UNIVERSITY OF ILLINOIS

DIGITAL COMPUTER

LIBRARY ROUTINE K 4 - 171

TITLE — Analysis and Intercorrelation of Scores Based on Paired Comparisons

TYPE — Entire Program

DURATION

Input program	21	seconds
Read data	$8N\, r[\, e(e-1)/2\,] \times 10^{-3}$	seconds
Computation	$N(103.2 + 8.3e + 63.5[e(e-1)/2]) \times 10^{-3}$	seconds
Punch results		
a. Scores (optional)	$458Ne \times 10^{-3}$	seconds
b. Sums and sums of squares (optional)	$2.1 + .64e + .69[e(e-1)/2]$	seconds
c. Correlation coefficients	$.2e + .4[e(e-1)/2]$	seconds

ACCURACY — The accuracy of the scores, sums, and squares is as printed. The accuracy of the correlation coefficient depends on the size of the correlation, the variances and means of the elements being correlated and the number of groups. The absolute maximum of the error is given by the expression

$$E\ \frac{\overline{E}_{max}}{N\sigma^2_{min} \cdot 10^2 + \overline{E}_{max}}$$ where σ^2_{min} is the smallest of the element variances and $\overline{E}_{max}$ is the largest of the element means. An error this large is to be expected less than 1% of the time.

METHOD OF USE — The master tape is read in until it stops, when the parameter tape is read in. The master tape is reinserted and read until it stops again, when the data tape is inserted. When the machine is started again the data are read, one group at a time, and the scores associated with the group are punched. (If the machine is started with the white switch instead of the black switch after insertion of the data, the print will be by-passed.) When all the data have been read the master tape is inserted again and read until it stops. Raising the black switch at this point causes the sums and sums of squares of the scores to be printed, as well as the sums and sums of squares of proportions for individual pairs. Raising the

white switch at this stop causes this print to be by-passed. In either case, the remainder of the program is read in and the upper half-matrix of off diagonal correlation coefficients punched.

PURPOSE

The program may be used whenever N groups of raters have chosen between each of the e(e-1)/2 pairs of statements or objects formed by all possible pairings of e elements. The score for each group with respect to each element is taken as

$$E_i = \sum_{\substack{i=1,\ j\neq 1}}^{i=e} p_{ij},$$ where p_{ij} is the proportion of the raters who chose the element e_i in preference to the element e_j.

Intercorrelation of the scores, E_i and E_j, will be biased if the proportion based on the pair $e_i e_j$ is included, since $p_{ij} = 1 - p_{ij}$. Therefore to obtain the intercorrelation we base it on the scores

$$E'_i = E_i - p_{ij} \text{ and } E'_j = E_j - (1 + p_{ij})$$

The usual formula for the product-moment correlation becomes, with this modification

$$r_{E_iE_j} = \frac{N(\Sigma E_iE_j - \Sigma E_i + \Sigma E_ip_{ij} - \Sigma E_jp_{ij} + \Sigma p_{ij} - \Sigma p_{ij}^2}{[\,N(\Sigma E_i^2 - 2\Sigma E_ip_{ij} + \Sigma p^2{}_{ij}) - (\Sigma E_i - \Sigma p_{ij})^2\,]^{1/2}} \;*$$

$$* \frac{- (\Sigma E_i - \Sigma p_{ij})\,(\Sigma E_j - N + \Sigma p_{ij})}{[N(\Sigma E_j^2 - 2\Sigma E_j + 2\Sigma E_jp_{ij} + N - 2\Sigma p_{ij} + \Sigma p_{ij}^2) - (\Sigma E_j - N + \Sigma p_{ij})^2]^{1/2}}$$

In order to compute $r_{E_iE_j}$, therefore, it is necessary to accumulate, as the data are read in, the values ΣE_i, $\Sigma E_i{}^2$, Σp_{ij}, $\Sigma p^2{}_{ij}$, ΣE_ip_{ij}, ΣE_jp_{ij}. These values are accumulated over all groups and the punching described under Method of Use performed before the correlation coeffieients are calculated and punched.

