Z(I),I=1,NFAK),(S(II),II=1,2)      EEIG2093
      DO 46 I=1,2                                                   EEIG2094
   46 V1(I)=V(I)                                                    EEIG2095
      CALL CERS2(KK)                                                EEIG2096
      GO TO (10,11),KK                                              EEIG2097
   10 IF(A4(1))9,11,9                                               EEIG2098
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    9 CONTINUE                                                          EEIG2099
   11 IF(ID-98)12,12,13                                                 EEIG2100
   12 CALL EXIT                                                         EEIG2101
   13 CALL LINK(ERSL2)                                                  EEIG2102
      END                                                               EEIG2103
// DUP                                                                  EEIG2104
*DELETE              EEIG2                                             EEIG2105
*STORE       WS  UA  EEIG2                                             EEIG2106

// JOB                                                                  CERS2000
// FOR                                                                  CERS2001
*ONE WORD INTEGERS                                                      CERS2002
*LIST ALL                                                               CERS2003
*EXTENDED PRECISION                                                     CERS2004
      SUBROUTINE CERS2(KK)                                              CERS2005
      DIMENSION A3(2),YCONT(10),ZLIM(2),XH(40),XV(40),YP1(5),XP1(5),YCONCERS2006
     11(10),YP(400),XP(400)                                             CERS2007
      COMMON R(120),X( 30,6,2),T(6),B(12),N,IREP,TITL(12),ID,XX(7),SD(5)CERS2008
     1,A4(2),XY(181),MN,NI,YS,XCNTR(2),ALAMD(2),AVECT(2,2)              CERS2009
   90 FORMAT(62H1IMAGINARY POINT CALCULATED, TRY CONTOURS CLOSER TO THE CERS2010
     1CENTRE)                                                           CERS2011
   89 FORMAT(64HOSADDLE EXISTS  -  CONTOUR POINTS PLOTTED IN UNTRANSFORMCERS2012
     1ED UNITS//5(12X,F8.2,3X)/5(10X2HX19X2HX2))                        CERS2013
   85 FORMAT(61H1IMAGINARY POINT CALCULATED - CONTOUR ON WRONG SIDE OF CCERS2014
     1ENTRE)                                                            CERS2015
   82 FORMAT(12F6.2)                                                    CERS2016
   81 FORMAT(2X,5(2X,F10.2,1X,F10.2))                                   CERS2017
   80 FORMAT(54HOPOWER TRANSFORMATIONS OF INDEPENDENT VARIABLES - A1 =F8CERS2018
     1.4,6H  A2 =F8.4)                                                  CERS2019
   83 FORMAT(1H112A6)                                                   CERS2020
   79 FORMAT(1HO,10X,54HDATA FOR PLOTTING OF 5 CONTOURS IN UNTRANSFORMEDCERS2021
     1 UNITS//5(12X,F8.2,3X)/5(10X2HX19X2HX2))                         CERS2022
      L=8                                                               CERS2023
      M=5                                                               CERS2024
      GO TO (7,8),KK                                                    CERS2025
    7 READ(L,82)YCON1,ZLIM                                              CERS2026
      DO 9 I=1,2                                                        CERS2027
    9 A3(I)=1.0                                                         CERS2028
      GO TO 10                                                          CERS2029
    8 DO 13 I=1,2                                                       CERS2030
   13 A3(I)=A4(I)                                                       CERS2031
   10 DO 4 I=1,2                                                        CERS2032
    4 ZLIM(I)=ZLIM(I)**A3(I)                                            CERS2033
      DO 29 I=1,10                                                      CERS2034
   29 YCONT(I)=YCON1(I)                                                 CERS2035
      DO 61 I=1,400                                                     CERS2036
      XP(I)=0.0                                                         CERS2037
   61 YP(I)=0.0                                                         CERS2038
      NSWCH=0                                                           CERS2039
      NSAD=0                                                            CERS2040
      KCY=0                                                             CERS2041
      IH=1                                                              CERS2042
      IV=2                                                              CERS2043
      N1=ALAMD(IH)/ABS(ALAMD(IH))                                       CERS2044
      N2=ALAMD(IV)/ABS(ALAMD(IV))                                       CERS2045
      NSIGN=N1*N2                                                       CERS2046
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      IF(NSIGN)11,11,40                                                 CERS2047
   11 NSAD=1                                                            CERS2048
      IF(N1)40,40,14                                                    CERS2049
   14 IDUM=IH                                                           CERS2050
      IH=IV                                                             CERS2051
      IV=IDUM                                                           CERS2052
      NSWCH=1                                                           CERS2053
   40 CONTINUE                                                          CERS2054
      KCY=KCY+1                                                         CERS2055
      ARG=(YCONT(KCY)-YS)/ALAMD(IH)                                     CERS2056
      IF(ARG)101,101,102                                                CERS2057
  101 WRITE(M,85)                                                       CERS2058
      GO TO 43                                                          CERS2059
  102 ZFRST=SQRT(ARG)                                                   CERS2060
      ZEND=ZLIM(IH)-ZFRST                                               CERS2061
      XH(1)=ZFRST                                                       CERS2062
      XV(1)=0.0                                                         CERS2063
      THETA=0.0                                                         CERS2064
      DO 1 I=2,10                                                       CERS2065
      THETA=THETA+0.15710                                               CERS2066
      IF(NSAD)51,51,52                                                  CERS2067
   51 XH(I)=ZFRST*COS(THETA)                                            CERS2068
      GO TO 53                                                          CERS2069
   52 XH(I)=ZFRST+ZEND-ZEND*COS(THETA)                                  CERS2070
   53 ARG=(YCONT(KCY)-YS-ALAMD(IH)*(XH(I)**2))/ALAMD(IV)                CERS2071
      IF(ARG)104,103,103                                                CERS2072
  104 WRITE(M,90)                                                       CERS2073
      GO TO 43                                                          CERS2074
  103 XV(I)=SQRT(ARG)                                                   CERS2075
      IL=42-I                                                           CERS2076
      XH(IL)=XH(I)                                                      CERS2077
      XV(IL)=-XV(I)                                                     CERS2078
    1 CONTINUE                                                          CERS2079
      IF(NSAD)54,54,55                                                  CERS2080
   54 XH(11)=0.0                                                        CERS2081
      ARGG=(YCONT(KCY)-YS)/ALAMD(IV)                                    CERS2082
      XV(11)=SQRT(ARGG)                                                 CERS2083
      GO TO 56                                                          CERS2084
   55 XH(11)=ZLIM(IH)                                                   CERS2085
      ARG=(YCONT(KCY)-YS-ALAMD(IH)*(XH(I)**2))/ALAMD(IV)                CERS2086
      XV(11)=SQRT(ARG)                                                  CERS2087
   56 DO 2 I=12,21                                                      CERS2088
      LL1=22-I                                                          CERS2089
      II=42-I                                                           CERS2090
      XH(I)=-XH(LL1)                                                    CERS2091
      XV(I)=XV(LL1)                                                     CERS2092
      XH(II)=XH(I)                                                      CERS2093
    2 XV(II)=-XV(I)                                                     CERS2094
      XV(31)=-XV(11)                                                    CERS2095
      XH(31)=XH(11)                                                     CERS2096
      IF(NSWCH)31,31,32                                                 CERS2097
   32 I1=IV                                                             CERS2098
      I2=IH                                                             CERS2099
      DO 33 I=1,40                                                      CERS2100
      XDUM=XH(I)                                                        CERS2101
      XH(I)=XV(I)                                                       CERS2102
```

```
   33 XV(I)=XDUM                                                    CERS2103
      GO TO 60                                                      CERS2104
   31 I1=IH                                                         CERS2105
      I2=IV                                                         CERS2106
   60 DO 41 I=1,40                                                  CERS2107
      L=(KCY-1)*40+I                                                CERS2108
      XP(L)=AVECT(I1,I1)*XH(I)+AVECT(I2,I1)*XV(I)+XCNTR(I1)         CERS2109
   41 YP(L)=AVECT(I1,I2)*XH(I)+AVECT(I2,I2)*XV(I)+XCNTR(I2)         CERS2110
      IF(KCY-5)40,34,34                                             CERS2111
   34 IF(NSAD-1)35,47,47                                            CERS2112
   47 IF(KCY-10)48,35,35                                            CERS2113
   48 IF(KCY-5)40,36,40                                             CERS2114
   36 IF(NSWCH)38,38,39                                             CERS2115
   38 NSWCH=1                                                       CERS2116
      GO TO 37                                                      CERS2117
   39 NSWCH=0                                                       CERS2118
   37 IDUM=IH                                                       CERS2119
      IH=IV                                                         CERS2120
      IV=IDUM                                                       CERS2121
      GO TO 40                                                      CERS2122
   35 WRITE(M,83)TITL                                               CERS2123
      GO TO (5,6),KK                                                CERS2124
    6 WRITE(M,80)A3                                                 CERS2125
    5 WRITE(M,79)(YCON1(I),I=1,5)                                   CERS2126
      DO 3 I=1,40                                                   CERS2127
      DO 49 J=1,5                                                   CERS2128
      L1=(J-1)*40+I                                                 CERS2129
      XP1(J)=XP(L1)                                                 CERS2130
   49 YP1(J)=YP(L1)                                                 CERS2131
      DO 12 J=1,5                                                   CERS2132
      N2=XP1(J)/ABS(XP1(J))                                         CERS2133
      XP1(J)=ABS(XP1(J))**(-1.0/A3(1))*N2                           CERS2134
      N2=YP1(J)/ABS(YP1(J))                                         CERS2135
   12 YP1(J)=ABS(YP1(J))**(-1.0/A3(2))*N2                           CERS2136
    3 WRITE(M,81)(XP1(J),YP1(J),J=1,5)                              CERS2137
      IF(NSAD)43,43,44                                              CERS2138
   44 WRITE(M,83)TITL                                               CERS2139
      WRITE(M,89)(YCON1(I),I=6,10)                                  CERS2140
      DO 42 I=1,40                                                  CERS2141
      DO 59 J=1,5                                                   CERS2142
      L1=200+(J-1)*40+I                                             CERS2143
      XP1(J)=XP(L1)                                                 CERS2144
   59 YP1(J)=YP(L1)                                                 CERS2145
      DO 18 J=1,5                                                   CERS2146
      N2=XP1(J)/ABS(XP1(J))                                         CERS2147
      XP1(J)=ABS(XP1(J))**(-1.0/A3(1))*N2                           CERS2148
      N2=YP1(J)/ABS(YP1(J))                                         CERS2149
   18 YP1(J)=ABS(YP1(J))**(-1.0/A3(2))*N2                           CERS2150
   42 WRITE(M,81)(XP1(J),YP1(J),J=1,5)                              CERS2151
   43 RETURN                                                        CERS2152
      END                                                           CERS2153
// DUP                                                            CERS2154
*DELETE            CERS2                                         CERS2155
*STORE      WS  UA  CERS2                                         CERS2156
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```
// JOB                                                                  COPM0000
// FOR                                                                  COPM0001
*LIST ALL                                                               COPM0002
*ONE WORD INTEGERS                                                      COPM0003
*EXTENDED PRECISION                                                     COPM0004
*IOCS(2501 READER)                                                      COPM0005
*IOCS(1403 PRINTER)                                                     COPM0006
*NAME COPM                                                              COPM0007
C                                                                       COPM0008
C   ONE AND TWO WAY ANALYSIS OF VARIANCE USING THE POISSON DISTRIBUTION COPM0009
C                                                                       COPM0010
C     THIS PROGRAM ANALYZES ONE- AND TWO-WAY FACTORIAL EXPERIMENTS WITH COPM0011
C A MAXIMUM OF TWENTY BLOCKS AND FOUR OBSERVATIONS PET BLOCK, USING A   COPM0012
C POISSON PROBABILITY DISTRIBUTION. FOR COMPARISON,NORMAL THEORY LINEAR,COPM0013
C LOG, AND SQUARE ROOT MODELS ARE ALSO ANALYZED, WITH EITHER NO INTERAC-COPM0014
C TION OR INTERACTION MATHEMATICAL MODELS, DEPENDING ON THE NUMBER OF   COPM0015
C OBSERVATIONS PER BLOCK. OPTIONS ALLOW PRINTOUT OF EXPECTED VALUES     COPM0016
C EITHER IN ORIGINAL OR TRANSFORMED UNITS WITH DEVIATIONS.              COPM0017
C                                                                       COPM0018
C     NUMBER OF ROWS (A) MUST BE GREATER THAN OR EQUAL TO NUMBER OF     COPM0019
C COLUMNS
C                                                                       COPM0020
C   SUBROUTINES CALLED                                                  COPM0021
C                                                                       COPM0022
C  CLP   - CALCULATES POISSON LIKELIHOOD                                COPM0023
C  CLIP  - CALCULATES MAXIMUM LIKELIHOOD ESTIMATES OF PARAMETERS        COPM0024
C  MATVK - INVERTS MATRICES UP TO 31 BY 31                              COPM0025
C                                                                       COPM0026
C   MAKEUP OF DATA DECK                                                 COPM0027
C                                                                       COPM0028
C 1.TITLE CARD (12A6)                                                   COPM0029
C 2.CONTROL CARD (I1,4I2,F5.3,I3)                                       COPM0030
C      I1 - OPTION - 0 - NOTHING                                        COPM0031
C                    1 - PRINT EXPECTED VALUES IN ORIGINAL UNITS WITH   COPM0032
C                        DEVIATIONS                                     COPM0033
C                    2 - PRINT EXPECTED VALUES IN TRANSFORMED UNITS WITH COPM0034
C                        DEVIATIONS                                     COPM0035
C      I2 - NUMBER OF BLOCKS                                            COPM0036
C      I2 - NUMBER OF OBSERVATIONS PER BLOCK                            COPM0037
C      I2 - NUMBER OF TREATMENT LEVELS IN DIRECTION A (NUMBER OF ROWS)  COPM0038
C      I2 - NUMBER OF TREATMENT LEVELS IN DIRECTION B (NUMBER OF COLUMNS)COPM0039
C      F5.3 - UNIT OF MEASUREMENT (USUALLY 1.0)                         COPM0040
C      I3 - NUMBER OF ITERATIONS ALLOWED                                COPM0041
C 3.DATA - SETS OF OBSERVATIONS FOR EACH BLOCK - ONE SET PER CARD -      COPM0042
C      PROCEED DOWN COLUMNS (4(6X,F6.3))                                COPM0043
C 4.99 IN COLS. 79-80 INDICATES END OF DATA, ANOTHER DATA DECK TO FOLLOWCOPM0044
C   98 IN COLS. 79-80 INDICATES END OF JOB, CALL EXIT AFTER THIS DECK   COPM0045
C 5.REPEAT 1. TO 4. AS REQUIRED                                         COPM0046
C                                                                       COPM0047
      DIMENSION R( 80),S( 80),Y1(4),TL(5,5),RS(5,5),B2(5),X(8),X1(8)    COPM0048
      COMMON T(20),TA(10),TB(4),S1(20,2),TOT,N1,MA,MB,NI,TITL(12)       COPM0049
  185 FORMAT(19HOORIGINAL VARIABLES)                                    COPM0050
  184 FORMAT(22HOTRANSFORMED VARIABLES)                                 COPM0051
  183 FORMAT(8E12.4)                                                    COPM0052
  182 FORMAT(15HONO INTERACTION33X11HINTERACTION/)                      COPM0053
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181 FORMAT(15HONO INTERACTION/)                                          COPM0054
180 FORMAT(47HOEXPECTED VALUES AND DEVIATIONS - POISSON MODEL)           COPM0055
 99 FORMAT(51HOEXPECTED VALUES AND DEVIATIONS - SQRT NORMAL MODEL)       COPM0056
 98 FORMAT(50HOEXPECTED VALUES AND DEVIATIONS - LOG NORMAL MODEL)        COPM0057
 97 FORMAT(1X)                                                           COPM0058
 96 FORMAT(33HOINCORRECT NUMBER OF OBSERVATIONS)                         COPM0059
 95 FORMAT(1X,4F11.0)                                                    COPM0060
 94 FORMAT(53HOEXPECTED VALUES AND DEVIATIONS - LINEAR NORMAL MODEL)     COPM0061
 93 FORMAT(6HOLOG R16X13HLINEAR NORMAL5X10HLOG NORMAL5X11HSQRT NORMAL7COPM0062
   1X7HPOISSON)                                                          COPM0063
 92 FORMAT(19HOVARIABLES OBSERVED/)                                      COPM0064
 91 FORMAT(23H MULTINOMIAL LIKELIHOODE14.6)                              COPM0065
 90 FORMAT(6HOLOG R18X13HLINEAR NORMAL2X10HLOG NORMAL3X11HSQRT NORMAL1COPM0066
   13X7HPOISSON)                                                         COPM0067
 88 FORMAT(11HOTREATMENTS12X5E14.6)                                      COPM0068
 87 FORMAT(12H TREATMENT A11X5E14.6)                                     COPM0069
 86 FORMAT(12H TREATMENT B11X5E14.6)                                     COPM0070
 85 FORMAT(12H INTERACTION11X4E14.6)                                     COPM0071
 89 FORMAT(12H INTERACTION67XE14.6)                                      COPM0072
 84 FORMAT(21H LACK OF FIT OF MODEL2X5E14.6)                             COPM0073
 83 FORMAT(I1,4I2,F5.3,I3)                                               COPM0074
 82 FORMAT(1H112A6)                                                      COPM0075
 81 FORMAT(4(6X,F6.3),30X,I2)                                            COPM0076
 80 FORMAT(12A6)                                                         COPM0077
    L=8                                                                  COPM0078
    M=5                                                                  COPM0079
 20 READ(L,80)TITL                                                       COPM0080
    READ(L,83)NJ,N1,IREP,MA,MB,D,NI                                      COPM0081
    NJ=NJ+1                                                              COPM0082
    N=N1*IREP                                                            COPM0083
    I=0                                                                  COPM0084
 22 I=I+1                                                                COPM0085
    READ(L,81)Y1,ID                                                      COPM0086
    IF(ID-98)27,23,23                                                    COPM0087
 27 DO 29 J=1,IREP                                                       COPM0088
    K=(J-1)*N1+I                                                         COPM0089
 29 R(K)=Y1(J)                                                           COPM0090
    GO TO 22                                                             COPM0091
 23 N2=I-1                                                               COPM0092
    IF(N1-N2)2,4,2                                                       COPM0093
  2 WRITE(M,96)                                                          COPM0094
  6 CALL EXIT                                                            COPM0095
  4 Y=0.0                                                                COPM0096
    DO 14 I=1,N                                                          COPM0097
 14 Y=Y+ALOG(R(I))/FLOAT(N)                                              COPM0098
    Y=EXP(Y)                                                             COPM0099
    D=FLOAT(N)*(ALOG(D*D*FLOAT(N)/6.283185)-1.0)/2.0                     COPM0100
    SLM=-N*ALOG(FLOAT(IREP))                                             COPM0101
    DO 10 KK=1,4                                                         COPM0102
    DO 16 I=1,N                                                          COPM0103
    GO TO (17,13,3,17),KK                                                COPM0104
 17 S(I)=R(I)                                                            COPM0105
    GO TO 16                                                             COPM0106
 13 S(I)=ALOG(R(I))*Y                                                    COPM0107
    GO TO 16                                                             COPM0108
  3 S(I)=SQRT(R(I)*Y)*2.0                                                COPM0109
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 16 CONTINUE                                                    COPM0110
    TOT=0.0                                                     COPM0111
    DO 18 I=1,N1                                                COPM0112
    T(I)=0.0                                                    COPM0113
    DO 18 J=1,IREP                                              COPM0114
    K=(J-1)*N1+I                                                COPM0115
    TOT=TOT+S(K)/FLOAT(N)                                       COPM0116
 18 T(I)=T(I)+S(K)/FLOAT(IREP)                                  COPM0117
    DO 21 I=1,MB                                                COPM0118
 21 TB(I)=0.0                                                   COPM0119
    DO 19 I=1,MA                                                COPM0120
    TA(I)=0.0                                                   COPM0121
    DO 19 J=1,MB                                                COPM0122
    K=(J-1)*MA+I                                                COPM0123
    TA(I)=TA(I)+T(K)/FLOAT(MB)                                  COPM0124
 19 TB(J)=TB(J)+T(K)/FLOAT(MA)                                  COPM0125
    IF(KK-4)24,25,24                                            COPM0126
 25 IF(IREP-1)54,54,53                                          COPM0127
 54 DO 55 I=1,5                                                 COPM0128
 55 TL(KK+1,I)=0.0                                              COPM0129
 53 DO 30 I=1,MA                                                COPM0130
    TA(I)=ALOG(TA(I))                                           COPM0131
    DO 30 J=1,MB                                                COPM0132
    K=(J-1)*MA+I                                                COPM0133
 30 T(K)=ALOG(T(K))                                             COPM0134
    DO 34 I=1,MB                                                COPM0135
 34 TB(I)=ALOG(TB(I))                                           COPM0136
    TOT=ALOG(TOT)                                               COPM0137
    IF(MB-1)61,24,61                                            COPM0138
 61 CALL CLIP                                                   COPM0139
    GO TO 59                                                    COPM0140
 24 DO 60 I1=1,MA                                               COPM0141
    DO 60 J1=1,MB                                               COPM0142
    I=(J1-1)*MA+I1                                              COPM0143
    S1(I,1)=T(I)-TA(I1)+TOT                                     COPM0144
 60 S1(I,2)=T(I)-TB(J1)+TOT                                     COPM0145
 59 GO TO (7,46,46),NJ                                          COPM0146
 46 DO 72 I=1,8                                                 COPM0147
    X1(I)=0.0                                                   COPM0148
 72 X(I)=0.0                                                    COPM0149
    GO TO (108,63,108,63),KK                                    COPM0150
 63 IF(MA*(IREP+2)-34)62,62,108                                 COPM0151
108 WRITE(M,82)TITL                                             COPM0152
    GO TO (7,100,101),NJ                                        COPM0153
100 WRITE(M,184)                                                COPM0154
    GO TO 62                                                    COPM0155
101 WRITE(M,185)                                                COPM0156
 62 GO TO (64,65,66,67),KK                                      COPM0157
 64 WRITE(M,94)                                                 COPM0158
    GO TO 68                                                    COPM0159
 65 WRITE(M,98)                                                 COPM0160
    GO TO 68                                                    COPM0161
 66 WRITE(M,99)                                                 COPM0162
    GO TO 68                                                    COPM0163
 67 WRITE(M,180)                                                COPM0164
 68 IF(IREP-1)69,69,70                                          COPM0165
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 69 WRITE(M,181)                                                    COPM0166
    IJK=MB                                                          COPM0167
    GO TO 71                                                        COPM0168
 70 WRITE(M,182)                                                    COPM0169
    IJK=MB+4                                                        COPM0170
 71 DO 73 I=1,MA                                                    COPM0171
    DO 74 J=1,MB                                                    COPM0172
    II=(J-1)*MA+I                                                   COPM0173
    X(J)=TA(I)+TB(J)-TOT                                            COPM0174
    IF(KK-4)105,106,105                                             COPM0175
106 X(J)=EXP(X(J))                                                  COPM0176
105 GO TO (7,104,79),NJ                                             COPM0177
 79 GO TO (104,109,110,104),KK                                      COPM0178
109 X(J)=EXP(X(J)/Y)                                                COPM0179
    GO TO 104                                                       COPM0180
110 X(J)=(X(J)/2.0)**2/Y                                            COPM0181
104 IF(IREP-1)74,74,75                                              COPM0182
 75 X(J+4)=T(II)                                                    COPM0183
    IF(KK-4)111,107,111                                             COPM0184
107 X(J+4)=EXP(X(J+4))                                              COPM0185
111 GO TO (7,74,112),NJ                                             COPM0186
112 GO TO (74,113,114,74),KK                                        COPM0187
113 X(J+4)=EXP(X(J+4)/Y)                                            COPM0188
    GO TO 74                                                        COPM0189
114 X(J+4)=(X(J+4)/2.0)**2/Y                                        COPM0190
 74 CONTINUE                                                        COPM0191
    WRITE(M,183)(X(J),J=1,IJK)                                      COPM0192
    DO 77 K1=1,IREP                                                 COPM0193
    DO 76 J=1,MB                                                    COPM0194
    K=(K1-1)*N1+(J-1)*MA+I                                          COPM0195
    GO TO (7,102,116),NJ                                            COPM0196
102 X1(J)=S(K)                                                      COPM0197
    GO TO 115                                                       COPM0198
116 X1(J)=R(K)                                                      COPM0199
115 IF(IREP-1)103,103,78                                            COPM0200
 78 X1(J+4)=X1(J)-X(J+4)                                            COPM0201
103 X1(J)=X1(J)-X(J)                                                COPM0202
 76 CONTINUE                                                        COPM0203
 77 WRITE(M,183)(X1(J),J=1,IJK)                                     COPM0204
 73 WRITE(M,97)                                                     COPM0205
  7 DO 37 I=1,5                                                     COPM0206
 37 TL(KK,I)=0.0                                                    COPM0207
    DO 26 I1=1,MA                                                   COPM0208
    DO 26 J1=1,MB                                                   COPM0209
    I=(J1-1)*MA+I1                                                  COPM0210
    DO 26 J=1,IREP                                                  COPM0211
    K=(J-1)*N1+I                                                    COPM0212
    IF(IREP-1)49,49,28                                              COPM0213
 49 IF(KK-4)8,28,8                                                  COPM0214
 28 B2(1)=T(I)                                                      COPM0215
    B2(2)=TOT                                                       COPM0216
    B2(3)=S1(I,1)                                                   COPM0217
    B2(4)=S1(I,2)                                                   COPM0218
    B2(5)=TA(I1)+TB(J1)-TOT                                         COPM0219
    IF(IREP-1)50,50,35                                              COPM0220
 50 DO 51 I2=1,5                                                    COPM0221
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      B2(I2)=EXP(B2(I2))                                                COPM0222
   51 TL(KK+1,I2)=TL(KK+1,I2)+CLP(S(K),B2(I2),KK)                       COPM0223
    8 B2(1)=TA(I1)+TB(J1)-TOT                                           COPM0224
      B2(2)=TOT                                                         COPM0225
      B2(3)=TB(J1)                                                      COPM0226
      B2(4)=TA(I1)                                                      COPM0227
      B2(5)=T(I)                                                        COPM0228
   35 IF(KK-4)9,38,9                                                    COPM0229
   38 DO 43 I2=1,5                                                      COPM0230
   43 B2(I2)=EXP(B2(I2))                                                COPM0231
    9 DO 26 K1=1,5                                                      COPM0232
   26 TL(KK,K1)=TL(KK,K1)+CLP(S(K),B2(K1),KK)                           COPM0233
      GO TO (31,31,31,32),KK                                            COPM0234
   31 DO 39 I=1,4                                                       COPM0235
      IF(TL(KK,I))39,39,44                                              COPM0236
   44 TL(KK,I)=-N*ALOG(TL(KK,I))/2.0                                    COPM0237
   39 CONTINUE                                                          COPM0238
      IF(IREP-1)32,32,33                                                COPM0239
   33 IF(TL(KK,5))32,32,45                                              COPM0240
   45 TL(KK,5)=-N*ALOG(TL(KK,5))/2.0                                    COPM0241
   32 DO 40 I=2,5                                                       COPM0242
   40 RS(KK,I-1)=TL(KK,I)-TL(KK,1)                                      COPM0243
      IF(KK-4)10,12,10                                                  COPM0244
   12 D=0.0                                                             COPM0245
      IF(IREP-1)48,48,10                                                COPM0246
   48 DO 56 I=2,5                                                       COPM0247
   56 RS(KK+1,I-1)=TL(KK+1,I)-TL(KK+1,1)                                COPM0248
      RS(KK+1,5)=TL(KK+1,1)-SLM+D                                       COPM0249
   10 RS(KK,5)=TL(KK,1)-SLM+D                                           COPM0250
      WRITE(M,82)TITL                                                   COPM0251
      WRITE(M,92)                                                       COPM0252
      DO 1 I=1,MA                                                       COPM0253
      DO 5 K1=1,IREP                                                    COPM0254
      DO 36 J=1,MB                                                      COPM0255
      K=(K1-1)*N1+(J-1)*MA+I                                            COPM0256
   36 TB(J)=R(K)                                                        COPM0257
    5 WRITE(M,95)(TB(J),J=1,MB)                                         COPM0258
    1 WRITE(M,97)                                                       COPM0259
      IJ=4                                                              COPM0260
      IF(IREP-1)57,57,52                                                COPM0261
   57 IJ=5                                                              COPM0262
      WRITE(M,90)                                                       COPM0263
      GO TO 58                                                          COPM0264
   52 WRITE(M,93)                                                       COPM0265
   58 WRITE(M,88)(RS(I,1),I=1,IJ)                                       COPM0266
      WRITE(M,87)(RS(I,2),I=1,IJ)                                       COPM0267
      WRITE(M,86)(RS(I,3),I=1,IJ)                                       COPM0268
      IF(IREP-1)41,41,42                                                COPM0269
   41 WRITE(M,89)RS(5,4)                                                COPM0270
      GO TO 47                                                          COPM0271
   42 WRITE(M,85)(RS(I,4),I=1,4)                                        COPM0272
   47 WRITE(M,84)(RS(I,5),I=1,IJ)                                       COPM0273
      WRITE(M,91)SLM                                                    COPM0274
      IF(ID-98)6,6,20                                                   COPM0275
      END                                                               COPM0276
// DUP                                                                  COPM0277
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*DELETE              COPM                                                COPM0278
*STORE       WS  UA  COPM                                                COPM0279

// JOB                                                                    CLP 0000
// FOR                                                                    CLP 0001
*LIST ALL                                                                 CLP 0002
*ONE WORD INTEGERS                                                        CLP 0003
*EXTENDED PRECISION                                                       CLP 0004
      FUNCTION CLP(X,Z,I)                                                 CLP 0005
      Y=Z                                                                 CLP 0006
      GO TO (1,1,1,2),I                                                   CLP 0007
    1 IF(X-Y)7,6,7                                                        CLP 0008
    6 CLP=0.0                                                             CLP 0009
      GO TO 4                                                             CLP 0010
    7 CLP=(X-Y)**2                                                        CLP 0011
      GO TO 4                                                             CLP 0012
    2 IF(Y)3,3,5                                                          CLP 0013
    3 Y=10.0**(-10)                                                       CLP 0014
    5 CLP=X*ALOG(Y)-Y-(X+0.5)*ALOG(X)-0.5*ALOG(6.283185)+X-1.0/X/12.0     CLP 0015
    4 RETURN                                                              CLP 0016
      END                                                                 CLP 0017
// DUP                                                                    CLP 0018
*DELETE              CLP                                                 CLP 0019
*STORE       WS  UA  CLP                                                 CLP 0020

// JOB                                                                    CLIP0000
// FOR                                                                    CLIP0001
*LIST ALL                                                                 CLIP0002
*ONE WORD INTEGERS                                                        CLIP0003
*EXTENDED PRECISION                                                       CLIP0004
      SUBROUTINE CLIP                                                     CLIP0005
      DIMENSION SS(31,31),S(31),S2(31)                                    CLIP0006
      COMMON T(20),TA(10),TB(4),S1(20,2),TOT,N1,MA,MB,NI,TITL(12)         CLIP0007
   92 FORMAT(1H112A6)                                                     CLIP0008
   91 FORMAT(32HONO CONVERGENCE - PARAMETERS ARE/)                        CLIP0009
   90 FORMAT(11E12.5)                                                     CLIP0010
      M=5                                                                 CLIP0011
      IJ=1                                                                CLIP0012
      DO 25 KK=1,2                                                        CLIP0013
      GO TO (4,5),KK                                                      CLIP0014
    4 M1=MA                                                               CLIP0015
      M2=N1+MA+1                                                          CLIP0016
      M3=MB                                                               CLIP0017
      GO TO 8                                                             CLIP0018
    5 M1=MB                                                               CLIP0019
      M2=N1+MB+1                                                          CLIP0020
      M3=MA                                                               CLIP0021
    8 S2(M2)=TOT                                                          CLIP0022
      DO 1 I=1,N1                                                         CLIP0023
    1 S2(I)=T(I)                                                          CLIP0024
      DO 2 I=1,M1                                                         CLIP0025
      II=I+N1                                                             CLIP0026
    2 S2(II)=0.0                                                          CLIP0027
      DO 27 JK=1,NI                                                       CLIP0028
      DO 10 I=1,M2                                                        CLIP0029
      S(I)=0.0                                                            CLIP0030
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      DO 10 J=1,M2                                                  CLIP0031
   10 SS(I,J)=0.0                                                   CLIP0032
      DO 17 I1=1,MA                                                 CLIP0033
      DO 17 J1=1,MB                                                 CLIP0034
      I=(J1-1)*MA+I1                                                CLIP0035
      GO TO (12,13),KK                                              CLIP0036
   12 K=I1+N1                                                       CLIP0037
      GO TO 22                                                      CLIP0038
   13 K=J1+N1                                                       CLIP0039
   22 S(I)=EXP(T(I))+S2(K)-EXP(S2(I))                               CLIP0040
      SS(I,I)=-EXP(S2(I))                                           CLIP0041
      SS(K,I)=1.0                                                   CLIP0042
   17 SS(I,K)=SS(K,I)                                               CLIP0043
      DO 21 I=1,M1                                                  CLIP0044
      II=I+N1                                                       CLIP0045
      S(M2)=S(M2)-FLOAT(M3)*S2(II)                                  CLIP0046
      SS(II,M2)=-FLOAT(M3)                                          CLIP0047
   21 SS(M2,II)=SS(II,M2)                                           CLIP0048
      GO TO (28,29),KK                                              CLIP0049
   28 DO 30 I=1,MA                                                  CLIP0050
      II=I+N1                                                       CLIP0051
      S(II)=-FLOAT(M3)*S2(M2)                                       CLIP0052
      DO 30 J=1,MB                                                  CLIP0053
      K=(J-1)*MA+I                                                  CLIP0054
   30 S(II)=S(II)+S2(K)                                             CLIP0055
      GO TO 31                                                      CLIP0056
   29 DO 26 J=1,MB                                                  CLIP0057
      JJ=J+N1                                                       CLIP0058
      S(JJ)=-FLOAT(M3)*S2(M2)                                       CLIP0059
      DO 26 I=1,MA                                                  CLIP0060
      K=(J-1)*MA+I                                                  CLIP0061
   26 S(JJ)=S(JJ)+S2(K)                                             CLIP0062
   31 CALL MATVK(SS,M2,S,1,DET)                                     CLIP0063
      DO 23 I=1,M2                                                  CLIP0064
   23 S2(I)=S2(I)-S(I)                                              CLIP0065
      DO 24 I=1,M2                                                  CLIP0066
      IF(ABS(S(I)/S2(I))-0.0001)24,24,27                            CLIP0067
   24 CONTINUE                                                      CLIP0068
      GO TO 3                                                       CLIP0069
   27 CONTINUE                                                      CLIP0070
      GO TO (15,16),IJ                                              CLIP0071
   15 WRITE(M,92)TITL                                               CLIP0072
      IJ=2                                                          CLIP0073
   16 WRITE(M,91)                                                   CLIP0074
      WRITE(M,90)(S2(I),I=1,M2)                                     CLIP0075
    3 DO 25 I=1,N1                                                  CLIP0076
   25 S1(I,KK)=S2(I)                                                CLIP0077
      RETURN                                                        CLIP0078
      END                                                           CLIP0079
// DUP                                                              CLIP0080
*DELETE              CLIP                                         CLIP0081
*STORE       WS  UA  CLIP                                         CLIP0082

// JOB                                                              MATVK000
// FOR                                                              MATVK001
*ONE WORD INTEGERS                                                  MATVK002
```

```
*LIST ALL                                                          MATVK003
*EXTENDED PRECISION                                                MATVK004
      SUBROUTINE MATVK(A,N,B,M,DETM)                               MATVK005
      DIMENSION A(31,31),B(31,1),PIVOT(31),IPVOT(31),INDEX(31,31)  MATVK006
      EQUIVALENCE (IROW,JROW),(ICLUM,JCLUM),(AMAX,T,SWAP)          MATVK007
      DO 20 J=1,N                                                  MATVK008
      DETM=1.0                                                     MATVK009
   20 IPVOT(J)=0                                                   MATVK010
      DO 550 I=1,N                                                 MATVK011
      AMAX=0.0                                                     MATVK012
      DO 105 J=1,N                                                 MATVK013
      IF(IPVOT(J)-1)60,105,60                                      MATVK014
   60 DO 100 K=1,N                                                 MATVK015
      IF(IPVOT(K)-1)80,100,740                                     MATVK016
   80 IF(ABS(AMAX)-ABS(A(J,K)))85,100,100                          MATVK017
   85 IROW=J                                                       MATVK018
      ICLUM=K                                                      MATVK019
      AMAX=A(J,K)                                                  MATVK020
  100 CONTINUE                                                     MATVK021
  105 CONTINUE                                                     MATVK022
      IPVOT(ICLUM)=IPVOT(ICLUM)+1                                  MATVK023
      IF(IROW-ICLUM)140,260,140                                    MATVK024
  140 DETM=-DETM                                                   MATVK025
      DO 200 L=1,N                                                 MATVK026
      SWAP=A(IROW,L)                                               MATVK027
      A(IROW,L)=A(ICLUM,L)                                         MATVK028
  200 A(ICLUM,L)=SWAP                                              MATVK029
      IF(M)260,260,210                                             MATVK030
  210 DO 250 L=1,M                                                 MATVK031
      SWAP=B(IROW,L)                                               MATVK032
      B(IROW,L)=B(ICLUM,L)                                         MATVK033
  250 B(ICLUM,L)=SWAP                                              MATVK034
  260 INDEX(I,1)=IROW                                              MATVK035
      INDEX(I,2)=ICLUM                                             MATVK036
      PIVOT(I)=A(ICLUM,ICLUM)                                      MATVK037
      DETM=DETM*PIVOT(I)                                           MATVK038
      A(ICLUM,ICLUM)=1.0                                           MATVK039
      DO 350 L=1,N                                                 MATVK040
  350 A(ICLUM,L)=A(ICLUM,L)/PIVOT(I)                               MATVK041
      IF(M)380,380,360                                             MATVK042
  360 DO 370 L=1,M                                                 MATVK043
  370 B(ICLUM,L)=B(ICLUM,L)/PIVOT(I)                               MATVK044
  380 DO 550 L1=1,N                                                MATVK045
      IF(L1-ICLUM)400,550,400                                      MATVK046
  400 T=A(L1,ICLUM)                                                MATVK047
      A(L1,ICLUM)=0.0                                              MATVK048
      DO 450 L=1,N                                                 MATVK049
  450 A(L1,L)=A(L1,L)-A(ICLUM,L)*T                                 MATVK050
      IF(M)550,550,460                                             MATVK051
  460 DO 500 L=1,M                                                 MATVK052
  500 B(L1,L)=B(L1,L)-B(ICLUM,L)*T                                 MATVK053
  550 CONTINUE                                                     MATVK054
      DO 710 I=1,N                                                 MATVK055
      L=N+1-I                                                      MATVK056
      IF(INDEX(L,1)-INDEX(L,2))630,710,630                         MATVK057
  630 JROW=INDEX(L,1)                                              MATVK058
```

