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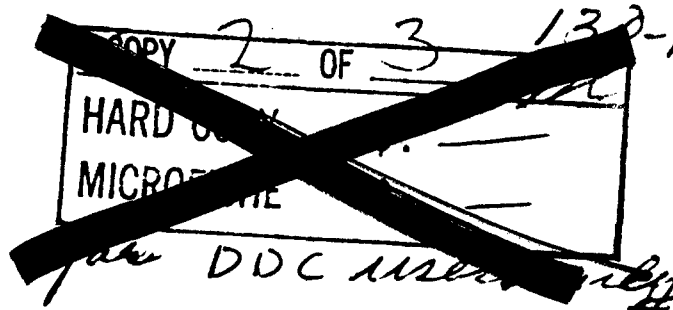
Technical Note N-709

NEUTRON STREAMING THROUGH HYDROGENOUS MEDIA

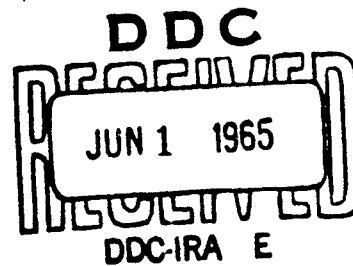
By

Leonard B. Gardner, Alan J. Mettler, Donald L. Peterson

10 May 1965



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U. S. NAVAL CIVIL ENGINEERING LABORATORY
Port Hueneme, California

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NEUTRON STREAMING THROUGH HYDROGENOUS MEDIA

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Type C

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ABSTRACT

The U. S. Naval Civil Engineering Laboratory is studying the design of various entranceways for protective structures. The particular portion of the work reported herein is concerned with air ducts in concrete. One of the essential parameters for the design optimization of such ducts is the neutron energy spectra as a function of position in the duct. From this parameter may be determined the type and quantity of shielding materials necessary to achieve a specified protection factor.

In order to achieve a uniform system of neutron dosimetry, it was decided to use the activation of bare and cadmium covered foils, foil sandwiches, and threshold foil detectors to measure flux spectra. This application represents one of the first times that foils were used to experimentally determine differential flux over the energy range from 0.001 ev to 15 Mev. It is believed to be the first application to protective structure shielding experiments.

Preliminary to the experimental determination of neutron spectra by foil activation, it is essential that the responses of the selected foils be measured in a medium of known moderating and scattering properties. A hydrogenous material such as paraffin, meets this requirement and is experimentally simple. A source of nominally 14-Mev neutrons was directed at successively increasing thicknesses of paraffin made from 1-inch slabs 12x24 inches. Selected foils were placed on the opposite side of the paraffin and their response to the neutron irradiation determined. From this study technology is developed by which the observed response of foils irradiated in complex shields may be related to neutron energy flux. The report of this technology will be made at the time neutron energy spectra for air ducts in concrete is reported. Herein is the report of the preliminary experiment where a study was made of neutrons streaming through hydrogenous media. The normalized activation responses of selected foils are given as a function of paraffin thickness.

Also described is the sequence of computer programs which process and analyze the radiometric data of such foils. These programs were specifically designed to handle the foil data associated with the experimental determination of neutron streaming through ducts; however, they are suitable for handling other radiometric analysis problems. By their use, radiometric analysis data may be rapidly processed with reasonable assurance of freedom from numerical error. Maximum utility of these programs is obtained when using automatic counting that punches data directly on cards usable as the computer input.

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INTRODUCTION

The application of foil activation for neutron flux measurement in the energy range above 1 Mev and below 0.5 ev has been described by Hughes.¹ Above 1 Mev threshold reactions are used and below 0.5 ev bare and cadmium responses are used. From the many foil techniques available for the measurement of neutrons with energy between 0.5 ev and 1 Mev, the application of foil sandwiches was selected. This application has been described by the author^{2,3} after a method of Stehn⁴ and the Staff of Argonne National Laboratory.⁵

The techniques for calculating neutron energy spectra from the activation response of several foils has been previously discussed.⁶ Essential to such calculations is a knowledge of the various responses in a medium of known moderating and scattering properties. For this purpose a neutron generator employing the d,t reaction with an acceleration of 150 kev was used as a source of nominally 14-Mev neutrons. This source was directed at a paraffin moderator so that the beam of deuterons was perpendicular to the exterior surface of the moderator. The response of selected foils was observed as a function of paraffin thickness in such a manner that no reflection was present. Each irradiation was normalized, maximizing the deuteron beam current by adjusting the focus, extraction, and accelerating voltage, and observing the counting rate of a slightly moderated BF₃ detector used as a flux monitor. The high voltage was adjusted last and assured that the incident neutron energy remained constant throughout the experiment. This is possible since the d,t reaction peaks at approximately 150 kev acceleration at which value the ejected neutrons have a most probable energy of 14 Mev.⁷

The activity of each foil was observed with an internal gas flow proportional detector with a "micromil" window and using "P" gas (90 percent argon, 10 percent methane). The detector was incorporated into an automatic counting system that directly punched cards. Data was identified by separate problem, sample, counting system, counting geometry, and observation numbers. All foils of the same type were of the same size and approximate mass and were irradiated for the same time. Data was corrected for detector resolution loss and decay after irradiation. Data was normalized in such a manner that knowledge of the distance from foil to the tritium target, counting efficiency, foil cross section, and irradiation time was not part of the analysis.

EXPERIMENT

The experiment consisted of irradiating certain selected foils, listed in Table I, with neutrons. Various thicknesses of paraffin were placed between the neutron source and the foils so as to moderate their initial nominal 14-Mev energy and to cause the neutrons to take on differing energy distribution. No paraffin was placed behind the foils so as to minimize response to neutron backscatter. For each specific foil material the same foil dimensions were used throughout the series of experiments; however, variations occurred between

different foil materials. The neutrons were produced by accelerating deuterium to approximately 150 kev before impinging on a tritium target. The accelerator operating conditions were optimized throughout the experiment by adjusting beam focus, extraction and acceleration voltage so as to maximize the beam current. It should be noted that the $d(t,n)$ cross section is near its maximum value at 150 kev energy. At this energy of bombardment, the neutrons have a most probable energy of about 14 Mev. All foils for threshold detectors were irradiated 30 minutes. The aluminum-manganese foil sandwiches were irradiated for 10 minutes followed by a 10-minute period for manipulation and counting. This in turn was followed by a 15-minute irradiation for all copper foil sandwiches. The bare and cadmium covered indium foil combinations were irradiated at the same time; they were placed for irradiation to begin with the 10-minute irradiation of the aluminum-manganese sandwich and were removed after the 15-minute copper sandwich irradiation. Since the irradiation time of each specific foil was the same, no corrections were made for activity buildup during irradiation. A slightly moderated BF_3 detector was placed in a fixed position near the generator. The count of this detector integrated over the irradiation period was used as a relative measure of neutron flux which in turn was used to normalize all observed foil activities. No corrections were made for very slight differences in mass between different foils of the same material or for counter efficiency. However, inverse square corrections were made for the varying distance between the foils and the tritium target. All observed foil activities were corrected for decay between the end of irradiation and the time of observation. Particular attention was directed toward precision. Care was taken to insure the purity and cleanliness of foils.

Foil activities were observed with an internal gas flow proportional detector having a micromil window. This detector was placed in an automatic sample changer. The counting gas was 90 percent argon and 10 percent methane, and counts were observed at the center of the beta plateau. A RaDEF source electro deposited on a platinum disk supplied by the National Bureau of Standards was used as a long lived standard to assist in obtaining uniform counter response during the period of the experiments. The output of the counter was the input to a data converter which punched on IBM cards the counting data. Other information necessary to the experiments and analysis of data was manually punched on these and other cards. A complete description of the data format on these cards and the information that they require will be found in the following section: Data Reduction. All counting data was analyzed by the methods described therein, which included statistical analysis of variance.

DATA REDUCTION

Data experimentally obtained from automatic counting systems during experiments that measure neutron streaming through ducts may best be reduced by computer techniques. Computer programs are also suitable for handling other types of radiometric analysis. The processing of data by a digital computer insures accurate reduction and rapid handling, thus affording immediate review between experiments. The programs about to be presented were

used to reduce the data from the experiment just discussed. However, to illustrate the broader applications of these programs, numerical examples are included from reduction of other counting data.

All output data from these programs may be used as data with which to calculate neutron flux. The calculations of this program are performed basically as has already been delineated.⁸ Only departures from previous work and new information is presented herein. The programs described are: pre- and post-data compiler, PDC I, II; three data organizations, DATORG I, II, III; resolution, RESOL; two decisions, DCISON I, II; Chi Square, CHISQ; three analyses of variance, VAR I, Prep VAR, VAR II; three decay analyses, DECAY I, II, III; dead-time determination, DEAD; and backing thickness determination, BACKTH. The latter two programs are not part of the routine analysis, but are included for completeness.

The program sequence is shown by the block diagram of Figure 1. All programs were written in Fortran I and were designed to be compiled with the PDQ processor, using the IBM 1620 computer. This computer was selected since it is available near the experimental facility. It is, however, possible to modify the program for use on larger computers (e.g., 7090 or 7094 as a chain job with a control program). This would be accomplished by changing a few input and output statements.

PDC takes the counting data as punched by automatic counting equipment, whose format is shown in Figure 2, preceded by a deck of program definition cards. The format of the problem definition cards is shown in Figure 3. The following programs are designed to be run in sequence according to on-line comments. For specialized cases of radiometric data certain of the programs could be omitted from the running sequence; however, the experimenter is cautioned that such omission could result in a data format that the computer does not properly recognize.

PDC organizes all data by problem number and sample number and into a format most suitable for further reduction. Its output is the input to DATORG which sorts the data according to counting systems, and geometry. These various sortings allow the intermixing of data, thus affording flexibility of counting operations. Its output is the input to RESOLN which corrects observed counts for detector dead time. Data is then fed to DCISON which corrects observed counts for decay during the counting period. DCISON also tests to determine if decay has occurred between two successive observations on the same sample. If so, each observation is called "number one", but if not, the observation number is advanced sequentially, regardless of the observation number punched on the card. The output from this program is the input either to DECAY or to CHISQ, according to a predetermined code number.

DECAY corrects for decay between count observations and adjusts these observations to that estimated for a previous time. CHISQ is customarily used only when a new system is put into operation or its performance is questioned. It determines if a series of observations is from the Poisson distribution associated with the characteristic randomness of radioactive disintegration. Correct performance is exhibited only if such a distribution exists. The output of DECAY is the input to VAR which averages the counts, corrected to a particular time, that are associated with like samples. The error associated with this average is also estimated along with the number of additional samples necessary for a smaller error. Not directly associated with the data processing, but included for completeness, are two programs, DEAD and BACKTH. The former calculates the counter dead time used in RESOL, and the latter calculates the thickness of sample backing material by three different methods: first, from data given in milligrams per square centimeter; second, from data given in mils along with the material density; third, from the ratio of the observed counts of another source with and without the backing material.

