TITLE: Centroid Factors with Fixed Communalities (SADOI Only)

TYPE: Entire Program

CAPACITY: 111 Variables

DURATION: TIME IN SECONDS

Var.	Input Matrix		Per Factor,	Residual Matrix	
n	$d_i=3$	$d_i=10$	average	$d_r=3$	$d_r=10$
20	7	14	9	28	53
40	27	52	26	96	194
60	60	114	52	207	425
80	107	200	87	360	745
100	166	310	130	554	1154
111	205	380	157	679	1416

Add 60 seconds for input of master tape and 15
seconds for parameters and communalities

PARAMETER TAPE: The parameter tape consists of three unsigned decimal
numbers separated by fifth-hole characters in the
following order:

   f space   f - factors to be extracted
   df space d_f - digits to be punched in factors
   dr space d_r - digits to be punched in residuals

Both d_f and d_r may be set to any value less than 12, but
the results are accurate to 8 decimal places only. The
value of f must be less than 100. If f = 0, no factor
extraction will take place. If d_f = 0, and f $\neq$ 0, the
factors will be calculated, but not punched. Only the
table of variance removed will be printed. If d_r = 0,
the residual matrix will not be punched.

COMMUNALITIES TAPE: The communalities tape consists of positive signed fractions
scaled by 10^{-1}. There must be exactly n numbers on the
tape, and the final number must be terminated by an N.

CORRELATION TAPE: The correlation tape is the lower triangular matrix output
of K-8, K-9, or any other triangular matrix of correlations.
This tape consists of n(n + 1)/2 signed fractions scaled by
10^{-1}. The numbers are punched by rows (i.e., r_{00}, r_{10},
r_{11} ... $r_{n-1, n-1}$). The diagonal entries must be present,
but it is unimportant what these are, for they are replaced
by the communalities.

OPERATOR TAPE: The operator tape is a record of the reflection process.
At the beginning of a factor extraction no operator tape is
required, for no reflection has taken place. For the
extraction of subsequent factors on the same data, see
part C under Methods of Use. Part of the output of each

problem consists of **this** operator tape, so as to permit subsequent continuation of the problem.

METHODS OF USE:

A. <u>To extract f factors and **punch** out residuals</u>

		Stops
1.	Master tape	2419O
2.	Parameter tape	2414L
3.	Communalities	3418S
4.	Correlations	2419O

At the conclusion of step 4 at stop 2419O, another problem can be begun **by** returning to step 2 and raising the black switch.

B. <u>To extract f factors without residual correlations</u>, set $d_r = 0$, and follow steps 1-4 as in A. The final stop will be 24OS2. At this point either a new problem can be begun or an additional factor can be extracted.
(1) To begin a new problem raise the black switch. The machine will stop on 2419O. Repeat steps 1-4 as in A.
(2) To extract an additional factor, raise the white switch. After the next factor is calculated, the machine will again stop on 24OS2. This option may be repeated as many times as desired, each time by raising the white switch.

C. <u>To extract g more factors on a subsequent machine run</u>, first clear the machine as at the beginning of a new problem ànd read the operator tape. The machine will stop on 2405J. Next read the master tape, and repeat steps as in A, substituting the residual communalities and residual correlations for the original data.

EXAMPLE:

A four-variable example is shown below.

2 space 3 space 3 space	<u>Parameter tape</u>
+1+1+1+1N	Communalities
+100	Correlations
+040+100	
-055+023+100	
-036-030-012+100	
	Results, Factor I
+0.90	
+0.58	
-0.47	
-0.60	
N	
-0.28	Factor II
+0.56	
+0.82	
-0.54	
N	Table of Per Cent of Variance
	Removed

NO	ROOT	PC OF V	CUM PC
01	+01.734	+043.361	+043.361
02	+01.358	+033.959	+077.320

EXAMPLE, continued.

RESIDUALS

+0.10
+0.35
+0.10
+0.35N

Residual _Communalities_

+0.10
-0.04 +0.35
-0.10 +0.04 +0.10
+0.04 -0.35 -0.04 +0.35

Residual _Correlations_

00689+
80F00 001F
00F00 000F
00F00 002F
80F00 001F
24999N

Operator _Tape_

GENERAL REMARKS:

The purpose of the centroid program is to decompose a matrix of correlations, R(n), to a set of f linearly independent effects or factors. The program calculates the factor matrix, F, such that

$$R(n) = F\ F' + R_{(n-f)}$$

where R$_{(n-f)}$ is the matrix of residual effects. Attempts are often made to reduce the size of the elements of R$_{(n-f)}$ by introducing communalities estimates which replace the diagonal entries of R. This program is called the _fixed_ _communalities_ program to distinguish it from other programs which continuously re-estimate the diagonal entries during the course of the calculation.

