t No. FHWA-RD-77-22

SSMENT OF NATIONAL SMALL RURAL WATERSHEDS PROGRAM

Vol. 2. Appendixes

June 1977
Final Report

Document is available to the public through
the National Technical Information Service,
Springfield, Virginia 22161

Prepared for
FEDERAL HIGHWAY ADMINISTRATION
Offices of Research & Development
Washington, D. C. 20590

NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof.

The contents of this report reflect the views of Meta Systems Inc in association with GKY & Associates who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policy of the Department of Transportation. This report does not constitute a standard, specification, or regulation.

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-RD-77-22		

4. Title and Subtitle	5. Report Date
Assessment of National Small Rural Watersheds Program. Volume 2, Appendices	June 1977
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
M. B. Fiering, R. E. Sharpin, G. K. Young	
9. Performing Organization Name and Address Meta Systems Inc. (in association with GKY & Associates) 10 Holworthy St. Cambridge, MA. 02138	10. Work Unit No. FCP-35H3-092
	11. Contract or Grant No. DOT-FH-11-8605
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address Office of Research and Development Federal Highway Administration U.S. Department of Transportation Washington, D.C. 20590	Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes

FHWA Contract Manager: Frank K. Stovicek

16. Abstract

A State-by-State assessment is made of the current status of the National Small Rural Watersheds Program with regard to adequacy of data collection and analysis. Methodology is recommended for flood frequency estimation to replace currently used biased approaches. Concepts of risk aversion are discussed, and decision criteria based on economic considerations are incorporated into the hydrologic evaluation. Stream gaging programs of various gaging densities for 48 States are evaluated and recommendations made for continuation or termination of the programs based on FHWA objectives of drainage culvert design.

Volumes 1 and 2 of the report are available upon request.

FHWA No.	Short Title
77-21	Technical Report (Volume 1)
77-22	Appendices (Volume 2)
77-23	Executive Summary

17. Key Words	18. Distribution Statement
Hydrology, Small Watershed, Gaging Networks, Worth of Data, Statistical Analysis, Drainage Structures, Design Flow; Economic Analysis.	This document is available to the public through the National Technical Information Service, Springfield, Virginia 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	295	

Form DOT F 1700.7 (8-69)

Table of Contents - Volume 2

Table of Contents - Volume 1

Table of Contents (continued)

APPENDIX A

STATEMENT OF WORK

"Assessment of National Small Rural Watershed Program"

CONTRACT OBJECTIVES

The objective of this contract is to make a comprehensive independent assessment of the National Small Rural Watershed Program in keeping with long range goals of the Federal Highway Administration and State highway agencies.

SCOPE OF WORK

This study is an assessment on a State-by-State basis of the current state of the National Small Rural Watershed Program with regard to adequacy of data collection and analysis as well as data dissemination. It is not intended to be an attempt to analytically derive prediction equations. Small watershed studies under the HP&R* program as well as similar studies under other agencies shall be included in the analysis which shall encompass all or nearly all 50 States. Included will be each State's future plans with regard to the program. Although the National Small Rural Watershed Program is a coordinated effort, the individual studies are essentially State run; consequently, the study shall set forth the best features of various State studies and make general recommendations for improving the program as a whole.

DELINEATION OF CONTRACTOR TASKS

The contractor shall, as a minimum, accomplish the following tasks in meeting the objectives of this contract:

Task A

Review the two previous nationwide reports concerning Small Watershed Program. (Travelers Research Corporation and Federal Interagency Work Group). Review other literature pertaining to presently known new concepts in planning of gaging networks, methods of data sampling and

---

* Highway Planning and Research.

analyses, and other information deemed to be important for program assessment and future development.

Task B

Establish criteria, define specific terms, promulgate guidelines and/or choose guidelines from available information, which will be used for program assessment and future development.

1. Establish and justify criteria for proper selection of representative watersheds, including density and location of gaging sites.
2. Establish and justify criteria for adequate data collection including type of data and length of record.
3. Define the term "small watershed" as it will be used in the program assessment.
4. Promulgate and justify guidelines to be used for determination of physiographic/climatic regions for data collection and analysis.

Task C

1. Assess the 30 HP&R small watershed studies and the programs of other agencies with respect to criteria, definitions, and guidelines specified in Task B.

2. Develop a master plot showing all small watersheds with gaging stations operated under the HP&R studies or under programs of other agencies. The master plot shall show a consolidated nationwide program dealing with collection and analysis of data from small rural watersheds including regional delineation using the guidelines developed in Subtask B4.

NOTE:

1. A field effort will be undertaken to acquire comprehensive information for applying the criteria developed in Task B. In cooperation with the contract manager, the contractor will conduct two regional conferences with all concerned parties (U.S. Geological Survey, state highway officials and others),

each regional conference to have most of the states represented. Contacts with concerned parties will be coordinated with the contract manager and U.S. Geological Survey.

If the two regional meetings are successful, additional regional meetings will be scheduled upon written approval of the contracting officer.

2. The data collection and analysis effort required under Task C shall be limited to a maximum of 10 states to be selected in cooperation with the contract manager. This collection and analysis effort is in addition to that required under Note 1 above.

Task D

1. Depending on data availability determined from the consolidated program described in Task C, decide for each region which method of peak estimating should be used in that region. (Runoff only or rainfall-runoff method.)
2. Using criteria developed in Task B, establish for each region the proportion of watersheds having:
    a. Complete record stations.
    b. Flood hydrograph and rainfall stations.
    c. Peak-flow stations.
3. Using criteria developed in Task B, determine for each region if the present station's net is:
    a. Too dense (state how many stations should be abolished.
    b. Adequate.
    c. Inadequate (recommend improvement).

    State in detail on what basis the density of watersheds will be established in each region.
4. Using criteria for adequate data collection developed in Task B, determine:

a. The length of records, necessary for a meaningful analysis for each region.
b. Necessary minimum length of records.
c. Optimum length of records.

Task E

Depending on data availability as determined for the consolidated program described in Task C and considering existing analytical approaches, suggest a method for data analysis in each region.

NOTE: If data analysis is not possible in the near future, recommend all necessary steps for program improvement or orientation in each region which would make a meaningful analysis possible at the earliest possible date.

Task F

For each region:

1. Estimate time required for final data analysis and program conclusion or phaseout.
2. Determine what part of the program should be continued after conclusion or phaseout of major studies and at what level of effort.
3. Calculate the minimum and optimum costs of the program up to the estimated year of conclusion or phaseout and the cost of continuation of the reduced program after that year.

APPENDIX B

PROGRAM DOCUMENTATION

Overview

These programs are designed to aid in the prediction of the fifty year flood (Q50) at ungauged streams. For the most part, the programs are used to provide the following data for use in "Big Basin"

a. A regression equation of the form

$$Q50 = aX_1^{b_1} X_2^{b_2} \ldots X_n^{b_n}$$

where Q50 is the fifty year flood of a stream, and the X_i are hydrological, geographical, or climatological data for the stream.

b. The average regional correlation of Q50's for streams in a state.

c. The average skew of Q50's for streams in a state.

d. The average number of years of flow records for gauging stations in a state.

The actual programs used are

1. Bigflow: calculates the unbiased (using WW1 tables) and biased (using U.S.G.S. program W4014) Q50's for selected gauging stations with basin area less than or equal to 50 square miles.

2. Reduce: recalculates the unbiased Q50's produced by "Bigflow" by limiting the raw space skew of the flow data.

3. R50: uses the annual flow data of selected stations to find the regional correlation of unbiased Q50's.

4. Skew: uses the data cards output by "Reduce" to find the average regional skew of the unbiased Q50's.

5. Nyears: finds the avarage number of recorded flow years per gauging station (only stations in small basins are counted).

6. Samp: calculates unbiased Q50's for random samples of the flows from a specific station.

7. Sp: calculates the correlation and Spearman rank correlation of unbiased and biased Q50's.

8. Prep: prepares data cards for use with the SPSS stepwise regression program. Each card has the unbiased and biased Q50's as well as selected basin characteristics for one gauging station.

Main Programs

number	name	name alphabetically	number
1	Bigflow	Bigflow	1
2	Reduce	Nyears	5
3	R50	Prep	8
4	Skew	Reduce	2
5	Nyears	R50	3
6	Samp	Samp	6
7	Sp	Skew	4
8	Prep	Sp	7

Subroutines

number	name	name alphabetically	number
9	Load	Calc	24
10	Statl	Gauss	20
11	Interp (Intery)	Genl	19
12	Offset	Gen2	25
13	W4014*	Instd	23
14	Vcor	Interp(Intery)	11
15	Outp	Load	9
16	Trans	Offset	12
17	Tr	Order	28
18	Rowq50	Outp	15
19	Genl	Rnd	26
20	Gauss	Rowq50	18
21	Stat2	Spcor	29

* and other subroutines from the U.S.G.S.

number	name	name alphabetically	number
22	Stat	Stat	22
23	Instd	Stats	27
24	Calc	Statl	10
25	Gen2	Stat2	21
26	Rnd	Tr	17
27	Stats	Trans	16
28	Order	Vcor	14
29	Spcor	W4014	13

1 BIGFLOW

1.1

1 Bigflow finds unbiased and biased Q50's. (Q50 is the flood with a return interval of 50 years.) The annual flows for different stations, are read from disk and the Q50's are calculated, printed, and punched.

It was originally intended to use these Q50's for input to the USGS "Transformation Generator" and "Step-backward Regression" programs. This was not done, but much of the output of Bigflow reflects that original plan.

The only output that was really used was that punched on device 16. This included: station identifier; Q50's; all of the statistics needed for finding the unbiased Q50's.

2 Calls:

* FillpL
* Filln
* Fillp
* Fillgn
* Fillgp

*These are needed by USGS program W4014

W4014

Statl

Load

Intery (Interp)

Offset

3 Assume that not all stations in the flow disk file are in the input card deck and vice versa. Each station in the flow file consists of a dummy (no year or flow) record followed by at least one real record.

4 Stations are processed one at a time. The unbiased Q50 is calculated and subroutine W4014 is called to calculate the biased Q50.

(Subroutine W4014 is really USGS program W4014 modified to be a subroutine instead of a main program. For full documentation see the USGS.)

5 The dummy record starting a station on the disk is read, and the cards are read until the corresponding station is reached. If the station is not in the card deck, the disk file is read until a good station comes up. Then, flow records are read until a new station is reached (a different station No.). Thus, the last record read for station I is the dummy record that will be used to start station I + 1.

When reading the flow records, only those > 0 are saved. The mean, std, and skew of these flow records are found in both raw and log (e) space. "Intery" is called to find a coefficient from the WW1 tables (see model) and the unbiased Q50 is found, printed and punched. Then, "W4014" is called to calculate the biased Q50 which is printed and punched. Finally, both Q50's and other data are printed and punched. The whole process is then repeated (remember, the dummy record of the next station has already been read) for the next station.

6 Suppose we have flows $x_1 \ldots x_n$ and we want the unbiased Q50. We assume that the x_i come from an underlying log normal distribution and that Q50 = .98 fractile of that distribution.

Let $Y_i = \text{Ln}(x_i) \quad i = 1,n$

μ_x = mean of $x = \sum_{i=1}^{n} \frac{x_i}{n}$

$$\delta_x = \text{std of } x = \left(\frac{\sum_{i=1}^{n} x_i^2 - n\mu_x^2}{n-1} \right)^{\frac{1}{2}}$$

$$\gamma_x = \text{skew of } x = \left(\frac{\delta_x}{\mu x} \right)^3 + 3\left(\frac{\delta_x}{\mu x} \right)$$

and define μ_y, δ_y, γ_y similarly for the Y_i $i = 1,n$. We find Q50 = exp $[\mu_y+CO\delta_y]$ where CO is a function of n,γ_x (in general, CO is also a function of the desired return interval, but we always are interested in the 50 year return interval).

CO is found by linear interpolation in the WW1 "expected value" table.

a The "true XT" value corresponding to γ_x (skew),N (No. obs), 50 (return interval) is found. Call this $\hat{X}$.

b Find TNEW such that the "log normal" entry (in the WW1 table) corresponding to γ_x,N,TNEW = $\hat{X}$.

c Find the "true XT" entry corresponding to γ_x,N,TNEW. This is CO.

A similar technique is used for finding the biased Q50's. The annual flows are passed to W4014. W4014 assumes a "log Pearson" distribution and uses log base 10 but the model is basically the same.

$$Q50 = 10^{**} [\mu_y+k\delta_y]$$

However, the K used in W4014 does not reflect the problems of sampling bias, so this Q50 is "biased." To find out exactly how W4014 works, you will have to check with USGS. I was given no documentation.

7 11/10/76 Raiffa

8

1.2

1 IPLOT set to 0 always (used in W4014)

2 Do loops:

Do 10 J = loops through stations

I = integer no. of flows for a station

3 Common

FK	=	real	array	used in W4014
PLUS	=	real	array	used in W4014
FNEG	=	real	array	used in W4014
GP	=	real	array	used in W4014
GN	=	real	array	used in W4014
X	=	real	array	holds log of flows also used in W4014
N	=	integer		no. of flows (I) used in W4014

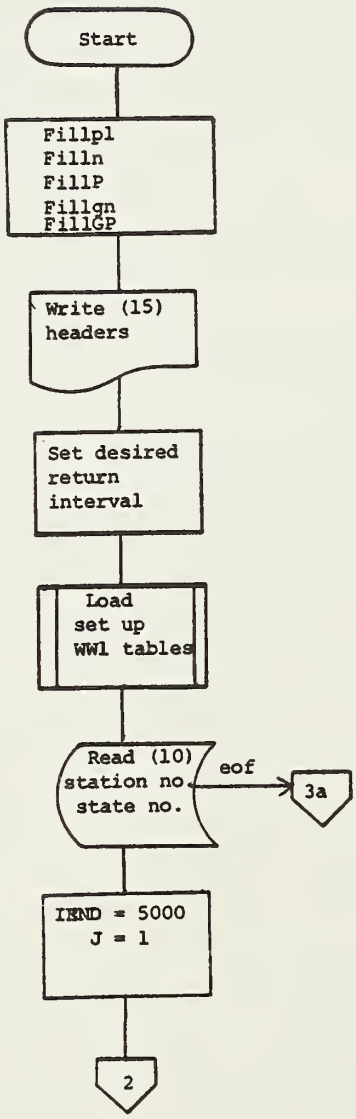
When W4014 was changed from a main program to a subroutine, I removed the data initialization routines (see * routines 1.1.2) and put them in Bigflow. The first 5 arrays listed above are initialized by the starred subroutines and used in W4014. Instead of W4014 reading the flows, X and N were passed through common.

SE	=	real	array	used in W4014 but not in common
SM	=	real	array	skew category values for interpolating in WW1 tables
YM	=	real	array	no. of observation category values
TM	=	real	array	return interval category values
XT	=	real	array	"true expected XT value" WW1 table
XL	=	real	array	"log normal expected value" WW1 table
SL	=	real	array	"log normal std" WW1 table
XNE	=	real	array	holds raw space flows (remember X holds log space values)

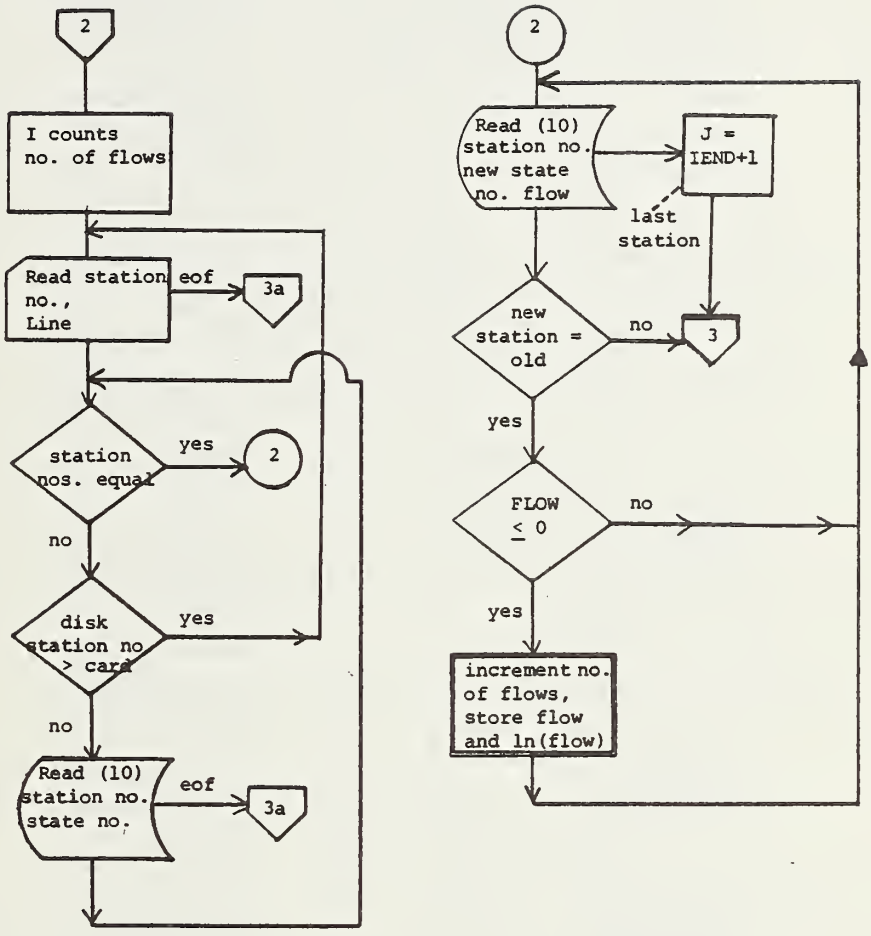
T	=	real	return interval (=50)
IST	=	integer	station no. from disk
ISTATE	=	integer	state no. of present state (from disk)
IEND	=	integer	IEND > no. of stations (=5,000)
ISTA	=	integer	station no. from cards (IST and ISTA are compared)
LINE	=	integer	line no. from basin characteristic file, no longer needed
IST2	=	integer	state no. from disk (when the station being processed ends, and we read the dummy record of the next station, IST2 will be the state no. of that next station. We don't need a new and old IST since ISTA fulfills that function).
FLOW	=	real	flow
XBAR	=	real	mean of log (flow)
STD	=	real	std of log (flow)
SKEW	=	real	skew of log (flow)
XNB	=	real	mean of flows
STB	=	real	std of flows
SKOB	=	real	skew of flows
YEAR	=	real	no. of flows, same as I
TNEW	=	real	unbiased return interval (see model)
CO	=	real	coefficient from WW1 tables (see model)

```
A50     =  real          log (unbiased Q50)
Q50     =  real          unbiased Q50
ANS     =  real          biased Q50
AN1     =  real          log (biased Q50)
```

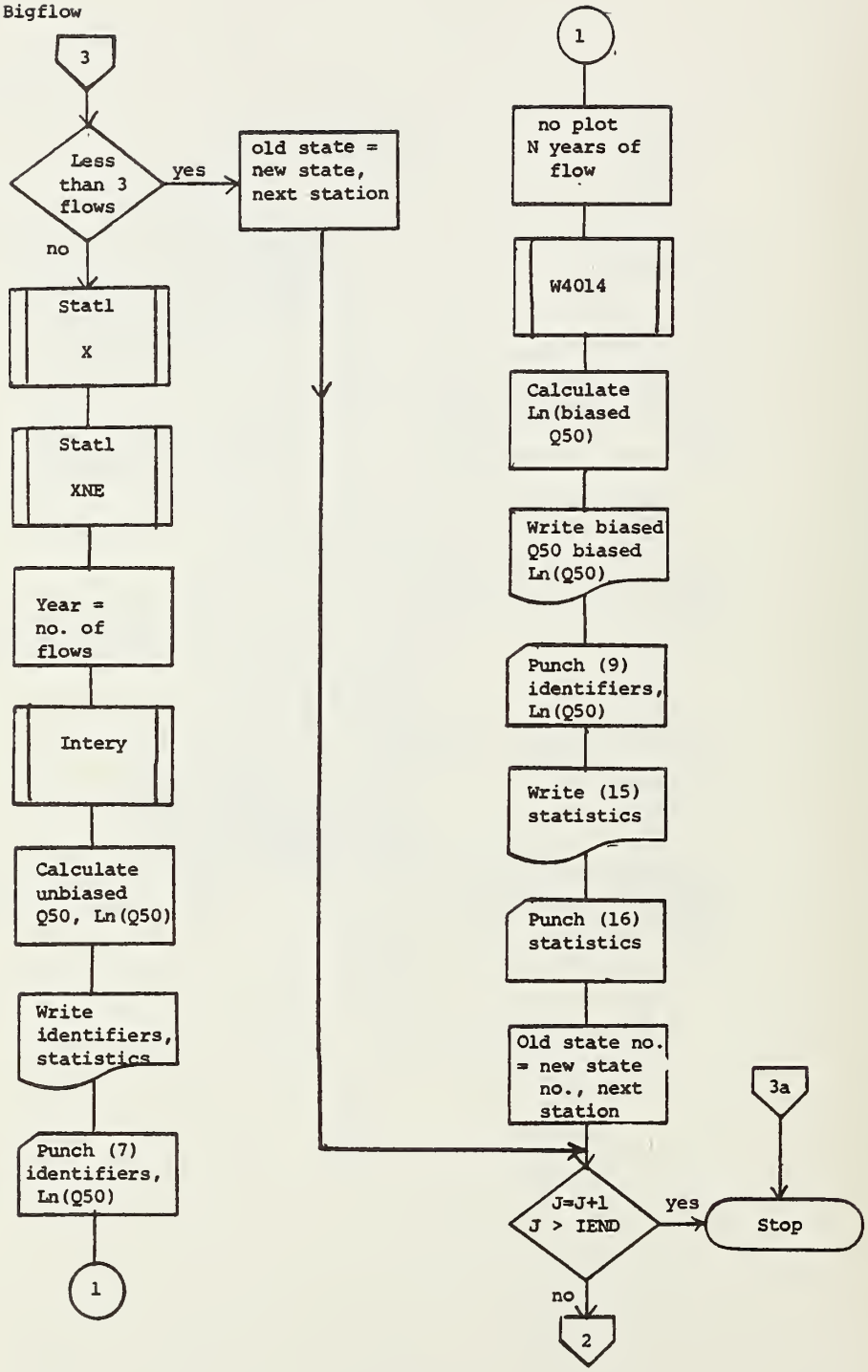
1.3 Bigflow


Start
Fillpl
Filln
FillP
Fillqn
FillGP
Write (15)
headers
Set desired
return
interval
Load
set up
WWl tables
Read (10)
station no.
state no.
eof
3a
IEND = 5000
J = 1
2

1.3 Bigflow


2
I counts no. of flows
Read station no., Line
eof
3a
station nos. equal
yes
2
no
disk station no > card
yes
no
Read (10) station no. state no.
eof
3a
2
Read (10) station no. new state no. flow
J = IEND+1
last station
new station = old
no
3
yes
FLOW ≤ 0
no
yes
increment no. of flows, store flow and ln(flow)

1.3 Bigflow


3
Less than 3 flows
yes
old state = new state, next station
no
Statl X
Statl XNE
Year = no. of flows
Intery
Calculate unbiased Q50, Ln(Q50)
Write identifiers, statistics
Punch (7) identifiers, Ln(Q50)
1
1
no plot N years of flow
W4014
Calculate Ln(biased Q50)
Write biased Q50 biased Ln(Q50)
Punch (9) identifiers, Ln(Q50)
Write (15) statistics
Punch (16) statistics
Old state no. = new state no., next station
J=J+1 J > IEND
yes
3a
Stop
no
2

1.5-1.7 Program run preparation

The following is a complete deck setup for this program.

1. Job card
2. System control cards
3. Source code
4. WWl deck
5. Station selection cards

Input preparation

Input is from cards and from a magnetic device (unit 10). Each card has the station number of a selected gauging station. The magnetic file is a subset (only small basins) of the USGS Peak Flow File.

Station selection cards (1 for each station for which Q50's should be calculated).

card	column	format	description
All	1-8	I8	station no.
	19-21	I3	statpac row no.

For a description of the input magnetic file (unit 10) see USGS Peak Flow File.

Output

Output is to two printer files, and to three card punch files.

Card punch file 1 unit 7.
One card for each station processed.

column	format	description
1-5	I5	statpac line no.
6-8	"Ø15"	for transformation generator
9-20	E12.5	log (unbiased Q50)
41-48	I8	station no.
54-55	I2	state no.

Card punch file 2 unit 9.
One card for each station processed.

column	format	description
1-5	I5	statpac line no.
6-8	"Ø15"	for transformation generator
9-20	E12.5	biased Q50
41-48	I8	station no.
54-55	I2	state no.
61-62	"**"	flag

The two above decks were never used.

Card punch file 3 unit 16.
One card for each station processed.

column	format	description
1-8	I8	station no.
9-10	I2	state no.
11-12	I2	no. of flow years
13-19	F7.4	log (unbiased Q50)
20-26	F7.4	log (biased Q50)
27-35	F9.2	mean (max. annual flows)
36-44	F9.2	std (max. annual flows)
45-51	F7.4	skew (max. annual flows)
52-58	F7.4	mean (log(max. annual flows))
59-65	F7.4	std (log(max. annual flows))
66-72	F7.4	skew (log(max. annual flows))

Printer file 1 unit 6.
Six lines per station processed.

line	column	format	description
1-2			blank
3	1-16		Title
	22-29	I8	station no.
	23-34		Title
	35-36	I2	state no.
4			Titles
5	1-8	I8	no. of flow years
	9-20	F12.4	mean (flow)
	21-32	F12.4	std (flow)
	33-44	F12.4	skew (flow)
	45-56	F12.4	mean (log(flow))
	57-68	F12.4	std (log(flow))
	69-80	F12.4	skew (log(flow))
	81-92	F12.4	log (unbaised Q50)

line	column	format	description
	93-104	F12.4	unbiased Q50
	105-116	F12.4	unbiased return interval
	117-128	F12.4	coefficient from WW1 table
6	1-16		Title
	17-27	E11.5	biased Q50
	33-43	E11.5	log (biased Q50)

```
//BIGFLOW JOB (0210,D75,DESK,,4000),'RAIFFA MJ',CLASS=D,REGION=200K       JOB 575
// EXEC PGM=ALLQ50S,ACCT=COST
//STEPLIB DD DSN=FLQQ50,DISP=OLD,UNIT=PACK,VOL=SER=DP5016
//SYSPRINT DD SYSOUT=A
//SYSUDUMP DD DUMMY
//FT05F001 DD DDNAME=SYSIN
//FT06F001 DD SYSOUT=A
//FT07F001 DD SYSOUT=(B,,2)
//FT09F001 DD SYSOUT=(B,,2)
//FT10F001    DD DSN=ALLFLOW2,UNIT=PACK,VOL=SER=DP5016,DISP=(OLD,KEEP),
// DCB=(RECFM=FB,LRECL=133,BLKSIZE=7182)
//FT15F001  DD SYSOUT=A
//FT16F001 DD SYSOUT=(B,,2)
//SYSIN DD *
//
*********************************************************************************************************************************
*     JOB BIGFLOW                                  STARTED 11.42.41    DEC 17, 1975                                OS VERSION 21.8A    *
*********************************************************************************************************************************
IEF236I ALLOC. FOR BIGFLOW
IEF237I 132   ALLOCATED TO STEPLIB
IEF237I 182   ALLOCATED TO SYSPRINT
IEF237I 181   ALLOCATED TO FT05F001
IEF237I 183   ALLOCATED TO FT06F001
IEF237I 1D0   ALLOCATED TO FT07F001
IEF237I 1D1   ALLOCATED TO FT09F001
IEF237I 132   ALLOCATED TO FT10F001
IEF237I 184   ALLOCATED TO FT15F001
IEF237I 1D2   ALLOCATED TO FT16F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   FLQQ50                                   KEPT
IEF285I   VOL SER NOS= DP5016.
IEF285I   ALLFLOW2                                 KEPT
IEF285I   VOL SER NOS= DP5016.
*********************************************************************************************************************************
*     STEP                CPU TIME   41.37 SECS  STARTED 11.42.41  ENDED 11.46.25  SYSIN: 1045   STEP USED 180K OF 200K REGION    *
*     EXCPS:   DISK    279                                                    JOBSTEP COST = $26.33(APPROXIMATE)                  *
*********************************************************************************************************************************
*********************************************************************************************************************************
*     JOB BIGFLOW   TOTAL CPU TIME   41.37 SECS  STARTED 11.42.41  ENDED 11.46.25   DEC 17, 1975  JOBLOG 753514216064BIGFLOW      *
*********************************************************************************************************************************
```

```
0001            COMMON FR(27),PLUS(27,35),FNEG(27,35),GP(35),GN(35),X(100),N      0000004
0002            DIMENSION      SM(13),YM(9),TM(9),XT(13,9),XL(13,6,9),
               XSL(13,6,9)
0003             DIMENSION SE(27)
0004             DIMENSION XNE(100)
0005            CALL FILLPL (SL)                                                  00000100
0006            CALL FILLN                                                        00000110
0007            CALL FILLP                                                        00000120
0008            CALL FILLGN                                                       00000130
0009            CALL FILLGP                                                       00000140
0010             WRITE(15,133)
0011        133 FORMAT('1 STAT  STATE  #    OUR Q50   THEIR Q50  ',
               X'    MEAN          STD         SKEW       LOG MEAN   ',
               X'   LOG STD    LOG SKEW'//)
0012             T=50.0
0013            CALL LOAD(SM,YM,TM,XT,XL,SL)
0014            READ(10,101,END=999)IST,ISTATE
0015            IEND=5000
0016            DO 10 J=1,IEND
0017            I=0
0018          7 READ(5,100,END=999)ISTA,LINE
0019          1 IF(IST .EQ. ISTA)GO TO 2
0020            IF(IST .GT. ISTA)GO TO 7
0021            READ(10,101,END=999)IST,ISTATE
0022            GO TO 1
0023          2 READ(10,102,END=999)IST,IST2,FLOW
0024            IF(IST .NE. ISTA)GO TO 3
0025            IF(FLOW .LE. 0.0)GO TO 2
0026            I=I+1
0027            XNE(I)=FLOW
0028            X(I)=ALOG(FLOW)
0029            GO TO 2
0030          3 CONTINUE
0031            IF(I .LE.2)ISTATE=IST2
0032            IF(I .LE. 2)GO TO 10
0033            CALL STAT1(X,I,XBAR,STD,SKEW)
0034            CALL STAT1(XNE,I,XNB,STB,SKOB)
0035            YEAR=I
0036            CALL INTERY(SKOB,YEAR,T,TNEW,CO,XT,XL,SM,YM,TM)
0037            A50=XBAR+CO*STD
0038            Q50=EXP(A50)
0039            WRITE(6,112)ISTA,ISTATE
0040            WRITE(6,111)
0041            WRITE(6,103)I,XNB,STB,SKOB,XBAR,STD,SKEW,A50,Q50,TNEW,CO
0042            WRITE(7,104)LINE,A50,ISTA,ISTATE
0043            IPLOT=0
0044            N=I
0045            CALL W4014(ISTA,'  ',IPLOT,ANS,SE)
```

```
0046                ANI=ALOG(ANS)
0047                WRITE(6,125)ANS,ANI
0048                WRITE(9,109)LINE,ANS,ISTA,ISTATE
0049                WRITE(15,130)ISTA,ISTATE,I,ASO,ANI,XNB,STB,SKOB,XBAR,STD,SKEW
0050                WRITE(16,131)ISTA,ISTATE,I,ASO,ANI,XNB,STB,SKOB,XBAR,STD,SKEW
0051          130   FORMAT(1X,I3,2X,I2,2X,I2,3F13.4)
0052          131   FORMAT(I3,2I2,3F7.4,2F9.2,F7.4,3F7.4)
0053                ISTATE=IST2
0054                GO TO 10
0055          998   CONTINUE
0056                J=IEND+1
0057                GO TO 3
0058           10   CONTINUE
0059          100   FORMAT(I3,T9,I2)
0060          101   FORMAT(I4,T66,I2)
0061          102   FORMAT(I3,T66,I2,T109,F7.0)
0062          103   FORMAT(I3,11F12.4)
0063          104   FORMAT(I5,' 15',G12.5,20X,I8,5X,I2)
0064          109   FORMAT(I5,' 15',G12.5,20X,I9,5X,I2,5X,'**')
0065          111     FORMAT('  # OBS      MEAN          STD           SKEW      LOG',
                     X' MEAN      LOG STD     LOG SKEW      LOG Q50        Q50     UNBIASED',
                     X' RET     COEFF')
0066          112   FORMAT(//'  STATION NUMBER',5X,I8,'    STATE #  ',I2)
0067          125   FORMAT('     THEIR Q50  ',G11.5,5X,G11.5)
0068          999   CONTINUE
0069                  STOP
0070                END
```

COMMON BLOCK / / MAP SIZE 20A0

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
FK	0	PLUS	9C	PNEG	1E30	GP	1DE4	GN	1E80
X	1E0C	N	2090						

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
FILLPL	F0	FILLN	F4	FILLP	F8	FILLGN	FC	FILLGP	100
IBCOM#	104	LOAD	108	STAIT	10C	INTERY	110	W4014	114
ALOG	118	EXP	11C						

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
T	1A0	IST	1B0	ISTATE	1B4	IEND	1B8	J	1BC
I	1C0	ISTA	1C4	LINE	1C8	IST2	1CC	FLOW	1D0
XPAR	1D4	STO	1D8	SKEW	1DC	XNB	1E0	STB	1E4
SKOB	1E8	YEAR	1EC	TNOW	1F0	CO	1F4	A50	1F8
Q50	1FC	IPLOT	200	ANS	204	AN1	208		

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
SM	20C	YM	240	TM	258	XT	27C	XL	450
SL	F40	SE	1A40	XNF	1AAC				

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
133	1D42	130	1DC2	131	1DD5	100	1DEF	101	1DF7
102	1DFF	103	1D0C	104	1D15	109	1D29	111	1D43
112	1DC8	125	1DF2						

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
5	1E73	6	1E76	7	1E94	8	1EA2	9	1EB0
10	1EBE	12	1ED4	13	1EE0	14	1EEE	15	1F18
16	1F20	17	1F22	18	1F34	19	1F5C	20	1F6A
21	1F79	22	1FA0	23	1FA6	24	1FD8	25	1FE6
26	1FF8	27	2004	28	2014	29	2032	30	2038
31	2048	32	2052	33	2064	34	2072	35	2080
36	2040	37	20A4	38	20BE	39	2000	40	20F4
41	2109	42	2174	43	21A8	44	2180	45	21BC
46	21CA	47	21DC	48	2200	49	2234	50	22A0
53	230C	54	2314	55	231A	56	2214	57	232A

```
   58      2330          69      2344          69      2344
```

```
*OPTIONS IN EFFECT*   ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
*OPTIONS IN EFFECT*   NAME = MAIN      , LINECNT =      50
*STATISTICS*  SOURCE STATEMENTS =       70,PROGRAM SIZE =    9042
*STATISTICS*  NO DIAGNOSTICS GENERATED
```

1 STA#	STATE	#	OUR Q50	THEIR Q50	MEAN	STD	SKEW	LOG MEAN	LOG STD	LOG SKEW
1101000	25	29	6.6429	6.2502	227.3793	102.4144	1.4426	5.3344	0.4366	0.2461
1101500	25	37	7.0843	6.7759	404.5134	163.4045	1.3211	5.9231	0.4029	0.2044
1105000	25	35	7.3873	7.0839	396.4856	261.8062	2.2689	5.8510	0.4770	0.2451
1109000	25	48	7.3337	7.1073	509.7083	242.8621	1.5376	6.1459	0.4078	0.1993
1162500	25	56	7.9278	7.3900	459.3213	437.3938	3.7203	5.9057	0.6195	0.3159
1165000	25	57	8.3086	7.9944	794.4736	779.8022	3.8902	6.4692	0.5620	0.2616
1165500	25	58	7.4885	6.9315	321.1377	247.4565	2.7692	5.5771	0.6025	0.3253
1171500	25	35	9.3077	8.5085	2155.4285	1192.6052	1.8293	7.5298	0.5743	0.2292
1172500	25	27	7.8536	7.5283	733.2961	362.0159	1.6014	6.4997	0.4356	0.2014
1174000	25	27	6.5416	5.7157	155.5555	69.4033	1.4273	4.9307	0.5310	0.3243
1174500	25	38	8.6433	8.1852	889.3157	1057.8687	5.2518	6.5357	0.6133	0.2824
[illegible]	25	28	7.0337	5.5515	59.9583	122.8515	5.7750	4.0965	0.8213	0.6095
[illegible]	25	53	10.3104	[illegible]	[illegible]	3372.7455	3.9399	7.3241	0.7674	0.2552
1197000	25	38	9.3752	8.7590	1929.5525	1425.7671	2.5202	7.3570	0.6135	0.2504
1198000	25	21	9.8884	8.6740	1669.7141	1800.6008	4.4892	7.1585	0.6842	0.2876
1331500	25	42	8.5217	8.2483	1297.6189	847.1892	2.2369	7.0406	0.4684	0.1999
1332000	25	43	9.5336	9.1013	2726.1860	1966.9792	2.5401	7.7366	0.5587	0.2170
1333000	25	24	8.6337	8.0323	1396.6665	644.9260	1.4837	7.1375	0.4783	0.2013
1484900	51	9	4.8867	4.2927	32.6667	14.1245	1.3780	3.4069	0.4228	0.3742
[illegible]	25	25	[illegible]	7.1053	551.2915	273.6958	1.6662	6.1650	0.5432	0.2650
[illegible]	[illegible]	21	[illegible]	[illegible]	162.5714	115.1241	[illegible]	4.8713	0.6983	0.4330
[illegible]	24	41	10.9710	[illegible]	102010.5625	651196.0625	279.2861	5.7373	1.6812	0.9051
1489000	24	24	12.8709	6.2296	88154.8125	430651.1250	131.2393	5.5599	2.1187	1.1985
1490000	24	23	7.1299	6.4486	250.1304	131.5975	1.7240	5.3907	0.5323	0.2972
1492000	24	24	13.3568	6.4486	184162.7500	900099.0625	131.4148	6.1205	2.0970	1.0681
1492500	24	22	17.1239	15.5246	360302.3125	1210163.0000	47.9667	6.2295	3.0280	1.5731
1493000	24	25	8.0382	7.1003	391.7200	263.5615	2.3231	5.7661	0.6629	0.3464
1493500	24	23	14.4862	7.1003	397273.6875	1901487.0000	124.0095	6.4942	2.2687	1.0906
1494000	24	13	8.7852	7.7299	608.9229	434.3691	2.5030	6.2082	0.6419	0.3113
1495500	24	10	9.2356	8.7650	2009.0000	1241.7234	2.0904	7.4978	0.4372	0.1751
1496000	24	25	9.0369	8.5383	1815.8398	1028.2266	1.8803	7.3741	0.5063	0.2063
1579000	24	19	17.5415	15.3547	230917.5000	702363.8125	37.2650	7.4921	2.5945	1.0804
1581500	24	24	9.5137	8.3883	1351.3333	1060.2429	2.8367	6.9707	0.7044	0.3042
1583000	24	26	11.6190	8.3883	57105.3047	290214.5625	146.5049	5.4467	1.8618	1.0654
1584500	24	47	11.6583	8.3883	108106.3750	720128.6250	315.5645	7.9601	1.3201	0.5021
1585500	24	25	12.1205	8.3883	43888.4375	217940.0625	137.3478	5.6054	1.9266	1.0717
1588000	24	42	11.3922	8.3883	91915.6875	587708.4375	280.5884	6.8477	1.5806	0.7048
1589100	24	17	16.5023	8.3883	430027.1875	1770351.0000	82.1239	6.9439	2.3210	1.0401
1589300	24	18	14.9535	13.3978	79406.1250	327101.3750	82.2593	7.5989	1.8421	0.7415
1589500	24	14	29.0556	20.1921	1385765.0000	2897946.0000	15.4191	6.5444	4.9550	2.7054
1590000	24	41	9.7973	20.1921	24673.8750	156130.1875	272.3491	5.2824	1.5620	0.9129

STATION NUMBER 1101000 STATE # 25

# OBS	MEAN	STD	SKEW	LOG MEAN	LOG STD	LOG SKEW	LOG Q50	Q50	UNBIASED RET	COEFF
29	227.3793	102.4144	1.4426	5.3344	0.4366	0.2461	6.6429	767.3035	76.5746	2.9967
THEIR Q50	0.51814E 03		0.62502E-01							

STATION NUMBER 1101500 STATE # 25

# OBS	MEAN	STD	SKEW	LOG MEAN	LOG STD	LOG SKEW	LOG Q50	Q50	UNBIASED RET	COEFF
37	404.5134	168.4045	1.3211	5.9231	0.4029	0.2044	7.0843	1193.0559	70.9839	2.8817
THEIR Q50	0.87644E 03		0.67759E 01							

STATION NUMBER 1105000 STATE # 25

# OBS	MEAN	STD	SKEW	LOG MEAN	LOG STD	LOG SKEW	LOG Q50	Q50	UNBIASED RET	COEFF
35	396.4856	261.8062	2.2689	5.8510	0.4770	0.2451	7.3873	1615.3335	75.9471	3.2208
THEIR Q50	0.11926E 04		0.70839E 01							

STATION NUMBER 1109000 STATE # 25

# OBS	MEAN	STD	SKEW	LOG MEAN	LOG STD	LOG SKEW	LOG Q50	Q50	UNBIASED RET	COEFF
48	509.7083	242.8621	1.5376	6.1459	0.4078	0.1993	7.3337	1531.1123	67.4274	2.9131
THEIR Q50	0.12208E 04		0.71073E 01							

STATION NUMBER 1162500 STATE # 25

# OBS	MEAN	STD	SKEW	LOG MEAN	LOG STD	LOG SKEW	LOG Q50	Q50	UNBIASED RET	COEFF
56	459.3213	437.3938	3.7203	5.9057	0.6195	0.3159	7.9278	2773.1975	68.5556	3.2641
THEIR Q50	0.16197E 04		0.73900E 01							

STATION NUMBER 1165000 STATE # 25

# OBS	MEAN	STD	SKEW	LOG MEAN	LOG STD	LOG SKEW	LOG Q50	Q50	UNBIASED RET	COEFF
57	794.4736	779.8022	3.8902	6.4692	0.5628	0.2616	8.3086	4058.6016	68.2854	3.2684
THEIR Q50	0.29642E 04		0.79944E 01							

STATION NUMBER 1165500 STATE # 25

# OBS	MEAN	STD	SKEW	LOG MEAN	LOG STD	LOG SKEW	LOG Q50	Q50	UNBIASED RET	COEFF
58	321.1377	247.4565	2.7692	5.5771	0.6025	0.3253	7.4885	1787.4451	67.7401	3.1727
THEIR Q50	0.10240E 04		0.69315E 01							

STATION NUMBER 1171500 STATE # 25

# OBS	MEAN	STD	SKEW	LOG MEAN	LOG STD	LOG SKEW	LOG Q50	Q50	UNBIASED RET	COEFF
35	2155.4285	1192.6052	1.8293	7.5298	0.5743	0.2292	9.3077	11022.1797	74.5041	3.0959
THEIR Q50	0.49556E 04		0.85085E 01							

STATION NUMBER 1172500 STATE # 25

# OBS	MEAN	STD	SKEW	LOG MEAN	LOG STD	LOG SKEW	LOG Q50	Q50	UNBIASED RET	COEFF
27	733.2961	362.0159	1.6014	6.4997	0.4356	0.2014	7.8536	2575.0110	81.1567	3.1080
THEIR Q50	0.18600E 04		0.75283E 01							

2 REDUCE

2.1

1 Recalculates unbiased Q50's limiting the raw data space skew.

2 Calls:

Load

Intery (Interp)

Offset

3

4 The data cards output by "Bigflow" are read. If the raw space skew is less than S1 the data is punched unchanged. Otherwise the raw space skew is set to S1, the raw space std is set to S2 times the raw space mean, the $\log_e$ space std is set to S3, and the $\log_e$ space skew is recalculated. "Intery" is then called with a skew of S1 and a new Q50 is calculated. The updated data is then punched. The actual values of S1, S2, S3 were:

S1 = 5.0

S2 = 1.155

S3 = 0.9206

5

6a skew (x) = $\left(\frac{\text{std}(x)}{\text{mean } x}\right)^3 + 3\left(\frac{\text{std}(x)}{\text{mean } x}\right)$. So if

we set the skew to 5.0, $\frac{\text{std}(x)}{\text{mean } x} = 1.1555$.

b The equations linking raw and log space are:

let μ_x = mean in raw space

δ_x = std in raw space

μ_y = mean in log space

δ_y = std in log space

1. $\exp(\mu_y + \frac{\delta_y}{2}) = \mu_x$

2. $\exp(2\mu_y+2\delta_y^2) - \exp(2\mu_y+\delta_y^2) = \delta_x^2$

3. $\delta_x^2 = \exp(2\mu_y+\delta_y^2)*(\exp(\delta_y^2)-1)$

1 and 3 $\rightarrow$ $\frac{\delta_x^2}{\mu_x^2} = \exp(\delta_y^2) - 1$

From 6a we have $\frac{\delta_x}{\mu_x} = 1.155$ so

$\delta_y = \sqrt{\text{Ln}(1.555^2 + 1)} = .9206$

7 12/15/75 Raiffa

8

2.2

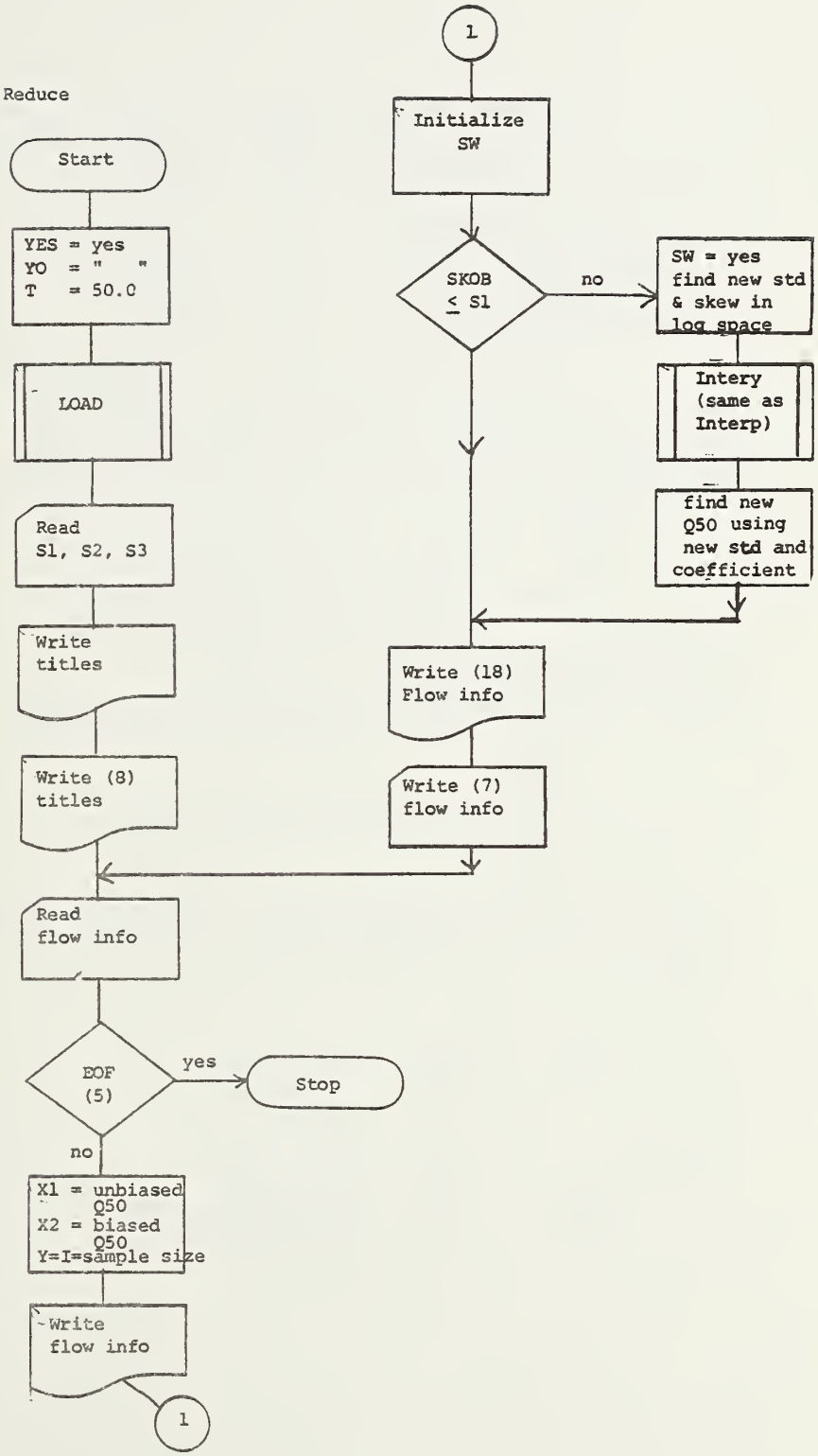
1 SW = initialized to blank for each station and set to "yes" if skew > S1 and updating is needed (not used for branching)

2

3	SM	=	real	array	holds skew category values
	YM	=	real	array	holds no. of observations category values
	TM	=	real	array	holds return interval category values
	XT	=	real	array	holds true expected value table
	XL	=	real	array	holds log normal expected value talbe
	SL	=	real	array	holds log normal std table
	Yes	=	real		"Yes" used in setting SW
	YO	=	real		" " used in setting SW
	T	=	real		desired return interval
	S1	=	real		maximum skew
	S2	=	real		C.V. corresponding to skew of S1
	S3	=	real		log std corresponding to skew of S1
	IST	=	integer		station no.
	ISTATE	=	integer		state no.
	I	=	integer		no. of observations
	A50	=	real		unbiased Q50 in log space
	ANI	=	real		biased Q50 in log space
	X1	=	real		unbiased Q50
	X2	=	real		biased Q50
	XNB	=	real		mean
	STB	=	real		std

SKOB	=	real	skew
XBAR	=	real	mean in log space
STD	=	real	std in log space
SKEW	=	real	skew in log space
TNEW	=	real	unbiased return interval
CO	=	real	coefficient from WW1 table

2.3 Reduce


Start
YES = yes
YO = " "
T = 50.0
LOAD
Read
S1, S2, S3
Write
titles
Write (8)
titles
Read
flow info
EOF
(5)
yes
Stop
no
X1 = unbiased
Q50
X2 = biased
Q50
Y=I=sample size
Write
flow info
1
1
Initialize
SW
SKOB
≤ S1
no
SW = yes
find new std
& skew in
log space
Intery
(same as
Interp)
find new
Q50 using
new std and
coefficient
Write (18)
Flow info
Write (7)
flow info

2.5-2.7 Program run preparation

The following is a complete deck setup for this program.

1. Job card
2. System control cards
3. Source code
4. WW1 deck
5. Max. skew card
6. Q50 statistics cards

Input preparation

Input is from cards.

Max. skew card (1 card).

column	format	description
1-7	F7.0	maximum skew (5.0)
8-14	F7.0	real space C.V. (1.155)
15-21	F7.0	log space skew (.9206)

Q50 statistics card (1 for each station).

These are the cards output by "Bigflow" to card punch file 3 unit 16. Check "Bigflow" for their format.

Output

Output is to one card file and two printer files.

Card output unit 7.

These cards are in the same format as the Q50 statistics' input cards. The only difference is that some of the output cards will have updated "skews," "std's," and "log std's."

Printer file 1 unit 6.

line	column	format	description
1			Titles
for each station	2-9	I8	station no.
	10-14	I5	state no.
	15-19	I5	no. of flow years
	20-28	F9.1	unbiased Q50
	29-37	F10.1	biased Q50

line	column	format	description
	38-50	F13.3	mean (flow)
	51-63	F13.3	std (flow)
	69-75	F7.4	skew (flow)
	79-85	F7.4	log (unbiased Q50)
	89-95	F7.4	log (biased Q50)
	99-105	F7.4	mean (log(flows))
	109-115	F7.4	std (log(flows))
	119-125	F7.4	skew (log(flows))

Printer file 2 unit 8.