The program will handle up to sixteen elements. The

* The formula, being too long for one line, has been broken here.

number of groups which may be scored without exceeding capacity is found from the formula

$$N = \sqrt{\frac{5.5 \times 10^7}{(e-2)^2}}$$

In the case of the maximum number of elements N = 530.

The program may be used for any number of raters in any group, including the special case where each rating is performed by <u>one</u> rater.

PARAMETER TAPE

A parameter tape must be prepared as follows:

00 3k
00 F00eF e = number of elements
00 F00NF N = number of groups
00 F00rF r = number of digits required to specify largest rater group
24 999N

DATA TAPE

The data are punched in the following manner. Let a_{ij} be the number of raters who responded to the pair formed by elements $e_i e_j$ by choosing e_i, and b_{ij} be the number who responded by choosing e_j. Then the data tape is punched

$$a_{12}, b_{12}, a_{13}, b_{13} \cdots a_{1e}, b_{1e}$$
$$\cdot \quad \cdot \quad a_{23}, b_{23a} \cdots a_{2e}, b_{2e}$$
$$\vdots$$
$$a_{e-1}, e\,b_{e-1,e}$$

Each frequency is punched without sign, but must contain the number of digits specified as <u>r</u> in the parameter tape. No terminating symbols are necessary.

OUTPUT

The printed results contain:

1. The scores for each group with respect to each element

$$E_i = \sum_{\substack{j = 1,\ j \neq i}}^{j = e-1} p_{ij}$$

This value is printed as a five digit number with 3 figures

to the right of the decimal. The scores are arranged 6 per line, with a double line feed between the scores for successive rater groups.

2. Sum E is printed, followed by the e summed values $\sum_{g=1}^{g=N} E_{ig}$ printed 6 per line. This value is printed as a 7 digit number with 3 places to the right of the decimal.

3. Sum E SQ is printed, followed by the e summed values,

$$\sum_{g=1}^{g=N} E^2_{ig}$$

This value is printed as a 9 digit number with 3 places to the right of the decimal.

4. Sum P is printed, followed by the e(e-1)/2 summed values,

$$\sum_{g=1}^{g=N} p_{ijg}$$

printed 6 per line. This value is printed as a 6 digit number with 3 places to the right of the decimal.

5. Sum P SQ is printed, followed by the e(e-1)/2 summed values,

$$\sum_{g=1}^{g=N} p^2_{ijg}$$

printed 6 per line. This value is printed as a 6 digit number with 3 places to the right of the decimal.

6. The e(e-1)/2 correlation coefficients which form the upper-half, off-diagonal elements of the matrix are punched.

DATE February 7, 1954
CODED BY G. C. Stone
APPROVED BY J. P. Nash

LOCATION	ORDER	NOTES	PAGE 1
	Routine X 1		
	00 8K		Constants
0	00 F		
	00 F		
1	00 205F		
	00 205F		
2	L4 221F		
	40 221F		
3	L4 237F		
	40 237F		
4	50 253F		
	75 253F		
5	L4 373F		
	40 373F		
6	L4 493F		
	40 493F		
7	L4 613F		
	40 613F		
8	L4 733F		
	40 733F		
9	L4 853F		
	40 853F		
10	00 F		
	00 1F		
11	00 1F		
	00 F		
12	00 1F		
	00 1F		
13	00 F		
	00 ( )F	by interlude in 74F ff. (e-1)	
14	00 F		
	00 ( )F	by interlude in 74 ff. e(e-1)/2	
15	00 F		
	00 F		
16	00 F		
	00 (N)F	by interlude in 74 ff.	

LOCATION	ORDER	NOTES	PAGE 2
	24 999N		Parameters inserted here
	00 25K		
	Routine N 1		
	00 45K		
	Routine P 1		
	00 74K		Interlude
0	L5 3F		
	40 F		
1	L0 18F		
	40 21F		
2	50 21F		
	75F		e(e-1)
3	10 1F		
	S5 F		
4	40 22F		
	L5 4F		
5	40 24F		
	26 999F		
	26 74N		
	00 74K		Read scores and form p_{ij}, p^2_{ij}, Σp_{ij}, Σp^2_{ij}
0	L5 12F	from 204F or 208F	
	40 14L		Set addresses and tests
1	42 12L		
	L5 13F		
2	40 13L		
	L5 14F		
3	42 15L		
	46 16L		
4	L1 22F		
	40 7F		Set item count
5	50 (r)F	from 24', by 27	
	50 5L		
6	26 25F		To N 1 to read a_{ij}
	40 5F		and return
7	50 (r)F	by 27	
	50 7L		

