

A COMPREHENSIVE, MATRIX FREE ALGORITHM FOR
ANALYSIS OF VARIANCE

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Institute of Statistics Mimeo Series #1211

C ****A COMPREHENSIVE, MATRIX FREE ALGORITHM FOR ANALYSIS OF VARIANCE**** D00000040
C D00000050
C ****STATISTICS COMPUTED**** D00000060
C #/211 D00000070
C 1) CELL SUMS, FREQUENCIES, AND MEANS. D00000080
C D00000090
C 2) CLASSIFICATION SUMS, FREQUENCIES, AND MEANS D00000100
C D00000110
C 3) RANK(DESIGN MATRIX FOR FULL MODEL) D00000120
C D00000130
C 4) SSE(FULL MODEL) AND SSR(FULL MODEL) D00000140
C D00000150
C 5) A G-INVERSE SOLUTION TO THE NORMAL EQUATIONS D00000160
C D00000170
C 6) ESTIMATES OF EXPECTED CELL MEANS D00000180
C D00000190
C 7) RANK(RESTRICTED DESIGN MATRIX FOR REDUCED MODEL) D00000200
C D00000210
C 8) SSE(REDUCED MODEL) AND SSR(REDUCED MODEL) D00000220
C D00000230
C 9) THE F STATISTIC FOR A SPECIFIED HYPOTHESIS D00000240
C D00000250
C 10) PROBABILITY OF A GREATER F GIVEN THE HYPOTHESIS D00000260
C D00000270
C ****FLOW OF CONTROL**** D00000280
C D00000290
C 1) FACTOR, LEVELS STATEMENT D00000300
C D00000310
C 2) VARIABLE FORMAT STATEMENT D00000320
C D00000330
C 3) DATA D00000340
C D00000350
C 4) BLANK LINE (CARD) D00000360
C D00000370
C 5) OPTIONS STATEMENT/MODEL STATEMENT/HYPOTHESIS STATEMENT/BLANK
C LINE/E D00000380
C D00000390
C D00000400
C E ENDS PROCESSING. BLANK LINE SENDS CONTROL TO 1), STATEMENTS
C RETURN CONTROL TO 5) FOLLOWING EXECUTION. D00000410
C D00000420
C D00000430
C ****FACTOR, LEVELS STATEMENT**** D00000440
C D00000450
C A DISTINCT ALPHABETIC CHARACTER IS USED TO NAME EACH FACTOR AND
C EACH SUBSCRIPT. THE STRING OF FACTOR SYMBOLS IS PLACED IN PARENS
C AND THEN PRECEDED BY THE LETTER F. THIS IS FOLLOWED BY THE LET-
C TER L AND A PARENTHEZIZED LIST OF ASSOCIATED SUBSCRIPTS WITH THE
C NUMBER OF LEVELS FOR THE FACTOR IN PARENS FOLLOWING THE ASSOCI-
C ATED SUBSCRIPT. D00000500
C D00000510
C D00000520
C EXAMPLE FOR 3 FACTORS NAMED A, B, C, ASSOCIATED SUBSCRIPTS NAMED
C I, J, K, AND NUMBER OF LEVELS OF THE FACTORS EQUAL TO 5, 10, 15: D00000530
C D00000540
C D00000550
C F(A,B,C) L(I(5),J(10),K(15)) D00000560
C D00000570
C COMMAS AND BLANKS ARE COSMETIC D00000580
C D00000590
C ORDERING OF THE ASSOCIATED SUBSCRIPTS IS ASSUMED TO CORRESPOND
C TO THE ORDERING OF THE DATA. THE NUMBER OF OBSERVATIONS WITHIN
C THE (I,J,K) CELL DEPENDS UPON THE DATA; NO SUBSCRIPT SYMBOL IS
C D00000600
C D00000610
C D00000620

USED TO DENOTE WITHIN CELL REPLICATION.

****DATA****

DATA INPUT FACILITIES ARE MINIMAL. DATA IS READ ONE OBSERVATION PER LINE WITH CELL INDICATORS PRECEDING THE OBSERVATION. CELL INDICATORS ARE THE FACTOR LEVELS FOR THE OBSERVATION; THERE IS NO INDICATOR FOR WITHIN CELL REPLICATION AND NO ENTRIES ARE MADE FOR MISSING CELLS. THE DATA MUST BE LEXICOGRAPHICALLY ORDERED SO THAT THE RIGHTMOST SUBSCRIPT (INDICATOR) MOVES MOST RAPIDLY. IN BATCH MODE, THE SAME VARIABLE FORMAT STATEMENT IS ALSO USED TO WRITE THE DATA. A CONSTANT (INDATA) IN THE PROGRAM DETERMINES THE INPUT UNIT FROM WHICH THE DATA IS READ.

EXAMPLE FOR 3 FACTORS EACH AT 2 LEVELS WITH CELLS (1,2,2) AND (2,1,2) MISSING:

(1X,3I2,F3.1)

1 1 1 41
1 1 1 45
1 1 2 35
1 2 1 53
1 2 1 62
1 2 1 56
2 1 1 47
2 2 1 55
2 2 2 59

****OPTICNS****

IDENTIFIER	FUNCTION OF OPTION	DEFAULT
S(D)	SIGNIFICANT DIGITS IN RESULTS	D=5
T(L*10**4)	TEST LEVEL	L=.05
I(M)	MAXIMUM NUMBER OF ITERATIONS	M=100
R	RANK COMPUTATIONS (ITERATIVE)	OFF
V	ESTIMATES OF EXPECTED CELL MEANS	OFF
G	G-INVERSE SOLUTION TO NORMAL EQUATIONS	OFF
P	PROBABILITY VALUES FOR F STATISTICS	OFF
Z	INTERMEDIATE OUTPUT	OFF
A	CELL SUMS, FREQUENCIES, AND MEANS	OFF
C	CLASSIFICATION SUMS, FREQUENCIES, AND MEANS	OFF

****OPTIONS STATEMENT****

STRING OF OPTION IDENTIFIERS, IN ANY ORDER, ARE PARENTHEZIZED AND PRECEDED BY THE LETTER O.

EXAMPLES WITH ALL OPTIONS IN DEFAULT STATUS

1) TO COMPUTE RANK ITERATIVELY, TEST HYPOTHESES AT ONE PERCENT LEVEL, AND OBTAIN INTERMEDIATE OUTPUT

O(R,T(100),Z)

2) TO OBTAIN ESTIMATES OF EXPECTED CELL MEANS, A G-INVERSE SOLUTION, AND 8 DIGIT ACCURACY

O(V,G,S(8))

D00000630
D00000640
D00000650
D00000660
D00000670
D00000680
D00000690
D00000700
D00000710
D00000720
D00000730
D00000740
D00000750
D00000760
D00000770
D00000780
D00000790
D00000800
D00000810
D00000820
D00000830
D00000840
D00000850
D00000860
D00000870
D00000880
D00000890
D00000900
D00000910
D00000920
D00000930
D00000940
D00000950
D00000960
D00000970
D00000980
D00000990
D00001000
D00001010
D00001020
D00001030
D00001040
D00001050
D00001060
D00001070
D00001080
D00001090
D00001100
D00001110
D00001120
D00001130
D00001140
D00001150
D00001160
D00001170
D00001180
D00001190
D00001200
D00001210
D00001220

COMMAS AND BLANKS ARE COSMETIC

THE A AND C OPTIONS ARE IMMEDIATE AND WILL NOT REMAIN IN ON STATUS; THE OTHER ON/OFF OPTIONS CHANGE STATUS WHENEVER THE OPTION IDENTIFIER IS SPECIFIED. THE S, T, AND I OPTIONS DO NOT RETURN TO DEFAULT STATUS.

WHEN RANK CANNOT BE COMPUTED NON-ITERATIVELY, IT WILL BE COMPUTED ITERATIVELY ONLY WHEN THE R OPTION IS ON.

THE IDENTIFIER S(0) MAY BE USED TO COMPUTE RANK WITHOUT COMPUTING SSR OR SSE.