Printer file 2 is exacly like printer file 1 except that in some lines the "skew," "std," and "log std" may have been updated. For those lines which have been updated, printer file 2 has "yes" in columns 129-132.

```
//REDUCE JOB (0210,D75,DESK),'RAIFFA MJ',CLASS=A,TIME=1                    JOB 558
// EXEC FORTGCLG,ACCT=COST
XXFORT     EXEC PGM=IEYFORT,REGION=128K                                   00000100
XXSYSLIN   DD DSN=&&LOADSET,DISP=(MOD,PASS),UNIT=DISK,                    00000200
XX            SPACE=(80,(200,100),RLSE),DCB=BLKSIZE=400                   00000300
XXSYSPRINT DD SYSOUT=A,DCB=(LRECL=120,RECFM=FBA,BLKSIZE=120)              00000400
XXSYSPUNCH DD SYSOUT=(B,,3),DCB=(LRECL=80,BLKSIZE=80,RECFM=FB)            00000500
XXSYSUDUMP DD SYSOUT=A                                                    00000600
//FORT.SYSIN DD *
*********************************************************************************************************************************
*     JOB REDUCE                                  STARTED 12.15.17    FEB 03, 1976                              OS VERSION 21.8A    *
*********************************************************************************************************************************
IEF236I ALLOC. FOR REDUCE   FORT
IEF237I 351   ALLOCATED TO SYSLIN
IEF237I 183   ALLOCATED TO SYSPRINT
IEF237I 1D0   ALLOCATED TO SYSPUNCH
IEF237I 187   ALLOCATED TO SYSUDUMP
IEF237I 162   ALLOCATED TO SYSIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS76034.T121513.RV000.REDUCE.LOADSET        PASSED
IEF285I   VOL SER NOS= SP0002.
*********************************************************************************************************************************
*     STEP FORT          CPU TIME    2.91 SECS  STARTED 12.15.17  ENDED 12.15.25  SYSIN:  150   STEP USED  84K OF 128K REGION    *
*     EXCPS:   DISK     31                                                          JOBSTEP COST =  $1.86(APPROXIMATE)    *
*********************************************************************************************************************************
XXLKED EXEC PGM=IEWL,PARM=(XREF,LET,LIST),COND=(4,LT,FORT)                00000700
XXSYSLIB   DD  DSNAME=SYS1.FORTLIB,DISP=SHR                               00000800
XXSYSLMOD  DD  DSN=&&GOSET(MAIN),DISP=(MOD,PASS),UNIT=DISK,               00000900
XX             SPACE=(1024,(20,10,1),RLSE)                                00001000
XXSYSUT1   DD  UNIT=(DISK,SEP=SYSLMOD),SPACE=(1024,(20,10),RLSE),         00001100
XX             DCB=BLKSIZE=1024                                           00001200
XXSYSLIN   DD  DSN=&&LOADSET,DISP=(OLD,DELETE)                            00001300
XX         DD  DDNAME=SYSIN                                               00001400
XXSYSPRINT DD  SYSOUT=A,DCB=(BLKSIZE=121,LRECL=121,RECFM=FBM),            00001500
XX    SPACE=(TRK,(10,10),RLSE)                                            00001600
XXSYSUDUMP DD SYSOUT=A                                                    00001700
IEF236I ALLOC. FOR REDUCE   LKED
IEF237I 150   ALLOCATED TO SYSLIB
IEF237I 351   ALLOCATED TO SYSLMOD
IEF237I 350   ALLOCATED TO SYSUT1
IEF237I 351   ALLOCATED TO SYSLIN
IEF237I 183   ALLOCATED TO SYSPRINT
IEF237I 187   ALLOCATED TO SYSUDUMP
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS1.FORTLIB                                 KEPT
IEF285I   VOL SER NOS= SP0017.
IEF285I   SYS76034.T121513.RV000.REDUCE.GOSET          PASSED
IEF285I   VOL SER NOS= SP0002.
IEF285I   SYS76034.T121513.RV000.REDUCE.R0000005       DELETED
IEF285I   VOL SER NOS= SP0004.
IEF285I   SYS76034.T121513.RV000.REDUCE.LOADSET        DELETED
IEF285I   VOL SER NOS= SP0002.
```

```
*********************************************************************************************************************************
*     STEP LKED           CPU TIME    1.05 SECS  STARTED 12.15.25  ENDED 12.16.09                    STEP USED 122K OF 128K REGION   *
*     EXCPS:   DISK    151                                                                          JOBSTEP COST =  $1.33(APPROXIMATE)   *
*********************************************************************************************************************************
XXGO EXEC PGM=*.LKED.SYSLMOD,COND=((4,LT,FORT),(4,LT,LKED))                                    00001800
XXFT05F001 DD  DDNAME=SYSIN                                                                    00001900
XXFT06F001 DD SYSOUT=A,DCB=(LRECL=133,RECFM=FBA,BLKSIZE=133)                                   00002000
XXFT07F001 DD  SYSOUT=(B,,2),DCB=(LRECL=80,RECFM=FB,BLKSIZE=80)                                00002100
XXSYSUDUMP DD SYSOUT=A                                                                         00002200
//GO.FT08F001 DD SYSOUT=A
IEF236I ALLOC. FOR REDUCE    GO
IEF237I 351    ALLOCATED TO PGM=*.DD
IEF237I 163    ALLOCATED TO FT05F001
IEF237I 183    ALLOCATED TO FT06F001
IEF237I 101    ALLOCATED TO FT07F001
IEF237I 187    ALLOCATED TO SYSUDUMP
IEF237I 188    ALLOCATED TO FT08F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I    SYS76034.T121513.RV000.REDUCE.GOSET          PASSED
IEF285I    VOL SER NOS= SP0002.
*********************************************************************************************************************************
*     STEP GO             CPU TIME   16.65 SECS  STARTED 12.16.09  ENDED 12.16.39  SYSIN: 1071   STEP USED  40K OF 128K REGION   *
*     EXCPS:   DISK     00                                                                         JOBSTEP COST =  $9.88(APPROXIMATE)   *
*********************************************************************************************************************************
IEF285I    SYS76034.T121513.RV000.REDUCE.GOSET          DELETED
IEF285I    VOL SER NOS= SP0002.
*********************************************************************************************************************************
*     JOB REDUCE    TOTAL CPU TIME   20.61 SECS  STARTED 12.15.17  ENDED 12.16.41    FEB 03, 1976  JOBLOG 76034411479REDUCE      *
*********************************************************************************************************************************
```

```
0001              DIMENSION SM(13),YM(6),TM(9),XT(13,9),XL(13,6,9),SL(13,6,9)
0002              DATA YES,YO/'YES','    '/
0003              T=50.0
0004              CALL LOAD(SM,YM,TM,XT,XL,SL)
0005              READ(5,100)S1,S2,S3
0006          100 FORMAT(3F7.0)
0007              WRITE(6,101)
0008              WRITE(8,102)
0009            1 READ(5,103,END=99)IST,ISTATE,I,A50,AN1,XNB,STB,SKOB,XBAR,
                 XSTD,SKEW
0010              X1=EXP(A50)
0011              X2=EXP(AN1)
0012              YEAR=I
0013              WRITE(6,104)IST,ISTATE,I,X1,X2,XNB,STB,SKOB,
                 XA50,AN1,XBAR,STD,SKEW
0014              SW=YO
0015              IF(SKOB .LE. S1)GO TO 2
0016              SW=YES
0017              SKOB=S1
0018              STB=S2*XNB
0019              STD=S3
0020              SKEW=S3/XBAR
0021              SKEW=SKEW**3+3*SKEW
0022              CALL INTERY(SKOB,YEAR,T,TNEW,CO,XT,XL,SM,YM,TM)
0023              A50=XBAR+CO*STD
0024              X1=EXP(A50)
0025            2 WRITE(8,104)IST,ISTATE,I,X1,X2,XNB,STB,SKOB,
                 XA50,AN1,XBAR,STD,SKEW,SW
0026              WRITE(7,103)IST,ISTATE,I,A50,AN1,XNB,STB,SKOB,XBAR,STD,SKEW
0027              GO TO 1
0028          101 FORMAT('  STA #   STATE    #  OUR Q50  THEIR Q50      MEAN',
                 X'          STD         SKEW    OUR Q50  THEIR Q50  LOG MEAN  ',
                 X'LOG STD  LOG SKEW'/)
0029          102 FORMAT('  STA #   STATE    #  OUR Q50  THEIR Q50      MEAN',
                 X'          STD         SKEW    OUR Q50  THEIR Q50  LOG MEAN  ',
                 X'LOG STD  LOG SKEW CHNG'/)
0030          103 FORMAT(I8,2I2,2F7.4,2F9.2,4F7.4)
0031          104 FORMAT(1X,I8,2I5,F9.1,F10.1,F13.3,F13.3,5X,F7.4,3X,F7.4,
                 X3X,F7.4,3X,F7.4,3X,F7.4,2X,F7.4,3X,A3)
0032           99 STOP
0033              END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
LOAD	B0	IBCOM#	B4	INTERY	B8	EXP	BC		

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
YES	10C	YO	110	T	114	S1	118	S2	11C
S3	120	IST	124	ISTATE	128	I	12C	A50	130
AN1	134	XNB	138	STB	13C	SKOB	140	XBAR	144
STD	148	SKEW	14C	X1	150	X2	154	YEAR	158
SW	15C	TNEW	160	CO	164				

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
SM	168	YM	19C	TM	1B4	XT	1D8	XL	3AC
SL	EA4								

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
100	199C	101	19A3	102	1A2A	103	1AB6	104	1ACD

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
2	1B68	3	1B68	4	1B74	5	1B82	7	1BB0
8	1BC4	9	1BD8	10	1C48	11	1C5A	12	1C6C
13	1C90	14	1D0C	15	1D14	16	1D22	17	1D2A
18	1D32	19	1D3E	20	1D46	21	1D52	22	1D6A
23	1D78	24	1D88	25	1D9A	26	1E20	27	1E8C
32	1E92								

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = MAIN , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 33,PROGRAM SIZE = 7840
STATISTICS NO DIAGNOSTICS GENERATED

STA #	STATE	#	OUR Q50	THEIR Q50	MEAN	STD	SKEW	OUR Q50	THEIR Q50	LOG MEAN	LOG STD	LOG SKEW
2181800	13	20	5920.8	1102.2	204.150	210.980	4.2042	8.6862	7.0051	4.8836	0.9428	0.5863
2182000	13	48	35774.8	11845.5	2978.750	2916.070	3.8751	10.4850	9.3797	7.6483	0.8533	0.3361
2188500	13	33	14067.2	4923.6	1744.820	1255.930	2.5324	9.5516	8.5018	7.2435	0.7003	0.2909
2189030	13	11	555.4	266.1	112.360	50.470	1.4383	6.3196	5.5840	4.6184	0.4891	0.3189
2190800	13	15	2042.2	592.2	214.200	122.830	1.9088	7.6218	6.3839	5.1809	0.6711	0.3908
2191270	13	11	79221.3	5481.9	1036.450	1197.110	5.0058	11.2800	8.6092	6.5014	0.9710	0.4514
2191280	13	11	2187.7	273.4	114.550	62.730	1.8071	7.6906	5.6109	4.5025	0.8529	0.5751
2191600	13	11	58442.6	4242.0	774.820	880.630	4.8778	10.9758	8.3528	6.2074	0.9740	0.4746
2191750	13	11	6048.1	2565.0	949.270	494.040	1.7023	8.7075	7.8497	6.7263	0.5409	0.2418
2191890	13	11	30302.9	4203.6	1119.360	844.700	2.6936	10.3190	8.3437	6.7267	0.8490	0.3806
2191910	13	16	1699.7	569.3	167.500	125.070	2.6565	7.4382	6.3444	4.9179	0.6434	0.3947
2191930	13	11	3398.2	1706.7	609.820	329.600	1.7793	8.1310	7.4423	6.2966	0.4934	0.2355
2191960	13	16	2627.5	726.4	240.690	167.450	2.4238	7.8738	6.5881	5.2769	0.6795	0.3884
2191970	13	14	2285.6	573.8	230.290	128.990	1.8561	7.7344	6.3522	5.2574	0.6797	0.3900
2192300	13	16	298.9	88.3	47.940	24.400	1.6587	5.7000	4.4804	3.7419	0.5681	0.4590
2192400	13	11	6216.7	1631.1	611.180	326.220	1.7533	8.7350	7.3970	6.2381	0.6749	0.3259
2192420	13	11	4069.2	532.9	165.270	108.290	2.2469	8.3112	6.2783	4.8295	0.8702	0.5464
2193300	13	11	7430.1	3038.4	994.270	596.080	2.0140	8.9133	8.0191	6.7563	0.5552	0.2471
2193400	13	11	3322.3	1382.6	543.180	274.260	1.6434	8.1084	7.2317	6.1734	0.5343	0.2603
2193600	13	11	1519.0	776.8	383.910	153.640	1.2647	7.3258	6.6552	5.8695	0.4363	0.2234
2197600	13	16	3187.5	1332.9	504.250	277.280	1.8159	8.0670	7.1951	6.0810	0.5609	0.2775
2200930	13	10	5017.1	1210.4	290.400	244.060	3.1149	8.5206	7.0987	5.4365	0.6840	0.3794
2201110	13	10	4425.8	1110.1	315.100	214.710	2.3606	8.3952	7.0122	5.5408	0.6932	0.3773
2201160	13	10	63430.4	2743.5	597.500	553.500	3.5740	11.0577	7.9170	5.9386	1.0971	0.5605
2201250	13	11	147.1	100.1	46.820	17.790	1.1950	4.9913	4.6059	3.7834	0.3682	0.2929
2201830	13	10	530.6	330.5	171.900	60.950	1.1083	6.2741	5.8005	5.0882	0.3667	0.2166
2202810	13	10	1194.8	246.2	151.800	61.210	1.2752	7.0857	5.5063	4.8874	0.6510	0.4019
2202820	13	9	1902.5	393.9	249.330	101.630	1.2906	7.5509	5.9762	5.3914	0.6310	0.3527
2202850	13	10	1668.2	285.1	168.400	77.080	1.4690	7.4195	5.6529	4.9720	0.6923	0.4204
2202910	13	10	21800.7	1050.5	160.100	181.390	4.8532	9.9897	6.9570	4.5475	1.0875	0.7311
2202950	13	10	2513.4	421.6	137.800	94.940	2.3939	7.8294	6.0440	4.6940	0.7581	0.4887
2203150	13	10	34372.1	1227.5	234.500	262.390	4.7577	10.4450	7.1127	4.9568	1.1014	0.6776
2203800	13	24	14920.6	8397.6	3254.170	1680.570	1.6870	9.6105	9.0357	7.9636	0.5111	0.1928
2204300	13	14	12896.4	4498.9	1542.000	898.720	1.9465	9.4647	8.4116	7.1721	0.6191	0.2596
2205000	13	20	2464.4	728.8	217.500	168.550	2.7903	7.8097	6.5914	5.1474	0.7071	0.4147
2205500	13	10	4828.1	884.8	344.400	191.420	1.8391	8.4822	6.7854	5.6389	0.7469	0.3997
2206000	13	11	85231.6	3654.8	417.000	659.180	8.6924	11.0857	8.2038	5.3355	1.1273	0.6433
2207000	13	10	10854.1	2486.7	692.700	501.390	2.5507	9.2923	7.8187	6.3185	0.7046	0.3359
2208050	13	10	2376.3	1852.0	859.000	318.140	1.1619	7.7733	7.5240	6.7042	0.3258	0.1459
2215220	13	10	12384.5	206.6	72.200	50.930	2.4670	9.4242	5.3309	3.8074	1.3453	1.1042
2215230	13	10	76741.6	724.5	308.800	244.600	2.8733	11.2482	6.5855	5.2601	1.3612	0.7937
2215245	13	11	52664.6	362.4	134.000	126.280	3.6640	10.8717	5.8928	4.3444	1.4167	1.0130
2215280	13	15	10067.8	800.1	281.870	203.370	2.7982	9.2171	6.6847	5.2161	0.9920	0.5774
2216610	13	9	55999.6	2409.8	379.780	304.800	4.0799	10.9331	7.7873	5.4302	1.1144	0.6243
2217000	13	23	12174.5	5070.0	1534.040	1022.050	2.2945	9.4071	8.5311	7.1332	0.6521	0.2750
2217250	13	11	1369.6	287.9	116.640	66.400	1.8923	7.2223	5.6625	4.5736	0.6971	0.4608
2217400	13	10	1182.0	886.5	469.000	149.230	0.9868	7.0750	6.7873	6.1068	0.3098	0.1523
2217660	13	11	1470.6	434.8	207.640	97.070	1.5048	7.2934	6.0750	5.2021	0.5934	0.3437
2218100	13	11	5643.2	1423.3	376.270	271.760	2.5434	8.6382	7.2607	5.7017	0.7071	0.3739
2218450	13	11	8582.7	2625.7	891.450	507.300	1.8915	9.0575	7.8731	6.6196	0.6417	0.2917
2221000	13	23	8610.2	3746.6	1389.610	793.160	1.8983	9.0607	8.2286	7.0778	0.5917	0.2514
2223300	13	12	16068.2	2339.3	492.080	492.030	3.9994	9.6846	7.7576	5.8624	0.8264	0.4257
2223700	13	8	943.7	322.5	112.130	61.550	1.8123	6.8498	5.7760	4.5753	0.5860	0.3864
2224200	13	10	5352.9	1344.8	686.700	334.220	1.5754	8.5854	7.2040	6.3957	0.6062	0.2852
2224400	13	10	22570.5	3064.4	452.800	632.370	6.9137	10.0244	8.0276	5.6715	0.8454	0.4505
2224650	13	9	811.9	552.5	250.890	97.490	1.2243	6.6994	6.3144	5.4628	0.3676	0.2022
2225180	13	8	9422.9	777.2	408.000	216.210	1.7386	9.1509	6.6557	5.7849	0.8807	0.4602
2225210	13	10	4470.7	636.6	201.700	147.640	2.5882	8.4053	6.4561	5.0579	0.7893	0.4719
2225240	13	9	6246.0	786.7	198.110	170.300	3.2140	8.7397	6.6679	5.0039	0.8074	0.4863
2225330	13	10	9211.4	906.1	292.900	229.300	2.8284	9.1282	6.8091	5.3968	0.8531	0.4782

STA #	STATE	#	OUR Q50	THEIR Q50	MEAN	STD	SKEW	OUR Q50	THEIR Q50	LOG MEAN	LOG STD	LOG SKEW	CHNG
2181800	13	20	5920.6	1102.2	204.150	210.980	4.2042	8.6862	7.0051	4.8836	0.9428	0.5863	
2182000	13	48	35774.8	11845.5	2978.750	2916.070	3.8751	10.4850	9.3797	7.6483	0.8533	0.3361	
2188500	13	33	14067.2	4923.6	1744.820	1255.930	2.5324	9.5516	8.5018	7.2435	0.7003	0.2909	
2189030	13	11	555.4	266.1	112.360	50.470	1.4383	6.3196	5.5840	4.6184	0.4891	0.3189	
2190800	13	15	2042.2	592.2	214.200	122.830	1.9088	7.6218	6.3839	5.1809	0.6711	0.3908	
2191270	13	11	61817.6	5481.9	1036.450	1197.099	5.0000	11.0319	8.6092	6.5014	0.9206	0.4277	YES
2191280	13	11	2187.7	273.4	114.550	62.730	1.8071	7.6906	5.6109	4.5025	0.8529	0.5751	
2191600	13	11	58442.6	4242.0	774.820	880.630	4.8778	10.9758	8.3528	6.2074	0.9740	0.4746	
2191750	13	11	6048.1	2565.0	949.270	494.040	1.7023	8.7075	7.8497	6.7263	0.5409	0.2418	
2191890	13	11	30302.9	4203.6	1119.360	844.700	2.6936	10.3190	8.3437	6.7267	0.8490	0.3806	
2191910	13	16	1699.7	569.3	167.500	125.070	2.6565	7.4382	6.3444	4.9179	0.6434	0.3947	
2191930	13	11	3398.2	1706.7	609.820	329.600	1.7793	8.1310	7.4423	6.2966	0.4934	0.2355	
2191960	13	16	2627.5	726.4	240.690	167.450	2.4238	7.8738	6.5881	5.2769	0.6795	0.3884	
2191970	13	14	2285.6	573.8	230.290	128.990	1.8561	7.7344	6.3522	5.2574	0.6797	0.3900	
2192300	13	16	298.9	88.3	47.940	24.400	1.6587	5.7000	4.4804	3.7419	0.5681	0.4590	
2192400	13	11	6216.7	1631.1	611.180	326.220	1.7533	8.7350	7.3970	6.2381	0.6749	0.3259	
2192420	13	11	4069.2	532.9	165.270	108.290	2.2469	8.3112	6.2783	4.8295	0.8702	0.5464	
2193300	13	11	7430.1	3038.4	994.270	596.080	2.0140	8.9133	8.0191	6.7563	0.5552	0.2471	
2193400	13	11	3322.3	1382.6	543.180	274.260	1.6434	8.1084	7.2317	6.1734	0.5343	0.2603	
2193600	13	11	1519.0	776.8	383.910	153.640	1.2647	7.3258	6.6552	5.8695	0.4363	0.2234	
2197600	13	16	3187.5	1332.9	504.250	277.280	1.8159	8.0670	7.1951	6.0810	0.5609	0.2775	
2200930	13	10	5017.1	1210.4	290.400	244.060	3.1149	8.5206	7.0987	5.4365	0.6840	0.3794	
2201110	13	10	4425.8	1110.1	315.100	214.710	2.3606	8.3952	7.0122	5.5408	0.6932	0.3773	
2201160	13	10	63430.4	2743.5	597.500	553.500	3.5740	11.0577	7.9170	5.9386	1.0971	0.5605	
2201250	13	11	147.1	100.1	46.820	17.790	1.1950	4.9913	4.6059	3.7834	0.3682	0.2929	
2201830	13	10	530.6	330.5	171.900	60.950	1.1083	6.2741	5.8005	5.0882	0.3667	0.2166	
2202810	13	10	1194.8	246.2	151.800	61.210	1.2752	7.0857	5.5063	4.8874	0.6510	0.4019	
2202820	13	9	1902.5	393.9	249.330	101.630	1.2906	7.5509	5.9762	5.3914	0.6310	0.3527	
2202850	13	10	1668.2	285.1	168.400	77.080	1.4690	7.4195	5.6529	4.9720	0.6923	0.4204	
2202910	13	10	21800.7	1050.5	160.100	181.390	4.8532	9.9897	6.9570	4.5475	1.0875	0.7311	
2202950	13	10	2513.4	421.6	137.800	94.940	2.3939	7.8294	6.0440	4.6940	0.7581	0.4887	
2203150	13	10	34372.1	1227.5	234.500	262.390	4.7577	10.4450	7.1127	4.9566	1.1014	0.6776	
2203800	13	24	14920.6	8397.6	3254.170	1680.570	1.6870	9.6105	9.0357	7.9636	0.5111	0.1928	
2204300	13	14	12896.4	4498.9	1542.000	898.720	1.9465	9.4647	8.4116	7.1721	0.6191	0.2596	
2205000	13	20	2464.4	728.8	217.500	168.550	2.7903	7.8097	6.5914	5.1474	0.7071	0.4147	
2205500	13	10	4828.1	884.8	344.400	191.420	1.8391	8.4822	6.7854	5.6389	0.7469	0.3997	
2206000	13	11	19265.0	3654.8	417.000	481.635	5.0000	9.8660	8.2038	5.3355	0.9206	0.5228	YES
2207000	13	10	10854.1	2486.7	692.700	501.390	2.5507	9.2923	7.8187	6.3185	0.7046	0.3359	
2208050	13	10	2376.3	1852.0	859.000	318.140	1.1619	7.7733	7.5240	6.7042	0.3258	0.1459	
2215220	13	10	12384.5	206.6	72.200	50.930	2.4670	9.4242	5.3309	3.8074	1.3453	1.1042	
2215230	13	10	76741.6	724.5	308.800	244.600	2.8733	11.2482	6.5855	5.2601	1.3612	0.7937	
2215245	13	11	52664.6	362.4	134.000	126.280	3.6640	10.8717	5.8928	4.3444	1.4167	1.0130	
2215280	13	15	10067.8	800.1	261.870	203.370	2.7982	9.2171	6.6847	5.2161	0.9920	0.5774	
2216810	13	9	55999.6	2409.8	379.780	384.800	4.0799	10.9331	7.7873	5.4302	1.1144	0.6243	
2217000	13	23	12174.5	5070.0	1534.040	1022.050	2.2945	9.4071	8.5311	7.1332	0.6521	0.2750	
2217250	13	11	1369.6	287.9	116.640	66.400	1.8923	7.2223	5.6625	4.5736	0.6971	0.4608	
2217400	13	10	1182.0	886.5	469.000	149.230	0.9868	7.0750	6.7873	6.1068	0.3098	0.1523	
2217660	13	11	1470.6	434.8	207.640	97.070	1.5048	7.2934	6.0750	5.2021	0.5934	0.3437	
2218100	13	11	5643.2	1423.3	376.270	271.760	2.5434	8.6382	7.2607	5.7017	0.7071	0.3739	
2218450	13	11	8582.7	2625.7	891.450	507.300	1.8915	9.0575	7.8731	6.6196	0.6417	0.2917	
2221000	13	23	8610.2	3746.6	1389.610	793.160	1.8983	9.0607	8.2286	7.0778	0.5917	0.2514	
2223300	13	12	16068.2	2339.3	492.080	492.030	3.9994	9.6846	7.7576	5.8624	0.8264	0.4257	
2223700	13	8	943.7	322.5	112.130	61.550	1.8123	6.8498	5.7760	4.5753	0.5860	0.3864	
2224200	13	10	5352.9	1344.8	686.700	334.220	1.5754	8.5854	7.2040	6.3957	0.6062	0.2852	
2224400	13	10	30009.0	3064.4	452.800	522.984	5.0000	10.3093	8.0276	5.6715	0.9206	0.4913	YES
2224650	13	9	811.9	552.5	250.890	97.490	1.2243	6.6994	6.3144	5.4628	0.3676	0.2022	
2225180	13	8	9422.9	777.2	408.000	216.210	1.7386	9.1509	6.6557	5.7849	0.8807	0.4602	
2225210	13	10	4470.7	636.6	201.700	147.640	2.5882	8.4053	6.4561	5.0579	0.7893	0.4719	
2225240	13	9	6246.0	786.7	198.110	170.300	3.2140	8.7397	6.6679	5.0039	0.8074	0.4883	
2225330	13	10	9211.4	906.1	292.900	229.300	2.8284	9.1282	6.8091	5.3968	0.8531	0.4782	
2225350	13	10	3019.7	498.7	130.800	94.850	2.5569	8.0129	6.2121	4.6034	0.8072	0.5314	

3 R50

3.1

1 R50 finds the cross correlations of Q50's for up to 25 stations. This is done by first calculating the cross correlations of the annual flows (QA), and then generating synthetic series of flows, using the statistics of the annual flows. From the synthetic series of annual flows, you can calculate Q50's and then find the cross correlation of the Q50's (see model).

2 Calls:

Load

Outp

Vcor

Trans

Tr

Rowq50

Gen

Gauss

Statl

Interp

Offset

Stat2

3a For each pair of stations, there must be at least three years when both stations have flows greater than 0.

b At most 70 years can be represented. i.e., you could not have station 1 with flow years 1900-1960 and station 2 with flow years 1915-1975, since this would be a spread of 75 years.

4 There are two possible approaches. Suppose you have three stations. Station 1 has flows from 1950-1970, station 2 has flows from 1950-1975, and station 3 has flows from 1955-1975.

Approach one says throw away the years 1950-1954 and 1971-1975. Then you have a nice solid 3 by 16 matrix with no missing entries.

Approach two says why waste data. For pair (1,2) use 1950-1970, for (1,3) use 1955-1970, and for (2,3) use 1955-1975.

We have adopted approach two. That means, for each pair (I,J) we not only have to find the cross correlation of the annual flows, but also the means and std's of the annual flows for the years that stations I and J have in common. (Since the correlation matrix is symmetric we really only consider pairs (I,J) where I<J).

5a Input flow data.

b Calculate and print means, std's cross correlations of annual flows.

c Transform to log space for calculating synthetic flows. Print the log space covariances, means, and variances.

d Generate synthetic sequences, find the correlation of the Q50's, and print the correlations for sequences of length L1 and L2 (10,25).

6 (See "Vcor," "Tr," and "Gen".)

Suppose we have two stations with n years of flow in common.

$x_1 \ldots x_n$, $y_1 \ldots y_n$. We find the means, std's and correlation (Vcor). We then transform to log space and find the means, variances, and covariance (Tr). Finally, we generate two new sets of m observations (Gen). Call these new sets $w_1 \ldots w_m$ and $z_1 \ldots z_m$.

Then, the expected mean and std of the w's = mean and std of the x's, and the expected mean and std of the z's = mean and std of the y's. In addition, the expected correlation of w & z = correlation of x & y.

We find the Q50 of the w's and the Q50 of the z's then generate new sets and find new Q50's. Finally, we find the correlation of the synthetic Q50's.

7 2/6/76 Raiffa

8

3.2

1 IY = integer — year of flow, if 99 next station

2 Do loops:

Do 50 I = zero array

Do 10 I = zero array

Do 10 J = zero array

Do 20 I = indexes through stations so that flows can be read

Do 30 I = write no. of flows, mean, and std for each station

3	Q =	real	array	holds flow data
	XB =	real	array	holds means of annual flows
	ST =	real	array	holds std's of annual flows (see *)
	R =	real	array	if I < J, R(I,J) = correlation of annual flows for stations I&J. If I > J, R(I,J) = no. of years in common for stations I&J.
	B =	real	array	holds correlations of Q50. If I < J, B(I,J) = correlation of Q50's for stations I&J based on sets of length L1 (L1 flows used to find each Q50). If I > J, B(I,J) = correlation based on sets of length L2.

XB1	=	real	array	holds means in log space (see *)
COV	=	real	array	variance covariance matrix in log space
B1	=	real	array	not used
ANS	=	real	array	holds variances in log space (see *)
N1	=	integer	array	no. of flow years for each station
LAB	=	integer	array	used for labeling matrices
FMT	=	real	array	variable format for printing matrices
XT	=	real	array	true expected value table (WW1)
SL	=	real	array	log normal expected value table
SM	=	real	array	skew category values (WW1)
YM	=	real	array	no. of observations category values
TM	=	real	array	return interval category values
L1	=	integer		L1 annual flows for each Q50
L2	=	integer		L2 annual flows for each Q50
M	=	integer		M pairs of Q50's to find the correlation of Q50 for each pair of stations
NS	=	integer		no. of stations
NY	=	integer		range of years (NY $\leq$ 70)
NMIN	=	integer		suppose the stations have flows in the range of years 1910 to 1975. Then, NY might be 66 (or greater)

			and you would pick NMIN s.t. 1 < 10-NMIN and 75-NMIN $\leq$ $\overline{NY}$.
IY	=	integer	year of flow, i.e., if flow was in 1966, IY = 66. Later, IY is reset to (IY - NMIN) the index into "Q" the flow array. IY = 99 means end of station.
VAL	=	real	the flow in year IY
L	=	integer	no. of pairs of stations, i.e., (NS(NS-1))/2
SUM	=	real	average correlation of annual flows
JSE	=	integer	seed for random no. generator

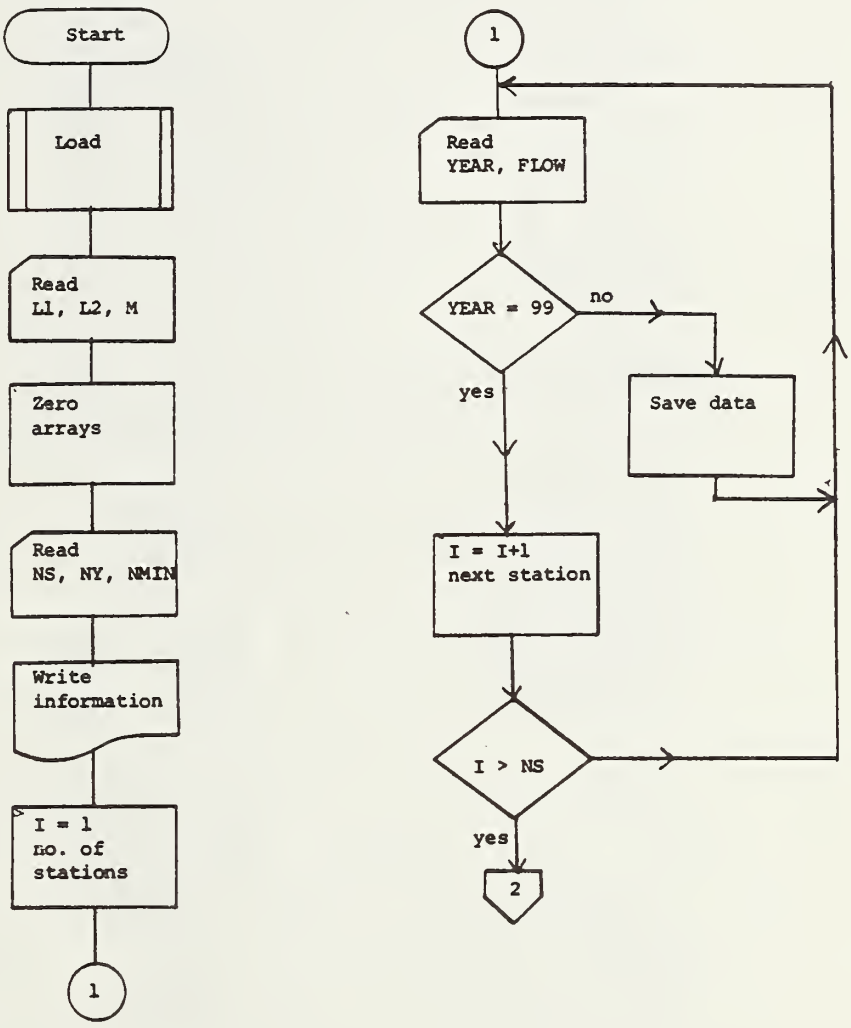
*(As mentioned above, means and std's have to be calculated for each pair of stations since only the years present for both stations are used.

XB(I,J) = mean of flows for station I if I < J

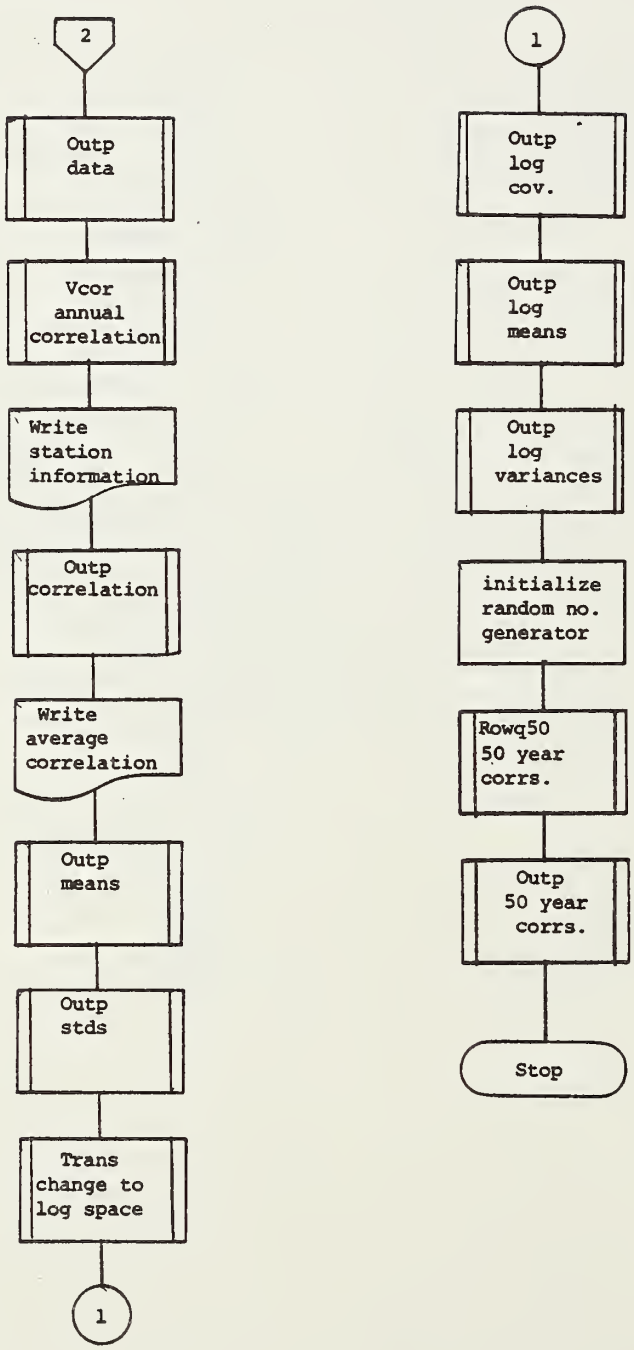
XB(I,J) = mean of flows for station J if I > J

XB(I,I) = mean of all flows for station I).

3.3 R50


Start
Load
Read
L1, L2, M
Zero
arrays
Read
NS, NY, NMIN
Write
information
I = 1
no. of
stations
1
1
Read
YEAR, FLOW
YEAR = 99
no
yes
Save data
I = I+1
next station
I > NS
yes
2

3.3 R50


2
Outp data
Vcor annual correlation
Write station information
Outp correlation
Write average correlation
Outp means
Outp stds
Trans change to log space
1
1
Outp log cov.
Outp log means
Outp log variances
initialize random no. generator
Rowq50 50 year corrs.
Outp 50 year corrs.
Stop

3.5-3.7 Program run preparation

The following is a complete deck for this program.

1. Job card
2. System control cards
3. Source code
4. WWl deck
5. Simulation control card
6. Input data control card
7. Input data cards
8. Label & Format cards

Input preparation

All input is from cards.

Simulation control card.

This card specifies the number of synthetic annual flows to use in finding a synthetic Q50, and the number of synthetic Q50's to use in finding the correlation of Q50.

column	format	name	description
1-3	I3	L1	no. of annual flows per Q50 (10)
4-6	I3	L2	no. of annual flows per Q50 (25)
7-9	I3	M	no. of Q50's to use in finding the correlation

* L1 & L2 $\leq$ 30, M $\leq$ 100

Input data control card.

This card specifies the number of stations, and the range of years of flow data.

column	format	name	description
1-2	I2	NS	no. of stations
3-4	I2	NY	no. of years
5-6	I2	NMIN	minimum year

The range of years for which flow data may be present is

NMIM + 1 to NY + NMIN

* NY = 60 and NMIN = 10 implies 1911 to 1970

Input data cards.

card	column	format	description
1	1-2	I2	year; 1st year of flow for the 1st station
	3-7	F5.0	flow
2	1-2	I2	year; next year of flow
	3-7	F5.0	flow
.			
.			
.			
I	1-2	I2	year; last year of flow for the 1st station
	3-7	F5.0	flow
I+1	1-9	"999999999"	end of station card
I+2	1-2	I2	year; 1st year of flow for the 2nd station
	3-7	F5.0	flow
.			
.			
.			
K	1-2	I2	year; last year of flow for the last station
	3-7	F5.0	flow
K+1	1-9	"999999999"	end of station card.

Label and Format cards.

These cards control the labeling and formating of matrices by subroutine "Outp." For each call to "Outp" (8 calls in all) you need a Label card followed by a Format card. "Outp" then prints a matrix using the label from the Label card and a run time format from the Format card.

Label cards

column	format	description
1-80	20 A4	label for the matrix

Format cards

column	format	description
1-80	20 A4	run time format

* The Label and Format cards actually used are listed below.

```
 1 MASS INPUT DATA
 2 (16,18F7.0)
 3 COR MATRIX R(I,J) = COR OF I AND J IF I<J
     AND = # OF YEARS IN COMMON FOR I<J
 4 (16,18F.3)
 5 MATRIX OF MEANS X(I,J) = MEAN OF I IF I<J AND
     THE MEAN OF J IF I>J
 6 (16,18F7.1)
 7 STANDARD DEVIATIONS (SEE MEAN MATRIX)
 8 (16.18F7.1)
 9 LOG SPACE VARIANCE COVARIANCE MATRIX
10 (16.18F7.4)
11 LOG SPACE MATRIX OF MEANS
12 (16,18F7.3)
13 VARIANCE IN LOG SPACE (SEE LOG MEAN MATRIX)
14 (15,1X,18F7.4)
15 COR. MATRIX FOR Q50  I<J = 10 YEAR SETS, I>J =
     25 YEAR SETS
16 (15,1X,18F7.3)
```

Output

Output is all to the printer, and most of it is printed by subroutine "Outp" using run time formats. I will just list the major sections of printout.

A. NS, M, L1, L2 (see Simulation control card & Input data control card).

B. Input data matrix (Outp).

C. Statistics of the stations.

line	column	format	description
1	1-8	I8	no. of flow years in 1st station
	9-18	F10.2	mean flow of 1st station
	19-28	F10.2	std of 1st station
.			
.			
.			

line	column	format	description
NS	1-8	I8	no. of years for last station
	9-18	F10.2	mean of last station
	19-28	F10.2	std of last station

D. Annual correlation matrix (Outp)
(I,J) = I<J correlation of station I&J
I>J no. of years in which stations I&J both have flows.

E. Number of pairs and average correlation.

F. Means of flows (Outp).

G. Stds of flows (Outp).

H. Log space covariances (Outp).

I. Log space means (Outp).

J. Log space varinaces (Outp).

K. Statistics of the simulation. There is one line of statistics for each pair of stations. Say there are NS stations, then the pairs are

(1,2) (1,3) ... (1,NS)
(2,3) ... (2,NS)
.
.
.
(NS-1,NS)

$\frac{NS(NS-1)}{2}$ pairs in all.

line	column	format	description
1			headers
2			pair (I,J) actually (1,2)
	1-3	I3	I
	4-6	I3	J
	7-13	F7.3	correlation based on L1 annual flows per Q50
	14-20	F7.3	correlation based on L2 annual flows per Q50
	21-32	F12.1	mean Q50 for station I and L1 annual flows

line	column	format	description
	33-44	F12.1	mean Q50 for station J and L1 annual flows
	45-56	F12.1	std of Q50 for station I and L1 annual flows
	57-68	F12.1	std of Q50 for station J and L1 annual flows
	69-70	F12.1	mean Q50 for station I and L2 annual flows per Q50
	71-82	F12.1	mean Q50 for station J and L2 annual flows per Q50
	83-94	F12.1	std of Q50 for station I and L2 annual flows
	95-106	F12.1	std of Q50 for station J and L2 annual flows
3			like 2 for pair (1,3)
.			
.			
.			
$\frac{NS(NS-1)}{2} + 1$			like 2 for pair (NS-1,NS)

L. Summary of statistics.

column	format	description
1-5	F5.0	no. of pairs
19-32	F14.4	average correlation of Q50's based on L1 annual flows per Q50
40-53	F14.4	average correlation of Q50's based on L2 annual flows per Q50

M. Correlations of the Q50's (Outp).

```
//RQ50 JOB (0210,D75,DESK),'RAIFFA MJ',CLASS=D,REGION=160K,TIME=1          JOB  25
// EXEC FORTGCLG,ACCT=COST
XXFORT    EXEC PGM=IEYFORT,REGION=128K                                    00000100
XXSYSLIN  DD DSN=&&LOADSET,DISP=(MOD,PASS),UNIT=DISK,                     00000200
XX           SPACE=(80,(200,100),RLSE),DCB=BLKSIZE=400                    00000300
XXSYSPRINT DD SYSOUT=A,DCB=(LRECL=120,RECFM=FBA,BLKSIZE=120)              00000400
XXSYSPUNCH DD SYSOUT=(B,,3),DCB=(LRECL=80,BLKSIZE=80,RECFM=FB)            00000500
XXSYSUDUMP DD SYSOUT=A                                                    00000600
//FORT.SYSIN DD *
*********************************************************************************************************************************
*     JOB RQ50                                  STARTED 15.19.52    FEB 20, 1976                              OS VERSION 21.8A    *
*********************************************************************************************************************************
IEF236I ALLOC. FOR RQ50     FORT
IEF237I 351    ALLOCATED TO SYSLIN
IEF237I 181    ALLOCATED TO SYSPRINT
IEF237I 100    ALLOCATED TO SYSPUNCH
IEF237I 182    ALLOCATED TO SYSUDUMP
IEF237I 161    ALLOCATED TO SYSIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I    SYS76051.T151945.RV000.RQ50.LOADSET          PASSED
IEF285I    VOL SER NOS= SP0002.
*********************************************************************************************************************************
*     STEP FORT          CPU TIME    9.14 SECS  STARTED 15.19.52  ENDED 15.20.09  SYSIN:  388   STEP USED  92K OF 160K REGION    *
*     EXCPS:   DISK     89                                                    JOBSTEP COST =  $5.33(APPROXIMATE)    *
*********************************************************************************************************************************
XXLKED EXEC PGM=IEWL,PARM=(XREF,LET,LIST),COND=(4,LT,FORT)                00000700
XXSYSLIB   DD  DSNAME=SYS1.FORTLIB,DISP=SHR                               00000800
XXSYSLMOD  DD  DSN=&&GOSET(MAIN),DISP=(MOD,PASS),UNIT=DISK,               00000900
XX             SPACE=(1024,(20,10,1),RLSE)                                00001000
XXSYSUT1   DD  UNIT=(DISK,SEP=SYSLMOD),SPACE=(1024,(20,10),RLSE),         00001100
XX             DCB=BLKSIZE=1024                                           00001200
XXSYSLIN   DD  DSN=&&LOADSET,DISP=(OLD,DELETE)                            00001300
XX             DD  DDNAME=SYSIN                                           00001400
XXSYSPRINT DD  SYSOUT=A,DCB=(BLKSIZE=121,LRECL=121,RECFM=FBM),            00001500
XX    SPACE=(TRK,(10,10),RLSE)                                            00001600
XXSYSUDUMP DD SYSOUT=A                                                    00001700
IEF236I ALLOC. FOR RQ50     LKED
IEF237I 150    ALLOCATED TO SYSLIB
IEF237I 351    ALLOCATED TO SYSLMOD
IEF237I 350    ALLOCATED TO SYSUT1
IEF237I 351    ALLOCATED TO SYSLIN
IEF237I 181    ALLOCATED TO SYSPRINT
IEF237I 182    ALLOCATED TO SYSUDUMP
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I    SYS1.FORTLIB                                 KEPT
IEF285I    VOL SER NOS= SP0017.
IEF285I    SYS76051.T151945.RV000.RQ50.GOSET            PASSED
IEF285I    VOL SER NOS= SP0002.
IEF285I    SYS76051.T151945.RV000.RQ50.R0000005         DELETED
IEF285I    VOL SER NOS= SP0004.
IEF285I    SYS76051.T151945.RV000.RQ50.LOADSET          DELETED
IEF285I    VOL SER NOS= SP0002.
```

```
*********************************************************************************************************************************
*     STEP LKED          CPU TIME    1.45 SECS  STARTED 15.20.09  ENDED 15.20.29                    STEP USED 122K OF 160K REGION     *
*     EXCPS:   DISK    274                                                                        JOBSTEP COST =  $2.18(APPROXIMATE)    *
*********************************************************************************************************************************
XXGO EXEC PGM=*.LKED.SYSLMOD,COND=((4,LT,FORT),(4,LT,LKED))                                    00001800
XXFT05F001 DD  DDNAME=SYSIN                                                                    00001900
XXFT06F001 DD SYSOUT=A,DCB=(LRECL=133,RECFM=FBA,BLKSIZE=133)                                   00002000
XXFT07F001 DD  SYSOUT=(B,,2),DCB=(LRECL=80,RECFM=FB,BLKSIZE=80)                                00002100
//GO.SYSUDUMP DD DUMMY                                                                         00002200
X//SYSUDUMP DD SYSOUT=A                                                                        00002300
//GO.FORTIN DD *
IEF236I ALLOC. FOR RQ50     GO
IEF237I 351    ALLOCATED TO PGM=*.DD
IEF237I 162    ALLOCATED TO FT05F001
IEF237I 181    ALLOCATED TO FT06F001
IEF237I 1D1    ALLOCATED TO FT07F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I    SYS76051.T151945.RV000.RQ50.GOSET              PASSED
IEF285I    VOL SER NOS= SP0002.
*********************************************************************************************************************************
*     STEP GO            CPU TIME    7.92 SECS  STARTED 15.20.29  ENDED 15.20.48  SYSIN:  795   STEP USED  78K OF 160K REGION     *
*     EXCPS:   DISK     00                                                                       JOBSTEP COST =  $4.79(APPROXIMATE)    *
*********************************************************************************************************************************
IEF285I    SYS76051.T151945.RV000.RQ50.GOSET              DELETED
IEF285I    VOL SER NOS= SP0002.
*********************************************************************************************************************************
*     JOB RQ50       TOTAL CPU TIME    18.51 SECS  STARTED 15.19.52  ENDED 15.20.48     FEB 20, 1976  JOBLOG 760515518767RQ50      *
*********************************************************************************************************************************
```

```
FORTRAN IV G LEVEL 21          MAIN          DATE = 76051          15/19/55          PAGE 0001

0001            DIMENSION Q(70,25),XB(25,25),ST(25,25),R(25,25),B(25,25),
               XXBL(25,25),COV(25,25),BI(25,25),ANS(25,25),N1(25),LAB(20),FMT(20)
0002            DIMENSION XT(13,9),XL(13,6,9),SL(13,6,9),SM(13),YM(6),TM(9)
0003            CALL LOAD(SM,YM,TM,XT,XL,SL)
0004            READ(5,200)L1,L2,M
0005        200 FORMAT(3I3)
0006            DO 50 I=1,25
0007         50 B(I,I)=0.0
0008            DO 10 I=1,70
0009            DO 10 J=1,25
0010         10 Q(I,J)=0.0
0011            READ(5,100)NS,NY,NMIN
0012        100 FORMAT(3I2)
0013            WRITE(6,201)NS,M,L1,L2
0014        201 FORMAT(I5,'  STATIONS WITH ',I5,' SETS OF ',I5,' AND ',I5//)
0015            DO 20 I=1,NS
0016          1 READ(5,101)IY,VAL
0017        101 FORMAT(I2,F5.0)
0018            IF(IY .EQ. 99)GO TO 20
0019            IY=IY-NMIN
0020            Q(IY,I)=VAL
0021            GO TO 1
0022         20 CONTINUE
0023            READ(5,102)LAB,FMT
0024        102 FORMAT(20A4)
0025            CALL OUTP(Q,70,25,NY,NS,FMT,LAB,18)
0026            CALL VCOR(Q,NS,NY,SUM,L,XB,ST,R,N1)
0027            WRITE(6,103)
0028        103 FORMAT('1 # OBS     MEAN        STD')
0029            DO 30 I=1,NS
0030         30 WRITE(6,104)N1(I),XB(I,I),ST(I,I)
0031        104 FORMAT(I8,2F10.2)
0032            READ(5,102)LAB,FMT
0033            CALL OUTP(R,25,25,NS,NS,FMT,LAB,18)
0034            WRITE(6,105)L,SUM
0035        105 FORMAT(//I8,'     CROSSCR,  MEAN=',F8.3)
0036            READ(5,102)LAB,FMT
0037            CALL OUTP(XB,25,25,NS,NS,FMT,LAB,18)
0038            READ(5,102)LAB,FMT
0039            CALL OUTP(ST,25,25,NS,NS,FMT,LAB,18)
0040            CALL TRANS(XB,ST,R,COV,XBL,ANS,NS)
0041            READ(5,102)LAB,FMT
0042            CALL OUTP(COV,25,25,NS,NS,FMT,LAB,18)
0043            READ(5,102)LAB,FMT
0044            CALL OUTP(XBL,25,25,NS,NS,FMT,LAB,18)
0045            READ(5,102)LAB,FMT
0046            CALL OUTP(ANS,25,25,NS,NS,FMT,LAB,18)
0047            JSE=65549
```

```
0048          CALL ROWQ50(JSE,NS,L1,L2,M,XBL,ANS,COV,XT,XL,SM,YM,TM,B)
0049          READ(5,102)LAB,FMT
0050          CALL OUTP(B,25,25,NS,NS,FMT,LAB,18)
0051          STOP
0052          END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
LOAD	D0	IBCOM#	D4	OUTP	D8	VCOR	DC	TRANS	E0
ROWQ50	E4								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
LI	278	L2	27C	M	280	I	284	J	288
NS	28C	NY	290	NMIN	294	IY	298	VAL	29C
SUM	2A0	L	2A4	JSE	2A8				

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
Q	2AC	XB	1E04	ST	27C8	R	318C	B	3B50
XBL	4514	COV	4ED8	B1	589C	ANS	6260	N1	6C24
LAB	6C88	FMT	6CD8	XT	6D28	XL	6EFC	SL	79F4
SM	84EC	YM	8520	TM	8538				

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
200	855C	100	8562	201	8568	101	8598	102	859F
103	85A5	104	85C2	105	85CB				

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
3	8684	4	8692	6	86C0	7	86D0	8	86F4
9	8704	10	8712	11	8752	13	8780	15	87B4
16	87C4	18	87E8	19	87FA	20	8806	21	8816
22	881C	23	8838	25	8864	26	8872	27	8880
29	8894	30	88AC	32	88F8	33	8924	34	8932
36	8958	37	8984	38	8992	39	89C0	40	89CE
41	89DC	42	8A08	43	8A16	44	8A44	45	8A52
46	8A80	47	8A8E	48	8A9A	49	8AA8	50	8AD4
51	8AE2								

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = MAIN , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 52,PROGRAM SIZE = 35568
STATISTICS NO DIAGNOSTICS GENERATED

```
F88-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED XREF,LET,LIST
          DEFAULT OPTION(S) USED - SIZE=(112650,24576)
****MAIN      DOES NOT EXIST BUT HAS BEEN ADDED TO DATA SET


                                CROSS REFERENCE TABLE

CONTROL SECTION                          ENTRY
    NAME    ORIGIN   LENGTH              NAME    LOCATION    NAME    LOCATION    NAME    LOCATION    NAME    LOCATION

MAIN            00     8AF0
VCOR          8AF0      856
OUTP          9348      474
TRANS         97C0      484
TR            9C78      314
ROWQ50        9F90      780
GEN           A710      E54
GAUSS         B568      232
STAT2         B7A0      394
INTERP        BB38      5D4
OFFSET        C110      234
LOAD          C348      420
STAT1         C768      28A
IHCSLOG *     C9F8      186
                                         ALOG10      C9F8    ALOG        CA10
IHCLSQRT*     C880      158
                                         DSQRT       C880
IHCSEXP *     CD10      192
                                         EXP         CD10
IHCECOMH*     CEA8      F61
                                         IBCOM#      CEA8    FD1OCS#     CF64    INTSWTCH    DDEE
IHCCOMH2*     DE10      65D
                                         SEQDASD     E188
IHCSSQRT*     E470      145
                                         SQRT        E470
IHCFCVTH*     E588      11B5
                                         ADCON#      E588    FCVAOUTP    E662    FCVLOUTP    E6F2    FCVZOUTP    E84A
                                         FCVIOUTP    E8FE    FCVEOUTP    F100    FCVCOUTP    F31A    INT6SWCH    F603
IHCEFNTH*     F770      542
                                         ARITH#      F770    ADJSWTCH    FB0C
IHCEFIOS*     FCB8      F28
                                         FIOCS#      FCB8    FIOCSBEP    FC8E
IHCFIOS2*   108E0      52E
IHCERRM *   11110      5DC
                                         ERRMON    11110     IHCERRE     11128
IHCUOPT *   116F0      300
IHCETRCH*   119F0      28E
                                         IHCTRCH     119F0   ERRTRA      119F8
IHCUATBL*   11C80      628
```

LOCATION	REFERS TO SYMBOL	IN CONTROL SECTION	LOCATION	REFERS TO SYMBOL	IN CONTROL SECTION
00	LOAD	LOAD	04	IBCOM#	IHCECOMH
08	OUTP	OUTP	0C	VCOR	VCOR
10	TRANS	TRANS	14	ROWQ50	ROWQ50
8BC4	SQRT	IHCSSQRT	940C	IBCOM#	IHCECOMH
9858	TR	TR	9D08	ALOG	IHCSLOG
9D0C	SQRT	IHCSSQRT	9D10	EXP	IHCSEXP
A028	IBCOM#	IHCECOMH	A02C	GEN	GEN
A7C4	IBCOM#	IHCECOMH	A7C8	GAUSS	GAUSS
A7CC	STATI	STATI	A7D0	INTERP	INTERP
A7D4	STAT2	STAT2	A7D8	SQRT	IHCSSQRT
A7DC	EXP	IHCSEXP	B834	DSQRT	IHCLSQRT
B8E0	OFFSET	OFFSET	C404	IBCOM#	IHCECOMH
C7FC	SQRT	IHCSSQRT	CD20	IBCOM#	IHCECOMH
C85C	IHCERRM	IHCERRM	CCA8	IBCOM#	IHCECOMH
CC98	IHCERRM	IHCERRM	CE18	IBCOM#	IHCECOMH
CEI4	IHCERRM	IHCERRM	CF64	SEQDASD	IHCCOMH2
DCF4	ADCON#	IHCFCVTH	DCEC	FIOCS#	IHCEFIOS
DCF8	ARITH#	IHCEFNTH	DD18	ADJSWTCH	IHCEFNTH
DDI4	IHCUOPT	IHCUOPT	DCFC	FCVEOUTP	IHCFCVTH
DD00	FCVLOUTP	IHCFCVTH	DD04	FCVIOUTP	IHCFCVTH
DD08	FCVCOUTP	IHCFCVTH	DD0C	FCVAOUTP	IHCFCVTH
DDI0	FCVZOUTP	IHCFCVTH	DCA0	IHCERRE	IHCERRM
DCCC	IHCCOMH2	IHCCOMH2	DCD0	IHCERRM	IHCERRM
DCA4	IHCCOMH2	IHCCOMH2	DCA8	IHCCOMH2	IHCCOMH2
DCAC	IHCCOMH2	IHCCOMH2	DCB0	IHCCOMH2	IHCCOMH2
E0AD	IHCECOMH	IHCECOMH	E0B0	IHCECOMH	IHCECOMH
DE58	IHCERRM	IHCERRM	DE54	IBCOM#	IHCECOMH
E2CD	IHCECOMH	IHCECOMH	E2DD	IHCECOMH	IHCECOMH
E2ED	IHCECOMH	IHCECOMH	E540	IBCOM#	IHCECOMH
E568	IHCERRM	IHCERRM	F5C4	IBCOM#	IHCECOMH
F5C0	IHCERRM	IHCERRM	FB5C	IBCOM#	IHCECOMH
FB60	INTSWTCH	IHCECOMH	FB08	INT6SWCH	IHCFCVTH
FB04	IHCUOPT	IHCUOPT	FB68	ADCON#	IHCFCVTH
FB64	FIOCS#	IHCEFIOS	FBD4	IHCERRM	IHCERRM
FE20	IHCERRM	IHCERRM	FE24	IHCFIOS2	IHCFIOS2
I0A30	IHCUATBL	IHCUATBL	I0A3C	IBCOM#	IHCECOMH
I0A5I	IHCFIOS2	IHCFIOS2	I0A68	IHCFIOS2	IHCFIOS2
I0BD9	IHCFIOS2	IHCFIOS2	I16DC	IHCUOPT	IHCUOPT
I16E0	IBCOM#	IHCECOMH	I16E4	IHCTRCH	IHCETRCH
I16E8	FIOCSBEP	IHCEFIOS	I1B64	IBCOM#	IHCECOMH
I1B68	ADCON#	IHCFCVTH	I1B6C	FIOCSBEP	IHCEFIOS

ENTRY ADDRESS 00
TOTAL LENGTH I22A8

15 STATIONS WITH 3 SETS OF 3 AND 3

MASS INPUT DATA 18 STATIONS

VAR#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.	0.	0.	0.	319.	255.	0.	0.	0.	0.	0.	0.	0.	0.	0.
2	0.	0.	0.	0.	0.	113.	0.	0.	0.	0.	0.	0.	0.	0.	0.
3	0.	0.	0.	0.	608.	365.	0.	0.	0.	0.	0.	0.	0.	0.	0.
4	0.	0.	0.	0.	732.	268.	0.	0.	0.	0.	0.	0.	0.	0.	0.
5	0.	0.	0.	0.	457.	195.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6	0.	0.	0.	0.	648.	350.	0.	0.	0.	0.	0.	0.	0.	0.	0.
7	0.	0.	0.	0.	530.	335.	0.	0.	0.	0.	0.	0.	0.	0.	0.
8	0.	0.	0.	0.	569.	365.	0.	0.	0.	0.	0.	0.	0.	0.	0.
9	0.	0.	0.	0.	148.	170.	0.	0.	0.	0.	0.	0.	0.	0.	0.
10	0.	0.	0.	350.	230.	113.	0.	0.	0.	0.	0.	0.	0.	0.	0.
11	0.	0.	0.	322.	368.	242.	0.	0.	0.	0.	0.	0.	0.	0.	0.
12	0.	0.	0.	270.	1000.	885.	0.	0.	0.	0.	0.	0.	9980.	0.	0.
13	0.	0.	0.	505.	319.	255.	0.	0.	0.	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	358.	136.	185.	0.	0.	0.	0.	0.	0.	0.	0.	0.
15	0.	0.	0.	843.	273.	195.	0.	0.	0.	0.	0.	0.	0.	0.	0.
16	0.	0.	0.	503.	457.	395.	0.	0.	0.	0.	0.	0.	1030.	1110.	0.
17	0.	0.	0.	646.	493.	280.	0.	0.	0.	0.	0.	0.	892.	3150.	0.
18	0.	0.	0.	506.	368.	560.	0.	0.	0.	0.	0.	0.	948.	1970.	0.
19	0.	0.	0.	480.	352.	185.	0.	0.	0.	0.	0.	0.	1110.	2380.	0.
20	0.	0.	0.	1030.	1840.	1540.	0.	0.	0.	0.	0.	6000.	3670.	6100.	0.
21	0.	0.	0.	487.	210.	205.	0.	0.	0.	392.	0.	1910.	1330.	1920.	0.
22	0.	608.	0.	714.	3000.	1070.	0.	0.	0.	6780.	0.	6400.	5080.	8950.	0.
23	0.	400.	0.	361.	370.	309.	1920.	0.	0.	672.	0.	3410.	1820.	2140.	0.
24	0.	387.	226.	472.	685.	364.	2000.	0.	0.	1000.	0.	1380.	1110.	1460.	0.
25	0.	194.	240.	339.	104.	94.	1800.	0.	0.	271.	0.	832.	560.	1050.	0.
26	0.	333.	304.	472.	550.	495.	2180.	0.	0.	1240.	0.	1440.	1260.	1710.	0.
27	0.	280.	230.	406.	169.	130.	2020.	0.	0.	339.	0.	1740.	1220.	1980.	0.
28	0.	224.	200.	319.	532.	164.	2110.	0.	0.	2300.	0.	1280.	980.	3210.	0.
29	0.	347.	254.	391.	280.	320.	2560.	0.	0.	428.	0.	1970.	1840.	2360.	0.
30	293.	490.	414.	682.	413.	235.	1700.	0.	0.	736.	37.	1190.	855.	1800.	0.
31	154.	297.	212.	325.	188.	123.	1200.	459.	0.	446.	49.	1730.	1180.	2420.	0.
32	352.	646.	398.	619.	565.	260.	2240.	1450.	109.	884.	95.	1970.	1250.	2110.	0.
33	100.	171.	165.	200.	242.	155.	2640.	441.	124.	575.	187.	5700.	3100.	6300.	0.
34	220.	329.	176.	256.	224.	226.	825.	467.	81.	434.	24.	1070.	750.	1780.	700.
35	184.	324.	255.	344.	605.	364.	3840.	480.	152.	554.	67.	3280.	1800.	5820.	2010.
36	196.	392.	336.	454.	389.	336.	2850.	525.	118.	547.	58.	2080.	1430.	3060.	1560.
37	260.	426.	398.	486.	479.	370.	2730.	620.	146.	680.	69.	1630.	1250.	2690.	1320.
38	246.	530.	430.	698.	325.	253.	2320.	957.	107.	666.	54.	1870.	885.	2870.	1360.
39	147.	302.	1490.	1170.	286.	735.	6300.	1120.	275.	1650.	680.	1640.	945.	1730.	1040.
40	247.	497.	486.	616.	568.	293.	5010.	1890.	193.	847.	149.	2010.	1250.	1930.	1110.
41	99.	232.	247.	313.	207.	180.	660.	365.	135.	540.	19.	1120.	925.	1460.	836.
42	479.	682.	384.	521.	276.	266.	2340.	964.	155.	645.	74.	1090.	1100.	2380.	1280.
43	217.	354.	321.	380.	646.	544.	1930.	999.	225.	948.	53.	1730.	1790.	1760.	1420.
44	196.	334.	247.	354.	744.	573.	3690.	1030.	289.	1220.	88.	1920.	1610.	3520.	2640.
45	221.	368.	318.	492.	159.	163.	1910.	454.	247.	422.	110.	998.	835.	1500.	1090.
46	241.	442.	368.	467.	434.	306.	1720.	888.	120.	948.	74.	1450.	970.	1960.	896.
47	385.	808.	473.	364.	305.	244.	1170.	1050.	199.	568.	30.	582.	598.	1140.	1060.
48	144.	349.	392.	464.	202.	115.	863.	449.	107.	374.	30.	908.	885.	2030.	1090.
49	122.	204.	304.	290.	116.	57.	354.	423.	29.	200.	9.	394.	444.	782.	374.
50	107.	197.	193.	254.	209.	166.	808.	357.	91.	477.	33.	654.	846.	964.	674.
51	152.	305.	392.	574.	279.	191.	1030.	635.	76.	645.	24.	1040.	762.	1570.	910.
52	489.	833.	1140.	1460.	366.	263.	2110.	793.	130.	852.	64.	1480.	960.	2470.	2300.
53	319.	688.	636.	819.	347.	255.	2120.	618.	147.	701.	116.	3710.	1340.	4140.	2730.
54	219.	550.	681.	779.	359.	346.	2080.	650.	223.	828.	117.	1060.	652.	1890.	2270.
55	164.	263.	298.	363.	213.	115.	1360.	463.	51.	477.	43.	1080.	798.	1470.	1100.
56	248.	476.	427.	517.	361.	199.	1810.	570.	176.	575.	53.	2700.	1200.	2300.	1470.
57	279.	413.	432.	431.	468.	354.	3240.	682.	246.	913.	85.	875.	1240.	3930.	2280.
58	114.	292.	410.	0.	0.	537.	0.	0.	249.	1120.	0.	0.	0.	0.	0.