The input and output formats, flow charts, and program listings will be presented later herein when each of the several programs is considered in more detail.

Program Description - Pre-Data Compiler

PDC sorts the counting data problem number, the major data breakdown, and transforms the raw data, punched by the automatic counting equipment, into a format more suitable for further reduction. The first cards read are all of the constants and problem identifying numbers required for further data reduction, such as sample numbers that should be compared, background data, decay constants, number of decay components, and special code numbers. Next, the data furnished by the automatic counting equipment is read. It should be noted that the sample counting time does not have the decimal point included on the card (a requirement of the counting equipment). Thus, this entry is immediately transferred from a fixed point number (no decimal point) to a floating point number (with decimal point). With the particular counting equipment utilized, the omitted decimal point on the input data card necessitates dividing the punched number by 100 in order to obtain the counting time in minutes. After preliminary sorting of data into separate problems, the input constants on cards are punched, followed by the data cards as they are processed. These comprise the input to post-data compiler, which organizes the problem by sample number and similarly punches the data in the same format. Table II lists the source program; the input and output data for a sample problem are given in Tables IIIa and IIIb, respectively.

Data Organization

DATORG consists of a sequence of programs beginning with the output of PDC. It arranges the data in ascending order with respect to system number, and geometry number, associating with each group the appropriate input constant. The input data is punched in time sequence so that each field will be organized in time. If the data is already organized, this sequence of programs may be bypassed and the output of PDC used directly as input to RESOL. Once the data has been stored, a loop in the program performs the task of making the necessary changes to the sequence of data cards for their organization. After the data is sequenced appropriately in the storage array, duplicate cards are punched in an identical sequence. At this point, the next set of raw data is loaded, to be arranged in similar manner. Tables VI, VII, and X list the source program, and the output listing of a sample problem is shown in Tables VII, IX, XI, for DATORG I, II, and III.

Resolution

RESOLN corrects the observed counts for detector dead time loss. It should be noted that if the counting rate of the data is sufficiently low so as not to exhibit the effects of resolution loss, this program may be bypassed, and the data used as input directly to DCISON. RESOL obtains the dead time from the data cards associated with the corresponding system. After processing data for a particular system, a new system number and value of resolution time is associated from the input with the counting data. The analysis is then repeated. Table XII is the source program listing and Table XIII lists the output for a sample problem.

Determining Dead Time

Dead time is calculated from a series of count rate observations made on a highly active, rapidly decaying radioactive sample. The analysis utilizes two data sets, N, the true count rate obtained by extrapolating low count rate observations with a known half-life, and M', the observed high count rate observations. For every point M' there must be an associated point N. A curve of the form for dead time corrections

$$N = \frac{M'}{1 - M'\tau}$$

where τ is dead time, is then fitted to the data by the least-squares method. The program is limited to 100 data points for each of the M' and N sets. Input data is obtained from DCISON I, bypassing RESOLN. Table XIV is a listing of the source program, and the output data is listed in Table XV.

Decision

DCISON determines whether or not radioactive decay is significant. It also supplies background count data and the decay constant of principal interest. There are two parts of this program: One, DCISON I, is used when the sample observed contains only one radioisotope (i.e. decays with a constant half-life) and the other, DCISON II, is used with a mixture of radioisotopes. Input data is obtained from RESOLN which senses the correct program and prints on-line instructions to the computer operator. If no background count information is given along with the counting data, the program searches for this information in the experimental constants section of the input data. It then determines if a decay constant is given by the counting data cards. If not, an effective decay constant is estimated by the relation

$$A_{i+1} = A_i e^{-\lambda t}$$

where A_i and A_{i+1} are two observations of count rate less background (made on the same sample using the same problem, system, and geometry numbers), A_{i+1} is the first observation made after observation A_i , t is the time difference between the two count rate observations, and λ is the effective decay constant. It should be noted that the value of λ for the second to the last card, $i = n-1$, is also used for the last card, $i = n$. The time difference is obtained by multiplying the difference in days by 24 and adding that number to the difference in hours. The result is multiplied by 60 and added to the remaining difference in fractional minutes. The effective decay constant thus determined is used only for computations within this program and is not otherwise transmitted to the output data.

Both forms of DCISON make additional tests and computations to correct for decay during counting and to determine if there is significant decay between observations. It is arbitrarily chosen that if the product of λt_c , t_c being the duration of count observations, is greater than 0.01, the observed counts (less background) are corrected for decay during observation by the relation

$$A_o = \frac{A\lambda t}{(1-e^{-\lambda t})}$$

where A is the observed counts and A_o is the corrected counts. For each such card, the observation number is set equal to one. If the count observation includes background, then it is necessary to convert sample and background counts to rates, subtracting the latter from the former, before

making the above correction. If the product of the time difference, t_d , between observations and the decay constant, λ , is greater than 0.01, significant decay is said to have occurred between observations. If such is the case, the observation number is set equal to one and the time at which the observation is made is unadjusted. If, however, the product λt_d is less than 0.01, then the time of observation is set equal to that time of the first data and the observation number is set equal to that of one plus the data immediately preceding. The source programs are listed in Table XVI, XVIII and the output listing for both forms of DCISON is given in Table XVIIab, XIX.

Chi Square

CHISQ is a program used to determine if a counting system is performing satisfactorily. This program obtains its input data from DCISON but it is not part of normal data reduction; rather, it is used when testing a counting system. Data for CHISQ is obtained as a series of count rate observations, each for an equal interval of time. It should be noted that any counting system should exhibit only the Poisson variations of random disintegration process except for minor long term changes. The source program is listed in Table XX, and in Table XXI is the output listing for a sample program.

Decay

DECAY is a program used to correct for radioactive decay in the counting rate of a sample. In the present scheme of analysis three programs are provided depending upon whether there are one, two or three components of decay. The number of decay components (i.e., decay constants), is sensed by the preceding program DCISON, and appropriate on-line instructions are provided to the computer operator. For this program the cards associated with the problem constants provide the decay constants. The program interprets these decay constants as the slope of straight lines on similog paper and fits the observed counting rate data to the straight lines such that the sum of the straight line components, one for each decay component, is equal to the observed counting data; as a function of time the smooth curve through the counting rate data is optimized by the least-squares process. The source programs are listed in Tables XXII, XXIV, and XXXI, for Decay I, II, and III corresponding to 1, 2, and 3 components of radioactivity. The program estimates the most probable counting rate for each component of the radioactive sample, up to a maximum of three components. This estimate is at either a given day and time, which must be less than the lowest day and time, or the lowest day and time depending upon the information given in the data of problem constants. Additionally, each data point is corrected back to that time so that the resulting output data which is shown in Tables XXIII, XXV, XXVII, respectively for Decay I, II, and III consists of the average

counting rate for each component as well as the average total counting rate of the sample along with the counting rate of each observation broken into its constituent radioactive components along with the sum of these components. In all cases the other experimental parameters such as time of observation, background counting, and time of observation of the background counts, number of samples, and number of observations per sample, are preserved so that subsequent programs can associate confidence limits with these count-rate estimates. Although some variance of data points from the idealized curve is possible, extreme variations are not tolerated by the present program. This is because weighting is not employed to allow counting rates that more closely approximate the predicted value (based upon known half-life) to be considered more important than those counting rates which deviate considerably from the predicted values. For the same reason, gross errors can result if the absolute magnitude of one component of radioactive decay is small in comparison with the absolute magnitude of the sum total of all components of radioactive decay present in the sample. These limitations, however, do not impose serious restrictions for practical radiometric analysis, and the incorporation of these limitations together with those concerning the duration of time of observation and number of observations per sample, which will be discussed as part of the following program VAR, greatly simplify the mathematical analysis and required computer programming.

Analysis of Variance

VAR is a program for determining the average counting rate of a series of observations made over a period of time. As such, there are possible mechanical, sampling, chemical, (when more than one sample is being compared) and non-Poisson counting errors in addition to the Poisson variation of radioactive decay process. Its input is the count rate of the sample and background counting rate provided by DCISON. The program also estimates the confidence interval associated with the average count rate.

The program considers m samples whose hypothetical true count rate is the average of an infinite number of observations made on an infinite number of samples. Thus, the m samples represent a random collection from the sample population. This population has a mean and a standard deviation, whose estimates based upon m samples observed a finite number of times are, respectively, μ and σ . These parameters, along with identification data, are provided as output data. It is assumed that each sample is observed for the same number of times, that each time duration of observation is the same, and that a separate background determination is made for each observation.

In addition to determining the best estimate of the counting rate, an estimate is made of the confidence limit associated with the standard deviation, 0.90, 0.95, and 0.99-level of significance. This level is used in calculating the upper and lower limits of the confidence interval associated

with $\tilde{\mu}$. Additionally, the number of additional samples, or observations, in the case of single sample, required to reduce the estimated error of the measurement is calculated and punched on cards together with the other output data. The program is listed in Table XXVIII, for the case of one sample, and the output of a sample program is listed in Table XXIX. The result is the best estimate of the counting rate of each component of radioactive material, up to a maximum of three, at a given day and time, along with the confidence interval of these estimates. This best estimate is based upon a series of observations made on a series of samples. Similar source programs for the case of many samples, are listed in Tables XXX and XXXII. The corresponding sample output data listings are in Tables XXXI and XXXIII.