The kth factor is obtained merely by dividing the column sums of R$_{(n-k)}$ by the square root of the total sum of elements of R$_{(n-k)}$; i.e.,

$$f_{ik} = \sum_j r_{ij}^{(k)} \bigg/ \sqrt{\sum_i \sum_j r_{ij}^{(k)}}$$

The centroid of a set of points is the center of gravity of equal weights at the points. If the axes are so placed that the centroid lies in the first axis of reference, then the centroid has zero projections on all the remaining coördinate axes. It is necessary to rearrange the points to proceed with successive factor extractions. The method chosen here is called the reflection process. To insure that successive effects to be removed from R are nearly as large as the method permits, whenever the column sum associated with a variable is negative (excluding the diagonal entry), the correlations associated with this variable are changed in sign. The process continues until all of the column sums are either positive or zero. Reflection occurs prior to the extraction of each factor including the first one. It is not necessary for the factor analyst to take this process into account, for a set of operators within the memory keep track of the bookkeeping. The factor loadings which are punched out carry the correct sign which is consistent with the original R-matrix.

GENERAL REMARKS, continued.

For further discussion of the method, see L.L. Thurstone, _Multiple Factor Analysis_, University of Chicago Press, 1947, pages 149-75.

NOTE 1:

If the routine stops on an FF order from location 026, raise the white switch. The routine will then print out the per cent of variance removed, the residual communalities, and the residual correlations. A stop on an FF order may be due to any of the following troubles: (1) overfactoring, (2) under-estimation of communalities, (3) R-matrix is non-Gramian, (4) machine errors, and (5) errors in data tapes.

NOTE 2:

If the routine stops on an FF order from location 04J, this indicates a failure in transferring orders from the drum to the William's Memory.

DATE   January 9, 1959

SUBMITTED BY _KWDickman_

APPROVED BY _JMSnyder_

lgr

Abs.	Rel.	Sym.	ORDER		NOTES
			J		
			Centroid Factors		Title
			Fixed Communalities		
			003K		
3		(F)	00F 00F		Factors
4		(D)	00F 00F	} by (I1)	Decimal places in factors
5		(R)	00F 00F		Decimal places in residuals
6		(N)	00F 00F		Order of matrix
7		(T)	00F 0064F		No. of words per track
8		(I)	00F 00F		Row number
9		(J)	00F 00F		Column number
10		(JT)	00F 00F		Temporary storage
11		(K)	00F 00F		" "
12		(A)	00467F 00467F		Location of drum addresses for vector "j"
13		(V)	00578F 00578F		Location of vector "j"
14		(OP)	00689F 00689F		Store of operators
15		(O1)	80F 001F		Control of operators
16		(C)	00800F 00800F		Store of communalities
17		(S)	00911F 00911F		Store of column sums and factor loadings
18		(DO)	8511F 002659F		Store of r-matrix on drum
19		(D1)	00F 00F	by 13(I1)	(DO) - 65
20		(D2)	00F 00F	by 17(I1)	(DO) - 4289
21		(D3)	8511F 002560F		Store of roots on drum
			00K		
22		(0)	00F 00F		Always zero
23		(1)	00F 001000 0000 0000J		10^{-1}
24		(2)	00F 006250 0000 0000J		$2^{-4} \times 10^{+1}$
25		(3)	00F 003F		Used to calculate print parameter
26		(4)	00F 0067F		Used in drum add. routine
27		(5)	00F 0070F		Number of digits per line of teletype
28		(6)	40F L521(N12)		Test for (N12)
29		(7)	26(N1) 00F		To transfer out of (N12)
30		(8)	01F 00F		To change drum read order to store order

