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10-13-74
UC-154 Suppl.
01-440

ANCR-1316

DATE PUBLISHED - SEPTEMBER 1976

IDAHO NATIONAL ENGINEERING LABORATORY

SALE: **MASTER**
SAFEGUARDS ANALYTICAL LABORATORY
EVALUATION COMPUTER CODE

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Printed in the United States of America
Available from
National Technical Information Service
U. S. Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22161
Price: Printed Copy \$6.75; Microfiche \$2.25

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SALE:

SAFEGUARDS ANALYTICAL LABORATORY

EVALUATION COMPUTER CODE

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ANCR-1316

Distributed Under Category:
UC-15
Safeguards — Nuclear
Materials Security
TID-4500, R64

SALE:

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EVALUATION COMPUTER CODE

by

Darla J. Carroll
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Cynthia A. Dolan

AEROJET NUCLEAR COMPANY

Date Published — September 1976

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ACKNOWLEDGMENTS

The authors gratefully acknowledge the research, developmental work, computer programming, and initial documentation efforts of Dr. F. H. Tingey, Dr. F. W. Spraktes, F. J. Balkovetz, and S. J. Bengston. We also extend gratitude to Dr. S. C. T. McDowell for his continuing contributions and support that made this project possible.

ABSTRACT

The Safeguards Analytical Laboratory Evaluation (SALE) program implements an industry-wide quality control and evaluation system aimed at identifying and reducing analytical chemical measurement errors. Samples of well-characterized materials are distributed to laboratory participants at periodic intervals for determination of uranium or plutonium concentration and isotopic distributions. The results of these determinations are statistically evaluated, and each participant is informed of the accuracy and precision of his results in a timely manner. The SALE computer code which produces the report is designed to facilitate rapid transmission of this information in order that meaningful quality control will be provided.

Various statistical techniques comprise the output of the SALE computer code. Assuming an unbalanced nested design, an analysis of variance is performed in subroutine NEST resulting in a test of significance for time and analyst effects. A trend test is performed in subroutine TREND. Microfilm plots are obtained from subroutine CUMPLT. Within-laboratory standard deviations are calculated in the main program or subroutine VAREST, and between-laboratory standard deviations are calculated in SBLV. Other statistical tests are also performed.

Up to 1,500 pieces of data for each nuclear material sampled by 75 (or fewer) laboratories may be analyzed with this code. The input deck necessary to run the program is shown, and input parameters are discussed in detail. Printed output and microfilm plot output are described. Output from a typical SALE run is included as a sample problem.

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SALE:
SAFEGUARDS ANALYTICAL LABORATORY
EVALUATION COMPUTER CODE

I. INTRODUCTION

The Safeguard Analytical Laboratory Evaluation (SALE) Computer Code is a statistical analysis program written to analyze the data received from laboratories participating in the SALE quality control program. This program is an outgrowth of the UMPIRE program conducted by Phillips Petroleum Company, Idaho Nuclear Corporation, and Aerojet Nuclear Company from 1965 to 1972. The SALE program began in 1972 with 19 participating laboratories performing analyses of samples from seven nuclear materials. Four years later, SALE has grown into a worldwide quality control program, receiving results from 60 laboratories, 19 of which are foreign laboratories, and involving the analysis of samples from 27 nuclear materials.

Because of the increasing amount of data accumulated as a result of the SALE program, the SALE computer code has been in a constant state of expansion. The version of the SALE code included in this document is the code used to produce the current SALE report. This code will handle up to 75 laboratories and 48 months of data for each laboratory-material-method combination and up to 1,500 pieces of data for each material. Since each statistical analysis of each material is performed separately, data from an unlimited number of materials can be analyzed.

This report is intended primarily as a user's manual, and only the major statistical theory is developed. The following sections present a program summary description, statistical theory discussion, plutonium decay correction explanation, program description, a complete discussion of input and output, writeups of system routines used by the code, a listing of the code, a sample problem, and an explanation of the SALE report. The sections and their general content are:

- (1) Section II, Program Summary Description, gives an overall summary of the SALE computer program.
- (2) Section III, Statistical Theory, derives the equations and discusses the theory used in the analysis of variance and between-laboratory variance routines of the SALE computer program.
- (3) Section IV, Decay Correction Calculations for Plutonium Materials, describes the decay correction equations used for the plutonium nitrate and plutonium oxide materials reference values.

- (4) Section V, Program Description, describes the capabilities and objective of the SALE program and briefly outlines the functions of the main routine and each subroutine in the program.
- (5) Section VI, Input, describes the necessary input, giving format and input order information. Tables are given which define code numbers used to facilitate input.
- (6) Section VII, Output, describes the output obtained from the SALE program.

Appendix A contains writeups of the system routines called by the SALE programs and includes information on error messages obtained from these routines. Appendix B consists of a complete listing of the version of the SALE program described in this document. Appendix C presents a SALE sample problem. Appendix D gives an explanation of the calculations used to generate the SALE report.

II. PROGRAM SUMMARY DESCRIPTION

The SALE computer code is specifically designed to handle the quality control charts and statistical evaluations of the data generated by the SALE Program. However, the statistical analyses including nested analysis of variance, autocorrelations, and the trend tests are valid for any similar data.

The program is used at present in three capacities:

- (1) To check input data by using the data listing option
- (2) To perform statistical analyses of the data
- (3) To generate the SALE report.

Data analyzed by the SALE program must be in the format described in Section VI. The user has control over the amount of output received. Complete output, printed output with no plots, or a data listing with no analysis may be obtained.

The nested analysis of variance routine automatically adjusts to either a balanced or an unbalanced design. The number of effects used in the design is also adjusted automatically according to the type of data analyzed. Up to 1,500 pieces of data for each material may be analyzed for an unlimited number of materials. The user must limit the amount of data input for each material; the program does not automatically limit the amount of data.

The program is written in FORTRAN IV for the IBM 360/75 computer. Compilation requires about 360K of core and execution requires about 430K. Compilation requires about 47 seconds. Execution time varies with the amount of input.

III. STATISTICAL THEORY

The following section describes the statistical theory implemented in the nested analysis of the variance and the between-laboratory variance subroutines of the SALE code. Output from these routines comprises a large portion of the SALE report.

Before any calculations are performed by the SALE code, each reported result is transformed to a relative percentage of the known reference value, $Y(h,i,j,k)$, as follows:

$$Y(h,i,j,k) = \left[\frac{X(h,i,j,k) - \mu}{\mu} \right] \times 100 \quad (1)$$

where

$X(h,i,j,k)$ = the k^{th} replicate of the
 i^{th} analyst effect in the
 j^{th} time period for
laboratory method combination h

μ = known reference value.

Note that $Y(h,i,j,k)$ is a transformation of the random variable $X(h,i,j,k)$. The assumption is that μ is known and, hence, the expected value of $Y(h,i,j,k)$ is zero.

1. NESTED ANALYSIS OF VARIANCE

The nested-analysis-of-variance subroutines are utilized in the SALE program to estimate the variance of the mean within each laboratory, including the effects due to time, analyst, and replication. For each laboratory-method combination the transformed result, $Y(h,i,j,k)$, consists of certain independent and linear effects as follows:

$$Y(h,i,j,k) = B(h) + T(h,i) + A(h,i,j) + R(h,i,j,k) \quad (2)$$

where

$B(h)$ = effect due to laboratory h , the systematic error

$T(h,i)$ = effect due to time within laboratory h

$A(h,i,j)$ = effect due to analysts within the h, i^{th}
laboratory-time combination

$R(h,i,j,k)$ = effect due to replication within the h,i,j^{th} laboratory-time-analyst combination.

$B(h)$, $T(h,i)$, $A(h,i,j)$, and $R(h,i,j,k)$ represent the corresponding deviations from the expected value of $Y(h,i,j,k)$, which is zero. $B(h)$ is a fixed value for each laboratory; therefore, the nested analysis of variance estimates the variance of the within-laboratory mean. The estimated within-laboratory variance of the mean for each laboratory, denoted

$S^2_{\text{TOT}(h)}$, is

$$S^2_{\text{TOT}(h)} = NT \cdot S^2_{T(h)} + NA \cdot S^2_{A(h)} + NR \cdot S^2_{R(h)} \quad (3)$$

where

$S^2_{T(h)}$ = variance estimate for the time effect for laboratory h

$S^2_{A(h)}$ = variance estimate for the analyst effect for laboratory h

$S^2_{R(h)}$ = variance estimate for the replicate effect for laboratory h

$NT = \frac{\sum n_i^2}{n^2}$

n_i = number of reported results in the i^{th} time period

$NA = \frac{\sum_i (\sum_j n_{ij})^2}{n^2}$

n_{ij} = number of observations for analyst effect j in the i^{th} time period

$NR = \frac{\sum_i \sum_j n_{ij}^2}{n^2}$

n = total number of observations.

A schematic diagram of the nested effects model is given in Figure 1.

Fig. 1 Schematic diagram — balanced nested design.

This figure shows the classic nested or hierarchical balanced design^[1]. When the complete or balanced design is not attained, the program will handle the data as an unbalanced nested design, making the necessary adjustments in the calculations.

The statistical treatment of the data within each laboratory includes a determination of the statistical significance of (a) the variance components of error postulated for a random-effects model, viz., time, analyst, and replicate error or (b) the effects on the overall mean postulated for a fixed effects model. The tests of significance are performed at both the 5% and 1% levels.

Table I represents the generalized formulas used in the nested analysis of variance for an unbalanced design. The notation is consistent with the above and follows the notational conventions found in Reference 1.

After each laboratory's data are processed by the nested analysis of variance routines, the total within-laboratory variance of the mean for laboratory h , $S_{TOT(h)}^2$, is stored for subsequent use in the between-laboratory variance computations.

TABLE I

ANALYSIS OF VARIANCE -- UNBALANCED NESTED DESIGN

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	Random-Effect Expected Mean Squares [a]
T's	$t-1$ [b]	$\sum_i \frac{Y_i^2}{n_i} - \frac{Y^2}{n} = SST$	$\frac{SST}{t-1} = MST$	$\sigma_R^2 + S_1 \sigma_A^2 + Q_1 \sigma_T^2$
Between A's within T	$\sum_i a_i - t$ [c]	$\sum_i \sum_j \frac{Y_{ij}^2}{n_{ij}} - \sum_i \frac{Y_i^2}{n_i} = SSA$	$\frac{SSA}{\sum_i a_i - t} = MSA$	$\sigma_R^2 + S_2 \sigma_A^2$
Replicate Error	$n - \sum_i a_i$	$\sum_i \sum_{j,k} Y_{ijk}^2 - \sum_i \sum_j \frac{Y_{ij}^2}{n_{ij}} = SSR$	$\frac{SSR}{n - \sum_i a_i} = MSR$	σ_R^2
Total	$n-1$	$\sum_i \sum_j \sum_k Y_{ijk}^2 - \frac{Y^2}{n} = SSTOT$	$\frac{SSTOT}{n-1} = MSTOT$	

[a] Explanation of the terms in the expected mean square column:

$$S_1 = \sum_i \sum_j n_{ij}^2 f_{ij} \quad f_i = \frac{\frac{1}{n_i} - \frac{1}{n}}{t-1}$$

$$S_2 = \sum_i \sum_j n_{ij}^2 f_{ij}$$

σ_T^2 is the variance between T.

$$Q_1 = \sum_i n_i^2 f_i \quad n = \sum_i n_i$$

$$f_{ij} = \frac{\frac{1}{n_{ij}} - \frac{1}{n_i}}{\sum_i a_i - t}$$

σ_A^2 is the A variance within T.

σ_R^2 is the replicate variance.

[b] t = number of time periods.

[c] a_i = number of analysts in the i^{th} time period.

2. BETWEEN-LABORATORY VARIANCE

The between-laboratory variance calculation is an iterative procedure used in lieu of analysis of variance. Analysis of variance is not applicable because the total within-laboratory variances are not equal among the participating laboratories.

Referring again to the model,

$$Y(h, i, j, k) = B(h) + T(h, i) + A(h, i, j) + R(h, i, j, k) \quad (4)$$

the variance of the mean of the within-laboratory effects, $S_{TOT(h)}^2$, has been estimated in the analysis of variance routines.

Let

$$TOT(h, i, j, k) = T(h, i) + A(h, i, j) + R(h, i, j, k) \quad (5)$$

then

$$Y(h, i, j, k) = B(h) + TOT(h, i, j, k) \quad (6)$$

Let $\bar{Y}(h)$ be the mean of all results from laboratory h ;

then

$$\bar{Y}(h) = B(h) + \overline{TOT}(h) \quad (7)$$

where $\overline{TOT}(h)$ is the mean of all the within-laboratory effects for a particular laboratory.

Consequently, the variance of $\bar{Y}(h)$, $\sigma_{\bar{Y}(h)}^2$, is

$$\sigma_{\bar{Y}(h)}^2 = \sigma_B^2 + \sigma_{\overline{TOT}(h)}^2 \quad (8)$$

where σ_B^2 = between-laboratory variance

$\sigma_{\overline{TOT}(h)}^2$ = within-laboratory variance for laboratory h .

The estimate for the within-laboratory variance of the mean, $\sigma_{\overline{TOT}(h)}^2$, is denoted $S_{TOT(h)}^2$. This was calculated in the nested analysis of variance routines and was stored for use in the between-laboratory variance estimate.

Define

$$Z(h) = \frac{\bar{Y}(h)}{\sqrt{\sigma_{\bar{Y}(h)}^2}} = \frac{\bar{Y}(h)}{\sqrt{\sigma_B^2 + \sigma_{TOT(h)}^2}} \quad (9)$$

Since $\bar{Y}(h)$ has expected value zero and $\sigma_{\bar{Y}(h)}^2$ is its variance, $Z(h)$ is a random variable with mean zero and variance one. Thus, solve for an estimated value of σ_B^2 , S_B^2 , such that

$$\left[\frac{1}{L}\right] \cdot \sum_{h=1}^L \frac{[\bar{Y}(h)]^2}{S_B^2 + S_{TOT(h)}^2} = 1 \quad (10)$$

where L is the number of laboratories.

Define

$$F(S_B^2) = \sum_{h=1}^L \frac{[\bar{Y}(h)]^2}{S_B^2 + S_{TOT(h)}^2} - L. \quad (11)$$

The desired value of S_B^2 is one such that

$$F(S_B^2) = 0. \quad (12)$$

This value for S_B^2 can easily be approximated by applying Newton's method for finding the zeroes of a function. Let

$$\begin{aligned} X_0 &= 0 \\ X_1 &= X_0 - \frac{F(X_0)}{F'(X_0)} \\ &\vdots \\ X_{i+1} &= X_i - \frac{F(X_i)}{F'(X_i)} \end{aligned} \quad (13)$$

be consecutive iterative approximations of S_B^2 ,

where

$$F'(X_i) = - \sum_{h=1}^L \frac{[\bar{Y}(h)]^2}{[X_i + S_{TOT(h)}^2]^2} \quad (14)$$

In practice this iteration is continued until

$$\left| \frac{X_i - X_{i+1}}{X_{i+1}} \right| < 10^{-10}. \quad (15)$$

Then X_{i+1} is the best approximation for S_B^2 , the estimate for σ_B^2 .

IV. DECAY CORRECTION CALCULATIONS FOR PLUTONIUM MATERIALS

Since Pu-241 decays with a relatively short half-life (14.7 years^[2]), the subroutines PUN1 and PUN2 adjust the plutonium reference values to describe the composition of the sample at the time the sample is analyzed. As Table II indicates, the routines also store some of the initial reference values.

TABLE II
PLUTONIUM SUBROUTINES CALLED

<u>Subroutine</u>	<u>Called for</u>	<u>Initial Reference Values Stored for Materials</u>
PUN1	Plutonium Nitrates (Materials 5-7, 10-12) ^[a]	6, 7, 11, 12 ^[a]
PUN2	Plutonium Oxide (Materials 15-27) ^[a]	15-27 ^[a]

[a] See Table V for material codes.

The following formulas are used to correct the reference values for Pu-241 decay:

$$P(t) = P(0) \cdot D(t) \quad (16)$$

$$P_{239}(t) = P_{239}(0) / D(t) \quad (17)$$

$$P_{241}(t) = P_{241}(0) \cdot F(t) / D(t) \quad (18)$$

where

t = the number of months between sample preparation and analysis

$P(t)$ = % Pu in sample after t months

$P_i(t)$ = % of total Pu in sample that is isotope i ($i = 239$ or 241), after t months

$F(t)$ = the fraction of the initial Pu-241 remaining after t months = $\exp(-\lambda t)$

$D(t)$ = fraction of the initial Pu not lost by the decay of Pu-241 to nonplutonium materials after t months = $1 - [0.01 P_{241}(0)] \cdot [1 - F(t)]$

λ = $\ln 2$ / half-life expressed in months = 0.003929406.

The initial reference values in the preceding equations (with $t = 0$) are indexed by material, lot number, and unit (atom or weight percent) for the Series B plutonium nitrate isotopes and for the plutonium oxide materials. However, subroutine PUN1 used additional formulas to obtain initial reference values for plutonium nitrate Series A materials, since two stock solutions were mixed to obtain these samples. More specifically, for Series A Materials 5 to 7 (having lot number zero) and for Materials 10 to 12, the atom percent of Pu-239 among the plutonium in the mixture, PM, is given on the data card and used to determine the proportions of each solution in the sample. The fraction of Solution 1 in the mixture, f_1 , is calculated as follows:

$$f_1 = \frac{(\text{initial atom \% Pu-239 in Solution 1}) - \text{PM}}{[(\text{initial atom \% Pu-239 in Solution 1}) - (\text{initial atom \% Pu-239 in Solution 2})]} \quad (19)$$

The desired initial isotopic reference values for the mixture are then obtained from the following relation:

$$P_1(0) = f_1 \cdot [P_1(0) \text{ percent for Solution 1}] + (1 - f_1) \cdot [P_1(0) \text{ percent for Solution 2}]. \quad (20)$$

The equations in subroutine PUN1 defining the variables A, B, and CW are based on this relation.

Subroutine PUN2 is also called for uranium and U-235 concentrations; it returns values stored in its data array for these.

V. PROGRAM DESCRIPTION

A description of the SALE code is given in this section. The objective and capabilities of the program are presented and the structure of the code is discussed in detail.

1. OBJECTIVE

The program is designed to provide the necessary computations to analyze a two-factor-plus-error or a one-factor-plus-error nested analysis of variance. The data may have only an error effect or error plus either one or two other nested effects. The code performs the necessary calculations for test of significance of random- or fixed-effects and calculates the random-effects expected mean squares. The calculated F-values with corresponding tabled F-values and adjusted degrees of freedom, when necessary, are calculated and printed. Individual variance component estimates are found by equating the expected mean square to the associated mean square. The sum of the variance component estimates is also given. The input data may be adjusted or coded, or both.

Three types of plots are produced for each analytical grouping of each material in subroutine CUMPLT. Six-month means, monthly means, and six-month standard deviations are graphed on these three plots by the Integrated Graphics System (IGS). Confidence limits are indicated on the standard deviation plots. Calcomp plots may also be obtained from subroutines GRAPH and GRAPH1. However, at present the IGS plots are the only plots appearing in the SALE report. An autocorrelation analysis^[3] and the standard Spearman's ρ test-statistic^[4] are calculated. The tabulated values associated with ρ are given for both the 5% and 1% significance levels.

2. MAIN PROGRAM AND SUBROUTINES

The main program and subroutines in the SALE code perform the following functions:

- (1) Main program - RPRT
RPRT reads all the pertinent input and initiates the calls to the statistical subroutines after ordering the data and storing them for calls to those subroutines. The laboratory data sheets and cumulative table for each material are printed by RPRT.
- (2) Subroutine HAD
HAD writes out header information for each laboratory-method combination.

- (3) Subroutine SBLV
SBLV calculates the between-laboratory standard deviation for each material type.
- (4) Subroutine PUN1
PUN1 calculates the decay correction for Materials 5, 6, 7, 10, 11, and 12. (See Section IV.) A half-life of 14.7 years for Pu-241 is used in the calculation^[2]. All reference (makeup) values are decay-corrected to match the dates of the participants' reported values.
- (5) Subroutine ADJUST
ADJUST stores the previous twelve months of data for each laboratory material type for plotting. It then resets the data for further calculations.
- (6) Subroutine NEST
NEST does all the necessary calculations for the nested analysis of variance.
- (7) Subroutine VAREST
VAREST calculates component variances and their associated degrees of freedom. Sums of the variance components are made, and this information is printed internal to VAREST.
- (8) Subroutine FVALUE
FVALUE calculates F-values.
- (9) Subroutine TVALUE
TVALUE calculates t-values by $t_{\alpha}(ndf)=[F_{\alpha}(1,ndf)]^{1/2}$.
- (10) Subroutine FPROB
Function FPROB calculates the probabilities of the F-distribution used to iterate in subroutines FVALUE and TVALUE.
- (11) Subroutine CNVRT8
CNVRT8 converts numerical output to A Format where necessary. (Note: The system subroutine INFILQ is called in this subroutine. See Appendix A.)
- (12) Subroutine BIAS
BIAS tests for a mean significantly different from zero for data that should be in this range.

- (13) Subroutine CORTRE
CORTRE initiates the calls to the autocorrelation, trend test, and Calcomp quality control plotting subroutines.
- (14) Subroutine CORR
CORR initiates the call to subroutine YAUTO and writes pertinent information fed to YAUTO.
- (15) Subroutine YAUTO
YAUTO calculates the autocorrelations, mean, variance, and standard deviation of input series. Every combination of lags is given for the previous twelve months of input^[3].
- (16) Subroutine VARY
VARY calculates standard deviations of autocorrelations and deviations of series values from their means.
- (17) Subroutine TREND
TREND calculates Spearman's ρ test statistic for the test of the null hypothesis of no trend. Both the 5% and 1% tables values are given^[4].
- (18) Subroutine SORT
SORT gives the ranks of the series for the calculations in TREND.
- (19) Subroutine TABLE
TABLE contains tabulated values of Spearman's ρ test statistic at the 5% significance level.
- (20) Subroutine TABLE1
TABLE1 contains tabulated values of Spearman's ρ statistic at the 1% significance level.
- (21) Subroutine GRAPH
GRAPH does the plotting of the Calcomp mean control charts by scaling the data and using standard calls to the Calcomp routines (see Appendix A).
- (22) Subroutine GRAPH1
GRAPH1 plots the Calcomp standard deviation plots by scaling the data and using standard calls to the Calcomp routines (see Appendix A).

(23) Subroutine PUN2

PUN2 calculates the decay correction for Materials 15 through 27 (see Section IV).

(24) Subroutine CUMPLT

CUMPLT produces the plots currently used in the SALE report by calls to the IGS routines (see Appendix A).

Table III gives a subroutine call map. Nineteen of the subroutines listed are system routines, most of which are involved with the plotting of the data. Writeups of the system routines are included in Appendix A, and a complete program listing is given in Appendix B.

SUBROUTINE CALL MAP

SUBROUTINE CALL MAP

[illegible]

X X X X X X X X X X X

[illegible]

VI. INPUT

The input for the SALE program may be card input or a combination of card and tape input. At present, due to the volume of data, program controls are read from cards and data are read from tape. The following section is a description of the SALE program input. Tables IV, V, VI, and VII are tables of participating laboratories, material, method, and group codes. The input is of the following form:

- (1) Laboratory name cards (≤ 75)

Columns	Content
1-2	Laboratory code (User assigned)
4-27	Laboratory name (See Table IV)

- (2) Blank card if data input is on cards. If tape data, put 7 in Column 36 and use FT07F001 for IBM 360 on JCL DD card defining input.

- (3) Material name card

Columns	Content
1-2	Material code (see Table V)
4-27	Material name

- (4) Analytical method cards (< 20)

Columns	Content
1-2	Method code (see Table VI)
4-27	Method name

- (5) Blank card

- (6) Analytical group cards (≤ 5)

Columns	Content
1-2	Group code (see Table VII)
3-4	Method code
5-6	Method code
7-8	Method code
9-10	Method code
11-12	Method code

(Continued on page 23)

TABLE IV
PARTICIPATING LABORATORIES

Allied Chemical - Idaho Chemical Processing Plant
Allied Gulf Nuclear Services
Argonne - Experimental Breeder Reactor II
Atlantic Richfield Hanford Company
Atomics International
Avco
Babcock and Wilcox
Battelle Northwest
Combustion Engineering
Combustion Engineering - Hematite
Dupont - Savannah River
Exxon Nuclear
General Electric - Morris
General Electric - San Jose
General Electric - Wilmington
General Electric - Vallecitos
General Atomic Company
General Atomic Company - Fuel Quality
Goodyear Atomic Corporation
Gulf United - Pawling
Intelcom Radiation Tech
Kerr McGee - Cimarron
LFE Environmental Analysis
Los Alamos Scientific Laboratory
Monsanto - Mound Laboratory
National Lead Company
New Brunswick Laboratory
Nuclear Fuel Services - Erwin
Nuclear Fuel Services - West Valley
Nuclear Materials and Equipment Corporation
Rockwell International
Teledyne Isotopes

TABLE IV (contd.)

Union Carbide - Y 12
United Nuclear Corporation
Westinghouse - Cheswick
Westinghouse - Columbia
Westinghouse - Hanford
Westinghouse - Madison
Bureau Central de Mesures Nucleaires - Belgium
Kernreaktorteile - Germany
Fabbricazioni Nucleari - Italy
Japanese Nuclear Fuel Company
Kernforschungszentrum - Germany
Centre d'Etudes Nucleaires - Saclay
Physikalisch - Technische Bundesanstalt - Germany
Reactor Centrum Nederland - The Netherlands
Centre d'Etudes Nucleaires - Grenoble
Alpha-Chemie und Metallurgie - Germany
Belgonucleaire - Belgium
Kernforschungsanlage Julich Institut für Chemische
Technologie - Germany
Kernforschungsanlage Julich Institut für Analytische
Chemie - Germany
Atomic Weapons Research Establishment - England
AERE Harwell - England
IAEA Laboratory Seibersdorf - Austria
Power Reactor and Nuclear Fuel Development Corporation -
Japan
British Nuclear Fuels Limited - England
Centre d'Etude de l'Energie Nucleaire - Belgium

TABLE V

MATERIAL CODE NUMBERS

No.	Material	Data File Acronym
1	Uranyl Nitrate Conc.	UCUN
2	Uranyl Nitrate U-235	35UN
3	Uranium Dioxide Conc.	UCUD
4	Uranium Dioxide U-235	35UD
5	Plutonium Nitrate Conc.	CØPN
6	Plutonium Nitrate Pu-239	39PN
7	Plutonium Nitrate Pu-241	41PN
8	(Pu,U) Nitrate U-Conc.	UPUN
9	(Pu,U) Nitrate U-235	5PUN
10	(Pu,U) Nitrate Pu-Conc.	PPUN
11	(Pu,U) Nitrate Pu-239	9PUN
12	(Pu,U) Nitrate Pu-241	1PUN
13	UO ₂ Pellet U-Conc.	CUPL
14	UO ₂ Pellet U-235	5UPL
15	(Pu,U) Dioxide U-Conc.	UPUD
16	(Pu,U) Dioxide U-235	5PUD
17	(Pu,U) Dioxide Pu-Conc.	PPUD
18	(Pu,U) Dioxide Pu-239	9PUD
19	(Pu,U) Dioxide Pu-241	1PUD
20	Plutonium Dioxide Conc.	PCPD
21	Plutonium Dioxide Pu-239	39PD
22	Plutonium Dioxide Pu-241	41PD
23	(Pu,U)O ₂ Pellet U-Conc.	UPUP
24	(Pu,U)O ₂ Pellet U-235	5PUP
25	(Pu,U)O ₂ Pellet Pu-Conc.	PPUP
26	(Pu,U)O ₂ Pellet Pu-239	9PUP
27	(Pu,U)O ₂ Pellet Pu-241	1PUP

TABLE VI

METHOD CODE NUMBERS

Uranium Concentration	U-235	Pu Concentration	Pu-239, Pu-241
1. Gravimetry (U_3O_8)	1. Thermal Ion Mass Spectrometry	1. Alpha Counting	1. Thermal Ion Mass Spectrometry
2. Gravimetry (UO_2)	2. Gas Source Mass Spectrometry	2. X-ray Fluorescence	2. Other
3. Gravimetry Other	3. Gamma Spectrometry	3. Iso Dil Mass Spectrometry	
4. No Method Assigned	4. Other	4. Coulometry	
5. Titrimetry NBL D&G (wt basis)		5. Titrimetry Amp $AgO/Fe(II)$	
6. Titrimetry NBL D&G (vol basis)		6. Titrimetry Pot $AgO/Fe(II)$	
7. Titrimetry D&G (wt basis)		7. Titrimetry Jones Redn/ $Cr(VI)$	
8. Titrimetry Jones Redn/ $Cr(VI)$		8. Titrimetry $CuI/Cr(VI)$	
9. Titrimetry Jones Redn/ $Ce(IV)$		9. Titrimetry $TiCl_3/Ce(IV)$	
10. Titrimetry $Cr(II)$ Redn/ $Fe(III)$		10. Miscellaneous	
11. Titrimetry NBL D&G (Auto)			
12. No Method Assigned			
13. Coulometry			
14. No Method Assigned			
15. Iso Dil Mas Spectrometry			
16. No Method Assigned			
17. X-ray Fluorescence			
18. Spectrophotometry			
19. Miscellaneous			

TABLE VII

ANALYTICAL GROUP CODE NUMBERS

<u>Group Number</u>	<u>Analytical Methods in Group</u>	<u>Group Name</u>
<u>U Concentration</u>		
1	5	Titration NBL D&G (wt basis)
2	6,7,8,9,10,11,12	Titration other
3	1,2,3	Gravimetry (all)
4	15	Iso Dil Mass Spectrometry
5	1,2,3,5,6,7,8,9,10,11,13,15,17,18,19	All methods
<u>U-235</u>		
1	1	Thermal Ion Mass Spectrometry
2	2	Gas Source Mass Spectrometry
3	3	Gamma Spectrometry
4	4	Other methods
5	1,2,3,4	All methods
<u>Pu Concentration</u>		
1	6	Titration Pot AgO/Fe (II)
2	5	Titration Amp AgO/Fe (II)
3	3	Iso Dil Mass Spectrometry
4	4	Coulometry
5	1,2,3,4,5,6,7,8,9,10	All methods
<u>Pu-239, Pu-241</u>		
1	1	Thermal Ion Mass Spectrometry
2	2	Other
5	1,2	All methods

Columns	Content
37-38	Method code
55	Standard deviation plot limit, expressed as multiple of 0.60
60-80	Group name

(7) Blank card

(8) Blank card for IGS plots. If Calcomp plots are reinstated,

Columns	Content
1-10	Confidence bounds for means
11-20	Confidence bounds for standard deviations

(9) Title and control card

Columns	Content
1-40	Title (material and analysis)
41-44	First month in report (XYY)
45-48	Last month in report (XYY) where X = year (2 = 1972) and Y = month (10 = October)
56	0 = plots 1 = no plots
60	0 = all computations 1 = data listing only

(10) Data cards $\leq 1,500$ (Can be input as cards or tape data)

Columns	Content
1-2	Material
3-4	Method
5-6	Laboratory
7	Year (2 = 1972)
8-9	Month (10 = October)
10	Analyst (all same number indicates same analyst within a laboratory method, different numbers indicate different analysts within a laboratory method for the same time period)
11-20	Reported value
21-30	Make-up value (leave blank for Materials 6,7,11, 12, 15-27)
37	Lot number
38	A = atom % W = weight % Defaults to atom %

<u>Columns</u>	<u>Content</u>
39-40	Months of decay
41-50	Pu-239 make-up value in atom % (required for Materials 5, 6, 7, Series A, and 10, 11, 12) Columns 37-50 not necessary for Materials 1-4, 8, 9, 13, 14

(11) End of block of data card

<u>Columns</u>	<u>Content</u>
1-2	0 = different material to follow Return to (3) -1 = no more data

For complete deck ordering, see Figure 2.

It should be noted that when data are read from tape the continuation control (11) must be read from the same tape. The data tape thus contains each material separated by an 80-character-length record in the format of (11).

Fig. 2 Input card order.

VII. OUTPUT

The following section is a description of output produced by the SALE program. Much of the output produced is not used in the current report. However, the statistical tests not used could be utilized in a further analysis of the data.

Six-month means and standard deviations are not necessarily calculated on six consecutive months of data. If a laboratory has reported data values for at least one month in the six months spanned by the report, these recent data are combined with a sufficient number of immediately preceding months of data to total six months data. These six months of data form the sample from which the first set of cumulative statistics are calculated. The remaining six-month samples are formed by removing the most recent data and adding a month of older data to the previous six-month sample.

The printed output of the SALE program is as follows:

- (1) The laboratories are listed alphabetically by name, and the corresponding number code is printed with each individual laboratory's name.
- (2) The name of the material type analyzed.
- (3) The analytical methods utilized for the analyses of the particular material type.
- (4) The input analytical method-groups for cumulative analysis.
- (5) A chronological data listing within each material-laboratory-method combination. The data consist of the laboratory reported value, the reference (makeup) value, and the percent bias.
- (6) The nested analysis of variance table is printed, together with variance component estimates and their associated degrees of freedom for laboratories with more than one month of data and at least one month with replication. A 95% confidence interval is calculated utilizing the variance component estimates and adjusted degrees of freedom^[5].
- (7) A complete table of all months reported per laboratory is generated. For each month of data, the mean for that month and the number of analyses performed are printed. Six-month moving means and standard deviations are tabulated.

- (8) The autocorrelations and standard deviations of the autocorrelations are printed followed by the results of the trend test with Spearman's ρ tabulated at both the 5% and 1% significance level.
- (9) Following the individual analyses of each laboratory's data, summary results are calculated and printed. First, the between-laboratory standard deviation is calculated for each method group. Second, a tabulation of each method group is generated together with the mean bias, mean within laboratory standard deviation, and the between-laboratory standard deviation. Third, a table of all coded laboratories is printed reflecting their results for the previous six months. Included in this table are the methods utilized by each laboratory, its within laboratory standard deviation, its mean bias from the known reference values, a 95% confidence interval about its mean bias, and the number of analyses performed over a previous six-month period. (see Appendix D).
- (10) Finally, for each method group a tabulation of laboratories together with their normalized moving means and their within laboratory standard deviations are calculated and printed.

Output specified in (1) is printed once per run. Output in (2), (3), (4), (9), and (10) is printed once per material, while output in (5) to (8) is repeated for each laboratory-method combination.

IGS plot output consists of a monthly mean plot, six-month moving mean plot, and six-month standard deviation plot for each analytical group of each material analyzed. The standard deviation plots feature a 95% confidence line, YCNTMX, computed by the following formula:

$$YCN\text{TMX} = \bar{\sigma}_H + 1.65 \cdot \sigma_{\sigma_H} \quad (21)$$

where each σ_h is the most recent six-month standard deviation for Laboratory h from the all-methods standard deviation plot. If the value of YCNTMX is larger than the maximum of the Y axis, no line is plotted.

VIII. REFERENCES

Henry Scheffé, *The Analysis of Variance*, New York: John Wiley & Sons, 1964.

National Bureau of Standards Certificate of Analysis, *Plutonium Isotopic Standard*, SRM 946 U.S. Dept. of Commerce, Washington, D. C. (December 3, 1971).

G.E.P. Box and G. M. Jenkins, *Time Series Analysis*, San Francisco: Holden-Day, 1970.

W. J. Conover, *Practical Nonparametric Statistics*, New York: John Wiley & Sons, 1971.

R. L. Anderson and T. A. Bancroft, *Statistical Theory in Research*, New York: McGraw-Hill Book Co., 1952.

APPENDIX A

SYSTEM ROUTINES CALLED BY THE SALE COMPUTER CODE

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APPENDIX A

SYSTEM ROUTINES CALLED BY THE SALE COMPUTER CODE

This appendix contains descriptions of the system subroutines used by the SALE computer code. Necessary arguments for the call statements are given, as are examples using these statements. Modifications of the functions of the subroutines are discussed where applicable. An error message table for IGS error messages is also included. Further explanation and examples are found in the References A-1 and A-2. Underscoring an argument designates it as an input variable to the called subroutine; overscoring designates it as an output variable.

1. SUBROUTINE INFILQ

INFILQ is an incore read and write subroutine written in IBM 360 Assembly Language. It modifies IBCOM incore in such a way that the next read or write request will cause the information in the user's list to be placed in a core buffer. Note that in using INFILQ:

- (1) Any unit number (1-99) may be used in the dummy read or write statements
- (2) No DD card is required for the unit used in the dummy statement
- (3) The PRINT b, list and READ b, list statements, where b is the format statement number, are also permissible
- (4) Double or multiple buffering can be used by simply dimensioning multiple arrays and using the appropriate array name on the call.

1.1 Standard Calls

The subroutine is called from FORTRAN as follows:

CALL INFILQ (ARRAY, NBYTES)

where ARRAY is the name of a temporary buffer sufficiently large to contain the information to be written and NBYTES is an integer constant (or variable) which specifies the size of the buffer in bytes.

1.2 Example

An example of usage is:

```
DIMENSION A(20), WD(80)

READ(5, 100) WD

CALL INFILQ (A, 80)

WRITE (10, 100) (WD(I), I=1, 80)

100  FORMAT (80A1)

CALL INFILQ (A, 80)

READ (10, 101) X, Y, Z

101  FORMAT (3F8.5)
```

A call to INFILQ must precede each dummy read or write.

2. SUBROUTINES PLOTL AND PLOTS

These subroutines are used to plot the job information or plot sequence number or both. The pen can be moved to the specified location to perform these tasks in either a raised or lowered position. It will be noted that a call to PLOTL or PLOTS must be the first plotting routine called in order to establish the step increment size for future plotting and to initialize the output data properly.

The calling sequence is as follows:

CALL PLOTL (X,Y,IC) for plotting on the large plotter

or

CALL PLOTS (X,Y,IC) for plotting on the small plotter

where

- (1) X and Y are the floating point coordinates (in inches) of the point to which the pen is to be moved before the job information and/or sequence number is plotted

- (2) IC is a fixed point number or variable name which specifies the pen position during the pen movement

IC = 0,1,2 for pen lowered
IC $\geq$ 3 for pen raised

- (3) The sign of IC specifies the setting of a new origin. If IC is negative, a new origin (X=0 and Y=0) is assigned the new pen location after the pen has been moved to X,Y.

