NASA TECHNICAL MEMORANDUM

NASA TM X-53222

MARCH 22, 1965

NASA TM X-53222

MONTE CARLO PERFORMANCE ANALYSIS COMPUTER PROGRAM WITH PROGRAMMED MIXTURE RATIO

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ABSTRACT

This report presents a detailed description of a Fortran IV computer program which uses the Monte Carlo technique to establish the stage residual and a total payload distribution for a vehicle with up to ten stages. The Monte Carlo technique employs the sampling of the independent engine and vehicle parameters, and, by the use of a large number of cases, is used to establish the probability distribution for stage residual and total payload.

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DEFINITION OF SYMBOLS

Symbol	Definition
W_{fi} nom	nominal total fuel weight for the i^{th} stage
W_{oi} nom	nominal total oxidizer weight for the i^{th} stage
F_i nom	nominal thrust for the i^{th} stage
Isp_i nom	nominal specific impulse for the i^{th} stage
MR_i nom	nominal mixture ratio for the i^{th} stage
W_{Di} nom	nominal dry weight for the i^{th} stage
D_1 nom	average atmospheric drag on the first stage
P_1 nom	average atmospheric pressure on the first stage
PA_1 nom	average atmospheric density on the first stage
PW_1 nom	average winds on the first stage
ϵ_i' nom	nominal fuel bias for the i^{th} stage
σW_{fi}	one standard deviation of total fuel weight in the i^{th} stage
σW_{oi}	one standard deviation of total oxidizer weight in the i^{th} stage
σF_i	one standard deviation of thrust in the i^{th} stage
σIsp_i	one standard deviation of specific impulse in the i^{th} stage
σMR_i	one standard deviation of mixture ratio in the i^{th} stage
σW_{Di}	one standard deviation of dry weight for the i^{th} stage
σD_1	one standard deviation of atmospheric drag on the first stage

DEFINITION OF SYMBOLS (Continued)

Symbol	Definition
σP_1	one standard deviation of atmospheric pressure on the first stage
σPA_1	one standard deviation of atmospheric density on the first stage
σPW_1	one standard deviation of winds on the first stage
σ_{ϵ_i}	one standard deviation of fuel bias for the i^{th} stage
W'_{oi}	random value of total oxidizer weight for the i^{th} stage
F'_i	random value of thrust for the i^{th} stage
Isp'_i	random value of specific impulse for the i^{th} stage
MR'_i	random value of mixture ratio for the i^{th} stage
WD'_i	random value of dry weight for the i^{th} stage
D'_1	random value of atmospheric drag for the first stage
P'_1	random value of atmospheric pressure for the first stage
PA'_1	random value of atmospheric density for the first stage
PW'_1	random value of winds for the first stage
TB_{fi}	burning time for fuel in the i^{th} stage
TB_{oi}	burning time for oxidizer in the i^{th} stage
ΔT	difference between TB_{fi} and TB_{oi}
$\dot{W}'_{fi}$	flow rate of fuel in the i^{th} stage
R'_{fi}	normally distributed mean zero fuel residual, at oxidizer depletion, due to PU inaccuracy in the i^{th} stage

DEFINITION OF SYMBOLS (Continued)

Symbol	Definition
$\dot{W}'_{oi}$	flow rate of oxidizer in the i^{th} stage
R_{fbi}	fuel residuals in the i^{th} stage
R_{obi}	oxidizer residuals in the i^{th} stage
β_i	fuel bias in the i^{th} stage
MR_{TUi}	calculated value for mixture ratio due to the PU system in the i^{th} stage
A, B, C	coefficients for PU influence equations in calculating F_i and Isp_i in the i^{th} stage
ΔF_i	calculated deviation, from the nominal, for thrust in the i^{th} stage
ΔIsp_i	calculated deviation, from the nominal, for specific impulse in the i^{th} stage
ΔR_i	calculated value of residuals in the i^{th} stage
ΔW_{pi}	calculated deviation, from the nominal, for total useable propellant in the i^{th} stage
ΔD	calculated deviation, from the nominal, for atmospheric drag effects on the first stage
ΔP	calculated deviation, from the nominal, for atmospheric pressure effects on the first stage
ΔPA	calculated deviation, from the nominal, for atmospheric density effects on the first stage
ΔPW	calculated deviation, from the nominal, for winds effects on the first stage
ΔW_{PL}	payload deviation from the nominal
$W_{PL\ nom}$	nominal payload; the nominal should have the effects of stage fuel biases
W_{PL}	calculated value of payload

DEFINITION OF SYMBOLS (Continued)

Symbol	Definition
MVAR	number of Monte Carlo cases
i	number of stages
δ_j	randomly selected values of a multiple of the standard deviation from a standard normal frequency distribution to be used in calculating values for the normally distributed perturbing parameters
NDIV	number of divisions desired in the grouping procedure
$\frac{\partial W_{PL}}{\partial F_i}$	rate of change of payload with respect to thrust in the i^{th} stage
$\frac{\partial W_{PL}}{\partial Isp_i}$	rate of change of payload with respect to specific impulse in the i^{th} stage
$\frac{\partial W_{PL}}{\partial R_i}$	rate of change of payload with respect to residuals in the i^{th} stage
$\frac{\partial W_{PL}}{\partial W_{Pi}}$	rate of change of payload with respect to useable propellant weight in the i^{th} stage
$\frac{\partial W_{PL}}{\partial WD_i}$	rate of change of payload with respect to dry weight in the i^{th} stage
$\frac{\partial W_{PL}}{\partial D}$	rate of change of payload with respect to atmospheric drag effects on the first stage

DEFINITION OF SYMBOLS (Continued)

Symbol	Definition
$\frac{\partial W_{PL}}{\partial P}$	rate of change of payload with respect to atmospheric pressure effects on the first stage
$\frac{\partial W_{PL}}{\partial PA}$	rate of change of payload with respect to atmospheric density effects on the first stage
$\frac{\partial W_{PL}}{\partial PW}$	rate of change of payload with respect to winds effect on the first stage

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MONTE CARLO PERFORMANCE ANALYSIS COMPUTER PROGRAM WITH PROGRAMMED MIXTURE RATIO

SUMMARY

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This report presents a detailed description of a Fortran IV computer program which uses the Monte Carlo technique to establish the stage residual and a total payload distribution for a vehicle with up to ten stages. The Monte Carlo technique employs the sampling of the independent engine and vehicle parameters, and, by the use of a large number of cases, is used to establish the probability distribution for stage residual and total payload.

Author ↑

I. INTRODUCTION

In the computation of the performance or nominal payload capabilities of a vehicle, certain simplifying assumptions must be made concerning propellant residuals and reserves required by the characteristics of the propulsion system and the propellant feed system. The nominal payload is computed by assuming that the independent engine and vehicle parameters perform nominally. For a realistic simulation,however, this assumption is invalid because of random perturbations on these parameters. It is necessary, therefore, to assign a level of probability to any value of payload that is computed.

The most direct method of determining the mission payload of a vehicle with a given set of independent engine and vehicle parameters is to compute a trajectory using these parameters. However, if it is required to establish a mission payload probability distribution based on many variations of these parameters, the computing time would be prohibitively expensive. Therefore, a statistical analysis of the vehicle tolerances and engine performance variations is required to specify the vehicle's payload capabilities as a function of cumulative probability.

The non-normality of one of the vehicle tolerances (residual propellant) prohibits the use of the "root-sum-square" technique. However, a method capabable of combining non-normal distributions in a statistical analysis is the "Monte Carlo Technique."

The Monte Carlo technique employs the sampling of the independent engine and vehicle parameters and, by the use of a large number of cases, is used to establish the probability distribution of the payload.

It is assumed that the stage and performance input variables are independent of time, and the random effect of the input variable on payload can be determined using performance partial derivatives.

It is also assumed that payload can be described as a function of total engine thrust, specific impulse, consumed propellant, residual propellant, stage dry weight, atmospheric drag, atmospheric pressure, atmospheric density, and winds. Symbolically, the function would be

$$W_{PL} = f(P_k); \quad P_k = \text{all perturbing parameters being considered}$$

or

$$W_{PL} = W_{PL\ nom} + \sum_{k=1}^{N} \frac{\partial W_{PL}}{\partial P_k} \Delta P_k; \quad N = \text{number of perturbed parameters.} \qquad (1)$$

The partial derivatives involved in equation (1) were determined by computing a number of trajectories where one parameter was varied while all others were fixed.

This program involves the solution of equation (1) for a large number of randomly selected values of the perturbing parameters.

ACKNOWLEDGEMENT

The author is indebted to Messrs. Robert Africano and Paul Fennell, at North American Aviation, Inc., Downey, California, whose report "IBM 7094 Fortran Propellant Utilizational Performance Program," was used as the basis for this program.

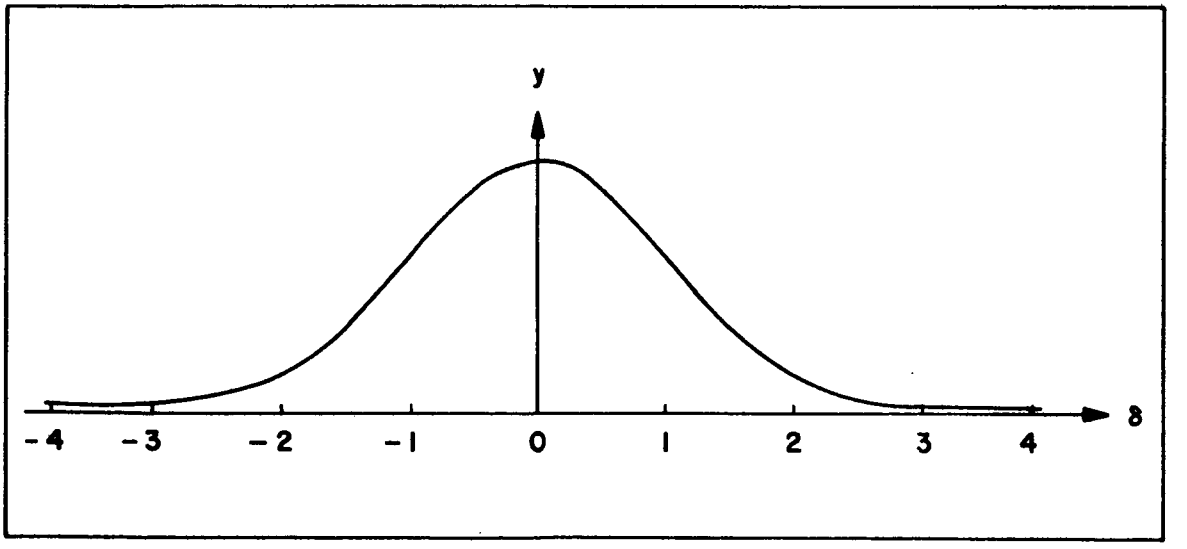
II. THE MONTE CARLO TECHNIQUE

The Monte Carlo technique is based on the random selection of a set of values for all the normally distributed parameters. This is done using the following technique.

A set of random numbers, (R_{N_i}), is determined by using a random number generator. These numbers have limits of

$$0 \leqq R_{N_i} \leqq 1.$$

These numbers (R_{N_i}) are then transformed to normalized numbers (δ_i) from the standard normal distribution. The standard normal frequency distribution is illustrated in the sketch below and is defined as the normal distribution with the mean equal to zero and one standard deviation equal to one.



STANDARD NORMAL FREQUENCY DISTRIBUTION

$$y = \frac{1}{\sqrt{2\pi}} \; e^{-\delta^2/2}$$

The probability that a number, δ, from the standard normal distribution will take on a value such that $a \leqq \delta \leqq b$ is defined as

$$P\ (a \leqq \delta \leqq b) = \frac{1}{\sqrt{2\pi}} \int_a^b e^{-\frac{\delta^2}{2}}\ dt.$$

The total area under the curve is defined to be 1; i.e.,

$$\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} e^{-\delta^2/2}\ dt = 1.$$

III. DETERMINATION OF PERTURBING PARAMETERS

Perturbing parameters are of two types: normal and non-normal.

A. Determination of Normally Distributed Perturbing Parameters

Using the values of δ_j that were generated above and a value for one standard deviation of the perturbing parameter, σW_{fi}, etc., a set of values for the normally distributed parameters is determined by the following:

$$W'_{fi} = W_{fi\ nom} + \delta_j\ \sigma W_{fi} \qquad i = 1, 2, 3 \ldots 10$$

$$W'_{oi} = W_{oi\ nom} + \delta_{j+11} \sigma W_{oi} \qquad i = 1, 2, 3 \ldots 10$$

$$F'_i = F_{i\ nom} + \delta_{j+21}\ \sigma F_i \qquad i = 1, 2, 3 \ldots 10$$

$$Isp'_i = Isp_{i\ nom} + \delta_{j+31}\ \sigma Isp_i \qquad i = 1, 2, 3 \ldots 10$$

$$MR'_i = MR_{i\ nom} + \delta_{j+41}\ \sigma MR_i \qquad i = 1, 2, 3 \ldots 10$$

$$WD'_i = WD_{i\ nom} + \delta_{j+51}\ \sigma WD_i \qquad i = 1, 2, 3 \ldots 10$$

$$D_i' = D_i \text{ nom} + \delta_{j+61}\ \sigma D_i \qquad i = 1, 2, 3 \ldots 10$$

$$P_i' = P_i \text{ nom} + \delta_{j+71}\ \sigma P_i \qquad i = 1, 2, 3 \ldots 10$$

$$PA_i' = P_i \text{ nom} + \delta_{j+81}\ \sigma PA_i \qquad i = 1, 2, 3 \ldots 10$$

$$PW_i' = PW_i \text{ nom} + \delta_{j+91}\ \sigma PW_i \qquad i = 1, 2, 3 \ldots 10$$

$$\epsilon' = \epsilon_{nom} + \delta_{101}\ \sigma_\epsilon \qquad i = 1, 2, 3 \ldots 10$$

B. Determination of Non-Normally Distributed Residuals

Since residuals are not normally distributed, it is necessary to calculate their effect on payload by a different method. The amount of residuals will depend on whether the stage has a propellant utilization (PU) system. There are two options in the computation depending on whether the stage has a PU system.

1. Option A (No PU System)

Calculation of Residuals Using Burn Time Equations With no Step Mixture Ratio

$$TB_{fi} = \frac{W_{fi}'}{\dot{W}_{fi}'} = W_{fi}' \left(\frac{Isp_i'}{F_i'}\right) (MR_i' + 1); \qquad i = 1, 2, 3, \ldots 10$$

$$\dot{W}_{fi}' = \frac{W_{fi}'}{TB_{fi}}$$

$$TB_{oi} = \frac{W_{oi}'}{\dot{W}_{oi}'} = W_{oi}' \left(\frac{Isp_i'}{F_i'}\right) \left(\frac{MR_i' + 1}{MR_i'}\right)$$

$$\dot{W}'_{oi} = \frac{W'_{oi}}{TB_{oi}}$$

$$\Delta T_B = TB_f - TB_o$$

It is now possible to determine if there is a fuel residual or an oxidizer residual. If $\Delta T_B > 0$, there is a fuel residual. If $\Delta T_B < 0$ there is an oxidizer residual. The amount of residual is determined by the following:

1. If $\Delta T_B > 0$, then

$$R_{fbi} = \Delta TB\ \dot{W}'_{fi}.$$

2. If $\Delta TB < 0$, then

$$R_{obi} = -\ \Delta TB\ \dot{W}'_{oi}.$$

These values R_{fbi} and R_{obi} are saved so that a statistical analysis of fuel residuals and oxidizer residuals can be made after the total number of simulations are made.

2. Option B (With PU System Using No Programmed Mixture Ratio)

It will be assumed that the PU system has a given inaccuracy. Under this assumption a normally distributed mean zero fuel residual at oxidizer depletion is defined.

Values of the residual propellant are randomly sampled from the distribution. A positive sample denotes a fuel residual, while a negative sample denotes an oxidizer residual.

Since it will be necessary to calculate the effect of fuel biasing (β), the value input of nominal fuel weight and oxidizer weight will be changed by the amount of bias under consideration, such that a constant stage weight at ignition is maintained.

Since the PU system would detect this bias and remove it, it is necessary to bias the PU system.

Calculations for Option B

If $R'_f > 0$, there exists a fuel residual. The PU system is biased by

$$W''_{fi} = W'_{fi} - \beta_i$$

$$W''_{oi} = W'_{oi} + \beta_i.$$

PU correction on mixture ratio:

$$MR_{TUi} = \frac{W''_{oi}}{W''_{fi} - R'_f}.$$

PU influence equation for thrust and specific impulse:

$$F'_i = F'_i + A(MR_{TUi} - MR_i \text{ nom})$$

$$Isp'_i = Isp'_i + B(MR_{TUi} - MR_i \text{ nom}) + C(MR_{TUi} - MR_i \text{ nom})^2.$$

Residuals are determined by

$$R_{fbi} = R'_{fi} + \beta\left(\frac{MR_{TUi} + 1}{MR_{TUi}}\right).$$

If $R'_f < 0$, there exists an oxidizer residual. The PU system is biased by

$$W''_{fi} = W'_{fi} - \beta$$

$$W''_{oi} = W'_{oi} + \beta.$$

The amount of oxidizer residual sampled is

$$R'_{oi} = - MR'_i \, R'_{fi}.$$

PU correction on mixture ratio:

$$MR_{TUi} = \frac{W''_{oi} - R'_{oi}}{W''_{fi}} .$$

PU influence equations for thrust and specific impulse:

$$F'_i = F'_i + A(MR_{TUi} - MR_i \text{ nom})$$

$$Isp'_i = Isp'_i + B(MR_{TUi} - MR_i \text{ nom}) + C(MR_{TUi} - MR_i \text{ nom})^2.$$

Let

$$RA = R'_{oi} - B(MR_{TUi} + 1).$$

RA indicates a residual. If

RA > 0, there exists an oxidizer residual,

RA = 0, there exists no residual,

RA < 0, there exists a fuel residual.

When RA > 0, the amount of oxidizer residual is

$$R_{obi} = R'_{oi} - \beta_i (MR_{TUi} + 1).$$

When RA < 0, the fuel residual is

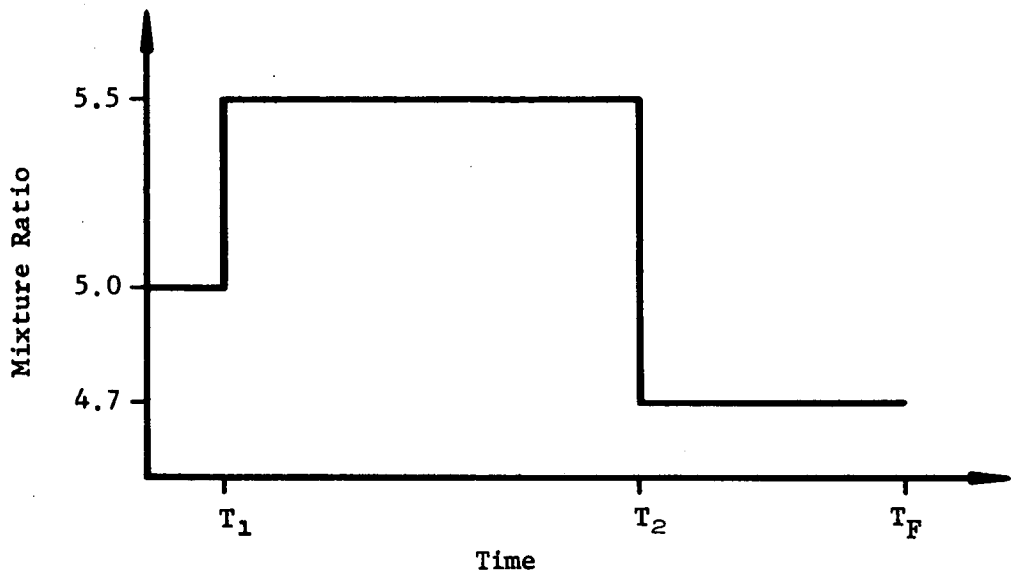
$$R_{fbi} = \frac{\beta_i (MR_{TUi} + 1) - R'_{oi}}{MR_{TUi}}.$$

As in Option A the values of R_{fbi} and R_{obi} are saved so that a statistical analysis of fuel and oxidizer may be made after the total number of simulations are made.

3. Option C (With PU System Using Programmed Mixture Ratio

In this program a stage with a programmed step mixture ratio is assumed to perform as a multiple stage vehicle. This can best be illustrated by an example.

Assume that a given stage uses an MR time history as shown in the sketch below.



Also assume that the engine is calibrated at the 5.5 step. The PU value is fixed such that an MR of 5.0 is used for the first T_1 seconds. This will cause the vehicle to perform as a stage with no PU for T_1 seconds. Since the engine is calibrated at the 5.5 MR with the PU value against the stop, the vehicle will also perform as a no PU stage from T_1 to T_2 seconds. From T_2 to T_F seconds the PU value will be operative and will be simulated as a stage with a PU system.

To assure continuity in thrust and Isp across each of the steps, the random effect of the perturbed thrust and Isp is determined for the 5.5 MR step and the same perturbations are used for the 5.0 and 4.7 step. Since the tolerance on MR is dependent on the PU value position, it will vary as the MR varies.

Likewise, to obtain the proper residual effect of this stage on the final payload, the residuals obtained at the end of each step will be carried across to the next step. This will result in only one value of residual for the entire stage. In this simulation it is assumed that the optimum step time is known. In the actual flight, however, the step

will occur when the fuel and LOX reach a state of depletion such that the ratio of LOX to fuel is equal to the reference mixture ratio of the lower step.

The effect of assuming a nominal step time is to perturb the reference mixture ratio slightly to offset the residuals which are carried forward from the higher step.

IV. DETERMINATION OF THE DEVIATION FROM THE NOMINAL VALUE

Under either Option A or Option B, the deviations from the nominal value are determined for each of the following perturbing parameters:

$$\Delta F'_i = F'_i - F_{i\ nom}$$

$$\Delta Isp_i = Isp'_i - Isp_{i\ nom}$$

$$\Delta R_i = R_{fbi} + R_{obi} - \epsilon'_i, \text{ where either } R_{fbi} \text{ or } R_{obi} \text{ always equals 0.}$$

$$\Delta W_{Pi} = (W'_{oi} - W_{oi\ nom}) + (W'_{fi} - W_{fi\ nom}) - \Delta R_i$$

$$\Delta W_{Di} = W'_{Di} - W_{Di\ nom}$$

$$\Delta D = D'_1 - D_{nom}$$

$$\Delta PW = PW'_1 - PW_{nom}$$

$$\Delta P = P'_1 - P_{nom}$$

$$\Delta PA = PA'_1 - PA_{nom}.$$

V. DETERMINATION OF PAYLOAD

The equation for the determination of the deviation from the nominal payload is as follows:

$$\Delta W_{PL} = \Delta F_i \frac{\partial W_{PL}}{\partial F_i} + \Delta Isp_i \frac{\partial W_{PL}}{\partial Isp_i} + \Delta R_i \frac{\partial W_{PL}}{\partial R_i} + \Delta W_{Pi} \frac{\partial W_{PL}}{\partial W_{Pi}} + \Delta W_{Di} \frac{\partial W_{PL}}{\partial W_{Di}}$$

$$+ \Delta D \frac{\partial W_{PL}}{\partial D} + \Delta P \frac{\partial W_{PL}}{\partial P} + \Delta PA \frac{\partial W_{PL}}{\partial PA} + \Delta PW \frac{\partial W_{PL}}{\partial PW}.$$

The payload is then determined by

$$W_{PL} = W_{PL\ nom} + \Delta W_{PL}.$$

The value of W_{P_L} nom, which is an input to this program is determined by using a trajectory program. The nominal value of all vehicle parameters, except fuel weight, should be used in calculating this trajectory. The nominal fuel weight for each stage should be increased by the amount of the fuel bias for that stage. This will result in a propellant residual left on board equal to the fuel bias. The payload resulting from this trajectory is W_{P_L} nom.

At this point one set of values for payload and stage residuals has been calculated with one set of randomly selected parameters.

This procedure is repeated for a specified number (MVAR) of times to provide a probability distribution of payloads and stage residuals.

VI. THE GROUPING TECHNIQUE

After the specified number (MVAR) of payloads, W_{PL}, and stage residuals have been calculated, the following technique is used.

The MVAR values of W_{PL} and stage residuals are investigated for a maximum and minimum.

Range is determined by

$$RANGE = MAX - MIN.$$

The range is then divided into some desired (NDIV) class interval by

$$\text{Class interval} = \frac{\text{Range}}{\text{NDIV}} .$$

The limits for each class are found by

$$\text{Class limit} = \text{Min} + K \text{ (class interval)}$$

$$K = 0, 1, 2, \ldots (\text{NDIV} + 1).$$

The NC values of W_{PL} and stage residuals are then classified by comparing with the class limits. That is, each W_{PL} will satisfy the following general equation:

$$\text{Class limit}_L \leq W_{PLj} \leq \text{Class limit}_{(L+1)}$$

$$j = 1, 2, \ldots \text{NC}$$

$$L = 0, 1, 2, \ldots (\text{NDIV} + 1).$$

The frequency for each (NDIV) class is determined by counting the number of W_{PL} and stage residuals within that class, i.e.,

$$(\text{NDIV})_{L-1} \qquad \text{Frequency}_{L-1}$$

$$(\text{NDIV})_{L} \qquad \text{Frequency}_{L}.$$

The cumulative probability for the L^{th} (NDIV) class is found by

$$\text{CUM. PROB.} = \left[\frac{\sum_{k=1}^{L} \text{Frequency}_k}{\text{NC}} \right] \cdot 100\%.$$

$$k = 1, 2, 3, \ldots, \text{NDIV}$$

NC = total number of values of W_{PL} and stage residuals.

The mean value for the NC value of W_{PL} and stage residual is determined by the following:

$$\bar{W}_{PL} = \frac{1}{NC} \sum_{j=1}^{NC} W_{PLj}$$

$$\overline{RES} = \frac{1}{NC} \sum_{j=1}^{NC} RES_j .$$

The standard deviation for the MVAR values of W_{PL} and stage residuals is determined by the following:

$$SD_{WPL} = \sqrt{\frac{\sum_{j=1}^{NC} (W_{PLj} - \overline{WPL})^2}{NC}}$$

$$SD_{RES} = \sqrt{\frac{\sum_{j=1}^{NC} (RES_j - \overline{RES})^2}{NC}} .$$

VII. CURVE FITTING THE HISTOGRAMS

To obtain the tables shown in Appendix B, we must determine the equations for the payload and each of the stage residuals.

All of these distributions have the same general shape. This fact leads to a general equation for all the distributions. This equation is

$$Y = \frac{N}{\sigma\sqrt{2\pi}} e^{-x^2/2\sigma^2} \left[1 - \frac{\alpha}{2}\left(\frac{x}{\sigma} - \frac{x^3}{3\sigma^3}\right)\right] ,$$

where

$x = U - \mu$

U = calculated values of payload or stage residual

μ = mean value of the U's

σ = standard deviation of U

α = skewness factor for the distribution

Y = frequency of U

N = total number of simulations made.

The mean and standard deviations for each of the distributions have been determined in Section VI. It is now necessary to determine the skewness factor. This is done using the equation

$$\alpha_3 = \frac{B_3}{\sqrt{\sigma^3}}$$

where

$$B_3 = \frac{\Sigma x^3}{N} - 3\,\frac{(\Sigma(x)^2)\ (\Sigma(x))}{N} + 2\,\frac{(\Sigma x)^3}{N}\ .$$

It is then possible to generate the frequency distribution for the payload and each of the stage residuals.

APPENDIX A

A DESCRIPTION OF INPUT

Input Format

Input Group	Nomenclature
1	13 Control Numbers {1 = No PU, 0 = PU}
2	Start
3	Beta (10) A(10) B(10) C(10)*
4	PARFI(10) PARWP(10) PARWD(10) PARISP(10) PARR(10) PARPA PARD PARP PARPW WPLN *
5	WFN(10) WθN(10) FN(10) AISPN(10) AMRN(10) RFN(10) RθN(10) WDN(10) EN(10) DN PN PAN PWN *
6	NC IS NDIV MVAR *
7	WF(10) Wθ(10) F(10) AISP(10) AMR(10) RF(10) Rθ(10) WD(10) E(10) D P PA PW *

* End of an input group.

EXPLANATION OF INPUT NAMES

Input Group		Definition
1		13 control numbers
2	Start	used to start the random number generator use: $0 < \text{start} < 1$.
3	Beta	fuel bias
	A, B, C	coefficients for thrust vs mixture ratio and specific impulse vs mixture ratio equations
4	PARFI	rate of change of payload with respect to thrust
	PARWP	rate of change of payload with respect to total propellant
	PARWD	rate of change of payload with respect to dry weight
	PARISP	rate of change of payload with respect to specific impulse
	PARR	rate of change of payload with respect to stage residuals
	PARPA	rate of change of payload with respect to atmospheric density
	PARD	rate of change of payload with respect to drag
	PARP	rate of change of payload with respect to pressure
	PARPW	rate of change of payload with respect to parallel winds
	WPLN	nominal payload (with effect of fuel bias)
5	WFN	nominal fuel weight
	WθN	nominal oxidizer weight
	FN	nominal thrust
	AISPN	nominal specific impulse
	AMRN	nominal mixture ratio

EXPLANATION OF INPUT NAMES (Continued)

Input Group		Definition
5 (cont'd)	RFN	not used set to zero
	RθN	not used set to zero
	WDN	nominal dry weight
	EN	fuel bias
	DN	nominal drag
	PN	nominal pressure
	PAN	nominal density
	PWN	nominal parallel winds
	NC	tape control, use 1000
	IS	number of stages
	NDIV	number of divisions
	MVAR	number of payloads, max = 16,000
6	WF	one standard deviation for total fuel weight
	Wθ	one standard deviation for total oxidizer weight
	F	one standard deviation for thrust
	AISP	one standard deviation for specific impulse
	AMR	one standard deviation for mixture ratio
	RF	one standard deviation for fuel residuals due to loading errors

DEFINITION OF INPUT NAMES (Continued)

Input Group	Definition	
6 (Cont'd)	Rθ	not used, set to zero
	WD	not used, set to dry weight
	E	one standard deviation for fuel bias
	D	one standard deviation for drag effects
	P	one standard deviation for pressure effects
	PA	one standard deviation for density effects
	PW	one standard deviation for parallel winds effects

APPENDIX B

Sample Printout

ØNE SIGMA DEVIATION

WF1	0.31405000E 03	WF2	0.	WF3	0.94609299E 02	WF4	0.
WØ1	0.71494325E 03	WØ2	0.	WØ3	0.51193730E 03	WØ4	0.
F1	0.56568532E 04	F2	0.	F3	0.23000000E 04	F4	0.
ISP1	0.30000000E-00	ISP2	0.	ISP3	0.13332999E 01	ISP4	0.
MR1	0.47029999E-02	MR2	0.16666000E-01	MR3	0.33329999E-02	MR4	0.30000000E-01
RF1	0.	RF2	0.	RF3	0.	RF4	0.30606999E 02
RØ1	0.	RØ2	0.	RØ3	0.	RØ4	0.
WD1	0.18200000E 03	WD2	0.80000000E 02	WD3	0.80000000E 02	WD4	0.80000000E 02
EPS1-	0.	EPS2-	0.	EPS3-	0.	EPS4-	0.

NØMINAL VALJES

WF1	0.26917799E 06	WF2	0.80200000E 03	WF3	0.23889399E 05	WF4	0.12108766E 05
WØ1	0.61279099E 06	WØ2	0.40102000E 04	WØ3	0.13139190E 06	WØ4	0.56646069E 05
F1	0.16000000E 07	F2	0.20500000E 06	F3	0.23000000E 06	F4	0.19000000E 06
ISP1	0.26340000E 03	ISP2	0.42600000E 03	ISP3	0.42309999E 03	ISP4	0.42747000E 03
MR1	0.22839999E 01	MR2	0.49999999E 01	MR3	0.55000000E 01	MR4	0.46999999E 01
RF1	0.	RF2	0.	RF3	0.	RF4	0.
RØ1	0.	RØ2	0.	RØ3	0.	RØ4	0.
WD1	0.	WD2	0.	WD3	0.	WD4	0.
EPS1	0.	EPS2	0.	EPS3	0.	EPS4	0.

BETA(I)=	0.	0.	0.	0.71666699E 02
A(I)=	0.	0.49999999E 05	0.49999999E 05	0.49999999E 05
B(I)=	0.	-0.52000000E 01	-0.52000000E 01	-0.52000000E 01
C(I)=	0.	-0.12000000E 01	-0.12000000E 01	-0.12000000E 01
PAR-WPL/F(I)	0.13800000E-01	0.39999999E-02	0.69999999E-01	0.84999999E-02
PAR-WPL/WP(I)	0.41599999E-01	0.	0.10420000E-01	0.10420000E-01
PAR-WPL/WD(I)	-0.12859999E-00	0.	0.	-0.09999999E 01
PAR-WPL/ISP(I)	0.24959999E 03	0.20000000E 01	0.10800000E 03	0.10800000E 03
PAR-WPL/XR(I)	-0.14060000E-00	0.	0.	-0.09999999E 01

ØNE SIGMA DEVIATIØN

WF5 0.	WF6 0.	WF7 0.	WF8 0.	WF9 0.	WF10 0.
WØ5 0.	WØ6 0.	WØ7 0.	WØ8 0.	WØ9 0.	WØ10 0.
FS 0.	F6 -0.	F7 -0.	F8 -0.	F9 -0.	F10 -0.
ISP5 0.	ISP6 0.	ISP7 0.	ISP8 0.	ISP9 0.	ISP0 0.
MR5 0.	MR6 0.	MR7 0.	MR8 0.	MR9 0.	MR10 0.
RF5 0.	RF6 0.	RF7 0.	RF8 0.	RF9 0.	RF10 0.
RØ5 0.	RØ6 0.	RØ7 0.	RØ8 0.	RØ9 0.	RØ10 0.
WD5 0.	WD6 -0.	WD7 -0.	WD8 -0.	WD9 -0.	WD10-0.
EPS5-0.	EPS6-0.	EPS7-0.	EPS8-0.	EPS9-0.	EPS0-0.
D 0.12500000E 03	P 0.	PA 0.22499999E 03	PW 0.83333299E 02		

NØMINAL VALUES

WF5 0.	WF6 -0.	WF7 -0.	WF8 -0.	WF9 -0.	WF10-0.
WØ5 0.	WØ6 -0.	WØ7 -0.	WØ8 -0.	WØ9 -0.	WØ10-0.
FS 0.	F6 -0.	F7 -0.	F8 -0.	F9 -0.	F10 -0.
ISP5 0.	ISP6-0.	ISP7-0.	ISP8-0.	ISP9-0.	ISP0-0.
MR5 0.	MR6 -0.	MR7 -0.	MR8 -0.	MR9 -0.	MR10-0.
RF5 0.	RF6 0.	RF7 0.	RF8 0.	RF9 0.	RF10 0.
RØ5 0.	RØ6 0.	RØ7 0.	RØ8 0.	RØ9 0.	RØ10 0.
WD5 0.	WD6 0.	WD7 0.	WD8 0.	WD9 0.	WD10 0.
EPS5 0.	EPS6 0.	EPS7 0.	EPS8 0.	EPS9 0.	EPS0 0.
D 0.	P 0.	PA 0.	PW 0.		

BETA(I)=	0.	-0.	-0.	-0.	-0.	-0.
A(I)=	0.	-0.	-0.	-0.	-0.	-0.
B(I)=	0.	-0.	-0.	-0.	-0.	-0.
C(I)=	0.	-0.	-0.	-0.	-0.	-0.
PAR-WPL/F(I)	0.	-0.	-0.	-0.	-0.	-0.
PAR-WPL/WP(I)	0.	-0.	-0.	-0.	-0.	-0.
PAR-WPL/WD(I)	0.	-0.	-0.	-0.	-0.	-0.
PAR-WPL/ISP(I)	0.	-0.	-0.	-0.	-0.	-0.
PAR-WPL/XR(I)	0.	-0.	-0.	-0.	-0.	-0.