# OBS	MEAN	STD
29	227.38	102.41
37	404.51	168.40
35	396.49	261.81
48	509.71	242.86
56	459.32	437.39
58	321.14	247.46
35	2155.43	1192.61
27	733.30	362.02
27	155.56	69.40
38	889.32	1057.87
28	88.96	122.85
38	1929.55	1425.77
42	1297.62	847.19
43	2726.19	1966.98
24	1396.67	644.93

COR MATRIX R(I,J)= COR OF I AND J IF I<J AND=# OF YEARS IN COMMON FOR I>J

VAR#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.000	0.927	0.325	0.503	0.263	0.022	0.084	0.444	0.093	0.107	-0.115	-0.101	-0.144	-0.011	0.406
2	29.000	1.000	0.454	0.608	0.266	0.208	0.083	0.480	0.132	0.195	-0.080	0.112	0.072	0.137	0.459
3	29.000	35.000	1.000	0.905	-0.003	0.451	0.507	0.336	0.337	0.323	0.726	-0.029	-0.199	-0.073	0.250
4	28.000	36.000	34.000	1.000	0.249	0.371	0.394	0.350	0.229	0.235	0.477	0.211	0.128	0.050	0.390
5	28.000	36.000	34.000	48.000	1.000	0.803	0.449	0.580	0.481	0.947	0.022	0.700	0.847	0.698	0.587
6	29.000	37.000	35.000	48.000	56.000	1.000	0.698	0.461	0.747	0.772	0.636	0.633	0.703	0.617	0.397
7	28.000	35.000	34.000	35.000	35.000	35.000	1.000	0.571	0.623	0.465	0.751	0.330	0.353	0.397	0.372
8	27.000	27.000	27.000	27.000	27.000	27.000	27.000	1.000	0.374	0.608	0.319	-0.002	0.029	-0.110	0.109
9	27.000	27.000	27.000	26.000	26.000	27.000	26.000	26.000	1.000	0.679	0.482	0.054	0.193	0.151	0.493
10	29.000	37.000	35.000	37.000	37.000	38.000	35.000	27.000	27.000	1.000	0.724	0.569	0.755	0.668	0.370
11	28.000	28.000	28.000	28.000	28.000	28.000	28.000	27.000	26.000	28.000	1.000	0.216	0.146	0.096	0.041
12	28.000	36.000	34.000	38.000	38.000	38.000	35.000	27.000	26.000	37.000	28.000	1.000	0.917	0.874	0.569
13	28.000	36.000	34.000	42.000	42.000	42.000	35.000	27.000	26.000	37.000	28.000	38.000	1.000	0.872	0.548
14	28.000	36.000	34.000	43.000	43.000	43.000	35.000	27.000	26.000	37.000	28.000	38.000	42.000	1.000	0.737
15	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	24.000	1.000

105 CROSSCR, MEAN= 0.378

MATRIX OF MEANS X(I,J)= MEAN OF I IF I<J AND THE MEAN OF J IF I>J

VAR#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	227.4	227.4	227.4	231.4	231.4	227.4	231.4	229.1	227.7	227.4	231.4	231.4	231.4	231.4	232.5
2	420.5	404.5	398.8	407.6	407.6	404.5	401.9	422.7	422.5	404.5	425.1	407.6	407.6	407.6	429.1
3	428.4	396.5	396.5	396.1	396.1	396.5	396.1	429.6	436.9	396.5	429.0	396.1	396.1	396.1	451.0
4	524.7	504.6	502.7	509.7	509.7	509.7	498.6	518.9	526.3	504.1	524.7	518.0	519.5	513.7	536.1
5	356.3	435.1	361.6	452.3	459.3	459.3	361.9	354.1	360.5	429.1	356.3	466.2	461.5	474.1	357.0
6	283.6	301.9	279.7	326.5	321.0	321.1	273.2	276.0	291.3	299.3	274.5	325.7	328.5	341.5	288.1
7	2173.2	2155.4	2162.4	2155.4	2155.4	2155.4	2155.4	2190.7	2228.8	2155.4	2173.2	2155.4	2155.4	2155.4	2211.3
8	733.3	733.3	733.3	733.3	733.3	733.3	733.3	733.3	743.8	733.3	733.3	733.3	733.3	733.3	727.0
9	155.6	155.6	155.6	152.0	152.0	155.6	152.0	152.0	155.6	155.6	152.0	152.0	152.0	152.0	154.9
10	702.5	902.8	741.4	883.1	883.1	889.3	728.6	685.8	710.7	889.3	687.6	883.1	883.1	883.1	692.1
11	89.0	89.0	89.0	89.0	89.0	89.0	89.0	90.9	92.5	89.0	89.0	89.0	89.0	89.0	88.5
12	1677.2	1817.0	1635.4	1929.6	1929.6	1929.6	1686.1	1695.2	1693.9	1819.5	1677.2	1929.6	1929.6	1929.6	1515.5
13	1130.4	1264.4	1135.9	1297.6	1297.6	1297.6	1155.4	1140.6	1139.0	1266.2	1130.4	1329.5	1297.6	1297.6	1052.7
14	2419.9	2517.1	2339.0	2726.2	2726.2	2726.2	2333.3	2442.8	2443.7	2501.0	2419.9	2595.7	2553.5	2726.2	2296.9
15	1396.7	1396.7	1396.7	1396.7	1396.7	1396.7	1396.7	1396.7	1396.7	1396.7	1396.7	1396.7	1396.7	1396.7	1396.7

STANDARD DEVIATIONS (SEE MEAN MATRIX)

VAR#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	102.4	102.4	102.4	101.9	101.9	102.4	101.9	103.1	104.5	102.4	101.9	101.9	101.9	101.9	101.9
2	176.4	168.4	169.6	169.7	169.7	168.4	168.6	180.8	180.9	168.4	177.8	169.7	169.7	169.7	176.9
3	277.2	261.8	261.8	265.7	265.7	261.8	265.7	287.7	284.4	261.8	282.3	265.7	265.7	265.7	296.5
4	276.6	252.3	254.1	242.9	242.9	242.9	253.4	280.1	282.9	240.8	276.6	259.8	247.7	247.7	286.2
5	159.6	470.1	171.2	467.1	437.4	437.4	168.7	162.2	161.9	465.0	159.6	512.6	487.5	488.6	161.4
6	153.7	196.8	152.2	266.9	248.6	247.5	145.6	151.0	155.9	194.8	148.4	278.0	267.8	277.9	154.8
7	1332.8	1192.6	1209.8	1192.6	1192.6	1192.6	1192.6	1354.9	1366.9	1192.6	1332.8	1192.6	1192.6	1192.6	1422.3
8	362.0	362.0	362.0	362.0	362.0	362.0	362.0	362.0	364.9	362.0	362.0	362.0	362.0	362.0	344.7
9	69.4	69.4	69.4	68.2	68.2	69.4	68.2	68.2	69.4	69.4	68.2	68.2	68.2	68.2	70.2
10	291.3	1069.2	407.5	1071.8	1071.8	1057.9	402.3	290.4	297.9	1057.9	285.2	1071.8	1071.8	1071.8	300.9
11	122.9	122.9	122.9	122.9	122.9	122.9	122.9	124.8	126.9	122.9	122.9	122.9	122.9	122.9	130.8
12	1096.8	1289.4	1007.9	1425.8	1425.8	1425.8	1037.3	1113.4	1135.5	1271.5	1096.8	1425.8	1425.8	1425.8	816.7
13	511.3	817.0	490.4	847.2	847.2	847.2	496.8	518.2	528.4	805.7	511.3	885.2	847.2	847.2	357.7
14	1309.4	1628.3	1233.3	1967.0	1967.0	1967.0	1215.4	1328.5	1354.8	1608.5	1309.4	1690.6	1627.7	1967.0	1149.5
15	644.9	644.9	644.9	644.9	644.9	644.9	644.9	644.9	644.9	644.9	644.9	644.9	644.9	644.9	644.9

LOG SPACE VARIANCE COVARIANCE MATRIX

VAR#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.1847	0.1613	0.0905	0.1104	0.0505	0.0054	0.0225	0.0941	0.0190	0.0199	-0.0723	-0.0296	-0.0291	-0.0026	0.0788
2	0.1613	0.1598	0.1200	0.1191	0.1130	0.0550	0.0190	0.0965	0.0249	0.0918	-0.0475	0.0324	0.0193	0.0362	0.0838
3	0.0905	0.1200	0.3619	0.2696	-0.0010	0.1501	0.1741	0.1053	0.0933	0.1107	0.5066	-0.0120	-0.0595	-0.0262	0.0730
4	0.1104	0.1191	0.2696	0.2046	0.1155	0.1350	0.1050	0.0892	0.0538	0.1318	0.2981	0.0752	0.0391	0.0171	0.0918
5	0.0505	0.1130	-0.0010	0.1155	0.6454	0.4651	0.1097	0.1233	0.0924	0.8092	0.0133	0.4504	0.4601	0.4181	0.1155
6	0.0054	0.0550	0.1501	0.1350	0.4651	0.4661	0.1871	0.1174	0.1641	0.4684	0.3887	0.3361	0.3178	0.3092	0.0939
7	0.0225	0.0190	0.1741	0.1050	0.1097	0.1871	0.2671	0.1608	0.1582	0.1329	0.4924	0.1063	0.0807	0.1082	0.1048
8	0.0941	0.0965	0.1053	0.0892	0.1233	0.1174	0.1608	0.2181	0.0791	0.1196	0.1957	-0.0006	0.0066	-0.0300	0.0236
9	0.0190	0.0249	0.0933	0.0538	0.0924	0.1641	0.1582	0.0791	0.1815	0.1196	0.2598	0.0160	0.0393	0.0367	0.0982
10	0.0199	0.0918	0.1107	0.1318	0.8092	0.4684	0.1329	0.1196	0.1196	0.8817	0.3467	0.3940	0.4594	0.4197	0.0717
11	-0.0723	-0.0475	0.5066	0.2981	0.0133	0.3887	0.4924	0.1957	0.2598	0.3467	1.0671	0.1782	0.0870	0.0592	0.0273
12	-0.0296	0.0324	-0.0120	0.0752	0.4504	0.3361	0.1063	-0.0006	0.0160	0.3940	0.1782	0.4357	0.3725	0.3512	0.1325
13	-0.0291	0.0193	-0.0595	0.0391	0.4601	0.3178	0.0807	0.0066	0.0393	0.4594	0.0870	0.3725	0.3550	0.3095	0.0825
14	-0.0026	0.0362	-0.0262	0.0171	0.4181	0.3092	0.1082	-0.0300	0.0367	0.4197	0.0692	0.3512	0.3095	0.4191	0.1573
15	0.0788	0.0838	0.0730	0.0918	0.1155	0.0939	0.1048	0.0236	0.0982	0.0717	0.0273	0.1325	0.0825	0.1573	0.1933

LOG SPACE MATRIX OF MEANS

VAR#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	5.334	5.334	5.334	5.356	5.356	5.334	5.356	5.342	5.332	5.334	5.356	5.356	5.356	5.356	5.361
2	5.960	5.923	5.905	5.930	5.930	5.923	5.915	5.963	5.962	5.923	5.972	5.930	5.930	5.930	5.985
3	5.885	5.802	5.802	5.796	5.796	5.802	5.796	5.878	5.903	5.802	5.882	5.796	5.796	5.796	5.932
4	6.140	6.112	6.105	6.132	6.132	6.132	6.097	6.124	6.139	6.114	6.140	6.138	6.150	6.137	6.159
5	5.784	5.689	5.789	5.751	5.807	5.807	5.793	5.774	5.796	5.673	5.784	5.748	5.760	5.799	5.785
6	5.519	5.533	5.504	5.533	5.536	5.539	5.485	5.489	5.549	5.525	5.487	5.512	5.540	5.579	5.536
7	7.524	7.542	7.543	7.542	7.542	7.542	7.542	7.530	7.550	7.542	7.524	7.542	7.542	7.542	7.528
8	6.488	6.488	6.488	6.488	6.488	6.488	6.488	6.488	6.504	6.488	6.488	6.488	6.488	6.488	6.488
9	4.956	4.956	4.956	4.932	4.932	4.956	4.932	4.932	4.956	4.956	4.932	4.932	4.932	4.932	4.950
10	6.475	6.367	6.477	6.331	6.331	6.350	6.458	6.448	6.485	6.350	6.454	6.331	6.331	6.331	6.453
11	3.955	3.955	3.955	3.955	3.955	3.955	3.955	3.980	3.998	3.955	3.955	3.955	3.955	3.955	3.903
12	7.247	7.301	7.239	7.347	7.347	7.347	7.270	7.256	7.249	7.308	7.247	7.347	7.347	7.347	7.196
13	6.937	6.968	6.950	6.991	6.991	6.991	6.967	6.945	6.940	6.974	6.937	7.009	6.991	6.991	6.904
14	7.663	7.656	7.635	7.701	7.701	7.701	7.635	7.671	7.667	7.651	7.663	7.685	7.675	7.701	7.628
15	7.145	7.145	7.145	7.145	7.145	7.145	7.145	7.145	7.145	7.145	7.145	7.145	7.145	7.145	7.145

VARIANCES IN LOG SPACE (SEE LOG MEAN MATRIX)

VAR#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.1847	0.1847	0.1847	0.1772	0.1772	0.1847	0.1772	0.1844	0.1912	0.1847	0.1772	0.1772	0.1772	0.1772	0.1756
2	0.1621	0.1598	0.1663	0.1598	0.1598	0.1598	0.1621	0.1680	0.1683	0.1598	0.1613	0.1598	0.1598	0.1598	0.1569
3	0.3499	0.3619	0.3619	0.3716	0.3716	0.3619	0.3716	0.3705	0.3533	0.3619	0.3598	0.3716	0.3716	0.3716	0.3593
4	0.2452	0.2232	0.2307	0.2046	0.2046	0.2046	0.2297	0.2557	0.2538	0.2180	0.2452	0.2244	0.2049	0.2090	0.2507
5	0.1828	0.7734	0.2023	0.7258	0.6454	0.6454	0.1967	0.1904	0.1837	0.7768	0.1828	0.7925	0.7494	0.7238	0.1860
6	0.2575	0.3542	0.2592	0.5117	0.4700	0.4661	0.2498	0.2620	0.2517	0.3530	0.2564	0.5472	0.5096	0.5082	0.2538
7	0.3193	0.2671	0.2723	0.2671	0.2671	0.2671	0.2671	0.3239	0.3192	0.2671	0.3193	0.2671	0.2671	0.2671	0.3462
8	0.2181	0.2181	0.2181	0.2181	0.2181	0.2181	0.2181	0.2181	0.2157	0.2181	0.2181	0.2181	0.2181	0.2181	0.2027
9	0.1815	0.1815	0.1815	0.1833	0.1833	0.1815	0.1833	0.1833	0.1815	0.1815	0.1833	0.1833	0.1833	0.1833	0.1867
10	0.1587	0.8766	0.2640	0.9054	0.9054	0.8817	0.2660	0.1650	0.1618	0.8817	0.1587	0.9054	0.9054	0.9054	0.1732
11	1.0671	1.0671	1.0671	1.0671	1.0671	1.0671	1.0671	1.0593	1.0590	1.0671	1.0671	1.0671	1.0671	1.0671	1.1590
12	0.3560	0.4078	0.3220	0.4357	0.4357	0.4357	0.3210	0.3586	0.3711	0.3976	0.3560	0.4357	0.4357	0.4357	0.2550
13	0.1862	0.3489	0.1709	0.3550	0.3550	0.3550	0.1696	0.1876	0.1949	0.3399	0.1862	0.3670	0.3550	0.3550	0.1093
14	0.2568	0.3496	0.2453	0.4191	0.4191	0.4191	0.2401	0.2591	0.2680	0.3462	0.2568	0.3536	0.3410	0.4191	0.2235
15	0.1933	0.1933	0.1933	0.1933	0.1933	0.1933	0.1933	0.1933	0.1933	0.1933	0.1933	0.1933	0.1933	0.1933	0.1933

I	J	R10	R25	MEAN I10	MEAN J10	STD I10	STD J10	MEAN I25	MEAN J25	STD I25	STD J25
		0.4298		0.3754	0.1455						
		0.4298		0.3754	0.1455						
1	2	1.000	0.986	2774.4	2467.6	4015.7	2989.6	1271.6	2987.2	1229.2	2535.8
		0.4298		0.2107	0.5527						
		0.4298		0.2107	0.5527						
1	3	0.870	-0.923	428.6	1032.8	91.3	709.5	789.8	15050.4	220.6	17572.8
		0.4210		0.2622	0.4201						
		0.4210		0.2622	0.4201						
1	4	0.746	-0.320	1100.7	5166.1	810.6	6866.3	649.9	3428.9	236.6	2026.4
		0.4210		0.1201	0.4104						
		0.4210		0.1201	0.4104						
1	5	0.635	-0.497	1236.9	1385.5	623.5	728.6	1910.1	5290.4	1605.7	7930.7
		0.4298		0.0126	0.5073						
		0.4298		0.0126	0.5073						
1	6	0.920	0.995	11418.9	5439.9	19079.3	3999.8	51538.3	2660.5	88274.7	3292.8
		0.4210		0.0534	0.5625						
		0.4210		0.0534	0.5625						
1	7	0.840	0.679	859.4	26905.4	453.3	7629.4	1392.5	6752.4	994.1	4476.1
		0.4294		0.2192	0.4124						
		0.4294		0.2192	0.4124						
1	8	0.987	0.999	5773.6	3789.5	6328.8	3786.6	2009.3	5541.6	1981.5	7518.3
		0.4373		0.0434	0.4239						
		0.4373		0.0434	0.4239						
1	9	-0.634	-0.730	1236.7	689.7	1525.8	426.2	843.8	1731.3	177.6	2571.4
		0.4298		0.0462	0.3956						
		0.4298		0.0462	0.3956						
1	10	0.837	-0.287	845.2	8219.7	774.6	4348.2	1126.5	9420.5	556.8	5500.4
		0.4210		-0.1719	1.0186						
		0.4210		-0.1719	1.0186						
1	11	-0.512	0.194	1274.4	5087.2	1720.1	8096.0	1503.0	1398898.9	308.7	2412103.9
		0.4210		-0.0703	0.5925						
		0.4210		-0.0703	0.5925						
1	12	-0.986	0.490	866.9	49135.1	57.2	76991.5	1683.7	25231.7	2187.4	15917.4
		0.4210		-0.0691	0.4259						
		0.4210		-0.0691	0.4259						
1	13	-0.643	-0.205	599.2	2020.6	360.3	929.8	895.8	6838.4	492.9	5152.0
		0.4210		-0.0063	0.5067						
		0.4210		-0.0063	0.5067						
1	14	-0.548	-0.151	633.7	7818.1	258.7	3313.0	1215.7	16379.6	254.4	11245.1
		0.4190		0.1882	0.3973						
		0.4190		0.1882	0.3973						
1	15	0.927	0.997	2374.8	6682.9	2324.0	7437.1	1353.5	46839.5	1357.2	58526.8
		0.4078		0.2943	0.5247						
		0.4078		0.2943	0.5247						
2	3	0.744	0.736	2980.2	13240.8	2136.6	22204.6	1517.4	2148.7	799.5	2534.4
		0.3998		0.2980	0.3666						
		0.3998		0.2980	0.3666						
2	4	0.938	0.456	2350.9	3752.0	2387.0	3320.9	1801.9	10567.4	1237.3	15297.7
		0.3998		0.2828	0.8327						
		0.3998		0.2828	0.8327						
2	5	-0.673	0.057	1070.2	1970.7	400.0	1473.1	2393.3	96197.8	1648.0	161097.1
		0.3998		0.1374	0.5790						
		0.3998		0.1374	0.5790						
2	6	-0.988	0.286	974.1	4559.0	413.3	7010.5	25138.5	541.1	42304.4	197.1
		0.4026		0.0473	0.5146						
		0.4026		0.0473	0.5146						
2	7	0.576	-0.351	7095.0	11452.9	4209.0	14216.7	1129.7	37155.2	777.7	40559.8
		0.4098		0.2355	0.4033						
		0.4098		0.2355	0.4033						
2	8	0.796	-0.931	887.3	1828.2	265.1	1257.8	4653.0	9044.9	4324.3	9942.9
		0.4103		0.0607	0.4217						

		0.4728		0.3327		0.2874					
14	15	0.996	0.982	16528.1	13342.5	11585.5	9633.2	82997.4	35714.3	71054.1	35444.8

105. COR, AV10= 0.2580 AV25= 0.1721

COR. MATRIX FOR Q50 I<J = 10 YEAR SETS, I>J = 25 YEAR SETS

VAR#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	0.0	1.000	0.870	0.746	0.635	0.920	0.840	0.987	-0.634	0.837	-0.512	-0.986	-0.643	-0.548	0.927
2	0.986	0.0	0.744	0.938	-0.673	-0.980	0.576	0.796	-0.377	-0.303	-0.320	0.062	-0.999	-0.072	-0.735
3	-0.923	0.736	0.0	0.761	-0.201	1.000	0.258	0.896	-0.214	-0.614	0.966	0.283	-0.311	-0.816	-0.210
4	-0.320	0.456	1.000	0.0	0.122	0.236	-0.516	-0.684	0.962	0.913	-0.022	0.754	0.983	-0.100	0.912
5	-0.497	0.057	-0.949	0.905	0.0	-0.719	-0.857	0.998	-0.097	0.996	-0.834	0.997	0.322	0.989	0.558
6	0.995	0.286	0.932	-0.701	0.969	0.0	0.106	-0.405	0.210	-0.864	0.901	0.388	0.994	0.416	0.824
7	0.679	-0.351	0.969	0.926	-0.607	-0.990	0.0	0.994	1.000	-0.081	0.997	0.955	0.953	-0.949	-0.300
8	0.999	-0.931	-1.000	-0.998	-0.848	0.865	1.000	0.0	0.675	0.180	0.284	0.987	0.249	-0.961	0.395
9	-0.730	-0.967	0.559	-0.720	-0.953	0.498	0.998	0.999	0.0	0.999	0.758	-0.148	-0.631	-0.313	1.000
10	-0.287	0.991	-0.632	-0.295	1.000	0.982	-0.461	0.432	0.967	0.0	0.884	0.997	-0.293	0.966	0.968
11	0.194	-0.406	0.993	1.000	-0.562	0.998	0.878	0.780	1.000	0.647	0.0	-0.018	0.913	0.988	-0.382
12	0.490	0.889	-0.998	0.992	0.853	0.930	-0.988	-1.000	-0.977	0.218	-0.488	0.0	0.964	-0.027	0.745
13	-0.205	-0.015	-0.998	-0.970	-0.334	0.965	0.278	0.122	0.993	0.530	-0.379	0.549	0.0	0.252	-0.652
14	-0.151	-0.235	0.887	-0.851	1.000	0.999	-0.609	-0.978	-0.384	-0.790	-0.672	-0.368	0.955	0.0	0.996
15	0.997	0.469	0.894	0.188	0.839	0.995	-0.452	0.996	-0.964	0.839	1.000	1.000	-0.512	0.982	0.0

4 SKEW

4.1

1 Finds the average skew of Q50 for each of 11 states (15 stations per state). These values are used in Big basin.

2 Calls:

Load

Interp

Offset

Instd

Offset

Stat

3

4 We have all of the arguments needed for "Interp" stored on cards. Read them in and use "Interp" to find the new unbiased return interval. Then use this as input to "Instd" to find the coefficient for the std (Q50). From the mean and std of Q50 we find the skew.

5 For 11 states

For 15 stations

Read data

Calculate skew (Q50)

Write information

Calculate mean and std of skews

Write information

6 Skew $= \left(\frac{\text{std(Q50)}}{\text{mean(Q50)}}\right)^3 + 3\left(\frac{\text{std(Q50)}}{\text{mean(Q50)}}\right)$

7 2/20/76 Raiffa

8

4.2

1

2 Do loops:

Do 20 J = indexes through states

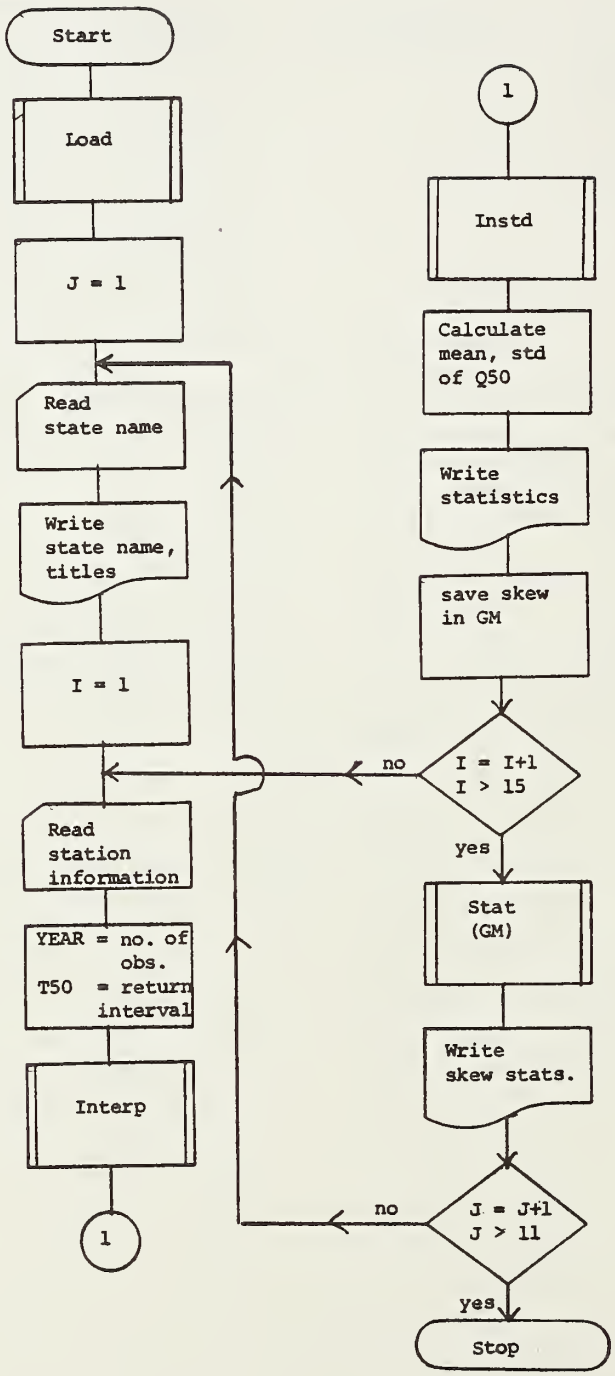
Do 10 I = indexes through 15 stations per state

3

XT	=	real	array	holds true expected value WW1 table
XL	=	real	array	holds log normal expected value table
SL	=	real	array	holds log normal std table
SM	=	real	array	holds skew category values
YM	=	real	array	holds no. of observations category values
TM	=	real	array	holds return interval category values
LAB	=	integer	array	state name for labeling
GM	=	real	array	holds 15 skews
IST	=	integer		holds state no.
IN	=	integer		holds no. of observations for "Interp" "Instd"
G	=	real		skew later C.V. of Q50
XB	=	real		mean in log space

STD	=	real	std in log space
YEAR	=	real	no. of observations
T50	=	real	return interval for "Interp"
TNEW	=	real	unbiased return interval output by "Interp" input by "Instd"
CO	=	real	coefficient from "Interp"
CL	=	real	coefficient from "Instd"
X1	=	real	log space Q50
X2	=	real	log space std (Q50)
EX1	=	real	Q50
EX2	=	real	std (Q50)
G1	=	real	skew of Q50
GXB	=	real	mean of the skews
GSTD	=	real	std of the skews

4.3 Skew


Start
Load
J = 1
Read state name
Write state name, titles
I = 1
Read station information
YEAR = no. of obs.
T50 = return interval
Interp
1
1
Instd
Calculate mean, std of Q50
Write statistics
save skew in GM
I = I+1
I > 15
no
yes
Stat (GM)
Write skew stats.
J = J+1
J > 11
no
yes
Stop

4.5-4.7 Program run preparation

The following is a complete job deck for this program.

1. Job card
2. System control cards
3. Source cards
4. WW1 deck
5. Label cards
6. Data cards
7. Repeart 4 & 5, 10 more times

Input preparation

All input is from cards. A combination of 4 and 5 (Label and Data) is needed for each state to be processed. The data cards come from "Reduce" and there are 15 cards per state.

Label card.

column	format	description
1-80	20 A4	state name plus whatever label you want

Data cards (15 per state).

column	format	description
1-8	I8	station no.
9-10	I2	state no.
11-12	I2	no. of flow years (sample size)
45-51	F7.4	raw space skew of the annual flows
52-58	F7.4	log space mean of the annual flows
59-65	F7.4	log space std of the annual flows

Output

Output is to the printer. For each of the 11 states there is a set of output.

For each state

line	column	format	description
1	1-8	20 A4	state name and label

line	column	format	description
2			blank
3			headers
4			1st station for this state
	3-10	I8	station no.
	11-18	I8	state no.
	19-26	I8	sample size
	27-40	F14.4	log (Q50)
	41-54	F14.4	log (std of Q50)
	55-68	F14.4	Q50
	69-82	F14.4	std of Q50
	83-96	F14.4	unbiased return interval
	97-110	F14.4	C.V. of Q50
	111-124	F14.4	skew of Q50
.			
.			
.			
18			same as 4 but for last station in the state
19			blank
20			blank
21	29-42	F14.4	mean of the skews of the Q50's
	43-56	F14.4	std of the skews of the Q50's

```
//SKEW JOB (0210,D75,DESK),'RAIFFA MJ',CLASS=A,TIME=1                    JOB 516
// EXEC FORTGCG,ACCT=COST
XXFORT EXEC PGM=IEYFORT                                                  00000100
XXSYSLIN   DD DSN=&&LOADSET,DISP=(MOD,PASS),UNIT=DISK,                   00000200
XX             SPACE=(80,(200,100),RLSE),DCB=BLKSIZE=400                 00000300
XXSYSPRINT DD  SYSOUT=A,DCB=(LRECL=120,RECFM=FBA,BLKSIZE=120)            00000400
XXSYSPUNCH DD SYSOUT=(B,,3),DCB=(LRLCL=80,BLKSIZE=80,RECFM=FB)           00000500
XXSYSUDUMP DD  SYSOUT=A                                                  00000600
//FORT.SYSIN DD *
*********************************************************************************************************************************
*     JOB SKEW                                  STARTED 15.17.45    FEB 24, 1976                          OS VERSION 21.8A      *
*********************************************************************************************************************************
IEF236I ALLOC. FOR SKEW     FORT
IEF237I 351   ALLOCATED TO SYSLIN
IEF237I 185   ALLOCATED TO SYSPRINT
IEF237I IDO   ALLOCATED TO SYSPUNCH
IEF237I 186   ALLOCATED TO SYSUDUMP
IEF237I 161   ALLOCATED TO SYSIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS76055.T151743.RV000.SKEW.LOADSET          PASSED
IEF285I   VOL SER NOS= SP0002.
*********************************************************************************************************************************
*     STEP FORT          CPU TIME    3.91 SECS  STARTED 15.17.45  ENDED 15.18.10  SYSIN:  162   STEP USED  88K OF 128K REGION    *
*     EXCPS:   DISK     35                                                        JOBSTEP COST =  $2.23(APPROXIMATE)    *
*********************************************************************************************************************************
XXGO EXEC PGM=LOADER,COND=(4,LT,FORT)                                    00000700
XXSYSLIN   DD  DSN=&&LOADSET,DISP=(OLD,DELETE)                           00000800
XX  DD  DDNAME=LOADIN                                                    00000900
XXSYSLIB DD    DSN=SYS1.FORTLIB,DISP=SHR                                 00001000
XXSYSLOUT DD SYSOUT=A,DCB=(LRECL=121,BLKSIZE=121),SPACE=(TRK,(1,1))      00001100
XXFT05F001 DD  DDNAME=SYSIN                                              00001200
XXFT06F001 DD  SYSOUT=A,DCB=(LRECL=133,RECFM=FBA,BLKSIZE=133)            00001300
XXFT07F001 DD  SYSOUT=(B,,2),DCB=(LRECL=80,RECFM=FB,BLKSIZE=80)          00001400
XXSYSUDUMP DD  SYSOUT=A                                                  00001500
//GO.SYSIN DD *
//
IEF236I ALLOC. FOR SKEW     GO
IEF237I 351   ALLOCATED TO SYSLIN
IEF237I 150   ALLOCATED TO SYSLIB
IEF237I 185   ALLOCATED TO SYSLOUT
IEF237I 162   ALLOCATED TO FT05F001
IEF237I 186   ALLOCATED TO FT06F001
IEF237I IDI   ALLOCATED TO FT07F001
IEF237I 187   ALLOCATED TO SYSUDUMP
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS76055.T151743.RV000.SKEW.LOADSET          DELETED
IEF285I   VOL SER NOS= SP0002.
IEF285I   SYS1.FORTLIB                                 KEPT
IEF285I   VOL SER NOS= SP0017.
*********************************************************************************************************************************
*     STEP GO            CPU TIME    3.04 SECS  STARTED 15.18.10  ENDED 15.18.38  SYSIN:  373   STEP USED 128K OF 128K REGION    *
*     EXCPS:   DISK    102                                                        JOBSTEP COST =  $2.65(APPROXIMATE)    *
*********************************************************************************************************************************
*********************************************************************************************************************************
*     JOB SKEW      TOTAL CPU TIME     6.95 SECS  STARTED 15.17.45  ENDED 15.18.38    FEB 24, 1976  JOBLOG 760555506446SKEW      *
*********************************************************************************************************************************
```

```
FORTRAN IV G LEVEL  21                  MAIN                DATE = 76055        15/17/48                PAGE 0001

0001                  DIMENSION XT(13,9),XL(13,6,9),SL(13,6,9),SM(13),YM(6),TM(9)
0002                  DIMENSION LAB(20),GM(15)
0003                  CALL LOAD(SM,YM,TM,XT,XL,SL)
0004                  DO 20 J=1,11
0005                  READ(5,102)LAB
0006              102 FORMAT(20A4)
0007                  WRITE(6,103)LAB
0008              103 FORMAT('1 ',20A4/,'     STA #  STATE #  # OBS      LN(Q50)  ',
                     X'   LN(STD Q50)     Q50          STD Q50     RETURN INT. ',
                     X'   CV OF Q50     SKEW OF Q50'/)
0009                  DO 10 I=1,15
0010                  READ(5,100,END=99)IST,ISTA,IN,G,XB,STD
0011              100 FORMAT(I8,2I2,32X,3F7.4)
0012                  YEAR=IN
0013                  T50=50.0
0014                  CALL INTERP(G,YEAR,T50,TNEW,CO,XT,XL,SM,YM,TM)
0015                  CALL INSTD(G,YEAR,TNEW,C1,SL,SM,YM,TM)
0016                  X1=XB+CO*STD
0017                  X2=XB+C1*STD
0018                  EX1=EXP(X1)
0019                  EX2=EXP(X2)
0020                  G=EX2/EX1
0021                  G1=G*G*G+3.0*G
0022                  WRITE(6,101)IST,ISTA,IN,X1,X2,EX1,EX2,TNEW,G,G1
0023              101 FORMAT(2X,3I8,7F14.4)
0024                  GM(I)=G1
0025               10 CONTINUE
0026                  CALL STAT(GM,GXB,GSTD)
0027                  WRITE(6,104)GXB,GSTD
0028              104 FORMAT(//'  MEAN AND STD OF THE SKEWS ',2F14.4)
0029               20 CONTINUE
0030               99 CONTINUE
0031                  STOP
0032                  END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
LOAD	A4	IBCOM#	A8	INTERP	AC	INSTD	B0	STAT	B4
EXP	B8								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
J	130	I	134	IST	138	ISTA	13C	IN	140
G	144	XB	148	STD	14C	YEAR	150	T50	154
TNEW	158	C0	15C	C1	160	X1	164	X2	168
EX1	16C	EX2	170	G1	174	GXB	178	GSTD	17C

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
XT	180	XL	354	SL	E4C	SM	1944	YM	1978
TM	1990	LAB	1984	GM	1A04				

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
-102	1A40	103	1A46	100	1AD2	101	1AE1	104	1AEE

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
3	1884	4	1892	5	189E	7	18C0	9	18E0
10	18F0	12	1C38	13	1C5C	14	1C64	15	1C72
16	1C80	17	1C90	18	1CA0	19	1CB2	20	1CC4
21	1CD0	22	1CEA	24	1D50	25	1D58	26	1D70
27	1D7E	29	1DA4	30	1DB8	31	1DB8		

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = MAIN , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 32,PROGRAM SIZE = 7622
STATISTICS NO DIAGNOSTICS GENERATED

OS/360 LOADER

OPTIONS USED - PRINT,MAP,NOLET,CALL,NORES,NOTERM,SIZE=106496,NAME=**GO

NAME	TYPE	ADDR	NAME	TYPE	ADDR	NAME	TYPE	ADDR	NAME	TYPE	ADDR	NAME	TYPE	ADDR
MAIN	SD	108010	STAT	SD	10CDD8	INSTD	SD	10CFC8	INTERP	SD	10D418	OFFSET	SD	10D9F0
LOAD	SD	10DC28	IHCECOMH*	SD	10E048	I8COM# *	LR	10E048	FDIOCS# *	LR	10E104	INTSWTCH*	LR	10EF8E
IHCCOMH2*	SD	10EFB0	SEQDASD *	LR	10F328	IHCSEXP *	SD	10F610	EXP *	LR	10F610	IHCSSORT*	SD	10F7A8
SORT *	LR	10F7A8	IHCFCVTH*	SD	10F8F0	ADCON# *	LR	10F8F0	FCVAOUTP*	LR	10F99A	FCVLOUTP*	LR	10FA2A
FCVZOUTP*	LR	10F882	FCVIOUTP*	LR	10FF36	FCVEOUTP*	LR	110438	FCVCOUTP*	LR	110652	INT6SWCH*	LR	11093B
IHCEFIOS*	SD	110AA8	FIOCS# *	LR	110AA8	FIOCSBEP*	LR	110AAE	IHCFIOS2*	SD	1119D0	IHCEFNTH*	SD	111F00
ARITH# *	LR	111F00	ADJSWTCH*	LR	11229C	IHCUOPT *	SD	112448	IHCERRM *	SD	112748	ERRMON *	LR	112748
IHCERRE *	LR	112760	IHCUATBL*	SD	112D28	IHCETRCH*	SD	113350	IHCTRCH *	LR	113350	ERRTRA *	LR	113358

TOTAL LENGTH 85D0
ENTRY ADDRESS 108010

GEORGIA

STA #	STATE #	# OBS	LN(Q50)	LN(STD Q50)	Q50	STD Q50	RETURN INT.	CV OF Q50	SKEW OF Q50
2191800	13	20	8.6862	6.7069	5920.3867	818.0383	115.7427	0.1382	0.4172
2188500	13	33	9.5516	8.0396	14067.4570	3101.4417	77.6079	0.2205	0.6721
2203800	13	24	9.6105	8.5274	14921.2617	5051.3477	87.5473	0.3385	1.0544
2205000	13	20	7.8097	6.2730	2464.3511	530.0540	106.7079	0.2151	0.6552
2217000	13	23	9.4072	8.0023	12175.4961	2987.8457	92.8627	0.2454	0.7510
2221000	13	23	9.0606	7.7928	8609.0625	2423.1411	91.0297	0.2815	0.8667
2227430	13	25	10.1686	7.9408	26072.7734	2809.6548	90.4315	0.1078	0.3245
2317900	13	24	8.6991	7.3485	5997.3945	1553.8984	89.3433	0.2591	0.7947
2337400	13	24	10.5319	8.9580	37491.4063	7769.6328	90.2498	0.2072	0.6306
2337500	13	20	9.4166	8.5656	12291.2422	5247.9609	93.2369	0.4270	1.3587
2349900	13	23	10.5282	8.3262	37354.4688	4130.8242	95.7422	0.1106	0.3331
2351800	13	26	9.9579	8.1830	21117.5977	3579.4597	89.7241	0.1695	0.5134
2383000	13	23	8.4428	7.0003	4641.5352	1097.0088	94.8591	0.2363	0.7222
2394400	13	24	9.7323	8.3959	16852.7188	4428.9141	90.0398	0.2628	0.8066
3545000	13	33	9.2306	8.1123	10204.9688	3335.1160	75.2357	0.3268	1.0153

MEAN AND STD OF THE SKEWS 0.7277 0.2799

5 NYEARS

5.1

1 This program finds the average no. of flow years reported per station for stations in basins of $\leq$ 50 mi^2. For each state, three numbers are reported.

1 number of stations ($\leq$ 50 mi^2) in that state

2 total number of flow years for the above stations

3 average no. of flow years per station

The average no. of years per station is needed for Bigbasin.

2

3a Only interested in states with state # $\leq$ 60 (not Puerto Rico).

b All records of a station are contiguous.

c A blank flow record means a missing observation not a 0.0 flow.

4 If a record has basin area > 50 mi^2 or blank flow, then skip it.

Otherwise, if the new record's station # is the same as that of the previous record accepted for that state, add one to the total no. of flow years for that state. If the new record's station # is different from that of the previous record accepted add one to the no. of stations in the state, add one to the total no. of flow years for the state, and update the "last station #" for that state.

5

6

7 2/22/76 Raiffa

8

5.2

1

2 Do loops

Do 10 I = zero arrays

Do 10 J = zero arrays

Do 20 I = 100 sets of 10,000 records (in the test, 2 sets of 10,000)

Do 40 J = 100 sets of 100 records

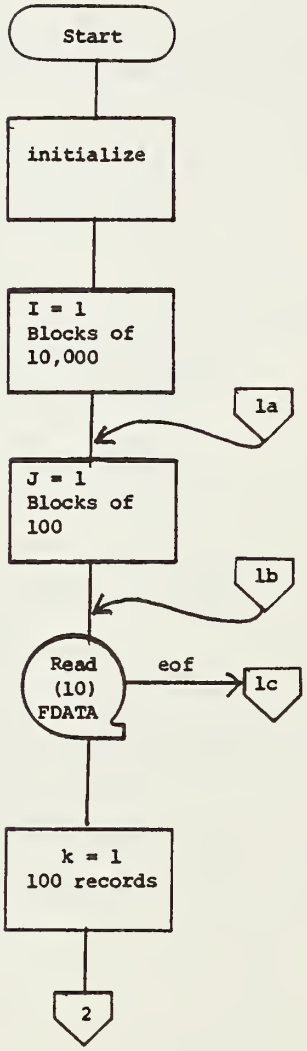
Do 30 K = examine each of 100 records

Do 50 K = write no. of stations, no of years, and average years per station, for each state, for the records read to date

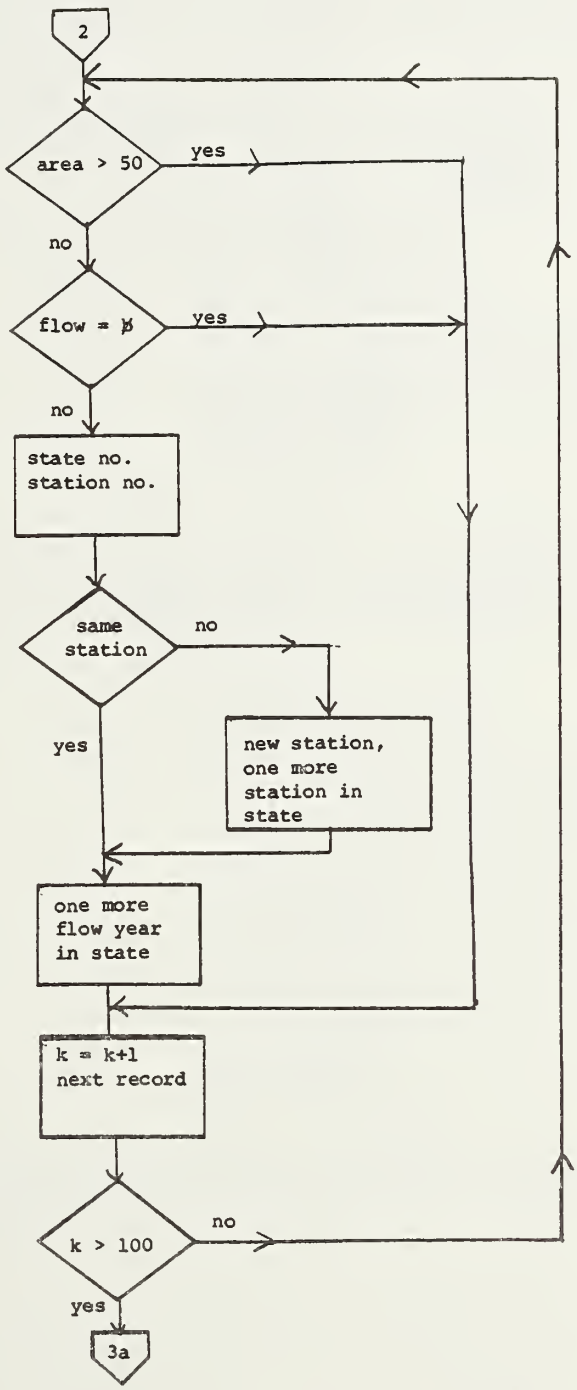
Do 60 K = write data for each state, for all records

FSTA =	real array	no. of stations in state
FYR =	real array	no. of flow years in state
FRL =	real array	1st half of most recent station # processed for that state
FR2 =	real array	2nd half of station #
FDATA =	real array	data matrix (100 records) FDATA (1, I) = 1st half station # (2, I) = 2nd half station # (3, I) = state # (4, I) = basin area (5, I) = flow
XBL =	real	set to blank, and used to test for blank flows
IN =	integer	state #
X1 =	real	1st half of station #
X2 =	real	2nd half of station #
X10 =	integer	no. of records processed
XA =	real	average no. of years per station

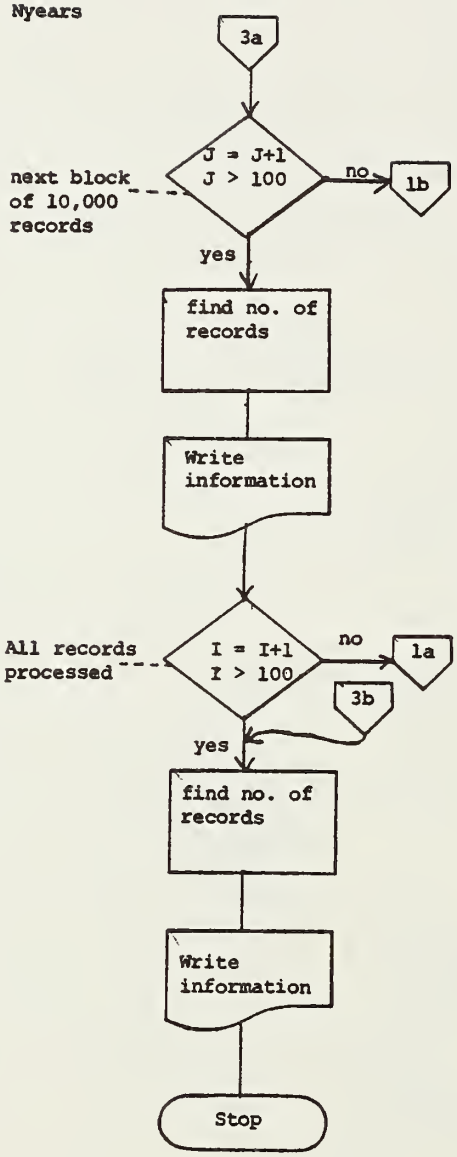
5.3 Nyears


Start
initialize
I = 1
Blocks of
10,000
1a
J = 1
Blocks of
100
1b
Read
(10)
FDATA
eof
1c
k = 1
100 records
2

5.3 Nyears


2
area > 50
yes
no
flow = ∅
yes
no
state no.
station no.
same station
no
yes
new station, one more station in state
one more flow year in state
k = k+1
next record
k > 100
no
yes
3a

5.3 Nyears


3a
J = J+1
J > 100
no
1b
next block of 10,000 records
yes
find no. of records
Write information
I = I+1
I > 100
no
1a
All records processed
3b
yes
find no. of records
Write information
Stop

5.5-5.7 Program run preparation

The following is a complete deck for this program.

1. Job card
2. System control cards
3. Source code

Input preparation

Input is from a magnetic device associated with unit 10. (See USGS Peak Flow File.)

column	format	description
1-4	A4	1st half of station no.
5-8	A4	2nd half of station no.
66-67	F2.0	state no.
68-77	F10.0	total basin drainage area
112-115	A4	flow

Output

All output is to the printer. A set of output is printed after every 10,000 input records, and a final set is printed after End of File on the input device (unit 10).

Each set

line	column	format	description
1	1-8	I8	no. of input records read so far (this will be a multiple of 10,000 except for the last set)
2	1-8	I8	state no. (1)
	9-22	F14.4	no. of stations in state
	23-36	F14.4	no. of flow years for state
	37-50	F14.4	average flow years per
3			station same as 2 for
.			state no. 2
.			
.			
61			same as 2 for state no. 60

* There are some lines for which there are no states (no state with that state number). These lines are all zeros.

```
//TEST JOB (0210,D75,DESK),'RAIFFA MJ',CLASS=F,TIME=I                    JOB 712
// EXEC FORTGCLG,ACCT=COST
XXFORT     EXEC PGM=IEYFORT,REGION=128K                                 00000100
XXSYSLIN   DD DSN=&&LOADSET,DISP=(MOD,PASS),UNIT=DISK,                  00000200
XX            SPACE=(80,(200,100),RLSE),DCB=BLKSIZE=400                 00000300
XXSYSPRINT DD SYSOUT=A,DCB=(LRECL=120,RECFM=FBA,BLKSIZE=120)            00000400
XXSYSPUNCH DD SYSOUT=(B,,3),DCB=(LRECL=80,BLKSIZE=80,RECFM=FB)          00000500
XXSYSUDUMP DD SYSOUT=A                                                  00000600
//FORT.SYSIN DD *
*********************************************************************************************************************************
*     JOB TEST                                  STARTED 12.44.58     FEB 25, 1976                              OS VERSION 21.8A    *
*********************************************************************************************************************************
IEF236I ALLOC. FOR TEST     FORT
IEF237I 351   ALLOCATED TO SYSLIN
IEF237I 181   ALLOCATED TO SYSPRINT
IEF237I 100   ALLOCATED TO SYSPUNCH
IEF237I 182   ALLOCATED TO SYSUDUMP
IEF237I 161   ALLOCATED TO SYSIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS76056.T124456.RV000.TEST.LOADSET          PASSED
IEF285I   VOL SER NOS= SP0002.
*********************************************************************************************************************************
*     STEP FORT          CPU TIME    1.07 SECS  STARTED 12.44.58  ENDED 12.45.04  SYSIN:   47   STEP USED  88K OF 128K REGION    *
*     EXCPS:   DISK    07                                                          JOBSTEP COST =  $0.62(APPROXIMATE)    *
*********************************************************************************************************************************
XXLKED EXEC PGM=IEWL,PARM=(XREF,LET,LIST),COND=(4,LT,FORT)              00000700
XXSYSLIB   DD  DSNAME=SYS1.FORTLIB,DISP=SHR                             00000800
XXSYSLMOD  DD  DSN=&&GOSET(MAIN),DISP=(MOD,PASS),UNIT=DISK,             00000900
XX            SPACE=(1024,(20,10,1),RLSE)                               00001000
XXSYSUT1   DD  UNIT=(DISK,SEP=SYSLMOD),SPACE=(1024,(20,10),RLSE),       00001100
XX            DCB=BLKSIZE=1024                                          00001200
XXSYSLIN   DD  DSN=&&LOADSET,DISP=(OLD,DELETE)                          00001300
XX         DD  DDNAME=SYSIN                                             00001400
XXSYSPRINT DD  SYSOUT=A,DCB=(BLKSIZE=121,LRECL=121,RECFM=FBM),          00001500
XX    SPACE=(TRK,(10,10),RLSE)                                          00001600
XXSYSUDUMP DD SYSOUT=A                                                  00001700
IEF236I ALLOC. FOR TEST     LKED
IEF237I 150   ALLOCATED TO SYSLIB
IEF237I 351   ALLOCATED TO SYSLMOD
IEF237I 350   ALLOCATED TO SYSUT1
IEF237I 351   ALLOCATED TO SYSLIN
IEF237I 181   ALLOCATED TO SYSPRINT
IEF237I 182   ALLOCATED TO SYSUDUMP
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS1.FORTLIB                                  KEPT
IEF285I   VOL SER NOS= SP0017.
IEF285I   SYS76056.T124456.RV000.TEST.GOSET             PASSED
IEF285I   VOL SER NOS= SP0002.
IEF285I   SYS76056.T124456.RV000.TEST.R0000005          DELETED
IEF285I   VOL SER NOS= SP0004.
IEF285I   SYS76056.TI24456.RV000.TEST.LOADSET           DELETED
IEF285I   VOL SER NOS= SP0002.
*********************************************************************************************************************************
*     STEP LKED          CPU TIME    0.77 SECS  STARTED 12.45.04  ENDED 12.45.14                STEP USED 122K OF 128K REGION    *
*     EXCPS:   DISK     91                                                        JOBSTEP COST =  $0.89(APPROXIMATE)    *
*********************************************************************************************************************************
XXGO EXEC PGM=*.LKED.SYSLMOD,COND=((4,LT,FORT),(4,LT,LKED))             00001800
XXFT05F001 DD  DDNAME=SYSIN                                             00001900
XXFT06F001 DD SYSOUT=A,DCB=(LRECL=133,RECFM=FBA,BLKSIZE=133)            00002000
XXFT07F001 DD  SYSOUT=(B,,2),DCB=(LRECL=80,RECFM=FB,BLKSIZE=80)         00002100
XXSYSUDUMP DD SYSOUT=A                                                  00002200
//GO.FT10F001 DD DSN=WRD.PKDA,DISP=(OLD,KEEP),UNIT=TAPE9,
// VOL=SER=(RAAI29,RAA130),
```

```
// DCB=(RECFM=FB,LRECL=133,BLKSIZE=32718,BUFNO=1)
//
IEF236I ALLOC. FOR TEST     GO
IEF237I 351   ALLOCATED TO PGM=*.DD
IEF237I 181   ALLOCATED TO FT06F001
IEF237I 1D1   ALLOCATED TO FT07F001
IEF237I 182   ALLOCATED TO SYSUDUMP
IEF237I 280   ALLOCATED TO FT10F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS76056.T124456.RV000.TEST.GOSET          PASSED
IEF285I   VOL SER NOS= SP0002.
IEF285I   WRD.PKDA                                   KEPT
IEF285I   VOL SER NOS= RAA129,RAA130.
*****************************************************************************************************************************
*     STEP GO             CPU TIME   15.11 SECS  STARTED 12.45.14  ENDED 12.46.25              STEP USED  62K OF 128K REGION     *
*     EXCPS:   DISK     00    TAPE     82                                                JOBSTEP COST =  $4.68(APPROXIMATE)     *
*****************************************************************************************************************************
IEF285I   SYS76056.T124456.RV000.TEST.GOSET          DELETED
IEF285I   VOL SER NOS= SP0002.
*****************************************************************************************************************************
*     JOB TEST      TOTAL CPU TIME   16.95 SECS  STARTED 12.44.58  ENDED 12.46.25    FEB 25, 1976  JOBLOG 760564589738TEST      *
*****************************************************************************************************************************
```

```
0001            DIMENSION FSTA(100),FYR(100),FR1(100),FR2(100),FDATA(5,100)
0002            DATA YBL/'    '/
0003            DO 10 I=1,100
0004            FSTA(I)=0.0
0005            FYR(I)=0.0
0006            FR1(I)=0.0
0007            FR2(I)=0.0
0008            DO 10 J=1,5
0009         10 FDATA(J,I)=0.0
0010            DO 20 I=1,2
0011            DO 40 J=1,100
0012            READ(10,100,END=99)FDATA
0013        100 FORMAT(2A4,57X,F2.0,F10.0,34X,A4)
0014            DO 30 K=1,100
0015            IF(FDATA(4,K) .GT. 50.0)GO TO 30
0016            IF(FDATA(5,K) .EQ. YBL)GO TO 30
0017            IN=FDATA(3,K)
0018            X1=FDATA(1,K)
0019            X2=FDATA(2,K)
0020            IF(X2 .NE. FR2(IN))GO TO 1
0021            IF(X1 .NE. FR1(IN))GO TO 1
0022          2 FYR(IN)=FYR(IN)+1.0
0023            GO TO 30
0024          1 FR1(IN)=X1
0025            FR2(IN)=X2
0026            FSTA(IN)=FSTA(IN)+1.0
0027            GO TO 2
0028         30 CONTINUE
0029         40 CONTINUE
0030            I10=I*10000
0031            WRITE(6,101)I10
0032        101 FORMAT('1',I8,' RECORDS')
0033            DO 50 K=1,60
0034            XA=0.0
0035            IF(FSTA(K) .GT. 0.0)XA=FYR(K)/FSTA(K)
0036         50 WRITE(6,102)K,FSTA(K),FYR(K),XA
0037        102 FORMAT(I8,3F14.4)
0038         20 CONTINUE
0039         99 I10=I*10000+J*100
0040            WRITE(6,101)I10
0041            DO 60 K=1,60
0042            XA=0.0
0043            IF(FSTA(K) .GT. 0.0)XA=FYR(K)/FSTA(K)
0044         60 WRITE(6,102)K,FSTA(K),FYR(K),XA
0045            STOP
0045            END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IBCOM#	E4								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
YBL	E8	I	EC	J	F0	K	F4	IN	F8
X1	FC	X2	100	I10	104	XA	108		

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
FSTA	10C	FYR	29C	FR1	42C	FR2	58C	FDATA	74C

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
100	F1C	101	F2E	102	F3F				

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
2	FC4	3	FC4	4	FD4	5	FDC	6	FE4
7	FEC	8	FF4	9	FFE	10	103A	11	1042
12	104A	14	1070	15	107C	16	108A	17	1098
18	1088	19	10C0	20	10C8	21	10DE	22	10EC
23	1100	24	1106	25	1116	26	111E	27	112A
28	1130	29	1148	30	115C	31	1168	33	1184
34	1190	35	1198	36	1182	38	1200	39	1214
40	122A	41	1248	42	1254	43	125C	44	1276
45	12C4								

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = MAIN , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 46,PROGRAM SIZE = 4818
STATISTICS NO DIAGNOSTICS GENERATED

F88-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED XREF,LET,LIST
DEFAULT OPTION(S) USED - SIZE=(112650,24576)