****MODEL STATEMENT****

EXAMPLES OF MODEL STATEMENT FOR 3 FACTORS:

1) 3-WAY CROSSED CLASSIFICATION

$M + A(I) + B(J) + C(K)$

2) 3-WAY NESTED CLASSIFICATION

$M + A(I) + B(IJ) + C(IJK)$

3) FACTORS A AND C ARE CROSSED, FACTOR B IS NESTED WITHIN A, AND THERE IS AN AC INTERACTION

$M + A(I) + B(IJ) + C(K) + AC(IK)$

4) FACTORS A AND B ARE CROSSED, FACTOR C IS NESTED WITHIN BOTH A AND B, AND THERE IS AN AB INTERACTION

$M + A(I) + B(J) + AB(IJ) + C(IJK)$

RULES FOR CONSTRUCTING MODEL STATEMENT:

1) BLANKS AND PLUSES ARE COSMETIC

2) THE ASSOCIATED SUBSCRIPT OF A FACTOR MUST ALWAYS APPEAR ALONG WITH THE FACTOR SYMBOL IN A MODEL TERM

3) IF A FACTOR IS NESTED, IT MUST BE NESTED WITHIN A FACTOR OR FACTORS APPEARING TO THE LEFT OF IT IN THE PREVIOUS FACTOR, LEVELS STATEMENT

4) THE LETTER M (FOR MU) MUST BEGIN EACH MODEL STATEMENT

5) CONTINUATION TO THE NEXT LINE IS INDICATED BY A SLASH (/) FOLLOWING THE LAST MODEL TERM ON THE CURRENT LINE

6) A FULL FACTORIAL MODEL MAY BE SPECIFIED BY AN ASTERISK (*) FOLLOWING M

****HYPOTHESIS STATEMENT****

BEGINS WITH THE LETTER H FOLLOWED BY THE MODEL TERM/S TO BE DELETED FROM THE FULL MODEL IN ORDER TO FORM THE REDUCED MODEL OF THE HYPOTHESIS.

D00001230
D00001240
D00001250
D00001260
D00001270
D00001280
D00001290
D00001300
D00001310
D00001320
D00001330
D00001340
D00001350
D00001360
D00001370
D00001380
D00001390
D00001400
D00001410
D00001420
D00001430
D00001440
D00001450
D00001460
D00001470
D00001480
D00001490
D00001500
D00001510
D00001520
D00001530
D00001540
D00001550
D00001560
D00001570
D00001580
D00001590
D00001600
D00001610
D00001620
D00001630
D00001640
D00001650
D00001660
D00001670
D00001680
D00001690
D00001700
D00001710
D00001720
D00001730
D00001740
D00001750
D00001760
D00001770
D00001780
D00001790
D00001800
D00001810
D00001820

C		D00001830
C	EXAMPLES APPLIED TO PREVIOUS MODEL STATEMENTS:	D00001840
C		D00001850
C	1) TO TEST FOR NO B EFFECT IN THE 3-WAY CROSSED CLASSIFICATION	D00001860
C		D00001870
C	H B(J)	D00001880
C		D00001890
C	2) TO TEST FOR NO C EFFECT IN THE 3-WAY NESTED CLASSIFICATION	D00001900
C		D00001910
C	H C(IJK)	D00001920
C		D00001930
C	3) TO TEST FOR NO INTERACTION IN MODEL 3	D00001940
C		D00001950
C	H AC(IK)	D00001960
C		D00001970
C	4) TO JOINTLY TEST FOR NO C EFFECT AND NO AB INTERACTION IN 4	D00001980
C		D00001990
C	H AB(IJ) C(IJK)	D00002000
C		D00002010
C	*****	D00002020

C MINI-AARDVARK BY W. J. HEMMERLE	00000040
DIMENSION W(800),LSTFI(32),LER(32),LE(5),LS(5),LV(5),LLIM(5)	00000050
DIMENSION LT(5),LP(10),LD(10),LO(10),IA(72),Q(8,8),QT(8)	00000060
COMMON YPY,SSRM,SSEM,IIN,IOUT,IRCPT,IVCPT,IGOPT,IPOPT,ICFLAG	00000070
COMMON IBST,IHST,IRST,ISST,IXST,ICD,NSUBS,LPOUT,NQ1,IDF,IDFM,IDFR	00000080
COMMON NCELLS,LCCD1,LCCD2,LCCV,LCCB,LCCA,IRANKM,IRANKR,MAXIT	00000090
COMMON NOBS,MAXDI,MINDI,FLEVEL,NOSIGD	00000100
DOUBLE PRECISION W,Q,QT,YPY,SSRM,SSEM,TEMP	00000110
DATA LD(1),LD(2),LD(3),LD(4),LD(5),LD(6),LD(7),LD(8),LD(9),LD(10)	00000120
* /1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/	00000130
DATA LC(1)/1HS/,LO(2)/1HT/,LO(3)/1HI/,LO(4)/1HR/,LO(5)/1HV/	00000140
DATA LO(6)/1HG/,LO(7)/1HP/,LO(8)/1HZ/,LO(9)/1HA/,LO(10)/1HC/	00000150
DATA IF/1HF/,IL/1HL/,ID/1HD/,IQ/1HQ/,IM/1HM/,IH/1HH/,IE/1HE/	00000160
DATA ILP/1H(/,IRP/1H)/,ISTAR/1H*/,IBLANK/1H /	00000170
C SET IBATCH=1 FOR BATCH PROCESSING; SET IBATCH=0 FOR INTERACTIVE USE	00000180
IBATCH=1	00000190
C MAXN, MAXW, MAXC, AND L MUST EQUAL DIMENSION OF LE, W, QT, AND IA	00000200
MAXN=5	00000210
MAXW=800	00000220
MAXMC=8	00000230
L=72	00000240
IIN=1	00000250
INCATA=1	00000260
ICLUT=3	00000270
C INITIALIZATION REQUIRED WHEN USING PART2 WITHOUT PART1	00000280
IRANKM=0	00000290
IRANKR=0	00000300
IBST=0	00000310
C DEFAULT SETTING FOR ITERATION PARAMETERS AND OPTIONS	00000320
MAXIT=100	00000330
NCSIGD=5	00000340
FLEVEL=.05	00000350
IRCPT=0	00000360
IVCPT=0	00000370
IGOPT=0	00000380
IPOPT=0	00000390
ICFLAG=0	00000400
C EXAMPLE OF F, L SPECIFICATION: F(A,B,C) L(I(3),J(10),K(5))	00000410
10 IF(IBATCH .EQ. 0) WRITE(IOUT,15)	00000420
15 FORMAT(29H FACTOR, LEVEL SPECIFICATION-)	00000430
READ(IIN,20) (IA(I),I=1,L)	00000440
20 FORMAT(80A1)	00000450
IF(IBATCH .EQ. 1) WRITE(IOUT,30) (IA(I),I=1,L)	00000460
30 FORMAT(1H ,80A1)	00000470
C CREATE LIST LE OF FACTOR SYMBOLS AND DETERMINE N=NO. OF FACTORS	00000480
II=1	00000490
ICD=IF	00000500
40 IF(II .GT. L) GO TO 400	00000510
IC=IGET(II,IA,L)	00000520
IF(IC .EQ. IF) GO TO 40	00000530
IF(IC .NE. 1LP) GO TO 400	00000540
N=0	00000550
50 IF(II .GT. L) GO TO 400	00000560
IC=IGET(II,IA,L)	00000570
IF(IC .EQ. IRP) GO TO 60	00000580
N=N+1	00000590
IF(N .GT. MAXN) GO TO 400	00000600
LE(N)=IC	00000610
GO TO 50	00000620

