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KSL 2.50 - 248

TITLE: Fisher's Z Transformation: $Z=\frac{1}{2}\ln(1+r)/(1-r)$ (SADOI Only)

TYPE: Entire Program

CAPACITY: No restrictions

DURATION: About 400 ms for each three-place number to about 430 ms for each twelve-place number

ORDER OF TAPES: 1. Master tape: stops on 24006
2. Data tape: with black switch at obey, data tape will stop at 24006 when an "N" is read; with black switch at disable, data tape will stop at OF when a "J" is read.
3. Additional data tapes may be read by raising the white switch.

DATA TAPE: The data tape consists of a set of signed fractions scaled by 10^{-1} and terminated by an N or an NJ. There must be at least one N at the end of the tape. If there are several N's separating groups, then it is desirable to punch a final J character so the problem may be run on stop disable. The typical data tape is the output of K-8, K-9, or any other correlation routine (either a triangular or square matrix) terminated by an N or NJ.

PURPOSE: The sampling distribution of the correlation coefficient, r, depends upon the size of the population value, r', which usually is unknown, and also it depends upon the sample size, N. Fisher's Z,

$$Z = \tanh^{-1} r = \frac{1}{2}\ln (1 + r)/(1 - r)$$

is so nearly normal for any value of r that it may be treated as such for all practical purposes.
The standard error of Z may be estimated by the formula,

$$S_z = \frac{1}{\sqrt{N - 3}}$$

The chief uses of Z are to be found in problems of averaging coefficients of correlation and in testing the significance of differences between r's.

SUM CHECK: The program tape is sum-checked during input. A failure to input the program correctly will result in an FF stop from location 1L5.

For reference see: R.A. Fisher, Statistical Methods for Research Workers, 10th Edition, Oliver and Boyd, Edinburgh, 1948.

NOTE: The value of Z can range from positive to negative infinity. A test is made in the routine such that whenever the absolute value of r attains or exceeds $.999999 \times 10^{-1}$, then a dash is punched on the tape, and the routine goes on to the next r value.

DATE December 8, 1958
SUBMITTED BY Fern W. Dickman
APPROVED BY J. N. Snyder

lgr

LOCATION			ORDER	NOTES PAGE 1
Abs.	Rel.	Sym.		
			J	
			FISHER'S TRANSFORMATION	Title
			$Z = \frac{1}{2}$ LN (1+R)/(1-R)	
			R Z	
			006K	Main routine
6	0		L5(-) 0020F	
	1		463L 50F	Set store address
	2		L5(E1) 40(E)	
	3		50F 503L	
	4		26(N12) 40F	Read in data; stop on N or store at 1023
	5		L3F 326L	Test for final J
	6		2213L L521(N12)	
	7		L0(13) 1020F	
	8		40(E) L0(-)	Set final store address at (E)
	9		40F L3F	
	10		3211L 5010L	
	11		26(Z) 92131F	
	12		92770F 92131F	
	13		24L 92131F	24006: stop at N
	14		92834F 92135F	
	15		0FF 26L	0F: stop at final J; white switch for new problem
			00K	
22		(-)	00F 00210F	Initial store of r's
23		(E)	00F 00F	Final store of r
24		(E1)	00F 001023F	
25		(C)	00F 00F	Tally counter
26		(R)	00F 00F	Temporary storage for r
27		(LN)	00F 00F	Temporary storage for ln (1-r) x 2^{-5}
28		(T)	401023F L521(N12)	Test constant for (N12)
29		(1)	00F 001000 0000 0000J	10^{-1}
30		(2)	00F 000999 9990 0000J	Largest r that will be transformed

LOCATION Abs.	Rel.	Sym.	ORDER	NOTES PAGE 2
31		(10)	00F 00F	Temporary Storage
32		(11)	00F 00F	Temporary Storage
33		(12)	00F 00F	Temporary Storage
34		(13)	40F L521(N12)	Test constant
35		(14)	**26(N)** 00F	Transfer order for (N12)
			00K	
36	0	(Z)	K5F 4221L	Subroutine to calculate and print Z's
	1		L5(-) 423L	
	2		L5(E) 4222L	Set initial address for r
	3		41(C) L5F	Set final test constant
	4		40(R) 50F	
	5		54103F 505L	
	6		26(P16) 92961F	Print r
	7		L5(2) L2(R)	Test r for maximum size
	8		329L 92714F	If too large, print a dash
	9		2218L L5(1)	
	10		L0(R) 5010L	
	11		26(S5) 40(LN)	$\ln (1-r) \times 2^{-5}$ at (LN)
	12		L5(1) L4(R)	
	13		50F 5013L	
	14		26(S5) L0(LN)	$\ln (1+r)/(1-r) \times 2^{-5}$ at N(0)
	15		40F 50(1)	
	16		75F 004F	$\frac{1}{2} \ln (1+r)/(1-r) \times 10^{-1}$
	17		54105F 5017L	
	18		26(P16) 92131F	Print Z
	19		92515F F53L	
	20		423L L022L	
	21		323L 22F	
	22		N1(C) L5F	
59		(S5)	00K	Natural logarithm
95		(P16)	00K	Infraprint
151		(N12)	00K	

LOCATION			ORDER	NOTES PAGE 3
Abs.	Rel.	Sym.		
			00K	Appendage for (N12)
190	0	(N)	L4(N12) 4621(N12) from (N12)	
	1		L1(T) L421(N12)	Test for store order in (N12) greater
	2		363L 2623(N12)	than 1023
	3		L5F 40(10)	
	4		L51F 40(11)	
	5		L52F 40(12)	
	6		50F 506L	
	7		26(Z) L5(-)	Transfer to subroutine to calculate Z's
	8		0020F 4621(N12)	
	9		L5(10) 40F	
	10		L5(11) 401F	
	11		L5(12) 402F	
	12		264(N12) 00F	Return to (N12) to continue inputting r's
			00500K	Interlude to set transfer in (N12)
	0		L5(14) 4022(N12)	
	1		26999F 00F	
			00500K	Sum check
	0		L3F 346F	
	1		FFF 266F	
	2		KL3579F 282430F	
			26L 261N	