CROSS REFERENCE TABLE

CONTROL SECTION

NAME	ORIGIN	LENGTH
MAIN	00	12D2
IHCECOMH*	12D8	F61
IHCCOMH2*	2240	650
IHCFCVTH*	28A0	1185
IHCEFNTH*	3A58	542
IHCEFIOS*	3FA0	F28
IHCFIOS2*	4EC8	52E
IHCUOPT *	53F8	300
IHCERRM *	56F8	5DC
IHCUATBL*	5CD8	628
IHCETRCH*	6300	28E

ENTRY

NAME	LOCATION	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION
IBCOM#	12D8	FDIOCS#	1394	INTSWTCH	221E		
SEQDASD	2588						
ADCON#	28A0	FCVAOUTP	294A	FCVLOUTP	29DA	FCVZOUTP	2832
FCVIOUTP	2EE6	FCVEOUTP	33E8	FCVCOUTP	3602	INT6SWCH	38E8
ARITH#	3A58	ADJSWTCH	3DF4				
FIOCS#	3FA0	FIOCSBEP	3FA6				
ERRMON	56F8	IHCERRE	5710				
IHCTRCH	6300	ERRTRA	6308				

LOCATION	REFERS TO SYMBOL	IN CONTROL SECTION	LOCATION	REFERS TO SYMBOL	IN CONTROL SECTION
E4	IBCOM#	IHCECOMH	1394	SEQDASD	IHCCOMH2
2124	ADCON#	IHCFCVTH	211C	FIOCS#	IHCEFIOS
2128	ARITH#	IHCEFNTH	2148	ADJSWTCH	IHCEFNTH
2144	IHCUOPT	IHCUOPT	212C	FCVEOUTP	IHCFCVTH
2130	FCVLOUTP	IHCFCVTH	2134	FCVIOUTP	IHCFCVTH
2138	FCVCOUTP	IHCFCVTH	213C	FCVAOUTP	IHCFCVTH
2140	FCVZOUTP	IHCFCVTH	20D0	IHCERRE	IHCERRM
20EC	IHCCOMH2	IHCCOMH2	2100	IHCERRM	IHCERRM
20D4	IHCCOMH2	IHCCOMH2	20D8	IHCCOMH2	IHCCOMH2
20DC	IHCCOMH2	IHCCOMH2	20E0	IHCCOMH2	IHCCOMH2
24D0	IHCECOMH	IHCECOMH	24E0	IHCECOMH	IHCECOMH
2288	IHCERRM	IHCERRM	2284	IBCOM#	IHCECOMH
26FD	IHCECOMH	IHCECOMH	270D	IHCECOMH	IHCECOMH
271D	IHCECOMH	IHCECOMH	38AC	IBCOM#	IHCECOMH
38A8	IHCERRM	IHCERRM	3E44	IBCOM#	IHCECOMH
3E48	INTSWTCH	IHCECOMH	3DF0	INT6SWCH	IHCFCVTH
3DEC	IHCUOPT	IHCUOPT	3E50	ADCON#	IHCFCVTH
3E4C	FIOCS#	IHCEFIOS	3EBC	IHCERRM	IHCERRM
4108	IHCERRM	IHCERRM	410C	IHCFIOS2	IHCFIOS2
4D18	IHCUATBL	IHCUATBL	4D24	IBCOM#	IHCECOMH
4D39	IHCFIOS2	IHCFIOS2	4D50	IHCFIOS2	IHCFIOS2

LOCATION	REFERS TO SYMBOL	IN CONTROL SECTION	LOCATION	REFERS TO SYMBOL	IN CONTROL SECTION
4EC1	IHCFIOS2	IHCFIOS2	5CC4	IHCUOPT	IHCUOPT
5CC8	IBCOM#	IHCECOMH	5CCC	IHCTRCH	IHCETRCH
5CD0	FIOCSBEP	IHCEFIOS	6474	IBCOM#	IHCECOMH
6478	ADCON#	IHCFCVTH	647C	FIOCSBEP	IHCEFIOS

ENTRY ADDRESS 00
TOTAL LENGTH 6590

****MAIN DOES NOT EXIST BUT HAS BEEN ADDED TO DATA SET

10000 RECORDS

1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	0.0	0.0
4	0.0	0.0	0.0
5	0.0	0.0	0.0
6	0.0	0.0	0.0
7	0.0	0.0	0.0
8	0.0	0.0	0.0
9	38.0000	370.0000	9.7368
10	0.0	0.0	0.0
11	0.0	0.0	0.0
12	0.0	0.0	0.0
13	0.0	0.0	0.0
14	0.0	0.0	0.0
15	0.0	0.0	0.0
16	0.0	0.0	0.0
17	0.0	0.0	0.0
18	0.0	0.0	0.0
19	0.0	0.0	0.0
20	0.0	0.0	0.0
21	0.0	0.0	0.0
22	0.0	0.0	0.0
23	28.0000	292.0000	10.4286
24	0.0	0.0	0.0
25	60.0000	999.0000	16.6500
26	0.0	0.0	0.0
27	0.0	0.0	0.0
28	0.0	0.0	0.0
29	0.0	0.0	0.0
30	0.0	0.0	0.0
31	0.0	0.0	0.0
32	0.0	0.0	0.0
33	16.0000	306.0000	19.1250
34	0.0	0.0	0.0
35	0.0	0.0	0.0
36	0.0	0.0	0.0
37	0.0	0.0	0.0
38	0.0	0.0	0.0
39	0.0	0.0	0.0
40	0.0	0.0	0.0
41	0.0	0.0	0.0
42	0.0	0.0	0.0
43	0.0	0.0	0.0
44	29.0000	345.0000	11.8966
45	0.0	0.0	0.0
46	0.0	0.0	0.0
47	0.0	0.0	0.0
48	0.0	0.0	0.0
49	0.0	0.0	0.0
50	26.0000	289.0000	11.1154
51	0.0	0.0	0.0
52	0.0	0.0	0.0
53	0.0	0.0	0.0
54	0.0	0.0	0.0
55	0.0	0.0	0.0
56	0.0	0.0	0.0
57	0.0	0.0	0.0
58	0.0	0.0	0.0
59	0.0	0.0	0.0
60	0.0	0.0	0.0

20000 RECORDS			
1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	0.0	0.0
4	0.0	0.0	0.0
5	0.0	0.0	0.0
6	0.0	0.0	0.0
7	0.0	0.0	0.0
8	0.0	0.0	0.0
9	133.0000	1629.0000	12.2481
10	0.0	0.0	0.0
11	0.0	0.0	0.0
12	0.0	0.0	0.0
13	0.0	0.0	0.0
14	0.0	0.0	0.0
15	0.0	0.0	0.0
16	0.0	0.0	0.0
17	0.0	0.0	0.0
18	0.0	0.0	0.0
19	0.0	0.0	0.0
20	0.0	0.0	0.0
21	0.0	0.0	0.0
22	0.0	0.0	0.0
23	28.0000	292.0000	10.4286
24	0.0	0.0	0.0
25	94.0000	1493.0000	15.8830
26	0.0	0.0	0.0
27	0.0	0.0	0.0
28	0.0	0.0	0.0
29	0.0	0.0	0.0
30	0.0	0.0	0.0
31	0.0	0.0	0.0
32	0.0	0.0	0.0
33	16.0000	306.0000	19.1250
34	47.0000	1212.0000	25.7872
35	0.0	0.0	0.0
36	49.0000	1092.0000	22.2857
37	0.0	0.0	0.0
38	0.0	0.0	0.0
39	0.0	0.0	0.0
40	0.0	0.0	0.0
41	0.0	0.0	0.0
42	0.0	0.0	0.0
43	0.0	0.0	0.0
44	29.0000	345.0000	11.8966
45	0.0	0.0	0.0
46	0.0	0.0	0.0
47	0.0	0.0	0.0
48	0.0	0.0	0.0
49	0.0	0.0	0.0
50	29.0000	320.0000	11.0345
51	0.0	0.0	0.0
52	0.0	0.0	0.0
53	0.0	0.0	0.0
54	0.0	0.0	0.0
55	0.0	0.0	0.0
56	0.0	0.0	0.0
57	0.0	0.0	0.0
58	0.0	0.0	0.0
59	0.0	0.0	0.0
60	0.0	0.0	0.0

30000 RECORDS

1	0.0	0.0	0.0
2	0.0	0.0	0.0
3	0.0	0.0	0.0
4	0.0	0.0	0.0
5	0.0	0.0	0.0
6	0.0	0.0	0.0
7	0.0	0.0	0.0
8	0.0	0.0	0.0
9	133.0000	1629.0000	12.2481
10	0.0	0.0	0.0
11	0.0	0.0	0.0
12	0.0	0.0	0.0
13	0.0	0.0	0.0
14	0.0	0.0	0.0
15	0.0	0.0	0.0
16	0.0	0.0	0.0
17	0.0	0.0	0.0
18	0.0	0.0	0.0
19	0.0	0.0	0.0
20	0.0	0.0	0.0
21	0.0	0.0	0.0
22	0.0	0.0	0.0
23	28.0000	292.0000	10.4286
24	0.0	0.0	0.0
25	94.0000	1493.0000	15.8830
26	0.0	0.0	0.0
27	0.0	0.0	0.0
28	0.0	0.0	0.0
29	0.0	0.0	0.0
30	0.0	0.0	0.0
31	0.0	0.0	0.0
32	0.0	0.0	0.0
33	16.0000	306.0000	19.1250
34	47.0000	1212.0000	25.7872
35	0.0	0.0	0.0
36	49.0000	1092.0000	22.2857
37	0.0	0.0	0.0
38	0.0	0.0	0.0
39	0.0	0.0	0.0
40	0.0	0.0	0.0
41	0.0	0.0	0.0
42	0.0	0.0	0.0
43	0.0	0.0	0.0
44	29.0000	345.0000	11.8966
45	0.0	0.0	0.0
46	0.0	0.0	0.0
47	0.0	0.0	0.0
48	0.0	0.0	0.0
49	0.0	0.0	0.0
50	29.0000	320.0000	11.0345
51	0.0	0.0	0.0
52	0.0	0.0	0.0
53	0.0	0.0	0.0
54	0.0	0.0	0.0
55	0.0	0.0	0.0
56	0.0	0.0	0.0
57	0.0	0.0	0.0
58	0.0	0.0	0.0
59	0.0	0.0	0.0
60	0.0	0.0	0.0

6 SAMP

6.1

1 Used for exploring the instability of Q50. A station with 61 years of flow data is found. A set of N flows is constructed by sampling with replacement, and its unbiased Q50 is calculated. After 100 such sets of N are processed the mean and std of the Q50's are found. This is done for N = 5, 10, 25.

2 Calls:

```
Load
Calc
  Gen
    Rnd
  Statl
  Interp
     Offset
```

3

4 Subroutine "Calc" handles almost all of the work. "Samp" merely inputs the data (the 61 flows) and calls "Calc" 3 times, corresponding to the 3 N values 5, 10, 25. "Calc" generates the 100 sets, finds the Q50's and the mean and std of the Q50's.

5

6

7 2/24/76 Raiffa

8

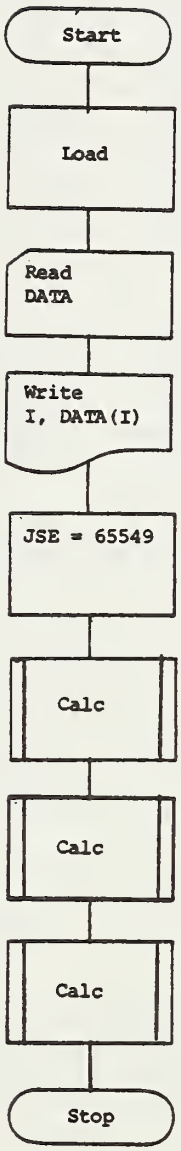
6.2

2 Do loops

Do 10 I = index to read 61 flows

3	XT	=	real	array	true expected value table
	XL	=	real	array	log normal expected value table
	SL	=	real	array	log normal std table
	SM	=	real	array	skew category values
	YM	=	real	array	no. of observations category values
	TM	=	real	array	return interval category values
	DATA	=	real	array	61 flow values
	JSE	=	integer		seed for random no. generator

6.3 Samp


Start
Load
Read
DATA
Write
I, DATA(I)
JSE = 65549
Calc
Calc
Calc
Stop

6.5-6.7 Program run preparation

The following is a complete deck for this job.

1. Job card
2. System control cards
3. Source code
4. WWl deck
5. Data cards

Input preparation

All input is from cards.

Data cards.

There are 61 data cards. Each card contains one maximum flow figure.

columns	format	description
1-5	F5.0	flow

Output

Output is to the printer. There are 4 sections of output: data listing; and 3 sets of statistics.

Data listing.

This is merely a listing of the 61 input flows.

line	column	format	description
1	1-8	I8	observation no. 1
	9-22	F14.4	flow
.			
.			
.			
61	1-8	I8	observation no. 61
	9-22	F14.4	flow

Statistics set 1.

In the first set of simulations, 5 annual flows are used to calculate each Q50. There are 100 lines, corresponding to 100 Q50's, plus one summary line.

line	column	format	description
1			statistics for 1st simulated Q50
	1-5	I5	I (1)
	6-19	F14.4	mean of annual flows
	20-33	F14.4	std of annual flows
	34-47	F14.4	skew of annual flows
	48-61	F14.4	mean of log (annual flows)
	62-75	F14.4	std of log (annual flows)
	76-89	F14.4	coefficient from WW1 table
	90-103	F14.4	Q50
.			
.			
.			
100			statistics for 100th Q50
101	1-8	I8	no. of annual flows per Q50 (5)
	9-22	F14.4	mean of Q50's
	23-36	F14.4	std of Q50's
	37-50	F14.4	skew of Q50's

Statistics set 2.

Exactly like statistics set 1 but with 10 annual flows per Q50.

Statistics set 3.

Exactly like statistics set 1 but with 25 annual flows per Q50.

```
//SAMP JOB (0210,D75,DESK),'RAIFFA MJ',CLASS=A,TIME=1                    JOB 986
// EXEC FORTGCG,ACCT=COST
XXFORT EXEC PGM=IEYFORT                                                  00000100
XXSYSLIN  DD DSN=&&LOADSET,DISP=(MOD,PASS),UNIT=DISK,                    00000200
XX             SPACE=(80,(200,100),RLSE),DCB=BLKSIZE=400                 00000300
XXSYSPRINT DD  SYSOUT=A,DCB=(LRECL=120,RECFM=FBA,BLKSIZE=120)            00000400
XXSYSPUNCH DD SYSOUT=(B,,3),DCB=(LRECL=80,BLKSIZE=80,RECFM=FB)           00000500
XXSYSUDUMP DD  SYSOUT=A                                                  00000600
//FORT.SYSIN DD *
*********************************************************************************************************************************
*     JOB SAMP                                  STARTED 14.19.38    FEB 26, 1976                              OS VERSION 21.8A    *
*********************************************************************************************************************************
IEF236I ALLOC. FOR SAMP     FORT
IEF237I 351   ALLOCATED TO SYSLIN
IEF237I 181   ALLOCATED TO SYSPRINT
IEF237I 100   ALLOCATED TO SYSPUNCH
IEF237I 182   ALLOCATED TO SYSUDUMP
IEF237I 161   ALLOCATED TO SYSIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS76057.T141937.RV000.SAMP.LOADSET          PASSED
IEF285I   VOL SER NOS= SP0002.
*********************************************************************************************************************************
*     STEP FORT          CPU TIME    3.49 SECS  STARTED 14.19.38  ENDED 14.19.46  SYSIN:  167   STEP USED  84K OF 128K REGION    *
*     EXCPS:   DISK    42                                                          JOBSTEP COST =  $2.27(APPROXIMATE)    *
*********************************************************************************************************************************
XXGO EXEC PGM=LOADER,COND=(4,LT,FORT)                                    00000700
XXSYSLIN   DD  DSN=&&LOADSET,DISP=(OLD,DELETE)                           00000800
XX DD DDNAME=LOADIN                                                      00000900
XXSYSLIB DD    DSN=SYS1.FORTLIB,DISP=SHR                                 00001000
XXSYSLOUT DD SYSOUT=A,DCB=(LRECL=121,BLKSIZE=121),SPACE=(TRK,(1,1))      00001100
XXFT05F001 DD  DDNAME=SYSIN                                              00001200
XXFT06F001 DD  SYSOUT=A,DCB=(LRECL=133,RECFM=FBA,BLKSIZE=133)            00001300
XXFT07F001 DD  SYSOUT=(B,,2),DCB=(LRECL=80,RECFM=FB,BLKSIZE=80)          00001400
XXSYSUDUMP DD  SYSOUT=A                                                  00001500
//GO.SYSIN DD *
//
IEF236I ALLOC. FOR SAMP     GO
IEF237I 351   ALLOCATED TO SYSLIN
IEF237I 150   ALLOCATED TO SYSLIB
IEF237I 181   ALLOCATED TO SYSLOUT
IEF237I 162   ALLOCATED TO FT05F001
IEF237I 182   ALLOCATED TO FT06F001
IEF237I 1D1   ALLOCATED TO FT07F001
IEF237I 183   ALLOCATED TO SYSUDUMP
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS76057.T141937.RV000.SAMP.LOADSET          DELETED
IEF285I   VOL SER NOS= SP0002.
IEF285I   SYS1.FORTLIB                                 KEPT
IEF285I   VOL SER NOS= SP0017.
*********************************************************************************************************************************
*     STEP GO            CPU TIME    3.94 SECS  STARTED 14.19.47  ENDED 14.20.01  SYSIN:  258   STEP USED 128K OF 128K REGION    *
*     EXCPS:   DISK    113                                                         JOBSTEP COST =  $2.97(APPROXIMATE)    *
*********************************************************************************************************************************
*********************************************************************************************************************************
*     JOB SAMP       TOTAL CPU TIME    7.43 SECS  STARTED 14.19.38  ENDED 14.20.01    FEB 26, 1976  JOBLOG 76057515776SAMP      *
*********************************************************************************************************************************
```

```
FORTRAN IV G LEVEL  21                MAIN              DATE = 76057        14/19/40              PAGE 0001

0001                  DIMENSION XT(13,9),XL(13,6,9),SL(13,6,9),SM(13),YM(6),TM(9)
0002                  DIMENSION DATA(61)
0003                  CALL LOAD(SM,YM,TM,XT,XL,SL)
0004                  READ(5,100)DATA
0005              100 FORMAT(F5.0)
0006                  DO 10 I=1,61
0007               10 WRITE(6,101)I,DATA(I)
0008              101 FORMAT(I8,F14.4)
0009                  JSE=65549
0010                  CALL CALC(DATA,05,XT,XL,SM,YM,TM,JSE)
0011                  CALL CALC(DATA,10,XT,XL,SM,YM,TM,JSE)
0012                  CALL CALC(DATA,25,XT,XL,SM,YM,TM,JSE)
0013                  STOP
0014                  END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
LOAD	98	IBCOM#	9C	CALC	A0				

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
I	11C	JSE	120						

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
XT	124	XL	2F8	SL	DF0	SM	18E8	YM	191C
TM	1934	DATA	1958						

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
100	1A4C	101	1A51						

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
3	1ACC	4	1ADA	6	1AFC	7	180C	9	184C
10	1858	11	1866	12	1874	13	1882		

OPTIONS IN EFFECT IO,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = MAIN , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 14,PROGRAM SIZE = 7056
STATISTICS NO DIAGNOSTICS GENERATED

OS/360 LOADER

OPTIONS USED - PRINT,MAP,NOLET,CALL,NORES,NOTERM,SIZE=106496,NAME=**GO

NAME	TYPE	ADDR	NAME	TYPE	ADDR	NAME	TYPE	ADDR	NAME	TYPE	ADDR	NAME	TYPE	ADDR
MAIN	SD	132810	CALC	SD	1343A0	GEN	SD	134A00	RND	SD	134BC8	STAT1	SD	134DD8
INTERP	SD	135068	OFFSET	SD	135640	LOAD	SD	135878	IHCECOMH*	SD	135C98	IHCOM# *	LR	135C98
FDIOCS# *	LR	135D54	INTSWTCH*	LR	1368DE	IHCCOMH2*	SD	136C00	SEQDASD *	LR	136F78	IHCSLOG *	SD	137260
ALOGIO *	LR	137260	ALOG *	LR	137278	IHCSEXP *	SD	137418	EXP *	LR	137418	IHCSSQRT*	SD	137580
SQRT *	LR	137580	IHCFCVTH*	SD	1376F8	ADCON# *	LR	1376F8	FCVAOUTP*	LR	1377A2	FCVLOUTP*	LR	137832
FCVZOUTP*	LR	13798A	FCVIOUTP*	LR	137D3E	FCVEOUTP*	LR	138240	FCVCOUTP*	LR	13845A	INTGSWCH*	LR	138743
IHCEFIOS*	SD	138880	FIOCS# *	LR	1388B0	FIOCSBEP*	LR	138886	IHCFIOS2*	SD	139708	IHCEFNTH*	SD	139D08
ARITH# *	LR	139D08	ADJSWTCH*	LR	13A0A4	IHCUOPT *	SD	13A250	IHCERRM *	SD	13A550	ERRMON *	LR	13A550
IHCERRE *	LR	13A568	IHCUATBL*	SD	13A830	IHCETRCH*	SD	138158	IHCTRCH *	LR	138158	ERRTRA *	LR	138160

TOTAL LENGTH 88D8
ENTRY ADDRESS 132810

1	1150.0000
2	690.0000
3	600.0000
4	1550.0000
5	1220.0000
6	1280.0000
7	1100.0000
8	1020.0000
9	1100.0000
10	868.0000
11	815.0000
12	771.0000
13	1040.0000
14	491.0000
15	1100.0000
16	1120.0000
17	884.0000
18	885.0000
19	1110.0000
20	1360.0000
21	1360.0000
22	1280.0000
23	1070.0000
24	1040.0000
25	2250.0000
26	1130.0000
27	1060.0000
28	695.0000
29	500.0000
30	1040.0000
31	1630.0000
32	506.0000
33	845.0000
34	798.0000
35	708.0000
36	1250.0000
37	758.0000
38	1210.0000
39	1010.0000
40	811.0000
41	1320.0000
42	1280.0000
43	955.0000
44	1100.0000
45	821.0000
46	834.0000
47	1010.0000
48	968.0000
49	1010.0000
50	603.0000
51	825.0000
52	6700.0000
53	1390.0000
54	825.0000
55	1080.0000
56	985.0000
57	812.0000
58	1120.0000
59	985.0000
60	1150.0000
61	1370.0000

1	973.0000	254.0079	0.8010	6.8485	0.2933	3.0564	2309.8699

2	981.5999	248.8855	0.7770	6.8619	0.2647	3.0316	2131.1465
3	967.3999	287.2280	0.9169	6.8403	0.2905	3.1783	2352.9607
4	967.2000	145.9203	0.4560	6.8652	0.1529	2.7018	1448.4561
5	1112.0000	101.8332	0.2755	7.0107	0.0892	2.5196	1387.6274
6	789.2000	275.9014	1.0930	6.6198	0.3545	3.3625	2469.9980
7	2222.5999	2529.4048	4.8880	7.3230	0.8946	5.6923	246529.3750
8	987.5999	270.5366	0.8424	6.8615	0.3000	3.0996	2419.9587
9	1055.5999	223.5582	0.6448	6.9417	0.2320	2.8949	2024.9519
10	2108.0000	2570.8232	5.0000	7.2469	0.9206	5.7315	274659.8750
11	1147.0000	166.0422	0.4373	7.0367	0.1431	2.6826	1670.0320
12	1090.0000	48.4768	0.1335	6.9931	0.0464	2.3812	1216.4153
13	1021.2000	219.4903	0.6547	6.9104	0.2138	2.9052	1865.7935
14	1023.0000	300.6992	0.9072	6.8903	0.3293	3.1680	2788.9678
15	676.3999	164.0625	0.7419	6.4913	0.2574	2.9955	1425.7158
16	948.2000	264.4565	0.8584	6.8142	0.3395	3.1165	2623.1030
17	1051.0000	209.0981	0.6047	6.9422	0.1943	2.8536	1802.0142
18	857.3999	304.7537	1.1112	6.6992	0.3769	3.3814	2903.2693
19	836.3999	385.4707	1.4805	6.6452	0.4553	3.7428	4226.7305
20	985.5999	264.6611	0.8249	6.8652	0.2629	3.0814	2154.8638
21	1084.0000	210.0417	0.5886	6.9731	0.1965	2.8370	1864.2478
22	892.5999	228.9869	0.7865	6.7651	0.2760	3.0414	2007.1865
23	1003.3999	311.8708	0.9625	6.8731	0.3067	3.2270	2599.0610
24	1308.5999	585.7663	1.4331	7.1024	0.4243	3.7021	5844.1406
25	980.0000	148.6186	0.4584	6.8781	0.1550	2.7043	1476.0669
26	1325.0000	289.5686	0.6661	7.1688	0.2291	2.9170	2532.9312
27	1340.5999	591.3489	1.4092	7.1174	0.4714	3.6815	6993.6719
28	940.2000	329.7246	1.0952	6.7895	0.3908	3.3648	3308.8083
29	952.3999	112.1450	0.3549	6.8536	0.1159	2.5989	1280.1892
30	1087.2000	406.9067	1.1752	6.9209	0.4467	3.4459	4723.5742
31	1065.0000	75.1665	0.2121	6.9687	0.0727	2.4572	1270.6448
32	1067.0000	189.7894	0.5392	6.9605	0.1727	2.7868	1705.5220
33	1176.0000	136.6748	0.3502	7.0646	0.1150	2.5942	1576.3650
34	2157.5999	2554.7759	5.0000	7.2737	0.9206	5.7315	282124.8750
35	886.2000	179.3342	0.6154	6.7708	0.2006	2.8645	1548.9670
36	1100.2000	426.6047	1.2216	6.9312	0.4471	3.4918	4877.7656
37	1010.5999	205.1414	0.6173	6.9006	0.2152	2.8665	1839.6965
38	1347.0000	540.1111	1.2674	7.1490	0.3657	3.5376	4640.6484
39	878.0000	128.8216	0.4433	6.7686	0.1525	2.6887	1310.9656
40	1222.0000	135.9044	0.3350	7.1033	0.1119	2.5789	1622.5359
41	928.7998	180.8784	0.5916	6.8191	0.1914	2.8401	1576.1592
42	1251.2000	597.0396	1.5263	7.0622	0.4253	3.7825	5830.0352
43	1105.0000	182.8251	0.5009	6.9960	0.1725	2.7481	1754.5420
44	2097.2000	2583.4202	5.0000	7.2206	0.9206	5.7315	267528.8125
45	2031.5999	2613.5447	5.0000	7.1612	0.9206	5.7315	252107.4375
46	1980.5999	2639.0066	5.0000	7.1077	0.9206	5.7315	238966.8125
47	1364.0000	497.4233	1.1425	7.1759	0.3061	3.4138	3717.4270
48	1345.7998	546.5117	1.2852	7.1466	0.3703	3.5556	4737.1953
49	1081.7998	243.0098	0.6852	6.9659	0.2275	2.9369	2067.0442
50	1004.0000	241.1016	0.7343	6.8831	0.2824	2.9876	2268.6304
51	949.0000	299.0066	0.9765	6.8069	0.3670	3.2420	2970.9170
52	968.3999	144.3035	0.4503	6.8666	0.1508	2.6960	1441.0806
53	1153.5999	270.9543	0.7176	7.0317	0.2098	2.9706	2110.6934
54	1053.0000	60.7865	0.1734	6.9581	0.0580	2.4196	1209.9534
55	1188.5999	363.0308	0.9448	7.0321	0.3720	3.2080	3734.8713
56	1088.5999	171.5408	0.4767	6.9826	0.1597	2.7231	1664.6067
57	796.2000	239.1077	0.9280	6.6407	0.3191	3.1901	2119.1201
58	961.0000	206.0764	0.6532	6.8509	0.2027	2.9036	1701.9524
59	897.5999	193.5588	0.6569	6.7787	0.2368	2.9075	1749.5210
60	1012.2000	304.4839	0.9297	6.8697	0.3841	3.1919	3280.0642
61	2233.5999	2501.1694	4.7635	7.3701	0.8148	5.6491	158428.9375
62	1324.0000	523.8606	1.2489	7.1386	0.3323	3.5191	4056.5237
63	1111.7998	279.3542	0.7697	6.9863	0.2671	3.0240	2426.2769
64	1061.5999	135.1453	0.3840	6.9608	0.1312	2.6282	1488.5208

65	2156.5999	2546.2986	5.0000	7.2929	0.9206	5.7315	287598.7500
66	981.7998	205.1402	0.6360	6.8701	0.2248	2.8857	1842.6956
67	1051.2000	216.0428	0.6252	6.9400	0.2131	2.8747	1905.3347
68	982.5999	201.7672	0.6247	6.8719	0.2189	2.8741	1809.8884
69	855.0000	362.7024	1.3490	6.6731	0.4500	3.6200	4031.8477
70	867.0000	321.6318	1.1640	6.7107	0.3695	3.4348	2921.0884
71	974.5999	216.2684	0.6766	6.8576	0.2611	2.9280	2042.5979
72	1100.0000	272.7637	0.7591	6.9749	0.2751	3.0132	2449.7249
73	886.2000	183.0061	0.6283	6.7674	0.2287	2.8779	1678.2224
74	2060.7998	2618.7937	5.0000	7.1342	0.9206	5.7315	245382.1250
75	982.5999	238.6001	0.7428	6.8657	0.2505	2.9964	2030.9880
76	1934.5999	2667.4707	5.0000	7.0345	0.9206	5.7315	222104.7500
77	1023.0000	276.4417	0.8304	6.8963	0.3049	3.0871	2533.8662
78	987.2000	132.0331	0.4036	6.8874	0.1387	2.6482	1414.6692
79	1139.7998	251.4791	0.6726	7.0184	0.2269	2.9238	2168.5503
80	1105.2000	352.5996	0.9896	6.9501	0.4143	3.2561	4019.9878
81	1118.0000	183.5279	0.4969	7.0090	0.1588	2.7440	1710.9258
82	919.7998	275.0227	0.9237	6.7898	0.2898	3.1856	2237.1763
83	1013.7998	244.1608	0.7365	6.8973	0.2481	2.9899	2077.9285
84	1176.2000	488.8083	1.3185	6.9814	0.5011	3.5891	6500.9961
85	1107.3999	722.2273	2.2339	6.8428	0.6458	4.3655	15706.8281
86	2133.3999	2573.8533	5.0000	7.2436	0.9206	5.7315	273759.5000
87	994.5999	219.2989	0.6722	6.8773	0.2662	2.9233	2112.4253
88	1126.0000	52.2494	0.1393	7.0256	0.0465	2.3868	1257.1248
89	999.3999	196.5146	0.5975	6.8919	0.1944	2.8462	1711.6013
90	1105.7998	243.2607	0.6706	6.9888	0.2218	2.9217	2073.3203
91	901.0000	312.1665	1.0810	6.7517	0.3684	3.3501	2938.9829
92	958.2000	304.9709	0.9871	6.8158	0.3693	3.2534	3033.1931
93	895.7998	150.7465	0.5096	6.7859	0.1738	2.7569	1429.4666
94	919.5999	323.6826	1.0996	6.7707	0.3731	3.3693	3065.3965
95	952.5999	172.2063	0.5482	6.8449	0.1941	2.7959	1615.7556
96	973.5999	243.6976	0.7666	6.8515	0.2830	3.0209	2222.7109
97	3264.0000	3150.9490	3.7957	7.6046	1.1592	5.2898	924119.8750
98	975.2000	328.9131	1.0502	6.8264	0.3960	3.3185	3430.7441
99	1013.5999	173.8491	0.5196	6.9087	0.1804	2.7669	1648.7678
100	1024.0000	185.7889	0.5503	6.9177	0.1879	2.7980	1708.5647
5	39047.5781	119035.5625	37.4755				
1	1059.2998	480.7036	1.4548	6.8875	0.4049	3.5254	4084.2163
2	1642.7998	1832.3420	4.7337	7.1091	0.6081	4.9775	37569.2891
3	985.7998	199.6530	0.6159	6.8749	0.2036	2.7834	1705.4277
4	989.0999	315.2773	0.9886	6.8495	0.3308	3.1275	2654.3269
5	992.8999	316.3025	0.9880	6.8575	0.3063	3.1269	2478.3862
6	919.7000	234.9333	0.7830	6.7901	0.2859	2.9368	2058.3945
7	973.3999	192.6655	0.6015	6.8633	0.1971	2.7702	1651.3030
8	932.8999	166.1779	0.5400	6.8219	0.1978	2.7141	1570.0847
9	1607.7998	1804.7639	4.7819	7.1080	0.6503	4.9883	31313.0273
10	921.8999	302.8457	1.0210	6.7778	0.3313	3.1567	2498.6084
11	1125.2000	213.6533	0.5770	7.0108	0.1791	2.7478	1813.5374
12	1282.0999	402.1799	0.9719	7.1179	0.2841	3.1118	2986.6121
13	1003.5999	270.3950	0.8278	6.8800	0.2622	2.9778	2123.6316
14	1447.2998	1855.5752	5.0000	6.9446	0.9206	5.0375	107160.5000
15	1653.0999	1825.3323	4.6588	7.1255	0.6713	4.9607	34733.3242
16	929.0000	214.1925	0.7039	6.8067	0.2567	2.8649	1886.1260
17	865.5000	200.3999	0.7070	6.7363	0.2529	2.8678	1739.6448
18	1015.5000	228.6368	0.6869	6.8992	0.2340	2.8490	1930.9460
19	982.7000	235.1163	0.7315	6.8650	0.2365	2.8899	1897.9119
20	1009.0000	141.4457	0.4233	6.9077	0.1420	2.6062	1447.7007
21	1602.5999	1810.7837	4.8322	7.0982	0.6595	4.9996	32705.0469
22	1074.3999	264.2224	0.7527	6.9512	0.2541	2.9091	2187.2329
23	1073.0000	452.1240	1.3389	6.9184	0.3414	3.4319	3261.6726
24	992.5999	286.5161	0.8900	6.8597	0.3073	3.0353	2422.4041
25	1266.2000	405.7134	0.9942	7.1032	0.2937	3.1327	3050.6602
26	1042.8999	219.0525	0.6394	6.9292	0.2158	2.8050	1871.3872

27	1615.7998	1841.3450	4.8987	7.0843	0.6920	5.0146	38347.5977
28	932.5000	176.0073	0.5730	6.8198	0.2069	2.7441	1615.7017
29	952.8999	264.9792	0.8557	6.8313	0.2380	3.0036	1893.7952
30	1071.3999	290.6560	0.8338	6.9448	0.2644	2.9834	2283.7495
31	1251.5000	402.2854	0.9975	7.0942	0.2770	3.1359	2872.4927
32	1100.2000	289.5220	0.8077	6.9636	0.3183	2.9594	2712.6689
33	1180.0999	338.7900	0.8849	7.0265	0.3450	3.0306	3203.4155
34	878.8999	147.5775	0.5085	6.7652	0.1764	2.6855	1392.5190
35	1094.5999	259.9023	0.7257	6.9726	0.2401	2.8847	2133.1575
36	1122.7998	274.3765	0.7477	6.9941	0.2641	2.9046	2348.1299
37	1065.3999	312.3103	0.9046	6.9288	0.3141	3.0489	2661.3303
38	875.3999	265.6899	0.9385	6.7289	0.3286	3.0804	2301.1763
39	1621.2000	1843.2725	4.8807	7.0787	0.7159	5.0105	42864.6602
40	933.8999	232.6867	0.7629	6.8076	0.2754	2.9185	2021.0916
41	1567.0999	1822.6797	5.0000	7.0621	0.9206	5.0375	120523.3125
42	987.3999	175.7644	0.5397	6.8811	0.1760	2.7138	1569.7898
43	1164.0000	170.1927	0.4418	7.0495	0.1514	2.6234	1714.2510
44	1498.7998	1838.7947	5.0000	6.9979	0.9206	5.0375	113028.8125
45	993.7998	215.8024	0.6617	6.8790	0.2276	2.8257	1848.5146
46	1027.3999	189.5955	0.5599	6.9197	0.1823	2.7322	1665.3464
47	950.7998	163.7471	0.5218	6.8443	0.1695	2.6975	1482.5071
48	1088.2000	223.2107	0.6240	6.9728	0.2097	2.7908	1916.0381
49	1114.8999	462.9807	1.3174	6.9523	0.3645	3.4134	3627.7097
50	1184.5999	389.6553	1.0224	7.0414	0.2619	3.1579	2613.8508
51	1450.2998	1858.4622	5.0000	6.9327	0.9206	5.0375	105895.9375
52	962.0000	230.3972	0.7322	6.8391	0.2696	2.8906	2035.2964
53	1062.0999	218.9325	0.6272	6.9489	0.2059	2.7938	1852.2751
54	1594.3999	1816.0498	4.8948	7.0837	0.6781	5.0137	35728.0781
55	1031.5999	296.5046	0.8860	6.9028	0.2830	3.0316	2346.7554
56	1201.5999	406.5364	1.0537	7.0504	0.2875	3.1856	2882.0032
57	989.2998	259.8611	0.8061	6.8632	0.2806	2.9579	2193.1501
58	946.8999	308.3381	1.0114	6.8075	0.3188	3.1483	2468.2014
59	904.3999	256.4512	0.8735	6.7716	0.2810	3.0200	2038.8127
60	1112.5000	487.8481	1.3999	6.9330	0.4262	3.4847	4529.2773
61	969.5999	210.8222	0.6626	6.8505	0.2574	2.8265	1954.9060
62	1037.8999	247.3764	0.7286	6.9198	0.2362	2.8873	2001.6394
63	1588.0999	1806.2971	4.8836	7.0992	0.6321	5.0112	28756.2969
64	1016.5999	266.6958	0.8051	6.8956	0.2477	2.9570	2054.7798
65	891.8999	303.7070	1.0610	6.7384	0.3550	3.1921	2621.9451
66	970.0000	256.2610	0.8110	6.8452	0.2692	2.9624	2085.4248
67	981.2998	529.4873	1.7758	6.7759	0.4899	3.7594	5527.6328
68	1054.3999	231.5508	0.6694	6.9377	0.2300	2.8328	1976.7542
69	940.8999	209.3063	0.6784	6.8255	0.2155	2.8411	1699.0317
70	1254.0000	388.2439	0.9585	7.0989	0.2681	3.0992	2778.0843
71	904.0999	315.0032	1.0875	6.7509	0.3581	3.2157	2703.8359
72	918.2000	277.9146	0.9357	6.7818	0.3019	3.0779	2232.5110
73	939.2000	183.1539	0.5924	6.8260	0.2119	2.7619	1654.6306
74	1072.5999	263.9224	0.7531	6.9503	0.2487	2.9095	2151.7485
75	885.2000	281.3237	0.9855	6.7363	0.3399	3.1246	2436.3513
76	1077.7000	486.1069	1.4449	6.8973	0.4380	3.5184	4620.6836
77	967.5999	160.4321	0.5020	6.8613	0.1770	2.6797	1534.0164
78	983.5999	231.2584	0.7183	6.8605	0.2774	2.8781	2119.4133
79	1533.7998	1831.4331	5.0000	7.0292	0.9206	5.0375	116619.0625
80	1175.8999	251.0044	0.6501	7.0484	0.2205	2.8149	2141.0000
81	959.2000	277.6052	0.8925	6.8223	0.3248	3.0376	2462.0818
82	945.5000	273.5334	0.8921	6.8047	0.3424	3.0372	2551.7847
83	1012.3999	194.8612	0.5846	6.9020	0.2048	2.7547	1747.8315
84	1008.7998	203.6184	0.6137	6.8954	0.2249	2.7814	1846.5007
85	1081.5000	254.0230	0.7176	6.9567	0.2672	2.8774	2265.1541
86	1049.0999	218.0772	0.6326	6.9329	0.2351	2.7988	1980.2485
87	856.5999	235.7296	0.8464	6.7166	0.2896	2.9950	1966.1260
88	1183.7000	443.6121	1.1769	7.0153	0.3747	3.2937	3825.6003
89	1002.8999	297.9731	0.9176	6.8672	0.3196	3.0609	2554.3264

90	1089.7998	312.2610	0.8831	6.9495	0.3302	3.0289	2834.8740
91	1072.5000	235.0142	0.6679	6.9570	0.2132	2.8314	1920.9141
92	1080.7000	265.1643	0.7509	6.9589	0.2423	2.9075	2128.9038
93	1245.5999	399.2725	0.9946	7.0891	0.2801	3.1331	2883.6611
94	1016.5999	171.9134	0.5122	6.9112	0.1712	2.6889	1590.1824
95	1615.7000	1808.0508	4.7585	7.1107	0.6545	4.9830	31951.7305
96	908.0999	311.5774	1.0697	6.7557	0.3579	3.1998	2700.0325
97	909.7998	282.3738	0.9610	6.7680	0.3224	3.1015	2363.2874
98	1045.5999	207.4316	0.6030	6.9337	0.2064	2.7715	1818.3518
99	922.2000	235.6546	0.7833	6.7948	0.2748	2.9370	2001.6870
100	967.8999	223.3990	0.7047	6.8499	0.2403	2.8656	1878.9033
10	10763.5078	25349.8398	20.1291				
1	1016.0798	302.2493	0.9187	6.8795	0.3090	2.7761	2292.7075
2	1282.4399	1162.3047	3.4634	6.9975	0.4824	3.6773	6447.7422
3	955.8398	278.3440	0.8983	6.8192	0.3068	2.7625	2136.1685
4	1072.5598	278.2983	0.7959	6.9428	0.2759	2.6943	2177.8706
5	947.2000	270.3147	0.8794	6.8129	0.2956	2.7499	2050.1702
6	1153.0798	410.4858	1.1131	6.9960	0.3321	2.9005	2861.7251
7	1246.9600	1166.9971	3.6273	6.9672	0.4749	3.6984	6146.8438
8	1048.5999	218.9794	0.6356	6.9322	0.2252	2.5865	1834.5229
9	872.3198	250.7030	0.8859	6.7299	0.2986	2.7542	1905.1748
10	1249.7200	1157.5508	3.5734	6.9767	0.4614	3.6915	5883.1289
11	1254.1599	1219.3745	3.8359	6.9324	0.5537	3.7255	8065.8516
12	1331.5598	1147.6194	3.2258	7.0500	0.4582	3.6467	6130.9609
13	1025.7998	279.0806	0.8363	6.8920	0.3054	2.7212	2260.1006
14	1075.1199	181.8974	0.5124	6.9660	0.1735	2.5024	1636.2944
15	1008.7998	359.0339	1.1128	6.8669	0.3099	2.9003	2358.0283
16	1058.4399	218.9779	0.6295	6.9435	0.2118	2.5823	1790.8799
17	1068.3999	259.3696	0.7426	6.9429	0.2621	2.6590	2079.4253
18	1069.2400	266.6282	0.7636	6.9416	0.2725	2.6729	2143.2554
19	1208.5999	1215.4414	4.0341	6.8882	0.5612	3.7484	8036.8047
20	1588.5598	1571.3667	3.9354	7.1513	0.5598	3.7384	10341.6875
21	1082.4399	438.8303	1.2829	6.9162	0.3798	2.9985	3149.8677
22	1247.5999	1158.2434	3.5853	6.9780	0.4482	3.6930	5615.4141
23	1265.2400	1205.5208	3.7234	6.9633	0.5027	3.7109	6827.1641
24	1290.3599	1161.7422	3.4308	7.0069	0.4736	3.6731	6287.1641
25	1021.8799	318.4189	0.9651	6.8937	0.2580	2.8071	2034.5376
26	1115.9600	383.1831	1.0706	6.9729	0.2908	2.8742	2461.9409
27	1233.5198	1175.8848	3.7261	6.9399	0.5162	3.7112	7013.2852
28	1109.7998	481.1423	1.3821	6.9380	0.3778	3.0554	3269.6047
29	939.6399	220.5236	0.7170	6.8165	0.2535	2.6421	1783.4744
30	1037.4800	347.1157	1.0412	6.8971	0.3106	2.8559	2402.1367
31	1282.9199	1185.7581	3.5624	6.9828	0.5104	3.6900	7087.0586
32	981.0398	272.7380	0.8555	6.8460	0.3090	2.7340	2188.3972
33	1041.4800	309.8860	0.9190	6.9025	0.3172	2.7763	2399.3730
34	1226.0798	1194.0896	3.8455	6.9280	0.5145	3.7267	6942.8633
35	1207.9600	1171.9292	3.8237	6.9260	0.4896	3.7239	6305.6523
36	1041.9199	245.8767	0.7211	6.9200	0.2503	2.6448	1962.6489
37	1090.6799	233.9202	0.6533	6.9734	0.2089	2.5906	1837.6992
38	988.5999	266.6421	0.8288	6.8597	0.2811	2.7162	2045.3933
39	1089.1599	383.8438	1.1010	6.9323	0.3648	2.8931	2944.5911
40	987.0798	223.5665	0.6911	6.8692	0.2360	2.6245	1787.4434
41	965.3599	195.0145	0.6143	6.8499	0.2256	2.5719	1685.9512
42	1252.2400	1164.7612	3.5952	6.9750	0.4660	3.6943	5981.0078
43	1019.6799	206.0356	0.6144	6.9063	0.2127	2.5720	1725.6296
44	1090.8398	296.2893	0.8349	6.9589	0.2745	2.7202	2220.7427
45	1282.0798	1169.9539	3.4975	6.9902	0.4974	3.6817	6777.9844
46	1045.7200	280.0679	0.8227	6.9126	0.3010	2.7121	2273.5620
47	1291.9199	1160.9297	3.4214	7.0088	0.4721	3.6719	6263.4297
48	1078.4399	228.7225	0.6458	6.9576	0.2433	2.5935	1975.4180
49	1025.8799	247.4146	0.7375	6.9057	0.2403	2.6557	1889.0205
50	1217.6399	369.9927	0.9396	7.0682	0.2643	2.7901	2454.4836
51	1275.6799	1153.3396	3.4513	7.0074	0.4347	3.6757	5460.4922

52	1227.0798	1162.4646	3.6922	6.9560	0.4564	3.7068	5698.5039
53	990.1199	281.4558	0.8758	6.8551	0.3077	2.7474	2209.6367
54	1006.4399	362.8232	1.1284	6.8576	0.3412	2.9100	2567.1917
55	1058.1599	190.0053	0.5445	6.9483	0.1864	2.5243	1667.0469
56	979.5198	321.2329	1.0191	6.8314	0.3485	2.8423	2494.2849
57	1062.2400	203.9134	0.5830	6.9497	0.1983	2.5505	1729.1929
58	994.8398	331.4141	1.0364	6.8605	0.2834	2.8530	2141.3613
59	1328.3999	1162.6177	3.2960	7.0437	0.4581	3.6557	6113.4805
60	1006.4399	214.9853	0.6506	6.8910	0.2238	2.5967	1758.2402
61	1135.4399	1169.7917	4.1843	6.8699	0.4483	3.7553	5184.8359
62	1359.8398	1156.2922	3.1658	7.0733	0.4498	3.6390	6063.1055
63	1048.7200	351.2483	1.0424	6.9099	0.2987	2.8567	2351.9690
64	1033.2000	259.3132	0.7688	6.9082	0.2642	2.6763	2028.7676
65	1702.5999	1901.4485	4.7433	7.1162	0.7044	3.7809	17667.5156
66	1346.1199	1186.4451	3.3288	7.0426	0.4891	3.6599	6854.5781
67	1067.1599	270.9624	0.7781	6.9412	0.2586	2.6825	2069.1011
68	1253.6399	1161.4736	3.5747	6.9814	0.4505	3.6916	5678.8438
69	1238.5598	1163.6787	3.6480	6.9616	0.4723	3.7011	6061.4375
70	1204.5598	1169.2263	3.8266	6.9289	0.4713	3.7243	5908.2852
71	1245.6399	1167.3633	3.6346	6.9630	0.4846	3.6994	6347.8164
72	1320.1199	1146.8279	3.2618	7.0474	0.4327	3.6513	5581.4063
73	1302.7598	1178.1587	3.4527	7.0063	0.4972	3.6759	6864.2266
74	1043.3198	244.9109	0.7172	6.9239	0.2348	2.6422	1889.7935
75	1216.0398	1169.5649	3.7750	6.9375	0.4773	3.7176	6075.3750
76	1413.4399	1606.9050	4.8800	6.9897	0.5964	3.7871	10386.3828
77	1485.5198	1607.0806	4.5116	7.0374	0.6285	3.7702	12171.8516
78	1002.9600	165.0394	0.4981	6.8978	0.1635	2.4927	1488.3008
79	1346.8398	1170.1538	3.2623	7.0530	0.4694	3.6514	6419.9531
80	1501.9199	1623.1685	4.5044	7.0382	0.6426	3.7699	12845.3867
81	1006.9199	212.9366	0.6439	6.8934	0.2112	2.5922	1704.2668
82	999.6399	206.4251	0.6283	6.8849	0.2219	2.5815	1733.1519
83	1074.5198	280.7751	0.8018	6.9398	0.3047	2.6982	2349.7271
84	985.0000	228.0731	0.7071	6.8634	0.2559	2.6355	1877.8840
85	1457.3999	1596.6877	4.6017	7.0290	0.5994	3.7744	10843.3125
86	1079.0798	216.3731	0.6096	6.9638	0.2064	2.5687	1797.1125
87	1279.5198	1150.3062	3.4236	7.0102	0.4412	3.6721	5598.3711
88	1150.7200	390.8120	1.0580	7.0008	0.3078	2.8664	2651.8247
89	984.5198	445.8333	1.4514	6.8144	0.3853	3.0899	2995.9404
90	1349.5198	1184.7510	3.3103	7.0494	0.4763	3.6576	6579.5859
91	1355.2000	1213.8057	3.4055	7.0268	0.5396	3.6698	8159.5547
92	1241.5999	1172.0610	3.6732	6.9539	0.4982	3.7044	6630.6914
93	1308.9199	1149.5959	3.3123	7.0353	0.4402	3.6578	5683.4688
94	1206.0398	1175.5569	3.8502	6.9240	0.4850	3.7273	6196.8008
95	979.3999	310.4900	0.9829	6.8316	0.3531	2.8190	2507.1226
96	1391.7200	1625.2178	5.0000	6.9450	0.9206	3.7926	34081.0820
97	1002.3599	293.0359	0.9020	6.8666	0.3084	2.7650	2251.4587
98	1029.6399	363.5886	1.1034	6.8804	0.3452	2.8945	2642.8342
99	1111.9600	363.3438	1.0152	6.9664	0.3126	2.8399	2576.1213
100	1019.4800	193.0354	0.5748	6.9076	0.2086	2.5450	1700.1597
25	4605.0859	4201.7695	3.4969				

7 SP

7.1

1 Sp performs the following analysis for sets of data. For two sets of Q50's find the means, std's, cross-correlations, and Spearman rank correlation. The calculations can either be done in "raw space" or in "log space" (the Spearman correlation will be the same). Since Q50's can be large, everything is in double precision.

2 Calls:

Stats

Order

Spcor

3 We assume that most Q50's are distinct. Thus, the Spearman correlation routine does not check for ties in rank. A set of data is ended when a Q50 value > 99 is read.

4

5a Read in data (originally in log space).

b If switch transform to raw space.

c Find means, std's, and cross correlations.

d Sort the arrays.

e Find Spearman correlation.

f Go to (a) if there are more cards.

6 Let the observations be $x_1 \ldots x_m$, $y_1 \ldots y_m$ where the x's and y's can be in either log or raw space.

Let $d_i(x)$ = rank of x_i, i.e., if the x's were sorted, the observation which started in place i would end up (after the sort) in place $d_i(x)$. Define $d_i(y)$ similarly. Then, let $D_i = d_i(x) - d_i(y)$ = the difference in rank of x_i and y_i.

The Spearman correlation =

$$1 - \left(\frac{6 \sum_{i=1}^{m} D_i^2}{m^3 - m} \right) = SP$$

A test on this value is t =

$$SP^* \left(\frac{m-2}{1-SP^2} \right)^{1/2}$$

7 1/12/76 Raiffa

7.2

1 ISW = integer — read from cards once for each set of data:

ISW = 1 leave in log space

ISW ≠ 1 transform to raw space

2 Do loops:

Do 10 J = indexes through observations to print data

3 I = integer — counts the no. of observations in a set of data

X = real*8 array — holds Q50's (unbiased)

Y = real*8 array — holds Q50's (biased)

IN1 = integer array — holds ranks of X's

IN2 = integer array — holds ranks of Y's

Example:

X(1) = 5 after sorting X(1) = 1, IN1(1) = 4

X(2) = 3 X(2) = 2, IN1(2) = 3

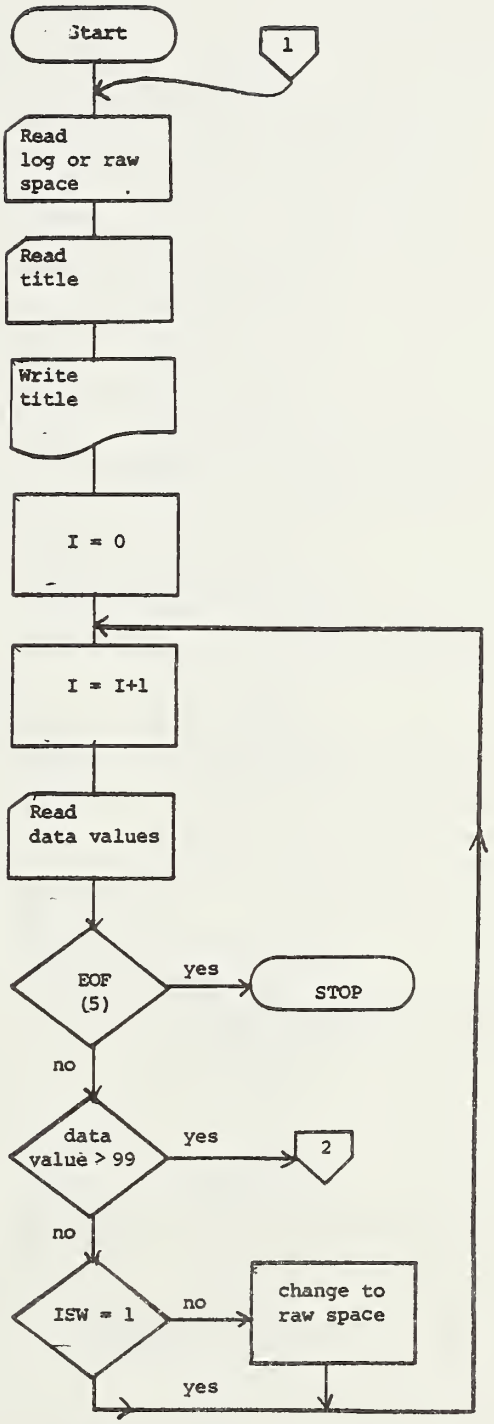
X(3) = 1 X(3) = 3, IN1(3) = 1

X(4) = 2 X(4) = 5, IN1(4) = 2

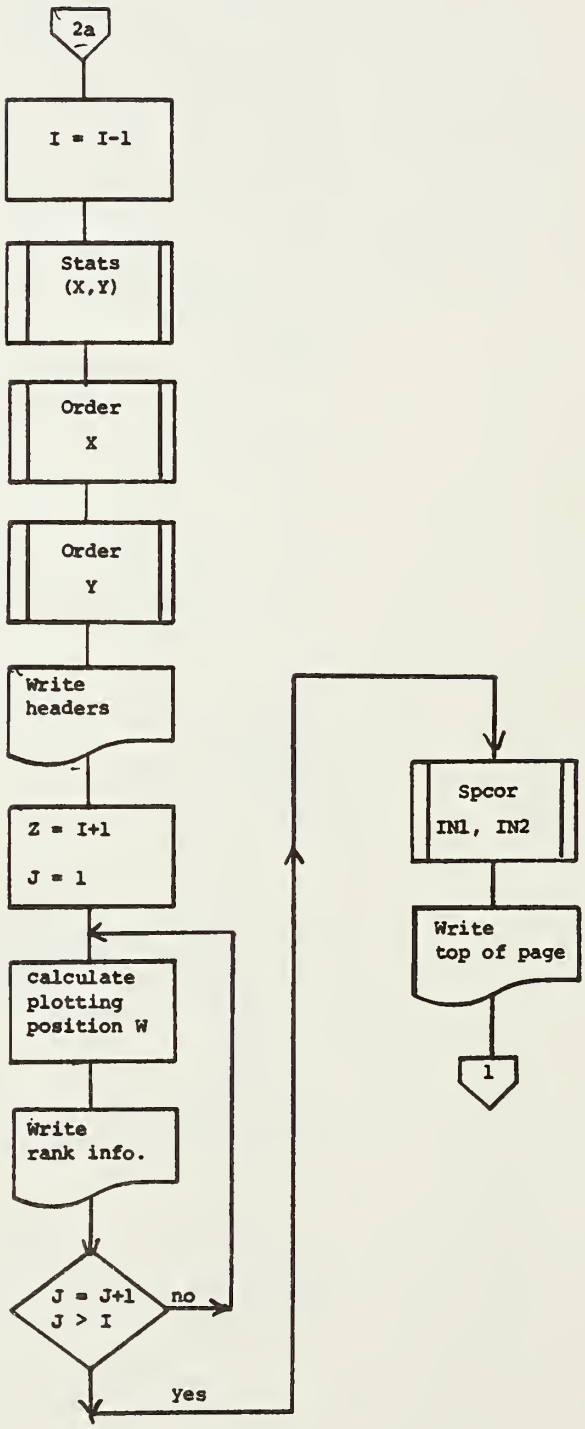
Notice that X(IN1 (I)) = original X(I)

TITLE	=	real*8	array	used for labeling
Z	=	real*8		no. of observations + 1, for finding plotting position
W	=	real*8		observation no., for finding plotting position

7.3 Sp


Start
1
Read log or raw space
Read title
Write title
I = 0
I = I+1
Read data values
EOF (5)
yes
STOP
no
data value > 99
yes
2
no
ISW = 1
no
change to raw space
yes

7.3 Sp


2a
I = I-1
Stats
(X,Y)
Order
X
Order
Y
Write
headers
Z = I+1
J = 1
calculate
plotting
position W
Write
rank info.
J = J+1
J > I
no
yes
Spcor
IN1, IN2
Write
top of page
1

7.5-7.7 Program run preparation

The following is a complete deck for this job.

1. Job card
2. System control cards
3. Source code
4. Log vs. raw space card
5. Title card
6. Data cards
7. End of data card
8. Repeat 4-7 as often as desired

Input preparation

All input is from cards. Input will continue until EOF on unit 5. There is one set (4-7) per state.

Log vs. raw space card.

column	format	description
1	I1	1 if you want log space 0 if you want raw space

Title card.

column	format	description
1-80	10 A8	state name plus any title

Data cards.

There is one data card per station. These are the cards produced by "Reduce."

column	format	description
13-19	F7.4	log (unbiased Q50)
20-26	F7.4	log (biased Q50)

End of data card.

Signals the end of a state.

column	format	description
13-19	"99.9999"	end of data signal

Output

Output is to the printer. There is one set of output for each set of input (4-7).

Each set

line	column	format	description
1	1-80	10 A8	state name and title
2	1-5	I5	no. of stations in the state
	17-30	F14.4	mean (log(unbiased Q50's))
	37-50	F14.4	std (log(unbiased Q50's))
	59-72	F14.4	skew (log(unbiased Q50's))
	79-92	F14.4	correlation of log (unbiased Q50's) and log (biased Q50's)
3			like 2 but for biased Q50's

* If raw space was selected on the "log vs. raw space" input card, the raw space rather than the log space values will be given.

4-6			blank
7	1-8	I8	no. of passes needed to sort unbiased Q50's
8	1-8	I8	no. of passes needed to sort biased Q50's
(New page)			
1			headers
2	1-8	I8	J (1)
	9-22	F14.4	log (unbiased Q50's) for 1st station in the state
	27-31	I5	rank of the unbiased Q50
	37-50	F14.4	log (biased Q50's) for 1st station in the state
	55-59	I5	rank of the biased Q50
	70-83	F14.4	Jth ranked unbiased Q50
	84-97	F14.4	Jth ranked biased Q50
	101-106	F6.2	plotting position $\frac{J*100}{\text{no. of stations} + 1}$
.			
.			
.			
K			like 2 but for last station in the state
K+1			blank
K+2			blank

line	column	format	description
K+3	1-8	I8	no. of stations in the state
	25-38	F14.4	Spearman correlation of unbiased and biased Q50's
	44-57	F14.4	test statistic on Spearman correlation

(See *)

