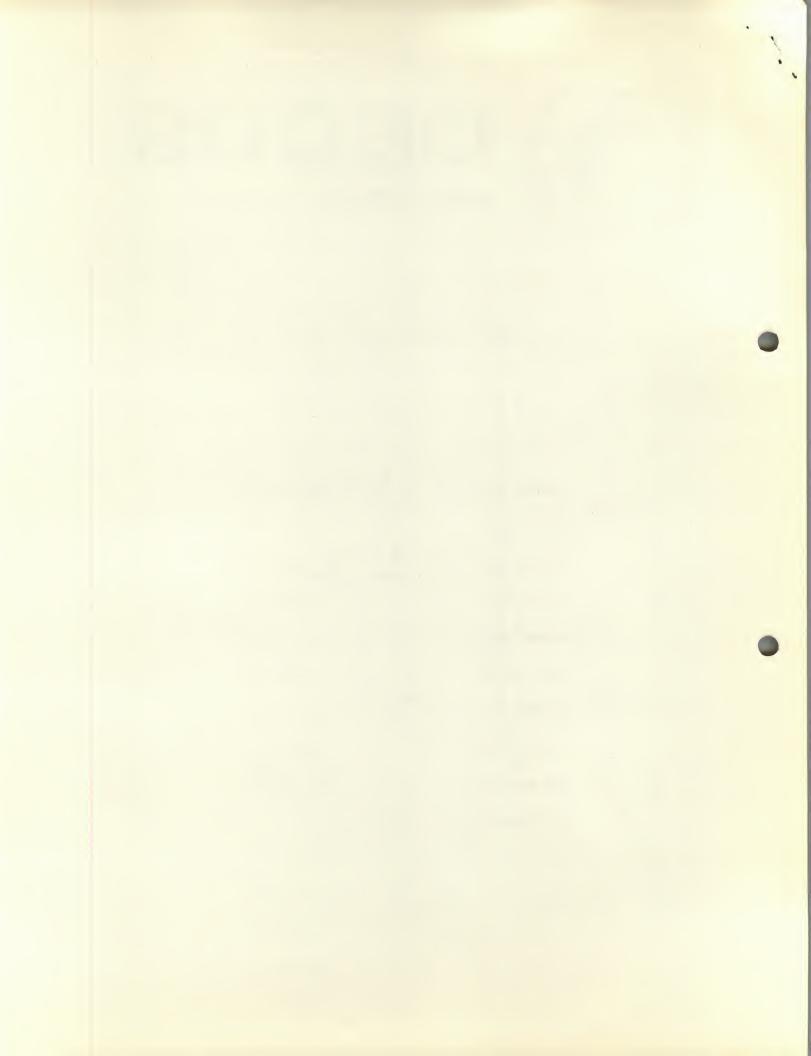


DECUS NO.	8-350
TITLE	WILCOXON-WHITE TWO SAMPLE RANK TEST
AUTHOR	Jens G. Rosenkrantz, M. D.
COMPANY	Childrens Hospital of Los Angeles Los Angeles, California
DATE	July 20, 1970
SOURCE LANGUAGE	8K FORTRAN

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DECUS Program Library Write-up

DECUS NO. 8-350

In the statistical analysis of two sets of data to discover differences, the 1,2,3Wilcoxon-White two sample rank test is quite useful, particularly when there is considerable variation in the measurements. This nonparametric statistical test may be used in comparing unpaired samples and assigns ranks to the pooled measurements, comparing the ranks as ordinal numbers in the two groups. The null hypothesis is that the ranks are randomly distributed between each of the two sets. The smaller of the ranks, T, is calculated and referred to a table for testing of the null hypothesis. Tables are available for unequal group sizes, as well as equal sizes. For values of group size, n_1 , and n_2 , which lie outside the limits of available tables, the approximate normal deviate, Z is calculated according to the formula:

Z = (Im - TI - 1/2)/s

where $m = n_1 (n_1 + n_2 + 1)/2$; $s = \sqrt{n_2 m/6}$

 $n_i = number of observations in smaller group$

 n_2 = number of observations in larger group

T = smaller sum of ranks (not necessarily corresponding to n_l).

The calculated value of Z can be referred to tables of normal distribution for the significance probability, P.