```
      JCLUM=INDEX(L,2)                                          MATVK059
      DO 705 K=1,N                                              MATVK060
      SWAP=A(K,JROW)                                            MATVK061
      A(K,JROW)=A(K,JCLUM)                                      MATVK062
      A(K,JCLUM)=SWAP                                           MATVK063
  705 CONTINUE                                                  MATVK064
  710 CONTINUE                                                  MATVK065
  740 IF(DETM-0.000001)750,750,760                              MATVK066
  750 DETM=0.0                                                  MATVK067
  760 RETURN                                                    MATVK068
      END                                                       MATVK069
// DUP                                                          MATVK070
*DELETE              MATVK                                     MATVK071
*STORE       WS  UA  MATVK                                     MATVK072
```

```
// JOB                                                                  PRSL2000
// FOR                                                                  PRSL2001
*LIST ALL                                                               PRSL2002
*ONE WORD INTEGERS                                                      PRSL2003
*EXTENDED PRECISION                                                     PRSL2004
*IOCS(2501 READER)                                                      PRSL2005
*IOCS(1403 PRINTER)                                                     PRSL2006
*NAME PRSL2                                                             PRSL2007
C                                                                       PRSL2008
C     RESPONSE SURFACE ANALYSIS USING THE POISSON DISTRIBUTION          PRSL2009
C                                                                       PRSL2010
C       THIS PROGRAM ANALYZES DATA SIMILAR TO THAT FOR BOX2 BUT ASSUMING APRSL2011
C  POISSON PROBABILITY DISTRIBUTION WITH NO TRANSFORMATION PARAMETERS    PRSL2012
C  ESTIMATED. THE CORRESPONDING LOG NORMAL THEORY ANOVA IS ALSO PRINTED  PRSL2013
C  OUT. IF POWER TRANSFORMATIONS OF THE INDEPENDENT VARIABLES ARE        PRSL2014
C  SUPPLIED, THE COMPLETE ANALYSIS IS DONE FOR BOTH LINEAR AND NONLINEAR PRSL2015
C  MODELS AS IN BOX2.                                                   PRSL2016
C                                                                       PRSL2017
C    LINK CALLED                                                        PRSL2018
C                                                                       PRSL2019
C   PEIG2 - PERFORMS CANONICAL ANALYSIS                                 PRSL2020
C                                                                       PRSL2021
C    SUBROUTINES CALLED                                                 PRSL2022
C                                                                       PRSL2023
C   PORT2 - CALCULATES NORMAL ORTHOGONAL POLYNOMIALS                    PRSL2024
C   PLE2  - CALCULATES MAXIMUM LIKELIHOOD ESTIMATES OF THE COEFFICIENT  PRSL2025
C  PARAMETERS USING LEAST SQUARES INITIAL ESTIMATES                     PRSL2026
C   MATV  - INVERTS MATRICES UP TO 12 BY 12                             PRSL2027
C   CLFP  - CALCULATES POISSON LIKELIHOOD FOR GIVEN PARAMETER VALUES    PRSL2028
C   PLOF  - CALCULATES NON-REGRESSION ENTRIES IN ANOVA TABLE  E.G. LACK PRSL2029
C  OF FIT                                                               PRSL2030
C   CAN2  - DIAGONALIZES MATRICES                                       PRSL2031
C   JACOB - CALCULATES EIGENVALUES AND VECTORS OF DIAGONAL MATRICES     PRSL2032
C   CBRS2 - CALCULATES POINTS ON THE RESPONSE SURFACE CONTOURS          PRSL2033
C                                                                       PRSL2034
C    MAKEUP OF DATA DECK                                                PRSL2035
C                                                                       PRSL2036
C 1.TITLE CARD - (12A6)                                                 PRSL2037
C 2.CONTROL CARD - (I1,2I2,F8.6,2F5.3,I3)                               PRSL2038
C       I1 - OPTION - 0 - NOTHING                                       PRSL2039
C                     1 - PRINT ITERATED VALUES OF COEFFICIENT PARAMETERS PRSL2040
C       I2 - NUMBER OF TREATMENT COMBINATIONS - MAXIMUM 40              PRSL2041
C       I2 - NUMBER OF OBSERVATION SETS - MAXIMUM 4                     PRSL2042
C       F8.6 - CONVERGENCE CRITERION                                    PRSL2043
C       2F5.3 - POWER TRANSFORMATIONS OF INDEPENDENT VARIABLES - IF BLANK,PRSL2044
C             OMITS THIS ANALYSIS                                       PRSL2045
C       I3 - NUMBER OF ITERATIONS ALLOWED                               PRSL2046
C 3.TREATMENT COMBINATIONS IN PAIRS (16F5.3)                            PRSL2047
C 4.DATA - SETS OF OBSERVATIONS FOR EACH TREATMENT COMBINATION          PRSL2048
C       ONE SET PER CARD (4(6X,F6.3))                                   PRSL2049
C 5.99 IN COLS. 79-80 INDICATES END OF DATA. ANOTHER DECK TO FOLLOW     PRSL2050
C    98 IN COLS. 79-80 INDICATES END OF JOB - CALL EXIT AFTER THIS DECK PRSL2051
C 6.CONTROL CARD (12F6.2)                                               PRSL2052
C       10F6.2 - 10 CONTOUR LEVELS IN UNITS OF DEPENDENT VARIABLE, 5 BELOWPRSL2053
C              AND 5 ABOVE THE CENTRE                                   PRSL2054
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C     2F6.2 - 2 FACTOR LIMITS IN UNITS OF INDEPENDENT VARIABLES          PRSL2055
C 1.REPEAT 1. TO 6. AS REQUIRED                                         PRSL2056
C                                                                        PRSL2057
      DIMENSION Y1(4),BB(6),SSY5(6),I5(6),X1(2),SSYN5(6),B(6)            PRSL2058
      COMMON R(160),W( 40,6,2),T(6),B4(6,2),N,IREP,TITL(12),ID,XX(7),SD(PRSL2059
     15),A3(2),E,D,X( 40,6),MN,NI,G(7)                                  PRSL2060
     96 FORMAT(36H0B(J) COEFFICIENTS IN ORIGINAL UNITS//6E15.6)          PRSL2061
     95 FORMAT(1X2F8.3,4F12.2)                                           PRSL2062
     90 FORMAT(21H0*** VARIABLES FITTED//4X2HX16X2HX27X4(8H0B5. SET(2,2X))PRSL2063
     89 FORMAT(54H0POWER TRANSFORMATIONS OF INDEPENDENT VARIABLES - A1 =F8PRSL2064
     1.4,6H  A2 =F8.4)                                                  PRSL2065
     88 FORMAT(18H0B(J) COEFFICIENTS/1H06E15.6/17H0LOG LIKELIHOOD =E15.6) PRSL2066
     87 FORMAT(27H0ANALYSIS OF VARIANCE TABLE/9H0  SOURCE10X7HLOG MLR9X8HLPRSL2067
     10G R(N))                                                          PRSL2068
     85 FORMAT(66H0INCORRECT NUMBER OF OBSERVATION SETS - SKIPPING TO NEXTPRSL2069
     1 DATA DECK)                                                       PRSL2070
     84 FORMAT(16F5.3)                                                  PRSL2071
     83 FORMAT(I1,2I2,F8.6,2F5.3,I3)                                    PRSL2072
     82 FORMAT(1H1I2A6)                                                 PRSL2073
     81 FORMAT(4(6X,F6.3),30X,I2)                                       PRSL2074
     80 FORMAT(12A6)                                                    PRSL2075
     77 FORMAT(13H TREATMENTS  2E16.6)                                  PRSL2076
     93 FORMAT(13H REGRESSION  2E16.6)                                  PRSL2077
     76 FORMAT(13H  LINEAR     2E16.6)                                  PRSL2078
     75 FORMAT(13H    X1 LINEAR 2E16.6)                                 PRSL2079
     74 FORMAT(13H    X2 LINEAR 2E16.6)                                 PRSL2080
     73 FORMAT(13H  QUADRATIC  2E16.6)                                  PRSL2081
     72 FORMAT(13H    X1 QUAD.  2E16.6)                                 PRSL2082
     78 FORMAT(13H    X2 QUAD.  2E16.6)                                 PRSL2083
     79 FORMAT(13H  X1 * X2     2E16.6)                                 PRSL2084
     92 FORMAT(13H LACK OF FIT 2E16.6)                                  PRSL2085
     97 FORMAT(13H FIT OF MODEL2E16.6)                                  PRSL2086
        L=8                                                             PRSL2087
        M=5                                                             PRSL2088
      7 READ(L,80)TITL                                                  PRSL2089
        E=0.0                                                           PRSL2090
        DO 55 I=1,160                                                   PRSL2091
     55 R(I)=0.0                                                        PRSL2092
        READ(L,83)MN,N1,IREP,D,A3,NI                                    PRSL2093
        N=N1*IREP                                                       PRSL2094
        READ(L,84)((W(I,J,1),J=2,3),I=1,N1)                             PRSL2095
        DO 3 I=1,N1                                                     PRSL2096
        W(I,1,1)=1.0                                                    PRSL2097
        W(I,4,1)=W(I,2,1)*W(I,2,1)                                      PRSL2098
        W(I,5,1)=W(I,3,1)*W(I,3,1)                                      PRSL2099
      3 W(I,6,1)=W(I,3,1)*W(I,2,1)                                      PRSL2100
        I=0                                                             PRSL2101
     22 I=I+1                                                           PRSL2102
        READ(L,81)Y1,ID                                                 PRSL2103
        IF(ID-98)9,23,23                                                PRSL2104
      9 DO 24 II=1,IREP                                                 PRSL2105
        K=N1*(II-1)+I                                                   PRSL2106
     24 R(K)=Y1(II)                                                     PRSL2107
        DO 29 J=1,6                                                     PRSL2108
     29 X(I,J)=W(I,J,1)                                                 PRSL2109
        GO TO 22                                                        PRSL2110
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23 N2=I-1                                                          PRSL2111
   IF(N1-N2)2,4,2                                                  PRSL2112
 2 WRITE(M,85)                                                     PRSL2113
   IF(ID-98)7,6,7                                                  PRSL2114
 6 CALL EXIT                                                       PRSL2115
 4 N=N1*IREP                                                       PRSL2116
   WRITE(M,82)TITL                                                 PRSL2117
   WRITE(M,90)(I,I=1,4)                                            PRSL2118
   DO 54 I=1,N1                                                    PRSL2119
   DO 19 J=1,2                                                     PRSL2120
19 X1(J)=X(I,J+1)                                                  PRSL2121
   N2=N1+I                                                         PRSL2122
   N3=N1*2+I                                                       PRSL2123
   N4=N1*3+I                                                       PRSL2124
54 WRITE(M,95)X1(1),X1(2),R(I),R(N2),R(N3),R(N4)                   PRSL2125
   DO 14 KK=1,2                                                    PRSL2126
   CALL PORT2(X,1,KK)                                              PRSL2127
   DO 5 JJ=1,6                                                     PRSL2128
   T(JJ)=0.0                                                       PRSL2129
   DO 5 II=1,N1                                                    PRSL2130
   DO 5 K1=1,IREP                                                  PRSL2131
   K=(K1-1)*N1+II                                                  PRSL2132
 5 T(JJ)=T(JJ)+R(K)*X(II,JJ)                                       PRSL2133
   IF(MN)12,13,12                                                  PRSL2134
12 WRITE(M,82)TITL                                                 PRSL2135
   GO TO (13,15),KK                                                PRSL2136
15 WRITE(M,89)A3                                                   PRSL2137
13 CALL PLE2(B,I5,0,SN)                                            PRSL2138
   DO 10 I=1,6                                                     PRSL2139
10 B4(I,KK)=B(I)                                                   PRSL2140
   S=CLFP(B)                                                       PRSL2141
   WRITE(M,88)B,S                                                  PRSL2142
   DO 1 I=2,6                                                      PRSL2143
   I5(1)=I                                                         PRSL2144
   CALL PLE2(BB,I5,1,SSYN5(I))                                     PRSL2145
   SSYN5(I)=SSYN5(I)-SN                                            PRSL2146
 1 SSY5(I)=CLFP(BB)-S                                              PRSL2147
   I5(1)=2                                                         PRSL2148
   I5(2)=3                                                         PRSL2149
   CALL PLE2(BB,I5,2,SSN4)                                         PRSL2150
   SSN4=SSN4-SN                                                    PRSL2151
   SS4=CLFP(BB)-S                                                  PRSL2152
   I5(1)=4                                                         PRSL2153
   I5(2)=5                                                         PRSL2154
   CALL PLE2(BB,I5,2,SSN5)                                         PRSL2155
   SSN5=SSN5-SN                                                    PRSL2156
   SS5=CLFP(BB)-S                                                  PRSL2157
   DO 11 I=2,6                                                     PRSL2158
11 I5(I-1)=I                                                       PRSL2159
   CALL PLE2(BB,I5,5,SSN3)                                         PRSL2160
   SSN3=SSN3-SN                                                    PRSL2161
   SS3=CLFP(BB)-S                                                  PRSL2162
   BB(1)=B(1)                                                      PRSL2163
   DO 27 I=1,5                                                     PRSL2164
   BB(I+1)=B(I+1)/SD(I)                                            PRSL2165
27 BB(1)=BB(1)-BB(I+1)*XX(I)                                       PRSL2166
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      BB(6)=BB(6)/SD(1)/SD(2)                                          PRSL2167
      BB(2)=BB(2)-BB(4)*XX(6)-BB(6)*XX(2)                              PRSL2168
      BB(3)=BB(3)-BB(5)*XX(7)-BB(6)*XX(1)                              PRSL2169
      BB(1)=BB(1)*BB(4)*XX(1)*XX(6)+BB(5)*XX(2)*XX(7)+BB(6)*XX(1)*XX(2) PRSL2170
      WRITE(M,96)BB                                                    PRSL2171
      DO 28 I=1,6                                                      PRSL2172
      B4(I,KK)=BB(I)                                                   PRSL2173
   28 B(I)=BB(I)                                                       PRSL2174
      F=FLOAT(N)*ALOG(FLOAT(IREP))                                     PRSL2175
      SS2=PLOF(2,KK)                                                   PRSL2176
      SS6=PLOF(1,KK)                                                   PRSL2177
      SS8=PLOF(4,KK)+F                                                 PRSL2178
      IF(IREP-1)26,26,25                                               PRSL2179
   25 SSN=PLOF(3,KK)                                                   PRSL2180
      SSN2=SN-SSN                                                      PRSL2181
      SSN6=SSN3+SSN2                                                   PRSL2182
      SSN8=SSN                                                         PRSL2183
      GO TO 36                                                         PRSL2184
   26 SSN8=SN                                                          PRSL2185
   36 SSN8=-FLOAT(N)*(ALOG(6.2831853/FLOAT(N))+1.0)/2.0+SSN8+F         PRSL2186
      DO 37 I=1,N                                                      PRSL2187
   37 SSN8=SSN8-ALOG(R(I))                                             PRSL2188
      WRITE(M,82)TITL                                                  PRSL2189
      GO TO (30,32),KK                                                 PRSL2190
   32 WRITE(M,89)A3                                                    PRSL2191
   30 WRITE(M,87)                                                      PRSL2192
      IF(IREP-1)8,8,20                                                 PRSL2193
   20 WRITE(M,77)SS6,SSN6                                              PRSL2194
      GO TO 31                                                         PRSL2195
    8 WRITE(M,77)SS6                                                   PRSL2196
   31 WRITE(M,93)SS3,SSN3                                              PRSL2197
      WRITE(M,76)SS4,SSN4                                              PRSL2198
      WRITE(M,75)SSY5(2),SSYN5(2)                                      PRSL2199
      WRITE(M,74)SSY5(3),SSYN5(3)                                      PRSL2200
      WRITE(M,73)SS5,SSN5                                              PRSL2201
      WRITE(M,72)SSY5(4),SSYN5(4)                                      PRSL2202
      WRITE(M,78)SSY5(5),SSYN5(5)                                      PRSL2203
      WRITE(M,79)SSY5(6),SSYN5(6)                                      PRSL2204
      IF(IREP-1)33,33,34                                               PRSL2205
   34 WRITE(M,92)SS2,SSN2                                              PRSL2206
      GO TO 35                                                         PRSL2207
   33 WRITE(M,92)SS2                                                   PRSL2208
   35 WRITE(M,97)SS8,SSN8                                              PRSL2209
      GO TO (18,17),KK                                                 PRSL2210
   18 IF(A3(1))16,17,16                                                PRSL2211
   16 DO 14 I=1,N1                                                     PRSL2212
      W(I,1,2)=1.0                                                     PRSL2213
      W(I,2,2)=W(I,2,1)**A3(1)                                         PRSL2214
      W(I,3,2)=W(I,3,1)**A3(2)                                         PRSL2215
      W(I,4,2)=W(I,2,2)*W(I,2,2)                                       PRSL2216
      W(I,5,2)=W(I,3,2)*W(I,3,2)                                       PRSL2217
      W(I,6,2)=W(I,3,2)*W(I,2,2)                                       PRSL2218
      DO 14 J=1,6                                                      PRSL2219
   14 X(I,J)=W(I,J,2)                                                  PRSL2220
   17 CALL LINK(PEIG2)                                                 PRSL2221
      END                                                              PRSL2222
```

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// DUP                                                                  PRSL2223
*DELETE              PRSL2                                             PRSL2224
*STORE       WS  UA  PRSL2                                             PRSL2225

// JOB                                                                  PORT2000
// FOR                                                                  PORT2001
*LIST ALL                                                             PORT2002
*ONE WORD INTEGERS                                                    PORT2003
*EXTENDED PRECISION                                                   PORT2004
      SUBROUTINE PORT2(X,L6,KK)                                       PORT2005
      DIMENSION W( 40,6),X( 40,6),SSX2(5,5)                           PORT2006
      COMMON R(160),Z( 40,6,2),T(6),B(12),N,IREP,TITL(12),ID,X5(7),S5(5)PORT2007
     1,A3(2)                                                          PORT2008
   85 FORMAT(54HOPOWER TRANSFORMATIONS OF INDEPENDENT VARIABLES - A1 =F8PORT2009
     1.4,6H  A2 =F8.4)                                              PORT2010
   84 FORMAT(5F15.5)                                                 PORT2011
   83 FORMAT(21HOCROSS PRODUCT MATRIX)                               PORT2012
   82 FORMAT(30HONORMAL ORTHOGONAL POLYNOMIALS//10X2HX113X2HX211X5HX1*X1PORT2013
     110X5HX2*X210X5HX1*X2)                                          PORT2014
   81 FORMAT(1H112A6)                                                PORT2015
      M=5                                                            PORT2016
      N1=N/IREP                                                      PORT2017
      DO 14 J=2,3                                                    PORT2018
      X5(J-1)=0.0                                                    PORT2019
      DO 14 I=1,N1                                                   PORT2020
   14 X5(J-1)=X5(J-1)+X(I,J)/N1                                      PORT2021
      DO 15 J=2,3                                                    PORT2022
      S5(J-1)=0.0                                                    PORT2023
      DO 15 I=1,N1                                                   PORT2024
   15 S5(J-1)=S5(J-1)+(X(I,J)-X5(J-1))**2                            PORT2025
      DO 1 J=2,3                                                     PORT2026
      S5(J-1)=SQRT(S5(J-1))                                          PORT2027
      DO 1 I=1,N1                                                    PORT2028
      W(I,1)=1.0                                                     PORT2029
    1 W(I,J)=(X(I,J)-X5(J-1))/S5(J-1)                                PORT2030
      GO TO (7,8),L6                                                 PORT2031
    7 DO 2 J=2,3                                                     PORT2032
      X5(J+1)=0.0                                                    PORT2033
      X5(J+4)=0.0                                                    PORT2034
      DO 2 I=1,N1                                                    PORT2035
      X5(J+1)=X5(J+1)+X(I,J+2)/N1                                    PORT2036
    2 X5(J+4)=X5(J+4)+X(I,J+2)*(X(I,J)-X5(J-1))/S5(J-1)/S5(J-1)      PORT2037
      X5(5)=0.0                                                      PORT2038
      DO 3 I=1,N1                                                    PORT2039
      W(I,6)=W(I,2)*W(I,3)                                           PORT2040
      X5(5)=X5(5)+W(I,6)/N1                                          PORT2041
      DO 3 J=4,5                                                     PORT2042
    3 W(I,J)=X(I,J)-X5(J-1)-(X(I,J-2)-X5(J-3))*X5(J+2)               PORT2043
      DO 4 J=4,5                                                     PORT2044
      S5(J-1)=0.0                                                    PORT2045
      DO 4 I=1,N1                                                    PORT2046
    4 S5(J-1)=S5(J-1)+W(I,J)*W(I,J)                                  PORT2047
      S5(3)=SQRT(S5(3))                                              PORT2048
      S5(4)=SQRT(S5(4))                                              PORT2049
      S5(5)=0.0                                                      PORT2050
      DO 5 I=1,N1                                                    PORT2051
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```
      S5(5)=S5(5)+(W(I,6)-X5(5))**2                                    PORT2052
      DO 5 J=4,5                                                       PORT2053
    5 W(I,J)=W(I,J)/S5(J-1)                                            PORT2054
      S5(5)=SQRT(S5(5))                                                PORT2055
    8 DO 16 I=1,N1                                                     PORT2056
   16 W(I,6)=(W(I,6)-X5(5))/S5(5)                                      PORT2057
      GO TO (9,10),L6                                                  PORT2058
   10 DO 12 I=1,N1                                                     PORT2059
      X(I,4)=W(I,6)                                                    PORT2060
      DO 12 J=1,3                                                      PORT2061
   12 X(I,J)=W(I,J)                                                    PORT2062
      GO TO 11                                                         PORT2063
    9 DO 6 I=1,N1                                                      PORT2064
      DO 6 J=1,6                                                       PORT2065
    6 X(I,J)=W(I,J)                                                    PORT2066
      WRITE(M,81)TITL                                                  PORT2067
      GO TO (13,17),KK                                                 PORT2068
   17 WRITE(M,85)A3                                                    PORT2069
   13 WRITE(M,82)                                                      PORT2070
      WRITE(M,84)((X(I,J),J=2,6),I=1,N1)                               PORT2071
      WRITE(M,83)                                                      PORT2072
      DO 18 I=1,5                                                      PORT2073
      DO 18 J=1,5                                                      PORT2074
      SSX2(I,J)=0.0                                                    PORT2075
      DO 18 K=1,N1                                                     PORT2076
   18 SSX2(I,J)=SSX2(I,J)+X(K,I+1)*X(K,J+1)                            PORT2077
      WRITE(M,84)((SSX2(I,J),J=1,5),I=1,5)                             PORT2078
   11 RETURN                                                           PORT2079
      END                                                              PORT2080
// DUP                                                                 PORT2081
*DELETE              PORT2                                            PORT2082
*STORE       WS  UA  PORT2                                            PORT2083

// JOB                                                                 PLE20000
// FOR                                                                 PLE20001
*LIST ALL                                                              PLE20002
*ONE WORD INTEGERS                                                     PLE20003
*EXTENDED PRECISION                                                    PLE20004
      SUBROUTINE PLE2(B,I5,J3,SS)                                      PLE20005
      DIMENSION A(12,12),C(12),B(6),I5(6)                              PLE20006
      COMMON R(160),Z(480),T(6),ZZ(12),N,IREP,TT(12),ID,S(15),DD,X( 40,6PLE20007
     1),MN,N1                                                          PLE20008
   81 FORMAT(39HOND CONVERGENCE - B(J) COEFFICIENTS ARE //6E15.6)      PLE20009
   80 FORMAT(6E15.7,I8,E15.6)                                          PLE20010
      M=5                                                              PLE20011
      N1=N/IREP                                                        PLE20012
      J4=J3+1                                                          PLE20013
      J6=6-J3                                                          PLE20014
      DO 16 I=J4,6                                                     PLE20015
   16 I5(I)=0                                                          PLE20016
      DO 4 I=1,6                                                       PLE20017
      C(I)=0.0                                                         PLE20018
      DO 4 J=1,6                                                       PLE20019
    4 A(I,J)=0.0                                                       PLE20020
      DO 13 I=1,N1                                                     PLE20021
      Y1=0.0                                                           PLE20022
```

```
      DO 14 J=1,IREP                                                    PLE20023
      K=(J-1)*N1+I                                                      PLE20024
      IF(R(K))10,10,42                                                  PLE20025
   10 Y1=Y1-10.0                                                        PLE20026
      GO TO 14                                                          PLE20027
   42 Y1=Y1+ALOG(R(K))/FLOAT(IREP)                                      PLE20028
   14 CONTINUE                                                          PLE20029
      IJ=1                                                              PLE20030
      DO 38 KK=1,6                                                      PLE20031
      IF(KK-I5(IJ))28,29,28                                             PLE20032
   29 IJ=IJ+1                                                           PLE20033
      GO TO 38                                                          PLE20034
   28 K1=KK-IJ+1                                                        PLE20035
      C(K1)=C(K1)+Y1*X(I,KK)                                            PLE20036
      JI=1                                                              PLE20037
      DO 37 II=1,6                                                      PLE20038
      IF(II-I5(JI))30,31,30                                             PLE20039
   31 JI=JI+1                                                           PLE20040
      GO TO 37                                                          PLE20041
   30 I1=II-JI+1                                                        PLE20042
      A(K1,I1)=A(K1,I1)+X(I,KK)*X(I,II)                                 PLE20043
   37 CONTINUE                                                          PLE20044
   38 CONTINUE                                                          PLE20045
   13 CONTINUE                                                          PLE20046
      CALL MATV(A,J6,C,1,DET)                                           PLE20047
      J=1                                                               PLE20048
      DO 39 I=1,6                                                       PLE20049
      IF(I-I5(J))40,41,40                                               PLE20050
   41 J=J+1                                                             PLE20051
      B(I)=0.0                                                          PLE20052
      GO TO 39                                                          PLE20053
   40 I1=I-J+1                                                          PLE20054
      B(I)=C(I1)                                                        PLE20055
   39 CONTINUE                                                          PLE20056
      SS=0.0                                                            PLE20057
      DO 43 I=1,N1                                                      PLE20058
      DO 43 J=1,IREP                                                    PLE20059
      K=(J-1)*N1+I                                                      PLE20060
      U=ALOG(R(K))                                                      PLE20061
      DO 44 J1=1,6                                                      PLE20062
   44 U=U-B(J1)*X(I,J1)                                                 PLE20063
   43 SS=SS+U*U                                                         PLE20064
      SS=-ALOG(SS)*FLOAT(N)/2.0                                         PLE20065
      DO 6 J5=1,NI                                                      PLE20066
      J=1                                                               PLE20067
      DO 12 KK=1,6                                                      PLE20068
      IF(KK-I5(J))5,11,5                                                PLE20069
   11 J=J+1                                                             PLE20070
      GO TO 12                                                          PLE20071
    5 K1=KK-J+1                                                         PLE20072
      C(K1)=T(KK)                                                       PLE20073
      K=1                                                               PLE20074
      DO 34 I=1,6                                                       PLE20075
      IF(I-I5(K))15,19,15                                               PLE20076
   19 K=K+1                                                             PLE20077
      GO TO 34                                                          PLE20078
```

```
15 I1=I-K+1                                                    PLE20079
   A(I1,K1)=0.0                                                PLE20080
34 CONTINUE                                                    PLE20081
12 CONTINUE                                                    PLE20082
   DO 1 I=1,N1                                                 PLE20083
   D=0.0                                                       PLE20084
   J=1                                                         PLE20085
   DO 2 JJ=1,6                                                 PLE20086
   IF(JJ-I5(J))20,21,20                                        PLE20087
21 J=J+1                                                       PLE20088
   GO TO 2                                                     PLE20089
20 D=D+B(JJ)*X(I,JJ)                                           PLE20090
 2 CONTINUE                                                    PLE20091
   D=EXP(D)                                                    PLE20092
   IJ=1                                                        PLE20093
   DO 1 KK=1,6                                                 PLE20094
   IF(KK-I5(IJ))22,23,22                                       PLE20095
23 IJ=IJ+1                                                     PLE20096
   GO TO 1                                                     PLE20097
22 K1=KK-IJ+1                                                  PLE20098
   JI=1                                                        PLE20099
   DO 32 II=1,6                                                PLE20100
   IF(II-I5(JI))24,25,24                                       PLE20101
25 JI=JI+1                                                     PLE20102
   GO TO 32                                                    PLE20103
24 I1=II-JI+1                                                  PLE20104
   DO 33 J=1,IREP                                              PLE20105
   A(K1,I1)=A(K1,I1)-X(I,KK)*X(I,II)*D                         PLE20106
   IF(K1-I1)33,3,33                                            PLE20107
 3 C(K1)=C(K1)-X(I,KK)*D                                       PLE20108
33 CONTINUE                                                    PLE20109
32 CONTINUE                                                    PLE20110
 1 CONTINUE                                                    PLE20111
   CALL MATV(A,J6,C,1,DET)                                     PLE20112
   J=1                                                         PLE20113
   DO 9 I=1,6                                                  PLE20114
   IF(I-I5(J))17,18,17                                         PLE20115
18 J=J+1                                                       PLE20116
   C(I)=0.0                                                    PLE20117
   GO TO 9                                                     PLE20118
17 I1=I-J+1                                                    PLE20119
   IF(ABS(C(I1))-0.1*B(I))26,26,27                             PLE20120
27 C(I1)=0.1*C(I1)                                             PLE20121
26 B(I)=B(I)-C(I1)                                             PLE20122
 9 CONTINUE                                                    PLE20123
   IF(MN)46,47,46                                              PLE20124
46 S1=CLFP(B)                                                  PLE20125
   WRITE(M,80)B,J5,S1                                          PLE20126
47 J=1                                                         PLE20127
   DO 7 I=1,6                                                  PLE20128
   IF(I-I5(J))35,36,35                                         PLE20129
36 J=J+1                                                       PLE20130
   GO TO 7                                                     PLE20131
35 I1=I-J+1                                                    PLE20132
   IF(ABS(C(I1)/B(I))-DD)7,7,6                                 PLE20133
 7 CONTINUE                                                    PLE20134
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```
      GO TO 8                                                          PLE20135
    6 CONTINUE                                                         PLE20136
      WRITE(M,81)B                                                     PLE20137
    8 RETURN                                                           PLE20138
      END                                                              PLE20139
// DUP                                                                 PLE20140
*DELETE              PLE2                                            PLE20141
*STORE       WS  UA  PLE2                                            PLE20142

// JOB                                                                 MATV0000
// FOR                                                                 MATV0001
*LIST ALL                                                             MATV0002
*ONE WORD INTEGERS                                                    MATV0003
*EXTENDED PRECISION                                                   MATV0004
      SUBROUTINE MATV(A,N,B,M,DETM)                                    MATV0005
      DIMENSION A(12,12),B(12,1),PIVOT(12),IPVOT(12),INDEX(12,12)      MATV0006
      EQUIVALENCE (IROW,JROW),(ICLUM,JCLUM),(AMAX,T,SWAP)              MATV0007
      DETM=1.0                                                         MATV0008
      DO 20 J=1,N                                                      MATV0009
   20 IPVOT(J)=0                                                       MATV0010
      DO 550 I=1,N                                                     MATV0011
      AMAX=0.0                                                         MATV0012
      DO 105 J=1,N                                                     MATV0013
      IF(IPVOT(J)-1)60,105,60                                          MATV0014
   60 DO 100 K=1,N                                                     MATV0015
      IF(IPVOT(K)-1)80,100,740                                         MATV0016
   80 IF(ABS(AMAX)-ABS(A(J,K)))85,100,100                              MATV0017
   85 IROW=J                                                           MATV0018
      ICLUM=K                                                          MATV0019
      AMAX=A(J,K)                                                      MATV0020
  100 CONTINUE                                                         MATV0021
  105 CONTINUE                                                         MATV0022
      IPVOT(ICLUM)=IPVOT(ICLUM)+1                                      MATV0023
      IF(IROW-ICLUM)140,260,140                                        MATV0024
  140 DETM=-DETM                                                       MATV0025
      DO 200 L=1,N                                                     MATV0026
      SWAP=A(IROW,L)                                                   MATV0027
      A(IROW,L)=A(ICLUM,L)                                             MATV0028
  200 A(ICLUM,L)=SWAP                                                  MATV0029
      IF(M)260,260,210                                                 MATV0030
  210 DO 250 L=1,M                                                     MATV0031
      SWAP=B(IROW,L)                                                   MATV0032
      B(IROW,L)=B(ICLUM,L)                                             MATV0033
  250 B(ICLUM,L)=SWAP                                                  MATV0034
  260 INDEX(I,1)=IROW                                                  MATV0035
      INDEX(I,2)=ICLUM                                                 MATV0036
      PIVOT(I)=A(ICLUM,ICLUM)                                          MATV0037
      DETM=DETM*PIVOT(I)                                               MATV0038
      A(ICLUM,ICLUM)=1.0                                               MATV0039
      DO 350 L=1,N                                                     MATV0040
  350 A(ICLUM,L)=A(ICLUM,L)/PIVOT(I)                                   MATV0041
      IF(M)380,380,360                                                 MATV0042
  360 DO 370 L=1,M                                                     MATV0043
  370 B(ICLUM,L)=B(ICLUM,L)/PIVOT(I)                                   MATV0044
  380 DO 550 L1=1,N                                                    MATV0045
      IF(L1-ICLUM)400,550,400                                          MATV0046
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  400 T=A(L1,ICLUM)                                                    MATV0047
      A(L1,ICLUM)=0.0                                                  MATV0048
      DO 450 L=1,N                                                     MATV0049
  450 A(L1,L)=A(L1,L)-A(ICLUM,L)*T                                     MATV0050
      IF(M)550,550,460                                                 MATV0051
  460 DO 500 L=1,M                                                     MATV0052
  500 B(L1,L)=B(L1,L)-B(ICLUM,L)*T                                     MATV0053
  550 CONTINUE                                                         MATV0054
      DO 710 I=1,N                                                     MATV0055
      L=N+1-I                                                          MATV0056
      IF(INDEX(L,1)-INDEX(L,2))630,710,630                             MATV0057
  630 JROW=INDEX(L,1)                                                  MATV0058
      JCLUM=INDEX(L,2)                                                 MATV0059
      DO 705 K=1,N                                                     MATV0060
      SWAP=A(K,JROW)                                                   MATV0061
      A(K,JROW)=A(K,JCLUM)                                             MATV0062
      A(K,JCLUM)=SWAP                                                  MATV0063
  705 CONTINUE                                                         MATV0064
  710 CONTINUE                                                         MATV0065
  740 IF(DETM-0.000001)750,750,760                                     MATV0066
  750 DETM=0.0                                                         MATV0067
  760 RETURN                                                           MATV0068
      END                                                              MATV0069
// DUP                                                                 MATV0070
*DELETE            MATV                                               MATV0071
*STORE       WS  UA  MATV                                            MATV0072

// JOB                                                                 CLFP0000
// FOR                                                                 CLFP0001
*LIST ALL                                                            CLFP0002
*ONE WORD INTEGERS                                                   CLFP0003
*EXTENDED PRECISION                                                  CLFP0004
      FUNCTION CLFP(B)                                               CLFP0005
      DIMENSION B(6)                                                 CLFP0006
      COMMON R(160),Z(480),T(6),ZZ(12),N,IREP,TT(12),ID,S(14),F,D,X(40,6CLFP0007
     1)                                                              CLFP0008
      EQUIVALENCE (E,F)                                              CLFP0009
      N1=N/IREP                                                      CLFP0010
      IF(E)4,5,4                                                     CLFP0011
    5 DO 6 I=1,N                                                     CLFP0012
    6 E=E-(R(I)+0.5)*ALOG(R(I))-0.5*ALOG(6.283185)+R(I)-1.0/R(I)/12.0 CLFP0013
    4 A=E                                                            CLFP0014
      DO 1 J=1,6                                                     CLFP0015
    1 A=A+T(J)*B(J)                                                  CLFP0016
      DO 2 I=1,N1                                                    CLFP0017
      C=0.0                                                          CLFP0018
      DO 3 JJ=1,6                                                    CLFP0019
    3 C=C+B(JJ)*X(I,JJ)                                              CLFP0020
      C=EXP(C)                                                       CLFP0021
    2 A=A-C*FLOAT(IREP)                                              CLFP0022
      CLFP=A                                                         CLFP0023
      RETURN                                                         CLFP0024
      END                                                            CLFP0025
// DUP                                                                 CLFP0026
*DELETE            CLFP                                              CLFP0027
*STORE       WS  UA  CLFP                                            CLFP0028
```