The first call to either PLOTL or PLOTS will plot the job information and a sequence number after moving to the specified X,Y coordinates. All subsequent calls to PLOTL or PLOTS will plot just the sequence number. A new origin (X=0, Y=0) will be assigned to the point at which the bottom edge of the plotting paper and the right edge of the sequence number intersect.

Normally, a call to PLOTL or PLOTS should be made at the beginning of each plot. This will make it possible in the event of operation problems (such as running out of paper or ink, mechanical failures, etc.) to restart the plotting at a given plot by referring to its associated sequence number.

The job information which will precede the first plot will contain the job name, the date, and time of day. The time of day will reflect the time when the first PLOTL or PLOTS routine was called.

3. SUBROUTINE PLOT

This subroutine is called to move the pen from its present position to a new position. The pen can be moved either in a raised or lowered position. The new position may also be established as a new origin for future pen movements.

The call sequence is as follows:

CALL PLOT (X,Y,IC)

where

- (1) X and Y are the floating point coordinates (in inches) of the point to which the pen is to be moved
- (2) IC is a fixed point number or variable name which specifies the pen position during the pen movement

IC = 0,1,2 for pen lowered
IC $\geq$ 3 for pen raised

- (3) The sign of IC specifies the setting of a new origin. If IC is negative, a new origin (X=0 and Y=0) is assigned the new pen location after the pen has been moved to X,Y.

4. SUBROUTINE AXIS

This subroutine is used to draw an axis with tic marks and scale values at every inch. Also, there is a provision for labeling the axis, drawing tic marks only, or drawing a dummy axis only (no scale values or label).

The calling sequence is as follows:

CALL AXIS (X,Y,LABEL,NC,SIZE,THETA,VMIN,DV,N)

where

- (1) X and Y are the floating point coordinates (in inches) for the start of the axis
- (2) LABEL is the character information (either Hollerith notation or location of the actual characters) for identifying the axis
- (3) NC is the fixed point number of characters in LABEL
If NC>0, a LABEL will be drawn

NC = 0, no LABEL
NC = -1, tic marks only
NC = -2, dummy axis

- (4) SIZE is the length of the axis (floating point) in inches
- (5) THETA is the angle in degrees (floating point) at which the axis will be drawn. Normally angle = 0.0° or 90.0°
- (6) VMIN is the minimum value on the axis (usually obtained from SCALE)
- (7) DV is the scale increment (floating point) or location thereof which represents the values between tic marks
- (8) N is an integer (fixed point) representing the number of decimal places for a value on the axis. (See table in NUMBER routine.)

5. SUBROUTINE SYMBL4

This subroutine is used to draw alphanumeric characters and special symbols on a plot.

The calling sequence is as follows:

CALL SYMBL4 (X,Y,HT,BCD,THETA,N)

where

- (1) X and Y are the floating point coordinates in inches for the lower left hand corner of the first character.
- (2) HT is the desired character height, 0.07 inches < HT < graph size
- (3) BCD is the starting location of a string of BCD characters, or it may be the actual characters expressed in standard Hollerith FORTRAN notation
- (4) THETA is the angle in degrees at which the characters are to be plotted
- (5) N is the number of characters to be plotted or the location where it may be found. If N is a negative value, the pen will not be raised between symbols.

Table A-I shows the plotter characters available for use with the IBM 360/75. A (✓) check indicates centered symbol.

TABLE A-I

PLOTTER SYMBOLS

<u>Character</u>	<u>Hex Code</u>	<u>Decimal Code</u>	<u>Character</u>	<u>Hex Code</u>	<u>Decimal Code</u>
BLANK	00-09	0-9	A	C1	193
✓ X	0A	10	B	C2	194
BLANK	0B	11	C	C3	195
✓ -	0C	12	D	C4	196
✓ ↑	0D	13	E	C5	197
✓ →	0E	14	F	C6	198
✓ ↓	0F	15	G	C7	199
BLANK	10-19	16-25	H	C8	200

TABLE A-I (contd.)

Character	Hex Code	Decimal Code	Character	Hex Code	Decimal Code
✓ ←	1A	26	I	C9	201
BLANK	1B	27	BLANK	CA-DO	202-208
BLANK	1C	28	J	D1	209
✓ X	1D	29	K	D2	210
✓ X	1E	30	L	D3	211
✓ X	1F	31	M	D4	212
BLANK	20-29	32-41	N	D5	213
✓ □	2A	42	O	D6	214
BLANK	2B	43	P	D7	215
✓ *	2C	44	Q	D8	216
✓ Y	2D	45	R	D9	217
✓ X	2E	46	BLANK	DA-E1	218-225
✓ Z	2F	47	S	E2	226
BLANK	30-39	48-57	T	E3	227
|	3A	58	U	E4	228
BLANK	3B-3C	59-60	V	E5	229
✓ ◇	3D	61	W	E6	230
✓ ▲	3E	62	X	E7	231
BLANK	3F-4A	63-74	Y	E8	232
.	4B	75	Z	E9	233
BLANK	4C	76	BLANK	EA-EF	234-239
(	4D	77	0	F0	240
+	4E	78	1	F1	241
BLANK	4F-5A	79-90	2	F2	242
\$	5B	91	3	F3	243
BLANK	5C	92	4	F4	244
)	5D	93	5	F5	245
BLANK	5E-5F	94-95	6	F6	246
-	60	96	7	F7	247
/	61	97	8	F8	248
BLANK	62-60	98-192	9	F9	249
			BLANK	FA-FF	250-255

6. SUBROUTINE NUMBER

This subroutine converts a floating point number (positive or negative) to BCD and draws the resulting alphanumeric characters on the plot.

The calling sequence is as follows:

CALL NUMBER (X,Y,HT,DIGIT,THETA,N)

where

- (1) X and Y are the floating point coordinates (in inches) which locate the lower left corner of the first character in the number
- (2) HT is the height of the number in inches (floating point) where $0.07 \leq HT < \text{graph size}$
- (3) DIGIT is the number (floating point) or location of the number which is to be plotted
- (4) THETA is the angle in degrees at which the number is to be plotted
- (5) N is a fixed point integer representing the number of decimal places to be printed.

<u>N</u>	<u>Number Plotted</u>
-6	±X.XXXXXX±EE
-5	±X.XXXX±EE
-4	±X.XXX±EE
-3	±X.XX±EE
-2	±X.X±EE
-1	±XXXXXX
0	±XXXXXX
1	±XXXXX.X
2	±XXXX.XX
3	±XXX.XXX
4	±XX.XXXX
5	±X.XXXXX
6	±.XXXXXX
7	±X.XXXXX±EE

For

N = -2, -3, ..., -6, an exponential will be plotted with the number of significant digits represented by the absolute value of N with a maximum of 6 digits.

For

N = -1, no decimal point will be plotted.
N = 0, a decimal point will be plotted with no fractional characters.

For

N = 1, 2, ..., 6, N fractional characters will be plotted.

For

N = 7, an exponential will be plotted with 6 significant digits.

7. SUBROUTINE MODESG

Subroutine MODESG initializes the graphics system, opens files, and sets all default values in the mode set array. It must be the first graphic subroutine called. Subroutine MODESG is written in FORTRAN IV.

7.1 Standard Calls

The calling sequence is as follows:

CALL MODESG (Z, ITAPE)

where

- (1) Z must be a 200-word array defined in the user's program. All mode sets and system communication pointers are stored in this array.
- (2) ITAPE specifies the FORTRAN unit on which to write the S-C 4060 output. If ITAPE = 0, the default unit is selected.

7.2 Example

To initialize IGS with the default output unit,

CALL MODESG (Z,0)

8. SUBROUTINE SUBJEG

Subroutine SUBJEG establishes the limits of the user's coordinate system (subject space), then calculates the scale factors.

The subroutine is written in FORTRAN IV. XMIN, YMIN, XMAX, and YMAX specify the boundaries of the user's data. XMIN and YMIN are not necessarily less than XMAX or YMAX. However, XMIN must not equal XMAX, or YMIN equal YMAX. SUBJEG recomputes the page margins so their relative positions in the new subject space are the same as in the old.

8.1 Standard Calls

The calling sequence is as follows:

CALL SUBJEG (Z, XMIN, YMIN, XMAX, YMAX)

where

- (1) Z is the mode set array
- (2) XMIN is the minimum x-coordinate of the user's data
- (3) YMIN is the minimum y-coordinate of the user's data
- (4) XMAX is the maximum x-coordinate of the user's data
- (5) YMAX is the maximum y-coordinate of the user's data.

8.2 Example

To set the subject space to range from 100 to -100 in the x-axis and -0.2 to 0 in the y-axis, the calling statement is as follows:

CALL SUBJEG (Z, 100., -0.2, -100., 0.)

9. SUBROUTINE OBJCTG

Subroutine OBJCTG establishes the size of the display scope (object space), then calculates the scale factors. The subroutine is written in FORTRAN IV. XMAX and YMAX must be greater than XMIN and YMIN, respectively.

9.1 Standard Calls

The calling sequence is as follows:

CALL OBJECTG (Z, XMIN, YMIN, XMAX, YMAX)

where

- (1) Z is the mode set array
- (2) XMIN is the minimum x-coordinate of the screen in normalized object space
- (3) YMIN is the minimum y-coordinate of the screen in normalized object space....
- (4) XMAX is the maximum x-coordinate of the screen in normalized object space
- (5) YMAX is the maximum y-coordinate of the screen in normalized object space.

9.2 Example

To set the object space so only the upper left quarter of the screen is used, the calling sequence is as follows:

CALL OBJECTG (Z, 0.0, 0.5, 0.6666, 1.)

10. SUBROUTINE SETSMG

Subroutine SETSMG sets a single value in the mode set array. Mode sets stay in effect until specifically reset or until the system is reinitialized. All mode sets have a unique default value set by the initialization call to MODESG and by calls to RSETMG. The subroutine is written in FORTRAN IV.

10.1 Standard Calls

The calling sequence is as follows:

CALL SETSMG (Z, NO, VALUE)

where

- (1) Z is the mode set array
- (2) NO is a number identifying the particular mode set
- (3) VALUE is the mode set value.

10.2 Example

To set the typing character size to 1.5 times normal

CALL SETSMG (Z, 45, 1.5).

11. SUBROUTINE GETSMG

Subroutine GETSMG retrieves a single value from the mode set array. The subroutine is written in FORTRAN IV.

11.1 Standard Calls

The calling sequence is as follows:

CALL GETSMG (Z, NO, VALUE)

where

- (1) Z is the mode set array
- (2) NO is a number identifying the particular mode set
- (3) VALUE will contain the mode set value on return.

11.2 Example

To retrieve the number of lines per page

CALL GETSMG (Z, 65, VALUE).

12. SUBROUTINE PAGEG

Subroutine PAGEG controls the forms flash, produces hardcopy, and advances the frame. The forms flash exposes the forms overlay on the current frame. Frame advance signals the completion of the current picture and advances the film. The subroutine is written in FORTRAN IV.

12.1 Standard Calls

The calling sequence is as follows:

CALL PAGEG (Z, NFORM, NCOPY, NADVAN)

where

- (1) Z is the mode set array
- (2) NFORM indicates the forms flash
 - If NFORM = 0, no forms flash
 - > 0, flash the forms NFORM times
- (3) NCOPY specifies the number of hardcopies of the frame to make. If NCOPY = 0, no copies are made
- (4) NADVAN specifies the number of frames to advance the film. If NADVAN = 0, the frame is not advanced. (One advance is normal.)

12.2 Example

To advance the film with no forms flash and obtain one hardcopy

CALL PAGEG (Z, 0, 1, 1).

13. SUBROUTINE EXITG

Subroutine EXITG turns off the graphic devices and closes the output files. This subroutine is written in FORTRAN IV.

13.1 Standard Calls

The calling sequence is as follows:

CALL EXITG (Z)

where

Z is the mode set array.

13.2 Special Calls

A call is provided to terminate the user's program abnormally without knowing the user's mode set array. The call is the same as that above, minus the reference to the mode set array:

CALL EXITG (0).

14. SUBROUTINE LEGNDG

Subroutine LEGNDG types characters, starting at a given x,y location. If the characters extend beyond the right margin, the line is ejected to the left margin; if beyond the bottom margin, the line is ejected to the top. The subroutine is written in FORTRAN IV.

14.1 Standard Calls

The calling sequence is as follows:

CALL LEGNDG (Z, X, Y, NCHAR)

where

- (1) Z is the mode set array
- (2) X, Y is the location of the center of the first character
- (3) N is the number of characters to type ($N \geq 1$)
- (4) CHAR is the name of a variable or an array that contains the characters to type.

14.2 Example

To type the sentence "This illustrates UPPER and lower case." in the lower left corner of the page

```
CALL LEGNDG (Z, 0., 0., 44, 44HT$LHIS ILLUSTRATES $UUPPER $LAND  
LOWER CASE)
```

15. SUBROUTINE MLTPLG

Subroutine MLTPLG draws multiple line segments. First, two line segments are drawn. Next, a given number of line segments are drawn between the two lines, in a direction similar to that of the original lines. MLTPLG facilitates drawing grid lines, crosshatching, and shading. It can draw lines at any orientation to each other, not just parallel. MLTPLG has many uses not at first apparent. It is a convenient means of drawing any two line segments with a single call. If the delimiting line segments are very short, the vectors drawn will appear as points. This allows the user to plot many points with a single call — exactly what one needs for shading. All mode sets described in LINESG are applicable to this subroutine. The subroutine is written in FORTRAN IV.

15.1 Standard Calls

The calling sequence is as follows:

```
CALL MLTPLG (Z, N, X1, Y1, X2, Y2, X3, Y3, X4, Y4)
```

where

- (1) Z is the mode set array
- (2) N specifies the number of lines to draw between the two given lines. If N = 0, only the two given lines will be drawn.
- (3) X1, Y1 and X2, Y2 are two points specifying a line
- (4) X3, Y3 and X4, Y4 are two points specifying a line.

15.2 Example

To draw four horizontal, parallel lines encompassing the entire screen

```
CALL MLTPLG (Z, 2, 0., 0., 4095., 0., 0., 3071., 4095., 3071).
```

16. SUBROUTINE NUMBRG

Subroutine NUMBRG displays integer or real numbers. The subroutine is written in FORTRAN IV.

16.1 Standard Calls

Several different formats can be displayed in the following ways:

- (1) To display an *integer* number in *I format*, the calling sequence is as follows:

CALL NUMBRG (Z, X, Y, IFMT, INTG)

where

- (a) Z is the mode set array
 - (b) X, Y is the x,y position at which to display the number, i.e., the center of the leftmost character
 - (c) IFMT is an integer indicating the number of digits to display
 - (d) INTG is the number to display.
- (2) To display a *real* number in *F format*, the calling sequence is as follows:

CALL NUMBRG (Z, X, Y, FMT, REAL)

where

- (a) Z is the mode set array
- (b) X, Y is the x,y position at which to display the number, i.e., the center of the leftmost character
- (c) FMT is a real number that specifies the format. It is of the form w.d, where w specifies the field width and d the number of decimal places ($d < 10$). Use the special call if $d \geq 10$.
- (d) REAL is the number to display.

- (3) To display a *real* number in *E format*, the calling sequence is as follows:

CALL NUMBRG (Z, X, Y, -FMT, REAL)

where

- (a) Z is the mode set array
 - (b) X, Y is the x,y position at which to display the number, i.e., the center of the leftmost character
 - (c) -FMT is a real number that specifies the format. It is of the form w.d, where w is the field width and d the number of decimal places ($d < 10$). Use the special call if $d \geq 10$. Four places must be provided for the exponent and two places for the sign and digit to the left of the decimal place. In general, $w = d + 7$.
 - (d) REAL is the number to display.
- (4) To display *characters* in *A format* (this call is equivalent to a call to LEGNDG), the calling sequence is as follows:

CALL NUMBRG (Z, X, Y, -IFMT, CHARS)

where

- (a) Z is the mode set array
- (b) X, Y is the x,y position at which to display the number, i.e., the center of the leftmost character
- (c) -IFMT is an integer indicating the number of characters to display
- (d) CHARS is the name of a variable or array that contains the character string to display.

16.2 Special Calls

A special call allows the format to be specified by mode sets as follows:

CALL NUMBRG (Z, X, Y, O, VALUE)

where VALUE is the name of the variable to display. The format must be specified by the following mode set calls prior to the call to NUMBRG:

- (1) CALL SETSMG (Z, 77, WIDTH)
WIDTH is the field width
- (2) CALL SETSMG (Z, 78, DEC)
DEC is the number of decimal places
- (3) CALL SETSMG (Z, 79, FMT)
FMT is the format in which to display the number.

If FMT = 1.0, I format
 = 2.0, F format
 = 3.0, E format
 = 4.0, A format.

16.3 Modifications

All mode sets described in LEGNDG are also applicable to this subroutine. Use mode sets to modify NUMBRG as follows:

- (1) To display numbers in scientific notation rather than E format,

CALL SETSMG (Z, 85, 1.)

- (2) To reset to the default condition of E format,

CALL SETSMG (Z, 85, 0.)

The number -0.00116 would appear as -0.116E-02 in E format and as -0.116×10^{-02} in scientific notation.

16.4 Example

To display the variable N in I6 format at location 0,0,

CALL LEGNDG (Z, 0., 0., 6, N).

17. SUBROUTINE GRIDG

Subroutine GRIDG constructs cartesian grids – draws all lines and emphasizes the major grid divisions. GRIDG assumes that the user has established his subject space with SUBJEG and his object space with OBJCTG. The object space should provide a margin because the grid will fill the entire object space. The subroutine is written in FORTRAN IV.

17.1 Standard Calls

The calling sequence is as follows:

CALL GRIDG (Z, DX, DY, IXTH, JYTH)

where

- (1) Z is the mode set array
- (2) DX, DY are the x,y grid intervals in user coordinates. If DX or DY = 0.0, no grid lines are drawn for that axis. DX controls spacing between the vertical grid lines and DY the horizontal. If the user's x-axis subject space decreases from left to right, or the y-axis subject space decreases from bottom to top, DX or DY must be negative, respectively. If the zero-axis lies within the grid, DX or DY is spaced from the zero-axis outward. Otherwise, it is spaced from left to right or from bottom to top. The grid lines are drawn with 0.5 times normal line width.
- (3) IXTH, JYTH specify the i^{th} x-grid line and the j^{th} y-grid line to emphasize. If IXTH or JYTH = 0.0, no lines are emphasized for it. The emphasis lines are drawn with twice the normal line weight.

17.2 Example

To draw a grid such that the x-axis ranges from -20 to 60 and the y-axis from -100 to 100, and to leave a 0.2-normalized-object-space margin around the grid, the calling sequence is as follows.

```
CALL SUBJEG (Z, -20., -100., 60., 100.)  
CALL OBJCTG (Z, 0.2, 0.2, 1.133, 0.8)  
CALL GRIDG (Z, 10., 50., 2, 1).
```


18. SUBROUTINE LABELG

Subroutine LABELG labels the axes of a grid drawn by GRIDG. The user may label both the x and y axes with numeric or alphanumeric labels. The y-axis will be labeled to the left of the grid. The subroutine is written in FORTRAN IV.

18.1 Standard Calls

- (1) To create alphanumeric labels, the calling sequence is as follows:

CALL LABELG (Z, IAXIS, DLXY, NCHAR, CHARS)

where

- (a) Z is the mode set array
- (b) IAXIS specifies the axis to label

If IAXIS = 0, label the x-axis
 = 1, label the y-axis
- (c) DLXY fixes the x-interval if IAXIS = 0, or the y-interval if IAXIS = 1, in user coordinates (subject space) between each label. If the x-axis decreases from left to right or the y-axis from bottom to top, then DLXY must be negative. For labeling log grids, DLXY specifies the cycle lines to label. For example, DLXY = 1.0 stipulates the labeling of each cycle line, and DLXY = 3.0 every third line.
- (d) NCHAR specifies the number of characters of display for each cycle of the label
- (e) CHAR contains the characters used in the label. CHAR must contain enough characters for all labels. For example, if NCHAR = 3 and four lines are to be labeled, CHAR must contain twelve characters.

- (2) To create integer numeric labels in I format, the calling sequence is as follows:

CALL LABELG (Z, IAXIS, DLXY, O, IFMT)

where

- (a) Z is the mode set array
- (b) IAXIS specifies the axis to label
 - If IAXIS = 0, label the x-axis
 - = 1, label the y-axis
- (c) DLXY fixes the x-interval if IAXIS = 0, or the y-interval if IAXIS = 1, in user coordinates (subject space) between each label. If the x-axis decreases from left to right or the y-axis from bottom to top, then DLXY must be negative. For labeling log grids, DLXY specifies the cycle lines to label. For example, DLXY = 1.0 stipulates the labeling of each cycle line and DLXY = 3.0 every third line.
- (d) IFMT is an integer fixing the number of digits to display.

- (3) To create real numeric labels in F format, the calling sequence is as follows:

CALL LABELG (Z, IAXIS, DLXY, O, FMT)

where

- (a) Z is the mode set array
- (b) IAXIS specifies the axis to label
 - If IAXIS = 0, label the x-axis
 - = 1, label the y-axis
- (c) DLXY fixes the x-interval if IAXIS = 0, or the y-interval if IAXIS = 1, in user coordinates (subject space) between each label. If the x-axis decreases from left to right or the y-axis from bottom to top, then DLXY must be negative. For labeling log grids, DLXY specifies the cycle lines to label. For example, DLXY = 1.0 stipulates the labeling of each cycle line and DLXY = 3.0 every third line.
- (d) FMT is a real number that specifies the format. It is of the form w.d, where w specifies the field width and d the number of decimal places (d<10).

- (4) To create real numeric labels in E format, the calling sequence is as follows:

CALL LABELG (Z, IAXIS, DLXY, O, -FMT)

where

- (a) Z is the mode set array

- (b) IAXIS specifies the axis to label

If IAXIS = 0, label the x-axis
= 1, label the y-axis

- (c) DLXY fixes the x-interval if IAXIS = 0, or y-interval if IAXIS = 1, in user coordinates (subject space) between each pair of labels. If the x-axis decreases from left to right, or the y-axis from bottom to top, then DLXY must be negative. For labeling log grids, DLXY specifies the cycle lines to label. For example, DLXY = 1.0 stipulates the labeling of each cycle line and DLXY = 3.0 every third line.

- (d) -FMT is a real number that specifies the format. It is of the form w.d, where w is the field width and d the number of decimal places. Four places must be provided for the exponent and two for the sign and digit to the left of the decimal place. In general, $w = d + 7$.

18.2 Modifications

Use mode sets to modify LABELG as follows:

- (1) To specify that a tick mark be drawn above the x-axis labels or beside the y-axis labels, the calling sequence is as follows:

CALL SETSMG (Z, 102, XSIZE)

for the X axis, where

XSIZE specifies the length of the tick mark for the x-axis label in normalized object space. If XSIZE = 0.0, no tick mark is drawn. XSIZE = 0.0 is the default value.

or

CALL SETSMG (Z, 103, YSIZE)

for the Y axis, where

YSIZE fixes the length of the tick mark for the y-axis label in normalized object space. If YSIZE = 0.0, no tick mark is drawn. YSIZE = 0.0 is the default value.

All modes described in LINESG are in effect when the tick marks are drawn. If XSIZE or YSIZE is positive, the tick marks are drawn inside the grid; if minus, outside. To draw tick marks alone without a label, set NCHAR = 1 and define CHARS to contain as many Hollerith blanks as there are labels.

- (2) To specify the locations at which to label, the calling sequence is as follows:

CALL SETSMG (Z, 104, XPLACE)

for x-axis labels, where

XPLACE defines the distance from the x-axis to the label as a multiple of character height. XPLACE = -1.0 is the default value.

If XPLACE = 0.0, label at y = 0 major axis. (This may cause the label to fall inside the grid.) If XPLACE > 0.0 (+), label the x-axis above the grid. If XPLACE < 0.0 (-), label the x-axis below the grid

or

CALL SETSMG (Z, 105, YPLACE)

for Y axis labels, where

YPLACE defines the distance from the y-axis to the label as a multiple of character width. YPLACE = -1.0 is the default value.

If YPLACE = 0.0, label at x = 0 major axis. (This may cause the label to fall inside the grid.) If YPLACE > 0.0 (+), label the y-axis on the right of the grid. If YPLACE < 0.0 (-), label the y-axis on the left of the grid.

- (3) To change the character size or font, give the mode set calls described in LEGNDG.

18.3 Example

To label a grid with the months of the year on the x-axis, the calling sequence is as follows:

```
CALL LABELG (Z, 0, 1., 3, 27HJANFEBMARAPRMAYJUNJULAUGSEP)
```

19. SUBROUTINE TITLEG

Subroutine TITLEG titles the x and y axes and the graph and automatically centers the titles. TITLEG provides a quick, easy method of titling a graph. For full control over titling, use LEGNDG rather than TITLEG. The subroutine is written in FORTRAN IV.

19.1 Standard Calls

The calling sequence is as follows:

```
CALL TITLEG (Z, NX, XCHAR, NY, YCHAR, NT, TCHAR)
```

where

- (1) Z is the mode set array
- (2) NX specifies the number of characters in the x-axis title, centered below the grid. If NX = 0, the x-axis is not titled.
- (3) XCHAR contains the NX characters for the x-axis title. If NX = 0, XCHAR should be a dummy argument.
- (4) NY specifies the number of characters in the y-axis title, vertically centered left of the grid. The line and character orientation will be 90°. If NY = 0, the y-axis is not titled.
- (5) YCHAR contains the NY characters for the y-axis title. If NY = 0, YCHAR should be a dummy argument.
- (6) NT specifies the number of characters in the graph title, centered below the x-axis title. If NT = 0, the graph is not titled.
- (7) TCHAR contains the NT characters for the graph title. If NT = 0, TCHAR should be a dummy argument.

19.2 Modifications

Use mode sets to modify TITLEG as follows:

- (1) The mode set array contains the area available for titling. Normally, these values are stored in the mode set array by GRIDG or LABELG. However, if neither GRIDG nor LABELG has been called, the user must supply the values himself with one of the following mode set calls:

CALL SETSMG (Z, 113, XMIN)

XMIN specifies the minimum x-location in normalized object space occupied by the graph, including labels.

CALL SETSMG (Z, 114, YMIN)

YMIN designates the minimum y-location in normalized object space occupied by the graph, including labels.

CALL SETSMG (Z, 115, XMAX)

XMAX specifies the maximum x-location in normalized object space occupied by the graph, including labels.

CALL SETSMG (Z, 116, YMAX)

YMAX stipulates the maximum y-location in normalized object space occupied by the graph, including labels.

- (2) To specify the position of the title,

CALL SETSMG (Z, 104, XPLACE)

XPLACE designates the distance from the grid to the x-axis title as a multiple of character height. It also fixes the distance from the x-axis title to the graph title. XPLACE = -1.0 is the default value.

If XPLACE > 0.0 (+), title above the grid. If XPLACE < 0.0 (-), title below the grid.

CALL SETSMG (Z, 105, YPLACE)

YPLACE specifies the distance from the y-axis to the title as a multiple of character width. YPLACE = -1.0 is the default value.

If YPLACE >0.0 (+), title on the right side of the grid. If YPLACE <0.0 (-), title on the left side of the grid.

- (3) Change the character size or font with the mode set calls described in LEGNDG.

19.3 Example

To title a grid the calling sequence is as follows:

CALL TITLEG (Z, 12, 12HX-AXIS TITLE, 12, 12HY-AXIS TITLE,
11, 11HGRAPH TITLE).

20. INTEGRATED GRAPHICS SYSTEM ERROR MESSAGES

When an error is detected by a graphic subroutine, ERRZZ is called to print the error message:

BAD BAD BAD, ERROR NO. xx, value I,
value F, value A FRAME nn

where xx is the error number, values I, F, and A are the values printed out under I, F, and Z format, and nn is the frame number. Table A-II shows the IGS error messages. The job continues in a normal manner after the message is printed.

TABLE A-II

INTEGRATED GRAPHICS SYSTEM ERROR MESSAGES

<u>Number</u>	<u>Subroutine</u>	<u>Value</u>	<u>Description</u>
1	GETSMG	NO	Illegal mode set number in call
2	LEGNDG	N	Illegal character count in call
3	LINESG	NO	Illegal number in call
4	MODESG	ITAPE	Illegal tape number in call
5	NUMBRG	FMT	Illegal format in call
6	OBJCTG	-	Max x or y LE min x or y in call
7	PAGEG	-	Illegal arguments in call
8	POINTG	N	Illegal number in call
9	SEGMTG	N	Illegal number in call
10	TABSG	N	Illegal number in call

TABLE A-II (contd.)

<u>Number</u>	<u>Subroutine</u>	<u>Value</u>	<u>Description</u>
11	MLTPLG	NLINES	Illegal number in call
12	GRIDG	-	Grid too small to draw
13	LABELG	-	Illegal format in call
14	TITLEG	-	Illegal arguments in call
15	SETUPG	-	Illegal arguments in call
16	SUBJEG	-	Max x or y EQ min x or y in call
17	LABELG	-	Illegal arguments in call
18	LABELG	-	Grid too small to label
19	LABELG	-	Zero subject space
20	GRIDG	-	Illegal arguments in call
21	SETUPG	-	Subject (object) space too small to draw a grid
22	SETUPG	-	Density LE 0
23	SETSMG	N	Illegal mode set number in call
24	SETUPG	-	Grid will not fit on page
25	TEXTG	N	Illegal character count in call
26	LABELG	-	Labels will not fit on page
27	PACKZZ	-	No initialization call to MODESG
28	GRAPHG	N	Illegal argument in call
29	SUBJEG	-	Minus value for log grid
30	SETUPG	-	Too many cycles in log grid
31	VECTZZ	-	No vector character font initialized
32	SCALZZ	X	Bad x-coordinate
33	SCALZZ	Y	Bad y-coordinate
34	VECTZZ	CHAR	Character not in font
35	TITLEG	-	Subject (object) space too small to title grid
36	VECTZZ	CHAR	Request for nonexistent vector character case

21. REFERENCES

- A-1. A. J. Smith, *Standard Package Description Calcomp Plotter Routines*, Phillips Petroleum Co. Program Number S0010, 1969.
- A-2. G. D. Brown, C. H. Bush, R. A. Berman, *The Integrated Graphics System for the S-C 4060: I. User's Manual*, Rand Corp., 1968.

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APPENDIX B

SALE COMPUTER CODE LISTING

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COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EEOCIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOIO,XREF
ISN 0002.    DIMENSION ZMA(6),NGR(5),ZMET(20,6),ZLA(75,6),N6(4E),PT(6),      PRPT0010
              1 NAT(80),NRT(120),NRTA(15,5),NP(120),IB(40),IA(40),IC(80),DAT(12),PRPT0020
              2 KMON(48),KYR(48),MONTH(12),NDA(40),NCA(40),NBA(40),PRPT0030
              3 NDB(40),NCB(40),NDC(80),GTITLE(36),STITLE(36),XTITLE(3),PRPT0040
              4 INGRP(25,2),SCUM(5,75,12),NGRUP(5,19),JLAB(5,75,3),GNAME(5,5),PRPT0050
              5 YTITLE(10),NIY(200),XGRUP(5,75,4),GNAM(5),SAVE(5,75,12),PRPT0060
              6A(1500,3),N(1500,7),IO(1500),LINE(13),TITLE(10),XCUM(5,75,12),PRPT0070
              7XLABIN(18),NSGRUP(5,75),GSUM(5,3)PRPT0080
ISN 0003    DOUBLE PRECISION SX,SXX,DX,DXX,AVE,SD,XS,XD,DNRTA(15,5),PRPT0090
              1 DD(120),COMP1(5),COMP2(5),DB(40),DA(20),DC(80),PRPT0100
              2BX(48),BXX(48),RX,RXX,RN,SN,XMEAN,OBS(300),FN(48),SDX,PRPT0110
              3TMN(75),TSD(75),SDS,SDR,XMNYR(200),Y(200),PMEAN(200),RMS(200),PRPT0120
ISN 0004    DIMENSION SAVAL(48,20),SAVA2(48,20),SAVA3(48,20),NANA(48,20)PRPT0121
ISN 0005    DOUBLE PRECISION AX(25),AXX(25),NAB(25),KAYR(25),KAMON(25)PRPT0125
ISN 0006    DATA LINE/13*'/PRPT0130
ISN 0007    DATA DAT/'JAN.', 'FEB.', 'MAR.', 'APR.', 'MAY ', 'JUNE', 'JULY', 'AUG.',PRPT0140
              1 'SEPT', 'OCT.', 'NOV.', 'DEC.'/PRPT0150
ISN 0008    DATA EH/'UNBL'/PRPT0160
ISN 0009    DATA CCMP1/' ', ' ', ' ', 'TIME', 'ANALYST', 'ERROR'/PRPT0170
ISN 0010    DATA COMP2/' ', ' ', ' ', ' ', ' ', 'TIME', 'ERROR'/PRPT0180
ISN 0011    DATA GTITLE/19* ' ', 'X = ', 'MEAN', ' FOR', ' THE', ' MON', ' TH ',PRPT0190
              1 3* ' ', 'SIX-', 'MONT', 'H MO', ' VING', ' MEA', 'N', ' '/PRPT0200
ISN 0012    DATA STITLE/19* ' ', 'X = ', 'WITH', '-IN ', 'LAB ', 'STO ', 'DEV ',PRPT0210
              1 11* '/PRPT0220
ISN 0013    DATA XTITLE/' ', ' ', 'ONTH', ' '/PRPT0230
ISN 0014    DIMENSION STAR(3,75)PRPT0240
ISN 0015    DATA YTITLE/3* ' ', ' PER', 'CENT', ' BIA', 'S ', '3* '/PRPT0250
ISN 0016    COMMON OBSPRPT0260
ISN 0017    COMMON XMEAN,NE,ND,NC,NF,NH,NG,ALFA(15),SOBX,SDXPRPT0270
ISN 0018    COMMON /AEFF/DAPRPT0280
ISN 0019    COMMON /BEFF/DBPRPT0290
ISN 0020    COMMON /CEFF/DCPRPT0300
ISN 0021    COMMON /DEFF/DDPRPT0310
ISN 0022    COMMON /COM1/MIN=0,NAUTOPRPT0320
ISN 0023    COMMON /COM2/XMNYRPRPT0330
ISN 0024    COMMON /COM5/NIYPRPT0340
ISN 0025    COMMON /COM6/YPRPT0350
ISN 0026    COMMON /CMA/ZMA,ISOR7PRPT0360
ISN 0027    COMMON /CMET/ZMETPRPT0370
ISN 0028    COMMON /CLA/ZLAPRPT0380
ISN 0029    COMMON /CONF/CIPRPT0390
ISN 0030    COMMON /STARD/STARNA,STARNT,STARCPRPT0400
ISN 0031    DIMENSION ALETER(75),ALFATO(4),ALET(5,75),ICMPLT(5)PRPT0410
ISN 0032    DIMENSION ISDSIZ(5),Z(500),STORE(12),STOR(12)PRPT0420
ISN 0033    DIMENSION STORE2(12)PRPT0425
ISN 0034    DATA ALFATO/'A ', 'B ', 'C ', 'D ', 'STA'/120* '/PRPT0430
ISN 0035    DATA BLANK1/' '/PRPT0440
ISN 0036    CALL HADPRPT0450
ISN 0037    200 CALL HAD1(MATT)PRPT0460
ISN 0038    DO 1 J=1,5PRPT0470
ISN 0039    NGR(J)=0PRPT0480
ISN 0040    DO 1 L= 1,19PRPT0490
ISN 0041    1 NGRUP(J,L)=0PRPT0500
ISN 0042    59 FOPMAT(LH1)PRPT0510

```

```

19
ISN 0043      2  READ(5,125) J,(NB(L),L=1,19),YCNTM,ISDSI,ICMPL,GNAM      PPRT0520
ISN 0044      125 FORMAT(I12,19I2,4X,F5.3,5X,I1,2X,I1,2X,10A4)      PPRT0530
ISN 0045      WRITE(6,126) J,(NB(L),L=1,19),YCNTM,ISDSI,ICMPL,GNAM      PPRT0540
ISN 0046      126 FORMAT(1H ,I2,19I3,4X,F5.3,5X,I1,2X,I1,2X,10A4)      PPRT0550
ISN 0047      IF(J.EQ.0) GO TO 161      PPRT0560
ISN 0049      ICMPLT(J)=ICMPL      PPRT0570
ISN 0050      ISDSI1(J)=ISDSI      PPRT0580
ISN 0051      DO 201 L=1,5      PPRT0590
ISN 0052      201 GNAME(J,L)=GNAM(L)      PPRT0600
ISN 0053      DO 3 L=1,19      PPRT0610
ISN 0054      3  NGRUP(J,L)=NB(L)      PPRT0620
ISN 0055      GO TO 2      PPRT0630
ISN 0056      161 READ(5,162) UPPER,GUP,UPCUM      PPRT0640
ISN 0057      162 FORMAT(6F10.4)      PPRT0650
ISN 0058      WRITE(6,127) UPPER,GUP,UPCUM      PPRT0660
ISN 0059      127 FORMAT(1H ,6F10.4)      PPRT0670
ISN 0060      XLOWER=(-1.0)*UPPER      PPRT0680
C*** READ AND STORE ALL DATA      PPRT0690
ISN 0061      4  READ(5,101) TITLE,MMIN,MMAX,NORDR,ICHECK,IFLIST      PPRT0700
ISN 0062      101 FORMAT(10A4,10I4)      PPRT0710
ISN 0063      WRITE(6,128) TITLE,MMIN,MMAX,NORDR ,ICHECK,IFLIST      PPRT0720
ISN 0064      128 FORMAT(1H0,10A4,10I4)      PPRT0730
ISN 0065      I=1      PPRT0740
ISN 0066      IF(I5DR7.EQ.0) ISOR7=5      PPRT0750
ISN 0068      5  READ(ISOR7,102,END=10) (N(I,J),J=1,6),A(I,1),A(I,2),IL,UNIT,T,PM      PPRT0760
ISN 0069      102 FORMAT(I2,2I2,I1,I2,I1,2F10.5,6X,I1,A1,F2.0,F10.5)      PPRT0770
ISN 0070      IF(N(I,1).LE.0) GO TO 10      PPRT0780
ISN 0072      IF(N(I,1).GE.5.AND.N(I,1).LE.7) CALL PUN1(PM,T,N(I,1),A(I,2),UNIT,PPRT0790
ISN 0074      1 ,IL)      PPRT0800
ISN 0076      IF(N(I,1).GE. 10 .AND. N(I,1).LE. 12)      PPRT0810
1CALL PUN1(PM,T,N(I,1),A(I,2),UNIT,IL)      PPRT0820
ISN 0078      IF(N(I,1).GE. 15 .AND. N(I,1).LE. 27) CALL PUN2(T,N(I,1),UNIT,      PPRT0830
ISN 0080      * A(I,2),N(I,4),N(I,5),IL)      PPRT0840
ISN 0082      IF (A(I,1).GT.100.0)A(I,1)=A(I,1)/1000.0      PPRT0850
ISN 0084      IF (A(I,2).GT.100.0)A(I,2)=A(I,2)/1000.0      PPRT0860
ISN 0086      IF(A(I,1).GT.10.0)A(I,1)=A(I,1)/100.0      PPRT0870
IF(A(I,2).GT.10.0)A(I,2)=A(I,2)/100.0      PPRT0880
ISN 0088      IF(N(I,1).NE.MATT) WRITE(6,231) (N(I,J),J=1,6),A(I,1),A(I,2),      PPRT0890
ISN 0089      231 UNIT,T,PM      PPRT0900
ISN 0090      FORMAT(1H ,6I2,2F10.5,7X,A1,F2.0,F10.5)      PPRT0910
ISN 0091      A(I,3)=100.0*(A(I,1)-A(I,2))/A(I,2)      PPRT0920
ISN 0092      N(I,7)=N(I,6)+10*N(I,5)+1000*N(I,4)+10000*N(I,3)+1000000*N(I,3)      PPRT0930
ISN 0093      7  IO(I)=I      PPRT0940
ISN 0094      I=I+1      PPRT0950
ISN 0095      GO TO 5      PPRT0960
C*** ORDER ALL DATA      PPRT0970
ISN 0096      10 IO(I)=I      PPRT0980
ISN 0097      N(I,7)=0      PPRT0990
ISN 0098      NDATA=I-1      PPRT1000
ISN 0099      JF=NDATA-1      PPRT1010
ISN 0100      DO 15 J=1,JE      PPRT1020
ISN 0101      LE=NDATA-J      PPRT1030
ISN 0102      DO 14 L=1,LE      PPRT1040
ISN 0103      IN=IO(L)      PPRT1050
JN=IO(L+1)      PPRT1060
IF(N(IN,7).LE.N(JN,7))GO TO 14      PPRT1070