LOCATION			ORDER		NOTES
Abs.	Rel.	Sym.			
31		(9)	OOF OOF	by 26(I1)	Maximum number of residuals per line
32		(10)	OOF OO1OF		Test on input of parameters
33		(11)	OOF OOF	by 11(I2)	Sum of communalities x 10^{-2} x 2^{-2}
34		(12)	OOF OOF	by 6(I2)	(N) - 1
35		(13)	OOF OOF		Temporary storage
36		(14)	OOF OOF		" "
37		(15)	OO1F OO1F		To increase addresses
38		(16)	FFF 26(M5)		Error stop; white switch to end of program
39		(17)	OO961F OO961F		To adjust (P1)
40		(18)	OO642F OO643F		To adjust (P1)
41		(19)	OOF OOF		Temporary storage for print of table
42		(20)	OOF OOF		" " " " " "
43		(21)	OOF OOF		" " " " " "
44		(22)	OOF OOF		" " " " " "
45		(Y1)	OOK		To transfer words to and from drum
			OOK		To place input routine in memory
85	0	(M1)	50335F 50L		
	1		26(Y1) OO2660F		
	2		OO63F 9259F		
	3		50400F 503L		
	4		26(Y1) OO2726F		
	5		OO62F 24(I1)		Stop for insertion of parameter tape
			OOK		Read last correlation
91	0	(M2)	914F 36L	from 24(N1)	
	1		914F 361L		
			OOK		To place
93	0		50335F 50L		portions of factor extraction
	1		26(Y1) OO2792F		routine in memory
	2		OO61F 41(19)		
	3		50400F 503L		
	4		26(Y1) OO2858F		
	5		OO4OF 26(M3)		
			OOK		
99	0	(M3)	L5(D3) 402(M6)		Preset drum add. for store and read

LOCATION			ORDER	NOTES PAGE 3	
Abs.	Rel.	Sym.			
	1		L4(8) 406 (M4)	of roots	
	2		L5(18) 466(P1)	Adjust (P1)	
	3		4222(P1) 41(20)		
	4		41(21) 41(22)		
	5		L3(F) 36(M9)	Test: (F) = 0	
			00K	Main routine	
105	0	(M4)	92135F 50L		
	1		26(SJ) 501L	Column sums	
	2		26(RF) 41F	Reflection process	
	3		9259F 503L		
	4		26(CL) 504L	Calculate factor loadings	
	5		26(PL) L5(14)	Print factor loadings	
	6		00F 00F	by 1(M3)	Drum address
	7		F56L 406L	for store of root	
	8		50(0) 508L		
	9		26(RC) 509L		
	10		26(RR) F5(19)	Residual communalities	
	11		42(19) L0(F)	Residual correlations	
	12		36(M5) 26L	Test for end of factor extraction.	
			00K		
118	0	(M5)	92135F 92259F	from 12(M4)	Title for table of variance
	1		92965F 92770F		
	2		92578F 92965F		
	3		92258F 92582F		
	4		92322F 92977F		
	5		922F 92835F		
	6		92961F 92578F		
	7		92898F 92961F		
	8		92323F 92977F		
	9		92835F 92450F		
	10		92643F 92961F		
	11		922F 92835F		
	12		92707F 92519F		

LOCATION			ORDER		NOTES PAGE 4
Abs.	Rel.	Sym.			
			OOK		Take roots off drum
131	0	(M6)	L5(S) 423L		
	1		421(M7) 92135F		
	2		OOF OOF	by 0(M3)	Drum address
	3		223L 40F	by 0(M6)	
	4		F52L 402L		
	5		F53L 423L		
	6		F5(22) 42(22)		
	7		LO(F) 36(M7)		
	8		262L OOF		
			OOK		Print table of variance
140	0	(M7)	L5(17) 466(P1)		
	1		4222(P1) L5F		
	2		40(K) F5(21) .		
	3		J022F 503L		
	4		26(P1) L5(18)		Factor number
	5		466(P1) 4222(P1)		
	6		L5(K) 002F		
	7		5252F 507L		
	8		26(P1) 92961F		Root
	9		L5(K) 66(11)		
	10		75(1) 40(JT)		
	11		5263F 5011L		
	12		26(P1) 92965F		Per cent of variance
	13		L5(JT) L4(20)		
	14		40(20) 50(1)		
	15		5263F 5015L		Cumulative per cent of variance
	16		26(P1) 92131F		
	17		92515F F51L		
	18		421L F5(21)		
	19		42(21) LO(F)		
	20		36(M71) 26L		
			OOK		
161		(M71)	92135F 92259F	from 20(M7)	