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// JOB                                                                  PLOF0000
// FOR                                                                  PLOF0001
*LIST ALL                                                               PLOF0002
*ONE WORD INTEGERS                                                      PLOF0003
*EXTENDED PRECISION                                                     PLOF0004
      FUNCTION PLOF(IJ,KK)                                              PLOF0005
      COMMON R(160),X( 40,6,2),T(6),B1(6,2),N,IR,TT(12),ID,S(14),E      PLOF0006
      N1=N/IR                                                           PLOF0007
      GO TO (8,9,9,17),IJ                                               PLOF0008
    8 B=0.0                                                             PLOF0009
      DO 5 K=1,N                                                        PLOF0010
    5 B=B+R(K)/N                                                        PLOF0011
    9 PLOF=0.0                                                          PLOF0012
      GO TO 19                                                          PLOF0013
   17 PLOF=E                                                            PLOF0014
   19 DO 1 I=1,N1                                                       PLOF0015
      A=0.0                                                             PLOF0016
      DO 2 J=1,IR                                                       PLOF0017
      K=(J-1)*N1+I                                                      PLOF0018
      GO TO (15,15,14,15),IJ                                            PLOF0019
   15 A=A+R(K)/IR                                                       PLOF0020
      GO TO 2                                                           PLOF0021
   14 A=A+ALOG(R(K))/FLOAT(IR)                                          PLOF0022
    2 CONTINUE                                                          PLOF0023
      IF(A)10,10,11                                                     PLOF0024
   10 A=10.0**(-10)                                                     PLOF0025
   11 GO TO (6,7,6,6),IJ                                                PLOF0026
    7 B=0.0                                                             PLOF0027
      DO 3 J=1,6                                                        PLOF0028
    3 B=B+X(I,J,KK)*B1(J,KK)                                            PLOF0029
      B=EXP(B)                                                          PLOF0030
    6 DO 4 J=1,IR                                                       PLOF0031
      K=(J-1)*N1+I                                                      PLOF0032
      GO TO (12,12,13,16),IJ                                            PLOF0033
   13 PLOF=PLOF+(A-ALOG(R(K)))**2                                       PLOF0034
      GO TO 4                                                           PLOF0035
   12 PLOF=PLOF+R(K)*ALOG(B/A)-B+A                                      PLOF0036
      GO TO 4                                                           PLOF0037
   16 PLOF=PLOF+R(K)*ALOG(A)-A                                          PLOF0038
    4 CONTINUE                                                          PLOF0039
    1 CONTINUE                                                          PLOF0040
      GO TO (18,18,20,18),IJ                                            PLOF0041
   20 PLOF=-ALOG(PLOF)*FLOAT(N)/2.0                                     PLOF0042
   18 RETURN                                                            PLOF0043
      END                                                               PLOF0044
// DUP                                                                  PLOF0045
*DELETE            PLOF                                               PLOF0046
*STORE       WS  UA  PLOF                                               PLOF0047

// JOB                                                                  CAN20000
// FOR                                                                  CAN20001
*LIST ALL                                                               CAN20002
*ONE WORD INTEGERS                                                      CAN20003
*EXTENDED PRECISION                                                     CAN20004
      SUBROUTINE CAN2(AA,AMBDA,N)                                       CAN20005
```

```
      DIMENSION AA(2,2),AMBDA(2),E(4),D(4)                          CAN20006
   80 FORMAT(4X,I2,5X,E15.6,5X,3E15.6)                              CAN20007
      M=5                                                           CAN20008
      NQ=+1                                                         CAN20009
      K=1                                                           CAN20010
      DO 1 I=1,N                                                    CAN20011
      DO 1 J=1,I                                                    CAN20012
      E(K)=AA(I,J)                                                  CAN20013
    1 K=K+1                                                         CAN20014
      CALL JACO2(E,D,AMBDA,N,NQ)                                    CAN20015
      K=1                                                           CAN20016
      DO 2 I=1,N                                                    CAN20017
      DO 2 J=1,N                                                    CAN20018
      AA(I,J)=D(K)                                                  CAN20019
    2 K=K+1                                                         CAN20020
      DO 3 I=1,N                                                    CAN20021
    3 WRITE(M,80)I,AMBDA(I),(AA(I,J),J=1,N)                         CAN20022
      RETURN                                                        CAN20023
      END                                                           CAN20024
// DUP                                                              CAN20025
*DELETE              CAN2                                         CAN20026
*STORE       WS  UA  CAN2                                         CAN20027

// JOB                                                              JACO2000
// FOR                                                              JACO2001
*LIST ALL                                                          JACO2002
*ONE WORD INTEGERS                                                 JACO2003
*EXTENDED PRECISION                                                JACO2004
      SUBROUTINE JACO2(A,B,C,NAA,NQ)                               JACO2005
      DIMENSION A(4),B(4),C(2)                                     JACO2006
  901 FORMAT(25H EIGENVALUE NOT CONVERGED  )                       JACO2007
      M=5                                                          JACO2008
      LOOPC=0                                                      JACO2009
      NA=NAA                                                       JACO2010
      NN=(NA*(NA+1))/2                                             JACO2011
      IF (NQ) 120,100,100                                          JACO2012
  100 K=1                                                          JACO2013
      DO 115 I=1,NA                                                JACO2014
      DO 115 J=1,NA                                                JACO2015
      IF(I-J)105,110,105                                           JACO2016
  105 B(K)=0.                                                      JACO2017
      GO TO 115                                                    JACO2018
  110 B(K)=1.                                                      JACO2019
  115 K=K+1                                                        JACO2020
  120 SUM=0.                                                       JACO2021
      IF(NA-1)325,310,125                                          JACO2022
  125 K=1                                                          JACO2023
      AMAX=0.                                                      JACO2024
      DO 155 I=1,NA                                                JACO2025
      DO 150 J=1,I                                                 JACO2026
      IF(I-J)135,145,135                                           JACO2027
  135 IF(ABS(A(K))-AMAX)145,145,140                                JACO2028
  140 AMAX=ABS(A(K))                                               JACO2029
  145 TERM=A(K)*A(K)                                               JACO2030
      SUM=SUM+TERM+TERM                                            JACO2031
  150 K=K+1                                                        JACO2032
```

```
155 SUM=SUM-TERM                                                    JAC02033
    SUM=SQRT(SUM)                                                   JAC02034
    THRES=SUM/SQRT(FLOAT(NA))                                       JAC02035
    THRSH=THRES*1.0E-08                                             JAC02036
    IF(THRSH-AMAX)165,310,310                                       JAC02037
165 THRES=AMAX/3.                                                   JAC02038
    IF(THRES-THRSH)175,180,180                                      JAC02039
175 THRES=THRSH                                                     JAC02040
180 K=2                                                             JAC02041
    N=0                                                             JAC02042
    JD=1                                                            JAC02043
    DO 270 J=2,NA                                                   JAC02044
    JD=JD+J                                                         JAC02045
    JJ=J-1                                                          JAC02046
    ID=0                                                            JAC02047
    DO 265 I=1,JJ                                                   JAC02048
    ID=ID+I                                                         JAC02049
    IF(ABS(A(K))-THRES)265,265,195                                  JAC02050
195 N=N+1                                                           JAC02051
    ALPHA=(A(JD)-A(ID))/(2.*A(K))                                   JAC02052
    BETA=1./(1.+ALPHA*ALPHA)                                        JAC02053
    ROOT=1.0+ABS(ALPHA)* SQRT(BETA)                                 JAC02054
    IF(ALPHA)205,200,200                                            JAC02055
200 SSQ=0.5*BETA/ROOT                                               JAC02056
    CSQ=0.5*ROOT                                                    JAC02057
    GO TO 210                                                       JAC02058
205 CSQ=0.5*BETA/ROOT                                               JAC02059
    SSQ=0.5*ROOT                                                    JAC02060
210 CC=SQRT(CSQ)                                                    JAC02061
    S=-SQRT(SSQ)                                                    JAC02062
    TWOSC=CC*S*2.                                                   JAC02063
    TEMPA=CSQ*A(ID)+TWOSC*A(K)+SSQ*A(JD)                            JAC02064
    A(JD)=CSQ*A(JD)-TWOSC*A(K)+SSQ*A(ID)                            JAC02065
    A(ID)=TEMPA                                                     JAC02066
    A(K)=0.                                                         JAC02067
    KA=JD-J                                                         JAC02068
    KB=ID-I                                                         JAC02069
    KC=NA*(I-1)                                                     JAC02070
    KD=NA*(J-1)                                                     JAC02071
    DO 260 L=1,NA                                                   JAC02072
    KC=KC+1                                                         JAC02073
    KD=KD+1                                                         JAC02074
    TEMPA=CC*B(KC)+S*B(KD)                                          JAC02075
    B(KD)=-S*B(KC)+CC*B(KD)                                         JAC02076
    B(KC)=TEMPA                                                     JAC02077
    IF(I-L)230,220,245                                              JAC02078
220 KB=KB+1                                                         JAC02079
225 KA=KA+1                                                         JAC02080
    GO TO 260                                                       JAC02081
230 KB=KB+L-1                                                       JAC02082
    IF(J-L)240,225,250                                              JAC02083
240 KA=KA+L-1                                                       JAC02084
    GO TO 255                                                       JAC02085
245 KB=KB+1                                                         JAC02086
250 KA=KA+1                                                         JAC02087
255 TEMPA=CC*A(KB)+S*A(KA)                                          JAC02088
```

```
      A(KA)=-S*A(KB)+CC*A(KA)                                          JACO2089
      A(KB)=TEMPA                                                      JACO2090
  260 CONTINUE                                                         JACO2091
  265 K=K+1                                                            JACO2092
  270 K=K+1                                                            JACO2093
      LOOPC=LOOPC+1                                                    JACO2094
      IF(LOOPC-50)275,305,305                                          JACO2095
  275 IF(N-NN/8)280,280,180                                            JACO2096
  280 IF(THRES-THRSH)285,300,285                                       JACO2097
  285 THRES=THRSH/3.                                                   JACO2098
      IF(THRES-THRSH)295,180,180                                       JACO2099
  295 THRES=THRSH                                                      JACO2100
      GO TO 180                                                        JACO2101
  300 IF(N)180,310,180                                                 JACO2102
  305 WRITE(M,901)                                                     JACO2103
  310 LL=0                                                             JACO2104
      DO 320 L=1,NA                                                    JACO2105
      LL=LL+L                                                          JACO2106
  320 C(L)=A(LL)                                                       JACO2107
  325 RETURN                                                           JACO2108
      END                                                              JACO2109
// DUP                                                                 JACO2110
*DELETE             JACO2                                            JACO2111
*STORE      WS  UA  JACO2                                            JACO2112

// JOB                                                                 PEIG2000
// FOR                                                                 PEIG2001
*LIST ALL                                                            PEIG2002
*ONE WORD INTEGERS                                                   PEIG2003
*EXTENDED PRECISION                                                  PEIG2004
*IOCS(1403 PRINTER)                                                  PEIG2005
*IOCS(2501 READER)                                                   PEIG2006
*NAME PEIG2                                                          PEIG2007
      DIMENSION BA(12,12),Z(2),S(2),A3(2),COE(6),V(6)                  PEIG2008
      COMMON R(160),X( 40,6,2),T(6),R(6,2),NS,NREPS,TITL(12),ID,XX(7),SDPEIG2009
     1(5),A4(2),XY(742),MN,NI,YS,V1(2),ALAMD(2),PREP(2,2)              PEIG2010
   89 FORMAT(1HO,8X,12HEIGEN VALUES,10X,21HEIGEN VECTORS AS ROWS/)     PEIG2011
   88 FORMAT(1HOE11.4,3H=YS3X)                                         PEIG2012
   87 FORMAT(1HO,2(E11.4,2H=X11,1HS))                                  PEIG2013
   86 FORMAT(I4,2F10.3,4F15.3)                                         PEIG2014
   85 FORMAT(1HO,1X,18HTABLE OF RESIDUALS)                             PEIG2015
   82 FORMAT(1H112A6)                                                  PEIG2016
   81 FORMAT(1HO,5X,3HY -,E15.6,3H = ,2(2H +,E15.6,2H Z,I1,3H SO),/,)  PEIG2017
   80 FORMAT(1HO,7X,5HR OBS3X8HESTIMATE11X11HVALUES OF Z18X13HFACTOR LEVPEIG2018
     1ELS/)                                                            PEIG2019
   79 FORMAT(54HOPOWER TRANSFORMATIONS OF INDEPENDENT VARIABLES - A1 =F8PEIG2020
     1.4,6H   A2 =F8.4)                                              PEIG2021
   77 FORMAT(29H0  CENTRE OF RESPONSE SURFACE  ,/,)                    PEIG2022
   78 FORMAT( 52HO CANONICAL REGRESSION   (Z ARE CANONICAL VARIABLES),/)PEIG2023
      M=5                                                              PEIG2024
      N1=NS/NREPS                                                      PEIG2025
      DO 9 KK=1,2                                                      PEIG2026
      WRITE(M,82)TITL                                                  PEIG2027
      DO 5 I=1,2                                                       PEIG2028
      GO TO (7,8),KK                                                   PEIG2029
    7 A3(I)=1.0                                                        PEIG2030
```

```
      GO TO 5                                                          PEIG2031
    8 A3(I)=A4(I)                                                      PEIG2032
    5 CONTINUE                                                         PEIG2033
      GO TO (1,2),KK                                                   PEIG2034
    2 WRITE(M,79)A3                                                    PEIG2035
    1 DO 29 J=1,4                                                      PEIG2036
      COE(J)=B(J,KK)                                                   PEIG2037
   29 V(J)=COE(J)                                                      PEIG2038
      COE(5)=B(6,KK)                                                   PEIG2039
      COE(6)=B(5,KK)                                                   PEIG2040
      V(5)=COE(5)                                                      PEIG2041
      V(6)=COE(6)                                                      PEIG2042
      NFAK=2                                                           PEIG2043
      KP=NFAK+2                                                        PEIG2044
      DO 32 I=1,NFAK                                                   PEIG2045
      DO 32 J=1,I                                                      PEIG2046
      IF(I-J)31,30,31                                                  PEIG2047
   30 PREP(I,J)=V(KP)                                                  PEIG2048
      GO TO 32                                                         PEIG2049
   31 PREP(I,J)=V(KP)*0.5                                              PEIG2050
      PREP(J,I)=PREP(I,J)                                              PEIG2051
   32 KP=KP+1                                                          PEIG2052
      DO 33 I=1,NFAK                                                   PEIG2053
   33 V(I)=-V(I+1)*0.500                                               PEIG2054
      DO 34 I=1,NFAK                                                   PEIG2055
      DO 34 J=1,NFAK                                                   PEIG2056
   34 BA(I,J)=PREP(I,J)                                                PEIG2057
      WRITE(M,77)                                                      PEIG2058
      CALL MATV(BA,NFAK,V,1,DET)                                       PEIG2059
      YS=COE(1)                                                        PEIG2060
      DO 44 I=1,NFAK                                                   PEIG2061
   44 YS=YS+0.5*V(I)*COE(I+1)                                          PEIG2062
      I1=1                                                             PEIG2063
      I2=2                                                             PEIG2064
      DO 3 I=1,2                                                       PEIG2065
      M1=V(I)/ABS(V(I))                                                PEIG2066
    3 S(I)=ABS(V(I))**(1.0/A3(I))*M1                                   PEIG2067
      WRITE(M,87)(S(I),I,I=1,NFAK)                                     PEIG2068
      Y1=EXP(YS)                                                       PEIG2069
      WRITE(M,88)Y1                                                    PEIG2070
      WRITE(M,89)                                                      PEIG2071
      CALL CAN2(PREP,ALAMD,NFAK)                                       PEIG2072
      WRITE(M,78)                                                      PEIG2073
      WRITE(M,81)YS,(ALAMD(J),J,J=1,NFAK)                              PEIG2074
      WRITE(M,65)                                                      PEIG2075
      WRITE(M,80)                                                      PEIG2076
      DO 18 J=1,N1                                                     PEIG2077
      YPRED=YS                                                         PEIG2078
      RD=0.0                                                           PEIG2079
      YD=0.0                                                           PEIG2080
      DO 16 I=1,NFAK                                                   PEIG2081
      Z(I)=0.0                                                         PEIG2082
      DO 16 L2=1,NFAK                                                  PEIG2083
   16 Z(I)=Z(I)+(X(J,L2+1,KK)-V(L2))*PREP(I,L2)                        PEIG2084
      DO 17 L1=1,NFAK                                                  PEIG2085
   17 YPRED=YPRED+(Z(L1)**2)*ALAMD(L1)                                 PEIG2086
```

```
      DO 6 K=1,NREPS                                                    PEIG2087
      K1=(K-1)*N1+J                                                     PEIG2088
    6 RD=RD+R(K1)                                                       PEIG2089
      YPRED=EXP(YPRED)                                                  PEIG2090
      DO 4 II=1,2                                                       PEIG2091
    4 S(II)=X(J,II+1,KK)**(1.0/A3(II))                                  PEIG2092
   18 WRITE(M,86)J,RD,YPRED,(Z(I),I=1,NFAK),(S(II),II=1,2)              PEIG2093
      DO 46 I=1,2                                                       PEIG2094
   46 V1(I)=V(I)                                                        PEIG2095
      CALL CPRS2(KK)                                                    PEIG2096
      GO TO (10,11),KK                                                  PEIG2097
   10 IF(A4(1))9,11,9                                                   PEIG2098
    9 CONTINUE                                                          PEIG2099
   11 IF(ID-98)12,12,13                                                 PEIG2100
   12 CALL EXIT                                                         PEIG2101
   13 CALL LINK(PRSL2)                                                  PEIG2102
      END                                                               PEIG2103
// DUP                                                                  PEIG2104
*DELETE              PEIG2                                             PEIG2105
*STORE       WS  UA  PEIG2                                             PEIG2106

// JOB                                                                  CPRS2000
// FOR                                                                  CPRS2001
*LIST ALL                                                              CPRS2002
*ONE WORD INTEGERS                                                     CPRS2003
*EXTENDED PRECISION                                                    CPRS2004
      SUBROUTINE CPRS2(KK)                                              CPRS2005
      DIMENSION A3(2),YCONT(10),ZLIM(2),XH(40),XV(40),YP1(5),XP1(5),YCONCPRS2006
     11(10),YP(400),XP(400)                                             CPRS2007
      COMMON R(160),X( 40,6,2),T(6),B(12),N,IREP,TITL(12),ID,XX(7),SD(5)CPRS2008
     1,A4(2),XY(242),MN,NI,YS,XCNTR(2),ALAMD(2),AVECT(2,2)              CPRS2009
   90 FORMAT(62H1IMAGINARY POINT CALCULATED, TRY CONTOURS CLOSER TO THE CPRS2010
     1CENTRE)                                                           CPRS2011
   89 FORMAT(64HOSADDLE EXISTS  -  CONTOUR POINTS PLOTTED IN UNTRANSFORMCPRS2012
     1ED UNITS//5(12X,F8.2,3X)/5(10X2HX19X2HX2))                        CPRS2013
   85 FORMAT(61H1IMAGINARY POINT CALCULATED - CONTOUR ON WRONG SIDE OF CCPRS2014
     1ENTRE)                                                            CPRS2015
   82 FORMAT(12F6.2)                                                    CPRS2016
   81 FORMAT(2X,5(2X,F10.2,1X,F10.2))                                   CPRS2017
   80 FORMAT(54HOPOWER TRANSFORMATIONS OF INDEPENDENT VARTABLES - A1 =F8CPRS2018
     1.4,6H  A2 =F8.4)                                                  CPRS2019
   83 FORMAT(1H112A6)                                                   CPRS2020
   79 FORMAT(1HO,10X,54HDATA FOR PLOTTING OF 5 CONTOURS IN UNTRANSFORMEDCPRS2021
     1 UNITS//5(12X,F8.2,3X)/5(10X2HX19X2HX2))                         CPRS2022
      L=8                                                               CPRS2023
      M=5                                                               CPRS2024
      GO TO (7,8),KK                                                    CPRS2025
    7 READ(L,82)YCON1,ZLIM                                              CPRS2026
      DO 29 I=1,10                                                      CPRS2027
   29 YCONT(I)=ALOG(YCON1(I))                                           CPRS2028
      DO 9 I=1,2                                                        CPRS2029
    9 A3(I)=1.0                                                         CPRS2030
      GO TO 10                                                          CPRS2031
    8 DO 13 I=1,2                                                       CPRS2032
   13 A3(I)=A4(I)                                                       CPRS2033
   10 DO 4 I=1,2                                                        CPRS2034
```

```
  4 ZLIM(I)=ZLIM(I)**A3(I)                                              CPRS2035
    DO 61 I=1,400                                                       CPRS2036
    XP(I)=0.0                                                           CPRS2037
 61 YP(I)=0.0                                                           CPRS2038
    NSWCH=0                                                             CPRS2039
    NSAD=0                                                              CPRS2040
    KCY=0                                                               CPRS2041
    IH=1                                                                CPRS2042
    IV=2                                                                CPRS2043
    N1=ALAMD(IH)/ABS(ALAMD(IH))                                         CPRS2044
    N2=ALAMD(IV)/ABS(ALAMD(IV))                                         CPRS2045
    NSIGN=N1*N2                                                         CPRS2046
    IF(NSIGN)11,11,40                                                   CPRS2047
 11 NSAD=1                                                              CPRS2048
    IF(N1)40,40,14                                                      CPRS2049
 14 IDUM=IH                                                             CPRS2050
    IH=IV                                                               CPRS2051
    IV=IDUM                                                             CPRS2052
    NSWCH=1                                                             CPRS2053
 40 CONTINUE                                                            CPRS2054
    KCY=KCY+1                                                           CPRS2055
    ARG=(YCONT(KCY)-YS)/ALAMD(IH)                                       CPRS2056
    IF(ARG)101,101,102                                                  CPRS2057
101 WRITE(M,85)                                                         CPRS2058
    GO TO 43                                                            CPRS2059
102 ZFRST=SQRT(ARG)                                                     CPRS2060
    ZEND=ZLIM(IH)-ZFRST                                                 CPRS2061
    XH(1)=ZFRST                                                         CPRS2062
    XV(1)=0.0                                                           CPRS2063
    THETA=0.0                                                           CPRS2064
    DO 1 I=2,10                                                         CPRS2065
    THETA=THETA+0.15710                                                 CPRS2066
    IF(NSAD)51,51,52                                                    CPRS2067
 51 XH(I)=ZFRST*COS(THETA)                                              CPRS2068
    GO TO 53                                                            CPRS2069
 52 XH(I)=ZFRST+ZEND-ZEND*COS(THETA)                                    CPRS2070
 53 ARG=(YCONT(KCY)-YS-ALAMD(IH)*(XH(I)**2))/ALAMD(IV)                  CPRS2071
    IF(ARG)104,103,103                                                  CPRS2072
104 WRITE(M,90)                                                         CPRS2073
    GO TO 43                                                            CPRS2074
103 XV(I)=SQRT(ARG)                                                     CPRS2075
    IL=42-I                                                             CPRS2076
    XH(IL)=XH(I)                                                        CPRS2077
    XV(IL)=-XV(I)                                                       CPRS2078
  1 CONTINUE                                                            CPRS2079
    IF(NSAD)54,54,55                                                    CPRS2080
 54 XH(11)=0.0                                                          CPRS2081
    ARGG=(YCONT(KCY)-YS)/ALAMD(IV)                                      CPRS2082
    XV(11)=SQRT(ARGG)                                                   CPRS2083
    GO TO 56                                                            CPRS2084
 55 XH(11)=ZLIM(IH)                                                     CPRS2085
    ARG=(YCONT(KCY)-YS-ALAMD(IH)*(XH(I)**2))/ALAMD(IV)                  CPRS2086
    XV(11)=SQRT(ARG)                                                    CPRS2087
 56 DO 2 I=12,21                                                        CPRS2088
    LL1=22-I                                                            CPRS2089
    II=42-I                                                             CPRS2090
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```
      XH(I)=-XH(LLI)                                                    CPRS2091
      XV(I)=XV(LLI)                                                     CPRS2092
      XH(II)=XH(I)                                                      CPRS2093
    2 XV(II)=-XV(I)                                                     CPRS2094
      XV(31)=-XV(11)                                                    CPRS2095
      XH(31)=XH(11)                                                     CPRS2096
      IF(NSWCH)31,31,32                                                 CPRS2097
   32 I1=IV                                                             CPRS2098
      I2=IH                                                             CPRS2099
      DO 33 I=1,40                                                      CPRS2100
      XDUM=XH(I)                                                        CPRS2101
      XH(I)=XV(I)                                                       CPRS2102
   33 XV(I)=XDUM                                                        CPRS2103
      GO TO 60                                                          CPRS2104
   31 I1=IH                                                             CPRS2105
      I2=IV                                                             CPRS2106
   60 DO 41 I=1,40                                                      CPRS2107
      L=(KCY-1)*40+I                                                    CPRS2108
      XP(L)=AVECT(I1,I1)*XH(I)+AVECT(I2,I1)*XV(I)+XCNTR(I1)             CPRS2109
   41 YP(L)=AVECT(I1,I2)*XH(I)+AVECT(I2,I2)*XV(I)+XCNTR(I2)             CPRS2110
      IF(KCY-5)40,34,34                                                 CPRS2111
   34 IF(NSAD-1)35,47,47                                                CPRS2112
   47 IF(KCY-10)48,35,35                                                CPRS2113
   48 IF(KCY-5)40,36,40                                                 CPRS2114
   36 IF(NSWCH)38,38,39                                                 CPRS2115
   38 NSWCH=1                                                           CPRS2116
      GO TO 37                                                          CPRS2117
   39 NSWCH=0                                                           CPRS2118
   37 IDUM=IH                                                           CPRS2119
      IH=IV                                                             CPRS2120
      IV=IDUM                                                           CPRS2121
      GO TO 40                                                          CPRS2122
   35 WRITE(M,83)TITL                                                   CPRS2123
      GO TO (5,6),KK                                                    CPRS2124
    6 WRITE(M,80)A3                                                     CPRS2125
    5 WRITE(M,79)(YCON1(I),I=1,5)                                       CPRS2126
      DO 3 I=1,40                                                       CPRS2127
      DO 49 J=1,5                                                       CPRS2128
      L1=(J-1)*40+I                                                     CPRS2129
      XP1(J)=XP(L1)                                                     CPRS2130
   49 YP1(J)=YP(L1)                                                     CPRS2131
      DO 12 J=1,5                                                       CPRS2132
      N2=XP1(J)/ABS(XP1(J))                                             CPRS2133
      XP1(J)=ABS(XP1(J))**(1.0/A3(1))*N2                                CPRS2134
      N2=YP1(J)/ABS(YP1(J))                                             CPRS2135
   12 YP1(J)=ABS(YP1(J))**(1.0/A3(2))*N2                                CPRS2136
    3 WRITE(M,81)(XP1(J),YP1(J),J=1,5)                                  CPRS2137
      IF(NSAD)43,43,44                                                  CPRS2138
   44 WRITE(M,83)TITL                                                   CPRS2139
      WRITE(M,89)(YCON1(I),I=6,10)                                      CPRS2140
      DO 42 I=1,40                                                      CPRS2141
      DO 59 J=1,5                                                       CPRS2142
      L1=200+(J-1)*40+I                                                 CPRS2143
      XP1(J)=XP(L1)                                                     CPRS2144
   59 YP1(J)=YP(L1)                                                     CPRS2145
      DO 18 J=1,5                                                       CPRS2146
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```
      N2=XP1(J)/ABS(XP1(J))                                          CPRS2147
      XP1(J)=ABS(XP1(J))**(1.0/A3(1))*N2                             CPRS2148
      N2=YP1(J)/ABS(YP1(J))                                          CPRS2149
   18 YP1(J)=ABS(YP1(J))**(1.0/A3(2))*N2                             CPRS2150
   42 WRITE(M,81)(XP1(J),YP1(J),J=1,5)                               CPRS2151
   43 RETURN                                                         CPRS2152
      END                                                            CPRS2153
// DUP                                                               CPRS2154
*DELETE              CPRS2                                         CPRS2155
*STORE       WS  UA  CPRS2                                         CPRS2156
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```
// JOB                                                                  COBM0000
// FOR                                                                  COBM0001
*ONE WORD INTEGERS                                                      COBM0002
*EXTENDED PRECISION                                                     COBM0003
*LIST ALL                                                               COBM0004
*IOCS(2501 READER)                                                      COBM0005
*IOCS(1403 PRINTER)                                                     COBM0006
*NAME COBM                                                              COBM0007
C                                                                       COBM0008
C   ONE AND TWO WAY ANALYSIS OF VARIANCE USING THE BINOMIAL DISTRIBUTIONCOBM0009
C                                                                       COBM0010
C     THIS PROGRAM ANALYZES ONE- AND TWO-WAY FACTORIAL EXPERIMENTS WITH COBM0011
C A MAXIMUM OF SIXTEEN BLOCKS AND FOUR OBSERVATIONS PER BLOCK, USING A  COBM0012
C BINOMIAL PROBABILITY DISTRIBUTION. FOR COMPARISON,NORMAL THEORY LOGIT,COBM0013
C ODDS, TRANSFORMED ODDS, PER CENT, TRANSFORMED PER CENT, AND ARCSINE   COBM0014
C MODELS ARE ALSO ANALYZED. BOTH NO INTERACTION AND INTERACTION MODELS  COBM0015
C ARE USED WITH THE BINOMIAL AND NORMAL LIKELIHOOD FUNCTIONS. OPTIONS   COBM0016
C ALLOW PRINTOUT OF EITHER EXPECTED VALUES IN TRANSFORMED UNITS OR      COBM0017
C EXPECTED PROPORTIONS PER BLOCK WITH THE DEVIATIONS.                   COBM0018
C                                                                       COBM0019
C     NUMBER OF ROWS (A) MUST BE GREATER THAN OR EQUAL TO NUMBER OF     COBM0020
C COLUMNS
C                                                                       COBM0021
C   SUBROUTINES CALLED                                                  COBM0022
C                                                                       COBM0023
C  CLB   - CALCULATES BINOMIAL LIKELIHOOD                               COBM0024
C  CLIB  - CALCULATES MAXIMUM LIKELIHOOD ESTIMATES OF PARAMETERS        COBM0025
C  TRANS - BACK TRANSFORMS VARIOUS NORMAL TRANSFORMATIONS               COBM0026
C  ARSIN - CALCULATES ARCSINE                                           COBM0028
C  MATVJ - INVERTS MATRICES UP TO 25 BY 25                              COBM0027
C                                                                       COBM0029
C   MAKEUP OF DATA DECK                                                 COBM0030
C                                                                       COBM0031
C 1.TITLE CARD (12A6)                                                   COBM0032
C 2.CONTROL CARD (I1,4I2,2F5.3,I3)                                      COBM0033
C     I1 - OPTION - 0 - NOTHING                                         COBM0034
C                   1 - PRINT EXPECTED VALUES IN TRANSFORMED UNITS AND  COBM0035
C                       DEVIATIONS                                      COBM0036
C                   2 - PRINT EXPECTED PROPORTIONS AND DEVIATIONS       COBM0037
C     I2 - NUMBER OF BLOCKS                                             COBM0038
C     I2 - NUMBER OF OBSERVATIONS PER BLOCK                             COBM0039
C     I2 - NUMBER OF TREATMENT LEVELS IN DIRECTION A (NUMBER OF ROWS)   COBM0040
C     I2 - NUMBER OF TREATMENT LEVELS IN DIRECTION B (NUMBER OF COLUMNS)COBM0041
C     F5.3 - POWER TRANSFORMATION FOR ODDS NORMAL MODEL                 COBM0042
C     F5.3 - POWER TRANSFORMATION FOR PER CENT NORMAL MODEL             COBM0043
C     I3 - NUMBER OF ITERATIONS ALLOWED                                 COBM0044
C 3.DATA - SETS OF OBSERVATIONS FOR EACH BLOCK - ONE SET PER CARD WITH  COBM0045
C     N AND Y ALTERNATELY - PROCEED DOWN COLUMNS (8F6.3)                COBM0046
C 4.99 IN COLS. 79-80 INDICATES END OF DATA, ANOTHER DATA DECK TO FOLLOWCOBM0047
C   98 IN COLS. 79-80 INDICATES END OF JOB, CALL EXIT AFTER THIS DECK   COBM0048
C 5.REPEAT 1. TO 4. AS REQUIRED                                         COBM0049
C                                                                       COBM0050
      DIMENSION Y2( 64),R( 64),S( 64),Y1(8),TL(7,5),TL1(7,5),RS(7,5),RS1COBM0051
     1(6,4),B2(5),A1(2),TL2(7,5),RS2(7,5),X(8),X1(8)                    COBM0052
      COMMON T(16),T3(16),TA( 8),TB(4),T1( 8),T2(4),S1(16,3),TOT,TOT1,N,COBM0053
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     1N1,MA,MB,IREP,T4(16),NI,TITL(12)                                  COBM0054
  189 FORMAT(25HOVARIABLES AS PROPORTIONS)                              COBM0055
  188 FORMAT(22HOTRANSFORMED VARIABLES)                                 COBM0056
  187 FORMAT(8E12.4)                                                    COBM0057
  186 FORMAT(15HONO INTERACTION33X11HINTERACTION/)                      COBM0058
  185 FORMAT(15HONO INTERACTION/)                                       COBM0059
  184 FORMAT(48HOEXPECTED VALUES AND DEVIATIONS - BINOMIAL MODEL)       COBM0060
  183 FORMAT(52HOEXPECTED VALUES AND DEVIATIONS - ARSIN NORMAL MODEL)   COBM0061
  182 FORMAT(60HOEXPECTED VALUES AND DEVIATIONS - 100*R/N NORMAL MODEL -COBM0062
     1 C = F7.4)                                                        COBM0063
  181 FORMAT(54HOEXPECTED VALUES AND DEVIATIONS - 100*R/N NORMAL MODEL) COBM0064
  180 FORMAT(60HOEXPECTED VALUES AND DEVIATIONS - R/(N-R) NORMAL MODEL -COBM0065
     1 C = F7.4)                                                        COBM0066
   99 FORMAT(54HOEXPECTED VALUES AND DEVIATIONS - R/(N-R) NORMAL MODEL) COBM0067
   98 FORMAT(52HOEXPECTED VALUES AND DEVIATIONS - LOGIT NORMAL MODEL)   COBM0068
   97 FORMAT(1X)                                                        COBM0069
   96 FORMAT(33HOINCORRECT NUMBER OF OBSERVATIONS)                      COBM0070
   95 FORMAT(4(F10.0,F5.0))                                             COBM0071
   94 FORMAT(18HOINTERACTION MODEL)                                     COBM0072
   93 FORMAT(20X6E14.6)                                                 COBM0073
   92 FORMAT(19HOVARIABLES OBSERVED/)                                   COBM0074
   91 FORMAT(20H BINOMIAL LIKELIHOOD1XE13.6)                            COBM0075
   90 FORMAT(6HOLOG R15X12HLOGIT NORMAL2X2(12HR/(N-R) NORM2X),2(12H100*RCOBM0076
     1/N NORM2X),12HARSIN NORMAL4X8HBINOMIAL)                           COBM0077
   89 FORMAT(50X2(4HC = F7.4,17X))                                      COBM0078
   88 FORMAT(11HOTREATMENTS9X7E14.6)                                    COBM0079
   87 FORMAT(12H TREATMENT A8X7E14.6)                                   COBM0080
   86 FORMAT(12H TREATMENT B8X7E14.6)                                   COBM0081
   85 FORMAT(12H INTERACTION8X7E14.6)                                   COBM0082
   84 FORMAT(21H LACK OF FIT OF MODELE13.6,6E14.6)                      COBM0083
   83 FORMAT(I1,4I2,2F5.3,I3)                                           COBM0084
   82 FORMAT(1H112A6)                                                   COBM0085
   81 FORMAT(8F6.3,30X,I2)                                              COBM0086
   80 FORMAT(12A6)                                                      COBM0087
      L=8                                                               COBM0088
      M=5                                                               COBM0089
   20 READ(L,80)TITL                                                    COBM0090
      READ(L,83)NJ,N1,IREP,MA,MB,A1,NI                                  COBM0091
      NJ=NJ+1                                                           COBM0092
      N=N1*IREP                                                         COBM0093
      I=0                                                               COBM0094
   22 I=I+1                                                             COBM0095
      READ(L,81)Y1,ID                                                   COBM0096
      IF(ID-98)27,23,23                                                 COBM0097
   27 IR=2*IREP                                                         COBM0098
      DO 29 J=1,IR,2                                                    COBM0099
      K=N1*(J-1)/2+I                                                    COBM0100
      R(K)=Y1(J+1)                                                      COBM0101
      Y2(K)=Y1(J)                                                       COBM0102
   29 CONTINUE                                                          COBM0103
      GO TO 22                                                          COBM0104
   23 N2=I-1                                                            COBM0105
      IF(N1-N2)2,4,2                                                    COBM0106
    2 WRITE(M,96)                                                       COBM0107
    6 CALL EXIT                                                         COBM0108
    4 DO 10 KK=1,7                                                      COBM0109
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      KKK2=KK/2                                                    COBM0110
      K2=1+KK/2                                                    COBM0111
      GO TO (62,62,63,62,63,62,5),KK                               COBM0112
   62 A3=1.0                                                       COBM0113
      GO TO 3                                                      COBM0114
   63 A3=A1(KKK2)                                                  COBM0115
    3 Y=0.0                                                        COBM0116
      DO 110 I=1,N                                                 COBM0117
      GO TO (34,34,34,35,35,35,5),KK                               COBM0118
   34 IF(Y2(I)-R(I))46,46,36                                       COBM0119
   46 S(I)=10.0**10                                                COBM0120
      GO TO 78                                                     COBM0121
   36 S(I)=R(I)/(Y2(I)-R(I))                                       COBM0122
      GO TO 14                                                     COBM0123
   35 S(I)=100.0*R(I)/Y2(I)                                        COBM0124
   14 IF(R(I))17,17,78                                             COBM0125
   17 S(I)=10.0**(-10)                                             COBM0126
   78 Y=Y+ALOG(S(I))/FLOAT(N)                                      COBM0127
  110 CONTINUE                                                     COBM0128
      Y=EXP(Y)                                                     COBM0129
    5 DO 12 I=1,N                                                  COBM0130
      GO TO (1,13,13,13,13,18,49),KK                               COBM0131
    1 S(I)=ALOG(S(I))                                              COBM0132
      GO TO 12                                                     COBM0133
   13 S(I)=(S(I)**A3-1.0)/A3/Y**(A3-1.0)                           COBM0134
      GO TO 12                                                     COBM0135
   18 S(I)=ARSIN(SQRT(S(I)/100.0))                                 COBM0136
      GO TO 12                                                     COBM0137
   49 S(I)=Y2(I)                                                   COBM0138
   12 CONTINUE                                                     COBM0139
      TOT=0.0                                                      COBM0140
      TOT1=0.0                                                     COBM0141
      DO 24 I=1,N1                                                 COBM0142
      T(I)=0.0                                                     COBM0143
      T3(I)=0.0                                                    COBM0144
      DO 48 J=1,IREP                                               COBM0145
      K=(J-1)*N1+I                                                 COBM0146
      TOT=TOT+S(K)/FLOAT(N)                                        COBM0147
      TOT1=TOT1+R(K)/FLOAT(N)                                      COBM0148
      T3(I)=T3(I)+R(K)/FLOAT(IREP)                                 COBM0149
   48 T(I)=T(I)+S(K)/FLOAT(IREP)                                   COBM0150
      T4(I)=T(I)                                                   COBM0151
      IF(KK-7)24,50,24                                             COBM0152
   50 IF(T3(I))59,59,79                                            COBM0153
   59 T(I)=-10.0                                                   COBM0154
      GO TO 24                                                     COBM0155
   79 IF(T(I)-T3(I))100,100,101                                    COBM0156
  100 T(I)=10.0                                                    COBM0157
      GO TO 24                                                     COBM0158
  101 T(I)=ALOG(T3(I)/(T(I)-T3(I)))                                COBM0159
   24 CONTINUE                                                     COBM0160
      IF(KK-7)44,51,44                                             COBM0161
   51 TOT=ALOG(TOT1/(TOT-TOT1))                                    COBM0162
   44 DO 21 I=1,MB                                                 COBM0163
      T2(I)=0.0                                                    COBM0164
   21 TB(I)=0.0                                                    COBM0165
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      DO 54 I=1,MA                                                      COBM0166
      T1(I)=0.0                                                         COBM0167
      TA(I)=0.0                                                         COBM0168
      DO 19 J=1,MB                                                      COBM0169
      K=(J-1)*MA+I                                                      COBM0170
      IF(KK-7)53,52,53                                                  COBM0171
   52 DO 45 K3=1,IREP                                                   COBM0172
      K1=(K3-1)*N1+K                                                    COBM0173
      T1(I)=T1(I)+R(K1)                                                 COBM0174
      T2(J)=T2(J)+R(K1)                                                 COBM0175
      TA(I)=TA(I)+Y2(K1)                                                COBM0176
   45 TB(J)=TB(J)+Y2(K1)                                                COBM0177
      GO TO 19                                                          COBM0178
   53 TA(I)=TA(I)+T(K)/FLOAT(MB)                                        COBM0179
      TB(J)=TB(J)+T(K)/FLOAT(MA)                                        COBM0180
   19 CONTINUE                                                          COBM0181
      IF(KK-7)54,38,54                                                  COBM0182
   38 IF(T1(I))102,102,103                                              COBM0183
  102 TA(I)=-10.0                                                       COBM0184
      GO TO 54                                                          COBM0185
  103 IF(TA(I)-T1(I))104,104,105                                        COBM0186
  104 TA(I)=10.0                                                        COBM0187
      GO TO 54                                                          COBM0188
  105 TA(I)=ALOG(T1(I)/(TA(I)-T1(I)))                                   COBM0189
   54 CONTINUE                                                          COBM0190
      IF(KK-7)55,56,55                                                  COBM0191
   56 DO 57 J=1,MB                                                      COBM0192
      IF(T2(J))106,106,107                                              COBM0193
  106 TB(J)=-10.0                                                       COBM0194
      GO TO 57                                                          COBM0195
  107 IF(TB(J)-T2(J))108,108,109                                        COBM0196
  108 TB(J)=10.0                                                        COBM0197
      GO TO 57                                                          COBM0198
  109 TB(J)=ALOG(T2(J)/(TB(J)-T2(J)))                                   COBM0199
   57 CONTINUE                                                          COBM0200
      IF(MA-1)111,55,111                                                COBM0201
  111 IF(MB-1)74,55,74                                                  COBM0202
   74 CALL CLIB                                                         COBM0203
      GO TO 73                                                          COBM0204
   55 DO 75 I1=1,MA                                                     COBM0205
      DO 75 J1=1,MB                                                     COBM0206
      I=(J1-1)*MA+I1                                                    COBM0207
      S1(I,1)=T(I)-TA(I1)+TOT                                           COBM0208
      S1(I,2)=T(I)-TB(J1)+TOT                                           COBM0209
   75 S1(I,3)=TA(I1)+TB(J1)-TOT                                         COBM0210
   73 GO TO (7,112,112),NJ                                              COBM0211
  112 GO TO (116,116,144,116,144,116,116),KK                            COBM0212
  144 IF(A1(KKK2)-1.0)116,7,116                                         COBM0213
  116 DO 138 I=1,8                                                      COBM0214
      X1(I)=0.0                                                         COBM0215
  138 X(I)=0.0                                                          COBM0216
      IF(KK-1)145,145,118                                               COBM0217
  118 IF(KKK*(MA*(IREP+2)+5)-56)117,117,145                             COBM0218
  145 WRITE(M,82)TITL                                                   COBM0219
      KKK=1                                                             COBM0220
      GO TO (7,142,143),NJ                                              COBM0221
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142 WRITE(M,188)                                                    COBM0222
    GO TO 117                                                       COBM0223
143 WRITE(M,189)                                                    COBM0224
117 GO TO (119,120,121,122,123,124,125),KK                          COBM0225
119 WRITE(M,98)                                                     COBM0226
    GO TO 126                                                       COBM0227
120 WRITE(M,99)                                                     COBM0228
    GO TO 126                                                       COBM0229
121 WRITE(M,180)A1(KKK2)                                            COBM0230
    GO TO 126                                                       COBM0231
122 WRITE(M,181)                                                    COBM0232
    GO TO 126                                                       COBM0233
123 WRITE(M,182)A1(KKK2)                                            COBM0234
    GO TO 126                                                       COBM0235
124 WRITE(M,183)                                                    COBM0236
    GO TO 126                                                       COBM0237
125 WRITE(M,184)                                                    COBM0238
126 IF(IREP-1)127,127,128                                           COBM0239
127 WRITE(M,185)                                                    COBM0240
    IJK=MB                                                          COBM0241
    GO TO 129                                                       COBM0242
128 WRITE(M,186)                                                    COBM0243
    IJK=MB+4                                                        COBM0244
129 DO 113 I=1,MA                                                   COBM0245
    IF(KK-7)130,132,130                                             COBM0246
132 DO 131 J=1,MB                                                   COBM0247
    II=(J-1)*MA+I                                                   COBM0248
    GO TO (7,149,150),NJ                                            COBM0249
149 Y1(J)=0.0                                                       COBM0250
    DO 133 K1=1,IREP                                                COBM0251
    K=(K1-1)*N1+(J-1)*MA+I                                          COBM0252
133 Y1(J)=Y1(J)+Y2(K)                                               COBM0253
150 X(J)=EXP(S1(II,3))/(1.0+EXP(S1(II,3)))                          COBM0254
    GO TO (7,146,147),NJ                                            COBM0255
146 X(J)=X(J)+Y1(J)                                                 COBM0256
147 IF(IREP-1)131,131,134                                           COBM0257
134 X(J+4)=EXP(T(II))/(1.0+EXP(T(II)))                              COBM0258
    GO TO (7,148,131),NJ                                            COBM0259
148 X(J+4)=X(J+4)+Y1(J)                                             COBM0260
131 CONTINUE                                                        COBM0261
    GO TO 135                                                       COBM0262
130 DO 136 J=1,MB                                                   COBM0263
    II=(J-1)*MA+I                                                   COBM0264
    X(J)=S1(II,3)                                                   COBM0265
    IF(IREP-1)136,136,137                                           COBM0266
137 X(J+4)=T(II)                                                    COBM0267
136 CONTINUE                                                        COBM0268
    GO TO (7,135,152),NJ                                            COBM0269
152 IF(IREP-1)159,159,160                                           COBM0270
159 KJ=1                                                            COBM0271
    GO TO 161                                                       COBM0272
160 KJ=2                                                            COBM0273
161 DO 151 J1=1,MB                                                  COBM0274
    DO 151 K=1,KJ                                                   COBM0275
    J=J1+(K-1)*6                                                    COBM0276
    GO TO (153,154,154,154,154,155,135),KK                          COBM0277
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153 X(J)=EXP(X(J))                                                    COBM0278
    GO TO 156                                                         COBM0279
154 X(J)=A3*Y**(A3-1.0)*X(J)+1.0                                      COBM0280
    IF(X(J))167,167,168                                               COBM0281
167 X(J)=10.0**(-10.0/A3)                                             COBM0282
    GO TO 156                                                         COBM0283
168 X(J)=X(J)**(1.0/A3)                                               COBM0284
    GO TO 156                                                         COBM0285
155 X(J)=SIN(X(J))**2                                                 COBM0286
156 GO TO (157,157,157,158,158,151,135),KK                            COBM0287
157 X(J)=X(J)/(1.0+X(J))                                              COBM0288
    GO TO 151                                                         COBM0289
158 X(J)=X(J)/100.0                                                   COBM0290
151 CONTINUE                                                          COBM0291
135 WRITE(M,187)(X(J),J=1,IJK)                                        COBM0292
    DO 114 K1=1,IREP                                                  COBM0293
    DO 115 J=1,MB                                                     COBM0294
    K=(K1-1)*N1+(J-1)*MA+I                                            COBM0295
    IF(KK-7)139,140,139                                               COBM0296
140 GO TO (7,162,163),NJ                                              COBM0297
162 X1(J)=R(K)-X(J)*FLOAT(Y2(K))/FLOAT(Y1(J))                         COBM0298
    X1(J+4)=R(K)-X(J+4)*FLOAT(Y2(K))/FLOAT(Y1(J))                     COBM0299
    GO TO 115                                                         COBM0300
139 GO TO (7,165,163),NJ                                              COBM0301
163 X1(J)=R(K)/Y2(K)                                                  COBM0302
    GO TO 166                                                         COBM0303
165 X1(J)=S(K)                                                        COBM0304
166 IF(IREP-1)164,164,141                                             COBM0305
141 X1(J+4)=X1(J)-X(J+4)                                              COBM0306
164 X1(J)=X1(J)-X(J)                                                  COBM0307
115 CONTINUE                                                          COBM0308
114 WRITE(M,187)(X1(J),J=1,IJK)                                       COBM0309
113 WRITE(M,97)                                                       COBM0310
    KKK=KKK+1                                                         COBM0311
  7 DO 37 I=1,5                                                       COBM0312
    TL2(KK,I)=0.0                                                     COBM0313
    TL1(KK,I)=0.0                                                     COBM0314
 37 TL(KK,I)=0.0                                                      COBM0315
    DO 26 I1=1,MA                                                     COBM0316
    DO 26 J1=1,MB                                                     COBM0317
    I=(J1-1)*MA+I1                                                    COBM0318
    DO 26 J=1,IREP                                                    COBM0319
    K=(J-1)*N1+I                                                      COBM0320
    B2(1)=T(I)                                                        COBM0321
    B2(2)=TOT                                                         COBM0322
    B2(3)=S1(I,1)                                                     COBM0323
    B2(4)=S1(I,2)                                                     COBM0324
    B2(5)=S1(I,3)                                                     COBM0325
    IF(IREP-1)28,28,9                                                 COBM0326
 28 DO 47 I2=1,5                                                      COBM0327
    IF(KK-7)61,60,61                                                  COBM0328
 61 B3=TRANS(K2,B2(I2),A3,Y)                                          COBM0329
    B3=ALOG(B3/(1.0-B3))                                              COBM0330
    GO TO 47                                                          COBM0331
 60 B3=B2(I2)                                                         COBM0332
 47 TL2(KK,I2)=TL2(KK,I2)+CLB(Y2(K),B3,R(K),7)                        COBM0333
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      B2(1)=S1(I,3)                                                    COBM0334
      B2(2)=TOT                                                        COBM0335
      B2(3)=TB(J1)                                                     COBM0336
      B2(4)=TA(I1)                                                     COBM0337
      B2(5)=T(I)                                                       COBM0338
    9 DO 26 K1=1,5                                                     COBM0339
      IF(KK-7)25,26,25                                                 COBM0340
   25 B3=TRANS(K2,B2(K1),A3,Y)                                         COBM0341
      B3=ALOG(B3/(1.0-B3))                                             COBM0342
      TL1(KK,K1)=TL1(KK,K1)+CLB(Y2(K),B3,R(K),7)                       COBM0343
   26 TL(KK,K1)=TL(KK,K1)+CLB(S(K),B2(K1),R(K),KK)                     COBM0344
      IF(KK-7)31,32,32                                                 COBM0345
   31 DO 39 I=1,4                                                      COBM0346
      IF(TL(KK,I))39,39,69                                             COBM0347
   69 TL(KK,I)=-N*ALOG(TL(KK,I))/2.0                                   COBM0348
   39 CONTINUE                                                         COBM0349
      IF(IREP-1)32,32,33                                               COBM0350
   33 IF(TL(KK,5))32,32,70                                             COBM0351
   70 TL(KK,5)=-N*ALOG(TL(KK,5))/2.0                                   COBM0352
   32 DO 72 I=2,5                                                      COBM0353
      IF(KK-7)30,40,30                                                 COBM0354
   30 RS1(KK,I-1)=TL1(KK,I)-TL1(KK,1)                                  COBM0355
   40 RS(KK,I-1)=TL(KK,I)-TL(KK,1)                                     COBM0356
      IF(IREP-1)65,65,72                                               COBM0357
   65 RS2(KK,I-1)=TL2(KK,I)-TL2(KK,1)                                  COBM0358
   72 CONTINUE                                                         COBM0359
   10 CONTINUE                                                         COBM0360
      TL1(7,1)=TL(7,1)                                                 COBM0361
      IF(IREP-1)68,68,66                                               COBM0362
   66 SLM=TL(7,1)                                                      COBM0363
      GO TO 67                                                         COBM0364
   68 SLM=TL2(7,1)                                                     COBM0365
   67 DO 64 KK=1,7                                                     COBM0366
      RS2(KK,5)=TL2(KK,1)-SLM                                          COBM0367
   64 RS(KK,5)=TL1(KK,1)-SLM                                           COBM0368
      DO 169 K=1,N                                                     COBM0369
      IF(R(K))169,169,170                                              COBM0370
  170 IF(Y2(K)-R(K))169,169,171                                        COBM0371
  171 SLM=SLM+(Y2(K)+0.5)*ALOG(Y2(K))-(R(K)+0.5)*ALOG(R(K))-(Y2(K)-R(K)+COBM0372
     10.5)*ALOG(Y2(K)-R(K))+(1.0/R(K)+1.0/(Y2(K)-R(K))-1.0/Y2(K))/12.0-ACOBM0373
     1LOG(6.283185)*0.5                                                COBM0374
  169 CONTINUE                                                         COBM0375
      WRITE(M,82)TITL                                                  COBM0376
      WRITE(M,92)                                                      COBM0377
      DO 58 I=1,MA                                                     COBM0378
      DO 76 K1=1,IREP                                                  COBM0379
      DO 77 J=1,MB                                                     COBM0380
      K=(K1-1)*N1+(J-1)*MA+I                                           COBM0381
      TB(J)=Y2(K)                                                      COBM0382
   77 T2(J)=R(K)                                                       COBM0383
   76 WRITE(M,95)(TB(J),T2(J),J=1,MB)                                  COBM0384
   58 WRITE(M,97)                                                      COBM0385
      WRITE(M,90)                                                      COBM0386
      WRITE(M,89)A1                                                    COBM0387
      WRITE(M,88)(RS(I,1),I=1,7)                                       COBM0388
      WRITE(M,93)(RS1(I,1),I=1,6)                                      COBM0389
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      WRITE(M,87)(RS(I,2),I=1,7)                                        COBM0390
      WRITE(M,93)(RS1(I,2),I=1,6)                                       COBM0391
      WRITE(M,86)(RS(I,3),I=1,7)                                        COBM0392
      WRITE(M,93)(RS1(I,3),I=1,6)                                       COBM0393
      IF(IREP-1)41,41,42                                                COBM0394
   42 WRITE(M,85)(RS(I,4),I=1,7)                                        COBM0395
      WRITE(M,93)(RS1(I,4),I=1,6)                                       COBM0396
   41 WRITE(M,84)(RS(I,5),I=1,7)                                        COBM0397
      WRITE(M,91)SLM                                                    COBM0398
      IF(IREP-1)43,43,71                                                COBM0399
   43 WRITE(M,94)                                                       COBM0400
      WRITE(M,88)(RS2(I,1),I=1,7)                                       COBM0401
      WRITE(M,87)(RS2(I,2),I=1,7)                                       COBM0402
      WRITE(M,86)(RS2(I,3),I=1,7)                                       COBM0403
      WRITE(M,85)(RS2(I,4),I=1,7)                                       COBM0404
      WRITE(M,84)(RS2(I,5),I=1,5)                                       COBM0405
   71 IF(ID-9816,6,20                                                   COBM0406
      END                                                               COBM0407
// DUP                                                                  COBM0408
*DELETE              COBM                                              COBM0409
*STORE      WS  UA  COBM                                               COBM0410