Backing Thickness

BACKTH calculates the thickness, XF, of backing material for radioactive samples by three different methods. First, the data may already be given in the desired units, mg/cm², which merely entails punching the sample number with its associated thickness. Second, the thickness may be given in mils, in which case the density, ρ , of the backing material must accompany the value of thickness. Third, the data may be given as the ratio of counts observed when the backing is used as a absorber. Input data is obtained from the output of DECAY I, since this program is also not part of the regular reduction routine. If the density is missing, this indicates that the backing thickness is already in the desired units, mg/cm². If the density is present, then the thickness is in mils, which requires changing these units to milligrams per square centimeter. This is accomplished by multiplying the given value of XF(1) by

$$10^{-3}(\text{in}) \quad 2.54 (\text{cm/in}) \quad \rho(\text{mg/cm}^3)$$

where ρ = the density of the backing material. Thus, XF(1) is now in the desired units. On the other hand, if the value of XF(1) is missing, then the data card must contain the maximum beta energy for this particular isotope, E, the counts observed when the backing is used as an absorber, AA, and the counts when the backing is not used as an absorber, A0. A zero value of XF(1) instructs the program to check the geometry number given for the present execution of BACKTH. A geometry code number less than 10 indicates narrow geometry. If this is the case, the above entries on the current data card are used in obtaining a value of the mass absorption coefficient, α , by employing the following equation for narrow geometry

$$\alpha = \frac{22}{E^{1.33}} \quad , \quad \text{cm}^2/\text{gm}$$

where E = energy, Mev. If the geometry code number is greater than or equal to 10, indicating wide geometry (2π or 4π), then the given value of the

maximum beta energy, E, is checked to see if it is less than 1.45 Mev. If so, the following equation for wide geometry is used to determine α

$$\alpha = \frac{60}{E^{1.54}}$$

If the value of E is greater or equal to 1.45 Mev., the equation, also for wide geometry, is employed

$$\alpha = \frac{200}{E^{6.25}}$$

After the appropriate value of α is determined, it is used in calculating the corresponding value of XF(1). This is done by substituting the values of A0, AA and α into the following expression

$$XF(1) = \frac{\ln(A0)}{\alpha} - \frac{\ln(AA)}{\alpha}$$

Immediately, this value of XF(1) and its associated sample number are punched on cards. The source program is listed in Table XXXIV and Table XXXV lists the output data for a sample problem. It should be noted that these programs do not handle the case where the geometry is actually neither narrow or wide but somewhere between the two special cases.

RESULTS

The response of the selected foils to moderated neutrons is shown in Figure 4. In this Figure the response of each foil was normalized by dividing the observed activity by the maximum observed activity. This normalized activity is the linear left ordinate and is plotted versus the paraffin thickness, measured in inches along the logarithmic abscissa. The only exception is the cadmium ratio determinations. The cadmium ratio was calculated by dividing the activity of the bare foil by the activity of the foil covered with 20 mils of cadmium. This ratio is the linear right ordinate plotted against the same abscissa. The reciprocal of the cadmium ratio is the fraction of the total number of neutrons having energies greater than the effective cadmium cutoff energy (N.B., for the cadmium thickness specified above and for an ambient temperature of 23°C, the effective cadmium cutoff energy is 0.48 ev). From the cadmium ratio an estimate may be visually obtained of the average neutron energy. This may be used as a comparison basis for the foil response.

It will be seen in Figure 3 that the response of each foil is fairly narrow and does not overlap more than a portion of the adjacent foil. Further, it will be seen that there is no energy at which some foil does not have a significant response. Most of the foils have responses between 1 and 16 Mev. This is the energy region where most resolution is needed in the study of the penetration of 14-Mev neutrons through shielded structures.⁹

CONCLUSIONS

Twelve feet of paraffin will thermalize at least 99 percent of all 14-Mev neutrons as evidenced by the measured cadmium ratio of Indium. The response of each selected foil, ordered in decreasing energy, overlap no more than the response of the adjacent foils and there is no energy "gap" for which there is no response of at least one foil. The resolution of foil response, i.e., the width of the response curve, is most suitable for measuring neutron streaming through ducted entranceways of protective structures.

A series of computer programs is most useful for the reduction of foil activation data. The programs are written for particular application to shielding studies where several different foils are irradiated in many different locations in the shield. The programs take care of the "bookkeeping" for such an experimental program, such as foil positions, foil type, radio-metric system and geometry, and different observations for the statistical analysis incorporated in the program.

ACKNOWLEDGEMENTS

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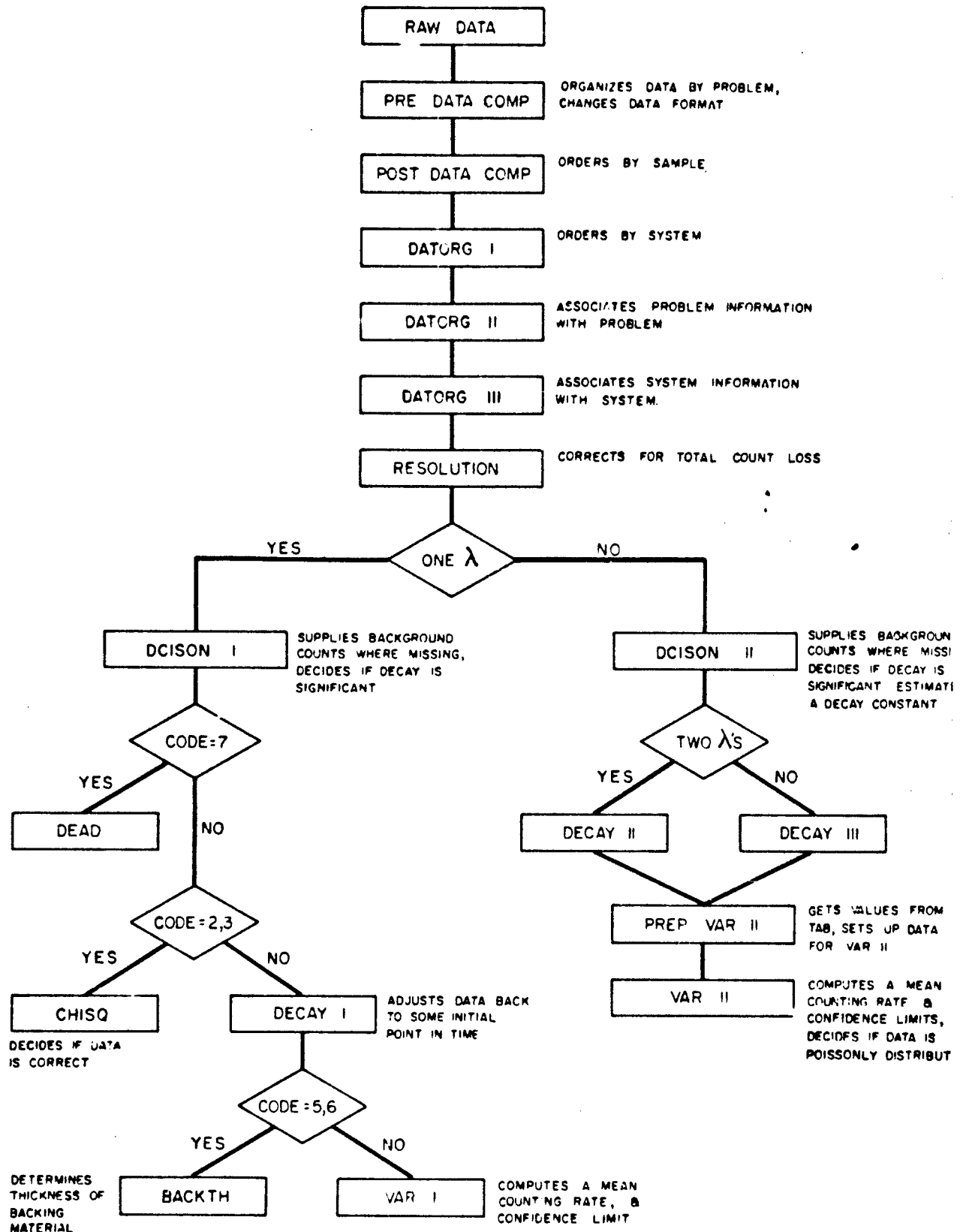


Figure 1. Program Sequence.

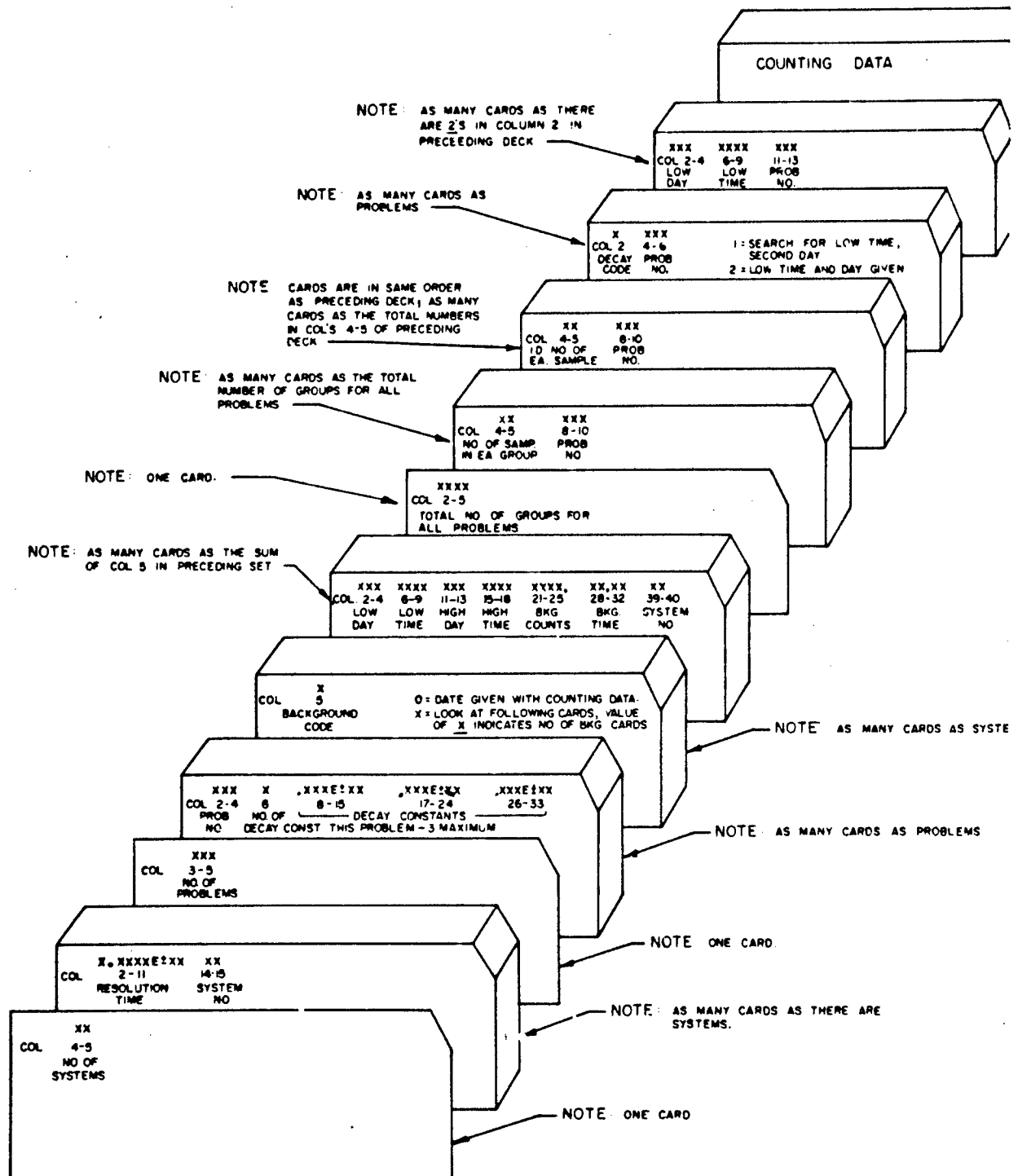


Figure 3. Format of problem definition cards.