LOCATION			ORDER		NOTES PAGE 5
Abs.	Rel.	Sym.			
			OOK		Print residual
162	0	(M8)	9259F 92135F		communalities x 10^{-1}
	1		L3(D) 36(M9)		
	2		L5(C) 424L		
	3		L5(D) 466L		
	4		41(I) 50F	by 2L	
	5		75(2) 004F		
	6		52F 506L		
	7		26(P1) F54L		
	8		424L F5(I)		
	9		42(I) L0(N)		
	10		3211L 92131F		
	11		224L 92770F		
			OOK .		To place routine to
174	0	(M9)	L3(R) 367L	from 1(M9)	print residuals in
	1		50335F 501L		memory
	2		26(Y1) 002990F		To test: (R) = 0
	3		0040F 92139F		
	4		50400F 504L		
	5		26(Y1) 003056F		
	6		0030F 26(PR)		
	7		F5(F) 42(F)		If (R) = 0, option: black switch yields
	8		241L 26(M4)		new problem, white switch calculates
					another factor.
			OOK		
183		(P1)	Insert (P1)		Print routine
			OOK		Routine to pre-calculate
211	0	(V1)	K5F 4230L	from 6(SJ)	addresses of vector "j"
	1		L5(A) 4212L	or 21(RF)	and read a column from a
	2		4223L L4(12)		triangular matrix stored on drum
	3		4231L L5(V)		
	4		4226L 41(I)		
	5		50(J) 75(T)		
	6		S5F 40(JT)		

LOCATION			ORDER	NOTES	PAGE 6
Abs.	Rel.	Sym.			
	7		L5(I) L0(J)		
	8		40(K) 3619L		
	9		L5(J) L0(4)		
	10		3216L L5(JT)		
	11		L4(D1) L4(J)		
	12		L4(I) 40F	by 1(V1)	Drum order for element i, j
	13		F512L 4212L		
	14		F5(I) 42(I)		
	15		L0(N) 3223L		
	16		267L 50(0)		
	17		L5(JT) 001F		
	18		L4(D2) 2211L		
	19		L1(K) 3614L		
	20		50(I) 75(T)		
	21		S5F 40(JT)		
	22		L5(I) 229L .		
	23		00F L5F		
	24		4025L 3225L		
	25		00F 00F	by 24L	Drum address
	26		3226L 40F	by 4L	Store
	27		F526L 4226L		
	28		F523L 4223L		
	29		L031L 3223L		
	30		001F 22F		
	31		80F L5F		
			00K		Reflect vector "j"
243	0	(RN)	K5F 4216L	from 22(RF)	and replace on drum
	1		L5(A) 426L		
	2		427L 4210L		
	3		L4(12) 4218L		
	4		L5(V) 4211L		
	5		L4(12) 4217L		
	6		50(0) L5F	by 11(RN)	
	7		L4(8) 40F	by 2(RN)	
	8		F56L 426L		

LOCATION			ORDER	NOTES	
Abs.	Rel.	Sym.			
	9		427L L018L		
	10		326L L5F		
	11		4012L L1F		
	12		00F 00F	by 11(RN)	Drum address precalculated
	13		F510L 4210L		
	14		F511L 4211L		
	15		L017L 3210L		
	16		001F 22F		
	17		N012L L1F		
	18		J0(0) L5F		
			00K		Calculate column sums
262	0	(SJ)	K5F 4215L	from 1(M4)	
	1		L5(S) 4212L		
	2		41(J) 41(13)		
	3		F5(13) 42(13)		
	4		L5(V) 426L		
	5		41(14) 505L		
	6		26(V1) L5F	by 4(M4)	
	7		L4(14) 40(14)		
	8		F56L 426L		
	9		F5(13) 42(13)		
	10		L0(N) 3612L		
	11		226L 00F		
	12		L5(14) 40F	by 1(SJ)	Column sums at (S)
	13		F512L 4212L		
	14		F5(J) 42(J)		
	15		L0(N) 32F		
	16		222L 00F		
			00K		Reflection process
279	0	(RF)	K5F 4218L	from 2(M4)	continue to reflect until all
	1		41(I) L5(S)		column sums are positive
	2		40F 402F		
	3		425L 465L		
	4		4229L 4629L		
	5		L1F L4F	by 3(RF)	Select lowest column