WPL/PA 0.09999999E 01 WPL/D -0.09999999E 01 WPL/P 0. WPL/PW 0.09999999E 01 WPLNØM 0.35784999E 05

NØ PU SYSTEM IN STAGE 1

NØ PU SYSTEM IN STAGE 2

NØ PJ SYSTEM IN STAGE 3

PU SYSTEM IN STAGE 4

PAYLØAD DIST.

CLASS INTERVAL	FREQ.	C FREQ.	C PRØB
0.33736978E 05	0.	0.	0.
0.33775061E 05	2.	2.	0.01
0.33813143E 05	1.	3.	0.02
0.33851225E 05	0.	3.	0.02
0.33889306E 05	1.	4.	0.02
0.33927388E 05	5.	9.	0.06
0.33965471E 05	0.	9.	0.06
0.34003553E 05	5.	14.	0.09
0.34041635E 05	5.	19.	0.12
0.34079717E 05	6.	25.	0.16
0.34117799E 05	6.	31.	0.19
0.34155881E 05	7.	38.	0.24
0.34193963E 05	9.	47.	0.29
0.34232045E 05	15.	62.	0.39
0.34270127E 05	18.	80.	0.50
0.34308209E 05	16.	96.	0.60
0.34346291E 05	20.	116.	0.72
0.34384373E 05	25.	141.	0.88
0.34422455E 05	32.	173.	1.08
0.34460537E 05	41.	214.	1.34
0.34498619E 05	58.	272.	1.70
0.34536701E 05	63.	335.	2.09
0.34574784E 05	73.	408.	2.55
0.34612865E 05	82.	490.	3.06
0.34650947E 05	92.	582.	3.64
0.34689029E 05	124.	706.	4.41
0.34727111E 05	117.	823.	5.14
0.34765194E 05	159.	982.	6.14
0.34803276E 05	148.	1130.	7.06
0.34841357E 05	176.	1306.	8.16
0.34879439E 05	196.	1502.	9.39
0.34917521E 05	199.	1701.	10.63
0.34955604E 05	244.	1945.	12.16
0.34993686E 05	261.	2206.	13.79
0.35031768E 05	296.	2502.	15.64
0.35069849E 05	329.	2831.	17.69
0.35107931E 05	340.	3171.	19.82
0.35146014E 05	398.	3569.	22.31
0.35184096E 05	402.	3971.	24.82
0.35222178E 05	405.	4376.	27.35
0.35260260E 05	397.	4773.	29.83
0.35298342E 05	429.	5202.	32.51
0.35336424E 05	439.	5641.	35.26
0.35374506E 05	491.	6132.	38.32
0.35412588E 05	485.	6617.	41.36
0.35450670E 05	491.	7108.	44.42
0.35488752E 05	487.	7595.	47.47
0.35526834E 05	506.	8101.	50.63
0.35564916E 05	525.	8626.	53.91
0.35602998E 05	505.	9131.	57.07
0.35641080E 05	520.	9651.	60.32
0.35679162E 05	475.	10126.	63.29
0.35717244E 05	439.	10565.	66.03
0.35755326E 05	457.	11022.	68.89
0.35793408E 05	430.	11452.	71.57
0.35831490E 05	441.	11893.	74.33
0.35869572E 05	403.	12296.	76.85
0.35907654E 05	424.	12720.	79.50
0.35945737E 05	377.	13097.	81.86
0.35983818E 05	332.	13429.	83.93
0.36021900E 05	278.	13707.	85.67

PAYLOAD DIST. (Continued)

0.36059982E 05	260.	13967.	87.29
0.36098064E 05	231.	14198.	88.74
0.36136147E 05	241.	14439.	90.24
0.36174229E 05	187.	14626.	91.41
0.36212311E 05	189.	14815.	92.59
0.36250392E 05	165.	14980.	93.62
0.36288475E 05	167.	15147.	94.67
0.36326557E 05	124.	15271.	95.44
0.36364639E 05	130.	15401.	96.26
0.36402721E 05	105.	15506.	96.91
0.36440803E 05	82.	15588.	97.42
0.36478885E 05	78.	15666.	97.91
0.36516967E 05	69.	15735.	98.34
0.36555049E 05	43.	15778.	98.61
0.36593131E 05	38.	15816.	98.85
0.36631213E 05	38.	15854.	99.09
0.36669295E 05	26.	15880.	99.25
0.36707377E 05	20.	15900.	99.37
0.36745459E 05	18.	15918.	99.49
0.36783541E 05	14.	15932.	99.57
0.36821623E 05	15.	15947.	99.67
0.36859705E 05	11.	15958.	99.74
0.36897787E 05	5.	15963.	99.77
0.36935869E 05	11.	15974.	99.84
0.36973951E 05	10.	15984.	99.90
0.37012033E 05	4.	15988.	99.92
0.37050115E 05	4.	15992.	99.95
0.37088197E 05	2.	15994.	99.96
0.37126280E 05	1.	15995.	99.97
0.37164361E 05	1.	15996.	99.97
0.37202443E 05	2.	15998.	99.99
0.37240525E 05	0.	15998.	99.99
0.37278607E 05	0.	15998.	99.99
0.37316690E 05	1.	15999.	99.99
0.37354772E 05	0.	15999.	99.99
0.37392853E 05	0.	15999.	99.99
0.37430935E 05	0.	15999.	99.99
0.37469018E 05	0.	15999.	99.99
0.37507100E 05	0.	15999.	99.99
0.37546209E 05	1.	16000.	100.00

TOTAL RESIDUAL DIST. FOR STAGE 1

CLASS INTERVAL	FREQ.	C FREQ.	C PRØB
0.48147063E-01	0.	0.	0.
0.42629232E 02	258.	258.	1.61
0.85210318E 02	293.	551.	3.44
0.12779140E 03	261.	812.	5.07
0.17037249E 03	266.	1078.	6.74
0.21295357E 03	321.	1399.	8.74
0.25553466E 03	300.	1699.	10.62
0.29811575E 03	330.	2029.	12.68
0.34069683E 03	392.	2421.	15.13
0.38327792E 03	332.	2753.	17.21
0.42585900E 03	360.	3113.	19.46
0.46844009E 03	358.	3471.	21.69
0.51102117E 03	335.	3806.	23.79
0.55360226E 03	390.	4196.	26.22
0.59618334E 03	419.	4615.	28.84
0.63876443E 03	402.	5017.	31.36
0.68134551E 03	415.	5432.	33.95
0.72392660E 03	427.	5859.	36.62
0.76650769E 03	426.	6285.	39.28
0.80908877E 03	405.	6690.	41.81
0.85166986E 03	445.	7135.	44.59
0.89425094E 03	406.	7541.	47.13
0.93683203E 03	421.	7962.	49.76
0.97941311E 03	416.	8378.	52.36
0.10219941E 04	407.	8785.	54.91
0.10645752E 04	418.	9203.	57.52
0.11071564E 04	397.	9600.	60.00
0.11497374E 04	369.	9969.	62.31
0.11923185E 04	391.	10360.	64.75
0.12348996E 04	347.	10707.	66.92
0.12774806E 04	361.	11068.	69.17
0.13200618E 04	332.	11400.	71.25
0.13626429E 04	341.	11741.	73.38
0.14052239E 04	325.	12066.	75.41
0.14478050E 04	315.	12381.	77.38
0.14903861E 04	292.	12673.	79.21
0.15329672E 04	287.	12960.	81.00
0.15755483E 04	267.	13227.	82.67
0.16181293E 04	236.	13463.	84.14
0.16607104E 04	238.	13701.	85.63
0.17032915E 04	213.	13914.	86.96
0.17458726E 04	184.	14098.	88.11
0.17884537E 04	192.	14290.	89.31
0.18310348E 04	169.	14459.	90.37
0.18736158E 04	145.	14604.	91.27
0.19161969E 04	157.	14761.	92.26
0.19587781E 04	146.	14907.	93.17
0.20013591E 04	139.	15046.	94.04
0.20439402E 04	102.	15148.	94.67
0.20865212E 04	91.	15239.	95.24
0.21291023E 04	77.	15316.	95.72
0.21716835E 04	83.	15399.	96.24
0.22142645E 04	62.	15461.	96.63
0.22568456E 04	55.	15516.	96.97
0.22994267E 04	62.	15578.	97.36
0.23420078E 04	58.	15636.	97.72
0.23845889E 04	54.	15690.	98.05
0.24271700E 04	38.	15728.	98.30
0.24697510E 04	41.	15769.	98.56
0.25123321E 04	35.	15804.	98.77

TOTAL RESIDUAL DIST. FOR STAGE 1 (Continued)

0.25549132E 04	31.	15835.	98.97
0.25974943E 04	20.	15855.	99.09
0.26400754E 04	23.	15878.	99.24
0.26826565E 04	15.	15893.	99.33
0.27252375E 04	18.	15911.	99.44
0.27678186E 04	15.	15926.	99.54
0.28103997E 04	10.	15936.	99.60
0.28529808E 04	14.	15950.	99.69
0.28955619E 04	7.	15957.	99.73
0.29381429E 04	4.	15961.	99.76
0.29807241E 04	4.	15965.	99.78
0.30233052E 04	4.	15969.	99.81
0.30658862E 04	2.	15971.	99.82
0.31084673E 04	7.	15978.	99.86
0.31510484E 04	2.	15980.	99.87
0.31936295E 04	2.	15982.	99.89
0.32362106E 04	2.	15984.	99.90
0.32787917E 04	2.	15986.	99.91
0.33213727E 04	1.	15987.	99.92
0.33639538E 04	2.	15989.	99.93
0.34065349E 04	1.	15990.	99.94
0.34491160E 04	1.	15991.	99.94
0.34916971E 04	2.	15993.	99.96
0.35342782E 04	2.	15995.	99.97
0.35768592E 04	0.	15995.	99.97
0.36194403E 04	0.	15995.	99.97
0.36620215E 04	1.	15996.	99.97
0.37046025E 04	0.	15996.	99.97
0.37471836E 04	0.	15996.	99.97
0.37897646E 04	0.	15996.	99.97
0.38323458E 04	0.	15996.	99.97
0.38749269E 04	0.	15996.	99.97
0.39175079E 04	0.	15996.	99.97
0.39600890E 04	1.	15997.	99.98
0.40026701E 04	0.	15997.	99.98
0.40452512E 04	1.	15998.	99.99
0.40878323E 04	0.	15998.	99.99
0.41304134E 04	0.	15998.	99.99
0.41729944E 04	0.	15998.	99.99
0.42155755E 04	0.	15998.	99.99
0.42591567E 04	2.	16000.	100.00

FUEL RESIDUALS DIST. FOR STAGE 1

CLASS INTERVAL	FREQ.	C FREQ.	C PRØ3
0.88678239E-01	0.	0.	0.
0.36682315E 02	150.	150.	1.05
0.73275952E 02	177.	327.	2.29
0.10986958E 03	168.	495.	3.46
0.14646322E 03	183.	678.	4.74
0.18305686E 03	193.	871.	6.09
0.21965050E 03	218.	1089.	7.61
0.25624413E 03	212.	1301.	9.09
0.29283777E 03	235.	1536.	10.74
0.32943141E 03	272.	1808.	12.64
0.36602504E 03	235.	2043.	14.28
0.40261868E 03	252.	2295.	16.04
0.43921231E 03	242.	2537.	17.74
0.47580595E 03	281.	2818.	19.70
0.51239958E 03	251.	3069.	21.45
0.54899321E 03	296.	3365.	23.52
0.58558685E 03	311.	3676.	25.70
0.62218048E 03	327.	4003.	27.98
0.65877412E 03	296.	4299.	30.05
0.69536776E 03	339.	4638.	32.42
0.73196139E 03	349.	4987.	34.85
0.76855503E 03	333.	5320.	37.19
0.80514867E 03	315.	5635.	39.39
0.84174230E 03	347.	5982.	41.82
0.87833594E 03	324.	6306.	44.08
0.91492958E 03	327.	6633.	46.37
0.95152321E 03	332.	6965.	48.69
0.98811685E 03	318.	7283.	50.91
0.10247105E 04	332.	7615.	53.23
0.10613041E 04	322.	7937.	55.48
0.10978977E 04	325.	8262.	57.76
0.11344913E 04	304.	8566.	59.88
0.11710849E 04	290.	8856.	61.91
0.12076786E 04	307.	9163.	64.05
0.12442722E 04	283.	9446.	66.03
0.12808658E 04	278.	9724.	67.98
0.13174595E 04	271.	9995.	69.87
0.13540531E 04	279.	10274.	71.82
0.13906467E 04	257.	10531.	73.62
0.14272404E 04	253.	10784.	75.39
0.14638340E 04	263.	11047.	77.22
0.15004276E 04	236.	11283.	78.87
0.15370212E 04	223.	11506.	80.43
0.15736149E 04	214.	11720.	81.93
0.16102085E 04	180.	11900.	83.19
0.16468021E 04	198.	12098.	84.57
0.16833957E 04	188.	12286.	85.89
0.17199894E 04	159.	12445.	87.00
0.17565830E 04	142.	12587.	87.99
0.17931766E 04	160.	12747.	89.11
0.18297703E 04	139.	12886.	90.08
0.18663639E 04	117.	13003.	90.90
0.19029575E 04	134.	13137.	91.84
0.19395512E 04	117.	13254.	92.65
0.19761448E 04	109.	13363.	93.41
0.20127384E 04	103.	13466.	94.13
0.20493320E 04	90.	13556.	94.76
0.20859256E 04	68.	13624.	95.24
0.21225193E 04	62.	13686.	95.67
0.21591129E 04	62.	13748.	96.11

FUEL RESIDUALS DIST. FOR STAGE 1 (Continued)

0.21957065E 04	61.	13809.	96.53
0.22323002E 04	46.	13855.	96.85
0.22688938E 04	53.	13908.	97.22
0.23054874E 04	41.	13949.	97.51
0.23420811E 04	46.	13995.	97.83
0.23786747E 04	39.	14034.	98.11
0.24152683E 04	36.	14070.	98.36
0.24518619E 04	30.	14100.	98.57
0.24884555E 04	32.	14132.	98.79
0.25250492E 04	27.	14159.	98.98
0.25616428E 04	20.	14179.	99.12
0.25982364E 04	15.	14194.	99.22
0.26348301E 04	18.	14212.	99.35
0.26714237E 04	10.	14222.	99.42
0.27080173E 04	11.	14233.	99.50
0.27446110E 04	12.	14245.	99.58
0.27812046E 04	8.	14253.	99.64
0.28177982E 04	9.	14262.	99.70
0.28543919E 04	7.	14269.	99.75
0.28909855E 04	5.	14274.	99.78
0.29275791E 04	4.	14278.	99.81
0.29641727E 04	3.	14281.	99.83
0.30007663E 04	4.	14285.	99.86
0.30373600E 04	1.	14286.	99.87
0.30739536E 04	2.	14288.	99.88
0.31105472E 04	5.	14293.	99.92
0.31471409E 04	1.	14294.	99.92
0.31837345E 04	1.	14295.	99.93
0.32203281E 04	3.	14298.	99.95
0.32569218E 04	0.	14298.	99.95
0.32935154E 04	2.	14300.	99.97
0.33301090E 04	0.	14300.	99.97
0.33667026E 04	1.	14301.	99.97
0.34032962E 04	1.	14302.	99.98
0.34398899E 04	0.	14302.	99.98
0.34764835E 04	0.	14302.	99.98
0.35130771E 04	1.	14303.	99.99
0.35496708E 04	1.	14304.	99.99
0.35862644E 04	0.	14304.	99.99
0.36228580E 04	0.	14304.	99.99
0.36604524E 04	1.	14305.	100.00

LOX RESIDUALS DIST. FOR STAGE 1

CLASS INTERVAL	FREQ.	C FREQ.	C PRØB
0.48147063E-01	0.	0.	0.
0.42629232E 02	86.	86.	5.07
0.85210318E 02	77.	163.	9.62
0.12779140E 03	60.	223.	13.16
0.17037249E 03	59.	282.	16.64
0.21295357E 03	61.	343.	20.24
0.25553466E 03	61.	404.	23.83
0.29811575E 03	55.	459.	27.08
0.34069683E 03	77.	536.	31.62
0.38327792E 03	52.	588.	34.69
0.42585900E 03	66.	654.	38.58
0.46844009E 03	44.	698.	41.18
0.51102117E 03	53.	751.	44.31
0.55360226E 03	41.	792.	46.73
0.59618334E 03	51.	843.	49.73
0.63876443E 03	43.	886.	52.27
0.68134551E 03	32.	918.	54.16
0.72392660E 03	31.	949.	55.99
0.76650769E 03	37.	986.	58.17
0.80908877E 03	32.	1018.	60.06
0.85166986E 03	48.	1066.	62.89
0.89425094E 03	30.	1096.	64.66
0.93683203E 03	27.	1123.	56.25
0.97941311E 03	39.	1162.	68.55
0.10219941E 04	29.	1191.	70.27
0.10645752E 04	50.	1241.	73.22
0.11071564E 04	19.	1260.	74.34
0.11497374E 04	26.	1286.	75.87
0.11923185E 04	25.	1311.	77.35
0.12348996E 04	27.	1338.	78.94
0.12774806E 04	27.	1365.	80.53
0.13200618E 04	23.	1388.	81.89
0.13626429E 04	17.	1405.	82.89
0.14052239E 04	18.	1423.	83.95
0.14478050E 04	17.	1440.	84.96
0.14903861E 04	16.	1456.	85.90
0.15329672E 04	20.	1476.	87.08
0.15755483E 04	21.	1497.	88.32
0.16181293E 04	19.	1516.	89.44
0.16607104E 04	15.	1531.	90.32
0.17032915E 04	14.	1545.	91.15
0.17458726E 04	6.	1551.	91.50
0.17884537E 04	11.	1562.	92.15
0.18310348E 04	6.	1568.	92.51
0.18736158E 04	10.	1578.	93.10
0.19161969E 04	5.	1583.	93.39
0.19587781E 04	11.	1594.	94.04
0.20013591E 04	8.	1602.	94.51
0.20439402E 04	7.	1609.	94.93
0.20865212E 04	6.	1615.	95.28
0.21291023E 04	3.	1618.	95.46
0.21716835E 04	4.	1622.	95.69
0.22142645E 04	2.	1624.	95.81
0.22568456E 04	5.	1629.	96.11
0.22994267E 04	8.	1637.	96.58
0.23420078E 04	5.	1642.	96.87
0.23845889E 04	7.	1649.	97.29
0.24271700E 04	1.	1650.	97.35
0.24697510E 04	2.	1652.	97.46
0.25123321E 04	2.	1654.	97.58

LOX RESIDUALS DIST. FOR STAGE 1 (Continued)

0.25549132E 04	6.	1660.	97.94
0.25974943E 04	1.	1661.	97.99
0.26400754E 04	3.	1664.	98.17
0.26826565E 04	3.	1667.	98.35
0.27252375E 04	5.	1672.	98.64
0.27678186E 04	3.	1675.	98.82
0.28103997E 04	3.	1678.	99.00
0.28529808E 04	3.	1681.	99.17
0.28955619E 04	2.	1683.	99.29
0.29381429E 04	0.	1683.	99.29
0.29807241E 04	0.	1683.	99.29
0.30233052E 04	0.	1683.	99.29
0.30658862E 04	0.	1683.	99.29
0.31084673E 04	2.	1685.	99.41
0.31510484E 04	1.	1686.	99.47
0.31936295E 04	0.	1686.	99.47
0.32362106E 04	0.	1686.	99.47
0.32787917E 04	0.	1686.	99.47
0.33213727E 04	1.	1687.	99.53
0.33639538E 04	1.	1688.	99.59
0.34065349E 04	0.	1688.	99.59
0.34491160E 04	1.	1689.	99.65
0.34916971E 04	1.	1690.	99.71
0.35342782E 04	1.	1691.	99.76
0.35768592E 04	0.	1691.	99.76
0.36194403E 04	0.	1691.	99.76
0.36620215E 04	0.	1691.	99.76
0.37046025E 04	0.	1691.	99.76
0.37471836E 04	0.	1691.	99.76
0.37897646E 04	0.	1691.	99.76
0.38323458E 04	0.	1691.	99.76
0.38749269E 04	0.	1691.	99.76
0.39175079E 04	0.	1691.	99.76
0.39600890E 04	1.	1692.	99.82
0.40026701E 04	0.	1692.	99.82
0.40452512E 04	1.	1693.	99.88
0.40878323E 04	0.	1693.	99.88
0.41304134E 04	0.	1693.	99.88
0.41729944E 04	0.	1693.	99.88
0.42155755E 04	0.	1693.	99.88
0.42591567E 04	2.	1695.	100.00

TOTAL RESIDUALS DIST. FOR STAGE 2

CLASS INTERVAL	FREQ.	C FREQ.	C PRØB
0.26918139E-00	0.	0.	0.
0.22728054E 01	12.	12.	0.07
0.42764296E 01	16.	28.	0.17
0.62800536E 01	12.	40.	0.25
0.82836776E 01	14.	54.	0.34
0.10287301E 02	14.	68.	0.42
0.12290926E 02	27.	95.	0.59
0.14294550E 02	22.	117.	0.73
0.16298173E 02	30.	147.	0.92
0.18301798E 02	30.	177.	1.11
0.20305421E 02	33.	210.	1.31
0.22309045E 02	35.	245.	1.53
0.24312669E 02	41.	286.	1.79
0.26316293E 02	63.	349.	2.18
0.28319918E 02	53.	402.	2.51
0.30323541E 02	72.	474.	2.96
0.32327165E 02	95.	569.	3.56
0.34330789E 02	80.	649.	4.06
0.36334413E 02	77.	726.	4.54
0.38338037E 02	119.	845.	5.28
0.40341661E 02	131.	976.	6.10
0.42345285E 02	129.	1105.	6.91
0.44348909E 02	143.	1248.	7.80
0.46352533E 02	170.	1418.	8.86
0.48356157E 02	189.	1607.	10.04
0.50359781E 02	213.	1820.	11.37
0.52363405E 02	238.	2058.	12.86
0.54367029E 02	237.	2295.	14.34
0.56370652E 02	250.	2545.	15.91
0.58374277E 02	259.	2804.	17.52
0.60377901E 02	273.	3077.	19.23
0.62381525E 02	299.	3376.	21.10
0.64385149E 02	333.	3709.	23.18
0.66388772E 02	331.	4040.	25.25
0.68392397E 02	333.	4373.	27.33
0.70396020E 02	351.	4724.	29.52
0.72399645E 02	354.	5078.	31.74
0.74403269E 02	395.	5473.	34.21
0.76406892E 02	409.	5882.	36.76
0.78410517E 02	409.	6291.	39.32
0.80414140E 02	389.	6680.	41.75
0.82417765E 02	434.	7114.	44.46
0.84421388E 02	428.	7542.	47.14
0.86425012E 02	435.	7977.	49.86
0.88428636E 02	349.	8326.	52.04
0.90432260E 02	445.	8771.	54.82
0.92435884E 02	404.	9175.	57.34
0.94439508E 02	458.	9633.	60.21
0.96443132E 02	408.	10041.	62.76
0.98446756E 02	360.	10401.	65.01
0.10045037E 03	388.	10789.	67.43
0.10245400E 03	371.	11160.	69.75
0.10445762E 03	356.	11516.	71.97
0.10646125E 03	364.	11880.	74.25
0.10846487E 03	336.	12216.	76.35
0.11046850E 03	304.	12520.	78.25
0.11247212E 03	276.	12796.	79.97
0.11447574E 03	295.	13091.	81.82
0.11647937E 03	280.	13371.	83.57
0.11848299E 03	219.	13590.	84.94

TOTAL RESIDUALS DIST. FOR STAGE 2 (Continued)

0.12048662E 03	245.	13835.	86.47
0.12249024E 03	228.	14063.	87.89
0.12449387E 03	191.	14254.	89.09
0.12649749E 03	194.	14448.	90.30
0.12850111E 03	185.	14633.	91.46
0.13050473E 03	142.	14775.	92.34
0.13250836E 03	154.	14929.	93.31
0.13451198E 03	144.	15073.	94.21
0.13651561E 03	108.	15181.	94.88
0.13851923E 03	114.	15295.	95.59
0.14052286E 03	88.	15383.	96.14
0.14252648E 03	81.	15464.	96.65
0.14453010E 03	70.	15534.	97.09
0.14653373E 03	66.	15600.	97.50
0.14853735E 03	48.	15648.	97.80
0.15054098E 03	50.	15698.	98.11
0.1525446CE 03	50.	15748.	98.42
0.15454823E 03	41.	15789.	98.68
0.15655185E 03	39.	15828.	98.92
0.15855547E 03	30.	15858.	99.11
0.1605591CE 03	27.	15885.	99.28
0.16256272E 03	17.	15902.	99.39
0.16456635E 03	13.	15915.	99.47
0.16656997E 03	16.	15931.	99.57
0.1685736CE 03	13.	15944.	99.65
0.17057721E 03	9.	15953.	99.71
0.17258084E 03	6.	15959.	99.74
0.17458446E 03	11.	15970.	99.81
0.17658809E 03	10.	15980.	99.87
0.17859171E 03	4.	15984.	99.90
0.18059534E 03	2.	15986.	99.91
0.18259896E 03	4.	15990.	99.94
0.18460258E 03	3.	15993.	99.96
0.18660621E 03	2.	15995.	99.97
0.18860983E 03	4.	15999.	99.99
0.19061346E 03	0.	15999.	99.99
0.19261708E 03	0.	15999.	99.99
0.19462071E 03	0.	15999.	99.99
0.19662433E 03	0.	15999.	99.99
0.19862795E 03	0.	15999.	99.99
0.20163159E 03	1.	16000.	100.00

FUEL RESIDUALS DIST. FOR STAGE 2

CLASS INTERVAL	FREQ.	C FREQ.	C PRØB
0.26918139E-00	0.	0.	0.
0.22728054E 01	11.	11.	0.07
0.42764296E 01	12.	23.	0.14
0.62800536E 01	11.	34.	0.21
0.82836776E 01	12.	46.	0.29
0.10287301E 02	14.	60.	0.38
0.12290926E 02	26.	86.	0.54
0.14294550E 02	20.	106.	0.66
0.16298173E 02	29.	135.	0.85
0.18301798E 02	30.	165.	1.03
0.20305421E 02	33.	198.	1.24
0.22309045E 02	34.	232.	1.45
0.24312669E 02	41.	273.	1.71
0.26316293E 02	61.	334.	2.09
0.28319918E 02	51.	385.	2.41
0.30323541E 02	70.	455.	2.85
0.32327165E 02	95.	550.	3.45
0.34330789E 02	78.	628.	3.94
0.36334413E 02	76.	704.	4.41
0.38338037E 02	119.	823.	5.16
0.40341661E 02	131.	954.	5.98
0.42345285E 02	127.	1081.	6.77
0.44348909E 02	142.	1223.	7.65
0.46352533E 02	159.	1392.	8.72
0.48356157E 02	187.	1579.	9.89
0.50359781E 02	211.	1790.	11.22
0.52363405E 02	238.	2028.	12.71
0.54367029E 02	235.	2263.	14.18
0.56370652E 02	250.	2513.	15.75
0.58374277E 02	259.	2772.	17.37
0.60377901E 02	272.	3044.	19.08
0.62381525E 02	299.	3343.	20.95
0.64385149E 02	333.	3676.	23.04
0.66388772E 02	331.	4007.	25.11
0.68392397E 02	330.	4337.	27.18
0.70396020E 02	351.	4688.	29.38
0.72399645E 02	354.	5042.	31.60
0.74403269E 02	395.	5437.	34.07
0.76406892E 02	409.	5846.	36.63
0.78410517E 02	408.	6254.	39.19
0.80414140E 02	389.	6643.	41.63
0.82417765E 02	434.	7077.	44.35
0.84421388E 02	427.	7504.	47.02
0.86425012E 02	435.	7939.	49.75
0.88428636E 02	349.	8288.	51.94
0.90432260E 02	445.	8733.	54.72
0.92435884E 02	403.	9136.	57.25
0.94439508E 02	458.	9594.	60.12
0.96443132E 02	407.	10001.	62.67
0.98446756E 02	360.	10361.	64.93
0.10045037E 03	388.	10749.	67.36
0.10245400E 03	370.	11119.	69.68
0.10445762E 03	356.	11475.	71.91
0.10646125E 03	364.	11839.	74.19
0.10846487E 03	336.	12175.	76.29
0.11046850E 03	304.	12479.	78.20
0.11247212E 03	276.	12755.	79.93
0.11447574E 03	295.	13050.	81.78
0.11647937E 03	280.	13330.	83.53
0.11848299E 03	219.	13549.	84.90

FUEL RESIDUALS DIST. FOR STAGE 2 (Continued)

0.12048662E 03	245.	13794.	86.44
0.12249024E 03	228.	14022.	87.87
0.12449387E 03	191.	14213.	89.07
0.12649749E 03	194.	14407.	90.28
0.12850111E 03	185.	14592.	91.44
0.13050473E 03	142.	14734.	92.33
0.13250836E 03	154.	14888.	93.29
0.13451198E 03	144.	15032.	94.20
0.13651561E 03	108.	15140.	94.87
0.13851923E 03	113.	15253.	95.58
0.14052286E 03	88.	15341.	96.13
0.14252648E 03	81.	15422.	96.64
0.14453010E 03	70.	15492.	97.08
0.14653373E 03	66.	15558.	97.49
0.14853735E 03	48.	15606.	97.79
0.15054098E 03	50.	15656.	98.11
0.15254460E 03	50.	15706.	98.42
0.15454823E 03	41.	15747.	98.68
0.15655185E 03	39.	15786.	98.92
0.15855547E 03	30.	15816.	99.11
0.16055910E 03	27.	15843.	99.28
0.16256272E 03	17.	15860.	99.39
0.16456635E 03	13.	15873.	99.47
0.16656997E 03	16.	15889.	99.57
0.16857360E 03	13.	15902.	99.65
0.17057721E 03	9.	15911.	99.71
0.17258084E 03	6.	15917.	99.74
0.17458446E 03	11.	15928.	99.81
0.17658809E 03	10.	15938.	99.87
0.17859171E 03	4.	15942.	99.90
0.18059534E 03	2.	15944.	99.91
0.18259896E 03	4.	15948.	99.94
0.18460258E 03	3.	15951.	99.96
0.18660621E 03	2.	15953.	99.97
0.18860983E 03	4.	15957.	99.99
0.19061346E 03	0.	15957.	99.99
0.19261708E 03	0.	15957.	99.99
0.19462071E 03	0.	15957.	99.99
0.19662433E 03	0.	15957.	99.99
0.19862795E 03	0.	15957.	99.99
0.20163159E 03	1.	15958.	100.00

. LOX RESIDUALS DIST. FOR STAGE 2

CLASS INTERVAL	FREQ.	C FREQ.	C PRØB
0.83493423E 00	0.	0.	0.
0.22074715E 01	1.	1.	2.38
0.35800089E 01	2.	3.	7.14
0.49525462E 01	2.	5.	11.90
0.63250835E 01	1.	6.	14.29
0.76976208E 01	1.	7.	16.67
0.90701581E 01	1.	8.	19.05
0.10442695E 02	0.	8.	19.05
0.11815232E 02	1.	9.	21.43
0.13187770E 02	1.	10.	23.81
0.14560307E 02	2.	12.	28.57
0.15932844E 02	0.	12.	28.57
0.17305381E 02	0.	12.	28.57
0.18677919E 02	0.	12.	28.57
0.20050456E 02	0.	12.	28.57
0.21422993E 02	0.	12.	28.57
0.22795530E 02	1.	13.	30.95
0.24168067E 02	0.	13.	30.95
0.25540604E 02	2.	15.	35.71
0.26913141E 02	2.	17.	40.48
0.28285678E 02	0.	17.	40.48
0.29658215E 02	1.	18.	42.86
0.31030753E 02	1.	19.	45.24
0.32403290E 02	0.	19.	45.24
0.33775827E 02	2.	21.	50.00
0.35148364E 02	0.	21.	50.00
0.36520901E 02	1.	22.	52.38
0.37893438E 02	0.	22.	52.38
0.39265975E 02	0.	22.	52.38
0.40638512E 02	0.	22.	52.38
0.42011049E 02	1.	23.	54.76
0.43383586E 02	2.	25.	59.52
0.44756123E 02	0.	25.	59.52
0.46128661E 02	1.	26.	61.90
0.47501198E 02	2.	28.	66.67
0.48873735E 02	1.	29.	69.05
0.50246272E 02	1.	30.	71.43
0.51618809E 02	0.	30.	71.43
0.52991346E 02	0.	30.	71.43
0.54363883E 02	2.	32.	76.19
0.55736421E 02	0.	32.	76.19
0.57108958E 02	0.	32.	76.19
0.58481495E 02	0.	32.	76.19
0.59854032E 02	1.	33.	78.57
0.61226569E 02	0.	33.	78.57
0.62599106E 02	0.	33.	78.57
0.63971644E 02	0.	33.	78.57
0.65344181E 02	0.	33.	78.57
0.66716717E 02	1.	34.	80.95
0.68089254E 02	1.	35.	83.33
0.69461790E 02	1.	36.	85.71
0.70834327E 02	0.	36.	85.71
0.72206864E 02	0.	36.	85.71
0.73579401E 02	0.	36.	85.71
0.74951937E 02	0.	36.	85.71
0.76324474E 02	0.	36.	85.71
0.77697010E 02	1.	37.	88.10
0.79069547E 02	0.	37.	88.10
0.80442084E 02	0.	37.	88.10
0.81814621E 02	0.	37.	88.10

PAYLOAD DISTRIBUTION (Continued)

0.36040942E 05	0.27835292E 03
0.36079024E 05	0.25423378E 03
0.36117105E 05	0.23071748E 03
0.36155187E 05	0.20803376E 03
0.36193269E 05	0.18637580E 03
0.36231352E 05	0.16589908E 03
0.36269434E 05	0.14672138E 03
0.36307516E 05	0.12892406E 03
0.36345597E 05	0.11255426E 03
0.36383680E 05	0.97627764E 02
0.36421762E 05	0.84132588E 02
0.36459844E 05	0.72032852E 02
0.36497926E 05	0.61272889E 02
0.36536008E 05	0.51781335E 02
0.36574090E 05	0.43475141E 02
0.36612172E 05	0.36263294E 02
0.36650254E 05	0.30050204E 02
0.36688336E 05	0.24738703E 02
0.36726418E 05	0.20232564E 02
0.36764500E 05	0.16438589E 02
0.36802582E 05	0.13268217E 02
0.36840664E 05	0.10638729E 02
0.36878746E 05	0.84740432E 01
0.36916828E 05	0.67051657E 01
0.36954910E 05	0.52703605E 01
0.36992992E 05	0.41150673E 01
0.37031075E 05	0.31916320E 01
0.37069156E 05	0.24589019E 01
0.37107238E 05	0.18817194E 01
0.37145320E 05	0.14303631E 01
0.37183402E 05	0.10799599E 01
0.37221485E 05	0.80989846E 00
0.37259567E 05	0.60326229E 00
0.37297648E 05	0.44629812E-00
0.37335730E 05	0.32792714E-00
0.37373812E 05	0.23930537E-00
0.37411895E 05	0.17343593E-00
0.37449977E 05	0.12483178E-00
0.37488059E 05	0.89227328E-01
0.37526140E 05	0.63334940E-01
0.37564223E 05	0.
MEAN= 0.355134696E 05	
STANDARD DEVIATION= 0.479711607E 03	
SKEWNESS= -0.166068502E-01	
PEAKNESS= 0.297706544E 01	

TOTAL RESIDUALS DIST. FOR STAGE 1

X(I)	Y(I)
0.21338689E 02	0.12802381E 03
0.63919776E 02	0.14729007E 03
0.10650086E 03	0.16782577E 03
0.14908195E 03	0.18947614E 03
0.19166303E 03	0.21204837E 03
0.23424412E 03	0.23531337E 03
0.27682520E 03	0.25900908E 03
0.31940629E 03	0.28284494E 03
0.36198737E 03	0.30650781E 03
0.40456846E 03	0.32966898E 03
0.44714954E 03	0.35199213E 03
0.48973063E 03	0.37314196E 03
0.53231172E 03	0.39279326E 03
0.57489280E 03	0.41063997E 03
0.61747389E 03	0.42640393E 03
0.66005497E 03	0.43984292E 03
0.70263606E 03	0.45075782E 03
0.74521714E 03	0.45899820E 03
0.78779823E 03	0.46446662E 03
0.83037931E 03	0.46712099E 03
0.87296040E 03	0.46697512E 03
0.91554148E 03	0.46409748E 03
0.95812257E 03	0.45860795E 03
0.10007036E 04	0.45067323E 03
0.10432847E 04	0.44050046E 03
0.10858658E 04	0.42833003E 03
0.11284468E 04	0.41442727E 03
0.11710279E 04	0.39907392E 03
0.12136091E 04	0.38255941E 03
0.12561901E 04	0.36517238E 03
0.12987712E 04	0.34719288E 03
0.13413523E 04	0.32888541E 03
0.13839334E 04	0.31049304E 03
0.14265145E 04	0.29223281E 03
0.14690956E 04	0.27429257E 03
0.15116766E 04	0.25682905E 03
0.15542577E 04	0.23996736E 03
0.15968388E 04	0.22380166E 03
0.16394199E 04	0.20839691E 03
0.16820010E 04	0.19379149E 03
0.17245821E 04	0.18000045E 03
0.17671631E 04	0.16701917E 03
0.18097442E 04	0.15482736E 03
0.18523254E 04	0.14339283E 03
0.18949064E 04	0.13267531E 03
0.19374875E 04	0.12262980E 03
0.19800685E 04	0.11320955E 03
0.20226496E 04	0.10436850E 03
0.20652308E 04	0.96063196E 02
0.21078118E 04	0.88254119E 02
0.21503929E 04	0.80906536E 02
0.21929740E 04	0.73990843E 02
0.22355551E 04	0.67482526E 02
0.22781362E 04	0.61361784E 02
0.23207173E 04	0.55612931E 02
0.23632983E 04	0.50223630E 02
0.24058794E 04	0.45184039E 02
0.24484605E 04	0.40485980E 02
0.24910416E 04	0.36122122E 02
0.25336227E 04	0.32085276E 02

TOTAL RESIDUALS DIST. FOR STAGE 1 (continued)

0.25762038E 04	0.28367795E 02
0.26187848E 04	0.24961140E 02
0.26613659E 04	0.21855553E 02
0.27039471E 04	0.19039898E 02
0.27465281E 04	0.16501617E 02
0.27891092E 04	0.14226810E 02
0.28316903E 04	0.12200376E 02
0.28742713E 04	0.10406248E 02
0.29168525E 04	0.88276622E 01
0.29594335E 04	0.74474405E 01
0.30020146E 04	0.62482874E 01
0.30445957E 04	0.52130704E 01
0.30871768E 04	0.43250737E 01
0.31297579E 04	0.35682227E 01
0.31723390E 04	0.29272648E 01
0.32149200E 04	0.23879150E 01
0.32575011E 04	0.19369528E 01
0.33000822E 04	0.15622861E 01
0.33426633E 04	0.12529753E 01
0.33852444E 04	0.99922892E 00
0.34278255E 04	0.79237170E 00
0.34704065E 04	0.62479282E 00
0.35129876E 04	0.48987862E-00
0.35555688E 04	0.38193464E-00
0.35981498E 04	0.29610172E-00
0.36407309E 04	0.22826935E-00
0.36833120E 04	0.17498985E-00
0.37258931E 04	0.13339536E-00
0.37684742E 04	0.10111961E-00
0.38110553E 04	0.76225641E-01
0.38536363E 04	0.57140271E-01
0.38962174E 04	0.42595478E-01
0.39387985E 04	0.31576876E-01
0.39813796E 04	0.23278978E-01
0.40239607E 04	0.17066802E-01
0.40665417E 04	0.12443385E-01
0.41091228E 04	0.90225115E-02
0.41517039E 04	0.65061419E-02
0.41942850E 04	0.46658523E-02
0.42368660E 04	0.33277778E-02
0.42794470E 04	0.