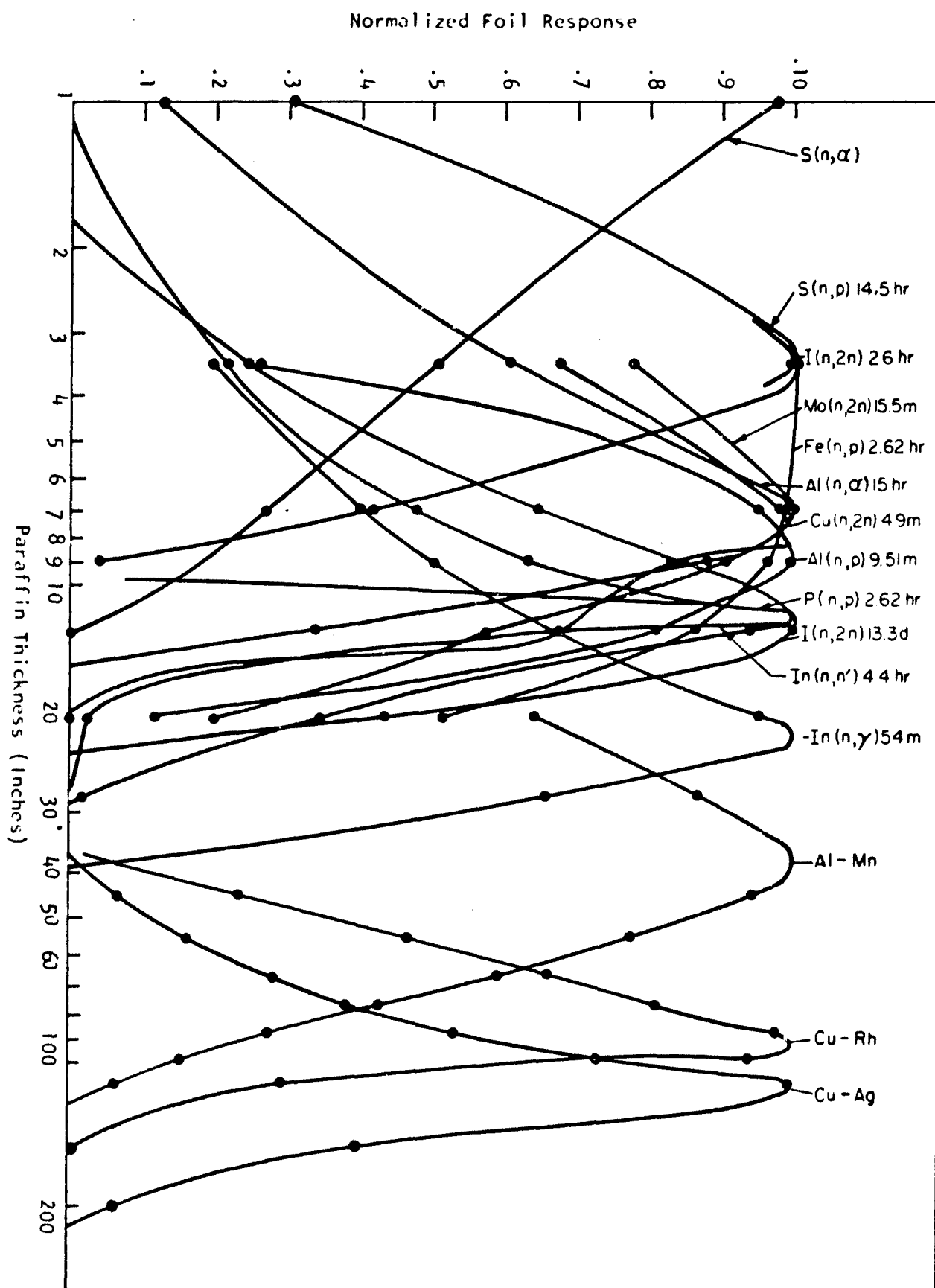


Figure 4. Response of selected foils to moderated neutrons.

TABLE 1. List of Foils

<u>Foil Reaction</u>	<u>Daughter Half-Life</u>
$\text{In}^{115} (n, n') \text{In}^{115m}$	4.4 hr
$\text{In}^{115} (n, \gamma) \text{In}^{116}$	54 min
$\text{Cu}^{63} (n, 2n) \text{Cu}^{62}$	9.9 min
$\text{I}^{127} (n, 2n) \text{I}^{126}$	13.3 d
$\text{S}^{32} (n, p) \text{P}^{32}$	14.3 d
$\text{S}^{34} (n, \alpha) \text{Si}^{31}$	2.62 hr
$\text{P}^{31} (n, p) \text{Si}^{31}$	2.62 hr
$\text{Fe}^{56} (n, p) \text{Mn}^{56}$	2.56 hr
$\text{Mo}^{92} (n, 2n) \text{Mo}^{91}$	15.5 min
$\text{Al}^{27} (n, p) \text{Mg}^{27}$	9.51 min
$\text{Al}^{27} (n, \alpha) \text{Na}^{24}$	15 hr
$\text{Al}^{27} (n, \gamma) \text{Al}^{28}$	2.3 min
$\text{Cu}^{65} (n, \gamma) \text{Cu}^{66}$	5.1 min

TABLE II PRE DATA COMPILER SOURCE PROGRAM

```

C      PRE-DATA COMPILER
      DIMENSION MM(125)
      K=1
10 READ 105,N1
105 FORMAT(15)
      PUNCH 105,N1
      DO 200 I=1,N1
      READ 106,NYX
200 PUNCH 106,NYX
106 FORMAT(40H
132H
      READ 105,N
      PUNCH 105,N
      DO 201 I=1,N
      READ 807,MM(I)
201 PUNCH 807,MM(I)
      N3=0
      DO 202 I=1,N1
      READ 105,N2
      N3=N3+N2
202 PUNCH 105,N2
      DO 203 I=1,N3
      READ 106,NYX
203 PUNCH 106,NYX
      READ 105,N5
      PUNCH 105,N5
      N6=0
      DO 205 I=1,N5
      READ 401,N7,NNM
      N6=N6+N7
205 PUNCH 401,N7,NNM
      DO 206 I=1,N6
      READ 106,NYX
206 PUNCH 106,NYX
      J=0
      DO 208 I=1,N
      READ 408,IC,IP
      IF(IC-2)208,209,208
209 J=J+1
408 FORMAT(12,14)
208 PUNCH 408,IC,IP
      DO 210 I=1,J
      READ 106,NYX
210 PUNCH 106,NYX
      IZ=-1

```

.12)

```

      PUNCH 109,12
109  FORMAT(40X,32X,12)
      3  READ 100, B4,B3,IA7,IA6,IA2,IA5,D,B6,IB5,IA3,IA4,IA1,IB2,B1
        IF(1B5)5,30,5
      30  PUNCH 110
110  FORMAT(40X,40X)
      PRINT 808
808  FORMAT(27HEND OF PROBLEM, REREAD DATA)
      PAUSE
      K=K+1
      IF(K-N)10,10,300
      5  IF(1B5-MM(K))3,4,3
      4  C2=1B2
        B2=C2/100.
        IF(B4) 1,2,1
      1  PUNCH 101, IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,D,B6
        GO TO 3
      2  PUNCH 102, IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,IB5,D,B6
        GO TO 3
300  12=-9
      PUNCH 109,12
      PRINT 500
      STOP
500  FORMAT(13HLOAD POST PDC)
100  FORMAT(F7.2,F8.0,3I3,12,E9.3,F5.2,2I4,15,I4,16,1X,F8.0)
101  FORMAT(14,I3,I4,I5,12,2I3,F8.0,F7.2,F8.0,F7.2,14,E9.3,F5.2)
102  FORMAT(14,I3,I4,I5,12,2I3,F8.0,F7.2,15X,I4,E9.3,F5.2)
401  FORMAT(2I5)
807  FORMAT(14,35H
      END

```

TABLE IIIA INPUT TO PRE DATA COMPILER

[illegible]

119 0830 6
220 0830 10

60.00	1832.	1	11	11	2	.100E+01	1.96	6	119	0832	1	100	9218.	33
		2	11	11	2	.100E+01	1.96	6	119	0835	1	100	8607.	34
		3	11	11	2	.100E+01	1.96	6	119	0838	1	100	7421.	35
		1	11	11	2	.100E+01	1.96	6	119	0841	1	100	6298.	36
		1	11	11	2	.100E+01	1.96	6	119	0843	1	100	5516.	37
		1	11	11	1	.100E-10	1.96	20	119	0855	1	200	6064.	38
60.00	1832.	1	1	2	4	.100E-10+1.96	1.96	90	119	0900	1	100	12642.	39
		2	11	11	1	.100E-10	1.96	20	119	0901	1	200	5964.	40
60.00	1832.	2	1	2	4	.100E-10+1.96	1.96	90	119	0903	1	100	12580.	41
		3	11	11	1	.100E-10	1.96	20	119	0905	1	200	5980.	42
60.00	1832.	3	1	2	4	.100E-10+1.96	1.96	90	119	0907	1	100	12673.	43
		4	11	11	1	.100E-10	1.96	20	119	0908	1	200	6020.	44
		5	11	11	1	.100E-10	1.96	20	119	0913	1	200	5887.	45
		6	11	11	1	.100E-10	1.96	20	119	0916	1	200	5864.	46
		7	11	11	1	.100E-10	1.96	20	119	0920	1	200	6064.	47
		8	11	11	1	.100E-10	1.96	20	119	0923	1	200	6078.	48
		9	11	11	1	.100E-10	1.96	20	119	0927	1	200	6094.	49
		10	11	11	1	.100E-10	1.96	20	119	0931	1	200	5984.	50
60.00	1821.	1	01	02	1	.100E-10	1.96	21	119	0935	1	100	14954.	51
60.00	1821	1	01	02	1	.100E-10	1.96	21	119	0938	1	100	14867.	52
60.00	1821	1	01	02	1	.100E-10	1.96	21	119	0944	1	100	14498.	53
		1	11	11	5	.100E-10	1.96	22	119	1011	1	100	3467.	54
		1	11	11	5	.100E-10	1.96	22	119	1015	1	100	3451.	55
		1	11	11	6	.100E-10	1.96	22	119	1017	1	100	1728.	56
		1	11	11	6	.100E-10	1.96	22	119	1022	1	100	1720.	57
		1	1	1	7	.128E-01	1.96	23	119	1030	1	100	103000.	58
		1	1	1	7	.128E-01	1.96	23	119	1037	1	100	100000.	59
		1	1	1	7	.128E-01	1.96	23	119	1044	1	100	95000.	60
		1	1	1	7	.128E-01	1.96	23	119	1051	1	100	90000.	61
		1	1	1	7	.128E-01	1.96	23	119	1058	1	100	85000.	62
		1	1	1	7	.128E-01	1.96	23	119	1105	1	100	80000.	63
		1	1	1	7	.128E-01	1.96	23	119	1112	1	100	75000.	64
		1	1	1	7	.128E-01	1.96	23	119	1119	1	100	70000.	65
		1	1	1	7	.128E-01	1.96	23	119	1126	1	100	65000.	66
		1	1	1	7	.128E-01	1.96	23	119	1133	1	100	60000.	67
		1	1	1	7	.128E-01	1.96	23	119	1140	1	100	55000.	68
		1	1	1	7	.128E-01	1.96	23	119	1147	1	100	50000.	69
		1	1	1	7	.128E-01	1.96	23	119	1158	1	100	45000.	70