LOCATION			ORDER		NOTES PAGE 8
Abs.	Rel.	Sym.			
	6		369L L52F		sum, S_j
	7		40F 0020F		
	8		465L 265L		
	9		F52F 422F		
	10		425L F5(I)		
	11		42(I) L0(N)		
	12		3613L 265L		
	13		L5F 4217L		
	14		40(13) L0(S)		
	15		42(J) L4(OP)		Test: $S_j < 0$
	16		4219L 0020F		
	17		4620L F1F		
	18		3619L 22F		
	19		L5(O1) L4F	by 16(RF)	Adjust operator
	20		40F 5020L	by 17(RF)	
	21		26(V1) 5021L ·		
	22		26(RN) L5(13)		Reflect vector
	23		4224L 0020F		
	24		4625L L1F	by 23(RF)	
	25		40F L5(V)	by 24(RF)	
	26		4628L 41(14)		
	27		L3(J) 3231L		
	28		L1F 001F	by 26(RF)	Adjust column sums on
	29		L4F 40F	by 4(RF)	Williams memory
	30		L528L L4(15)		
	31		4628L L529L		
	32		L4(15) 4029L		
	33		F5(14) 42(14)		
	34		L0(J) 401F		
	35		L31F 3231L		
	36		L5(14) L0(N)		
	37		361L 2628L		
			00K		Residual communalities
317	0	(RC)	K5F 4212L	from 9(M4)	
	1		L5(C) 426L		

LOCATION			ORDER		NOTES PAGE 9
Abs.	Rel.	Sym.			
	2		427L L5(S)		
	3		425L 465L		
	4		41(K) 50(0)		
	5		50F 7JF	by 3(RC)	
	6		401F L5F	by 1(RC)	$r_{ii}^{(k)} = r_{ii}^{(k-1)} - f_{1k}^2$
	7		L01F 40F	by 2(RC)	
	8		L55L L4(15)		
	9		405L F56L		
	10		426L 427L		
	11		F5(K) 42(K)		
	12		L0(N) 32F		
	13		265L 00F		
			00335K (PR)(I2)		
335		(R1)	00335K		Square root routine
			00K		Calculate factor
344	0	(CL)	K5F 4222L	from 4(M4)	loadings
	1		L5(C) 466L		
	2		L5(S) 426L		
	3		427L 4617L		
	4		4218L 41(14)		
	5		41(K) 41(J)		
	6		L5F L4F	by 1 and 2L	$(C_j + S_j) \times 10^{-2} \times 2^{-4}$
	7	(I3)	104F 40F	by 3L	
	8		104F L4(14)		
	9		40(14) L56L		Sum of $(C_j + S_j) \times 10^{-2}$
	10		L4(15) 406L		$\times 2^{-8}$ at (14)
	11		427L F5(K)		
	12	(N12)	42(K) L0(N)		
	13		3614L 266L		
	14		L5(14) 3215L		
	15		26(16) 5015L		Test: (14) < 0; if positive
	16		26(R1) 40(14)		take square root of (14)
	17		L5F 66(14)		
	18		S5F 40F	by 4(CL)	$|f_{1k}| \times 10^{-1}$
	19		F518L 4218L		

Abs.	Rel.	Sym.	ORDER		NOTES
	20		0020F 4617L		
	21		F5(J) 42(J)		
	22		L0(N) 32F		
	23		2617L 00F		
			00K		Print factor loadings
368	0	(PL)	K5F 4225L	from 5(M4)	
	1		L5(OP) 426L		
	2		L5(S) 427L		
	3		4215L 41(14)		
	4		L3(D) 3617L		Test: (D) = 0
	5		L5(D) 468L		
	6		41(K) L5F	by 1(PL)	Test operator: print $+ f_{ik}$ or $- f_{ik}$
	7		3215L L1F		
	8		52F 508L		
	9		26(P1) 92131F		
	10		F56L 426L		
	11		F57L 427L		
	12		4215L F5(K)		
	13		42(K) L0(N)		
	14		3216L 226L		
	15		00F L5F	from 7(PL)	
	16		228L 92770F		
	17		41(K) L5(S)		
	18		4220L 4620L		
	19		2120L S5F		
	20		50F 74F	by 18(PL)	
	21		102F L4(14)		Sum of squares of
	22		40(14) L520L		factor loadings
	23		L4(15) 4020L		
	24		F5(K) 42(K)		
	25		L0(N) 32F		
	26		2219L 00F		
			00400K (P0)(I1)		To calculate residual
400	0	(RR)	K5F 423L	from 10(M4)	correlations
	1		41(J) 41(I)		