```
//COMP JOB (0210,D75,DESK),'RAIFFA MJ',CLASS=A,TIME=1                    JOB 572
// EXEC FORTGC,ACCT=COST
XXFORT    EXEC PGM=ILYFORT,REGION=128K                                  00000100
XXSYSLIN  DD DSN=&&LOADSET,DISP=(MOD,PASS),UNIT=DISK,                   00000200
XX SPACE=(400,(40,20)),DCB=BLKSIZE=400                                  00000300
XXSYSPRINT DD SYSOUT=A,DCB=(LRECL=120,RECFM=FBA,BLKSIZE=120)            00000400
XXSYSPUNCH DD SYSOUT=B,,3),DCB=(LRECL=80,BLKSIZE=80,RECFM=FB)           00000500
XXSYSUDUMP DD SYSOUT=A                                                  00000600
//FORT.SYSIN DD *
//
*********************************************************************************************************************************
*    JOB COMP                                STARTED 10.28.53  MARCH 19, 1976                              OS VERSION 21.8A    *
*********************************************************************************************************************************
IEF236I ALLOC. FOR COMP    FORT
IEF237I 351   ALLOCATED TO SYSLIN
IEF237I 182   ALLOCATED TO SYSPRINT
IEF237I 100   ALLOCATED TO SYSPUNCH
IEF237I 183   ALLOCATED TO SYSUDUMP
IEF237I 163   ALLOCATED TO SYSIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS76079.T102845.RV000.COMP.LOADSET          PASSED
IEF285I   VOL SER NOS= SP0002.
*********************************************************************************************************************************
*    STEP FORT          CPU TIME    5.05 SECS  STARTED 10.28.53  ENDED 10.29.41  SYSIN:  266  STEP USED  92K OF 128K REGION    *
*    EXCPS:   DISK     45                                                  JOBSTEP COST =  $3.05(APPROXIMATE)    *
*********************************************************************************************************************************
IEF285I   SYS76079.T102845.RV000.COMP.LOADSET          DELETED
IEF285I   VOL SER NOS= SP0002.
*********************************************************************************************************************************
*    JOB COMP       TOTAL CPU TIME    5.06 SECS  STARTED 10.28.53  ENDED 10.29.42  MARCH 20, 1976  JOBLOG 760793772754COMP    *
*********************************************************************************************************************************
```

```
FORTRAN IV G LEVEL  21                  MAIN                DATE = 76079        10/28/59              PAGE 0001

0001                    IMPLICIT REAL*8 (A-H,O-Z)
0002                    DIMENSION X(2000),Y(2000),IN1(2000),IN2(2000)
0003                    REAL*8 TITLE(5)
0004                  5 CONTINUE
0005                    READ(5,205)ISW
0006                205 FORMAT(I1)
0007                    READ(5,203)TITLE
0008                    WRITE(6,203)TITLE
0009                203 FORMAT(10A8)
0010                    I=0
0011                  1 I=I+1
0012                    READ(5,100,END=98)X(I),Y(I)
0013                100 FORMAT(12X,2F7.4)
0014                    IF(X(I) .GT. 99.0)GO TO 99
0015                    IF(ISW .EQ. 1)GO TO 1
0016                    X(I)=DEXP(X(I))
0017                    Y(I)=DEXP(Y(I))
0018                    GO TO 1
0019                 99 I=I-1
0020                    CALL STATS(X,Y,I)
0021                    CALL ORDER(X,IN1,I)
0022                    CALL ORDER(Y,IN2,I)
0023                    WRITE(6,105)
0024                105 FORMAT('1 # OBS     FLOW 1        RANK 1        FLOW 2        '
                       X'RANK 2              FLOW 1        FLOW 2        PERCENT'/)
0025                    Z=I+1
0026                    DO 10 J=1,I
0027                    W=J
0028                    W=W*100.0/Z
0029                    WRITE(6,101)J,X(IN1(J)),IN1(J),Y(IN2(J)),IN2(J),X(J),Y(J),W
0030                101 FORMAT(I8,F14.4,4X,I5,5X,F14.4,4X,I5,10X,2F14.4,3X,F6.2)
0031                 10 CONTINUE
0032                    CALL SPCOR(IN1,IN2,I)
0033                 50 WRITE(6,204)
0034                204 FORMAT('1')
0035                    GO TO 5
0036                 98 CONTINUE
0037                    STOP
0038                    END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IBCOM#	CC	STATS	D0	ORDER	D4	SPCOR	D8	DEXP	DC

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
Z	118	W	120	ISW	128	I	12C	J	130

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
X	138	Y	3FD8	IN1	7E38	IN2	9D78	TITLE	BCB8

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
205	BCE0	203	BCE4	100	BCEA	105	BGF3	101	B066
204	B086								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
4	BE18	5	BE18	7	BE34	8	BE54	10	BE74
11	BE90	12	BE90	14	BEC8	15	BED6	16	BEE4
17	BF0A	18	BF38	19	BF3E	20	BF4E	21	BF5C
22	BF6A	23	BF78	25	BF8C	26	BF80	27	BFC8
28	BFEC	29	BFFC	31	C068	32	C084	33	C092
35	C0A8	36	C0AE	37	C0AE				

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = MAIN , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 38,PROGRAM SIZE = 49340
STATISTICS NO DIAGNOSTICS GENERATED

```
STATE #  13
123 OBS, MEAN=      8.4715  STD=      1.3780  SKEW=      0.4923  COR=      0.7556
123 OBS, MEAN=      6.9667  STD=      1.0947  SKEW=      0.4753  COR=      0.7556


   104  ITERATIONS IN THE SORT
   101  ITERATIONS IN THE SORT
```

# OBS	FLOW 1	RANK 1	FLOW 2	RANK 2	FLOW 1	FLOW 2	PERCENT
1	8.6862	71	7.0051	64	4.9913	4.4804	0.81
2	10.4850	113	9.3797	123	5.7000	4.6059	1.61
3	9.5516	96	8.5018	111	5.8089	4.6298	2.42
4	6.3196	7	5.5840	15	5.8564	4.7497	3.23
5	7.6218	34	6.3839	40	6.2741	5.1221	4.03
6	11.0319	120	8.6092	115	6.2797	5.1598	4.84
7	7.6906	37	5.6109	16	6.3196	5.3309	5.65
8	10.9758	119	8.3528	108	6.4348	5.4141	6.45
9	8.7075	73	7.8497	95	6.5152	5.4357	7.26
10	10.3190	111	8.3437	106	6.6192	5.4366	8.06
11	7.4382	32	6.3444	36	6.6994	5.4452	8.87
12	8.1310	55	7.4423	84	6.7522	5.4865	9.68
13	7.8738	45	6.5881	45	6.8457	5.5063	10.48
14	7.7344	39	6.3522	37	6.8494	5.5829	11.29
15	5.7000	2	4.4804	1	6.8498	5.5840	12.10
16	8.7350	74	7.3970	83	6.9301	5.6109	12.90
17	8.3112	61	6.2783	33	6.9439	5.6529	13.71
18	8.9133	76	8.0191	100	6.9562	5.6625	14.52
19	8.1084	54	7.2317	76	7.0750	5.7760	15.32
20	7.3258	27	6.6552	48	7.0857	5.8005	16.13
21	8.0670	52	7.1951	73	7.1211	5.8928	16.94
22	8.5206	66	7.0987	69	7.1724	5.9423	17.74
23	8.3952	62	7.0122	65	7.1897	5.9567	18.55
24	11.0577	121	7.9170	99	7.2223	5.9762	19.35
25	4.9913	1	4.6059	2	7.2706	6.0287	20.16
26	6.2741	5	5.8005	20	7.2934	6.0440	20.97
27	7.0857	20	5.5063	13	7.3258	6.0682	21.77
28	7.5509	33	5.9762	24	7.3774	6.0750	22.58
29	7.4195	29	5.6529	17	7.4195	6.1120	23.39
30	9.9897	106	6.9570	62	7.4197	6.1202	24.19
31	7.8294	44	6.0440	26	7.4249	6.1637	25.00
32	10.4450	112	7.1127	70	7.4382	6.2121	25.81
33	9.6105	98	9.0357	121	7.5509	6.2783	26.61
34	9.4647	95	8.4116	110	7.6218	6.3144	27.42
35	7.8097	42	6.5914	46	7.6358	6.3379	28.23
36	8.4822	65	6.7854	53	7.6905	6.3444	29.03
37	9.8660	104	8.2039	104	7.6906	6.3522	29.84
38	9.2923	88	7.8187	93	7.7222	6.3603	30.65
39	7.7733	40	7.5240	89	7.7344	6.3637	31.45
40	9.4242	93	5.3309	7	7.7733	6.3839	32.26
41	11.2482	122	6.5855	44	7.7771	6.4561	33.06
42	10.8717	117	5.8928	21	7.8097	6.5500	33.87
43	9.2171	83	6.6847	52	7.8203	6.5770	34.68
44	10.9331	118	7.7873	92	7.8294	6.5855	35.48
45	9.4071	91	8.5311	113	7.8738	6.5881	36.29
46	7.2223	24	5.6625	18	7.8799	6.5914	37.10
47	7.0750	19	6.7873	54	7.8997	6.6416	37.90
48	7.2934	26	6.0750	28	7.9201	6.6552	38.71
49	8.6382	70	7.2607	77	7.9794	6.6557	39.52
50	9.0575	78	7.8731	97	8.0129	6.6679	40.32
51	9.0607	79	8.2286	105	8.0578	6.6723	41.13
52	9.6846	99	7.7576	91	8.0670	6.6847	41.94
53	6.8498	15	5.7760	19	8.0976	6.7854	42.74
54	8.5854	68	7.2040	74	8.1084	6.7873	43.55
55	10.3093	110	8.0276	101	8.1310	6.8046	44.35
56	6.6994	11	6.3144	34	8.1704	6.8091	45.16
57	9.1509	81	6.6557	49	8.1954	6.8503	45.97
58	8.4053	63	6.4561	41	8.2103	6.8577	46.77
59	8.7397	75	6.6679	50	8.2380	6.8643	47.58
60	9.1282	80	6.8091	56	8.2754	6.8894	48.39
61	8.0129	50	6.2121	32	8.3112	6.9246	49.19

62	9.7731	101	7.3342	81	8.3952	6.9570	50.00	
63	10.1688	109	8.1957	103	8.4053	6.9715	50.81	
64	5.8089	3	4.6298	3	8.4429	7.0051	51.61	
65	7.4197	30	5.4141	8	8.4822	7.0122	52.42	
66	6.8494	14	5.9567	23	8.5206	7.0160	53.23	
67	6.9562	18	5.4865	12	8.5646	7.0423	54.03	
68	9.5835	97	6.6416	47	8.5854	7.0942	54.84	
69	8.2754	60	6.1637	31	8.6134	7.0987	55.65	
70	6.2797	6	5.5829	14	8.6382	7.1127	56.45	
71	9.2539	86	6.6723	51	8.6862	7.1233	57.26	
72	7.6358	35	6.1120	29	8.6990	7.1761	58.06	
73	8.6134	69	6.0682	27	8.7075	7.1951	58.87	
74	7.1897	23	5.1598	6	8.7350	7.2040	59.68	
75	7.1211	21	5.4357	9	8.7397	7.2187	60.48	
76	9.4482	94	7.2971	79	8.9133	7.2317	61.29	
77	5.8564	4	4.7497	4	8.9744	7.2607	62.10	
78	8.1954	57	7.2782	78	9.0575	7.2782	62.90	
79	6.5152	9	5.9423	22	9.0607	7.2971	63.71	
80	7.6905	36	5.1221	5	9.1282	7.3281	64.52	
81	8.6990	72	7.8187	94	9.1509	7.3342	65.32	
82	8.5646	67	6.8503	57	9.1841	7.3504	66.13	
83	6.9439	17	6.1202	30	9.2171	7.3970	66.94	
84	9.2971	89	6.5500	42	9.2305	7.4423	67.74	
85	6.8457	13	5.4366	10	9.2378	7.4631	68.55	
86	9.8613	103	7.2187	75	9.2539	7.4765	69.35	
87	8.2380	59	6.9715	63	9.2845	7.4906	70.16	
88	12.3562	123	8.8844	119	9.2923	7.5152	70.97	
89	9.1841	82	7.4906	87	9.2971	7.5240	71.77	
90	10.5319	115	9.3775	122	9.3150	7.7267	72.58	
91	9.4166	92	8.9385	120	9.4071	7.7576	73.39	
92	10.5280	114	8.4040	109	9.4166	7.7873	74.19	
93	8.0976	53	6.3379	35	9.4242	7.8187	75.00	
94	9.9580	105	8.5212	112	9.4482	7.8187	75.81	
95	9.8541	102	8.3453	107	9.4647	7.8497	76.61	
96	8.9744	77	7.3504	82	9.5516	7.8562	77.42	
97	7.2706	25	6.0287	25	9.5835	7.8731	78.23	
98	10.6170	116	8.5621	114	9.6105	7.8734	79.03	
99	10.0834	108	7.1761	72	9.6846	7.9170	79.84	
100	7.1724	22	7.0160	66	9.7321	8.0191	80.65	
101	7.8203	43	7.1233	71	9.7731	8.0276	81.45	
102	7.7222	38	6.8643	59	9.8541	8.1618	82.26	
103	7.8997	47	7.3281	80	9.8613	8.1957	83.06	
104	8.4429	64	7.5152	88	9.8660	8.2038	83.87	
105	7.8799	46	6.8046	55	9.9580	8.2286	84.68	
106	8.2103	58	6.5770	43	9.9697	8.3437	85.48	
107	7.7771	41	7.0942	68	10.0458	8.3453	86.29	
108	6.7522	12	6.3603	38	10.0834	8.3528	87.10	
109	7.4249	31	6.8577	58	10.1688	8.4040	87.90	
110	7.3774	28	6.8894	60	10.3093	8.4116	88.71	
111	6.4348	8	5.4452	11	10.3190	8.5018	89.52	
112	6.6192	10	6.3637	39	10.4450	8.5212	90.32	
113	6.9301	16	6.9246	61	10.4850	8.5311	91.13	
114	7.9794	49	7.4765	86	10.5280	8.5621	91.94	
115	9.3150	90	7.8734	98	10.5319	8.6092	92.74	
116	7.9201	48	7.4631	85	10.6170	8.7051	93.55	
117	8.0578	51	7.0423	67	10.8717	8.7445	94.35	
118	10.0458	107	8.7051	116	10.9331	8.8220	95.16	
119	9.7321	100	8.8220	118	10.9758	8.8844	95.97	
120	8.1704	56	7.7267	90	11.0319	8.9385	96.77	
121	9.2305	84	8.7445	117	11.0577	9.0357	97.58	
122	9.2845	87	8.1618	102	11.2482	9.3775	98.39	
123	9.2378	85	7.9562	96	12.3562	9.3797	99.19	

123 SAMPLES, RS= 0.7490 T= 12.4350

8 Prep

8.1

1 Prep prepares cards for input to the SPSS stepwise regression program. Each card contains:

1. station no.
2. log (unbiased Q50)
3. log (biased Q50)
4. log (1st basin characteristic)
5. log (2nd basin characteristic)

.
.
.

for up to 7 basin characteristics. Prep allows you to select up to 7 of the 20 basin characteristics in the input disk file. If any of the selected basin characteristics are missing (0) the station is skipped.

2 Calls:

None

3 The 1st record of the disk file contains headers which we don't want. All of the stations on cards are in the disk file.

4

5 The number of basin characteristics desired and their indexes are entered. Then for each card, the basin characteristic file is scanned until the appropriate record is found. The desired basin characteristics are converted to $\log_e$ space. If all of the characteristics are >0 (before conversion), the information is printed and punched. If one or more characteristics are missing, a warning is printed.

6

7 2/4/76 Raiffa

8

8.2

1

2 Do loops:

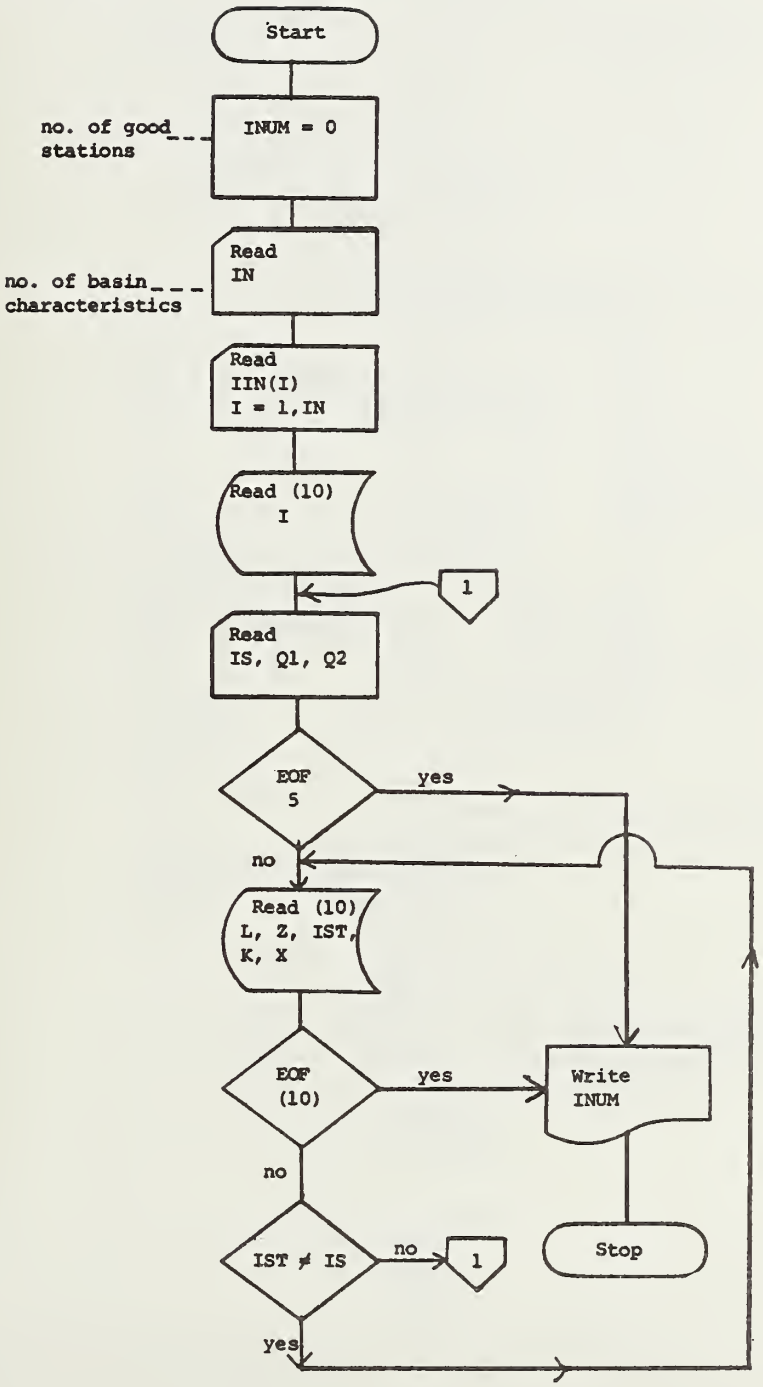
Do 10 I = read in indexes of selected characteristics

Do 20 I = check if characteristics are present and convert to log space

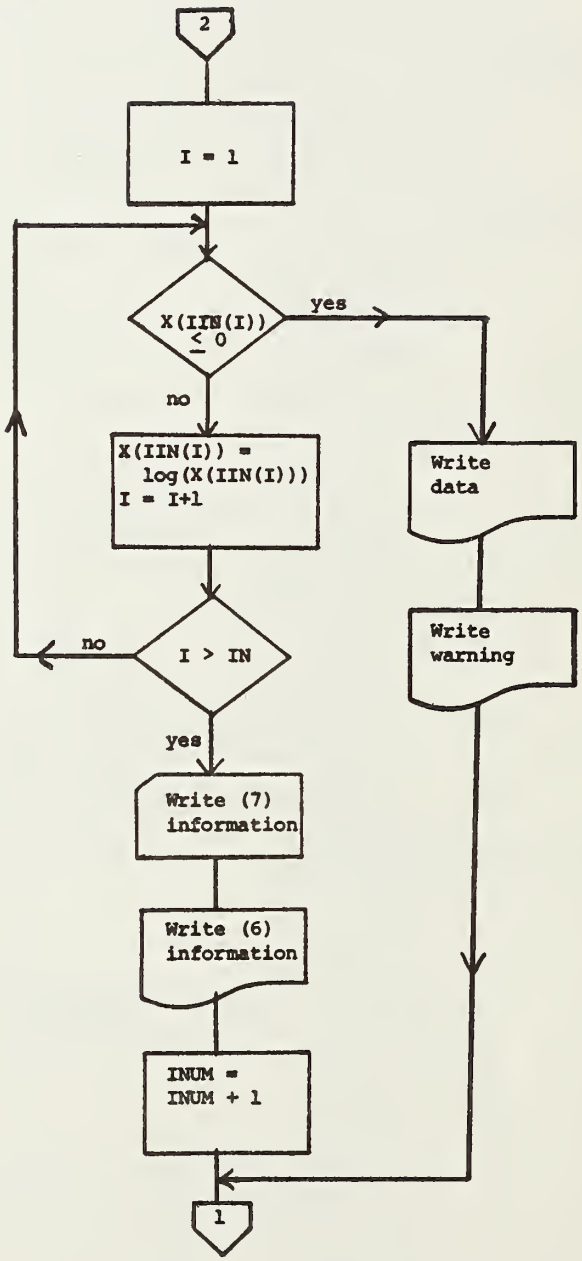
3

INUM	=	integer		counts the number of stations accepted
X	=	real	array	holds all (20) basin characteristics
IST	=	integer	array	holds station no. from disk record
IIN	=	integer	array	holds indexes of desired characteristics
IS	=	integer	array	holds station no. from cards
IN	=	integer		no. of characteristics desired
Q1	=	real		log (unbiased Q50)
Q2	=	real		log (biased Q50)
L	=	integer		dummy
Z	=	real		dummy
K	=	integer		dummy
J	=	integer		temporary index of Ith desired characteristic

8.3 Prep


Start
no. of good stations
INUM = 0
Read
IN
no. of basin characteristics
Read
IIN(I)
I = 1,IN
Read (10)
I
1
Read
IS, Q1, Q2
EOF
5
yes
no
Read (10)
L, Z, IST,
K, X
EOF
(10)
yes
Write
INUM
no
IST ≠ IS
no
1
Stop
yes

8.3 Prep


2
I = 1
X(IIN(I)) ≤ 0
yes
no
X(IIN(I)) = log(X(IIN(I)))
I = I+1
Write data
Write warning
I > IN
no
yes
Write (7) information
Write (6) information
INUM = INUM + 1
1

8.5-8.7 Program run preparation

The following is a complete deck setup for this program.

1. Job card
2. System control cards
3. Source code
4. Number of characteristics card
5. Characteristics cards
6. Station selection cards

Input preparation

Input is from cards and from a magnetic device (file 10).

Number of characteristics card

column	format	name	description
1-2	I2	IN	the no. of basin characteristics desired

Characteristics cards

card	column	format	description
1	1-2	I2	index of 1st desired basin characteristic
.			
.			
.			
IN	1-2	I2	index of last desired basin characteristic

Station selection cards

One card for each station.

column	format	description
1-4	A4	1st half of station no.
5-8	A4	2nd half of station no.
13-19	F7.4	log (unbiased Q50)
20-26	F7.4	log (biased Q50)

The input magnetic file (unit 10) is a statpac data set.

Output

Output is to cards and the printer.

Card output unit (7).

One card for each station selected (and which has all IN desired basin characteristics).

column	format	description
1-4	A4	1st half of station no.
5-8	A4	2nd half of station no.
9-16	F8.4	log (unbiased Q50)
17-24	F8.4	log (biased Q50)
25-32	F8.4	log (1st selected basin characteristic)
	.	
	.	
	.	
	F8.4	log (INth selected basin characteristic)

Printer output.

There are two types of output.

a. If a station has all of the desired basin characteristics.

column	format	description
6-9	A4	1st half of station no.
10-13	A4	2nd half of station no.
19-26	F8.4	log (unbiased Q50)
32-39	F8.4	log (biased Q50)
45-52	F8.4	log (1st basin characteristic)
	.	
	.	
	.	
	F8.4	log (INth basin characteristic)

b. If some of the desired basin characteristics are missing

line	column	format	description
1			blank
2	1-11		title
	12-15	A4	1st half of station no.
	16-19	A4	2nd half of station no.
	22-31	F10.3	log (unbiased Q50)
	34-43	F10.3	log (biased Q50)
	46-55	F10.3	log (1st selected characteristic)
		.	
		.	
		.	
		F10.3	1st missing (0) characteristic
		F10.3	next characteristic
		.	
		.	
		.	
		F10.3	INth characteristic
3			blank

```
//PREPARE JOB (0210,D75,DESK),'RAIFFA MJ',CLASS=F,TIME=1                    JOB 437
// EXEC FORTGCL,ACCT=COST
XXFORT    EXEC PGM=IEYFORT,REGION=128K                                     00000100
XXSYSLIN  DD DSN=&&LOADSET,DISP=(MOD,PASS),UNIT=DISK,                      00000200
XX           SPACE=(80,(200,100),RLSE),DCB=BLKSIZE=400                     00000300
XXSYSPRINT DD SYSOUT=A,DCB=(LRECL=120,RECFM=FBA,BLKSIZE=120)               00000400
XXSYSPUNCH DD SYSOUT=(B,,3),DCB=(LRECL=80,BLKSIZE=80,RECFM=FB)             00000500
XXSYSUDUMP DD SYSOUT=A                                                     00000600
//FORT.SYSIN DD *
*********************************************************************************************************************************
*     JOB PREPARE                                  STARTED 12.08.11    FEB 06, 1976                        OS VERSION 21.8A
*********************************************************************************************************************************
IEF236I ALLOC. FOR PREPARE  FORT
IEF237I 351   ALLOCATED TO SYSLIN
IEF237I 181   ALLOCATED TO SYSPRINT
IEF237I 1D0   ALLOCATED TO SYSPUNCH
IEF237I 182   ALLOCATED TO SYSUDUMP
IEF237I 161   ALLOCATED TO SYSIN
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS76037.T120808.RV000.PREPARE.LOADSET       PASSED
IEF285I   VOL SER NOS= SP0002.
*********************************************************************************************************************************
*     STEP FORT          CPU TIME    0.91 SECS  STARTED 12.08.11  ENDED 12.08.18  SYSIN:    33   STEP USED  84K OF 128K REGION
*     EXCPS:   DISK     07                                                        JOBSTEP COST =   $0.52 (APPROXIMATE)
*********************************************************************************************************************************
XXLKED EXEC PGM=IEWL,REGION=128K,PARM=(XREF,LET,LIST),COND=(4,LT,FORT)     00000700
XXSYSLIB  DD  DSNAME=SYS1.FORTLIB,DISP=SHR                                 00000800
//LKED.SYSLMOD DD DSN=PRLIB(PREP),DISP=(NEW,KEEP),
// UNIT=PACK,VOL=SER=DP5016,SPACE=(TRK,(200,100,5))
X/SYSLMOD  DD  DSN=&&GOSET(MAIN),DISP=(MOD,PASS),UNIT=DISK,                00000900
XX             SPACE=(1024,(20,10,1),RLSE)                                 00001000
XXSYSPRINT DD  SYSOUT=A,DCB=(BLKSIZE=121,LRECL=121,RECFM=FBM),             00001100
XX    SPACE=(TRK,(10,10),RLSE)                                             00001200
XXSYSUT1   DD  UNIT=(DISK,SEP=SYSLMOD),SPACE=(1024,(20,10),RLSE),          00001300
XX             DCB=BLKSIZE=1024                                            00001400
XXSYSLIN   DD  DSN=&&LOADSET,DISP=(OLD,DELETE)                             00001500
XX         DD  DDNAME=SYSIN                                                00001600
XXSYSUDUMP DD SYSOUT=A                                                     00001700
IEF236I ALLOC. FOR PREPARE  LKED
IEF237I 150   ALLOCATED TO SYSLIB
IEF237I 132   ALLOCATED TO SYSLMOD
IEF237I 181   ALLOCATED TO SYSPRINT
IEF237I 351   ALLOCATED TO SYSUT1
IEF237I 351   ALLOCATED TO SYSLIN
IEF237I 182   ALLOCATED TO SYSUDUMP
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   SYS1.FORTLIB                                 KEPT
IEF285I   VOL SER NOS= SP0017.
IEF285I   PRLIB                                        KEPT
IEF285I   VOL SER NOS= DP5016.
IEF285I   SYS76037.T120808.RV000.PREPARE.R0000006      DELETED
IEF285I   VOL SER NOS= SP0002.
IEF285I   SYS76037.T120808.RV000.PREPARE.LOADSET       DELETED
IEF285I   VOL SER NOS= SP0002.
```

```
*      STEP LKED          CPU TIME    0.65 SECS  STARTED 12.08.18  ENDED 12.11.02            STEP USED 122K OF 128K REGION      *
*      EXCPS:    DISK     89                                                                JOBSTEP COST =   $0.86 (APPROXIMATE)      *
// EXEC PGM=PREP,ACCT=COST
//STEPLIB DD DSN=PRLIB,DISP=OLD,UNIT=PACK,VOL=SER=DP5016
//SYSPRINT DD SYSOUT=A
//SYSUDUMP DD DUMMY
//FT06F001 DD SYSOUT=A
//FT07F001 DD SYSOUT=(B,,2)
//FT10F001  DD DSN=MASS001,DISP=(OLD,KEEP),UNIT=PACK,VOL=SER=DP5016,
// DCB=(RECFM=VBS,LRECL=7272,BLKSIZE=7279)
//SYSIN DD *
//
IEF236I ALLOC. FOR PREPARE
IEF237I 132   ALLOCATED TO STEPLIB
IEF237I 181   ALLOCATED TO SYSPRINT
IEF237I 162   ALLOCATED TO FT05F001
IEF237I 182   ALLOCATED TO FT06F001
IEF237I 1D1   ALLOCATED TO FT07F001
IEF237I 132   ALLOCATED TO FT10F001
IEF142I - STEP WAS EXECUTED - COND CODE 0000
IEF285I   PRLIB                                    KEPT
IEF285I   VOL SER NOS= DP5016.
IEF285I   MASS001                                  KEPT
IEF285I   VOL SER NOS= DP5016.
*      STEP               CPU TIME    0.50 SECS  STARTED 12.11.02  ENDED 12.11.11  SYSIN:    26  STEP USED  44K OF 128K REGION      *
*      EXCPS:    DISK     03                                                                JOBSTEP COST =   $0.31 (APPROXIMATE)      *
*      JOB PREPARE  TOTAL CPU TIME    2.06 SECS  STARTED 12.08.11  ENDED 12.11.13    FEB 06, 1976  JOBLOG 760374369005PREPARE      *
```

```
0001            DIMENSION X(20),IST(2),IIN(10),IS(2)
0002            INUM=0
0003            READ(5,100)IN
0004       100  FORMAT(I2)
0005            DO 10 I=1,IN
0006        10  READ(5,100)IIN(I)
0007            READ(10)I
0008         2  READ(5,101,END=99)IS,Q1,Q2
0009       101  FORMAT(2A4,4X,2F7.4)
0010         1  READ(10,END=99)L,Z,IST,K,X
0011            IF(IST(2) .NE. IS(2))GO TO 1
0012            IF(IST(1) .NE. IS(1))GO TO 1
0013            DO 20 I=1,IN
0014            J=IIN(I)
0015            IF(X(J) .LE. 0.0)GO TO 3
0016        20  X(J)=ALOG(X(J))
0017            WRITE(7,103)IST,Q1,Q2,(X(IIN(I)),I=1,IN)
0018            WRITE(6,104)IST,Q1,Q2,(X(IIN(I)),I=1,IN)
0019       103  FORMAT(2A4,9F8.4)
0020       104  FORMAT(5X,2A4,9(5X,F8.4))
0021            INUM=INUM+1
0022            GO TO 2
0023         3  WRITE(6,105)IST,Q1,Q2,(X(IIN(I)),I=1,IN)
0024       105  FORMAT(/'  NO GOOD  ',2I4,9(2X,F10.3))
0025            WRITE(6,106)
0026       106  FORMAT(/)
0027            GO TO 2
0028        99  CONTINUE
0029            WRITE(6,107)INUM
0030       107  FORMAT(//'   NUMBER OF STATIONS',I8)
0031            STOP
0032            END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IBCOM#	D0	ALOG	D4						

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
INUM	DC	IN	E0	I	E4	Q1	E8	Q2	EC
L	F0	Z	F4	K	F8	J	FC		

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
X	100	IST	150	IIN	158	IS	180		

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
100	188	101	18C	103	199	104	1A4	105	1B4
106	1D0	107	1D3						

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
2	254	3	25C	5	278	6	284	7	288
8	2D0	10	304	11	348	12	356	13	364
14	370	15	378	16	38E	17	3C4	18	428
21	48C	22	498	23	49E	25	504	27	518
28	51E	29	51E	31	53C				

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = MAIN , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 32,PROGRAM SIZE = 1354
STATISTICS NO DIAGNOSTICS GENERATED

F88-LEVEL LINKAGE EDITOR OPTIONS SPECIFIED XREF,LET,LIST
DEFAULT OPTION(S) USED - SIZE=(112650,24576)

CROSS REFERENCE TABLE

CONTROL SECTION NAME	ORIGIN	LENGTH	ENTRY NAME	LOCATION	NAME	LOCATION	NAME	LOCATION	NAME	LOCATION
MAIN	00	54A								
IHCSLOG *	550	1B6								
			ALOG10	550	ALOG	568				
IHCECOMH*	708	F61								
			IBCOM#	708	FDIOCS#	7C4	INTSWTCH	164E		
IHCCOMH2*	1670	65D								
			SEQDASD	19E8						
IHCFCVTH*	1CD0	11B5								
			ADCON#	1CD0	FCVAOUTP	1D7A	FCVLOUTP	1E0A	FCVZOUTP	1F62
			FCVIOUTP	2316	FCVEOUTP	2818	FCVCOUTP	2A32	INT6SWCH	2D1B
IHCEPNTH*	2E88	542								
			ARITH#	2E88	ADJSWTCH	3224				
IHCEFIOS*	33D0	F28								
			FIOCS#	33D0	FIOCSBEP	33D6				
IHCFIOS2*	42F8	52E								
IHCERRM *	4828	5DC								
			ERRMON	4828	IHCERRE	4840				
IHCUOPT *	4E08	300								
IHCETRCH*	5108	28E								
			IHCTRCH	5108	ERRTRA	5110				
IHCUATBL*	5398	628								

LOCATION	REFERS TO SYMBOL	IN CONTROL SECTION	LOCATION	REFERS TO SYMBOL	IN CONTROL SECTION
D0	IBCOM#	IHCECOMH	D4	ALOG	IHCSLOG
678	IBCOM#	IHCECOMH	6B4	IHCERRM	IHCERRM
7C4	SEQDASD	IHCCOMH2	1554	ADCON#	IHCFCVTH
154C	FIOCS#	IHCEFIOS	1558	ARITH#	IHCEPNTH
1578	ADJSWTCH	IHCEPNTH	1574	IHCUOPT	IHCUOPT
155C	FCVEOUTP	IHCFCVTH	1560	FCVLOUTP	IHCFCVTH
1564	FCVIOUTP	IHCFCVTH	1568	FCVCOUTP	IHCFCVTH
156C	FCVAOUTP	IHCFCVTH	1570	FCVZOUTP	IHCFCVTH
1500	IHCERRE	IHCERRM	152C	IHCCOMH2	IHCCOMH2
1530	IHCERRM	IHCEPRM	1504	IHCCOMH2	IHCCOMH2
1508	IHCCOMH2	IHCCOMH2	150C	IHCCOMH2	IHCCOMH2
1510	IHCCOMH2	IHCCOMH2	190D	IHCECOMH	IHCECOMH
1910	IHCECOMH	IHCECOMH	16B8	IHCERRM	IHCERRM
16B4	IBCOM#	IHCECOMH	1B2D	IHCECOMH	IHCECOMH
1B3D	IHCECOMH	IHCECOMH	1B4D	IHCECOMH	IHCECOMH
2CDC	IBCOM#	IHCECOMH	2CD8	IHCERRM	IHCERRM
3274	IBCOM#	IHCECOMH	3278	INTSWTCH	IHCECOMH
3220	INT6SWCH	IHCFCVTH	321C	IHCUOPT	IHCUOPT

LOCATION	REFERS TO SYMBOL	IN CONTROL SECTION	LOCATION	REFERS TO SYMBOL	IN CONTROL SECTION
3280	ADCON#	IHCFCVTH	327C	FIOCS#	IHCEFIOS
32EC	IHCERRM	IHCERRM	3538	IHCERRM	IHCERRM
353C	IHCFIOS2	IHCFIOS2	4148	IHCUATBL	IHCUATBL
4154	IBCOM#	IHCECOMM	4169	IHCFIOS2	IHCFIOS2
4180	IHCFIOS2	IHCFIOS2	42F1	IHCFIOS2	IHCFIOS2
4DF4	IHCUOPT	IHCUOPT	4DF8	IBCOM#	IHCECOMM
4DFC	IHCTRCH	IHCETRCH	4E00	FIOCSBEP	IHCEFIOS
527C	IBCOM#	IHCECOMM	5280	ADCON#	IHCFCVTH
5284	FIOCSBEP	IHCEFIOS			

ENTRY ADDRESS 00
TOTAL LENGTH 59C0

****PREP DOES NOT EXIST BUT HAS BEEN ADDED TO DATA SET

9 SUBROUTINE LOAD

9.1

1 Loads WW1 tables and category values from cards into arrays.

2 Called by:

Bigflow

Reduce

Samp

R50

Skew

Calls:

None

This subroutine is needed whenever unbiased Q50's are to be calculated.

3

4 Simply read arrays one by one.

5

6

7 10/4/75 Raiffa

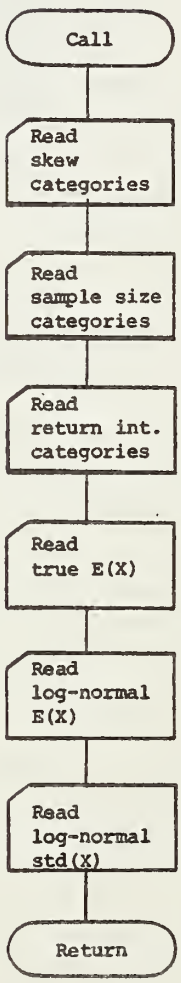
9.2

0 Arguments:

SM	=	real	array	holds skew category values
YM	=	real	array	holds no. of observations category values

```
            TM  =  real   array   holds return interval
                                  category values

            XT  =  real   array   holds true expected
                                  value table

            XL  =  real   array   holds log normal
                                  expected value table

            SL  =  real   array   holds log normal std
                                  value table

1

2   Just Do loops controlling "reads."

3
```

9.3 Subroutine Load (SM, YM, TM, XT, XL, SL)



```
FORTRAN IV G LEVEL 21          LOAD          DATE = 76051      15/19/55          PAGE 0001

0001                SUBROUTINE LOAD(SM,YM,TM,XT,XL,SL)
0002                DIMENSION SM(13),YM(6),TM(9),XT(13,9),XL(13,6,9),SL(13,6,9)
0003                DO 1 I=1,13
0004                READ(5,100)SM(I)
0005              1 CONTINUE
0006                DO 2 I=1,6
0007                READ(5,100)YM(I)
0008              2 CONTINUE
0009                DO 3 I=1,9
0010                READ(5,100)TM(I)
0011              3 CONTINUE
0012            100 FORMAT(F8.2)
0013                DO 4 I=1,13
0014                READ(5,101)(XT(I,K),K=1,9)
0015              4 CONTINUE
0016                DO 5 I=1,13
0017                DO 5 J=1,6
0018                READ(5,101)(XL(I,J,K),K=1,9)
0019              5 CONTINUE
0020              DO 6 I=1,13
0021                DO 6 J=1,6
0022                READ(5,101)(SL(I,J,K),K=1,9)
0023              6 CONTINUE
0024            101 FORMAT(9F6.3)
0025                RETURN
0026                END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IBCOM#	BC								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
I	C0	K	C4	J	C8				

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
SM	CC	YM	D0	TM	D4	XT	D8	XL	DC
SL	E0								

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
100	E4	101	E9						

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	182	3	182	4	1C2	5	1E0	6	1F8
7	208	8	224	9	23C	10	24C	11	268
13	280	14	290	15	2D8	16	2F0	17	300
18	30A	19	354	20	384	21	394	22	39E
23	3E8	25	418						

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = LOAD , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 26,PROGRAM SIZE = 1056
STATISTICS NO DIAGNOSTICS GENERATED

SUBROUTINE STAT1

10

10.1

1 Finds the mean, std, and skew of values in an array.

2 Called by:

Calc

Bigflow

Reduce

Rowq50

Calls:

None

3

4

5

6 Want statistics on observations $x_1 \ldots x_n$

$$\text{mean} = \sum_{i=1}^{n} \frac{x_i}{n}, \quad \text{std} = \text{sqrt}\left(\frac{\sum x_i^2 - n \cdot \text{mean}^2}{n-1}\right)$$

$$\text{skew} = \left(\frac{\text{std}}{\text{mean}}\right)^3 + 3\left(\frac{\text{std}}{\text{mean}}\right)$$

7 10/20/75 Raiffa

8

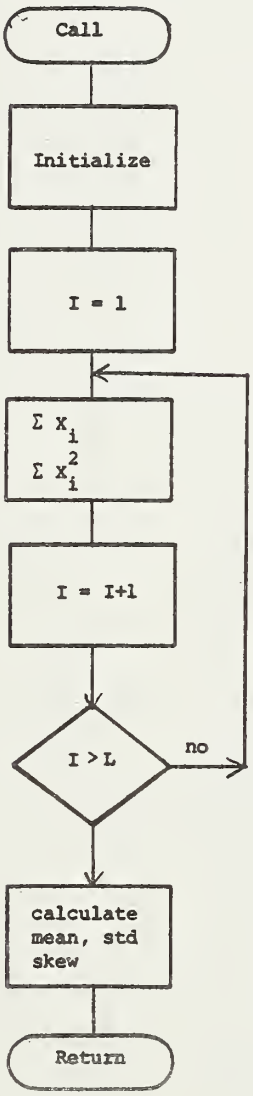
10.2

0 Arguments:

X = real array	data values
L = integer	dimension of X and no. of data points in X

```
            XBAR = real          returns mean
             STD = real          returns std
            SKEW = real          returns skew
1
2   Do loops
    Do 10 I = index through L data points
3   XN = real no. of observations
    T = real temporary
```

10.3 Subroutine Statl (X, L, XBAR, STD, SKEW)



```
FORTRAN IV G LEVEL 21          STAT1          DATE = 76051      15/19/55          PAGE 0001

0001                SUBROUTINE STAT1(X,L,XBAR,STD,SKEW)
0002                DIMENSION X(L)
0003                XBAR=0.0
0004                STD=0.0
0005                XN=L
0006                DO 10 I=1,L
0007                T=X(I)
0008                XBAR=XBAR+T
0009                STD=STD+T*T
0010             10 CONTINUE
0011                XBAR=XBAR/XN
0012                STD=SQRT((STD-XN*XBAR*XBAR)/(XN-1.0))
0013                T=STD/XBAR
0014                SKEW=T*T*T+3*T
0015                RETURN
0016                END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
SQRT	94								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
L	9C	XBAR	A0	STD	A4	XN	A8	I	AC
T	B0	SKEW	B4						

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
X	B8								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	19E	3	19E	4	1A6	5	1AE	6	1CE
7	1D6	8	1EE	9	1FA	10	20A	11	21E
12	22A	13	25C	14	268	15	282		

```
*OPTIONS IN EFFECT*   ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
*OPTIONS IN EFFECT*   NAME = STAT1    , LINECNT =      50
*STATISTICS*     SOURCE STATEMENTS =       16,PROGRAM SIZE =      650
*STATISTICS*  NO DIAGNOSTICS GENERATED

*STATISTICS*  NO DIAGNOSTICS THIS STEP
```

11 SUBROUTINE INTERP (also Intery)

11.1

1 Given values for

1 skew

2 no. of observations

3 return interval

Interp uses the WW1 tables to find the unbiased return interval, and the associated coefficient from the WW1 tables.

2 Called by:

Bigflow

Reduce

Calc

R50

Skew

Calls:

Offset

4a Use linear interpolation in the true expected value table to find the "true expected value."

b Use linear interpolation in the log normal expected value table to find the unbiased return interval associated with the "true expected value."

c Use linear interpolation in the true expected value table to find the coefficient associated with the new return interval.

5

6

7 10/7/75 Raiffa

8

11.2

0 Arguments:

SKEW	=	real		holds skew value
YEAR	=	real		holds the no. of observations
T	=	real		holds the desired return interval
TNEW	=	real		returns the unbiased return interval
CO	=	real		returns the coefficient found in the table
XT	=	real	array	holds the "true expected value" table
WL	=	real	array	holds the log normal expected value table
SM	=	real	array	holds the skew categories
YM	=	real	array	holds the no. of observations categories
TM	=	real	array	holds the return interval categories

1

2 Do loops:

Do 1 KVAL = indexes through the return interval categories

IS = lower bound category for skew

IS1 = upper bound category for skew

IY = lower bound category for no. of observations

IY1 = upper bound category for no. of observations

IT = lower bound category for return interval

IT1 = upper bound category for return interval

3

S1 = offset from IS to IS1

Y1 = offset from IY to IY1

T1 = offset from IT to IT1

*If we want to categorize a skew g and the category values are $x_1 \ldots x_n$ then find $x_i \leq g < x_{i+1}$

Then offset = $\frac{g-x_i}{x_{i+1}-x_i}$

B = temporary used in interpolation

B1 = temporary used in interpolation to hold value at lower skew category

B2 = temporary used in interpolation to hold value at upper skew category

CO = temporary used in interpolation, later used to return desired coefficient

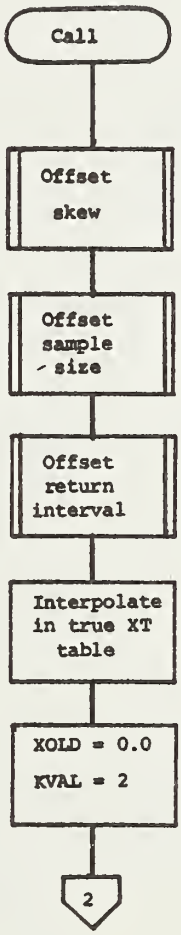
XOLD = temporary used to hold values at successive return interval categories

ICAT = lower bound category for new unbiased return interval

XOFF = offset of new unbiased return interval

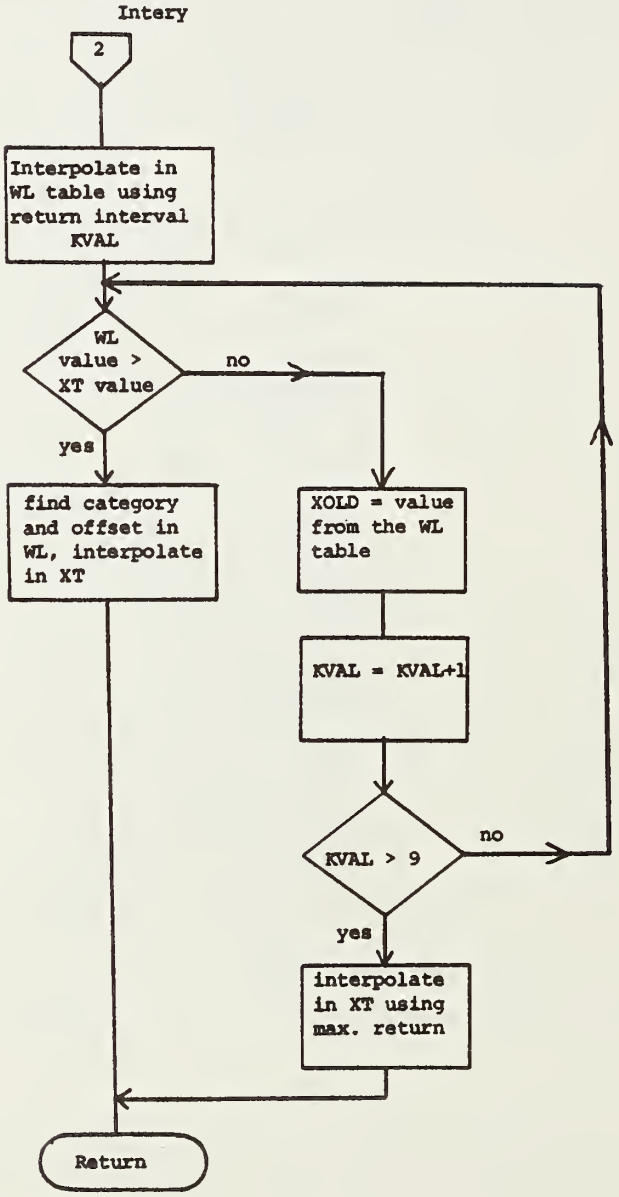
IC1 = upper bound category for new unbiased return interval

11.3 Subroutine Interp (SKEW, YEAR, T, TNEW, CO, XT, WL, SM, YM, TM)
Intery



11.3 Subroutine Interp

Intery



```
0001                SUBROUTINE INTERP(SKEW,YEAR,T,TNEW,CO,XT,WL,SM,YM,TM)
0002                DIMENSION XT(13,9),WL(13,6,9),SM(13),YM(6),TM(9)
                C   XT HOLDS XT HAT TRUE
                C   WL HOLDS XT HAT LOG-NORMAL
                C  SM,YM,TM HOLD THE CATEGORY BOUNDRIES FOR SKEW, # YEARS, TYEAR
                C   CATEGORIZE SKEW
0003                CALL OFFSET(SM,13,IS,S1,SKEW)
                C   CATEGORIZE # YEARS
0004                CALL OFFSET(YM,6,IY,Y1,YEAR)
                C   CATEGORIZE TYEAR
0005                CALL OFFSET(TM,9,IT,T1,T)
0006                IS1=IS+1
0007                IY1=IY+1
0008                IT1=IT+1
0009                B=XT(IS,IT)
0010                B1=B+T1*(XT(IS,IT1)-B)
0011                B=XT(IS1,IT)
0012                B2=B+T1*(XT(IS1,IT1)-B)
0013                CO=B1+S1*(B2-B1)
0014                XOLD=0.0
0015                DO 1 KVAL=2,9
0016                B=WL(IS,IY,KVAL)
0017                B1=B+Y1*(WL(IS,IY1,KVAL)-B)
0018                B=WL(IS1,IY,KVAL)
0019                B2=B+Y1*(WL(IS1,IY1,KVAL)-B)
0020                B=B1+S1*(B2-B1)
0021                IF(B .GT. CO)GO TO 7
0022                XOLD=B
0023              1 CONTINUE
0024                TNEW=10000.0
0025                CO=XT(IS,9)+S1*(XT(IS1,9)-XT(IS,9))
0026                GO TO 99
0027              7 ICAT=KVAL-1
0028                XOFF=(CO-XOLD)/(B-XOLD)
0029                IC1=ICAT+1
0030                B=XT(IS,ICAT)
0031                B1=B+XOFF*(XT(IS,IC1)-B)
0032                B=XT(IS1,ICAT)
0033                B2=B+XOFF*(XT(IS1,IC1)-B)
0034                CO=B1+S1*(B2-B1)
0035                TNEW=TM(ICAT)+XOFF*(TM(IC1)-TM(ICAT))
0036             99 CONTINUE
0037                RETURN
0038                END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
OFFSET	A8								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IS	E8	S1	EC	SKEW	F0	IY	F4	Y1	F8
YEAR	FC	IT	100	T1	104	T	108	IS1	10C
IY1	110	IT1	114	B	118	B1	11C	B2	120
CO	124	XOLD	128	KVAL	12C	TNEW	130	ICAT	134
XOFF	138	IC1	13C						

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
XT	140	WL	144	SM	148	YM	14C	TM	150

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	288	3	288	4	29E	5	284	6	2CA
7	2D6	8	2E2	9	2EE	10	310	11	33A
12	358	13	382	14	396	15	39E	16	3AE
17	3C8	18	3EE	19	408	20	42E	21	442
22	450	23	458	24	470	25	478	26	4C0
27	4C6	28	4D2	29	4E8	30	4F4	31	516
32	540	33	55E	34	588	35	59C	36	5CC
37	5CC								

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = INTERP , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 38,PROGRAM SIZE = 1492
STATISTICS NO DIAGNOSTICS GENERATED

12 SUBROUTINE OFFSET

12.1

1 Categorizes value; returning lower bound, upper bound, and how far to go up from the lower bound.

2 Called by:

Interp (Intery)

Instd

Calls:

None

3 The category values are increasing, and the variable to be categorized is greater than the first category value.

4 Suppose category values $x_1 \ldots x_n$ where $x_i > x_j$ if $i > j$, and we want to categorize y.

1 We've assume $y \geq x_1$

2 If $y \geq x_n$ return ICAT = n-1, coefficient = 1.0

3 If $x_1 \leq y < x_n$ then

find i s.t. $x_i \leq y < x_{i+1}$. Then,

ICAT = i, coefficient = $\frac{y-x_i}{x_{i+1}-x_i}$

5

6

7 10/5/75 Raiffa

8

12.2

0 Arguments:

X	=	real	array	holds category values
INUM	=	integer		no. of entries in X
ICAT	=	integer		returns lower category value
COEF	=	real		returns offset
VAR	=	real		holds number to categorize

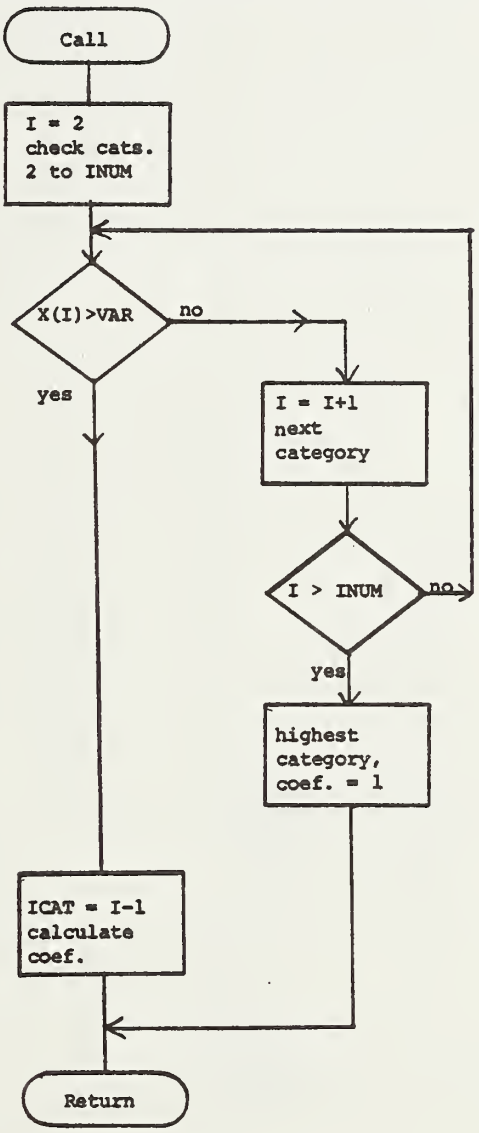
1

2 Do loops:

Do 1 I = indexes through $x_2 \ldots x_n$

3

12.3 Subroutine Offset (X, INUM, ICAT, COEF, VAR)



```
FORTRAN IV G LEVEL 21          OFFSET          DATE = 76051      15/19/55          PAGE 0001

0001                SUBROUTINE OFFSET(X,INUM,ICAT,COEF,VAR)
0002                DIMENSION X(INUM)
                C     X IS MONOTONE INCREASING AND CONTAINS CATEGORY VALUES FOR
                C           SKEW, # YEARS, OR TYEAR
                C     VAR IS THE NUMBER YOU ARE TRYING TO PLACE IN A CATEGORY
                C     FIND CATEGORY I=CAT+1  I.E. UPPER BOUND OF CATEGORY
0003                DO 1 I=2,INUM
0004                IF(X(I) .GT. VAR)GO TO 2
0005              1 CONTINUE
                C     VAR IS >= HIGHEST CATEGORIES UPPER BOUND
0006                ICAT=INUM-1
0007                COEF=1.0
                C  INTERPOLATED VALUE WILL BE
                C  X(ICAT)+COEF*(X(ICAT+1)-X(ICAT))
                C   IF ICAT = INUM-1, AND COEF=1 THE INTERPOLATED VALUE IS X(INUM)
0008                GO TO 99
                C   CALCULATE CAT AND OFFSET
0009              2 ICAT=I-1
0010                COEF=(VAR-X(ICAT))/(X(I)-X(ICAT))
0011             99 CONTINUE
0012                RETURN
0013                END
```

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
INUM	A8	I	AC	VAR	B0	ICAT	B4	COEF	B8

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
X	BC								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	19A	3	19A	4	1A2	5	1C0	6	1D4
7	1E0	8	1E8	9	1EE	10	1FA	11	22C
12	22C								

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = OFFSET , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 13,PROGRAM SIZE = 564
STATISTICS NO DIAGNOSTICS GENERATED

13 Subroutine W4014 and other USGS routines used in finding biased Q50's

13.1

1 W4014 was designed as a main program to find floods corresponding to different return intervals. The following changes were made to turn W4014 into a subroutine:

a The data initialization routines

Fillpl
Filln
Fillp
Fillgn
Fillgp

were removed from W4014 and placed at the front of the calling routine Biflow.

b The procedures for inputing original flow data to W4014 were removed and the annual flow data was passed to W4014 through Common. Since W4014 was passed $\log_e$ of the flow valves but uses $\log_{10}$, code was added to convert $\log_{10}$.

c Originally W4014 calculated many return intervals. Now only Q50 is found and is passed back to Bigflow.

d The printing of results by W4014 was bypassed.

e Flow control associated with inputing more than one set of data was eliminated.