// JOB                                                                  CLB 0000
// FOR                                                                  CLB 0001
*ONE WORD INTEGERS                                                      CLB 0002
*LIST ALL                                                              CLB 0003
*EXTENDED PRECISION                                                    CLB 0004
      FUNCTION CLB(X,Y,Z,I)                                             CLB 0005
      IF(I-7)1,2,2                                                      CLB 0006
    1 IF(X-Y)7,3,7                                                      CLB 0007
    7 CLB=(X-Y)**2                                                      CLB 0008
      GO TO 4                                                           CLB 0009
    2 IF(ABS(Y)-60.0)10,10,3                                            CLB 0010
   10 U=EXP(Y)/(1.0+EXP(Y))                                             CLB 0011
      IF(U-10.0**(-10))3,3,5                                            CLB 0012
    5 IF(1.0-10.0**(-10)-U)3,3,6                                        CLB 0013
    3 CLB=0.0                                                           CLB 0014
      GO TO 4                                                           CLB 0015
    6 CLB=Z*Y-X*ALOG(1.0+EXP(Y))                                        CLB 0016
    4 RETURN                                                            CLB 0017
      END                                                               CLB 0018
// DUP                                                                  CLB 0019
*DELETE              CLB                                               CLB 0020
*STORE      WS  UA  CLB                                                CLB 0021

// JOB                                                                  CLIB0000
// FOR                                                                  CLIB0001
*ONE WORD INTEGERS                                                      CLIB0002
*LIST ALL                                                              CLIB0003
*EXTENDED PRECISION                                                    CLIB0004
      SUBROUTINE CLIB                                                   CLIB0005
      DIMENSION SS(25,25),S(25),S2(25)                                  CLIB0006
      COMMON T(16),T3(16),TA( 8),TB(4),T1( 8),T2(4),S1(16,3),TOT,TOT1,N,CLIB0007
     1N1,MA,MB,IREP,T4(16),NI,TITL(12)                                  CLIB0008
   92 FORMAT(1H112A6)                                                   CLIB0009
   91 FORMAT(32HONO CONVERGENCE - PARAMETERS ARE/)                      CLIB0010
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90 FORMAT(11E12.5)                                                  CLIB0011
   M=5                                                              CLIB0012
   IJ=1                                                             CLIB0013
   DO 51 K=1,N1                                                     CLIB0014
   T4(K)=FLOAT(IREP)*T4(K)                                          CLIB0015
51 T3(K)=FLOAT(IREP)*T3(K)                                          CLIB0016
   DO 25 KK=1,2                                                     CLIB0017
   GO TO (4,5),KK                                                   CLIB0018
 4 M1=MA                                                            CLIB0019
   M2=N1+MA+1                                                       CLIB0020
   M3=MB                                                            CLIB0021
   GO TO 8                                                          CLIB0022
 5 M1=MB                                                            CLIB0023
   M2=N1+MB+1                                                       CLIB0024
   M3=MA                                                            CLIB0025
 8 S2(M2)=TOT                                                       CLIB0026
   DO 1 I=1,N1                                                      CLIB0027
 1 S2(I)=T(I)                                                       CLIB0028
   DO 2 I=1,M1                                                      CLIB0029
   II=I+N1                                                          CLIB0030
 2 S2(II)=0.0                                                       CLIB0031
   DO 27 JK=1,NI                                                    CLIB0032
   DO 10 I=1,M2                                                     CLIB0033
   S(I)=0.0                                                         CLIB0034
   DO 10 J=1,M2                                                     CLIB0035
10 SS(I,J)=0.0                                                      CLIB0036
   DO 17 I1=1,MA                                                    CLIB0037
   DO 17 J1=1,MB                                                    CLIB0038
   I=(J1-1)*MA+I1                                                   CLIB0039
   GO TO (12,13),KK                                                 CLIB0040
12 K=I1+N1                                                          CLIB0041
   GO TO 22                                                         CLIB0042
13 K=J1+N1                                                          CLIB0043
22 IF(ABS(S2(I))-60.0)7,7,9                                         CLIB0044
 9 SS(I,I)=0.0                                                      CLIB0045
   IF(S2(I))11,11,14                                                CLIB0046
11 S(I)=T3(I)+S2(K)                                                 CLIB0047
   GO TO 15                                                         CLIB0048
14 S(I)=T3(I)+S2(K)-T4(I)                                           CLIB0049
   GO TO 15                                                         CLIB0050
 7 S3=EXP(S2(I))                                                    CLIB0051
   S(I)=T3(I)+S2(K)-T4(I)*S3/(1.0+S3)                               CLIB0052
   SS(I,I)=-T4(I)*S3/(1.0+S3)/(1.0+S3)                              CLIB0053
15 SS(K,I)=1.0                                                      CLIB0054
17 SS(I,K)=SS(K,I)                                                  CLIB0055
   DO 21 I=1,M1                                                     CLIB0056
   II=I+N1                                                          CLIB0057
   S(M2)=S(M2)-FLOAT(M3)*S2(II)                                     CLIB0058
   SS(II,M2)=-FLOAT(M3)                                             CLIB0059
21 SS(M2,II)=SS(II,M2)                                              CLIB0060
   GO TO (28,29),KK                                                 CLIB0061
28 DO 30 I=1,MA                                                     CLIB0062
   II=I+N1                                                          CLIB0063
   S(II)=-FLOAT(M3)*S2(M2)                                          CLIB0064
   DO 30 J=1,MB                                                     CLIB0065
   K=(J-1)*MA+I                                                     CLIB0066
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```
30 S(II)=S(II)+S2(K)                                                    CLIB0067
   GO TO 31                                                             CLIB0068
29 DO 26 J=1,MB                                                         CLIB0069
   JJ=J+M1                                                              CLIB0070
   S(JJ)=-FLOAT(M3)*S2(M2)                                              CLIB0071
   DO 26 I=1,MA                                                         CLIB0072
   K=(J-1)*MA+I                                                         CLIB0073
26 S(JJ)=S(JJ)+S2(K)                                                    CLIB0074
31 CALL MATVJ(SS,M2,S,1,DET)                                            CLIB0075
   DO 23 I=1,M2                                                         CLIB0076
23 S2(I)=S2(I)-S(I)                                                     CLIB0077
   DO 24 I=1,M2                                                         CLIB0078
   IF(ABS(S(I)/S2(I))-0.0001)24,24,27                                   CLIB0079
24 CONTINUE                                                             CLIB0080
   GO TO 3                                                              CLIB0081
27 CONTINUE                                                             CLIB0082
   GO TO (18,16),IJ                                                     CLIB0083
18 WRITE(M,92)TITL                                                      CLIB0084
   IJ=2                                                                 CLIB0085
16 WRITE(M,91)                                                          CLIB0086
   WRITE(M,90)(S2(I),I=1,M2)                                            CLIB0087
 3 DO 25 I=1,N1                                                         CLIB0088
25 S1(I,KK)=S2(I)                                                       CLIB0089
   M1=MA+1                                                              CLIB0090
   M2=MA+MB+1                                                           CLIB0091
   M3=MA+MB+3                                                           CLIB0092
   TOT1=FLOAT(N)*TOT1                                                   CLIB0093
   A=0.0                                                                CLIB0094
   B=0.0                                                                CLIB0095
   DO 32 I=1,MA                                                         CLIB0096
32 A=A+TA(I)/FLOAT(MA)                                                  CLIB0097
   DO 33 J=1,MB                                                         CLIB0098
33 B=B+TB(J)/FLOAT(MB)                                                  CLIB0099
   S2(1)=A+B-TOT                                                        CLIB0100
   DO 34 I=1,MA                                                         CLIB0101
34 S2(I+1)=TA(I)-A                                                      CLIB0102
   DO 35 J=1,MB                                                         CLIB0103
   JJ=J+M1                                                              CLIB0104
35 S2(JJ)=TB(J)-B                                                       CLIB0105
   S2(M2+1)=0.0                                                         CLIB0106
   S2(M3)=0.0                                                           CLIB0107
   DO 36 JK=1,NI                                                        CLIB0108
   DO 43 I=1,M3                                                         CLIB0109
   S(I)=0.0                                                             CLIB0110
   DO 43 J=1,M3                                                         CLIB0111
43 SS(I,J)=0.0                                                          CLIB0112
   S(1)=TOT1                                                            CLIB0113
   DO 38 I=1,MA                                                         CLIB0114
   S(M2+1)=S(M2+1)+S2(I+1)                                              CLIB0115
   SS(M2+1,I+1)=1.0                                                     CLIB0116
   SS(I+1,M2+1)=SS(M2+1,I+1)                                            CLIB0117
   S(I+1)=T1(I)+S2(M2+1)                                                CLIB0118
   DO 39 J=1,MB                                                         CLIB0119
   JJ=J+M1                                                              CLIB0120
   K=(J-1)*MA+I                                                         CLIB0121
   A=EXP(S2(1)+S2(I+1)+S2(JJ))                                          CLIB0122
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```
      SS(I+1,JJ)=-T4(K)*A/(1.0+A)/(1.0+A)                              CLIB0123
      SS(1,1)=SS(1,1)+SS(I+1,JJ)                                       CLIB0124
      S(1)=S(1)-T4(K)*A/(1.0+A)                                        CLIB0125
      SS(JJ,I+1)=SS(I+1,JJ)                                            CLIB0126
      SS(1,I+1)=SS(1,I+1)+SS(I+1,JJ)                                   CLIB0127
      SS(I+1,I+1)=SS(I+1,I+1)+SS(I+1,JJ)                               CLIB0128
   39 S(I+1)=S(I+1)-T4(K)*A/(1.0+A)                                    CLIB0129
   38 SS(I+1,1)=SS(1,I+1)                                              CLIB0130
      DO 40 J=1,MB                                                     CLIB0131
      JJ=J+M1                                                          CLIB0132
      S(M3)=S(M3)+S2(JJ)                                               CLIB0133
      SS(M3,JJ)=1.0                                                    CLIB0134
      SS(JJ,M3)=SS(M3,JJ)                                              CLIB0135
      S(JJ)=T2(J)+S2(M3)                                               CLIB0136
      DO 41 I=1,MA                                                     CLIB0137
      K=(J-1)*MA+I                                                     CLIB0138
      A=EXP(S2(1)+S2(I+1)+S2(JJ))                                      CLIB0139
      SS(1,JJ)=SS(1,JJ)-T4(K)*A/(1.0+A)/(1.0+A)                        CLIB0140
      SS(JJ,JJ)=SS(JJ,JJ)-T4(K)*A/(1.0+A)/(1.0+A)                      CLIB0141
   41 S(JJ)=S(JJ)-T4(K)*A/(1.0+A)                                      CLIB0142
   40 SS(JJ,1)=SS(1,JJ)                                                CLIB0143
      CALL MATVJ(SS,M3,S,1,DET)                                        CLIB0144
      DO 48 I=1,M3                                                     CLIB0145
   48 S2(I)=S2(I)-S(I)                                                 CLIB0146
      DO 49 I=1,M2                                                     CLIB0147
      IF(ABS(S(I)/S2(I))-0.0001)49,49,36                               CLIB0148
   49 CONTINUE                                                         CLIB0149
      GO TO 6                                                          CLIB0150
   36 CONTINUE                                                         CLIB0151
      GO TO (19,20),IJ                                                 CLIB0152
   19 WRITE(M,92)TITL                                                  CLIB0153
   20 WRITE(M,91)                                                      CLIB0154
      WRITE(M,90)(S2(I),I=1,M3)                                        CLIB0155
    6 DO 50 I=1,MA                                                     CLIB0156
      DO 50 J=1,MB                                                     CLIB0157
      JJ=J+M1                                                          CLIB0158
      K=(J-1)*MA+I                                                     CLIB0159
   50 S1(K,3)=S2(1)+S2(I+1)+S2(JJ)                                     CLIB0160
      RETURN                                                           CLIB0161
      END                                                              CLIB0162
// DUP                                                                 CLIB0163
*DELETE            CLIB                                              CLIB0164
*STORE      WS  UA  CLIB                                              CLIB0165

// JOB                                                                 TRANS000
// FOR                                                                 TRANS001
*ONE WORD INTEGERS                                                     TRANS002
*LIST ALL                                                            TRANS003
*EXTENDED PRECISION                                                  TRANS004
      FUNCTION TRANS(I,Y,A,B)                                          TRANS005
      X=Y                                                              TRANS006
      GO TO (1,2,2,4),I                                                TRANS007
    1 TRANS=EXP(X)/(1.0+EXP(X))                                        TRANS008
      GO TO 5                                                          TRANS009
    2 X=A*B**(A-1.0)*X+1.0                                             TRANS010
      M1=X/ABS(X)                                                      TRANS011
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      X=M1*ABS(X)**(1.0/A)                                                  TRANS012
      GO TO (1,3,9,4),I                                                     TRANS013
    3 TRANS=X/(1.0+X)                                                       TRANS014
      GO TO 6                                                               TRANS015
    9 TRANS=X/100.0                                                         TRANS016
    6 IF(TRANS)7,7,8                                                        TRANS017
    7 TRANS=10.0**(-4)                                                      TRANS018
      GO TO 5                                                               TRANS019
    8 IF(1.0-TRANS)10,10,5                                                  TRANS020
   10 TRANS=1.0-10.0**(-4)                                                  TRANS021
      GO TO 5                                                               TRANS022
    4 TRANS=SIN(X)**2                                                       TRANS023
    5 RETURN                                                                TRANS024
      END                                                                   TRANS025
// DUP                                                                      TRANS026
*DELETE              TRANS                                                 TRANS027
*STORE      WS  UA  TRANS                                                  TRANS028

// JOB                                                                      ARSIN000
// FOR                                                                      ARSIN001
*EXTENDED PRECISION                                                        ARSIN002
*LIST ALL                                                                  ARSIN003
*ONE WORD INTEGERS                                                         ARSIN004
      FUNCTION ARSIN(X)                                                     ARSIN005
      IF(X-1.0)3,2,1                                                        ARSIN006
    2 ARSIN=1.5707963                                                       ARSIN007
      GO TO 1                                                               ARSIN008
    3 ARSIN=1.5707963-SQRT(1.0-X)*(1.5707288-0.2121144*X+0.074261*X*X-0.ARSIN009
     10187293*X*X*X)                                                        ARSIN010
    1 RETURN                                                                ARSIN011
      END                                                                   ARSIN012
// DUP                                                                      ARSIN013
*DELETE              ARSIN                                                 ARSIN014
*STORE      WS  UA  ARSIN                                                  ARSIN015