LOCATION	ORDER		NOTES PAGE 3
8	26 25F		To N 1 to read b_{ij}
	L4 5F		
9	00 1F		
	40 6F		
10	50 23F		Clear Q
	26 11L		Waste
11	L5 5F		
	66 6F		$a_{ij}/2(a_{ij} + b_{ij}) = p_{ij}/2$
12	7J 25L		$p_{ij} \times 10^{3} \times 2^{-39}$
	40 ( )F	by 1, 18	
13	L4 ( )F	by 2, 20	Σp_{ij}
	40 ( )F	by 2, 20	
14	50 ( )F	by 0, 21	
	75 ( )F	by 0, 21	Σp^{2}_{ij}
15	S5 F		
	L4 ( )F	by 3, 24	
16	40 ( )F	by 3, 23	
	F5 7F		
17	40 7F		
	36 100F		Have all p_{ij}'s been formed to form E routine?
18	F5 12L		
	40 12L		
19	L5 13L		
	L4 20F		
20	40 13L		
	L5 14L		
21	L4 20F		Adjust addresses
	40 14L		
22	L5 16L		
	L4 19F		
23	40 16L		
	F5 15L		
24	40 15L		
	26 5L		Loop
25	00 F		
	00 2000F		

LOCATION	ORDER		NOTES PAGE 4
26	L5 5F		
	00 20F		
27	46 5L		Interlude
	46 7L		
28	26 999F		
	26 26L		
	26 1N		
	00 100K		Form E_i, ΣE_i, ΣE_i^2
0	92 135F		
	L5 12F		
1	42 12L		
	42 19L		
2	L5 9F		
	42 29L		
3	L5 10F		
	40 25L		Set addresses and test constants
4	L5 11F		
	40 28L		
5	41 7F		
	41 6F	from 39', 43	
6	41 2F		
	41 3F		
7	L5 21F		
	L0 7F		
8	40 5F		
	L1 7F		Switch
9	32 19L		Skip to add cycle on 1st test only
	L5 7F		
10	L0 18F		Set address of subtraction order
	40 4F		for first subtraction
11	L4 12F		
	42 12L		
12	L5 44L	from 19	
	L0 ( )F	by 1, 11, 16	$(1 - p_{ij}) \times 10^3 \times 2^{-39}$
13	L4 6F		
	40 6F		

LOCATION	ORDER	NOTES	PAGE 5
14	F5 2F		
	40 2F		
15	L5 21F		
	L0 2F		Adjust subtraction order
16	L4 12L		
	40 12L		
17	L5 4F		
	L0 2F		
18	36 12L		Test for end of subtraction cycle
	L1 5F		
19	32 24L		Skips add cycle on last E
	L5 ( )F	from 9', 24 by 1', 21	Start add cycle
20	L4 6F		
	40 6F		
21	F5 19L		
	40 91L		
22	F5 3F		
	40 3F		
23	L0 5F		
	32 24L		End of add cycle?
24	22 19L		Loop
	L5 6F	from 23'	
25	L4 ( )F	by 3, 34	
	40 ( )F	"	ΣE_{ij}
26	50 6F		
	75 6F		$E^2_i \times 10^6 \times 2^{-39}$
27	S5 F		
	26 28L		Waste
28	L4 ( )F	by 4, 36	ΣE^2_i
	40 ( )F		
29	L5 6F		
	40 ( )F	by 2, 37	
30	50 52F		
	50 30L		
31	(26 45F)		To P 1 May be modified by by-pass
	F5 7F		