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ISN 0105      IC(L)=JN
ISN 0106      IC(L+1)=IN
ISN 0107      14 CONTINUE
ISN 0108      15 CONTINUE
C**** ZERO STORAGE LOCATIONS FOR CUMULATIVE PLOT TABLE
ISN 0109      YBIG = 1.
ISN 0110      DO 165 J1=1,5
ISN 0111      DO 165 J2=1,75
ISN 0112      DO 165 J3=1,12
ISN 0113      XCUM(J1,J2,J3)=0.0
ISN 0114      SAVE(J1,J2,J3)=0.0
ISN 0115      165 SCUM(J1,J2,J3)=0.0
C*** PRINT ALL DATA
ISN 0116      IN=1
ISN 0117      I=IO(IN)
ISN 0118      NLAB=N(I,3)+100*N(I,2)+10000*N(I,1)
ISN 0119      NMUN=N(I,5)+100*N(I,4)
C**** RETURNS FROM 100 TO 20 IF CHANGE IN MATERIAL, METHOD, OR LAB
ISN 0120      20 LAB=NLAB
ISN 0121      LC=0
ISN 0122      103 FORMAT(1H ,7X,13A4)
ISN 0123      SX=0.00+0
ISN 0124      SXX=0.00+0
ISN 0125      SDS=0.
ISN 0126      SDR=0.
C**** ZERO STORAGE LOCATIONS FOR ANOV DATA
ISN 0127      DO 64 J1=1,48
ISN 0128      DO 64 J2=1,23
ISN 0129      SAVA1(J1,J2)=0.0
ISN 0130      SAVA2(J1,J2)=0.0
ISN 0131      SAVA3(J1,J2)=0.0
ISN 0132      54 MANA(J1,J2)=0
ISN 0133      DO 68 J1=1,15
ISN 0134      DO 68 J2=1,5
ISN 0135      68 MATA(J1,J2)=0
ISN 0136      NS=0
ISN 0137      NC=0
ISN 0138      KC=0
ISN 0139      DO 21 J=1,120
ISN 0140      DO(J)=0.00+0
ISN 0141      NP(J)=0
ISN 0142      21 NRT(J)=0
ISN 0143      DO 22 J=1,80
ISN 0144      DC(J)=0.00+0
ISN 0145      IC(J)=0
ISN 0146      NAT(J)=0
ISN 0147      22 NDC(J)=0
ISN 0148      DO 23 J=1,40
ISN 0149      DB(J)=0.00+0
ISN 0150      IB(J)=0
ISN 0151      IA(J)=0
ISN 0152      NDA(J)=0
ISN 0153      NCA(J)=0
ISN 0154      NBA(J)=0
ISN 0155      NDA(J)=0
ISN 0156      23 NCB(J)=0

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RPRT1080
RPRT1090
RPRT1100
RPRT1110
RPRT1120
RPRT1121
RPRT1130
RPRT1140
RPRT1150
RPRT1160
RPRT1165
RPRT1170
RPRT1180
RPRT1190
RPRT1200
RPRT1210
RPRT1220
RPRT1230
RPRT1240
RPRT1260
RPRT1270
RPRT1280
RPRT1290
RPRT1294
RPRT1295
RPRT1300
RPRT1301
RPRT1302
RPRT1303
RPRT1304
RPRT1305
RPRT1306
RPRT1307
RPRT1308
RPRT1309
RPRT1310
RPRT1320
RPRT1330
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RPRT1360
RPRT1370
RPRT1380
RPRT1390
RPRT1400
RPRT1410
RPRT1420
RPRT1430
RPRT1440
RPRT1450
RPRT1460
RPRT1470
RPRT1480
RPRT1490
RPRT1500
RPRT1510

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ISN 0157      DO 24 J=1,20
ISN 0158      24 DA(J)=0.00+0
C****      RETURNS FROM 42 TO 25 IF CHANGE IN MONTH
ISN 0159      25 MON=NMON
ISN 0160      CX=0.00+0
ISN 0161      DXX=0.00+0
ISN 0162      ND=0
ISN 0163      KC=KC+1
ISN 0164      KMON(KC)=N(I,5)
ISN 0165      KYR(KC)=N(I,4)
ISN 0166      104 FOPMAT(1H,7X,A4,' 197',I1,I',3F10.5,7X,I1)
ISN 0167      35 DX=DX+A(I,3)
ISN 0168      DXX=DXX+A(I,3)*A(I,3)
ISN 0169      ND=ND+1
ISN 0170      SAVA1(KC,ND)=A(I,1)
ISN 0171      SAVA2(KC,ND)=A(I,2)
ISN 0172      SAVA3(KC,ND)=A(I,3)
ISN 0173      NANA(KC,ND)=N(I,6)
ISN 0174      37 IN=IN+1
ISN 0175      I=10(IN)
ISN 0176      NLAB=N(I,3)+100*N(I,2)+10000*N(I,1)
ISN 0177      NMON=N(I,5)+100*N(I,4)
ISN 0178      IF(NLAB.NE.LAB) GO TO 40
ISN 0180      IF(NMON.NE.MON) GO TO 40
ISN 0182      GO TO 35
ISN 0183      40 NB(KC)=ND
ISN 0184      BX(KC)=DX
ISN 0185      BXX(KC)=DXX
ISN 0186      105 FOPMAT(1H,7X,'AVERAGE',23X,F10.5)
ISN 0187      42 IF(NLAB.EQ.LAB) GO TO 25
ISN 0189      IF(MON.LT.MMIN) GO TO 100
ISN 0191      9 IF(KMON(KC)+100*KYR(KC).LE.MMAX) GO TO 8
ISN 0193      KC=KC-1
ISN 0194      GO TO 9
ISN 0195      8 IM1=10(IN-1)
ISN 0196      CALL HEAD(N(IM1,1),N(IM1,2),N(IM1,3),LC)
ISN 0197      IF(KC.EQ.0) GO TO 100
ISN 0199      IF(KC.GE.6) KC6=KC-5
ISN 0201      IF(KC.LT.6) KC6=1
ISN 0203      DO 66 K1=KC6,KC
ISN 0204      ND=NB(K1)
ISN 0205      NC=NC+1
ISN 0206      NRT(NC)=ND
ISN 0207      DO 67 K2=1,ND
ISN 0208      IF(LC.GT.45) CALL HEAD(N(IM1,1),N(IM1,2),N(IM1,3),LC)
ISN 0210      WRITE(6,104) DAT(KMON(K1)),KYR(K1),SAVA1(K1,K2),SAVA2(K1,K2),
*SAVA3(K1,K2),NANA(K1,K2)
ISN 0211      NAT(NC)=NANA(K1,K2)
ISN 0212      NRTA(NC,NANA(K1,K2))=NRTA(NC,NANA(K1,K2))+1
ISN 0213      NS=NS+1
ISN 0214      OBS(NS)=SAVA3(K1,K2)
ISN 0215      LC=LC+1
ISN 0216      SX=SX+SAVA3(K1,K2)
ISN 0217      SXX=SXX+SAVA3(K1,K2)*SAVA3(K1,K2)
ISN 0218      67 CONTINUE
ISN 0219      XD=ND
FOPRT1520
FOPRT1530
FOPRT1540
FOPRT1550
FOPRT1570
FOPRT1580
FOPRT1590
FOPRT1610
FOPRT1620
FOPRT1630
FOPRT1710
FOPRT1790
FOPRT1800
FOPRT1810
FOPRT1811
FOPRT1812
FOPRT1813
FOPRT1814
FOPRT1820
FOPRT1830
FOPRT1840
FOPRT1850
FOPRT1860
FOPRT1870
FOPRT1880
FOPRT1910
FOPRT1920
FOPRT1930
FOPRT1960
FOPRT1962
FOPRT1963
FOPRT1964
FOPRT1965
FOPRT1966
FOPRT1967
FOPRT1968
FOPRT1969
FOPRT1970
FOPRT1971
FOPRT1972
FOPRT1974
FOPRT1976
FOPRT1978
FOPRT1980
FOPRT1982
FOPRT1984
FOPRT1986
FOPRT1988
FOPRT1990
FOPRT1992
FOPRT1994
FOPRT1996
FOPRT1998
FOPRT2000
FOPRT2002
FOPRT2004

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ISN 0220      AVE=BX(K1)/XD
ISN 0221      WRITE(6,105)AVE
ISN 0222      WRITE(6,103)LINE
ISN 0223      LC=LC+2
ISN 0224      66 CONTINUE
ISN 0225      XS=NS
ISN 0226      IF(NS.LE.1)GO TO 100
ISN 0228      AVE=SX/XS
ISN 0229      SD=(SX-AVE*SX)/(XS-1.00+0)
ISN 0230      IF(SD.LE.0.00+0) GO TO 41
ISN 0232      SD=DSQRT(SD)
ISN 0233      41 WRITE(6,103) LINE
ISN 0234      WRITE(6,106) AVE,SD,NS
ISN 0235      106 FORMAT(1H0,7X,'MEAN =' ,F8.5,4X,'STD.DEV.=' ,F8.5,4X,'NO.=' ,I3)
ISN 0236      IF(IFLIST.EQ.1)GO TO 100

C***
C*** PREPARE INPUT FOR ANOV
ISN 0238      44 ND=0
ISN 0239      NF=1
ISN 0240      NG=1
ISN 0241      NH=1
ISN 0242      NE=NS
ISN 0243      DB(1)=NE
ISN 0244      DA(1)=NE
ISN 0245      IB(1)=NC
ISN 0246      IA(1)=1
ISN 0247      IC(1)=NC
ISN 0248      DO 45 J=1,NC
ISN 0249      ND=ND+NAT(J)
ISN 0250      DC(J)=NRT(J)
ISN 0251      KE=NAT(J)
ISN 0252      DO 45 K=1,KE
ISN 0253      45 DNRTA(J,K)=NRTA(J,K)
ISN 0254      NDA(1)=ND
ISN 0255      NCA(1)=NC
ISN 0256      NBA(1)=1
ISN 0257      NOB(1)=ND
ISN 0258      NCB(1)=NC
ISN 0259      STARNA=BLANK1
ISN 0260      STARNT=BLANK1
ISN 0261      IF(NC.LE.1) GO TO 100
ISN 0263      IF(ND.EQ.NE) GO TO 50
ISN 0265      IF(NC.EQ.ND) GO TO 50
C***** ANOV WITH ANALYST EFFECT
ISN 0267      L=0
ISN 0268      DO 46 J=1,NC
ISN 0269      KE=NAT(J)
ISN 0270      DO 46 K=1,KE
ISN 0271      L=L+1
ISN 0272      NP(L)=NRTA(J,K)
ISN 0273      46 DD(L)=DNRTA(J,K)
ISN 0274      CALL NEST(EH,COMPL,NP,NAT,IB,IA,NDA,NCA,NBA,NDB,NCB,NAT,MONTH)
ISN 0275      GO TO 60
C***** ANOV WITHOUT ANALYST EFFECT
ISN 0276      50 IF(NE.GT.NC) GO TO 52
ISN 0278      XMEAN=AVE

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RPRT2006
RPRT2008
RPRT2010
RPRT2012
RPRT2014
RPRT2030
RPRT2031
RPRT2040
RPRT2050
RPRT2060
RPRT2070
RPRT2080
RPRT2090
RPRT2100
RPRT2101
RPRT2120
RPRT2130
RPRT2140
RPRT2150
RPRT2160
RPRT2170
RPRT2180
RPRT2190
RPRT2200
RPRT2210
RPRT2220
RPRT2230
RPRT2240
RPRT2250
RPRT2260
RPRT2270
RPRT2280
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RPRT2420
RPRT2430
RPRT2440
RPRT2450
RPRT2460
RPRT2470
RPRT2480
RPRT2490
RPRT2500
RPRT2510
RPRT2520

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ISN 0279      SDX=SD
ISN 0280      SDBX=SD/DSQRT(XS)
ISN 0281      DEGREE=NS-I
ISN 0282      CALL TVALUE(TVDFMM,DEGREE,0.05)
ISN 0283      CI = TVDFMM * SDBX
ISN 0284      GO TO 60
ISN 0285      51 DO 56 K=1,NC
ISN 0286      DO(K)=DC(K)
ISN 0287      56 DC(K)=0.00+0
ISN 0288      NDC(1)=NC
ISN 0289      ND=NC
ISN 0290      NC=NF
ISN 0291      CC(1)=NE
ISN 0292      CALL NEST(EH,COMP2,NRT,IC,IA,IA,NCA,NBA,NBA,NCA,NBA,NDC,MONTH)
C**** STORE DATA FOR BETWEEN LAB VARIANCE
ISN 0293      60 KN=IN-1
ISN 0294      K=IO(KN)
ISN 0295      KB=K
ISN 0296      NGG=0
ISN 0297      KL=N(K,2)
ISN 0298      DO 63 J=1,5
ISN 0299      DO 61 L=1,19
ISN 0300      IF(KL.EQ.NGRUP(J,L)) GO TO 62
ISN 0302      61 CONTINUE
ISN 0303      GO TO 63
ISN 0304      62 NGR(J)=NGR(J)+1
ISN 0305      NGG=NGG+1
ISN 0306      JJ=NGR(J)
ISN 0307      INGRP(NGG,1)=J
ISN 0308      INGRP(NGG,2)=JJ
ISN 0309      JLAB(J,JJ,2)=N(K,1)
ISN 0310      JLAB(J,JJ,3)=N(K,2)
ISN 0311      JLAB(J,JJ,1)=N(K,3)
ISN 0312      XGRUP(J,JJ,1)=XMEAN
ISN 0313      XGRUP(J,JJ,3)=SDBX
ISN 0314      XGRUP(J,JJ,2)=SDX
ISN 0315      XGRUP(J,JJ,4)=CI
ISN 0316      NSGRUP(J,JJ)=NS
ISN 0317      IF(J.EQ.5) STAR(2,JJ)=STARNT
ISN 0319      IF(J.EQ.5) STAR(3,JJ)=STARNA
ISN 0321      63 CONTINUE
C**** PRINT CUMULATIVE MEANS AND STD DEV
ISN 0322      IF(KC.LE.1) GO TO 100
ISN 0324      CALL HEAD(N(K,1),N(K,2),N(K,3),100)
ISN 0325      WRITE(6,120)
ISN 0326      120 FORMAT(1H0,32X,'SIX MONTH')
ISN 0327      WRITE(6,121)
ISN 0328      121 FORMAT(1H ,14X,'N',5X,'MEAN',6X,'MEAN STD.DEV')
ISN 0329      WRITE(6,122) LINE,(LINE(K),K=1,3)
ISN 0330      122 FORMAT(1H ,2X,15A4,A3)
ISN 0331      RN=0.0
ISN 0332      SN=0.0
ISN 0333      RX=0.00+0
ISN 0334      SX=0.00+0
ISN 0335      RXX=0.00+0
ISN 0336      SXX=0.00+0
RPRT2530
RPRT2540
RPRT2550
RPRT2560
RPRT2570
RPRT2580
RPRT2590
RPRT2600
RPRT2610
RPRT2620
RPRT2630
RPRT2640
RPRT2650
RPRT2660
RPRT2670
RPRT2680
RPRT2690
RPRT2700
RPRT2710
RPRT2720
RPRT2730
RPRT2740
RPRT2750
RPRT2760
RPRT2770
RPRT2780
RPRT2790
RPRT2800
RPRT2810
RPRT2820
RPRT2830
RPRT2840
RPRT2850
RPRT2860
RPRT2870
RPRT2880
RPRT2890
RPRT2900
RPRT2910
RPRT2920
RPRT2930
RPRT2940
RPRT2950
RPRT2960
RPRT2970
RPRT2980
RPRT2990
RPRT3000
RPRT3020
RPRT3030
RPRT3040
RPRT3050
RPRT3060
RPRT3070
RPRT3080
RPRT3090

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ISN 0337      DO 90 K=1,KC
ISN 0338      FN(K)=NB(K)
ISN 0339      IF(NB(K).EQ.0) GC TO 90
ISN 0341      IF(K.GT.6) GO TO 65
ISN 0343      SX=SX+BX(K)/FN(K)
ISN 0344      SXX=SXX+BX(K)
ISN 0345      SN=SN+FN(K)
ISN 0346      GO TO 70
ISN 0347      65 SX=SX+BX(K)/FN(K)-3X(K-6)/FN(K-6)
ISN 0348      SXX=SXX+BX(K)-BXX(K-6)
ISN 0349      SN=SN+FN(K)-FN(K-6)
ISN 0350      70 IF(K.GT.3) GO TO 75
ISN 0352      RX=RX+BX(K)
ISN 0353      RXX=RXX+BX(K)
ISN 0354      RN=RN+FN(K)
ISN 0355      GO TO 80
ISN 0356      75 RX=RX+BX(K)-BX(K-3)
ISN 0357      RXX=RXX+BX(K)-BXX(K-3)
ISN 0358      RN=RN+FN(K)-FN(K-3)
ISN 0359      80 IF(SN.LE.0.50+0) GO TC 81
ISN 0361      IF(K.GT.6)AVES=SX/6.
ISN 0363      XK=XK
ISN 0364      IF(K.LE.6)AVES=SX/XK
ISN 0366      IF(SN.LE.1.50+0) GO TO 81
ISN 0368      SDS= (SXX-AVES*SX)/(SN-1.00+0)
ISN 0369      IF(SDS.LT.0.00+0) SDS=0.00+0
ISN 0371      SDS=DSQRT(SDS)
ISN 0372      81 IF(RN.LE.0.50+0) GO TO 82
ISN 0374      AVER=RX/RN
ISN 0375      IF(RN.LE.1.50+0) GO TO 82
ISN 0377      SDR= (RXX-AVER*RX)/(RN-1.00+0)
ISN 0378      IF(SDR.LT.0.00+0) SDR=0.00+0
ISN 0380      SDR=DSQRT(SDR)
ISN 0381      92 AVE=BX(K)/FN(K)
ISN 0382      WRITE(6,130)DAT(KMON(K)),KYR(K),NB(K),AVE,AVES,SDS
ISN 0383      130 FORMAT(1H,2X,A4,' 197',I1,I4,3F10.5)
C**** STORE DATA FOR COMBINED PLOTS
C
C      CHECK FOR 12 MONTHS DATA
C
ISN 0384      NTEST = KMON(K) + 100 * KYR(K)
ISN 0385      LIMIT = MMAX - 100
ISN 0386      IF(NTEST.LE. LIMIT) GO TO 84
ISN 0388      J3=KMON(K)
ISN 0389      DO 83 J=1,NGG
ISN 0390      J1=INGRP(J,1)
ISN 0391      J2=INGRP(J,2)
ISN 0392      XCUM(J1,J2,J3)=AVES
ISN 0393      SAVE(J1,J2,J3)=AVE
ISN 0394      83 SCUM(J1,J2,J3)=SDS
ISN 0395      84 CONTINUE
C**** STORE DATA FOR INDIVIDUAL PLOTS
ISN 0396      XMNYR(K) =DAT(KMON(K))
ISN 0397      N(Y(K)=NB(K)
ISN 0398      Y(K)=AVE
ISN 0399      RMEAN(K)=AVES

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PPRT3100
PPRT3110
PPRT3120
PPRT3130
PPRT3140
PPRT3150
PPRT3160
PPRT3170
PPRT3180
PPRT3190
PPRT3200
PPRT3210
PPRT3220
PPRT3230
PPRT3240
PPRT3250
PPRT3260
PPRT3270
PPRT3280
PPRT3290
PPRT3300
PPRT3301
PPRT3302
PPRT3310
PPRT3320
PPRT3330
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PPRT3470
PPRT3480
PPRT3490
PPRT3500
PPRT3510
PPRT3520
PPRT3530
PPRT3540
PPRT3550
PPRT3555
PPRT3560
PPRT3570
PPRT3580
PPRT3590
PPRT3600
PPRT3610
PPRT3620

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ISN 0400      RMS(K)=SDS*SDS
ISN 0401      90  CONTINUE
ISN 0402      DO 91 J=1,6
ISN 0403      XLABIN(J)=ZLA(N(KB,3),J)
ISN 0404      XLABIN(J+6)=ZMA(J)
ISN 0405      91  XLABIN(J+12)=ZMET(N(KB,2),J)
ISN 0406      NAUTO=KC-I
ISN 0407      MINFO=KC

C
C      ADJUST TO LAST 12 MONTHS OF DATA
C

ISN 0408      NDIF12 = MINFO - 12
ISN 0409      POINT = 1.0
ISN 0410      IF(NDIF12 .GT. 0) CALL ADJUST(XMNYR,Y,RMEAN,RMS,NIY,MINFO,
ISN 0412      1 NDIF12,NAUTO,POINT)
ISN 0413      CALL CORTRE(PT,GTITLE,STITLE,XTITLE,YTITLE,UPPER,XLOWER,1,GUP,1,
ISN 0414      1 XLABIN,RMEAN,RMS,0)
ISN 0413      POINT = 2.0
ISN 0414      IF(NDIF12 .GT. 0) CALL ADJUST(XMNYR,Y,RMEAN,RMS,NIY,MINFO,
ISN 0416      1 NDIF12,NAUTO,POINT)
ISN 0417      STAR(1,NGR(5)) = STARC
ISN 0417      100 IF(IN.LE.NDATA) GO TO 20
ISN 0419      IF(IFLIST.EQ.1) GO TO 230
C****      ENTERS HERE AFTER ALL DATA HAS BEEN EVALUATED
C****
C****      PRINTS SUMMARY BY GROUP AND CALCULATES BETWEEN LAB VARIANCE
C****      DO 160 J=1,5
ISN 0421      IF(NGR(J).EQ.0) GO TO 160
ISN 0422      IF(J.EQ.5)WRITE(6,150)ZMA,(GNAME(J,L),L=1,5)
ISN 0424      150 FORMAT(1H1,8X,6A4,1X,5A4)
ISN 0426      IF(J.EQ.5)WRITE(6,151)
ISN 0427      151 FORMAT(1H0,11X,'LAB MAT. METH. MEAN STD.DEV SD. MEAN')
ISN 0429      IF(J.EQ.5)WRITE(6,152)((LINE(L),L=1,10)
ISN 0430      152 FORMAT(1H ,11X,10A4)
ISN 0432      XMN=0.0
ISN 0433      XSD=0.0
ISN 0434      XBM=0.0
ISN 0435      XXMN=0.0
ISN 0436      XXSD=0.0
ISN 0437      XXBM=0.0
ISN 0438      LE=NGR(J)
ISN 0439      DO 154 L=1,LE
ISN 0440      XMN=XMN+XGRUP(J,L,1)
ISN 0441      XSD=XSD+XGRUP(J,L,2)
ISN 0442      XBM=XBM+XGRUP(J,L,3)
ISN 0443      XXMN=XXMN+XGRUP(J,L,1)*XGRUP(J,L,1)
ISN 0444      XXSD=XXSD+XGRUP(J,L,2)*XGRUP(J,L,2)
ISN 0445      XXBM=XXBM+XGRUP(J,L,3)*XGRUP(J,L,3)
ISN 0446      IF(J.EQ.5)WRITE(6,153)((JLAB(J,L,LL),LL=1,3),(XGRUP(J,L,JJ),JJ=1,3)
ISN 0447      153 FORMAT(1H ,11X,12,15,1X,16,3F9.5)
ISN 0449      TMN(L)=XGRUP(J,L,1)
ISN 0450      154 TSD(L)=XGRUP(J,L,3)
ISN 0451      TX=LE
ISN 0452      XMN=XMN/TX
ISN 0453      XSD=XSD/TX
ISN 0454      XBM=XBM/TX
ISN 0455

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RPRT3630
RPRT3640
RPRT3650
RPRT3660
RPRT3670
RPRT3680
RPRT3690
RPRT3700
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RPRT3990
RPRT4000
RPRT4010
RPRT4020
RPRT4030
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RPRT4070
RPRT4080
RPRT4090
RPRT4100
RPRT4110
RPRT4120
RPRT4130
RPRT4140
RPRT4150
RPRT4160
RPRT4170
RPRT4180

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ISN 0456      ASD=XSD
ISN 0457      GSUM(J,1)=XMN
ISN 0458      GSUM(J,2)=XSD
ISN 0459      GSUM(J,3)=0.0
ISN 0460      IF(J.EQ.5)WRITE(6,155)XMN,XSD,XBM
ISN 0462      155 FORMAT(1H0,15X,'AVERAGE',3X,3F9.5)
ISN 0463      IF(LE.EQ.1) GO TO 160
ISN 0465      XMN=SQRT((XXMN-TX*XMN*XMN)/(TX-1.0))
ISN 0466      XSD=SQRT((XXSD-TX*XSD*XSD)/(TX-1.0))
ISN 0467      XBM=SQRT((XXBM-TX*XBM*XBM)/(TX-1.0))
ISN 0468      IF(J.EQ.5)WRITE(6,156)XMN,XSD,XEM
ISN 0470      156 FORMAT(1H0,15X,'STD DEV',3X,3F9.5)
ISN 0471      IF(J.EQ.5)WRITE(6,152)(LINE(L),L=1,10)
ISN 0473      CALL SBLV(TMN,TSD,AA,LE)
ISN 0474      GSUM(J,3)=AA
ISN 0475      AAA=2.0*SQRT(AA*AA+ASD*ASD/2.0)
ISN 0476      AAA=ASD+1.65*XSD
ISN 0477      YCNTMX=AAA
ISN 0478      AAA=SQRT(AA*AA+XBM*XBM)
ISN 0479      160 CONTINUE
C**** PRINT SUMMARY TABLES
ISN 0480      WRITE(6,205)ZMA
ISN 0481      205 FORMAT(1H1,27X,6A4)
ISN 0482      IYEAR1 = MMIN/100
ISN 0483      IYEAR2 = MMAX/100
ISN 0484      IMON1 = MMIN - IYEAR1 * 100
ISN 0485      IMON2 = MMAX - IYEAR2 * 100
ISN 0486      IYEAR1 = 1970 + IYEAR1
ISN 0487      IYEAR2 = 1970 + IYEAR2
ISN 0488      WRITE(6,998) DAT(IMON1),IYEAR1,DAT(IMON2),IYEAR2
ISN 0489      998 FORMAT(1H0,27X,A4,1X,I4,2X,'-',2X,A4,1X,I4)
ISN 0490      WRITE(6,211) LINE,LINE(1),LINE(1)
ISN 0491      211 FORMAT(1H0, 9X,14A4,A2)
ISN 0492      WRITE(6,212)
ISN 0493      212 FORMAT(1H ,40X,'AVERAGE BETWEEN')
ISN 0494      WRITE(6,213)
ISN 0495      213 FORMAT(1H ,30X,'AVERAGE WITHIN LAB LAB NUMBER')
ISN 0496      WRITE(6,214)
ISN 0497      214 FORMAT(1H ,9X,'METHOD',16X,'BIAS STD. DEV. STD. DEV. OF LABS'
1 )
ISN 0498      WRITE(6,215) LINE,LINE(1),LINE(1)
ISN 0499      215 FORMAT(1H ,9X,14A4,A2)
ISN 0500      IF(IMON2.EQ.12) GO TO 303
ISN 0502      DO 300 J=1,5
ISN 0503      IF(NGR(J).EQ.0) GO TO 300
ISN 0505      LE = NGR(J)
ISN 0506      DO 301 L=1,LE
ISN 0507      IMON2I = IMON2 + 1
ISN 0508      DO 304 K=1,12
ISN 0509      STOR(K)=SCUM(J,L,K)
ISN 0510      STORE2(K)=SAVE(J,L,K)
ISN 0511      304 STORE(K)=XCUM(J,L,K)
ISN 0512      DO 301 K=1,12
ISN 0513      SCUM(J,L,K)=STOR(IMON2I)
ISN 0514      XCUM(J,L,K)=STORE(IMON2I)
ISN 0515      SAVE(J,L,K)=STORE2(IMON2I)

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RPRT4190
RPRT4200
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RPRT4770
RPRT4771
RPRT4775
RPRT4780
RPRT4790
RPRT4791
RPRT4800
RPRT4805

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ISN 0516      IF(IMON2I.EQ. 12) IMON2I=0      PPRT4810
ISN 0518      301 IMON2I = IMON2I + 1          PPRT4820
ISN 0519      300 CONTINUE                    PPRT4830
ISN 0520      IMON2I=IMON2 + 1                PPRT4840
ISN 0521      DO 305 K=1,12                  PPRT4850
ISN 0522      305 STORE(K)= DAT(K)            PPRT4860
ISN 0523      DO 302 K=1,12                  PPRT4870
ISN 0524      DAT(K)=STORE(IMON2I)           PPRT4880
ISN 0525      IF(IMON2I.EQ. 12) IMON2I=0     PPRT4890
ISN 0527      302 IMON2I= IMON2I+ 1          PPRT4900
ISN 0528      303 CONTINUE                   PPRT4910
ISN 0529      DO 220 J=1,5                   PPRT4920
ISN 0530      IF(NGR(J).EQ.0) GO TO 220       PPRT4930
ISN 0532      WRITE(6,216)(GNAME(J,L),L=1,5),(GSUM(J,K),K=1,3),NGR(J) PPRT4940
ISN 0533      216 FOPMAT(1H ,9X,5A4,F8.3,2F10.3,17) PPRT4950
ISN 0534      220 CONTINUE                   PPRT4960
ISN 0535      WRITE(6,215) LINE,LINE(1),LINE(1) PPRT4970
ISN 0536      WRITE(6,206)                   PPRT4980
ISN 0537      206 FORMAT(1H0,14X,'AVERAGE 95% PLUS WITHIN LAB SIGNIFICANCE OF PPRT4990
1FFECTS',/,,' LAB ANALYSES BIAS OR MINUS STD. DEV. TREND
2 TIME ANALYST METHOD')
ISN 0538      WRITE(6,207)                   PPRT5000
ISN 0539      207 FORMAT(1H )                PPRT5010
ISN 0540      LE=NGR(5)                      PPRT5020
ISN 0541      JLAB(5,LE+1,1)=100             PPRT5030
ISN 0542      N1=1                           PPRT5040
ISN 0543      DO 208 L=1,LE                  PPRT5050
ISN 0544      IF(N1.GT.L)GO TO 208            PPRT5060
ISN 0546      DO 192 IJK=1,5                 PPRT5070
ISN 0547      IF(L+IJK .GT. LE) GO TO 195     PPRT5080
ISN 0549      192 IF(JLAB(5,L,1).EQ.JLAB(5,L+IJK,1))N1=L+IJK PPRT5090
ISN 0551      195 DO 193 IJ=L,N1              PPRT5100
ISN 0552      ALETER(IJ)=BLANK1              PPRT5110
ISN 0553      IF(L.NE.N1)ALETER(IJ)=ALFATO(IJ-L+1) PPRT5120
ISN 0555      IF(IJ.GT.LE)GO TO 208          PPRT5130
ISN 0557      IF(IJ.EQ. 29) WRITE(6,204)     PPRT5140
ISN 0559      204 FORMAT(1H1,14X,'AVERAGE 95% PLUS WITHIN LAB SIGNIFICANCE OF PPRT5150
1FFECTS',/,,' LAB ANALYSES BIAS OR MINUS STD. DEV. TREND
2 TIME ANALYST METHOD',/)
ISN 0560      193 WRITE(6,209)JLAB(5,IJ,1),ALETER(IJ),NSGRUP(5,IJ), PPRT5155
1 XGRUP(5,IJ,1),XGRUP(5,IJ,4),XGRUP(5,IJ,2),(STAR(K,IJ),K=1,3), PPRT5156
2 (ZMET(JLAB(5,IJ,3),KK),KK=1,6)            PPRT5157
ISN 0561      N1=N1+1                        PPRT5160
ISN 0562      208 CONTINUE                   PPRT5170
ISN 0563      209 FORMAT(1H ,12,A1,17,F10.3,F9.3,1X,F11.3,6X,A4,4X,A4,4X,A4,6X,6A4) PPRT5180
ISN 0564      210 CONTINUE                   PPRT5190
ISN 0565      C**** PRINTS NORMALIZED DATA FOR CUMALATIVE MEAN PLOT TABLE PPRT5200
ISN 0566      DO 170 J=1,5                   PPRT5210
ISN 0568      IF(NGR(J).EQ.0) GO TO 170       PPRT5220
ISN 0569      WRITE(6,168)J,ZMA,(GNAME(J,K),K=1,5) PPRT5230
ISN 0570      168 FORMAT(1H1,29X,'MOVING MEANS FOR GROUP',12,3X,6A4,1X,5A4) PPRT5240
ISN 0571      WRITE(6,163)(DAT(K),K=1,12)     PPRT5250
ISN 0572      163 FOPMAT(1H0,3X,'LAB MAT. METH.',3X,A4,11(5X,A4)) PPRT5260
ISN 0573      WRITE(6,164) LINE,LINE,(LINE(K),K=1,5) PPRT5270
ISN 0574      164 FORMAT(1H ,3X,30A4,A2)      PPRT5280
LE=NGR(J) PPRT5290
PPRT5300
PPRT5310
PPRT5320

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ISN 0575      JLAB(J,LE+1,1) = 100      RPRT5330
ISN 0576      N1 = 1                    RPRT5340
ISN 0577      DO 167 L=1,LE              RPRT5350
ISN 0578      IF(N1.GT.L) GO TO 167      RPRT5360
ISN 0580      DO 190 IJK=1,5             RPRT5370
ISN 0581      IF(L+IJK.GT.LE) GO TO 194  RPRT5380
ISN 0583      190 IF(JLAB(J,L,1).EQ.JLAB(J,L+IJK,1))N1=L+IJK RPRT5390
ISN 0585      194 DO 191 IJ=L,N1         RPRT5400
ISN 0586      ALET(IJ,IJ)=BLANK1         RPRT5410
ISN 0587      IF(L.NE.N1)ALET(IJ,IJ)=ALFATO(IJ-L+1) RPRT5420
ISN 0589      IF(IJ.GT.LE) GO TO 167     RPRT5430
ISN 0591      191 WRITE(6,166)JLAB(J,IJ,1),ALET(IJ,IJ),(JLAB(J,IJ,LL),LL=2,3), RPRT5440
      1 (XCUM(J,IJ,LM),LM=1,12)          RPRT5450
ISN 0592      166 FORMAT(1F,14,A1,15,E6,1X,12F9.5) RPRT5460
ISN 0593      N1=N1+1                    RPRT5470
ISN 0594      167 CONTINUE               RPRT5480
ISN 0595      IF(ICHECK.EQ.1)GO TO 170   RPRT5481
ISN 0597      CALL CUMPLT(1,YBIG,J,GNAME,DAT,JLAB,XCUM,ALET,LE,0,Z) RPRT5490
ISN 0598      CALL CUMPLT(3,YBIG,J,GNAME,DAT,JLAB,SAVE,ALET,LE,0,Z) RPRT5500
ISN 0599      170 CONTINUE               RPRT5510
      C*** PRINTS DATA FOR WITHIN LAB STD DEV PLOT TABLE RPRT5520
ISN 0600      DO 180 J=1,5               RPRT5530
ISN 0601      IF(NGR(J).EQ.0) GO TO 180   RPRT5540
ISN 0603      WRITE(6,171)J,ZMA,(GNAME(J,K),K=1,5) RPRT5550
ISN 0604      171 FORMAT(1H1,22X,'WITHIN LAB STANDARD DEVIATIONS FOR GROUP',I2,3X, RPRT5560
      1 6A4,1X,5A3)                      RPRT5570
ISN 0605      WRITE(6,163) (DAT(K),K=1,12) RPRT5580
ISN 0606      WRITE(6,164) LINE,LINE,(LINE(K),K=1,5) RPRT5590
ISN 0607      LE=NGR(J)                  RPRT5600
ISN 0608      DO 172 L=L,LE              RPRT5610
ISN 0609      172 WRITE(6,166) JLAB(J,L,1),ALET(J,L),(JLAB(J,L,LE),LL=2,3), RPRT5620
      1 (SCUM(J,L,LM),LM=1,12)            RPRT5630
ISN 0610      IF(ICHECK.EQ.1)GO TO 180   RPRT5631
ISN 0612      CALL CUMPLT(2,YCNTMX,J,GNAME,DAT,JLAB,SCUM,ALET,LE,ISDSIZ(J),Z) RPRT5640
ISN 0613      180 CONTINUE               RPRT5660
ISN 0614      IF(IIMON2.EQ.12)GO TO 230  RPRT5661
ISN 0616      DO 307 L=1,12              RPRT5670
ISN 0617      307 DAT(L)=STCRL           RPRT5680
ISN 0618      230 IF(NINDATA+1,1).EQ.0) GO TO 200 RPRT5690
ISN 0620      CALL GETSMG(Z,1,VALUE)     RPRT5700
ISN 0621      IF(VALUE.EQ.4060)CALL EXITG(Z) RPRT5710
ISN 0623      RETURN                     RPRT5740
ISN 0624      END                       RPRT5750