// JOB                                                                      MATVJ000
// FOR                                                                      MATVJ001
*ONE WORD INTEGERS                                                         MATVJ002
*LIST ALL                                                                  MATVJ003
*EXTENDED PRECISION                                                        MATVJ004
      SUBROUTINE MATVJ(A,N,B,M,DETM)                                        MATVJ005
      DIMENSION A(25,25),B(25,1),PIVOT(25),IPVOT(25),INDEX(25,25)           MATVJ006
      EQUIVALENCE (IROW,JROW),(ICLUM,JCLUM),(AMAX,T,SWAP)                   MATVJ007
      DO 20 J=1,N                                                           MATVJ008
      DETM=1.0                                                              MATVJ009
   20 IPVOT(J)=0                                                            MATVJ010
      DO 550 I=1,N                                                          MATVJ011
      AMAX=0.0                                                              MATVJ012
      DO 105 J=1,N                                                          MATVJ013
      IF(IPVOT(J)-1)60,105,60                                               MATVJ014
   60 DO 100 K=1,N                                                          MATVJ015
      IF(IPVOT(K)-1)80,100,740                                              MATVJ016
   80 IF(ABS(AMAX)-ABS(A(J,K)))85,100,100                                   MATVJ017
   85 IROW=J                                                                MATVJ018
      ICLUM=K                                                               MATVJ019
      AMAX=A(J,K)                                                           MATVJ020
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  100 CONTINUE                                                          MATVJ021
  105 CONTINUE                                                          MATVJ022
      IPVOT(ICLUM)=IPVOT(ICLUM)+1                                       MATVJ023
      IF(IROW-ICLUM)140,260,140                                         MATVJ024
  140 DETM=-DETM                                                        MATVJ025
      DO 200 L=1,N                                                      MATVJ026
      SWAP=A(IROW,L)                                                    MATVJ027
      A(IROW,L)=A(ICLUM,L)                                              MATVJ028
  200 A(ICLUM,L)=SWAP                                                   MATVJ029
      IF(M)260,260,210                                                  MATVJ030
  210 DO 250 L=1,M                                                      MATVJ031
      SWAP=B(IROW,L)                                                    MATVJ032
      B(IROW,L)=B(ICLUM,L)                                              MATVJ033
  250 B(ICLUM,L)=SWAP                                                   MATVJ034
  260 INDEX(I,1)=IROW                                                   MATVJ035
      INDEX(I,2)=ICLUM                                                  MATVJ036
      PIVOT(I)=A(ICLUM,ICLUM)                                           MATVJ037
      DETM=DETM*PIVOT(I)                                                MATVJ038
      A(ICLUM,ICLUM)=1.0                                                MATVJ039
      DO 350 L=1,N                                                      MATVJ040
  350 A(ICLUM,L)=A(ICLUM,L)/PIVOT(I)                                    MATVJ041
      IF(M)380,380,360                                                  MATVJ042
  360 DO 370 L=1,M                                                      MATVJ043
  370 B(ICLUM,L)=B(ICLUM,L)/PIVOT(I)                                    MATVJ044
  380 DO 550 L1=1,N                                                     MATVJ045
      IF(L1-ICLUM)400,550,400                                           MATVJ046
  400 T=A(L1,ICLUM)                                                     MATVJ047
      A(L1,ICLUM)=0.0                                                   MATVJ048
      DO 450 L=1,N                                                      MATVJ049
  450 A(L1,L)=A(L1,L)-A(ICLUM,L)*T                                      MATVJ050
      IF(M)550,550,460                                                  MATVJ051
  460 DO 500 L=1,M                                                      MATVJ052
  500 B(L1,L)=B(L1,L)-B(ICLUM,L)*T                                      MATVJ053
  550 CONTINUE                                                          MATVJ054
      DO 710 I=1,N                                                      MATVJ055
      L=N+1-I                                                           MATVJ056
      IF(INDEX(L,1)-INDEX(L,2))630,710,630                              MATVJ057
  630 JROW=INDEX(L,1)                                                   MATVJ058
      JCLUM=INDEX(L,2)                                                  MATVJ059
      DO 705 K=1,N                                                      MATVJ060
      SWAP=A(K,JROW)                                                    MATVJ061
      A(K,JROW)=A(K,JCLUM)                                              MATVJ062
      A(K,JCLUM)=SWAP                                                   MATVJ063
  705 CONTINUE                                                          MATVJ064
  710 CONTINUE                                                          MATVJ065
  740 IF(DETM-0.000001)750,750,760                                      MATVJ066
  750 DETM=0.0                                                          MATVJ067
  760 RETURN                                                            MATVJ068
      END                                                               MATVJ069
// DUP                                                                  MATVJ070
*DELETE              MATVJ                                             MATVJ071
*STORE       WS  UA  MATVJ                                             MATVJ072
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// JOB                                                                  COCBM000
// FOR                                                                  COCBM001
*ONE WORD INTEGERS                                                      COCBM002
*EXTENDED PRECISION                                                     COCBM003
*LIST ALL                                                               COCBM004
*IOCS(2501 READER)                                                      COCBM005
*IOCS(1403 PRINTER)                                                     COCBM006
*NAME COCBM                                                             COCBM007
C                                                                       COCBM008
C      THIS PROGRAM ANALYZES I 2*2 CONTINGENCY TABLES FOR COMMON EFFECT COCBM009
C WITHIN TABLES USING BOTH NO-INTERACTION AND INTERACTION MATHEMATICAL  COCBM010
C MODELS (ONLY NO-INTERACTION FOR I=1). POINTS ON RELATIVE LIKELIHOOD   COCBM011
C GRAPHS OF A (LOGIT DIFFERENCE) FOR THESE TWO MODELS ARE LISTED.       COCBM012
C OPTIONS ALLOW CONDITIONAL AND/OR UNCONDITIONAL ANALYSES. WITH THE     COCBM013
C CONDITIONAL ANALYSIS, THE EXACT SIGNIFICANCE LEVEL IS GIVEN FOR A     COCBM014
C SUPPLIED VALUE OF A (USUALLY A=0), SPLIT INTO TWO ONE-SIDED TESTS AND COCBM015
C GIVING THE NUMBER OF POINTS IN THE SAMPLE SUBSPACE WITH AT LEAST AS   COCBM016
C SMALL PROBABILITY AS THE ONE OBSERVED.                                COCBM017
C                                                                       COCBM018
C    THE DATA DECK FOR COBM MAY BE USED WITH ONE ADDITION TO THE CONTROLCOCBM019
C CARD.                                                                 COCBM020
C                                                                       COCBM021
C   SUBROUTINES CALLED                                                  COCBM022
C                                                                       COCBM023
C   DEN    - CALCULATES POSSIBLE OBSERVABLE VALUES OF THE SUFFICIENT    COCBM024
C            STATISTIC AND MAXIMUM LIKELIHOOD ESTIMATES FOR UNCONDITIONAL COCBM025
C            ANALYSIS                                                   COCBM026
C   COEF   - CALCULATES ALL POSSIBLE OUTCOMES FOR GIVEN SUFFICIENT      COCBM027
C            STATISTIC                                                  COCBM028
C   PCOMB  - CALCULATES PRODUCT OF COMBINATORIALS FOR A GIVEN OUTCOME   COCBM029
C   COMB   - EVALUATES THE COMBINATORIAL                                COCBM030
C   MATVK  - INVERTS MATRICES UP TO 31 BY 31                            COCBM031
C                                                                       COCBM032
C   MAKEUP OF DATA DECK                                                 COCBM033
C                                                                       COCBM034
C 1.TITLE CARD - (12A6)                                                 COCBM035
C 2.CONTROL CARD - (I1,4X,I2,12X,I3,F4.2)                               COCBM036
C      I1 - OPTION - 0 - UNCONDITIONAL AND CONDITIONAL ANALYSES         COCBM037
C                    1 - CONDITIONAL ANALYSIS                           COCBM038
C                    2 - UNCONDITIONAL ANALYSIS                         COCBM039
C      I2 - NUMBER OF 2*2 TABLES - MAXIMUM 15                           COCBM040
C      I3 - NUMBER OF ITERATIONS ALLOWED IN UNCONDITIONAL ANALYSIS      COCBM041
C      F4.2 - VALUE OF A FOR TEST OF SIGNIFICANCE (USUALLY ZERO)        COCBM042
C 3.DATA - OBSERVATIONS - ONE PER CARD WITH N THEN Y - FIRST HALF OF ALLCOCBM043
C          TABLES, THEN SECOND HALF                                     COCBM044
C 4.99 IN COLS. 79-80 INDICATES END OF DATA, ANOTHER DATA DECK TO FOLLOWCOCBM045
C   98 IN COLS. 79-80 INDICATES END OF JOB, CALL EXIT AFTER THIS DECK   COCBM046
C 5.REPEAT 1. TO 4. AS REQUIRED                                         COCBM047
C                                                                       COCBM048
      DIMENSION TITL(12),Y1(2)                                          COCBM049
      COMMON NN(15,2),NR(15,2),NRI(15),IX(14),IZ,NRJ,MM,MA,D,E,NRIJ,RL(1COCBM050
     121),A1(121),C(2),N2,JZ1,KZ1,NR2(15),NR3(15),NL,T,H(2),R,N,N1,L9(2)COCBM051
   98 FORMAT(6HOUSINGI4,10H POINTS OFI4,23H IN THE SAMPLE SUBSPACE)      COCBM052
   97 FORMAT(43HOMAXIMUM RELATIVE LIKELIHOOD OF NO EFFECT= E16.8)       COCBM053
   96 FORMAT(33HOINCORRECT NUMBER OF OBSERVATIONS)                      COCBM054
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 95 FORMAT(39HOMAXIMUM LIKELIHOOD - INTERACTION MODEL)                    COCBM055
 94 FORMAT(42HOMAXIMUM LIKELIHOOD - NO INTERACTION MODEL)                 COCBM056
 93 FORMAT(19HOMAXIMUM LIKELIHOOD)                                        COCBM057
 92 FORMAT(23HOCONDITIONAL LIKELIHOOD)                                    COCBM058
 91 FORMAT(21HOSIGNIFICANCE LEVEL = E16.8,3H  =E16.8,3H  +E16.8,9H  FOCOCBM059
   1R A =F5.2)                                                           COCBM060
 90 FORMAT(78X,I2)                                                       COCBM061
 89 FORMAT(I4,418)                                                       COCBM062
 88 FORMAT(13HOOBSERVATIONS//39H   I      N(I,1)  R(I,1)  N(I,2)  R(I,2COCBM063
   1))                                                                   COCBM064
 87 FORMAT(43HOCONDITIONAL LIKELIHOOD - INTERACTION MODEL)               COCBM065
 86 FORMAT(46HOCONDITIONAL LIKELIHOOD - NO INTERACTION MODEL)            COCBM066
 85 FORMAT(47HOCONDITIONAL RELATIVE LIKELIHOOD OF NO EFFECT= E16.8)      COCBM067
 84 FORMAT(4HOA =10E11.4/4H R =10E11.4)                                  COCBM068
 83 FORMAT(I1,4XI2,12X,I3,F4.2)                                          COCBM069
 82 FORMAT(1H1I2A6)                                                      COCBM070
 81 FORMAT(2F6.3)                                                        COCBM071
 80 FORMAT(12A6)                                                         COCBM072
    L=8                                                                  COCBM073
    M=5                                                                  COCBM074
 20 READ(L,80)TITL                                                       COCBM075
    READ(L,83)NJ,MA,NL,T                                                 COCBM076
    NJ=NJ+1                                                              COCBM077
    GO TO (19,21,25),NJ                                                  COCBM078
 19 NI=1                                                                 COCBM079
    NK=2                                                                 COCBM080
    GO TO 23                                                             COCBM081
 21 NI=1                                                                 COCBM082
    NK=1                                                                 COCBM083
    GO TO 23                                                             COCBM084
 25 NI=2                                                                 COCBM085
    NK=2                                                                 COCBM086
 23 JI=1                                                                 COCBM087
    DO 1 J=1,2                                                           COCBM088
    DO 1 I=1,MA                                                          COCBM089
    READ(L,81)(Y1(K),K=1,2)                                              COCBM090
    NR(I,J)=Y1(2)                                                        COCBM091
  1 NN(I,J)=Y1(1)                                                        COCBM092
    READ(L,90)ID                                                         COCBM093
    IF(ID-98)3,4,4                                                       COCBM094
  3 WRITE(M,96)                                                          COCBM095
  6 CALL EXIT                                                            COCBM096
  4 MM=MA-1                                                              COCBM097
    NRJ=0                                                                COCBM098
    NRIJ=0                                                               COCBM099
    DO 5 I=1,MA                                                          COCBM100
    NRI(I)=0                                                             COCBM101
    NRJ=NRJ+NR(I,1)                                                      COCBM102
    DO 5 J=1,2                                                           COCBM103
    NRIJ=NRIJ+NR(I,J)                                                    COCBM104
  5 NRI(I)=NRI(I)+NR(I,J)                                                COCBM105
    DO 7 I=1,121                                                         COCBM106
  7 A1(I)=-1.525+FLOAT(I)*0.025                                          COCBM107
    DO 42 JK=NI,NK                                                       COCBM108
    DO 30 KK=1,2                                                         COCBM109
    GO TO (43,44),JK                                                     COCBM110
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   43 GO TO (44,46),KK                                              COCBM111
   44 R=2.0                                                         COCBM112
      GO TO 45                                                      COCBM113
   46 R=2*MA                                                        COCBM114
   45 GO TO (12,18),JI                                              COCBM115
   12 WRITE(M,82)TITL                                               COCBM116
      WRITE(M,88)                                                   COCBM117
      DO 29 I=1,MA                                                  COCBM118
   29 WRITE(M,89)I,(NN(I,J),NR(I,J),J=1,2)                          COCBM119
   18 IF(MA-10)10,10,11                                             COCBM120
   11 WRITE(M,82)TITL                                               COCBM121
      JI=2                                                          COCBM122
   10 CALL DEN(KK,JK)                                               COCBM123
      X=RL(1)                                                       COCBM124
      DO 16 I=2,121                                                 COCBM125
      IF(X-RL(I))17,17,16                                           COCBM126
   17 X=RL(I)                                                       COCBM127
   16 CONTINUE                                                      COCBM128
      DO 2 I=1,121                                                  COCBM129
    2 RL(I)=RL(I)-X                                                 COCBM130
      IF(MM)8,9,8                                                   COCBM131
    9 GO TO (26,32),JK                                              COCBM132
   26 WRITE(M,92)                                                   COCBM133
      GO TO 24                                                      COCBM134
   32 WRITE(M,93)                                                   COCBM135
      GO TO 24                                                      COCBM136
    8 GO TO (33,34),JK                                              COCBM137
   33 GO TO (27,28),KK                                              COCBM138
   27 WRITE(M,86)                                                   COCBM139
      GO TO 24                                                      COCBM140
   28 WRITE(M,87)                                                   COCBM141
      GO TO 24                                                      COCBM142
   34 GO TO (35,36),KK                                              COCBM143
   35 WRITE(M,94)                                                   COCBM144
      GO TO 24                                                      COCBM145
   36 WRITE(M,95)                                                   COCBM146
   24 I1=0                                                          COCBM147
      DO 13 K3=1,2                                                  COCBM148
      DO 14 K=1,6                                                   COCBM149
      K1=((K3-1)*6+(K-1))*10+I1+1                                   COCBM150
      K2=((K3-1)*6+K)*10+I1                                         COCBM151
   14 WRITE(M,84)(A1(I),I=K1,K2),(RL(J),J=K1,K2)                    COCBM152
   13 I1=1                                                          COCBM153
      GO TO (37,38),JK                                              COCBM154
   37 WRITE(M,85)RL(61)                                             COCBM155
      WRITE(M,91)E,H,T                                              COCBM156
      WRITE(M,98)L9                                                 COCBM157
      GO TO 39                                                      COCBM158
   38 WRITE(M,97)RL(61)                                             COCBM159
   39 IF(MM)42,42,30                                                COCBM160
   30 CONTINUE                                                      COCBM161
   42 CONTINUE                                                      COCBM162
      IF(ID-98)20,6,20                                              COCBM163
      END                                                           COCBM164
// DUP                                                             COCBM165
*DELETE              COCBM                                        COCBM166
```

```
*STORE      WS  UA  COCBM                                          COCBM167

// JOB                                                             DEN 0000
// FOR                                                             DEN 0001
*ONE WORD INTEGERS                                                 DEN 0002
*LIST ALL                                                          DEN 0003
*EXTENDED PRECISION                                                DEN 0004
      SUBROUTINE DEN(KK,JK)                                        DEN 0005
      DIMENSION S(31),S2(31),SS(31,31),G(2),F(2)                   DEN 0006
      COMMON NN(15,2),NR(15,2),NRI(15),IX(14),IZ,NRJ,MM,MA,D,E,NRIJ,RL(1DEN 0007
     121),A1(121),C(2),N2,JZ1,KZ1,NR2(15),NR3(15),NL,T,H(2),R,N,N1,L9(2)DEN 0008
      GO TO (31,32),JK                                             DEN 0009
   31 IF(MM)7,11,22                                                DEN 0010
   22 GO TO (29,76),KK                                             DEN 0011
   29 IF(NN(MA,2)-NRI(MA))39,36,36                                 DEN 0012
   39 KZ1=NRI(MA)-NN(MA,2)                                         DEN 0013
      GO TO 35                                                     DEN 0014
   36 KZ1=0                                                        DEN 0015
   35 IF(NRI(MA)-NN(MA,1))23,23,24                                 DEN 0016
   23 JZ1=NRI(MA)                                                  DEN 0017
      GO TO 25                                                     DEN 0018
   24 JZ1=NN(MA,1)                                                 DEN 0019
   25 N=JZ1                                                        DEN 0020
      N1=KZ1                                                       DEN 0021
      DO 26 I=1,MM                                                 DEN 0022
      IF(NRI(I)-NN(I,2))37,37,38                                   DEN 0023
   37 NR3(I)=0                                                     DEN 0024
      GO TO 34                                                     DEN 0025
   38 NR3(I)=NRI(I)-NN(I,2)                                        DEN 0026
   34 IF(NRI(I)-NN(I,1))27,27,28                                   DEN 0027
   27 NR2(I)=NRI(I)                                                DEN 0028
      GO TO 20                                                     DEN 0029
   28 NR2(I)=NN(I,1)                                               DEN 0030
   20 N=N+NR2(I)                                                   DEN 0031
      N1=N1+NR3(I)                                                 DEN 0032
   26 CONTINUE                                                     DEN 0033
      NN1=(N1+N+1)/2                                               DEN 0034
      NN2=N1+1                                                     DEN 0035
      GO TO 12                                                     DEN 0036
   76 NN2=-NR(1,1)                                                 DEN 0037
      NN1=NR(1,2)                                                  DEN 0038
      IF(NN2-NR(1,2)+NN(1,2))77,78,78                              DEN 0039
   77 NN2=NR(1,2)-NN(1,2)                                          DEN 0040
   78 IF(NN1-NN(1,1)+NR(1,1))79,79,80                              DEN 0041
   80 NN1=NN(1,1)-NR(1,1)                                          DEN 0042
   79 DO 81 I=2,MA                                                 DEN 0043
      IF(NN2+NR(I,1))82,83,83                                      DEN 0044
   82 NN2=-NR(I,1)                                                 DEN 0045
   83 IF(NN2-NR(I,2)+NN(I,2))84,85,85                              DEN 0046
   84 NN2=NR(I,2)-NN(I,2)                                          DEN 0047
   85 IF(NN1-NR(I,2))87,87,86                                      DEN 0048
   86 NN1=NR(I,2)                                                  DEN 0049
   87 IF(NN1-NN(I,1)+NR(I,1))81,81,88                              DEN 0050
   88 NN1=NN(I,1)-NR(I,1)                                          DEN 0051
   81 CONTINUE                                                     DEN 0052
      NN1=NN1+NRJ+1                                                DEN 0053
```

```
      NN2=NN2+NRJ+1                                                    DEN 0054
      GO TO 12                                                         DEN 0055
   11 NN1=(1+NRIJ)/2                                                   DEN 0056
      NN2=1                                                            DEN 0057
      N1=0                                                             DEN 0058
      N=NRIJ                                                           DEN 0059
   12 IZ=NRJ                                                           DEN 0060
      N2=1                                                             DEN 0061
      CALL COEF(KK)                                                    DEN 0062
      D=C(1)*EXP(R*T*FLOAT(IZ))*(1.0+10.0**(-10))                      DEN 0063
      E=0.0                                                            DEN 0064
      DO 68 I=1,2                                                      DEN 0065
      L9(I)=0                                                          DEN 0066
      F(I)=0.0                                                         DEN 0067
   68 H(I)=0.0                                                         DEN 0068
      GO TO (89,90),KK                                                 DEN 0069
   89 N2=2                                                             DEN 0070
      GO TO 91                                                         DEN 0071
   90 N2=1                                                             DEN 0072
   91 DO 1 I=1,121                                                     DEN 0073
    1 RL(I)=0.0                                                        DEN 0074
      U=0.0                                                            DEN 0075
      DO 3 I=NN2,NN1                                                   DEN 0076
      IZ=I-1                                                           DEN 0077
      G(1)=IZ                                                          DEN 0078
      G(2)=N-IZ+N1                                                     DEN 0079
      CALL COEF(KK)                                                    DEN 0080
      DO 4 J=1,N2                                                      DEN 0081
      IF(C(J))4,4,13                                                   DEN 0082
   13 L9(2)=L9(2)+1                                                    DEN 0083
      Z=C(J)*EXP(R*T*G(J))                                             DEN 0084
      U=U+Z                                                            DEN 0085
      IF(D-Z)72,5,5                                                    DEN 0086
    5 E=E+Z                                                            DEN 0087
      L9(1)=L9(1)+1                                                    DEN 0088
      GO TO (67,69),J                                                  DEN 0089
   67 IF(F(J)-Z)70,70,71                                               DEN 0090
   69 IF(F(J)-Z)71,71,70                                               DEN 0091
   70 H(1)=H(1)+Z                                                      DEN 0092
      GO TO 72                                                         DEN 0093
   71 H(2)=H(2)+Z                                                      DEN 0094
   72 F(J)=Z                                                           DEN 0095
      DO 2 K=1,121                                                     DEN 0096
    2 RL(K)=RL(K)+C(J)*EXP(R*A1(K)*(G(J)-FLOAT(NRJ)))                  DEN 0097
    4 CONTINUE                                                         DEN 0098
    3 CONTINUE                                                         DEN 0099
      GO TO (93,7),KK                                                  DEN 0100
   93 IF(N-N1-2*(NN1-NN2)-1)7,7,6                                      DEN 0101
    6 IZ=NN1                                                           DEN 0102
      N2=1                                                             DEN 0103
      CALL COEF(KK)                                                    DEN 0104
      Z=C(1)*EXP(R*T*FLOAT(IZ))                                        DEN 0105
      U=U+Z                                                            DEN 0106
      L9(2)=L9(2)+1                                                    DEN 0107
      IF(D-Z)9,8,8                                                     DEN 0108
    8 E=E+Z                                                            DEN 0109
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```
      L9(1)=L9(1)+1                                                     DEN 0110
      IF(F(1)-Z)73,73,75                                                DEN 0111
   73 H(1)=H(1)+Z                                                       DEN 0112
      GO TO 9                                                           DEN 0113
   75 H(2)=H(2)+Z                                                       DEN 0114
    9 DO 10 J=1,121                                                     DEN 0115
   10 RL(J)=RL(J)+C(1)*EXP(R*A1(J)*FLOAT(IZ-NRJ))                       DEN 0116
    7 DO 21 J=1,121                                                     DEN 0117
   21 RL(J)=-ALOG(RL(J))                                                DEN 0118
      E=E/U                                                             DEN 0119
      DO 74 I=1,2                                                       DEN 0120
   74 H(I)=H(I)/U                                                       DEN 0121
      GO TO 33                                                          DEN 0122
   32 GO TO (40,41),KK                                                  DEN 0123
   40 DO 42 J=1,121                                                     DEN 0124
      RL(J)=0.0                                                         DEN 0125
      DO 42 I=1,MA                                                      DEN 0126
      A=NN(I,1)+NN(I,2)-NRI(I)                                          DEN 0127
      B=FLOAT(NN(I,1)-NRI(I))*EXP(A1(J))+FLOAT(NN(I,2)-NRI(I))*EXP(-A1(JDEN 0128
     1))                                                                DEN 0129
      C1=-NRI(I)                                                        DEN 0130
      S(I)=(-B+SQRT(B*B-4.0*A*C1))/2.0/A                                DEN 0131
      IF(S(I))92,92,94                                                  DEN 0132
   92 S(I)=-25.0                                                        DEN 0133
      GO TO 42                                                          DEN 0134
   94 S(I)=ALOG(S(I))                                                   DEN 0135
   42 RL(J)=RL(J)+S(I)*FLOAT(NRI(I))+A1(J)*FLOAT(NR(I,1)-NR(I,2))-FLOAT(DEN 0136
     1NN(I,1))*ALOG(1.0+EXP(S(I)+A1(J)))-FLOAT(NN(I,2))*ALOG(1.0+EXP(S(IDEN 0137
     2)-A1(J)))                                                         DEN 0138
      GO TO 33                                                          DEN 0139
   41 M2=2*MA+1                                                         DEN 0140
      KL=1                                                              DEN 0141
      DO 45 J=1,121                                                     DEN 0142
      S2(M2)=0.0                                                        DEN 0143
      GO TO (65,66),KL                                                  DEN 0144
   65 DO 43 I=1,MA                                                      DEN 0145
      II=I+MA                                                           DEN 0146
      DO 51 K=1,2                                                       DEN 0147
      IF(NR(I,K))52,52,53                                               DEN 0148
   52 C(K)=-60.0                                                        DEN 0149
      GO TO 51                                                          DEN 0150
   53 IF(NN(I,K)-NR(I,K))54,54,55                                       DEN 0151
   54 C(K)=60.0                                                         DEN 0152
      GO TO 51                                                          DEN 0153
   55 C(K)=ALOG(FLOAT(NR(I,K))/FLOAT(NN(I,K)-NR(I,K)))                  DEN 0154
   51 CONTINUE                                                          DEN 0155
      S2(I)=(C(1)+C(2))/2.0                                             DEN 0156
   43 S2(II)=(C(1)-C(2))/2.0                                            DEN 0157
      KL=2                                                              DEN 0158
   66 DO 46 KKK=1,NL                                                    DEN 0159
      DO 47 I=1,M2                                                      DEN 0160
      S(I)=0.0                                                          DEN 0161
      DO 47 K=1,M2                                                      DEN 0162
   47 SS(I,K)=0.0                                                       DEN 0163
      DO 44 I=1,MA                                                      DEN 0164
      II=I+MA                                                           DEN 0165
```

```
      S3=A1(J)+S2(I)+S2(II)                                          DEN 0166
      IF(ABS(S3)-60.0)56,56,57                                       DEN 0167
   57 S3=10.0**(10*S3/ABS(S3))                                       DEN 0168
      GO TO 58                                                       DEN 0169
   56 S3=EXP(S3)                                                     DEN 0170
   58 S4=-A1(J)+S2(I)-S2(II)                                         DEN 0171
      IF(ABS(S4)-60.0)59,59,60                                       DEN 0172
   60 S4=10.0**(10*S4/ABS(S4))                                       DEN 0173
      GO TO 61                                                       DEN 0174
   59 S4=EXP(S4)                                                     DEN 0175
   61 S(I)=FLOAT(NRI(I))-FLOAT(NN(I,1))*S3/(1.0+S3)-FLOAT(NN(I,2))*S4/(1DEN 0176
     1.0+S4)                                                         DEN 0177
      S(II)=FLOAT(NR(I,1)-NR(I,2))-FLOAT(NN(I,1))*S3/(1.0+S3)+FLOAT(NN(IDEN 0178
     1,2))*S4/(1.0+S4)                                               DEN 0179
      S(M2)=S(M2)+S2(II)                                             DEN 0180
      SS(M2,II)=1.0                                                  DEN 0181
      SS(II,M2)=1.0                                                  DEN 0182
      SS(I,I)=-FLOAT(NN(I,1))*S3/(1.0+S3)/(1.0+S3)-FLOAT(NN(I,2))*S4/(1.DEN 0183
     10+S4)/(1.0+S4)                                                 DEN 0184
      SS(II,II)=SS(I,I)                                              DEN 0185
      SS(I,II)=-FLOAT(NN(I,1))*S3/(1.0+S3)/(1.0+S3)+FLOAT(NN(I,2))*S4/(1DEN 0186
     1.0+S4)/(1.0+S4)                                                DEN 0187
   44 SS(II,I)=SS(I,II)                                              DEN 0188
      CALL MATVK(SS,M2,S,1,DET)                                      DEN 0189
      DO 48 I=1,M2                                                   DEN 0190
   48 S2(I)=S2(I)-S(I)                                               DEN 0191
      DO 49 I=1,M2                                                   DEN 0192
      IF(ABS(S(I)/S2(I))-0.0001)49,49,46                             DEN 0193
   49 CONTINUE                                                       DEN 0194
      GO TO 50                                                       DEN 0195
   46 CONTINUE                                                       DEN 0196
   50 RL(J)=0.0                                                      DEN 0197
      DO 45 I=1,MA                                                   DEN 0198
      II=I+MA                                                        DEN 0199
      A=A1(J)+S2(I)+S2(II)                                           DEN 0200
      IF(ABS(A)-60.0)63,63,64                                        DEN 0201
   64 A=25*A/ABS(A)                                                  DEN 0202
      KL=1                                                           DEN 0203
   63 B=-A1(J)+S2(I)-S2(II)                                          DEN 0204
      IF(ABS(B)-60.0)45,45,62                                        DEN 0205
   62 B=25*B/ABS(B)                                                  DEN 0206
      KL=1                                                           DEN 0207
   45 RL(J)=RL(J)+FLOAT(NR(I,1))*A+FLOAT(NR(I,2))*B-FLOAT(NN(I,1))*ALOG(DEN 0208
     11.0+EXP(A))-FLOAT(NN(I,2))*ALOG(1.0+EXP(B))                    DEN 0209
   33 RETURN                                                         DEN 0210
      END                                                            DEN 0211
// DUP                                                               DEN 0212
*DELETE             DEN                                            DEN 0213
*STORE      WS  UA  DEN                                            DEN 0214

// JOB                                                               COEF0000
// FOR                                                               COEF0001
*ONE WORD INTEGERS                                                   COEF0002
*LIST ALL                                                           COEF0003
*EXTENDED PRECISION                                                 COEF0004
      SUBROUTINE COEF(KK)                                            COEF0005
```

```
      COMMON NN(15,2),NR(15,2),NRI(15),IX(14),IZ,NRJ,MM,MA,D,E,NRIJ,RL(1COEF0006
     121),A1(121),C(2),N2,JZ1,KZ1,NR2(15),NR3(15),NL,T,H(2),R,N,N1,L9(2)COEF0007
      IF(MM)7,9,10                                                      COEF0008
   10 GO TO (5,6),KK                                                    COEF0009
    5 DO 14 J=1,N2                                                      COEF0010
   14 C(J)=0.0                                                          COEF0011
      JZ=IZ-JZ1                                                         COEF0012
      KZ=IZ-KZ1                                                         COEF0013
      IX1=0                                                             COEF0014
      DO 1 I=1,MM                                                       COEF0015
      IX1=IX1+NR3(I)                                                    COEF0016
    1 IX(I)=NR3(I)                                                      COEF0017
      IF(IX1-JZ)26,12,12                                                COEF0018
   26 DO 19 I=1,MM                                                      COEF0019
      IX1=IX1+NR2(I)-NR3(I)                                             COEF0020
      IX(I)=NR2(I)                                                      COEF0021
      IF(IX1-JZ)19,12,18                                                COEF0022
   18 IX(I)=JZ-IX1+NR2(I)                                               COEF0023
      IX1=IX1-NR2(I)+IX(I)                                              COEF0024
      IF(IX(I)-NR3(I))4,12,12                                           COEF0025
    4 IX1=IX1-IX(I)+NR3(I)                                              COEF0026
      IX(I)=NR3(I)                                                      COEF0027
      GO TO 12                                                          COEF0028
   19 CONTINUE                                                          COEF0029
      GO TO 7                                                           COEF0030
   12 DO 15 J=1,N2                                                      COEF0031
   15 C(J)=C(J)+PCOMB(IX1,J)                                            COEF0032
      JK=0                                                              COEF0033
      DO 2 I=1,MM                                                       COEF0034
      IF(IX(I)-NR2(I))3,11,11                                           COEF0035
    3 IF(KZ-IX1-1)11,23,23                                              COEF0036
   23 IX(I)=IX(I)+1                                                     COEF0037
      IX1=IX1+1                                                         COEF0038
      GO TO 12                                                          COEF0039
   11 IF(IX(I)-NR3(I))2,2,24                                            COEF0040
   24 IF(I-MM)17,2,2                                                    COEF0041
   17 IF(IX(I+1)-NR2(I+1))13,34,34                                      COEF0042
   13 IJ=JZ+IX(I)-IX1-NR3(I)-1                                          COEF0043
      IF(IJ+JK)35,35,28                                                 COEF0044
   28 DO 16 J=2,I                                                       COEF0045
      IF(IX(J-1)-NR2(J-1))27,16,16                                      COEF0046
   27 IX1=IX1-IX(J-1)+NR2(J-1)                                          COEF0047
      IJ=IJ+IX(J-1)-NR2(J-1)                                            COEF0048
      IX(J-1)=NR2(J-1)                                                  COEF0049
   16 CONTINUE                                                          COEF0050
   35 IF(IJ)20,21,21                                                    COEF0051
   21 IF(IJ-NR2(I))25,2,2                                               COEF0052
   25 IF(IJ-NR3(I))29,22,22                                             COEF0053
   20 IF(I-1)29,29,30                                                   COEF0054
   30 DO 31 J=2,I                                                       COEF0055
      II=I-J+1                                                          COEF0056
      IF(IX(II)-NR3(II)+IJ-1)33,32,32                                   COEF0057
   32 IX1=IX1+IJ                                                        COEF0058
      IX(II)=IX(II)+IJ                                                  COEF0059
      GO TO 29                                                          COEF0060
   33 IX1=IX1-IX(II)+NR3(II)                                            COEF0061
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```
      IJ=IJ+IX(II)-NR3(II)                                              COEF0062
   31 IX(II)=NR3(II)                                                    COEF0063
   29 IJ=NR3(I)                                                         COEF0064
   22 IX1=IX1-IX(I)+IJ                                                  COEF0065
      IX(I)=IJ                                                          COEF0066
   34 JK=JK+IX(I)-NR3(I)                                                COEF0067
    2 CONTINUE                                                          COEF0068
      GO TO 7                                                           COEF0069
    9 C(1)=COMB(NN(1,1),IZ)*COMB(NN(1,2),NRI(1)-IZ)                     COEF0070
      C(2)=COMB(NN(1,2),IZ)*COMB(NN(1,1),NRI(1)-IZ)                     COEF0071
      GO TO 7                                                           COEF0072
    6 C(1)=10.0**(-30)                                                  COEF0073
      DO 8 I=1,MA                                                       COEF0074
    8 C(1)=C(1)*COMB(NN(I,1),NR(I,1)-NRJ+IZ)*COMB(NN(I,2),NR(I,2)+NRJ-IZCOEF0075
     1)                                                                 COEF0076
    7 RETURN                                                            COEF0077
      END                                                               COEF0078
// DUP                                                                  COEF0079
*DELETE             COEF                                               COEF0080
*STORE      WS  UA  COEF                                               COEF0081

// JOB                                                                  PCOMB000
// FOR                                                                  PCOMB001
*ONE WORD INTEGERS                                                      PCOMB002
*LIST ALL                                                              PCOMB003
*EXTENDED PRECISION                                                    PCOMB004
      FUNCTION PCOMB(IX3,IJ)                                            PCOMB005
      DIMENSION IX(14)                                                  PCOMB006
      COMMON NN(15,2),NR(15,2),NRI(15),IX2(14),IZ1,NRJ,MM,MA,D,E,NRIJ,RLPCOMB007
     1(121),A1(121),C(2),N2,JZ1,KZ1,NR2(15),NR3(15),NL,T,H(2),R,N,N1,L9(PCOMB008
     12)                                                                PCOMB009
      GO TO (1,4),IJ                                                    PCOMB010
    1 IZ=IZ1                                                            PCOMB011
      IX1=IX3                                                           PCOMB012
      DO 5 I=1,MM                                                       PCOMB013
    5 IX(I)=IX2(I)                                                      PCOMB014
      GO TO 6                                                           PCOMB015
    4 IZ=N-IZ1+N1                                                       PCOMB016
      IX1=N-JZ1-IX3+N1-KZ1                                              PCOMB017
      DO 7 I=1,MM                                                       PCOMB018
    7 IX(I)=NR2(I)-IX2(I)+NR3(I)                                        PCOMB019
    6 PCOMB=COMB(NN(MA,1),IZ-IX1)*COMB(NN(MA,2),NRI(MA)-IZ+IX1)*10.0**(-PCOMB020
     130)                                                               PCOMB021
      DO 2 I=1,MM                                                       PCOMB022
      PCOMB=PCOMB*COMB(NN(I,1),IX(I))*COMB(NN(I,2),NRI(I)-IX(I))        PCOMB023
      IF(PCOMB)3,3,2                                                    PCOMB024
    2 CONTINUE                                                          PCOMB025
    3 RETURN                                                            PCOMB026
      END                                                               PCOMB027
// DUP                                                                  PCOMB028
*DELETE             PCOMB                                              PCOMB029
*STORE      WS  UA  PCOMB                                              PCOMB030

// JOB                                                                  COMB0000
// FOR                                                                  COMB0001
*ONE WORD INTEGERS                                                      COMB0002
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```
*LIST ALL                                                          COMB0003
*EXTENDED PRECISION                                                COMB0004
      FUNCTION COMB(N,M)                                           COMB0005
      COMB=1.0                                                     COMB0006
      IF(N-M)2,1,3                                                 COMB0007
    3 IF(M)2,1,4                                                   COMB0008
    2 COMB=0.0                                                     COMB0009
      GO TO 1                                                      COMB0010
    4 N1=M                                                         COMB0011
      IF(M-N/2)5,6,6                                               COMB0012
    5 N1=N-M                                                       COMB0013
    6 M1=N1+1                                                      COMB0014
      DO 7 I=M1,N                                                  COMB0015
    7 COMB=COMB*FLOAT(I)/FLOAT(I-N1)                               COMB0016
    1 RETURN                                                       COMB0017
      END                                                          COMB0018
// DUP                                                             COMB0019
*DELETE             COMB                                          COMB0020
*STORE      WS  UA  COMB                                          COMB0021

// JOB                                                             MATVK000
// FOR                                                             MATVK001
*ONE WORD INTEGERS                                                 MATVK002
*LIST ALL                                                          MATVK003
*EXTENDED PRECISION                                                MATVK004
      SUBROUTINE MATVK(A,N,B,M,DETM)                               MATVK005
      DIMENSION A(31,31),B(31,1),PIVOT(31),IPVOT(31),INDEX(31,31)  MATVK006
      EQUIVALENCE (IROW,JROW),(ICLUM,JCLUM),(AMAX,T,SWAP)          MATVK007
      DO 20 J=1,N                                                  MATVK008
      DETM=1.0                                                     MATVK009
   20 IPVOT(J)=0                                                   MATVK010
      DO 550 I=1,N                                                 MATVK011
      AMAX=0.0                                                     MATVK012
      DO 105 J=1,N                                                 MATVK013
      IF(IPVOT(J)-1)60,105,60                                      MATVK014
   60 DO 100 K=1,N                                                 MATVK015
      IF(IPVOT(K)-1)80,100,740                                     MATVK016
   80 IF(ABS(AMAX)-ABS(A(J,K)))85,100,100                          MATVK017
   85 IROW=J                                                       MATVK018
      ICLUM=K                                                      MATVK019
      AMAX=A(J,K)                                                  MATVK020
  100 CONTINUE                                                     MATVK021
  105 CONTINUE                                                     MATVK022
      IPVOT(ICLUM)=IPVOT(ICLUM)+1                                  MATVK023
      IF(IROW-ICLUM)140,260,140                                    MATVK024
  140 DETM=-DETM                                                   MATVK025
      DO 200 L=1,N                                                 MATVK026
      SWAP=A(IROW,L)                                               MATVK027
      A(IROW,L)=A(ICLUM,L)                                         MATVK028
  200 A(ICLUM,L)=SWAP                                              MATVK029
      IF(M)260,260,210                                             MATVK030
  210 DO 250 L=1,M                                                 MATVK031
      SWAP=B(IROW,L)                                               MATVK032
      B(IROW,L)=B(ICLUM,L)                                         MATVK033
  250 B(ICLUM,L)=SWAP                                              MATVK034
  260 INDEX(I,1)=IROW                                              MATVK035
```

```
      INDEX(I,2)=ICLUM                                                  MATVK036
      PIVOT(I)=A(ICLUM,ICLUM)                                           MATVK037
      DETM=DETM*PIVOT(I)                                                MATVK038
      A(ICLUM,ICLUM)=1.0                                                MATVK039
      DO 350 L=1,N                                                      MATVK040
  350 A(ICLUM,L)=A(ICLUM,L)/PIVOT(I)                                    MATVK041
      IF(M)380,380,360                                                  MATVK042
  360 DO 370 L=1,M                                                      MATVK043
  370 B(ICLUM,L)=B(ICLUM,L)/PIVOT(I)                                    MATVK044
  380 DO 550 L1=1,N                                                     MATVK045
      IF(L1-ICLUM)400,550,400                                           MATVK046
  400 T=A(L1,ICLUM)                                                     MATVK047
      A(L1,ICLUM)=0.0                                                   MATVK048
      DO 450 L=1,N                                                      MATVK049
  450 A(L1,L)=A(L1,L)-A(ICLUM,L)*T                                      MATVK050
      IF(M)550,550,460                                                  MATVK051
  460 DO 500 L=1,M                                                      MATVK052
  500 B(L1,L)=B(L1,L)-B(ICLUM,L)*T                                      MATVK053
  550 CONTINUE                                                          MATVK054
      DO 710 I=1,N                                                      MATVK055
      L=N+1-I                                                           MATVK056
      IF(INDEX(L,1)-INDEX(L,2))630,710,630                              MATVK057
  630 JROW=INDEX(L,1)                                                   MATVK058
      JCLUM=INDEX(L,2)                                                  MATVK059
      DO 705 K=1,N                                                      MATVK060
      SWAP=A(K,JROW)                                                    MATVK061
      A(K,JROW)=A(K,JCLUM)                                              MATVK062
      A(K,JCLUM)=SWAP                                                   MATVK063
  705 CONTINUE                                                          MATVK064
  710 CONTINUE                                                          MATVK065
  740 IF(DETM-0.000001)750,750,760                                      MATVK066
  750 DETM=0.0                                                          MATVK067
  760 RETURN                                                            MATVK068
      END                                                               MATVK069
// DUP                                                                  MATVK070
*DELETE              MATVK                                            MATVK071
*STORE       WS  UA  MATVK                                            MATVK072
```

