

UNIVERSITY OF ILLINOIS
DIGITAL COMPUTER LABORATORY
STATISTICAL LIBRARY

KSL 5.60 - 301

TITLE: Matrix Normalization
TYPE: Entire program
ACCURACY: 6 decimal places
CAPACITY: $1 \leq j \leq 701$ and i is not limited when normalizing by rows.
 $1 \leq j \leq 351$ and $i(j + 1) \leq 10,240$ when normalizing by columns. Here i is the number of rows and j is the number of columns of the matrix.

DURATION: $.022ij(d + 1)$ seconds. Add 20 seconds for read-in of the master tape.

DESCRIPTION: This routine will normalize a matrix by rows or by columns. That is, it will convert each row or column of the matrix into a unit vector. The elements of the normalized matrix will be printed by rows, up to 12 decimal places as designated by the user.

METHOD OF USE:

	<u>STOPS</u>	<u>PROCEDURE</u>
1. Master tape	34016	Bl. sw.
2. Parameter tape	2001K	Bl. sw.
3. Data tape	0F000	Described below

To begin a new problem at stop 0F, move the white switch up and down. The computer will stop on 24016. Raise the black switch to read a new parameter tape; move white switch up and down to retain old parameters.

PREPARATION OF PARAMETER TAPE:

The parameter tape consists of one signed integer terminated by an N or J. The signed integer is the number of decimal places in the output. When the parameter tape is terminated by an N the normalization will be done by rows. When terminated by a J the normalization will be done by columns.

PREPARATION OF DATA TAPES:

The elements of the matrix are punched by rows as signed fractions, with an N after each row and a J after the final N. If, instead of an N, an F or L is punched at the end of a row, the computer will stop. By raising the black switch, reading of the matrix is resumed.

ERROR STOPS:

The number of elements per row must be equal for each row of the matrix. Otherwise the computer will stop. This condition is indicated by an FFO01 stop while normalizing by columns, and by an FFO02 stop while normalizing by rows. Moving the white switch up and down at these points will allow a new matrix to be read in. During the read-in of the master tape, if an FFO03 should occur, do a clear start and input master tape again.

DATE	<u>May 27, 1960</u>
PROGRAMMED BY	<u>Frank Shimamoto</u>
APPROVED BY	<u><i>[Signature]</i></u>

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LOCATION			ORDER	NOTES	PAGE 1	KSL 5.60
Abs.	Rel.	Sym.				
			00 3K			
3			00F 00322F	Location of A vector.		
4			00F 00673F	Location of sum boxes.		
			00 10K			
10		(A1)	L4S4 40S4	Constants		
		(A2)	50S3 75S3			
		(N)	40S3 L521(N12)			
		(D1)	J0S3 501(WR)			
		(D2)	26(Y5) 002560F			
		(D3)	50S3 501(RD)			
		(0)	00F 00F			
		(1)	00F 001F			
		(70)	00F 0070F			
		(1-1)	001F 001F			
		(+1)	00F 0099999999999999J			
		(-1)	80F 00F			
			00K			
22	0	(P)	524F 50L	Read parameters		
	1		26(N12) 407F			
	2		L54F 0020F			
	3		463(PR) 419F			
	4		204L 509F			
	5		F54F 007F			
	6		404F L5(70)	Calculate number of elts/line		
	7		664F S5F			
	8		1032F 429F			
	9		50S3 509L	Read first row of matrix		
	10		26(N12) 406F			
	11		L521(N12) L0(N)	Initialize addresses in drum transfer		
	12		463(WR) 463(RD)	routines		
	13		1020F 403F			
	14		L5(1) 405F			
	15		L37F 36(ROWS)			

LOCATION			ORDER	NOTES	PAGE 2	KSL 5.60
Abs.	Rel.	Sym.				
38	0	(COL)	00K			
	1		L5(D1) 401(WR)			
	2		L5(D2) 402(WR)			
	3		L5(A1) 423L			
	4		41F 41F			
	5		F5F 40F			
	6		L03F 327L			
	7		F53L 423L			
	8		223L 507L			
	9		26(S) L5(A2)	Scale elts. of one row		
	10		4011L L5(A1)			
	11		4012L 41F			
	12		50F 75F	Square one element		
	13		L4F 40F			
	14		F5F 40F			
	15		L03F 3218L			
	16		L511L L4(1-1)			
	17		4011L L512L			
	18		L4(1-1) 4012L			
	19		2611L 5018L			
	20		26(WR) 2620L	Transfer one row of matrix to drum		
	21		50S3 5020L	Read in one row of matrix		
	22		26(N12) 406F			
	23		L36F 3224L			
	24		L4(1) 3231L			
	25		2024L L52(WR)			
	26		F43F 402(WR)			
	27		F55F 405F			
	28		L521(N12) L0(N)	TEST: Are number of elts/row equal?		
	29		1020F L03F			
	30		40F L3F			
	31		327L FF1F	FF001; elts. unequal; wh. sw. to read new matrix.		
	32		269(P) L5(D3)	Initialize addresses for drum transfer.		
	33		401(RD) L5(D2)			
			402(RD) L5(A1)			