MEAN= 0.997950144E 03

STANDARD DEVIATION= 0.602314599E 03

SKEWNESS= 0.560839526E 00

PEAKNESS= 0.307310149E 01

FUEL RESIDUALS FOR STAGE 1

X(I)	Y(I)
0.18385497E 02	0.83686201E 02
0.54979134E 02	0.95351172E 02
0.91572770E 02	0.10783827E 03
0.12816641E 03	0.12109867E 03
0.16476005E 03	0.13506690E 03
0.20135368E 03	0.14966068E 03
0.23794731E 03	0.16478126E 03
0.27454095E 03	0.18031415E 03
0.31113459E 03	0.19613031E 03
0.34772823E 03	0.21208777E 03
0.38432186E 03	0.22803381E 03
0.42091550E 03	0.24380733E 03
0.45750914E 03	0.25924173E 03
0.49410277E 03	0.27416804E 03
0.53069640E 03	0.28841814E 03
0.56729004E 03	0.30182829E 03
0.60388368E 03	0.31424241E 03
0.64047731E 03	0.32551555E 03
0.67707095E 03	0.33551693E 03
0.71366458E 03	0.34413282E 03
0.75025821E 03	0.35126899E 03
0.78685185E 03	0.35685272E 03
0.82344548E 03	0.36083418E 03
0.86003912E 03	0.36318748E 03
0.89663276E 03	0.36391080E 03
0.93322639E 03	0.36302611E 03
0.96982003E 03	0.36057832E 03
0.10064136E 04	0.35663370E 03
0.10430072E 04	0.35127798E 03
0.10796009E 04	0.34461392E 03
0.11161945E 04	0.33675851E 03
0.11527882E 04	0.32784001E 03
0.11893818E 04	0.31799477E 03
0.12259754E 04	0.30736403E 03
0.12625691E 04	0.29609075E 03
0.12991627E 04	0.28431661E 03
0.13357563E 04	0.27217923E 03
0.13723499E 04	0.25980972E 03
0.14089435E 04	0.24733052E 03
0.14455371E 04	0.23485372E 03
0.14821308E 04	0.22247981E 03
0.15187244E 04	0.21029674E 03
0.15553181E 04	0.19837955E 03
0.15919117E 04	0.18679032E 03
0.16285053E 04	0.17557848E 03
0.16650990E 04	0.16478145E 03
0.17016926E 04	0.15442554E 03
0.17382862E 04	0.14452702E 03
0.17748798E 04	0.13509340E 03
0.18114734E 04	0.12612469E 03
0.18480670E 04	0.11761476E 03
0.18846607E 04	0.10955267E 03
0.19212543E 04	0.10192388E 03
0.19578479E 04	0.94711408E 02
0.19944416E 04	0.87896824E 02
0.20310352E 04	0.81461120E 02
0.20676289E 04	0.75385417E 02
0.21042225E 04	0.69651496E 02
0.21408161E 04	0.64242187E 02
0.21774098E 04	0.59141627E 02

FUEL RESIDUALS FOR STAGE 1 (Continued)

0.22140034E 04	0.54335365E 02
0.22505970E 04	0.49810379E 02
0.22871906E 04	0.45555012E 02
0.23237842E 04	0.41558815E 02
0.23603778E 04	0.37812370E 02
0.23969715E 04	0.34307065E 02
0.24335651E 04	0.31034889E 02
0.24701588E 04	0.27988199E 02
0.25067524E 04	0.25159532E 02
0.25433460E 04	0.22541425E 02
0.25799397E 04	0.20126285E 02
0.26165333E 04	0.17906279E 02
0.26531269E 04	0.15873268E 02
0.26897205E 04	0.14018769E 02
0.27263141E 04	0.12333973E 02
0.27629077E 04	0.10809752E 02
0.27995014E 04	0.94367308E 01
0.28360950E 04	0.82053398E 01
0.28726887E 04	0.71059097E 01
0.29092823E 04	0.61287557E 01
0.29458759E 04	0.52642699E 01
0.29824696E 04	0.45030094E 01
0.30190632E 04	0.38357840E 01
0.30556568E 04	0.32537287E 01
0.30922505E 04	0.27483710E 01
0.31288441E 04	0.23116836E 01
0.31654377E 04	0.19361281E 01
0.32020313E 04	0.16146823E 01
0.32386249E 04	0.13408586E 01
0.32752185E 04	0.11087113E 01
0.33118122E 04	0.91283195E 00
0.33484058E 04	0.74833853E 00
0.33849995E 04	0.61085619E 00
0.34215931E 04	0.49649254E-00
0.34581867E 04	0.40180843E-00
0.34947804E 04	0.32378595E-00
0.35313740E 04	0.25979465E-00
0.35679676E 04	0.20755655E-00
0.36045612E 04	0.16511171E-00
0.36411548E 04	0.13078436E-00
0.36777484E 04	0.

MEAN= 0.102419928E 04

STANDARD DEVIATION= 0.589595035E 03

SKEWNESS= 0.485901058E-00

PEAKNESS= 0.286779977E 01

LOX RESIDUALS DIST. FOR STAGE 1

X(I)	Y(I)
0.21338689E 02	0.32475276E 02
0.63919776E 02	0.35137153E 02
0.10650086E 03	0.37700698E 02
0.14908195E 03	0.40125934E 02
0.19166303E 03	0.42373779E 02
0.23424412E 03	0.44407089E 02
0.27682520E 03	0.46191692E 02
0.31940629E 03	0.47697373E 02
0.36198737E 03	0.48898776E 02
0.40456846E 03	0.49776181E 02
0.44714954E 03	0.50316139E 02
0.48973063E 03	0.50511909E 02
0.53231172E 03	0.50363716E 02
0.57489280E 03	0.49878780E 02
0.61747389E 03	0.49071130E 02
0.66005497E 03	0.47961220E 02
0.70263606E 03	0.46575315E 02
0.74521714E 03	0.44944730E 02
0.78779823E 03	0.43104893E 02
0.83037931E 03	0.41094306E 02
0.87296040E 03	0.38953427E 02
0.91554148E 03	0.36723507E 02
0.95812257E 03	0.34445446E 02
0.10007036E 04	0.32158694E 02
0.10432847E 04	0.29900231E 02
0.10858658E 04	0.27703687E 02
0.11284468E 04	0.25598588E 02
0.11710279E 04	0.23609792E 02
0.12136091E 04	0.21757103E 02
0.12561901E 04	0.20055063E 02
0.12987712E 04	0.18512945E 02
0.13413523E 04	0.17134915E 02
0.13839334E 04	0.15920352E 02
0.14265145E 04	0.14864302E 02
0.14690956E 04	0.13958051E 02
0.15116766E 04	0.13189766E 02
0.15542577E 04	0.12545195E 02
0.15968388E 04	0.12008385E 02
0.16394199E 04	0.11562385E 02
0.16820010E 04	0.11189923E 02
0.17245821E 04	0.10874015E 02
0.17671631E 04	0.10598512E 02
0.18097442E 04	0.10348542E 02
0.18523254E 04	0.10110873E 02
0.18949064E 04	0.98741595E 01
0.19374875E 04	0.96291044E 01
0.19800685E 04	0.93685165E 01
0.20226496E 04	0.90872905E 01
0.20652308E 04	0.87823070E 01
0.21078118E 04	0.84522757E 01
0.21503929E 04	0.80975290E 01
0.21929740E 04	0.77197838E 01
0.22355551E 04	0.73218822E 01
0.22781362E 04	0.69075258E 01
0.23207173E 04	0.64810170E 01
0.23632983E 04	0.60470105E 01
0.24058794E 04	0.56102901E 01
0.24484605E 04	0.51755711E 01
0.24910416E 04	0.47473342E 01
0.25336227E 04	0.43296923E 01

LOX RESIDUALS DIST. FOR STAGE 1 (Continued)

0.25762038E 04	0.39262925E 01
0.26187848E 04	0.35402457E 01
0.26613659E 04	0.31740896E 01
0.27039471E 04	0.28297780E 01
0.27465281E 04	0.25086898E 01
0.27891092E 04	0.22116590E 01
0.28316903E 04	0.19390189E 01
0.28742713E 04	0.16906552E 01
0.29168525E 04	0.14660674E 01
0.29594335E 04	0.12644321E 01
0.30020146E 04	0.10846668E 01
0.30445957E 04	0.92549279E 00
0.30871768E 04	0.78549166E 00
0.31297579E 04	0.66315909E 00
0.31723390E 04	0.55695084E 00
0.32149200E 04	0.46532225E-00
0.32575011E 04	0.38676137E-00
0.33000822E 04	0.31981475E-00
0.33426633E 04	0.26310772E-00
0.33852444E 04	0.21535812E-00
0.34278255E 04	0.17538563E-00
0.34704065E 04	0.14211631E-00
0.35129876E 04	0.11458362E-00
0.35555688E 04	0.91926540E-01
0.35981498E 04	0.73385418E-01
0.36407309E 04	0.58296088E-01
0.36833120E 04	0.46082889E-01
0.37258931E 04	0.36251014E-01
0.37684742E 04	0.28378523E-01
0.38110553E 04	0.22108406E-01
0.38536363E 04	0.17140817E-01
0.38962174E 04	0.13225744E-01
0.39387985E 04	0.10156194E-01
0.39813796E 04	0.77619652E-02
0.40239607E 04	0.59040406E-02
0.40665417E 04	0.44696231E-02
0.41091228E 04	0.33677747E-02
0.41517039E 04	0.25256443E-02
0.41942850E 04	0.18852307E-02
0.42368660E 04	0.14006382E-02
0.42794470E 04	0.

MEAN= 0.776473582E 03

STANDARD DEVIATION= 0.660215147E 03

SKEWNESS= 0.134027310E 01

PEAKNESS= 0.528357118E 01

TOTAL RESIDUALS DIST. FOR STAGE 2

X(I)	Y(I)
0.12709934E 01	0.67332231E 01
0.32746175E 01	0.82572728E 01
0.52782416E 01	0.99525095E 01
0.72818656E 01	0.12007166E 02
0.92854897E 01	0.14412449E 02
0.11289114E 02	0.17212286E 02
0.13292737E 02	0.20452959E 02
0.15296362E 02	0.24182603E 02
0.17299986E 02	0.28450564E 02
0.19303609E 02	0.33306628E 02
0.21307234E 02	0.38800109E 02
0.23310858E 02	0.44978766E 02
0.25314482E 02	0.51887639E 02
0.27318106E 02	0.59567719E 02
0.29321729E 02	0.68054571E 02
0.31325354E 02	0.77376858E 02
0.33328977E 02	0.87554844E 02
0.35332602E 02	0.98598920E 02
0.37336225E 02	0.11050815E 03
0.39339849E 02	0.12326895E 03
0.41343473E 02	0.13685391E 03
0.43347097E 02	0.15122076E 03
0.45350721E 02	0.16631173E 03
0.47354345E 02	0.18205301E 03
0.49357969E 02	0.19835474E 03
0.51361593E 02	0.21511127E 03
0.53365217E 02	0.23220178E 03
0.55368841E 02	0.24949144E 03
0.57372465E 02	0.26683283E 03
0.59376089E 02	0.28406791E 03
0.61379713E 02	0.30103021E 03
0.63383336E 02	0.31754750E 03
0.65386961E 02	0.33344457E 03
0.67390585E 02	0.34854636E 03
0.69394208E 02	0.36268121E 03
0.71397833E 02	0.37568407E 03
0.73401456E 02	0.38739975E 03
0.75405081E 02	0.39768606E 03
0.77408704E 02	0.40641667E 03
0.79412328E 02	0.41348877E 03
0.81415953E 02	0.41880024E 03
0.83419576E 02	0.42230148E 03
0.85423201E 02	0.42394672E 03
0.87426824E 02	0.42371978E 03
0.89430448E 02	0.42162933E 03
0.91434072E 02	0.41770856E 03
0.93437696E 02	0.41201433E 03
0.95441320E 02	0.40462582E 03
0.97444944E 02	0.39564268E 03
0.99448568E 02	0.38518286E 03
0.10145219E 03	0.37338004E 03
0.10345581E 03	0.36038074E 03
0.10545944E 03	0.34634143E 03
0.10746306E 03	0.33142541E 03
0.10946669E 03	0.31579969E 03
0.11147031E 03	0.29963201E 03
0.11347393E 03	0.28308794E 03
0.11547755E 03	0.26632824E 03
0.11748118E 03	0.24950641E 03
0.11948480E 03	0.23276671E 03

TOTAL RESIDUALS DIST. FOR STAGE 2 (Continued)

0.12148843E 03	0.21624223E 03
0.12349205E 03	0.20005365E 03
0.12549568E 03	0.18430814E 03
0.12749930E 03	0.16909868E 03
0.12950292E 03	0.15450380E 03 ✓
0.13150655E 03	0.14058750E 03
0.13351017E 03	0.12739962E 03
0.13551380E 03	0.11497635E 03
0.13751742E 03	0.10334103E 03
0.13952105E 03	0.92505097E 02
0.14152467E 03	0.82469189E 02
0.14352829E 03	0.73224306E 02 ✓
0.14553192E 03	0.64753070E 02
0.14753554E 03	0.57030983E 02
0.14953917E 03	0.50027678E 02
0.15154279E 03	0.43708119E 02
0.15354642E 03	0.38033755E 02
0.15555003E 03	0.32963578E 02
0.15755366E 03	0.28455090E 02
0.15955728E 03	0.24465165E 02
0.16156091E 03	0.20950805E 02 ✓
0.16356453E 03	0.17869779E 02
0.16556816E 03	0.15181149E 02
0.16757178E 03	0.12845705E 02
0.16957540E 03	0.10826287E 02
0.17157903E 03	0.90880270E 01
0.17358265E 03	0.75985016E 01
0.17558628E 03	0.63278198E 01
0.17758990E 03	0.52486458E 01
0.17959353E 03	0.43361691E 01
0.18159715E 03	0.35680389E 01
0.18360077E 03	0.29242577E 01
0.18560439E 03	0.23870546E 01
0.18760802E 03	0.19407402E 01
0.18961164E 03	0.15715503E 01
0.19161527E 03	0.12674831E 01
0.19361889E 03	0.10181365E 01
0.19562252E 03	0.81454795E 00
0.19762614E 03	0.64903859E 00
0.19962976E 03	0.51506738E 00
0.20163339E 03	0.

MEAN= 0.868734784E 02

STANDARD DEVIATION= 0.301655769E 02

SKEWNESS= 0.458989017E-01

PEAKNESS= 0.287989244E 01

FUEL RESIDUALS FOR STAGE 2

X(I)	Y(I)
0.12709934E 01	0.63243465E 01
0.32746175E 01	0.77408486E 01
0.52782416E 01	0.94236407E 01
0.72818656E 01	0.11411140E 02
0.92854897E 01	0.13744876E 02
0.11289114E 02	0.16469242E 02
0.13292737E 02	0.19631138E 02
0.15296362E 02	0.23279487E 02
0.17299986E 02	0.27464582E 02
0.19303609E 02	0.32237322E 02
0.21307234E 02	0.37648273E 02
0.23310858E 02	0.43746591E 02
0.25314482E 02	0.50578819E 02
0.27318106E 02	0.58187533E 02
0.29321729E 02	0.66609928E 02
0.31325354E 02	0.75876293E 02
0.33328977E 02	0.86008485E 02
0.35332602E 02	0.97018377E 02
0.37336225E 02	0.10890638E 03
0.39339849E 02	0.12166005E 03
0.41343473E 02	0.13525285E 03
0.43347097E 02	0.14964312E 03
0.45350721E 02	0.16477334E 03
0.47354345E 02	0.18056960E 03
0.49357969E 02	0.19694152E 03
0.51361593E 02	0.21378256E 03
0.53365217E 02	0.23097065E 03
0.55368841E 02	0.24836927E 03
0.57372465E 02	0.26582905E 03
0.59376089E 02	0.28318966E 03
0.61379713E 02	0.30028219E 03
0.63383336E 02	0.31693169E 03
0.65386961E 02	0.33296026E 03
0.67390585E 02	0.34819012E 03
0.69394208E 02	0.36244697E 03
0.71397833E 02	0.37556330E 03
0.73401456E 02	0.38738171E 03
0.75405081E 02	0.39775813E 03
0.77408704E 02	0.40656473E 03
0.79412328E 02	0.41369261E 03
0.81415953E 02	0.41905401E 03
0.83419576E 02	0.42258418E 03
0.85423201E 02	0.42424263E 03
0.87426824E 02	0.42401394E 03
0.89430448E 02	0.42190791E 03
0.91434072E 02	0.41795920E 03
0.93437696E 02	0.41222645E 03
0.95441320E 02	0.40479085E 03
0.97444944E 02	0.39575417E 03
0.99448568E 02	0.38523655E 03
0.10145219E 03	0.37337383E 03
0.10345581E 03	0.36031465E 03
0.10545944E 03	0.34621741E 03
0.10746306E 03	0.33124712E 03
0.10946669E 03	0.31557225E 03
0.11147031E 03	0.29936177E 03
0.11347393E 03	0.28278211E 03
0.11547755E 03	0.26599460E 03
0.11748118E 03	0.24915305E 03
0.11948480E 03	0.23240162E 03

FUEL RESIDUALS FOR STAGE 2 (Continued)

0.12148843E 03	0.21587323E 03
0.12349205E 03	0.19968800E 03
0.12549568E 03	0.18395244E 03
0.12749930E 03	0.16875871E 03
0.12950292E 03	0.15418439E 03
0.13150655E 03	0.14029253E 03
0.13351017E 03	0.12713198E 03
0.13551380E 03	0.11473792E 03
0.13751742E 03	0.10313281E 03
0.13952105E 03	0.92327221E 02
0.14152467E 03	0.82321045E 02
0.14352829E 03	0.73104649E 02
0.14553192E 03	0.64660139E 02
0.14753554E 03	0.56962621E 02
0.14953917E 03	0.49981438E 02
0.15154279E 03	0.43681390E 02
0.15354642E 03	0.38023850E 02
0.15555003E 03	0.32967829E 02
0.15755366E 03	0.28470916E 02
0.15955728E 03	0.24490135E 02
0.16156091E 03	0.20982681E 02
0.16356453E 03	0.17906547E 02
0.16556816E 03	0.15221038E 02
0.16757178E 03	0.12887195E 02
0.16957540E 03	0.10868108E 02
0.17157903E 03	0.91291464E 01
0.17358265E 03	0.76381116E 01
0.17558628E 03	0.63653143E 01
0.17758990E 03	0.52835990E 01
0.17959353E 03	0.43683122E 01
0.18159715E 03	0.35972341E 01
0.18360077E 03	0.29504748E 01
0.18560439E 03	0.24103495E 01
0.18760802E 03	0.19612338E 01
0.18961164E 03	0.15894107E 01
0.19161527E 03	0.12829096E 01
0.19361889E 03	0.10313468E 01
0.19562252E 03	0.82576718E 00
0.19762614E 03	0.65849094E 00
0.19962976E 03	0.52296942E 00
0.20163339E 03	0.

MEAN= 0.869961381E 02

STANDARD DEVIATION= 0.300684720E 02

SKEWNESS= 0.542395771E-01

PEAKNESS= 0.287451975E 01

LOX RESIDUALS DIST. FOR STAGE 2

X(I)	Y(I)
0.15212028E 01	0.43501520E-00
0.28937402E 01	0.46339163E-00
0.42662775E 01	0.49175566E-00
0.56388148E 01	0.51993735E 00
0.70113521E 01	0.54776160E 00
0.83838893E 01	0.57504983E 00
0.97564266E 01	0.60162210E 00
0.11128964E 02	0.62729897E 00
0.12501501E 02	0.65190364E 00
0.13874038E 02	0.67526407E 00
0.15246575E 02	0.69721510E 00
0.16619112E 02	0.71760046E 00
0.17991650E 02	0.73627485E 00
0.19364187E 02	0.75310581E 00
0.20736724E 02	0.76797538E 00
0.22109261E 02	0.78078178E 00
0.23481798E 02	0.79144073E 00
0.24854335E 02	0.79988664E 00
0.26226872E 02	0.80607337E 00
0.27599410E 02	0.80997501E 00
0.28971947E 02	0.81158610E 00
0.30344484E 02	0.81092169E 00
0.31717021E 02	0.80801717E 00
0.33089558E 02	0.80292762E 00
0.34462095E 02	0.79572702E 00
0.35834633E 02	0.78650726E 00
0.37207170E 02	0.77537657E 00
0.38579707E 02	0.76245824E 00
0.39952244E 02	0.74788861E 00
0.41324781E 02	0.73181535E 00
0.42697318E 02	0.71439523E 00
0.44069856E 02	0.69579206E 00
0.45442393E 02	0.67617447E 00
0.46814930E 02	0.65571371E 00
0.48187467E 02	0.63458135E 00
0.49560004E 02	0.61294723E 00
0.50932541E 02	0.59097739E 00
0.52305079E 02	0.56883209E 00
0.53677616E 02	0.54666409E 00
0.55050153E 02	0.52461703E 00
0.56422690E 02	0.50282404E 00
0.57795227E 02	0.48140660E-00
0.59167764E 02	0.46047358E-00
0.60540301E 02	0.44012056E-00
0.61912838E 02	0.42042928E-00
0.63285375E 02	0.40146759E-00
0.64657912E 02	0.38328934E-00
0.66030449E 02	0.36593460E-00
0.67402985E 02	0.34943020E-00
0.68775522E 02	0.33379024E-00
0.70148058E 02	0.31901697E-00
0.71520595E 02	0.30510168E-00
0.72893132E 02	0.29202573E-00
0.74265669E 02	0.27976175E-00
0.75638206E 02	0.26827475E-00
0.77010742E 02	0.25752345E-00
0.78383279E 02	0.24746150E-00
0.79755815E 02	0.23803870E-00
0.81128352E 02	0.22920222E-00
0.82500888E 02	0.22089779E-00

LOX RESIDUALS DIST. FOR STAGE 2 (Continued)

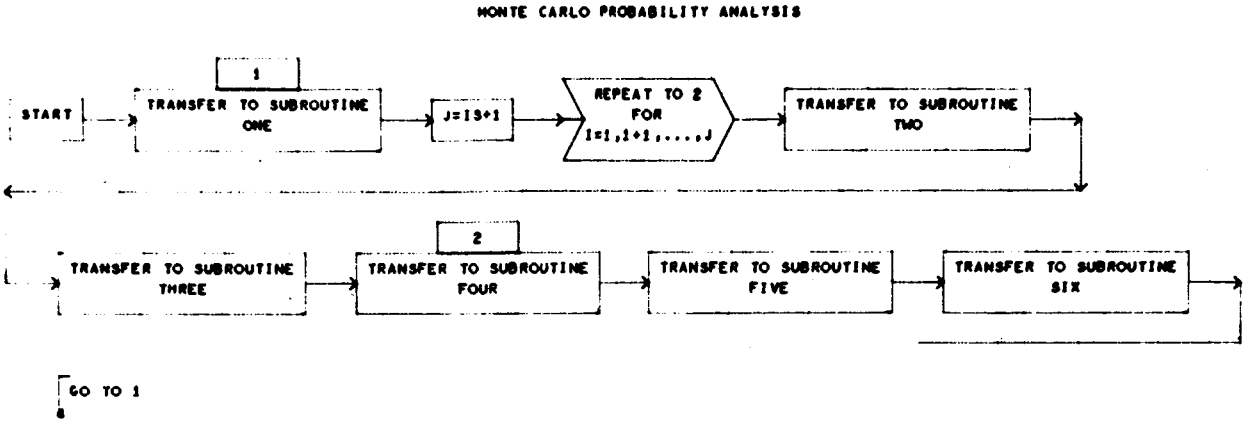
0.83873425E 02	0.21307074E-00
0.85245962E 02	0.20566700E-00
0.86618499E 02	0.19863401E-00
0.87991035E 02	0.19192155E-00
0.89363572E 02	0.18548230E-00
0.90736108E 02	0.17927255E-00
0.92108645E 02	0.17325252E-00
0.93481182E 02	0.16738671E-00
0.94853719E 02	0.16164415E-00
0.96226255E 02	0.15599845E-00
0.97598792E 02	0.15042785E-00
0.98971328E 02	0.14491507E-00
0.10034386E 03	0.13944720E-00
0.10171640E 03	0.13401542E-00
0.10308894E 03	0.12861472E-00
0.10446147E 03	0.12324358E-00
0.10583401E 03	0.11790353E-00
0.10720655E 03	0.11259882E-00
0.10857908E 03	0.10733595E-00
0.10995162E 03	0.10212330E-00
0.11132415E 03	0.96970653E-01
0.11269669E 03	0.91888871E-01
0.11406923E 03	0.86889466E-01
0.11544176E 03	0.81984259E-01
0.11681430E 03	0.77185072E-01
0.11818684E 03	0.72503415E-01
0.11955938E 03	0.67950246E-01
0.12093191E 03	0.63535766E-01
0.12230445E 03	0.59269226E-01
0.12367699E 03	0.55158791E-01
0.12504952E 03	0.51211440E-01
0.12642206E 03	0.47432893E-01
0.12779459E 03	0.43827566E-01
0.12916713E 03	0.40398580E-01
0.13053967E 03	0.37147760E-01
0.13191220E 03	0.34075681E-01
0.13328474E 03	0.31181728E-01
0.13465727E 03	0.28464171E-01
0.13602981E 03	0.25920246E-01
0.13740235E 03	0.23546264E-01
0.13877488E 03	0.
MEAN= 0.402737446E 02	
STANDARD DEVIATION= 0.309003226E 02	
SKEWNESS= 0.949535973E 00	
PEAKNESS= 0.375302516E 01	

APPENDIX C

Flow Diagram

DIMENSIONED VARIABLES

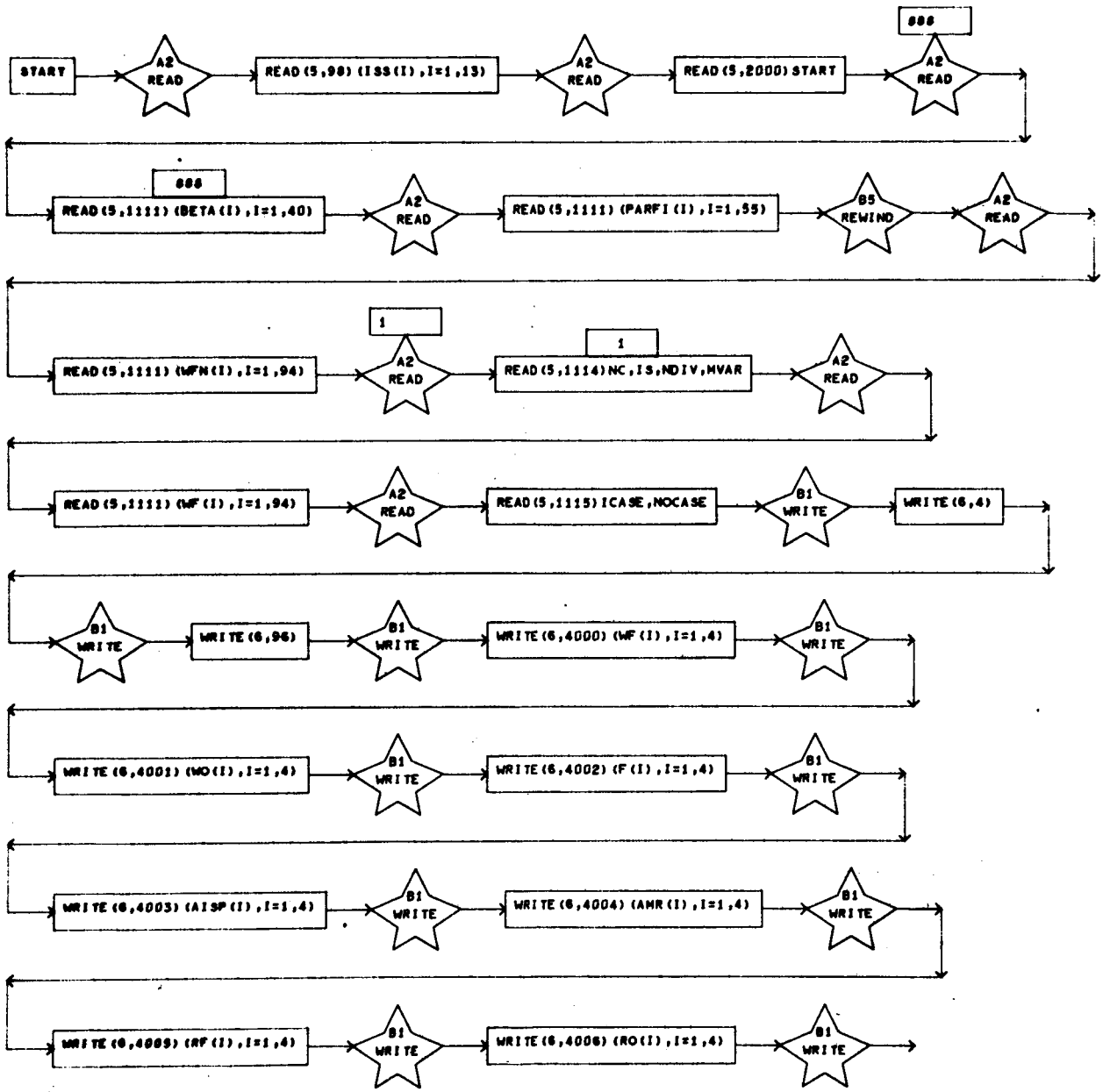
SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES
CLIN	101	SIG	136	FREQ	101	PHI	101	CFREQ	101
STO	14000	GAR	10	BLOCK	6000				

