

UNIVERSITY OF ILLINOIS
DIGITAL COMPUTER
STATISTICAL LIBRARY

KSL 5.55 - 325

TITLE: Triangular matrix to square (or rectangular) SADOI Only
TYPE: Entire program
SYMBOLS: d: decimal places per number on data tape

n: order of matrix
X: number of selected rows (or columns)
 s_i : selected row or column numbers

RESTRICTIONS: $0 \leq d \leq 8$; $1 \leq n \leq 111$; $0 \leq X$; $1 \leq s_i \leq n$

DURATION: A. Square matrix
 $n^2(.020 d + .037)$ seconds

B. Rectangular matrix
 $n^2(.0025 d + .0035) + nX(.0167 d + .0332)$ seconds

DESCRIPTION: Symmetric matrices often are punched in triangular form.
For example, the order of output for K17 may be punched
as follows:

$r_{11} r_{21} r_{22} r_{31} r_{32} r_{33} \dots r_{n1} r_{n2} \dots r_{nn}$

For some subsequent computer operation, however, a square matrix may be required. The purpose of this routine is merely to read a symmetric matrix in triangular form and to punch out the complete square matrix with N terminating symbols at the end of each row (or column) and a J at the end of the matrix.

An alternate use of this routine is to punch out only selected rows (or columns) of the full square matrix)

METHOD OF USE:

	<u>STOPS</u>
1. Master tape KSL 5.55	34 09N
2. Parameter tape	24 09N
3. Data tape	24 09N

At stop 24 09N a new problem can be begun by raising the black switch to read a new parameter tape.

PARAMETER TAPE:

A. Square matrix

Punch three unsigned integers separated by fifth-hole characters in the following order:

d space n space 0 space

B. Rectangular matrix (selected rows)

Punch unsigned integers separated by fifth-hole characters as follows:

d space n space X space s_1 space s_2 space ... s_x space

The parameter X is interpreted by the machine to be the number of selected rows. When $X = 0$, of course no rows are selected; a square matrix is punched. Otherwise, when $X > 0$, then X additional integers are read into the machine. These are the selected row numbers. Since the row numbers may be punched in any order, it is possible to rearrange the rows of a symmetric matrix in any order whatsoever.

The computer will detect three parameter tape errors:

1. If $d > 8$, the computer will print "D GREATER THAN 8" and stop on FF 123.
2. If any $s_i = 0$, the computer will print "ROW NUMBER = 0" and stop on FF 123.
3. If any $s_i > n$, the computer will print "ROW NUMBER GREATER THAN ORDER" and stop on FF 123.

By moving the white switch up and down at stop FF 123, a corrected parameter tape may be read and the problem continued.

DATA TAPE:

The data tape consists of the $n(n + 1)/2$ number of a symmetric matrix punched in the following order:

r_{11} r_{21} r_{22} ... r_{n1} r_{n2} ... r_{nn}

Each number is punched as a sign followed by d digits.

(See Note 2)

NOTE 1: A stop on FF 000 indicates a sum check failure in reading the master tape. Try rereading the master tape.

NOTE 2: This routine does not check for signs. Instead the numbers are read with the order, $81 \ 4(d \neq 1)$. Thus, the routine will work equally well for unsigned numbers provided the parameter d is reduced by one. For example, to read a triangular matrix consisting of single unsigned digits, set $d = 0$.