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LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.36.39

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,

SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XREF

ISN 0002	SUBROUTINE ADJUST(XMNYR,Y,RMEAN,PMS,NIY,MINFO,NDIF12,NAUTO,POINT)	AJST0010
ISN 0003	DOUBLE PRECISION XMNYR(200),Y(200),RMEAN(200),RMS(200),	AJST0020
	1 A(200),B(200),C(200),D(200)	AJST0030
ISN 0004	DIMENSION NIY(200),NE(200)	AJST0040
ISN 0005	IF(POINT .EQ. 1.0) GO TO 1	AJST0050
ISN 0007	IF(POINT .EQ. 2.0) GO TO 2	AJST0060
ISN 0009	1 CONTINUE	AJST0070
ISN 0010	DO 10 I = 1,200	AJST0080
ISN 0011	A(I) = XMNYR(I)	AJST0090
ISN 0012	B(I) = Y(I)	AJST0100
ISN 0013	C(I) = RMEAN(I)	AJST0110
ISN 0014	D(I) = RMS(I)	AJST0120
ISN 0015	10 NE(I) = NIY(I)	AJST0130
ISN 0016	NOLD = MINFO	AJST0140
ISN 0017	NNEW = 12	AJST0150
ISN 0018	NADJ = NDIF12 + 1	AJST0160
ISN 0019	J = 0	AJST0170
ISN 0020	DO 20 I = NADJ,NOLD	AJST0180
ISN 0021	J = J + 1	AJST0190
ISN 0022	XMNYR(J) = XMNYR(I)	AJST0200
ISN 0023	Y(J) = Y(I)	AJST0210
ISN 0024	RMEAN(J) = RMEAN(I)	AJST0220
ISN 0025	RMS(J) = RMS(I)	AJST0230
ISN 0026	20 NIY(J) = NIY(I)	AJST0240
ISN 0027	MINFO = 12	AJST0250
ISN 0028	NAUTO = 0	AJST0260
ISN 0029	RETURN	AJST0270
ISN 0030	2 CONTINUE	AJST0280
ISN 0031	DO 30 I = 1,200	AJST0290
ISN 0032	XMNYR(I) = A(I)	AJST0300
ISN 0033	Y(I) = B(I)	AJST0310
ISN 0034	RMEAN(I) = C(I)	AJST0320
ISN 0035	RMS(I) = D(I)	AJST0330
ISN 0036	30 NIY(I) = NE(I)	AJST0340
ISN 0037	MINFO = NOLD	AJST0350
ISN 0038	RETURN	AJST0360
ISN 0039	END	AJST0370

LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.36.49

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NCDECK,LOAD,MAP,NOEDIT,NOID,KPEF

ISN 0002		SUBROUTINE HAD	HAD 0010
ISN 0003		REAL*4 MA(6),MET(20,6),LA(75,6),N(6)	HAD 0020
ISN 0004		COMMON /CMA/ MA,ISOR7	HAD 0030
ISN 0005		COMMON /CMET/MET	HAD 0040
ISN 0006		COMMON /CLA/LA	HAD 0050
ISN 0007		WRITE(6,99)	HAD 0060
ISN 0008	99	FORMAT(1H1)	HAD 0070
ISN 0009	5	READ(5,100) I,N,ISOR7	HAD 0080
ISN 0010		WRITE(6,110) I,N	HAD 0090
ISN 0011		IF(I.EQ.0) RETURN	HAD 0100
ISN 0013		DO 6 J=1,6	HAD 0110
ISN 0014	6	LA(I,J)=N(J)	HAD 0120
ISN 0015		GO TO 5	HAD 0130
ISN 0016		ENTRY HAD1(L)	HAD 0140
ISN 0017		WRITE(6,99)	HAD 0150
ISN 0018	1	READ(5,100) I,MA	HAD 0160
ISN 0019	100	FORMAT(12,1X, 6A4,5X,14)	HAD 0170
ISN 0020		L=1	HAD 0180
ISN 0021		WRITE(6,110) I,MA	HAD 0190
ISN 0022	110	FORMAT(1H ,12,1X,6A4)	HAD 0200
ISN 0023	3	READ(5,100) I,N	HAD 0210
ISN 0024		WRITE(6,110) I,N	HAD 0220
ISN 0025		IF(I.EQ.0) GO TO 50	HAD 0230
ISN 0027		DO 4 J=1,6	HAD 0240
ISN 0028	4	MET(I,J)=N(J)	HAD 0250
ISN 0029		GO TO 3	HAD 0260
ISN 0030	50	RETURN	HAD 0270
ISN 0031		ENTRY HEAD(MAT,METH,LAB,LC)	HAD 0280
ISN 0032		WRITE(6,101) (MA(I),I=1,6)	HAD 0290
ISN 0033	101	FORMAT(1H1,22X,6A4)	HAD 0300
ISN 0034		WRITE(6,102) (MET(METH,I),I=1,6)	HAD 0310
ISN 0035	102	FORMAT(1H ,22X,12A4)	HAD 0320
ISN 0036		WRITE(6,103) LAB,(LA(LAB,I),I=1,6)	HAD 0330
ISN 0037	103	FORMAT(1H0,7X,12,' - ',12A4)	HAD 0340
ISN 0038		IF(LC.EQ.100) RETURN	HAD 0350
ISN 0040		WRITE(6,104)	HAD 0360
ISN 0041	104	FORMAT(1H0,9X,'DATA',7X,'REPORTED MAKE-UP % BIAS ANALYST')	HAD 0370
ISN 0042		LC=7	HAD 0380
ISN 0043		RETURN	HAD 0390
ISN 0044		END	HAD 0400

LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.36.57

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XPEF

ISN 0002		SUBROUTINE SBLV(XS,V,SD,K)	SBLV0010
	C	SALE BETWEEN LAB VARIANCE	SBLV0020
	C		SBLV0030
ISN 0003		IMPLICIT REAL*8(A-H,O-Z)	SBLV0040
ISN 0004		REAL*4 SD	SBLV0045
ISN 0005		DIMENSION TITLE(19),XS(75),V(75)	SBLV0050
ISN 0006		DO 10 I=1,K	SBLV0060
ISN 0007		XS(I)=XS(I)*XS(I)	SBLV0070
ISN 0008		V(I)=V(I)*V(I)	SBLV0080
ISN 0009	10	CONTINUE	SBLV0090
ISN 0010		T=0.00+0	SBLV0130
ISN 0011	11	DO 20 J=1,10	SBLV0140
ISN 0012		F=0.00+0	SBLV0150
ISN 0013		DF=0.00+0	SBLV0160
ISN 0014		DO 15 I=1,K	SBLV0170
ISN 0015		D=V(I)+T	SBLV0180
ISN 0016		F=F+XS(I)/D	SBLV0190
ISN 0017	15	DF=DF+XS(I)/(D*D)	SBLV0200
ISN 0018		FK=K	SBLV0210
ISN 0019		F=F-FK	SBLV0220
ISN 0020		IF(F.LE.0.00+0.AND.J.EQ.1) GO TO 25	SBLV0230
ISN 0022		E=F/DF	SBLV0240
ISN 0023	20	T=T+E	SBLV0270
ISN 0024		IF(DABS(E).GT.1.00-10) GO TO 11	SBLV0280
ISN 0026		SD=DSQRT(T)	SBLV0290
ISN 0027	21	WRITE(6,106) SD	SBLV0300
ISN 0028	106	FORMAT(1H0,'BETWEEN LAB STD DEV =',F12.8)	SBLV0310
ISN 0029		RETURN	SBLV0320
ISN 0030	25	SD=0.00+0	SBLV0330
ISN 0031		GO TO 21	SBLV0340
ISN 0032		END	SBLV0350

LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.37.05

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XREF

ISN 0002	SUBROUTINE PUN1(PM,T,METH,S,UNIT,IL)	PUN10010
ISN 0003	DIMENSION VALNUL(2,2,6)	PUN10015
ISN 0004	C 2ND VALNUL PARAMETER IS 1 FOR PU239 PERCENTS AND 2 FOR PU ISOTOPE #241	PUN10016
ISN 0005	DATA AP,WP/'A','W'/	PUN10020
	DATA VALNUL/82.5378,82.4709,1.3745,1.3849,82.5935,82.5267,	PUN10021
	* 1.3677,1.3781,82.6718,82.6053,1.3592,1.3695,	PUN10022
	* 82.2607,82.1932,1.3967,1.4073,82.6133,82.5469,	PUN10023
	* 1.3690,1.3794,82.4928,82.4261,1.3773,1.3877 /	PUN10024
ISN 0006	E=EXP((-0.003929411*T)	PUN10030
ISN 0007	IF(IL.GT.0) GO TO 40	PUN10035
ISN 0009	D=(E3.1888-PM)/1.5676	PUN10040
ISN 0010	A=1.402+D.154*D	PUN10050
ISN 0011	B=1.41265+D.15506*D	PUN10060
ISN 0012	IF(METH.EQ.6.OR.METH.EQ.11) GO TO 20	PUN10070
ISN 0014	IF(METH.EQ.7.OR.METH.EQ.12) GO TO 30	PUN10080
	C*** TIME CORRECTION FOR CONCENTRATION MEASUREMENT	PUN10090
ISN 0016	S=S*(1.0-B*0.01*(1.0-E))	PUN10100
ISN 0017	RETURN	PUN10110
	C*** TIME CORRECTION FOR PU-239 MEASUREMENT	PUN10120
ISN 0018	20 IF(UNIT.EQ.WP) GO TO 25	PUN10130
ISN 0020	S=PM/(1.0-A*0.01*(1.0-E))	PUN10140
ISN 0021	RETURN	PUN10150
ISN 0022	25 CW=83.12378-D*1.572464	PUN10160
ISN 0023	S=CW/(1.0-B*0.01*(1.0-E))	PUN10170
ISN 0024	RETURN	PUN10180
	C*** TIME CORRECTION FOR PU-241 MEASUREMENT	PUN10190
ISN 0025	30 IF(UNIT.EQ.WP) GO TO 35	PUN10200
ISN 0027	S=(A+E)/(1.0-A*0.01*(1.0-E))	PUN10210
ISN 0028	RETURN	PUN10220
ISN 0029	35 S=(B+E)/(1.0-B*0.01*(1.0-E))	PUN10230
ISN 0030	RETURN	PUN10240
	C DECAY CORRECTIONS FOR SERIES B PLUTONIUM NITRATES (MAT. #5,6,AND 7)	PUN10250
ISN 0031	40 ILNIT = 1	PUN10260
ISN 0032	IF (UNIT.EQ.WP .OR. METH.EQ.5) IUNIT = 2	PUN10270
ISN 0034	D = 1.0 - .01 * VALNUL(IUNIT,2,IL) *(1.-E)	PUN10280
ISN 0035	IF (METH.EQ.5) S = S * D	PUN10290
ISN 0037	IF (METH.EQ.6) S = VALNUL(IUNIT,1,IL)/D	PUN10300
ISN 0039	IF (METH.EQ.7) S = VALNUL(IUNIT,2,IL) * E/D	PUN10310
ISN 0041	RETURN	PUN10320
ISN 0042	END	PUN10330

LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.37.13

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COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XPEF
ISN 0002 SUBROUTINE NEST (TYPE, COMP, ID, IC, IB, IA, NDA, NCA, NBA, NDB, NCB,
        .INDC, MONTH)
C
C NESTED ANALYSIS OF VARIANCE PROGRAM
C MAXIMUM OF FOUR FACTORS (PLUS ERROR)
C GENERAL MODEL FOLLOWS
C Y(I,J,K,L,M) =
C MU + A(I) + B(J,I) + C(K,I,J) + D(L,I,J,K) + R(M,I,J,K,L)
C
ISN 0003 DATA TYPE1,TYPE2/'BALN','UNBL'/
ISN 0004 DOUBLE PRECISION XNUMCV
ISN 0005 DOUBLE PRECISION QQ1,PP1,SS1,TT1,QQ2,PP2,SS2,QQ3,PP3,QQ4
ISN 0006 DOUBLE PRECISION FCALC(4),FTABLE(4)
ISN 0007 DOUBLE PRECISION COMP(5)
ISN 0008 DOUBLE PRECISION SUM(5),XMS(5),DF(5),SS(5),F(4),
1 GTOT,GTSS,XMST,T,TSD,XMEAN,SST,CC,XMC,TOTAL,Q1,Q2,Q3,Q4,P1,P2,
2 P3,S1,S2,T1,FF1,DOG,CAT,XMSF2,FF2,ADF2,AE,AEE,AEEE,XMSF3,FF3,
3 ADF3,EA,EAA,EAAA,EAAAA,XMSF4,FF4,ADF4,
4 TOTD(120),TOTC(80),TOTB(40),TOTA(20),OBS(300),X(5,300),D(5,300),
5 DA(20),DB(40),DC(80),DD(120),Z(5,300),FV(40),F1(40),F2(80),
6 F3(120)
ISN 0009 DIMENSION LX(5),ID(120),IC(80),IB(40),IA(40),ALPHA(15),
1 NDA(40),NCA(40),NBA(40),NDB(40),NCB(40),NDC(80)
ISN 0010 DIMENSION NDF(5)
ISN 0011 DIMENSION DFN(4),DFD(4)
ISN 0012 DIMENSION STAR(32)
ISN 0013 DATA STAR/32*'*****'/
ISN 0014 COMMON OBS
ISN 0015 COMMON XMEAN,NOBS,ND,NC,NB,NA,NFTTST,ALPHA,STOMN,XNUMCV
ISN 0016 COMMON/AEFF/DA
ISN 0017 COMMON/BEFF/DB
ISN 0018 COMMON/CEFF/DC
ISN 0019 COMMON/DEFF/DD
ISN 0020 COMMON/CONF/CI
ISN 0021 COMMON/STARD/STARNA,STARNT,STARC
ISN 0022 DIMENSION STARS(4),FFIXT1(4)
ISN 0023 DIMENSION FFIX(4),FFIXT(4)
ISN 0024 DATA FIXED/'FIXT'/
ISN 0025 DOUBLE PRECISION BLANK1
ISN 0026 DATA BLANK1/' '/
ISN 0027 DATA SAME/'SAME'/
ISN 0028 DATA STARS/4*' ',STAR5/' ',STAR1/' '*/
ISN 0029 DIMENSION SPXMS(5),SPDF(5)
ISN 0030 DIMENSION NDFD(3)
C
C TITLE = REFERENCE
C TITLE(1) COLUMNS 1 - 4
C SALE = SALE PROGRAM DATA
C UMPQ = UMPIRE PROGRAM DATA
C EXIT = CALL EXIT
C TITLE(14&15) = DATE XX/XX/XX (COLUMNS 53 - 60)
C YAM = MAKE-UP VALUE
C

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NEST0010
 NEST0020
 NEST0030
 NEST0040
 NEST0050
 NEST0060
 NEST0070
 NEST0080
 NEST0090
 NEST0100
 NEST0120
 NEST0130
 NEST0140
 NEST0150
 NEST0160
 NEST0170
 NEST0180
 NEST0190
 NEST0200
 NEST0210
 NEST0220
 NEST0230
 NEST0240
 NEST0250
 NEST0270
 NEST0280
 NEST0290
 NEST0300
 NEST0310
 NEST0320
 NEST0340
 NEST0350
 NEST0360
 NEST0370
 NEST0371
 NEST0372
 NEST0373
 NEST0380
 NEST0390
 NEST0400
 NEST0410
 NEST0420
 NEST0421
 NEST0430
 NEST0440
 NEST0450
 NEST0460
 NEST0470
 NEST0480
 NEST0490
 NEST0500
 NEST0510
 NEST0520
 NEST0530

ISN 0031	3073	CONTINUE	NEST0540
ISN 0032		DD 6500 I=1,4	NEST0541
ISN 0033	6500	STARS(I)=BLANK1	NEST0542
	C	READ(5,3072) TITLE,YAM	NEST0550
	C	IF(TITLE(1) .EQ. EXIT) GO TO 1010	NEST0560
	C		NEST0570
	C	READ TITLE	NEST0580
	C	ALPHA = TITLE (COLUMNS 1 - 60) - A FORMAT	NEST0590
	C	IF ALPHA(1) = AECL (COLUMNS 1 - 4) THIS DATA SET IS USED	NEST0600
	C	AS STANDARD IN --TEST IN SUBROUTINE VAREST	NEST0610
	C	IF ALPHA(2) = RANC (COLUMNS 5 - 8) CALL SUBROUTINE MEVS	NEST0620
	C	RANDOM ERROR ONLY	NEST0630
	C	NCODE = (COLUMN 65) - I FORMAT	NEST0640
	C	NCODE = 1 FOR CODED VALUES	NEST0650
	C	NCODE = 0 OR BLANK FOR NO CODED VALUES	NEST0660
	C	C = + OR - VALUE USED FOR CODING (COLUMNS 66 - 72) - F FORMAT	NEST0670
	C	+1.0 ADDS VALUE	NEST0680
	C	-1.0 SUBTRACTS VALUE	NEST0690
	C	NVAR = (COLUMN 75) - I FORMAT	NEST0700
	C	NVAR = 0 CALL VARIANCE COMPONENT ESTIMATES	NEST0710
	C	NVAR NE 0 NO CALL	NEST0720
	C	NNNN = -1 (COLUMNS 79 - 80) CALL EXIT	NEST0730
	C		NEST0740
	C	13 READ(5,502) (ALPHA(I), I = 1,15),NCODE,C,NVAR,NNNN	NEST0750
	C	IF(NNNN .EQ. -1) GO TO 3073	NEST0760
	C		NEST0770
	C	CALL MEVS	NEST0780
	C		NEST0790
	C	IF(ALPHA(2) .EQ. SWCH .OR. NNNN .GT. 1) GO TO 3025	NEST0800
	C	WRITE(6,501) (ALPHA(I), I = 1,15)	NEST0810
	C	501 FORMAT(1H1,T16,15A4)	NEST0820
	C		NEST0830
	C	READ NUMBER OF FACTORS	NEST0840
	C	NOBS = TOTAL NUMBER OF OBSERVATIONS (COLUMN 1 - 3)	NEST0850
	C	ND = TOTAL NUMBER OF D FACTORS (COLUMNS 4 - 6)	NEST0860
	C	NC = TOTAL NUMBER OF C FACTORS (COLUMNS 7 - 9)	NEST0870
	C	NB = TOTAL NUMBER OF B FACTORS (COLUMNS 10 - 12)	NEST0880
	C	NA = TOTAL NUMBER OF A FACTORS (COLUMNS 13 - 15)	NEST0890
	C	NF = TOTAL NUMBER OF FACTORS (COLUMNS 16 - 18)	NEST0900
	C		NEST0910
	C		NEST0920
	C	TYPE = BALN - BALANCED DESIGN	NEST0930
	C	TYPE = UNBL - UNBALANCED DESIGN	NEST0940
	C	PUT ON SECOND CARD - COLUMNS 30 - 33	NEST0950
	C	TYPMOD = TYPE MODEL - FIXED OR RANDOM	NEST0960
	C	RAWO = SAME - INDICATES SAME RAW DATA AS PROBLEM BEFORE	NEST0970
	C	NFTTST COLUMN 80 USED IN SUBROUTINE VAREST	NEST0980
	C	NFTTST = 1 FOR F - AND T - TEST VALUES	NEST0990
	C	NFTTST = 0 FOR NO VALUES	NEST1000
	C		NEST1010
	C		NEST1020
	C	READ(5,10) NOBS,ND,NC,NB,NA,NF,TYPE,TYPMOD,RAWO,NFTTST	NEST1030
	C	IF(ND .LT. 2) GO TO 6400	NEST1040
	C	NF = 4	NEST1050
	C	IF(NC .EQ. 0) NC = 1	NEST1060
	C	IF(NB .EQ. 0) NB = 1	NEST1070
	C	IF(NA .EQ. 0) NA = 1	

ISN 0034
ISN 0036
ISN 0037
ISN 0039
ISN 0041

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ISN 0043      IF(TYPMOD .EQ. FIXED) NVAR = 1
C
C      COMP(1) = 1TH EFFECT
C      COMP(1) - (COLUMNS 1 - 8)
C      COMP(2) - (COLUMNS 11 - 18)
C      COMP(3) - (COLUMNS 21 - 28)
C      COMP(4) - (COLUMNS 31 - 38)
C      COMP(5) - (COLUMNS 41 - 48)
C      ADJUST DOWN ON EFFECTS
C      IE - FOR TWO EFFECTS AND ERROR USE COM(3),COMP(4),COMP(5)
C
C      READ(5,4002) (COMP(I),I = 1,5),MONTH
C
C      READ TOTAL NUMBER OF OBSERVATIONS AT ALL LEVELS
C      ON A 809.1 FORMAT
C      DD(I) = NUMBER OF OBSERVATIONS AT THE ITH D LEVEL
C      DC(J) = NUMBER OF OBSERVATIONS AT THE JTH C LEVEL
C      DB(K) = NUMBER OF OBSERVATIONS AT THE KTH B LEVEL
C      DA(L) = NUMBER OF OBSERVATIONS AT THE LTH A LEVEL
C      D'S GO IN THE FOLLOWING COLUMNS
C      6      15      24      33      42      51      60      69
C
ISN 0045      IF(TYPE.NE.TYPE1) GO TO 6060
C      READ(5,6020) TOD,TDC,TDB,TDA
ISN 0047      IF(TDC .EQ. 0.0) TDC = NOBS
ISN 0049      IF(TDB .EQ. 0.0) TDB = NOBS
ISN 0051      IF(TDA .EQ. 0.0) TDA = NOBS
ISN 0053      DO 6061 I = 1,ND
ISN 0054      DD(I) = TOD
ISN 0055      6061 CONTINUE
ISN 0056      DO 6062 I = 1,NC
ISN 0057      DC(I) = TDC
ISN 0058      6062 CONTINUE
ISN 0059      DO 6063 I = 1,NB
ISN 0060      DB(I) = TDB
ISN 0061      6063 CONTINUE
ISN 0062      DO 6064 I = 1,NA
ISN 0063      DA(I) = TDA
ISN 0064      6064 CONTINUE
ISN 0065      GO TO 6070
ISN 0066      6060 CONTINUE
ISN 0067      6070 CONTINUE
C
C      READ NUMBER OF TERMS IN SUMS AT ALL LEVELS ON A 2613 FORMAT
C      ID(I) = NUMBER OF TERMS IN ITH D SUM
C      IC(J) = NUMBER OF TERMS IN JTH C SUM
C      IB(K) = NUMBER OF TERMS IN KTH B SUM
C      IA(L) = NUMBER OF TERMS IN LTH A SUM
C
ISN 0068      IF(TYPE.NE.TYPE1) GO TO 6080
ISN 0070      6021 FORMAT(4,3)
ISN 0071      IF(NC .EQ. 1) NIC = ND
ISN 0073      IF(NB .EQ. 1) NIB = NC
ISN 0075      IF(NA .EQ. 1) NIA = NB
ISN 0077      DO 6065 I = 1,ND
ISN 0078      ID(I) = NID

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NEST1080
NEST1090
NEST1100
NEST1110
NEST1120
NEST1130
NEST1140
NEST1150
NEST1160
NEST1170
NEST1180
NEST1190
NEST1200
NEST1210
NEST1220
NEST1230
NEST1240
NEST1250
NEST1260
NEST1270
NEST1280
NEST1290
NEST1300
NEST1310
NEST1320
NEST1330
NEST1340
NEST1350
NEST1360
NEST1370
NEST1380
NEST1390
NEST1400
NEST1410
NEST1420
NEST1430
NEST1440
NEST1450
NEST1460
NEST1470
NEST1480
NEST1490
NEST1500
NEST1510
NEST1520
NEST1530
NEST1540
NEST1550
NEST1560
NEST1570
NEST1580
NEST1590
NEST1600
NEST1610
NEST1620
NEST1630

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ISN 0079      6065 CONTINUE                                NEST1640
ISN 0080      DO 6066 I = 1,NC                            NEST1650
ISN 0081      IC(I) = NIC                                  NEST1660
ISN 0082      6066 CONTINUE                                NEST1670
ISN 0083      DO 6067 I = 1,NB                            NEST1680
ISN 0084      IB(I) = NIB                                  NEST1690
ISN 0085      6067 CONTINUE                                NEST1700
ISN 0086      DO 6068 I = 1,NA                            NEST1710
ISN 0087      IA(I) = NIA                                  NEST1720
ISN 0088      6068 CONTINUE                                NEST1730
ISN 0089      GO TO 5090                                    NEST1740
ISN 0090      6080 CONTINUE                                NEST1750
C             READ(5,21) (ID(I),I=1,NDI),(IC(J),J=1,NC),(IB(K),K=1,NB),(IA(L),L=1,NEST1760
C             1,NA)                                         NEST1770
ISN 0091      5090 CONTINUE                                NEST1780
ISN 0092      IF(TYPMOD .EQ. FIXED) GO TO 2180             NEST1790
C                                                         NEST1800
C             SKIPS FOLLOWING FOR FIXED-EFFECTS           NEST1810
C                                                         NEST1820
C                                                         NEST1830
C             READ IN NUMBER OF FACTORS WITHIN FOR COEFF CALCULATIONS NEST1840
C             ON A 4012 FORMAT                             NEST1850
C             NDA(I) = NUMBER OF D'S WITHIN ITH A         NEST1860
C             NCA(I) = NUMBER OF C'S WITHIN ITH A         NEST1870
C             NBA(I) = NUMBER OF B'S WITHIN ITH A         NEST1880
C             NDB(J) = NUMBER OF D'S WITHIN JTH B         NEST1890
C             NCB(J) = NUMBER OF C'S WITHIN JTH B         NEST1900
C             NDC(K) = NUMBER OF D'S WITHIN KTH C         NEST1910
C                                                         NEST1920
ISN 0094      IF(TYPE.NE.TYPE1) GO TO 6091                NEST1930
ISN 0096      IF(NC .EQ. 1) GO TO 6111                    NEST1940
ISN 0098      GO TO 6112                                    NEST1950
ISN 0099      6111 NNDA = ND                                NEST1960
ISN 0100      NNCA = 1                                      NEST1970
ISN 0101      NNBA = 1                                      NEST1980
ISN 0102      NNDB = ND                                    NEST1990
ISN 0103      NNCB = 1                                      NEST2000
ISN 0104      NNDC = ND                                    NEST2010
ISN 0105      GO TO 6113                                    NEST2020
ISN 0106      6112 IF(NB .EQ. 1) GO TO 6114                NEST2030
ISN 0108      GO TO 6115                                    NEST2040
ISN 0109      6114 NNDA = ND                                NEST2050
ISN 0110      NNCA = NC                                    NEST2060
ISN 0111      NNBA = 1                                      NEST2070
ISN 0112      NNDB = ND                                    NEST2080
ISN 0113      NNCB = NC                                    NEST2090
ISN 0114      NNDC = ND / NC                               NEST2100
ISN 0115      GO TO 6113                                    NEST2110
ISN 0116      6115 IF(NA .EQ. 1) GO TO 6116                NEST2120
ISN 0118      GO TO 6117                                    NEST2130
ISN 0119      6116 NNDA = ND                                NEST2140
ISN 0120      NNCA = NC                                    NEST2150
ISN 0121      NNBA = NB                                    NEST2160
ISN 0122      NNDB = ND / NB                               NEST2170
ISN 0123      NNCB = NC / NB                               NEST2180
ISN 0124      NNDC = ND / NC                               NEST2190

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ISN 0125      GO TO 6113
ISN 0126      6117 NNDA = ND / NA
ISN 0127      NNCA = NC / NA
ISN 0128      NNBA = NB / NA
ISN 0129      NNDB = NC / NB
ISN 0130      NNCB = NC / NB
ISN 0131      NNDC = NC / NC
ISN 0132      6113 CONTINUE
ISN 0133      DO 6092 I = 1,NA
ISN 0134      NDA(I) = NNDA
ISN 0135      NCA(I) = NNCA
ISN 0136      NBA(I) = NNBA
ISN 0137      6092 CONTINUE
ISN 0138      DO 6093 I = 1,NB
ISN 0139      NDB(I) = NNDB
ISN 0140      NCB(I) = NNCB
ISN 0141      6093 CONTINUE
ISN 0142      DO 6094 I = 1,NC
ISN 0143      NDC(I) = NNDC
ISN 0144      6094 CONTINUE
ISN 0145      GO TO 6095
ISN 0146      6091 CONTINUE
C             READ (5,400) (NDA(I),NCA(I),NBA(I),I=1,NA),(NDB(J),NCB(J),J=1,NB)
C             1  , (NDC(K),K=1,NC)
C             NDA(I) = NO.OF D'S IN A(I)
ISN 0147      6095 CONTINUE
ISN 0148      2180 CONTINUE
C
C             READ IN DATA ON A 6D13.4 FORMAT
C             READ IN DATA BY COLUMNS
C             D'S GO IN FOLLOWING COLUMNS
C             10      23      36      49      62      75
C
ISN 0149      IF (RAWD .EQ. SAME) GO TO 2542
C             READ(5,30) (OBS(M),M=1,NOBS)
ISN 0151      2542 CONTINUE
C
C             CALCULATES SUBTOTALS
C
ISN 0152      NDO=ID(1)
ISN 0153      TOTD(1)=0.00+00
ISN 0154      DO 41 M=1,NDO
ISN 0155      TOTD(1)=TOTD(1)+OBS(M)
ISN 0156      41 CONTINUE
ISN 0157      ND1=0
ISN 0158      DO 40 I=2,ND
ISN 0159      NDO=NDO+ID(I)
ISN 0160      ND1=ND1+ID(I-1)
ISN 0161      TCTD(I)=0.00+00
ISN 0162      ID1=ND1+1
ISN 0163      DO 40 M=IC1,NDO
ISN 0164      TOTD(I)=TOTD(I)+OBS(M)
ISN 0165      40 CONTINUE
ISN 0166      NCO=IC(1)
ISN 0167      TOTC(1)=0.00+00
ISN 0168      DO 51 I=1,NCO

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```

NEST2200
NEST2210
NEST2220
NEST2230
NEST2240
NEST2250
NEST2260
NEST2270
NEST2280
NEST2290
NEST2300
NEST2310
NEST2320
NEST2330
NEST2340
NEST2350
NEST2360
NEST2370
NEST2380
NEST2390
NEST2400
NEST2410
NEST2420
NEST2430
NEST2440
NEST2450
NEST2460
NEST2470
NEST2480
NEST2490
NEST2500
NEST2510
NEST2520
NEST2530
NEST2540
NEST2550
NEST2560
NEST2570
NEST2580
NEST2590
NEST2600
NEST2610
NEST2620
NEST2630
NEST2640
NEST2650
NEST2660
NEST2670
NEST2680
NEST2690
NEST2700
NEST2710
NEST2720
NEST2730
NEST2740
NEST2750

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ISN 0169      TOTC(I)=TOTC(I)+TOTD(I)
ISN 0170      51 CONTINUE
ISN 0171      NC1=0
ISN 0172      DO 50 J=2,NC
ISN 0173      NCO=NCO+IC(J)
ISN 0174      NC1=NC1+IC(J-1)
ISN 0175      TOTC(J)=0.00+00
ISN 0176      IC1=NC1+1
ISN 0177      DO 50 I=IC1,NCO
ISN 0178      TOTC(J)=TOTC(J)+TOTD(I)
ISN 0179      50 CONTINUE
ISN 0180      NBO=IB(1)
ISN 0181      TOTB(1)=0.00+00
ISN 0182      DO 61 J=1,NBO
ISN 0183      TOTB(1)=TOTB(1)+TOTC(J)
ISN 0184      61 CONTINUE
ISN 0185      NB1=0
ISN 0186      DO 60 K=2,NB
ISN 0187      NBO=NBO+IB(K)
ISN 0188      NB1=NB1+IB(K-1)
ISN 0189      TOTB(K)=0.00+00
ISN 0190      IB1=NB1+1
ISN 0191      DO 60 J=IB1,NBO
ISN 0192      TOTB(K)=TOTB(K)+TOTC(J)
ISN 0193      60 CONTINUE
ISN 0194      NAO=IA(1)
ISN 0195      TOTA(1)=0.00+00
ISN 0196      DO 71 K=1,NAO
ISN 0197      TOTA(1)=TOTA(1)+TOTB(K)
ISN 0198      71 CONTINUE
ISN 0199      NA1=0
ISN 0200      DO 70 L=2,NA
ISN 0201      NAO=NAO+IA(L)
ISN 0202      NA1=NA1+IA(L-1)
ISN 0203      TOTA(L)=0.00+00
ISN 0204      IA1=NA1+1
ISN 0205      DO 70 K=IA1,NAO
ISN 0206      TOTA(L)=TOTA(L)+TOTB(K)

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C
C
C      CALCULATES GRAND TOTALS

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ISN 0207      70 CONTINUE
ISN 0208      GTOT=0.00+00
ISN 0209      DO 80 M=1,NBBS
ISN 0210      GTOT=GTOT+GBS(M)

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C
C
C      CHANGE TO DOUBLE SUBSCRIPT NOTATION

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ISN 0211      80 CONTINUE
ISN 0212      DO 1 M=1,NBBS
ISN 0213      X(5,M)=GBS(M)
ISN 0214      D(5,M)=1.00+00
ISN 0215      1 CONTINUE
ISN 0216      DO 2 I=1,ND
ISN 0217      X(4,I)=TOTD(I)
ISN 0218      D(4,I)=DD(I)

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NEST2760
NEST2770
NEST2780
NEST2790
NEST2800
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NEST2980
NEST2990
NEST3000
NEST3010
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NEST3100
NEST3110
NEST3120
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NEST3170
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NEST3200
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NEST3250
NEST3260
NEST3270
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NEST3290
NEST3300
NEST3310

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ISN 0219      2 CONTINUE
ISN 0220      DO 3 J=1,NC
ISN 0221      X(3,J)=TCTC(J)
ISN 0222      D(3,J)=DC(J)
ISN 0223      3 CONTINUE
ISN 0224      DO 4 K=1,NB
ISN 0225      X(2,K)=TOTB(K)
ISN 0226      D(2,K)=DB(K)
ISN 0227      4 CONTINUE
ISN 0228      DO 5 L=1,NA
ISN 0229      X(1,L)=TOTL(L)
ISN 0230      D(1,L)=DA(L)
ISN 0231      5 CONTINUE
ISN 0232      LX(5)=NOBS
ISN 0233      LX(4)=ND
ISN 0234      LX(3)=NC
ISN 0235      LX(2)=NB
ISN 0236      LX(1)=NA
ISN 0237      NSS=NF+1
ISN 0238      DO 100 I=1,NSS
ISN 0239      SUM(I)=0.0D+00
ISN 0240      NSQ=LX(I)

C
C      CALCULATES SUMS OF SQUARES AND DEGREES OF FREEDOM
C
ISN 0241      DO 100 J=1,NSQ
ISN 0242      Z(I,J)=(X(I,J)*X(I,J))/D(I,J)
ISN 0243      SUM(I)=SUM(I)+Z(I,J)
ISN 0244      100 CONTINUE
ISN 0245      GTSS=GTOT*GTOT
ISN 0246      TSD=NOBS
ISN 0247      T=GTSS/TSD
ISN 0248      SS(1)=SUM(1)-T
ISN 0249      DF(1)=LX(1)-1
ISN 0250      DO 200 I=1,NF
ISN 0251      SS(I+1)=SUM(I+1)-SUM(I)
ISN 0252      DF(I+1)=LX(I+1)-LX(I)
ISN 0253      IF(DF(I+1)-.95D+00)201,201,713

C
C      CALCULATES MEAN SQUARES
C
ISN 0254      201 XMS(I+1)=0.0D+00
ISN 0255      SS(I+1)=0.0D+00
ISN 0256      GO TO 200
ISN 0257      713 XMS(I+1)=SS(I+1)/DF(I+1)
ISN 0258      200 CONTINUE
ISN 0259      SST=SUM(NSS)-T
ISN 0260      IF(DF(1)-.95D+00)202,202,55
ISN 0261      202 XMS(1)=0.0D+00
ISN 0262      SS(1)=0.0D+00
ISN 0263      GO TO 56
ISN 0264      55 XMS(1)=SS(1)/DF(1)
ISN 0265      56 DFT=TSD-1.0D+00
ISN 0266      XMST=SST/DFT

C
C      PRINTS OUT NEGATIVE SS WARNING
C

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NEST3320
NEST3330
NEST3340
NEST3350
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NEST3800
NEST3810
NEST3820
NEST3830
NEST3840
NEST3850
NEST3860
NEST3870

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C
ISN 0267      DO 2710 I = 1,NSS
ISN 0268      IF(SS(I) .LT. 0.00+00) GO TO 2720
ISN 0270      GO TO 2710
ISN 0271      2720 WRITE(6,2721) I,SS(I)
ISN 0272      2721 FORMAT(1H0,T5,'NEGATIVE SS',T20,'I = ',T25,I2,T30,'SS = ',
          1 T35,D15.8)
ISN 0273      2710 CCNTINUE
ISN 0274      IF(SS(I) .LT. 0.00+00) WRITE(6,2711) SST
ISN 0276      2711 FORMAT(1H0,T5,'NEGATIVE SS = ',D15.8)
ISN 0277      IF(TYPMOD .EQ. FIXED) GO TO 3955

C
C          SKIPS FOLLOWING FOR FIXED-EFFECTS
C
ISN 0279      DO 2390 I = 1,4
ISN 0280      F(I) = 0.00+00
ISN 0281      2390 CONTINUE
ISN 0282      IF(TYPE .EQ. TYPE2) GO TO 2400