Abs.	Rel.	Sym.	ORDER	NOTES	
	2		F5(J) 42(J)		
	3		L0(N) 32F		
	4		L5(S) 4225L		Take triangular matrix
	5		L4(J) 0020F		off drum, a row at a
	6		4625L L5(V)		time, and calculate
	7		4216L 4226L		$r_{ij}^{(k)} = r_{ij}^{(k-1)}$
	8		4232L 4626L		
	9		41(I) L5(J)		
	10		L0(4) 3221L		$- f_{ik}\, f_{jk}$
	11		50(J) 75(T)		
	12		L5(D1) L4(J)		then replace on drum
	13		S4F 4015L		
	14		L4(8) 4033L		
	15		00F 00F	by 13(RR)	drum address
	16		3216L 40F	by 7(RR)	
	17		F515L 4015L		
	18		F516L 4216L		
	19		F5(I) 42(I)		
	20		L0(J) 3224L		
	21		2615L 50(J)		
	22		75(T) 001F		
	23		L5(D2) 2212L		
	24		00F 41(I)		
	25		50F 71F	by 6(RR)	
	26		L4F 40F	by 7(RR)	
	27		F525L 4225L		
	28		L526L L4(15)		
	29		4026L F5(I)		
	30	(N1)	42(I) L0(J)		
	31		3632L 2625L		
	32		41(I) L5F	by 8(RR)	
	33		00F 00F	by 14(RR)	drum address
	34		F532L 4232L		
	35		F533L 4033L		
	36		F5(I) 42(I)		

Abs.	Rel.	Sym.	ORDER		NOTES
	37		LO(J) 362L		
	38		2232L 00F		
			00911K		Store Drum Set I
911	0		J0335F 50L		
	1		26(Y1) 002792F		
	2		0061F 263L		
	3		J0400F 503L		
	4		26(Y1) 002858F		
	5		0040F 26999F		
			26911N		
			00335K		Input communalities tape
335	0	(I2)	L5(C) 46(6)	from 29(I1)	
	1		463L 428L		
	2		429L 41(J) .		
	3		50F 503L		
	4		26(N12) L521(N12)		
	5		LO(6) 1020F		
	6		40(N) F0(0)		Store order of matrix at (N)
	7		40(12) 41(I)		
	8		41(11) 50F		
	9		75(1) 40F		$C_j \times 10^{-2}$
	10		102F L4(11)		
	11		40(11) F58L		Sum of $C_j \times 10^{-2} \times 2^{-2}$
	12		428L 429L		at (11)
	13		F5(J) 42(J)		
	14		LO(N) 34(I6)		Stop for insertion of R-tape
	15		228L 00F		
			00K		Input correlations tape
351	0	(I3)	L5(8) 463L	from (I6)	
	1		L4(15) 46(5)		
	2		L5(7) 4022(N12)		
	3		50F 503L		
	4		26(N12) 222(N1)		

Abs.	Rel.	Sym.			
356		(N12)	OOK		Input routine (N12)
			OOK		
395		(I6)	41(J) 26(I3)	from 14(I2)	
			00400K		
400	0	(I1)	192F 401F	from 5(M1)	Input parameters: f space
	1		L5(3) 428L		d_f space
	2		41F 914F		d_r space
	3		325L 222L		
	4		914F 325L		
	5		268L 50F		
	6		74(10) S5F		
	7		40F 264L		
	8		L5F 40F	by 1(I1)	
	9		F58L 428L		
	10		L51F L41F		
	11		401F 362L		
	12		L5(D0) F0(T)		
	13		40(D1) F5(T)		Form (D1) and (D2)
	14		40F 50F		
	15		75F L5(D0)		
	16		L0(T) S0F		
	17		40(D2) L3(D)		Calculate print parameter
	18		3621L 50(D)		
	19		75(10) K5F		
	20		0020F 46(D)		
	21		L3(R) 3629L		
	22		L5(R) L4(3)		
	23		008F 40F		
	24		L5(5) 66F		
	25		S5F 1031F		
	26		40(9) 50(R)		Store number of residuals
	27		75(10) K5F		per line at (9)
	28		0020F 46(R)		
	29		24(I2) 00F		Transfer to C_j input