All of the changes made appeared obvious and the basic operation of W4014 was left unchanged. For complete documentation on W4014 see U.S.G.S.

* A listing of subroutine W4014 along with all of the necessary subroutines follows.

```
0001          SUBROUTINE W4014(ISTA,IA,IPLOT,ANS,SE)
              C     W4014 LOG PEARSON TYPE III                                  00000010
              C     PURPOSE FIT A LOG PEARSON TYPE III DISTRIBUTION TO ONE OR MORE  00000020
              C           SETS OF INPUT DATA                                    00000030
0002          COMMON FK(27),PLUS(27,35),FNEG(27,35),GP(35),GN(35),X(100),N      0000004
0003          DIMENSION Y(100), C(27), ID(16), DATA(10),      ICK(3), IAC(26    00000050
              1)                                                                00000060
0004          DIMENSION GRID(70,120), SZ(100), SE(27)                           00000070
0005          DATA IAC/'A','B','C','D','E','F','G','H','I','J','K','L','M','N',' 00000080
              1O','P','Q','R','S','T','U','V','W','X','Y','Z'/                  00000090
0006          ICARD=5                                                           00000160
0007          IPRINT=6                                                          00000170
0008          SUM1=0.0                                                          00000540
              C     CONVERT DATA TO LOGS BASE 10                                00000550
              C     AND ACCUMULATE THE SUM OF THE LOGS FOR COMPUTATION OF MEAN  00000560
0009          DO 110 I=1,N                                                      00000570
0010           X(I)=X(I)*0.4342945
0011          SUM1=SUM1+X(I)                                                    00000610
0012        110 CONTINUE                                                        00000620
              C     ACCUMMULATE THE SUM OF SQUARE AND CUBE OF DEVIATIONS FROM THE MEAN00000630
0013          FN=FLOAT(N)                                                       00000640
0014          XBAR=SUM1/FN                                                      00000650
0015          SUM2=0.0                                                          00000670
0016          SUM3=0.0                                                          00000680
0017          DO 120 I=1,N                                                      00000690
0018          DEV=X(I)-XBAR                                                     00000700
0019          SUM2=SUM2+DEV*DEV                                                 00000710
0020          SUM3=SUM3+DEV*DEV*DEV                                             00000720
0021        120 CONTINUE                                                        00000730
              C     COMPUTE THE STANDARD DEVIATION                              00000740
0022          VAR=SUM2/(FN-1.0)                                                 00000750
0023          IF (VAR-0.1E-07) 140,140,130                                      00000760
0024        130 STD=SQRT(VAR)                                                   00000770
0025          GO TO 150                                                         00000790
0026        140 WRITE (IPRINT,200)                                              00000800
0027          GO TO 230                                                         00000810
              C     COMPUTE THE SKEWNESS                                        00000820
0028        150 SKEW=(FN*SUM3)/((FN-1.0)*(FN-2.0)*STD*STD*STD)                  00000830
              C     COMPUTE THE STANDARD ERROR OF THE SKEWNESS                  00000850
0029          SVAR=(6.0*FN*(FN-1.0))/((FN-2.0)*(FN+1.0)*(FN+3.0))               00000860
0030          SESKEW=SQRT(SVAR)                                                 00000870
0031          CALL RANK                                                         00000890
0032          IF (ABS(SKEW).LE.3.00) GO TO 160                                  00000900
0033          WRITE (IPRINT,420)                                                00000910
0034          GO TO 230                                                         00000920
0035        160 IF (SKEW.LT.0.0) GO TO 170                                      00000930
0036          CALL INTERP (SKEW,IK)                                             00000940
0037          IF (IK.EQ.0) GO TO 180                                            00000950
```

```
0038              WRITE (IPRINT,430)                                          00000960
0039              GO TO 230                                                   00000970
0040          170 CALL INTERN (SKEW,IK)                                       00000980
0041              IF (IK.EQ.0) GO TO 180                                      00000990
0042              WRITE (IPRINT,430)                                          00001000
0043              GO TO 230                                                   00001010
0044          180 DO 190 I=1,27                                               00001020
0045              C(I)=XBAR+FK(I)*STD                                         00001030
0046          190 CONTINUE                                                    00001040
0047              P=C(22)                                                     00001380
0048              RT=1.0/P                                                    00001390
0049              XFT=10.0**C(22)                                             00001400
0050               ANS=XFT                                                    
0051              DO 200 I=1,N                                                00001510
0052              FI=FLOAT(I)                                                 00001520
0053              SZ(I)=FI/(FN+1.0)                                           00001530
0054          200 CONTINUE                                                    00001540
0055              IF (IPLOT.EQ.0) GO TO 210                                   00001550
0056              CALL PLOT (X,SZ,C,SE,N)                                     00001560
0057          210 CONTINUE                                                    00001570
0058          230 CONTINUE                                                    00001620
0059              GO TO 260                                                   00001660
0060          250 CONTINUE                                                    00001670
0061              WRITE (IPRINT,470) ISTA                                     00001680
                C                                                             00001710
0062          270 FORMAT (A1)                                                 00001720
0063          280 FORMAT (I1)                                                 00001730
0064          290 FORMAT (16A4,1X,I4,1X,I2,I4,I2,A2)                          00001740
0065          300 FORMAT ('1','MORE THAN 100 DATA VALUES SPECIFIED ON STATION CARD'/00001750
             1'0','CONTAINING THE FOLLOWING:'/'0','IDENTIFICATION = ',16A4/'0','00001760
             2 N = ',I5/'0','STATION ',I2,'-',I4,'.',I2//'0','CODE = ',A2)      00001770
0066          310 FORMAT      ('1',10X,'N = ',I6,10X,'STATION ',I9              ,'  00001780
             1 CODE    ',A2//)                                                 00001790
0067          320 FORMAT (10F7.0,I2,I4,I2,A2)                                 00001800
0068          330 FORMAT ('0','DATA CARD COL 71-78 CONTAINS THE FOLLOWING STATION','00001810
             1 NUMBER ',I2,'-',I4,'.',I2/' ','SHOULD BE ',I2,'-',I4,'.',I2)     00001820
0069          340 FORMAT ('0','DATA CARD (COL 79-80) FOR STATION ',I2,'-',I4,'.',I2,00001830
             1' HAS A CODE OF ',A2/' ','SHOULD BE ',A2)                         00001840
0070          350 FORMAT (' ','INPUT DATA'/)                                  00001850
0071          360 FORMAT (10F13.3)                                            00001860
0072          370 FORMAT ('0','MEAN LOGS = ',F13.3)                           00001870
0073          380 FORMAT ('0','STANDARD DEVIATION LOGS = ',F13.3)             00001880
0074          390 FORMAT ('0','VARIANCE IS NEGATIVE OR EQUAL TO ZERO'/)       00001890
0075          400 FORMAT ('0','SKEWNESS LOGS = ',F13.3)                       00001900
0076          410 FORMAT ('0','STANDARD ERROR OF SKEWNESS LOGS = ',F13.3)     00001910
0077          420 FORMAT ('0','ABSOLUTE VALUE OF SKEWNESS IS GREATER THAN ',F3.00. A00001920
             1LL FURTHER CALCULATIONS DELETED.'/)                               00001930
0078          430 FORMAT ('0','ERROR OCCURRED IN INTERPOLATION SUBROUTINE.'/' ','NO 00001940
```

```
                1FURTHER COMPUTATIONS ATTEMPTED./')                                    00001950
0079          440 FORMAT ('0','EXCEEDANCE PROB   RECURRENCE INTERVAL   MAGNITUDES'/)  00001960
0080          450 FORMAT (' ',F12.4,9X,F12.2,6X,F12.3)                                 00001970
0081          460 FORMAT ('0','DATA CARDS FOR STATION ',I2,'-',I4,'.',I2,'CONTAINS A  00001980
                  1 ZERO DATA FIELD FOR THE ',I5,' VALUE.'/' ','IT IS LOCATED ON THE  00001990
                  2',I3,' CARD')                                                       00002000
0082          470 FORMAT ('0','DATA CARD CONTAINS AN INVALID CHARACTER'/' ','STATION  00002010
                  1 ',I2,'-',I4,'.',I2)                                                00002020
0083          260 RETURN                                                             00001700
0084              END                                                                00002030
```

COMMON BLOCK / / MAP SIZE 2040

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
FK	0	PLUS	8C	FNEG	E30	GP	10E4	GN	1E80
X	1F0C	N	209C						

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IBCOM#	108	RANK	10C	INTERP	110	INTERN	114	FRXPR#	118
PLOT	11C	SQRT	120						

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IGARD	154	IPRINT	158	SUM1	16C	I	170	FN	174
XBAR	178	SUM2	17C	SUM3	180	DEV	184	VAR	188
STD	18C	SKEW	190	SVAR	194	SESKEW	198	IK	19C
P	1A0	RI	1A4	XF1	1A8	ANS	1AC	FI	1B0
IPLOT	1B4	ISTA	1B8	I6	1BC				

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
Y	1C0	C	350	ID	3BC	DATA	3FC	ICK	424
IAC	430	GRID	498	SZ	87D8	SC	8968		

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
270	896C	280	8970	290	8974	300	8988	310	8A32
320	8A5F	330	8A6E	340	8AD9	350	8B33	360	8B45
370	8B4C	380	8B62	390	8B86	400	8BB3	410	8BCD
420	8BE9	430	8C55	440	8CB0	450	8CEA	460	8CFC
470	8D78								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	8EC2	5	8EC2	6	8EC2	7	8EC2	8	8ED6
9	8EDE	10	8EEA	11	8EFA	12	8F06	13	8F22
14	8F4A	15	8F56	16	8F5E	17	8F66	18	8F72
19	8F7E	20	8F8E	21	8FA2	22	8FC2	23	8FD8
24	8FE8	25	8FFA	26	9006	27	9014	28	901A
29	904A	30	907E	31	9090	32	909C	33	90AE
34	90C4	35	90CA	36	90DC	37	90EA	38	90F8
39	910C	40	9112	41	9120	42	9132	43	914E
44	914E	45	9162	46	9172	47	9192	48	91A2

49	91AE	50	91C8	51	91D4	52	91E0	53	9204		
54	9216	55	9232	56	9244	57	925A	58	9428		
59	9258	60	9250	61	9250	62	9270				

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = W4014 , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 64,PROGRAM SIZE = 37508
STATISTICS NO DIAGNOSTICS GENERATED

STATISTICS NO DIAGNOSTICS THIS STEP

```
FORTRAN IV G LEVEL 21          FILLPL          DATE = 75324          19748/02          PAGE 0001

0001                SUBROUTINE FILLPL (SP)                                          00007380
0002                DIMENSION SP(27), X(27)                                         00007390
0003                DATA X/0.9999,0.9995,0.999,0.995,0.99,0.98,0.975,0.96,0.95,0.9,0.800007400
                   1,0.7,0.6,0.5,0.4,0.3,0.2,0.1,0.05,0.04,0.025,0.02,0.01,0.005,0.00100007410
                   2,0.0005,0.0001/                                                00007420
0004                DO 10 I=1,27                                                    00007430
0005                SP(I)=X(I)                                                      00007440
0006              10 CONTINUE                                                       00007450
0007                RETURN                                                          00007460
0008                END                                                             00007470
```

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
I	94								

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
SP	98	X	9C						

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	17E	3	17E	4	17E	5	192	6	19A
7	186								

```
*OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
*OPTIONS IN EFFECT*  NAME = FILLPL  , LINECNT =      50
*STATISTICS*    SOURCE STATEMENTS =         8,PROGRAM SIZE =       446
*STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
0001          SUBROUTINE FILLN                                                  00004580
0002          COMMON FK(27),PLUS(27,35),FNEG(27,35),GP(35),GN(35),X(100),N      00004590
0003          DIMENSION PL01(35), PL02(35), PL03(35), PL04(35), PL05(35), PL06(3000004600
             15), PL07(35), PL08(35), PL09(35), PL10(35), PL11(35), PL12(35), PL00004610
             213(35), PL14(35), PL15(35), PL16(35), PL17(35), PL18(35), PL19(35)00004620
             3, PL20(35), PL21(35), PL22(35), PL23(35), PL24(35), PL25(35), PL2600004630
             4(35), PL27(35)                                                   00004640
0004          DATA PL01/-3.71902,-3.93453,-4.15301,-4.37394,-4.59687,-4.82141,-500004650
             1.04718,-5.27389,-5.50124,-5.72899,-5.95691,-6.18480,-6.41249,-6.6300004660
             2980,-6.86661,-7.09277,-7.31818,-7.54272,-7.76632,-7.98888,-8.2103400004670
             3,-8.43064,-8.64971,-8.86753,-9.08403,-9.29920,-9.51301,-9.72543,-900004680
             4.93643,-10.14602,-10.35418,-10.56090,-10.76618,-10.97001,-11.1723900004690
             57                                                                00004700
0005          DO 10 J=1,35                                                      00004710
0006          FNEG(1,J)=PL01(J)                                                 00004720
0007       10 CONTINUE                                                          00004730
0008          DATA PL02/-3.29053,-3.45513,-3.62113,-3.78820,-3.95605,-4.12443,-400004740
             1.29311,-4.46189,-4.63057,-4.79899,-4.96701,-5.13449,-5.30130,-5.4600004750
             2735,-5.63252,-5.79673,-5.95990,-6.12196,-6.28285,-6.44251,-6.6009000004760
             3,-6.75798,-6.91370,-7.06804,-7.22098,-7.37250,-7.52258,-7.67121,-700004770
             4.81839,-7.96411,-8.10936,-8.25115,-8.39248,-8.53236,-8.670797    00004780
0009          DO 20 J=1,35                                                      00004790
0010          FNEG(2,J)=PL02(J)                                                 00004800
0011       20 CONTINUE                                                          00004810
0012          DATA PL03/-3.09023,-3.23322,-3.37703,-3.52139,-3.66608,-3.81090,-300004820
             1.95567,-4.10022,-4.24439,-4.38807,-4.53112,-4.67344,-4.81492,-4.9500004830
             2549,-5.09505,-5.23353,-5.37087,-5.50701,-5.64190,-5.77549,-5.907760000004840
             3,-6.03865,-6.16816,-6.29626,-6.42292,-6.54814,-6.67191,-6.79421,-600004850
             4.91505,-7.03443,-7.15235,-7.26881,-7.38382,-7.49739,-7.609537    00004860
0013          DO 30 J=1,35                                                      00004870
0014          FNEG(3,J)=PL03(J)                                                 00004880
0015       30 CONTINUE                                                          00004890
0016          DATA PL04/-2.57583,-2.66965,-2.76321,-2.85636,-2.94900,-3.04102,-300004900
             1.13232,-3.22281,-3.31243,-3.40109,-3.48874,-3.57530,-3.66073,-3.7400004910
             2497,-3.82798,-3.90973,-3.99016,-4.06925,-4.14700,-4.22336,-4.298320000004920
             3,-4.37186,-4.44398,-4.51467,-4.58393,-4.65176,-4.71815,-4.78313,-400004930
             4.84669,-4.90884,-4.96959,-5.02897,-5.08697,-5.14362,-5.198927    00004940
0017          DO 40 J=1,35                                                      00004950
0018          FNEG(4,J)=PL04(J)                                                 00004960
0019       40 CONTINUE                                                          00004970
0020          DATA PL05/-2.32635,-2.39951,-2.47226,-2.54421,-2.61539,-2.68572,-200004980
             1.75514,-2.82359,-2.89101,-2.95735,-3.02256,-3.08660,-3.14944,-3.2100004990
             2103,-3.27134,-3.33035,-3.38804,-3.44438,-3.49935,-3.55295,-3.605170000005000
             3,-3.65600,-3.70543,-3.75347,-3.80013,-3.84540,-3.88930,-3.93183,-300005010
             4.97301,-4.01286,-4.05138,-4.08859,-4.12452,-4.15917,-4.192577    00005020
0021          DO 50 J=1,35                                                      00005030
0022          FNEG(5,J)=PL05(J)                                                 00005040
0023       50 CONTINUE                                                          00005050
```

```
0024            DATA PL06/-2.05375,-2.10697,-2.15935,-2.21081,-2.26133,-2.31084,-200005060
                1.35931,-2.40470,-2.45293,-2.49811,-2.54206,-2.58480,-2.62631,-2.6600005070
                2657,-2.70556,-2.74325,-2.77964,-2.81472,-2.84848,-2.88091,-2.9120200005080
                3,-2.94181,-2.97028,-2.99744,-3.02330,-3.04787,-3.07116,-3.09320,-300005090
                4.11399,-3.13356,-3.15193,-3.16911,-3.18512,-3.20000,-3.213757      00005100
0025            DO 60 J=1,35                                                        00005110
0026            FNEG(6,J)=PL06(J)                                                   00005120
0027          60 CONTINUE                                                           00005130
0028            DATA PL07/-1.95996,-2.00688,-2.05290,-2.09795,-2.14202,-2.18505,-200005140
                1.22702,-2.26790,-2.30764,-2.34623,-2.38364,-2.41984,-2.45482,-2.4800005150
                2855,-2.52102,-2.55222,-2.58214,-2.61076,-2.63810,-2.66413,-2.6888800005160
                3,-2.71234,-2.73451,-2.75541,-2.77506,-2.79345,-2.81062,-2.82658,-200005170
                4.84134,-2.85492,-2.86735,-2.87865,-2.88884,-2.89795,-2.905997      00005180
0029            DO 70 J=1,35                                                        00005190
0030            FNEG(7,J)=PL07(J)                                                   00005200
0031          70 CONTINUE                                                           00005210
0032            DATA PL08/-1.75069,-1.78462,-1.81756,-1.84949,-1.88039,-1.91022,-100005220
                1.93896,-1.96660,-1.99311,-2.01848,-2.04269,-2.06573,-2.08758,-2.1000005230
                2823,-2.12768,-2.14591,-2.16293,-2.17873,-2.19332,-2.20670,-2.2188800005240
                3,-2.22986,-2.23967,-2.24831,-2.25581,-2.26217,-2.26743,-2.27160,-200005250
                4.27470,-2.27676,-2.27780,-2.27785,-2.27693,-2.27506,-2.272297      00005260
0033            DO 80 J=1,35                                                        00005270
0034            FNEG(8,J)=PL08(J)                                                   00005280
0035          80 CONTINUE                                                           00005290
0036            DATA PL09/-1.54485,-1.67279,-1.69971,-1.72562,-1.75048,-1.77428,-100005300
                1.79701,-1.81864,-1.83916,-1.85856,-1.87683,-1.89395,-1.90992,-1.9200005310
                2472,-1.93836,-1.95093,-1.96213,-1.97227,-1.98124,-1.98906,-1.9957300005320
                3,-2.00128,-2.00570,-2.00903,-2.01128,-2.01247,-2.01263,-2.01177,-200005330
                4.00992,-2.00710,-2.00335,-1.99869,-1.99314,-1.98674,-1.979517      00005340
0037            DO 90 J=1,35                                                        00005350
0038            FNEG(9,J)=PL09(J)                                                   00005360
0039          90 CONTINUE                                                           00005370
0040            DATA PL10/-1.28155,-1.29178,-1.30105,-1.30935,-1.31671,-1.32309,-100005380
                1.32850,-1.33294,-1.33640,-1.33889,-1.34039,-1.34092,-1.34047,-1.3300005390
                2904,-1.33665,-1.33330,-1.32900,-1.32376,-1.31760,-1.31054,-1.3025900005400
                3,-1.29377,-1.28412,-1.27365,-1.26240,-1.25039,-1.23766,-1.22422,-100005410
                4.21013,-1.19539,-1.18006,-1.16416,-1.14772,-1.13078,-1.113377      00005420
0041            DO 100 J=1,35                                                       00005430
0042            FNEG(10,J)=PL10(J)                                                  00005440
0043          100 CONTINUE                                                          00005450
0044            DATA PL11/-0.84152,-0.83639,-0.83044,-0.82377,-0.81638,-0.80829,-000005460
                1.79950,-0.79002,-0.77986,-0.76902,-0.75752,-0.74537,-0.73257,-0.7100005470
                2915,-0.70512,-0.69050,-0.67532,-0.65959,-0.64335,-0.62662,-0.6094400005480
                3,-0.59183,-0.57383,-0.55549,-0.53683,-0.51789,-0.49872,-0.47934,-000005490
                4.45980,-0.44015,-0.42040,-0.40061,-0.38081,-0.36104,-0.341337      00005500
0045            DO 110 J=1,35                                                       00005510
0046            FNEG(11,J)=PL11(J)                                                  00005520
0047          110 CONTINUE                                                          00005530
```

```
0048          DATA PLI27=0.52440,-0.51207,-0.49927,-0.48600,-0.47228,-0.45812,-00005540
             1.44352,-0.42851,-0.41309,-0.39729,-0.38111,-0.36458,-0.34772,-0.3300005550
             2054,-0.31307,-0.29535,-0.27740,-0.25925,-0.24094,-0.22250,-0.2039700005560
             3,-0.18540,-0.16682,-0.14827,-0.12979,-0.11143,-0.09323,-0.07523,-000005570
             4.05746,-0.03997,-0.02279,-0.00596,0.01050,0.02654,0.042157           00005580
0049          DO 120 J=1,35                                                       00005590
0050          FNEG(12,J)=PLI2(J)                                                  00005600
0051      120 CONTINUE                                                            00005610
0052          DATA PLI3/-0.25335,-0.23763,-0.22168,-0.20552,-0.18916,-0.17261,-0000005620
             1.15589,-0.13901,-0.12199,-0.10486,-0.08763,-0.07032,-0.05297,-0.0300005630
             2550,-0.01824,-0.00092,0.01531,0.03340,0.05040,0.06718,0.08371,0.0900005640
             3997,0.11590,0.13148,0.14665,0.16138,0.17564,0.18939,0.20259,0.215200005650
             43,0.22726,0.23868,0.24946,0.25958,0.269047                         00005660
0053          DO 130 J=1,35                                                       00005670
0054          FNEG(13,J)=PLI3(J)                                                  00005680
0055      130 CONTINUE                                                            00005690
0056          DATA PLI4/-0.0,0.01662,0.03325,0.04993,0.06651,0.08302,0.09945,0.100005700
             11578,0.13199,0.14807,0.16397,0.17968,0.19517,0.21040,0.22535,0.23900005710
             296,0.25422,0.26808,0.28150,0.29443,0.30685,0.31872,0.32999,0.3406300005720
             3,0.35062,0.35992,0.36852,0.37640,0.38353,0.38991,0.39554,0.40041,000005730
             4.40454,0.40792,0.410587                                            00005740
0057          DO 140 J=1,35                                                       00005750
0058          FNEG(14,J)=PLI4(J)                                                  00005760
0059      140 CONTINUE                                                            00005770
0060          DATA PLI5/0.25335,0.26882,0.28403,0.29897,0.31362,0.32796,0.34198,00005780
             10.35565,0.36889,0.38186,0.39434,0.40638,0.41794,0.42899,0.43949,0.00005790
             244942,0.45873,0.46739,0.47538,0.48265,0.48917,0.49494,0.49991,0.5000005800
             3409,0.50744,0.50999,0.51171,0.51263,0.51276,0.51212,0.51073,0.508600005810
             43,0.50585,0.50244,0.498447                                         00005820
0061          DO 150 J=1,35                                                       00005830
0062          FNEG(15,J)=PLI5(J)                                                  00005840
0063      150 CONTINUE                                                            00005850
0064          DATA PLI6/0.52440,0.53624,0.54757,0.55839,0.56867,0.57840,0.58757,00005860
             10.59615,0.60412,0.61146,0.61815,0.62415,0.62944,0.63400,0.63779,0.00005870
             264080,0.64300,0.64436,0.64488,0.64453,0.64333,0.64125,0.63833,0.6300005880
             3456,0.62999,0.62463,0.61854,0.61176,0.60434,0.59634,0.58783,0.578000005890
             47,0.56953,0.55989,0.550007                                         00005900
0065          DO 160 J=1,35                                                       00005910
0066          FNEG(16,J)=PLI6(J)                                                  00005920
0067      160 CONTINUE                                                            00005930
0068          DATA PLI7/0.84162,0.84511,0.84986,0.85285,0.85508,0.85653,0.85718,00005940
             10.85703,0.85607,0.85426,0.85161,0.84809,0.84369,0.83841,0.83223,0.00005950
             282516,0.81720,0.80837,0.79868,0.78816,0.77686,0.76482,0.75211,0.7300005960
             3880,0.72495,0.71067,0.69602,0.68111,0.66603,0.65086,0.63569,0.620600005970
             40,0.60567,0.59096,0.576527                                         00005980
0069          DO 170 J=1,35                                                       00005990
0070          FNEG(17,J)=PLI7(J)                                                  00006000
0071      170 CONTINUE                                                            00006010
```

```
0072            DATA PLI8/1.28155,1.27037,1.25824,1.24516,1.23114,1.21618,1.20028,00006020
                1 1.18347,1.16574,1.14712,1.12762,1.10726,1.08608,1.06413,1.04144,1.00006030
                2 01810,0.99418,0.96977,0.94496,0.91983,0.89464,0.86938,0.84422,0.81000006040
                3929,0.79472,0.77062,0.74709,0.72422,0.70209,0.68075,0.66023,0.640500006050
                4 46,0.62175,0.60379,0.586667                                        00006060
0073            DO 180 J=1,35                                                        00006070
0074            FNEG(18,J)=PLI8(J)                                                   00006080
0075      180 CONTINUE                                                               00006090
0076            DATA PLI9/1.64485,1.61594,1.58607,1.55527,1.52357,1.49101,1.45762,00006100
                1 1.42345,1.38855,1.35299,1.31684,1.28019,1.24313,1.20578,1.16827,1.00006110
                2 13075,1.09338,1.05631,1.01973,0.98381,0.94871,0.91458,0.88156,0.8400006120
                3976,0.81927,0.79015,0.76242,0.73610,0.71116,0.68759,0.66532,0.644200006130
                4 49,0.62445,0.60572,0.588027                                        00006140
0077            DO 190 J=1,35                                                        00006150
0078            FNEG(19,J)=PLI9(J)                                                   00006160
0079      190 CONTINUE                                                               00006170
0080            DATA PL20/1.75069,1.71580,1.67999,1.64329,1.60574,1.56740,1.52830,00006180
                1 1.48852,1.44813,1.40720,1.36584,1.32414,1.28225,1.24028,1.19842,1.00006190
                2 15682,1.11566,1.07513,1.03543,0.99672,0.95918,0.92295,0.88814,0.8500006200
                3486,0.82315,0.79306,0.76456,0.73765,0.71227,0.68336,0.66585,0.644600006210
                4 45,0.62459,0.60587,0.588127                                        00006220
0081            DO 200 J=1,35                                                        00006230
0082            FNEG(20,J)=PL20(J)                                                   00006240
0083      200 CONTINUE                                                               00006250
0084            DATA PL21/1.95996,1.91219,1.86360,1.81427,1.76427,1.71366,1.66253,00006260
                1 1.61099,1.55914,1.50712,1.45507,1.40314,1.35153,1.30042,1.25004,1.00006270
                2 20059,1.15229,1.10537,1.06001,1.01640,0.97468,0.93495,0.89720,0.8600006280
                3169,0.82817,0.79667,0.76712,0.73943,0.71348,0.68917,0.66638,0.645000006290
                4 40,0.62491,0.60601,0.588217                                        00006300
0085            DO 210 J=1,35                                                        00006310
0086            FNEG(21,J)=PL21(J)                                                   00006320
0087      210 CONTINUE                                                               00006330
0088            DATA PL22/2.05375,1.99973,1.94499,1.88959,1.83361,1.77716,1.72033,00006340
                1 1.66325,1.60604,1.54886,1.49188,1.43529,1.37929,1.32412,1.26999,1.00006350
                2 22176,1.16584,1.11628,1.06864,1.02311,0.97980,0.93878,0.90009,0.8600006360
                3371,0.82959,0.79765,0.76779,0.73987,0.71377,0.68935,0.66649,0.645000006370
                4 47,0.62495,0.60603,0.588227                                        00006380
0089            DO 220 J=1,35                                                        00006390
0090            FNEG(22,J)=PL22(J)                                                   00006400
0091      220 CONTINUE                                                               00006410
0092            DATA PL23/2.32635,2.25258,2.17840,2.10396,2.02933,1.95472,1.88029,00006420
                1 1.80621,1.73271,1.66001,1.58838,1.51808,1.44942,1.38267,1.31815,1.00006430
                2 22551I,1.19580,1.14042,1.08711,1.03695,0.98995,0.94607,0.90521,0.8600006440
                3723,0.83196,0.79921,0.76878,0.74049,0.71415,0.68959,0.66663,0.645100006450
                4 44,0.62499,0.60605,0.588237                                        00006460
0093            DO 230 J=1,35                                                        00006470
0094            FNEG(23,J)=PL23(J)                                                   00006480
0095      230 CONTINUE                                                               00006490
```

```
0096            DATA PL24/2.57503,2.48187,2.38795,2.29423,2.20092,2.10825,2.01644,00006500
                11.92580,1.83660,1.74919,1.66390,1.58110,1.50114,1.42439,1.35114,1.00006510
                228167,1.21619,1.15477,1.09749,1.04427,0.99499,0.94945,0.90742,0.860000006520
                3863,0.83283,0.79973,0.76909,0.74067,0.71425,0.68964,0.66666,0.645100006530
                46,0.62500,0.60605,0.588247                                       00006540
0097             DO 240 J=1,35                                                    00006550
0098             FNEG(24,J)=PL24(J)                                               00006560
0099        240 CONTINUE                                                         00006570
0100             DATA PL25/3.09023,2.94834,2.80786,2.66915,2.53261,2.39867,2.26780,00006580
                12.14053,2.01739,1.89894,1.78572,1.67825,1.57695,1.48216,1.39408,1.00006590
                231275,1.23805,1.16974,1.10743,1.05068,0.99900,0.95188,0.90885,0.860000006600
                3945,0.83328,0.79998,0.76922,0.74074,0.71428,0.68965,0.66667,0.645100006610
                46,0.62500,0.60605,0.588247                                       00006620
0101             DO 250 J=1,35                                                    00006630
0102             FNEG(25,J)=PL25(J)                                               00006640
0103        250 CONTINUE                                                         00006650
0104             DATA PL26/3.29053,3.12767,2.96698,2.80889,2.65390,2.50257,2.35549,00006660
                12.21328,2.07661,1.94611,1.82241,1.70603,1.59738,1.49673,1.40413,1.00006670
                231944,1.24235,1.17240,1.10901,1.05159,0.99950,0.95215,0.90899,0.860000006680
                3952,0.83331,0.79999,0.76923,0.74074,0.71429,0.68966,0.66667,0.645100006690
                46,0.62500,0.60605,0.588247                                       00006700
0105             DO 260 J=1,35                                                    00006710
0106             FNEG(26,J)=PL26(J)                                               00006720
0107        260 CONTINUE                                                         00006730
0108             DATA PL27/3.71902,3.50703,3.29921,3.09631,2.89907,2.70836,2.52507,00006740
                12.35015,2.18448,2.02891,1.88410,1.75053,1.62838,1.51752,1.41753,1.00006750
                232774,1.24728,1.17520,1.11054,1.05239,0.99990,0.95234,0.90908,0.860000006760
                3956,0.83333,0.80000,0.76923,0.74074,0.71429,0.68966,0.66667,0.645100006770
                46,0.62500,0.60605,0.588247                                       00006780
0109             DO 270 J=1,35                                                    00006790
0110             FNEG(27,J)=PL27(J)                                               00006800
0111        270 CONTINUE                                                         00006810
0112             RETURN                                                           00006820
0113             END                                                              00006830
```

COMMON BLOCK / / MAP SIZE 20A0

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
FK	0	PLUS	6C	FNEG	F30	GP	1DF4	GN	1E80
X	1F0C	N	209C						

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
J	104								

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
PL01	108	PL02	194	PL03	220	PL04	2AC	PL05	338
PL06	3C4	PL07	450	PL08	4DC	PL09	568	PL10	5F4
PL11	680	PL12	70C	PL13	798	PL14	824	PL15	8B0
PL16	93C	PL17	9C8	PL18	A54	PL19	AE0	PL20	B6C
PL21	BF8	PL22	C84	PL23	D10	PL24	D9C	PL25	E28
PL26	EB4	PL27	F40						

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	1042	4	1042	5	1042	6	1052	7	105A
8	1076	9	1076	10	1086	11	108E	12	10AA
13	10AA	14	10BA	15	10C2	16	10DE	17	10DE
18	10EE	19	10F6	20	1112	21	1112	22	1122
23	112A	24	1146	25	1146	26	1156	27	115E
28	117A	29	117A	30	118A	31	1192	32	11AE
33	11AE	34	11BE	35	11C6	36	11E2	37	11F2
38	11F2	39	11FA	40	1216	41	1216	42	1226
43	122E	44	124A	45	124A	46	1254	47	1262
48	127E	49	127E	50	128E	51	1296	52	12B2
53	12B2	54	12C2	55	12CA	56	12E6	57	12F6
58	12F6	59	12FE	60	131A	61	131A	62	132A
63	1332	64	134E	65	134E	66	135E	67	1356
68	1382	69	1382	70	1392	71	139A	72	13B6
73	13B6	74	13C6	75	13CE	76	13EA	77	13FA
78	13FA	79	1402	80	141E	81	141E	82	142E
83	1436	84	1452	85	1452	86	1462	87	146A
88	1486	89	1486	90	1496	91	149E	92	14AA
93	14BA	94	14CA	95	14D2	96	14EE	97	14EE
98	14FE	99	1506	100	1522	101	1522	102	1532
103	153A	104	1556	105	1556	106	1566	107	1576
108	158A	109	158A	110	159A	111	15A2	112	15BE

```
*OPTIONS IN EFFECT*   ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
*OPTIONS IN EFFECT*   NAME = FILLN    , LINECNT =      50
*STATISTICS*     SOURCE STATEMENTS =      113,PROGRAM SIZE =     5574
*STATISTICS*   NO DIAGNOSTICS GENERATED
```

```
0001          SUBROUTINE FILLP                                                  00002330
0002          COMMON FK(27),PLUS(27,35),FNEG(27,35),GP(35),GN(35),X(100),N      00002340
0003          DIMENSION PL01(35), PL02(35), PL03(35), PL04(35), PL05(35), PL06(300002350
             15), PL07(35), PL08(35), PL09(35), PL10(35), PL11(35), PL12(35), PL00002360
             213(35), PL14(35), PL15(35), PL16(35), PL17(35), PL18(35), PL19(35)00002370
             3, PL20(35), PL21(35), PL22(35), PL23(35), PL24(35), PL25(35), PL2600002380
             4(35), PL27(35)                                                   00002390
0004          DATA PL01/-3.71902,-3.50703,-3.29921,-3.09631,-2.89907,-2.70836,-200002400
             1.52507,-2.35015,-2.18448,-2.02891,-1.88410,-1.75053,-1.62838,-1.5100002410
             2752,-1.41753,-1.32774,-1.24728,-1.17520,-1.11054,-1.05239,-0.9999000002420
             3,-0.95234,-0.90908,-0.86956,-0.83333,-0.80000,-0.76923,-0.74074,-000002430
             4.71429,-0.68966,-0.66667,-0.64516,-0.62500,-0.60606,-0.58824/     00002440
0005          DO 10 J=1,35                                                      00002450
0006          PLUS(1,J)=PL01(J)                                                 00002460
0007       10 CONTINUE                                                          00002470
0008          DATA PL02/-3.29053,-3.12767,-2.96698,-2.80839,-2.65390,-2.50257,-200002480
             1.35549,-2.21328,-2.07661,-1.94611,-1.82241,-1.70603,-1.59730,-1.4900002490
             2673,-1.40413,-1.31944,-1.24235,-1.17240,-1.10901,-1.05159,-0.9995000002500
             3,-0.95215,-0.90899,-0.86952,-0.83331,-0.79999,-0.76923,-0.74074,-000002510
             4.71429,-0.68966,-0.66667,-0.64516,-0.62500,-0.60606,-0.58824/     00002520
0009          DO 20 J=1,35                                                      00002530
0010          PLUS(2,J)=PL02(J)                                                 00002540
0011       20 CONTINUE                                                          00002550
0012          DATA PL03/-3.09023,-2.94834,-2.80786,-2.66915,-2.53261,-2.39867,-200002560
             1.26780,-2.14053,-2.01739,-1.89894,-1.78572,-1.67825,-1.57695,-1.4800002570
             2216,-1.39408,-1.31275,-1.23805,-1.16974,-1.10743,-1.05068,-0.9990000002580
             3,-0.95188,-0.90885,-0.86945,-0.83328,-0.79998,-0.76922,-0.74074,-000002590
             4.71428,-0.68965,-0.66667,-0.64516,-0.62500,-0.60606,-0.58824/     00002600
0013          DO 30 J=1,35                                                      00002610
0014          PLUS(3,J)=PL03(J)                                                 00002620
0015       30 CONTINUE                                                          00002630
0016          DATA PL04/-2.57583,-2.48187,-2.38795,-2.29423,-2.20092,-2.10825,-200002640
             1.01644,-1.92580,-1.83660,-1.74919,-1.66390,-1.58110,-1.50114,-1.4200002650
             2439,-1.35114,-1.28167,-1.21618,-1.15477,-1.09749,-1.04427,-0.9949900002660
             3,-0.94945,-0.90742,-0.86863,-0.83283,-0.79973,-0.76909,-0.74067,-000002670
             4.71425,-0.68964,-0.66666,-0.64516,-0.62500,-0.60606,-0.58824/     00002680
0017          DO 40 J=1,35                                                      00002690
0018          PLUS(4,J)=PL04(J)                                                 00002700
0019       40 CONTINUE                                                          00002710
0020          DATA PL05/-2.32635,-2.25258,-2.17840,-2.10394,-2.02933,-1.95472,-100002720
             1.88029,-1.80621,-1.73271,-1.66001,-1.58838,-1.51808,-1.44942,-1.3800002730
             2247,-1.31815,-1.25611,-1.19680,-1.14042,-1.08711,-1.03695,-0.9899500002740
             3,-0.94607,-0.90521,-0.86723,-0.83196,-0.79921,-0.76878,-0.74049,-000002750
             4.71415,-0.68959,-0.66663,-0.64514,-0.62499,-0.60606,-0.58823/     00002760
0021          DO 50 J=1,35                                                      00002770
0022          PLUS(5,J)=PL05(J)                                                 00002780
0023       50 CONTINUE                                                          00002790
0024          DATA PL06/-2.05375,-1.99973,-1.94499,-1.88959,-1.83361,-1.77716,-100002800
```

```
                1.72033,-1.66325,-1.60604,-1.54886,-1.49188,-1.43529,-1.37929,-1.3200002810
                2412,-1.26999,-1.21716,-1.16584,-1.11628,-1.11628,-1.02311,-0.9794000002820
                3,-0.93878,-0.90009,-0.86371,-0.82959,-0.79765,-0.76779,-0.73987,-000002830
                4.71377,-0.68935,-0.66649,-0.64507,-0.62495,-0.60603,-0.58822/      00002840
0025            DO 60 J=1,35                                                        00002850
0026            PLUS(6,J)=PL06(J)                                                   00002860
0027          60 CONTINUE                                                           00002870
0028            DATA PL07/-1.95996,-1.91219,-1.86360,-1.81427,-1.76427,-1.71366,-100002880
                1.66253,-1.61099,-1.55914,-1.50712,-1.45507,-1.40314,-1.35153,-1.3000002890
                2042,-1.25004,-1.20059,-1.15299,-1.10537,-1.06001,-1.01640,-0.9746800002900
                3,-0.93495,-0.89728,-0.86169,-0.82817,-0.79667,-0.76712,-0.73943,-000002910
                4.71348,-0.68917,-0.66638,-0.64500,-0.62491,-0.60601,-0.58821/      00002920
0029            DO 70 J=1,35                                                        00002930
0030            PLUS(7,J)=PL07(J)                                                   00002940
0031          70 CONTINUE                                                           00002950
0032            DATA PL08/-1.75069,-1.71580,-1.67999,-1.64329,-1.60574,-1.56740,-100002960
                1.52830,-1.48852,-1.44813,-1.40720,-1.36584,-1.32414,-1.28225,-1.2400002970
                2028,-1.19842,-1.15682,-1.11566,-1.07513,-1.03543,-0.99672,-0.9591800002980
                3,-0.92295,-0.88814,-0.85486,-0.82315,-0.79306,-0.76456,-0.73765,-000002990
                4.71227,-0.68336,-0.66585,-0.64465,-0.62469,-0.60587,-0.58812/      00003000
0033            DO 80 J=1,35                                                        00003010
0034            PLUS(8,J)=PL08(J)                                                   00003020
0035          80 CONTINUE                                                           00003030
0036            DATA PL09/-1.64485,-1.61594,-1.58607,-1.55527,-1.52357,-1.49101,-100003040
                1.45762,-1.42345,-1.38855,-1.35299,-1.31684,-1.28019,-1.24313,-1.2000003050
                2578,-1.16827,-1.13075,-1.09338,-1.05631,-1.01973,-0.98381,-0.9487100003060
                3,-0.91458,-0.88156,-0.84976,-0.81927,-0.79015,-0.76242,-0.73610,-000003070
                4.71116,-0.68759,-0.66532,-0.64429,-0.62445,-0.60572,-0.58802/      00003080
0037            DO 90 J=1,35                                                        00003090
0038            PLUS(9,J)=PL09(J)                                                   00003100
0039          90 CONTINUE                                                           00003110
0040            DATA PL10/-1.28155,-1.27037,-1.25824,-1.24516,-1.23114,-1.21618,-100003120
                1.20028,-1.18347,-1.16574,-1.14712,-1.12762,-1.10726,-1.08608,-1.0640003130
                2413,-1.04144,-1.01810,-0.99418,-0.96977,-0.94496,-0.91988,-0.8946400003140
                3,-0.86938,-0.84422,-0.81929,-0.79472,-0.77062,-0.74709,-0.72422,-000003150
                4.70209,-0.68075,-0.66023,-0.64056,-0.62175,-0.60379,-0.58666/      00003160
0041            DO 100 J=1,35                                                       00003170
0042            PLUS(10,J)=PL10(J)                                                  00003180
0043          100 CONTINUE                                                          00003190
0044            DATA PL11/-0.84162,-0.84611,-0.84986,-0.85285,-0.85508,-0.85653,-000003200
                1.85718,-0.85703,-0.85607,-0.85426,-0.85161,-0.84809,-0.84369,-0.8300003210
                2841,-0.83223,-0.82516,-0.81720,-0.80837,-0.79868,-0.78816,-0.7768600003220
                3,-0.76482,-0.75211,-0.73880,-0.72495,-0.71067,-0.69602,-0.68111,-000003230
                4.66603,-0.65086,-0.63569,-0.62060,-0.60567,-0.59096,-0.57652/      00003240
0045            DO 110 J=1,35                                                       00003250
0046            PLUS(11,J)=PL11(J)                                                  00003260
0047          110 CONTINUE                                                          00003270
0048            DATA PL12/-0.52440,-0.53624,-0.54757,-0.55839,-0.56867,-0.57840,-000003280
```

```
                1.58757,-0.59615,-0.60412,-0.61146,-0.61815,-0.62415,-0.62944,-0.6300000329
                2400,-0.63779,-0.64080,-0.64300,-0.64436,-0.64488,-0.64453,-0.6433300003300
                3,-0.64125,-0.63833,-0.63455,-0.62999,-0.62463,-0.61854,-0.61176,-000003310
                4.60434,-0.59434,-0.58783,-0.57887,-0.56953,-0.55989,-0.55000/      00003320
0049            DO 120 J=1,35                                                       00003330
0050             PLUS(12,J)=PL12(J)                                                 00003340
0051          120 CONTINUE                                                          00003350
0052            DATA PL13/-0.25335,-0.26882,-0.28403,-0.29897,-0.31362,-0.32796,-000003360
                1.34198,-0.35555,-0.36889,-0.38186,-0.39434,-0.40638,-0.41794,-0.4200003370
                2899,-0.43949,-0.44942,-0.45873,-0.46739,-0.47538,-0.48265,-0.4891700003380
                3,-0.49494,-0.49991,-0.50409,-0.50744,-0.50999,-0.51171,-0.51263,-000003390
                4.51276,-0.51212,-0.51073,-0.50863,-0.50585,-0.50244,-0.49844/      00003400
0053            DO 130 J=1,35                                                       00003410
0054             PLUS(13,J)=PL13(J)                                                 00003420
0055          130 CONTINUE                                                          00003430
0056            DATA PL14/0.0,-0.01662,-0.03325,-0.04993,-0.06651,-0.08302,-0.099400003440
                15,-0.11578,-0.13199,-0.14807,-0.16397,-0.17968,-0.19517,-0.21040,-00003450
                20.22535,-0.23996,-0.25422,-0.26808,-0.28150,-0.29443,-0.30685,-0.300003460
                31872,-0.32999,-0.34063,-0.35062,-0.35992,-0.36852,-0.37640,-0.3835000003470
                43,-0.38991,-0.39554,-0.40041,-0.40454,-0.40792,-0.41058/           00003480
0057            DO 140 J=1,35                                                       00003490
0058             PLUS(14,J)=PL14(J)                                                 00003500
0059          140 CONTINUE                                                          00003510
0060            DATA PL15/0.25335,0.23763,0.22168,0.20552,0.18916,0.17261,0.15589,00003520
                10.13901,0.12199,0.10486,0.08763,0.07032,0.05297,0.03560,0.01824,0.00003530
                200092,-0.01631,-0.03344,-0.05040,-0.06718,-0.08371,-0.09997,-0.11500003540
                390,-0.13148,-0.14665,-0.16138,-0.17564,-0.18939,-0.20259,-0.21523,00003550
                4-0.22726,-0.23868,-0.24946,-0.25958,-0.26904/                      00003560
0061            DO 150 J=1,35                                                       00003570
0062             PLUS(15,J)=PL15(J)                                                 00003580
0063          150 CONTINUE                                                          00003590
0064            DATA PL16/0.52440,0.51207,0.49927,0.48600,0.47228,0.45812,0.44352,00003600
                10.42851,0.41309,0.39729,0.38111,0.36458,0.34772,0.33054,0.31307,0.00003610
                229535,0.27740,0.25925,0.24094,0.22250,0.20397,0.18540,0.16682,0.1400003620
                3827,0.12979,0.11143,0.09323,0.07523,0.05746,0.03997,0.02279,0.0059000003630
                46,-0.01050,-0.02654,-0.04215/                                      00003640
0065            DO 160 J=1,35                                                       00003650
0066             PLUS(16,J)=PL16(J)                                                 00003660
0067          160 CONTINUE                                                          00003670
0068            DATA PL17/0.84162,0.83639,0.83044,0.82377,0.81638,0.80829,0.79950,00003680
                10.79002,0.77986,0.76902,0.75752,0.74537,0.73257,0.71915,0.70512,0.00003690
                269050,0.67532,0.65959,0.64335,0.62662,0.60944,0.59183,0.57383,0.5500003700
                3549,0.53683,0.51789,0.49872,0.47934,0.45980,0.44015,0.42040,0.4006000003710
                41,0.38081,0.36104,0.34133/                                         00003720
0069            DO 170 J=1,35                                                       00003730
0070             PLUS(17,J)=PL17(J)                                                 00003740
0071          170 CONTINUE                                                          00003750
0072            DATA PL18/1.28155,1.29178,1.30105,1.30936,1.31671,1.32309,1.32850,00003760
```

```
                11.33294,1.33640,1.33889,1.34039,1.34092,1.34047,1.33904,1.33665,1.00003770
                233330,1.32900,1.32376,1.31760,1.31054,1.30259,1.29377,1.28412,1.2700003780
                3365,1.26240,1.25039,1.23766,1.22422,1.21013,1.19539,1.18006,1.164100003790
                46,1.14772,1.13078,1.11337/                                          00003800
0073            DO 180 J=1,35                                                        00003810
0074            PLUS(18,J)=PL18(J)                                                   00003820
0075        180 CONTINUE                                                             00003830
0076            DATA PL19/1.64485,1.67279,1.69971,1.72562,1.75048,1.77428,1.79701,00003840
                11.81864,1.83916,1.85858,1.87683,1.89395,1.90992,1.92472,1.93836,1.00003850
                295083,1.96213,1.97227,1.98124,1.98906,1.99573,2.00128,2.00570,2.0000003860
                3903,2.01128,2.01247,2.01263,2.01177,2.00992,2.00710,2.00335,1.998600003870
                49,1.99314,1.98674,1.97951/                                          00003880
0077            DO 190 J=1,35                                                        00003890
0078            PLUS(19,J)=PL19(J)                                                   00003900
0079        190 CONTINUE                                                             00003910
0080            DATA PL20/1.75069,1.78462,1.81756,1.84949,1.88039,1.91022,1.93896,00003920
                11.96660,1.99311,2.01848,2.04269,2.06573,2.08758,2.10823,2.12768,2.00003930
                214591,2.16293,2.17873,2.19332,2.20670,2.21888,2.22986,2.23967,2.2400003940
                3831,2.25581,2.26217,2.26743,2.27160,2.27470,2.27676,2.27780,2.277800003950
                45,2.27693,2.27506,2.27229/                                          00003960
0081            DO 200 J=1,35                                                        00003970
0082            PLUS(20,J)=PL20(J)                                                   00003980
0083        200 CONTINUE                                                             00003990
0084            DATA PL21/1.95996,2.00688,2.05290,2.09795,2.14202,2.18505,2.22702,00004000
                12.26790,2.30764,2.34623,2.38364,2.41984,2.45482,2.48855,2.52102,2.00004010
                255222,2.58214,2.61076,2.63810,2.66413,2.68888,2.71234,2.73451,2.7500004020
                3541,2.77506,2.79345,2.81062,2.82658,2.84134,2.85492,2.86735,2.878600004030
                45,2.88884,2.89795,2.90599/                                          00004040
0085            DO 210 J=1,35                                                        00004050
0086            PLUS(21,J)=PL21(J)                                                   00004060
0087        210 CONTINUE                                                             00004070
0088            DATA PL22/2.05375,2.10697,2.15935,2.21081,2.26133,2.31084,2.35931,00004080
                12.40670,2.45298,2.49811,2.54206,2.58480,2.62631,2.66657,2.70556,2.00004090
                274325,2.77964,2.81472,2.84848,2.88091,2.91202,2.94181,2.97028,2.9900004100
                3744,3.02330,3.04787,3.07116,3.09320,3.11399,3.13356,3.15193,3.169100004110
                41,3.18512,3.20000,3.21375/                                          00004120
0089            DO 220 J=1,35                                                        00004130
0090            PLUS(22,J)=PL22(J)                                                   00004140
0091        220 CONTINUE                                                             00004150
0092            DATA PL23/2.32635,2.39961,2.47226,2.54421,2.61539,2.68572,2.75514,00004160
                12.82359,2.89101,2.95735,3.02256,3.08660,3.14944,3.21103,3.27134,3.00004170
                233035,3.38804,3.44438,3.49935,3.55295,3.60517,3.65600,3.70543,3.7500004180
                3347,3.80013,3.84540,3.88930,3.93183,3.97301,4.01286,4.05138,4.088500004190
                49,4.12452,4.15917,4.19257/                                          00004200
0093            DO 230 J=1,35                                                        00004210
0094            PLUS(23,J)=PL23(J)                                                   00004220
0095        230 CONTINUE                                                             00004230
0096            DATA PL24/2.57583,2.66965,2.76321,2.85536,2.94900,3.04102,3.13232,00004240
```

```
                13.22281,3.31243,3.40109,3.48874,3.57530,3.65073,3.74497,3.82798,3.00004250
                290973,3.99016,4.06926,4.14700,4.22336,4.29832,4.37186,4.44398,4.5100004260
                3467,4.58393,4.65176,4.71815,4.78313,4.84669,4.90884,4.96959,5.0289000004270
                47,5.08697,5.14362,5.19892/                                      00004280
0097            DO 240 J=1,35                                                    00004290
0098            PLUS(24,J)=PL24(J)                                               00004300
0099        240 CONTINUE                                                         00004310
0100            DATA PL25/3.09023,3.23322,3.37703,3.52139,3.66608,3.81090,3.95567,00004320
                14.10022,4.24439,4.38807,4.53112,4.67344,4.81492,4.95549,5.09505,5.00004330
                223353,5.37087,5.50701,5.64190,5.77549,5.90776,6.03865,6.16816,6.2900004340
                3626,6.42292,6.54814,6.67191,6.79421,6.91505,7.03443,7.15235,7.2680000004350
                41,7.38382,7.49739,7.60953/                                      00004360
0101            DO 250 J=1,35                                                    00004370
0102            PLUS(25,J)=PL25(J)                                               00004380
0103        250 CONTINUE                                                         00004390
0104            DATA PL26/3.29053,3.45513,3.62113,3.78820,3.95605,4.12443,4.29311,00004400
                14.45189,4.63057,4.79899,4.96701,5.13449,5.30130,5.46735,5.63252,5.00004410
                279673,5.95990,6.12196,6.28285,6.44251,6.60090,6.75798,6.91370,7.0600004420
                3804,7.22098,7.37250,7.52258,7.67121,7.81839,7.96411,8.10836,8.2511000004430
                45,8.39248,8.53236,8.67076/                                      00004440
0105            DO 260 J=1,35                                                    00004450
0106            PLUS(26,J)=PL26(J)                                               00004460
0107        260 CONTINUE                                                         00004470
0108            DATA PL27/3.71902,3.93453,4.15301,4.37394,4.59687,4.82141,5.04718,00004480
                15.27389,5.50124,5.72899,5.95691,6.18480,6.41249,6.63980,6.86661,7.00004490
                209277,7.31818,7.54272,7.76632,7.98888,8.21034,8.43064,8.64971,8.8600004500
                3753,9.08403,9.29920,9.51301,9.72543,9.93643,10.14602,10.35418,10.5000004510
                46090,10.76618,10.97001,11.17239/                                00004520
0109            DO 270 J=1,35                                                    00004530
0110            PLUS(27,J)=PL27(J)                                               00004540
0111        270 CONTINUE                                                         00004550
0112            RETURN                                                           00004560
0113            END                                                              00004570
```

COMMON BLOCK / / MAP SIZE 20A0

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
FK	0	PLUS	6C	FNEG	F30	GP	1DF4	GN	1E80
X	1F0C	N	209C						

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
J	104								

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
PL01	108	PL02	194	PL03	220	PL04	2AC	PL05	338
PL06	3C4	PL07	450	PL08	4DC	PL09	568	PL10	5F4
PL11	680	PL12	70C	PL13	793	PL14	824	PL15	880
PL16	93C	PL17	9C8	PL18	A54	PL19	AE0	PL20	B6C
PL21	BF8	PL22	C84	PL23	D10	PL24	D9C	PL25	E28
PL26	E84	PL27	F40						

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	1042	4	1042	5	1042	6	1052	7	105A
8	1076	9	1076	10	1086	11	108E	12	10AA
13	10AA	14	10BA	15	10C2	16	10DE	17	10DE
18	10EE	19	10F6	20	1112	21	1112	22	1122
23	112A	24	1146	25	1146	26	1156	27	115E
28	117A	29	117A	30	118A	31	1192	32	11AE
33	11AE	34	11BE	35	11C6	36	11E2	37	11E2
38	11F2	39	11FA	40	1216	41	1216	42	1226
43	122E	44	124A	45	124A	46	125A	47	1252
48	127E	49	127E	50	128E	51	1296	52	12B2
53	12B2	54	12C2	55	12CA	56	12E6	57	12E6
58	12F6	59	12FE	60	131A	61	131A	62	132A
63	1332	64	134E	65	134E	66	135E	67	1366
68	1382	69	1382	70	1392	71	139A	72	13B6
73	13B6	74	13C6	75	13CE	76	13EA	77	13EA
78	13FA	79	1402	80	141E	81	141E	82	142E
83	1436	84	1452	85	1452	86	1462	87	146A
88	1486	89	1486	90	1496	91	149E	92	14BA
93	14BA	94	14CA	95	14D2	96	14EE	97	14EE
98	14FE	99	1506	100	1522	101	1522	102	1532
103	153A	104	1556	105	1556	106	1566	107	156E
108	158A	109	158A	110	159A	111	15A2	112	15BE

```
*OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
*OPTIONS IN EFFECT*  NAME = FILLP    , LINECNT =      50
*STATISTICS*    SOURCE STATEMENTS =      113,PROGRAM SIZE =    5574
*STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
0001                SUBROUTINE FILLGN                                          00006840
0002                COMMON FK(27),PLUS(27,35),FNEG(27,35),GP(35),GN(35),X(100),N  00006850
0003                DIMENSION GK(35)                                           00006860
0004                DATA GK/0.0,-0.1,-0.2,-0.3,-0.4,-0.5,-0.6,-0.7,-0.8,-0.9,-1.0,-1.100006870
                   1,-1.2,-1.3,-1.4,-1.5,-1.6,-1.7,-1.8,-1.9,-2.0,-2.1,-2.2,-2.3,-2.4,00006880
                   2-2.5,-2.6,-2.7,-2.8,-2.9,-3.0,-3.1,-3.2,-3.3,-3.4/         00006890
0005                DO 10 I=1,35                                               00006900
0006                GN(I)=GK(I)                                                00006910
0007              10 CONTINUE                                                  00006920
0008                RETURN                                                     00006930
0009                END                                                        00006940
```

COMMON BLOCK / / MAP SIZE 20A0

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
FK	0	PLUS	6C	FNEG	F30	GP	1DF4	GN	1E80
X	1F0C	N	209C						

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
I	9C								

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
GK	A0								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	19E	4	19E	5	19E	6	1AE	7	1B6
8	1D2								

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = FILLGN , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 9,PROGRAM SIZE = 474
STATISTICS NO DIAGNOSTICS GENERATED

```
FORTRAN IV G LEVEL 21          FILLGP          DATE = 75324          19748/02          PAGE 0001

0001                SUBROUTINE FILLGP                                                00006950
0002                COMMON FK(27),PLUS(27,35),FNEG(27,35),GP(35),GN(35),X(100),N     00006960
0003                DIMENSION GK(35)                                                 00006970
0004                DATA GK/0.0,0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1.0,1.1,1.2,1.3,1.00006980
                   I4,1.5,1.6,1.7,1.8,1.9,2.0,2.1,2.2,2.3,2.4,2.5,2.6,2.7,2.8,2.9,3.0,00006990
                   23.1,3.2,3.3,3.4/                                                00007000
0005                DO 10 I=1,35                                                     00007010
0006                GP(I)=GK(I)                                                      00007020
0007             10 CONTINUE                                                         00007030
0008                RETURN                                                           00007040
0009                END                                                              00007050
```

COMMON BLOCK / / MAP SIZE 20A0

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
FK	0	PLUS	6C	FNEG	F30	GP	10F4	GN	1E80
X	1F0C	N	209C						