LOCATION	ORDER	NOTES
32	40 7F	
	F0 21F	
33	36 146F	E = e?
	L5 25L	to E_iE_j routine
34	L4 20F	
	40 25L	
35	L5 28L	Adjust addresses
	L4 20F	
36	40 28L	
	F5 29L	
37	40 29L	
	L5 7F	
38	L0 45L	from 42
	36 40L	Line feed?
39	92 967F	2 spaces
	22 5L	Loop
40	40 F	from 38
	L3 F	
41	32 42L	Line feed?
	L5 F	
42	26 38L	
	92 131F	from 41
43	22 5L	Loop
	00 F	
44	00 F	
	00 1000F	
45	00 F	
	00 6F	
	00 146K	Form and store E_iE_j
0	F5 9F	
	46 4L	
1	42 4L	
	41 5F	Set initial addresses
2	L5 15F	
	40 6L	
3	L1 21F	
	40 4F	

LOCATION	ORDER	NOTES	PAGE 7
4	50 ( )F	by 0, 14 from 11	
	75 ( )F	by 1, 9, 16	$E_i E_j \times 10^6 \times 2^{-39}$
5	S5 F		
	26 6L		Waste
6	L4 ( )F		
	40 ( )F		$\Sigma E_i E_j$
7	F5 4F		
	40 4F		
8	32 11L		End of row?
	F5 4L		
9	40 4L		
	L5 6L	from 8, 18	
10	L4 20F		
	40 6L		
11	26 4L		Loop
	F5 5F	from 8	
12	40 5F		
	L0 21F		
13	36 165F		End of form $E_i E_j$?
	L5 4L		
14	L4 19F		
	40 4L		
15	F5 9F		
	L4 5F		Adjust for end of row
16	42 4L		
	L1 21F		
17	L4 5F		
	40 4F		
18	22 9L		
	00 F		
	00 165K		Form $E_i p_{ij}$
0	L1 21F		
	40 4F		
1	41 5F		
	L5 9F		
2	46 5L		
	L5 12F		Set address and tests

LOCATION	ORDER		NOTES
3	42 52		
	L5 16F		
4	22 4L		Waste
	40 7L		
5	50 ( )F	by 2 from 12	
	75 ( )F	by 3, 10	$E_i p_{ij} \times 10^6 \times 2^{-39}$
6	S5 F		
	26 7L		Waste
7	L4 ( )F	by 4, 11	
	40 ( )F	"	$\Sigma E_i p_{ij} \times 10^6 \times 2^{-39}$
8	F5 4F		
	40 4F		
9	32 12L		End of row?
	F5 5L	from 17	
10	40 5L		Adjust if row not complete
	L5 7L		
11	L4 20F		
	40 7L		
12	26 5L		Loop
	F5 5F	from 9	
13	40 5F		
	L0 21F		
14	36 183F		$E_i p_{ij}$ complete?
	L1 21F		
15	L4 5F		Adjust if row complete
	40 4F		
16	L5 5L		
	L4 19F		
17	40 5L		
	22 9L		
	00 183K		Form $E_j p_{ij}$
0	L5 17F		
	40 7L		
1	F5 9F		
	42 5L		Set addresses and tests
2	L5 12F		
	46 5L		

LOCATION	ORDER		NOTES PAGE 9
3	L1 21F		
	40 4F		
4	41 5F		
	26 5L		Waste
5	50 ( )F	by 2, 10, from 12'	
	75 ( )F	by 1, 10	$E_j p_{ij} \times 10^6 \times 2^{-39}$
6	S5 F		
	26 7L		Waste
7	L4 ( )F	by 0, 12	
	40 ( )F	"	$\Sigma E_j p_{ij} \times 10^6 \times 2^{-39}$
8	F5 4F		
	40 4F		
9	36 13L		End of row?
	L5 5L	from 18	
10	L4 20F		
	40 5L		
11	L5 7L		Adjust; row not complete
	L4 20F		
12	40 7L		
	26 5L		Loop
13	F5 5F	from 9	
	40 5F		
14	L0 21F		
	36 19L		$E_j p_{ij}$ complete?
15	L1 21F		
	L4 5F		Adjust, row complete
16	40 4F		
	L5 9F		
17	L4 5F		
	42 5L		
18	22 9L		
	00 F		
19	F5 8F		
	40 8F		
20	L0 24F		
	34 999F		Ready for print sums?
21	26 74F		Loop to read another group
	00 F		