C	CREATE LIST LS OF SUBSCRIPT SYMBOLS AND LIST LLIM OF FACTOR LEVELS	00000630
60	ICD=IL	00000640
70	IF(II .GT. L) GO TO 400	00000650
	IC=IGET(II,IA,L)	00000660
	IF(IC .EQ. IL) GO TO 70	00000670
	IF(IC .NE. ILP) GO TO 400	00000680
	DO 100 I=1,N	00000690
	LEVEL=0	00000700
	IF(II .GT. L) GO TO 400	00000710
	IC=IGET(II,IA,L)	00000720
	LS(I)=IC	00000730
80	IF(II .GT. L) GO TO 400	00000740
	IC=IGET(II,IA,L)	00000750
	IF(IC .EQ. ILP) GO TO 80	00000760
	DO 90 J=1,10	00000770
	IF(LD(J) .EQ. IC) LEVEL=LEVEL*10+J-1	00000780
90	CONTINUE	00000790
	IF(IC .NE. IRP) GO TO 80	00000800
100	LLIM(I)=LEVEL	00000810
	IF(II .GT. L) GO TO 400	00000820
	IC=IGET(II,IA,L)	00000830
	IF(IC .NE. IRP) GO TO 400	00000840
C	DETERMINE NCELLS=NC. OF CELLS AND M=2**N; CREATE LISTS LV AND LSTFI	00000850
	NCELLS=1	00000860
	NPRIME=1	00000870
	DO 110 I=1,N	00000880
	NPRIME=NPRIME*(LLIM(I)+1)	00000890
110	NCELLS=NCELLS*LLIM(I)	00000900
	LSTFI(1)=NCELLS	00000910
	M=1	00000920
	K1=2	00000930
	DO 130 I=1,N	00000940
	K2=N-I+1	00000950
	DO 120 J=1,M	00000960
	LSTFI(K1)=LSTFI(J)/LLIM(K2)	00000970
120	K1=K1+1	00000980
	LV(K2)=M	00000990
130	M=2*M	00001000
C	INITIALIZE POINTERS TO VECTORS IN W ARRAY; CHECK PROBLEM SIZE	00001010
	LCCD1=NCELLS	00001020
	LCCD2=LCCD1+NCELLS	00001030
	LCCV=LCCD2+NCELLS	00001040
	LCCB=LCCV+NCELLS	00001050
	LCCA=LCCB+NCELLS	00001060
	NW=LCCA+NPRIME	00001070
	INCW=NW-MAXW	00001080
	IF(INCW .GT. 0) GO TO 420	00001090
C	ZERO Y (CELL SUM VECTOR) AND D1 (CELL FREQUENCY VECTOR)	00001100
	DO 140 I=1,NCELLS	00001110
	ID1=LCCD1+I	00001120
	W(I)=0	00001130
140	W(ID1)=0	00001140
C	READ INPUT DATA AND CHECK INDICATORS; COMPUTE CELL SUMS, CELL	00001150
C	FREQUENCIES, NC. OF OBSERVATIONS, AND Y*Y.	00001160
	WRITE(ICUT,145)	00001170
145	FORMAT(28H DATA FORMAT AND INPUT DATA-)	00001180
	READ(INCATA,20) (IA(I),I=1,L)	00001190
	IF(IBATCH .EQ. 1) WRITE(IOUT,30) (IA(I),I=1,L)	00001200
	CALL LABEL(M,0,LLIM,ICUT,N,LV,LP)	00001210
	ICC=ID	00001220

YPY=0	00001230
NCES=0	00001240
ITEMP=0	00001250
C FIRST COLUMN OF DATA CARD MUST BE BLANK WHEN USING BATCH	00001260
150 READ(INDATA,IA) (LT(I),I=1,N),TEMP	00001270
IF(IBATCH .EQ. 1) WRITE(ICOUT,IA) (LT(I),I=1,N),TEMP	00001280
IF(LT(1) .EQ. 0) GC TO 170	00001290
I=1	00001300
DO 160 J=1,N	00001310
160 I=I+(LT(J)-1)*LP(J)	00001320
IF(I .GT. NCELLS) GO TO 400	00001330
IF(I .LT. ITEMP) GO TO 400	00001340
ID1=LCCD1+I	00001350
W(I)=W(I)+TEMP	00001360
W(ID1)=W(ID1)+1.000	00001370
NCBS=NCBS+1	00001380
YPY=YPY+TEMP*TEMP	00001390
ITEMP=I	00001400
GC TO 150	00001410
C COMPUTE MAXIMUM AND MINIMUM CELL FREQUENCIES	00001420
170 MAXDI=0	00001430
MINDI=NCBS	00001440
DO 180 I=1,NCELLS	00001450
ID1=LCCD1+I	00001460
ITEMP=W(ID1)	00001470
IF(ITEMP .GT. MAXDI) MAXDI=ITEMP	00001480
IF(ITEMP .LT. MINDI) MINDI=ITEMP	00001490
180 CONTINUE	00001500
LER(M)=0	00001510
C READ OPTIONS/MODEL/HYPOTHESIS/BLANK TRAILER/END CARD	00001520
190 IF(IBATCH .EQ. 0) WRITE(ICOUT,195)	00001530
195 FORMAT(40H OPTIONS/MODEL/HYPCTHESIS SPECIFICATION-)	00001540
READ(IIN,20) (IA(I),I=1,L)	00001550
IF(IBATCH .EQ. 1) WRITE(ICOUT,30) (IA(I),I=1,L)	00001560
II=1	00001570
IC=IGET(II,IA,L)	00001580
ICD=IC	00001590
IF(IC .EQ. IM .OR. IC .EQ. IH) GC TO 200	00001600
IF(IC .EQ. IC) GO TO 210	00001610
IF(IC .EQ. IBLANK .AND. II .GT. L) GC TO 10	00001620
IF(IC .EQ. IE) GO TO 440	00001630
GC TO 400	00001640
C SCAN MODEL/HYPOTHESIS STATEMENT AND PROCESS THE DATA	00001650
C EXAMPLE OF MODEL SPECIFICATION: M+A(I)+B(J)+AB(IJ)+C(JK)	00001660
200 CALL SCAN(II,M,LER,N,LE,LS,LV,LLIM,LP,L,IA,IBATCH)	00001670
IF(ISST .EQ. 1) GO TO 400	00001680
CALL PART1(NW,W,M,LSTFI,LER,N,LV,LLIM,LT,LP,MAXMC,Q,QT)	00001690
IF(NCSIGD .EQ. 0) GO TO 190	00001700
IF(IRST .EQ. 1) GO TO 190	00001710
CALL PART2(NW,W,M,LSTFI,LER,N,LE,LV,LLIM,LT,LP)	00001720
GC TO 190	00001730
C SCAN OPTICNS STATEMENT AND SET OPTICNS	00001740
C EXAMPLE CF OPTICNS SPECIFICATION: C(S(0),I(50),R,Z)	00001750
210 IF(II .GT. L) GO TO 400	00001760
IC=IGET(II,IA,L)	00001770
IF(IC .NE. ILP) GO TO 400	00001780
220 IF(II .GT. L) GO TO 400	00001790
IC=IGET(II,IA,L)	00001800
IF(IC .EQ. IRP) GO TO 380	00001810
DO 230 I=1,10	00001820

	IF(LC(I) .EQ. IC) GO TO 240	00001830
230	CONTINUE	00001840
	GC TO 400	00001850
240	IF(I .GT. 3) GC TO 270	00001860
C	CCOMPUTE PARENTHESESIZED VALUE FOR S, T, AND I OPTIONS	00001870
	NUM=0	00001880
250	IF(II .GT. L) GO TO 400	00001890
	IC=IGET(II,IA,L)	00001900
	IF(IC .EQ. ILP) GO TO 250	00001910
	DO 260 J=1,10	00001920
	IF(LD(J) .EQ. IC) NUM=NUM*10+J-1	00001930
260	CONTINUE	00001940
	IF(IC .NE. IFP) GO TO 250	00001950
	IF(I .EQ. 1) NCSIGD=NUM	00001960
	IF(I .EQ. 2) FNUM=NUM	00001970
	IF(I .EQ. 2) FLEVEL=FNUM/10000.0	00001980
	IF(I .EQ. 3) MAXIT=NUM	00001990
	GC TO 220	00002000
270	IF(I .EQ. 4) IROPT=1-IROPT	00002010
	IF(I .EQ. 5) IVOPT=1-IVOPT	00002020
	IF(I .EQ. 6) IGOPT=1-IGOPT	00002030
	IF(I .EQ. 7) IPOPT=1-IPOPT	00002040
	IF(I .EQ. 8) IDFLAG=1-IDFLAG	00002050
	IF(I .EQ. 9) GC TO 280	00002060
	IF(I .EQ. 10) GC TO 340	00002070
	GC TO 220	00002080
C	IMMEDIATE COMPUTATION OF CELL MEANS (A) OPTION	00002090
280	WRITE(ICUT,290)	00002100
290	FORMAT(35H CELL SUMS, FREQUENCIES, AND MEANS-	00002110
	* /8H CELL,7X,3HSUM,7X,5HFREQ.,6X,4HMEAN)	00002120
	DO 310 I=1,NCELLS	00002130
	ID1=LOCID1+I	00002140
	IF(W(ID1) .EQ. 0.0) WRITE(ICUT,320) I	00002150
	IF(W(ID1) .GT. 0.0) TEMP=W(I)/W(ID1)	00002160
	IF(W(ID1) .GT. 0.0) WRITE(ICUT,330) I,W(I),W(ID1),TEMP	00002170
310	CONTINUE	00002180
	GC TO 220	00002190
320	FORMAT(1H ,I6,I2X,14H(MISSING CELL))	00002200
330	FORMAT(1H ,I6,1X,E16.8,F5.0,1X,E16.8)	00002210
C	IMMEDIATE COMPUTATION OF CLASSIFICATION MEANS (C) OPTION	00002220
340	WRITE(ICUT,350)	00002230
350	FORMAT(45H CLASSIFICATION SUMS, FREQUENCIES, AND MEANS-	00002240
	DO 360 I=1,NCELLS	00002250
	IAA=LOCA+I	00002260
360	W(IAA)=W(I)	00002270
	CALL DECCMP(1,LOCA,ICUT,NW,W,M,LSTFI,N,LS,LV,LLIM,LP)	00002280
	DO 370 I=1,NCELLS	00002290
	ID1=LOCID1+I	00002300
	IAA=LOCA+I	00002310
370	W(IAA)=W(ID1)	00002320
	CALL DECCMP(2,LOCA,ICUT,NW,W,M,LSTFI,N,LS,LV,LLIM,LP)	00002330
	GC TO 220	00002340
380	WRITE(ICUT,390) NCSIGD,FLEVEL,MAXIT,IRCPT,IVOPT,IGOPT,IPOPT	00002350
390	FORMAT(12H OPTICNS- S=,I2,4H, T=,F6.4,4H, I=,I3,4H, R=,I1,	00002360
	*4H, V=,I1,4H, G=,I1,4H, P=,I1)	00002370
	GC TO 190	00002380
400	WRITE(ICUT,410) ICD	00002390
410	FORMAT(10H ERROR IN ,A1,14H SPECIFICATION)	00002400
	IF(IBATCH .EQ. 1) GO TO 440	00002410
	IF(ICD .EQ. IF .OR. ICD .EQ. IL) GC TO 10	00002420