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
I	9C								

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
GK	A0								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	19E	4	19E	5	19E	6	1AE	7	1B6
8	1D2								

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = FILLGP , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 9,PROGRAM SIZE = 474
STATISTICS NO DIAGNOSTICS GENERATED

```
FORTRAN IV G LEVEL 21          RANK          DATE = 75324      19/48/02          PAGE 0001

0001                SUBROUTINE RANK                                          00002040
0002                COMMON FK(27),PLUS(27,35),FNEG(27,35),GP(35),GN(35),X(100),N  00002050
0003                DIMENSION Z(100)                                         00002060
0004                M=N                                                      00002070
0005                DO 10 K=1,N                                              00002080
0006                Z(K)=X(K)                                                00002090
0007             10 CONTINUE                                                 00002100
0008                I=1                                                      00002110
0009             20 K=1                                                      00002120
0010                XMAX=-1.0E49                                             00002130
0011                DO 40 J=I,M                                              00002140
0012                IF (XMAX.GE.Z(J)) GO TO 30                               00002150
0013                K=J                                                      00002160
0014                XMAX=Z(J)                                                00002170
0015             30 CONTINUE                                                 00002180
0016             40 CONTINUE                                                00002190
0017                X(I)=Z(K)                                                00002200
0018                IF (K.EQ.M) GO TO 60                                     00002210
0019                IK=K+1                                                   00002220
0020                DO 50 J=IK,M                                             00002230
0021                IJ=J-1                                                   00002240
0022                Z(IJ)=Z(J)                                               00002250
0023             50 CONTINUE                                                 00002260
0024             60 M=M-1                                                   00002270
0025                I=I+1                                                    00002280
0026                IF (I.GT.N) GO TO 70                                     00002290
0027                GO TO 20                                                 00002300
0028             70 RETURN                                                   00002310
0029                END                                                      00002320
```

COMMON BLOCK / / MAP SIZE 20A0

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
FK	0	PLUS	6C	FNEG	F30	GP.	1DF4	GN	1E80
X	1F0C	N	209C						

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
M	D0	K	D4	I	D8	XMAX.	DC	J	E0
IK	E4	IJ	E8						

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
Z	EC								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	2F6	4	2F6	5	302	6	312	7	31A
8	33A	9	342	10	34A	11	352	12	35E
13	36C	14	374	15	37C	16	37C	17	394
18	3B0	19	3BE	20	3CA	21	3E0	22	3EC
23	3FC	24	414	25	420	26	42C	27	43E
28	444								

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = RANK , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 29,PROGRAM SIZE = 1100
STATISTICS NO DIAGNOSTICS GENERATED

```
FORTRAN IV G LEVEL 21          INTERP          DATE = 75324          19748702          PAGE 0001

0001                SUBROUTINE INTERP (SKEW,K)                                    00007060
0002                COMMON FK(27),PLUS(27,35),FNEG(27,35),GP(35),GN(35),X(100),N  00007070
0003                REAL M                                                        00007080
0004                DO 10 I=1,34                                                  00007090
0005                IP=I+1                                                        00007100
0006                IF ((SKEW.GE.GP(I)).AND.(SKEW.LT.GP(I+1))) GO TO 20           00007110
0007             10 CONTINUE                                                      00007120
0008                K=1                                                           00007130
0009                GO TO 40                                                      00007140
0010             20 K=0                                                           00007150
0011                M=(SKEW-GP(I))/(GP(IP)-GP(I))                                 00007160
0012                DO 30 J=1,27                                                  00007170
0013                FK(J)=PLUS(J,I)+M*(PLUS(J,IP)-PLUS(J,I))                      00007180
0014             30 CONTINUE                                                      00007190
0015             40 RETURN                                                        00007200
0016                END                                                           00007210
```

COMMON BLOCK / / MAP SIZE 20A0

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
FK	0	PLUS	6C	FNEG	F30	GP	1DF4	GN	1E60
X	1F0C	N	209C						

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
I	B4	IP	B8	SKEW	BC	K	C0	M	C4
J	C8								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	17A	4	17A	5	185	6	192	7	1C4
8	1DC	9	1E4	10	1EA	11	1F2	12	224
13	230	14	286	15	29E				

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = INTERP , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 16,PROGRAM SIZE = 678
STATISTICS NO DIAGNOSTICS GENERATED

```
FORTRAN IV G LEVEL 21          INTERN          DATE = 75324      19748/02      PAGE 0001

0001                SUBROUTINE INTERN (SKEW,K)                                00007220
0002                COMMON FK(27),PLUS(27,35),FNEG(27,35),GP(35),GN(35),X(100),N  00007230
0003                REAL M                                                    00007240
0004                DO 10 I=1,34                                              00007250
0005                IP=I+1                                                    00007260
0006                IF ((SKEW.LE.GN(I)).AND.(SKEW.GT.GN(IP))) GO TO 20        00007270
0007             10 CONTINUE                                                  00007280
0008                K=1                                                       00007290
0009                GO TO 40                                                  00007300
0010             20 K=0                                                       00007310
0011                M=(SKEW-GN(I))/(GN(IP)-GN(I))                             00007320
0012                DO 30 J=1,27                                              00007330
0013                FK(J)=FNEG(J,I)+M*(FNEG(J,IP)-FNEG(J,I))                  00007340
0014             30 CONTINUE                                                  00007350
0015             40 RETURN                                                    00007360
0016                END                                                       00007370
```

COMMON BLOCK / / MAP SIZE 2040

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
FK	0	PLUS	6C	FNEG	F30	GP	1DF4	GN	1E80
X	1F0C	N	209C						

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
I	B4	IP	B8	SKEW	BC	K	C0	M	C4
J	C8								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	176	4	176	5	182	6	18E	7	1CC
8	1E4	9	1EC	10	1F2	11	1FA	12	224
13	230	14	286	15	29E				


```
*OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
*OPTIONS IN EFFECT*  NAME = INTERN  , LINECNT =      50
*STATISTICS*    SOURCE STATEMENTS =      16,PROGRAM SIZE =     678
*STATISTICS*  NO DIAGNOSTICS GENERATED
```

```
FORTRAN IV G LEVEL 21          PLOT          DATE = 75324      19/48/02          PAGE 0001

0001            SUBROUTINE PLOT (X,SZ,C,SE,N)                                  00007480
0002            DIMENSION X(100), SZ(100), SE(27), C(27), IGRID(127,111), IX(100),00007490
               1 ISZ(100), ISE(27), IC(27)                                     00007500
0003            DATA IBLK/' '/,IAST/'*'/,IAX/'X'/,IA0/'0'/,IA1/'1'/,IA2/'2'/,IA3/'00007510
               13'/,IDASH/'-'/,IVERT/'|'/,IAA/'A'/,IAB/'B'/                    00007520
0004            DO 20 I=1,127                                                  00007530
0005            DO 10 J=1,111                                                  00007540
0006            IGRID(I,J)=IBLK                                                00007550
0007         10 CONTINUE                                                       00007560
0008         20 CONTINUE                                                       00007570
0009            DO 40 I=1,127,18                                               00007580
0010            DO 30 J=2,110                                                  00007590
0011            IGRID(I,J)=IDASH                                               00007600
0012         30 CONTINUE                                                       00007610
0013         40 CONTINUE                                                       00007620
0014            DO 50 I=1,127                                                  00007630
0015            IGRID(I,1)=IVERT                                               00007640
0016            IGRID(I,6)=IVERT                                               00007650
0017            IGRID(I,21)=IVERT                                              00007660
0018            IGRID(I,29)=IVERT                                              00007670
0019            IGRID(I,38)=IVERT                                              00007680
0020            IGRID(I,56)=IVERT                                              00007690
0021            IGRID(I,74)=IVERT                                              00007700
0022            IGRID(I,83)=IVERT                                              00007710
0023            IGRID(I,93)=IVERT                                              00007720
0024            IGRID(I,100)=IVERT                                             00007730
0025            IGRID(I,106)=IVERT                                             00007740
0026            IGRID(I,111)=IVERT                                             00007750
0027         50 CONTINUE                                                       00007760
0028            DO 60 I=1,N                                                    00007770
0029            X1=X(I)                                                        00007780
0030            I1=X1                                                          00007790
0031            X2=(X1-I1)*18.0 + 1.5                                          00007800
0032            IX2=X2                                                         00007810
0033            IX1=I1*18+IX2                                                  00007820
0034            IX(I)=IX1                                                      00007830
0035         60 CONTINUE                                                       00007840
0036            DO 70 I=4,24                                                   00007850
0037            X1=C(I)                                                        00007860
0038            I1=X1                                                          00007870
0039            X2=(X1-I1)*18.0 + 1.5                                          00007880
0040            IX2=X2                                                         00007890
0041            IX1=I1*18+IX2                                                  00007900
0042            IC(I)=IX1                                                      00007910
0043         70 CONTINUE                                                       00007920
0044            DO 120 I=1,N                                                   00007930
0045            X1=SZ(I)                                                       00007940
0046            IF (X1-0.5) 80,90,100                                          00007950
```

```
0047          80 T=SQRT(ALOG(1.0/(X1**2)))                                    00007960
0048             XP=T-((2.30753+0.27061*T)/(1.0+0.99229*T+0.04481*T**2))      00007970
0049             PPOS=21.359*XP+0.5                                           00007980
0050             IPPOS=PPOS                                                   00007990
0051             ISZ(I)=56+IPPOS                                              00008000
0052             GO TO 110                                                    00008010
0053          90 ISZ(I)=56                                                    00008020
0054             GO TO 110                                                    00008030
0055         100 X1=1.0-X1                                                    00008040
0056             T=SQRT(ALOG(1.0/(X1**2)))                                    00008050
0057             XP=T-((2.30753+0.27061*T)/(1.0+0.99229*T+0.04481*T**2))      00008060
0058             PPOS=21.359*XP+0.5                                           00008070
0059             IPPOS=PPOS                                                   00008080
0060             ISZ(I)=56-IPPOS                                              00008090
0061         110 CONTINUE                                                     00008100
0062         120 CONTINUE                                                     00008110
0063             DO 170 I=4,24                                                00008120
0064             X1=SE(I)                                                     00008130
0065             IF (X1-0.5) 130,140,150                                      00008140
0066         130 T=SQRT(ALOG(1.0/(X1**2.0)))                                  00008150
0067             XP=T-((2.30753+0.27061*T)/(1.0+0.99229*T+0.04481*T**2))      00008160
0068             PPOS=21.359*XP+0.5                                           00008170
0069             IPPOS=PPOS                                                   00008180
0070             ISE(I)=56+IPPOS                                              00008190
0071             GO TO 160                                                    00008200
0072         140 ISE(I)=56                                                    00008210
0073             GO TO 160                                                    00008220
0074         150 X1=1.0-X1                                                    00008230
0075             T=SQRT(ALOG(1.0/(X1**2)))                                    00008240
0076             XP=T-((2.30753+0.27061*T)/(1.0+0.99229*T+0.04481*T**2))      00008250
0077             PPOS=21.359*XP+0.5                                           00008260
0078             IPPOS=PPOS                                                   00008270
0079             ISE(I)=56-IPPOS                                              00008280
0080         160 CONTINUE                                                     00008290
0081         170 CONTINUE                                                     00008300
0082             DO 230 I=1,N                                                 00008310
0083             IND1=IX(I)                                                   00008320
0084             IND2=ISZ(I)                                                  00008330
0085             IF ((IND1.LE.0).OR.(IND1.GE.128).OR.(IND2.LE.0).OR.(IND2.GE.112)) 00008340
                1GO TO 210                                                   00008350
0086             IX1=IGRID(IND1,IND2)                                         00008360
0087             IF (IX1.EQ.IBLK) GO TO 180                                   00008370
0088             IF (IX1.EQ.IAX) GO TO 190                                    00008380
0089             IF (IX1.EQ.IA2) GO TO 200                                    00008390
0090         180 IGRID(IND1,IND2)=IAX                                         00008400
0091             GO TO 220                                                    00009410
0092         190 IGRID(IND1,IND2)=IA2                                         00008420
0093             GO TO 220                                                    00008430
```

```
0094          200 IGRID(IND1,IND2)=IA3                                                  00008440
0095              GO TO 220                                                             00008450
0096          210 XXK=10.0**X(I)                                                        00008460
0097              WRITE (6,400) XXK,SZ(I)                                               00008470
0098          220 CONTINUE                                                              00008480
0099          230 CONTINUE                                                              00008490
0100              DO 300 I=4,24                                                         00008500
0101              IND1=IC(I)                                                            00008510
0102              IND2=ISE(I)                                                           00008520
0103              IF ((IND1.LE.0).OR.(IND1.GE.128).OR.(IND2.LE.0).OR.(IND2.GE.112)) GO  00008530
                 1TO 280                                                               00008540
0104              IX1=IGRID(IND1,IND2)                                                  00008550
0105              IF (IX1.EQ.IBLK) GO TO 240                                            00008560
0106              IF (IX1.EQ.IAX) GO TO 250                                             00008570
0107              IF (IX1.EQ.IA2) GO TO 260                                             00008580
0108              IF (IX1.EQ.IA3) GO TO 270                                             00008590
0109          240 IGRID(IND1,IND2)=IAST                                                 00008600
0110              GO TO 290                                                             00008610
0111          250 IGRID(IND1,IND2)=IAO                                                  00008620
0112              GO TO 290                                                             00008630
0113          260 IGRID(IND1,IND2)=IAA                                                  00008640
0114              GO TO 290                                                             00008650
0115          270 IGRID(IND1,IND2)=IAR                                                  00008660
0116              GO TO 290                                                             00008670
0117          280 XXK=10.0**C(I)                                                        00008680
0118              WRITE (6,410) XXK,SE(I)                                               00008690
0119          290 CONTINUE                                                              00008700
0120          300 CONTINUE                                                              00008710
0121              K1=24                                                                 00008720
0122              DO 310 I=4,24                                                         00008730
0123              K=24-I+1                                                              00008740
0124              IF (C(K).GE.7.0) K1=K1-1                                              00008750
0125          310 CONTINUE                                                              00008760
0126              K2=4                                                                  00008770
0127              DO 320 I=4,24                                                         00008780
0128              IF (C(I).LE.0.0) K2=K2+1                                              00008790
0129          320 CONTINUE                                                              00008800
0130              IF (C(K1).GT.X(1)) GO TO 330                                          00008810
0131              I1 = (IX(1)-1)/18                                                     00008820
0132              ILAST=(I1+1)*18+1                                                     00008830
0133              GO TO 340                                                             00008840
0134          330 I1 = (IC(K1)-1)/18                                                    00008850
0135              ILAST=(I1+1)*18+1                                                     00008860
0136          340 IF (C(K2).LT.X(N)) GO TO 350                                          00008870
0137              I1 = (IX(N)-1)/18                                                     00008880
0138              IBEG=I1*18+1                                                          00008890
0139              GO TO 360                                                             00008900
0140          350 I1 = (IC(K2)-1)/18                                                    00008910
```

```
0141          IBEG=I1*I8+1                                                    00008920
0142      360 WRITE (6,420)                                                   00008930
0143          IF (IBEG.LE.0) IBEG=1                                           00008940
0144          IF (ILAST.GT.127) ILAST=127                                     00008950
0145          DO 390 K=IBEG,ILAST                                             00008960
0146          I=ILAST-K+IBEG                                                  00008970
0147          IF (MOD(I,I8).NE.1) GO TO 370                                   00008980
0148          I1=I-1                                                          00008990
0149          I2=I1/I8                                                        00009000
0150          I3=10**I2                                                       00009010
0151          WRITE (6,430) I3,(IGRID(I,J),J=1,III),I3                        00009020
0152          GO TO 380                                                       00009030
0153      370 WRITE (6,440) (IGRID(I,J),J=1,III)                              00009040
0154      380 CONTINUE                                                        00009050
0155      390 CONTINUE                                                        00009060
0156          WRITE (6,450)                                                   00009070
0157          WRITE (6,460)                                                   00009080
0158          RETURN                                                          00009090
C                                                                             00009100
0159      400 FORMAT ('0','THE FOLLOWING DATA VALUE ',F13.3,' WITH ASSOCIATED ',00009110
             1'PROBABILITY OF ',F7.4,' WAS NOT PLOTTED')                      00009120
0160      410 FORMAT ('0','THE FOLLOWING COMPUTED VALUE ',F13.3,' WITH ASSOCIAT'00009130
             1,'ED PROBABILITY OF ',F7.4,' WAS NOT PLOTTED')                  00009140
0161      420 FORMAT (' ',56X,'PROBABILITY'/' ',7X,'0.995 0.99',11X,'0.95',4X,'000009150
            1.90',5X,'0.80',14X,'0.50',14X,'0.20',5X,'0.1',7X,'0.04',3X,'0.02',00009160
            22X,'0.01',1X,'0.005',1X)                                         00009170
0162      430 FORMAT (' ',I8,1X,111A1,1X,I8)                                  00009180
0163      440 FORMAT (' ',9X,111A1,9X)                                        00009190
0164      450 FORMAT (' ',7X,'1.005 1.01',11X,'1.05',4X,'1.11',5X,'1.25',15X,'2'00009200
            1,17X,'5',7X,'10',8X,'25',5X,'50',4X,'100',2X,'200'/' ',56X,'RECURR00009210
            2ENCE INTERVALS',1X)                                              00009220
0165      460 FORMAT ('0','THE FOLLOWING SYMBOLS MAY APPEAR IN THE PLOT'/' ','X 00009230
             1- AN INPUT DATA VALUE'/' ','* - A CALCULATED VALUE'/' ','O - A CAL00009240
             2CULATED VALUE AND ONE DATA VALUE AT SAME'/' ','    POSITION'/' ','00009250
             32 - TWO INPUT DATA VALUES PLOTTED AT SAME POSITION'/' ','3 - THREE00009260
             4 INPUT DATA VALUES PLOTTED AT SAME POSITION'/' ','A - A CALCULATED00009270
             5 VALUE AND TWO DATA VALUES AT THE '/' ','    SAME POSITION'/' ','B00009280
             6 - A CALCULATED VALUE AND THREE DATA VALUES AT THE'/' ','    SAME 00009290
             7POSITION'////)                                                  00009300
0166          END                                                             00009310
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
FRXPR#	1DC	IBCOM#	1E0	FIXPI#	1E4	SQRT	1E8	ALOG	1EC

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IBLK	238	IAST	23C	IAX	240	IAO	244	IA1	248
IA2	24C	IA3	250	IDASH	254	IVERT	258	IAA	25C
IAB	260	I	264	J	268	N	26C	X1	270
II	274	X2	278	IX2	27C	IX1	280	T	284
XP	288	PPOS	28C	IPPOS	290	IND1	294	IND2	298
XXK	29C	K1	2A0	K	2A4	K2	2A8	ILAST	2AC
IBEG	2B0	I2	2B4	I3	2B8				

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
X	2BC	SZ	2C0	SE	2C4	C	2C8	IGRID	2CC
IX	DF10	ISZ	E0A0	ISE	E230	IC	E29C		

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
400	E308	410	E365	420	E3C6	430	E43E	440	E44F
450	E45C	460	E4CF						

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	E7EC	3	E7EC	4	E7EC	5	E7FC	6	E80A
7	E812	8	E82E	9	E84A	10	E85A	11	E85F
12	E870	13	E88C	14	E8A8	15	E8C4	16	E8CC
17	E8D4	18	E8DC	19	E8E4	20	E8EC	21	E8FC
22	E908	23	E914	24	E924	25	E930	26	E93C
27	E94C	28	E964	29	E97C	30	E984	31	E9AC
32	E9D6	33	E9F6	34	EA06	35	EA0E	36	EA2A
37	EA42	38	EA4A	39	EA6E	40	EA9C	41	EA9C
42	EACC	43	EAD4	44	EAF0	45	EB08	46	EB10
47	EB2A	48	EB62	49	EB92	50	EBA2	51	EBC2
52	EBCE	53	EBD4	54	EBE0	55	EBE6	56	EBF6
57	EC2A	58	EC5A	59	EC6A	60	EC8A	61	EC96
62	EC96	63	ECB6	64	ECCE	65	ECD6	66	ECF0
67	ED30	68	ED60	69	ED70	70	ED90	71	ED9C
72	EDA2	73	EDAE	74	EDB4	75	EDC4	76	EDF6
77	EE28	78	EE33	79	EE59	80	EE64	81	EE64
82	EE84	83	EEA9	84	EEB0	85	EEB8	86	EF1A

87	EF34	88	EF42	89	EF50	90	EF5E	91	EF7C
92	EF82	93	EFA0	94	EFA6	95	EFC4	96	EFCA
97	EFE8	98	F00C	99	F00C	100	F030	101	F050
102	F058	103	F060	104	F0C2	105	F00C	106	F0EA
107	F0F8	108	F106	109	F114	110	F132	111	F138
112	F156	113	F15C	114	F17A	115	F180	116	F19E
117	F1A4	118	F1C2	119	F1E8	120	F1E8	121	F20C
122	F218	123	F220	124	F234	125	F25E	126	F272
127	F27E	128	F28E	129	F2AC	130	F2C8	131	F2EE
132	F302	133	F318	134	F31E	135	F33E	136	F354
137	F386	138	F39A	139	F3AA	140	F3B0	141	F3D0
142	F3E0	143	F3F4	144	F40E	145	F428	146	F430
147	F440	148	F464	149	F470	150	F480	151	F492
152	F4F4	153	F4FA	154	F550	155	F550	156	F564
157	F578	158	F58C	166	F594				

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = PLOT , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 166,PROGRAM SIZE = 62870
STATISTICS NO DIAGNOSTICS GENERATED

STATISTICS NO DIAGNOSTICS THIS STEP

14 SUBROUTINE VCOR

14.1

1 Given a data matrix whose columns represent up to 25 stations and whose rows represent up to 70 years of flows, (each row represents a specific calendar year, say row 5 represents 1945. Thus if station 1 had flows from 1900 to 1960 and station 2 had flows from 1915 to 1975, the matrix could not hold all flows. You could decide to hold the flows for 1900-1970 or from 1905-1975.), "Vcor" finds the means, std's, and cross correlations for each pair of stations. For each pair, these statistics are based only on the years in which both stations have a flow reported. The average correlation is also calculated.

2 Called by:

R50

Calls:

None

3 All of the pairs of stations must have at least 3 years of flow in common.

4 Since the correlation matrix is symmetrical only the section lying above the diagonal is calculated; thus the pairs are

(i,j) i = 1, no. of stations -1,
j = i, no. of stations.

For each pair, the means, std's, no. of observations in common, and the cross correlation are computed and stored.

(Station 1 may have some years in common with station 2, and different years in common with station 3. Thus, the mean, and std of station 1's flow when the pair (1,2) is being processed, may be different than 1's mean and std when the pair (1,3) is being processed.)

After the "pairs" have been done, the means and std's of the individual stations are calculated and stored.

One note: since there are not likely to be 70 years of flow data, a maximum year index is passed to the subroutine (NY) and only rows 1 through NY of the flow matrix are used.

5

6 For pair (I,J) and data matrix Q

$$\text{mean I} = \frac{\sum_{i=1}^{NY} Q(i,I)}{Z}$$

where Z is the number of years in which both I and J have non-zero flows,

$$\text{std I} = \text{sqrt}\left(\frac{\sum_{i=1}^{NY} Q(i,I) - Z(\text{mean I})^2}{Z-1}\right)$$

$$\text{correlation} = \frac{\left(\sum_{i=1}^{NY} Q(i,I)Q(i,J)\right) - Z(\text{mean I})(\text{mean J})}{(Z-1)(\text{std I})(\text{std J})}$$

7 2/8/76 Raiffa

8

14.2

0 Arguments:

Q	= real	array	holds flow data
NS	= integer		no. of stations
NY	= integer		no. of years of flow only rows 1-NY of Q are used
SUM	= real		will return average correlation
L	= integer		no. of pairs = $\frac{NS(NS-1)}{2}$

XB	= real	array	on return will hold means (for storage mode see "R50").
N1	= integer	array	on return will hold no. of observations for each individual station.

1

2 Do loops:

Do 10 I: zero arrays

Do 10 J: zero arrays

Do 20 I: first index of pairs

Do 20 J: second index of pairs (I,J) J = I, no. of stations

Do 30 H: index through years (flows)

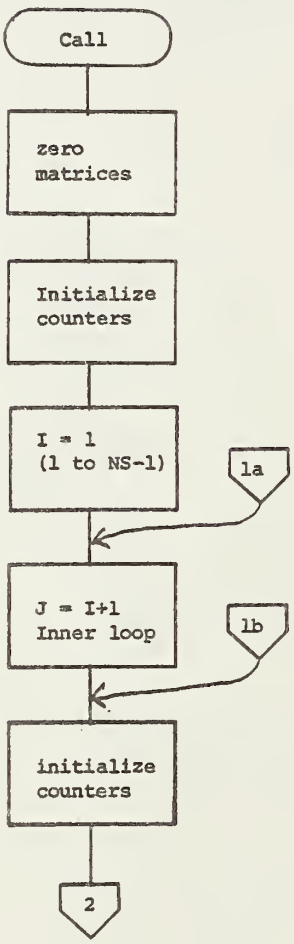
Do 30 I: index through stations to find individual station means and std's,

Do 50 H: index through years for individual stations

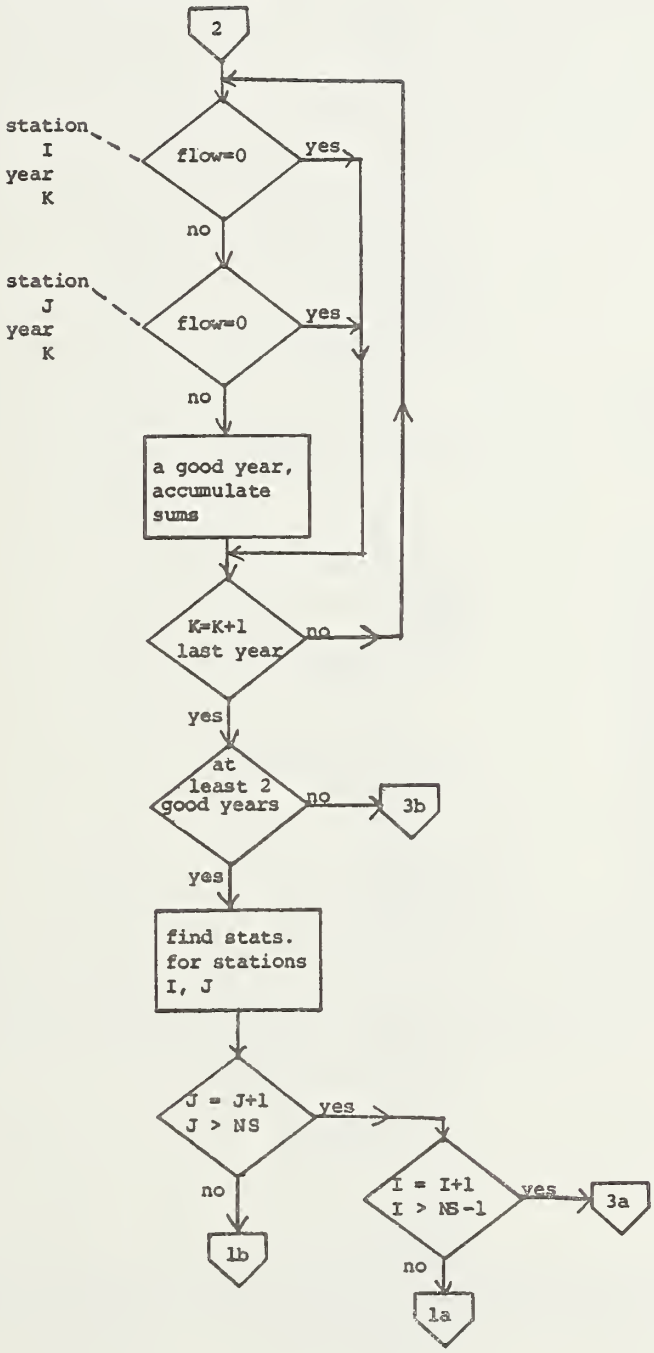
Z	=	real	counts no. of flow years in common for stations (I,J). Later, it counts no. of flow years for station I.
SUM	=	real	counts total of correlations. Later SUM will be divided by no. of pairs to find and return the average correlation.
LEND	=	integer	25, dimension for zeroing arrays
NS1	=	integer	no. of stations -1, used in Do loops
I2	=	integer	used in Do loop
X1	=	real	temporary, holds a flow for station I of pair (I,J)

X2	=	real	temporary, holds flow for station J
Z1	=	real	Z-1

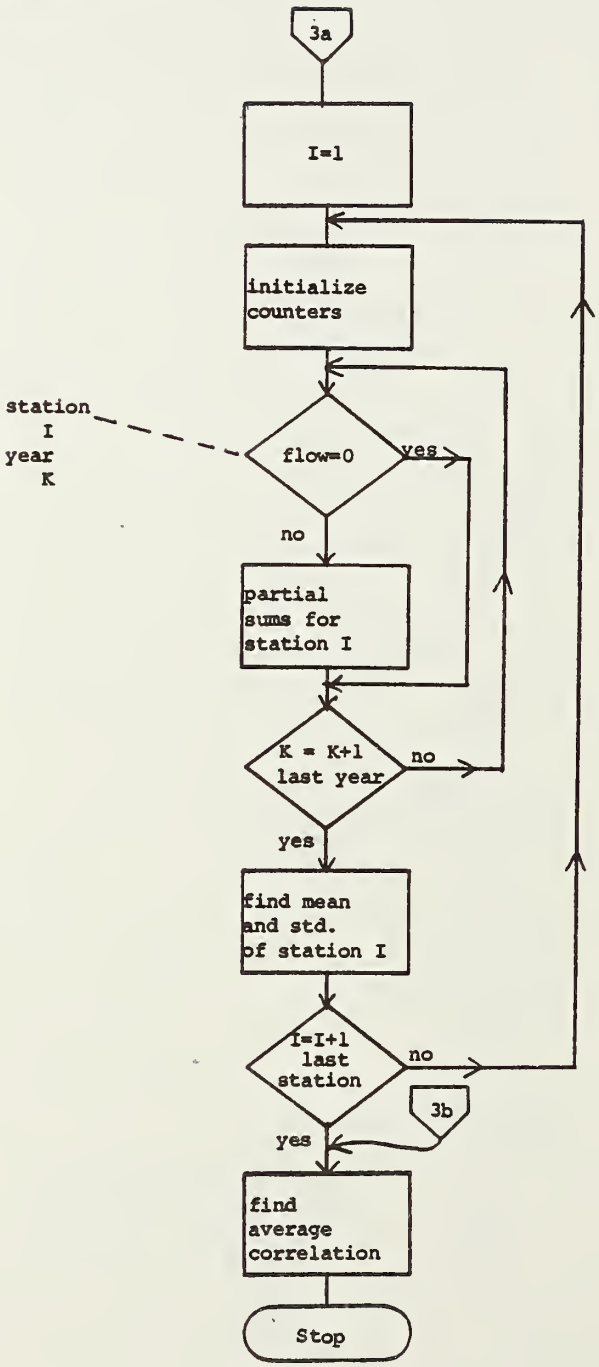
14.3 Subroutine Vcor (Q, NS, NY, SUM, L, XB, ST, R, N1)



14.3 Subroutine Vcor



14.3 Subroutine Vcor



```
0001            SUBROUTINE VCOR(Q,NS,NY,SUM,L,XB,ST,R,N1)
0002            DIMENSION Q(70,25),XB(25,25),ST(25,25),R(25,25),N1(25)
0003            IEND=25
0004            DO 10 I=1,IEND
0005            N1(I)=0
0006            DO 10 J=1,IEND
0007            XB(I,J)=0.0
0008            ST(I,J)=0.0
0009            R(I,J)=0.0
0010         10 CONTINUE
0011            SUM=0.0
0012            L=NS*(NS-1)/2
0013            NS1=NS-1
0014            DO 20 I=1,NS1
0015            II1=I+1
0016            DO 20 J=II1,NS
0017            Z=0.0
0018            DO 30 K=1,NY
0019            X1=Q(K,I)
0020            IF(X1 .EQ. 0.0)GO TO 30
0021            X2=Q(K,J)
0022            IF(X2 .EQ. 0.0)GO TO 30
0023            Z=Z+1.0
0024            XB(I,J)=XB(I,J)+X1
0025            XB(J,I)=XB(J,I)+X2
0026            ST(I,J)=ST(I,J)+X1*X1
0027            ST(J,I)=ST(J,I)+X2*X2
0028            R(I,J)=R(I,J)+X1*X2
0029         30 CONTINUE
0030            IF(Z .LE. 2.0)GO TO 99
0031            XB(I,J)=XB(I,J)/Z
0032            XB(J,I)=XB(J,I)/Z
0033            Z1=Z-1.0
0034            X1=XB(I,J)
0035            X2=XB(J,I)
0036            ST(I,J)= SQRT((ST(I,J)-Z*X1*X1)/Z1)
0037            ST(J,I)= SQRT((ST(J,I)-Z*X2*X2)/Z1)
0038            R(I,J)=(R(I,J)-Z*X1*X2)/(Z1*ST(I,J)*ST(J,I))
0039            R(J,I)=Z
0040            SUM=SUM+R(I,J)
0041         20 CONTINUE
0042            DO 40 I=1,NS
0043            Z=0.0
0044            DO 50 K=1,NY
0045            X1=Q(K,I)
0046            IF(X1 .EQ. 0.0)GO TO 50
0047            Z=Z+1.0
0048            XB(I,I)=XB(I,I)+X1
```

```
0049                ST(I,I)=ST(I,I)+X1*X1
0050              50 CONTINUE
0051                XB(I,I)=XB(I,I)/Z
0052                X1=XB(I,I)
0053                Z1=Z-1.0
0054                ST(I,I)=SQRT((ST(I,I)-Z*X1*X1)/Z1)
0055                R(I,I)=1.0
0056                N1(I)=Z
0057              40 CONTINUE
0058              99 CONTINUE
0059                SUM=SUM/L
0060                RETURN
0061                END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
SQRT	D4								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IEND	E4	I	E8	J	EC	SUM	F0	L	F4
NS	F8	NS1	FC	III	100	Z	104	K	108
NY	10C	X1	110	X2	114	Z1	118		

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
Q	11C	XB	120	ST	124	R	128	N1	12C

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	29A	3	29A	4	2A2	5	2D6	6	2E2
7	2F4	8	2FC	9	304	10	30C	11	363
12	370	13	38C	14	398	15	3FC	16	408
17	462	18	46A	19	476	20	47E	21	48C
22	498	23	4A6	24	4B2	25	4BE	26	4CA
27	4DA	28	4F2	29	50A	30	522	31	530
32	53C	33	548	34	554	35	55C	36	564
37	590	38	5C4	39	5F4	40	600	41	610
42	6D4	43	70C	44	714	45	71E	46	726
47	734	48	740	49	74C	50	75C	51	774
52	780	53	788	54	794	55	7C0	56	7CC
57	7F0	58	820	59	828	60	84E		

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = VCOR , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 61,PROGRAM SIZE = 2134
STATISTICS NO DIAGNOSTICS GENERATED

15 SUBROUTINE OUTP

15.1

1 This subroutine prints a title and then a matrix (up to 18 columns at a time, the columns must be printed seven characters wide). The title, and the format for the columns are passed as input arguments to "Outp".

2 Called by:

R50

Calls:

None

3 The format passed to the subroutine must specify six print positions for the row label and seven for each entry in the matrix. IW must be > 1 and $\leq$ 18.

4 A number IW specifying the number of columns per page is passed to the subroutine. The matrix is divided into sets of IW columns (the last set may have less than IW columns) and each set is output on a separate page with all rows printed for each set of columns.

5a Find out how many complete sets of IW columns there are.

b Print the complete sets (if no complete set, i.e., matrix, has less than IW columns, go directly to 5c).

c Print the final partial set (if the no. of columns/ IW is an integer, there will be no "partial set").

6

7 2/10/76 Raiffa

8

15.2

0 Arguments:

X	= real	array	holds matrix to be printed
IA	= integer		i dimension of X
JA	= integer		j dimension of X
IN	= integer		no. of rows of X actually used
JN	= integer		no. of columns of X actually used
FMT	= real	array	format for printing matrix
IBCD	= integer	array	title for matrix
IW	= integer		no. of columns to print at a time

1

2 Do loops:

Do 10 J1 = starting column of each set

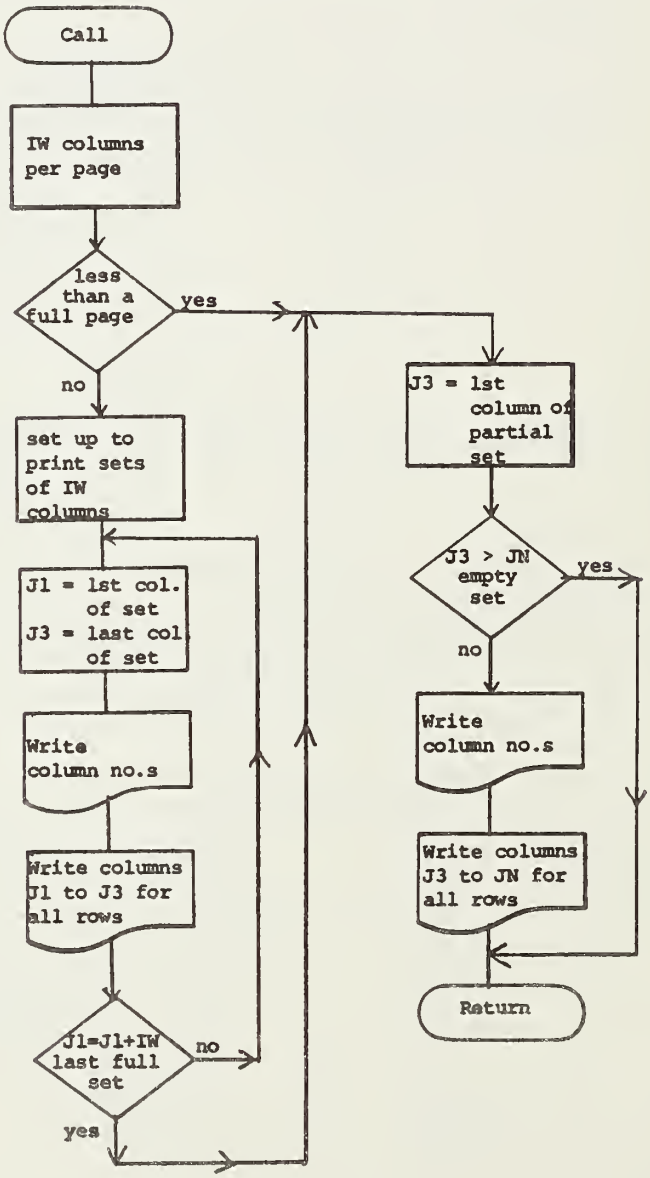
Do 10 I = indexes through rows from each complete set

Do 15 I = indexes through rows for last "partial set"

3

IW1	= integer		IW-1 used for finding last column to be printed in each set
I1	= integer		no. of complete sets, i.e., int (no. of columns/IW)
J2	= integer		total no. of columns included in complete sets
J3	= integer		last column of set
J	= integer		column number

15.3 Subroutine Outp (X, IA, JA, IN, JN, FMT, IBCD, IW)



```
FORTRAN IV G LEVEL 21          OUTP          DATE = 76051      15/19/55          PAGE 0001

0001                SUBROUTINE OUTP(X,IA,JA,IN,JN,FMT,IBCD,IW)
0002                DIMENSION X(IA,JA),IBCD(20)
0003                DIMENSION FMT(20)
0004                IW1=IW-1
0005                I1=JN/IW
0006                IF(JN .LT. IW)GO TO 98
0007                J2=I1*IW-IW1
0008                DO 10 J1=1,J2,IW
0009                J3=J1+IW1
0010                WRITE(6,100)IBCD,(J,J=J1,J3)
0011           100  FORMAT('1',20A4,/' VAR#  ',18I7,/)
0012                DO 10 I=1,IN
0013            10  WRITE(6,FMT)I,(X(I,J),J=J1,J3)
0014            98  CONTINUE
0015                J3=I1*IW+1
0016                IF(J3 .GT. JN)GO TO 99
0017                WRITE(6,100)IBCD,(J,J=J3,JN)
0018                DO 15 I=1,IN
0019            15  WRITE(6,FMT)I,(X(I,J),J=J3,JN)
0020            99  CONTINUE
0021                RETURN
0022                END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IBCOM#	C4								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IA	C8	JA	CC	IW1	D0	IW	D4	I1	D8
JN	DC	J2	E0	J1	E4	J3	E8	J	EC
I	F0	IN	F4						

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
X	F8	IBCD	FC	FMT	100				

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
100	104								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	238	4	238	5	244	6	254	7	262
8	272	9	27A	10	286	12	2D8	13	2E0
14	374	15	374	16	384	17	392	18	3E4
19	3EC	20	46C	21	46C				

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = OUTP , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 22,PROGRAM SIZE = 1140
STATISTICS NO DIAGNOSTICS GENERATED

16 SUBROUTINE TRANS

16.1

1 "Trans" inputs the matrices of means, stds, and correlations in raw space, and, for each pair of stations (i, j) i = 1, no. of stations
j = 1, no. of stations,
"Trans" passes means, stds, and correlations of stations i and j to "Tr". "Tr" converts these values to log space and passes the log values back to "Trans", which stores them in new matrices.

2 Called by:

R50

Calls:

Tr

3 NS $\leq$ 25 (no. stations)

4

5

6 See "Tr"

7 2/13/76 Raiffa

8

16.2

0 Arguments:

XB	=	real	array	means in raw space
ST	=	real	array	std's in raw space
R	=	real	array	correlations in raw space
COV	=	real	array	returns log space covariances

	XBL	=	real array	returns log space means
	ANS	=	real array	returns log space variances

For storage mode of XB, ST, R, COV, XBL, ANS see "R50".

	NS	=	integer	no. of stations

1

2 Do loops:

Do 10 I = pair (i,j), I = 1, no. of stations

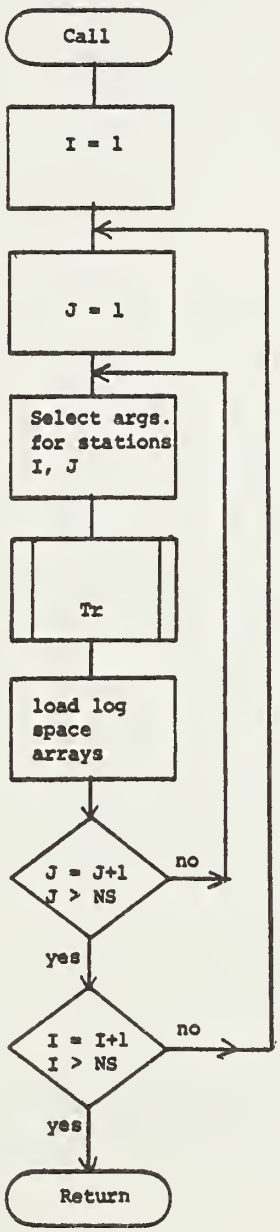
Do 10 J = pair (i,j), J = I, no. of stations

3	X1	=	real	raw space mean of i for pair (i,j)
	X2	=	real	raw space mean of j for pair (i,j)
	S1	=	real	raw space std of i for pair (i,j)
	S2	=	real	raw space std of j for pair (i,j)
	R1	=	real	raw space correlation of i and j
	CO	=	real	log space covariance of i and j
	XL1	=	real	log space mean of i for pair (i,j)
	XL2	=	real	log space mean of j for pair (i,j)

*On return from "Tr" S1 and S2 have been altered:

	S1	=	real	log space variance of i for pair (i,j)
	S2	=	real	log space variance of j for pair (i,j)

16.3 Subroutine Trans (XB, ST, R, COV, XBL, ANS, NS)



```
FORTRAN IV G LEVEL 21          TRANS          DATE = 76051      15/19/55          PAGE 0001

0001                SUBROUTINE TRANS(XB,ST,R,COV,XBL,ANS,NS)
0002                DIMENSION ANS(25,25)
0003                DIMENSION XB(25,25),ST(25,25),R(25,25),COV(25,25),XBL(25,25)
0004                DO 10 I=1,NS
0005                DO 10 J=I,NS
0006                X1=XB(I,J)
0007                X2=XB(J,I)
0008                S1=ST(I,J)
0009                S2=ST(J,I)
0010                R1=R(I,J)
0011                CALL TR(X1,X2,S1,S2,R1,CO,XL1,XL2)
0012                COV(I,J)=CO
0013                COV(J,I)=CO
0014                XBL(I,J)=XL1
0015                XBL(J,I)=XL2
0016                ANS(I,J)=S1
0017                ANS(J,I)=S2
0018             10 CONTINUE
0019                RETURN
0020                END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
TR	98								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
I	BC	NS	C0	J	C4	X1	C8	X2	CC
S1	D0	S2	D4	R1	D8	C0	DC	XL1	E0
XL2	E4								

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
ANS	E8	XB	EC	ST	F0	R	F4	COV	F8
XBL	FC								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	218	4	218	5	2A4	6	31A	7	322
8	32A	9	336	10	342	11	34E	12	35C
13	368	14	374	15	380	16	38C	17	394
18	39C	19	4AC						

```
*OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
*OPTIONS IN EFFECT*  NAME = TRANS    , LINECNT =      50
*STATISTICS*     SOURCE STATEMENTS =      20,PROGRAM SIZE =     1204
*STATISTICS*  NO DIAGNOSTICS GENERATED
```

17 Subroutine TR

17.1

1 Given the means, stds, and correlation of two variables, TR transforms to log space and returns the log transform means, variances, and covariance.

2 Called by:

Trans

Calls:

None

3 V1 (raw space correlation) ≤ 1.0

4 See model

5

6 We have two sets of samples:

$x_1 \cdots x_n$, $y_1 \cdots y_n$

Let μ_x = mean x

μ_y = mean y

δ_x = std x

δ_y = std y

p_{xy} = correlation of x and y

We find the log space means and variances by using the following equations:

(a_x = log std x, a_y = log std y, b_x = log mean x, b_y = log mean y, c = log space correlation)

1a $$\exp\left[b_x + \frac{a_x^2}{2}\right] = \mu_x$$

1b $$\exp\left[b_y + \frac{a_y^2}{2}\right] = \mu_y$$

2a $\exp\left[2b_x + 2a_x^2\right] - \exp\left[2b_x + a_x^2\right] = \delta_x^2$

2b $\exp\left[2b_y + 2a_y^2\right] - \exp\left[2b_y + a_y^2\right] = \delta_y^2$

From 1a and 2a we find:

3 $\exp\left[a_x^2\right] = \frac{\delta_x^2}{\mu_x^2} + 1 \rightarrow a_x^2 = \ln\left[\frac{\delta_x^2}{\mu_y^2} + 1\right]$

4 $b_x = \ln(\mu_x) + \frac{a_x^2}{2}$

and the corresponding equations for y.

Finally we have the equation for the correlation in log space

5 $$p_{xy} = \frac{\exp\left[a_x a_y c\right] - 1}{\left\{\exp\left[a_x^2\right] - 1\right\}^{\frac{1}{2}} \left\{\exp\left[a_y^2\right] - 1\right\}^{\frac{1}{2}}}$$

so the log space covariance is

6 $cov = ca_x a_y =$

$$\text{Ln}\left(p_{xy}\left\{\exp\left[a_x^2\right] - 1\right\}^{\frac{1}{2}}\left\{\exp\left[a_y^2\right] - 1\right\}^{\frac{1}{2}} + 1\right)$$

7 2/13/76 Raiffa

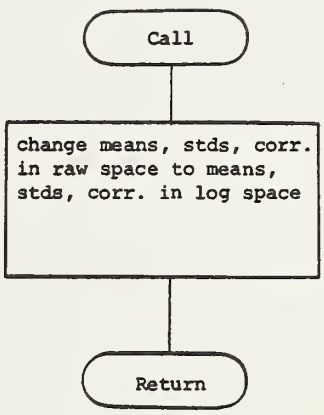
8

17.2

0 Arguments:

XL	=	real	mean X
X2	=	real	mean Y
S1	=	real	std X; on return log variance of X
S2	=	real	std Y; on return log variance of Y
R1	=	real	correlation of X and Y
CO	=	real	on return holds log covariance
XL1	=	real	on return holds log mean of X
XL2	=	real	on return holds log mean of Y

17.3 Subroutine Tr (X1, X2, S1, S2, R1, CO, XL1, XL2)



```
FORTRAN IV G LEVEL 21          TR          DATE = 76051      15/19/55          PAGE 0001

0001          SUBROUTINE TR(X1,X2,S1,S2,R1,CO,XL1,XL2)
0002          SY1=      (ALOG((S1*S1)/(X1*X1)+1.0))
0003          SY2=      (ALOG((S2*S2)/(X2*X2)+1.0))
0004          XL1=ALOG(X1)-SY1/2.0
0005          XL2=ALOG(X2)-SY2/2.0
0006          CO=1.0+R1* SQRT( EXP(SY1)-1.0)* SQRT( EXP(SY2)-1.0)
0007          CO=ALOG(CO)
0008          S1=SY1
0009          S2=SY2
0010          RETURN
0011          END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
ALOG	90	SQRT	94	EXP	98				

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
SY1	C0	S1	C4	X1	C8	SY2	CC	S2	D0
X2	D4	XL1	D8	XL2	DC	CO	E0	R1	E4

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	1FA	2	1FA	3	226	4	252	5	270
6	28E	7	2EA	8	2FC	9	304	10	30C

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = TR , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 11,PROGRAM SIZE = 788
STATISTICS NO DIAGNOSTICS GENERATED

18 SUBROUTINE ROWQ50

18.1

1 This subroutine calculates the correlation of Q50's for up to 25 stations. For each pair of stations (for n stations n(n-1)/2 pairs) two correlations are calculated. Each correlation is based on M pairs of Q50's. For the first correlation, each Q50 is based on a set of L1 flows. For the second correlation each Q50 is based on a set of L2 flows. For each pair the subroutine prints the statistics of the Q50's as well as their correlation.

In addition, the subroutine finds the average correlation of the pairs and returns a matrix containing all of the correlations.

2 Called by:

R50

Calls:

Gen

3 $M \leq 100$, L1 and L2 ≤ 30, $NS \leq 25$

4 The statistics needed for the simulation are passed to "RowQ50" in matrices. For each pair, the relevant statistics are retrieved and passed to "Gen" which does the actual simulation. "Gen" is called twice for each pair, once to do the sets of L1 and once to do the sets of length L2. "Gen" returns relevant statistics which are printed by "RowQ50."

5

6 For the discussion of what statistics are input to "RowQ50", see the models in "R50", "Tr", and "Gen".

7 2/16/76 Raiffa

8

18.2

0 Arguments:

JSE	=	integer		seed for random number generator
NS	=	integer		no. of stations
L1	=	integer		no. of flows in a set (one set per Q50)
L2	=	integer		used like L1 but different number
M	=	integer		no. of sets of Q50's generated for each pair of stations
XBL	=	real	array	log transform means of flows (see "R50" for storage model)
ANS	=	real	array	log transform variances of flows (see "R50" for storage model)
COV	=	real	array	log transform covariances for stations i and j
XT	=	real	array	true expected value table (WW1)
XL	=	real	array	log normal expected value table
SM	=	real	array	skew category values
YM	=	real	array	no. of observations category values
TM	=	real	array	return interval category values

B = real array on return will hold correlations of Q50, B(i,j) = correlation based on sets of L1 if i<j, correlations based on sets of L2 if j<i.

1

2 Do loops:

Do 60 I = are going to do pairs
(1,2) ... (1,n) n = no. of stations
(2,3) ... (2,n)
:
(n-1),n)

Do 60 J = I+1 to number of stations

S10 = real total correlations based on sets of L1 (used in finding average correlations)

S25 = real same as S10 but for L2

Q1B = real*8 mean of Q50's based on L1 flows per set, for station i of (i,j) pair

Q2B = real*8 like Q1B but for station j

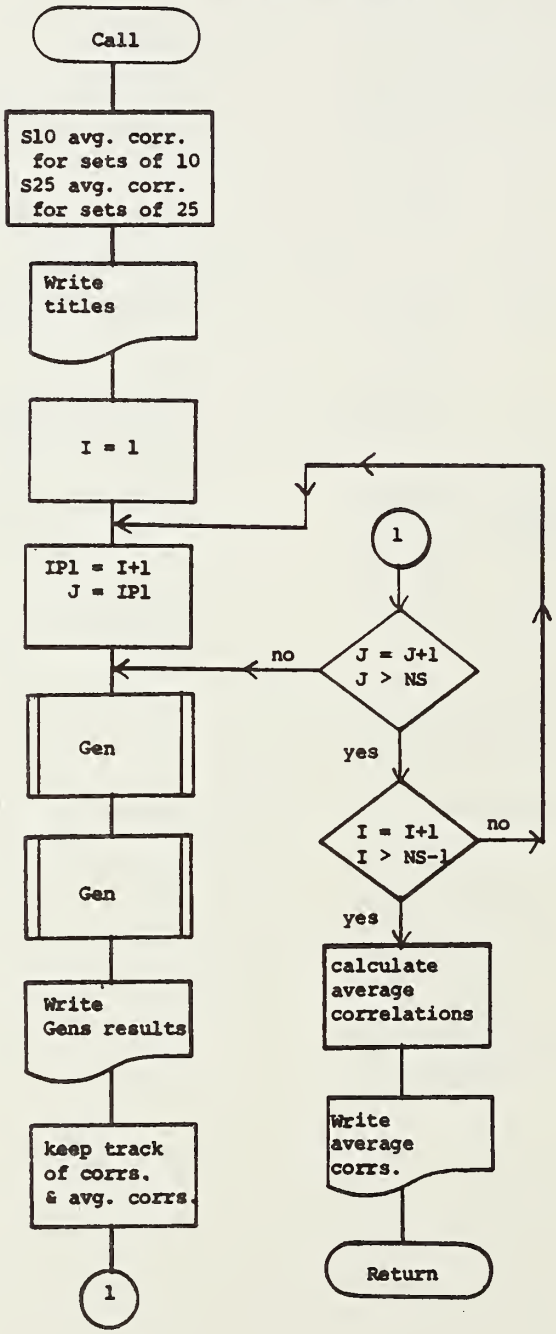
Q3B = real*8 like Q1B but for sets of L2

Q4B = real*8 like Q2B but for sets of L2

S1 = real*8 std of Q50's based on L1 flows per set for station i of pair (i,j)

S2	=	real*8	like S1 but for station j
S3	=	real*8	like S1 but for sets of L2
S4	=	real*8	like S2 but for sets of L2
RQ1	=	real*8	correlation of Q50's based on sets of length L2
RQ2	=	real*8	correlations based on sets of length L2
NSL	=	integer	no. of stations -1, upper bound of outer do loop
IPL	=	integer	index of outer loop +1, lower bound of inner loop
Z	=	real	no. of stations, no. of pairs

18.3 Subroutine Rowq50 (JSE, NS, L1, L2, M, XBL, ANS, COV, XT, XL, SL, SM, YM, TM, B)



```
FORTRAN IV G LEVEL 21          ROWQ50          DATE = 76051          15/19/55          PAGE 0001

0001            SUBROUTINE ROWQ50(JSE,NS,L1,L2,M,XBL,ANS,COV,XT,XL,SM,YM,TM,B)
0002            REAL*8 Q1B,Q2B,Q3B,Q4B,S1,S2,S3,S4,RQ1,RQ2
0003            DIMENSION XBL(25,25),ANS(25,25),COV(25,25),B(25,25)
0004            DIMENSION XT(13,9),XL(13,6,9),SM(13),YM(6),TM(9)
0005            S10=0.0
0006            S25=0.0
0007            NS1=NS-1
0008            WRITE(6,100)
0009        100 FORMAT('1 I   J   R10    R25     MEAN I10     MEAN J10     STD I10  ',
                X'   STD J10     MEAN I25     MEAN J25      STD I25      STD J25'/)
0010            DO 60 I=1,NS1
0011            IP1=I+1
0012            DO 60 J=IP1,NS
0013            CALL GEN(XBL(I,J),XBL(J,1),ANS(1,J),ANS(J,1),COV(I,J),
               XQ1B,Q2B,S1,S2,RQ1,L1,M,XT,XL,SM,YM,TM,JSE)
0014            CALL GEN(XBL(I,J),XBL(J,I),ANS(1,J),ANS(J,I),COV(I,J),
               XQ3B,Q4B,S3,S4,RQ2,L2,M,XT,XL,SM,YM,TM,JSE)
0015            WRITE(6,101)I,J,RQ1,RQ2,Q1B,Q2B,S1,S2,Q3B,Q4B,S3,S4
0016        101 FORMAT(2I3,2F7.3,8F12.1)
0017            B(I,J)=RQ1
0018            B(J,I)=RQ2
0019            S10=S10+RQ1
0020            S25=S25+RQ2
0021         60 CONTINUE
0022            Z=NS
0023            Z=Z*(Z-1.0)/2.0
0024            S10=S10/Z
0025            S25=S25/Z
0026            WRITE(6,102)Z,S10,S25
0027        102 FORMAT(//F5.0,'  COR,  AV10=',F14.4,'  AV25=',F14.4)
0028            RETURN
0029            END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IBCOM#	98	GEN	9C						

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
Q1B	130	Q2B	138	S1	140	S2	148	RQ1	150
Q3B	158	Q4B	160	S3	168	S4	170	RQ2	178
S10	180	S25	184	NS1	188	NS	18C	1	190
IP1	194	J	198	L1	19C	M	1A0	JSE	1A4
L2	1A8	Z	1AC						

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
XBL	1B0	ANS	1B4	COV	1B8	B	1BC	XT	1C0
XL	1C4	SM	1C8	YM	1CC	TM	1D0		

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
100	1D4	101	24C	102	25C				

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	3FC	5	3FC	6	404	7	40C	8	418
10	42C	11	488	12	494	13	4E2	14	544
15	5A6	17	61C	18	628	19	634	20	642
21	650	22	700	23	720	24	734	25	740
26	74C	28	778						

```
*OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
*OPTIONS IN EFFECT*  NAME = ROWQ50  , LINECNT =    50
*STATISTICS*    SOURCE STATEMENTS =       29,PROGRAM SIZE =     1920
*STATISTICS*  NO DIAGNOSTICS GENERATED
```

19 SUBROUTINE GEN I

19.1

1 Finds the correlation of Q50's for two stations given their means, stds, and correlation of annual flows in log space.

2 Called by:

Rowq50

Calls:

Gauss
Statl
Interp
Stat2

3 Assume $\frac{cov}{\sqrt{V1*V2}} \leq 1.0$ (this is the log space correlation)

If this is not true, you will try to take the square root of a negative number when calculating B3.

4

5 A set of L flows is generated for each station (see model), and the Q50's of these two sets are calculated; call these $Q50_1^{(1)}$ and $Q50_1^{(2)}$. This is done M times resulting in $Q50_i^{(1)}$ $i = 1,M$ and $Q50_j^{(2)}$ $j = 1,M$. Then, the means, stds, and correlation of $Q50^{(1)}$, $Q50^{(2)}$ are calculated.