LOCATION	ORDER		NOTES PAGE 10
22	24 74F		Bypass score print with WS
	L5 25L		
23	40 131F		
	L5 26L		Establish print bypass
24	40 137F		
	26 74F		
25	22 131F		
	F5 7F		
26	40 129F		
	22 105F		Orders to be planted for bypass
	26 205N		
	[Spaces - Data inserted here.]		
	00 35K		
	Routine R 1		
	00 74K		Rectangular matrix S-R
0	K5 F		
	42 13L		
1	F5 13L		Plant links
	42 7L		
2	42 10L		
	01 7F		
3	01 12F		
	40 15L		Store test
4	F5 17L		
	40 17L		
5	L0 15L		
	36 11L		Matrix complete?
6	L5 16L		
	L0 17L		
7	22 7L		Waste
	36 ( )F	by 1	Line feed? link
8	92 131F		
	92 515F		
9	L5 16L		Adjust line feed test
	L4 14L		
10	40 16L		
	26 ( )F	by 2	Link

LOCATION	ORDER	NOTES	PAGE 11
11	92 135F	from 5'	
	41 17L		
12	L5 14L		Reset line feed test
	L0 18F		
13	40 16L		
	22 ( )F	by 0	Link
14	00 F		
	00 6F		
15	00 F		Test
	00 ( )F	by 3	
16	00 F		
	00 (5)F	by 10, 13	
17	00 F		
	00 ( )F		Count
	00 92K		Print sums (overwritten)
0	92 135F		
	92 259F		
1	92 706F		S
	92 450F		U
2	92 643F		M
	92 963F		space
3	92 194F		E
	92 131F		
4	92 707F		
	L5 ( )F	by 9, 50, from 10	
5	50 74F		
	50 5L		
6	26 45F		To P 1
	92 963F		
7	50 ( )F	by 47	
	50 7L		
8	26 74F		To matrix routine
	22 10L		when all sum E's printed
9	F5 4L	from S-R	Adjust address
	40 4L		
10	22 4L		Loop
	92 259F	from 8'	

LOCATION	ORDER	NOTES	PAGE 12
11	92 706F		S
	92 450F		U
12	92 643F		M
	92 963F		space
13	92 194F		E
	92 963F		space
14	92 706F		S
	92 66F		Q
15	92 131F		
	92 707F		
16	50 45L	from 22	
	7J ( )F	by 21, 51	$\Sigma F^2_{ij} \times 10^3 \times 2^{-39}$
17	50 96F		
	50 17L		
18	26 45F		To P 1
	26 19L		Waste
19	50 ( )F	by 471	
	50 19L		
20	26 74F		To Rectangular Matrix S-R
	22 22L		where all sum E S Q's printed
21	F5 16L	from S-R	Adjust address
	40 16L		
22	26 16L		and loop
	92 259F	from 20'	
23	92 706F		S
	92 450F		U
24	92 643F		M
	92 963F		space
25	92 2F		P
	92 131F		
26	92 707F		
	L5 ( )F	by 31, 52, from 32	
27	50 63F		
	50 27L		
28	26 45F		To P 1
	92 967F	from S-R	
29	50 ( )F	by 49	
	50 29L		

LOCATION	ORDER		NOTES
30	26 74F		
	22 32L	from S-R	When all Σp's punched
31	F5 26L	from S-R	except last time
	40 26L		Adjust address and loop
32	22 26L		
	92 259F	from 30'	
33	92 706F		S
	92 450F		U
34	92 643F		M
	92 963F		space
35	92 2F		P
	92 963F		space
36	92 706F		S
	92 66F		Q
37	92 131F		
	92 707F		
38	50 45L	from 44	
	7J ( )F	by 43, 53	$\Sigma p^2_{ij} \times 10^3 \times 2^{-39}$
39	50 63F		
	50 39L		
40	26 45F		To P 1
	92 967F		
41	50 ( )F	by 491	
	50 41L		
42	26 74F		When all Σp^2 punched
	24 999F	from S-R	Last time only
43	F5 38L	from S-R	Except last time
	40 38L		Adjust address and loop
44	26 38L		
	00 F		
45	00 F		Waste
	00 10 0000 0000 J		10^{-3}
46	F5 21F		Set program parameter
	00 20F		for rectangular
47	46 7L		matrix routine - Interlude
	46 19L		
48	L5 22F		
	00 20F		