60.00	1821.	1	1	1	7	.128E-01	1.96	23	119	1208	1	100	40000.	70
60.00	1792.	1	1	1	7	.128E-01	1.96	23	119	1219	1	100	35000.	71
60.00	1803.	1	1	1	7	.128E-01	1.96	23	119	1311	1	100	20000.	72
60.00	1822.	1	1	2	4	.400E-04	1.96	7	220	0823	1	100	9600.	73
60.00	1798.	1	11	11	4	.400E-03	1.96	10	220	0851	1	100	11263.	74
60.00	1791.	1	1	2	4	.400E-04	1.96	7	222	0832	2	100	9012.	75
60.00	1803.	1	11	11	4	.400E-03	1.96	10	222	0841	2	100	6913.	76
60.00	1822.	1	1	2	4	.400E-04	1.96	7	224	0816	1	100	8605.	77
60.00	1798.	1	11	11	4	.400E-03	1.96	10	224	0820	1	100	5321.	78
60.00	1791.	1	11	11	4	.400E-03	1.96	10	225	0835	41	100	47829.	79
60.00	1800.	1	11	11	4	.400E-03	1.96	10	226	0841	41	100	43108.	80
60.00	1803.	1	1	2	4	.400E-04	1.96	7	228	0833	2	100	7123.	81
60.00	1821.	1	11	11	4	.400E-03	1.96	10	228	0839	2	100	3794.	82
60.00	1818.	1	1	2	4	.400E-04	1.96	7	229	0841	1	100	6684.	83
60.00	1831.	1	11	11	4	.400E-03	1.96	10	229	0855	1	100	3728.	84
60.00	1801.	1	1	2	4	.400E-04	1.96	7	231	0823	2	100	5859.	85
60.00	1792.	1	11	11	4	.400E-03	1.96	10	231	0829	2	100	3452.	86
60.00	1798.	1	1	2	4	.400E-04	1.96	7	233	0835	1	100	5128.	87
60.00	1801.	1	11	11	4	.400E-03	1.96	10	233	0840	1	100	3207.	88
60.00	1816.	1	11	11	4	.400E-03	1.96	10	234	0829	41	100	30968.	89
60.00	1821.	1	11	11	4	.400E-03	1.96	10	235	0830	41	100	30026.	90
60.00	1821.	1	11	11	4	.400E-03	1.96	10	235	0830	2	100	3007.	91
60.00	1821.	1	11	11	4	.400E-03	1.96	10	235	0835	1	100	2980.	92
60.00	1821.	1	11	11	4	.400E-03	1.96	10	235	0841	2	100	3196.	93
60.00	1821.	2	11	11	4	.400E-03	1.96	10	235	0843	1	100	2907.	94
60.00	1821.	2	11	11	4	.400E-03	1.96	10	235	0845	2	100	3012.	95

119 0830 6
220 0830 10

0
0
-1

1	11	119	832	2	11	1	9218.	1.00
1	11	119	835	2	11	2	8607.	1.00
1	11	119	838	2	11	3	7421.	1.00
1	11	119	841	2	11	1	6298.	1.00
1	11	119	843	2	11	1	5516.	1.00

6 .100E 01 1.96
6 .100E 01 1.96
6 .100E 01 1.96
6 .100E 01 1.96
6 .100E 01 1.96

3

1.2370E-06 01
1.2370E-06 02
0.3829E-05 11

8

6	1	.100E+01						
7	2	.400E-04	.400E-05					
10	3	.400E-03	.400E-04	.400E-05				
20	1	.100E-10						
21	1	.100E-10						
22	1	.100E-10						
23	1	.128E-01						
90	1							

1

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1

119	0800	119	1600	1800.	60.00	1
119	0800	119	1200	1800.	60.00	2
119	1200	119	1600	2400.	60.00	2
220	0800	220	1200	1800.	60.00	2
220	1200	220	1600	1800.	60.00	2
119	0800	119	1600	6600.	60.00	11

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2 6
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2 10
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1 21
1 22
1 23
1 90

119 0830 6
220 0830 10

0
0
-1

1	11	220	851	4	11	1	11263.	1.00	1821.	60.00	10	.400E-03	1.96
2	11	222	841	4	11	1	6913.	1.00	1803.	60.00	10	.400E-03	1.96
1	11	224	820	4	11	1	5321.	1.00	1798.	60.00	10	.400E-03	1.96
4	11	225	835	4	11	1	47829.	1.00	1791.	60.00	10	.400E-03	1.96
4	11	226	841	4	11	1	43108.	1.00	1800.	60.00	10	.400E-03	1.96
2	11	228	839	4	11	1	3794.	1.00	1821.	60.00	10	.400E-03	1.96
1	11	229	855	4	11	1	3728.	1.00	1831.	60.00	10	.400E-03	1.96
2	11	231	829	4	11	1	3452.	1.00	1792.	60.00	10	.400E-03	1.96
1	11	233	840	4	11	1	3207.	1.00	1801.	60.00	10	.400E-03	1.96
4	11	234	829	4	11	1	30968.	1.00	1816.	60.00	10	.400E-03	1.96
4	11	235	830	4	11	1	30026.	1.00	1821.	60.00	10	.400E-03	1.96
2	11	235	830	4	11	1	3007.	1.00	1821.	60.00	10	.400E-03	1.96
1	11	235	835	4	11	1	2980.	1.00	1821.	60.00	10	.400E-03	1.96
2	11	235	841	4	11	1	3196.	1.00	1821.	60.00	10	.400E-03	1.96
1	11	235	843	4	11	2	2907.	1.00	1821.	60.00	10	.400E-03	1.96
2	11	235	845	4	11	2	3012.	1.00	1821.	60.00	10	.400E-03	1.96

3
1.2370E-06 01
1.2370E-06 02
0.3829E-05 11

8
4 1 -100E-01

7 2 .400E-04 .400E-05
 10 3 .400E-03 .400E-04 .400E-05
 20 1 .100E-10
 21 1 .100E-10
 22 1 .100E-10
 23 1 .128E-01
 90 1

119 0800 119 1600 1800. 60.00 1
 119 0800 119 1200 1800. 60.00 2
 119 1200 119 1600 2400. 60.00 2
 220 0800 220 1200 1800. 60.00 2
 220 1200 220 1600 1800. 60.00 2
 119 0800 119 1600 6600. 60.00 11

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2 6
 1 7
 2 10
 1 7
 2 7
 1 10
 2 10

0 0 0 0

2 6
 1 7
 2 10
 1 20
 1 21
 1 22
 1 23
 1 90
 119 0830 6
 220 0830 10

0 0 -1

1 11 119 855 1 11 1 6064. 2.00
 1 11 119 901 1 11 2 5964. 2.00
 1 11 119 905 1 11 3 5980. 2.00
 1 11 119 908 1 11 4 6020. 2.00
 1 11 119 913 1 11 5 5887. 2.00
 1 11 119 916 1 11 6 5864. 2.00

20 .100E-10 1.96
 20 .100E-10 1.96
 20 .100E-10 1.96
 20 .100E-10 1.96
 20 .100E-10 1.96
 20 .100E-10 1.96

1	11	119	920	1	11	7	6064.	2.00	20	.100E-10	1.96
1	11	119	923	1	11	8	6078.	2.00	20	.100E-10	1.96
1	11	119	927	1	11	9	6094.	2.00	20	.100E-10	1.96
1	11	119	931	1	11	10	5984.	2.00	20	.100E-10	1.96

3	1.2370E-06	01
1.2370E-06	02	
0.3829E-05	11	
8		
6	1 .100E+01	
7	2 .400E-04	.400E-05
10	3 .400E-03	.400E-04 .400E-05
20	1 .100E-10	
21	1 .100E-10	
22	1 .100E-10	
23	1 .128E-01	
90	1	

119	0800	119	1600	1800.	60.00	1	0
119	0800	119	1200	1800.	60.00	2	0
119	1200	119	1600	2400.	60.00	2	0
220	0800	220	1200	1800.	60.00	2	0
220	1200	220	1600	1800.	60.00	2	0
119	0800	119	1600	6600.	60.00	11	0
2							
2	7						
2	10						
1	7						0
2	7						0
1	10						0
2	10						0
2	6						
1	7						
2	10						
1	20						
1	21						

[illegible]

2 . 10
1 20
1 21
1 22
1 23
1 90
119 0830 6
220 0830 10

1 11 119 1011 5 11 1 3467. 1.00
1 11 119 1015 5 11 1 3451. 1.00
1 11 119 1017 6 11 1 1728. 1.00
1 11 119 1022 6 11 1 1720. 1.00

0
0
-1
22 .100E-10 1.96
22 .100E-10 1.96
22 .100E-10 1.96
22 .100E-10 1.96

3

1.2370E-06 01
1.2370E-06 02
0.3829E-05 11

8

6 1 .100E+01
7 2 .400E-04 .400E-05
10 3 .400E-03 .400E-04 .400E-05
20 1 .100E-10
21 1 .100E-10
22 1 .100E-10
23 1 .128E-01
90 1