C
C          CALCULATES F-VALUES WITHOUT POOLING
C          AND ASSUMING COMPLETELY BALANCED DESIGN
C          DENOTED BY FOLLOWING
C          FAB IS A TO B
C          FBC IS B TO C
C          FCD IS C TO D
C          FCE IS D TO ERROR
C
ISN 0284      IF(XMS(2) .LE. 0.00+00) GO TO 57
ISN 0286      58 F(1)=XMS(1)/XMS(2)
ISN 0287      57 K=NSS-2
ISN 0288      DO 300 I=1,K
ISN 0289      IF(XMS(I+2) .LE. 0.00+00) GO TO 300
ISN 0291      59 F(I+1)=XMS(I+1)/XMS(I+2)
ISN 0292      300 CONTINUE
ISN 0293      GO TO 2590
ISN 0294      2400 CONTINUE
ISN 0295      3955 CONTINUE

C
C          STARS F-EAL WHEN DESIGN IS UNBALANCED
C          OR FIXED-EFFECTS
C
ISN 0296      DO 2401 I = 1,4
ISN 0297      F(I) = BLANK1
ISN 0298      2401 CONTINUE
ISN 0299      2590 CONTINUE

C
C          CALCULATES MEAN
C
ISN 0300      XMEAN=GTOT/TSD
ISN 0301      TOTAL = NQBS
ISN 0302      IF(TYPMOD .EQ. FIXED) GO TO 5665

C
C          SKIPS FOLLOWING FOR FIXED-EFFECTS
C
C          CALCULATES EXPECTED MEAN SQUARE COEFFS

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NEST3880
NEST3890
NEST3900
NEST3910
NEST3920
NEST3930
NEST3940
NEST3950
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NEST3970
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NEST3990
NEST4000
NEST4010
NEST4020
NEST4030
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NEST4090
NEST4100
NEST4110
NEST4120
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NEST4330
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NEST4350
NEST4360
NEST4370
NEST4380
NEST4390
NEST4400
NEST4410
NEST4420
NEST4430

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C      CALCULATES FACTOR F(I),F(I,J),ETC. FIRST
C
ISN 0304      DO 401 L = 1, NA
ISN 0305      IF(DF(I).GT.0.00+00) GO TO 3001
ISN 0307      FV(L) = 0.00+00
ISN 0308      GO TO 401
ISN 0309      3001 CONTINUE
ISN 0310      FV(L) = (1.00+00/DA(L)-1.00+00/TOTAL)/DF(I)
ISN 0311      401 CONTINUE
ISN 0312      JJJJ= 1
ISN 0313      K = 0
ISN 0314      DO 402 I = 1,NA
ISN 0315      K= K + NBA(I)
ISN 0316      DO 402 J = JJJJ,K
ISN 0317      IF(DF(2).GT.0.00+00) GO TO 3002
ISN 0319      F1(J) = 0.00+00
ISN 0320      GO TO 402
ISN 0321      3002 CONTINUE
ISN 0322      F1(J)= (1.00+00/DB(J)-1.00+00/DA(I))/DF(2)
ISN 0323      JJJJ= J+1
ISN 0324      402 CONTINUE
ISN 0325      JJJJ=1
ISN 0326      K=0
ISN 0327      DO 403 I = 1,NB
ISN 0328      K=K + NCB (I)
ISN 0329      DO 403 J= JJJJ,K
ISN 0330      IF(DF(3).GT.0.00+00) GO TO 3003
ISN 0332      F2(J) = 0.00+00
ISN 0333      GO TO 403
ISN 0334      3003 CONTINUE
ISN 0335      F2(J)= (1.00+00/DC(J)-1.00+00/DB(I))/DF(3)
ISN 0336      JJJJ= J+1
ISN 0337      403 CONTINUE
ISN 0338      JJJJ=1
ISN 0339      K=0
ISN 0340      DO 404 I=1, NC
ISN 0341      K= K+ NDC(I)
ISN 0342      DO 404 J = JJJJ,K
ISN 0343      IF(DF(4).GT.0.00+00) GO TO 3004
ISN 0345      F3(J) = 0.00+00
ISN 0346      GO TO 404
ISN 0347      3004 CONTINUE
ISN 0348      F3(J)=(1.00+00/DD(J)-1.00+00/DC(I))/DF(4)
ISN 0349      JJJJ= J+1
ISN 0350      404 CONTINUE
C
C      NOW CALCULATES COEFF
C
ISN 0351      Q1 = 0.00+00
ISN 0352      IIII = 1
ISN 0353      KKKK = 0
ISN 0354      DO 405 K = 1,NA
ISN 0355      KKKK = NDA(K) + KKKK
ISN 0356      DO 405 I = IIII,KKKK
ISN 0357      Q1 = Q1 + DD(I)**2 * FV(K)
ISN 0358      IIII = KKKK + 1

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NEST4440
NEST4450
NEST4460
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NEST4680
NEST4690
NEST4700
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NEST4930
NEST4940
NEST4950
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NEST4970
NEST4980
NEST4990

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ISN 0359 405 CONTINUE
 ISN 0360 Q2 = 0.0D+00
 ISN 0361 I111 = 1
 ISN 0362 KKKK = 0
 ISN 0363 DO 406 K = 1,NB
 ISN 0364 KKKK = NCB(K) + KKKK
 ISN 0365 DO 406 I = I111,KKKK
 ISN 0366 Q2 = Q2 + DD(I)**2 * F1(K)
 ISN 0367 I111 = KKKK + 1
 ISN 0368 406 CONTINUE
 ISN 0369 Q3 = 0.0D+00
 ISN 0370 I111 = 1
 ISN 0371 KKKK = 0
 ISN 0372 DO 407 K = 1,NC
 ISN 0373 KKKK = NDC(K) + KKKK
 ISN 0374 DO 407 I = I111,KKKK
 ISN 0375 Q3 = Q3 + DD(I)**2 * F2(K)
 ISN 0376 I111 = KKKK + 1
 ISN 0377 407 CONTINUE
 ISN 0378 Q4 = 0.0D+00
 ISN 0379 DO 408 K = 1,ND
 ISN 0380 Q4 = Q4 + DD(K)**2 * F3(K)
 ISN 0381 408 CONTINUE
 ISN 0382 P1 = 0.0D+00
 ISN 0383 I111 = 1
 ISN 0384 KKKK = 0
 ISN 0385 DO 409 K = 1,NA
 ISN 0386 KKKK = NCA(K) + KKKK
 ISN 0387 DO 409 I = I111,KKKK
 ISN 0388 P1 = P1 + DC(I)**2 * FV(K)
 ISN 0389 I111 = KKKK + 1
 ISN 0390 409 CONTINUE
 ISN 0391 P2 = 0.0D+00
 ISN 0392 I111 = 1
 ISN 0393 KKKK = 0
 ISN 0394 DO 410 K = 1,NB
 ISN 0395 KKKK = NCB(K) + KKKK
 ISN 0396 DO 410 I = I111,KKKK
 ISN 0397 P2 = P2 + DC(I)**2 * F1(K)
 ISN 0398 I111 = KKKK + 1
 ISN 0399 410 CONTINUE
 ISN 0400 P3 = 0.0D+00
 ISN 0401 DO 411 K = 1,NC
 ISN 0402 P3 = P3 + CC(K) * *2 * F2(K)
 ISN 0403 411 CONTINUE
 ISN 0404 S1 = 0.0D+00
 ISN 0405 I111 = 1
 ISN 0406 KKKK = 0
 ISN 0407 DO 412 K = 1,NA
 ISN 0408 KKKK = NBA(K) + KKKK
 ISN 0409 DO 412 I = I111,KKKK
 ISN 0410 S1 = S1 + DB(I)**2 * FV(K)
 ISN 0411 I111 = KKKK + 1
 ISN 0412 412 CONTINUE
 ISN 0413 S2 = 0.0D+00
 ISN 0414 DO 413 K = 1,NB

NEST5000
 NEST5010
 NEST5020
 NEST5030
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 NEST5060
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 NEST5480
 NEST5490
 NEST5500
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 NEST5520
 NEST5530
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 NEST5550

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ISN 0415      S2 = S2 + DB(K)** 2 * F1(K)          NEST5560
ISN 0416      413 CONTINUE                          NEST5570
ISN 0417      T1 = 0.0D+00                          NEST5580
ISN 0418      DO 414 K= 1,NA                         NEST5590
ISN 0419      T1 = T1 + DA(K)**2 * FV(K)            NEST5600
ISN 0420      414 CONTINUE                          NEST5610
ISN 0421      IF(TYPE .EQ. TYPE1) GO TO 4300        NEST5620
C                                                     NEST5630
C      CALCULATES F-VALUES WHEN COMP ARE SIGNIFICANT NEST5640
C      AND NESTING IS UNBALANCED                     NEST5650
C      DENOTED BY FOLLOWING                          NEST5660
C      FF1 IS D TO ERROR                             NEST5670
C      FF2 IS C TO ADJUSTED D                       NEST5680
C      FF3 IS B TO ADJUSTED C                       NEST5690
C      FF4 IS A TO ADJUSTED B                       NEST5700
C                                                     NEST5710
ISN 0423      FF1 = 0.0D+00                          NEST5720
ISN 0424      FF2 = 0.0D+00                          NEST5730
ISN 0425      FF3 = 0.0D+00                          NEST5740
ISN 0426      FF4 = 0.0D+00                          NEST5750
ISN 0427      ADF2 = 0.0D+00                          NEST5760
ISN 0428      ADF3 = 0.0D+00                          NEST5770
ISN 0429      ADF4 = 0.0D+00                          NEST5780
ISN 0430      FF1 = XMS(4)/XMS(5)                     NEST5790
ISN 0431      IF((XMS(3) .LE. 0.0D+00) .OR. (DF(3) .LE. 0.0D+00)) GO TO 4001 NEST5800
ISN 0432      DOG = (Q3/Q4)*XMS(4)                   NEST5810
ISN 0433      CAT = (1.0D+00 - (Q3/Q4))*XMS(5)        NEST5820
ISN 0434      XMSF2 = DOG + CAT                      NEST5830
ISN 0435      FF2 = XMS(3)/XMSF2                     NEST5840
ISN 0436      ADF2 = (XMSF2**2)/(((DOG**2)/DF(4)) + ((CAT**2)/DF(5))) NEST5850
ISN 0437      IF((XMS(2) .LE. 0.0D+00) .OR. (DF(2) .LE. 0.0D+00)) GO TO 4001 NEST5860
ISN 0438      AE = (P2/P3)*XMS(3)                   NEST5870
ISN 0439      AEE = ((Q2/Q4) - ((P2*Q3)/(P3*Q4)))*XMS(4) NEST5880
ISN 0440      AEEE = (1.0D+00 - (P2/P3) - (Q2/Q4) + ((P2*Q3)/(P3*Q4)))*XMS(5) NEST5890
ISN 0441      XMSF3 = AE + AEE + AEEE                NEST5900
ISN 0442      FF3 = XMS(2)/XMSF3                     NEST5910
ISN 0443      ADF3 = (XMSF3**2)/(((AEE**2)/DF(3)) + ((AEEE**2)/DF(4)) + ((AEEE**2)/DF(5))) NEST5920
ISN 0444      1 (5)))                                NEST5930
ISN 0445      IF((XMS(1) .LE. 0.0D+00) .OR. (DF(1) .LE. 0.0D+00)) GO TO 4001 NEST5940
ISN 0446      EA = (S1/S2)*XMS(2)                   NEST5950
ISN 0447      EAA = ((P1/P3) - ((S1*P2)/(S2*P3)))*XMS(3) NEST5960
ISN 0448      EAAA = ((Q1/Q4) - ((S1*Q2)/(S2*Q4)) - ((P1*Q3)/(P3*Q4)) + ((S1*P2)/(S2*P3)))*XMS(4) NEST5970
ISN 0449      EAAAA = (1.0D+00 - (S1/S2) - (P1/P3) - (Q1/Q4) + ((S1*P2)/(S2*P3)) + ((S1*Q2)/(S2*Q4)) + ((P1*Q3)/(P3*Q4)) - ((S1*P2*Q3)/(S2*P3*Q4)))*XMS(5) NEST5980
ISN 0450      1 ) + ((S1*Q2)/(S2*Q4)) + ((P1*Q3)/(P3*Q4)) - ((S1*P2*Q3)/(S2*P3*Q4)))*XMS(5) NEST5990
ISN 0451      2 ))*XMS(5)                            NEST6000
ISN 0452      XMSF4 = EA + EAA + EAAA + EAAAA        NEST6010
ISN 0453      FF4 = XMS(1)/XMSF4                    NEST6020
ISN 0454      ADF4 = (XMSF4 **2)/(((EAA**2)/DF(2)) + ((EAAA**2)/DF(3)) + ((EAAAA**2)/DF(4)) + ((EAAAA**2)/DF(5))) NEST6030
ISN 0455      GO TO 4001                             NEST6040
ISN 0456      4300 CONTINUE                          NEST6050
ISN 0457      5665 CONTINUE                          NEST6060
C                                                     NEST6070
C      STARS F-UNBAL AND ADJ DF WHEN DESIGN IS BALANCED NEST6080
C      OR FIXED-EFFECTS                             NEST6090
C                                                     NEST6100
C                                                     NEST6110

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C
ISN 0458      FF1 = BLANK1
ISN 0459      FF2 = BLANK1
ISN 0460      FF3 = BLANK1
ISN 0461      FF4 = BLANK1
ISN 0462      ADF2 = BLANK1
ISN 0463      ADF3 = BLANK1
ISN 0464      ADF4 = BLANK1
ISN 0465      40C1  CONTINUE
ISN 0466      DO 2712 I = 1,NSS
ISN 0467      NDF(I) = DF(I)
ISN 0468      2712  CONTINUE
ISN 0469      NDFT = DFT
ISN 0470      IF(TYPMOD .EQ. FIXED) GO TO 6295

C
C      SKIPS FOLLOWING FOR FIXED-EFFECTS
C
ISN 0472      IF(TYPE .EQ. TYPE1) GO TO 5470
ISN 0474      IF(TYPE .EQ. TYPE2) GO TO 5475
ISN 0476      5470  CONTINUE

C
C      STORE VALUES FOR F-CALCULATION OF BALANCED DATA
C
ISN 0477      DO 5471 I = 1,4
ISN 0478      FCALC(I) = F(I)
ISN 0479      DFN(I) = NDF(I)
ISN 0480      DFD(I) = NDF(I + 1)
ISN 0481      5471  CONTINUE
ISN 0482      GO TO 5477
ISN 0483      5475  CONTINUE

C
C      STORE VALUES FOR F-CALCULATION OF UNBALANCED DATA
C
ISN 0484      DO 5472 I = 1,4
ISN 0485      DFN(I) = NDF(I)
ISN 0486      5472  CONTINUE
ISN 0487      FCALC(1) = FF4
ISN 0488      NDFD(1) = ADF4 + 0.5
ISN 0489      DFD(1) = NDFD(1)
ISN 0490      FCALC(2) = FF3
ISN 0491      NDFD(2) = ADF3 + 0.5
ISN 0492      DFD(2) = NDFD(2)
ISN 0493      FCALC(3) = FF2
ISN 0494      NDFD(3) = ADF2 + 0.5
ISN 0495      DFD(3) = NDFD(3)
ISN 0496      FCALC(4) = FF1
ISN 0497      DFD(4) = NDF(5)
ISN 0498      5477  CONTINUE

C
C      CALCULATE TABLED F-VALUES
C
ISN 0499      IF(XMS(1) .NE. 0.00+00) GO TO 2821
ISN 0501      IF(XMS(2) .NE. 0.00+00) GO TO 2822
ISN 0503      IF(XMS(3) .NE. 0.00+00) GO TO 2823
ISN 0505      GO TO 2824
ISN 0506      2821  ND = 1

NEST6120
NEST6130
NEST6140
NEST6150
NEST6160
NEST6170
NEST6180
NEST6190
NEST6200
NEST6210
NEST6220
NEST6230
NEST6240
NEST6250
NEST6260
NEST6270
NEST6280
NEST6290
NEST6300
NEST6310
NEST6320
NEST6330
NEST6340
NEST6350
NEST6360
NEST6370
NEST6380
NEST6390
NEST6400
NEST6410
NEST6420
NEST6430
NEST6440
NEST6450
NEST6460
NEST6470
NEST6480
NEST6490
NEST6500
NEST6510
NEST6520
NEST6530
NEST6540
NEST6550
NEST6560
NEST6570
NEST6580
NEST6590
NEST6600
NEST6610
NEST6620
NEST6630
NEST6640
NEST6650
NEST6660
NEST6670

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```

      GO TO 2825
      NO = 2
      GO TO 2825
      NO = 3
      GO TO 2825
      NO = 4
      2825 CONTINUE
      DO 2826 I = NO,4
      IF(DFD(I) .LE. 1.0) DFD(I) = 1.0
      CALL FVALUE(FVAL,DFN(I),DFD(I),0.05)
      FTABLE(I) = FVAL
      2826 CONTINUE
      6295 CONTINUE
      IF(TYPMOD .NE. FIXED) GO TO 6296

C
C      STARS EXPECTED MEAN SQUARES COEFFS. FOR FIXED EFFECTS
C
      DO 6300 I = 1,4
      FCALC(I) = BLANK1
      FTABLE(I) = BLANK1
      6300 CONTINUE
      Q1 = BLANK1
      P1 = BLANK1
      S1 = BLANK1
      T1 = BLANK1
      Q2 = BLANK1
      P2 = BLANK1
      S2 = BLANK1
      Q3 = BLANK1
      P3 = BLANK1
      Q4 = BLANK1
      6296 CONTINUE

C
C      FIXED EFFECTS F-VALUES
C
      IF(XMS(1) .NE. 0.0) GO TO 6261
      IF(XMS(2) .NE. 0.0) GO TO 6262
      IF(XMS(3) .NE. 0.0) GO TO 6263
      GO TO 6264
      6261 NFIX = 1
      GO TO 6265
      6262 NFIX = 2
      GO TO 6265
      6263 NFIX = 3
      GO TO 6265
      6264 NFIX = 4
      6265 CONTINUE
      DO 6266 I = NFIX,4
      FFIX(I) = XMS(I) / XMS(5)
      CALL FVALUE(FVAL,DF(I),DF(5),0.05)
      FFIXT(I) = FVAL
      CALL FVALUE(FVAL,DF(I),DF(5),0.01)
      FFIXTL(I) = FVAL
      IF(FFIX(I).GT.FFIXTL(I)) STARS(I) = STAR5
      IF(FFIX(I).GT.FFIXTL(I)) STARS(I) = STAR1
      6266 CONTINUE

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```

NEST6680
NEST6690
NEST6700
NEST6710
NEST6720
NEST6730
NEST6740
NEST6750
NEST6760
NEST6770
NEST6780
NEST6790
NEST6800
NEST6810
NEST6820
NEST6830
NEST6840
NEST6850
NEST6860
NEST6870
NEST6880
NEST6890
NEST6900
NEST6910
NEST6920
NEST6930
NEST6940
NEST6950
NEST6960
NEST6970
NEST6980
NEST6990
NEST7000
NEST7010
NEST7020
NEST7030
NEST7040
NEST7050
NEST7060
NEST7070
NEST7080
NEST7090
NEST7100
NEST7110
NEST7120
NEST7130
NEST7140
NEST7150
NEST7160
NEST7170
NEST7180
NEST7184
NEST7186
NEST7187
NEST7188
NEST7190

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ISN 0564      STARNA = STARS(3)
ISN 0565      STARNT = STARS(4)
ISN 0566      IF(NFIX.EQ.3)STARNA=STARS(4)
ISN 0568      IF(NFIX.EQ.3)STARNT=STARS(3)

C
C      WRITES OUT ANALYSIS OF VARIANCE TABLE
C
ISN 0570      WRITE(6,358)
ISN 0571      358 FORMAT(1H1,10(1H*),5X,102H-NEST-A CODE CONTAINING NESTED ANOVA CALCULATIONS DESIGNED FOR THE SALE PROGRAM-WJB,VERSION 02,04/01/73,5
ISN 0572      2,10(1H*))
ISN 0573      4000 WRITE(6,4000)
ISN 0574      4000 FORMAT(1H0,//////,T40,
ISN 0575      1'A N A L Y S I S   O F   V A R I A N C E   T A B L E ',/)
ISN 0576      4010 WRITE(6,4010)
ISN 0577      4010 FORMAT(1H0,T2,'COMPONENT',T16,'DF',T23,'SUM OF SQUARES',
      1 T40,'MEAN SQUARE',T59,'EXPECTED MEAN SQUARE COEFFS',
      2 T90,'F-RANDOM',T98,' F-TABLE',T107,' ADJ DF',
      3 T114,' F-FIXED',T122,' F-TABLE')
ISN 0578      WRITE(6,4444) STAR
ISN 0579      4444 FORMAT(1H0,T2,32A4)

C
C      STORE EMS COEFFS. TO BE PASSEC TO VAREST
C
ISN 0578      QQ1 = Q1
ISN 0579      PP1 = P1
ISN 0580      SS1 = S1
ISN 0581      TT1 = T1
ISN 0582      QQ2 = Q2
ISN 0583      PP2 = P2
ISN 0584      SS2 = S2
ISN 0585      QQ3 = Q3
ISN 0586      PP3 = P3
ISN 0587      QQ4 = Q4

C
C      CONVERT NUMBERS TO A FORMAT
C
ISN 0588      IF(Q1 .NE. BLANK1) CALL CNVRT8(Q1)
ISN 0590      IF(P1 .NE. BLANK1) CALL CNVRT8(P1)
ISN 0592      IF(S1 .NE. BLANK1) CALL CNVRT8(S1)
ISN 0594      IF(T1 .NE. BLANK1) CALL CNVRT8(T1)
ISN 0596      IF(Q2 .NE. BLANK1) CALL CNVRT8(Q2)
ISN 0598      IF(P2 .NE. BLANK1) CALL CNVRT8(P2)
ISN 0600      IF(S2 .NE. BLANK1) CALL CNVRT8(S2)
ISN 0602      IF(Q3 .NE. BLANK1) CALL CNVRT8(Q3)
ISN 0604      IF(P3 .NE. BLANK1) CALL CNVRT8(P3)
ISN 0606      IF(Q4 .NE. BLANK1) CALL CNVRT8(Q4)
ISN 0608      IF(ADF4 .NE. BLANK1) CALL CNVRT8(ADF4)
ISN 0610      IF(ADF3 .NE. BLANK1) CALL CNVRT8(ADF3)
ISN 0612      IF(ADF2 .NE. BLANK1) CALL CNVRT8(ADF2)
ISN 0614      DO 5891 I = NO,4
ISN 0615      IF(FCALC(I) .NE. BLANK1) CALL CNVRT8(FCALC(I))
ISN 0617      IF(FTABLE(I) .NE. BLANK1) CALL CNVRT8(FTABLE(I))
ISN 0619      5891 CONTINUE
ISN 0620      IF(XMS(1) .NE. 0.00+00) GO TO 4012
ISN 0622      IF(XMS(2) .NE. 0.00+00) GO TO 4014

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ISN 0624      IF(XMS(3) .NE. 0.00+00) GO TO 4016      NEST7680
ISN 0626      GO TO 4018      NEST7690
ISN 0627      4012 CONTINUE      NEST7700
ISN 0628      WRITE(6,4020) COMP(1),NDF(1),SS(1),XMS(1),Q1,P1,S1,T1,      NEST7710
ISN 0629      1 FCALC(1),FTABLE(1),ADF4,FFIX(1),FFIXT(1)      NEST7720
ISN 0629      4020 FORMAT(1H0,T2,A8,T14,I4,T22,1PD15.8,      NEST7730
ISN 0629      1 T39,D15.8,T55,A8,1X,A8,1X,      NEST7740
ISN 0629      2 A8,1X,A8,      NEST7750
ISN 0629      3 T90,A8,T98,A8,T106,A8,T114,OPF8.2,T122,F8.2)      NEST7760
ISN 0630      4014 CONTINUE      NEST7770
ISN 0631      WRITE(6,4030) COMP(2),NDF(2),SS(2),XMS(2),Q2,P2,S2,      NEST7780
ISN 0632      1 FCALC(2),FTABLE(2),ADF3,FFIX(2),FFIXT(2)      NEST7790
ISN 0632      4030 FORMAT(1H0,T2,A8,T14,I4,T22,1PD15.8,      NEST7800
ISN 0632      1 T39,D15.8,T55,A8,1X,A8,1X,      NEST7810
ISN 0632      2 A8,      NEST7820
ISN 0632      3 T90,A8,T98,A8,T106,A8,T114,OPF8.2,T122,F8.2)      NEST7830
ISN 0633      4016 CONTINUE      NEST7840
ISN 0634      WRITE(6,4040) COMP(3),NDF(3),SS(3),XMS(3),Q3,P3,      NEST7850
ISN 0635      1 FCALC(3),FTABLE(3),ADF2,FFIX(3),FFIXT(3)      NEST7860
ISN 0635      4040 FORMAT(1H0,T2,A8,T14,I4,T22,1PD15.8,      NEST7870
ISN 0635      1 T39,D15.8,T55,A8,1X,A8,      NEST7880
ISN 0635      2 T90,A8,T98,A8,T106,A8,T114,OPF8.2,T122,F8.2)      NEST7890
ISN 0636      4018 CONTINUE      NEST7900
ISN 0637      WRITE(6,4050) COMP(4),NDF(4),SS(4),XMS(4),Q4,FCALC(4),FTABLE(4),      NEST7910
ISN 0637      1 FFIX(4),FFIXT(4)      NEST7920
ISN 0638      4050 FORMAT(1H0,T2,A8,T14,I4,T22,1PD15.8,      NEST7930
ISN 0638      1 T39,D15.8,T55,A8,      NEST7940
ISN 0638      2 T90,A8,T98,A8,      NEST7950
ISN 0638      3 T114,OPF8.2,T122,F8.2)      NEST7960
ISN 0639      WRITE(6,4060) COMP(5),NDF(5),SS(5),XMS(5)      NEST7970
ISN 0640      4060 FORMAT(1H0,T2,A8,T14,I4,T22,1PD15.8,T39,D15.8)      NEST7980
ISN 0641      WRITE(6,4444) STAR      NEST7990
ISN 0642      WRITE(6,4070) NDF1,SST,XMST      NEST8000
ISN 0643      4070 FORMAT(1H0,T2,'TOTAL',T14,I4,T22,1PD15.8,T39,D15.8)      NEST8010
C      WRITES OUT MEAN      NEST8020
C      NEST8030
C      NEST8040
ISN 0644      XNOBS=NOBS      NEST8050
ISN 0645      VXMST=XMST/XNOBS      NEST8060
ISN 0646      SXMST= SQRT(VXMST)      NEST8070
ISN 0647      WRITE(6,903)XMEAN,SXMST      NEST8080
ISN 0648      903 FORMAT(1H0,/,/,T10,'MEAN= ',1PD15.8,T50,'STD OF MEAN= ',1PD15.8)      NEST8090
ISN 0649      DO 3074 I = 1,5      NEST8100
ISN 0650      SPXMS(I) = XMS(I)      NEST8110
ISN 0651      SPDF(I) = DF(I)      NEST8120
ISN 0652      3074 CONTINUE      NEST8130
ISN 0653      SPMEAN = XMEAN      NEST8140
ISN 0654      CALL BIAS(XMEAN,XMST,NOBS)      NEST8150
ISN 0655      320 CONTINUE      NEST8160
ISN 0656      CALL VAREST(XMS,DF,QQ1,PP1,SS1,TT1,QQ2,PP2,SS2,QQ3,PP3,QQ4,COMP)      NEST8170
ISN 0657      4810 CONTINUE      NEST8180
ISN 0658      GO TO 1010      NEST8190
ISN 0659      6400 WRITE(6,6401)      NEST8200
ISN 0660      6401 FORMAT(1H0,T10,'ND IS LESS THAN 2, CALL EXIT')      NEST8210
ISN 0661      1010 CONTINUE      NEST8220
ISN 0662      RETURN      NEST8230
ISN 0663      END      NEST8240

```

```

1  SUBROUTINE VAREST(XMS,DF,Q1,P1,S1,T1,Q2,P2,S2,Q3,P3,Q4,COMP)
1  DOUBLE PRECISION OBS(300)
1  DOUBLE PRECISION XMS(5),DF(5),Q1,P1,S1,T1,Q2,P2,S2,Q3,P3,Q4,
1  VE,DFVE,VD,DFVD,VC,DFVC,V8,DFVB,VA,DFVA,COMP(5)
1  DOUBLE PRECISION D1,D2,C1,C21,C2,C31,C3,B1,B21,B2,B31,B3,B41,B4,
1  A1,A2,A3,A4,A5
1  DOUBLE PRECISION VAR(5),DFVAR(5)
1  DOUBLE PRECISION XNUMCV,CV
1  DOUBLE PRECISION XMEAN,A21,A31,A41,A51,DFTTST
1  COMMON/AEFF/DA
1  COMMON/BEFF/DB
1  COMMON/CEFF/DC
1  COMMON/DEFF/DD
1  DOUBLE PRECISION DA(20),DB(40),DC(80),DD(120)
1  DOUBLE PRECISION DIVSTD,DIVPAR
1  DIMENSION SOA(20),SDS(40),SDC(80),SDO(120)
1  DIMENSION CXMS(5),FV(5,5)
1  DIMENSION ALPHA(15)
1  COMMON OBS
1  COMMON XMEAN,NOBS,ND,VC,NB,NA,NFTTST,ALPHA,STDMN,XNUMCV
1  COMMON/CONF/CI

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```

XMS(5) = VE
XMS(4) = VE + Q4 * VD
XMS(3) = VE + Q3 * VD + P3 * VC
XMS(2) = VE + Q2 * VD + P2 * VC + S2 * VB
XMS(1) = VE + Q1 * VD + P1 * VC + S1 * VB + T1 * VA

```

```
VE = VARIANCE OF ERROR (COMP(5))
VD = VARIANCE OF COMP(4)
VC = VARIANCE OF COMP(3)
VB = VARIANCE OF COMP(2)
VA = VARIANCE OF COMP(1)
```

ISN 0021	VE = 0.0	VARC0450
ISN 0022	DFVE = 0.0	VARC0460
ISN 0023	VD = 0.0	VARC0470
ISN 0024	DFVD = 0.0	VARC0500
ISN 0025	VC = 0.0	VARC0510
ISN 0026	DFVC = 0.0	VARC0520
ISN 0027	VB = 0.0	VARC0530
ISN 0028	DFVB = 0.0	VARC0540
ISN 0029	VA = 0.0	VARC0550
ISN 0030	DFVA = 0.0	VARC0560
ISN 0031	C21 = 0.0	VARC0570
ISN 0032	C31 = 0.0	VARC0580
ISN 0033	B21 = 0.0	VARC0590
ISN 0034	B31 = 0.0	VARC0600
ISN 0035	B41 = 0.0	VARC0610
ISN 0036	A21 = 0.0	VARC0620
		VARC630

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ISN 0037      A31 = 0.0
ISN 0038      A41 = 0.0
ISN 0039      A51 = 0.0
ISN 0040      IF(XMS(4).EQ.0.00+00) GO TO 77

C
C
C      ERROR VARIANCE AND DF

ISN 0042      VE = XMS(5)
ISN 0043      DFVE = DF(5)

C
C
C      CALCULATES VARIANCE OF COMP(4) AND DF

ISN 0044      D1 = XMS(4) / Q4
ISN 0045      D2 = XMS(5) / Q4
ISN 0046      VD = (XMS(4) - VE) / Q4
ISN 0047      DFVD = (VD * VD) /
1 ((D1 * D1) / DF(4)) + ((D2 * D2) / DF(5))
ISN 0048      IF(XMS(3).EQ.0.00+00) GO TO 10

C
C
C      CALCULATES VARIANCE OF COMP(3) AND DF

ISN 0050      C1 = XMS(3) / P3
ISN 0051      C21 = Q3 / (Q4 * P3)
ISN 0052      C2 = C21 * XMS(4)
ISN 0053      C31 = ((Q3 / Q4) - 1.00+00) / P3
ISN 0054      C3 = C31 * XMS(5)
ISN 0055      VC = (XMS(3) - VE - (Q3 * VD)) / P3
ISN 0056      DFVC = (VC * VC) /
1 (((C1 * C1) / DF(3)) + ((C2 * C2) / DF(4)) +
2 ((C3 * C3) / DF(5)))
ISN 0057      IF(XMS(2).EQ.0.00+00) GO TO 10

C
C
C      CALCULATES VARIANCE OF COMP(2) AND DF

ISN 0059      B1 = XMS(2) / S2
ISN 0060      B21 = P2 / (S2 * P3)
ISN 0061      B2 = B21 * XMS(3)
ISN 0062      B31 = ((P2 * C21) / S2) - (Q2 / (S2 * Q4))
ISN 0063      B3 = B31 * XMS(4)
ISN 0064      B41 = (Q2 / (S2 * Q4)) - (1.00+00 / S2) - ((P2 / S2) * C31)
ISN 0065      B4 = B41 * XMS(5)
ISN 0066      VB = (XMS(2) - VE - (Q2 * VD) - (P2 * VC)) / S2
ISN 0067      DFVB = (VB * VB) /
1 (((B1 * B1) / DF(2)) + ((B2 * B2) / DF(3)) +
2 ((B3 * B3) / DF(4)) + ((B4 * B4) / DF(5)))
ISN 0068      IF(XMS(1).EQ.0.00+00) GO TO 10

C
C
C      CALCULATES VARIANCE OF COMP(1) AND DF

ISN 0070      A1 = XMS(1) / T1
ISN 0071      A21 = S1 / (T1 * S2)
ISN 0072      A2 = A21 * XMS(2)
ISN 0073      A31 = ((S1 * B21) / T1) - (P1 / (T1 * P3))
ISN 0074      A3 = A31 * XMS(3)
ISN 0075      A41 = ((P1 * C21) / T1) - (Q1 / (T1 * Q4)) - ((S1 * B31) / T1)
ISN 0076      A4 = A41 * XMS(4)

```

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VARF0640
VARE0650
VARF0660
VARE0670
VARE0680
VARE0690
VARE0700
VARE0710
VARE0720
VARE0730
VARE0740
VARE0750
VARE0760
VARE0770
VARE0780
VARE0790
VARE0800
VARE0810
VARE0820
VARE0830
VARE0840
VARE0850
VARE0860
VARE0870
VARE0880
VARE0890
VARE0900
VARE0910
VARE0920
VARE0930
VARE0940
VARE0950
VARE0960
VARE0970
VARE0980
VARE0990
VARE1000
VARE1010
VARE1020
VARE1030
VARE1040
VARE1050
VARE1060
VARE1070
VARE1080
VARE1090
VARE1100
VARE1110
VARE1120
VARE1130
VARE1140
VARE1150
VARE1160
VARE1170
VARE1180
VARE1190

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ISN 0077      A51 = (Q1 / (T1 * Q4)) - (1.0D+00 / T1) -          VARE1200
1 ((P1 * C31) / T1) - ((S1 * B41) / T1)          VARE1210
ISN 0078      A5 = A51 * XMS(5)          VARE1220
ISN 0079      VA = (XMS(1) - VE - (Q1 * VD) - (P1 * VC) - (S1 * V8)) / T1 VARE1230
ISN 0080      DFVA = (VA * VA) /          VARE1240
1 ((A1 * A1) / DF(1)) + ((A2 * A2) / DF(2)) + VARE1250
2 ((A3 * A3) / DF(3)) + ((A4 * A4) / DF(4)) + VARE1260
3 ((A5 * A5) / DF(5))          VARE1270
ISN 0081      10 CONTINUE          VARE1280
ISN 0082      WRITE(6,20)          VARE1290
ISN 0083      20 FORMAT(1H0,//////////,-20, VARE1300
1 'VARIANCE COMPONENT ESTIMATES AND ASSOCIATED DEGREES OF FREEDOM') VARE1310
C          VARE1320
C          ZEROS NEGATIVE VARIANCES          VARE1330
C          VARE1340
ISN 0084      IF(IVA .LE. 0.0) VA = 0.0          VARE1350
ISN 0086      IF(IVB .LE. 0.0) VB = 0.0          VARE1360
ISN 0088      IF(IVC .LE. 0.0) VC = 0.0          VARE1370
ISN 0090      IF(IVD .LE. 0.0) VD = 0.0          VARE1380
ISN 0092      IF(XMS(1) .NE. 0.0D+00) GO TO 30 VARE1390
ISN 0094      IF(XMS(2) .NE. 0.0D+00) GO TO 40 VARE1400
ISN 0096      IF(XMS(3) .NE. 0.0D+00) GO TO 50 VARE1410
ISN 0098      GO TO 60          VARE1420
ISN 0099      30 CONTINUE          VARE1430
C          VARE1440
C          WRITES OUT COMPONENT, VARIANCE ESTIMATES, AND DEGREES OF FREEDOM VARE1450
C          VARE1460
ISN 0100      WRITE(6,11) COMP(1),VA,DFVA          VARE1470
ISN 0101      11 FORMAT(1H0,T10,'VAR OF',T17,A8,T25,' = ',1PD15.8, VARE1480
1 T6C,'DEGREES OF FREEDOM = ',OPF8.2)          VARE1490
ISN 0102      40 CONTINUE          VARE1500
ISN 0103      WRITE(6,11) COMP(2),VB,DFVB          VARE1510
ISN 0104      50 CONTINUE          VARE1520
ISN 0105      WRITE(6,11) COMP(3),VC,DFVC          VARE1530
ISN 0106      60 CONTINUE          VARE1540
ISN 0107      WRITE(6,11) COMP(4),VD,DFVD          VARE1550
ISN 0108      WRITE(6,11) COMP(5),VE,DFVE          VARE1560
ISN 0109      DO 31 I = 1,NA          VARE1570
ISN 0110      31 SDA(I) = DA(I)          VARE1580
ISN 0111      DO 32 I = 1,NB          VARE1590
ISN 0112      32 SDB(I) = DB(I)          VARE1600
ISN 0113      DO 33 I = 1,NC          VARE1610
ISN 0114      33 SDC(I) = DC(I)          VARE1620
ISN 0115      DO 34 I = 1,ND          VARE1630
ISN 0116      34 SDD(I) = DD(I)          VARE1640
C          VARE1650
ISN 0117      SUMDA1= 0.0          VARE1660
ISN 0118      SUMDB1= 0.0          VARE1670
ISN 0119      SUMDC1= 0.0          VARE1680
ISN 0120      SUMDD1= 0.0          VARE1690
ISN 0121      DO 121 I = 1,NA          VARE1700
ISN 0122      121 SUMDA1= SUMDA1+ (SDA(I) * SDA(I)) VARE1710
ISN 0123      DO 122 I = 1,NB          VARE1720
ISN 0124      122 SUMDB1= SUMDB1+ (SDB(I) * SDB(I)) VARE1730
ISN 0125      DO 123 I = 1,NC          VARE1740
ISN 0126      123 SUMDC1= SUMDC1+ (SDC(I) * SDC(I)) VARE1750