LOCATION	ORDER		NOTES
49	46 29L		
	46 41L		
50	L5 10F		
	42 4L		Set addresses
51	L5 11F		and counts -
	42 16L		Interlude continued
52	L5 13F		
	42 26L		
53	L5 14F		
	42 38L		
54	24 0L		By-pass print if W. S. raised
	26 999F		
	26 138N		
	00 30K - 00F 001 000F		
	00 92K		Set up for correlation (adjust for bias)
0	41 5F		
	40 5F		Waste
1	L0 21F		
	40 4F		
2	L5 ( )F	by 40, 48	
	L0 ( )F	by 4, 53	$\Sigma X - \Sigma E_i - \Sigma p_{ij} \times 10^3 \times 2^{-39}$
3	40 25F		
	F5 2L		
4	40 2L		
	50 24F		
5	71 30F		
	00 39F		$\Sigma Y = \Sigma E_j - N + \Sigma p_{ij}$
6	L4 ( )F	by 8, 42, 50	
	L4 ( )F	by 8, 54	
7	40 26F		
	L5 6L		
8	L4 20F		Adjust addresses
	40 6L		
9	L5 ( )F	by 44, 51	
	L4 ( )F	by 12, 56	$\Sigma X^2 = \Sigma E_i^2 - 2\Sigma E_i p_{ij} + \Sigma p^2_{ij}$
10	L0 ( )F	by 13, 59	
	L0 ( )F	by 13, 59	

LOCATION	ORDER	NOTES
11	40 27F	
	F5 9L	
12	40 9L	Adjust addresses
	L5 10L	
13	L4 20F	
	40 10L	
14	50 24F	
	75 30F	
15	S5 F	
	40 F	
16	L1 ( )F	by 23', 42, 50
	L0 ( )F	by 23', 54
17	00 1F	
	L4 F	$\Sigma Y^2 = \Sigma E_j^{\,2} - 2\Sigma E_j + 2\Sigma E_j p_{ij} + N$
18	40 F	$- 2\Sigma p_{ij} + \Sigma p^2_{ij}$
	50 F	
19	75 30F	
	00 39F	
20	L4 ( )F	by 25, 45, 52
	L4 ( )F	by 25, 61
21	L4 ( )F	by 26', 61
	L4 ( )F	by 26', 56
22	40 28F	
	L5 16L	
23	L4 20F	
	40 16L	
24	L5 20L	
	L4 20F	Adjust addresses
25	40 20L	
	L5 21L	
26	L4 20F	
	40 21L	
27	L1 ( )F	by 41, 49
	L4 ( )F	by 33, 55
28	40 F	
	50 F	$\Sigma XY = \Sigma E_i E_j - \Sigma E_i + \Sigma E_i p_{ij} - \Sigma E_j p_{ij}$
29	75 30F	$+ \Sigma p_{ij} - \Sigma p_{ij}^{\,2}$
	00 39F	

LOCATION	ORDER	NOTES	PAGE 16
30	L4 ( )F	by 35, 58	
	L4 ( )F	by 35, 60	
31	L0 ( )F	by 36, 62	
	L0 ( )F	by 36, 57	
32	40 29F		
	L5 27L		
33	L4 18F		
	40 27L		
34	L5 30L		
	L4 20F		Adjust addresses
35	40 30L		
	L5 31L		
36	L4 20F		
	40 31L		
37	26 140F		To correlation routine
	F5 4F	from 171F	End of row?
38	40 4F		
	32 39L		
39	26 2L		
	L5 2L		
40	L4 19F		
	40 2L		
41	46 27L		
	L4 19F		Reset addresses at end of row
42	46 6L		
	46 16L		
43	L5 9L		
	L4 19F		
44	40 9L		
	L4 19F		
45	46 20L		
	F5 5F		
46	40 5F		
	L0 21F		Adjust row length test
47	40 4F		
	26 2L		Loop
48	L5 10F	from 63	
	46 2L		