1

4

1

119 0800 119 1600 1800. 60.00 1
119 0800 119 1200 1800. 60.00 2
119 1200 119 1600 2400. 60.00 2
220 0800 220 1200 1800. 60.00 2
220 1200 220 1600 1800. 60.00 2
119 0800 119 1600 6600. 60.00 11

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0
0
0
0

2

2

2

10

7

10

TABLE IV POST DATA COMPILER SOURCE PROGRAM

```

C      POST DATA COMPILER
      DIMENSION NS(100)
      2  I=1
      1  READ 100,NYX
      PUNCH 100,NYX
      IF(NYX+1)1,10,1
10     READ 101, IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,D,B6,NYX
      NS(I)=IA1
11     READ 101, IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,D,B6,NYX
      IF(IA1)16,15,16
16     J=1
13     IF(NS(J)-IA1)12,11,12
12     J=J+1
      IF(J-I)13,13,14
14     I=I+1
      NS(I)=IA1
      GO TO 11
15     PRINT 102
      IF(I-1)400,400,408
408    N=I
      DO 300 I=2,N
      J=1
402    IF(NS(J)-NS(J-1))401,300,300
401    KEP=NS(J)
      NS(J)=NS(J-1)
      NS(J-1)=KEP
      IF(J-2)40,300,40
40     J=J-1
      GO TO 402
300    CONTINUE
      I=N
400    DO 2000 J=1,I
200    READ 100,NYX
      IF(NYX+1)200,204,200
204    READ 101, IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,D,B6,NYX
      IF(IA1)202,2001,202
202    IF(IA1-NS(J))204,203,204
203    PUNCH 101,IA1,IA2,IA3,IA4,IA5,IA5,IA7,B1,B2,B3,B4,IB5,D,B6,NYX
      GO TO 204
2001   IF(J-I)2002,2000,2002
2002   PRINT 102
2000   CONTINUE
      PRINT 103
      PUNCH 101,IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,D,B6,NYX
      PAUSE
  
```

```
GO TO 2
100 FORMAT(40H
      132H                                ,12)
101 FORMAT(I4,I3,I4,I5,I2,2I3,F8.0,F7.2,F8.0,F7.2,I4,E9.3,F5.2.
102 FORMAT(11H REREAD DATA)
103 FORMAT(16H READ NEW PROBLEM)
      END
```


[illegible]

[illegible]

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

[illegible]

1	119	0800	119	1600	1800.	60.00
2	119	0800	119	1200	1800.	60.00
3	119	1200	119	1200	2400.	20.00

1	2	119	907	4	1	3	12673.	1.00	1832.	60.00	90	.000	1.96	0
0	0	0	0	0	0	0	.	.00	.	.00	0	.000	.00	0

TABLE VI DATAORG I SOURCE PROGRAM

```

C      DATA ORG I
      DIMENSION NN(200)
400 K=1
      READ 100,N1
      PUNCH 100,N1
      DO 3 I=1,N1
      READ 101,TAU,NN(I)
      3 PUNCH 101,TAU,NN(I)
      4 READ 102,NYX
      PUNCH 102,NYX
      IF(NYX+1)4,5,4
      5 IF(N1-1)901,900,901
901 DO 800 I=2,N1
      J=I
402 IF(NN(J)-NN(J-1))401,800,800
401 KEP=NN(J)
      NN(J)=NN(J-1)
      NN(J-1)=KEP
      IF(J-2)40,800,40
      40 J=J-1
      GO TO 402
800 CONTINUE
      22 READ 103,IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,DK,B6
      IF(IA2-NN(K))20,21,20
      21 PUNCH 103, IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,DK,
      GO TO 22
      20 IF(IA2)22,23,22
      23 K=K+1
      IF(K-N1)24,24,300
      24 PRINT 801
801 FORMAT(23HREREAD DATA, PUSH START)
      PAUSE
500 READ 102,NYX
      IF(NYX+1)500,22,500
300 PRINT 108
      PUNCH 110
110 FORMAT(40X,40X)
      PAUSE
      GO TO 400
900 K=1
      GO TO 22
108 FORMAT(17HLOAD NEXT PROBLEM)
100 FORMAT(15)
101 FORMAT(E11.4,14)
102 FORMAT(40H

```

1324

121

103 FORMAT(14,13,14,15,12,213,F8.0,F7.2,F8.0,F7.2,14,E9.3,F5.2)
END

TABLE VII OUTPUT DATORG I - INPUT DATORG II

3	1.2370E-06	01		1
	1.2370E-06	02		2
	0.3829E-05	11		2
8				11
6	1.100E+01			
7	2.400E-04	.400E-05		
10	3.400E-03	.400E-04	.400E-05	
20	1.100E+10			
21	1.100E-10			
22	1.100E-10			
23	1.128E-01			
90	1			
1				
4				
1				
119	0800	119	1600	1800.
119	0800	119	1200	1800.
119	1200	119	1600	2400.
220	0800	220	1200	1800.
220	1200	220	1600	1800.
119	0800	119	1600	6600.
2				
2	7			
2	10			
1	7			
2	7			
1	10			
2	10			
2	6			
1	7			
2	10			
1	20			
1	21			
1	22			
1	23			

8
 6 1 .100E+01
 7 2 .400E-04 .400E-05
 10 3 .400E-03 .400E-04 .400E-05
 20 1 .100E-10
 21 1 .100E-10
 22 1 .100E-10
 23 1 .128E-01
 90 1

1
 4
 1
 119 0800 119 1600 1800. 60.00 1
 119 0800 119 1200 1800. 60.00 2
 119 1200 119 1600 2400. 60.00 2
 220 0800 220 1200 1800. 60.00 2
 220 1200 220 1600 1800. 60.00 2
 119 0800 119 1600 6600. 60.00 11

2
 2 7
 2 10
 1 7
 2 7
 1 10
 2 10

2 6
 1 7
 2 10
 1 20
 1 21
 1 22
 1 23
 1 90
 119 0830 6
 220 0830 10

1 11 119 855 1 11 1 6064. 2.00
 1 11 119 901 1 11 2 5964. 2.00
 1 11 119 905 1 11 3 5980. 2.00
 1 11 119 908 1 11 4 6020. 2.00

 .00 20
 .00 20
 .00 20
 .00 20
 1.96
 1.96
 1.96
 1.96

TABLE VIII DATORG II SOURCE PROGRAM

```

C      DATA ORG II
1 READ 200,NYX
  IF(NYX+1)1,2,1
2 READ 201,IB5
  IX5=IB5
  PRINT 202
  PAUSE
  READ 100,N1
  PUNCH 100,N1
  DO 10 I=1,N1
    READ 200,NYX
10 PUNCH 200,NYX
  READ 100,N2
  DO 20 I=1,N2
    READ 204,IPROB,NLM,XLAM1,XLAM2,XLAM3
    IF(IPROB-IB5)20,21,20
21 IY1=IPROB
  IY2=NLM
  XX1=XLAM1
  XX2=XLAM2
  XX3=XLAM3
20 CONTINUE
  NN=0
  DO 22 I=1,N1
    READ 205,N3,N4
    PUNCH 205,N3,N4
22 NN=NN+N3
  DO 23 I=1,NN
    READ 200,NYX
23 PUNCH 200,NYX
  NYX=-2
  PUNCH 203,NYX
  PUNCH 204,IY1,IY2,XX1,XX2,XX3
  READ 100,N5
  NN=0
  DO 25 I=1,N5
    READ 205,N3,N4
    NN=NN+N3
  IF(N4-IX5)25,26,25
26 PUNCH 205,N3,N4
25 CONTINUE
  DO 27 I=1,NN
    READ 205,N3,N4
    IF(N4-IX5)27,28,27
28 PUNCH 205,N3,N4

```

```

27 CONTINUE
  NYX=-3
  PUNCH 203,NYX
  NN=0
  DO 29 I=1,N2
  READ 209,N
  IF(N-2)29,30,29
30 NN=NN+1
29 CONTINUE
  IF(NN)31,32,31
31 DO 33 I=1,NN
  READ 206,J1,J2,J3
  IF(IJ3-IX5)33,34,33
34 PUNCH 206,J1,J2,J3
33 CONTINUE
32 READ 200,NYX
  PUNCH 200,NYX
  IF(NYX+1)32,35,32
35 READ 207,IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,DK,B6
  IF(IA1)36,37,36
36 PUNCH 207, IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,DK,B6
  GO TO 35
37 NYX=-9
  PUNCH 203,NYX
  PRINT 208
  PAUSE
  GO TO 1
100 FORMAT(15)
200 FORMAT(40H
132H
,12)
201 FORMAT(40X,14X,14)
202 FORMAT(11HREREAD DATA)
203 FORMAT(40X,32X,12)
204 FORMAT(14,12,3E9.3)
205 FORMAT(215)
206 FORMAT(14,15,14)
207 FORMAT(14,13,14,15,12,213,F8.0,F7.2,F8.0,F7.2,14,E9.3,F5.2)
208 FORMAT(14HLCAD NEXT PROB)
209 FORMAT(12)
END

```

TABLE IX. OUTPUT DATA OF II - INPUT DATA III

[illegible]

220 1200 220 1600 1800. 60.00 2
 119 0800 119 1600 6600. 60.00 11

0
 0
 -2

7 2 .400E-04 .400E-05 .000E-50

2
 1
 2

-3
 -3
 -1

1 2 220 823 4 1 1 1 9600. 1.00
 1 2 224 816 4 1 1 1 8605. 1.00
 1 2 229 841 4 1 1 1 6684. 1.00
 1 2 233 835 4 1 1 1 5128. 1.00
 2 2 222 832 4 1 1 1 9012. 1.00
 2 2 228 833 4 1 1 1 7123. 1.00
 2 2 231 823 4 1 1 1 5859. 1.00

1822.
 1818.
 1798.
 1792.
 1803.
 1801.
 .00
 60.00
 60.00
 60.00
 60.00
 60.00
 60.00
 60.00

7
 7
 7
 7
 7
 7
 7

1.96
 1.96
 1.96
 1.96
 1.96
 1.96
 1.96

-9

3

1.2370E-06 01
 1.2370E-06 02
 0.3829E-05 11

1
 4
 1

119 0800 119 1600 1800. 60.00
 119 0800 119 1200 1800. 60.00
 119 1200 119 1600 2400. 60.00
 220 0800 220 1200 1800. 60.00
 220 1200 220 1600 1800. 60.00
 119 0800 119 1600 6600. 60.00