Abs.	Rel.	Sym.	ORDER		NOTES
			OOK		
430	0	(N1)	L4(N12) 4621(N12) from(N12)		Addition to (N12) to
	1		L5(6) L021(N12)		read in a triangular matrix,
	2		3623(N12) L5(6)		to calculate drum
	3		L4(N12) 46(6)		addresses, and store
	4		1020F 4228L		on drum.
	5		4229L F5(S)		
	6		428L 429L		
	7		4218L 4621(N12)		
	8		41(I) 50F		$r_{ij} \times 10^{-2}$
	9		75(1) 40F	by 6(N1)	
	10		F58L 428L		
	11		429L L028L		
	12		328L F5(J)		
	13		42(J) L0(4)		
	14		3625L 50(0)		
	15		50(J) 75(T)		
	16		L5(D1) S4F		
	17		L4(J) L4(8)		
	18		4019L L5F		
	19		OOF OOF	by 18L	Drum order
	20		F519L 4019L		
	21		F518L 4218L		
	22		L029L 3218L		
	23		L5(J) L0(12)		
	24		36(M2) 3623(N12)		
	25		50(J) 75(T)		
	26		001F L5(D2)		
	27		2216L OOF		
	28		N1(I) 50F		
	29		N019L L5F		
			00911K		Store Drum Set II
911	0		J0335F 50L		
	1		26(Y1) 002660F		
	2		0063F 263L		

Abs.	Rel.	Sym.	ORDER		NOTES		
	3		J0400F 503L				
	4		26(Y1) 002726F				
	5		0062F 26999F				
			26911N				
			00335K				
335		(PR)	L3(R) 3621(P0)		Test: $(R) = 0$		
			00K		Print residual		
336	0		L5(R) 466L		correlations		
	1		4630L 9259F				
	2		92135F L5(C)				
	3		424L 41(J)				
	4		41(I) 50F	by 3L			
	5		75(2) 004F				
	6		52F 506L				
	7		26(P1) 92135F				
	8		92519F F54L				
	9		424L F5(J)				
	10		42(J) L0(N)				
	11		36(P0) 41(I)				
	12		L5(V) 4219L				
	13		4228L L5(J)				
	14		L0(4) 3224L				
	15		50(J) 75(T)				
	16		L5(D1) L4(J)				
	17		S4F 4018L				
	18		Q0F 00F	by 17L	Drum address		
	19		3219L 40F	by 12L			
	20		F518L 4018L				
	21		F519L 4219L				
	22		F5(I) 42(I)				
	23		L0(J) 3227L				
	24		2618L 50(J)				
	25		75(T) 001F				
	26		L5(D2) 2216L				
	27		00F 41(I)				
	28		41(K) 50F	by 13L			

Abs.	Rel.	Sym.	ORDER		NOTES		
	29		75(2) 004F				
	30		52F 5030L				
	31		26(P1) F5(K)				
	32		42(K) L0(9)				
	33		3634L 2235L				
	34		92131F 92519F				
	35		41(K) F528L				
	36		4228L F5(I)				
	37		42(I) L0(J)				
	38		324L 2228L				
			00400K				
400	0	(PO)	92981F 9259F	from 347F	Print operator tape		
	1		92135F 41(I)				
	2		922F 922F				
	3		L5(17) 466(P1)				
	4		L5(18) L0(15)				
	5		4222(P1) L5(OP)				
	6		1020F 4210L				
	7		J033F 507L				
	8		26(P1) 92131F				
	9		L512L 1020F				
	10		4222(P1) L5F				
	11		42(J) 828F				
	12		92898F L5(J)				
	13		J055F 5013L				
	14		26(P1) 92131F				
	15		F510L 4210L				
	16		F5(I) 42(I)				
	17		L0(N) 3218L				
	18		2210L 92130F				
	19		92258F 92586F				
	20		92770F 92981F				
	21		921001F L5(OP)				
	22		4223L L4(N)				

Abs.	Rel.	Sym.	ORDER		NOTES	
	23		4227L 41F			
	24		F523L 4223L			
	25		L027L 3223L			
	26		26(M1) 00F			
	27		N227L 41F			
			00911K		Store Drum Set III	
911	0		J0335F 50L			
	1		26(Y1) 002990F			
	2		0040F 263L			
	3		J0400F 503L			
	4		26(Y1) 003056F			
	5		0030F 26(M1)			
			26911N			