LOCATION	ORDER	NOTES PAGE 17
49	46 27L	
	L4 19F	
50	46 6L	
	46 16L	
51	L5 11F	
	46 9L	
52	L4 19F	
	46 20L	
53	L5 13F	
	42 2L	
54	42 6L	
	42 16L	
55	42 27L	
	L5 14F	
56	42 9L	Interlude to set initial addresses
	42 21L	
57	42 31L	
	L5 15F	
58	46 30L	
	L5 16F	
59	46 10L	
	42 10L	
60	42 30L	
	L5 17F	
61	42 20L	
	46 21L	
62	46 31L	
	26 999F	
63	22 63L	Waste
	26 48L	
	26 1N	
	00 74K	Triangular matrix routine
0	K5 F	
	42 9L	Establish links
1	F5 9L	
	42 10L	

LOCATION	ORDER		NOTES
2	L5 21F		
	LO 12L		Row test
3	40 13L		
	F5 11L		
4	40 11L		
	LO 13L		
5	36 6L		Row complete?
	26 10L		
6	41 11L		
	92 131F		
7	92 770F		"N"
	92 135F		
8	F5 12L		
	40 12L		
9	LO 21F		
	32 ( )F	by 0	Matrix complete?
10	92 131F	from 5	
	26 ( )F	by 1	Link
11	00 F		Punch count
	00 F		
12	00 F		Row count
	00 F		
13	00 F		Length of row test
	00 ( )F	by 3	
	00 140K		Correlation routine
0	50 25F		
	7J 32L		
1	40 25F		
	50 26F		
2	7J 32L		
	40 26F		
3	50 27F		
	7J 31L		Scaling
4	40 27F		
	50 28F		
5	7J 31L		
	40 28F		

LOCATION	ORDER		NOTES	PAGE 19 K 4
6	50 29F			
	7J 31L			
7	40 29F			
	50 25F			
8	75 25F			
	S5 F			
9	40 1F			$(\Sigma X)^2 \times 10^4 \times 2^{-39}$
	41 F			Clear zero for square root
10	50 27F			
	75 24F			
11	S5 F			
	L0 1F			$[N\Sigma X^2 - (\Sigma X)^2] \times 10^4 \times 2^{-39}$
12	00 1F			
	50 12L			
13	26 35F			To square root
	40 6F	from S-R		$N\Sigma X^2 - (\Sigma X)^2 \times 10^2 \times 2^{-19}$
14	50 26F			
	75 26F			
15	S5 F			
	40 1F			$\Sigma Y^2 \times 10^4 \times 2^{-39}$
16	50 28F			
	75 24F			
17	S5 F			
	L0 1F			$[N\Sigma Y^2 - (\Sigma Y)^2] \times 10^4 \times 2^{-39}$
18	00 1F			
	50 18L			
19	26 35F			$N\Sigma Y^2 - (\Sigma Y)^2 \times 10^2 \times 2^{-19}$
	40 1F			
20	50 1F			
	7J 6F			$N\Sigma X^2 - (\Sigma X)^2 \quad N\Sigma Y^2 - (\Sigma Y)^2 \times 10^4 \times 2^{-38}$
21	40 6F			
	50 25F			
22	75 26F			
	S5 F			
23	40 25F			$\Sigma X \Sigma Y \times 10^4 \times 2^{-39}$
	50 29F			

LOCATION	ORDER	NOTES	PAGE 20
24	75 24F		
	S5 F		
25	L0 25F		$(N\Sigma XY - \Sigma X\Sigma Y) \times 10^{4} \times 2^{-39}$
	66 6F		r/2
26	S5 F		
	00 1F		r
27	52 57F		
	50 27L		
28	26 45F		To P 1
	50 28L	from P 1	
29	26 74F		To triangular matrix routine
	0F F	from S-R last time only	
30	22 129F	from S-R except last time	To adjust bias routine
	00 F		
31	00 F		
	00 10 000 000 000 J	10^{-2}	
32	00 F		
	00 100 000 000 000 J	10^{-1}	
	26 92N		