1
 2
 2
 2
 2
 11

0
 0
 0
 0
 0
 0
 -2

10 3 .400E-03 .400E-04 .400E-05

2
 1
 2

-3
 -3

220 830 10

-1

1	11	220	851	4	11	1	11263.	1.00	1821.	60.00	10	1.96
1	11	224	820	4	11	1	5321.	1.00	1798.	60.00	10	1.96
1	11	229	855	4	11	1	3728.	1.00	1831.	60.00	10	1.96
1	11	233	840	4	11	1	3207.	1.00	1801.	60.00	10	1.96
1	11	225	835	4	11	1	2980.	1.00	1821.	60.00	10	1.96
1	11	225	843	4	11	2	2907.	1.00	1821.	60.00	10	1.96
2	11	222	841	4	11	1	6913.	1.00	1803.	60.00	10	1.96
2	11	228	839	4	11	1	3794.	1.00	1821.	60.00	10	1.96
2	11	231	829	4	11	1	3452.	1.00	1792.	60.00	10	1.96
2	11	235	830	4	11	1	3007.	1.00	1821.	60.00	10	1.96
2	11	235	841	4	11	1	3196.	1.00	1821.	60.00	10	1.96
2	11	235	845	4	11	2	3012.	1.00	1821.	60.00	10	1.96
4	11	235	835	4	11	1	47829.	1.00	1791.	60.00	10	1.96
4	11	236	841	4	11	1	43108.	1.00	1800.	60.00	10	1.96
4	11	234	829	4	11	1	30968.	1.00	1816.	60.00	10	1.96
4	11	235	830	4	11	1	30026.	1.00	1821.	60.00	10	1.96

-9

3

1.2370E-06 01
1.2370E-06 02
0.3829E-05 11
1 0
4 0
1 0

119	0800	119	1600	1800.	60.00	1
119	0800	119	1200	1800.	60.00	2
119	1200	119	1600	2400.	60.00	2
220	0800	220	1200	1800.	60.00	2
220	1200	220	1600	1800.	60.00	2
119	0800	119	1600	6600.	60.00	11

0
0
0
0
0
0
0
-2

20 1 .100E-10 .000E-50 .000E-50

-3
-3
-1

1	11	119	855	1	11	1	6064.	2.00	.	.00	20	1.96
1	11	119	901	1	11	2	5964.	2.00	.	.00	20	1.96
1	11	119	905	1	11	3	5980.	2.00	.	.00	20	1.96

1	11	119	908	1	11	4	6020.	2.00	.	.00	20	1.96
1	11	119	913	1	11	5	5887.	2.00	.	.00	20	1.96
1	11	119	916	1	11	6	5864.	2.00	.	.00	20	1.96
1	11	119	920	1	11	7	6064.	2.00	.	.00	20	1.96
1	11	119	923	1	11	8	6078.	2.00	.	.00	20	1.96
1	11	119	927	1	11	9	6094.	2.00	.	.00	20	1.96
1	11	119	931	1	11	10	5984.	2.00	.	.00	20	1.96

-9

3
1.2370E-06 01
1.2370E-06 02
0.3829E-05 11
1 0
4 0
1 0

119	0800	119	1600	1800.	60.00	1
119	0800	119	1200	1800.	60.00	2
119	1200	119	1600	2400.	60.00	2
220	0800	220	1200	1800.	60.00	2
220	1200	220	1600	1800.	60.00	2
119	0800	119	1600	6600.	60.00	11

21 1 .100E-10 .000E-50 .000E-50

-2
-3
-3
-1

1	2	119	935	1	1	1	14954.	1.00	18210.	60.00	21	1.96
1	2	119	938	1	1	1	14867.	1.00	18210.	60.00	21	1.96
1	2	119	944	1	1	1	14498.	1.00	18210.	60.00	21	1.96

-9

3
1.2370E-06 01
1.2370E-06 02
0.3829E-05 11
1 0
4 0
1 0

119	0800	119	1600	1800.	60.00	1	0
-----	------	-----	------	-------	-------	---	---

119 0800 119 1200 1800.	60.00	2	0
119 1200 119 1600 2400.	60.00	2	0
220 0800 220 1200 1800.	60.00	2	0
220 1200 220 1600 1800.	60.00	2	0
119 0800 119 1600 6600.	60.00	11	-2
22 1 .100E-10 .000E-50 .000E-50			
1 11 119 1011 5 11 1	3467.	1.00	1.96
1 11 119 1015 5 11 1	3451.	1.00	1.96
1 11 119 1017 6 11 1	1728.	1.00	1.96
1 11 119 1022 6 11 1	1720.	1.00	1.96
3			
1.2370E-06 01			-9
1.2370E-06 02			
0.3829E-05 11			
1 0			
4 0			
1 0			
119 0800 119 1600 1800.	60.00	1	0
119 0800 119 1200 1800.	60.00	2	0
119 1200 119 1600 2400.	60.00	2	0
220 0800 220 1200 1800.	60.00	2	0
220 1200 220 1600 1800.	60.00	2	0
119 0800 119 1600 6600.	60.00	11	-2
23 1 .128E-01 .000E-50 .000E-50			
1 1 119 1030 7 1 1 103000.		1.00	1.96
1 1 119 1037 7 1 1 100000.		1.00	1.96
1 1 119 1044 7 1 1 95000.		1.00	1.96
1 1 119 1051 7 1 1 90000.		1.00	1.96
1 1 119 1058 7 1 1 85000.		1.00	1.96
1 1 119 1105 7 1 1 80000.		1.00	1.96
-3			
-3			
-1			

1.2370E-06 01			
1.2370E-06 02			
0.3829E-05 11			
1 0			
4 0			
1 0			
119 0800 119 1600 1800.	60.00	1	0
119 0800 119 1200 1800.	60.00	2	0
119 1200 119 1600 2400.	60.00	2	0
220 0800 220 1200 1800.	60.00	2	0
220 1200 220 1600 1800.	60.00	2	0
119 0800 119 1600 6600.	60.00	11	-2
23 1 .128E-01 .000E-50 .000E-50			
1 1 119 1030 7 1 1 103000.		1.00	1.96
1 1 119 1037 7 1 1 100000.		1.00	1.96
1 1 119 1044 7 1 1 95000.		1.00	1.96
1 1 119 1051 7 1 1 90000.		1.00	1.96
1 1 119 1058 7 1 1 85000.		1.00	1.96
1 1 119 1105 7 1 1 80000.		1.00	1.96
-3			
-3			
-1			

1	1	119	1112	7	1	1	1	75000.	1.00	.	.00	23	1.96
1	1	119	1119	7	1	1	1	70000.	1.00	.	.00	23	1.96
1	1	119	1126	7	1	1	1	65000.	1.00	.	.00	23	1.96
1	1	119	1133	7	1	1	1	60000.	1.00	.	.00	23	1.96
1	1	119	1140	7	1	1	1	55000.	1.00	.	.00	23	1.96
1	1	119	1147	7	1	1	1	50000.	1.00	.	.00	23	1.96
1	1	119	1158	7	1	1	1	45000.	1.00	.	.00	23	1.96
1	1	119	1208	7	1	1	1	40000.	1.00	.	.00	23	1.96
1	1	119	1219	7	1	1	1	35000.	1.00	.	.00	23	1.96
1	1	119	1311	7	1	1	1	20000.	1.00	.	.00	23	1.96

-9

3
1.2370E-06 01
1.2370E-06 02
0.3829E-05 11
1 0
4 0
1 0

119	0800	119	1600	1800.	60.00	1	0
119	0800	119	1200	1800.	60.00	2	0
119	1200	119	1600	2400.	60.00	2	0
220	0800	220	1200	1800.	60.00	2	0
220	1200	220	1600	1800.	60.00	2	0
119	0800	119	1600	6600.	60.00	11	0

-2

-3

-3

-1

1	2	119	900	4	1	1	12642.	1.00	1832.	60.00	90	1.96
1	2	119	903	4	1	2	12580.	1.00	1832.	60.00	90	1.96
1	2	119	907	4	1	3	12673.	1.00	1832.	60.00	90	1.96

-9

90 1 .000E-50 .000E-50 .000E-50

TABLE X DATORG III SOURCE PROGRAM

```

C      DATA ORG III
      DIMENSION TAU(50),ISYS(50),INTD(100),INTT(100),IFD(100),BKGC(100)
      DIMENSION BKGT(100),IFT(100),ISM(100)
      1 READ 100,N1,NYX
      2 DO 10 I=1,N1
10     READ 101,TAU(I),ISYS(I)
      NX=0
      DO 11 I=1,N1
      READ 200,N2,ISM
11     NX=NX+N2
      DO 12 I=1,NX
12     READ 102,INTD(I),INTT(I),IFD(I),IFT(I),BKGC(I),BKGT(I),ISM(I)
15     READ 103,NYX
      PUNCH 103,NYX
      IF(NYX+1)15,14,15
14     READ 104,A1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,DKC,B6,NYX
34     IX2=IA2
      IY5=IB5
      DO 16 I=1,N1
      IF(IA2-ISYS(I))16,17,16
17     PUNCH 101,TAU(I),ISYS(I)
      J=I
16     CONTINUE
      DO 50 I=1,NX
      IF(ISM(I)-IX2)50,51,50
51     PUNCH 102,INTD(I),INTT(I),IFD(I),IFT(I),BKGC(I),BKGT(I),ISM(I)
50     CONTINUE
      NYX=-5
      PUNCH 300,NYX
      NYX=0
52     PUNCH 104,A1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,DKC,B6,NYX
      IGD=IA5
      READ 104,A1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,DKC,B6,NYX
      IF(IA2-IX2)53,52,53
53     IF(NYX+9)60,54,60
60     NYX=-6
      PUNCH 300,NYX
      GO TO 34
54     PUNCH 300,NYX
300    FORMAT(40X,32X,I2)
100    FORMAT(I5,35H
      132H
      ,I2)
101    FORMAT(E11.4,I4)
200    FORMAT(I5,I5)
102    FORMAT(I4,I5,I4,I5,F8.0,F7.2,I7)

```

103 FORMAT(40H

132H

,12)