IF(ICD .EQ. IC) GO TO 150	00002430
GO TO 190	00002440
420 WRITE(IOUT,430) INCW	00002450
430 FORMAT(42F DIMENSION OF W ARRAY MUST BE INCREASED BY,I6)	00002460
440 STCP	00002470
END	00002480
SUBROUTINE SCAN(IPT,M,LER,N,LE,LS,LV,LLIM,LP,L,IA,IBATCH)	00002490
COMMON YPY,SSRM,SSEM,IIN,ICUT,IRCPT,IVCPT,IGOPT,IPOPT,ICFLAG	00002500
COMMON IBST,IHST,IRST,ISST,IXST,ICD,NSUBS,LPCUT,NC1,IDF,IDFM,IDFR	00002510
DIMENSION LER(M),LE(N),LS(N),LV(N),LLIM(N),LP(10),IA(L)	00002520
DOUBLE PRECISION YPY,SSRM,SSEM	00002530
DATA ILP/1F(/,IRP/1H)/,IM/1HM/,IH/1HH/,ISTAR/1F*/,ISLASH/1H//	00002540
DATA IELANK/1H /	00002550
ISST=0	00002560
IXST=0	00002570
M1=M-1	00002580
II=IPT	00002590
IF(II .GT. L) GO TO 250	00002600
IC=IGET(II,IA,L)	00002610
IF(ICD .EQ. IH) GO TO 20	00002620
IF(IC .EQ. ISTAR) GO TO 170	00002630
C INITIALIZE E/R LIST TO ZEROES FOR M AND ABSOLUTE VALUES FOR H	00002640
DO 10 I=1,M1	00002650
10 LER(I)=0	00002660
LER(M)=1	00002670
20 IF(LER(M) .EQ. 0) GO TO 250	00002680
DO 30 I=1,M1	00002690
30 LER(I)=IABS(LER(I))	00002700
M2=2*M	00002710
C SCAN TERM TO CONSTRUCT E/R LIST; ENTER NEGATIVES FOR H TERM	00002720
40 DO 50 I=1,N	00002730
50 LP(I)=M2	00002740
SUM VALUES OF FACTOR SYMBOLS FOR E/R ENTRY; ZERO LP POSITIONS	00002750
NE=0	00002760
NVS=0	00002770
60 IFLAG=0	00002780
DO 70 I=1,N	00002790
IF(IC .NE. LE(I)) GO TO 70	00002800
LP(I)=0	00002810
IFLAG=1	00002820
NE=NE+1	00002830
NVS=NVS+LV(I)	00002840
70 CONTINUE	00002850
IF(IFLAG .NE. 1) GO TO 80	00002860
IF(II .GT. L) GO TO 250	00002870
IC=IGET(II,IA,L)	00002880
GO TO 60	00002890
80 IF(NE .EQ. 0) GO TO 250	00002900
IF(IC .NE. ILP) GO TO 250	00002910
C SCAN SUBSCRIPTS; SET NONZERO LP ENTRIES TO NUMERICAL VALUES	00002920
NS=0	00002930
NAS=0	00002940
90 IF(II .GT. L) GO TO 250	00002950
IC=IGET(II,IA,L)	00002960
IFLAG=0	00002970
DO 100 I=1,N	00002980
IF(IC .NE. LS(I)) GO TO 100	00002990
IF(LP(I) .NE. 0) LP(I)=LV(I)	00003000
IF(LP(I) .EQ. 0) NAS=NAS+1	00003010

C	CHECK FOR INVALID NESTED TERM	00003020
	DO 92 J=1,N	00003030
	IF(LP(J) .EQ. 0) GO TO 94	00003040
92	CJNTINUE	00003050
	GO TO 250	00003060
94	IFLAG=1	00003070
	NS=NS+1	00003080
100	CONTINUE	00003090
	IF(IFLAG .NE. 1) GO TO 110	00003100
	GO TO 90	00003110
110	IF(NAS .NE. NE) GO TO 250	00003120
	IF(IC .NE. IRP) GO TO 250	00003130
	IF(NS .NE. NE) GO TO 120	00003140
C	CHECK FOR INVALID CROSSED TERM	00003150
	DO 115 I=1,N	00003160
	IF(LP(I) .EQ. M2) GO TO 115	00003170
	IF(LP(I) .NE. 0) GO TO 250	00003180
115	CONTINUE	00003190
	I=M-NVS	00003200
	ITEMP=0	00003210
	IF(ICD .EQ. IH) ITEMP=NVS+1	00003220
	IF(LER(I) .NE. ITEMP) GO TO 250	00003230
	LER(I)=NVS+1	00003240
	IF(ICD .EQ. IH) LER(I)=-LER(I)	00003250
	GO TO 156	00003260
C	ENTER SUM FOR NESTED TERM INTC E/R POSITIONS TO PCCL	00003270
120	DO 150 I=1,M1	00003280
	NUM=I-NVS	00003290
	DO 130 J=1,N	00003300
	NUM=NUM-LP(J)	00003310
	IF(NUM .GT. 0) GO TO 130	00003320
	IF(NUM .EQ. 0) GO TO 140	00003330
	NUM=NUM+LP(J)	00003340
130	CONTINUE	00003350
	GO TO 150	00003360
140	K=M-I	00003370
	ITEMP=0	00003380
	IF(ICD .EQ. IH) ITEMP=NVS+1	00003390
	IF(LER(K) .NE. ITEMP) GO TO 250	00003400
	LER(K)=NVS+1	00003410
	IF(ICD .EQ. IH) LER(K)=-LER(K)	00003420
150	CONTINUE	00003430
156	IF(II .GT. L) GO TO 160	00003440
	IC=IGET(II,IA,L)	00003450
	IF(IC .EQ. IBLANK .AND. II .GT. L) GO TO 160	00003460
	IF(IC .NE. ISLASH) GO TO 40	00003470
C	READ MODEL OR HYPOTHESIS CONTINUATION CARD (SLASH FOLLOWS TERM)	00003480
	READ(IIN,158) (IA(I),I=1,L)	00003490
158	FORMAT(80A1)	00003500
	IF(IBATCH .EQ. 1) WRITE(ICUT,159) (IA(I),I=1,L)	00003510
159	FORMAT(1H ,80A1)	00003520
	II=1	00003530
	IC=IGET(II,IA,L)	00003540
	GO TO 40	00003550
C	CHECK FOR INVALID HYPOTHESIS TERM	00003560
160	DO 162 I=1,M1	00003570
	DO 162 J=I,M1	00003580
	IF(LER(I) .EQ. 0) GO TO 162	00003590
	IF(LER(I) .EQ. (-LER(J))) GO TO 250	00003600
162	CONTINUE	00003610