From the Department of Surgery, Childrens Hospital of Los Angeles, 4650 Sunset Boulevard, Los Angeles, California 90027. Supported in part by USPHS Grant #HE 12973

DESCRIPTION OF PROGRAM

The program accepts data from each of two groups on the high speed reader. Up to 50 data points may be used for each group. Data acceptable range from -999.999 to 9999.999. Input format is as follows: Number of observations in first group (in I format) CRLF * Ist datum (in F format) CRLF*, and so forth for the first group, then repeat for the second group. To input subsequent pairs of groups, repeat the format above. When finished with the data tape, let number of observations of first group = 100 (or any number above 50). The program runs more quickly if the first group presented is the smaller one.

The program reads the data for the first group, and types back the data on the teletype. It calculates the mean and variance for the first group and then prints them. The data in the second group are then read, analyzed and reported similarly.

The program then ranks the numbers and prints the sum of the ranks of the first group. It considers ties and ranks negative numbers below positive ones. From this, the program calculates the T value by the Wilcoxon-White test and prints this, along with the numbers in the two groups. The program also calculates and prints the corresponding Z value in case the numbers exceed available tables.

In the "If" statements before line 68 and below line 70, there is a statement transferring control to line: 80 B = B+C, prior to assignment of a value to C. Note however that the conditions leading to this transfer cannot occur, since the data have already been arranged in ascending order by the subroutine, Ranks.

* Carriage - Return - Line - Feed

page 2

LOADING AND RUNNING THE PROGRAM

- There are two relocatable binary tapes, the main program and a subroutine, ranks. These are loaded with Linking Loader (DEC # 08-A2 B3), the main program into Field O and the subroutine into Field 1.
- The program also requires Tape 1 and sections 1-3 of Tape 2 of the Fortran 8K Library.

Sections 1-2 of Tape 1 is loaded into Field \emptyset and the remainder of Tape 1 and sections 1-3 of Tape 2 into Field 1.

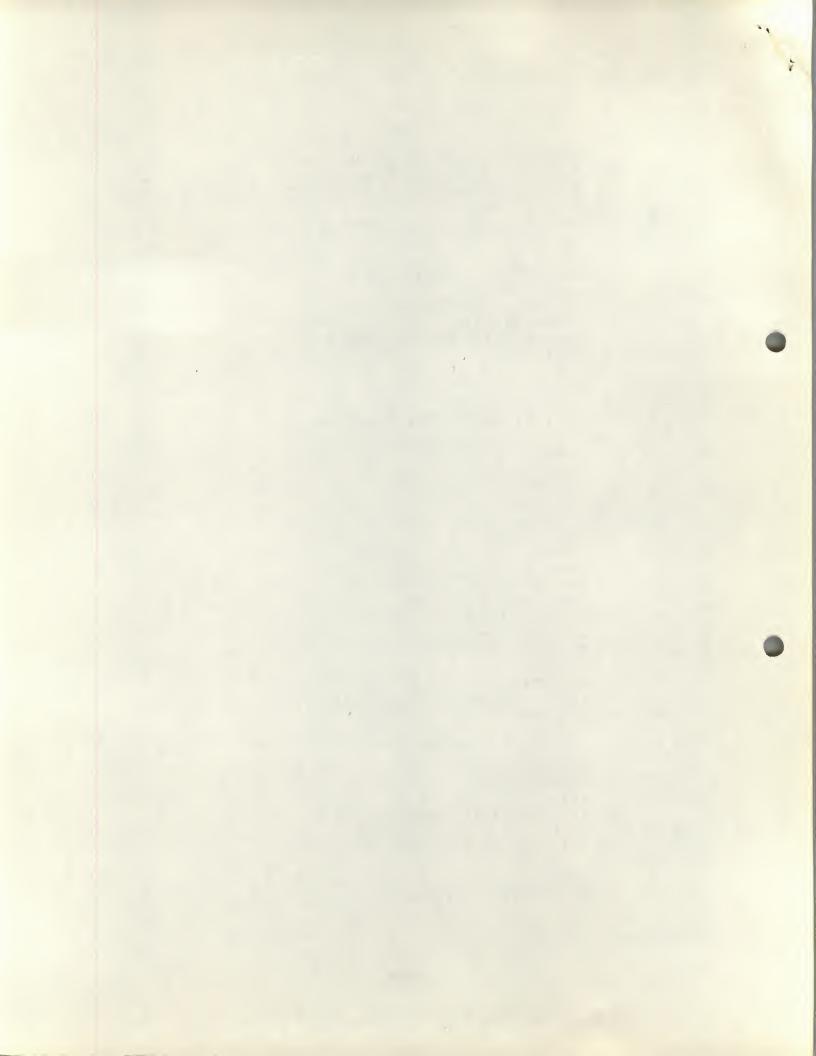
With this loading scheme the rank analysis program begins at starting address
1102 in Field O.