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ISN 0127      DO 124 I = 1,ND
ISN 0128      124 SUMDD1= SUMDD1+ (SDD(I)*SDD(I))
ISN 0129      XNOBS = NOBS
ISN 0130      DIV = XNOBS * XNOBS
ISN 0131      IF(XMS(1) .NE. 0.0) GO TO 131
ISN 0133      IF(XMS(2) .NE. 0.0) GO TO 132
ISN 0135      IF(XMS(3) .NE. 0.0) GO TO 133
ISN 0137      GO TO 134

C
C      CALCULATES MULT. FACTORS OF VAR. COMP.
C
ISN 0138      131 FACT11= SUMDA1/ DIV
ISN 0139      132 FACT21= SUMDB1/ DIV
ISN 0140      133 FACT31= SUMOC1/ DIV
ISN 0141      134 FACT41= SUMDD1/ DIV
ISN 0142      FACT51= 1.0 / XNOBS

C
C      VARIANCE AND STD. DEV.
C
ISN 0143      VARMN = (FACT11* VA) + (FACT21* VB) + (FACT31* VC) +
ISN 0144      1 (FACT41* VD) + (FACT51* VE)
ISN 0145      STDMN = SQRT(VARMN)
ISN 0146      35 FORMAT(1H0,/,T10,'VAR OF MEAN = ',1PE15.5,
ISN 0146      1 T50,'STD DEV = ',E15.5,15H(BY COMPONENTS))

C
C      CALCULATES DEGREES OF FREEDOM FOR A 95 %
C      CONFIDENCE INTERVAL ON THE MEAN BY COMPONENTS
C      THEN WRITES OUT INTERVAL ABOUT THE MEAN
C
ISN 0147      INCRE = 5
ISN 0148      DO 7501 I = 1,3
ISN 0149      IF(XMS(I).EQ. 0.0D+00) INCRE = INCRE - 1
ISN 0151      7501 CONTINUE
ISN 0152      DO 7607 J = 1,5
ISN 0153      DO 7606 I = 1,5
ISN 0154      CXMS(I)=0.0
ISN 0155      7606 FV(J,I)=0.0
ISN 0156      7607 CONTINUE
ISN 0157      FV(5,5) = FACT51
ISN 0158      FV(5,4) = -(FACT51 * FACT41) / Q4
ISN 0159      IF((INCRE - 2) .EQ. 0) GO TO 7601
ISN 0161      FV(5,3) = (FACT31 / P3) * (-FACT51 - (Q3 * FV(5,4)))
ISN 0162      IF((INCRE - 3) .EQ. 0) GO TO 7601
ISN 0164      FV(5,2) = (FACT21 / S2) * (-FACT51 - (Q2 * FV(5,4)) - (P2 *
ISN 0164      1 FV(5,3)))
ISN 0165      IF((INCRE - 4) .EQ. 0) GO TO 7601
ISN 0167      FV(5,1) = (FACT11 / T1) * (-FACT51 - (Q1 * FV(5,4)) - (P1 * FV(5,3)
ISN 0167      1 ) - (S1 * FV(5,2)))
ISN 0168      7601 FV(4,4) = FACT41 / Q4
ISN 0169      IF((INCRE - 2) .EQ. 0) GO TO 7604
ISN 0171      FV(4,3) = (FACT31 / P3) * (-Q3 * FV(4,4))
ISN 0172      IF((INCRE - 3) .EQ. 0) GO TO 7602
ISN 0174      FV(4,2) = (FACT21 / S2) * (-Q2 * FV(4,4)) - (P2 * FV(4,3))
ISN 0175      IF((INCRE - 4) .EQ. 0) GO TO 7602
ISN 0177      FV(4,1) = (FACT11 / T1) * (-Q1 * FV(4,4)) - (P1 * FV(4,3)) - (S1
ISN 0177      1 * FV(4,2))

```

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VARE1760
VARE1770
VARE1780
VARE1790
VARE1800
VARE1810
VARE1820
VARE1830
VARE1840
VARE1850
VARE1860
VARE1870
VARE1880
VARE1890
VARE1900
VARE1910
VARE1920
VARE1930
VARE1940
VARE1950
VARE1960
VARE1970
VARE1980
VARE1990
VARE2000
VARE2010
VARE2020
VARE2030
VARE2040
VARE2050
VARE2060
VARE2070
VARE2080
VARE2090
VARE2100
VARE2110
VARE2120
VARE2130
VARE2140
VARE2150
VARE2160
VARE2170
VARE2180
VARE2190
VARE2200
VARE2210
VARE2220
VARE2230
VARE2240
VARE2250
VARE2260
VARE2270
VARE2280
VARE2290
VARE2300
VARE2310

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ISN 0178      7602 FV(3,3) = FACT31 / P3                                VARE2320
ISN 0179      IF((INCR - 3) .EQ. 0) GO TO 7604                        VARE2330
ISN 0181      FV(3,2) = (-P2 * FACT21 / S2) * FV(3,3)                VARE2340
ISN 0182      IF((INCR - 4) .EQ. 0) GO TO 7603                        VARE2350
ISN 0184      FV(3,1) = (FACT11 / T1) * ((-P1 * FV(3,3)) - (S1 * FV(3,2))) VARE2360
ISN 0185      7603 FV(2,2) = FACT21 / S2                                VARE2370
ISN 0186      IF((INCR - 4) .EQ. 0) GO TO 7604                        VARE2380
ISN 0188      FV(2,1) = (FACT11 / T1) * (-S1 * FV(2,2))              VARE2390
ISN 0189      FV(1,1) = FACT11 / T1                                    VARE2400
ISN 0190      7604 CONTINUE                                           VARE2410
ISN 0191      TONOM = 0.0                                              VARE2420
ISN 0192      DO 7503 I = 1, INCR                                       VARE2430
ISN 0193      H = 6 - I                                                VARE2440
ISN 0194      DO 7502 J = 1, INCR                                       VARE2450
ISN 0195      K = 6 - J                                                VARE2460
ISN 0196      7502 CXMS(H) = CXMS(H) + FV(1,K)                        VARE2470
ISN 0197      7503 CXMS(H) = ((CXMS(H) * XMS(H)) ** 2) / DF(H)        VARE2480
ISN 0198      DO 7504 M = 1, INCR                                       VARE2490
ISN 0199      N = 6 - M                                                VARE2500
ISN 0200      7504 TONOM = CXMS(N) + TONOM                             VARE2510
ISN 0201      DFFMN = (VARMN * VARMN) / TONOM                         VARE2520
ISN 0202      IDFFMN = DFFMN + 0.5                                       VARE2530
ISN 0203      DFFMN = IDFFMN                                           VARE2535
ISN 0204      CALL TVALUE(TVDFMN, DFFMN, 0.05)                         VARE2540
ISN 0205      CONINT = TVDFMN * STDMN                                    VARE2550
ISN 0206      CI = CONINT                                              VARE2551
ISN 0207      XNUMCV = VA + VB + VC + VD + VE                          VARE2554
ISN 0208      XNUMCV = DSORT(XNUMCV)                                    VARE2555
ISN 0209      CLMNLO = XMEAN - CONINT                                   VARE2560
ISN 0210      CLMMX = XMEAN + CONINT                                   VARE2570
ISN 0211      WRITE(6,7609) CLMNLO, CLMMX, IDFFMN                     VARE2580
ISN 0212      7609 FORMAT(1H0, '//, T20, '95 % CONFIDENCE INTERVAL FOR THE MEAN WITH THE VARE2590
1 ASSOCIATED DEGREES OF FREEDOM BY COMPONENTS', '// , T10, 'LOWER LIMIT VARE2600
2T = ', 1PE15.5, T55, 'UPPER LIMIT = ', 1PE15.5, T95, 'DEGREES OF VARE2610
3FREEDOM = ', I3)                                                     VARE2620
ISN 0213      77 CONTINUE                                             VARE2630
ISN 0214      RETURN                                                  VARE2640
ISN 0215      END                                                    VARE2650

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LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.37.56

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XREF

ISN 0002		SUBROUTINE FVALUE(F,DFN,DFD,ALPHA)	FVAL0010
ISN 0003		SMLNO = 1.0E-06	FVAL0020
	C		FVAL0030
	C	GL = LOW GUESS	FVAL0040
	C	GH = HIGH GUESS	FVAL0050
	C	CHANGE GL AND GH TO CORRESPOND WITH PARTICULAR ALPHA IN USE	FVAL0060
	C		FVAL0070
ISN 0004		GL = 1.0	FVAL0080
ISN 0005		GH = 255.0	FVAL0090
ISN 0006		IF(DFD .GT. 1.0) GH = 22.0	FVAL0100
ISN 0008		IF(DFD .GT. 2.0) GH = 13.0	FVAL0110
ISN 0010		IF(DFD .GT. 10.0) GH = 6.0	FVAL0120
ISN 0012		IF(ALPHA .EQ. 0.01)GH=6500.0	FVAL0130
ISN 0014		IF(ALPHA .EQ. 0.01 .AND. DFD.GT.1.0)GH=105.0	FVAL0140
ISN 0016		IF(ALPHA .EQ. 0.01 .AND. DFD.GT.2.0)GH=40.0	FVAL0150
ISN 0018		IF(ALPHA .EQ. 0.01 .AND. DFD.GT.10.0)GH=15.0	FVAL0160
ISN 0020	10	CONTINUE	FVAL0170
ISN 0021		GN = (GL + GH) / 2.0	FVAL0180
ISN 0022		PGN = AMAX1(.001,FPROB(DFN,DFD,GN))	FVAL0190
ISN 0023		DIFF = PGN - ALPHA	FVAL0200
ISN 0024		ADIFF = ABS(DIFF)	FVAL0210
ISN 0025		IF(ADIFF .LT. SMLNO) GO TO 20	FVAL0220
ISN 0027		IF(PGN .GT. ALPHA) GL = GN	FVAL0230
ISN 0029		IF(PGN .LT. ALPHA) GH = GN	FVAL0240
ISN 0031		GO TO 10	FVAL0250
ISN 0032	20	CONTINUE	FVAL0260
ISN 0033		F = GN	FVAL0270
ISN 0034		RETURN	FVAL0280
ISN 0035		END	FVAL0290

LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.38.15

COMPILER OPTIONS - NAME= MAIN,OPT=GO,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NULIST,NODECK,LOAD,MAP,NOEDIT,NOID,XPEF
ISN 0002 SUBROUTINE TVALUE(T,DFD,ALPHA)
ISN 0003 SMLNG = 1.0E-06

	C		TVAL0010
	C		TVAL0020
	C	GL = LOW GUESS	TVAL0030
	C	GH = HIGH GUESS	TVAL0040
	C	CHANGE GL AND GH TO CORRESPOND WITH PARTICULAR ALPHA IN USE	TVAL0050
	C		TVAL0060
ISN 0004		GL = 3.0	TVAL0070
ISN 0005		GH = 162.0	TVAL0080
ISN 0006	10	CONTINUE	TVAL0090
ISN 0007		GN = (GL + GH) / 2.0	TVAL0100
ISN 0008		PGN = AMAX1(.001,FPROB(1.0,DFD,GN))	TVAL0110
ISN 0009		DIFF = PGN - ALPHA	TVAL0120
ISN 0010		ADIFF = ABS(DIFF)	TVAL0130
ISN 0011		IF(ADIFF .LT. SMLNG) GO TO 20	TVAL0140
ISN 0013		IF(PGN .GT. ALPHA) GL = GN	TVAL0150
ISN 0015		IF(PGN .LT. ALPHA) GH = GN	TVAL0160
ISN 0017		GO TO 10	TVAL0170
ISN 0018	20	CONTINUE	TVAL0180
ISN 0019		T = SQRT(GN)	TVAL0190
ISN 0020		RETURN	TVAL0200
ISN 0021		END	TVAL0210
			TVAL0220

LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.38.31

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XPEF

ISN 0002	FUNCTION FPROB(U,V,F)	FPRB0010
ISN 0003	A=.5*U	FPRB0020
ISN 0004	B=.5*V	FPRB0030
ISN 0005	TEMP=B+A*F	FPRB0040
ISN 0006	X=A*F/TEMP	FPRB0050
ISN 0007	IF(F.GT. 0. .AND. X.GT. 0.) GO TO 100	FPRB0060
ISN 0009	FPROB = 1.0	FPRB0070
ISN 0010	GO TO 150	FPRB0080
ISN 0011	100 XC=B/TEMP	FPRB0090
ISN 0012	AB=A+B	FPRB0100
ISN 0013	CON=0.	FPRB0110
ISN 0014	SGN=+1.	FPRB0120
ISN 0015	IF(F-1.) 110,120,120	FPRB0130
ISN 0016	110 TEMP=A	FPRB0140
ISN 0017	A=B	FPRB0150
ISN 0018	B=TEMP	FPRB0160
ISN 0019	TEMP=XC	FPRB0170
ISN 0020	XC=X	FPRB0180
ISN 0021	X=TEMP	FPRB0190
ISN 0022	CON=1.	FPRB0200
ISN 0023	SGN=-1.	FPRB0210
ISN 0024	120 TOP=AB	FPRB0220
ISN 0025	BOT=B+1.	FPRB0230
ISN 0026	SUM=1.	FPRB0240
ISN 0027	TERM=1.	FPRB0250
ISN 0028	130 TEMP=SUM	FPRB0260
ISN 0029	TERM=TERM*(TOP/BOT)*XC	FPRB0270
ISN 0030	SUM=SUM+TERM	FPRB0280
ISN 0031	TOP=TOP+1.	FPRB0290
ISN 0032	BOT=BOT+1.	FPRB0300
ISN 0033	IF(SUM-TEMP) 140,140,130	FPRB0310
ISN 0034	140 FPROB=CON+SGN*EXP(A*ALOG(X)+B*ALOG(XC)+ALGAMA(AB)-ALGAMA(A)	FPRB0320
	1 -ALGAMA(B))*SUM/B	FPRB0330
ISN 0035	150 RETURN	FPRB0340
ISN 0036	END	FPRB0350

LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.38.44

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0030K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XREF

ISN 0002	SUBROUTINE CNVRT8(A)	CVRT0010
ISN 0003	REAL*8 A,B	CVRT0020
ISN 0004	CALL INFLQ(B,8)	CVRT0030
ISN 0005	WRITE(6,10) A	CVRT0040
ISN 0006	10 FORMAT(F8.2)	CVRT0050
ISN 0007	A = B	CVRT0060
ISN 0008	RETURN	CVRT0070
ISN 0009	END	CVRT0080

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LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.38.53

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0030K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XREF

ISN 0002	SUBROUTINE BIAS(XMEAN,XMST,NOBS)	BIAS0010
ISN 0003	DATA N1,N2,N3/' ','* ','**'/	BIAS0020
ISN 0004	DOUBLE PRECISION XMEAN,XMST,XNOBS,DEN	BIAS0030
ISN 0005	K = N1	BIAS0040
ISN 0006	XNOBS = NOBS	BIAS0050
ISN 0007	DEN = DSQRT(XMST / XNOBS)	BIAS0060
ISN 0008	TC = (XMEAN / DEN)	BIAS0070
ISN 0009	DFD = XNOBS - 1.0	BIAS0080
ISN 0010	CALL TVALUE(T05,DFD,0.05)	BIAS0090
ISN 0011	IF TC .LT. -1.0*T05 .OR. TC .GT. T05) K = N2	BIAS0100
ISN 0013	CALL TVALUE(T01,DFD,0.01)	BIAS0110
ISN 0014	IF TC .LT. -1.0*T01 .OR. TC .GT. T01) K = N3	BIAS0120
ISN 0016	WRITE(6,1)	BIAS0130
ISN 0017	1 FORMAT(1H,T10,'RESULT OF BIAS TEST FOLLOWS')	BIAS0140
ISN 0018	WRITE(6,2) TC,K	BIAS0150
ISN 0019	2 FORMAT(1H,T10,'T-CALCULATED = ',F10.4,2X,A2)	BIAS0160
ISN 0020	WRITE(6,3) T05,T01	BIAS0170
ISN 0021	3 FORMAT(1H,T10,'T-TABLED(0.05) = ',F10.4,	BIAS0180
	1 T48,'T-TABLED(0.01) = ',F10.4)	BIAS0190
ISN 0022	RETURN	BIAS0200
ISN 0023	END	BIAS0210

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COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XREF
ISN 0002 SUBROUTINE CORTRE(TITLE,GTITLE,STITLE,XTITLE,YTITLE,UPPER,XLOWEP,INPT0010
1 IBOUND,CUP, IG,XLABIN,RMEAN,RMS,ICHECK) INPT0020
ISN 0003 DOUBLE PRECISION XMOVE,SQR INPT0030
ISN 0004 DOUBLE PRECISION XMNYR(200),Y INPT0040
ISN 0005 DOUBLE PRECISION DY(200),RMEAN(200),RMS(200) INPT0050
ISN 0006 COMMON/COM1/MINFO,NAUTO,IB(100) INPT0060
ISN 0007 COMMON/COM2/XMNYR INPT0070
ISN 0008 COMMON/COM3/XMOVE(100),SQR(200) INPT0080
ISN 0009 COMMON/COM4/MOVE INPT0090
ISN 0010 COMMON/COM5/NIY(200) INPT0100
ISN 0011 COMMON/COM6/Y(200) INPT0110
ISN 0012 DIMENSION XNIY(200) INPT0120
ISN 0013 DIMENSION GTITLE(36),STITLE(36),XTITLE(3),YTITLE(10),XLABIN(18), INPT0130
1 TITLE(13),VX(200),VY(200),SDY(200),VY1(200),SDY1(200) INPT0140
C TITLE = TITLE SUCH AS MATERIAL,ETC INPT0150
C TITLE(17&18) = DATE XX/XX/XX (COLUMNS 65 - 72) INPT0160
C NLAB = TOTAL NUMBER OF LABS INPT0170
C IF(NAUTO.EQ. 0) NAUTO = MINFO - 1 INPT0180
ISN 0014 IF(NAUTO.EQ. 0) NAUTO = MINFO - 1 INPT0190
C XMNYR(I) = ITH MONTH AND YEAR OF VALUE INPT0200
C NIY(I) = NUMBER OF INDIVIDUAL OBSERVATIONS IN ITH MONTH INPT0210
C Y(I) = MEAN OF ITH MONTH INPT0220
C RMEAN(I) = RUNNING MEAN THRU ITH MONTH INPT0230
C RMS(I) = RUNNING TOTAL MS THRU ITH MONTH INPT0240
C IF(MINFO.LT. 2) GO TO 20 INPT0250
ISN 0016 ***** INPT0260
C CUMULATE THREE MONTH MOVING MEAN AND STANDARD DEVIATION INPT0270
C THEN PASSED TO CORR INPT0280
C DO 50 I = 1,MINFO INPT0290
ISN 0018 XNIY(I) = NIY(I) INPT0300
ISN 0019 SQR(I) = DSQRT(RMS(I)) INPT0310
ISN 0020 J = 1 INPT0320
ISN 0021 K = 0 INPT0330
ISN 0022 90 CONTINUE INPT0340
ISN 0023 N1 = J INPT0350
ISN 0024 N2 = N1 + 2 INPT0360
ISN 0025 IF(N2.GT. MINFO) GO TO 99 INPT0370
ISN 0026 SUM1 = 0.0 INPT0380
ISN 0027 SUM2 = 0.0 INPT0390
ISN 0028 DO 91 I = N1,N2 INPT0400
ISN 0029 SUM1 = SUM1 + (XNIY(I) * Y(I)) INPT0410
ISN 0030 SUM2 = SUM2 + XNIY(I) INPT0420
ISN 0031 J = I - 1 INPT0430
ISN 0032 91 CONTINUE INPT0440
ISN 0033 K = K + 1 INPT0450
ISN 0034 XMOVE(K) = SUM1 / SUM2 INPT0460
ISN 0035 MOVE = K INPT0470
ISN 0036 GO TO 90 INPT0480
ISN 0037 99 CONTINUE INPT0490
ISN 0038 ***** INPT0500
ISN 0039 C INPT0510
C INPT0520
C INPT0530
C INPT0540

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C          CALL CORRELATION ROUTINES
C
ISN 0040      CALL CORR
C
C          CALL TREND TEST
C
ISN 0041      CALL TREND
C
C          SET INPUT FOR PLOTS
C
ISN 0042      DO 30 I = 1,18
ISN 0043          GTITLE(I) = XLABIN(I)
ISN 0044          STITLE(I) = XLABIN(I)
ISN 0045      30 CONTINUE
ISN 0046      20 DO 40 I = 1,MINFO
ISN 0047          VX(I) = XMNYR(I)
ISN 0048          VY(I) = Y(I)
ISN 0049          V*1(I) = RMEAN(I)
ISN 0050          SOY(I) = DSQRT(RMS(I))
ISN 0051          SOY1(I) = SOY(I)
ISN 0052      40 CONTINUE
ISN 0053          GU=GUP
ISN 0054          XLCW=XLOWR
ISN 0055          UPF=UPPER
C
C          CALL PLOT PACKAGES
C
ISN 0056      IF(ICHECK.EQ.0)GO TO 400
ISN 0058      CALL GRAPH(VX,VY,VY1,MINFO,
ISN 0059          1 XTITLE,12,YTITLE,40,GTITLE,UPP,XLOW,1,18OUND)
ISN 0059      CALL GRAPH1(VX,SOY,SOY1,MINFO,
ISN 0060          1 XTITLE,12,YTITLE,40,STITLE,1,GU,IG)
ISN 0060      400 CONTINUE
ISN 0061      RETURN
ISN 0062      END

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INPT0550
INPT0560
INPT0570
INPT0580
INPT0590
INPT0600
INPT0610
INPT0620
INPT0630
INPT0640
INPT0650
INPT0660
INPT0670
INPT0680
INPT0690
INPT0700
INPT0710
INPT0720
INPT0730
INPT0740
INPT0750
INPT0760
INPT0770
INPT0780
INPT0790
INPT0800
INPT0810
INPT0820
INPT0830
INPT0840
INPT0850
INPT0860
INPT0870
INPT0880
INPT0890

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LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.39.06

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XREF

ISN 0002	SUBROUTINE CORR	CORR0010
ISN 0003	IMPLICIT REAL*8(A-H,O-Z)	CORR0020
ISN 0004	COMMON/COM6/ Y(200),PY(50),YAV,YVAR,YSTD,XNY,SUM,RQ(100)	CORR0030
ISN 0005	COMMON/COM1/NY,NAUTO,IB(100)	CORR0040
ISN 0006	COMMON/COM3/XMOVE(100),SQR(200)	CORR0050
ISN 0007	COMMON/COM4/MOVE	CORR0060
ISN 0008	COMMON/COM5/NIY(200)	CORR0070
ISN 0009	DO 50 I=1,100	CORR0080
ISN 0010	50 IB(I)=I-1	CORR0090
ISN 0011	CALL YAUTO	CORR0100
ISN 0012	WRITE(6,13)	CORR0110
ISN 0013	13 FORMAT(1H-,6HAUTOS-)	CORR0120
ISN 0014	WRITE(6,30)(K,PY(K),K=1,NAUTO)	CORR0130
ISN 0015	30 FORMAT(1H ,12,F7.3,15,F7.3,15,F7.3,15,F7.3,15,F7.3,15, 1F7.3,15,F7.3,15,F7.3,15,F7.3)	CORR0140
ISN 0016	CALL VARY	CORR0150
ISN 0017	RETURN	CORR0160
ISN 0018	END	CORR0170
		CORR0180

LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.39.19

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XREF

ISN 0002	SUBROUTINE YAUTO	AUTO0010
ISN 0003	IMPLICIT REAL*8(A-H,O-Z)	AUTO0020
ISN 0004	COMMON/COM6/ Y(200),PY(50),YAV,YVAR,YSTD,XNY,SUM,RQ(100)	AUTO0030
ISN 0005	COMMON/COM1/NY,NAUTO,IB(100)	AUTO0040
ISN 0006	SUM=0.0	AUTO0050
ISN 0007	DO 11 I=1,NY	AUTO0060
ISN 0008	11 SUM=SUM+Y(I)	AUTO0070
ISN 0009	XNY=NY	AUTO0080
ISN 0010	YAV=SUM/XNY	AUTO0090
ISN 0011	NAT=NAUTO+1	AUTO0100
ISN 0012	DO 12 K=1,NAT	AUTO0110
ISN 0013	PY(K)=0.0	AUTO0120
ISN 0014	KL=K-1	AUTO0130
ISN 0015	MY=NY-KL	AUTO0140
ISN 0016	DO 13 I=1,MY	AUTO0150
ISN 0017	I2=I+KL	AUTO0160
ISN 0018	13 PY(K)=PY(K)+(Y(I)-YAV)*(Y(I2)-YAV)	AUTO0170
ISN 0019	12 CONTINUE	AUTO0180
	C PY(1)=UN-NORMALIZED VARIANCE	AUTO0190
ISN 0020	YVAR=PY(1)/XNY	AUTO0200
ISN 0021	YZAR=PY(1)	AUTO0210
ISN 0022	YSTD=DSQRT(YVAR)	AUTO0220
	C NORMALIZATION TO CORRELATION COEFFICIENTS	AUTO0230
ISN 0023	DO 14 K=1,NAUTO	AUTO0240
ISN 0024	14 PY(K)=PY(K+1)/YZAR	AUTO0250
ISN 0025	RETURN	AUTO0260
ISN 0026	END	AUTO0270

LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.39.24

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XDEF

ISN 0002	SUBROUTINE VARY	VARY0010
ISN 0003	IMPLICIT REAL*8(A-H,O-Z)	VARY0020
ISN 0004	COMMON/COM6/ Y(200),PY(50),YAV,YVAR,YSTD,XNY,SUM,RQ(100)	VARY0030
ISN 0005	COMMON/B88/STD(100)	VARY0040
ISN 0006	COMMON/COM1/NY,NAUTO,IB(100)	VARY0050
ISN 0007	RQ(1)=1.00	VARY0060
ISN 0008	DO 1 IQ=2,NAUTO	VARY0070
ISN 0009	1 RQ(IQ)=RQ(IQ-1)+2.00*PY(IQ-1)*PY(IQ-1)	VARY0080
ISN 0010	DO 2 IQ=1,NAUTO	VARY0090
ISN 0011	2 RQ(IQ)=DSQRT(RQ(IQ)/XNY)	VARY0100
ISN 0012	WRITE(6,3)	VARY0110
ISN 0013	3 FORMAT(1H0/1H0	VARY0120
	1 50HSTANDARD DEVIATIONS FOR THE PREVIOUS CORRELATIONS.1	VARY0130
ISN 0014	WRITE(6,4)	VARY0140
ISN 0015	4 FORMAT(1H-,9HY SERIES-1	VARY0150
ISN 0016	WRITE(6,5)(IB(K),RQ(K),K=1,NAUTO)	VARY0160
ISN 0017	5 FORMAT(1H ,12,F7.3,15,F7.3,15,F7.3,15,F7.3,15,F7.3,15,F7.3,	VARY0170
	115,F7.3,15,F7.3,15,F7.3,15,F7.3)	VARY0180
ISN 0018	RETURN	VARY0190
ISN 0019	END	VARY0200

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XREF

ISN 0002		SUBROUTINE TREND	TREN0010
	C		TREN0020
	C	TREND TEST	TREN0030
	C	HO NO TREND	TREN0040
	C	HA TREND EXISTS	TREN0050
	C		TREN0060
ISN 0003		IMPLICIT REAL*8(A-H,O-Z)	TREN0070
ISN 0004		REAL*4 STARNA,STARNT,CONC4	TREN0071
ISN 0005		COMMON/STARD/STARNA,STARNT,CONC4	TREN0072
ISN 0006		COMMON/COM6/A(200)	TREN0080
ISN 0007		COMMON/COM1/N,NAUTO,IB(100)	TREN0090
ISN 0008		DIMENSION XIR(200),R(200),DIFF(200)	TREN0100
ISN 0009		DIMENSION IR(200),NUM(200)	TREN0110
ISN 0010		DIMENSION IRTEMP(200)	TREN0120
	C		TREN0130
	C	RANK DATA	TREN0140
	C		TREN0150
ISN 0011		CALL SORT(A,IRTEMP,N)	TREN0160
ISN 0012		DO 3 I = 1,N	TREN0170
ISN 0013		K = IRTEMP(I)	TREN0180
ISN 0014		IR(K) = I	TREN0190
ISN 0015	3	CONTINUE	TREN0200
	C		TREN0210
	C	CHECK FOR TIES	TREN0220
	C		TREN0230
ISN 0016		DO 33 ISET = 1,N	TREN0240
ISN 0017	33	XIR(ISET) = 0.0	TREN0250
ISN 0018		DO 400 I = 1,N	TREN0260
ISN 0019		IF(XIR(I) .NE. 0.0) GO TO 400	TREN0270
ISN 0021		NSUM = 0	TREN0280
ISN 0022		NCT = 1	TREN0290
ISN 0023		K = 0	TREN0300
ISN 0024		DO 200 J = 1,N	TREN0310
ISN 0025		IF(A(I) .EQ. A(J)) GO TO 300	TREN0320
ISN 0027		GO TO 200	TREN0330
ISN 0028	300	CONTINUE	TREN0340
ISN 0029		IF(I .GE. J) GO TO 200	TREN0350
ISN 0031		NCT = NCT + 1	TREN0360
ISN 0032		K = K + 1	TREN0370
ISN 0033		IF(NCT .EQ. 2) GO TO 201	TREN0380
ISN 0035		IF(NCT .NE. 2) GO TO 202	TREN0390
ISN 0037	201	NSUM = IR(I) + IR(J)	TREN0400
ISN 0038		NUM(K) = I	TREN0410
ISN 0039		NUM(K+1) = J	TREN0420
ISN 0040		K = K + 1	TREN0430
ISN 0041		GO TO 200	TREN0440
ISN 0042	202	NSUM = NSUM + IR(J)	TREN0450
ISN 0043		NUM(K) = J	TREN0460
ISN 0044	200	CONTINUE	TREN0470
ISN 0045		IF(NCT .EQ. 1) GO TO 600	TREN0480
ISN 0047		SUM = NSUM	TREN0490
ISN 0048		DIV = NCT	TREN0500
ISN 0049		AVE = SUM / DIV	TREN0510
ISN 0050		DO 500 II = 1,K	TREN0520

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ISN 0051      NK = NUM(I1)
ISN 0052      XIR(NK) = AVE
ISN 0053      500 CONTINUE
ISN 0054      GO TO 400
ISN 0055      600 XIR(I) = IR(I)
ISN 0056      400 CONTINUE
ISN 0057      DO 67 I = 1,N
ISN 0058      RII = I
ISN 0059      67 CONTINUE

C
C      CALCULATE TREND TEST STATISTIC
C
ISN 0060      TOTAL = 0.0
ISN 0061      DO 40 I = 1,N
ISN 0062      DIFF(I) = XIR(I) - RII
ISN 0063      TOTAL = TOTAL + (DIFF(I) * DIFF(I))
ISN 0064      40 CONTINUE
ISN 0065      TN = N
ISN 0066      RHO = 1.0 - ((6.0 * TOTAL) / (TN * ((TN * TN) - 1.0)))
ISN 0067      WRITE(6,23)
ISN 0068      23 FORMAT(1H0,/,/,T5,'RESULTS OF TREND TEST FOLLOW')
ISN 0069      CALL TABLE(N,RHO,WW,CONC)
ISN 0070      CONC4=CONC
ISN 0071      WRITE(6,640) RHO,CONC,TOTAL
ISN 0072      640 FORMAT(1H0,T10,'RHO = ',F10.4,A4,T40,'T = ',F10.2)

C
C      GO FETCH TABLED VALUE
C
ISN 0073      IF(N .LE. 4) GO TO 645
ISN 0075      CALL TABLE(N,0.0,WW5,CONC)
ISN 0076      IF(N .LE. 5) GO TO 648
ISN 0078      CALL TABLE1(N,0.0,WW1,CONC)
ISN 0079      WRITE(6,647)WW5,WW1
ISN 0080      647 FORMAT(1H0,T10,'TABLED VALUE(0.05) = ',F10.4,5X,'TABLED VALUE(C.OTREN0840
ISN 0081      11) = ',F10.4)
ISN 0082      RETURN
ISN 0083      648 WRITE(6,649)WW5
ISN 0084      649 FORMAT(1H0,T10,'TABLED VALUE(0.05) = ',F10.4,5X,'SAMPLE SIZE TOO TREN0880
ISN 0085      1SMALL FOR (0.01) TABLED VALUE')
ISN 0086      RETURN
ISN 0087      645 WRITE(6,644)
ISN 0088      644 FORMAT(1H0,T10,'SAMPLE SIZE TOO SMALL FOR TABLED VALUES')
ISN 0089      RETURN
ISN 0090      END
ISN 0091
ISN 0092
ISN 0093
ISN 0094

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LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.39.36

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOIO,XREF

ISN 0302		SUBROUTINE SORT(A,IRTEMP,N)	SORT0010
ISN 0303		DOUBLE PRECISION A(N)	SORT0020
ISN 0004		DIMENSION IRTEMP(N)	SORT0030
ISN 0005		DO 20 I = 1,N	SORT0040
ISN 0006		IRTEMP(I) = I	SORT0050
ISN 0007		L = I - 1	SORT0060
ISN 0008	10	IF(L.EQ. 0) GO TO 20	SORT0070
ISN 0010		K = IRTEMP(L)	SORT0080
ISN 0011		IF(A(I) .GE. A(K)) GO TO 20	SORT0090
ISN 0013		IRTEMP(L + 1) = K	SORT0100
ISN 0014		IRTEMP(L) = I	SORT0110
ISN 0015		L = L - 1	SORT0120
ISN 0016		GO TO 10	SORT0130
ISN 0017	20	CONTINUE	SORT0140
ISN 0018		RETURN	SORT0150
ISN 0019		END	SORT0160

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XREF

ISN 0002	SJBROTIME TABLE(N,RHO,WW,CONC)	TBLE0010
ISN 0003	IMPLICIT REAL*8(W,R,X)	TBLE0020
ISN 0004	DIMENSION W(30)	TBLE0030
ISN 0005	DATA CONC1,CONC2/' ' ' ' /*	TBLE0040
ISN 0006	CONC = CONC1	TBLE0050
ISN 0007	W(1) = 2.0	TBLE0060
ISN 0008	W(2) = 2.0	TBLE0070
ISN 0009	W(3) = 2.0	TBLE0080
ISN 0010	W(4) = 2.0	TBLE0090
ISN 0011	W(5) = 0.9000	TBLE0100
ISN 0012	W(6) = 0.8286	TBLE0110
ISN 0013	W(7) = 0.7450	TBLE0120
ISN 0014	W(8) = 0.7143	TBLE0130
ISN 0015	W(9) = 0.6833	TBLE0140
ISN 0016	W(10) = 0.6364	TBLE0150
ISN 0017	W(11) = 0.6091	TBLE0160
ISN 0018	W(12) = 0.5804	TBLE0170
ISN 0019	W(13) = 0.5549	TBLE0180
ISN 0020	W(14) = 0.5341	TBLE0190
ISN 0021	W(15) = 0.5179	TBLE0200
ISN 0022	W(16) = 0.5000	TBLE0210
ISN 0023	W(17) = 0.4853	TBLE0220
ISN 0024	W(18) = 0.4716	TBLE0230
ISN 0025	W(19) = 0.4579	TBLE0240
ISN 0026	W(20) = 0.4451	TBLE0250
ISN 0027	W(21) = 0.4351	TBLE0260
ISN 0028	W(22) = 0.4241	TBLE0270
ISN 0029	W(23) = 0.4150	TBLE0280
ISN 0030	W(24) = 0.4061	TBLE0290
ISN 0031	W(25) = 0.3977	TBLE0300
ISN 0032	W(26) = 0.3894	TBLE0310
ISN 0033	W(27) = 0.3822	TBLE0320
ISN 0034	W(28) = 0.3749	TBLE0330
ISN 0035	W(29) = 0.3685	TBLE0340
ISN 0036	W(30) = 0.3620	TBLE0350
ISN 0037	IF(N.GT. 30) GO TO 10	TBLE0360
ISN 0039	WW = WIN)	TBLE0370
ISN 0040	IF((DABS(RHO) - WW) .GE. -1.0D-06) CONC=CONC2	TBLE0380
ISN 0042	IF(N.LE. 5) RETURN	TBLE0391
ISN 0044	IF(CONC.EQ. CONC2) CALL TABLE1(N,RHO,WW,CONC)	TBLE0392
ISN 0046	RETURN	TBLE0400
ISN 0047	10 CONTINUE	TBLE0410
ISN 0048	XXN = N	TBLE0420
ISN 0049	XXN = XXN - 1.0	TBLE0430
ISN 0050	XXN = DSORT(XXN)	TBLE0440
ISN 0051	WW = 1.96 / XXXN	TBLE0450
ISN 0052	IF((DABS(RHO) - WW) .GE. -1.0D-06) CONC=CONC2	TBLE0460
ISN 0054	IF(CONC.EQ. CONC2) CALL TABLE1(N,RHO,WW,CONC)	TBLE0471
ISN 0056	RETURN	TBLE0480
ISN 0057	END	TBLE0490

LEVEL 21.8 (JUN 74)

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DATE 76.124/16.39.48

COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XDEF

ISN 0002	SUBROUTINE TABLE1(N,RHO,WW,CONC)	TABL0010
ISN 0003	IMPLICIT REAL*8(W,R,X)	TABL0020
ISN 0004	DIMENSION W(30)	TABL0030
ISN 0005	DATA CONC2,CONC3/' **,' **'/	TABL0040
ISN 0006	CONC = CONC2	TABL0050
ISN 0007	W(6) = 0.9429	TABL0060
ISN 0008	W(7) = 0.8929	TABL0070
ISN 0009	W(8) = 0.8571	TABL0080
ISN 0010	W(9) = 0.8167	TABL0090
ISN 0011	W(10) = 0.7818	TABL0100
ISN 0012	W(11) = 0.7455	TABL0110
ISN 0013	W(12) = 0.7273	TABL0120
ISN 0014	W(13) = 0.6978	TABL0130
ISN 0015	W(14) = 0.6747	TABL0140
ISN 0016	W(15) = 0.6536	TABL0150
ISN 0017	W(16) = 0.6324	TABL0160
ISN 0018	W(17) = 0.6152	TABL0170
ISN 0019	W(18) = 0.5975	TABL0180
ISN 0020	W(19) = 0.5825	TABL0190
ISN 0021	W(20) = 0.5684	TABL0200
ISN 0022	W(21) = 0.5545	TABL0210
ISN 0023	W(22) = 0.5426	TABL0220
ISN 0024	W(23) = 0.5306	TABL0230
ISN 0025	W(24) = 0.5200	TABL0240
ISN 0026	W(25) = 0.5100	TABL0250
ISN 0027	W(26) = 0.5002	TABL0260
ISN 0028	W(27) = 0.4915	TABL0270
ISN 0029	W(28) = 0.4828	TABL0280
ISN 0030	W(29) = 0.4744	TABL0290
ISN 0031	W(30) = 0.4665	TABL0300
ISN 0032	IF(N .GT. 30) GO TO 10	TABL0310
ISN 0034	WW = W(N)	TABL0320
ISN 0035	IF((DABS(RHO) - WW) .GE. -1.00-06) CONC=CONC3	TABL0330
ISN 0037	RETURN	TABL0350
ISN 0038	10 CONTINUE	TABL0360
ISN 0039	XN = N	TABL0370
ISN 0040	XXN = XN - 1.0	TABL0380
ISN 0041	XXXN = DSQRT(XXN)	TABL0390
ISN 0042	WW = 2.58 / XXXN	TABL0400
ISN 0043	IF((DABS(RHO) - WW) .GE. -1.00-06) CONC=CONC3	TABL0410
ISN 0045	RETURN	TABL0430
ISN 0046	END	TABL0440

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COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0300K,
SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XREF
ISN 0002      SUBROUTINE GRAPH(X,Y,U,N,XTL,NXTL,YTL,NYTL,TTL,XSUP,XINF,IFL,IBDD)PLTM0010
C
C      SUBROUTINE FOR PLOTTING MEANS AND
C      CUMULATIVE MEANS WITH ERROR BOUNDS
C
ISN 0003      DIMENSION X(200),Y(200),U(200),XTL(3),YTL(10),TTL(36),SYM(2)
ISN 0004      DATA SYM/1HX,1H*/
C      PLOT = NO PLOT
C
ISN 0005      IF(N.LE.1) GO TO 1
ISN 0007      GO TO 2
ISN 0008      1 CONTINUE
ISN 0009      WRITE(3)
ISN 0010      3 FORMAT(1H1,////,T5,' P L O T   =   N O   P L O T   ')
ISN 0011      RETURN
ISN 0012      2 CONTINUE
C
C      X = POINT
C      * = RUNNING POINT
C
C      IFL = 0 X ARE INTEGERS
C      = 1 X ARE ALPHABETIC
C
ISN 0013      YMAX = Y(1)
ISN 0014      YMIN = Y(1)
ISN 0015      DO 50 I=1,N
ISN 0016      IF(Y(I).GE.YMIN) GO TO 15
ISN 0018      YMIN = Y(I)
ISN 0019      15 IF(U(I).GE.YMIN) GO TO 20
ISN 0021      YMIN = U(I)
ISN 0022      20 IF(Y(I).LE.YMAX) GO TO 25
ISN 0024      YMAX = Y(I)
ISN 0025      25 IF(U(I).LE.YMAX) GO TO 50
ISN 0027      YMAX = U(I)
ISN 0028      50 CONTINUE
ISN 0029      IF(1BDD.EQ.0)GO TO 52
ISN 0031      IF(YMAX.LT.XSUP)YMAX=XSUP
ISN 0033      IF(YMIN.GT.XINF)YMIN=XINF
ISN 0035      52 CONTINUE
ISN 0036      IF(YMIN.GE.0.0) GO TO 60
ISN 0038      IF(YMAX.GE.0.0) GO TO 55
ISN 0040      DY = ABS(YMIN) / 3.5
ISN 0041      GO TO 65
ISN 0042      55 DY = (YMAX - YMIN) / 3.5
ISN 0043      GO TO 65
ISN 0044      60 DY = YMAX / 3.5
ISN 0045      65 CONTINUE
ISN 0046      DO 100 I=1,N
ISN 0047      Y(I) = Y(I) / DY
ISN 0048      U(I) = U(I) / DY
ISN 0049      100 CONTINUE
C

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PLTM0020
 PLTM0030
 PLTM0040
 PLTM0050
 PLTM0060
 PLTM0070
 PLTM0080
 PLTM0090
 PLTM0100
 PLTM0110
 PLTM0120
 PLTM0130
 PLTM0140
 PLTM0150
 PLTM0160
 PLTM0170
 PLTM0180
 PLTM0190
 PLTM0200
 PLTM0210
 PLTM0220
 PLTM0230
 PLTM0240
 PLTM0250
 PLTM0260
 PLTM0270
 PLTM0280
 PLTM0290
 PLTM0300
 PLTM0310
 PLTM0320
 PLTM0330
 PLTM0340
 PLTM0350
 PLTM0360
 PLTM0370
 PLTM0380
 PLTM0390
 PLTM0400
 PLTM0410
 PLTM0420
 PLTM0430
 PLTM0440
 PLTM0450
 PLTM0460
 PLTM0470
 PLTM0480
 PLTM0490
 PLTM0500
 PLTM0510
 PLTM0520
 PLTM0530
 PLTM0540

ISN 0050	C	PLOTTING SECTION	PLTM0550
ISN 0051	C	CALL PLOTS(15.0,-11.0,-3)	PLTM0560
ISN 0052		CALL PLOT(0.0,5.5,-3)	PLTM0570
ISN 0053		XST=-3.5*DY	PLTM0580
ISN 0054		CALL AXIS(0.0,-3.5,YTL,NYTL,7.0,90.0,XST,DY,2)	PLTM0590
ISN 0055		CALL PLOT(0.0,3.5,3)	PLTM0600
ISN 0056		CALL PLOT(0.0,4.25,2)	PLTM0610
ISN 0057		CALL PLOT(11.0,4.25,2)	PLTM0620
ISN 0058		CALL PLOT(8.0,4.25,3)	PLTM0630
ISN 0059		CALL PLOT(8.0,3.5,2)	PLTM0640
ISN 0060		CALL PLOT(11.0,3.5,2)	PLTM0650
ISN 0061		CALL PLOT(11.0,4.25,3)	PLTM0660
ISN 0062		CALL PLOT(11.0,-4.25,2)	PLTM0670
ISN 0063		CALL PLOT(0.0,-4.25,2)	PLTM0680
ISN 0064		CALL PLOT(0.0,-3.5,2)	PLTM0690
ISN 0065		CALL PLOT(0.0,0.0,3)	PLTM0700
ISN 0066		CALL PLOT(11.0,0.0,2)	PLTM0710
ISN 0067		XN1 = N - 1	PLTM0720
ISN 0068		N2 = N - 2	PLTM0730
ISN 0069		SPACE = 11.0 / (XN1 + 1.0)	PLTM0740
ISN 0070		X1 = SPACE / 2.0	PLTM0750
ISN 0071		Y1 = 0.0	PLTM0760
ISN 0072		DO 150 I=1,N2	PLTM0770
ISN 0073		CALL PLOT(X1,Y1,3)	PLTM0780
ISN 0074		CALL PLOT(X1,Y1-0.1,2)	PLTM0790
ISN 0075		X1 = X1 + SPACE	PLTM0800
ISN 0076	150	CONTINUE	PLTM0810
ISN 0077		X1 = SPACE / 2.0	PLTM0820
ISN 0078		Y1 = -4.25	PLTM0830
ISN 0079		DO 170 I=1,N	PLTM0840
ISN 0080		CALL PLOT(X1,Y1,3)	PLTM0850
ISN 0081		CALL PLOT(X1,Y1-0.1,2)	PLTM0860
ISN 0082		IF(1FL.EQ.0) GO TO 155	PLTM0870
ISN 0083		Y2 = Y1 - 0.5	PLTM0880
ISN 0084		CALL SYMBL4(X1,Y2,0.07,X(1),90.0,4)	PLTM0890
ISN 0085		GO TO 160	PLTM0900
ISN 0086	155	Y2 = Y1 - 0.2	PLTM0910
ISN 0087		CALL NUMBER(X1,Y2,0.07,X(1),0.0,-1)	PLTM0920
ISN 0088	160	X1 = X1 + SPACE	PLTM0930
ISN 0089	170	CONTINUE	PLTM0940
ISN 0090		CALL SYMBL4(5.0,-5.2,0.14,XTL,0.0,NXTL)	PLTM0950
ISN 0091		X1 = SPACE / 2.0	PLTM0960
ISN 0092		DO 200 I=1,N	PLTM0970
ISN 0093		CALL SYMBL4(X1,Y(I),0.14,SYM(1),0.0,1)	PLTM0980
ISN 0094		X1 = X1 + SPACE	PLTM0990
ISN 0095	200	CONTINUE	PLTM1000
ISN 0096		X1 = SPACE / 2.0	PLTM1010
ISN 0097		DO 210 I=1,N	PLTM1020
ISN 0098		CALL SYMBL4(X1,U(I),0.14,SYM(2),0.0,1)	PLTM1030
ISN 0099		X1 = X1 + SPACE	PLTM1040
ISN 0100	210	CONTINUE	PLTM1050
ISN 0101		IF(1BOD.EQ.0) GO TO 220	PLTM1060
ISN 0102		XINF = XINF / DY	PLTM1070
ISN 0103		XSUP = XSUP / DY	PLTM1080
ISN 0104		IF(XINF.LE.-4.25) GO TO 218	PLTM1090
ISN 0105			PLTM1100

ISN 0107 CALL PLOT(0.0,XINF,3)
ISN 0108 CALL PLOT(11.0,XINF,2)
ISN 0109 218 CONTINUE
ISN 0110 IF(XSLP.GE.4.25) GO TO 220
ISN 0112 CALL PLOT(11.0,XSUP,3)
ISN 0113 CALL PLOT(0.0,XSUP,2)
ISN 0114 220 CONTINUE
ISN 0115 CALL SYMBL4(8.7,4.12,0.07,TTL(1),0.0,24)
ISN 0116 CALL SYMBL4(8.7,3.99,0.07,TTL(7),0.0,24)
ISN 0117 CALL SYMBL4(8.7,3.86,0.07,TTL(13),0.0,24)
ISN 0118 CALL SYMBL4(8.06,3.73,0.07,TTL(19),0.0,36)
ISN 0119 CALL SYMBL4(8.06,3.60,0.07,TTL(28),0.0,36)
ISN 0120 RETURN
ISN 0121 END

PLTM1110
PLTM1120
PLTM1130
PLTM1140
PLTM1150
PLTM1160
PLTM1170
PLTM1180
PLTM1190
PLTM1200
PLTM1210
PLTM1220
PLTM1230
PLTM1240

LEVEL 21.8 (JUN 74)

OS/360 FORTRAN H

DATE 76.124/16.39.58

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      COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
      SOURCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XREF
ISN 0002      SUBROUTINE GRAPH1(X,Y,U,N,XTL,NXTL,YTL,NYTL,TTL,TFL,XSUP,IBOD)
C
C      SUBROUTINE FOR PLOTTING STANDARD DEVIATIONS AND
C      CUMULATIVE STANDARD DEVIATIONS
C
ISN 0003      DIMENSION X(200),Y(200),U(200),XTL(3),YTL(10),TTL(36),SYM(2)
ISN 0004      DATA SYM/1HX,1H./
C
C      X = POINT
C
C      . = RUNNING POINT
C
C      IFL = 0  X ARE INTEGERS
C
C      = 1  X ARE ALPHABETIC
C
C      PLOT = NOPLOT
C
ISN 0005      IF(N .GE. 2) GO TO 2
ISN 0007      WRITE(6,3)
ISN 0008      3. FORMAT(1H1,/////,4X,25H P L O T = N O P L O T )
ISN 0009      RETURN
ISN 0010      2 YMAX = Y(1)
ISN 0011      YMIN = Y(1)
ISN 0012      DO 50 I=1,N
ISN 0013      IF(Y(I) .GE. YMIN) GO TO 15
ISN 0015      YMIN = Y(I)
ISN 0016      15 IF(U(I) .GE. YMIN) GO TO 20
ISN 0018      YMIN = U(I)
ISN 0019      20 IF(Y(I) .LE. YMAX) GO TO 25
ISN 0021      YMAX = Y(I)
ISN 0022      25 IF(U(I) .LE. YMAX) GO TO 50
ISN 0024      YMAX = U(I)
ISN 0025      50 CONTINUE
ISN 0026      IF(1BOD.EQ.0)GO TO 52
ISN 0028      IF(YMAX.LT.XSUP)YMAX=XSUP
ISN 0030      52 CONTINUE
ISN 0031      IF(YMIN .GE. 0.0) GO TO 60
ISN 0033      IF(YMAX .GE. 0.0) GO TO 55
ISN 0035      DY = ABS(YMIN) / 7.0
ISN 0036      GO TO 65
ISN 0037      55 DY = (YMAX - YMIN) / 7.0
ISN 0038      GO TO 65
ISN 0039      60 DY = YMAX / 7.0
ISN 0040      65 CONTINUE
ISN 0041      DO 100 I=1,N
ISN 0042      Y(I) = Y(I) / DY
ISN 0043      U(I) = U(I) / DY
ISN 0044      100 CONTINUE
C
C      PLOTTING SECTION
C
ISN 0045      CALL PLCTS(15.0,-11.0,-3)