C	CONSTRUCT LP FROM E/R; DETERMINE EFFECTIVE FACTORS	00003620
	NSUBS=N	00003630
	DO 168 I=1,N	00003640
	LP(I)=0	00003650
	INC1=LV(I)	00003660
	INC2=LV(1)/INC1	00003670
	LCC=1	00003680
	DO 166 J=1,INC2	00003690
	DO 164 K=1,INC1	00003700
	IF(LER(LCC) .GT. 0) LP(I)=LP(I)+1	00003710
164	LCC=LCC+1	00003720
166	LCC=LCC+INC1	00003730
	IF(LP(I) .EQ. 0) NSUBS=NSUBS-1	00003740
168	CONTINUE	00003750
C	DETERMINE IF THE EFFECTIVE X MATRIX IS SQUARE	00003760
	IV=N-NSUBS+1	00003770
	DO 169 I=1,N	00003780
	IF(LP(I) .EQ. 0) GO TO 169	00003790
	IF(LP(I) .NE. LV(IV)) GO TO 224	00003800
169	CONTINUE	00003810
	GO TO 222	00003820
C	CONSTRUCT E/R LIST FOR COMPLETELY CROSSED MODEL	00003830
170	DO 180 I=1,M1	00003840
180	LER(I)=M-I+1	00003850
210	NSUBS=N	00003860
	DO 220 I=1,N	00003870
220	LP(I)=LV(1)	00003880
222	IXST=1	00003890
224	IF(ICFLAG .EQ. 1)WRITE(ICUT,226)(LER(I),I=1,M)	00003900
226	FORMAT(10H E/R LIST-/(1H ,16I5))	00003910
C	COMPUTE PARAMETERS REQUIRED TO RESTRUCTURE CELL FREQUENCY ARRAY	00003920
	LPCUT=1	00003930
	NO1=1	00003940
	DO 230 I=1,N	00003950
	IF(LP(I) .EQ. 0) LPQUT=LPCUT*LLIM(I)	00003960
	IF(LP(I) .NE. 0) NO1=NO1+LV(I)	00003970
230	CONTINUE	00003980
C	COMPUTE DEGREES OF FREEDOM FOR FULL OR REDUCED MODEL	00003990
	IDF=0	00004000
	DO 240 I=1,M	00004010
	IF(LER(I) .LE. 0) GO TO 240	00004020
	NO2=M-I+1	00004030
	CALL LABEL(NO2,0,LLIM,ICUT,N,LV,LP)	00004040
	K=1	00004050
	DO 235 J=1,N	00004060
	IF(LP(J) .NE. 0) K=K*(LLIM(J)-1)	00004070
235	CONTINUE	00004080
	IDF=IDF+K	00004090
240	CONTINUE	00004100
	IDFR=0	00004110
	IF(ICD .EQ. IH) IDFR=IDF	00004120
	IF(ICD .EQ. IM) IDFM=IDF	00004130
	RETURN	00004140
250	ISST=1	00004150
	RETURN	00004160
	END	00004170
	FUNCTION IGET(ICURS,ISTRNG,LANGH)	00004180
	DIMENSION ISTRNG(LANGH)	00004190

	DATA IELANK/IF /,IPLUS/1H+/,ICOMMA/1H,/	00004200
100	IGET=ISTRNG(ICURS)	00004210
	ICURS=ICURS+1	00004220
	IF (ICURS .GT. LENGH) RETURN	00004230
	IF (IGET .EQ. IBLANK .OR. IGET .EQ. IPLUS) GOTC 100	00004240
	IF(IGET .EQ. ICOMMA) GC TC 100	00004250
	RETURN	00004260
	END	00004270
	 SUBROUTINE PART1(NW,W,M,LSTFI,LER,N,LV,LLIM,LT,LP,MAXMC,Q,QT)	00004280
	COMMON YPY,SSRM,SSEM,IIN,ICUT,IROPT,ILOPT,IGOPT,IPCPT,IOFLAG	00004290
	COMMON IBST,IHST,IRST,ISST,IXST,ICD,NSUBS,LPQUT,NC1,IDF,IDFM,IDFR	00004300
	COMMON NCELLS,LCCD1,LCCD2,LCCV,LCCB,LCCA,IRANKM,IRANKR,MAXIT	00004310
	DIMENSION W(NW),LSTFI(M),LER(M),LV(N),LLIM(N),LT(N),LP(10)	00004320
	DIMENSION Q(MAXMC,MAXMC),QT(MAXMC)	00004330
	DOUBLE PRECISION W,C,S,TRACE,TEMP,Q,QT,YPY,SSRM,SSEM	00004340
	DATA IH/1HH/,IM/1HM/	00004350
	IHST=0	00004360
	IRST=0	00004370
	IBST=0	00004380
	IRANK=0	00004390
	IF(NSUBS .EQ. N) GC TC 140	00004400
C	FORM RESTRUCTURED CELL FREQUENCY ARRAY (EFFECTIVE D MATRIX)	00004410
	DO 40 I=1,NCELLS	00004420
	ID1=LCCD1+I	00004430
	IA=LCCA+I	00004440
40	W(IA)=W(ID1)	00004450
	CALL DECOMP(1,LCCA,IOUT,NW,W,M,LSTFI,N,LT,LV,LLIM,LP)	00004460
	NS=LCCA	00004470
	NN=M-NC1	00004480
	DO 50 I=1,NN	00004490
50	NS=NS+LSTFI(I)	00004500
	CALL LABEL(N01,0,LLIM,IOUT,N,LV,LP)	00004510
	CALL PCCL(0,LCCD2,NS,NW,W,N,LLIM,LT,LP)	00004520
C	CHECK FOR A SQUARE EFFECTIVE X MATRIX	00004530
	60 IF(IXST .EQ. 1) GC TO 120	00004540
	K=LCCD2+1	00004550
	IFLAG=0	00004560
	DO 70 I=1,NCELLS	00004570
	ID2=LCCD2+I	00004580
	IF(W(ID2) .EQ. 0.0) GO TO 170	00004590
	IF(W(ID2) .NE. W(K)) IFLAG=1	00004600
70	CONTINUE	00004610
	IF(IFLAG .EQ. 1) GO TO 110	00004620
C	THE EFFECTIVE D MATRIX IS A SCALAR TIMES THE IDENTITY	00004630
	IRANK=IDF	00004640
	80 DO 90 I=1,NCELLS	00004650
	ID2=LCCD2+I	00004660
	W(ID2)=W(ID2)/FLCAT(LPQUT)	00004670
100	C=1.000	00004680
	IBST=1	00004690
	GC TO 160	00004700
C	ALL ELEMENTS OF THE EFFECTIVE D MATRIX ARE NONZERO	00004710
110	IRANK=IDF	00004720
	GC TO 160	00004730
C	THE EFFECTIVE X MATRIX IS SQUARE	00004740
	120 DO 130 I=1,NCELLS	00004750
	ID2=LCCD2+I	00004760
	IF(W(ID2) .NE. 0.0) IRANK=IRANK+1	00004770
130	CONTINUE	00004780