LOCATION			ORDER	NOTES	PAGE 3	KSL 5.60
Abs.	Rel.	Sym.				
	34		4235L 4237L			
	35		41F L5F			
	36		50F 5036L	Enter square root subroutine		
	37		26(R1) 40F			
	38		F54F 404F			
	39		L03F 3642L			
	40		F535L 4235L			
	41		4237L 2635L			
	42		416F L13F			
	43		404F 408F			
	44		L5(A1) 4249L			
	45		4251L L5(A2)			
	46		4248L 4250L			
	47		4252L 5047L	Transfer row from drum to WM		
	48		26(RD) L7F			
	49		2249L L0F			
	50		3669L L5F			
	51		50(0) 66F			
	52		S5F 40F			
	53		F54F 404F			
	54		3258L F548L			
	55		4248L 4250L			
	56		4252L F549L			
	57		4249L 4251L			
	58		2248L F56F			
	59		406F 5059L	Print a row of normalized matrix		
	60		26(PR) L56F			
	61		L05F 3665L			
	62		92131F 92515F	Line feed and carriage return		
	63		L52(RD) F43F			
	64		402(RD) 2242L			
	65		92834F 92147F	Print J; 5 line feeds and carriage returns		
	66		92515F OFF	Delay; 0: end of program. Wh.sw. to stop 24016		
	67		24(P) 269(P)	tl.sw. to read new parameters or wh.sw. to retain		

LOCATION			ORDER	NOTES	PAGE 4	KSL 5.60
Abs.	Rel.	Sym.				
	68		L5(+1) 2252L	old parameters.		
	69		L548L 4270L			
	70		2270L L5F			
	71		3668L L5(-1)			
	72		2252L 50F			
			00K			
111	0	(ROWS)	50F 50L	Scale one row of matrix		
	1		26(S) L13F			
	2		401F 404F			
	3		408F 411023F			
	4		L5(A2) 405L			
	5		50F 75F	Square one element		
	6		L41023F 401023F			
	7		F51F 401F			
	8		3210L L55L			
	9		L4(1-1) 405L			
	10		265L 41F			
	11		L51023F 5011L	Enter square root subroutine		
	12		26(R1) 401023F			
	13		L5(A2) 4615L			
	14		4617L 4218L			
	15		L7F L01023F			
	16		3637L 50(0)			
	17		L5F 661023F			
	18		S5F 40F			
	19		F54F 404F			
	20		3225L L515L			
	21		L4(1-1) 4615L			
	22		4617L F518L			
	23		4218L 2615L			
	24		L5(+1) 2218L			
	25		50F 5025L	Print a row of normalized matrix		
	26		26(PR) 2627L			

LOCATION			ORDER	NOTES
Abs.	Rel.	Sym.		
	27		50S3 5027L	Read in one row of matrix
	28		26(N12) 406F	
	29		L36F 3231L	
	30		L4(1) 3665(COL)	
	31		2031L 92131F	Line feed and carriage return
	32		92515F L521(N12)	Delay
	33		L0(N) 1020F	
	34		L03F 40F	
	35		L3F 32L	TEST: Are number of elts/row equal?
	36		FF2F 269(P)	FF002; elts. unequal; wh.sw. to read new matrix
	37		L515L 4638L	
	38		L5F 3624L	
	39		L5(-1) 2218L	
			00K	
151	0	(S)	K5F 428L	Scaling routine
	1		L13F 404F	
	2		L5(A2) 423L	
	3		424L L5F	
	4		105F 40F	
	5		F54F 404F	
	6		328L F53L	
	7		423L 424L	
	8		223L 22F	
			00K	
160	0	(PR)	K5F 4211L	Print routine
	1		L5(A2) 422L	
	2		414F L5F	
	3		50F 503L	
	4		26(P16) F58F	
	5		408F 3611L	
	6		F52L 422L	
	7		F54F 404F	
	8		L09F 329L	

LOCATION			ORDER	NOTES	PAGE 6	KSL 5.60
Abs.	Rel.	Sym.				
	9		222L 92131F			
	10		92515F 262L			
	11		92770F 22F	Print N		
			00K			
172	0	(WR)	K5F 423L	Write one row on drum		
	1		JOS3 501L			
	2		26(Y5) 00F			
	3		00F 22F			
			00K			
176	0	(RD)	K5F 423L	Read one row from drum		
	1		50S3 501L			
	2		26(Y5) 00F			
	3		00F 22F			
180	0		00K(Y5)	Drum transfer routine(Y5)		
215			00K(N12)	Input routine(N12)		
254			00K(R1)	Square root routine(R1)		
263			00K(P16)	Print routine(P16)		
			00K			
319	0		L3F 34(P)			
	1		FF3F 26(P)	FF003: Read failure on master tape		
	2		N51027F 09428F			
			26L 261N			