```
// JOB                                                                  APLIK000
// FOR                                                                  APLIK001
*ONE WORD INTEGERS                                                      APLIK002
*LIST ALL                                                               APLIK003
*EXTENDED PRECISION                                                     APLIK004
*IOCS(2501 READER)                                                      APLIK005
*IOCS(1403 PRINTER)                                                     APLIK006
*NAME APLIK                                                            APLIK007
C                                                                       APLIK008
C     THIS PROGRAM LISTS POINTS ON THE APPROXIMATE LIKELIHOOD FUNCTION  APLIK009
C ASSUMED WHEN MAKING AN ASYMPTOTIC CHI-SQUARED TEST OF INDEPENDENCE ON APLIK010
C A 2*2 CONTINGENCY TABLE. THE CHI-SQUARED VALUE FOR THE NULL-HYPOTHESISAPLIK011
C OF INDEPENDENCE IS ALSO GIVEN.                                        APLIK012
C                                                                       APLIK013
C   MAKEUP OF DATA DECK                                                 APLIK014
C 1.TITLE CARD - (12A6)                                                 APLIK015
C 2.CONTROL CARD - (1XI2)                                               APLIK016
C      I2 - 02                                                          APLIK017
C 3.DATA - TWO CARDS EACH WITH N THEN Y (2F6.3)                         APLIK018
C 4.99 IN COLS. 79-80 INDICATES END OF DATA, ANOTHER DATA DECK TO FOLLOWAPLIK019
C    98 IN COLS. 79-80 INDICATES END OF JOB, CALL EXIT AFTER THIS DECK  APLIK020
C 5.REPEAT 1. TO 4. AS REQUIRED                                         APLIK021
C                                                                       APLIK022
      DIMENSION Y1(3,2),A1(121),RL(121),TITL(12),II(4)                  APLIK023
   89 FORMAT(I4,4I8)                                                    APLIK024
   88 FORMAT(13HOOBSERVATIONS//39H   I      N(I,1)  R(I,1)  N(I,2)  R(I,2APLIK025
     1))                                                                APLIK026
   87 FORMAT(20HOCHI-SQUARED VALUE= E16.8)                              APLIK027
   86 FORMAT(23HOAPPROXIMATE LIKELIHOOD)                                APLIK028
   85 FORMAT(47HOAPPROXIMATE RELATIVE LIKELIHOOD OF NO EFFECT= E16.8)   APLIK029
   84 FORMAT(4HOA =10E12.4/4H R =10E12.4)                               APLIK030
   83 FORMAT(1XI2)                                                      APLIK031
   82 FORMAT(1H112A6)                                                   APLIK032
   81 FORMAT(2F6.3,66X,I2)                                              APLIK033
   80 FORMAT(12A6)                                                      APLIK034
      L=8                                                               APLIK035
      M=5                                                               APLIK036
    6 READ(L,80)TITL                                                    APLIK037
      READ(L,83)N1                                                      APLIK038
      DO 5 I=1,3                                                        APLIK039
    5 READ(L,81)(Y1(I,J),J=1,2),ID                                      APLIK040
      Z=Y1(1,2)+Y1(2,2)                                                 APLIK041
      WRITE(M,82)TITL                                                   APLIK042
      WRITE(M,88)                                                       APLIK043
      DO 11 K=1,2                                                       APLIK044
      DO 11 J=1,2                                                       APLIK045
      I=(K-1)*2+J                                                       APLIK046
   11 II(I)=Y1(K,J)                                                     APLIK047
      I=1                                                               APLIK048
      WRITE(M,89)I,II                                                   APLIK049
      WRITE(M,86)                                                       APLIK050
      DO 4 I=1,121                                                      APLIK051
      A1(I)=-1.525+FLOAT(I)*0.025                                       APLIK052
      X=EXP(2.0*A1(I))                                                  APLIK053
      A=1.0-X                                                           APLIK054
```

```
      B=X*(Y1(1,1)+Z)+Y1(2,1)-Z                                          APLIK055
      C=-X*Y1(1,1)*Z                                                     APLIK056
      IF(A)15,16,15                                                      APLIK057
   16 D=-C/B                                                             APLIK058
      GO TO 2                                                            APLIK059
   15 D=(-B+SQRT(B*B-4.0*A*C))/2.0/A                                     APLIK060
      IF(D)1,1,2                                                         APLIK061
    1 D=(-B-SQRT(B*B-4.0*A*C))/2.0/A                                     APLIK062
      IF(D)9,9,2                                                         APLIK063
    9 RL(I)=D.0                                                          APLIK064
      GO TO 4                                                            APLIK065
    2 D1=D/Y1(1,1)                                                       APLIK066
      D=D-Y1(1,2)                                                        APLIK067
      IF(Y1(2,2)-D)9,9,12                                                APLIK068
   12 IF(Y1(1,1)-Y1(1,2)-D)9,9,13                                        APLIK069
   13 IF(Y1(2,1)-Y1(2,2)+D)9,9,14                                        APLIK070
   14 RL(I)=-0.5*D*D*(1.0/(D+Y1(1,2))+1.0/(Y1(2,2)-D)+1.0/(Y1(1,1)-Y1(1,APLIK071
     12)-D)+1.0/(Y1(2,1)-Y1(2,2)+D))+ALOG(D1*(1.0-D1)/X/(D1+X-D1*X)**2)*APLIK072
     20.5                                                                APLIK073
      IF(I-61)4,17,4                                                     APLIK074
   17 A2=D*D*(1.0/(D+Y1(1,2))+1.0/(Y1(2,2)-D)+1.0/(Y1(1,1)-Y1(1,2)-D)+1.APLIK075
     10/(Y1(2,1)-Y1(2,2)+D))                                             APLIK076
    4 CONTINUE                                                           APLIK077
      X=RL(1)                                                            APLIK078
      DO 19 I=2,121                                                      APLIK079
      IF(X-RL(I))18,18,19                                                APLIK080
   18 X=RL(I)                                                            APLIK081
   19 CONTINUE                                                           APLIK082
      DO 20 I=1,121                                                      APLIK083
   20 RL(I)=RL(I)-X                                                      APLIK084
      I2=0                                                               APLIK085
      DO 7 I=1,2                                                         APLIK086
      DO 8 K=1,6                                                         APLIK087
      J=((I-1)*6+(K-1))*10+I2+1                                          APLIK088
      L1=((I-1)*6+K)*10+I2                                               APLIK089
    8 WRITE(M,84)(A1(I1),I1=J,L1),(RL(J1),J1=J,L1)                       APLIK090
    7 I2=1                                                               APLIK091
      WRITE(M,85)RL(61)                                                  APLIK092
      WRITE(M,87)A2                                                      APLIK093
      IF(ID-98)3,3,6                                                     APLIK094
    3 CALL EXIT                                                          APLIK095
      END                                                                APLIK096
// DUP                                                                   APLIK097
*DELETE              APLIK                                               APLIK098
*STORE       WS  UA  APLIK                                               APLIK099

*STORE       WS  UA  READ2                                               READ2061
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// JOB                                                                  BRSL2000
// FOR                                                                  BRSL2001
*LIST ALL                                                               BRSL2002
*ONE WORD INTEGERS                                                      BRSL2003
*EXTENDED PRECISION                                                     BRSL2004
*IOCS(2501 READER)                                                      BRSL2005
*IOCS(1403 PRINTER)                                                     BRSL2006
*NAME BRSL2                                                             BRSL2007
C                                                                       BRSL2008
C     RESPONSE SURFACE ANALYSIS USING THE BINOMIAL DISTRIBUTION         BRSL2009
C                                                                       BRSL2010
C       THIS PROGRAM ANALYZES DATA SIMILAR TO THAT FOR BOX2 BUT ASSUMING ABRSL2011
C BINOMIAL PROBABILITY DISTRIBUTION WITH NO TRANSFORMATION PARAMETERS    BRSL2012
C ESTIMATED. THE CORRESPONDING LOGIT NORMAL THEORY ANOVA IS ALSO PRINTEDBRSL2013
C OUT. IF POWER TRANSFORMATIONS OF THE INDEPENDENT VARIABLES ARE         BRSL2014
C SUPPLIED, THE COMPLETE ANALYSIS IS DONE FOR BOTH LINEAR AND NONLINEAR BRSL2015
C MODELS AS IN BOX2.                                                    BRSL2016
C                                                                       BRSL2017
C    LINK CALLED                                                        BRSL2018
C                                                                       BRSL2019
C BEIG2 - PERFORMS CANONICAL ANALYSIS                                   BRSL2020
C                                                                       BRSL2021
C    SUBROUTINES CALLED                                                 BRSL2022
C                                                                       BRSL2023
C  BORT2 - CALCULATES NORMAL ORTHOGONAL POLYNOMIALS                     BRSL2024
C  BLE2  - CALCULATES MAXIMUM LIKELIHOOD ESTIMATES OF THE COEFFICIENT   BRSL2025
C PARAMETERS USING LEAST SQUARES INITIAL ESTIMATES                      BRSL2026
C  MATV  - INVERTS MATRICES UP TO 12 BY 12                             BRSL2027
C  CLFB  - CALCULATES BINOMIAL LIKELIHOOD FOR GIVEN PARAMETER VALUES    BRSL2028
C  BLOF  - CALCULATES NON-REGRESSION ENTRIES IN ANOVA TABLE E.G.LACK OF BRSL2029
C FIT                                                                   BRSL2030
C  CY82  - PERFORMS INVERSE LOGIT TRANSFORMATION                        BRSL2034
C  CAN2  - DIAGONALIZES MATRICES                                        BRSL2031
C  JACOB - CALCULATES EIGENVALUES AND EIGENVECTORS OF DIAGONAL MATRICES BRSL2032
C  CBRS2 - CALCULATES POINTS ON RESPONSE SURFACE CONTOURS               BRSL2033
C                                                                       BRSL2035
C    MAKEUP OF DATA DECK                                                BRSL2036
C                                                                       BRSL2037
C 1.TITLE CARD - (12A6)                                                 BRSL2038
C 2.CONTROL CARD - (I1,2I2,F8.6,2F5.3,I3)                               BRSL2039
C       I1 - OPTION - 0 - NOTHING                                       BRSL2040
C                     1 - PRINT ITERATED VALUES OF COEFFICIENT PARAMETERS BRSL2041
C       I2 - NUMBER OF TREATMENT COMBINATIONS - MAXIMUM 30               BRSL2042
C       I2 - NUMBER OF OBSERVATION SETS - MAXIMUM 4                     BRSL2043
C       F8.6 - CONVERGENCE CRITERION                                    BRSL2044
C       2F5.3 - POWER TRANSFORMATIONS OF INDEPENDENT VARIABLES - IF BLANK,BRSL2045
C             OMITS THIS ANALYSIS                                       BRSL2046
C       I3 - NUMBER OF ITERATIONS ALLOWED                               BRSL2047
C 3.TREATMENT COMBINATIONS IN PAIRS (16F5.3)                            BRSL2048
C 4.DATA - SETS OF OBSERVATIONS FOR EACH TREATMENT COMBINATION          BRSL2049
C     ONE SET PER CARD WITH N AND Y ALTERNATELY (8F6.3)                 BRSL2050
C 5.99 IN COLS. 79-80 INDICATES END OF DATA, ANOTHER DECK TO FOLLOW     BRSL2051
C    98 IN COLS. 79-80 INDICATES END OF JOB - CALL EXIT AFTER THIS DECK BRSL2052
C 6.CONTROL CARD (12F6.2)                                               BRSL2053
C       10F6.2 - 10 CONTOUR LEVELS AS PER CENTS, 5 BELOW AND 5 ABOVE THE BRSL2054
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C          CENTRE                                                        BRSL2055
C       2F6.2 - 2 FACTOR LIMITS IN UNITS OF INDEPENDENT VARIABLES        BRSL2056
C 7.REPEAT 1 TO 6. AS REQUIRED                                           BRSL2057
C                                                                        BRSL2058
      DIMENSION Y1(8),BB(6),SSY5(6),I5(6),X1(2),B1(6),SSYN5(6),B3(6),B(6BRSL2059
     1)                                                                  BRSL2060
      COMMON Y(120),R(120),W( 30,6,2),T(6),B4(6,2),N,IREP,TITL(12),ID,XXBRSL2061
     1(7),SD(5),A3(2),E,D,X(30,6),MN,NI,B2(6),G(3)                       BRSL2062
   96 FORMAT(36HOB(J) COEFFICIENTS IN ORIGINAL UNITS//6E15.6)            BRSL2063
   95 FORMAT(1X2F8.3,8F11.2)                                             BRSL2064
   90 FORMAT(21HO*** VARIABLES FITTED//4X2HX16X2HX210X4(8HOBS. SETI2,12XBRSL2065
     1))                                                                 BRSL2066
   89 FORMAT(54HOPOWER TRANSFORMATIONS OF INDEPENDENT VARIABLES - A1 =F8BRSL2067
     1.4,6H  A2 =F8.4)                                                   BRSL2068
   88 FORMAT(18HOB(J) COEFFICIENTS/1HO6E15.6/17HOLOG LIKELIHOOD =E15.6) BRSL2069
   87 FORMAT(27HOANALYSIS OF VARIANCE TABLE/9HO  SOURCE10X7HLOG MLR9X8HLBRSL2070
     1OG R(N))                                                           BRSL2071
   85 FORMAT(66HOINCORRECT NUMBER OF OBSERVATION SETS - SKIPPING TO NEXTBRSL2072
     1 DATA DECK)                                                        BRSL2073
   84 FORMAT(16F5.3)                                                     BRSL2074
   83 FORMAT(I1,2I2,F8.6,2F5.3,I3)                                       BRSL2075
   82 FORMAT(1H1I2A6)                                                    BRSL2076
   81 FORMAT(8F6.3,30X,I2)                                               BRSL2077
   80 FORMAT(12A6)                                                       BRSL2078
   77 FORMAT(13H TREATMENTS  2E16.6)                                     BRSL2079
   93 FORMAT(13H REGRESSION  2E16.6)                                     BRSL2080
   76 FORMAT(13H  LINEAR     2E16.6)                                     BRSL2081
   75 FORMAT(13H    X1 LINEAR 2E16.6)                                    BRSL2082
   74 FORMAT(13H    X2 LINEAR 2E16.6)                                    BRSL2083
   73 FORMAT(13H  QUADRATIC  2E16.6)                                     BRSL2084
   72 FORMAT(13H    X1 QUAD.  2E16.6)                                    BRSL2085
   78 FORMAT(13H    X2 QUAD.  2E16.6)                                    BRSL2086
   79 FORMAT(13H  X1 * X2     2E16.6)                                    BRSL2087
   92 FORMAT(13H LACK OF FIT 2E16.6)                                     BRSL2088
   94 FORMAT(13H REPLICATES  E16.6)                                      BRSL2089
   97 FORMAT(13H LIKELIHOOD  E16.6)                                      BRSL2090
      L=8                                                                BRSL2091
      M=5                                                                BRSL2092
    7 READ(L,80)TITL                                                     BRSL2093
      E=0.0                                                              BRSL2094
      DO 55 I=1,120                                                      BRSL2095
      R(I)=0.0                                                           BRSL2096
   55 Y(I)=0.0                                                           BRSL2097
      READ(L,83)MN,N1,IREP,D,A3,NI                                       BRSL2098
      N=N1*IREP                                                          BRSL2099
      READ(L,84)((W(I,J,1),J=2,3),I=1,N1)                                BRSL2100
      DO 3 I=1,N1                                                        BRSL2101
      W(I,1,1)=1.0                                                       BRSL2102
      W(I,4,1)=W(I,2,1)*W(I,2,1)                                         BRSL2103
      W(I,5,1)=W(I,3,1)*W(I,3,1)                                         BRSL2104
    3 W(I,6,1)=W(I,3,1)*W(I,2,1)                                         BRSL2105
      I=0                                                                BRSL2106
   22 I=I+1                                                              BRSL2107
      READ(L,81)Y1,ID                                                    BRSL2108
      IF(ID-98)9,23,23                                                   BRSL2109
    9 IR=2*IREP                                                          BRSL2110
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      DO 24 II=1,IR,2                                                   BRSL2111
      K=N1*(II-1)/2+I                                                   BRSL2112
      R(K)=Y1(II+1)                                                     BRSL2113
   24 Y(K)=Y1(II)                                                       BRSL2114
      DO 29 J=1,6                                                       BRSL2115
   29 X(I,J)=W(I,J,1)                                                   BRSL2116
      GO TO 22                                                          BRSL2117
   23 N2=I-1                                                            BRSL2118
      IF(N1-N2)2,4,2                                                    BRSL2119
    2 WRITE(M,85)                                                       BRSL2120
      IF(ID-98)7,6,7                                                    BRSL2121
    6 CALL EXIT                                                         BRSL2122
    4 N=N1*IREP                                                         BRSL2123
      WRITE(M,82)TITL                                                   BRSL2124
      WRITE(M,90)(I,I=1,4)                                              BRSL2125
      DO 54 I=1,N1                                                      BRSL2126
      DO 19 J=1,2                                                       BRSL2127
   19 X1(J)=X(I,J+1)                                                    BRSL2128
      N2=N1+I                                                           BRSL2129
      N3=N1*2+I                                                         BRSL2130
      N4=N1*3+I                                                         BRSL2131
   54 WRITE(M,95)X1(1),X1(2),Y(I),R(I),Y(N2),R(N2),Y(N3),R(N3),Y(N4),R(NBRSL2132
     14)                                                                BRSL2133
      DO 14 KK=1,2                                                      BRSL2134
      CALL BORT2(X,1,KK)                                                BRSL2135
      DO 5 JJ=1,6                                                       BRSL2136
      T(JJ)=0.0                                                         BRSL2137
      DO 5 II=1,N1                                                      BRSL2138
      DO 5 K1=1,IREP                                                    BRSL2139
      K=(K1-1)*N1+II                                                    BRSL2140
    5 T(JJ)=T(JJ)+R(K)*X(II,JJ)                                         BRSL2141
      IF(MN)12,13,12                                                    BRSL2142
   12 WRITE(M,82)TITL                                                   BRSL2143
      GO TO (13,15),KK                                                  BRSL2144
   15 WRITE(M,89)A3                                                     BRSL2145
   13 CALL BLE2(B,I5,0)                                                 BRSL2146
      DO 33 I=1,6                                                       BRSL2147
      B4(I,KK)=B(I)                                                     BRSL2148
   33 B3(I)=B2(I)                                                       BRSL2149
      S=CLFB(B)                                                         BRSL2150
      SN=CLFB(B2)                                                       BRSL2151
      WRITE(M,88)B,S                                                    BRSL2152
      DO 1 I=2,6                                                        BRSL2153
      I5(1)=I                                                           BRSL2154
      CALL BLE2(BB,I5,1)                                                BRSL2155
      SSYN5(I)=CLFB(B2)-SN                                              BRSL2156
    1 SSY5(I)=CLFB(BB)-S                                                BRSL2157
      I5(1)=2                                                           BRSL2158
      I5(2)=3                                                           BRSL2159
      CALL BLE2(BB,I5,2)                                                BRSL2160
      SS4=CLFB(BB)-S                                                    BRSL2161
      SSN4=CLFB(B2)-SN                                                  BRSL2162
      I5(1)=4                                                           BRSL2163
      I5(2)=5                                                           BRSL2164
      CALL BLE2(BB,I5,2)                                                BRSL2165
      SS5=CLFB(BB)-S                                                    BRSL2166
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      SSN5=CLFB(B2)-SN                                                  BRSL2167
      DO 11 I=2,6                                                       BRSL2168
   11 I5(I-1)=I                                                         BRSL2169
      CALL BLE2(BB,I5,5)                                                BRSL2170
      SS3=CLFB(BB)-S                                                    BRSL2171
      SSN3=CLFB(B2)-SN                                                  BRSL2172
      DO 28 J=1,2                                                       BRSL2173
      BB(1)=B(1)                                                        BRSL2174
      DO 27 I=1,5                                                       BRSL2175
      BB(I+1)=B(I+1)/SD(I)                                              BRSL2176
   27 BB(1)=BB(1)-BB(I+1)*XX(I)                                         BRSL2177
      BB(6)=BB(6)/SD(1)/SD(2)                                           BRSL2178
      BB(2)=BB(2)-BB(4)*XX(6)-BB(6)*XX(2)                               BRSL2179
      BB(3)=BB(3)-BB(5)*XX(7)-BB(6)*XX(1)                               BRSL2180
      BB(1)=BB(1)+BB(4)*XX(1)*XX(6)+BB(5)*XX(2)*XX(7)+BB(6)*XX(1)*XX(2) BRSL2181
      GO TO (8,10),J                                                    BRSL2182
    8 WRITE(M,96)BB                                                     BRSL2183
      DO 28 I=1,6                                                       BRSL2184
      B1(I)=BB(I)                                                       BRSL2185
      B4(I,KK)=BB(I)                                                    BRSL2186
   28 B(I)=B3(I)                                                        BRSL2187
   10 DO 31 I=1,6                                                       BRSL2188
   31 B(I)=B1(I)                                                        BRSL2189
      SS2=BLOF(2,B1,KK)                                                 BRSL2190
      SS6=BLOF(1,B1,KK)                                                 BRSL2191
      SS8=BLOF(4,B,KK)                                                  BRSL2192
      SSN2=BLOF(5,BB,KK)                                                BRSL2193
      SSN6=BLOF(6,BB,KK)                                                BRSL2194
      WRITE(M,82)TITL                                                   BRSL2195
      GO TO (30,32),KK                                                  BRSL2196
   32 WRITE(M,89)A3                                                     BRSL2197
   30 WRITE(M,87)                                                       BRSL2198
      WRITE(M,77)SS6,SSN6                                               BRSL2199
      WRITE(M,93)SS3,SSN3                                               BRSL2200
      WRITE(M,76)SS4,SSN4                                               BRSL2201
      WRITE(M,75)SSY5(2),SSYN5(2)                                       BRSL2202
      WRITE(M,74)SSY5(3),SSYN5(3)                                       BRSL2203
      WRITE(M,73)SS5,SSN5                                               BRSL2204
      WRITE(M,72)SSY5(4),SSYN5(4)                                       BRSL2205
      WRITE(M,78)SSY5(5),SSYN5(5)                                       BRSL2206
      WRITE(M,79)SSY5(6),SSYN5(6)                                       BRSL2207
      WRITE(M,92)SS2,SSN2                                               BRSL2208
      IF(IREP-1)26,26,25                                                BRSL2209
   25 SS7=BLOF(3,B1,KK)                                                 BRSL2210
      WRITE(M,94)SS7                                                    BRSL2211
   26 WRITE(M,97)SS8                                                    BRSL2212
      GO TO (18,17),KK                                                  BRSL2213
   18 IF(A3(1))16,17,16                                                 BRSL2214
   16 DO 14 I=1,N1                                                      BRSL2215
      W(I,1,2)=1.0                                                      BRSL2216
      W(I,2,2)=W(I,2,1)**A3(1)                                          BRSL2217
      W(I,3,2)=W(I,3,1)**A3(2)                                          BRSL2218
      W(I,4,2)=W(I,2,2)*W(I,2,2)                                        BRSL2219
      W(I,5,2)=W(I,3,2)*W(I,3,2)                                        BRSL2220
      W(I,6,2)=W(I,3,2)*W(I,2,2)                                        BRSL2221
      DO 14 J=1,6                                                       BRSL2222
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   14 X(I,J)=W(I,J,2)                                                    BRSL2223
   17 CALL LINK(BEIG2)                                                   BRSL2224
      END                                                                BRSL2225
// DUP                                                                   BRSL2226
*DELETE              BRSL2                                              BRSL2227
*STORE       WS  UA  BRSL2                                              BRSL2228

// JOB                                                                   BORT2000
// FOR                                                                   BORT2001
*LIST ALL                                                                BORT2002
*ONE WORD INTEGERS                                                       BORT2003
*EXTENDED PRECISION                                                      BORT2004
      SUBROUTINE BORT2(X,L6,KK)                                          BORT2005
      DIMENSION W( 30,6),X( 30,6),SSX2(5,5)                              BORT2006
      COMMON Y(120),R(120),Z( 30,6,2),T(6),B(12),N,IREP,TITL(12),ID,X5(7BORT2007
     1),S5(5),A3(2)                                                      BORT2008
   85 FORMAT(54HOPOWER TRANSFORMATIONS OF INDEPENDENT VARIABLES - A1 =F8BORT2009
     1.4,6H  A2 =F8.4)                                                   BORT2010
   84 FORMAT(5F15.5)                                                     BORT2011
   83 FORMAT(21HOCROSS PRODUCT MATRIX)                                   BORT2012
   82 FORMAT(30HONORMAL ORTHOGONAL POLYNOMIALS//10X2HX113X2HX211X5HX1*X1BORT2013
     110X5HX2*X210X5HX1*X2)                                              BORT2014
   81 FORMAT(1H1I12A6)                                                   BORT2015
      M=5                                                                BORT2016
      N1=N/IREP                                                          BORT2017
      DO 14 J=2,3                                                        BORT2018
      X5(J-1)=0.0                                                        BORT2019
      DO 14 I=1,N1                                                       BORT2020
   14 X5(J-1)=X5(J-1)+X(I,J)/N1                                          BORT2021
      DO 15 J=2,3                                                        BORT2022
      S5(J-1)=0.0                                                        BORT2023
      DO 15 I=1,N1                                                       BORT2024
   15 S5(J-1)=S5(J-1)+(X(I,J)-X5(J-1))**2                                BORT2025
      DO 1 J=2,3                                                         BORT2026
      S5(J-1)=SQRT(S5(J-1))                                              BORT2027
      DO 1 I=1,N1                                                        BORT2028
      W(I,1)=1.0                                                         BORT2029
    1 W(I,J)=(X(I,J)-X5(J-1))/S5(J-1)                                    BORT2030
      GO TO (7,8),L6                                                     BORT2031
    7 DO 2 J=2,3                                                         BORT2032
      X5(J+1)=0.0                                                        BORT2033
      X5(J+4)=0.0                                                        BORT2034
      DO 2 I=1,N1                                                        BORT2035
      X5(J+1)=X5(J+1)+X(I,J+2)/N1                                        BORT2036
    2 X5(J+4)=X5(J+4)+X(I,J+2)*(X(I,J)-X5(J-1))/S5(J-1)/S5(J-1)          BORT2037
      X5(5)=0.0                                                          BORT2038
      DO 3 I=1,N1                                                        BORT2039
      W(I,6)=W(I,2)*W(I,3)                                               BORT2040
      X5(5)=X5(5)+W(I,6)/N1                                              BORT2041
      DO 3 J=4,5                                                         BORT2042
    3 W(I,J)=X(I,J)-X5(J-1)-(X(I,J-2)-X5(J-3))*X5(J+2)                   BORT2043
      DO 4 J=4,5                                                         BORT2044
      S5(J-1)=0.0                                                        BORT2045
      DO 4 I=1,N1                                                        BORT2046
    4 S5(J-1)=S5(J-1)+W(I,J)*W(I,J)                                      BORT2047
      S5(3)=SQRT(S5(3))                                                  BORT2048
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      S5(4)=SQRT(S5(4))                                                 BORT2049
      S5(5)=0.0                                                         BORT2050
      DO 5 I=1,N1                                                       BORT2051
      S5(5)=S5(5)+(W(I,6)-X5(5))**2                                     BORT2052
      DO 5 J=4,5                                                        BORT2053
    5 W(I,J)=W(I,J)/S5(J-1)                                             BORT2054
      S5(5)=SQRT(S5(5))                                                 BORT2055
    8 DO 16 I=1,N1                                                      BORT2056
   16 W(I,6)=(W(I,6)-X5(5))/S5(5)                                       BORT2057
      GO TO (9,10),L6                                                   BORT2058
   10 DO 12 I=1,N1                                                      BORT2059
      X(I,4)=W(I,6)                                                     BORT2060
      DO 12 J=1,3                                                       BORT2061
   12 X(I,J)=W(I,J)                                                     BORT2062
      GO TO 11                                                          BORT2063
    9 DO 6 I=1,N1                                                       BORT2064
      DO 6 J=1,6                                                        BORT2065
    6 X(I,J)=W(I,J)                                                     BORT2066
      WRITE(M,81)TITL                                                   BORT2067
      GO TO (13,17),KK                                                  BORT2068
   17 WRITE(M,85)A3                                                     BORT2069
   13 WRITE(M,82)                                                       BORT2070
      WRITE(M,84)((X(I,J),J=2,6),I=1,N1)                                BORT2071
      WRITE(M,83)                                                       BORT2072
      DO 18 I=1,5                                                       BORT2073
      DO 18 J=1,5                                                       BORT2074
      SSX2(I,J)=0.0                                                     BORT2075
      DO 18 K=1,N1                                                      BORT2076
   18 SSX2(I,J)=SSX2(I,J)+X(K,I+1)*X(K,J+1)                             BORT2077
      WRITE(M,84)((SSX2(I,J),J=1,5),I=1,5)                              BORT2078
   11 RETURN                                                            BORT2079
      END                                                               BORT2080
// DUP                                                                  BORT2081
*DELETE              BORT2                                             BORT2082
*STORE       WS  UA  BORT2                                             BORT2083

// JOB                                                                  BLE20000
// FOR                                                                  BLE20001
*LIST ALL                                                             BLE20002
*ONE WORD INTEGERS                                                    BLE20003
*EXTENDED PRECISION                                                   BLE20004
      SUBROUTINE BLE2(B,I5,J3)                                          BLE20005
      DIMENSION A(12,12),C(12),B(6),I5(6)                               BLE20006
      COMMON Y(120),R(120),Z(360),T(6),ZZ(12),N,IREP,TT(12),ID,S(15),DD,BLE20007
     1X( 30,6),MN,NI,B1(6)                                              BLE20008
   81 FORMAT(39HONO CONVERGENCE - B(J) COEFFICIENTS ARE //6E15.6)       BLE20009
   80 FORMAT(6E15.6,I8,E15.6)                                           BLE20010
      M=5                                                               BLE20011
      N1=N/IREP                                                         BLE20012
      J4=J3+1                                                           BLE20013
      J6=6-J3                                                           BLE20014
      DO 16 I=J4,6                                                      BLE20015
   16 I5(I)=0                                                           BLE20016
      DO 4 I=1,6                                                        BLE20017
      C(I)=0.0                                                          BLE20018
      DO 4 J=1,6                                                        BLE20019
```

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  4 A(I,J)=0.0                                                          BLE20020
    DO 13 I=1,N1                                                        BLE20021
    Y1=0.0                                                              BLE20022
    DO 14 J=1,IREP                                                      BLE20023
    K=(J-1)*N1+I                                                        BLE20024
    IF(R(K))10,10,42                                                    BLE20025
 10 Y1=Y1-5.0                                                           BLE20026
    GO TO 14                                                            BLE20027
 42 IF(Y(K)-R(K))43,43,44                                               BLE20028
 43 Y1=Y1+5.0                                                           BLE20029
    GO TO 14                                                            BLE20030
 44 Y1=Y1+ALOG(R(K)/(Y(K)-R(K)))/FLOAT(IREP)                            BLE20031
 14 CONTINUE                                                            BLE20032
    IJ=1                                                                BLE20033
    DO 38 KK=1,6                                                        BLE20034
    IF(KK-I5(IJ))28,29,28                                               BLE20035
 29 IJ=IJ+1                                                             BLE20036
    GO TO 38                                                            BLE20037
 28 K1=KK-IJ+1                                                          BLE20038
    C(K1)=C(K1)+Y1*X(I,KK)                                              BLE20039
    JI=1                                                                BLE20040
    DO 37 II=1,6                                                        BLE20041
    IF(II-I5(JI))30,31,30                                               BLE20042
 31 JI=JI+1                                                             BLE20043
    GO TO 37                                                            BLE20044
 30 I1=II-JI+1                                                          BLE20045
    A(K1,I1)=A(K1,I1)+X(I,KK)*X(I,II)                                   BLE20046
 37 CONTINUE                                                            BLE20047
 38 CONTINUE                                                            BLE20048
 13 CONTINUE                                                            BLE20049
    CALL MATV(A,J6,C,1,DET)                                             BLE20050
    J=1                                                                 BLE20051
    DO 39 I=1,6                                                         BLE20052
    IF(I-I5(J))40,41,40                                                 BLE20053
 41 J=J+1                                                               BLE20054
    B(I)=0.0                                                            BLE20055
    GO TO 45                                                            BLE20056
 40 I1=I-J+1                                                            BLE20057
    B(I)=C(I1)                                                          BLE20058
 45 B1(I)=B(I)                                                          BLE20059
 39 CONTINUE                                                            BLE20060
    DO 6 J5=1,N1                                                        BLE20061
    J=1                                                                 BLE20062
    DO 12 KK=1,6                                                        BLE20063
    IF(KK-I5(J))5,11,5                                                  BLE20064
 11 J=J+1                                                               BLE20065
    GO TO 12                                                            BLE20066
  5 K1=KK-J+1                                                           BLE20067
    C(K1)=T(KK)                                                         BLE20068
    K=1                                                                 BLE20069
    DO 34 I=1,6                                                         BLE20070
    IF(I-I5(K))15,19,15                                                 BLE20071
 19 K=K+1                                                               BLE20072
    GO TO 34                                                            BLE20073
 15 I1=I-K+1                                                            BLE20074
    A(I1,K1)=0.0                                                        BLE20075
```

```
34 CONTINUE                                                        BLE20076
12 CONTINUE                                                        BLE20077
   DO 1 I=1,N1                                                     BLE20078
   D=0.0                                                           BLE20079
   J=1                                                             BLE20080
   DO 2 JJ=1,6                                                     BLE20081
   IF(JJ-I5(J))20,21,20                                            BLE20082
21 J=J+1                                                           BLE20083
   GO TO 2                                                         BLE20084
20 D=D+B(JJ)*X(I,JJ)                                               BLE20085
 2 CONTINUE                                                        BLE20086
   D=EXP(D)                                                        BLE20087
   IJ=1                                                            BLE20088
   DO 1 KK=1,6                                                     BLE20089
   IF(KK-I5(IJ))22,23,22                                           BLE20090
23 IJ=IJ+1                                                         BLE20091
   GO TO 1                                                         BLE20092
22 K1=KK-IJ+1                                                      BLE20093
   JI=1                                                            BLE20094
   DO 32 II=1,6                                                    BLE20095
   IF(II-I5(JI))24,25,24                                           BLE20096
25 JI=JI+1                                                         BLE20097
   GO TO 32                                                        BLE20098
24 I1=II-JI+1                                                      BLE20099
   DO 33 J=1,IREP                                                  BLE20100
   K=(J-1)*N1+I                                                    BLE20101
   A(K1,I1)=A(K1,I1)-Y(K)*X(I,KK)*X(I,II)*D/(1.0+D)/(1.0+D)        BLE20102
   IF(K1-I1)33,3,33                                                BLE20103
 3 C(K1)=C(K1)-Y(K)*X(I,KK)*D/(1.0+D)                              BLE20104
33 CONTINUE                                                        BLE20105
32 CONTINUE                                                        BLE20106
 1 CONTINUE                                                        BLE20107
   CALL MATV(A,J6,C,1,DET)                                         BLE20108
   J=1                                                             BLE20109
   DO 9 I=1,6                                                      BLE20110
   IF(I-I5(J))17,18,17                                             BLE20111
18 J=J+1                                                           BLE20112
   GO TO 9                                                         BLE20113
17 I1=I-J+1                                                        BLE20114
   IF(ABS(C(I1))-0.1*B(I))26,26,27                                 BLE20115
27 C(I1)=0.1*C(I1)                                                 BLE20116
26 B(I)=B(I)-C(I1)                                                 BLE20117
 9 CONTINUE                                                        BLE20118
   IF(MN)46,47,46                                                  BLE20119
46 S1=CLFB(B)                                                      BLE20120
   WRITE(M,80)B,J5,S1                                              BLE20121
47 J=1                                                             BLE20122
   DO 7 I=1,6                                                      BLE20123
   IF(I-I5(J))35,36,35                                             BLE20124
36 J=J+1                                                           BLE20125
   GO TO 7                                                         BLE20126
35 I1=I-J+1                                                        BLE20127
   IF(ABS(C(I1)/B(I))-DD)7,7,6                                     BLE20128
 7 CONTINUE                                                        BLE20129
   GO TO 8                                                         BLE20130
 6 CONTINUE                                                        BLE20131
```

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      WRITE(M,81)B                                                    BLE20132
    8 RETURN                                                          BLE20133
      END                                                             BLE20134
// DUP                                                              BLE20135
*DELETE              BLE2                                           BLE20136
*STORE       WS  UA  BLE2                                           BLE20137

// JOB                                                              MATV0000
// FOR                                                              MATV0001
*LIST ALL                                                           MATV0002
*ONE WORD INTEGERS                                                  MATV0003
*EXTENDED PRECISION                                                 MATV0004
      SUBROUTINE MATV(A,N,B,M,DETM)                                 MATV0005
      DIMENSION A(12,12),B(12,1),PIVOT(12),IPVOT(12),INDEX(12,12)   MATV0006
      EQUIVALENCE (IROW,JROW),(ICLUM,JCLUM),(AMAX,T,SWAP)           MATV0007
      DETM=1.0                                                      MATV0008
      DO 20 J=1,N                                                   MATV0009
   20 IPVOT(J)=0                                                    MATV0010
      DO 550 I=1,N                                                  MATV0011
      AMAX=0.0                                                      MATV0012
      DO 105 J=1,N                                                  MATV0013
      IF(IPVOT(J)-1)60,105,60                                       MATV0014
   60 DO 100 K=1,N                                                  MATV0015
      IF(IPVOT(K)-1)80,100,740                                      MATV0016
   80 IF(ABS(AMAX)-ABS(A(J,K)))85,100,100                           MATV0017
   85 IROW=J                                                        MATV0018
      ICLUM=K                                                       MATV0019
      AMAX=A(J,K)                                                   MATV0020
  100 CONTINUE                                                      MATV0021
  105 CONTINUE                                                      MATV0022
      IPVOT(ICLUM)=IPVOT(ICLUM)+1                                   MATV0023
      IF(IROW-ICLUM)140,260,140                                     MATV0024
  140 DETM=-DETM                                                    MATV0025
      DO 200 L=1,N                                                  MATV0026
      SWAP=A(IROW,L)                                                MATV0027
      A(IROW,L)=A(ICLUM,L)                                          MATV0028
  200 A(ICLUM,L)=SWAP                                               MATV0029
      IF(M)260,260,210                                              MATV0030
  210 DO 250 L=1,M                                                  MATV0031
      SWAP=B(IROW,L)                                                MATV0032
      B(IROW,L)=B(ICLUM,L)                                          MATV0033
  250 B(ICLUM,L)=SWAP                                               MATV0034
  260 INDEX(I,1)=IROW                                               MATV0035
      INDEX(I,2)=ICLUM                                              MATV0036
      PIVOT(I)=A(ICLUM,ICLUM)                                       MATV0037
      DETM=DETM*PIVOT(I)                                            MATV0038
      A(ICLUM,ICLUM)=1.0                                            MATV0039
      DO 350 L=1,N                                                  MATV0040
  350 A(ICLUM,L)=A(ICLUM,L)/PIVOT(I)                                MATV0041
      IF(M)380,380,360                                              MATV0042
  360 DO 370 L=1,M                                                  MATV0043
  370 B(ICLUM,L)=B(ICLUM,L)/PIVOT(I)                                MATV0044
  380 DO 550 LI=1,N                                                 MATV0045
      IF(LI-ICLUM)400,550,400                                       MATV0046
  400 T=A(LI,ICLUM)                                                 MATV0047
      A(LI,ICLUM)=0.0                                               MATV0048
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      DO 450 L=1,N                                                    MATV0049
  450 A(L1,L)=A(L1,L)-A(ICLUM,L)*T                                    MATV0050
      IF(M)550,550,460                                                MATV0051
  460 DO 500 L=1,M                                                    MATV0052
  500 B(L1,L)=B(L1,L)-B(ICLUM,L)*T                                    MATV0053
  550 CONTINUE                                                        MATV0054
      DO 710 I=1,N                                                    MATV0055
      L=N+1-I                                                         MATV0056
      IF(INDEX(L,1)-INDEX(L,2))630,710,630                            MATV0057
  630 JROW=INDEX(L,1)                                                 MATV0058
      JCLUM=INDEX(L,2)                                                MATV0059
      DO 705 K=1,N                                                    MATV0060
      SWAP=A(K,JROW)                                                  MATV0061
      A(K,JROW)=A(K,JCLUM)                                            MATV0062
      A(K,JCLUM)=SWAP                                                 MATV0063
  705 CONTINUE                                                        MATV0064
  710 CONTINUE                                                        MATV0065
  740 IF(DETM-0.000001)750,750,760                                    MATV0066
  750 DETM=0.0                                                        MATV0067
  760 RETURN                                                          MATV0068
      END                                                             MATV0069
// DUP                                                                MATV0070
*DELETE              MATV                                           MATV0071
*STORE       WS  UA  MATV                                           MATV0072