DATE	June 13, 1961
PROGRAMMED BY	<i>KW Dickman</i>
APPROVED BY	<i>KW Dickman</i>

LOCATION			ORDER	NOTES	PAGE 1	KSL 5.55.
Abs.	Rel.	Sym.				
			003K			
3		(0)	00F 00F			
		(01)	01F 00F			
		(1)	00F 001F			
		(9)	00F 009F			
		(10)	00F 0010F			
		(40)	00F 0040F			
		(65)	00F 0065F	Teletype character per line		
		(67)	00F 0067F			
		(+)	00F 00F			
		(-)	00F 00F			
		(I)	00F 00F	row		
		(J)	00F 00F	Column		
		(S)	00500F 00500F	Store selected s_i		
		(A)	00625F 00625F	addresses of vector		
		(V)	00750F 00750F	store vector		
		(C)	00875F 00875F	store diagonals		
		(D1)	8511F 002495F	drum order: 8511F 002560F	- 65	
		(D2)	8510F 112367F	drum order: 8511F 002560F	-4289	
		(P)	80F 00F	No. elements per line		
		(L)	00F 00F			
		(N-1)	00F 00F			
		(D)	00F 00F	parameters { (D): decimal places (N): order of matrix (X): directive		
		(N)	00F 00F			
		(X)	00F 00F			
			00K(2.1)			
27			K5F 4228L	Subroutine to remove a row from the		
			L5(A) 4211L	drum, given i at (I)		
			4221L L5(V)			
			4224L 41(I)	from 5(1.7); 1(1.8)		
			50(0) L5(J)			
			006F 40(+)			
			L5(I) L0(J)			
			40(-) 3217L			
			L5(J) L0(67)			

LOCATION			ORDER	NOTES	PAGE 2	KSL 5.55
Abs.	Rel.	Sym.				
36			3215L L5(+)			
			L4(D1) L4(J)			
			L4(I) 40F			
			F511L 4211L			
			F5(I) 42(I)			
			L0(N) 3221L			
			266L L5(+)			
			001F L4(D2)			
			2210L L1(-)			
			3630L L5(I)			
			006F 40(+)			
	20		L5(I) 228L			
	21		00F L5F			
			4023L 3232L			
	23		00F 00F			
	24		3224L 40F			
			F524L 4224L			
			F521L 4221L			
			L029L 3221L			
			001F 22F			
	29		80F L5F	by 10(1.2)		
			L5(C) L4(J)			
			4232L 41F			
			2211L L5F			
			2224L 00F			
			00K(2.2)			
61			K5F 4210L	Subroutine to print vector		
			L5(V) 422L	from 6(1.7); 2(1.8)		
			41(L) L5F			
			82F F52L	by 6(2.2)		
			422L L011L			
			369L F5(L)			
			42(L) L0(P)			
			322L 92131F			
			92519F 262L			

LOCATION			ORDER	NOTES	PAGE 3	KSL 5.55
Abs.	Rel.	Sym.				
			92770F 92135F			
			92519F 22F	by 14(1.2)		
			41(L) 15F			
			00K(2.3)			
73			425L 914F	Subroutine to read parameters		
			362L 22L	from 1(1.1); 1(1.2); 3(1.3); 1(1.5)		
			50F 74(10)			
			S5F 40F			
			914F 362L			
			L5F 22F			
			00K(2.4)			
79			K5F 4226L	Subroutine to read triangular matrix		
			L5(V) 424L	and store on drum		
			L4(1) 4217L	from 1(1.6)		
			41(J) 81F			
			00F 40F	by 5(1.2)		
			F54L 424L	by 8(1.2)		
			F5(J) 42(J)			
			L027L 323L			
			L5F 40F	by 8(1.2); 15(1.2)		
			F58L 428L			
			F527L 4227L			
			F528L 4228L			
			F5(I) 42(I)			
			L0(67) 3629L			
			50(I) 006F			
			L5(D1) -4F			
			L4(I) L4(01)			
			4018L L5F			
			00F 00F			
			F518L 4018L			
	20		F517L 4217L			
			L028L 3217L			
			L5(I) L0(N-1)			
			3224L 261L			
	24		00F 81F	by 5(1.2)		

LOCATION			ORDER	NOTES	PAGE 4	KSL 5.55
Abs.	Rel.	Sym.				
104	25		00F 40F	by 9(1.2); 16(1.2)		
			001F 22F			
	27		80F 002F	by 11(1.2)		
	28		N018L L5F	by 12(1.2); 17(1.2)		
			50(I) 007F			
			L5(D2) 2215L			
			00K(ER)			
110			4210L 92135F	from 1(ER1); 1(ER2); 1(ER3)		
			92259F 922F			
			92387F 92258F			
			92387F 92643F	Print: PARAMETER ERROR:		
			92194F 92322F			
			92194F 92258F			
			92961F 92194F			
			92262F 92578F			
			92258F 92707F			
			92835F 92965F			
			92259F 22F			
			00K(RN)			
121			425L 92258F	from 2(ER2); 2(ER3)		
			92578F 92130F			
			92961F 92770F			
			92450F 92643F	Print: ROW NUMBER		
			92195F 92194F			
			92258F 22F			
			00K(GR)			
127			426L 92579F	from 3(ER1); 4(ER3)		
			92258F 92194F			
			92387F 92322F	Print: GREATER THAN		
			92194F 92258F			
			92961F 92322F			
			92771F 92387F			
			92770F 22F			