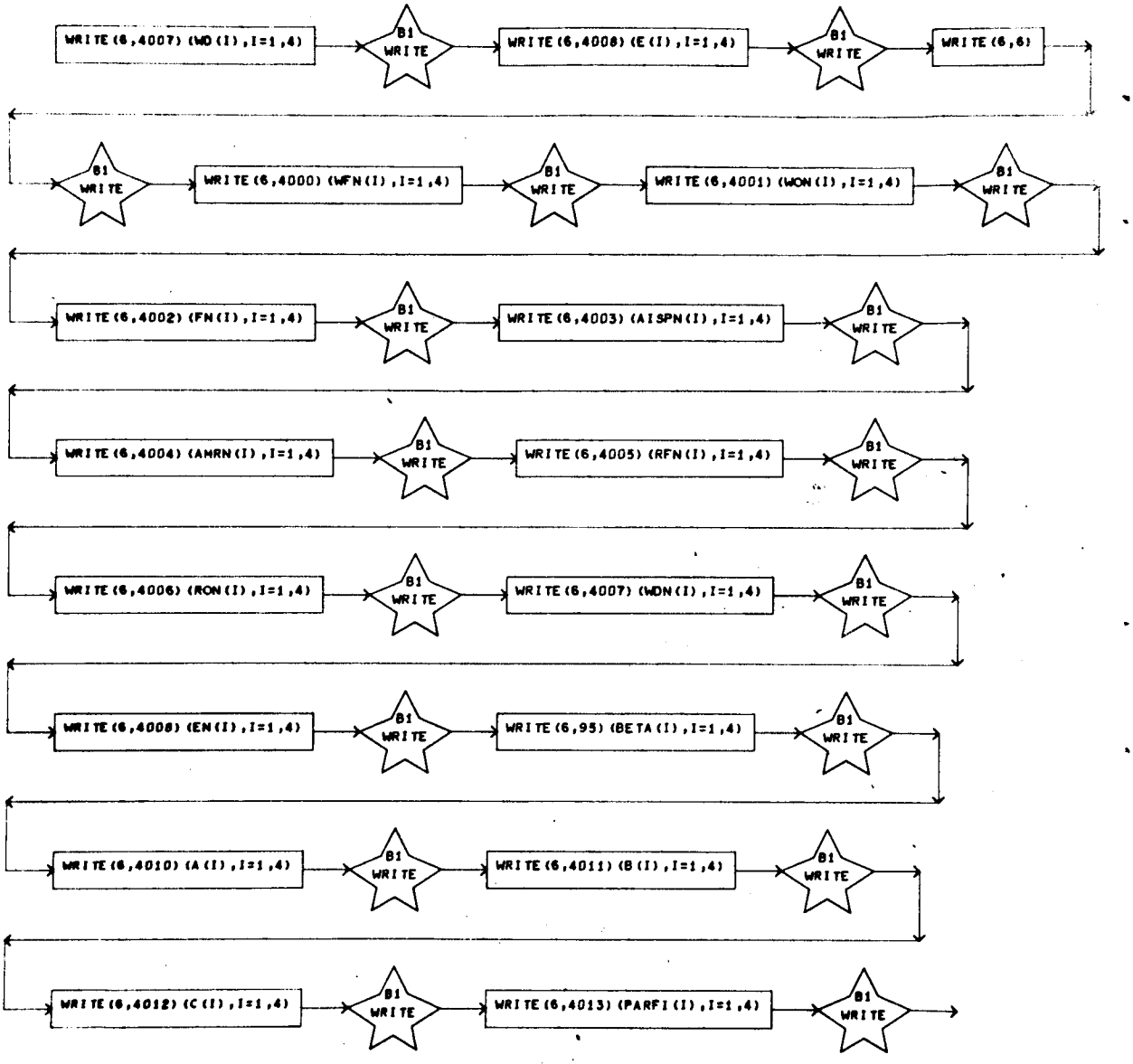

MONTE CARLO PROBABILITY ANALYSIS
1
START
TRANSFER TO SUBROUTINE ONE
J=I3+1
REPEAT TO 2 FOR I=1,1+1,...,J
TRANSFER TO SUBROUTINE TWO
2
TRANSFER TO SUBROUTINE THREE
TRANSFER TO SUBROUTINE FOUR
TRANSFER TO SUBROUTINE FIVE
TRANSFER TO SUBROUTINE SIX
GO TO 1

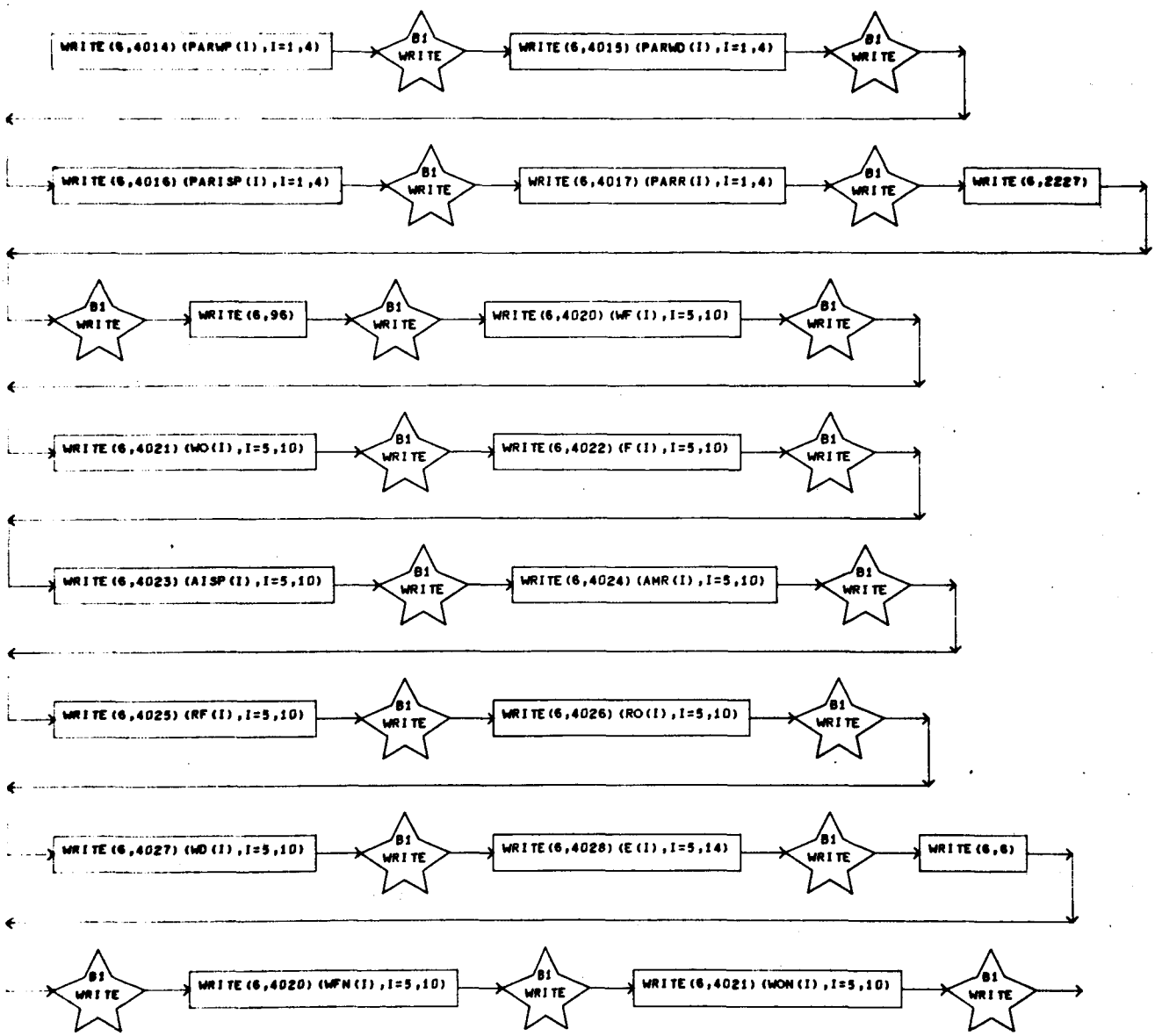
DIMENSIONED VARIABLES

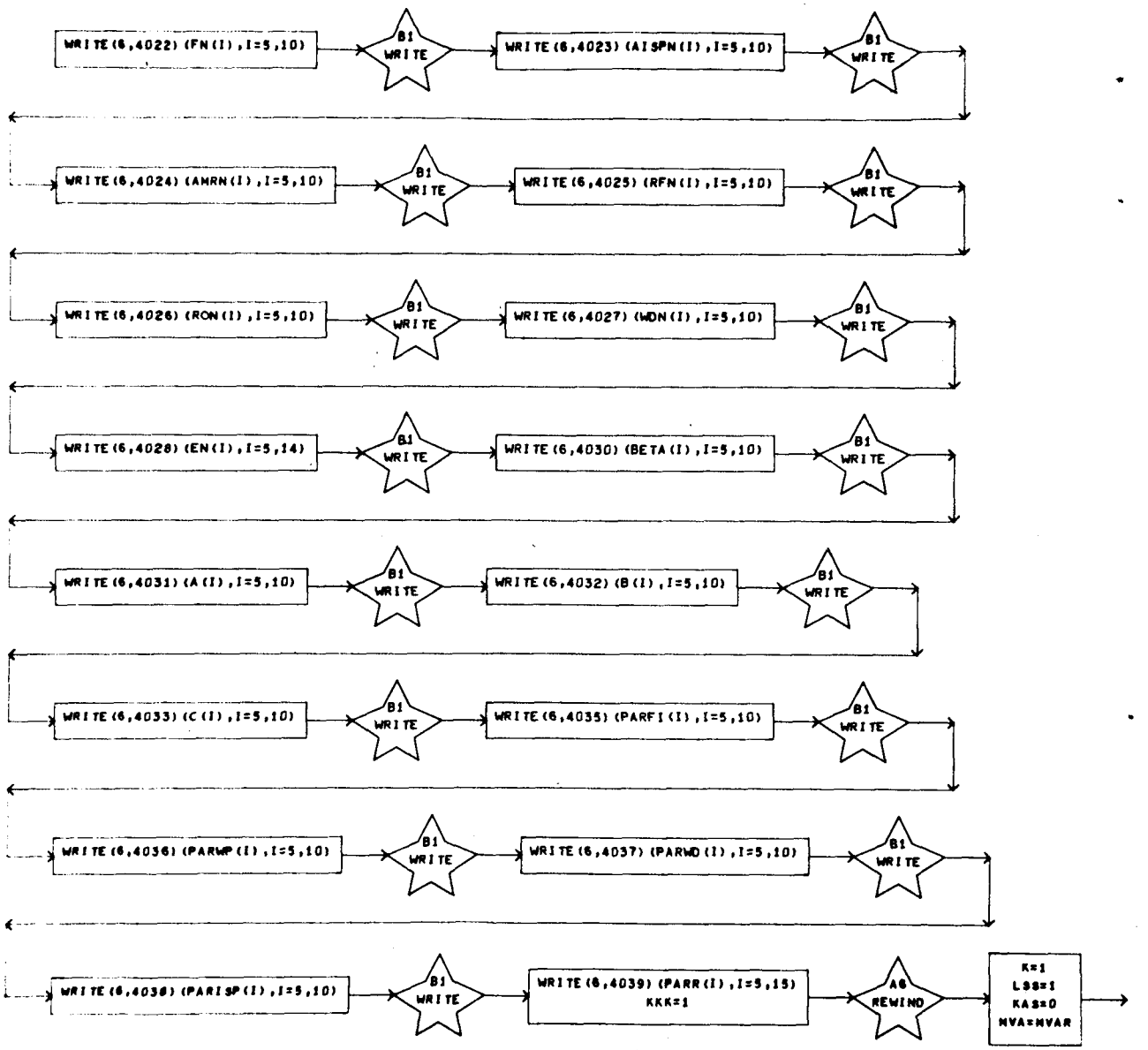
SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES
CLIN	101	SIG	136	FREQ	101	PHI	101	CFREQ	101
BLOCK	6000	SWOH	10	SWTH	10	SMRL	10	SMRH	10
E	10	WD	10	RO	10	RF	10	AMR	10
AISP	10	F	10	WO	10	WF	10	AWOH	10
AWTH	10	AMRL	10	AMRH	10	EN	10	WDN	10
RON	10	RFN	10	AMRN	10	AISPN	10	FN	10
WON	10	WFN	10	PARR	10	PARISP	10	PARWD	10
PARWP	10	PARFI	10	WFPR	10	WOPR	10	FPR	10
AISPPR	10	AMRPR	10	RFPR	10	ROPR	10	WDPR	10
EPR	10	TBF	10	WFDOTP	10	TBO	10	WODOTP	10
DELTB	10	ROBPR	10	RFBPR	10	DELFI	10	DELISP	10
DELR	10	DELWP	10	SUM5	10	SUM4	10	SUM3	10
SUM2	10	SUM1	10	WF2P	10	WO2P	10	AMRTU	10
RO2P	10	RA	10	RN	136	VAR	1000	C	10
B	10	A	10	BETA	10	DELWPL	1	ADELR	10
ISS	13								

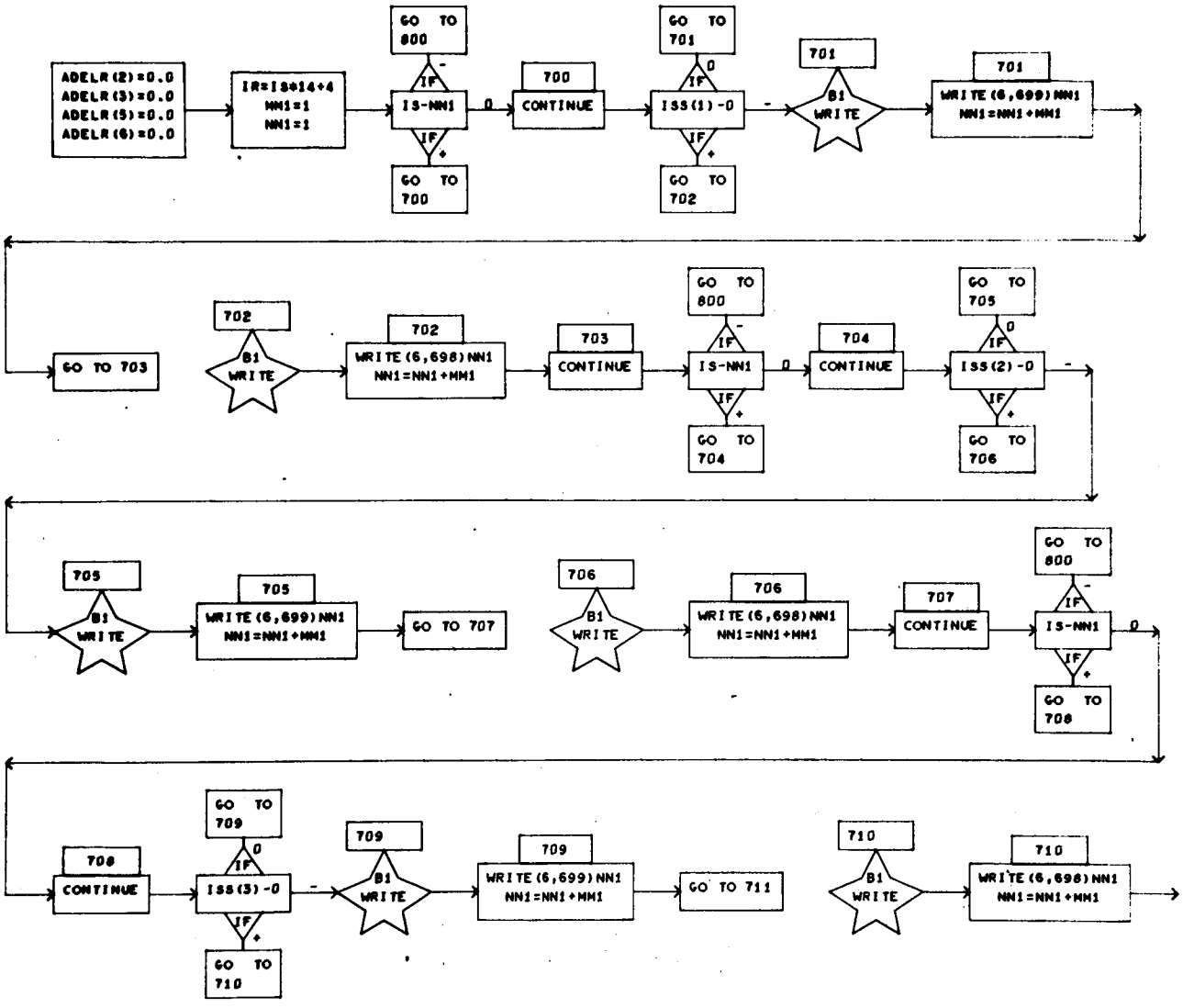
SUBROUTINE ONE

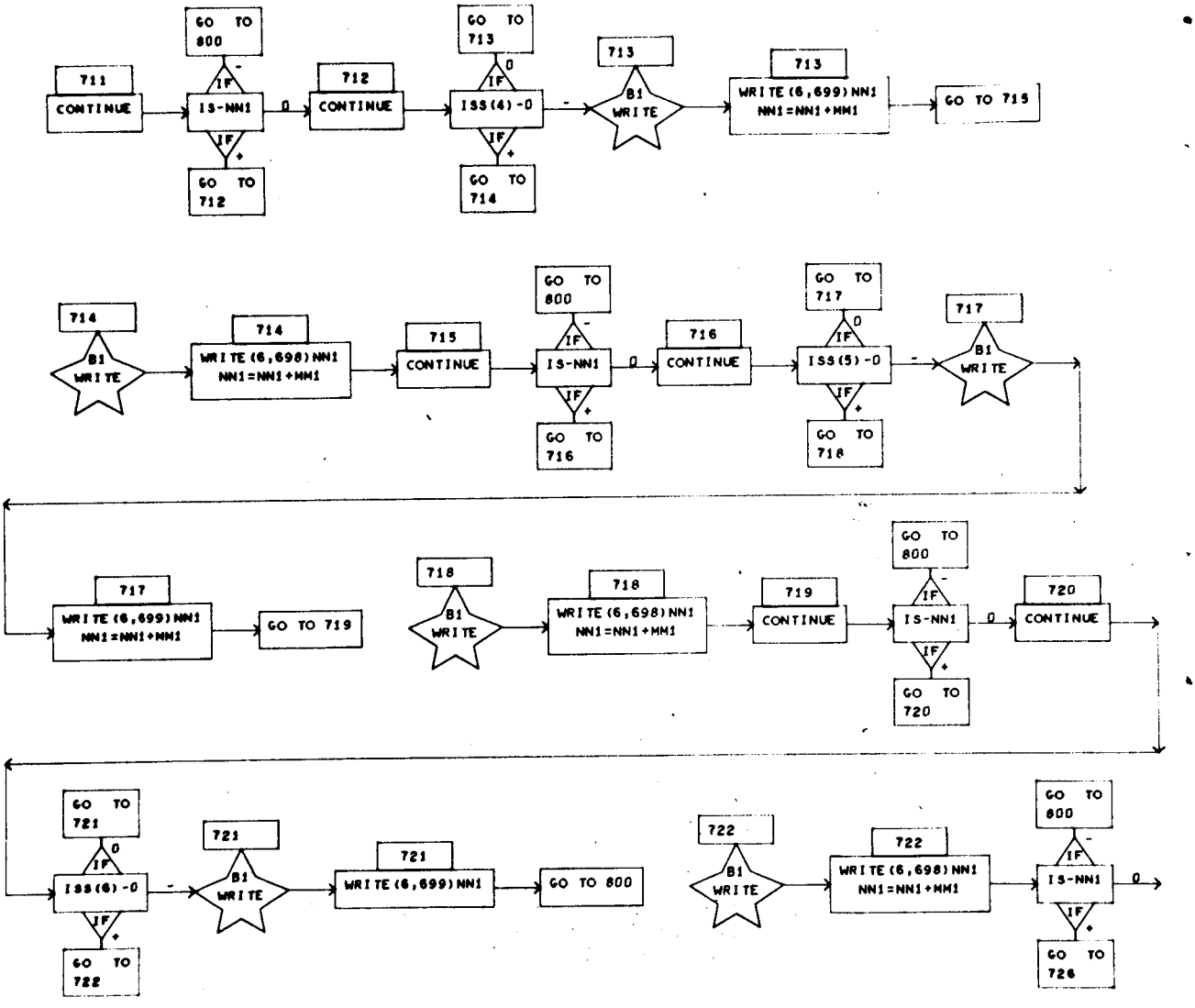


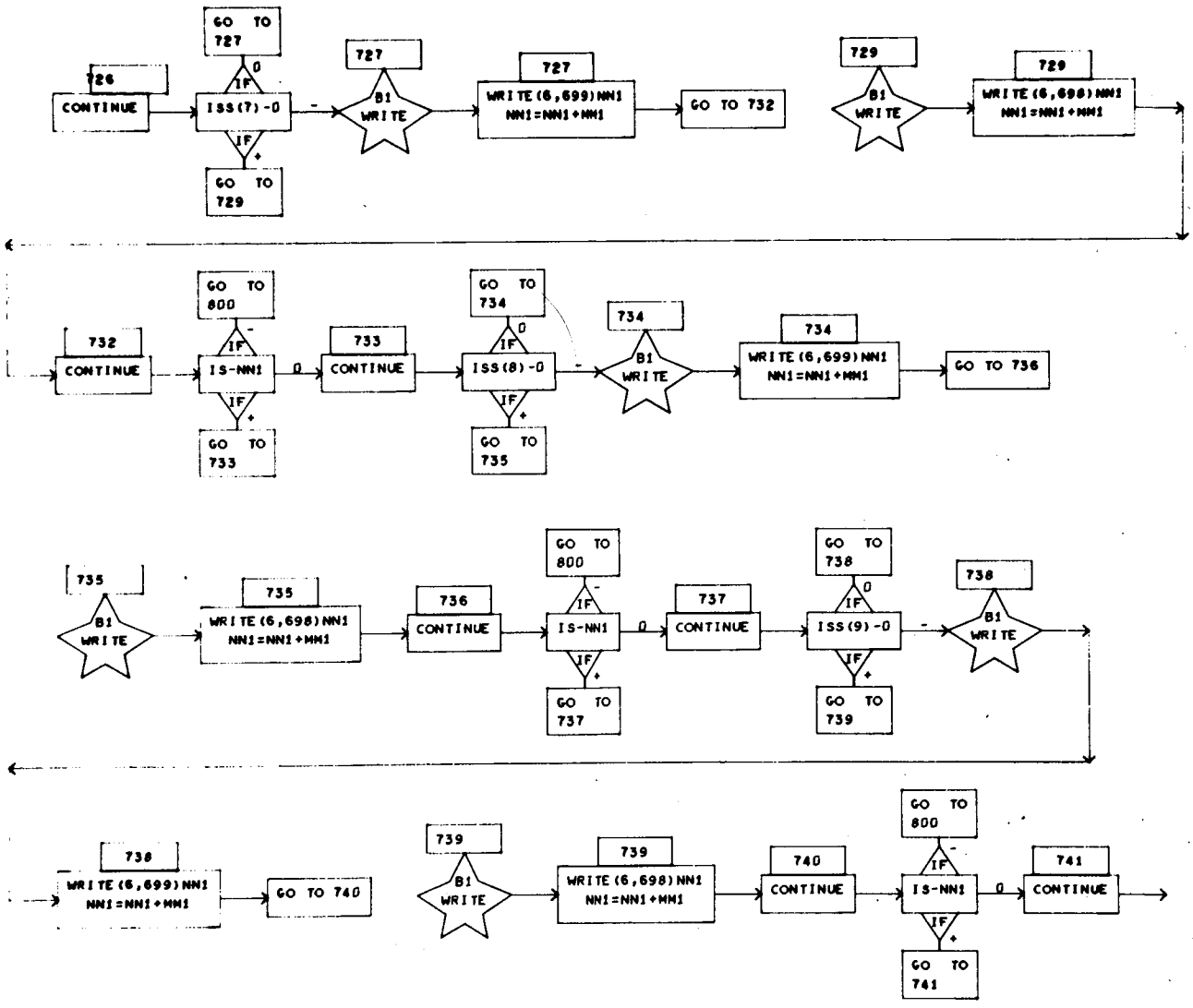

WRITE(6,4007) (WD(I),I=1,4)
B1 WRITE
WRITE(6,4008) (E(I),I=1,4)
B1 WRITE
WRITE(6,6)
B1 WRITE
WRITE(6,4000) (WFN(I),I=1,4)
B1 WRITE
WRITE(6,4001) (WON(I),I=1,4)
B1 WRITE
WRITE(6,4002) (FN(I),I=1,4)
B1 WRITE
WRITE(6,4003) (AISPN(I),I=1,4)
B1 WRITE
WRITE(6,4004) (AMRN(I),I=1,4)
B1 WRITE
WRITE(6,4005) (RFN(I),I=1,4)
B1 WRITE
WRITE(6,4006) (RON(I),I=1,4)
B1 WRITE
WRITE(6,4007) (WDN(I),I=1,4)
B1 WRITE
WRITE(6,4008) (EN(I),I=1,4)
B1 WRITE
WRITE(6,95) (BETA(I),I=1,4)
B1 WRITE
WRITE(6,4010) (A(I),I=1,4)
B1 WRITE
WRITE(6,4011) (B(I),I=1,4)
B1 WRITE
WRITE(6,4012) (C(I),I=1,4)
B1 WRITE
WRITE(6,4013) (PARFI(I),I=1,4)
B1 WRITE

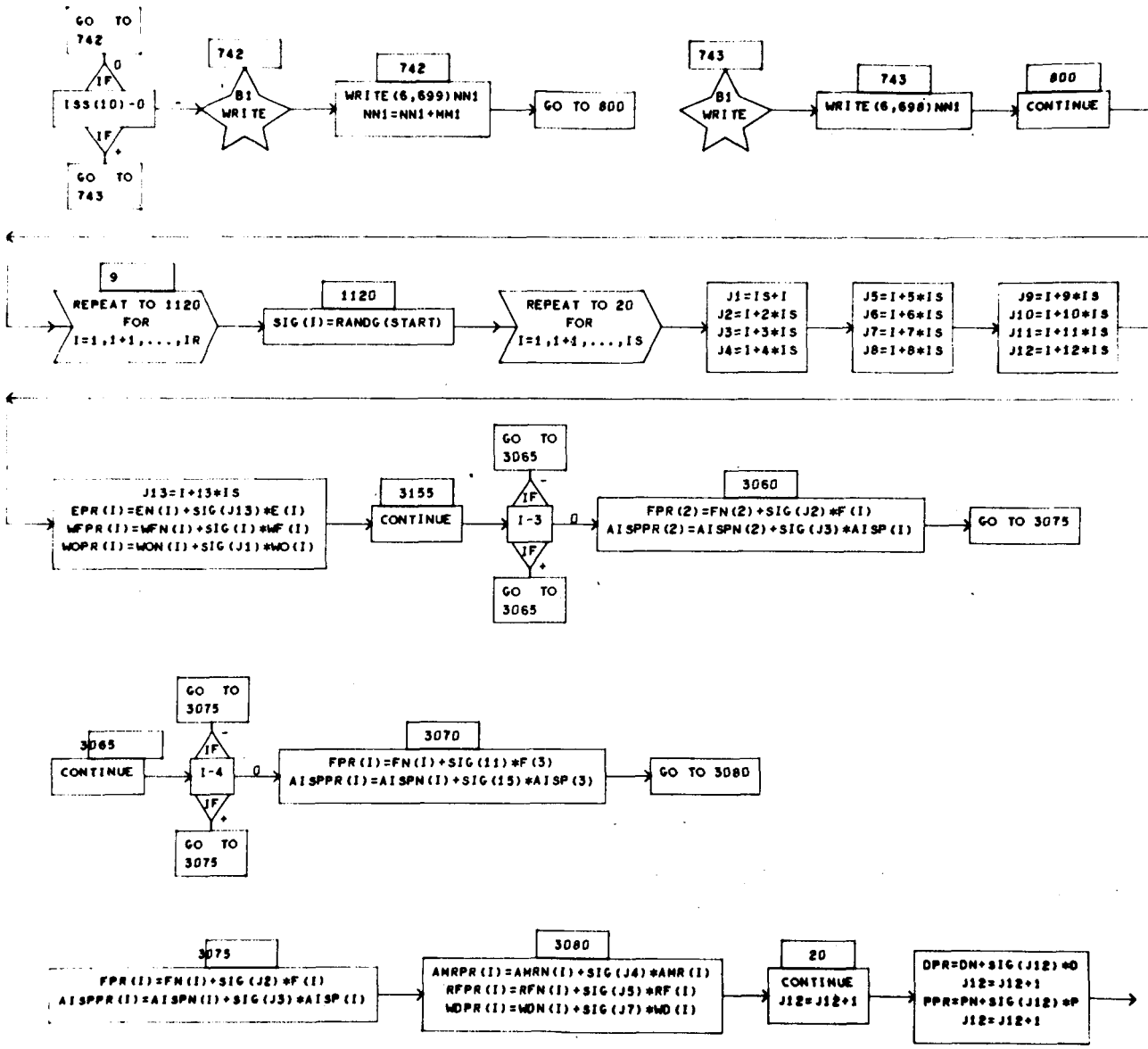

WRITE(6,4014) (PARWP(I),I=1,4)
B1 WRITE
WRITE(6,4015) (PARWD(I),I=1,4)
B1 WRITE
WRITE(6,4016) (PARISP(I),I=1,4)
B1 WRITE
WRITE(6,4017) (PARR(I),I=1,4)
B1 WRITE
WRITE(6,2227)
B1 WRITE
WRITE(6,96)
B1 WRITE
WRITE(6,4020) (WF(I),I=5,10)
B1 WRITE
WRITE(6,4021) (WO(I),I=5,10)
B1 WRITE
WRITE(6,4022) (F(I),I=5,10)
B1 WRITE
WRITE(6,4023) (AISP(I),I=5,10)
B1 WRITE
WRITE(6,4024) (AMR(I),I=5,10)
B1 WRITE
WRITE(6,4025) (RF(I),I=5,10)
B1 WRITE
WRITE(6,4026) (RO(I),I=5,10)
B1 WRITE
WRITE(6,4027) (WD(I),I=5,10)
B1 WRITE
WRITE(6,4028) (E(I),I=5,14)
B1 WRITE
WRITE(6,6)
B1 WRITE
WRITE(6,4020) (WFN(I),I=5,10)
B1 WRITE
WRITE(6,4021) (WON(I),I=5,10)
B1 WRITE

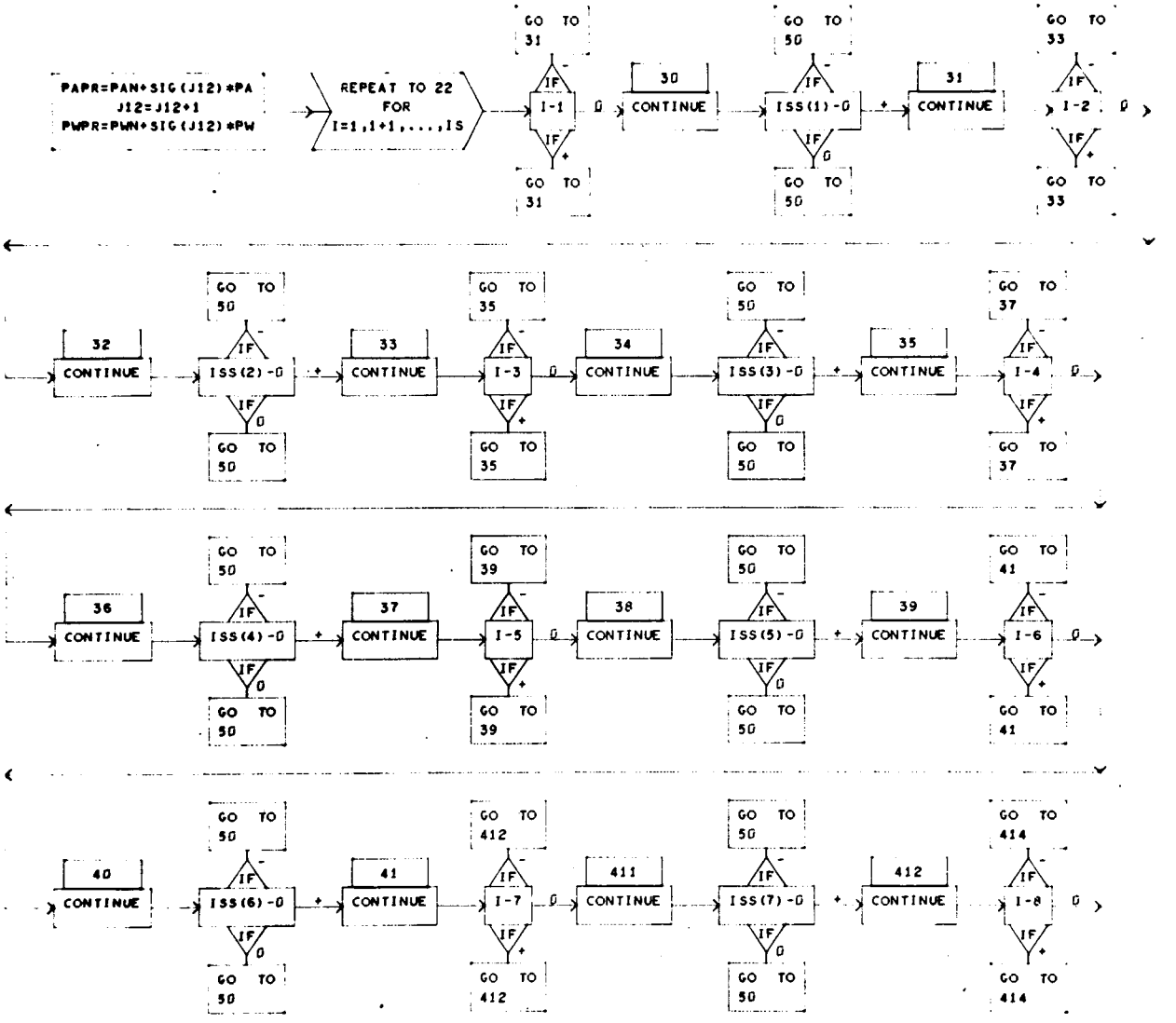

WRITE(6,4022) (FN(I),I=5,10)
B1 WRITE
WRITE(6,4023) (AISPN(I),I=5,10)
B1 WRITE
WRITE(6,4024) (AMRN(I),I=5,10)
B1 WRITE
WRITE(6,4025) (RFN(I),I=5,10)
B1 WRITE
WRITE(6,4026) (RON(I),I=5,10)
B1 WRITE
WRITE(6,4027) (WDN(I),I=5,10)
B1 WRITE
WRITE(6,4028) (EN(I),I=5,14)
B1 WRITE
WRITE(6,4030) (BETA(I),I=5,10)
B1 WRITE
WRITE(6,4031) (A(I),I=5,10)
B1 WRITE
WRITE(6,4032) (B(I),I=5,10)
B1 WRITE
WRITE(6,4033) (C(I),I=5,10)
B1 WRITE
WRITE(6,4035) (PARFI(I),I=5,10)
B1 WRITE
WRITE(6,4036) (PARWP(I),I=5,10)
B1 WRITE
WRITE(6,4037) (PARWD(I),I=5,10)
B1 WRITE
WRITE(6,4038) (PARISP(I),I=5,10)
B1 WRITE
WRITE(6,4039) (PARR(I),I=5,15)
KKK=1
A6 REWIND
K=1
LSS=1
KAS=0
NVA=NVAR