```

PLTS0010
 PLTS0020
 PLTS0030
 PLTS0040
 PLTS0050
 PLTS0060
 PLTS0070
 PLTS0080
 PLTS0090
 PLTS0100
 PLTS0110
 PLTS0120
 PLTS0130
 PLTS0140
 PLTS0150
 PLTS0160
 PLTS0170
 PLTS0180
 PLTS0190
 PLTS0200
 PLTS0210
 PLTS0220
 PLTS0230
 PLTS0240
 PLTS0250
 PLTS0260
 PLTS0270
 PLTS0280
 PLTS0290
 PLTS0300
 PLTS0310
 PLTS0320
 PLTS0330
 PLTS0340
 PLTS0350
 PLTS0360
 PLTS0370
 PLTS0380
 PLTS0390
 PLTS0400
 PLTS0410
 PLTS0420
 PLTS0430
 PLTS0440
 PLTS0450
 PLTS0460
 PLTS0470
 PLTS0480
 PLTS0490
 PLTS0500
 PLTS0510
 PLTS0520
 PLTS0530
 PLTS0540

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ISN 0046      CALL PLOT(0.0,2.0,-3)
ISN 0047      CALL AXIS(0.0,0.0,YTL,NYTL,7.0,90.0,0.0,DY,2)
ISN 0048      CALL PLOT(0.0,7.0,3)
ISN 0049      CALL PLOT(0.0,7.75,2)
ISN 0050      CALL PLOT(11.0,7.75,2)
ISN 0051      CALL PLOT(8.0,7.75,3)
ISN 0052      CALL PLOT(8.0,7.0,2)
ISN 0053      CALL PLOT(11.0,7.0,2)
ISN 0054      CALL PLOT(11.0,7.75,3)
ISN 0055      CALL PLOT(11.0,-0.75,2)
ISN 0056      CALL PLOT(0.0,-0.75,2)
ISN 0057      CALL PLOT(0.0,0.0,2)
ISN 0058      XN1 = N - 1
ISN 0059      N2 = N - 2
ISN 0060      SPACE = 11.0 / (XN1 + 1.0)
ISN 0061      X1 = SPACE / 2.0
ISN 0062      Y1 = -0.75
ISN 0063      DO 170 I=1,N
ISN 0064      CALL PLOT(X1,Y1,3)
ISN 0065      CALL PLOT(X1,Y1-0.1,2)
ISN 0066      IF(IFL .EQ. 0) GO TO 155
ISN 0068      Y2 = Y1 - 0.5
ISN 0069      CALL SYMBL4(X1,Y2,C.07,X(1),90.0,4)
ISN 0070      GO TO 160
ISN 0071      155 Y2 = Y1 - 0.2
ISN 0072      CALL NUMBER(X1,Y2,C.07,X(1),0.0,-1)
ISN 0073      160 X1 = X1 + SPACE
ISN 0074      170 CONTINUE
ISN 0075      CALL SYMBL4(5.0,-1.7,0.14,XTL,0.0,NXTL)
ISN 0076      X1 = SPACE / 2.0
ISN 0077      DO 200 I=1,N
ISN 0078      CALL SYMBL4(X1,Y(I),0.14,SYM(1),0.0,1)
ISN 0079      X1 = X1 + SPACE
ISN 0080      200 CONTINUE
ISN 0081      X1 = SPACE / 2.0
ISN 0082      DO 210 I=1,N
ISN 0083      CALL SYMBL4(X1,U(I),0.07,SYM(2),0.0,1)
ISN 0084      X1 = X1 + SPACE
ISN 0085      210 CONTINUE
ISN 0086      IF(180D .EQ. 0) GO TO 220
ISN 0088      XSUP = XSUP / DY
ISN 0089      IF(XSUP.GE.7.75) GO TO 220
ISN 0091      CALL PLOT(0.0,XSUP,3)
ISN 0092      CALL PLOT(11.0,XSUP,2)
ISN 0093      220 CONTINUE
ISN 0094      CALL SYMBL4(8.7,7.62,C.07,TTL(1),0.0,24)
ISN 0095      CALL SYMBL4(8.7,7.49,C.07,TTL(7),0.0,24)
ISN 0096      CALL SYMBL4(8.7,7.36,C.07,TTL(13),0.0,24)
ISN 0097      CALL SYMBL4(8.06,7.23,C.07,TTL(19),0.0,36)
ISN 0098      CALL SYMBL4(8.06,7.10,C.07,TTL(28),0.0,36)
ISN 0099      RETURN
ISN 0100      END

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PLTS0550
PLTS0560
PLTS0570
PLTS0580
PLTS0590
PLTS0600
PLTS0610
PLTS0620
PLTS0630
PLTS0640
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PLTS0660
PLTS0670
PLTS0680
PLTS0690
PLTS0700
PLTS0710
PLTS0720
PLTS0730
PLTS0740
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PLTS0760
PLTS0770
PLTS0780
PLTS0790
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PLTS0960
PLTS0970
PLTS0980
PLTS0990
PLTS1000
PLTS1010
PLTS1020
PLTS1030
PLTS1040
PLTS1050
PLTS1060

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COMPILER OPTIONS - NAME= MAIN,OPT=00,LINECNT=58,SIZE=0000K,
                    SOUPCE,EBCDIC,NOLIST,NODECK,LOAD,MAP,NOEDIT,NOID,XPEF
ISN 0002      SUBROUTINE PUN2(TIME,MATTER,UNIT,REFVAL,IYR,MONTH,IL)      PUN20010
ISN 0003      DIMENSION VALNUL(2,4,5,3),A(40),B(40),C(40)                PUN20020
ISN 0004      EQUIVALENCE (A(1),VALNUL(1,1,1,1)),(B(1),VALNUL(1,1,1,2)), PUN20030
                    * (C(1),VALNUL(1,1,1,3))                             PUN20040
ISN 0005      DATA A / 66.3,21.85,.7217,.7127,86.278,86.2228,1.7793,1.7931, PUN20050
                    * 67.75,20.28,.7193,.7103,86.2993,86.2438,1.7563,1.7699, PUN20060
                    * 64.27,23.7,.7217,.7126,86.288,86.2317,1.7803,1.7941, PUN20070
                    * 70.43,17.65,.7254,.7163,86.4090,86.3540,1.6570,1.6698, PUN20080
                    * 66.80,21.17,.7262,.7171,86.4270,86.3710,1.6610,1.6738 / PUN20090
ISN 0006      DATA B/ C.0,87.16,0.0,0.0,81.726,81.653,2.571,2.59, PUN20100
                    * 0.0,86.86,0.0,0.0,86.204,86.148,1.705,1.718, PUN20110
                    * 0.0,87.42,0.0,0.0,85.823,85.766,1.677,1.69, PUN20120
                    * 0.0,87.626,0.0,0.0,93.9182,93.8930,.3072,.3069, PUN20130
                    * 8 * 0.0 / PUN20140
ISN 0007      DATA C/ 66.13,22.02,.7217,.7127,86.28,86.2238,1.7543,1.7679, PUN20150
                    * 67.78,20.36,.7217,.7126,86.2907,86.2313,1.745,1.7584, PUN20160
                    * 64.04,24.12,.722,.7129,86.2943,86.2387,1.7593,1.7729, PUN20170
                    * 16 * 0.0 / PUN20180
C THE 2ND PARAMETER OF VALNUL IS 1 FOR PERCENT ELEMENT (U OT PU) IN PUN20190
C SAMPLE; 2 FOR PERCENT U235 OUT OF TOTAL U IN SAMPLE; 3 FOR PERCENT OF PUN20195
C TOTAL PU IN SAMPLE THAT IS PU239, AND, SIMILARLY, 4 FOR PERCENT PU241. PUN20200
C THE 3RD PARAM. IS THE LOT NO., AND THE FOURTH INDICATES THE TYPE OF PUN20205
C MATERIAL (1 FOR MIXED OXIDES, 2 FOR PURE OXIDES, AND 3 FOR PELLETS). PUN20206
ISN 0008      DATA WT/'W'/ PUN20210
ISN 0009      MAT = MATTER - 14 PUN20220
ISN 0010      IMAT = 1 PUN20230
ISN 0011      IF(MAT .LE. 8 .AND. MAT .GE. 6) IMAT = 2 PUN20240
ISN 0013      IF(MAT .LE. 13 .AND. MAT .GE. 9) IMAT = 3 PUN20250
ISN 0015      MTIME = IYR * 100 + MONTH PUN20260
ISN 0016      ITIME = 3 PUN20270
ISN 0017      IF(MTIME .GE. 309 .AND. MTIME .LE. 402) ITIME = 2 PUN20280
ISN 0019      IF(IMAT .EQ. 2 .AND. MTIME .EQ. 309) ITIME = 1 PUN20290
ISN 0021      IF(IMAT .EQ. 2 .AND. MTIME .EQ. 403) ITIME = 2 PUN20300
ISN 0023      IF(MTIME .LE. 308) ITIME = 1 PUN20310
ISN 0025      IF(IL.NE.0)ITIME=IL PUN20320
ISN 0027      IF(IMAT.EQ.2 .AND. IL.NE.0 .AND. IL.LT.4) ITIME = MOD(IL,3)+1 PUN20330
ISN 0029      IF (IMAT.NE.2) ICATEG = MOD(MAT,8) PUN20340
ISN 0031      IF(IMAT.EQ.2) ICATEG = MAT-3 PUN20350
C ICATEG = 1 FOR U, 2 FOR U235, 3 FOR PU, 4 FOR PU239, AND 5 FOR PU241 PUN20360
ISN 0033      IUNIT = 1 PUN20370
ISN 0034      IF ( (UNIT.EQ.WT .AND. ICATEG .NE. 1).OR.(ICATEG.EQ.3)) IUNIT = 2 PUN20380
ISN 0036      IF(ICATEG.GT.2) GO TO 100 PUN20390
C NO DECAY CALCULATIONS FOR URANIUM PUN20400
ISN 0038      REFVAL = VALNUL(IUNIT,ICATEG,ITIME,IMAT) PUN20410
ISN 0039      RETURN PUN20420
C DECAY CORRECTIONS FOR PLUTONIUM MATERIALS: PUN20430
ISN 0040      100 REMAIN = EXP(-3.929406E-3 * TIME) PUN20440
ISN 0041      DECAYD = 1.0 - REMAIN PUN20450
ISN 0042      D = 1.0 - .01 * VALNUL(IUNIT,4,ITIME,IMAT) * DECAYD PUN20460
ISN 0043      IF (ICATEG .EQ. 3) REFVAL = VALNUL(IUNIT,1,ITIME,IMAT) * D PUN20470
ISN 0045      IF (ICATEG .EQ. 4) REFVAL = VALNUL(IUNIT,3,ITIME,IMAT)/D PUN20480
ISN 0047      IF (ICATEG.EQ.5) REFVAL = VALNUL(IUNIT,4,ITIME,IMAT) * REMAIN/D PUN20490
ISN 0049      RETURN PUN20500
ISN 0050      END PUN20510