6 We have two stations with n overlapping years of flow data.

$x_1 \cdots x_n$, $y_1 \cdots y_n$

Using techniques described in "Tr" we find the log space means, variances and covariance of these two sets of flows.

μ_1 = log transform mean of the x's

μ_2 = log transform mean of the y's

δ_1^2 = log transform variance of the x's

δ_2^2 = log transform variance of the y's

cov = log transform covariance of x & y

Let M = variance covariance matrix

$$= \begin{bmatrix} \delta_1^2 & \text{cov} \\ \text{cov} & \delta_2^2 \end{bmatrix}$$

Then if

$$B = \begin{bmatrix} \delta_1 & 0 \\ \frac{\text{cov}}{\delta_1} & \sqrt{\delta_2^2 - \frac{\text{cov}}{\delta_1^2}} \end{bmatrix}$$

B has the property that $BB^T = M$.

Now let $XB = \begin{bmatrix} \mu_1 \\ \mu_2 \end{bmatrix}$ the vector of means,

and let $E = \begin{bmatrix} e^{(1)} \\ e^{(2)} \end{bmatrix}$ where $e^{(1)}$ and $e^{(2)}$ are normal $\left[0,1\right]$ variables. Then, for i = 1,L let

$$S_i = BE_i + XB = \begin{bmatrix} B(1,1)e_i^{(1)} + \mu_1 \\ B(2,1)e_i^{(1)} + B(2,2)e_i^{(2)} + \mu_2 \end{bmatrix}$$

and let $\hat{x}_i = \exp(S_i\{1\})$, $\hat{y}_i = \exp(S_i\{2\})$.

Then, $\hat{x}$ and $\hat{y}$ should have (expectation) the same means, std's, correlation as the original x and y.

7 2/15/76 Raiffa

8

19.2

0 Arguments:

X1	=	real	log transform mean of station 1
X2	=	real	log transform mean of station 2

V1	=	real		log transform variance of station 1
V2	=	real		log transform variance of station 2
COV	=	real		log transform covariance of stations 1 and 2
Q1B	=	real*8		returns mean of Q50's generated for station 1
Q2B	=	real*8		returns mean for Q50's generated for station 2
S1	=	real*8		std of Q50 for station 1
S2	=	real*8		std of Q50 for station 2
RQ	=	real*8		correlation of Q50's for stations 1 and 2
L	=	integer		no. of synthetic flows in each set (one Q50 for each set)
M	=	integer		no. of sets (no. of Q50's for each station)
XT	=	real	array	holds true expected value table (WW1)
XL	=	real	array	holds log normal expected value table
SM	=	real	array	holds skew category values
YM	=	real	array	holds no. of observations category values
TM	=	real	array	holds return interval category values

JSE	=	integer		seed for random numbers

1

2 Do loops:

Do 10 I = M sets of L flow

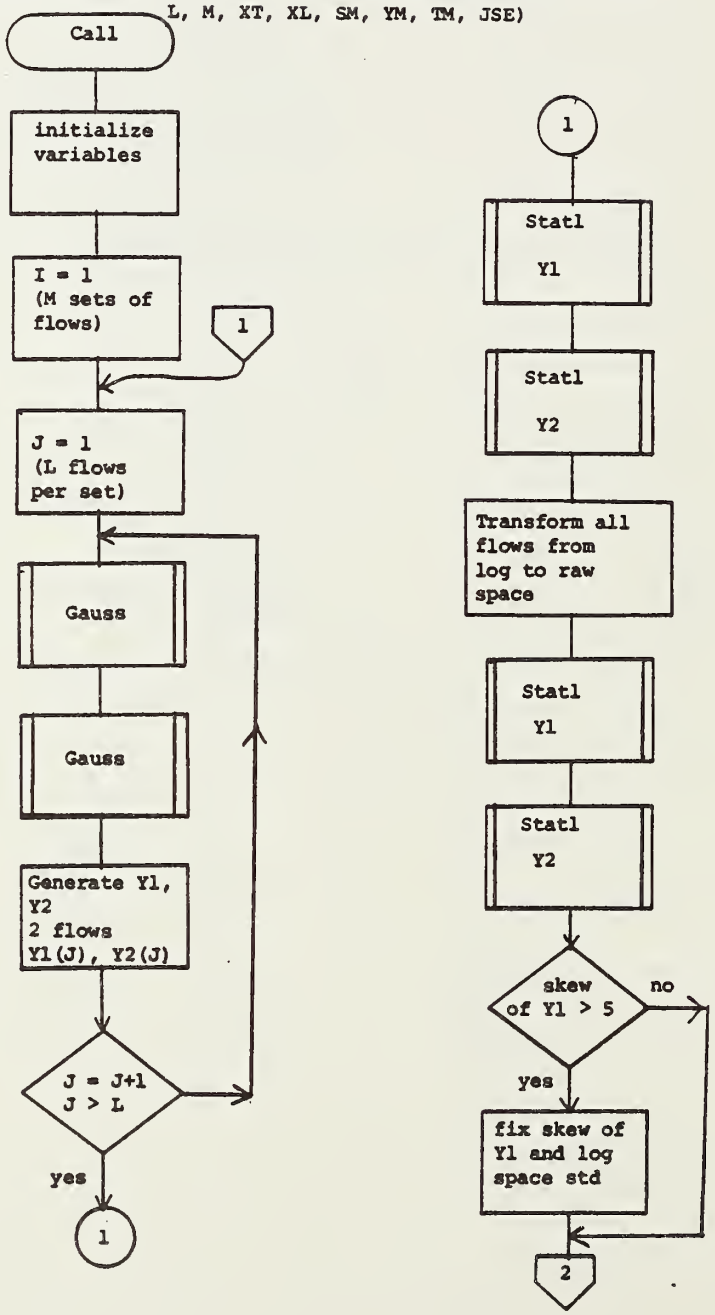
Do 20 J = L flows to a set

Do 30 J = transform flows to raw space so that the skew can be calculated for use with WW1 tables

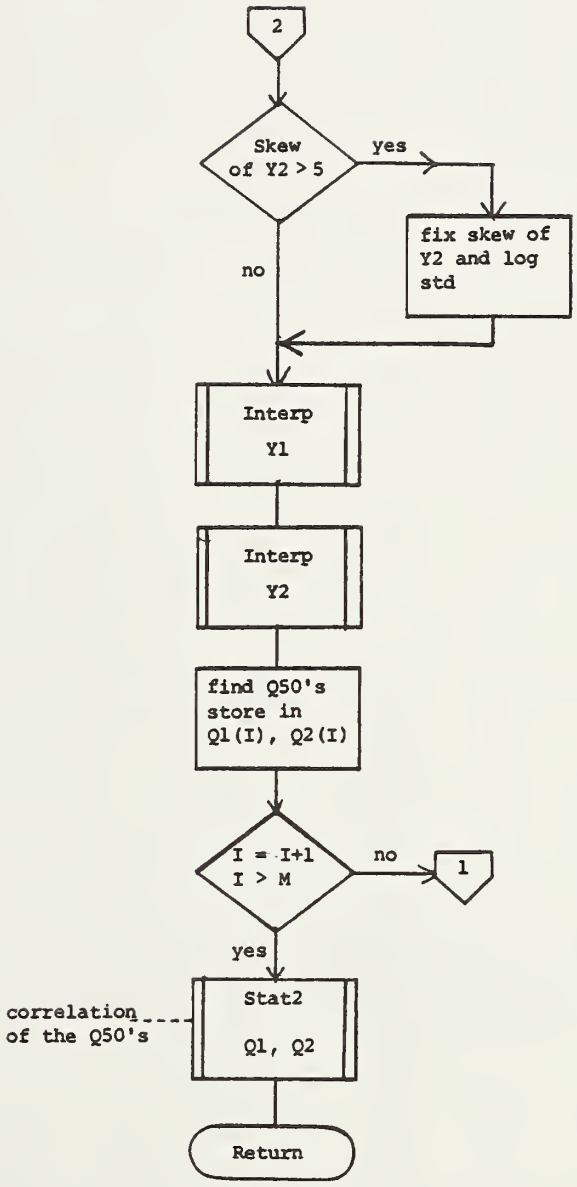
Q1	=	real*8	array	Q50's for station 1
Q2	=	real*8	array	Q50's for station 2
Y1	=	real	array	synthetic flows (1 set) for station 1
Y2	=	real	array	set of flows for station 2
Z	=	real		no. of flows per set
Z1	=	real		desired return interval
B1	=	real		B(1,1) see "model"
B2	=	real		B(2,1) see "model"
B3	=	real		B(2,2) see "model"
E1	=	real		Normal (0,1) no.
E2	=	real		Normal (0,1) no.
YB1	=	real		log mean of a set for station 1
YB2	=	real		log mean of a set for station 2
YS1	=	real		log std of a set for station 1

YS2	=	real	log std of a set for station 2
RQ1	=	real	log skew of a set for station 1
RQ2	=	real	log skew of a set for station 2
XB1	=	real	raw mean of a set for station 1
XB2	=	real	raw mean of a set for station 2
XS1	=	real	raw std of a set for station 1
XS2	=	real	raw std of a set for station 2
XQ1	=	real	raw skew of a set for station 1
XQ2	=	real	raw skew of a set for station 2
TNEW	=	real	unbiased return interval
CO	=	real	coefficient from WW1

19.3 Subroutine Gen I (X1, X2, U1, U2, COV, Q1B, Q2B, S1, S2, RQ, L, M, XT, XL, SM, YM, TM, JSE)



19.3 Subroutine Gen I



```
FORTRAN IV G LEVEL 21          GEN          DATE = 76051    15/19/55          PAGE 0001

0001            SUBROUTINE GEN(X1,X2,V1,V2,COV,Q1B,Q2B,S1,S2,RQ,L,M,XT,XL,SM,YM,
               XTM,JSE)
0002            REAL*8 Q1,Q2,Q1B,Q2B,S1,S2,RQ
0003            DIMENSION Q1(100),Q2(100),Y1(30),Y2(30)
0004            DIMENSION XT(13,9),XL(13,6,9),SM(13),YM(6),TM(9)
0005            Z=L
0006            Z1=50.0
0007            B1=SQRT(V1)
0008            B2=COV/B1
0009            B3=SQRT(V2-B2*B2)
0010            WRITE(6,100)B1,B2,B3
0011        100 FORMAT(10F13.4)
0012            DO 10 I=1,M
0013            DO 20 J=1,L
0014            CALL GAUSS(JSE,1.0,0.0,E1)
0015            CALL GAUSS(JSE,1.0,0.0,E2)
0016            Y1(J)=B1*E1+X1
0017            Y2(J)=B2*E1+B3*E2+X2
0018         20 CONTINUE
0019            CALL STAT1(Y1,L,YB1,YS1,RQ1)
0020            CALL STAT1(Y2,L,YB2,YS2,RQ2)
0021            DO 30 J=1,L
0022            Y1(J)=EXP(Y1(J))
0023            Y2(J)=EXP(Y2(J))
0024         30 CONTINUE
0025            CALL STAT1(Y1,L,XB1,XS1,XQ1)
0026            CALL STAT1(Y2,L,XB2,XS2,XQ2)
0027            IF(XQ1 .LE. 5.0)GO TO 1
0028            XQ1=5.0
0029            YS1=.9206
0030          1 IF(XQ2 .LE. 5.0)GO TO 2
0031            XQ2=5.0
0032            YS2=.9206
0033          2 CONTINUE
0034            CALL INTERP(XQ1,Z,Z1,TNEW,CO,XT,XL,SM,YM,TM)
0035            Q1(I)=EXP(YB1+CO*YS1)
0036            CALL INTERP(XQ2,Z,Z1,TNEW,CO,XT,XL,SM,YM,TM)
0037            Q2(I)=EXP(YB2+CO*YS2)
0038         10 CONTINUE
0039            CALL STAT2(M,Q1,Q2,Q1B,Q2B,S1,S2,RQ)
0040            RETURN
0041            END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IBCOM#	B4	GAUSS	B8	STAT1	BC	INTERP	C0	STAT2	C4
SQRT	C8	EXP	CC						

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
Q1B	1C8	Q2B	1D0	S1	1D8	S2	1E0	RQ	1E8
Z	1F0	L	1F4	Z1	1F8	B1	1FC	V1	200
B2	204	COV	208	B3	20C	V2	210	I	214
M	218	J	21C	JSE	220	E1	224	E2	228
X1	22C	X2	230	YB1	234	YS1	238	RQ1	23C
YB2	240	YS2	244	RQ2	248	XB1	24C	XS1	250
XQ1	254	XB2	258	XS2	25C	XQ2	260	TNEW	264
CO	268								

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
Q1	270	Q2	590	Y1	8B0	Y2	928	XT	9A0
XL	9A4	SM	9A8	YM	9AC	TM	9B0		

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
100	984								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	B84	5	B84	6	BA4	7	BAC	8	BBE
9	BCA	10	BEE	12	C1C	13	C28	14	C34
15	C42	16	C50	17	C60	18	C7A	19	C92
20	CA0	21	CAE	22	CBA	23	CD8	24	CF6
25	D0E	26	D1C	27	D2A	28	D38	29	D40
30	D48	31	D56	32	D5E	33	D66	34	D66
35	DA0	36	DC6	37	E00	38	E26	39	E3E
40	E4C								

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = GEN , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 41,PROGRAM SIZE = 3668
STATISTICS NO DIAGNOSTICS GENERATED

20 SUBROUTINE GAUSS

20.1

1 Generates a normally distributed number with mean AM, and std S. This is really IBM fortran SSP routine "Gauss" with routine "Randu" included rather than called. This was done only to save calls and returns.

2 Called by:

Gen

Calls:

None

3 See IBM fortran SSP routines "Gauss" and Randu."

4 "Randu" was imbedded in "Gauss" to save overhead.

5 See 3

6 See 3

7 2/16/76 Raiffa

8

20.2

0 Arguments:

IX = integer	seed for "Randu", on return holds new seed
S = real	std of desired number
AM = real	mean of desired number
V = real	normal number with mean = AM, std = S

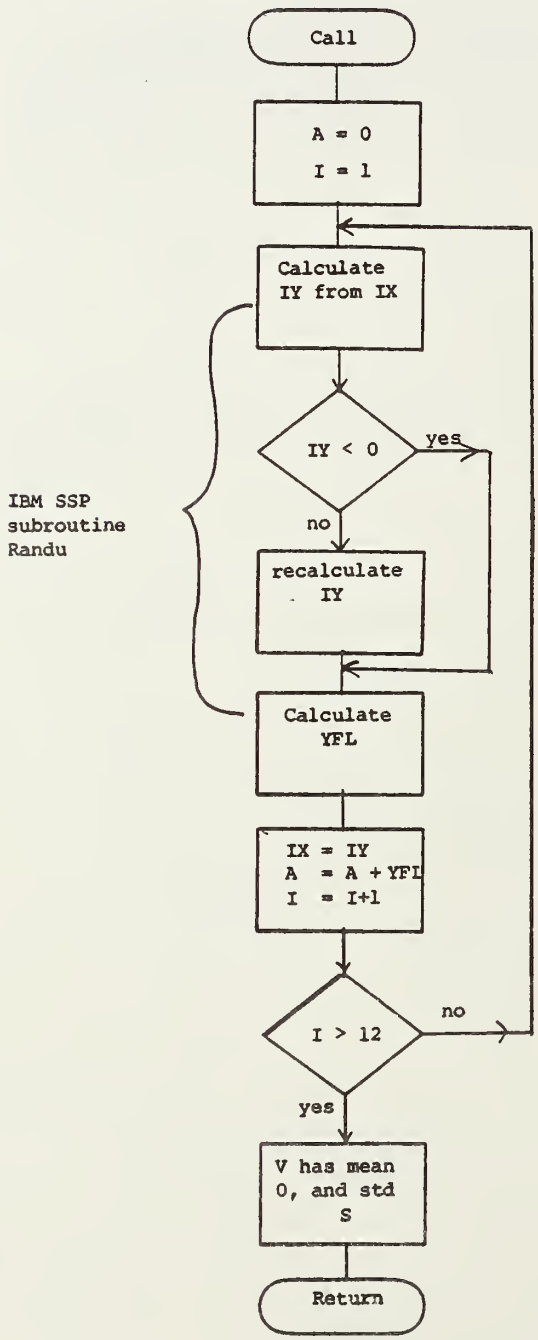
1

2 Do loops:

Do 50 I = need sum of 12
uniform [0,1] numbers

A = real	holds sum of 12 uniform numbers
IY = integer	used in generating a uniform number, will be new seed
YFL = real	uniform [0,1] number

20.3 Subroutine Gauss (IX, S, AM, V)



```
FORTRAN IV G LEVEL 21          GAUSS          DATE = 76051      15/19/55          PAGE 0001

0001                SUBROUTINE GAUSS(IX,S,AM,V)
0002                A=0.0
0003                DO 50 I=1,12
0004                IY=IX*65539
0005                IF(IY)5,6,6
0006              5 IY=IY+2147483647+1
0007              6 YFL=IY
0008                YFL=YFL*.4656613E-9
0009                IX=IY
0010             50 A=A+YFL
0011                V=(A-6.0)*S+AM
0012                RETURN
0013                END
```

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
A	A4	I	A8	IY	AC	IX	B0	YFL	B4
V	B8	S	BC	AM	C0				

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	18A	2	18A	3	192	4	19A	5	1A6
6	1B2	7	1C2	8	1E2	9	1EE	10	1F6
11	216	12	22A						

```
*OPTIONS IN EFFECT*   ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
*OPTIONS IN EFFECT*   NAME = GAUSS    , LINECNT =      50
*STATISTICS*    SOURCE STATEMENTS =      13,PROGRAM SIZE =     562
*STATISTICS*  NO DIAGNOSTICS GENERATED
```

SUBROUTINE STAT2

21

21.1

1 Finds the means, stds, correlation of two arrays in double precision.

2 called by:

Gen

calls:

None

3 $M \geq 2$; at least 2 observations

4 everything except indexes is in double precision

5

6 $$\text{mean} = \sum_{i=1}^{N} x_i \frac{}{N}, \quad \text{std} = \text{sqrt}\left(\frac{\Sigma x_i^2 - N\ \text{mean}^2}{N-1}\right)$$

$$\text{correlation} = \frac{\sum_{i=1}^{N} x_i y_i - N(\text{mean } x)(\text{mean } y)}{(\text{std } x)(\text{std } y)(N-1)}$$

7 2/15/76 Raiffa

8

21.2

0 Arguments:

M = integer		dimension of data arrays and no. of observations
Q1 = real*8	array	data values
Q2 = real*8	array	data values
Q1BAR = real*8		on return holds mean of Q1
Q2BAR = real*8		on return holds mean of Q2
SSQ1 = real*8		on return holds std of Q1
SSQ2 = real*8		on return holds std of Q2

RQ = real*8 on return holds correlation of Q1 and Q2

1

2 Do loops:

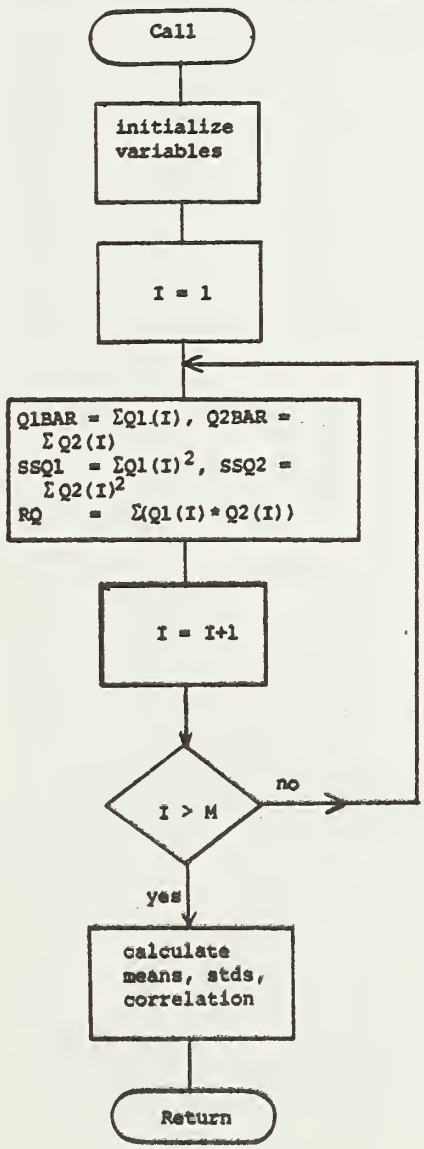
Do 10 I = steps through data

XN = real*8 no. of observations

T1 = real*8 temporary to hold one observation from Q1

T2 = real*8 temporary to hold one observation from Q2

21.3 Subroutine Stat2 (M, Q1, Q2, Q1BAR, Q2BAR, SS91, SS92, RQ)



```
FORTRAN IV G LEVEL 21          STAT2          DATE = 76051      15/19/55          PAGE 0001

0001                SUBROUTINE STAT2(M,Q1,Q2,Q1BAR,Q2BAR,SSQ1,SSQ2,RQ)
0002                IMPLICIT REAL*8 (A-H,O-Z)
0003                DIMENSION Q1(M),Q2(M)
0004                XN=M
0005                Q1BAR=0.0
0006                Q2BAR=0.0
0007                SSQ1=0.0
0008                SSQ2=0.0
0009                RQ=0.0
0010                DO 10 I=1,M
0011                T1=Q1(I)
0012                T2=Q2(I)
0013                Q1BAR=Q1BAR+T1
0014                Q2BAR=Q2BAR+T2
0015                SSQ1=SSQ1+T1*T1
0016                SSQ2=SSQ2+T2*T2
0017                RQ=RQ+T1*T2
0018             10 CONTINUE
0019                Q1BAR=Q1BAR/XN
0020                Q2BAR=Q2BAR/XN
0021               SSQ1=DSQRT((SSQ1-XN*Q1BAR*Q1BAR)/(XN-1.0))
0022               SSQ2=DSQRT((SSQ2-XN*Q2BAR*Q2BAR)/(XN-1.0))
0023                RQ=(RQ-XN*Q1BAR*Q2BAR)/(SSQ1*SSQ2*(XN-1.0))
0024                RETURN
0025                END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
DSORT	94								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
XN	A0	Q1BAR	A8	Q2BAR	B0	SSQ1	B8	SSQ2	C0
RQ	C8	T1	D0	T2	D8	M	E0	I	E4

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
Q1	E8	Q2	EC						

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	216	4	216	5	236	6	23E	7	246
8	24E	9	256	10	25E	11	266	12	27E
13	28A	14	296	15	2A2	16	2B2	17	2C2
18	2D2	19	2E6	20	2F2	21	2FE	22	330
23	362	24	38C						

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = STAT2 , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 25,PROGRAM SIZE = 916
STATISTICS NO DIAGNOSTICS GENERATED

22 SUBROUTINE STAT

22.1

1 Stat computes and returns the mean and std of a real array of length 15.

2 Called by:

Skew

Calls:

None

3

4

5 Compute Σx_i and Σx_i^2, then find the mean and std.

6 $\text{mean} = \frac{\Sigma x_i}{15}$ $\quad \text{std} = \text{sqrt}\left(\frac{\Sigma x_i - 15*\text{mean}^2}{14}\right)$

7 2/20/76 Raiffa

8

22.2

0 Arguments:

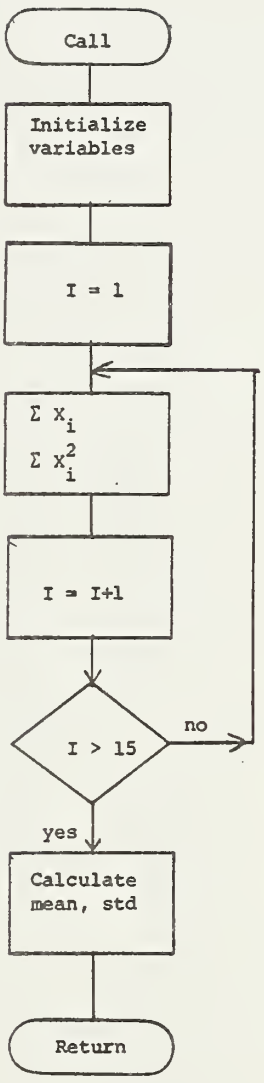
X	=	real	array	holds data values
XB	=	real	array	holds mean on return
STD	=	real	array	holds std on return

1

2 Do loops:

Do 10 I = indexes through X

22.3 Subroutine Stat (X, XB, STD)



```
FORTRAN IV G LEVEL  21                STAT                DATE = 76055        15/17/48              PAGE 0001

0001                  SUBROUTINE STAT(X,XB,STD)
0002                  DIMENSION X(15)
0003                  XB=0.0
0004                  STD=0.0
0005                  DO 10 I=1,15
0006                  XB=XB+X(I)
0007                  STD=STD+X(I)*X(I)
0008               10 CONTINUE
0009                  XB=XB/15.0
0010                  STD=SQRT((STD-15.0*XB*XB)/14.0)
0011                  RETURN
0012                  END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
SQRT	94								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
XB	9C	STD	A0	I	A4				

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
X	A8								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	156	3	156	4	15E	5	166	6	176
7	182	8	192	9	1AA	10	1B6	11	1E2

```
*OPTIONS IN EFFECT*  ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
*OPTIONS IN EFFECT*  NAME = STAT     , LINECNT =      50
*STATISTICS*    SOURCE STATEMENTS =       12,PROGRAM SIZE =      490
*STATISTICS*  NO DIAGNOSTICS GENERATED
```

23 SUBROUTINE INSTD

23.1

1 Does interpolation in the WW1 std table, and finds the coefficient corresponding to a given skew, number of observations, and return interval.

2 Called by:

Skew

Calls:

Offset

3

4 Linear interpolation in the log normal section of the WW1 table.

5 1 Categorize skew, number of observations, and return interval.

2 Find table value at low return interval.

3 Find table value at high return interval.

4 Interpolate between low and high return intervals.

6

7 2/20/76 Raiffa

8

23.2

0 Arguments:

SKEW	=	real	holds skew
YEAR	=	real	holds no. of observations
TNEW	=	real	holds desired return interval

	CO	=	real	on return will hold value from the table
	WL	=	real array	holds WW1 std table
	SM	=	real array	holds skew category values
	YM	=	real array	holds number of observations category values
	TM	=	real array	holds return interval category values

1

2

3 IS = lower category for SKEW

ISl = upper category for SKEW

Sl = SKEW is Sl of the way from the lower category to the upper category

IY = like IS but for YEAR

IYl = like ISl but for YEAR

Yl = like Sl but for YEAR

IT = like IS but for TNEW; later reset to IT+1 at which time it is like ISl

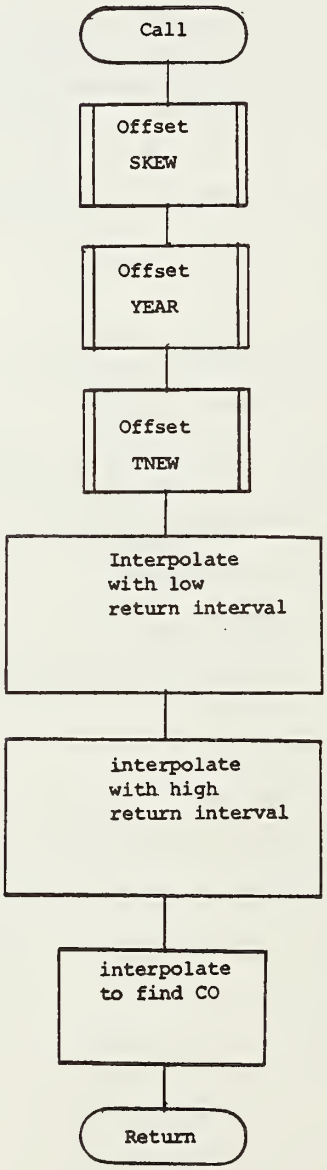
Tl = like Sl but for TNEW

B,Bl,B2 = temporaries used in interpolation

Xl = table value at low return interval

X2 = table value at high return interview

23.3 Subroutine Instd (SKEW, YEAR, TNEW, CO, WL, SM, YM, TM)



```
0001          SUBROUTINE INSTD(SKEW,YEAR,TNEW,CO,WL,SM,YM,TM)
0002          DIMENSION WL(13,6,9),SM(13),YM(6),TM(9)
0003          CALL OFFSET(SM,13,IS,S1,SKEW)
0004          CALL OFFSET(YM,6,IY,Y1,YEAR)
0005          CALL OFFSET(TM,9,IT,T1,TNEW)
0006          IS1=IS+1
0007          IY1=IY+1
0008          B= WL(IS,IY,IT)
0009          B1=B+Y1*(WL(IS,IY1,IT)-B)
0010          B=WL(IS1,1Y,IT)
0011          B2=B+Y1*(WL(IS1,IY1,IT)-B)
0012          B=B1+S1*(B2-B1)
0013          X1=B
0014          IT=IT+1
0015          B= WL(IS,1Y,IT)
0016          B1=B+YI*(WL(IS,IY1,IT)-B)
0017          B=WL(IS1,IY,1T)
0018          B2=B+YI*(WL(IS),IY1,IT)-B)
0019          B=B1+SI*(B2-B1)
0020          X2=B
0021          CO=X1+TI*(X2-X1)
0022          RETURN
0023          END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
OFFSET	90								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IS	D0	S1	D4	SKEW	D8	IY	DC	Y1	E0
YEAR	E4	IT	E8	T1	EC	TNEW	F0	IS1	F4
IY1	F8	B	FC	B1	100	B2	104	X1	108
X2	10C	C0	110						

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
WL	114	SM	118	YM	11C	TM	120		

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	21E	3	21E	4	234	5	24A	6	260
7	25C	8	278	9	2A4	10	208	11	300
12	334	13	348	14	350	15	35C	16	384
17	388	18	3E0	19	414	20	428	21	430
22	444								

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = INSTD , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 23,PROGRAM SIZE = 1100
STATISTICS NO DIAGNOSTICS GENERATED

24 SUBROUTINE CALC

24.1

1 Calc generates 100 sets of flows, finds the Q50 for each set, and the mean and std of the Q50's.

2 Called by:

Samp

Calls:

Gen

Rnd

Statl

Interp

Offset

3

4 The flows to be sampled are input. A set of N is sampled with replacement, and their Q50 is calculated.

After 100 sets, the mean and the std of the Q50's are found.

5

6

7 2/20/76 Raiffa

8

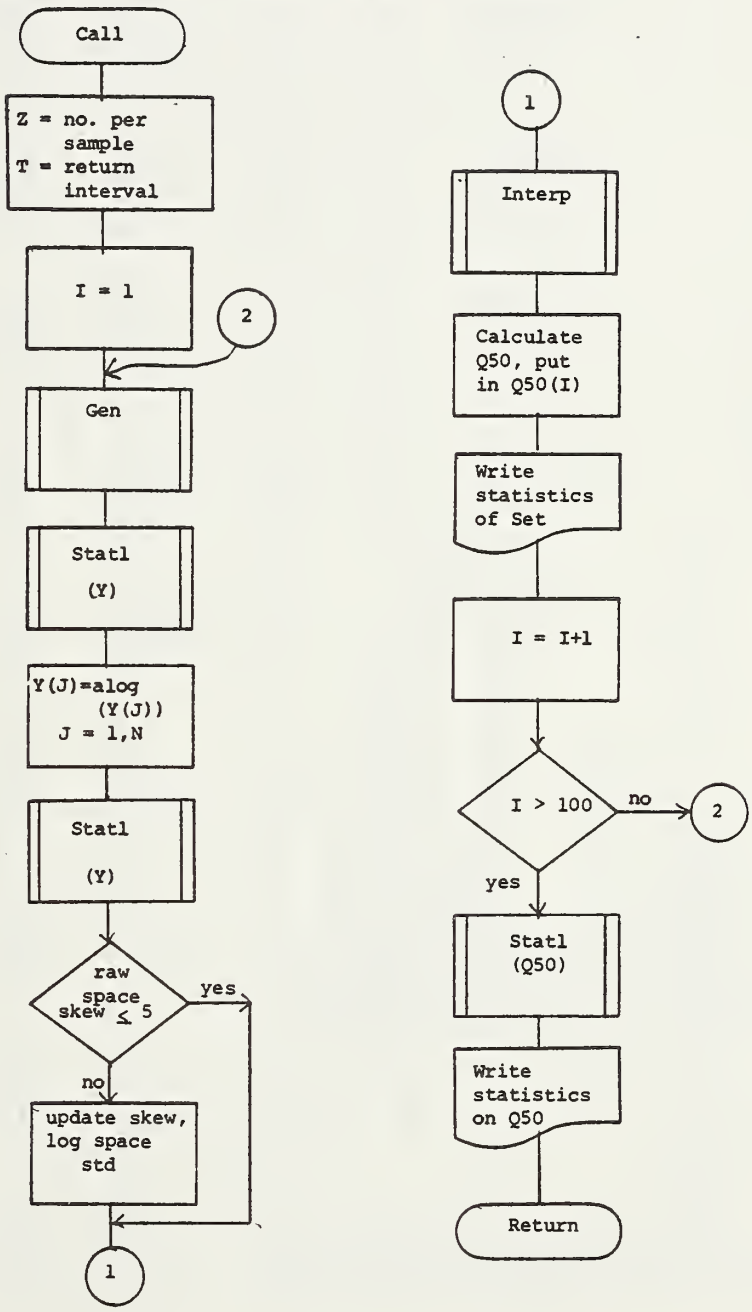
24.2

0 Arguments:

X	=	real	array	holds original flows
N	=	integer		no. of flows per set

```
            XT   =  real     array   true expected value
                                      table

            XL   =  real     array   log normal expected
                                      values

            SM   =  real     array   skew category values

            YM   =  real     array   no. of observations
                                      category values

            TM   =  real     array   return interval cate-
                                      gory values

            JSE  =  integer          seed for random no.
                                      generator

1

2   Do loops

    Do 10 I = index for 100 sets

    Do 20 J = index for N in each set

3   Z     =  real           no. in each set

    T     =  real           return interval

    Y     =  real   array   holds one set of flows

    XB    =  real           mean of a set, later of Q50's

    STD   =  real           std of a set, later of Q50's

    SKEW  =  real           skew of a set, later of Q50's

    Xl    =  real           mean of logs of a set

    SL    =  real           std of logs of a set

    SKL   =  real           skew of logs of a set

    TNEW  =  real           unbiased return interval

    CO    =  real           coefficient from WWl table

    TEMP  =  real           log of Q50

    Q50   =  real   array   holds 100 Q50's
```

24.3 Subroutine Calc (X, N, XT, XL, SM, YM, TM, JSE)



```
0001                SUBROUTINE CALC(X,N,XT,XL,SM,YM,TM,JSE)
0002                DIMENSION X(61),Q50(100),Y(25)
0003                DIMENSION XT(13,9),XL(13,6,9),          SM(13),YM(6),TM(9)
0004                Z=N
0005                T=50.0
0006                DO 10 I=1,100
0007                CALL GEN(X,Y,N,JSE)
0008                CALL STAT1(Y,N,XB,STD,SKEW)
0009                DO 20 J=1,N
0010             20 Y(J)=ALOG(Y(J))
0011                CALL STAT1(Y,N,X1,SL,SKL)
0012                IF(SKEW .LE. 5.0)GO TO 30
0013                SKEW=5.0
0014                SL=.9206
0015             30 CONTINUE
0016                CALL INTERP(SKEW,Z,T,TNEW,CO,XT,XL,SM,YM,TM)
0017                TEMP=X1+CO*SL
0018                Q50(I)=EXP(TEMP)
0019                WRITE(6,100)I,XB,STD,SKEW,X1,SL,CO,Q50(I)
0020            100 FORMAT(I5,8F14.4)
0021             10 CONTINUE
0022                CALL STAT1(Q50,100,XB,STD,SKEW)
0023                WRITE(6,101)N,XB,STD,SKEW
0024            101 FORMAT(I8,3F14.4)
0025                RETURN
0026                END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
GEN	A4	STATI	A8	INTERP	AC	IBCOM#	B0	ALOG	B4
EXP	B8								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
Z	138	N	13C	T	140	I	144	JSE	148
XB	14C	STD	150	SKEW	154	J	158	X1	15C
SL	160	SKL	164	TNEW	168	CO	16C	TEMP	170

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
X	174	Q50	178	Y	308	XT	36C	XL	370
SM	374	YM	378	TM	37C				

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
100	380	101	389						

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	482	4	482	5	4A2	6	4AA	7	4B6
8	4CC	9	4DA	10	4E6	11	51C	12	52A
13	538	14	540	15	548	16	548	17	582
18	592	19	5A4	21	5F8	22	610	23	61E
25	654								

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = CALC , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 26,PROGRAM SIZE = 1628
STATISTICS NO DIAGNOSTICS GENERATED

25 SUBROUTINE GEN2

25.1

1 Takes N samples with replacement from one array, and places the samples in a second array.

2 Called by:

Calc

Calls:

Rnd

3 $N \leq 25$

4 Uniform numbers between 1 and 61 inclusive are generated as an index into the array of 61 flows.

5

6

7 2/20/76 Raiffa

8

25.2

0 Arguments:

X	=	real	array	holds original flows
Y	=	real	array	on return holds sample flow
N	=	integer		no. in a sample
JSE	=	integer		seed for random no. generator

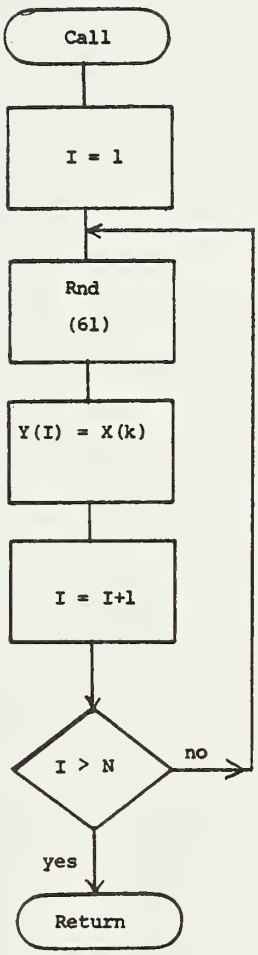
1

2 Do loops

Do 10 I = index for N samples in a set

3 K = integer random integer between 1 and 61 used as index

25.3 Subroutine Gen II (X, Y, N, JSE)



```
FORTRAN IV G LEVEL  21                GEN                DATE = 76057        14/19/40              PAGE 0001

0001                  SUBROUTINE GEN(X,Y,N,JSE)
0002                  DIMENSION X(61),Y(25)
0003                  DO 10 I=1,N
0004                  CALL RND(JSE,61,K)
0005                  Y(I)=X(K)
0006               10 CONTINUE
0007                  RETURN
0008                  END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
RND	94								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
I	A4	N	AA	JSE	AC	K	B0		

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
X	B4	Y	B8						

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	16E	3	16E	4	17E	5	18C	6	1A4
7	18C								

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = GEN , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 8,PROGRAM SIZE = 452
STATISTICS NO DIAGNOSTICS GENERATED

26 SUBROUTINE RND

26.1

1 Generates a random integer between 1 and N.

2 Called by:

Gen

3

4 Except for the last 2 lines, this is IBM Fortran SSP routine "Randu". The last 2 lines up date the seed, and scale the number so that it is between 1 and 61.

5

6

7 2/20/76 Raiffa

8

26.2

0 Arguments:

IX	=	integer	seed
N	=	integer	want number between 1, N
K	=	integer	$1 \leq K \leq N$ and is uniform

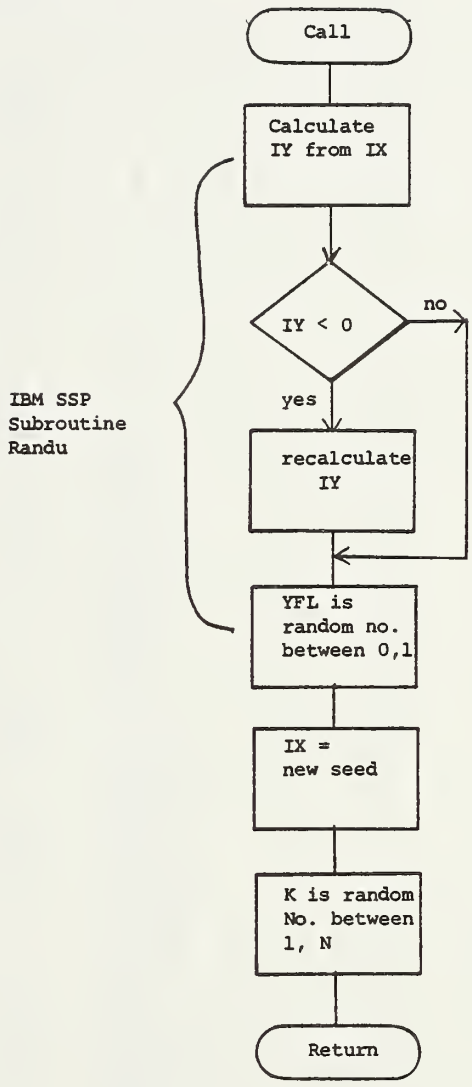
1

2

3 IY = integer used in generating, will be next seed

YFL = real random no., $0 \leq YFL \leq 1.0$

26.3 Subroutine Rnd (IX, N, K)



```
0001            SUBROUTINE RND(IX,N,K)
0002            IY=IX*65539
0003            IF(IY)5,6,6
0004          5 IY=IY+2147483647+1
0005          6 YFL=IY
0006            YFL=YFL*.4656613E-9
0007            IX=IY
0008            K=N*YFL+1
0009            RETURN
0010            END
```

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IY	A0	IX	A4	YFL	A8	K	AC	N	B0

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	168	2	168	3	174	4	180	5	190
6	180	7	18C	8	1C4	9	206		

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = RND , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 10,PROGRAM SIZE = 526
STATISTICS NO DIAGNOSTICS GENERATED

27 SUBROUTINE STATS

27.1

1 "Stats" calculates and prints the means, stds, and cross-correlation of two arrays.

2 Called by:

Spcor

Calls:

None

3

4

5

6

7 1/10/76 Raiffa

8

27.2

0 Arguments:

X	=	real	array	holds first array
Y	=	real	array	holds second array
N	=	integer		no. of points in X and Y

1

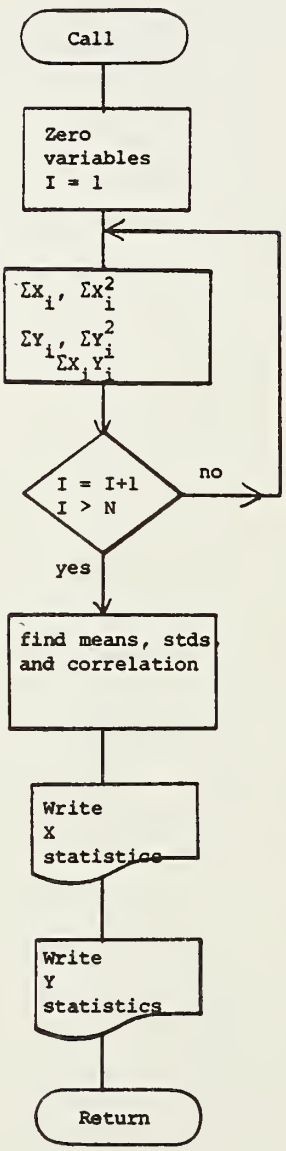
2 Do loops:

Do 10 I = partial sums

3 Z	=	real	same as N
Z1	=	real	Z-1
X1	=	real	mean of X

```
X2   =  real          mean of Y
S1   =  real          std of X
S2   =  real          std of Y
R    =  real          cross-correlation
T    =  real          temporary
T1   =  real          temporary
G1   =  real          skew of X
G2   =  real          skew of Y
```

27.3 Subroutine Stats (X, Y, N)



```
0001                  SUBROUTINE STATS(X,Y,N)
0002                  DIMENSION X(100),Y(100)
0003                  Z=N
0004                  Z1=Z-1.
0005                  X1=0.0
0006                  X2=0.0
0007                  S1=0.0
0008                  S2=0.0
0009                  R=0.0
0010                  DO 10 I=1,N
0011                  T=X1
0012                  T1=X2
0013                  X1=X1+T
0014                  X2=X2+T1
0015                  S1=S1+T*T
0016                  S2=S2+T1*T1
0017                  R=R+T*T1
0018               10 CONTINUE
0019                  X1=X1/Z
0020                  X2=X2/Z
0021                  S1=SQRT((S1-Z*X1*X1)/Z1)
0022                  S2=SQRT((S2-Z*X2*X2)/Z1)
0023                  G1=S1/X1
0024                  G2=X2/S2
0025                  G1=G1**3+3.*G1
0026                  G2=G2**3+3.*G2
0027                  R=(R-Z*X1*X2)/(Z1*S1*S2)
0028                  WRITE(6,100)N,X1,S1,G1,R
0029                  WRITE(6,100)N,X2,S2,G2,R
0030              100 FORMAT(I4,' OBS, MEAN=',F14.4,'  STD=',F14.4,'   SKEW=',
                     X' COR=',F14.4)
0031                  STOP
0032                  END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IBCOM#	94	SORT	98						

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
Z	A4	N	A8	Z1	AC	X1	B0	X2	B4
S1	B8	S2	BC	R	C0	I	C4	T	C8
T1	CC	G1	D0	G2	D4				

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
X	D8	Y	DC						

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
100	E0								

28 SUBROUTINE ORDER

28.1

1 "Order" sorts a set of data into ascending order (destroying the original array). It returns the sorted array, and an array containing the ranks of the original points (see "Sp").

2 Called by:

Sp

Calls:

None

3 Assume we don't care about ties.

4 A bubble sort is used.

Suppose there are k points.

a For i = 1, k-1 x_i and x_{i+1} are compared and if $x_i > x_{i+1}$ they are exchanged.

b If no exchanges were made ($x_1 \leq x_2$, $x_2 \leq x_3 \ldots x_{k-1} \leq x_k$) you are done, otherwise repeat "a." You will have to repeat "a" at most k times (this would allow x_k to be moved to x_1).

Before the sort is begun, a second array, "IN" is loaded with the integers 1...k. Each time x_i & x_{i+1} are switched, IN_i & IN_{i+1} are switched. Thus, when the sort is done IN will give the original position of the now sorted points. Let INN(IN(I)) = I for I = 1,k and INN will contain the ranks of the original points.

$x_1 = 5$	$x_1 = 1$	$IN_1 = 3$	$INN_1 = 4$
$x_2 = 3$	$x_2 = 2$	$IN_2 = 4$	$INN_2 = 3$
$x_3 = 1$	$x_3 = 3$	$IN_3 = 2$	$INN_3 = 1$
$x_4 = 2$	$x_4 = 5$	$IN_4 = 1$	$INN_4 = 2$

5

6

7 1/8/76 Raiffa

8

28.2

0 Arguments:

X	=	real*8	array	originally contains the points to be sorted, will contain the sorted points
INN	=	integer	array	will contain the ranks
K	=	integer		no. of points in X
J	=	integer		tells whether the sort is done. If $x_i \leq x_{i+1}$ for all i, J = 0. If a switch had to be made J = 1. J is initialized to 0 each time we go through the K points.

1

2 Do loops:

Do 10 I = load IN with 1...k

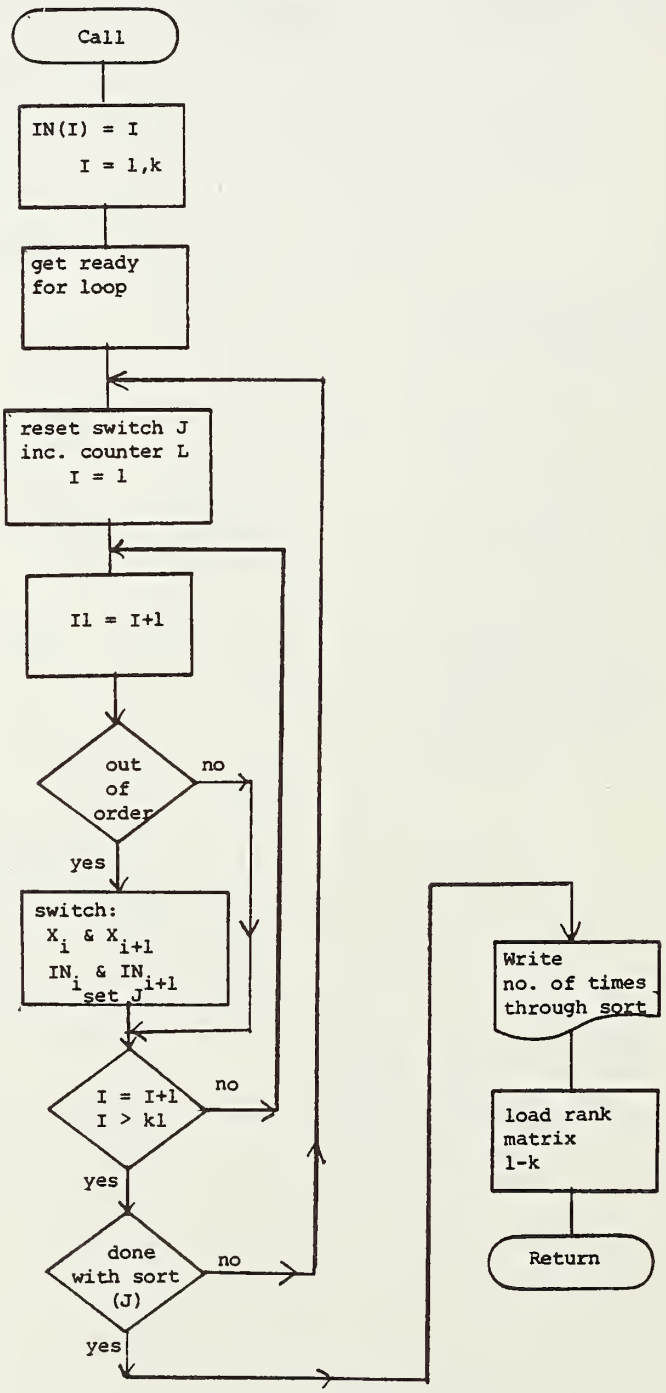
Do 20 I = check x_i & x_{i+1} for i = 1, k-1

Do 50 I = INN(IN(I)) = I

L	=	integer	counts no. of times sort goes through the k points
IN	=	integer array	original position of the sorted points
KL	=	integer	k = 1 for Do loop

T	=	real*8	temporary used in switching
IT	=	integer	temporary used in swithcing

28.3 Subroutine Order (X, INN, K)



```
FORTRAN IV G LEVEL  21          ORDER           DATE = 76079      10/28/59      PAGE 0001

0001                  SUBROUTINE ORDER(X,INN,K)
0002                  IMPLICIT REAL*8 (A-H,O-Z)
0003                  DIMENSION X(K),IN(2000)
0004                  DIMENSION INN(K)
0005                   DO 10 I=1,K
0006                10 IN(I)=I
0007                  L=0
0008                  K1=K-1
0009                 1 J=0
0010                  L=L+1
0011                  DO 20 I=1,K1
0012                  II=I+1
0013                  IF(X(I) .LE. X(II))GO TO 20
0014                  J=1
0015                  T=X(I)
0016                  X(I)=X(II)
0017                  X(II)=T
0018                  II=IN(I)
0019                  IN(I)=IN(II)
0020                  IN(II)=II
0021                20 CONTINUE
0022                  IF(J .NE.0)GO TO 1
0023                  WRITE(6,100)L
0024                100 FORMAT(I9,' ITERATIONS IN THE SORT')
0025                  DO 50 I=1,K
0026                50 INN(IN(I))=I
0027                  RETURN
0028                  END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IBCOM#	88								

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
T	C0	K	C8	I	CC	L	D0	K1	D4
J	D8	I1	DC	IT	E0				

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
X	E4	IN	F8	INN	2028				

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
100	202C								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	2110	5	2110	6	2120	7	2144	8	2150
9	215C	10	2168	11	2174	12	2180	13	2190
14	219A	15	21C2	16	21CA	17	2102	18	21DA
19	21E2	20	21F2	21	21FA	22	2216	23	2228
25	2244	26	2250	27	2284				

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = ORDER , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 28,PROGRAM SIZE = 0644
STATISTICS NO DIAGNOSTICS GENERATED

29 SUBROUTINE SPCOR

29.1

1 Finds the Spearman correlation, and a test on this correlation, given two sets of ranks.

2 Called by:

Sp

Calls:

None

3 If the Spearman correlation is 1 or -1 the test equation fails (divide by 0) so set test = 999.999

4 The equations are a direct steal from "SPSS."

5

6 Spearman correlation = for m observations

$$1 - \frac{6 \sum_{i=1}^{m} (\text{diff. in rank of } x_i \& y_i)}{m^3 - m}$$

$$\text{Test} = (\text{Spear. corr.}) * \left(\frac{m-2}{1-\text{Spear. Cor.}} \right)^{\frac{1}{2}}$$

7 1/8/76 Raiffa

8

29.2

0 Arguments:

IN1 = integer array ranks of x's

IN2 = integer array ranks of y's

K = integer No. of observations

1

2 Do loops:

Do 10 I = sum the square of the difference in rank

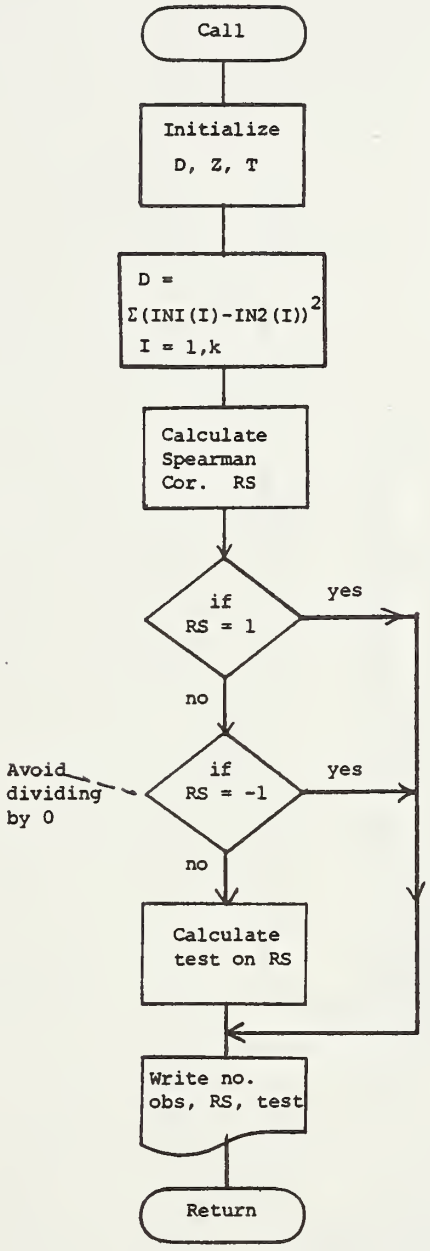
3 D = real*8 sum of squares of difference in rank

Z = real*8 no. of observations

T = real*8 test statistic (999.999 if Abs(RS) = 1)

RS = real*8 Spearman correlation

29.3 Subroutine Spcor (IN1, IN2, K)



```
FORTRAN IV G LEVEL  21          SPCOR           DATE = 76079      10/28/59          PAGE 0001

0001                SUBROUTINE SPCOR(IN1,IN2,K)
0002                IMPLICIT REAL*8 (A-H,O-Z)
0003                DIMENSION IN1(K),IN2(K)
0004                D=0.0
0005                Z=K
0006                T=999.999
0007                DO 10 I=1,K
0008             10 D=D+(IN1(I)-IN2(I))**2
0009                RS=1.0-(6.0*D/(Z**3-Z))
0010                IF(RS .EQ. 1.0)GO TO 1
0011                IF(RS .EQ. -1.0)GO TO 1
0012               T=RS*DSQRT((Z-2.0)/(1.0-RS*RS))
0013              1 CONTINUE
0014                WRITE(6,100)K,RS,T
0015            100 FORMAT(//I8,' SAMPLES,  RS=',F14.4,'  T=',F14.4)
0016                RETURN
0017                END
```

SUBPROGRAMS CALLED

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IBCOM#	A4	DSQRT	A8						

SCALAR MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
D	B0	Z	B8	T	C0	RS	C8	K	D0
I	D4								

ARRAY MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
IN1	D8	IN2	DC						

FORMAT STATEMENT MAP

SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION	SYMBOL	LOCATION
100	E0								

STATEMENT NUMBER MAP

STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION	STATEMENT	LOCATION
1	1EC	4	1CC	5	1F4	6	214	7	21C
9	224	9	278	10	29A	11	2A8	12	2B6
13	2E8	14	2F8	16	314				

OPTIONS IN EFFECT ID,EBCDIC,SOURCE,NOLIST,NODECK,LOAD,MAP
OPTIONS IN EFFECT NAME = SPCOR , LINECNT = 50
STATISTICS SOURCE STATEMENTS = 17,PROGRAM SIZE = 796
STATISTICS NO DIAGNOSTICS GENERATED

APPENDIX C

GAGING STATIONS, BY STATE

GAGING STATIONS USED IN THE REGRESSIONS

Georgia: 2181800, 2188500, 2203800, 2205000, 2217000, 2221000, 2227430, 2317900, 2337400, 2337500, 2349900, 2351800, 2383000, 2394400, 3545000

Massachusetts: 1101000, 1101500, 1105000, 1109000, 1162500, 1165500, 1171500, 1172500, 1174000, 1174500, 1180000, 1197000, 1331500, 1332000, 1333000

Missouri: 5502000, 6816000, 6820000, 6821000, 6896180, 6910200, 6925300, 6929000, 6931000, 6931600, 7011500, 7015000, 7040110, 7064500, 7185500

Montana: 5014000, 5014500, 6026000, 6046500, 6115500, 6128900, 6129800, 6177050, 6216200, 6216300, 6308300, 6332900, 6334100, 12324100, 12350500

New Mexico: 7205000, 8253000, 8253500, 8267500, 8271000, 8295000, 8302500, 8317700, 8361650, 8379600, 8477570, 8478000, 9357200, 9367860, 9395600

Ohio: 3089500, 3109000, 3125000, 3139930, 3139990, 3140020, 3226200, 3231600, 3235500, 3241600, 3263100, 3274100, 4189100, 4197500, 4210100

Oregon: 11340500, 13325000, 14011000, 14051000, 14073000, 14134000, 14163000, 14189500, 14203000, 14211800, 14299500, 14314500, 14333500, 14371500, 14378900

Tennessee: 3425500, 3427000, 3465000, 3491000, 3519600, 3519700, 3528400, 3565300, 3578500, 3581500, 3587500, 3594430, 3600500, 3604800, 7028700

Utah: 9182000, 9268000, 9268500, 9273500, 9275000, 9276000, 9287500, 9298000, 9331500, 9338000, 10135000, 10142000, 10143000, 10143500, 10145000

Virginia: 1620500, 1636210, 1654000, 1665000, 1668500, 1670000, 1671500, 1673500, 2015600, 2018500, 2036500, 2048400, 2076500, 3165000, 3530000

Wyoming: 6278300, 6299500, 6300500, 6311000, 6320500, 6321500, 6629800, 6652400, 9199500, 9204000, 9208000, 9214000, 9220500, 9224600, 9258000

*U.S. GOVERNMENT PRINTING OFFICE: 1977 728-230/1195 1-5