LOCATION			ORDER	NOTES	PAGE 5	KSL 5.55
Abs.	Rel.	Sym.				
134			00K(ER1) 9259F F5L 26(ER) 9267F 92961F F52L 26(GR) 92961F 92707F 92514F 92135F FF291F 26(1.1) 00F	from 2(1.1); $d > 8$ Error stop: FF123		
141			00K(ER2) 9259F F5L 26(ER) F51L 26(RN) 92707F 92961F 92579F 92961F 922F 265(ER1) 00F	from 4(1.4); $s_i = 0$		
147			00K(ER3) 9259F F5L 26(ER) F51L 26(RN) 92961F 001F F53L 26(GR) 92961F 92578F 92258F 9267F 92194F 92258F 92707F 265(ER1) 00F	from 5(1.4); $s_i > n$		
156			00K(1.1) 41F F5L 26(2.3) 40(D) L0(9) 36(ER1) 41F 42(P) F5(D) 401F L5(65) 402F L52F L01F 368L 26(1.2)	Begin: read d		

LOCATION			ORDER	NOTES	PAGE 6	KSL 5.55
Abs.	Rel.	Sym.				
164			402F F5(P) 42(P) 266L 00K(1.2)	Tally elements per line at (P)		
166			41F F5L 26(2.3) 40(N) L0(1) 40(N-1) 50(0) F5(D) 002F 402F 423(2.4) 4224(2.4) 0020F 463(2.2) L5(40) L02F 0020F 464(2.4) 4625(2.4) L5(A) L4(N) 4229(2.1) F5(1) 4227(2.4) L5(V) 4228(2.4) 468(2.4) L4(N) 4211(2.2) L5(C) 428(2.4) L4(N-1) 4225(2.4) F528(2.4) 4228(2.4) 26(1.5)	read n		
184			00K(1.3) L5(S) 423L L4(X) 427L 41F F52L 26(2.3) 40F F53L 423L L07L 362L 26(1.4) 00F K6(2.3) 40F	from 2(1.5) read s_i		
192			00K(1.4) L5(S) 422L 423L L4(X) 429L L5F	test all s_i for size		

LOCATION			ORDER	NOTES	PAGE 7	KSL 5.55
Abs.	Rel.	Sym.				
195			LO(1) 40F 365L 26(ER2) LO(N) 36(ER3) F53L 423L 422L L09L 322L 263(1.5) 70(1) 40F 00K(1.5)			
202			41F F5L 26(2.3) 40(X) LO(1) 36(1.3) 41(I) 24(1.6) 00K(1.6)	from 17(1.2) read X Stop: 240NF		
206			41(I) 50L 26(2.4) 9259F 9259F 92135F 92707F 26(1.7) 00K(1.7)	Read triangular matrix		
210			L3(X) 36(1.8) L5(S) 423L L4(X) 429L 50(O) L5F 40(J) 504L 26(2.1) 505L 26(2.2) F53L 423L L09L 323L 265(1.8) J0(O) L5F 00K(1.8)	Test X \neq 0		
220			41(J) 50L 26(2.1) 501L 26(2.2) F5(J) 42(J) LO(N) 365L 22L	Punch selected rows Punch complete matrix		

LOCATION			ORDER	NOTES	PAGE 8	KSL 5.55
Abs.	Rel.	Sym.				
225			92834F 92555F 92135F 24(1.1)	Final stop: 2409N		
227			00K L3F 34(1.1) FFF 26(1.1) -90059F F21758F 26L 261N	Sum check		