IRANK=IRANK/LFOUT	00004790
GO TO 80	00004800
140 DC 150 I=1,NCELLS	00004810
ID1=LCCD1+I	00004820
ID2=LCCD2+I	00004830
150 W(ID2)=W(ID1)	00004840
GO TO 60	00004850
RANK HAS BEEN DETERMINED (NONITERATIVELY OR ITERATIVELY)	00004860
160 IF(ICD .EQ. IH) IRANKR=IRANK	00004870
IF(ICD .EQ. IM) IRANKM=IRANK	00004880
GC TO 330	00004890
170 IF(ICD .EQ. IM) GO TO 175	00004900
IRANKR=0	00004910
IF(IRANKM .NE. IDFM) GO TO 180	00004920
IFANKR=IDFR	00004930
GC TO 330	00004940
175 IRANKM=0	00004950
180 IF(IROPT .EQ. 0) GO TO 400	00004960
C ITERATIVELY COMPUTE RANK OF FULL OR REDUCED MODEL	00004970
C=1.000	00004980
RTCL=0.1	00004990
NMC=0	00005000
DC 190 I=1,NCELLS	00005010
ID1=LCCD1+I	00005020
ID2=LCCD2+I	00005030
IF(W(ID1) .EQ. 0.0) NMC=NMC+1	00005040
190 W(ID2)=W(I)	00005050
IF(NMC .GT. MAXMC) GO TO 270	00005060
C COMPUTE Q, POWERS OF Q, AND RELATED TRACES (FEW EMPTY CELLS)	00005070
K=1	00005080
IVEC=0	00005090
DC 210 I=1,NCELLS	00005100
ID1=LCCD1+I	00005110
IF(W(ID1) .NE. 0.0) GO TO 210	00005120
DC 200 J=1,NCELLS	00005130
IV=LCCV+J	00005140
IB=LCCB+J	00005150
W(IV)=0	00005160
W(IB)=0	00005170
W(J)=0	00005180
IF(J .EQ. I) W(J)=1.000	00005190
200 CONTINUE	00005200
CALL STEP(3,C,S,NW,W,M,LSTFI,LER,N,LV,LLIM,LT,LP)	00005210
LL=1	00005220
DC 205 J=1,NCELLS	00005230
ID1=LCCD1+J	00005240
IV=LCCV+J	00005250
IF(W(ID1) .NE. 0.0) GO TO 205	00005260
G(K,LL)=W(IV)	00005270
LL=LL+1	00005280
205 CONTINUE	00005290
K=K+1	00005300
210 CONTINUE	00005310
C POWER Q AND COMPUTE TR(I-Q**(2*K))	00005320
TEMP=IDF	00005330
DC 213 I=1,NMC	00005340
213 TEMP=TEMP-Q(I,I)	00005350
IT=0	00005360
215 IF(ICFLAG .EQ. 1) WRITE(ICUT,216) IT,TEMP	00005370
216 FORMAT(10H ITERATION,I3.8H, TRACE=,F16.9)	00005380

DO 230	J=1,NMC	00005390
DO 220	I=J,NMC	00005400
	QT(I)=0	00005410
DO 220	K=1,NMC	00005420
220	QT(I)=QT(I)+Q(K,J)*Q(K,I)	00005430
DO 230	K=J,NMC	00005440
230	Q(K,J)=QT(K)	00005450
	TRACE=IDF	00005460
DO 240	I=1,NMC	00005470
	TRACE=TRACE-Q(I,I)	00005480
DO 240	J=I,NMC	00005490
240	Q(I,J)=Q(J,I)	00005500
	IT=IT+1	00005510
	TEMP=TRACE-TEMP	00005520
C	TRACE IS MONOTONICALLY INCREASING	00005530
	IF(TEMP .LE. RTOL) GO TO 250	00005540
	IF(IT .GE. MAXIT) GO TO 310	00005550
	TEMP=TRACE	00005560
	GO TO 215	00005570
250	DO 260 I=1,NCELLS	00005580
	ID2=LCCD2+I	00005590
260	W(I)=W(ID2)	00005600
C	ADD ONE (BASED ON MONOTONICITY) TO OBTAIN INTEGER RANK	00005610
265	IRANK=TRACE+1.0D0	00005620
	GO TO 160	00005630
C	COMPUTE S FOR UNIT VECTORS (MANY EMPTY CELLS)	00005640
270	TRACE=0	00005650
	RTOL=RTOL/(FLCAT(NCELLS)-FLCAT(NMC))	00005660
DO 300	I=1,NCELLS	00005670
	ID1=LCCD1+I	00005680
	IF(W(ID1) .EQ. 0.0) GO TO 300	00005690
DO 280	J=1,NCELLS	00005700
	IV=LCCV+J	00005710
	IS=LCCB+J	00005720
	W(IV)=0	00005730
	W(IS)=0	00005740
	W(J)=0	00005750
	IF(J .EQ. I) W(J)=1.0D0	00005760
280	CONTINUE	00005770
	IT=0	00005780
	TEMP=0	00005790
290	CALL STEP(3,C,S,NW,W,M,LSTFI,LER,N,LV,LLIM,LT,LP)	00005800
	IT=IT+1	00005810
	TEMP=S-TEMP	00005820
C	THE VALUE OF S IS MONOTONICALLY INCREASING	00005830
	IF(TEMP .LE. RTOL) GO TO 295	00005840
	IVEC=I	00005850
	IF(IT .GE. MAXIT) GO TO 310	00005860
	TEMP=S	00005870
	GO TO 290	00005880
295	TRACE=TRACE+S	00005890
	IF(ICFLAG .EQ. 1)WRITE(ICUT,296)I,IT,TRACE	00005900
296	FORMAT(7H VECTOR,I4,12H, ITERATIONS,I4,8F, TRACE=,F16.9)	00005910
300	CONTINUE	00005920
	GO TO 250	00005930
310	WRITE(ICUT,320) MAXIT,TEMP,RTOL,IVEC	00005940
320	FORMAT(11H MAXIMUM OF,I4,38H ITERATIONS EXCEEDED IN COMPUTING RANK,	00005950
	*7H DELTA=,F22.9,10X,8HEPSILON=,F22.9,10X,7HVECTOR=,I10)	00005960
	IF(NMC .GT. MAXMC) TRACE=TRACE+S	00005970
	IRST=1	00005980

GC TO 265	00005990
330 IF(IRCPT .EQ. 1) WRITE(IOUT,340) ICD,IRANK	00006000
340 FCFMAT(17H THE RANK OF THE ,A1,17H DESIGN MATRIX IS,15)	00006010
400 RETURN	00006020
ENC	00006030
<hr/>	
SLERCUTINE PART2(NW,W,M,LSTFI,LER,N,LE,LV,LLIM,LT,LP)	00006040
COMMON YPY,SSRM,SSEM,IIN,ICUT,IRCPT,ILOPT,IGOPT,IPOPT,IOFLAG	00006050
COMMON IBST,IHST,IRST,ISST,IXST,ICD,NSUBS,LPCUT,NO1,IDF,IDFM,IDFR	00006060
COMMON NCELLS,LOCD1,LOCD2,LCCV,LCCB,LOCA,IRANKM,IRANKR,MAXIT	00006070
COMMON NOBS,MAXDI,MINDI,FLEVEL,NOSIGD	00006080
DIMENSION W(NW),LSTFI(M),LER(M),LE(N),LV(N),LLIM(N),LT(N),LP(10)	00006090
DOUBLE PRECISION W,C,S,TEMP,YPY,SSRM,SSEM,DABS,F	00006100
DATA IBLANK/1H /,ISTAR/1H*/ ,IM/1HM/,IH/1HH/	00006110
FTCL=.005	00006120
STCL=(.05*YPY)/(10.0**NOSIGD)	00006130
C ZERO THE VECTORS B AND V TO INITIALIZE THE ITERATIVE ALGORITHM	00006140
DO 10 I=1,NCELLS	00006150
IB=LCCB+I	00006160
IV=LCCV+I	00006170
W(IB)=0	00006180
10 W(IV)=0	00006190
IT=0	00006200
TEMP=0	00006210
IF(IBST .EQ. 1) GO TO 310	00006220
IF(ICD .EQ. IH) GO TO 220	00006230
C COMPUTE SSR FOR THE FULL MODEL USING OPTIMUM C FOR CONVERGENCE	00006240
C=(FLOAT(MAXDI)+FLOAT(MINDI))/2.0	00006250
IF(MINDI .EQ. 0) C=MAXDI	00006260
30 CALL STEP(1,C,S,NW,W,M,LSTFI,LER,N,LV,LLIM,LT,LP)	00006270
IT=IT+1	00006280
TEMP=S-TEMP	00006290
IF(IOFLAG .EQ. 1) WRITE(IOUT,40) IT,ICD,S	00006300
40 FCFMAT(10H ITERATION,I4,5H, SSR,A1,1H=,E16.8)	00006310
IF(DABS(TEMP) .LE. STCL) GC TO 50	00006320
IF(IT .GE. MAXIT) GO TO 200	00006330
TEMP=S	00006340
GC TO 30	00006350
C APPLY THE E OPERATOR TO THE VECTOR B	00006360
50 DO 60 I=1,NCELLS	00006370
IB=LCCB+I	00006380
IA=LOCA+I	00006390
60 W(IA)=W(IB)	00006400
CALL DECOMP(0,LOCA,ICUT,NW,W,M,LSTFI,N,LT,LV,LLIM,LP)	00006410
C COMPUTE SSR AND SSE FOR THE FULL MODEL	00006420
70 SSRM=S	00006430
SSEM=YPY-S	00006440
WRITE(IOUT,75) IT,SSRM,SSEM	00006450
75 FCFMAT(10H ITERATION,I4,18H, SSR(FULL MODEL)=,E16.8,1H, /	00006460
*14X,18H SSE(FULL MODEL)=,E16.8)	00006470
IF(ILOPT .EQ. 0) GC TO 115	00006480
WRITE(ICUT,80)	00006490
80 FCFMAT(34H ESTIMATES OF EXPECTED CELL MEANS-	00006500
*/24H CELL ESTIMATED MEAN)	00006510
DO 90 I=1,NCELLS	00006520
ID1=LCCD1+I	00006530
IV=LCCV+I	00006540
IF(W(ID1) .EQ. 0.0) WRITE(ICUT,100) I,W(IV)	00006550
IF(W(IC1) .GT. 0.0) WRITE(ICUT,110) I,W(IV)	00006560