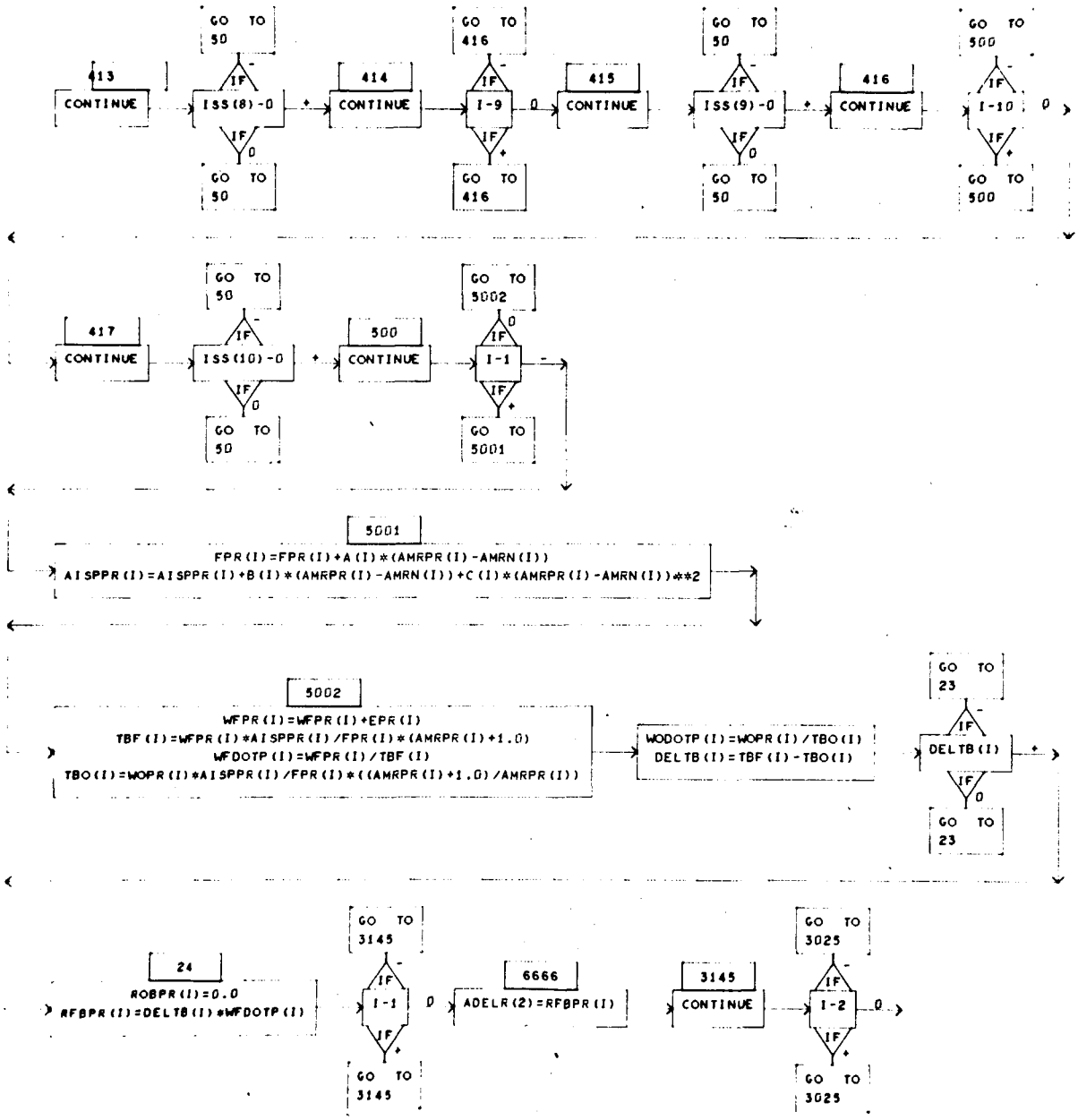

ADELR(2)=0.0
ADELR(3)=0.0
ADELR(5)=0.0
ADELR(6)=0.0
IR=IS*14+4
MM1=1
NN1=1
GO TO 800
IF -
IS-NN1
0
IF +
GO TO 700
700
CONTINUE
GO TO 701
IF 0
ISS(1)-0
-
IF +
GO TO 702
701
B1 WRITE
701
WRITE(6,699)NN1
NN1=NN1+MM1
GO TO 703
702
B1 WRITE
702
WRITE(6,698)NN1
NN1=NN1+MM1
703
CONTINUE
GO TO 800
IF -
IS-NN1
0
IF +
GO TO 704
704
CONTINUE
GO TO 705
IF 0
ISS(2)-0
-
IF +
GO TO 706
705
B1 WRITE
705
WRITE(6,699)NN1
NN1=NN1+MM1
GO TO 707
706
B1 WRITE
706
WRITE(6,698)NN1
NN1=NN1+MM1
707
CONTINUE
GO TO 800
IF -
IS-NN1
0
IF +
GO TO 708
708
CONTINUE
GO TO 709
IF 0
ISS(3)-0
-
IF +
GO TO 710
709
B1 WRITE
709
WRITE(6,699)NN1
NN1=NN1+MM1
GO TO 711
710
B1 WRITE
710
WRITE(6,698)NN1
NN1=NN1+MM1

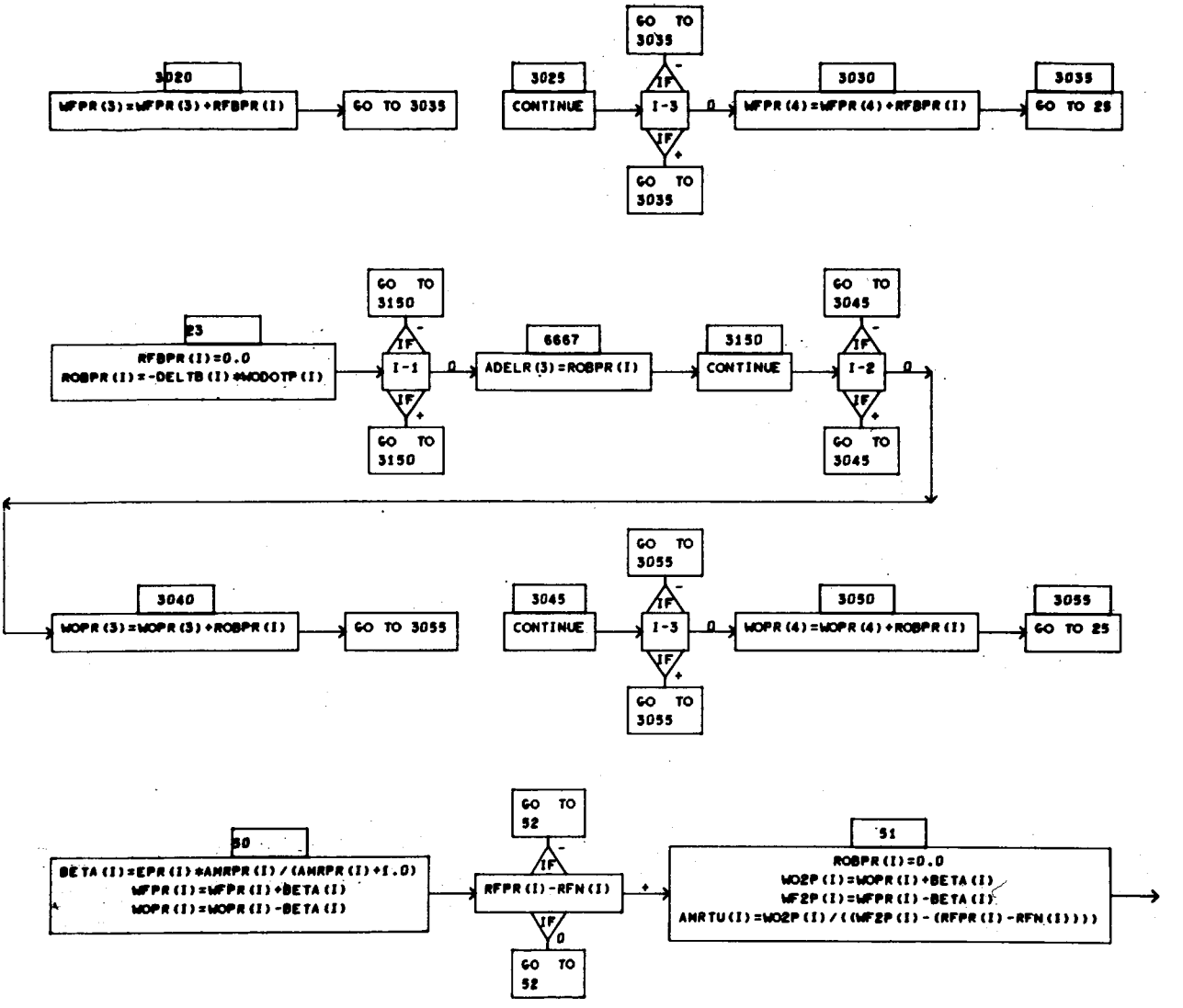

711
CONTINUE
GO TO 800
IF -
IS-NN1
IF 0
712
CONTINUE
GO TO 713
IF 0
ISS(4)-0
IF +
GO TO 714
713
B1 WRITE
713
WRITE (6,699) NN1
NN1=NN1+MM1
GO TO 715
714
B1 WRITE
714
WRITE (6,698) NN1
NN1=NN1+MM1
715
CONTINUE
GO TO 800
IF -
IS-NN1
IF 0
716
CONTINUE
GO TO 716
GO TO 717
IF 0
ISS(5)-0
IF +
GO TO 718
717
B1 WRITE
717
WRITE (6,699) NN1
NN1=NN1+MM1
GO TO 719
718
B1 WRITE
718
WRITE (6,698) NN1
NN1=NN1+MM1
719
CONTINUE
GO TO 800
IF -
IS-NN1
IF 0
720
CONTINUE
GO TO 720
GO TO 721
IF 0
ISS(6)-0
IF +
GO TO 722
721
B1 WRITE
721
WRITE (6,699) NN1
GO TO 800
722
B1 WRITE
722
WRITE (6,698) NN1
NN1=NN1+MM1
GO TO 800
IF -
IS-NN1
IF 0
GO TO 726

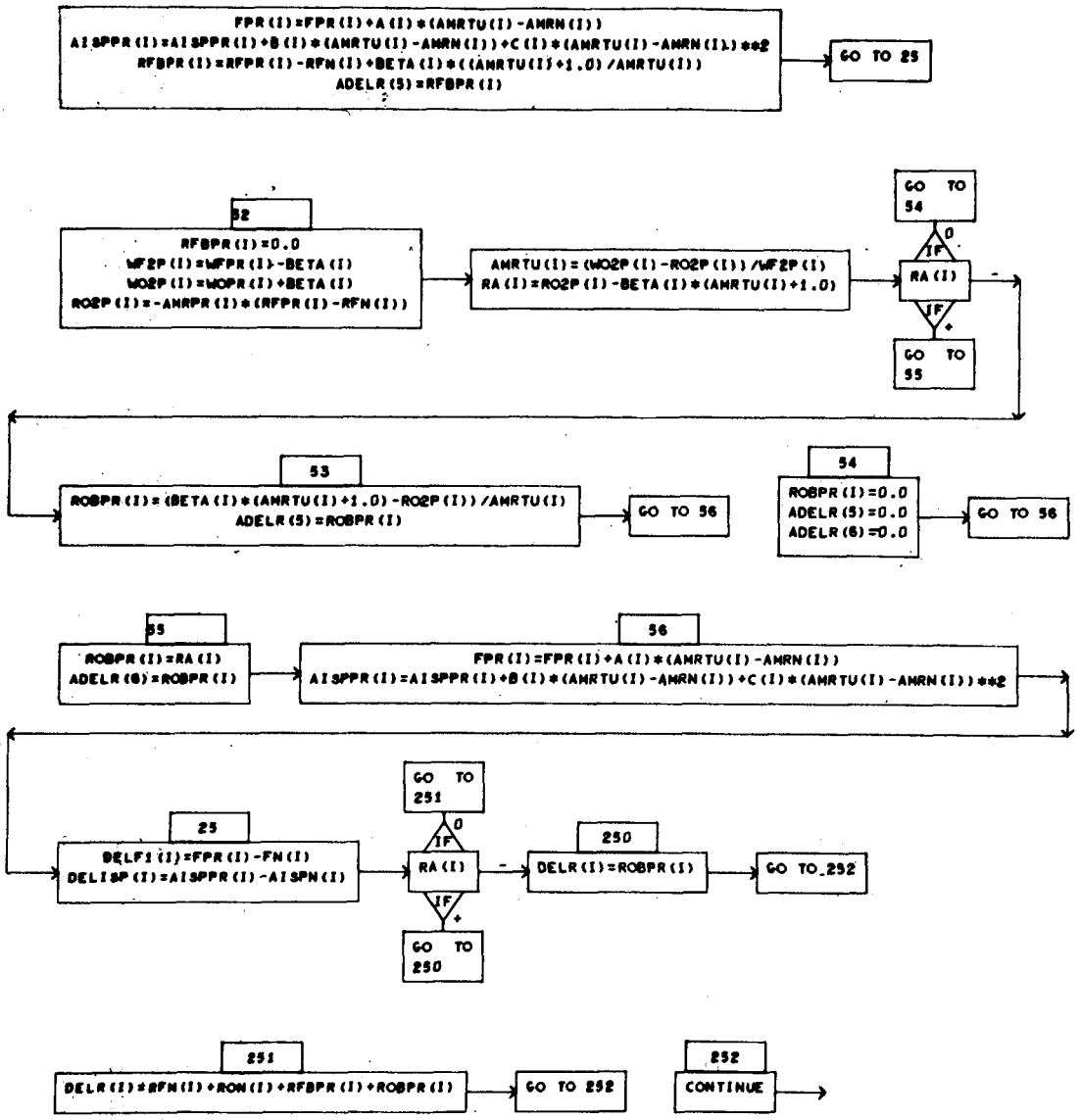

726
CONTINUE
ISS(7)-0
IF
0
-
+
GO TO 727
GO TO 729
727
B1 WRITE
727
WRITE(6,699)NN1
NN1=NN1+MM1
GO TO 732
729
B1 WRITE
729
WRITE(6,698)NN1
NN1=NN1+MM1
732
CONTINUE
IS-NN1
GO TO 800
GO TO 733
733
CONTINUE
ISS(8)-0
GO TO 734
GO TO 735
734
B1 WRITE
734
WRITE(6,699)NN1
NN1=NN1+MM1
GO TO 736
735
B1 WRITE
735
WRITE(6,698)NN1
NN1=NN1+MM1
736
CONTINUE
IS-NN1
GO TO 800
GO TO 737
737
CONTINUE
ISS(9)-0
GO TO 738
GO TO 739
738
B1 WRITE
738
WRITE(6,699)NN1
NN1=NN1+MM1
GO TO 740
739
B1 WRITE
739
WRITE(6,698)NN1
NN1=NN1+MM1
740
CONTINUE
IS-NN1
GO TO 800
GO TO 741
741
CONTINUE

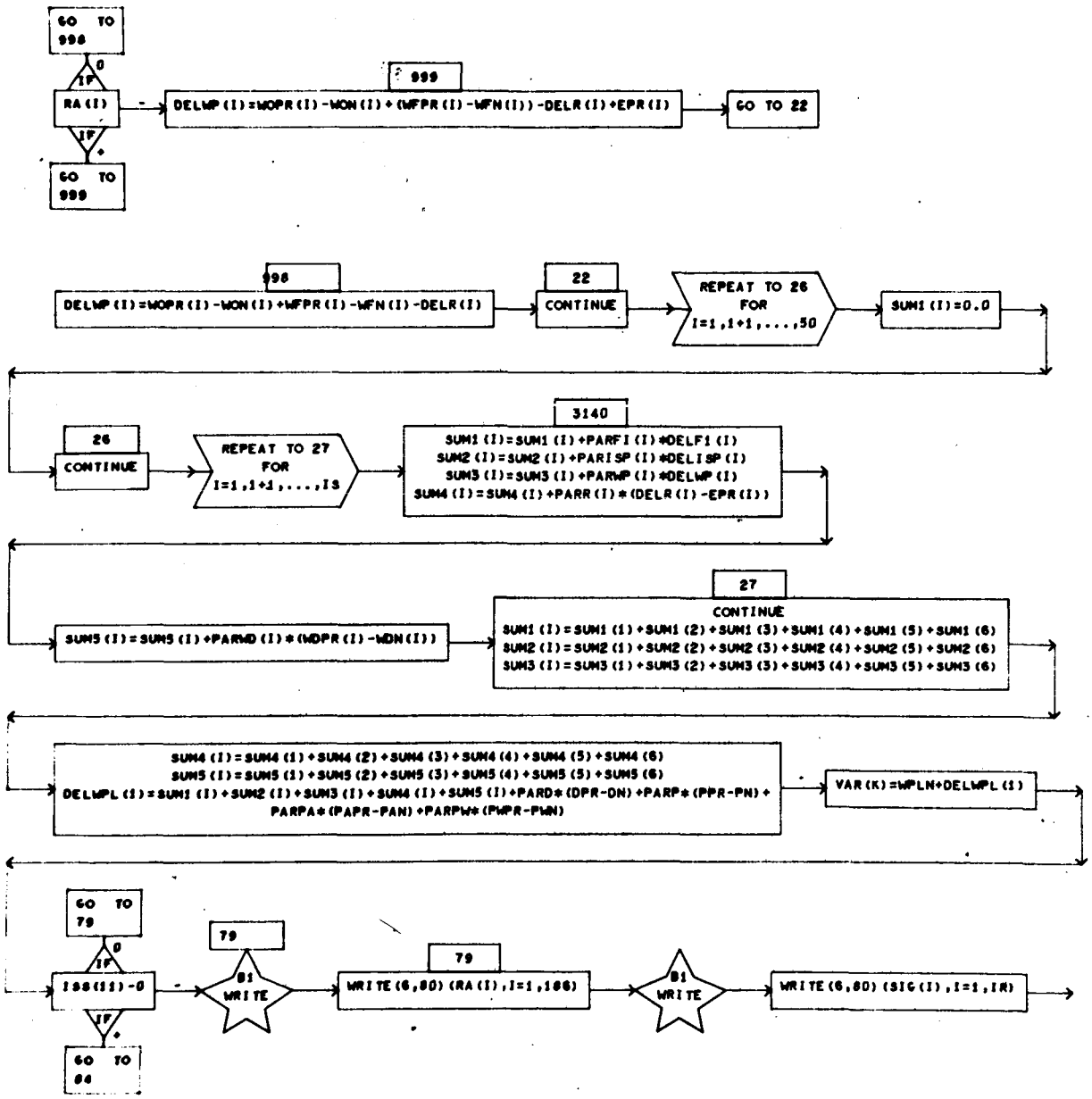

GO TO 742
IF 0
ISS(10)-0
IF +
GO TO 743
742
BI WRITE
742
WRITE (6,699) NN1
NN1=NN1+MM1
GO TO 800
743
BI WRITE
743
WRITE (6,698) NN1
800
CONTINUE
9
REPEAT TO 1120 FOR I=1,1+1,...,IR
1120
SIG(I)=RANDG(START)
REPEAT TO 20 FOR I=1,1+1,...,IS
J1=IS+I
J2=I+2*IS
J3=I+3*IS
J4=I+4*IS
J5=I+5*IS
J6=I+6*IS
J7=I+7*IS
J8=I+8*IS
J9=I+9*IS
J10=I+10*IS
J11=I+11*IS
J12=I+12*IS
J13=I+13*IS
EPR(I)=EN(I)+SIG(J13)*E(I)
WFPR(I)=WFN(I)+SIG(I)*WF(I)
WOPR(I)=WON(I)+SIG(J1)*WO(I)
3155
CONTINUE
GO TO 3065
IF -
I-3
0
IF +
GO TO 3065
3060
FPR(2)=FN(2)+SIG(J2)*F(I)
AISPPR(2)=AISPN(2)+SIG(J3)*AISP(I)
GO TO 3075
GO TO 3075
IF -
3065
CONTINUE
I-4
0
IF +
GO TO 3075
3070
FPR(I)=FN(I)+SIG(11)*F(3)
AISPPR(I)=AISPN(I)+SIG(15)*AISP(3)
GO TO 3080
3075
FPR(I)=FN(I)+SIG(J2)*F(I)
AISPPR(I)=AISPN(I)+SIG(J3)*AISP(I)
3080
AMRPR(I)=AMRN(I)+SIG(J4)*AMR(I)
RFPR(I)=RFN(I)+SIG(J5)*RF(I)
WDPR(I)=WDN(I)+SIG(J7)*WD(I)
20
CONTINUE
J12=J12+1
DPR=DN+SIG(J12)*D
J12=J12+1
PPR=PN+SIG(J12)*P
J12=J12+1

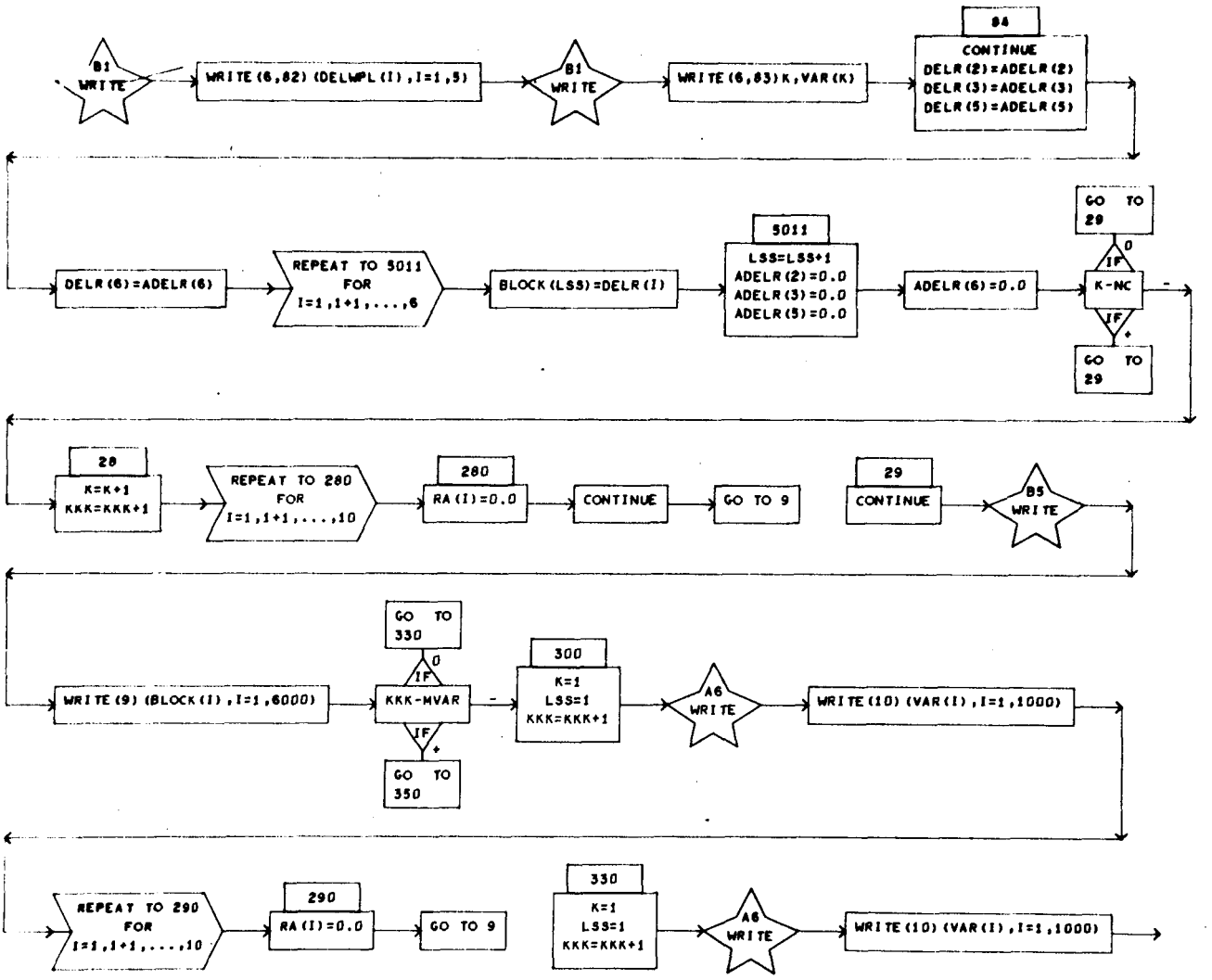

PAPR=PAN+SIG(J12)*PA
J12=J12+1
PWPR=PWN+SIG(J12)*PW
REPEAT TO 22
FOR
I=1,1+1,...,IS
GO TO 31
I-1
IF
GO TO 31
30
CONTINUE
GO TO 50
ISS(1)-0
GO TO 50
31
CONTINUE
GO TO 33
I-2
GO TO 33
32
CONTINUE
GO TO 50
ISS(2)-0
GO TO 50
33
CONTINUE
GO TO 35
I-3
GO TO 35
34
CONTINUE
GO TO 50
ISS(3)-0
GO TO 50
35
CONTINUE
GO TO 37
I-4
GO TO 37
36
CONTINUE
GO TO 50
ISS(4)-0
GO TO 50
37
CONTINUE
GO TO 39
I-5
GO TO 39
38
CONTINUE
GO TO 50
ISS(5)-0
GO TO 50
39
CONTINUE
GO TO 41
I-6
GO TO 41
40
CONTINUE
GO TO 50
ISS(6)-0
GO TO 50
41
CONTINUE
GO TO 412
I-7
GO TO 412
411
CONTINUE
GO TO 50
ISS(7)-0
GO TO 50
412
CONTINUE
GO TO 414
I-8
GO TO 414

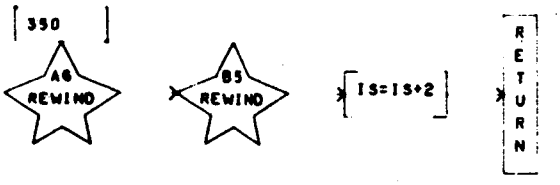

413
CONTINUE
IF
ISS(8)-0
GO TO 50
414
CONTINUE
GO TO 416
I-9
415
CONTINUE
ISS(9)-0
416
CONTINUE
GO TO 500
I-10
417
CONTINUE
ISS(10)-0
500
CONTINUE
GO TO 5002
I-1
GO TO 5001
5001
FPR(I)=FPR(I)+A(I)*(AMRPR(I)-AMRN(I))
AISPPR(I)=AISPPR(I)+B(I)*(AMRPR(I)-AMRN(I))+C(I)*(AMRPR(I)-AMRN(I))**2
5002
WFPR(I)=WFPR(I)+EPR(I)
TBF(I)=WFPR(I)*AISPPR(I)/FPR(I)*(AMRPR(I)+1.0)
WFDOTP(I)=WFPR(I)/TBF(I)
TBO(I)=WOPR(I)*AISPPR(I)/FPR(I)*((AMRPR(I)+1.0)/AMRPR(I))
WODOTP(I)=WOPR(I)/TBO(I)
DELTB(I)=TBF(I)-TBO(I)
GO TO 23
DELTB(I)
24
ROBPR(I)=0.0
RFBPR(I)=DELTB(I)*WFDOTP(I)
GO TO 3145
I-1
6666
ADELR(2)=RFBPR(I)
3145
CONTINUE
GO TO 3025
I-2


3020
WFPR(3)=WFPR(3)+RFBPR(I)
GO TO 3035
3025
CONTINUE
GO TO 3035
IF -
I-3
0
IF +
GO TO 3035
3030
WFPR(4)=WFPR(4)+RFBPR(I)
3035
GO TO 25
23
RFBPR(I)=0.0
ROBPR(I)=-DELTB(I)*WDOTP(I)
GO TO 3150
IF -
I-1
0
IF +
GO TO 3150
6667
ADELR(3)=ROBPR(I)
3150
CONTINUE
GO TO 3045
IF -
I-2
0
IF +
GO TO 3045
3040
WOPR(3)=WOPR(3)+ROBPR(I)
GO TO 3055
3045
CONTINUE
GO TO 3055
IF -
I-3
0
IF +
GO TO 3055
3050
WOPR(4)=WOPR(4)+ROBPR(I)
3055
GO TO 25
50
BETA(I)=EPR(I)*AMRPR(I)/(AMRPR(I)+1.0)
WFPR(I)=WFPR(I)+BETA(I)
WOPR(I)=WOPR(I)-BETA(I)
GO TO 52
IF -
RFPR(I)-RFN(I)
+
IF 0
GO TO 52
51
ROBPR(I)=0.0
WO2P(I)=WOPR(I)+BETA(I)
WF2P(I)=WFPR(I)-BETA(I)
AMRTU(I)=WO2P(I)/((WF2P(I)-(RFPR(I)-RFN(I))))


FPR(I)=FPR(I)+A(I)*(AMRTU(I)-AMRN(I))
AISPPR(I)=AISPPR(I)+B(I)*(AMRTU(I)-AMRN(I))+C(I)*(AMRTU(I)-AMRN(I))**2
RFBPR(I)=RFPR(I)-RFN(I)+BETA(I)*((AMRTU(I)+1.0)/AMRTU(I))
ADELR(5)=RFBPR(I)
GO TO 25
32
RFBPR(I)=0.0
WF2P(I)=WFPR(I)-BETA(I)
WO2P(I)=WOPR(I)+BETA(I)
RO2P(I)=-AMRPR(I)*(RFPR(I)-RFN(I))
AMRTU(I)=(WO2P(I)-RO2P(I))/WF2P(I)
RA(I)=RO2P(I)-BETA(I)*(AMRTU(I)+1.0)
GO TO 54
IF 0
RA(I)
IF +
GO TO 55
53
ROBPR(I)=(BETA(I)*(AMRTU(I)+1.0)-RO2P(I))/AMRTU(I)
ADELR(5)=ROBPR(I)
GO TO 56
54
ROBPR(I)=0.0
ADELR(5)=0.0
ADELR(6)=0.0
GO TO 56
55
ROBPR(I)=RA(I)
ADELR(6)=ROBPR(I)
56
FPR(I)=FPR(I)+A(I)*(AMRTU(I)-AMRN(I))
AISPPR(I)=AISPPR(I)+B(I)*(AMRTU(I)-AMRN(I))+C(I)*(AMRTU(I)-AMRN(I))**2
25
DELF1(I)=FPR(I)-FN(I)
DELISP(I)=AISPPR(I)-AISPN(I)
GO TO 251
IF 0
RA(I)
IF +
GO TO 250
250
DELR(I)=ROBPR(I)
GO TO 252
251
DELR(I)=RFN(I)+RON(I)+RFBPR(I)+ROBPR(I)
GO TO 252
252
CONTINUE


GO TO 998
IF 0
RA(I)
IF +
GO TO 999
999
DELWP(I)=WOPR(I)-WON(I)+(WFPR(I)-WFN(I))-DELR(I)+EPR(I)
GO TO 22
998
DELWP(I)=WOPR(I)-WON(I)+WFPR(I)-WFN(I)-DELR(I)
22
CONTINUE
REPEAT TO 26 FOR I=1,1+1,...,50
SUM1(I)=0.0
26
CONTINUE
REPEAT TO 27 FOR I=1,1+1,...,IS
3140
SUM1(I)=SUM1(I)+PARFI(I)*DELF1(I)
SUM2(I)=SUM2(I)+PARISP(I)*DELISP(I)
SUM3(I)=SUM3(I)+PARWP(I)*DELWP(I)
SUM4(I)=SUM4(I)+PARR(I)*(DELR(I)-EPR(I))
SUM5(I)=SUM5(I)+PARWD(I)*(WDPR(I)-WDN(I))
27
CONTINUE
SUM1(I)=SUM1(1)+SUM1(2)+SUM1(3)+SUM1(4)+SUM1(5)+SUM1(6)
SUM2(I)=SUM2(1)+SUM2(2)+SUM2(3)+SUM2(4)+SUM2(5)+SUM2(6)
SUM3(I)=SUM3(1)+SUM3(2)+SUM3(3)+SUM3(4)+SUM3(5)+SUM3(6)
SUM4(I)=SUM4(1)+SUM4(2)+SUM4(3)+SUM4(4)+SUM4(5)+SUM4(6)
SUM5(I)=SUM5(1)+SUM5(2)+SUM5(3)+SUM5(4)+SUM5(5)+SUM5(6)
DELWPL(I)=SUM1(I)+SUM2(I)+SUM3(I)+SUM4(I)+SUM5(I)+PARD*(DPR-DN)+PARP*(PPR-PN)+PARPA*(PAPR-PAN)+PARPW*(PWPR-PWN)
VAR(K)=WPLN+DELWPL(I)
GO TO 79
IF 0
ISS(11)-0
IF +
GO TO 84
79
81 WRITE
79
WRITE(6,80)(RA(I),I=1,166)
81 WRITE
WRITE(6,80)(SIG(I),I=1,IR)

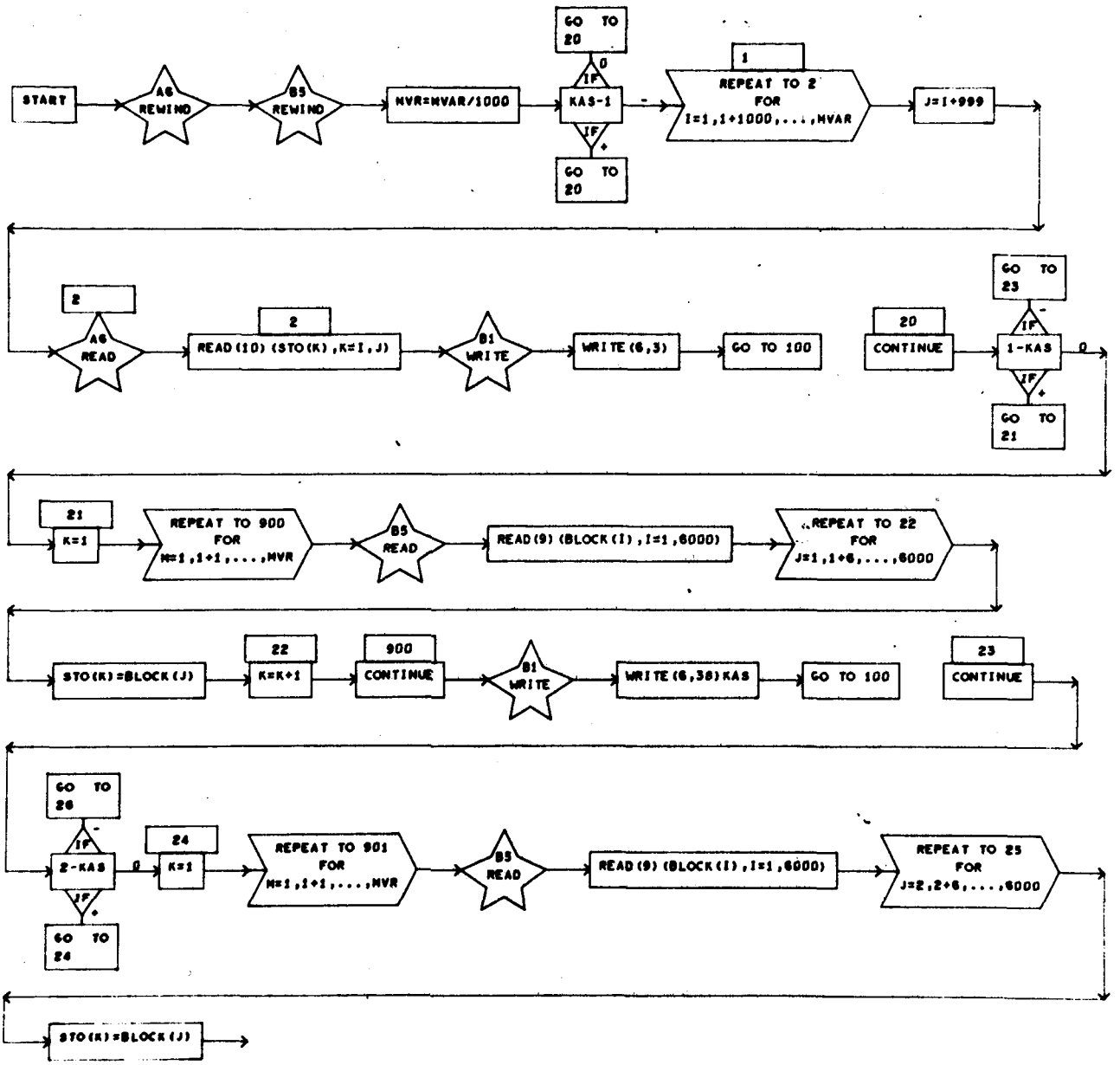

B1 WRITE
WRITE (6,82) (DELWPL (I) ,I=1,5)
B1 WRITE
WRITE (6,83) K,VAR (K)
84
CONTINUE
DELR (2) =ADELR (2)
DELR (3) =ADELR (3)
DELR (5) =ADELR (5)
DELR (6) =ADELR (6)
REPEAT TO 5011 FOR I=1,1+1,...,6
BLOCK (LSS) =DELR (I)
5011
LSS=LSS+1
ADELR (2) =0.0
ADELR (3) =0.0
ADELR (5) =0.0
ADELR (6) =0.0
GO TO 29
0
IF
K-NC
IF
+
GO TO 29
-
28
K=K+1
KKK=KKK+1
REPEAT TO 280 FOR I=1,1+1,...,10
280
RA (I) =0.0
CONTINUE
GO TO 9
29
CONTINUE
B5 WRITE
WRITE (9) (BLOCK (I) ,I=1,6000)
GO TO 330
0
IF
KKK-MVAR
IF
+
GO TO 350
-
300
K=1
LSS=1
KKK=KKK+1
A6 WRITE
WRITE (10) (VAR (I) ,I=1,1000)
REPEAT TO 290 FOR I=1,1+1,...,10
290
RA (I) =0.0
GO TO 9
330
K=1
LSS=1
KKK=KKK+1
A6 WRITE
WRITE (10) (VAR (I) ,I=1,1000)

