TITLE	Principal Axes Factor Analysis (DOI only)
TYPE	Entire program, includes DOI
DURATION	Approximately the same as for M 3 - 117
DESCRIPTION	A modification of M 3 which prints the eigenvectors scaled by the square root of the corresponding eigenvalue (i.e., latent root). The eigenvectors become factors by this scaling. Each factor is printed as a column terminated by the character "N". The eigenvalues are punched as a separate column after the last factor. The user of this program has to supply only the problem tap which is described below.
METHOD OF USE	(1) Read program tape in until it stops.
	(2) Insert problem tape in reader and input the symmetrical matrix and two parameters.
	(3) Replace program tape in reader and continue input. The first part of the computing will begin before the program tape has been read completely. When this part of the computing is finished the rest of the program tape will be input, computation completed, and the results punched out in the manner described above.

PREPARATION OF TAPES

PROGRAM TAPE	Obtain a copy of the tape in the computer library.
PROBLEM TAPE	The first part of this tape consists of the matrix to be factored. The lower left triangular half of the matrix is punched by rows, each element being in the form required by Illinois Code N 3, 23, Decimal Number Input. Each element should be scaled by 10^{-2} before being punched. The last element in the matrix should be followed by the character "N". The second part of the tape consists of two decimal numbers, each followed by a sexadecimal character. If (d) is the number of places desired in the printed results

and (p) is the order of the symmetric matrix to be factored then the second part of this tape can be represented as

(d) J (p) F.

COMMENTS

The capacity of the routine is a matrix of order 23. The factor loadings will be scaled by 10^{-1} when printed and the eigenvalues by 10^{-2}. Either unities or communalities can be used in the leading diagonal.

EXAMPLE

Let
$$\begin{Vmatrix} .906 & .438 & .072 \\ .438 & .891 & -.309 \\ .072 & -.309 & .650 \end{Vmatrix}$$

be the symmetric matrix which we are to factor, securing results to four decimal places. Then we will make a copy of the program tape in the library and make the following problem tape:

spaces
+00906
+00438
+00891   the lower half of the matrix
+00072   punched by rows
-00309
+00650

N   the printed results will have a
5   scaling zero and four significant
J   figures