SUMMARY

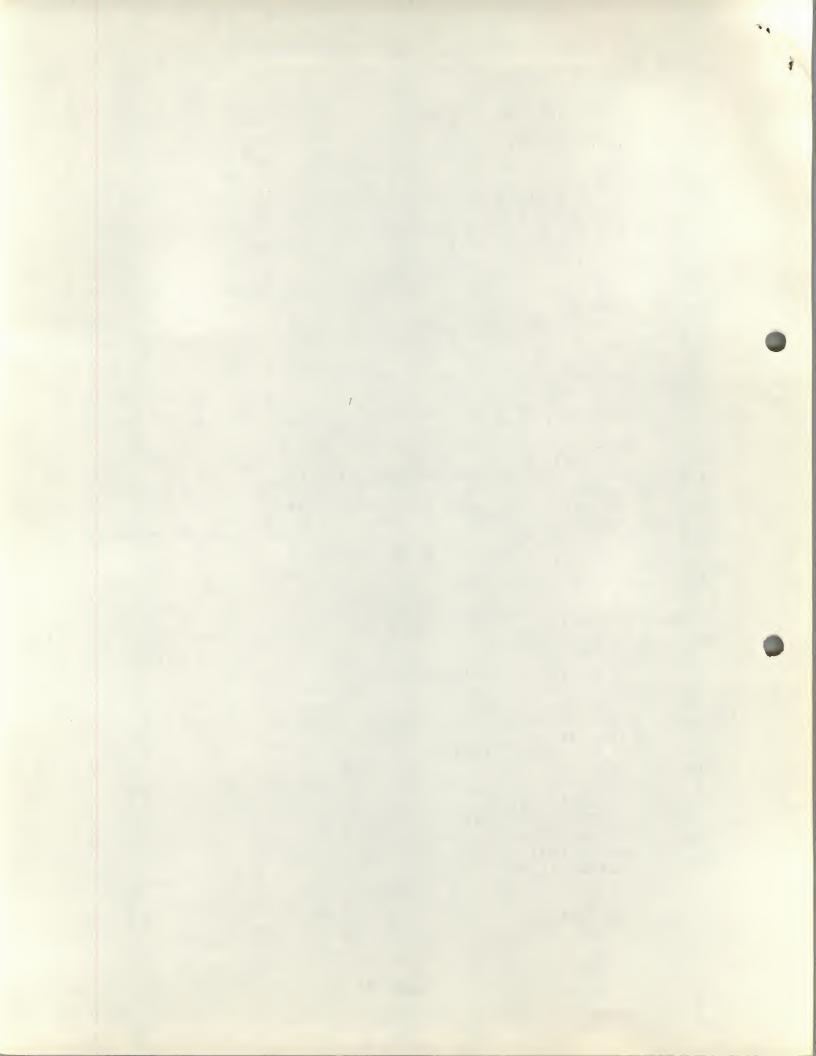
The program performs the Wilcoxon-White two sample rank test on unpaired observations from two groups, which need not be of equal size. Ties are considered in assignment of ranks. Input is from the DEC high-speed reader; output on the teletype. The program calculates mean and standard deviation for each group, the sum of ranks for the first group, the smaller sum of ranks and the approximate normal deviate. It is written in Fortran 8K.

- I. Wilcoxon, F.: Biometrics Bul. 1: 80, 1945.
- 2. White, C.: Biometrics 8:33, 1952.
- 3. Mann, H.B. and Whitney, D.R.: Ann. Math. Statistics 18: 50, 1947.