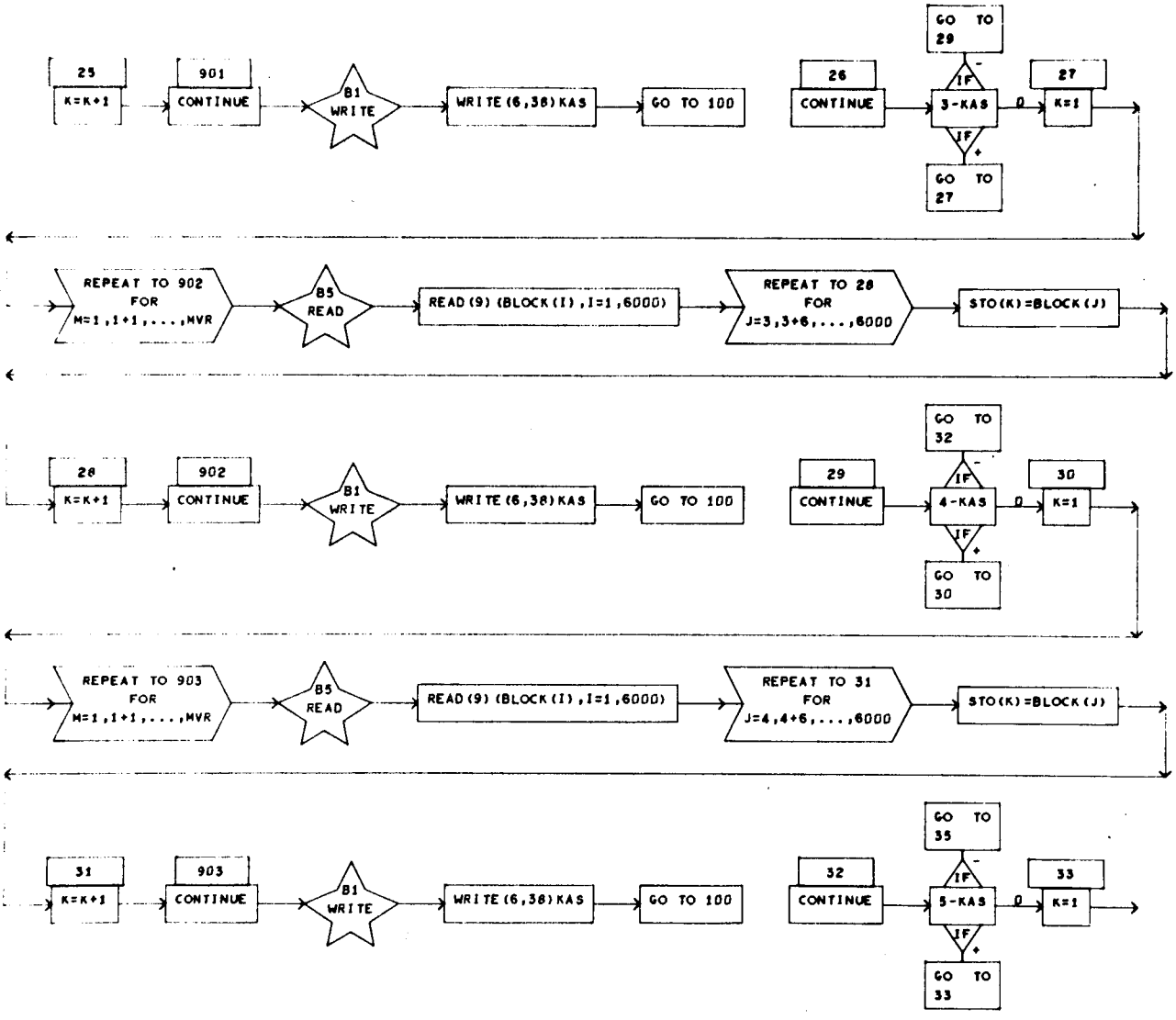

350
A6
REWIND
B5
REWIND
IS=IS+2
RETURN

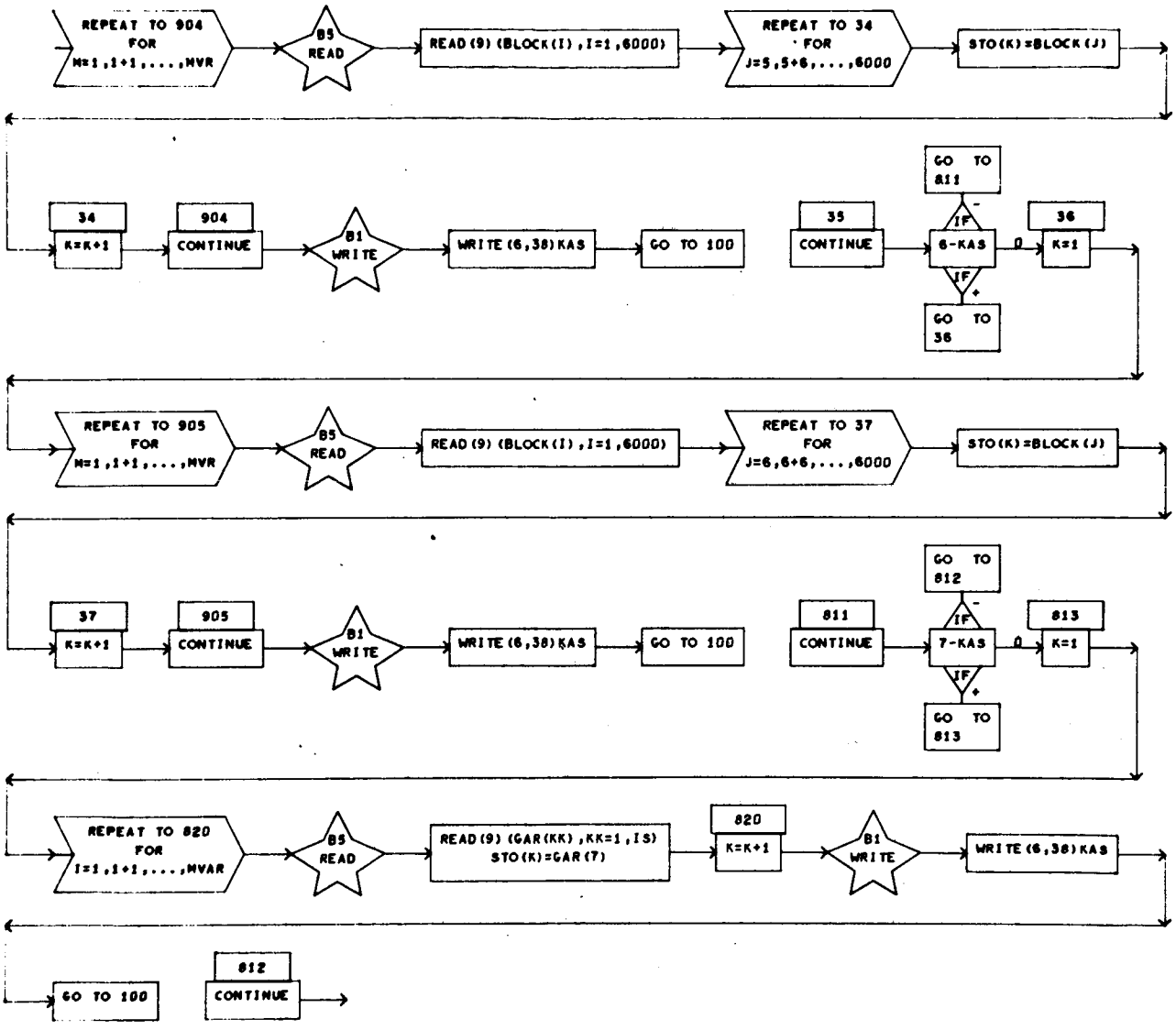
DIMENSIONED VARIABLES

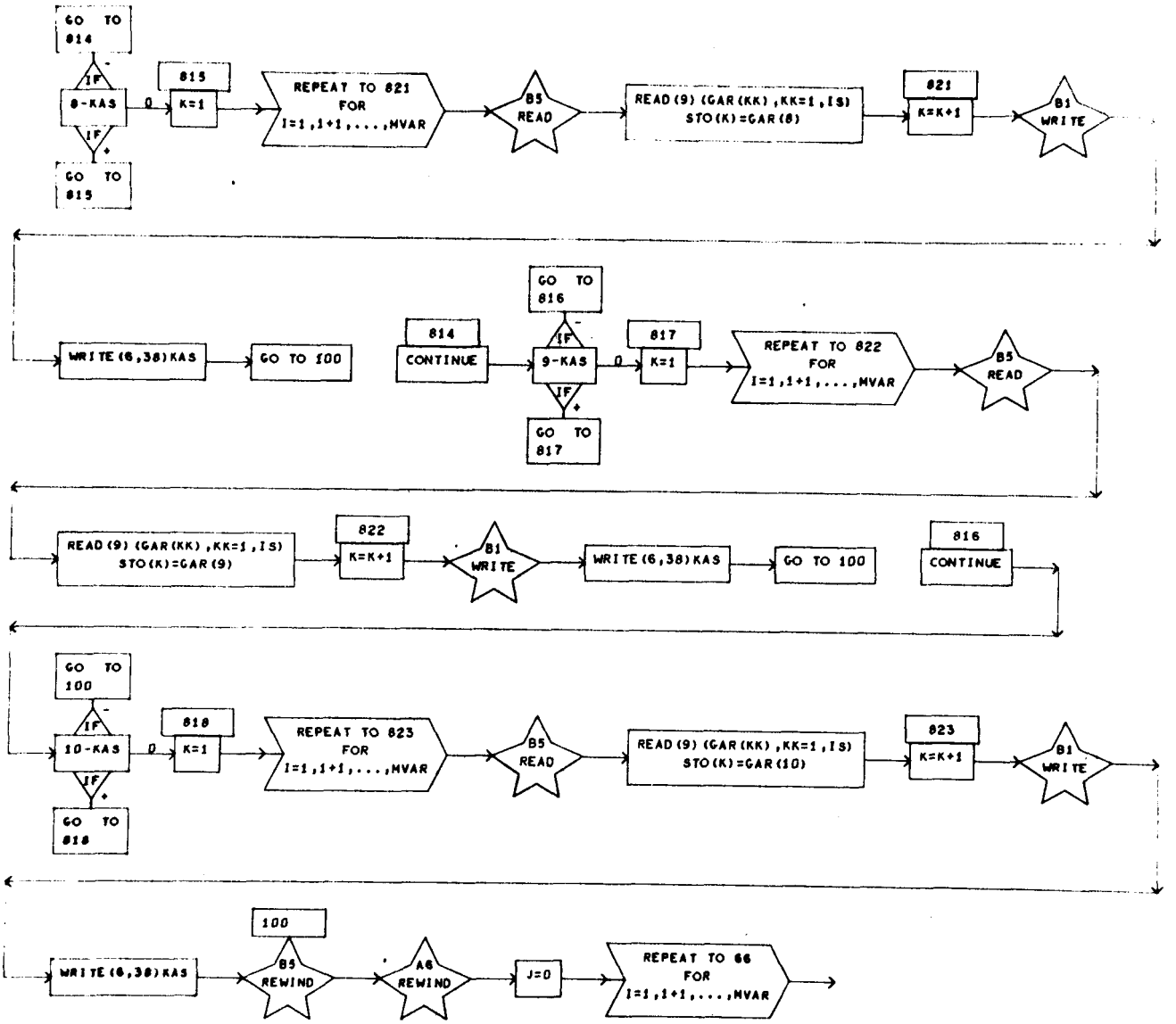
SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES
CLIN	101	SIG	136	FREQ	101	PHI	101	CFREQ	101
STO	14000	CAR	10	BLOCK	6000				

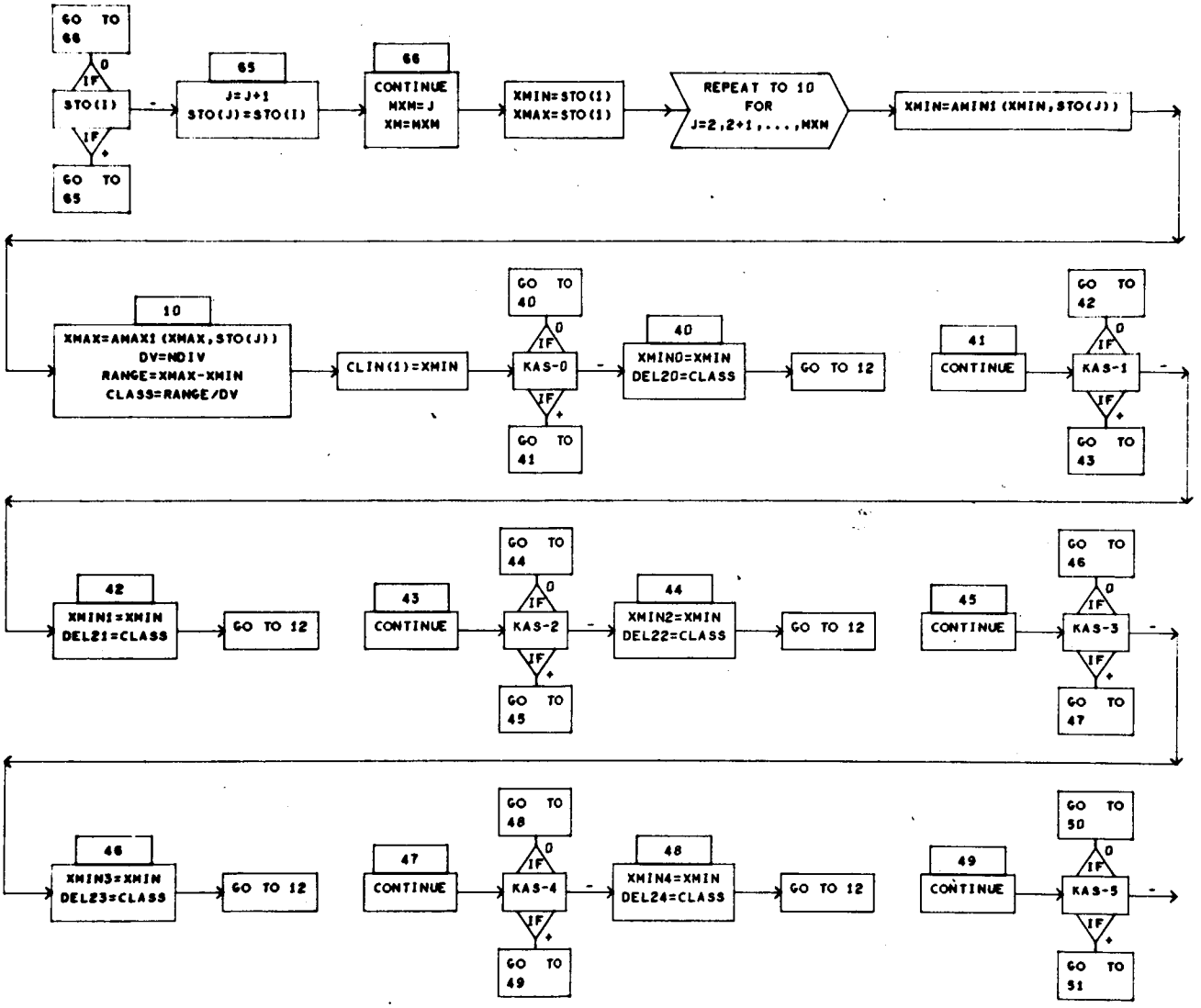
SUBROUTINE TWO

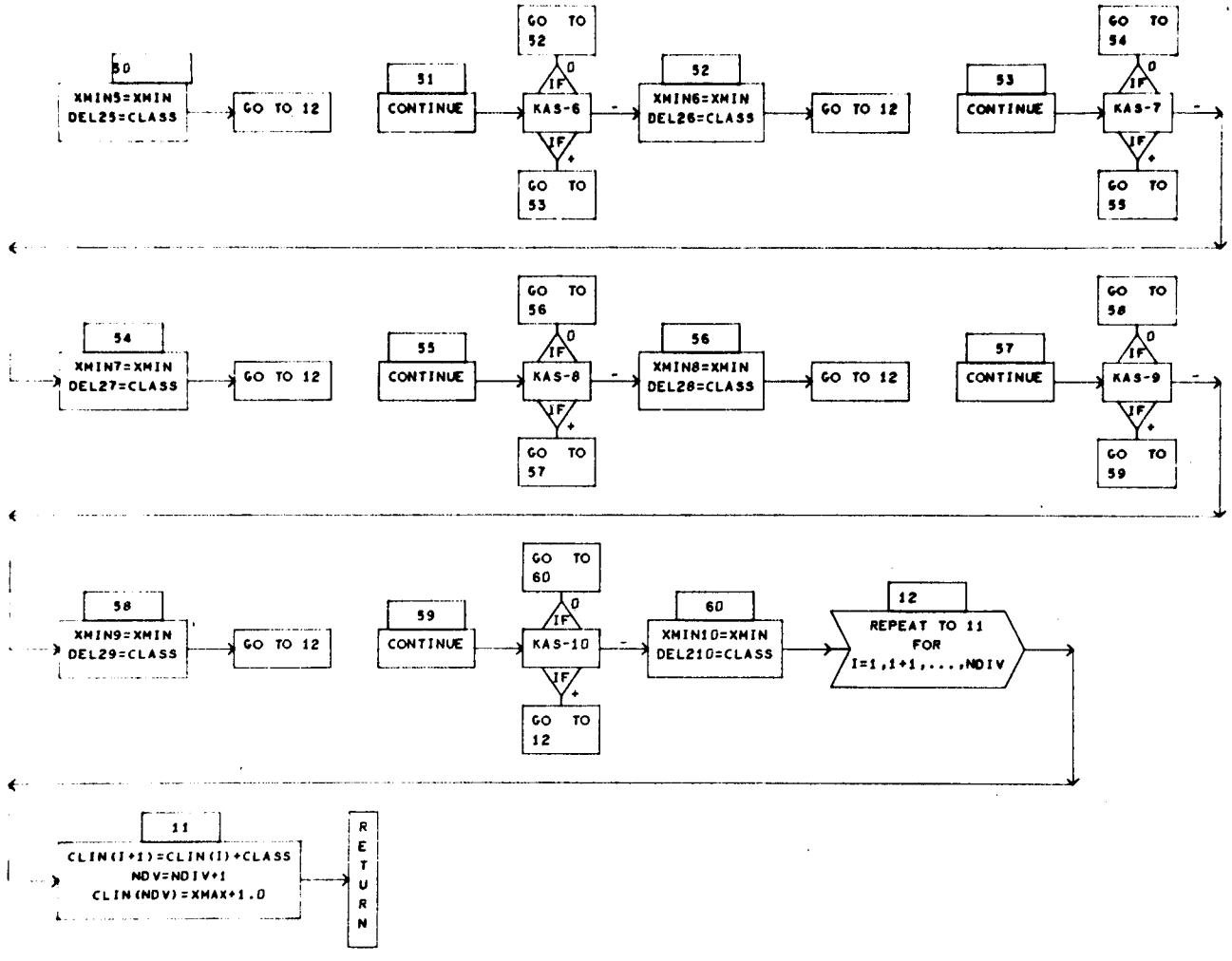



25
K=K+1
901
CONTINUE
B1
WRITE
WRITE(6,38)KAS
GO TO 100
26
CONTINUE
GO TO
29
IF
3-KAS
0
27
K=1
IF
+
GO TO
27
REPEAT TO 902
FOR
M=1,1+1,...,MVR
B5
READ
READ(9)(BLOCK(I),I=1,6000)
REPEAT TO 28
FOR
J=3,3+6,...,6000
STO(K)=BLOCK(J)
28
K=K+1
902
CONTINUE
B1
WRITE
WRITE(6,38)KAS
GO TO 100
29
CONTINUE
GO TO
32
IF
4-KAS
0
30
K=1
IF
+
GO TO
30
REPEAT TO 903
FOR
M=1,1+1,...,MVR
B5
READ
READ(9)(BLOCK(I),I=1,6000)
REPEAT TO 31
FOR
J=4,4+6,...,6000
STO(K)=BLOCK(J)
31
K=K+1
903
CONTINUE
B1
WRITE
WRITE(6,38)KAS
GO TO 100
32
CONTINUE
GO TO
35
IF
5-KAS
0
33
K=1
IF
+
GO TO
33


REPEAT TO 904
FOR
M=1,1+1,...,MVR
B5
READ
READ(9)(BLOCK(I),I=1,6000)
REPEAT TO 34
FOR
J=5,5+6,...,6000
STO(K)=BLOCK(J)
34
K=K+1
904
CONTINUE
B1
WRITE
WRITE(6,38)KAS
GO TO 100
35
CONTINUE
GO TO
811
IF
6-KAS
IF
0
+
36
K=1
GO TO
36
REPEAT TO 905
FOR
M=1,1+1,...,MVR
B5
READ
READ(9)(BLOCK(I),I=1,6000)
REPEAT TO 37
FOR
J=6,6+6,...,6000
STO(K)=BLOCK(J)
37
K=K+1
905
CONTINUE
B1
WRITE
WRITE(6,38)KAS
GO TO 100
811
CONTINUE
GO TO
812
IF
7-KAS
IF
0
+
813
K=1
GO TO
813
REPEAT TO 820
FOR
I=1,1+1,...,MVAR
B5
READ
READ(9)(GAR(KK),KK=1,IS)
STO(K)=GAR(7)
820
K=K+1
B1
WRITE
WRITE(6,38)KAS
GO TO 100
812
CONTINUE


GO TO 814
IF
8-KAS
0
815
K=1
REPEAT TO 821 FOR I=1,1+1,...,MVAR
B5 READ
READ(9) (GAR(KK),KK=1,IS) STO(K)=GAR(8)
821
K=K+1
B1 WRITE
GO TO 815
WRITE(6,38)KAS
GO TO 100
814
CONTINUE
GO TO 816
9-KAS
817
K=1
REPEAT TO 822 FOR I=1,1+1,...,MVAR
B5 READ
GO TO 817
READ(9) (GAR(KK),KK=1,IS) STO(K)=GAR(9)
822
K=K+1
B1 WRITE
WRITE(6,38)KAS
GO TO 100
816
CONTINUE
GO TO 100
10-KAS
818
K=1
REPEAT TO 823 FOR I=1,1+1,...,MVAR
B5 READ
READ(9) (GAR(KK),KK=1,IS) STO(K)=GAR(10)
823
K=K+1
B1 WRITE
GO TO 818
WRITE(6,38)KAS
100
B5 REWIND
A6 REWIND
J=0
REPEAT TO 66 FOR I=1,1+1,...,MVAR

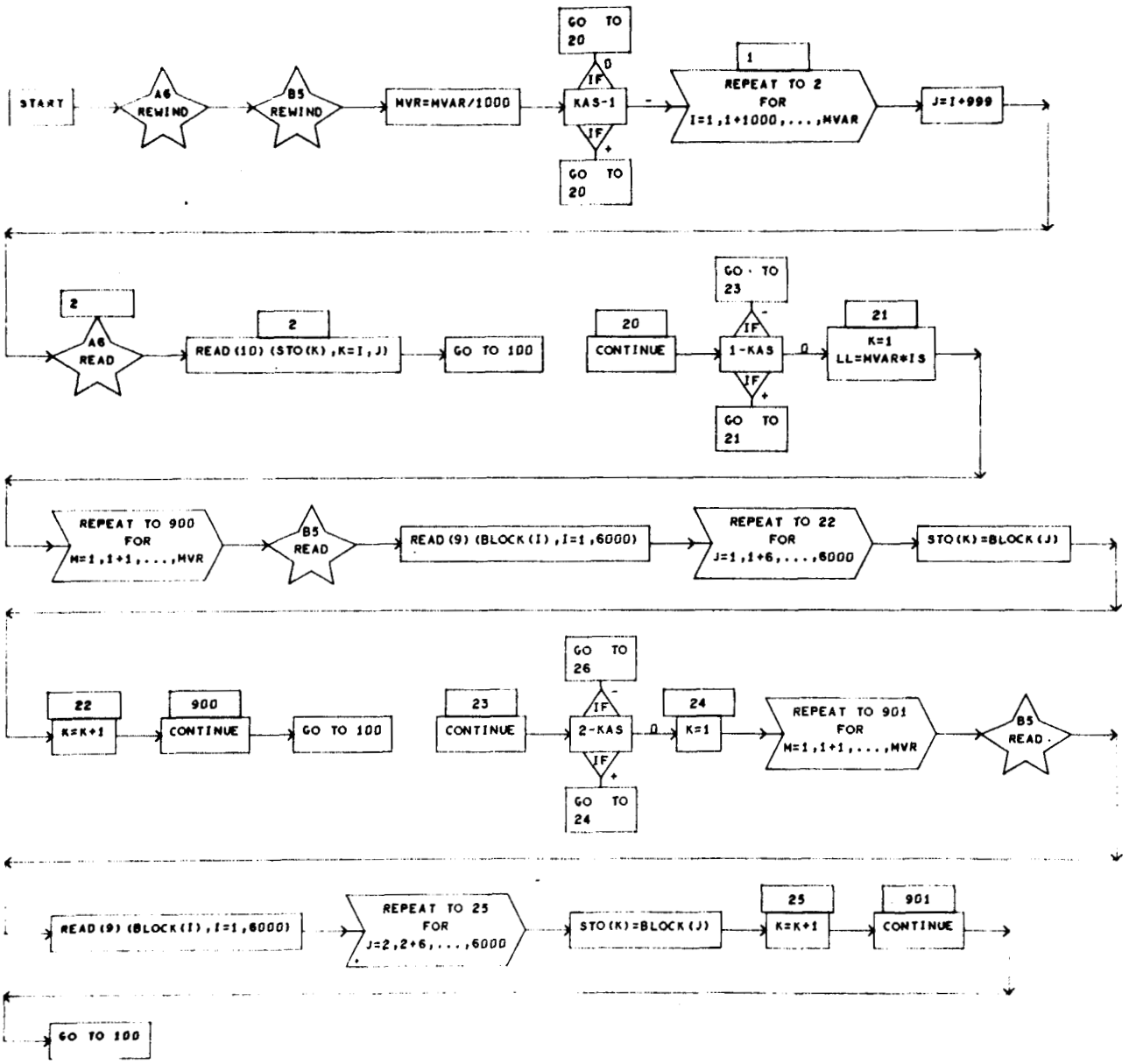

GO TO 66
IF 0
STO(I)
IF +
GO TO 65
65
J=J+1
STO(J)=STO(I)
66
CONTINUE
MXM=J
XM=MXM
XMIN=STO(1)
XMAX=STO(1)
REPEAT TO 10
FOR
J=2,2+1,...,MXM
XMIN=AMIN1(XMIN,STO(J))
10
XMAX=AMAX1(XMAX,STO(J))
DV=NDIV
RANGE=XMAX-XMIN
CLASS=RANGE/DV
CLIN(1)=XMIN
GO TO 40
KAS-0
GO TO 41
40
XMIN0=XMIN
DEL20=CLASS
GO TO 12
41
CONTINUE
GO TO 42
KAS-1
GO TO 43
42
XMIN1=XMIN
DEL21=CLASS
GO TO 12
43
CONTINUE
GO TO 44
KAS-2
GO TO 45
44
XMIN2=XMIN
DEL22=CLASS
GO TO 12
45
CONTINUE
GO TO 46
KAS-3
GO TO 47
46
XMIN3=XMIN
DEL23=CLASS
GO TO 12
47
CONTINUE
GO TO 48
KAS-4
GO TO 49
48
XMIN4=XMIN
DEL24=CLASS
GO TO 12
49
CONTINUE
GO TO 50
KAS-5
GO TO 51

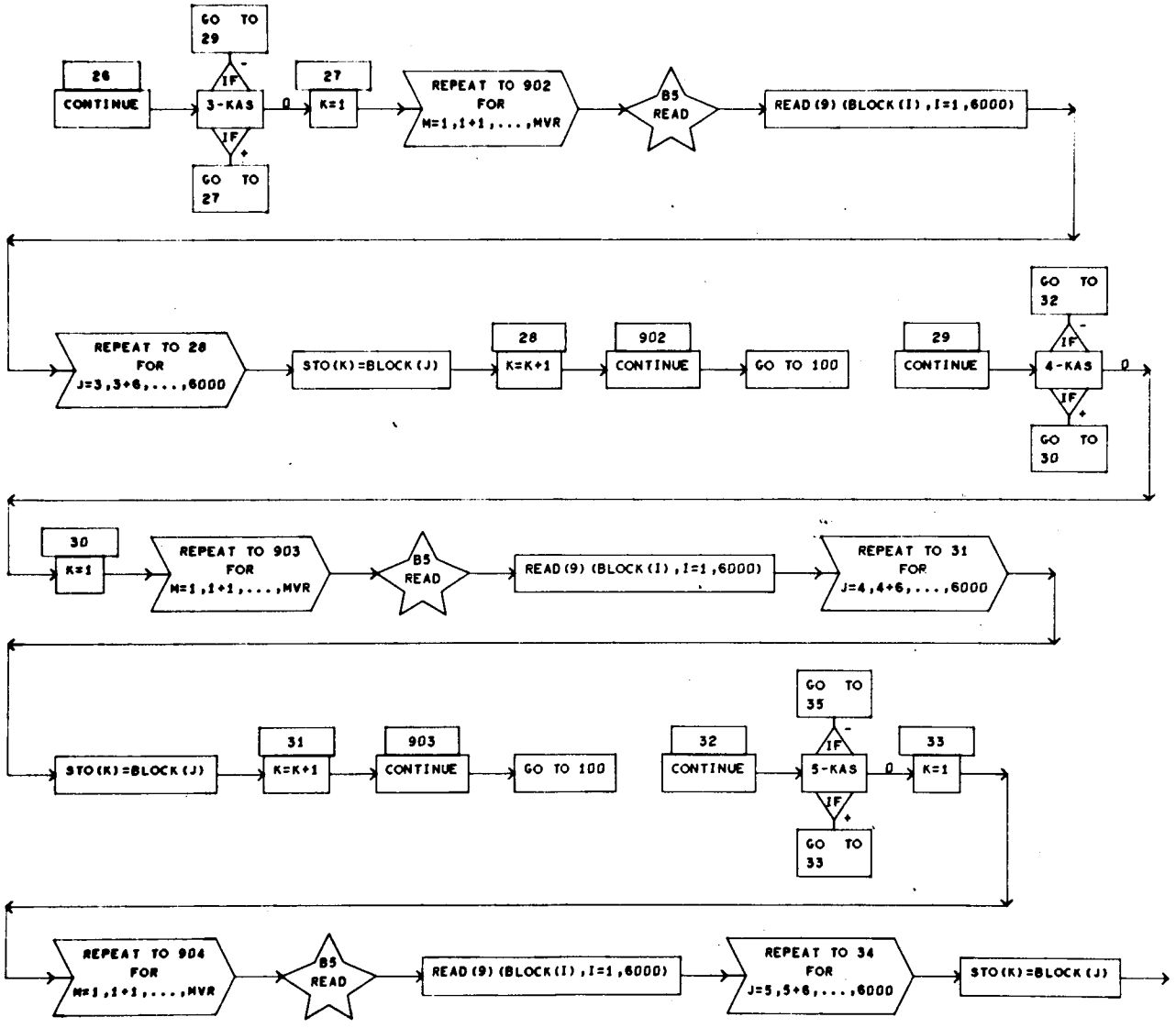

50
XMIN5=XMIN
DEL25=CLASS
GO TO 12
51
CONTINUE
KAS-6
IF 0
GO TO 52
IF +
GO TO 53
52
XMIN6=XMIN
DEL26=CLASS
GO TO 12
53
CONTINUE
KAS-7
IF 0
GO TO 54
IF +
GO TO 55
54
XMIN7=XMIN
DEL27=CLASS
GO TO 12
55
CONTINUE
KAS-8
IF 0
GO TO 56
IF +
GO TO 57
56
XMIN8=XMIN
DEL28=CLASS
GO TO 12
57
CONTINUE
KAS-9
IF 0
GO TO 58
IF +
GO TO 59
58
XMIN9=XMIN
DEL29=CLASS
GO TO 12
59
CONTINUE
KAS-10
IF 0
GO TO 60
IF +
GO TO 12
60
XMIN10=XMIN
DEL210=CLASS
12
REPEAT TO 11
FOR
I=1,1+1,...,NDIV
11
CLIN(I+1)=CLIN(I)+CLASS
NDV=NDIV+1
CLIN(NDV)=XMAX+1.0
RETURN

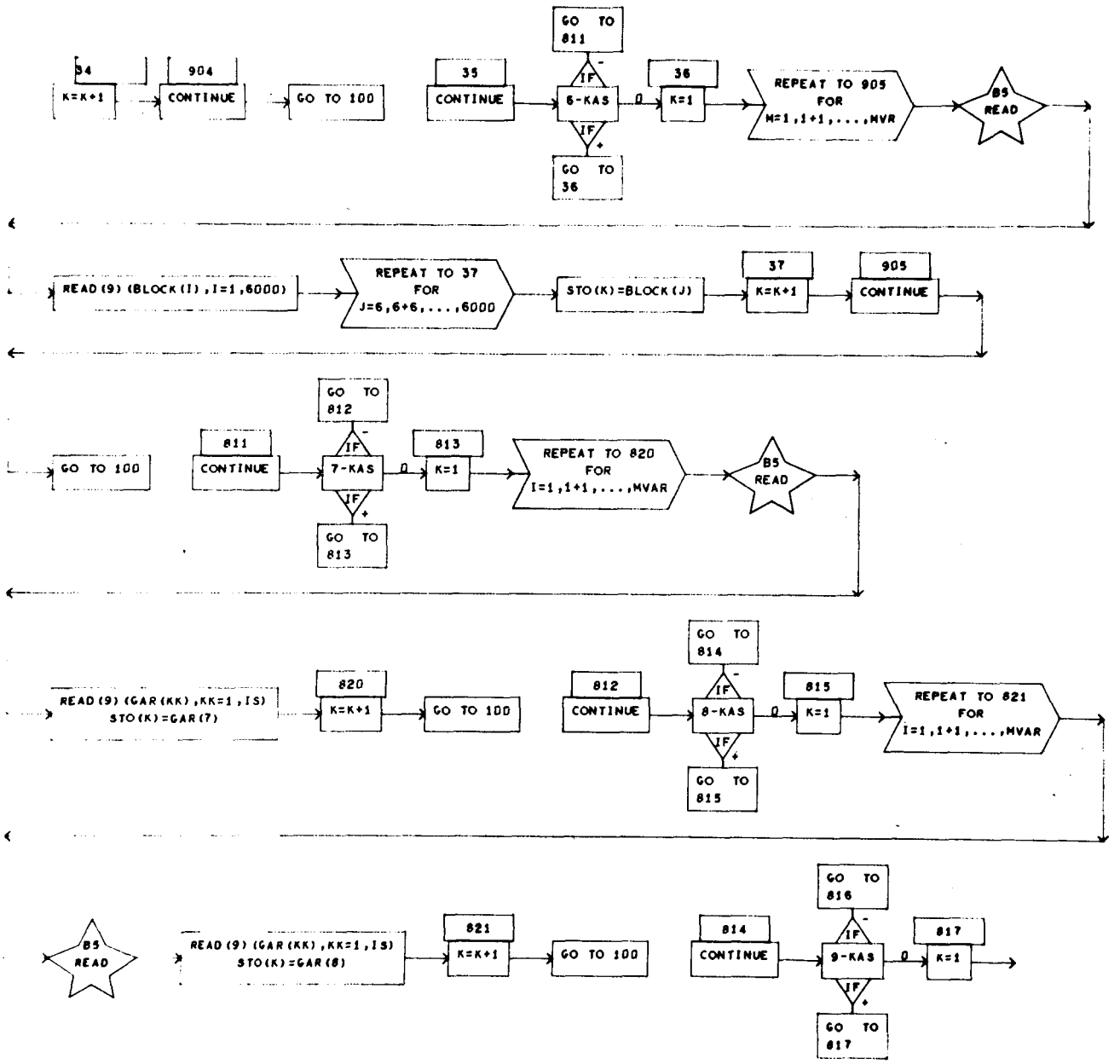
D I M E N S I O N E D V A R I A B L E S .