spaces

3   the matrix is of order three
F

The results will be printed as

+07495
+08563
-02891
N
-02526
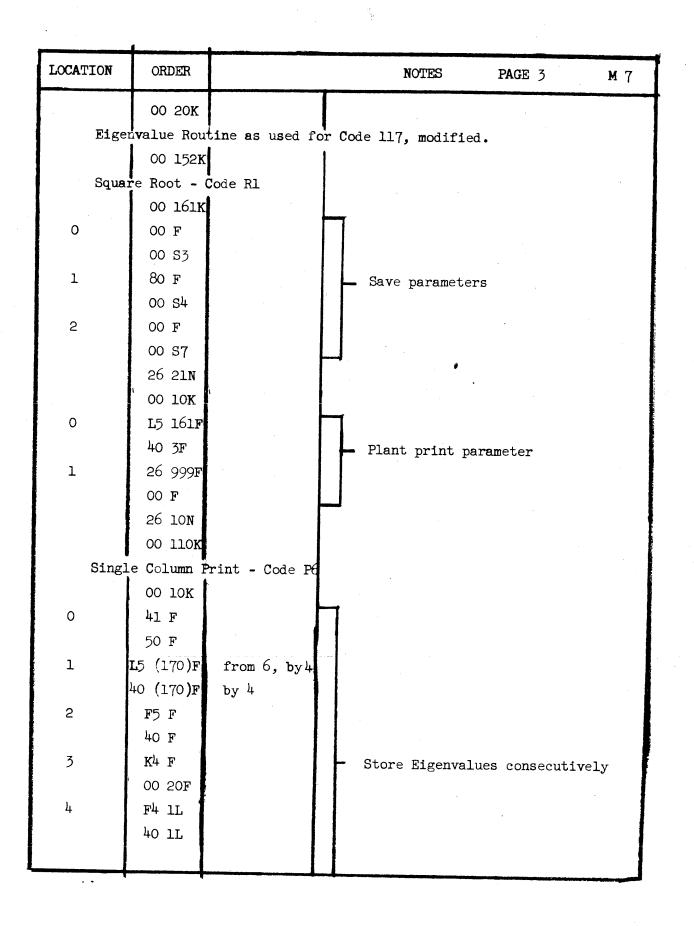+03231

+03022
N
+05296
-02308
+06892
N

$\left.\right\}$ factor loadings scaled by 10^{-1}

+01379
+00259
+00809

$\left.\right\}$ eigenvalues scaled by 10^{-2}

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Retyped: 9/24/59

LOCATION	ORDER			NOTES
	Decimal Order Input - Code X1			
	00 100K			
	Input Decimal Fractions - Code N2			
	00 10K			
0	40 170F			
	50 L			Read in correlation matrix
1	26 100F			
	41 F	from 9		
2	81 4F	from 6		
	L0 28L			
3	32 6L			
	L4 28L			
4	50 F			
	74 28L			Read in parameters and convert
5	S5 F			
	40 F			
6	26 2L			
	42 7L	from 3		
7	L5 F			
	40 ( )F	by 6		
8	L1 10L			
	40 10L			
9	32 1L			
	50 4F			
10	L5 (4)F	by 8		
	74 4F			
11	S5 F			
	10 1F			
12	L4 29L			
	40 7F			
13	42 17L			
	L5 4F			
14	L4 4F			Form dependent parameters
	40 5F			
15	41 1F			
	F5 17L			

LOCATION	ORDER	NOTES
16	42 20L	
	00 1F	
17	L5 30L	
	40 ( )F	by 13, 25
18	F5 1F	
	40 1F	
19	L0 4F	
	32 26L	
20	41 F	
	41 ( )F	by 16, 23 Generate unit matrix
		from 24
21	F5 F	
	40 F	
22	L0 4F	
	32 24L	
23	F5 20L	
	42 20L	
24	22 20L	Generate unit matrix
	L5 17L	from 22
25	F4 4F	
	42 17L	
26	22 15L	
	L5 4F	from 19
27	40 13F	
	24 999F	
28	00 F	10×2^{-39}
	00 10F	
29	00 F	first storage location Constants
	00 170F	
30	80 F	-1
	00 F	
	24 10N	Enter parameters and matrix

	00 20K		

Eigenvalue Routine as used for Code 117, modified.

	00 152K		

Square Root - Code R1

	00 161K		
0	00 F		
	00 S3		
1	80 F		Save parameters
	00 S4		
2	00 F		
	00 S7		
	26 21N		
	00 10K		
0	L5 161F		
	40 3F		Plant print parameter
1	26 999F		
	00 F		
	26 10N		
	00 110K		

Single Column Print - Code P6

	00 10K		
0	41 F		
	50 F		
1	L5 (170)F	from 6, by 4	
	40 (170)F	by 4	
2	F5 F		
	40 F		
3	K4 F		Store Eigenvalues consecutively
	00 20F		
4	F4 1L		
	40 1L		

LOCATION	ORDER	NOTES
5	L5 F	
	LO 162F	
6	36 1L	
	41 F	
7	L7 (170)F	by 10, from 13
	50 7L	
8	26 152F	to sq. rt.
	40 (80)F	by 11
9	19 18F	
	L4 7L	Take square root of eigenvalues
10	46 7L	
	F5 8L	
11	42 8L	
	F5 F	
12	40 F	
	LO 162F	Take square root of eigenvalues
13	36 7L	
	L5 163F	
14	42 16L	
	92 171F	
15	41 4F	
	41 5F	from 27
16	50 (80)F	from 21, by 26
	79 ( )F	by 14, 19, 24
17	22 17L	
	50 17L	
18	26 110F	to S. C. P.
	L5 16L	
19	L4 162F	Punch factor loadings
	42 16L	
		("N" punched after last loading in each factor)
20	F5 5F	
	40 5F	

LOCATION	ORDER	NOTES	
21	LO 162F		
	36 16L		
22	92 770F		
	92 139F		
23	F5 4F		
	40 4F		
24	L4 163F		
	42 16L		
25	19 18F		Punch factor loadings
	L4 16L		("N" punched after last loading in each factor)
26	46 16L		
	L5 4F		
27	LO 162F		
	32 15L		
28	92 171		Punch spaces
	92 171F		
29	41 5F		
	L5 (170)F	by 32, from 34	
30	22 30L		
	50 30L		
31	26 110F	to S. C. P.	
	F5 29L		
32	42 29L		
	F5 5F		Punch eigenvalues
33	40 5F		
	LO 162F		
34	32 29L		
	OF F		End
	26 10N		Enter output code