C	MILCONON-MHITE THO SAMPLE RANK TEST.
	ACCEPTS UP TO SU ENTRIES IN EACH OF 2 GROUPS.
С	FROM -999 TO +9999 WITH 3 DECIMEL PLACES.
С С С С	HIGH SPEED READER.
C	
C	USES FLOAT, ABS AND SORT LIBRARY SUBROUTIMES AND
U	1 SUDPROGRAM, RANKS.
	CONTION A.N
	DIMENSION A(50,2), M(2).
	WRITE (1,2)
2	FORMAT ('RANK TEST')
9	2RITE (1,10)
19	FORMAT (///5X, 'DATA ARE: ')
	CALL RAMKS
	B=9
	I=1
	M=1
52	IF (A(I,1)-A(M,2)) 67,65,54
54	IF (N-N(2)) 56,53,59
56	11=M+1
	GOTO 52
53	JD=I+M
20	GOTO A2
60	
62	JD = I + H - 1
04	C=FLOAT(JO)
	I=I+1
	GOTO 30
65	√3=N(1)-I
	N4=N(2)-11
	DO 68 K=1,N3
	IF (A(I,1)-A(I+K,1)) 70,68,80
63	CONTINUE
	K=N3+1
70	DO 74 L=1, N4
	IF (A(H,2)-A(H+L,2)) 76,74,30
74	CONTINUE
,	L = N 4 + 1
76	NU=K*(2+I+2+H+K+L-3)
	XN=FLOAT(NJ)
	C=XN/2.
	I=I+K
	IF (M+L-N(2)) 73,78,79
78	新二的+L
	GOTO SO
79	M=M+L-1
80	B=3+C
0.5	IF(I-N(1)) = 52.52.72