90	CCONTINUE	00006570
100	FCRMT(1H ,I6,IX,E16.8,15H (MISSING CELL))	00006580
110	FCRMT(1H ,I6,IX,E16.8)	00006590
115	IF(IGOPT .EQ. C) GC TO 190	00006600
C	CCMPUTE THE G-INVERSE SOLUTION TO THE NORMAL EQUATIONS	00006610
	WRITE(ICUT,120)	00006620
120	FORMAT(20H G-INVERSE SOLUTION-)	00006630
	PCCL ARRAYS CF "ESTIMATES" WITH EQUAL E/R LIST VALUES	00006640
	NP=LOCA	00006650
	DO 170 I=1,M	00006660
	NC=LER(I)	00006670
	IF(NC .LE. 0) GO TO 170	00006680
	NS=NP	00006690
	NCP=M-I+1	00006700
	CALL LABEL(NOP,0,LLIM,ICUT,N,LV,LP)	00006710
C	POSITIVE VALUES IN LLIM WILL CORRESPOND TO SUBSCRIPTS IN PRIMARY	00006720
	DO 130 K=1,N	00006730
	IF(LP(K) .EQ. 0) LLIM(K)=-LLIM(K)	00006740
130	CONTINUE	00006750
	DO 140 J=I,M	00006760
	IF(J .EQ. I) GC TO 140	00006770
	IF(LER(J) .NE. NC) GO TO 140	00006780
	LER(J)=-NC	00006790
	NGS=M-J+1	00006800
C	OBTAIN MAP COEFFICIENTS FOR SECONDARY ARRAY AND PCCL INTO PRIMARY	00006810
	CALL LABEL(NOS,0,LLIM,ICUT,N,LV,LP)	00006820
	CALL PCCL(1,NP,NS,NW,W,N,LLIM,LT,LP)	00006830
140	NS=NS+LSTFI(J)	00006840
	DO 150 K=1,N	00006850
150	LLIM(K)=IABS(LLIM(K))	00006860
C	LABEL AND OUTPUT "ESTIMATES" FOR MODEL TERM	00006870
	CALL LABEL(NC,IBLANK,LE,ICUT,N,LV,LP)	00006880
	MST=LSTFI(I)	00006890
	DO 160 K=1,MST	00006900
	IA=NP+K	00006910
160	WRITE(ICUT,110) K,W(IA)	00006920
170	NP=NP+LSTFI(I)	00006930
190	RETURN	00006940
200	WRITE(ICUT,210) MAXIT,ICD,TEMP,STOL	00006950
210	FCRMT(11H MAXIMUM OF,I4,37H ITERATIONS EXCEEDED IN COMPUTING SSR,	00006960
	*A1/7H DELTA=,E16.8,10X,8HEPSILCN=,E16.8)	00006970
	GC TO 50	00006980
C	SELECT C FOR MONOTONICITY OF SSR AND F	00006990
220	C=MAXDI	00007000
C	CCMPUTE DEGREES OF FREEDOM TO USE FOR F STATISTIC	00007010
225	IF(IRANKM .EQ. 0) GO TO 240	00007020
	IF(IRANKR .EQ. 0) GO TO 240	00007030
	IDFD=NCBS-IRANKM	00007040
	IDFN=IRANKM-IRANKR	00007050
	WRITE(ICUT,230) IDFN,IDFD	00007060
230	FORMAT(33H FROM RANK COMPUTATIONS- DF(NUM)=,I4,10H, DF(DEN)=,I5)	00007070
	GC TO 260	00007080
240	IDFD=NCBS-IDFM	00007090
	IDFN=IDFM-IDFR	00007100
	WRITE(ICUT,250) IDFN,IDFD	00007110
250	FCRMT(50H ASSUMES FULL RANK AND EQUAL LEVELS WITH- DF(NUM)=,I4,	00007120
	*10H, DF(DEN)=,I5)	00007130
260	IF(IDFD*IDFN .LE. 0) GO TO 190	00007140
	IF(IBST .EQ. 1) GO TO 275	00007150
	CCMPUTE MONOTONICALLY DECREASING APPROXIMATION TO F	00007160

270 CALL STEP(1,C,S,NW,W,M,LSTFI,LER,N,LV,LLIM,LT,LP)	00007170
IT=IT+1	00007180
275 F=(((SSRM-S)/FLCAT(IDFN))/(SSEM/FLCAT(IDFD)))	00007190
IF(ICFLAG .EQ. 1) WRITE(IOUT,40) IT,ICD,S	00007200
C APPROXIMATION TO F PROBABILITY (SMILLIE AND ANSTEY)	00007210
U1=2.0/(9.0*FLCAT(IDFN))	00007220
U2=2.0/(9.0*FLCAT(IDFD))	00007230
F1=F*(1.0/3.0)	00007240
U=(((1.0-U2)*F1-1.0+U1)/SQRT(2.0*(U2*F1*F1+U1)))	00007250
PRCB=0.5/(1.0+(((.078108*U+.000972)*U+.230389)*U+.278393)*U)**4	00007260
IF(IBST .EQ. 1) GO TO 290	00007270
IF(IPOPT .EQ. 1) GO TO 278	00007280
IF(PROB .GE. FLEVEL) GO TO 290	00007290
278 TEMP=TEMP-F	00007300
IF(DABS(TEMP) .LE. FTCL) GO TO 290	00007310
IF(IT .GE. MAXIT) GO TO 280	00007320
TEMP=F	00007330
GO TO 270	00007340
280 WRITE(IOUT,210)MAXIT,ICD,TEMP,FTCL	00007350
290 ISIG=ISTAR	00007360
IF(PROB .GE. FLEVEL) ISIG=IBLANK	00007370
WRITE(IOUT,300) IT,F,ISIG,PRCB,FLEVEL,S	00007380
300 FORMAT(10H ITERATION,I4,4H, F=,F12.3,A1,15H, PRCB(F) .GT. ,F6.4,	00007390
*16F VS. F LEVEL OF ,F6.4/20H SSR(REDUCED MODEL)=,E16.8)	00007400
GO TO 190	00007410
C BALANCED CASE; ONE ITERATION	00007420
310 CALL STEP(2,C,S,NW,W,M,LSTFI,LER,N,LV,LLIM,LT,LP)	00007430
IT=IT+1	00007440
IF(ICD .EQ. IM) GO TO 70	00007450
GO TO 225	00007460
END	00007470
SUBROUTINE STEP(IND,C,S,NW,W,M,LSTFI,LER,N,LV,LLIM,LT,LP)	00007480
DIMENSION W(NW),LSTFI(M),LER(M),LV(N),LLIM(N),LT(N),LP(10)	00007490
DOUBLE PRECISION W,C,S,T1,T2	00007500
S=0	00007510
NCELLS=LSTFI(1)	00007520
DO 40 I=1,NCELLS	00007530
C INCREMENT BASE ADDRESSES OF ARRAYS	00007540
ID1=NCELLS+I	00007550
ID2=ID1+NCELLS	00007560
IV=ID2+NCELLS	00007570
IB=IV+NCELLS	00007580
IA=IB+NCELLS	00007590
C GENERAL ITERATION (IND=1); NON-ITERATIVE (IND=2); RANK (IND=3)	00007600
IF(IND .EQ. 1) GO TO 20	00007610
IF(IND .EQ. 2) GO TO 10	00007620
W(IA)=W(I)-W(IV)	00007630
IF(W(ID1) .EQ. 0.0) W(IA)=W(I)	00007640
GO TO 30	00007650
10 W(IA)=-W(IV)	00007660
IF(W(ID2) .GT. 0.0) W(IA)=W(IA)+W(I)/W(ID2)	00007670
GO TO 30	00007680
20 W(IA)=(W(I)-W(ID1)*W(IV))/C	00007690
C V=V+A; B=B+A	00007700
30 W(IV)=W(IV)+W(IA)	00007710
W(IB)=W(IB)+W(IA)	00007720
40 CCNTINUE	00007730
RESIDUAL OPERATOR	00007740
IA=IB	00007750