// JOB                                                                CLFB0000
// FOR                                                                CLFB0001
*LIST ALL                                                             CLFB0002
*ONE WORD INTEGERS                                                    CLFB0003
*EXTENDED PRECISION                                                   CLFB0004
      FUNCTION CLFB(B)                                                CLFB0005
      DIMENSION B(6)                                                  CLFB0006
      COMMON Y(120),R(120),Z(360),T(12),ZZ(6),N,IREP,TT(12),ID,S(14),F,DCLFB0007
     1,X( 30,6)                                                       CLFB0008
      EQUIVALENCE (E,F)                                               CLFB0009
      N1=N/IREP                                                       CLFB0010
      IF(E)4,5,4                                                      CLFB0011
    5 DO 6 I=1,N                                                      CLFB0012
      IF(R(I))6,6,8                                                   CLFB0013
    8 IF(Y(I)-R(I))6,6,7                                              CLFB0014
    7 E=E+(Y(I)+0.5)*ALOG(Y(I))-(R(I)+0.5)*ALOG(R(I))-(Y(I)-R(I)+0.5)*ALCLFB0015
     1OG(Y(I)-R(I))-0.5*ALOG(6.283185)+(1.0/Y(I)-1.0/R(I)-1.0/(Y(I)-R(ICLFB0016
     1))/12.0                                                         CLFB0017
    6 CONTINUE                                                        CLFB0018
    4 A=E                                                             CLFB0019
      DO 1 J=1,6                                                      CLFB0020
    1 A=A+T(J)*B(J)                                                   CLFB0021
      DO 2 I=1,N1                                                     CLFB0022
      DO 2 J=1,IREP                                                   CLFB0023
      K=(J-1)*N1+I                                                    CLFB0024
      C=0.0                                                           CLFB0025
      DO 3 JJ=1,6                                                     CLFB0026
    3 C=C+B(JJ)*X(I,JJ)                                               CLFB0027
      C=EXP(C)                                                        CLFB0028
    2 A=A-Y(K)*ALOG(C+1.0)                                            CLFB0029
      CLFB=A                                                          CLFB0030
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      RETURN                                                            CLFB0031
      END                                                               CLFB0032
// DUP                                                                  CLFB0033
*DELETE              CLFB                                              CLFB0034
*STORE       WS  UA  CLFB                                              CLFB0035

// JOB                                                                  BLDF0000
// FOR                                                                  BLDF0001
*LIST ALL                                                               BLDF0002
*ONE WORD INTEGERS                                                      BLDF0003
*EXTENDED PRECISION                                                     BLDF0004
      FUNCTION BLDF(IJ,B1,KK)                                           BLDF0005
      DIMENSION B1(6),S(120)                                            BLDF0006
      COMMON Y(120),R(120),X( 30,6,2),T(6),BB(12),N,IR,TT(12),ID,V(14),EBLDF0007
      EQUIVALENCE (R(1),S(1))                                           BLDF0008
      N1=N/IR                                                           BLDF0009
      GO TO (8,9,9,21,9,28),IJ                                          BLDF0010
    8 B=0.0                                                             BLDF0011
      C=0.0                                                             BLDF0012
      DO 5 K=1,N                                                        BLDF0013
      B=B+R(K)                                                          BLDF0014
    5 C=C+Y(K)                                                          BLDF0015
      B=B/C                                                             BLDF0016
      GO TO 9                                                           BLDF0017
   28 B=0.0                                                             BLDF0018
      DO 30 K=1,N                                                       BLDF0019
      IF(R(K))35,35,36                                                  BLDF0020
   35 B=B-25.0                                                          BLDF0021
      GO TO 30                                                          BLDF0022
   36 IF(Y(K)-R(K))37,37,38                                             BLDF0023
   37 B=B+25.0                                                          BLDF0024
      GO TO 30                                                          BLDF0025
   38 B=R+ALOG(R(K)/(Y(K)-R(K)))/FLOAT(N)                               BLDF0026
   30 CONTINUE                                                          BLDF0027
      B=EXP(B)/(1.0+EXP(B))                                             BLDF0028
    9 BLDF=0.0                                                          BLDF0029
      GO TO 22                                                          BLDF0030
   21 BLDF=E                                                            BLDF0031
   22 DO 1 I=1,N1                                                       BLDF0032
      A=0.0                                                             BLDF0033
      C=0.0                                                             BLDF0034
      GO TO(24,24,24,24,25,25),IJ                                       BLDF0035
   24 DO 2 J=1,IR                                                       BLDF0036
      K=(J-1)*N1+I                                                      BLDF0037
      C=C+R(K)                                                          BLDF0038
    2 A=A+Y(K)                                                          BLDF0039
      A=C/A                                                             BLDF0040
      GO TO 26                                                          BLDF0041
   25 DO 27 J=1,IR                                                      BLDF0042
      K=(J-1)*N1+I                                                      BLDF0043
      IF(R(K))34,34,31                                                  BLDF0044
   34 A=A-25.0                                                          BLDF0045
      GO TO 27                                                          BLDF0046
   31 IF(Y(K)-R(K))33,33,32                                             BLDF0047
   33 A=A+25.0                                                          BLDF0048
      GO TO 27                                                          BLDF0049
```

```
   32 A=A+ALOG(R(K)/(Y(K)-R(K)))/FLOAT(IR)                          BLOF0050
   27 CONTINUE                                                      BLOF0051
      A=EXP(A)/(1.0+EXP(A))                                         BLOF0052
   26 IF(A)10,10,11                                                 BLOF0053
   10 A=10.0**(-10)                                                 BLOF0054
   11 IF(1.0-A)16,16,17                                             BLOF0055
   16 A=1.0-10.0**(-10)                                             BLOF0056
   17 GO TO (6,7,18,6,7,6),IJ                                       BLOF0057
   18 B=A                                                           BLOF0058
      GO TO 6                                                       BLOF0059
    7 B=0.0                                                         BLOF0060
      DO 3 J=1,6                                                    BLOF0061
    3 B=B+X(I,J,KK)*B1(J)                                           BLOF0062
      B=EXP(B)/(1.0+EXP(B))                                         BLOF0063
    6 DO 4 J=1,IR                                                   BLOF0064
      K=(J-1)*N1+I                                                  BLOF0065
      GO TO (12,12,13,23,12,12),IJ                                  BLOF0066
   13 IF(R(K))14,14,15                                              BLOF0067
   14 S(K)=10.0**(-10)                                              BLOF0068
      GO TO 19                                                      BLOF0069
   15 IF(Y(K)-R(K))20,20,19                                         BLOF0070
   20 S(K)=Y(K)*(1.0-10.0**(-30))                                   BLOF0071
   19 A=R(K)/Y(K)                                                   BLOF0072
   12 BLOF=BLOF+R(K)*ALOG(B/A)+(Y(K)-R(K))*ALOG((1.0-B)/(1.0-A))    BLOF0073
      GO TO 4                                                       BLOF0074
   23 BLOF=BLOF+R(K)*ALOG(A)+(Y(K)-R(K))*ALOG(1.0-A)                BLOF0075
    4 CONTINUE                                                      BLOF0076
    1 CONTINUE                                                      BLOF0077
      RETURN                                                        BLOF0078
      END                                                           BLOF0079
// DUP                                                              BLOF0080
*DELETE              BLOF                                          BLOF0081
*STORE       WS  UA  BLOF                                          BLOF0082

// JOB                                                              CYB20000
// FOR                                                              CYB20001
*LIST ALL                                                           CYB20002
*ONE WORD INTEGERS                                                  CYB20003
*EXTENDED PRECISION                                                 CYB20004
      FUNCTION CYB2(Y,Z)                                            CYB20005
      CYB2=Z*EXP(Y)/(1.0+EXP(Y))                                    CYB20006
      RETURN                                                        CYB20007
      END                                                           CYB20008
// DUP                                                              CYB20009
*DELETE              CYB2                                          CYB20010
*STORE       WS  UA  CYB2                                          CYB20011

// JOB                                                              CAN20000
// FOR                                                              CAN20001
*LIST ALL                                                           CAN20002
*ONE WORD INTEGERS                                                  CAN20003
*EXTENDED PRECISION                                                 CAN20004
      SUBROUTINE CAN2(AA,AMBDA,N)                                   CAN20005
      DIMENSION AA(2,2),AMBDA(2),E(4),D(4)                          CAN20006
   80 FORMAT(4X,I2,5X,E15.6,5X,3E15.6)                              CAN20007
      M=5                                                           CAN20008
```

```
      NQ=+1                                                          CAN20009
      K=1                                                            CAN20010
      DO 1 I=1,N                                                     CAN20011
      DO 1 J=1,I                                                     CAN20012
      E(K)=AA(I,J)                                                   CAN20013
    1 K=K+1                                                          CAN20014
      CALL JACO2(E,D,AMBDA,N,NQ)                                     CAN20015
      K=1                                                            CAN20016
      DO 2 I=1,N                                                     CAN20017
      DO 2 J=1,N                                                     CAN20018
      AA(I,J)=D(K)                                                   CAN20019
    2 K=K+1                                                          CAN20020
      DO 3 I=1,N                                                     CAN20021
    3 WRITE(M,80)I,AMBDA(I),(AA(I,J),J=1,N)                          CAN20022
      RETURN                                                         CAN20023
      END                                                            CAN20024
// DUP                                                               CAN20025
*DELETE              CAN2                                          CAN20026
*STORE       WS  UA  CAN2                                          CAN20027

// JOB                                                               JACO2000
// FOR                                                               JACO2001
*LIST ALL                                                           JACO2002
*ONE WORD INTEGERS                                                  JACO2003
*EXTENDED PRECISION                                                 JACO2004
      SUBROUTINE JACO2(A,B,C,NAA,NQ)                                JACO2005
      DIMENSION A(4),B(4),C(2)                                      JACO2006
  901 FORMAT(25H EIGENVALUE NOT CONVERGED  )                        JACO2007
      M=5                                                           JACO2008
      LOOPC=0                                                       JACO2009
      NA=NAA                                                        JACO2010
      NN=(NA*(NA+1))/2                                              JACO2011
      IF (NQ) 120,100,100                                           JACO2012
  100 K=1                                                           JACO2013
      DO 115 I=1,NA                                                 JACO2014
      DO 115 J=1,NA                                                 JACO2015
      IF(I-J)105,110,105                                            JACO2016
  105 B(K)=0.                                                       JACO2017
      GO TO 115                                                     JACO2018
  110 B(K)=1.                                                       JACO2019
  115 K=K+1                                                         JACO2020
  120 SUM=0.                                                        JACO2021
      IF(NA-1)325,310,125                                           JACO2022
  125 K=1                                                           JACO2023
      AMAX=0.                                                       JACO2024
      DO 155 I=1,NA                                                 JACO2025
      DO 150 J=1,I                                                  JACO2026
      IF(I-J)135,145,135                                            JACO2027
  135 IF(ABS(A(K))-AMAX)145,145,140                                 JACO2028
  140 AMAX=ABS(A(K))                                                JACO2029
  145 TERM=A(K)*A(K)                                                JACO2030
      SUM=SUM+TERM+TERM                                             JACO2031
  150 K=K+1                                                         JACO2032
  155 SUM=SUM-TERM                                                  JACO2033
      SUM=SQRT(SUM)                                                 JACO2034
      THRES=SUM/SQRT(FLOAT(NA))                                     JACO2035
```

```
      THRSH=THRES*1.0E-08                                              JACO2036
      IF(THRSH-AMAX)165,310,310                                        JACO2037
  165 THRES=AMAX/3.                                                    JACO2038
      IF(THRES-THRSH)175,180,180                                       JACO2039
  175 THRES=THRSH                                                      JACO2040
  180 K=2                                                              JACO2041
      N=0                                                              JACO2042
      JD=1                                                             JACO2043
      DO 270 J=2,NA                                                    JACO2044
      JD=JD+J                                                          JACO2045
      JJ=J-1                                                           JACO2046
      ID=0                                                             JACO2047
      DO 265 I=1,JJ                                                    JACO2048
      ID=ID+I                                                          JACO2049
      IF(ABS(A(K))-THRES)265,265,195                                   JACO2050
  195 N=N+1                                                            JACO2051
      ALPHA=(A(JD)-A(ID))/(2.*A(K))                                    JACO2052
      BETA=1./(1.+ALPHA*ALPHA)                                         JACO2053
      ROOT=1.0+ABS(ALPHA)* SQRT(BETA)                                  JACO2054
      IF(ALPHA)205,200,200                                             JACO2055
  200 SSQ=0.5*BETA/ROOT                                                JACO2056
      CSQ=0.5*ROOT                                                     JACO2057
      GO TO 210                                                        JACO2058
  205 CSQ=0.5*BETA/ROOT                                                JACO2059
      SSQ=0.5*ROOT                                                     JACO2060
  210 CC=SQRT(CSQ)                                                     JACO2061
      S=-SQRT(SSQ)                                                     JACO2062
      TWOSC=CC*S*2.                                                    JACO2063
      TEMPA=CSQ*A(ID)+TWOSC*A(K)+SSQ*A(JD)                             JACO2064
      A(JD)=CSQ*A(JD)-TWOSC*A(K)+SSQ*A(ID)                             JACO2065
      A(ID)=TEMPA                                                      JACO2066
      A(K)=0.                                                          JACO2067
      KA=JD-J                                                          JACO2068
      KB=ID-I                                                          JACO2069
      KC=NA*(I-1)                                                      JACO2070
      KD=NA*(J-1)                                                      JACO2071
      DO 260 L=1,NA                                                    JACO2072
      KC=KC+1                                                          JACO2073
      KD=KD+1                                                          JACO2074
      TEMPA=CC*B(KC)+S*B(KD)                                           JACO2075
      B(KD)=-S*B(KC)+CC*B(KD)                                          JACO2076
      B(KC)=TEMPA                                                      JACO2077
      IF(I-L)230,220,245                                               JACO2078
  220 KB=KB+1                                                          JACO2079
  225 KA=KA+1                                                          JACO2080
      GO TO 260                                                        JACO2081
  230 KB=KB+L-1                                                        JACO2082
      IF(J-L)240,225,250                                               JACO2083
  240 KA=KA+L-1                                                        JACO2084
      GO TO 255                                                        JACO2085
  245 KB=KB+1                                                          JACO2086
  250 KA=KA+1                                                          JACO2087
  255 TEMPA=CC*A(KB)+S*A(KA)                                           JACO2088
      A(KA)=-S*A(KB)+CC*A(KA)                                          JACO2089
      A(KB)=TEMPA                                                      JACO2090
  260 CONTINUE                                                         JACO2091
```

```
  265 K=K+1                                                          JACO2092
  270 K=K+1                                                          JACO2093
      LOOPC=LOOPC+1                                                  JACO2094
      IF(LOOPC-50)275,305,305                                        JACO2095
  275 IF(N-NN/8)280,280,180                                          JACO2096
  280 IF(THRES-THRSH)285,300,285                                     JACO2097
  285 THRES=THRSH/3.                                                 JACO2098
      IF(THRES-THRSH)295,180,180                                     JACO2099
  295 THRES=THRSH                                                    JACO2100
      GO TO 180                                                      JACO2101
  300 IF(N)180,310,180                                               JACO2102
  305 WRITE(M,901)                                                   JACO2103
  310 LL=0                                                           JACO2104
      DO 320 L=1,NA                                                  JACO2105
      LL=LL+L                                                        JACO2106
  320 C(L)=A(LL)                                                     JACO2107
  325 RETURN                                                         JACO2108
      END                                                            JACO2109
// DUP                                                             JACO2110
*DELETE              JACO2                                         JACO2111
*STORE      WS  UA  JACO2                                          JACO2112

// JOB                                                             BEIG2000
// FOR                                                             BEIG2001
*LIST ALL                                                          BEIG2002
*ONE WORD INTEGERS                                                 BEIG2003
*EXTENDED PRECISION                                                BEIG2004
*IOCS(1403 PRINTER)                                                BEIG2005
*IOCS(2501 READER)                                                 BEIG2006
*NAME BEIG2                                                        BEIG2007
      DIMENSION BA(12,12),Z(2),S(2),A3(2),COE(6),V(6)              BEIG2008
      COMMON Y(120),R(120),X( 30,6,2),T(6),B(6,2),NS,NREPS,TITL(12),ID,XBEIG2009
     1X(7),SD(5),A4(2),XY(182),MN,NI,YS,V1(2),ALAMD(2),PREP(2,2)   BEIG2010
   89 FORMAT(1HO,8X,12HEIGEN VALUES,10X,21HEIGEN VECTORS AS ROWS/)  BEIG2011
   88 FORMAT(1HOE11.4,3H=YS3X)                                      BEIG2012
   87 FORMAT(1HO,2(E11.4,2H=XI1,1HS))                               BEIG2013
   86 FORMAT(I4,3F10.3,4F15.3)                                      BEIG2014
   85 FORMAT(1HO,1X,18HTABLE OF RESIDUALS)                          BEIG2015
   82 FORMAT(1H112A6)                                               BEIG2016
   81 FORMAT(1HO,5X,3HY -,E15.6,3H = ,2(2H +,E15.6,2H Z,I1,3H SQ),/,) BEIG2017
   80 FORMAT(1HO,7X,5HN OBS5X5HR OBS3X8HESTIMATE11X11HVALUES OF Z18X13HFBEIG2018
     1ACTOR LEVELS/)                                                BEIG2019
   79 FORMAT(54HOPOWER TRANSFORMATIONS OF INDEPENDENT VARIABLES - A1 =F8BEIG2020
     1.4,6H  A2 =F8.4)                                              BEIG2021
   77 FORMAT(29HO  CENTRE OF RESPONSE SURFACE  ,/,)                 BEIG2022
   78 FORMAT( 52HO CANONICAL REGRESSION   (Z ARE CANONICAL VARIABLES),/)BEIG2023
      M=5                                                           BEIG2024
      N1=NS/NREPS                                                   BEIG2025
      DO 9 KK=1,2                                                   BEIG2026
      WRITE(M,82)TITL                                               BEIG2027
      DO 5 I=1,2                                                    BEIG2028
      GO TO (7,8),KK                                                BEIG2029
    7 A3(I)=1.0                                                     BEIG2030
      GO TO 5                                                       BEIG2031
    8 A3(I)=A4(I)                                                   BEIG2032
    5 CONTINUE                                                      BEIG2033
```

```
      GO TO (1,2),KK                                                BEIG2034
    2 WRITE(M,79)A3                                                 BEIG2035
    1 DO 29 J=1,4                                                   BEIG2036
      COE(J)=B(J,KK)                                                BEIG2037
   29 V(J)=COE(J)                                                   BEIG2038
      COE(5)=B(6,KK)                                                BEIG2039
      COE(6)=B(5,KK)                                                BEIG2040
      V(5)=COE(5)                                                   BEIG2041
      V(6)=COE(6)                                                   BEIG2042
      NFAK=2                                                        BEIG2043
      KP=NFAK+2                                                     BEIG2044
      DO 32 I=1,NFAK                                                BEIG2045
      DO 32 J=1,I                                                   BEIG2046
      IF(I-J)31,30,31                                               BEIG2047
   30 PREP(I,J)=V(KP)                                               BEIG2048
      GO TO 32                                                      BEIG2049
   31 PREP(I,J)=V(KP)*0.5                                           BEIG2050
      PREP(J,I)=PREP(I,J)                                           BEIG2051
   32 KP=KP+1                                                       BEIG2052
      DO 33 I=1,NFAK                                                BEIG2053
   33 V(I)=-V(I+1)*0.500                                            BEIG2054
      DO 34 I=1,NFAK                                                BEIG2055
      DO 34 J=1,NFAK                                                BEIG2056
   34 BA(I,J)=PREP(I,J)                                             BEIG2057
      WRITE(M,77)                                                   BEIG2058
      CALL MATV(BA,NFAK,V,1,DET)                                    BEIG2059
      YS=COE(1)                                                     BEIG2060
      DO 44 I=1,NFAK                                                BEIG2061
   44 YS=YS+0.5*V(I)*COE(I+1)                                       BEIG2062
      I1=1                                                          BEIG2063
      I2=2                                                          BEIG2064
      DO 3 I=1,2                                                    BEIG2065
      M1=V(I)/ABS(V(I))                                             BEIG2066
    3 S(I)=ABS(V(I))**(1.0/A3(I))*M1                                BEIG2067
      WRITE(M,87)(S(I),I,I=1,NFAK)                                  BEIG2068
      Y1=CYR2(YS,100.0)                                             BEIG2069
      WRITE(M,88)Y1                                                 BEIG2070
      WRITE(M,89)                                                   BEIG2071
      CALL CAN2(PREP,ALAMD,NFAK)                                    BEIG2072
      WRITE(M,78)                                                   BEIG2073
      WRITE(M,81)YS,(ALAMD(J),J,J=1,NFAK)                           BEIG2074
      WRITE(M,85)                                                   BEIG2075
      WRITE(M,80)                                                   BEIG2076
      DO 18 J=1,N1                                                  BEIG2077
      YPRED=YS                                                      BEIG2078
      RD=0.0                                                        BEIG2079
      YD=0.0                                                        BEIG2080
      DO 16 I=1,NFAK                                                BEIG2081
      Z(I)=0.0                                                      BEIG2082
      DO 16 L2=1,NFAK                                               BEIG2083
   16 Z(I)=Z(I)+(X(J,L2+1,KK)-V(L2))*PREP(I,L2)                     BEIG2084
      DO 17 L1=1,NFAK                                               BEIG2085
   17 YPRED=YPRED+(Z(L1)**2)*ALAMD(L1)                              BEIG2086
      DO 6 K=1,NREPS                                                BEIG2087
      K1=(K-1)*N1+J                                                 BEIG2088
      RD=RD+R(K1)                                                   BEIG2089
```

```
    6 YD=YD+Y(K1)                                                    BEIG2090
      YPRED=CYB2(YPRED,YD)                                           BEIG2091
      DO 4 II=1,2                                                    BEIG2092
    4 S(II)=X(J,II+1,KK)**(1.0/A3(II))                               BEIG2093
   18 WRITE(M,86)J,YD,RD,YPRED,(Z(I),I=1,NFAK),(S(II),II=1,2)        BEIG2094
      DO 46 I=1,2                                                    BEIG2095
   46 V1(I)=V(I)                                                     BEIG2096
      CALL CBRS2(KK)                                                 BEIG2097
      GO TO (10,11),KK                                               BEIG2098
   10 IF(A4(1))9,11,9                                                BEIG2099
    9 CONTINUE                                                       BEIG2100
   11 IF(ID-98)12,12,13                                              BEIG2101
   12 CALL EXIT                                                      BEIG2102
   13 CALL LINK(BRSL2)                                               BEIG2103
      END                                                            BEIG2104
// DUP                                                               BEIG2105
*DELETE             BEIG2                                          BEIG2106
*STORE      WS  UA  BEIG2                                          BEIG2107

// JOB                                                               CBRS2000
// FOR                                                               CBRS2001
*LIST ALL                                                           CBRS2002
*ONE WORD INTEGERS                                                  CBRS2003
*EXTENDED PRECISION                                                 CBRS2004
      SUBROUTINE CBRS2(KK)                                          CBRS2005
      DIMENSION A3(7),YCONT(10),ZLIM(2),XH(40),XV(40),YP1(5),XP1(5),YCONCBRS2006
     11(10),YP(400),XP(400)                                         CBRS2007
      COMMON Y(120),X(120),X( 30,6,2),T(6),B(12),N,IREP,TITL(12),ID,XX(7CBRS2008
     1),SD(5),A4(2),XY(182),MN,NI,YS,XCNTR(2),ALAMD(2),AVECT(2,2)   CBRS2009
   90 FORMAT(62H1IMAGINARY POINT CALCULATED, TRY CONTOURS CLOSER TO THE CBRS2010
     1CENTRE)                                                       CBRS2011
   89 FORMAT(64H0SADDLE EXISTS  -  CONTOUR POINTS PLOTTED IN UNTRANSFORMCBRS2012
     1ED UNITS//5(12X,F8.2,3X)/5(10X2HX19X2HX2))                    CBRS2013
   85 FORMAT(61H1IMAGINARY POINT CALCULATED - CONTOUR ON WRONG SIDE OF CCBRS2014
     1ENTRE)                                                        CBRS2015
   82 FORMAT(12F6.2)                                                CBRS2016
   81 FORMAT(2X,5(2X,F10.2,1X,F10.2))                               CBRS2017
   80 FORMAT(54HOPOWER TRANSFORMATIONS OF INDEPENDENT VARIABLES - A1 =FBCBRS2018
     1.4,6H  A2 =F8.4)                                              CBRS2019
   83 FORMAT(1H1,12A6)                                              CBRS2020
   79 FORMAT(1H0,10X,54HDATA FOR PLOTTING OF 5 CONTOURS IN UNTRANSFORMEDCBRS2021
     1 UNITS//5(12X,F8.2,3X)/5(10X2HX19X2HX2))                      CBRS2022
      L=8                                                           CBRS2023
      M=5                                                           CBRS2024
      GO TO (7,8),KK                                                CBRS2025
    7 READ(L,82)YCON1,ZLIM                                          CBRS2026
      DO 29 I=1,10                                                  CBRS2027
   29 YCONT(I)=ALOG(YCON1(I)/(100.0-YCON1(I)))                      CBRS2028
      DO 9 I=1,2                                                    CBRS2029
    9 A3(I)=1.0                                                     CBRS2030
      GO TO 10                                                      CBRS2031
    8 DO 13 I=1,2                                                   CBRS2032
   13 A3(I)=A4(I)                                                   CBRS2033
   10 DO 4 I=1,2                                                    CBRS2034
    4 ZLIM(I)=ZLIM(I)**A3(I)                                        CBRS2035
      DO 61 I=1,400                                                 CBRS2036
```

```
      XP(I)=0.0                                                         CBRS2037
   61 YP(I)=0.0                                                         CBRS2038
      NSWCH=0                                                           CBRS2039
      NSAD=0                                                            CBRS2040
      KCY=0                                                             CBRS2041
      IH=1                                                              CBRS2042
      IV=2                                                              CBRS2043
      N1=ALAMD(IH)/ABS(ALAMD(IH))                                       CBRS2044
      N2=ALAMD(IV)/ABS(ALAMD(IV))                                       CBRS2045
      NSIGN=N1*N2                                                       CBRS2046
      IF(NSIGN)11,11,40                                                 CBRS2047
   11 NSAD=1                                                            CBRS2048
      IF(N1)40,40,14                                                    CBRS2049
   14 IDUM=IH                                                           CBRS2050
      IH=IV                                                             CBRS2051
      IV=IDUM                                                           CBRS2052
      NSWCH=1                                                           CBRS2053
   40 CONTINUE                                                          CBRS2054
      KCY=KCY+1                                                         CBRS2055
      ARG=(YCONT(KCY)-YS)/ALAMD(IH)                                     CBRS2056
      IF(ARG)101,101,102                                                CBRS2057
  101 WRITE(M,85)                                                       CBRS2058
      GO TO 43                                                          CBRS2059
  102 ZFRST=SQRT(ARG)                                                   CBRS2060
      ZEND=ZLIM(IH)-ZFRST                                               CBRS2061
      XH(1)=ZFRST                                                       CBRS2062
      XV(1)=0.0                                                         CBRS2063
      THETA=0.0                                                         CBRS2064
      DO 1 I=2,10                                                       CBRS2065
      THETA=THETA+0.15710                                               CBRS2066
      IF(NSAD)51,51,52                                                  CBRS2067
   51 XH(I)=ZFRST*COS(THETA)                                            CBRS2068
      GO TO 53                                                          CBRS2069
   52 XH(I)=ZFRST+ZEND-ZEND*COS(THETA)                                  CBRS2070
   53 ARG=(YCONT(KCY)-YS-ALAMD(IH)*(XH(I)**2))/ALAMD(IV)                CBRS2071
      IF(ARG)104,103,103                                                CBRS2072
  104 WRITE(M,90)                                                       CBRS2073
      GO TO 43                                                          CBRS2074
  103 XV(I)=SQRT(ARG)                                                   CBRS2075
      IL=42-I                                                           CBRS2076
      XH(IL)=XH(I)                                                      CBRS2077
      XV(IL)=-XV(I)                                                     CBRS2078
    1 CONTINUE                                                          CBRS2079
      IF(NSAD)54,54,55                                                  CBRS2080
   54 XH(11)=0.0                                                        CBRS2081
      ARGG=(YCONT(KCY)-YS)/ALAMD(IV)                                    CBRS2082
      XV(11)=SQRT(ARGG)                                                 CBRS2083
      GO TO 56                                                          CBRS2084
   55 XH(11)=ZLIM(IH)                                                   CBRS2085
      ARG=(YCONT(KCY)-YS-ALAMD(IH)*(XH(I)**2))/ALAMD(IV)                CBRS2086
      XV(11)=SQRT(ARG)                                                  CBRS2087
   56 DO 2 I=12,21                                                      CBRS2088
      LL1=22-I                                                          CBRS2089
      II=42-I                                                           CBRS2090
      XH(I)=-XH(LL1)                                                    CBRS2091
      XV(I)=XV(LL1)                                                     CBRS2092
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```
      XH(II)=XH(I)                                                      CBRS2093
    2 XV(II)=-XV(I)                                                     CBRS2094
      XV(31)=-XV(11)                                                    CBRS2095
      XH(31)=XH(11)                                                     CBRS2096
      IF(NSWCH)31,31,32                                                 CBRS2097
   32 I1=IV                                                             CBRS2098
      I2=IH                                                             CBRS2099
      DO 33 I=1,40                                                      CBRS2100
      XDUM=XH(I)                                                        CBRS2101
      XH(I)=XV(I)                                                       CBRS2102
   33 XV(I)=XDUM                                                        CBRS2103
      GO TO 60                                                          CBRS2104
   31 I1=IH                                                             CBRS2105
      I2=IV                                                             CBRS2106
   60 DO 41 I=1,40                                                      CBRS2107
      L=(KCY-1)*40+I                                                    CBRS2108
      XP(L)=AVECT(I1,I1)*XH(I)+AVECT(I2,I1)*XV(I)+XCNTR(I1)             CBRS2109
   41 YP(L)=AVECT(I1,I2)*XH(I)+AVECT(I2,I2)*XV(I)+XCNTR(I2)             CBRS2110
      IF(KCY-5)40,34,34                                                 CBRS2111
   34 IF(NSAD-1)35,47,47                                                CBRS2112
   47 IF(KCY-10)48,35,35                                                CBRS2113
   48 IF(KCY-5)40,36,40                                                 CBRS2114
   36 IF(NSWCH)38,38,39                                                 CBRS2115
   38 NSWCH=1                                                           CBRS2116
      GO TO 37                                                          CBRS2117
   39 NSWCH=0                                                           CBRS2118
   37 IDUM=IH                                                           CBRS2119
      IH=IV                                                             CBRS2120
      IV=IDUM                                                           CBRS2121
      GO TO 40                                                          CBRS2122
   35 WRITE(M,83)TITL                                                   CBRS2123
      GO TO (5,6),KK                                                    CBRS2124
    6 WRITE(M,80)A3                                                     CBRS2125
    5 WRITE(M,79)(YCON1(I),I=1,5)                                       CBRS2126
      DO 3 I=1,40                                                       CBRS2127
      DO 49 J=1,5                                                       CBRS2128
      L1=(J-1)*40+I                                                     CBRS2129
      XP1(J)=XP(L1)                                                     CBRS2130
   49 YP1(J)=YP(L1)                                                     CBRS2131
      DO 12 J=1,5                                                       CBRS2132
      N2=XP1(J)/ABS(XP1(J))                                             CBRS2133
      XP1(J)=ABS(XP1(J))**(1.0/A3(1))*N2                                CBRS2134
      N2=YP1(J)/ABS(YP1(J))                                             CBRS2135
   12 YP1(J)=ABS(YP1(J))**(1.0/A3(2))*N2                                CBRS2136
    3 WRITE(M,81)(XP1(J),YP1(J),J=1,5)                                  CBRS2137
      IF(NSAD)43,43,44                                                  CBRS2138
   44 WRITE(M,83)TITL                                                   CBRS2139
      WRITE(M,89)(YCON1(I),I=6,10)                                      CBRS2140
      DO 42 I=1,40                                                      CBRS2141
      DO 59 J=1,5                                                       CBRS2142
      L1=200+(J-1)*40+I                                                 CBRS2143
      XP1(J)=XP(L1)                                                     CBRS2144
   59 YP1(J)=YP(L1)                                                     CBRS2145
      DO 18 J=1,5                                                       CBRS2146
      N2=XP1(J)/ABS(XP1(J))                                             CBRS2147
      XP1(J)=ABS(XP1(J))**(1.0/A3(1))*N2                                CBRS2148
```