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ISN 0026      K= I-1
ISN 0027      7 LINE2(I) = ZMA(K)
ISN 0028      DO 8 I=3,7
ISN 0029      K= I-2
ISN 0030      8 LINE3(I) = GNAME(J,K)
C
C ORDER DATA POINTS
C
ISN 0031      DO 9 I=1,12
ISN 0032      DO 9 K=1,LE
ISN 0033      ITEMP(K,I) = K
ISN 0034      L = K-1
ISN 0035      10 IF(L.EQ. 0) GO TO 11
ISN 0037      M = ITEMP(L,I)
ISN 0038      IF(POINTS(J,K,I) .LE. POINTS(J,M,I)) GO TO 11
ISN 0040      ITEMP(L+1,I) = M
ISN 0041      ITEMP(L,I) = K
ISN 0042      L = L-1
ISN 0043      GO TO 10
ISN 0044      11 CONTINUE
ISN 0045      9 CONTINUE
ISN 0046      IF(IPONTR.NE.1.AND.IPONTR.NE.3)GO TO 12
C
C SET VALUES FOR CUMULATIVE MEAN PLOTS
C NYBIG=YCNTMX
C
ISN 0048
ISN 0049      DO 4 I=1,8
ISN 0050      4 LINEX(I)=XB LIN2(I)
ISN 0051      DO 13 I=1,10
ISN 0052      13 YITL(I) = XB TITL(I)
ISN 0053      IF(IPONTR.EQ.3)GO TO 19
ISN 0055      DO 32 I=1,8
ISN 0056      32 LINE1(I)=XB LIN1(I)
ISN 0057      YLINE1=NYBIG*1.25
ISN 0058      YLINEX=NYBIG*1.20
ISN 0059      GO TO 25
ISN 0060      19 DO 35 I=1,8
ISN 0061      35 LINE1(I)=IBL IN1(I)
ISN 0062      YLINE1=NYBIG*1.20
ISN 0063      25 XMTN=0.0
ISN 0064      IF(NYBIG.EQ.0)NYBIG=1
ISN 0066      YMIN=-NYBIG
ISN 0067      XMAX = 13.0
ISN 0068      YMAX=NYBIG
ISN 0069      YCNTMN = -2.0
ISN 0070      YDIFF = 0.0667
ISN 0071      AXFLG = 3.0
ISN 0072      YINC=NYBIG*.25
ISN 0073      TOPMRG=NYBIG*1.4
ISN 0074      YLINE2=NYBIG*1.15
ISN 0075      YLINE3=NYBIG*1.10
ISN 0076      GO TO 16
C
C SET VALUES FOR CUMULATIVE STANDARD DEVIATION PLOTS
C
ISN 0077      L2 DO 17 I=1,10

```

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CUMP0470
CUMP0480
CUMP0490
CUMP0500
CUMP0510
CUMF0520
CUMP0530
CUMP0540
CUMP0550
CUMP0560
CUMP0570
CUMP0580
CUMP0590
CUMP0600
CUMP0610
CUMP0620
CUMP0630
CUMP0640
CUMP0650
CUMP0660
CUMP0670
CUMP0680
CUMP0690
CUMP0700
CUMP0705
CUMP0710
CUMP0715
CUMP0716
CUMP0720
CUMP0730
CUMP0735
CUMP0740
CUMP0750
CUMP0751
CUMP0752
CUMP0755
CUMP0756
CUMP0757
CUMP0758
CUMP0760
CUMP0766
CUMP0770
CUMP0780
CUMP0790
CUMP0800
CUMP0810
CUMP0820
CUMP0830
CUMP0840
CUMP0860
CUMP0870
CUMP0880
CUMP0890
CUMP0900
CUMP0910
CUMP0920

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17 YFTL(I) = SDTTL(I)
DO 33 I=1,8
33 LINE1(I)=SDLIN1(I)
XMIN = 0.0
YMIN = 0.0
XMAX = 13.0
YSISZ=ISDSIZ
IF(YSISZ.EQ. 0) YISIZ =.2
YMAX = 0.6 * YISIZ
YCENTM = YCENTMX
YINC = 0.1 * YISIZ
YDIFF = .0667 * YINC
AXFLG = 3.0
TOPMR3 = .75 * YISIZ
YLINE1=.68*YSISZ
YLINE2=.66*YSISZ
YLINE3 = .64 * YISIZ
YLINE3 = .62 * YISIZ

C
C ADJUST POINTS WHICH ARE ON TOP OF EACH OTHER
C
16 DO 14 I=1,12
L = 1
DO 14 K=1,LE
IF(K.LT. L) GO TO 14
IF(K+1.GT. LE.AND. LE.NE. 1) GO TO 14
DO 15 M=1,3
N=M-1
IF(K+N.GT. LE) GO TO 30
15 XMPNT(IRTEMP(K+N,I),I) = I
30 IF(LE.EQ. 1) GO TO 14
IF(POINTS(J,IRTEMP(K,I),I) - POINTS(J,IRTEMP(K+1,I),I) .GE. YDIFF
1 GO TO 14
IF(POINTS(J,IRTEMP(K,I),I) .EQ. 0.0) GO TO 14
IF(POINTS(J,IRTEMP(K+1,I),I) .EQ. 0.0) GO TO 14
L = K + 2
XMPNT(IRTEMP(K+1,I),I) = I + .5
POINTS(J,IRTEMP(K+1,I),I) = POINTS(J,IRTEMP(K,I),I)
IF(K+2.GT. LE .OR. POINTS(J,IRTEMP(K+2,I),I) .EQ. 0.) GO TO 14
IF(POINTS(J,IRTEMP(K,I),I) - POINTS(J,IRTEMP(K+2,I),I) .GE. YDIFF
1 GO TO 14
POINTS(J,IRTEMP(K+2,I),I) = POINTS(J,IRTEMP(K,I),I) - YDIFF
14 CONTINUE

C
C DRAW GRID
C
CALL MODESG(Z,0)
CALL GBJCTG(Z,.12,.17,.2,.87)
CALL SUBJEG(Z,XMIN,YMIN,XMAX,YMAX)
CALL SETSMG(Z,102,.02)
CALL SETSMG(Z,103,.02)
CALL SETSMG(Z,100,AXFLG)
CALL LABELG(Z,0,1,.4,MONTH)
IF(IPONTR.NE.2)CALL LABELG(Z,1,YINC,0,5,2)
IF(IPONTR.NE.1.AND.(PONTR.NE.3))CALL LABELG(Z,1,YINC,0,4,2)
CALL SETSMG(Z,104,1.)

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CUMP0930
CUMP0940
CUMP0950
CUMP0960
CUMP0970
CUMP0980
CUMP0990
CUMP1000
CUMP1010
CUMP1020
CUMP1030
CUMP1040
CUMP1050
CUMP1060
CUMP1070
CUMP1071
CUMP1080
CUMP1090
CUMP1100
CUMP1110
CUMP1120
CUMP1130
CUMP1140
CUMP1150
CUMP1160
CUMP1170
CUMP1180
CUMP1190
CUMP1200
CUMP1210
CUMP1215
CUMP1220
CUMP1230
CUMP1235
CUMP1240
CUMP1250
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CUMP1270
CUMP1280
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CUMP1350
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CUMP1370
CUMP1380
CUMP1390
CUMP1400
CUMP1410
CUMP1420
CUMP1430
CUMP1440
CUMP1450

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ISN 0138      CALL SETSMG(Z,105,1.)          CUMP1460
ISN 0139      CALL LABELG(Z,0,1.,1,BLANK)     CUMP1470
ISN 0140      IF(IPONTR.NE.2)CALL LABELG(Z,1,YINC,1,BLANK) CUMP1480
ISN 0142      IF(IPONTR.NE.1.AND.IPONTR.NE.3)CALL LABELG(Z,1,YINC,1,BLANK) CUMP1490
ISN 0144      DO 2 I=1,3                     CUMP1500
ISN 0145      2 CALL GRIDG(Z,0.,0.,0.,0.)      CUMP1510
ISN 0146      CALL TITLEG(Z,0,XTITL,40,YTITL,0,TITL1) CUMP1520
ISN 0147      CALL SETSMG(Z,63,TOPMRG)        CUMP1530
ISN 0148      CALL LEGNDG(Z,4.,YLINE1,32,LINE1) CUMP1540
ISN 0149      IF(IPONTR.NE.3)CALL LEGNDG(Z,4.,YLINEX,32,LINEX) CUMP1541
ISN 0151      CALL LEGNDG(Z,4.,YLINE2,32,LINE2) CUMP1550
ISN 0152      CALL LEGNDG(Z,4.,YLINE3,32,LINE3) CUMP1560
ISN 0153      CALL SETSMG(Z,31,3.)           CUMP1570
ISN 0154      IF(YCNTMX .GT. YMAX) GO TO 20    CUMP1580
ISN 0156      IF(IPONTR.EQ.2)CALL MLTPLG(Z,0,XMIN,YCNTMX,XMAX,YCNTMX,XMIN,YCNTMNCUMP1590
1,XMAX,YCNTMN)                                CUMP1595
ISN 0158      20 CALL SETSMG(Z,53,1.5)        CUMP1600
ISN 0159      CALL SETSMG(Z,55,2.)           CUMP1610
ISN 0160      CALL SETSMG(Z,84,1H4)          CUMP1620
ISN 0161      CALL SETSMG(Z,45,.75)         CUMP1630
ISN 0162      CALL SETSMG(Z,52,1.0)         CUMP1640
C                                                CUMP1650
C PLOT POINTS.                                CUMP1660
DO 1 I=1,12                                  CUMP1680
DO 1 K=1,LE                                  CUMP1690
L = IRTMP(K,I)                              CUMP1700
Y = POINTS(J,L,I)                          CUMP1710
IF( Y .GT. YMAX .OR. Y .EQ. 0.0 .OR. Y .LT. YMIN) GO TO 1 CUMP1720
X = XMNPT(L,I)                             CUMP1730
X=X-SHIFT                                   CUMP1731
CALL NUMBRG(Z,X,Y,3,JLAB(J,L,1))           CUMP1740
CALL LEGNDG(Z,X,Y,4,ALETR(L))              CUMP1760
1 CONTINUE                                  CUMP1770
C                                                CUMP1780
C ADJUST POINTS OUTSIDE OF GRID AND PLOT     CUMP1790
C                                                CUMP1800
CALL OBJCTG(Z,.12,.17,1.2,1.)              CUMP1810
YMAXT = YMAX + YINC                         CUMP1820
CALL SUBJEG(Z,XMIN,YMIN,XMAX,YMAXT)         CUMP1830
DO 21 I=1,12                                CUMP1840
M = 0                                       CUMP1850
DO 18 K=1,LE                               CUMP1860
L = IRTMP(K,I)                             CUMP1870
Y = POINTS(J,L,I)                          CUMP1880
IF( Y .LT. YMAX) GO TO 21                  CUMP1890
M = M+1                                    CUMP1900
Y = YMAX + M*(YDIFF+YDIFF*.2)              CUMP1910
X = I                                       CUMP1920
IF(I.GE. 4 .AND. I .LE. 8)Y=YLINE1+(YDIFF+YDIFF*.2)*M CUMP1930
X=X-SHIFT                                   CUMP1931
CALL NUMBRG(Z,X,Y,3,JLAB(J,L,1))           CUMP1950
CALL LEGNDG(Z,X,Y,4,ALETR(L))              CUMP1960
X = X - .5                                 CUMP1970
CALL NUMBRG(Z,X,Y,5.3,POINTS(J,L,1))       CUMP1980
18 CONTINUE                                CUMP1990
21 CONTINUE                                CUMP2000

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ISN 0196      IF(IPONTR.NE.1.AND.IPONTR.NE.3)GO TO 24
ISN 0198      DO 22 I=1,12
ISN 0199      M = 0
ISN 0200      DO 23 K =1,LE
ISN 0201      K1 = LE - K + 1
ISN 0202      L = IPTMP(K1, I)
ISN 0203      Y = POINTS(J,L,I)
ISN 0204      IF(Y .GT. YMIN) GO TO 22
ISN 0206      M = M+1
ISN 0207      Y = YMIN -(M*(YDIFF + YDIFF * .2) + .3)
ISN 0208      X = I
ISN 0209      X=X-SHIFT
ISN 0210      CALL NUMBRG(Z,X,Y,3,JLAB(J,L,1))
ISN 0211      CALL LEGNDG(Z,X,Y,4,ALETR(L))
ISN 0212      X = X - .5
ISN 0213      CALL NUMBRG(Z,X,Y,5.2,POINTS(J,L,I))
ISN 0214      23 CONTINUE
ISN 0215      22 CONTINUE
ISN 0216      24 CALL PAGEG(Z,0,0,1)
ISN 0217      RETURN
ISN 0218      END

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CUMP2010
CUMP2020
CUMP2030
CUMP2040
CUMP2050
CUMP2060
CUMP2070
CUMP2080
CUMP2090
CUMP2100
CUMP2110
CUMP2111
CUMP2130
CUMP2140
CUMP2150
CUMP2160
CUMP2170
CUMP2180
CUMP2190
CUMP2200
CUMP2210

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APPENDIX C

SAMPLE PROBLEM

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SAMPLE PROBLEM

Output for one representative laboratory is shown as an example of laboratory and method output. The complete output for this run contains a data sheet, analysis of variance (for laboratories with suitable data), and cumulative data summary for each laboratory and method combination. The preceding convention was also followed in choosing the plots included. Plots containing points for the representative laboratory are included. The complete plot output contains three plots from each of the five analytical groups. IGS error messages are printed when points are plotted outside the y-axis bounds; these are system messages and do not represent mathematical inaccuracies.

ALLIED CHEMICAL - ICPP
AGNS
APGONNE - EBR II
APHCO
ATOMICS INTERNATIONAL
AVCO
BARCOCK AND WILCOX
BATTELLE NORTHWEST
COMBUSTION ENGINEERING
COMBUSTION ENG. HEWATITE
DUPONT - SAVANNAH RIVER
EXXON NUCLEAR
G.E. - MORRIS
GE - SAN JOSE
GE - WILMINGTON
GE - VALLECILOS
GENERAL ATOMIC CO
GENERAL ATOMIC CO - FUEL O
GOODYEAR ATOMIC CORP
GULF UNITED - PAWLING
INTELCOM RADIATION TECH.
KEAR MC-GE - CIMARRON
LEDOUX TEANFCK, N.J.
LFE ENVIRONMENTAL
LOS ALAMOS
MONSANTO - MOUND LAB
NATIONAL LEAD COMPANY
NEW BRUNSWICK LAB
NFS - FRWIN
NFS - WEST VALLEY
NUMEC
ROCKWELL INTERNATIONAL - RF
TELEDYNE ISOTOPIES
UNION CARBIDE - Y-12
UNITED NUCLEAR CORP
WESTINGHOUSE - CHESWICK
WESTINGHOUSE - COLUMBIA
WESTINGHOUSE HANFORD CO.
WESTINGHOUSE - MADISON
BCMN (BELGIUM)
KRT-GE
FN-GE
JNF-GE
KFKK
CFN-SACLAY
LFM-PTB
RCN
LEN-GRENOBLE

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 1234567890123456789012345678901234567890123456789012345678901234567890

ALKE
 CEN-BN
 KFA-CT
 KFA-AC
 AWPE (ENGLAND)
 AEPE (ENG)
 TAFE (AUSTRALIA)
 PNC (JAPAN)
 BNFL (ENGLAND)
 CEN-SCK

1 URANYL NITRATE - CONC.
 1 GRAVIMETRY (U308)
 2 GRAVIMETRY (UO2)
 3 GRAVIMETRY OTHER
 5 TITR NBL DEG (WT BASIS)
 6 TITR NBL DEG (VOL BASIS)
 7 TITR DEG (WT BASIS)
 8 TITR JONES REDN/CR(VI)
 9 TITR JONES REDN/CE(IV)
 10 TITR CR(III)REDN/FE(III)
 11 TITR NBL DEG AUTO
 13 COULOMETRY
 15 ISO DIL MASS SPEC
 17 X-RAY FLUORESCENCE
 18 SPECTROPHOTOMETRY
 19 MISC

1 5
 2 6 7 8 91011
 3 1 2 3
 040412131415171819
 5 1 2 3 5 6 7 8 910111315171819

1 TITR NBL DEG (WT)
 1 TITR OTHER
 1 GRAVIMETRY (ALL)
 1 OTHER METHODS
 1 ALL METHODS

URANYL NITRATE - CONC.

412 511

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 1234567890123456789012345678901234567890123456789012345678901234567890

CEN-SCK

URANYL NITRATE - CONC.
GRAVIMETRY (USOB)

DATA	REPORTED	MAKE-UP	Z BIAS	ANALYST
SEPT 1974	0.21460	0.21440	0.09489	1
SEPT 1974	0.21464	0.21440	0.11334	1
SEPT 1974	0.21471	0.21440	0.14601	2
SEPT 1974	0.21471	0.21440	0.14601	2
AVERAGE			0.12501	
JAN. 1975	0.21563	0.21534	0.13422	1
JAN. 1975	0.21561	0.21534	0.12482	1
JAN. 1975	0.21553	0.21534	0.08777	2
JAN. 1975	0.21551	0.21534	0.07847	2
AVERAGE			0.10834	
MAR. 1975	0.21787	0.21783	0.01899	1
MAR. 1975	0.21789	0.21783	0.02816	1
MAR. 1975	0.21788	0.21783	0.05828	2
MAR. 1975	0.21782	0.21783	0.03982	2
AVERAGE			0.03534	
MAY 1975	0.21383	0.21387	0.12218	1
MAY 1975	0.21389	0.21387	0.10344	1
MAY 1975	0.21378	0.21387	0.09197	2
MAY 1975	0.21382	0.21387	0.07889	2
AVERAGE			0.09788	
AUG. 1975	0.21288	0.21279	0.07881	1
AUG. 1975	0.21288	0.21279	0.10784	1
AUG. 1975	0.21282	0.21279	0.07843	2
AUG. 1975	0.21280	0.21279	0.07884	2
AVERAGE			0.08413	
SEPT 1975	0.21471	0.21439	0.14683	1
SEPT 1975	0.21470	0.21439	0.14228	1
SEPT 1975	0.21470	0.21439	0.14228	2
SEPT 1975	0.21472	0.21439	0.15157	2
AVERAGE			0.14576	

MEAN = 0.09787 STD. DEV. = 0.04078 NO. = 24

***** NEST-A CODE CONTAINING NESTED ANOVA CALCULATIONS DESIGNED FOR THE SALE PROGRAM-WJS VERSION 02.04/01/73 *****

ANALYSIS OF VARIANCE TABLE

COMPONENT	DF	SUM OF SQUARES	MEAN SQUARE	EXPECTED MEAN SQUARE	COEFFS	F-RANDOM F-TABLE	ADJ OF F-FIXED F-TABLE
TIME	5	2.62607028D-02	5.25214056D-03	2.00	4.00	4.57	4.39
ANALYST	6	7.68609288D-03	1.28101548D-03	2.00		11.67	3.00
ERROR	12	1.31770482D-03	1.09808719D-04				
TOTAL	23	3.62986393D-02	1.58367392D-03				

MEAN= 9.72745248D-02 STD OF MEAN= 8.37484873E-03

RESULT OF BIAS TEST FOLLOWS
T-CALCULATED = 11.0839 **
T-TABLED(0.05) = 2.0687 T-TABLED(0.01) = 2.8073

VARIANCE COMPONENT ESTIMATES AND ASSOCIATED DEGREES OF FREEDOM

VAR OF TIME = 1.14278128D-03 DEGREES OF FREEDOM = 2.93
VAR OF ANALYST = 5.85603384D-04 DEGREES OF FREEDOM = 5.00
VAR OF ERROR = 1.09808719D-04 DEGREES OF FREEDOM = 12.00
VAR OF MEAN = 2.43839E-04 STD DEV = 1.56153E-02(BY COMPONENTS)

95 % CONFIDENCE INTERVAL FOR THE MEAN WITH THE ASSOCIATED DEGREES OF FREEDOM BY COMPONENTS

LOWER LIMIT = 9.71342E-02 UPPER LIMIT = 1.37415E-01 DEGREES OF FREEDOM

URANYL NITRATE - CONC.
GRAVIMETRY (U308)

	N	MEAN	SIX MONTH MEAN	STD. DEV
SEPT 1973	4	-0.03884	-0.03884	0.03940
NOV. 1973	8	-0.00004	-0.01934	0.04335
DEC. 1973	4	0.07348	0.01160	0.05387
JAN. 1974	4	0.08267	0.02937	0.08019
FEB. 1974	4	-0.00809	0.02187	0.05539
MAR. 1974	4	0.03134	0.02345	0.05265
APR. 1974	4	0.06222	0.04026	0.05380
MAY 1974	4	0.01698	0.04310	0.05248
JUNE 1974	4	0.02575	0.03514	0.04980
JULY 1974	4	0.04360	0.02883	0.03643
SEPT 1974	4	0.12501	0.05082	0.06034
JAN. 1975	4	0.10634	0.06332	0.07147
MAR. 1975	4	0.03534	0.05884	0.06941
MAY 1975	4	0.08708	0.07052	0.07610
AUG. 1975	4	0.08413	0.08025	0.08085
SEPT 1975	4	0.14576	0.09727	0.09523

AUTOS-
1 0.273 2 0.001 3 0.027 4 0.275 5 0.184 6 -0.381 7 -0.258 8 -0.108 9 -0.101 10 -0.170
11 -0.242

STANDARD DEVIATIONS FOR THE PREVIOUS CORRELATIONS.

Y SERIES-
0 0.289 1 0.309 2 0.309 3 0.310 4 0.329 5 0.338 6 0.372 7 0.387 8 0.389 9 0.391
10 0.397

RESULTS OF TREND TEST FOLLOW

RHO = 0.7413 ** T = 74.00
TABLED VALUE(0.05) = 0.5804 TABLED VALUE(0.01) = 0.7273

URANYL NITRATE - CONC. ALL METHODS

LAB	MAT.	METH.	MEAN	STD. DEV	SD. MEAN
1	1	1	0.09727	0.04287	0.01562
1	1	5	0.09625	0.04755	0.01825
1	1	6	0.12201	0.10690	0.04360
2	1	5	0.02788	0.13185	0.04244
3	1	5	0.00896	0.03456	0.00737
6	1	5	0.00272	0.08183	0.03295
7	1	1	0.01097	0.01934	0.00468
7	1	5	0.03447	0.13802	0.05278
8	1	1	-0.02289	0.05472	0.02118
10	1	6	-0.18294	0.29971	0.12108
10	1	13	0.08881	0.50299	0.19840
12	1	5	0.03352	0.03715	0.01107
13	1	1	0.31755	0.15939	0.07869
13	1	7	0.20975	0.18242	0.05500
16	1	10	0.11389	0.39880	0.21513
19	1	5	0.00396	0.01008	0.00392
20	1	13	0.01121	0.05935	0.01814
21	1	5	0.03233	0.32199	0.13122
33	1	5	0.33815	0.57032	0.26209
54	1	1	0.14624	0.17205	0.07446
54	1	5	0.13189	0.26798	0.09200
54	1	17	0.40387	0.52435	0.20408
57	1	5	0.15636	0.07240	0.01330
58	1	9	-0.02305	0.13405	0.03263
58	1	17	0.05961	0.12828	0.06639
59	1	1	0.02105	0.04896	0.02320
59	1	7	0.02834	0.29957	0.12024
61	1	6	0.95190	0.90708	0.36437
61	1	17	1.25829	1.31186	0.51682
65	1	5	0.04550	0.04943	0.01676
67	1	5	-0.16373	0.08997	0.03499
AVERAGE			0.14929	0.23621	0.09304
STD DEV			0.29272	0.28976	0.11677

BETWEEN LAB STD DEV = 0.14127374

URANYL NITRATE - CONC.

DEC. 1974 - NOV. 1975

METHOD	AVERAGE BIAS	AVERAGE WITHIN LAB STD. DEV.	BETWEEN LAB STD. DEV.	NUMBER OF LABS
TITR NBL D&O (MT)	0.057	0.141	0.077	13
TITR OTHER	0.216	0.353	0.272	7
GRAVIMETRY (ALL)	0.095	0.083	0.129	6
OTHER METHODS	0.381	0.505	0.360	5
ALL METHODS	0.149	0.238	0.141	31

LAB	ANALYSES	AVERAGE BIAS	95% PLUS OR MINUS	WITHIN LAB STD. DEV.	SIGNIFICANCE OF TREND	EFFECTS TIME	ANALYST	METHOD
1A	24	0.097	0.040	0.043	**	**	**	GRAVIMETRY (U308)
1B	48	0.096	0.047	0.048	*	**		TITR NBL D&O (MT BASIS)
1C	48	0.122	0.113	0.109		**		TITR NBL D&O (VOL BASIS)
2	40	0.028	0.109	0.132		**		TITR NBL D&O (MT BASIS)
3	22	0.009	0.017	0.035		**		TITR NBL D&O (MT BASIS)
6	12	0.003	0.085	0.082		**		TITR NBL D&O (MT BASIS)
7A	18	0.011	0.013	0.019	*	**		GRAVIMETRY (U308)
7B	21	0.034	0.138	0.138	*	**		TITR NBL D&O (MT BASIS)
8	15	-0.023	0.054	0.055		**		GRAVIMETRY (U308)
10A	12	-0.193	0.311	0.300		**		TITR NBL D&O (VOL BASIS)
10B	12	0.069	0.310	0.303		**		COULOMETRY
12	12	0.034	0.035	0.037		**		TITR NBL D&O (MT BASIS)
13A	4	0.318	0.254	0.159		**		GRAVIMETRY (U308)
13B	11	0.210	0.178	0.182	**	**		TITR D&O (MT BASIS)
18	12	0.413	0.553	0.539		**		TITR CR(III)REDN/FE(III)
19	12	0.004	0.010	0.010		**		TITR NBL D&O (MT BASIS)
20	12	0.011	0.050	0.056		**		COULOMETRY
21	12	0.032	0.337	0.322		**		TITR NBL D&O (MT BASIS)
33	26	0.336	0.648	0.570		**		TITR NBL D&O (MT BASIS)
54A	8	0.146	0.191	0.172		**		GRAVIMETRY (U308)
54B	22	0.132	0.228	0.268		**		TITR NBL D&O (MT BASIS)
54C	18	0.404	0.528	0.524		**		X-RAY FLUORESCENCE
57	35	0.156	0.037	0.072		*		TITR NBL D&O (MT BASIS)
58A	40	-0.023	0.091	0.134		*	**	TITR JONES REDN/CE(IV)
58B	23	0.060	0.266	0.128		**		X-RAY FLUORESCENCE
59A	8	0.021	0.074	0.049		*		GRAVIMETRY (U308)
59B	12	0.028	0.309	0.300		**		TITR D&O (MT BASIS)
61A	17	0.052	1.012	0.907		**		TITR NBL D&O (VOL BASIS)

LAB	ANALYSES	AVERAGE BIAS	95% PLUS OR MINUS	WITHIN LAB STD. DEV.	SIGNIFICANCE OF TREND	EFFECTS TIME	ANALYST	METHOD
61B	27	1.259	1.435	1.312		**		X-RAY FLUORESCENCE
65	24	0.046	0.043	0.048		**		TITR NBL D&O (MT BASIS)
67	4	-0.164	0.111	0.070				TITR NBL D&O (MT BASIS)

MOVING MEANS FOR GROUP 1 URANYL NITRATE - CONC. TITR NBL D&O (MT)														
LAB	MAT.	METH.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV
1	1	5	0.0	0.07114	0.0	0.08029	0.0	0.07074	0.0	0.0	0.08010	0.09825	0.0	0.0
2	1	5	0.0	-0.11157	0.0	-0.07043	0.0	-0.08882	0.0	0.0	0.0	0.01912	0.0	0.0
3	1	5	0.0	0.03670	0.0	0.03207	0.0	0.02284	0.0	0.01910	0.0	0.00858	0.0	0.0
6	1	5	0.0	0.07274	0.0	0.07857	0.0	0.07857	0.0	0.0	0.0	0.00272	0.0	0.0
7	1	5	0.0	0.0	0.0	0.12185	0.0	0.07134	0.0	0.05948	0.0	0.02321	0.0	0.0
12	1	5	0.0	0.0	0.0	0.03394	0.0	0.0	0.04192	0.03352	0.0	0.0	0.0	0.0
19	1	5	0.0	0.00782	0.0	0.01128	0.0	0.00870	0.0	0.00342	0.0	0.00386	0.0	0.0
21	1	5	0.0	0.00972	0.0	-0.04451	0.0	-0.04971	0.0	0.0	0.0	0.03233	0.0	0.0
33	1	5	0.0	0.11865	0.0	0.15650	0.0	0.08650	0.0	0.27701	0.0	0.32245	0.0	0.0
54	1	5	0.0	0.0	0.0	0.0	0.0	0.0	0.12953	0.0	0.11942	0.0	0.0	0.0
57	1	5	0.16568	0.0	0.15778	0.0	0.15347	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65	1	5	0.01185	0.01411	0.0	0.02178	0.0	0.0	0.03878	0.0	0.03387	0.0	0.04558	0.0
67	1	5	0.0	0.0	0.0	0.0	0.0	0.0	-0.18424	0.0	0.0	0.0	-0.18373	0.0
BAD BAD BAD. ERROR NO.				33	*****	1.280	4114780A	FRAME 2.						
BAD BAD BAD. ERROR NO.				33	*****	1.280	4114780A	FRAME 2.						
BAD BAD BAD. ERROR NO.				33	*****	1.280	4114780A	FRAME 2.						

MOVING MEANS FOR GROUP 2 URANYL NITRATE - CONC. TITR OTHER														
LAB	MAT.	METH.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.
1	1	6	0.0	0.05637	0.0	0.03048	0.0	0.04051	0.0	0.0	0.05800	0.12201	0.0	0.0
10	1	6	0.0	0.10669	0.0	0.00125	0.0	-0.03059	0.0	-0.13377	0.0	-0.16294	0.0	0.0
13	1	7	0.0	0.06802	0.0	0.11775	0.0	0.18664	0.0	0.23941	0.0	0.0	0.0	0.0
18	1	10	0.0	0.51134	0.0	0.54540	0.0	0.52785	0.0	0.0	0.54688	0.41295	0.0	0.0
58	1	9	-0.02561	0.0	0.0	0.0	0.0	0.0	-0.00474	0.0	0.00688	0.0	-0.01663	0.0
59	1	7	-0.01184	0.00354	0.0	0.02834	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61	1	6	0.0	1.02220	0.0	1.16214	0.0	0.0	1.16069	0.0	0.89649	0.0	0.0	0.0
BAD	BAD	BAD, ERROR NO.	33	-	.....	1.330		41154707	FRAME 3.					
BAD	BAD	BAD, ERROR NO.	33	-	.....	1.330		41154707	FRAME 3.					
BAD	BAD	BAD, ERROR NO.	33	-	.....	1.330		41154707	FRAME 3.					
BAD	BAD	BAD, ERROR NO.	33	-	.....	1.330		41154707	FRAME 3.					
BAD	BAD	BAD, ERROR NO.	33	-	.....	1.330		41154707	FRAME 3.					
BAD	BAD	BAD, ERROR NO.	33	-	.....	1.330		41154707	FRAME 3.					
BAD	BAD	BAD, ERROR NO.	33	-	.....	1.280		4114780A	FRAME 4.					
BAD	BAD	BAD, ERROR NO.	33	-	.....	1.280		4114780A	FRAME 4.					
BAD	BAD	BAD, ERROR NO.	33	-	.....	1.280		4114780A	FRAME 4.					
BAD	BAD	BAD, ERROR NO.	33	-	.....	1.280		4114780A	FRAME 4.					
BAD	BAD	BAD, ERROR NO.	33	-	.....	1.280		4114780A	FRAME 4.					
BAD	BAD	BAD, ERROR NO.	33	-	.....	1.280		4114780A	FRAME 4.					

MOVING MEANS FOR GROUP 3 URANYL NITRATE - CONC. GRAVIMETRY (ALL)														
LAB	MAT.	METH.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.
1	1	1	0.0	0.06332	0.0	0.05884	0.0	0.07052	0.0	0.0	0.08025	0.09727	0.0	0.0
7	1	1	0.0	0.03790	0.0	0.03280	0.0	0.03254	0.0	0.01522	0.0	0.01097	0.0	0.0
8	1	1	0.0	0.0	0.0	-0.01912	0.0	-0.02022	0.0	-0.03029	0.0	0.0	0.0	0.0
13	1	1	0.0	0.12027	0.0	0.19027	0.0	0.26567	0.0	0.31755	0.0	0.0	0.0	0.0
54	1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.14434	0.0	0.0	0.0
59	1	1	0.02110	0.02697	0.0	0.02105	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MOVING MEANS FOR GROUP 4 URANYL NITRATE - CONC. OTHER METHODS														
LAB	MAT.	METH.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.
10	1	13	0.0	0.07111	0.0	0.15468	0.0	-0.03674	0.0	0.03718	0.0	0.06681	0.0	0.0
20	1	13	0.0	0.00694	0.0	0.00923	0.0	0.01235	0.0	0.02136	0.0	0.03120	0.0	0.01121
54	1	17	0.0	0.0	0.0	0.0	0.0	0.0	0.31188	0.0	0.40334	0.0	0.0	0.0
58	1	17	0.11427	0.12081	0.0	0.06080	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61	1	17	0.0	1.79380	0.0	1.58121	0.0	0.0	1.46917	0.0	1.21853	0.0	0.0	0.0
BAD BAD BAD,	ERROR	NO.	33	-	.....	1.330		41154707	FRAME 7.					
BAD BAD BAD,	ERROR	NO.	33	-	.....	1.330		41154707	FRAME 7.					
BAD BAD BAD,	ERROR	NO.	33	-	.....	1.330		41154707	FRAME 7.					
BAD BAD BAD,	ERROR	NO.	33	-	.....	1.330		41154707	FRAME 7.					
BAD BAD BAD,	ERROR	NO.	33	-	.....	1.330		41154707	FRAME 7.					
BAD BAD BAD,	ERROR	NO.	33	-	.....	1.280		4114780A	FRAME 8.					
BAD BAD BAD,	ERROR	NO.	33	-	.....	1.280		4114780A	FRAME 8.					
BAD BAD BAD,	ERROR	NO.	33	-	.....	1.280		4114780A	FRAME 8.					
BAD BAD BAD,	ERROR	NO.	33	-	.....	1.280		4114780A	FRAME 8.					

MOVING MEANS FOR GROUP 5 URANYL NITRATE - CONC. ALL METHODS

LAB	MAT.	METH.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.
1A	1	1	0.0	0.08332	0.0	0.05884	0.0	0.07052	0.0	0.0	0.08025	0.09727	0.0	0.0
1B	1	5	0.0	0.07114	0.0	0.06029	0.0	0.07074	0.0	0.0	0.08010	0.09625	0.0	0.0
1C	1	6	0.0	0.05637	0.0	0.03046	0.0	0.04051	0.0	0.0	0.05800	0.12201	0.0	0.0
2	1	5	0.0	-0.11157	0.0	-0.07043	0.0	-0.00882	0.0	0.0	0.0	0.01912	0.0	0.0
3	1	5	0.0	0.03870	0.0	0.03207	0.0	0.02294	0.0	0.01910	0.0	0.00898	0.0	0.0
6	1	5	0.0	0.07274	0.0	0.07897	0.0	0.07657	0.0	0.0	0.0	0.00272	0.0	0.0
7A	1	1	0.0	0.03790	0.0	0.03280	0.0	0.03294	0.0	0.01522	0.0	0.01097	0.0	0.0
7B	1	5	0.0	0.0	0.0	0.12185	0.0	0.07134	0.0	0.05948	0.0	0.02321	0.0	0.0
8	1	1	0.0	0.0	0.0	-0.01912	0.0	-0.02022	0.0	-0.03029	0.0	0.0	0.0	0.0
10A	1	6	0.0	0.10669	0.0	0.00125	0.0	-0.03059	0.0	-0.13377	0.0	-0.19294	0.0	0.0
10B	1	13	0.0	0.07111	0.0	0.15468	0.0	-0.03674	0.0	0.03716	0.0	0.06881	0.0	0.0
12	1	5	0.0	0.0	0.0	0.03394	0.0	0.0	0.04192	0.03352	0.0	0.0	0.0	0.0
13A	1	1	0.0	0.12027	0.0	0.18027	0.0	0.26567	0.0	0.31755	0.0	0.0	0.0	0.0
13B	1	7	0.0	0.06802	0.0	0.11775	0.0	0.18864	0.0	0.23941	0.0	0.0	0.0	0.0
18	1	10	0.0	0.51134	0.0	0.94940	0.0	0.52785	0.0	0.0	0.54888	0.41295	0.0	0.0
19	1	5	0.0	0.00762	0.0	0.01126	0.0	0.00970	0.0	0.00342	0.0	0.00398	0.0	0.0
20	1	13	0.0	0.00694	0.0	0.00923	0.0	0.01235	0.0	0.02136	0.0	0.03120	0.0	0.01121
21	1	5	0.0	0.00972	0.0	-0.04461	0.0	-0.06871	0.0	0.0	0.0	0.03233	0.0	0.0
33	1	5	0.0	0.11905	0.0	0.15650	0.0	0.06850	0.0	0.27701	0.0	0.32245	0.0	0.0
34A	1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.14434	0.0	0.0	0.0	0.0
34B	1	5	0.0	0.0	0.0	0.0	0.0	0.0	0.12953	0.0	0.11947	0.0	0.0	0.0
34C	1	17	0.0	0.0	0.0	0.0	0.0	0.0	0.31168	0.0	0.40334	0.0	0.0	0.0
57	1	5	0.18568	0.0	0.15778	0.0	0.15347	0.0	0.0	0.0	0.0	0.0	0.0	0.0
58A	1	9	-0.02561	0.0	0.0	0.0	0.0	0.0	-0.00474	0.0	0.00568	0.0	-0.01863	0.0
58B	1	17	0.11427	0.12081	0.0	0.06080	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
58A	1	1	0.02110	0.02697	0.0	0.02105	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
58B	1	7	-0.01184	0.00354	0.0	0.02834	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61A	1	6	0.0	1.02220	0.0	1.16214	0.0	0.0	1.18069	0.0	0.89849	0.0	0.0	0.0
61B	1	17	0.0	1.79380	0.0	1.58121	0.0	0.0	1.46917	0.0	1.21853	0.0	0.0	0.0
65	1	5	0.01185	0.01411	0.0	0.02178	0.0	0.0	0.03678	0.0	0.03387	0.0	0.04558	0.0
67	1	5	0.0	0.0	0.0	0.0	0.0	0.0	-0.18424	0.0	0.0	0.0	-0.18373	0.0

WITHIN LAB STANDARD DEVIATIONS FOR GROUP 1 URANYL NITRATE - CONC. TITR NBL D&G (MT)

LAB	MAT.	METH.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.
1	1	5	0.0	0.07629	0.0	0.08901	0.0	0.07872	0.0	0.0	0.08336	0.10123	0.0	0.0
2	1	5	0.0	0.18388	0.0	0.15862	0.0	0.15491	0.0	0.0	0.0	0.12927	0.0	0.0
3	1	5	0.0	0.05259	0.0	0.04886	0.0	0.04253	0.0	0.04162	0.0	0.03349	0.0	0.0
6	1	5	0.0	0.13051	0.0	0.12967	0.0	0.12887	0.0	0.0	0.0	0.07829	0.0	0.0
7	1	5	0.0	0.0	0.0	0.13404	0.0	0.09312	0.0	0.09829	0.0	0.13262	0.0	0.0
12	1	5	0.0	0.0	0.0	0.05671	0.0	0.0	0.05478	0.04455	0.0	0.0	0.0	0.0
19	1	5	0.0	0.02397	0.0	0.02352	0.0	0.02301	0.0	0.01136	0.0	0.01011	0.0	0.0
21	1	5	0.0	0.11532	0.0	0.09360	0.0	0.09484	0.0	0.0	0.0	0.30804	0.0	0.0
33	1	5	0.0	0.17719	0.0	0.22233	0.0	0.34854	0.0	0.61269	0.0	0.60372	0.0	0.0
34	1	5	0.0	0.0	0.0	0.0	0.0	0.0	0.24427	0.0	0.26365	0.0	0.0	0.0
57	1	5	0.17945	0.0	0.16773	0.0	0.18104	0.0	0.0	0.0	0.0	0.0	0.0	0.0
65	1	5	0.03126	0.02544	0.0	0.02906	0.0	0.0	0.05245	0.0	0.04746	0.0	0.06231	0.0
67	1	5	0.0	0.0	0.0	0.0	0.0	0.0	0.18424	0.0	0.0	0.0	0.14730	0.0

WITHIN LAB STANDARD DEVIATIONS FOR GROUP 2 URANYL NITRATE - CONC. TITR OTHER

LAB	MAT.	METH.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.
1	1	6	0.0	0.10401	0.0	0.08942	0.0	0.09185	0.0	0.0	0.10878	0.15312	0.0	0.0
10	1	6	0.0	0.23925	0.0	0.11945	0.0	0.17210	0.0	0.33149	0.0	0.31986	0.0	0.0
13	1	7	0.0	0.15528	0.0	0.16395	0.0	0.20509	0.0	0.20931	0.0	0.0	0.0	0.0
18	1	10	0.0	0.55540	0.0	0.56713	0.0	0.55472	0.0	0.0	0.64417	0.56994	0.0	0.0
58	1	9	0.15398	0.0	0.0	0.0	0.0	0.0	0.13449	0.0	0.13095	0.0	0.12683	0.0
59	1	7	0.30421	0.27639	0.0	0.26135	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61	1	8	0.0	1.44730	0.0	1.40802	0.0	0.0	1.29543	0.0	1.20197	0.0	0.0	0.0

WITHIN LAB STANDARD DEVIATIONS FOR GROUP 3 URANYL NITRATE - CONC.										GRAVIMETRY (ALL)				
LAB	MAT.	METH.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.
1	1	1	0.0	0.07147	0.0	0.06941	0.0	0.07610	0.0	0.0	0.08065	0.09523	0.0	0.0
7	1	1	0.0	0.04674	0.0	0.04515	0.0	0.04421	0.0	0.02629	0.0	0.02139	0.0	0.0
8	1	1	0.0	0.0	0.0	0.03366	0.0	0.03751	0.0	0.05381	0.0	0.0	0.0	0.0
13	1	1	0.0	0.0	0.0	0.09900	0.0	0.14817	0.0	0.15939	0.0	0.0	0.0	0.0
54	1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.18461	0.0	0.0	0.0
59	1	1	0.08672	0.05496	0.0	0.04876	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

WITHIN LAB STANDARD DEVIATIONS FOR GROUP 4										URANYL NITRATE - CONC.		OTHER METHODS			
LAB	MAT.	METH.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	
10	1	13	0.0	0.30187	0.0	0.39541	0.0	0.46594	0.0	0.46628	0.0	0.46531	0.0	0.0	
20	1	13	0.0	0.08175	0.0	0.06355	0.0	0.06904	0.0	0.08540	0.0	0.05395	0.0	0.05524	
54	1	17	0.0	0.0	0.0	0.0	0.0	0.0	0.55113	0.0	0.60193	0.0	0.0	0.0	
58	1	17	0.13439	0.13907	0.0	0.12230	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
61	1	17	0.0	2.27529	0.0	2.01423	0.0	0.0	1.85656	0.0	1.69474	0.0	0.0	0.0	

WITHIN LAB STANDARD DEVIATIONS FOR GROUP 5 URANYL NITRATE - CONC. ALL METHODS														
LAB	MAT.	METH.	DEC.	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.
1A	1	1	0.0	0.07147	0.0	0.06941	0.0	0.07610	0.0	0.0	0.08065	0.09523	0.0	0.0
1B	1	5	0.0	0.07629	0.0	0.06901	0.0	0.07672	0.0	0.0	0.08336	0.10123	0.0	0.0
1C	1	6	0.0	0.10401	0.0	0.08942	0.0	0.09165	0.0	0.0	0.10578	0.15312	0.0	0.0
2	1	5	0.0	0.16398	0.0	0.15662	0.0	0.15491	0.0	0.0	0.0	0.12927	0.0	0.0
3	1	5	0.0	0.05259	0.0	0.04686	0.0	0.04253	0.0	0.04162	0.0	0.03349	0.0	0.0
6	1	5	0.0	0.13051	0.0	0.12667	0.0	0.12667	0.0	0.0	0.0	0.07825	0.0	0.0
7A	1	1	0.0	0.04674	0.0	0.04515	0.0	0.04421	0.0	0.02629	0.0	0.02139	0.0	0.0
7B	1	5	0.0	0.0	0.0	0.13404	0.0	0.09312	0.0	0.09629	0.0	0.13262	0.0	0.0
8	1	1	0.0	0.0	0.0	0.03366	0.0	0.03751	0.0	0.05381	0.0	0.0	0.0	0.0
10A	1	6	0.0	0.23925	0.0	0.11945	0.0	0.13219	0.0	0.33149	0.0	0.31886	0.0	0.0
10B	1	13	0.0	0.30187	0.0	0.39541	0.0	0.46594	0.0	0.46628	0.0	0.46531	0.0	0.0
12	1	5	0.0	0.0	0.0	0.05671	0.0	0.0	0.05478	0.04455	0.0	0.0	0.0	0.0
13A	1	1	0.0	0.0	0.0	0.09900	0.0	0.14817	0.0	0.15939	0.0	0.0	0.0	0.0
13B	1	7	0.0	0.15528	0.0	0.16395	0.0	0.20509	0.0	0.20931	0.0	0.0	0.0	0.0
18	1	10	0.0	0.55240	0.0	0.56713	0.0	0.55472	0.0	0.0	0.54417	0.59994	0.0	0.0
19	1	5	0.0	0.02397	0.0	0.02352	0.0	0.02301	0.0	0.01136	0.0	0.01011	0.0	0.0
20	1	13	0.0	0.08175	0.0	0.06355	0.0	0.06904	0.0	0.08540	0.0	0.05395	0.0	0.05524
21	1	5	0.0	0.11532	0.0	0.09380	0.0	0.09494	0.0	0.0	0.0	0.30804	0.0	0.0
33	1	5	0.0	0.17719	0.0	0.22233	0.0	0.24964	0.0	0.61269	0.0	0.60372	0.0	0.0
54A	1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.18461	0.0	0.0	0.0
54B	1	5	0.0	0.0	0.0	0.0	0.0	0.0	0.24427	0.0	0.28365	0.0	0.0	0.0
54C	1	17	0.0	0.0	0.0	0.0	0.0	0.0	0.55113	0.0	0.60193	0.0	0.0	0.0
57	1	5	0.17945	0.0	0.16773	0.0	0.16194	0.0	0.0	0.0	0.0	0.0	0.0	0.0
58A	1	9	0.15398	0.0	0.0	0.0	0.0	0.0	0.13449	0.0	0.13095	0.0	0.12683	0.0
58B	1	17	0.13439	0.13907	0.0	0.12230	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59A	1	1	0.06672	0.05496	0.0	0.04876	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
59B	1	7	0.30423	0.27839	0.0	0.28735	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
61A	1	6	0.0	1.44730	0.0	1.40802	0.0	0.0	1.29543	0.0	1.20197	0.0	0.0	0.0
61B	1	17	0.0	2.27529	0.0	2.01423	0.0	0.0	1.85656	0.0	1.69474	0.0	0.0	0.0
65	1	5	0.03126	0.02554	0.0	0.02999	0.0	0.0	0.05245	0.0	0.04746	0.0	0.06231	0.0
67	1	5	0.0	0.0	0.0	0.0	0.0	0.0	0.18424	0.0	0.0	0.0	0.14730	0.0

***** 16 FRAMES OF MICROFILM HAVE BEEN GENERATED.

MONTHLY MEANS
URANYL NITRATE - CONC.
GRAVIMETRY (ALL)

MOVING MEANS
 BASED ON LAST 6 DATA REPORTS
 URANYL NITRATE - CONC.
 GRAVIMETRY (ALL)

WITHIN LAB STANDARD DEVIATIONS
 BASED ON LAST 6 DATA REPORTS
 URANYL NITRATE - CONC.
 GRAVIMETRY (ALL)

1.000 61b

1.150 61b 1.230 33

1.161 18

MONTHLY MEANS
URANYL NITRATE - CONC.
ALL METHODS.

1.022 51b

1.022 51b

1.022 51a

1.794 51b

MOVING MEANS
 BASED ON LAST 6 DATA REPORTS
 URANYL NITRATE - CONC.
 ALL METHODS

1.217 51b

1.408 61a
2.014 61b

1.295 61a
1.857 61b 0.613 33

WITHIN LAB STANDARD DEVIATIONS
BASED ON LAST 6 DATA REPORTS

URANYL NITRATE - CONC.
ALL METHODS

1.447 61a
2.275 61b

0.602 54c
1.202 61a 0.604 18
1.695 61b 0.604 33

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APPENDIX D

THE SALE REPORT

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APPENDIX D

THE SALE REPORT

The current SALE report consists of a material summary sheet followed by three IGS plots (monthly mean, moving mean, and six-month standard deviation) for each analytical group for every material analyzed. A typical summary sheet is shown on page 126. Plots are shown on pages 130 through 135.

The top of page 126 shows statistics calculated for each of the five analytical groups. The average bias and average within-laboratory standard deviation are calculated using the mean and standard deviation estimates on the bottom half of page 125. For example, in the gravimetry (all) group, six laboratories submitted data for analysis. From page 125, the following is obtained:

<u>Laboratory</u>	<u>Method</u>	<u>Mean</u>	<u>Standard Deviation</u>
1	1	0.09727	0.04287
7	1	0.01097	0.01934
8	1	-0.02289	0.05472
13	1	0.31755	0.15936
54	1	0.14624	0.17205
59	1	0.02105	0.04896

Summing the mean column and dividing by six yields an average bias of 0.09503. Similarly the average standard deviation is found to equal 0.08288. These estimates, rounded to three places, are shown on the gravimetry (all) line at the top of page 126. The between-laboratory standard deviation shown is calculated in subroutine SBLV using formulas from Section III-2.

Below the group summary, a laboratory summary is printed with each laboratory participating in the material analysis represented. In the first line of this summary, the results for Laboratory 1A are shown. The data sheet for this laboratory is reproduced on the top of page 124. The number of analyses and the average bias shown on page 126 are obtained from the lowest line of the data sheet on page 124.

The number appearing in the column headed "95% plus or minus" on page 126 can be calculated using the confidence limits shown in the lowest line of page 124. Since the average bias is 0.097 and the limits on page 124 are 0.057 and 0.137, a 95% confidence interval is obtained by adding 0.040 to the average bias and subtracting 0.040 from the average bias.

The within-laboratory standard deviation shown in the column next to the "95% plus or minus" column is calculated in one of two ways. If no analysis of variance is

performed on the laboratory's data, the within-laboratory standard deviation shown in the lowest line of the data sheet is printed. If an analysis of variance is performed on the laboratory's data, the within-laboratory standard deviation is calculated using the variance component estimates listed below the analysis of variance table. The within-laboratory standard deviation, σ_w , is calculated as:

$$\sigma_w = \sqrt{\sum_{i=1}^k \sigma_{c_i}^2} \quad (D-1)$$

where $\sigma_{c_i}^2$ is the variance component estimate of the i th component and k is the number of components. For example, the variance component estimates obtained for Laboratory 1A from page 124 are as follows:

variance of time = 0.0011427128
variance of analyst = 0.000585603364
variance of error = 0.000109608719

Thus, the within-laboratory standard deviation shown for Laboratory 1A on page 126 is:

$$\sigma_w = \sqrt{0.0011427128 + 0.000585603364 + 0.000109608719} = 0.042871025$$

Rounded to three decimals, this is the value shown on page 126 as the within-laboratory standard deviation for Laboratory 1A.

The significant effects are indicated by one star at the 5% level and two stars at the 1% level. The trend test, shown on page 125, is performed in subroutine TREND using the hypotheses:

H_0 : no trend exists
 H_1 : trend exists.

Thus, the trend test is a two-sided test. The Spearman's ρ statistic is used to perform the test. The significance test for time and analyst effects is performed in subroutine BIAS using values obtained from the analysis of variance subroutine NEST.

Values shown on the IGS plots are printed at the top of page 125. Monthly means plotted are obtained from the mean column. Moving means and six-month standard deviations plotted are obtained from the remaining two columns. Since only twelve-month data are shown on the plots, not all the values on page 125 are plotted. The only values plotted are values dated within one year of the upper month of the report period. The values plotted on the moving mean and six-month standard deviation plots are also printed by group on pages 126 through 129. A 95% confidence line is calculated for the six-month standard deviations as explained in Section VII. This line does not appear on the plots in Appendix C since the value calculated was larger than the upper limit of the y-axis of the corresponding plots.

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