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CALL DECOMP(0,IB,ICUT,NW,W,M,LSTFI,N,LT,LV,LLIM,LP)
IFLAG=0
DO 50 I=1,M
  IF(LER(I) .GT. 0) GO TO 50
  IF(I .EQ. 1) GO TO 45
  NC=M-I+1
  CALL LABEL(NC,0,LLIM,ICUT,N,LV,LP)
  CALL PCOL(IFLAG,IA,IB,NW,W,N,LLIM,LT,LP)
45  IFLAG=1
50  IB=IB+LSTFI(I)
C V=V-T; S=2*Y*V-V*D*V
DO 60 I=1,NCELLS
  ID1=NCELLS+I
  IV=ID2+I
  IA=IA+1
  IF(IFLAG .EQ. 1) W(IV)=W(IV)-W(IA)
  T1=2.0D0*W(I)
  T2=W(ID1)
  IF(T2 .EQ. 0.0) GO TO 60
  IF(IND .EQ. 3) T2=1.0D0
  T1=T1-W(IV)*T2
60  S=S+T1*W(IV)
RETURN
END

SUBROUTINE DECOMP(IND,LCCA,ICUT,NW,W,M,LSTFI,N,LS,LV,LLIM,LP)
C NOTE: THE ARGUMENTS LS,LV,LP, AND ICUT ARE USED ONLY FOR C MEANS
DOUBLE PRECISION W,TEMP,DNFM,CMEAN
DIMENSION W(NW),LSTFI(M),LS(N),LV(N),LLIM(N),LP(10)
DATA IDOT/1H./
LL=1
MM=1
NN=1
LCCTWO=LCCA+1
10 LCCCNE=LJCA+1
KK=LL
C FIND NUMBER OF ELEMENTS IN THIS MEAN
K1=N+1-NN
NPM=LLIM(K1)
DNFM=NPM
20 LCCTWO=LCCTWO+LSTFI(MM)
C FIND NUMBER OF MEANS FOR EACH RESIDUAL
MEANST=LSTFI(MM+1)
C FIND INCREMENT
K1=M+1-KK
INC=LSTFI(K1)
C FORM THE ARRAY OF MEANS
MD=1
NC=M-MM
IF(IND .EQ. 2) CALL LABEL(NC,ICUT,LS,ICUT,N,LV,LP)
DO 70 I=1,MEANST,INC
  JTWG=I+INC-1
  DO 60 J=1,JTWG
    L=MD
    LD=MD
    I1=LJCTWO+J-1
    TEMP=0.00
    DO 30 K=1,NPM
      I2=LCCCNE+L-1
      TEMP=TEMP+W(I2)

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30	L=L+INC	00008350
	C DEVIATES (IND=0); SUMS (IND=1); CLASSIFICATION MEANS (IND=2)	00008360
	IF (IND .EQ. 0) GGTJ 40	00008370
	IF(IND .EQ. 1) GC TC 36	00008380
	IF(TEMP .EQ. 0.0) WRITE(ICUT,32) J	00008390
	IF(TEMP .GT. 0.0) CMEAN=W(I1)/TEMP	00008400
	IF(TEMP .GT. 0.0) WRITE(ICUT,34) J,W(I1),TEMP,CMEAN	00008410
32	FJRMAT(1H ,I6,4X,29H(MISSING CLASSIFICATION CELL))	00008420
34	FORMAT(1H ,I6,1X,E16.8,FS.0,1X,E16.8)	00008430
36	W(I1)=TEMP	00008440
	GOTO 60	00008450
40	W(I1)=TEMP/DNPM	00008460
	C FORM DEVIATES	00008470
	DO 50 K=1,NPM	00008480
	I2=LOCCNE+LD-1	00008490
	W(I2)=W(I2)-W(I1)	00008500
50	LD=LD+INC	00008510
60	MD=MD+1	00008520
70	MD=L-INC+1	00008530
	IF (KK .EQ. 1) GCTC 80	00008540
	KK=KK-1	00008550
	MM=MM+1	00008560
	K1=LL-KK	00008570
	LOCCNE=LOCCNE+LSTF1(K1)	00008580
	GCTC 20	00008590
80	IF (NN .EQ. N) RETURN	00008600
	LL=LL+LL	00008610
	NN=NN+1	00008620
	MM=MM+1	00008630
	GCTC 10	00008640
	END	00008650
	SUEROUTINE POCL(IND,NP,NS,NW,W,N,LLIM,LT,LP)	00008660
	DIMENSION W(NW),LLIM(N),LT(N),LP(10)	00008670
	DOUBLE PRECISION W,TEMP	00008680
	C NP=LCCATION OF PRIMARY ARRAY; NS=LCCATION OF SECCNDRY ARRAY;	00008690
	C MAP CJEFFICIENTS OBTAINED FROM LP; REPLACE (IND=0); ADD (IND .NE. 0)	00008700
	LCC1=NP	00008710
	I=1	00008720
10	DO 20 J=1,N	00008730
20	LT(J)=1	00008740
30	LCC1=LCC1+1	00008750
	LCC2=NS+1	00008760
	DO 40 J=1,N	00008770
40	LCC2=LCC2+(LT(J)-1)*LP(J)	00008780
	TEMP=W(LCC2)	00008790
	IF(IND .NE. 0) TEMP=TEMP+W(LCC1)	00008800
	W(LCC1)=TEMP	00008810
	DO 50 J=1,N	00008820
	K=N-J+1	00008830
	IF(LLIM(K) .LT. 0) GC TC 50	00008840
	IF(LT(K) .EQ. LLIM(K)) GC TC 50	00008850
	LT(K)=LT(K)+1	00008860
	IF(K .EQ. N) GC TC 30	00008870
	I=K+1	00008880
	GC TC 10	00008890
50	CONTINUE	00008900
	RETURN	00008910
	END	00008920

SUBROUTINE LABEL(NC, ICHAR, LIST, IOUT, N, LV, LCA)	00008930
DIMENSION LIST(N), LV(N), LCA(10)	00008940
DATA IBLANK/IH /	00008950
C MAP COEFFICIENTS: (NC=2**N-I+1, ICHAR=0, LIST=LLIM)	00008960
C LABELS: MODEL TERM (NC=LER(I), ICHAR=, LIST=LE)	00008970
C SUBSCRIPTS (NC=2**N-I+1, ICHAR=., LIST=LS)	00008980
NUM=NC-1	00008990
DC 10 I=N,10	00009000
10 LCA(I)=IBLANK	00009010
DC 20 I=1,N	00009020
20 LCA(I)=ICHAR	00009030
IF(NUM .EQ. 0) GO TO 70	00009040
I=0	00009050
J=0	00009060
30 I=I+1	00009070
40 J=J+1	00009080
50 NUM=NUM-LV(J)	00009090
IF(NUM .GE. 0) GO TO 60	00009100
NUM=NUM+LV(J)	00009110
IF(ICHAR .NE. IBLANK) GO TO 30	00009120
GO TO 40	00009130
60 LCA(I)=LIST(J)	00009140
IF(NUM .NE. 0) GO TO 30	00009150
70 IF(ICHAR .EQ. 0) GO TO 90	00009160
WRITE(IOUT,80) (LCA(K),K=1,10)	00009170
80 FORMAT(IH ,10A1)	00009180
RETURN	00009190
90 DC 110 I=1,N	00009200
IF(LCA(I) .EQ. 0) GO TO 110	00009210
LCA(I)=1	00009220
DC 100 J=I,N	00009230
IF(LCA(J) .EQ. 0) GO TO 100	00009240
LCA(I)=IABS(LCA(I)*LCA(J))	00009250
100 CONTINUE	00009260
110 CONTINUE	00009270
RETURN	00009280
END	00009290