```
      N2=YP1(J)/ABS(YP1(J))                                          CBRS2149
   18 YP1(J)=ABS(YP1(J))**(1.0/A3(2))*N2                             CBRS2150
   42 WRITE(M,81)(XP1(J),YP1(J),J=1,5)                               CBRS2151
   43 RETURN                                                         CBRS2152
      END                                                            CBRS2153
// DUP                                                               CBRS2154
*DELETE                CBRS2                                       CBRS2155
*STORE       WS  UA  CBRS2                                         CBRS2156
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```
// JOB                                                                  COBM2000
// FOR                                                                  COBM2001
*LIST ALL                                                               COBM2002
*ONE WORD INTEGERS                                                      COBM2003
*EXTENDED PRECISION                                                     COBM2004
*IOCS(2501 READER)                                                      COBM2005
*IOCS(1403 PRINTER)                                                     COBM2006
*NAME COBM2                                                             COBM2007
C                                                                       COBM2008
C     THIS PROGRAM ANALYZES BINOMIAL COUNT DATA FROM TWO-FACTOR RESPONSE COBM2009
C SURFACE EXPERIMENTS USING VARIOUS TRANSFORMATIONS WITH NORMAL THEORY. COBM2010
C THE ANALYSIS OF VARIANCE, PREDICTED VALUES, AND DEVIATIONS ARE PRINTEDCOBM2011
C OUT. THE ANALYSIS IS DONE FOR THE LOGIT, ODDS, PER CENT, AND ARCSINE  COBM2012
C TRANSFORMATIONS FOR BOTH LINEAR AND NONLINEAR MATHEMATICAL MODELS     COBM2013
C USING THE NORMAL AND BINOMIAL LIKELIHOOD FUNCTIONS. VALUES OF ALL     COBM2014
C POWER TRANSFORMATIONS MUST BE SUPPLIED.                               COBM2015
C                                                                       COBM2016
C     THE DATA DECK FOR BRSL2 MAY BE USED, WITH A DIFFERENT CONTROL CARD.COBM2017
C                                                                       COBM2018
C    SUBROUTINES CALLED                                                 COBM2019
C                                                                       COBM2020
C   ARSIN - CALCULATES ARCSINE                                          COBM2024
C   MATV  - INVERTS MATRICES UP TO 12 BY 12                             COBM2021
C   ORTH  - CALCULATES NORMAL ORTHOGONAL POLYNOMIALS                    COBM2022
C   TRANS - BACKTRANSFORMS VARIOUS NORMAL TRANSFORMATIONS               COBM2023
C                                                                       COBM2025
C    MAKEUP OF DATA DECK                                                COBM2026
C                                                                       COBM2027
C 1.TITLE CARD - (12A6)                                                 COBM2028
C 2.CONTROL CARD - (1X,2I2,10F5.3)                                      COBM2029
C       I2 - NUMBER OF TREATMENT COMBINATIONS                           COBM2030
C       I2 - NUMBER OF OBSERVATION SETS                                 COBM2031
C       F5.3 - POWER TRANSFORMATION OF DEPENDENT VARIABLE FOR ODDS NORMALCOBM2032
C       F5.3 - POWER TRANSFORMATION OF DEPENDENT VARIABLE FOR PER CENT  COBM2033
CC            NORMAL                                                    COBM2034
C       8F5.3 - PAIRS OF POWER TRANSFORMATIONS FOR INDEPENDENT VARIABLES COBM2035
C             FOR LOGIT, ODDS, PER CENT, AND ARCSINE NORMAL MODELS.     COBM2036
C 3.TREATMENT COMBINATIONS IN PAIRS - (16F5.3)                          COBM2037
C 4.DATA - SETS OF OBSERVATIONS FOR EACH TREATMENT COMBINATION          COBM2038
C       ONE SET PER CARD - (4F6.3)                                      COBM2039
C 5.99 IN COLS. 79-80 INDICATES END OF DATA, ANOTHER DECK TO FOLLOW     COBM2040
C   98 IN COLS. 79-80 INDICATES END OF JOB - CALL EXIT AFTER THIS DECK  COBM2041
C 6.REPEAT 1. TO 5. AS REQUIRED                                         COBM2042
C                                                                       COBM2043
      DIMENSION A2(2,4),X(30,6),Y1(8),Y2(120),A1(2),Z2(30),SSX(12,12),SSCOBM2044
     1XY(12),Y3(30),SSR1(6),SLR1(6),SSR2(2),SLR2(2),RLR2(2),RSR2(2),RLR1COBM2045
     2(6),RSR1(6),Y4(30,2),Y5(30,4,2)                                   COBM2046
      COMMON Y(120),R(120),W(30,6),Z(12),N,IREP,TITL(12),ID,U(12),A3(3) COBM2047
  191 FORMAT(4HO X15X2HX25X12HLINEAR MODEL/)                            COBM2048
  190 FORMAT(4HO X15X2HX25X16HNON-LINEAR MODEL/)                        COBM2049
  189 FORMAT(2F7.3,5E14.6)                                              COBM2050
  188 FORMAT(32HOPREDICTED VALUES AND DEVIATIONS)                       COBM2051
  186 FORMAT(1HO24X8HLOG L(B)8X8HLOG R(B)8X8HLOG R(N))                  COBM2052
  185 FORMAT(11HOTREATMENTS10X3E16.8)                                   COBM2053
  184 FORMAT(11H REGRESSION10X3E16.8)                                   COBM2054
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183 FORMAT(8H  LINEAR13X3E16.8)                                                 COBM2055
182 FORMAT(12H    X1 LINEAR9X3E16.8)                                            COBM2056
181 FORMAT(12H    X2 LINEAR9X3E16.8)                                            COBM2057
180 FORMAT(11H  QUADRATIC10X3E16.8)                                             COBM2058
 99 FORMAT(11H    X1 QUAD.10X3E16.8)                                            COBM2059
 98 FORMAT(11H    X2 QUAD.10X3E16.8)                                            COBM2060
 97 FORMAT(7H  X1*X214X3E16.8)                                                  COBM2061
 96 FORMAT(20H LACK OF FIT OF REG.1X3E16.8)                                     COBM2062
 95 FORMAT(21H LACK OF FIT OF MODEL2E16.8)                                      COBM2063
 94 FORMAT(11H REPLICATES10X2E16.8)                                             COBM2064
187 FORMAT(12H COMMON MEAN9XE16.8)                                              COBM2065
 93 FORMAT(24 HONON-LINEAR MODEL  A1 = F7.4,6H A2 = F7.4,5H C = F7.4)           COBM2066
 92 FORMAT(24 HONON-LINEAR MODEL  A1 = F7.4,6H A2 = F7.4)                       COBM2067
 91 FORMAT(13HOLINEAR MODEL)                                                    COBM2068
 90 FORMAT(58HOANALYSIS OF BINOMIAL DATA   SIN(SQRT(R/N)) TRANSFORMATICOBM2069
   ION)                                                                         COBM2070
 89 FORMAT(58HOANALYSIS OF BINOMIAL DATA   100*R/N         TRANSFORMATICOBM2071
   ION)                                                                         COBM2072
 88 FORMAT(58HOANALYSIS OF BINOMIAL DATA   R/(N-R)         TRANSFORMATICOBM2073
   ION)                                                                         COBM2074
 87 FORMAT(58HOANALYSIS OF BINOMIAL DATA   LOG(R/(N-R))    TRANSFORMATICOBM2075
   ION)                                                                         COBM2076
 86 FORMAT(66HOINCORRECT NUMBER OF OBSERVATION SETS - SKIPPING TO NEXTCOBM2077
   1 DATA DECK)                                                                 COBM2078
 85 FORMAT(8F6.3,30X,I2)                                                        COBM2079
 84 FORMAT(16F5.3)                                                              COBM2080
 82 FORMAT(1X,212,10F5.3)                                                       COBM2081
 81 FORMAT(1H1I2A6)                                                             COBM2082
 80 FORMAT(12A6)                                                                COBM2083
    L=8                                                                         COBM2084
    M=5                                                                         COBM2085
  1 READ(L,80)TITL                                                              COBM2086
    READ(L,82)N1,IREP,(A1(K),K=1,2),((A2(I,J),I=1,2),J=1,4)                     COBM2087
    READ(L,84)((W(I,J),J=2,3),I=1,N1)                                           COBM2088
    I=0                                                                         COBM2089
  2 I=I+1                                                                       COBM2090
    READ(L,85)Y1,ID                                                             COBM2091
    IF(ID-98)3,4,4                                                              COBM2092
  3 IR=2*IREP                                                                   COBM2093
    DO 5 II=1,IR,2                                                              COBM2094
    K=N1*(II-1)/2+I                                                             COBM2095
    R(K)=Y1(I+1)                                                                COBM2096
  5 Y(K)=Y1(II)                                                                 COBM2097
    GO TO 2                                                                     COBM2098
  4 N2=I-1                                                                      COBM2099
    IF(N1-N2)6,7,6                                                              COBM2100
  6 WRITE(M,86)                                                                 COBM2101
    IF(ID-98)1,8,1                                                              COBM2102
  7 N=N1*IREP                                                                   COBM2103
    SL=0.0                                                                      COBM2104
    DO 12 K=1,N                                                                 COBM2105
    IF(R(K))12,12,68                                                            COBM2106
 68 IF(Y(K)-R(K))12,12,69                                                       COBM2107
 69 SL=SL+(Y(K)+0.5)*ALOG(Y(K))-(R(K)+0.5)*ALOG(R(K))-(Y(K)-R(K)+0.5)*COBM2108
   1ALOG(Y(K)-R(K))+(1.0/R(K)+1.0/(Y(K)-R(K))-1.0/Y(K))/12.0-ALOG(6.28COBM2109
    23185)*0.5                                                                  COBM2110
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 12 CONTINUE                                                        COBM2111
    SLA=SL                                                          COBM2112
    SLB=SL                                                          COBM2113
    DO 10 I=1,N1                                                    COBM2114
    SA=0.0                                                          COBM2115
    SB=0.0                                                          COBM2116
    DO 11 J=1,IREP                                                  COBM2117
    K=N1*(J-1)+I                                                    COBM2118
    SA=SA+R(K)                                                      COBM2119
 11 SB=SB+Y(K)                                                      COBM2120
    DO 10 J=1,IREP                                                  COBM2121
    K=N1*(J-1)+I                                                    COBM2122
    IF(SA)76,76,72                                                  COBM2123
 72 IF(SB-SA)76,76,73                                               COBM2124
 73 SLB=SLB+R(K)*ALOG(SA/SB)+(Y(K)-R(K))*ALOG(1.0-SA/SB)            COBM2125
 76 IF(R(K))74,74,70                                                COBM2126
 74 R(K)=10.0**(-10)                                                COBM2127
    GO TO 10                                                        COBM2128
 70 IF(Y(K)-R(K))75,75,71                                           COBM2129
 75 R(K)=Y(K)*(1.0-10.0**(-10))                                     COBM2130
    GO TO 10                                                        COBM2131
 71 SLA=SLA+R(K)*ALOG(R(K)/Y(K))+(Y(K)-R(K))*ALOG(1.0-R(K)/Y(K))    COBM2132
 10 CONTINUE                                                        COBM2133
    DO 100 KK=1,4                                                   COBM2134
    WRITE(M,81)TITL                                                 COBM2135
    DO 13 JJ1=1,2                                                   COBM2136
    GO TO (67,27),JJ1                                               COBM2137
 27 IF(A2(1,KK))67,13,67                                            COBM2138
 67 GO TO (14,15,15,14),KK                                          COBM2139
 15 GO TO (112,113),JJ1                                             COBM2140
112 A=1.0                                                           COBM2141
    GO TO 114                                                       COBM2142
113 A=A1(KK-1)                                                      COBM2143
114 B=0.0                                                           COBM2144
    DO 16 K=1,N                                                     COBM2145
    GO TO (14,17,18,14),KK                                          COBM2146
 17 Y2(K)=R(K)/(Y(K)-R(K))                                          COBM2147
    GO TO 16                                                        COBM2148
 18 Y2(K)=100.0*R(K)/Y(K)                                           COBM2149
 16 B=B+ALOG(Y2(K))/N                                               COBM2150
    B=EXP(B)                                                        COBM2151
 14 Z3=0.0                                                          COBM2152
    DO 20 I=1,N1                                                    COBM2153
    Z2(I)=0.0                                                       COBM2154
    DO 20 J=1,IREP                                                  COBM2155
    K=N1*(J-1)+I                                                    COBM2156
    GO TO (21,22,22,23),KK                                          COBM2157
 21 Y2(K)=ALOG(R(K)/(Y(K)-R(K)))                                    COBM2158
    GO TO 24                                                        COBM2159
 22 Y2(K)=(Y2(K)**A-1.0)/A/B**(A-1.0)                               COBM2160
    GO TO 24                                                        COBM2161
 23 Y2(K)=ARSIN(SQRT(R(K)/Y(K)))                                    COBM2162
 24 Z3=Z3+Y2(K)/N                                                   COBM2163
 20 Z2(I)=Z2(I)+Y2(K)/IREP                                          COBM2164
    SST=0.0                                                         COBM2165
    SSTO=0.0                                                        COBM2166
```

```
      DO 19 I=1,N1                                                      COBM2167
      SST=SST+(Z2(I)-Z3)**2*IREP                                        COBM2168
      DO 29 J=1,IREP                                                    COBM2169
      K=N1*(J-1)+I                                                      COBM2170
   29 SSTO=SSTO+(Y2(K)-Z3)**2                                           COBM2171
   19 Z2(I)=TRANS(KK,Z2(I),A,B)                                         COBM2172
      SSE=SSTO-SST                                                      COBM2173
      Z3=TRANS(KK,Z3,A,B)                                               COBM2174
      SLN=SL                                                            COBM2175
      SLT=SL                                                            COBM2176
      DO 26 I=1,N1                                                      COBM2177
      DO 26 J=1,IREP                                                    COBM2178
      Y5(I,J,JJ1)=0.0                                                   COBM2179
      K=N1*(J-1)+I                                                      COBM2180
      SLN=SLN+R(K)*ALOG(Z2(I))+(Y(K)-R(K))*ALOG(1.0-Z2(I))              COBM2181
   26 SLT=SLT+R(K)*ALOG(Z3)+(Y(K)-R(K))*ALOG(1.0-Z3)                    COBM2182
      DO 77 I=1,2                                                       COBM2183
      GO TO (78,79),JJ1                                                 COBM2184
   78 A3(I)=1.0                                                         COBM2185
      GO TO 77                                                          COBM2186
   79 A3(I)=A2(I,KK)                                                    COBM2187
   77 CONTINUE                                                          COBM2188
      DO 9 I=1,N1                                                       COBM2189
      X(I,1)=1.0                                                        COBM2190
      DO 25 J=2,3                                                       COBM2191
      X(I,J)=W(I,J)**A3(J-1)                                            COBM2192
   25 X(I,J+2)=X(I,J)*X(I,J)                                            COBM2193
    9 X(I,6)=X(I,2)*X(I,3)                                              COBM2194
      CALL ORTH(X)                                                      COBM2195
      DO 115 I=1,6                                                      COBM2196
      SSXY(I)=0.0                                                       COBM2197
      DO 115 J=1,6                                                      COBM2198
  115 SSX(I,J)=0.0                                                      COBM2199
      DO 30 I=1,6                                                       COBM2200
      DO 30 II=1,N1                                                     COBM2201
      DO 117 JJ=1,IREP                                                  COBM2202
      K=N1*(JJ-1)+II                                                    COBM2203
  117 SSXY(I)=SSXY(I)+Y2(K)*X(II,I)                                     COBM2204
      DO 30 J=1,6                                                       COBM2205
   30 SSX(I,J)=SSX(I,J)+X(II,I)*X(II,J)*IREP                            COBM2206
      CALL MATV(SSX,6,SSXY,1,DET)                                       COBM2207
      SSR=0.0                                                           COBM2208
      DO 31 I=1,N1                                                      COBM2209
      Y3(I)=0.0                                                         COBM2210
      DO 32 J=1,6                                                       COBM2211
   32 Y3(I)=Y3(I)+SSXY(J)*X(I,J)                                        COBM2212
      Y4(I,JJ1)=Y3(I)                                                   COBM2213
      DO 31 J=1,IREP                                                    COBM2214
      K=N1*(J-1)+I                                                      COBM2215
      Y5(I,J,JJ1)=Y4(I,JJ1)-Y2(K)                                       COBM2216
   31 SSR=SSR+(Y3(I)-Y2(K))**2                                          COBM2217
      SLR=SL                                                            COBM2218
      DO 33 I=1,N1                                                      COBM2219
      Z4=TRANS(KK,Y3(I),A,B)                                            COBM2220
      DO 33 J=1,IREP                                                    COBM2221
      K=N1*(J-1)+I                                                      COBM2222
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 33 SLR=SLR+R(K)*ALOG(Z4)+(Y(K)-R(K))*ALOG(1.0-Z4)                  COBM2223
    DO 35 I=2,6                                                     COBM2224
    DO 116 J=1,6                                                    COBM2225
    SSXY(J)=0.0                                                     COBM2226
    DO 116 II=1,6                                                   COBM2227
116 SSX(II,J)=0.0                                                   COBM2228
    J1=0                                                            COBM2229
    DO 34 J=1,6                                                     COBM2230
    IF(I-J)36,34,36                                                 COBM2231
 36 J1=J1+1                                                         COBM2232
    DO 118 JJ=1,N1                                                  COBM2233
    DO 119 K1=1,IREP                                                COBM2234
    K=N1*(K1-1)+JJ                                                  COBM2235
119 SSXY(J1)=SSXY(J1)+Y2(K)*X(JJ,J)                                 COBM2236
    I11=0                                                           COBM2237
    DO 38 II=1,6                                                    COBM2238
    IF(II-I)37,38,37                                                COBM2239
 37 III=III+1                                                       COBM2240
    SSX(III,J1)=SSX(III,J1)+X(JJ,II)*X(JJ,J)*IREP                  COBM2241
 38 CONTINUE                                                        COBM2242
118 CONTINUE                                                        COBM2243
 34 CONTINUE                                                        COBM2244
    CALL MATV(SSX,5,SSXY,1,DET)                                     COBM2245
    SSR1(I)=0.0                                                     COBM2246
    DO 40 J=1,N1                                                    COBM2247
    Y3(J)=0.0                                                       COBM2248
    K1=0                                                            COBM2249
    DO 41 K=1,6                                                     COBM2250
    IF(I-K)42,41,42                                                 COBM2251
 42 K1=K1+1                                                         COBM2252
    Y3(J)=Y3(J)+SSXY(K1)*X(J,K)                                     COBM2253
 41 CONTINUE                                                        COBM2254
    DO 40 II=1,IREP                                                 COBM2255
    K=N1*(II-1)+J                                                   COBM2256
 40 SSR1(I)=SSR1(I)+(Y3(J)-Y2(K))**2                                COBM2257
    SLR1(I)=SL                                                      COBM2258
    DO 35 J=1,N1                                                    COBM2259
    Z4=TRANS(KK,Y3(J),A,B)                                          COBM2260
    DO 35 J1=1,IREP                                                 COBM2261
    K=N1*(J1-1)+J                                                   COBM2262
 35 SLR1(I)=SLR1(I)+R(K)*ALOG(Z4)+(Y(K)-R(K))*ALOG(1.0-Z4)          COBM2263
    DO 44 II=1,2                                                    COBM2264
    DO 120 I=1,6                                                    COBM2265
    SSXY(I)=0.0                                                     COBM2266
    DO 120 J=1,6                                                    COBM2267
120 SSX(I,J)=0.0                                                    COBM2268
    I1=0                                                            COBM2269
    DO 43 I=1,6                                                     COBM2270
    IF(I-II*2)45,43,45                                              COBM2271
 45 IF(I-II*2-1)46,43,46                                            COBM2272
 46 I1=I1+1                                                         COBM2273
    DO 121 JJ=1,N1                                                  COBM2274
    DO 122 JK=1,IREP                                                COBM2275
    K=N1*(JK-1)+JJ                                                  COBM2276
122 SSXY(I1)=SSXY(I1)+Y2(K)*X(JJ,I)                                 COBM2277
    J1=0                                                            COBM2278
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      DO 47 J=1,6                                                       COBM2279
      IF(J-II*2)48,47,48                                                COBM2280
   48 IF(J-II*2-1)49,47,49                                              COBM2281
   49 J1=J1+1                                                           COBM2282
      SSX(I1,J1)=SSX(I1,J1)+X(JJ,I)*X(JJ,J)*IREP                        COBM2283
   47 CONTINUE                                                          COBM2284
  121 CONTINUE                                                          COBM2285
   43 CONTINUE                                                          COBM2286
      CALL MATV(SSX,4,SSXY,1,DET)                                       COBM2287
      SSR2(II)=0.0                                                      COBM2288
      DO 51 J=1,N1                                                      COBM2289
      Y3(J)=0.0                                                         COBM2290
      I1=0                                                              COBM2291
      DO 52 I=1,6                                                       COBM2292
      IF(I-II*2)53,52,53                                                COBM2293
   53 IF(I-II*2-1)54,52,54                                              COBM2294
   54 I1=I1+1                                                           COBM2295
      Y3(J)=Y3(J)+SSXY(I1)*X(J,I)                                       COBM2296
   52 CONTINUE                                                          COBM2297
      DO 51 I=1,IREP                                                    COBM2298
      K=N1*(I-1)+J                                                      COBM2299
   51 SSR2(II)=SSR2(II)+(Y3(J)-Y2(K))**2                                COBM2300
      SLR2(II)=SL                                                       COBM2301
      DO 44 J=1,N1                                                      COBM2302
      Z4=TRANS(KK,Y3(J),A,B)                                            COBM2303
      DO 44 J1=1,IREP                                                   COBM2304
      K=N1*(J1-1)+J                                                     COBM2305
   44 SLR2(II)=SLR2(II)+R(K)*ALOG(Z4)+(Y(K)-R(K))*ALOG(1.0-Z4)          COBM2306
      GO TO (59,60),JJ1                                                 COBM2307
   59 GO TO (55,56,57,58),KK                                            COBM2308
   55 WRITE(M,87)                                                       COBM2309
      GO TO 61                                                          COBM2310
   56 WRITE(M,88)                                                       COBM2311
      GO TO 61                                                          COBM2312
   57 WRITE(M,89)                                                       COBM2313
      GO TO 61                                                          COBM2314
   58 WRITE(M,90)                                                       COBM2315
   61 WRITE(M,91)                                                       COBM2316
      GO TO 64                                                          COBM2317
   60 GO TO (62,63,63,62),KK                                            COBM2318
   62 WRITE(M,92)(A2(I,KK),I=1,2)                                       COBM2319
      GO TO 64                                                          COBM2320
   63 WRITE(M,93)(A2(I,KK),I=1,2),A1(KK-1)                              COBM2321
   64 IF(IREP-1)28,28,83                                                COBM2322
   83 RLT=SLT-SLN                                                       COBM2323
      RST=N*ALOG(SSE/SSTO)/2.0                                          COBM2324
      RSF=N*ALOG(SSE/SSR)/2.0                                           COBM2325
      RLRP=SLB-SLA                                                      COBM2326
   28 RLR=SLT-SLR                                                       COBM2327
      RSR=N*ALOG(SSR/SSTO)/2.0                                          COBM2328
      DO 65 I=1,2                                                       COBM2329
      RLR2(I)=SLR2(I)-SLR                                               COBM2330
   65 RSR2(I)=N*ALOG(SSR/SSR2(I))/2.0                                   COBM2331
      DO 66 I=2,6                                                       COBM2332
      RLR1(I)=SLR1(I)-SLR                                               COBM2333
   66 RSR1(I)=N*ALOG(SSR/SSR1(I))/2.0                                   COBM2334
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      RLF=SLR-SLN                                                       COBM2335
      RLN=SLN-SLB                                                       COBM2336
      WRITE(M,186)                                                      COBM2337
      IF(IREP-1)109,109,110                                             COBM2338
  110 WRITE(M,185)SLT,RLT,RST                                           COBM2339
  109 WRITE(M,184)SLR,RLR,RSR                                           COBM2340
      WRITE(M,183)SLR2(1),RLR2(1),RSR2(1)                               COBM2341
      WRITE(M,182)SLR1(2),RLR1(2),RSR1(2)                               COBM2342
      WRITE(M,181)SLR1(3),RLR1(3),RSR1(3)                               COBM2343
      WRITE(M,180)SLR2(2),RLR2(2),RSR2(2)                               COBM2344
      WRITE(M,99)SLR1(4),RLR1(4),RSR1(4)                                COBM2345
      WRITE(M,98)SLR1(5),RLR1(5),RSR1(5)                                COBM2346
      WRITE(M,97)SLR1(6),RLR1(6),RSR1(6)                                COBM2347
      IF(IREP-1)108,108,107                                             COBM2348
  107 WRITE(M,96)SLN,RLF,RSF                                            COBM2349
      WRITE(M,95)SLB,RLN                                                COBM2350
      WRITE(M,94)SLA,RLRP                                               COBM2351
      GO TO 13                                                          COBM2352
  108 WRITE(M,96)SLN,RLF                                                COBM2353
      WRITE(M,187)SLT                                                   COBM2354
   13 CONTINUE                                                          COBM2355
      DO 123 JJ=1,2                                                     COBM2356
      WRITE(M,81)TITL                                                   COBM2357
      GO TO (101,102,103,104),KK                                        COBM2358
  101 WRITE(M,87)                                                       COBM2359
      GO TO 105                                                         COBM2360
  102 WRITE(M,88)                                                       COBM2361
      GO TO 105                                                         COBM2362
  103 WRITE(M,89)                                                       COBM2363
      GO TO 105                                                         COBM2364
  104 WRITE(M,90)                                                       COBM2365
  105 WRITE(M,188)                                                      COBM2366
      GO TO (124,125),JJ                                                COBM2367
  124 WRITE(M,191)                                                      COBM2368
      DO 106 I=1,N1                                                     COBM2369
  106 WRITE(M,189)(W(I,L),L=2,3),Y4(I,1),(Y5(I,K,1),K=1,4)              COBM2370
      IF(N1-21)125,125,123                                              COBM2371
  125 WRITE(M,190)                                                      COBM2372
      DO 126 I=1,N1                                                     COBM2373
  126 WRITE(M,189)(W(I,L),L=2,3),Y4(I,2),(Y5(I,K,2),K=1,4)              COBM2374
      GO TO 100                                                         COBM2375
  123 CONTINUE                                                          COBM2376
  100 CONTINUE                                                          COBM2377
      IF(ID-98)8,8,1                                                    COBM2378
    8 CALL EXIT                                                         COBM2379
      END                                                               COBM2380
// DUP                                                                  COBM2381
*DELETE             COBM2                                              COBM2382
*STORE      WS  UA  COBM2                                              COBM2383

// JOB                                                                  ARSIN000
// FOR                                                                  ARSIN001
*EXTENDED PRECISION                                                     ARSIN002
*LIST ALL                                                               ARSIN003
*ONE WORD INTEGERS                                                      ARSIN004
      FUNCTION ARSIN(X)                                                 ARSIN005
```

```
      IF(X-1.0)3,2,1                                                    ARSIN006
    2 ARSIN=1.5707963                                                   ARSIN007
      GO TO 1                                                           ARSIN008
    3 ARSIN=1.5707963-SQRT(1.0-X)*(1.5707288-0.2121144*X+0.074261*X*X-0.ARSIN009
     10187293*X*X*X)                                                    ARSIN010
    1 RETURN                                                            ARSIN011
      END                                                               ARSIN012
// DUP                                                                  ARSIN013
*DELETE              ARSIN                                            ARSIN014
*STORE       WS  UA  ARSIN                                            ARSIN015

// JOB                                                                  MATV0000
// FOR                                                                  MATV0001
*LIST ALL                                                             MATV0002
*ONE WORD INTEGERS                                                    MATV0003
*EXTENDED PRECISION                                                   MATV0004
      SUBROUTINE MATV(A,N,B,M,DETM)                                     MATV0005
      DIMENSION A(12,12),B(12,1),PIVOT(12),IPVOT(12),INDEX(12,12)       MATV0006
      EQUIVALENCE (IROW,JROW),(ICLUM,JCLUM),(AMAX,T,SWAP)               MATV0007
      DETM=1.0                                                          MATV0008
      DO 20 J=1,N                                                       MATV0009
   20 IPVOT(J)=0                                                        MATV0010
      DO 550 I=1,N                                                      MATV0011
      AMAX=0.0                                                          MATV0012
      DO 105 J=1,N                                                      MATV0013
      IF(IPVOT(J)-1)60,105,60                                           MATV0014
   60 DO 100 K=1,N                                                      MATV0015
      IF(IPVOT(K)-1)80,100,740                                          MATV0016
   80 IF(ABS(AMAX)-ABS(A(J,K)))85,100,100                               MATV0017
   85 IROW=J                                                            MATV0018
      ICLUM=K                                                           MATV0019
      AMAX=A(J,K)                                                       MATV0020
  100 CONTINUE                                                          MATV0021
  105 CONTINUE                                                          MATV0022
      IPVOT(ICLUM)=IPVOT(ICLUM)+1                                       MATV0023
      IF(IROW-ICLUM)140,260,140                                         MATV0024
  140 DETM=-DETM                                                        MATV0025
      DO 200 L=1,N                                                      MATV0026
      SWAP=A(IROW,L)                                                    MATV0027
      A(IROW,L)=A(ICLUM,L)                                              MATV0028
  200 A(ICLUM,L)=SWAP                                                   MATV0029
      IF(M)260,260,210                                                  MATV0030
  210 DO 250 L=1,M                                                      MATV0031
      SWAP=B(IROW,L)                                                    MATV0032
      B(IROW,L)=B(ICLUM,L)                                              MATV0033
  250 B(ICLUM,L)=SWAP                                                   MATV0034
  260 INDEX(I,1)=IROW                                                   MATV0035
      INDEX(I,2)=ICLUM                                                  MATV0036
      PIVOT(I)=A(ICLUM,ICLUM)                                           MATV0037
      DETM=DETM*PIVOT(I)                                                MATV0038
      A(ICLUM,ICLUM)=1.0                                                MATV0039
      DO 350 L=1,N                                                      MATV0040
  350 A(ICLUM,L)=A(ICLUM,L)/PIVOT(I)                                    MATV0041
      IF(M)380,380,360                                                  MATV0042
  360 DO 370 L=1,M                                                      MATV0043
  370 B(ICLUM,L)=B(ICLUM,L)/PIVOT(I)                                    MATV0044
```

```
  380 DO 550 L1=1,N                                                     MATV0045
      IF(L1-ICLUM)400,550,400                                           MATV0046
  400 T=A(L1,ICLUM)                                                     MATV0047
      A(L1,ICLUM)=0.0                                                   MATV0048
      DO 450 L=1,N                                                      MATV0049
  450 A(L1,L)=A(L1,L)-A(ICLUM,L)*T                                      MATV0050
      IF(M)550,550,460                                                  MATV0051
  460 DO 500 L=1,M                                                      MATV0052
  500 B(L1,L)=B(L1,L)-B(ICLUM,L)*T                                      MATV0053
  550 CONTINUE                                                          MATV0054
      DO 710 I=1,N                                                      MATV0055
      L=N+1-I                                                           MATV0056
      IF(INDEX(L,1)-INDEX(L,2))630,710,630                              MATV0057
  630 JROW=INDEX(L,1)                                                   MATV0058
      JCLUM=INDEX(L,2)                                                  MATV0059
      DO 705 K=1,N                                                      MATV0060
      SWAP=A(K,JROW)                                                    MATV0061
      A(K,JROW)=A(K,JCLUM)                                              MATV0062
      A(K,JCLUM)=SWAP                                                   MATV0063
  705 CONTINUE                                                          MATV0064
  710 CONTINUE                                                          MATV0065
  740 IF(DETM-0.000001)750,750,760                                      MATV0066
  750 DETM=0.0                                                          MATV0067
  760 RETURN                                                            MATV0068
      END                                                               MATV0069
// DUP                                                                  MATV0070
*DELETE              MATV                                              MATV0071
*STORE      WS  UA   MATV                                              MATV0072

// JOB                                                                  ORTH0000
// FOR                                                                  ORTH0001
*LIST ALL                                                             ORTH0002
*ONE WORD INTEGERS                                                    ORTH0003
*EXTENDED PRECISION                                                   ORTH0004
      SUBROUTINE ORTH(X)                                              ORTH0005
      DIMENSION W( 30,6),X( 30,6)                                     ORTH0006
      COMMON Y(120),R(120),Z( 30,6),T(6),B(6),N,IREP,TITL(12),ID,X5(7),SORTH0007
     15(5),A3(3)                                                      ORTH0008
      M=5                                                             ORTH0009
      N1=N/IREP                                                       ORTH0010
      DO 14 J=2,3                                                     ORTH0011
      X5(J-1)=0.0                                                     ORTH0012
      DO 14 I=1,N1                                                    ORTH0013
   14 X5(J-1)=X5(J-1)+X(I,J)/N1                                       ORTH0014
      DO 15 J=2,3                                                     ORTH0015
      S5(J-1)=0.0                                                     ORTH0016
      DO 15 I=1,N1                                                    ORTH0017
   15 S5(J-1)=S5(J-1)+(X(I,J)-X5(J-1))**2                             ORTH0018
      DO 1 J=2,3                                                      ORTH0019
      S5(J-1)=SQRT(S5(J-1))                                           ORTH0020
      DO 1 I=1,N1                                                     ORTH0021
      W(I,1)=1.0                                                      ORTH0022
    1 W(I,J)=(X(I,J)-X5(J-1))/S5(J-1)                                 ORTH0023
      DO 2 J=2,3                                                      ORTH0024
      X5(J+1)=0.0                                                     ORTH0025
      X5(J+4)=0.0                                                     ORTH0026
```

```
      DO 2 I=1,N1                                                    ORTH0027
      X5(J+1)=X5(J+1)+X(I,J+2)/N1                                    ORTH0028
    2 X5(J+4)=X5(J+4)+X(I,J+2)*(X(I,J)-X5(J-1))/S5(J-1)/S5(J-1)      ORTH0029
      X5(5)=0.0                                                      ORTH0030
      DO 3 I=1,N1                                                    ORTH0031
      W(I,6)=W(I,2)*W(I,3)                                           ORTH0032
      X5(5)=X5(5)+W(I,6)/N1                                          ORTH0033
      DO 3 J=4,5                                                     ORTH0034
    3 W(I,J)=X(I,J)-X5(J-1)-(X(I,J-2)-X5(J-3))*X5(J+2)               ORTH0035
      DO 4 J=4,5                                                     ORTH0036
      S5(J-1)=0.0                                                    ORTH0037
      DO 4 I=1,N1                                                    ORTH0038
    4 S5(J-1)=S5(J-1)+W(I,J)*W(I,J)                                  ORTH0039
      S5(3)=SQRT(S5(3))                                              ORTH0040
      S5(4)=SQRT(S5(4))                                              ORTH0041
      X5(5)=0.0                                                      ORTH0042
      DO 5 I=1,N1                                                    ORTH0043
      S5(5)=S5(5)+(W(I,6)-X5(5))**2                                  ORTH0044
      DO 5 J=4,5                                                     ORTH0045
    5 W(I,J)=W(I,J)/S5(J-1)                                          ORTH0046
      S5(5)=SQRT(S5(5))                                              ORTH0047
      DO 16 I=1,N1                                                   ORTH0048
   16 W(I,6)=(W(I,6)-X5(5))/S5(5)                                    ORTH0049
      DO 6 I=1,N1                                                    ORTH0050
      DO 6 J=1,6                                                     ORTH0051
    6 X(I,J)=W(I,J)                                                  ORTH0052
      RETURN                                                         ORTH0053
      END                                                            ORTH0054
// DUP                                                               ORTH0055
*DELETE              ORTH                                           ORTH0056
*STORE       WS  UA  ORTH                                           ORTH0057

// JOB                                                               TRANS000
// FOR                                                               TRANS001
*LIST ALL                                                           TRANS002
*ONE WORD INTEGERS                                                  TRANS003
*EXTENDED PRECISION                                                 TRANS004
      FUNCTION TRANS(I,Y,A,B)                                        TRANS005
      X=Y                                                            TRANS006
      GO TO (1,2,2,4),I                                              TRANS007
    1 TRANS=EXP(X)/(1.0+EXP(X))                                      TRANS008
      GO TO 5                                                        TRANS009
    2 X=A*B**(A-1.0)*X+1.0                                           TRANS010
      M1=X/ABS(X)                                                    TRANS011
      X=M1*ABS(X)**(1.0/A)                                           TRANS012
      GO TO (1,3,9,4),I                                              TRANS013
    3 TRANS=X/(1.0+X)                                                TRANS014
      GO TO 6                                                        TRANS015
    9 TRANS=X/100.0                                                  TRANS016
    6 IF(TRANS)7,7,8                                                 TRANS017
    7 TRANS=10.0**(-4)                                               TRANS018
      GO TO 5                                                        TRANS019
    8 IF(1.0-TRANS)10,10,5                                           TRANS020
   10 TRANS=1.0-10.0**(-4)                                           TRANS021
      GO TO 5                                                        TRANS022
    4 TRANS=SIN(X)**2                                                TRANS023
```

```
     5 RETURN                                                    TRANS024
       END                                                       TRANS025
// DUP                                                          TRANS026
*DELETE                TRANS                                   TRANS027
*STORE        WS  UA   TRANS                                   TRANS028
```

THREE SAMPLE DECKS FOR PROGRAMS COIS, GAMMA, PPE1

```
FREQUENCY DISTRIBUTION OF SILKWORM LARVA SURVIVAL TIMES A  BLISS (1967)
50   1  10 5100.0-0.4 40.0   2.5   15
 210   1  215   1  217   1  218   1  226   1  229   1  233   1  235   1
 238   1  239   1  240   1  241   2  244   2  248   1  250   1  251   1
 253   3  254   2  255   1  260   2  261   2  262   1  265   1  267   1
 270   2  271   3  273   2  275   2  276   1  278   1  279   2  280   3
 282   1  283   2  285   2  286   1  287   1  289   1  292   1  293   2
 294   2  296   1  298   2  299   1  300   1  309   1  310   1  314   1
 345   1  366   1
                                                                        99
FREQUENCY DISTRIBUTION OF SILKWORM LARVA SURVIVAL TIMES B  BLISS (1967)
54   1  10 5108.0 0.4 40.0   3.0   15
 203   1  212   1  215   1  218   1  222   2  226   1  228   1  230   1
 233   1  235   1  237   1  240   2  241   1  243   1  245   1  246   1
 250   1  252   1  254   1  255   1  256   1  258   1  259   1  260   1
 263   1  266   2  267   4  270   2  271   1  273   1  274   1  275   2
 276   1  277   2  280   2  281   2  283   2  284   1  285   4  286   2
 287   1  289   1  291   1  299   1  302   1  304   1  307   1  310   1
 319   1  322   1  327   1  330   1  338   1  339   1
                                                                        99
FREQUENCY DISTRIBUTION OF SILKWORM LARVA SURVIVAL TIMES C  BLISS (1967)
56   1  10 5166.0-0.4 40.0   3.0   15
 210   1  215   2  218   1  226   1  228   1  230   1  233   2  235   1
 236   1  240   2  241   2  243   1  244   1  248   1  251   1  253   1
 254   2  255   1  256   1  258   2  259   1  260   3  261   1  267   3
 270   1  271   3  273   1  274   1  275   3  279   1  280   4  282   1
 283   2  284   1  285   3  286   2  287   1  289   1  291   1  292   1
 293   2  294   1  296   1  298   2  299   1  300   1  302   1  307   1
 309   1  310   2  314   1  319   1  330   1  339   1  345   1  366   1
                                                                        98
```

SAMPLE DECK FOR PROGRAMS PPE2, COEM

```
   SURVIVAL TIMES   -   BOX AND COX (1964)
12 4 5     -0.76 0.1  1.0   15
  031    046    045    043
  082    088    110    072
  043    063    045    076
  045    066    071    062
  036    040    029    023
  092    049    061    124
  044    031    035    040
  056    071    102    038
  022    018    021    023
  030    038    037    029
  023    024    025    022
  030    031    036    033
                                                                        98
```

SAMPLE DECK FOR PROGRAM COPM

```
    SUGAR BEET SURVIVAL   -   SNEDECOR AND COCHRAN (1967)
216 1 4 4 1.0  10
      183
      356
      224
      329
      176
      300
      258
      283
      291
      301
      244
      308
      254
      271
      217
      326                                                                  98
```

SAMPLE DECK FOR PROGRAM PRSL2

```
   PINK SALMON CAUGHT IN B.C.      P. WICKETT
20 1 0.001              10
19.5 217.  5.4 219. 20.5 175. 17.2 242. 15.7 201. 11.6 210. 26.6 291.  6.8 153.
29.4 233. 17.4 210. 24.3 231. 13.8 234. 10.7 193. 11.0 172. 10.1 262. 18.5 178.
22.2 354. 17.8 278. 19.8 293. 13.2 301.
      8496.
      1242.
      2532.
      3928.
      1504.
       680.
      1234.
      2230.
      2040.
      2800.
      2800.
      2406.
      1752.
      3719.
      2026.
      2488.
     17381.
      5152.
      7031.
      9706.                                                                98
500  1000  1500  2000  3000  3212  3212  3212  3212  3212    40   400
```

SAMPLE DECK FOR PROGRAMS COBM, COCBM

```
    TUMORS IN MICE  -  GART (1970)
 8 1 4 2 1.0  1.0   3
16    4
16    2
18    4
15    1
79    5
87    3
90   10
o2    3                                                              98
```

SAMPLE DECK FOR PROGRAMS BRSL2, COBM2

```
    ENGLISH SOLE EGGS HATCHING  LINDSEY, ALDERDICE, AND PIENAAR (1970)
 18 4 0.001  0.34 -0.55 10
15   4   15   8   15   12   25   4   25   8   25   12   35   4   35   8
35  12   10  10   10    6   40  10   40   6   20   10   20   6   30  10
30  10   30   6
666  236   724   203   764   183   723   212
656  600   747   697   746   615   703   641
566  407   603   343   560   365   394   302
717  203   782   177   852   155   590   138
621  591   640   564   754   714   570   532
622  475   645   465   608   506   532   415
738    1   655     3   742    10   743     3
616  526   467   419   484   410   606   374
362  272   478   352   590   392   459   382
681  303   710   329   611   262   700   301
757  277   681   234   647   263   801   287
450  387   553   389   564   388   604   318
662  276   542   247   527   248   591   149
391  351   650   559   603   527   548   476
643  585   671   620   497   437   771   667
491  447   530   462   545   475   556   499
573  522   680   615   581   539   561   517
666  563   704   600   656   562   723   615
                                                                     98
 20.0  30.0  40.0  60.0  80.0                          40    20
```