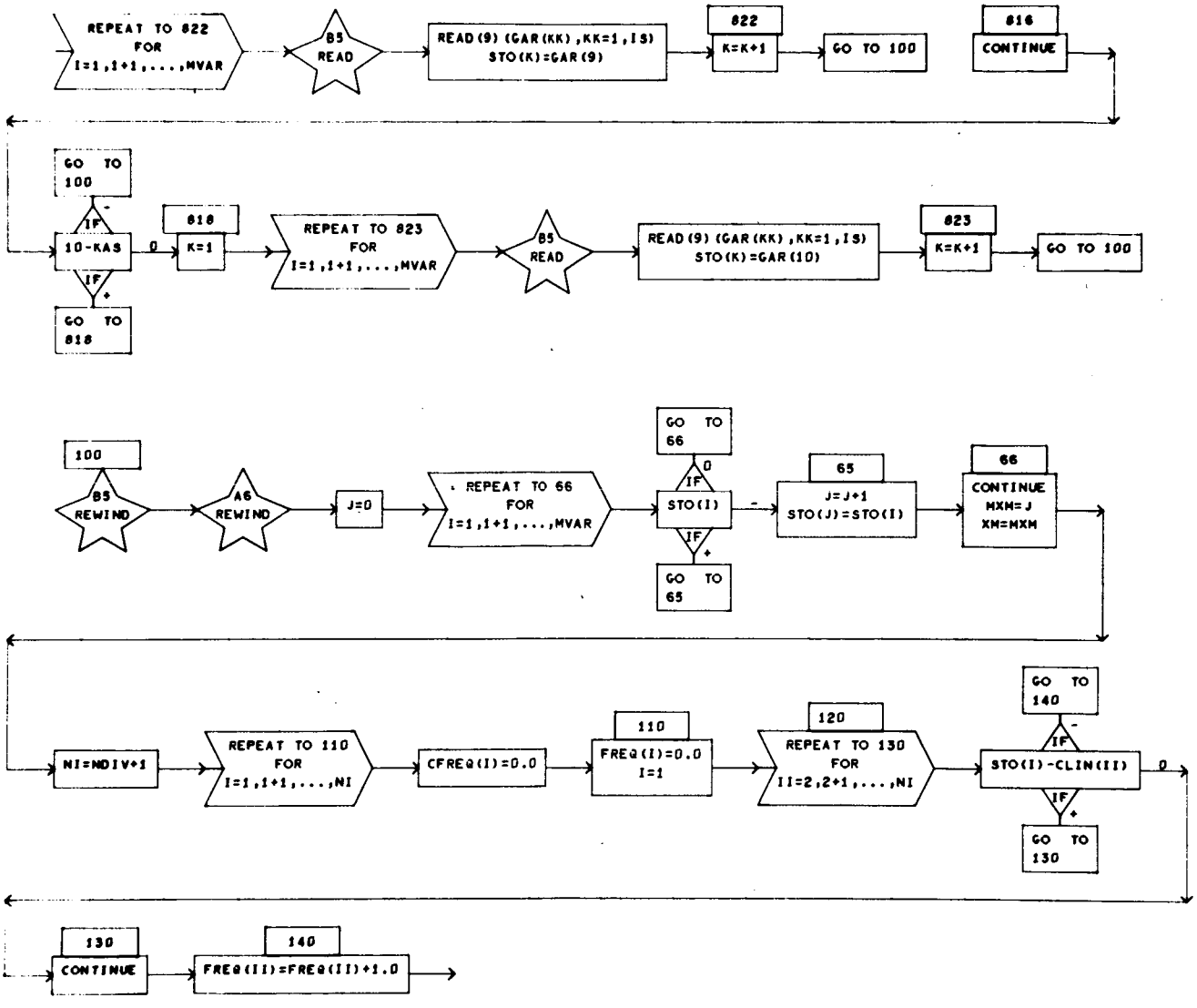
SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES
CLIN	101	SIG	136	FREQ	101	PHI	101	CFREQ	101
STO	14000	GAR	10	BLOCK	6000				

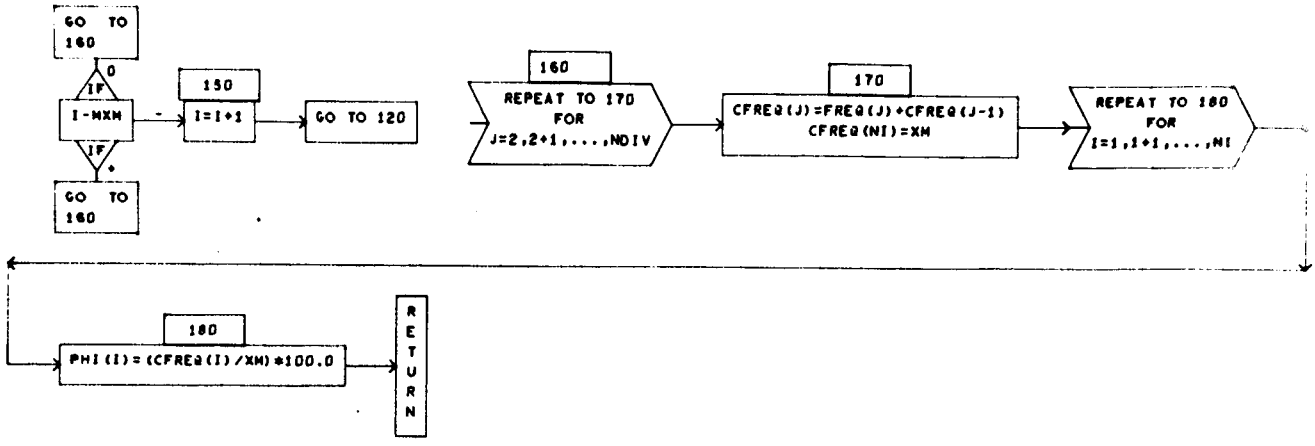
SUBROUTINE THREE




GO TO 29
26
CONTINUE
IF
3-KAS
-
0
+
IF
27
K=1
GO TO 27
REPEAT TO 902 FOR M=1,1+1,...,MVR
B5 READ
READ(9) (BLOCK(I),I=1,6000)
REPEAT TO 28 FOR J=3,3+6,...,6000
STO(K)=BLOCK(J)
28
K=K+1
902
CONTINUE
GO TO 100
GO TO 32
29
CONTINUE
IF
4-KAS
-
0
+
IF
GO TO 30
30
K=1
REPEAT TO 903 FOR M=1,1+1,...,MVR
B5 READ
READ(9) (BLOCK(I),I=1,6000)
REPEAT TO 31 FOR J=4,4+6,...,6000
STO(K)=BLOCK(J)
31
K=K+1
903
CONTINUE
GO TO 100
GO TO 35
32
CONTINUE
IF
5-KAS
-
0
+
IF
33
K=1
GO TO 33
REPEAT TO 904 FOR M=1,1+1,...,MVR
B5 READ
READ(9) (BLOCK(I),I=1,6000)
REPEAT TO 34 FOR J=5,5+6,...,6000
STO(K)=BLOCK(J)


34
K=K+1
904
CONTINUE
GO TO 100
35
CONTINUE
GO TO 811
IF -
6-KAS
0
IF +
GO TO 36
36
K=1
REPEAT TO 905 FOR M=1,1+1,...,MVR
85 READ
READ (9) (BLOCK (I), I=1,6000)
REPEAT TO 37 FOR J=6,6+6,...,6000
STO(K)=BLOCK(J)
37
K=K+1
905
CONTINUE
GO TO 100
811
CONTINUE
GO TO 812
IF -
7-KAS
0
IF +
GO TO 813
813
K=1
REPEAT TO 820 FOR I=1,1+1,...,MVAR
B5 READ
READ (9) (GAR (KK), KK=1, IS)
STO(K)=GAR(7)
820
K=K+1
GO TO 100
812
CONTINUE
GO TO 814
IF -
8-KAS
0
IF +
GO TO 815
815
K=1
REPEAT TO 821 FOR I=1,1+1,...,MVAR
B5 READ
READ (9) (GAR (KK), KK=1, IS)
STO(K)=GAR(8)
821
K=K+1
GO TO 100
814
CONTINUE
GO TO 816
IF -
9-KAS
0
IF +
GO TO 817
817
K=1

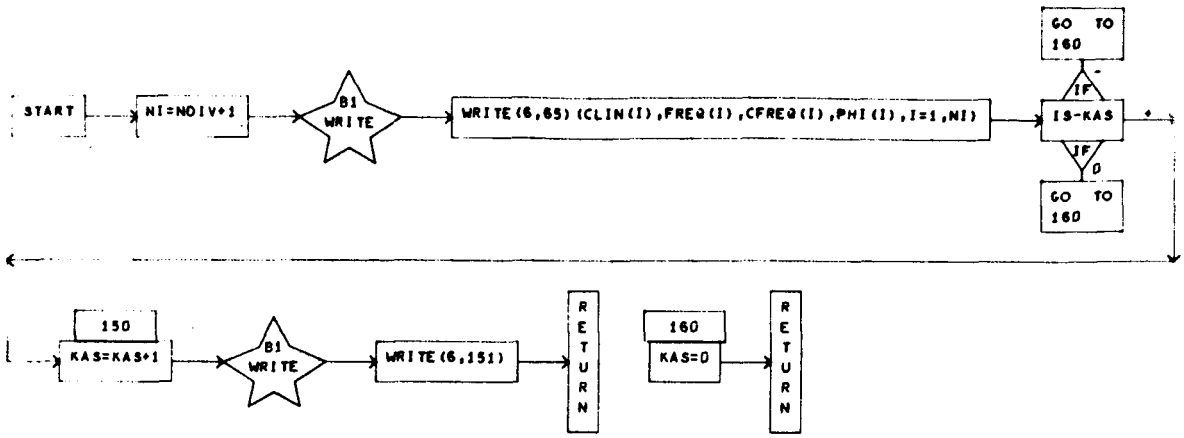

REPEAT TO 822
FOR
I=1,1+1,...,MVAR
B5
READ
READ(9) (GAR(KK),KK=1,IS)
STO(K)=GAR(9)
822
K=K+1
GO TO 100
816
CONTINUE
GO TO
100
IF
-
10-KAS
0
IF
+
GO TO
818
818
K=1
REPEAT TO 823
FOR
I=1,1+1,...,MVAR
B5
READ
READ(9) (GAR(KK),KK=1,IS)
STO(K)=GAR(10)
823
K=K+1
GO TO 100
100
B5
REWIND
A6
REWIND
J=0
REPEAT TO 66
FOR
I=1,1+1,...,MVAR
GO TO
66
IF
0
STO(I)
IF
+
GO TO
65
-
65
J=J+1
STO(J)=STO(I)
66
CONTINUE
MXM=J
XM=MXM
NI=NDIV+1
REPEAT TO 110
FOR
I=1,1+1,...,NI
CFREQ(I)=0.0
110
FREQ(I)=0.0
I=1
120
REPEAT TO 130
FOR
II=2,2+1,...,NI
GO TO
140
IF
-
STO(I)-CLIN(II)
0
IF
+
GO TO
130
130
CONTINUE
140
FREQ(II)=FREQ(II)+1.0


GO TO 160
IF 0
I-MXM
150
I=I+1
GO TO 120
IF +
GO TO 160
160
REPEAT TO 170 FOR J=2,2+1,...,NDIV
170
CFREQ(J)=FREQ(J)+CFREQ(J-1)
CFREQ(NI)=XM
REPEAT TO 180 FOR I=1,1+1,...,NI
180
PHI(I)=(CFREQ(I)/XM)*100.0
RETURN

DIMENSIONED VARIABLES

SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES
CLIN	101	SIG	136	FREQ	101	PHI	101	CFREQ	101
STO	14000	CAR	10	BLOCK	6000				

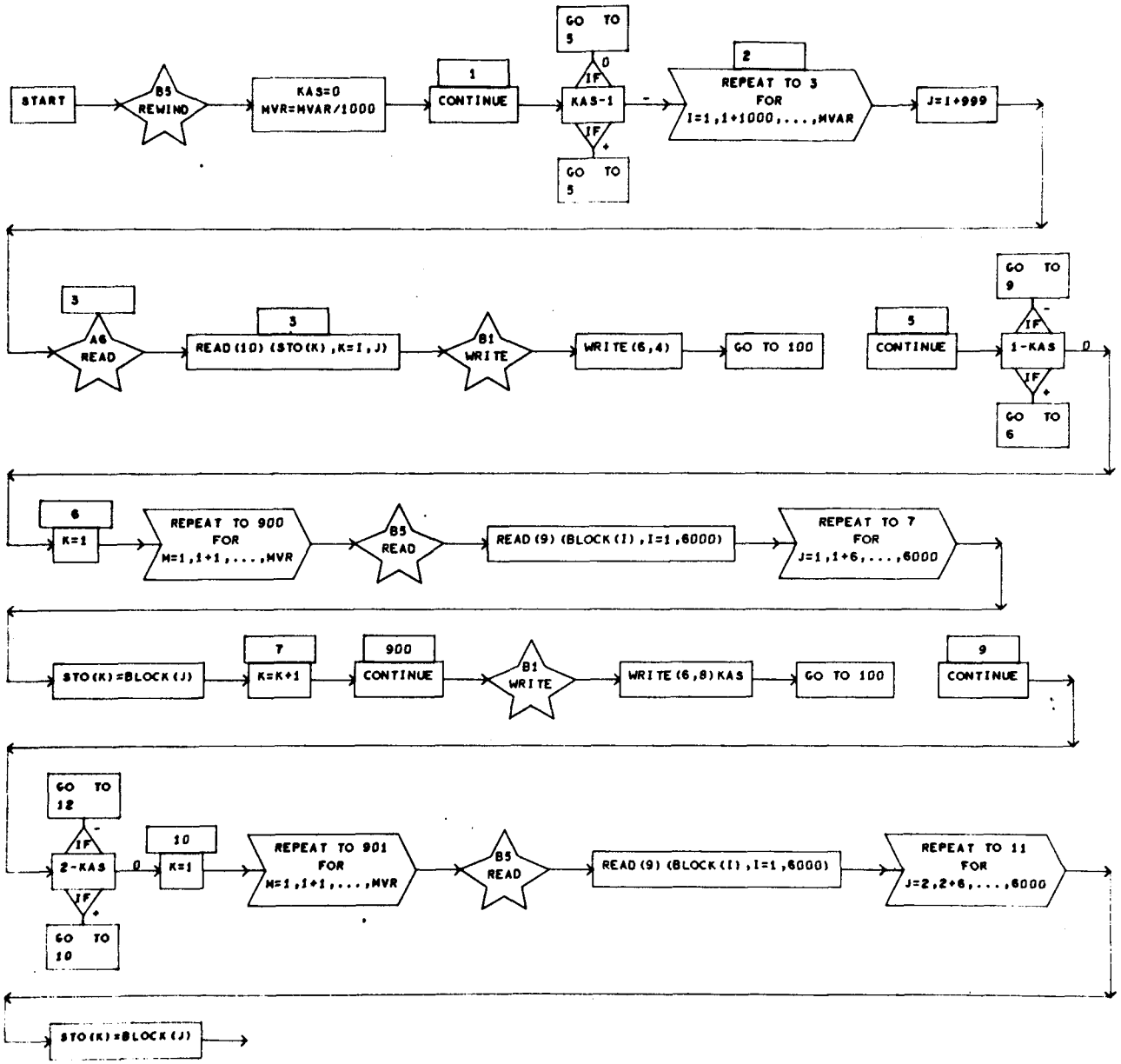
SUBROUTINE FOUR

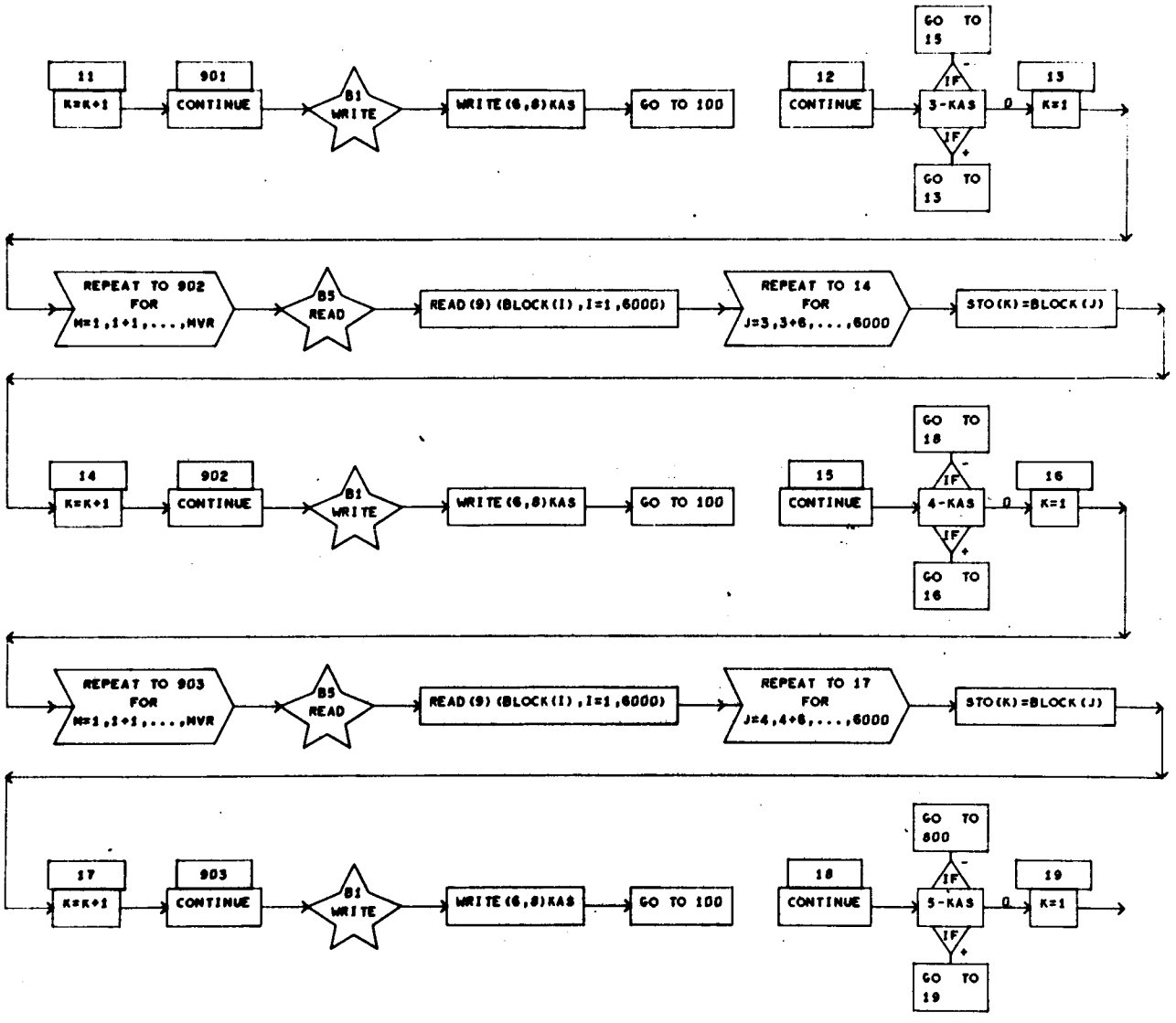


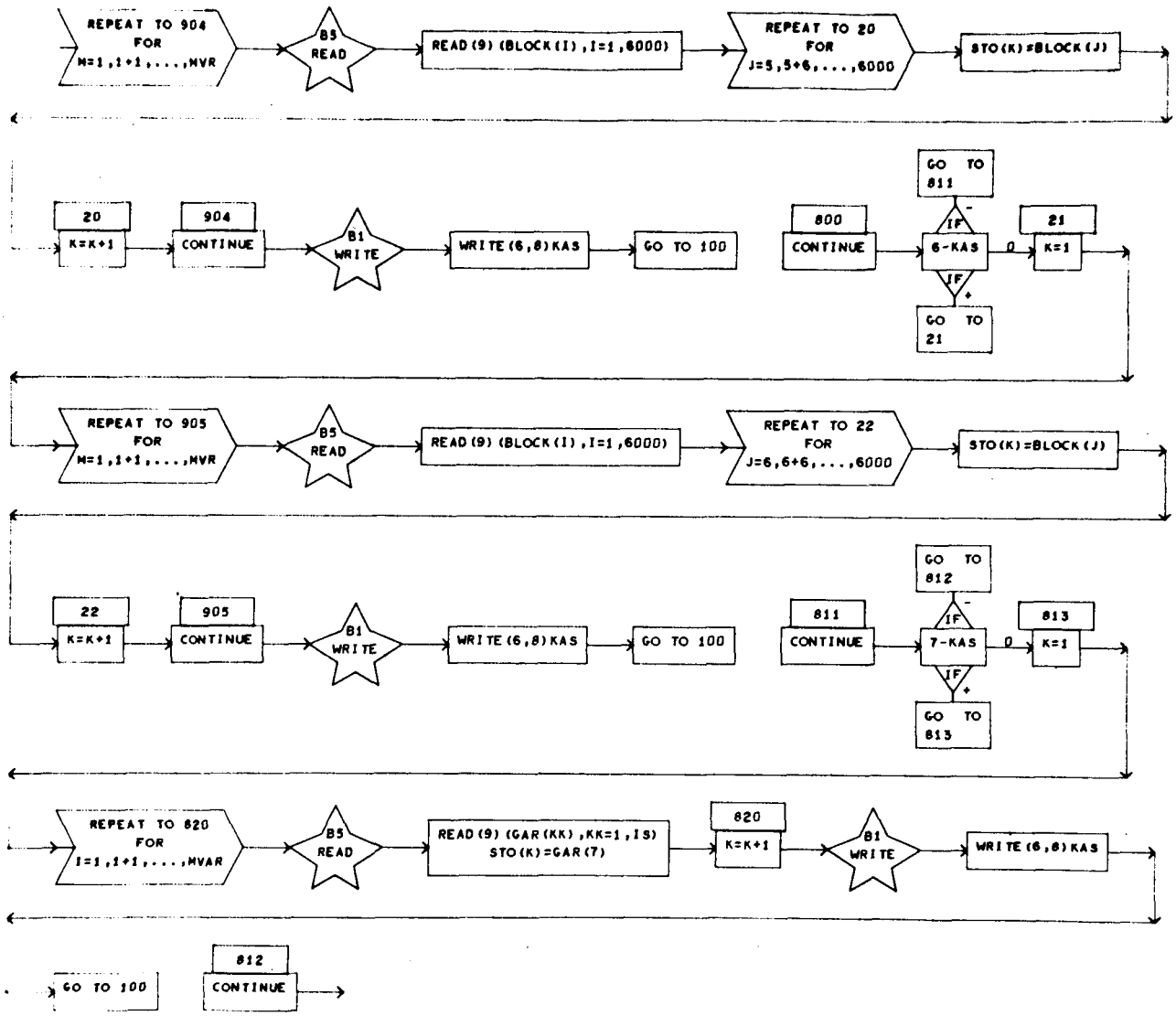
D I M E N S I O N E D V A R I A B L E S

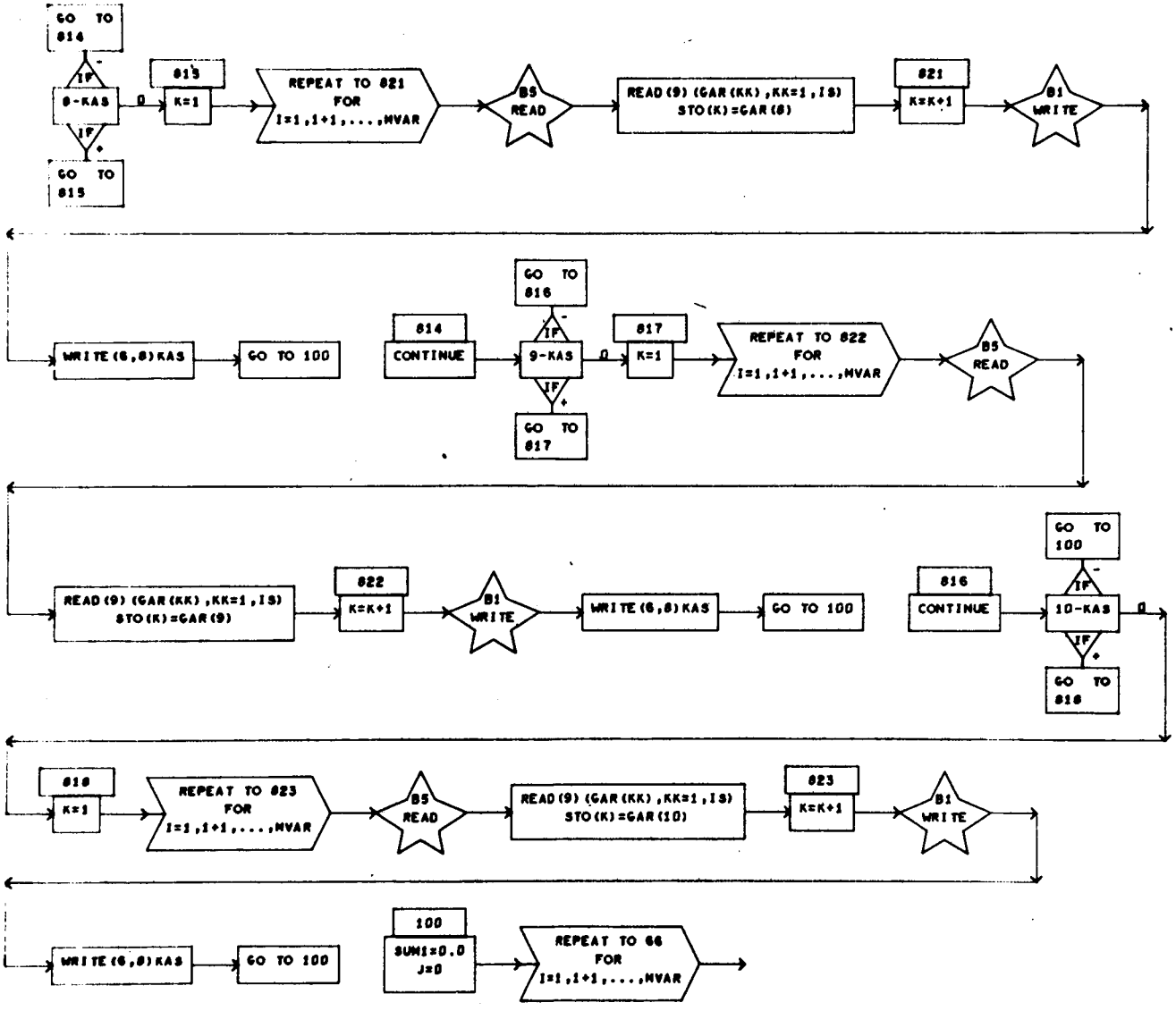
SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES
CLIN	101	SIG	136	FREQ	101	PHI	101	CFREQ	101
STO	14000	GAR	10	BLOCK	6000				

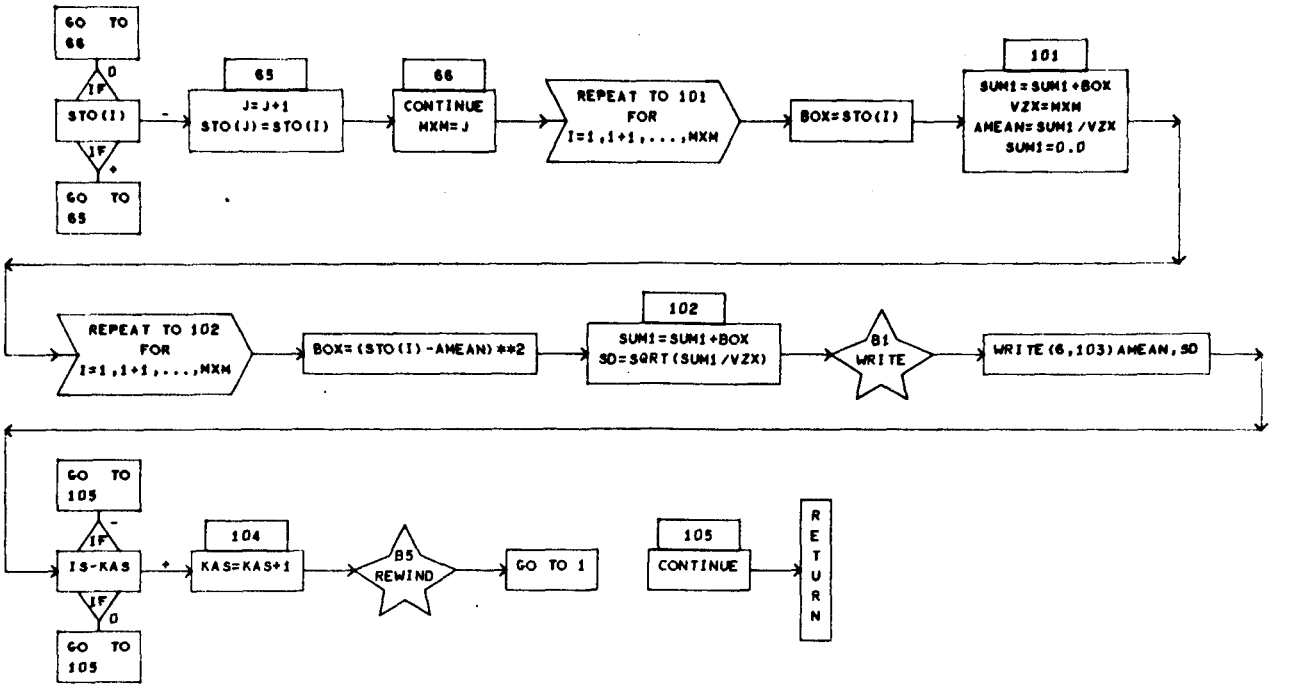
SUBROUTINE FIVE




11
K=K+1
901
CONTINUE
B1
WRITE
WRITE(6,8)KAS
GO TO 100
12
CONTINUE
GO TO
15
IF
-
3-KAS
0
IF
+
13
K=1
GO TO
13
REPEAT TO 902
FOR
M=1,1+1,...,MVR
B5
READ
READ(9)(BLOCK(I),I=1,6000)
REPEAT TO 14
FOR
J=3,3+6,...,6000
STO(K)=BLOCK(J)
14
K=K+1
902
CONTINUE
B1
WRITE
WRITE(6,8)KAS
GO TO 100
15
CONTINUE
GO TO
18
IF
-
4-KAS
0
IF
+
16
K=1
GO TO
16
REPEAT TO 903
FOR
M=1,1+1,...,MVR
B5
READ
READ(9)(BLOCK(I),I=1,6000)
REPEAT TO 17
FOR
J=4,4+6,...,6000
STO(K)=BLOCK(J)
17
K=K+1
903
CONTINUE
B1
WRITE
WRITE(6,8)KAS
GO TO 100
18
CONTINUE
GO TO
800
IF
-
5-KAS
0
IF
+
19
K=1
GO TO
19


REPEAT TO 904
FOR
M=1,1+1,...,MVR
B5
READ
READ(9) (BLOCK(I),I=1,6000)
REPEAT TO 20
FOR
J=5,5+6,...,6000
STO(K)=BLOCK(J)
20
K=K+1
904
CONTINUE
B1
WRITE
WRITE(6,8)KAS
GO TO 100
800
CONTINUE
GO TO
811
IF
-
6-KAS
0
IF
+
21
K=1
GO TO
21
REPEAT TO 905
FOR
M=1,1+1,...,MVR
B5
READ
READ(9) (BLOCK(I),I=1,6000)
REPEAT TO 22
FOR
J=6,6+6,...,6000
STO(K)=BLOCK(J)
22
K=K+1
905
CONTINUE
B1
WRITE
WRITE(6,8)KAS
GO TO 100
811
CONTINUE
GO TO
812
IF
-
7-KAS
0
IF
+
813
K=1
GO TO
813
REPEAT TO 820
FOR
I=1,1+1,...,MVAR
B5
READ
READ(9) (GAR(KK),KK=1,15)
STO(K)=GAR(7)
820
K=K+1
B1
WRITE
WRITE(6,8)KAS
GO TO 100
812
CONTINUE