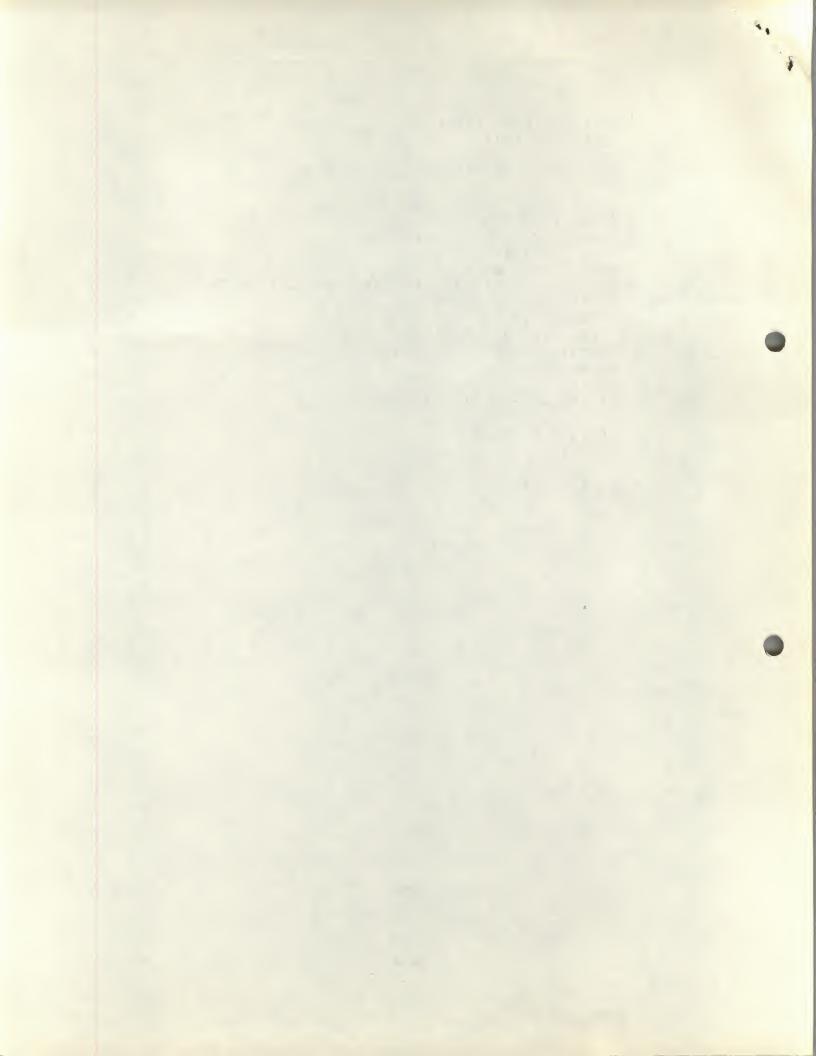


	82	IF (N(1)-N(2)) 84,84,86
	34	21=FLOAT(\(1))
	U-1	
		Z2=FLOAT(N(2))
		T1= B
		GOTO 38
	86	Z1=FLOAT(N(2))
		Z2=FLOAT()(1))
		T1=(Z1+Z2)*(Z1+Z2+1·)/2·-B
١	88	T2=Z1*(Z1+Z2+1.)-T1
		IF (T1-T2) 91,91,92
	90	T=T1 .
		GOTO 94
	92	T=T2
	9.1	XH=E1+(Z1+Z2+1·)/2·
		F=20*X176.
1.0		URITE (1,95)
	96	FORMAT (/5%, 'RESULTS ANE:')
		G=SORT(7)
		Y=T-101
		YZ=ABS(Y)
		Z=(Y25)/0
		JRITE (1,100) B
	100	FORMAT(/19H3UL RANKS GROUP #1:F6.1)
	160	
		FORMAT(/2HT=F6.1/3HU1=F4.0/3HU2=F4.0)
	102	
		WRITE (1,134) FORMAT(5K,'IF NUMBERS ABOVE EMORED TABLE, USE Z FELOM')
	104	
		URITE (1,1.3) 4
	106	FORMAT(BHZ=F1.3)
		G0T0 9
		EUD
		SUCTOUTINE ANYS
	С	NEADS IN DATA.
		CONTON A.N
		DINENSIGN ACSP,2),M(2)
		DC 49 J=1,2
		READ (2,12) N(J)
	12	FORMAT (13)
		N1=@(J)
		IF (5.3-N1) 53,13,13
	13	S=0
		SS=0
		DO 13 I=1,11
		READ (2,14) A(I,J)
	14	FO.NAT (F8.3)
		S=S+A(I,J)
	18	SS=SS+A(I,J)**2
		K=N1+1 ·
		L=N1+4
	-	DO 20 I=K,L



20	A(I,J)=111111.1111
	ZW=EFOVI(ACA))
	X=S/ZN
	S1=(SS-S**2/ZN)/(ZN-1.)
	G=SORT(S1)
	IND=1
	MRITE (1,21) J
21	FORMAT (/SNGROUP #:11)
22	DO 24 I=1,N1,5
23	FORMAT (5(2),FS.3))
24	$\exists RITE(1, C3) \land (I, J), \land (I+1, J), \land (I+2, J), \land (I+3, J), \land (I+4, J)$
	IF (IND) 49,49,26
26	IND=IND-1
	WRITE (1,28) X,G,N1
28	FORMAT(/5X, 5HNTAN=F10.3/5X, 7HST DEV=F8.3/5X, 2HN=19/)
	DO 49 I=2,11
	i = I - 1
33	IF (A(N,J)-A(M+1,J)) 42,42,47
43	TEN=A(I),J)
	(U, (1+1)J) = (U, (1+1)J)
	\wedge (1+1, J) = TE1
42	1=11-1
	IF (11) 49,49,33
49	CONTINUE
	NE TUNN
50	WRITE (1,51)
51	FORMAR ("TIMISHED")
	STOP
	THD

3



PDP-8 LINKING LOADER DEC-03-A2B3-96

HAIN	01102	4-
OPEN	13525	•
URITE	03352	
ICH	05142	
RAMKS	11053	
FLOT	97153	
STO	96444	
SUBSC		
	14200	
IFAD	57116	
CHS	07211	
FAD	96-119	
CLEAR	07227	
FLOAT	07034	
MPY	13009	
FDV	06711	
FIIP	06623	
FSB	06099	
SORT	15411	
ABS	13236	
READ	03271	
FIPCI	15076	
ISTO	07061	
CKIC	12521	
SETERR	13600	
ERROR	137 33	
TTYOUT	13427	
HSOUT	.13455	
TTYIN	13400	
HSIN	13445	
DIV	13045	
IRE!!	13216	
FIX	06510	
IFIX	06556	
IABS	13270	
IRDSH	13313	
EXIT		
CLRERR		
IIPOW	13631	
IFP04	15060	
FFPOI	15062	
EXP	15250	
ALOG	14652	
ALUG 0301	14547	
0016		

LOADING SCHEME:
MAIN PROGRAM - FIELD Ø
SUBROUTINE RANHS - FIELD 2
SECT 1-2, TAPE 2 - FIELD & LIBRARY - FIELD &
SECT 3-JT, TAPE 1)
SECT 3-5, TAPE 1 SECT 1-3, TAPE 2 - FIELD 1 LIBRANI