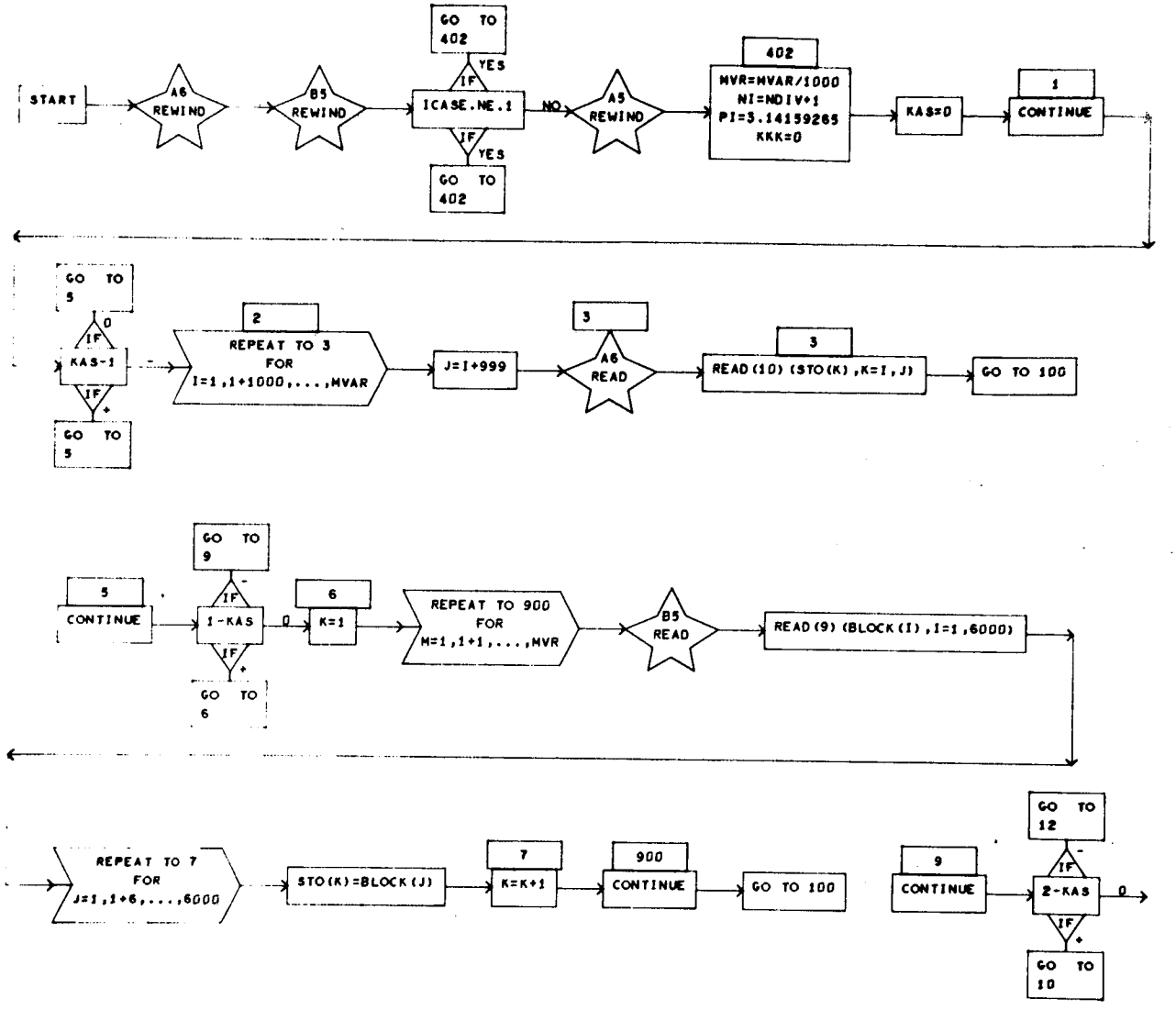

GO TO 814
IF
8-KAS
0
813
K=1
REPEAT TO 821 FOR I=1,1+1,...,MVAR
B5 READ
READ(9) (GAR(KK),KK=1,IS) STO(K)=GAR(8)
821
K=K+1
B1 WRITE
IF
+
GO TO 815
WRITE(6,8)KAS
GO TO 100
814
CONTINUE
GO TO 816
IF
9-KAS
0
817
K=1
REPEAT TO 822 FOR I=1,1+1,...,MVAR
B5 READ
IF
+
GO TO 817
READ(9) (GAR(KK),KK=1,IS) STO(K)=GAR(9)
822
K=K+1
B1 WRITE
WRITE(6,8)KAS
GO TO 100
816
CONTINUE
GO TO 100
IF
10-KAS
0
IF
+
GO TO 818
818
K=1
REPEAT TO 823 FOR I=1,1+1,...,MVAR
B5 READ
READ(9) (GAR(KK),KK=1,IS) STO(K)=GAR(10)
823
K=K+1
B1 WRITE
WRITE(6,8)KAS
GO TO 100
100
SUM1=0.0
J=0
REPEAT TO 66 FOR I=1,1+1,...,MVAR

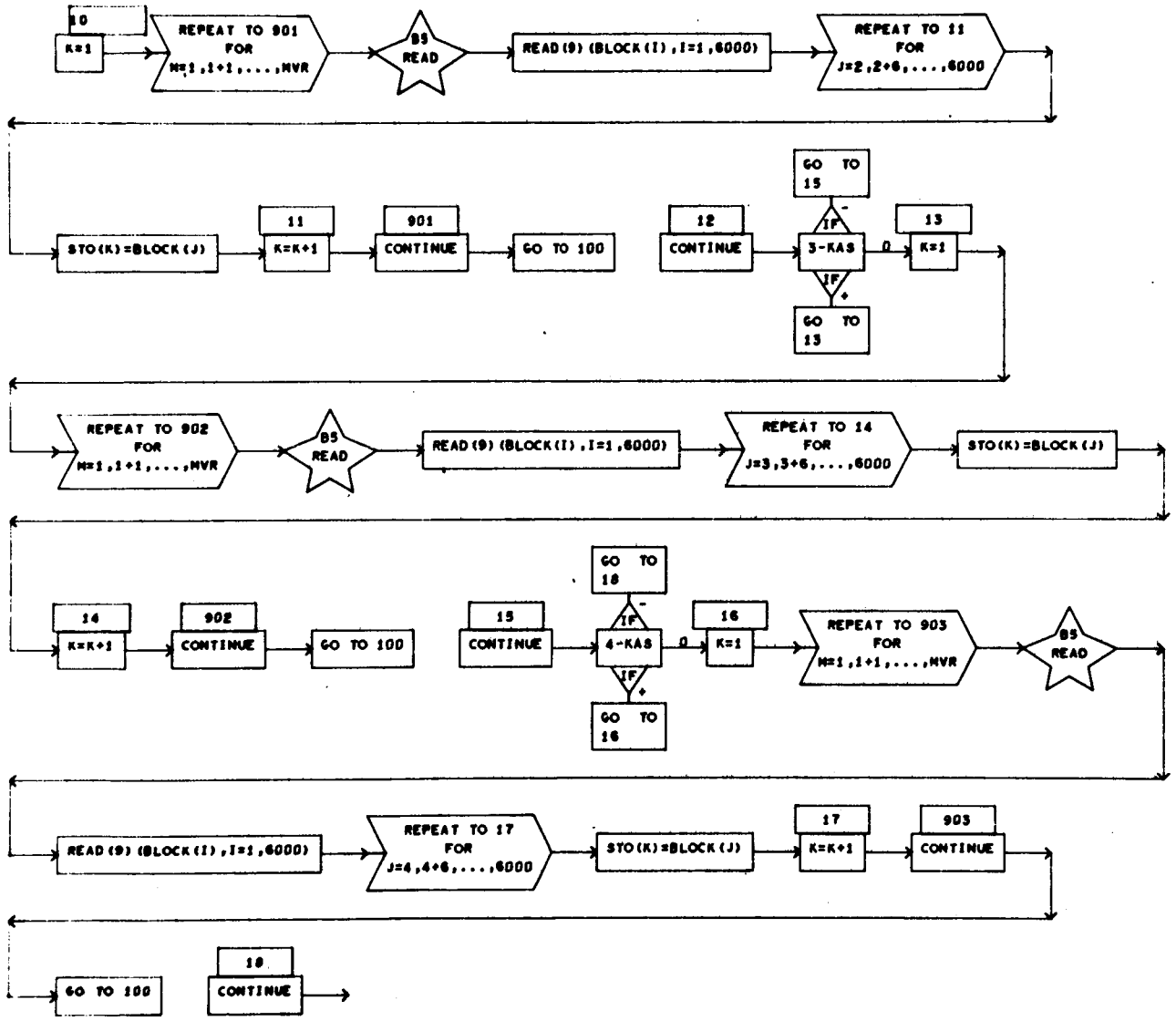

GO TO 66
IF 0
STO(I)
IF +
GO TO 65
65
J=J+1
STO(J)=STO(I)
66
CONTINUE
MXM=J
REPEAT TO 101
FOR
I=1,1+1,...,MXM
BOX=STO(I)
101
SUM1=SUM1+BOX
VZX=MXM
AMEAN=SUM1/VZX
SUM1=0.0
REPEAT TO 102
FOR
I=1,1+1,...,MXM
BOX=(STO(I)-AMEAN)**2
102
SUM1=SUM1+BOX
SD=SQRT(SUM1/VZX)
81
WRITE
WRITE(6,103)AMEAN,SD
GO TO 105
IF -
IS-KAS
IF 0
GO TO 105
104
KAS=KAS+1
85
REWIND
GO TO 1
105
CONTINUE
RETURN

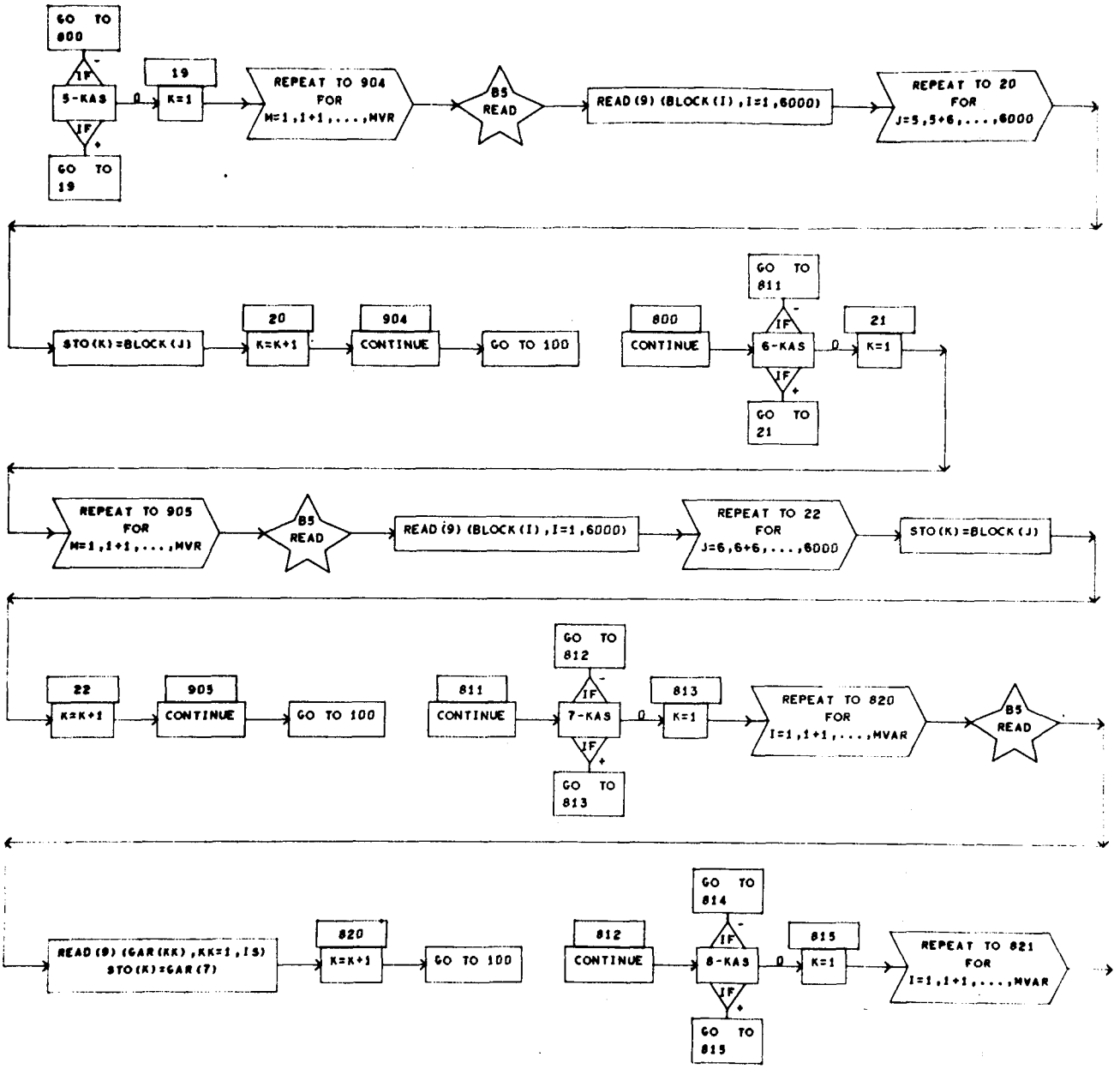
DIMENSIONED VARIABLES

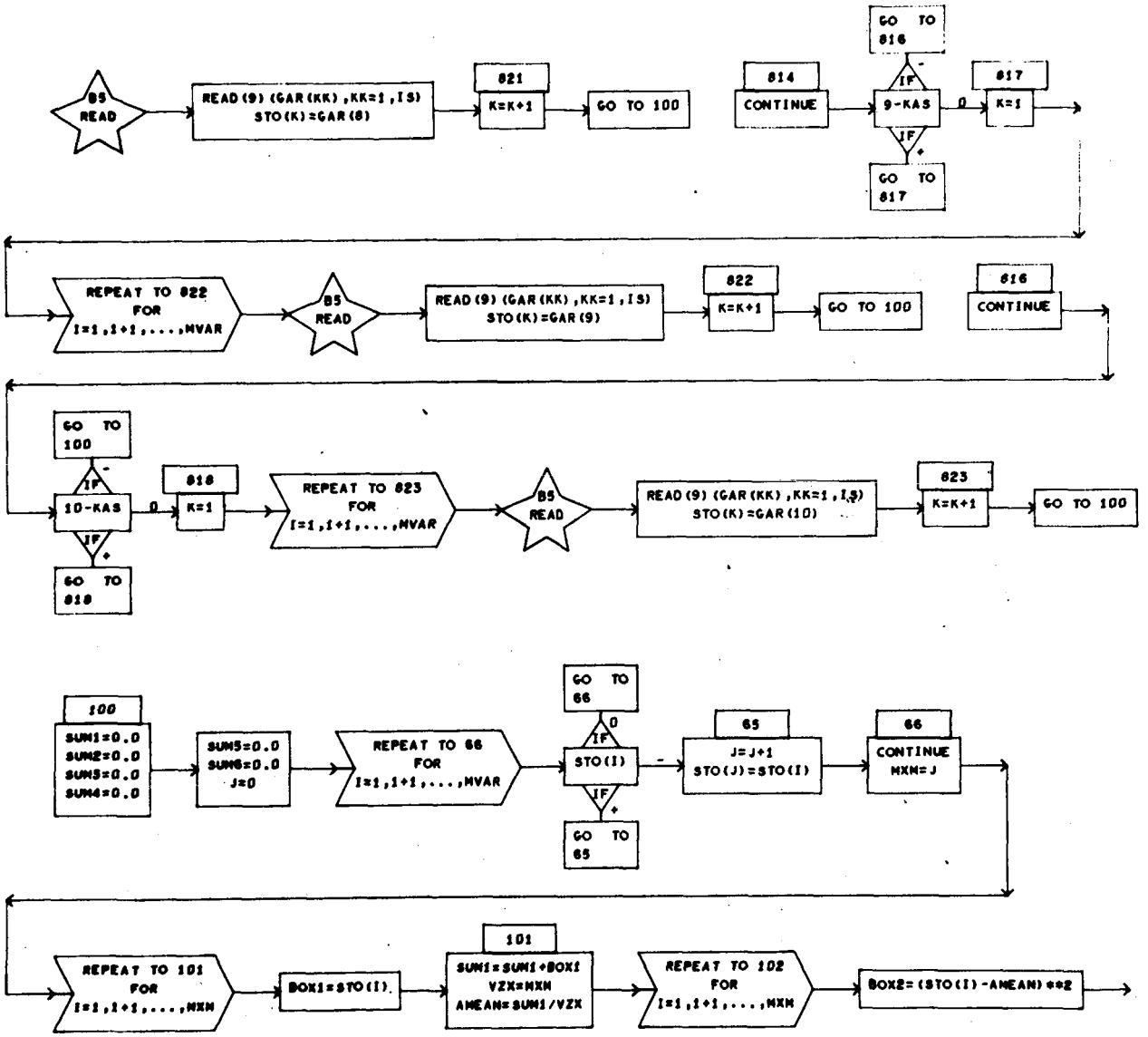
SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES	SYMBOL	STORAGES
CLIN	101	SIG	136	FREQ	101	PHI	101	CFREQ	101
STO	14000	GAR	10	BLOCK	6000	X	101	Y	101

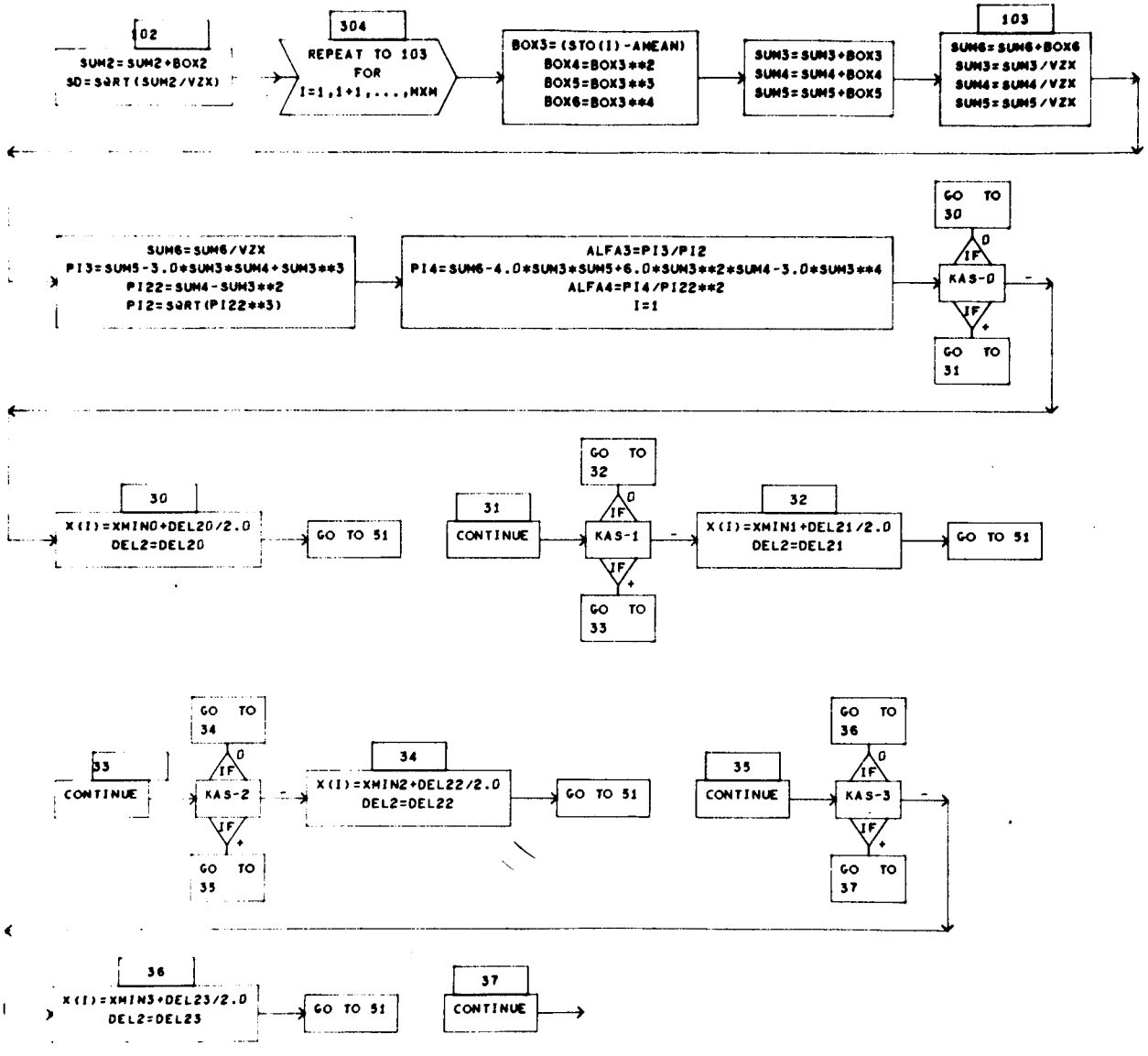
SUBROUTINE SIX

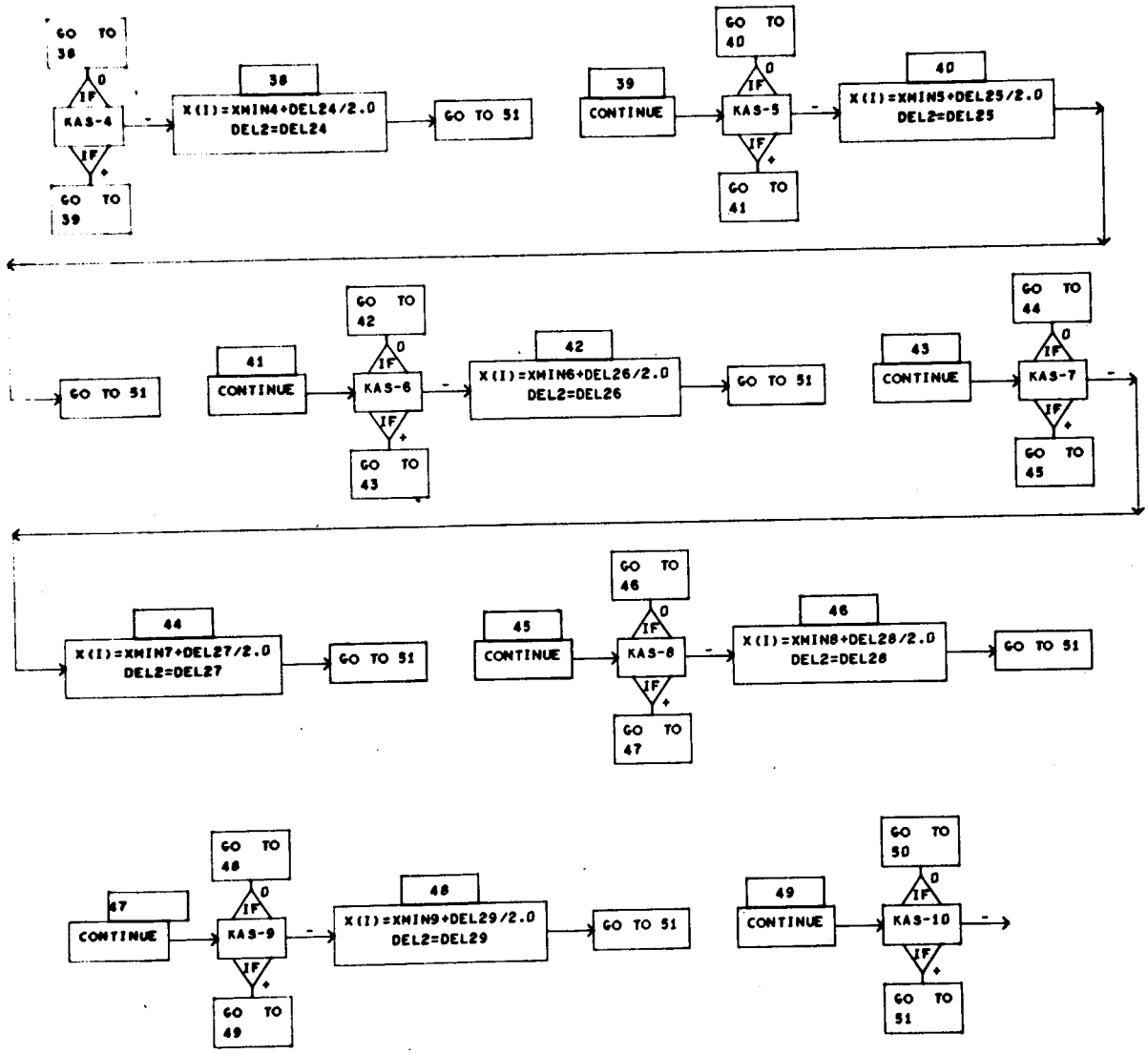


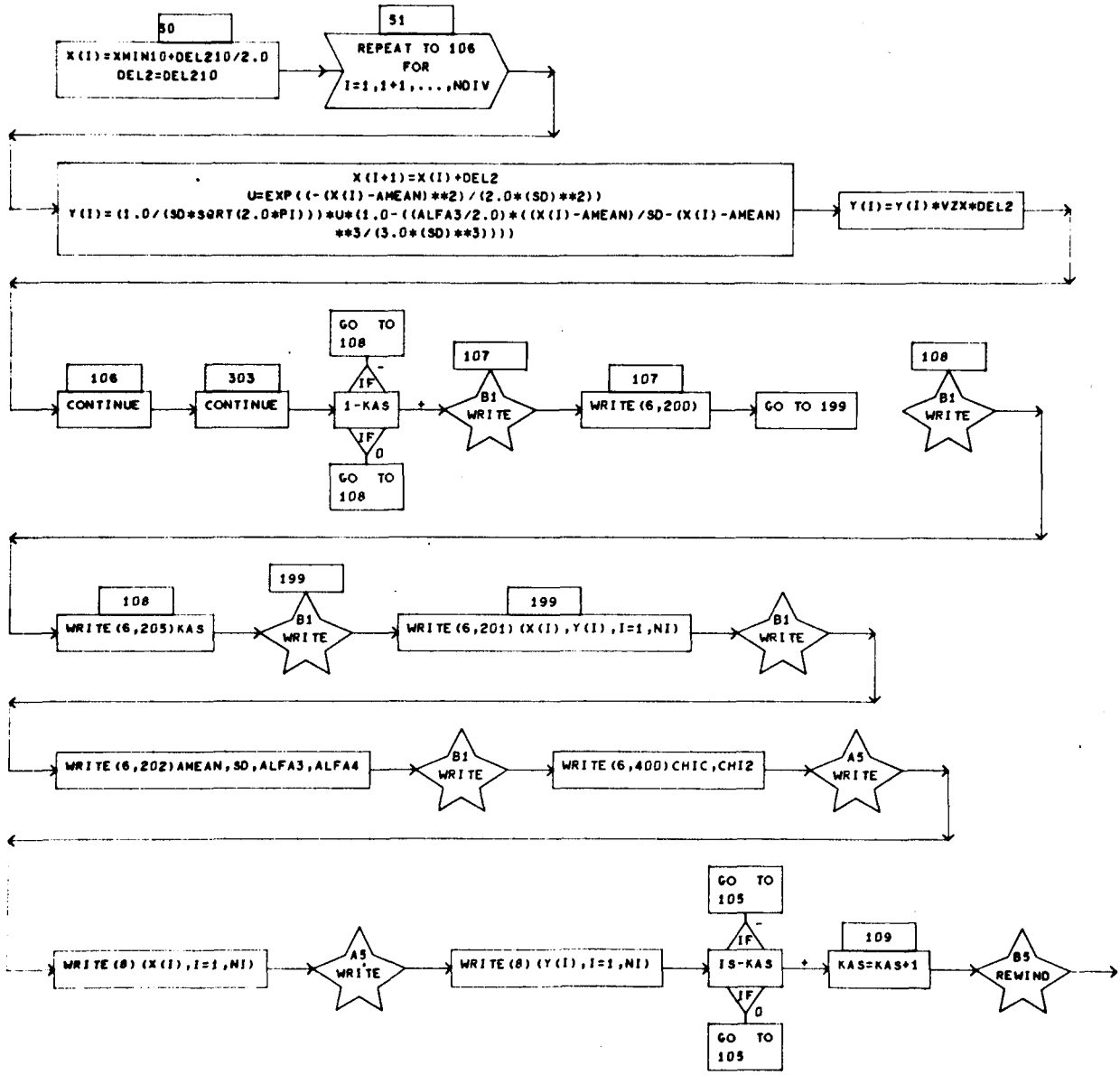

10
K=1
REPEAT TO 901
FOR
M=1,1+1,...,MVR
85
READ
READ(9)(BLOCK(I),I=1,6000)
REPEAT TO 11
FOR
J=2,2+6,...,6000
STO(K)=BLOCK(J)
11
K=K+1
901
CONTINUE
GO TO 100
12
CONTINUE
GO TO
15
IF
3-KAS
0
13
K=1
IF
+
GO TO
13
REPEAT TO 902
FOR
M=1,1+1,...,MVR
85
READ
READ(9)(BLOCK(I),I=1,6000)
REPEAT TO 14
FOR
J=3,3+6,...,6000
STO(K)=BLOCK(J)
14
K=K+1
902
CONTINUE
GO TO 100
15
CONTINUE
GO TO
16
IF
4-KAS
0
16
K=1
IF
+
GO TO
16
REPEAT TO 903
FOR
M=1,1+1,...,MVR
85
READ
READ(9)(BLOCK(I),I=1,6000)
REPEAT TO 17
FOR
J=4,4+6,...,6000
STO(K)=BLOCK(J)
17
K=K+1
903
CONTINUE
GO TO 100
18
CONTINUE

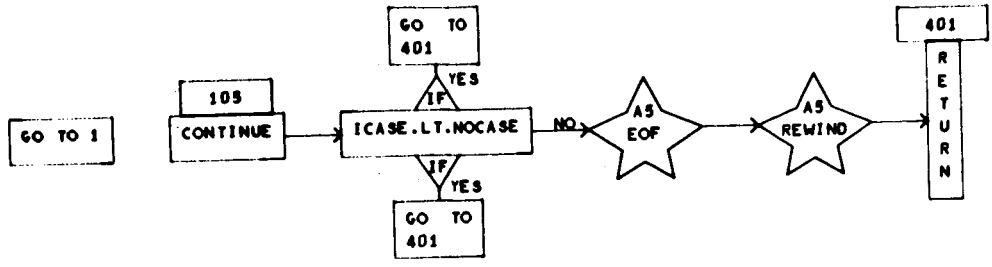

GO TO 800
IF
5-KAS
0
19
K=1
REPEAT TO 904 FOR M=1,1+1,...,MVR
85 READ
READ (9) (BLOCK (I), I=1,6000)
REPEAT TO 20 FOR J=5,5+6,...,6000
GO TO 19
IF +
STO(K)=BLOCK(J)
20
K=K+1
904
CONTINUE
GO TO 100
800
CONTINUE
GO TO 811
IF -
6-KAS
0
21
K=1
IF +
GO TO 21
REPEAT TO 905 FOR M=1,1+1,...,MVR
85 READ
READ (9) (BLOCK (I), I=1,6000)
REPEAT TO 22 FOR J=6,6+6,...,6000
STO(K)=BLOCK(J)
22
K=K+1
905
CONTINUE
GO TO 100
811
CONTINUE
GO TO 812
IF -
7-KAS
0
813
K=1
IF +
GO TO 813
REPEAT TO 820 FOR I=1,1+1,...,MVAR
85 READ
READ (9) (GAR(KK), KK=1, IS)
STO(K)=GAR(7)
820
K=K+1
GO TO 100
812
CONTINUE
GO TO 814
IF -
8-KAS
0
815
K=1
IF +
GO TO 815
REPEAT TO 821 FOR I=1,1+1,...,MVAR


85
READ
READ (9) (GAR(KK),KK=1,IS)
STO(K)=GAR(8)
821
K=K+1
GO TO 100
814
CONTINUE
GO TO
816
IF
9-KAS
0
817
K=1
IF
+
GO TO
817
REPEAT TO 822
FOR
I=1,1+1,...,MVAR
85
READ
READ (9) (GAR(KK),KK=1,IS)
STO(K)=GAR(9)
822
K=K+1
GO TO 100
816
CONTINUE
GO TO
100
IF
10-KAS
0
818
K=1
IF
+
GO TO
818
REPEAT TO 823
FOR
I=1,1+1,...,MVAR
85
READ
READ (9) (GAR(KK),KK=1,IS)
STO(K)=GAR(10)
823
K=K+1
GO TO 100
100
SUM1=0.0
SUM2=0.0
SUM3=0.0
SUM4=0.0
SUM5=0.0
SUM6=0.0
J=0
REPEAT TO 66
FOR
I=1,1+1,...,MVAR
GO TO
66
0
IF
STO(I)
IF
+
GO TO
65
65
J=J+1
STO(J)=STO(I)
66
CONTINUE
MXM=J
REPEAT TO 101
FOR
I=1,1+1,...,MXM
BOX1=STO(I).
101
SUM1=SUM1+BOX1
VZX=MXM
AMEAN=SUM1/VZX
REPEAT TO 102
FOR
I=1,1+1,...,MXM
BOX2=(STO(I)-AMEAN)**2


102
SUM2=SUM2+BOX2
SD=SQRT(SUM2/VZX)
304
REPEAT TO 103
FOR
I=1,1+1,...,MXM
BOX3=(STO(I)-AMEAN)
BOX4=BOX3**2
BOX5=BOX3**3
BOX6=BOX3**4
SUM3=SUM3+BOX3
SUM4=SUM4+BOX4
SUM5=SUM5+BOX5
103
SUM6=SUM6+BOX6
SUM3=SUM3/VZX
SUM4=SUM4/VZX
SUM5=SUM5/VZX
SUM6=SUM6/VZX
PI3=SUM5-3.0*SUM3*SUM4+SUM3**3
PI22=SUM4-SUM3**2
PI2=SQRT(PI22**3)
ALFA3=PI3/PI2
PI4=SUM6-4.0*SUM3*SUM5+6.0*SUM3**2*SUM4-3.0*SUM3**4
ALFA4=PI4/PI22**2
I=1
GO TO 30
IF 0
KAS-0
IF -
IF +
GO TO 31
30
X(I)=XMIN0+DEL20/2.0
DEL2=DEL20
GO TO 51
31
CONTINUE
GO TO 32
IF 0
KAS-1
IF -
IF +
GO TO 33
32
X(I)=XMIN1+DEL21/2.0
DEL2=DEL21
GO TO 51
33
CONTINUE
GO TO 34
IF 0
KAS-2
IF -
IF +
GO TO 35
34
X(I)=XMIN2+DEL22/2.0
DEL2=DEL22
GO TO 51
35
CONTINUE
GO TO 36
IF 0
KAS-3
IF -
IF +
GO TO 37
36
X(I)=XMIN3+DEL23/2.0
DEL2=DEL23
GO TO 51
37
CONTINUE


GO TO 38
IF 0
KAS-4
IF +
GO TO 39
38
X(I)=XMIN4+DEL24/2.0
DEL2=DEL24
GO TO 51
39
CONTINUE
GO TO 40
IF 0
KAS-5
IF +
GO TO 41
40
X(I)=XMIN5+DEL25/2.0
DEL2=DEL25
GO TO 51
41
CONTINUE
GO TO 42
IF 0
KAS-6
IF +
GO TO 43
42
X(I)=XMIN6+DEL26/2.0
DEL2=DEL26
GO TO 51
43
CONTINUE
GO TO 44
IF 0
KAS-7
IF +
GO TO 45
44
X(I)=XMIN7+DEL27/2.0
DEL2=DEL27
GO TO 51
45
CONTINUE
GO TO 46
IF 0
KAS-8
IF +
GO TO 47
46
X(I)=XMIN8+DEL28/2.0
DEL2=DEL28
GO TO 51
47
CONTINUE
GO TO 48
IF 0
KAS-9
IF +
GO TO 49
48
X(I)=XMIN9+DEL29/2.0
DEL2=DEL29
GO TO 51
49
CONTINUE
GO TO 50
IF 0
KAS-10
IF +
GO TO 51


50
X(I)=XMIN10+DEL210/2.0
DEL2=DEL210
51
REPEAT TO 106
FOR
I=1,1+1,...,NDIV
X(I+1)=X(I)+DEL2
U=EXP((-(X(I)-AMEAN)**2)/(2.0*(SD)**2))
Y(I)=(1.0/(SD*SQRT(2.0*PI)))*U*(1.0-((ALFA3/2.0)*((X(I)-AMEAN)/SD-(X(I)-AMEAN)
3/(3.0*(SD)3))))
Y(I)=Y(I)*VZX*DEL2
106
CONTINUE
303
CONTINUE
GO TO
108
IF
-
1-KAS
+
IF
0
GO TO
108
107
B1
WRITE
107
WRITE(6,200)
GO TO 199
108
B1
WRITE
108
WRITE(6,205)KAS
199
B1
WRITE
199
WRITE(6,201)(X(I),Y(I),I=1,NI)
B1
WRITE
WRITE(6,202)AMEAN,SD,ALFA3,ALFA4
B1
WRITE
WRITE(6,400)CHIC,CHI2
A5
WRITE
WRITE(8)(X(I),I=1,NI)
A5
WRITE
WRITE(8)(Y(I),I=1,NI)
GO TO
105
IF
-
IS-KAS
+
IF
0
GO TO
105
109
KAS=KAS+1
B5
REWIND


GO TO 1
105
CONTINUE
GO TO
401
YES
IF
ICASE.LT.NOCASE
IF
YES
GO TO
401
NO
AS
EOF
AS
REWIND
401
RETURN

REFERENCES

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MONTE CARLO PERFORMANCE ANALYSIS COMPUTER PROGRAM WITH PROGRAMMED MIXTURE RATIO

By Roy C. Lester

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