104 FORMAT(14,I3,I4,I5,I2,2I3,F8.0,F7.2,F8.0,F7.2,I4,E9.3,F5.2,I2)

204 FORMAT(21HEND DATA ORG PROGRAMS)

800 FORMAT(13HLOAD NEW PROB)

END

TABLE XI OUTPUT DATORG III - INPUT RESOLUTION

6 1 .100E 01 .000E-50 .000E-50										-2
										0
										-3
										-3
										0
										-1
119	830	6								
0.3829E-05 11										
119	800	119	1600	6600.	60.00	11				
1	11	119	832	2	11	1	9218.	1.00		-5
1	11	119	835	2	11	2	8607.	1.00	1.96 0	
1	11	119	838	2	11	3	7421.	1.00	1.96 0	
1	11	119	841	2	11	1	6298.	1.00	1.96 0	
1	11	119	843	2	11	1	5516.	1.00	1.96 0	
										-9
7 2 .400E-04 .400E-05 .000E-50										
2	7									-2
1	7									0
2	7									0
										0
										-3
										-3
										-1
1.2370E-06 02										
119	800	119	1200	1800.	60.00	2				
119	1200	119	1600	2400.	60.00	2				
220	800	220	1200	1800.	60.00	2				
220	1200	220	1600	1800.	60.00	2				
1	2	220	823	4	1	1	9600.	1.00		-5
1	2	224	816	4	1	1	8605.	1.00	1.96 0	
1	2	229	841	4	1	1	6684.	1.00	1.96 0	
1	2	233	835	4	1	1	5128.	1.00	1.96 0	
2	2	222	832	4	1	1	9012.	1.00	1.96 0	
2	2	228	833	4	1	1	7123.	1.00	1.96 0	
2	2	231	823	4	1	1	5859.	1.00	1.96 0	

-9
-2
-2
0
0
0
0
-3
-3
0
-1

10 3 .400E-03 .400E-04 .400E-05
2 10
1 10
2 10

220 830 10

0.3829E-05 11
119 800 119 1600 6600. 60.00 11

1 11 220 851 4 11 1 11263. 1.00 1821. 60.00 10
1 11 224 820 4 11 1 5321. 1.00 1798. 60.00 10
1 11 229 855 4 11 1 3728. 1.00 1831. 60.00 10
1 11 233 840 4 11 1 3207. 1.00 1801. 60.00 10
1 11 225 835 4 11 1 2980. 1.00 1821. 60.00 10
1 11 225 843 4 11 2 2907. 1.00 1821. 60.00 10
2 11 222 841 4 11 1 6913. 1.00 1803. 60.00 10
2 11 228 839 4 11 1 3794. 1.00 1821. 60.00 10
2 11 231 829 4 11 1 3452. 1.00 1792. 60.00 10
2 11 235 830 4 11 1 3007. 1.00 1821. 60.00 10
2 11 235 841 4 11 1 3196. 1.00 1821. 60.00 10
2 11 235 845 4 11 2 3012. 1.00 1821. 60.00 10
41 11 235 835 4 11 1 47829. 1.00 1791. 60.00 10
41 11 236 841 4 11 1 43108. 1.00 1800. 60.00 10
41 11 234 829 4 11 1 30968. 1.00 1816. 60.00 10
41 11 235 830 4 11 1 30026. 1.00 1821. 60.00 10

20 1 .100E-10 .000E-50 .000E-50

-2
0
-3
-3
-1

0.3829E-05 11
119 800 119 1600 6600. 60.00 11

1	11	119	855	1	11	1	6064.	2.00	.	.00	20	1.96	0
1	11	119	901	1	11	2	5964.	2.00	.	.00	20	1.96	0
1	11	119	905	1	11	3	5980.	2.00	.	.00	20	1.96	0
1	11	119	908	1	11	4	6020.	2.00	.	.00	20	1.96	0
1	11	119	913	1	11	5	5887.	2.00	.	.00	20	1.96	0
1	11	119	916	1	11	6	5864.	2.00	.	.00	20	1.96	0
1	11	119	920	1	11	7	6064.	2.00	.	.00	20	1.96	0
1	11	119	923	1	11	8	6078.	2.00	.	.00	20	1.96	0
1	11	119	927	1	11	9	6094.	2.00	.	.00	20	1.96	0
1	11	119	931	1	11	10	5984.	2.00	.	.00	20	1.96	0

21 1 .100E-10 .000E-50 .000E-50

1.2370E-06 02

119	800	119	1200	1800.	60.00	2
119	1200	119	1600	2400.	60.00	2
220	800	220	1200	1800.	60.00	2
220	1200	220	1600	1800.	60.00	2

1	2	119	935	1	1	1	14954.	1.00	18210.	60.00	21	1.96	0
1	2	119	938	1	1	1	14867.	1.00	18210.	60.00	21	1.96	0
1	2	119	944	1	1	1	14498.	1.00	18210.	60.00	21	1.96	0

22 1 .100E-10 .000E-50 .000E-50

0.3829E-05 11

119	800	119	1600	6600.	60.00	11							
1	11	119	1011	5	11	1	3467.	1.00	.	.00	22	1.96	0
1	11	119	1015	5	11	1	3451.	1.00	.	.00	22	1.96	0
1	11	119	1017	6	11	1	1728.	1.00	.	.00	22	1.96	0

1	11	119	1022	6	11	1	1720.	1.00	.	.00	22	1.96 0 -9
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23 1 .128E-01 .000E-50 .000E-50

1.2370E-06 01

119	800	119	1600	1800.	60.00	1
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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524
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90 1 .000E-50 .000E-50 .000E-50

1.2370E-06 02

119	800	119	1200	1800.	60.00
119	1200	119	1600	2400.	60.00
220	800	220	1200	1800.	60.00
220	1200	220	1600	1800.	60.00

1	2	119	900	4	1	1	12642.	1.00	1832.	60.00	90	1.96	0
1	2	119	903	4	1	2	12580.	1.00	1832.	60.00	90	1.96	0
1	2	119	907	4	1	3	12673.	1.00	1832.	60.00	90	1.96	0

TABLE XII RESOLUTION SOURCE PROGRAM

```

C      RESOLUTION
1  READ 201,NYX
   PUNCH 201,NYX
   IF(NYX+1)1,10,1
10 READ 100,TAU,ISY
11 READ 201,NYX
   PUNCH 201,NYX
   IF(NYX+5)11,12,11
12 READ 101,IA1,IA2,IA3,IA4,IA5,IA6,IA7, B1,B2,B3,B4,IB5,D,B6,NYX
   IF(ISY-IA2)13,14,13
13 PRINT 104
   PAUSE
   GO TO 1
14 C=B1/B2
   FTAU=1.-C*TAU
   TRUE=B1/FTAU
   PUNCH 101,IA1,IA2,IA3,IA4,IA5,IA6,IA7,TRUE,B2,B3,B4,IB5,D,B6,NYX
   READ 101,IA1,IA2,IA3,IA4,IA5,IA6,IA7, B1,B2,B3,B4,IB5,D,B6,NYX
   IF(NYX+6)16,15,16
16 IF(NYX+9)14,20,14
20 PRINT 105
   PUNCH 202,NYX
   PAUSE
   GO TO 1
15 PUNCH 202,NYX
   GO TO 10
100 FORMAT(E11.4,I4)
101 FORMAT(I4,I3,I4,I5,I2,2I3,F8.0,F7.2,F8.0,F7.2,I4,E9.3,F5.2,I2)
104 FORMAT(27HERROR, MIXED SYSTEM NUMBERS)
105 FORMAT(16HLOAD NEW PROBLEM)
201 FORMAT(40H
132H
202 FORMAT(40X,32X,I2)
   .I2)
END

```


1	11	119	913	1	11	5	5954.	2.00	.	.00	20	.000E-50	1.96	000
1	11	119	916	1	11	6	5930.	2.00	.	.00	20	.000E-50	1.96	000
1	11	119	920	1	11	7	6135.	2.00	.	.00	20	.000E-50	1.96	000
1	11	119	923	1	11	8	6149.	2.00	.	.00	20	.000E-50	1.96	000
1	11	119	927	1	11	9	6165.	2.00	.	.00	20	.000E-50	1.96	000
1	11	119	931	1	11	10	6053.	2.00	.	.00	20	.000E-50	1.96	000

-9

21 1 .100E-10 .000E-50 .000E-50

-2

0

-3

-3

-1

0

0

0

0

-5

119	800	119	1200	1800.	60.00	2
119	1200	119	1600	2400.	60.00	2
220	800	220	1200	1800.	60.00	2
220	1200	220	1600	1800.	60.00	2

1	2	119	935	1	1	15235.	1.00	18210.	60.00	21	.000E-50	1.96	000
1	2	119	938	1	1	15145.	1.00	18210.	60.00	21	.000E-50	1.96	000
1	2	119	944	1	1	14762.	1.00	18210.	60.00	21	.000E-50	1.96	000

-9

22 1 .100E-10 .000E-50 .000E-50

-2

0

-3

-3

-1

0

-5

119 800 119 1600 6600. 60.00 11

1	11	119	1011	5	11	1	3513.	1.00	.	.00	22	.000E-50	1.96	000
1	11	119	1015	5	11	1	3497.	1.00	.	.00	22	.000E-50	1.96	000
1	11	119	1017	6	11	1	1739.	1.00	.	.00	22	.000E-50	1.96	000
1	11	119	1022	6	11	1	1731.	1.00	.	.00	22	.000E-50	1.96	000

-9

23 1 .128E-01 .000E-50 .000E-50

-2

0

-3

-3

TABLE XIV DEAD SOURCE PROGRAM

```

C      GM DEAD TIME LOSS CALCULATION
      DIMENSION AMP(200),AN(200),IT(200)
      90 READ 100,NYX
      READ 107,IPRB,NSLAM,XLAM
107    FORMAT(I4,12,E9.3)
      10 READ 100,NYX
      IF(NYX-1)10,11,10
      11 READ 101,IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,NYX
      IF(IA5-7)71,12,71
      12 ISMP=IA1
      ISYS=IA2
      IDY=IA3
      IGEO=IA6
      I=0
      GO TO 200
201    READ 101,IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,NYX
      IF(IA1-ISMP)205,202,205
202    IF(ISYS-IA2)205,203,205
203    IF(IDY-IA3)205,204,205
204    IF(IGEO-IA6)205,200,205
200    I=I+1
      AMP(I)=B1
222    LFT=IA4/100
      IT(I)=IA4-LFT*100+LFT*60
      GO TO 201
      71 PRINT 103
103    FORMAT(12HNOT TAU DATA)
      PAUSE
      GO TO 90
205    J=1
      AN(J)=AMP(J)
      N=J-1
      DO 300 I=1,N
      TIME=IT(J)-IT(I)
300    AN(I)=AN(J)*EXP(XLAM*TIME)
      SUMT = 0.0
      SUMB = 0.0
      DO 40 I=1,J
      ST = AMP(I)*(1.-AMP(I)/AN(I))
      SUMT = SUMT + ST
      SB = AMP(I)**2
40    SUMB = SUMB + SB
      DT = SUMT/SUMB
      IF(DT)400,402,402
400    DT=0.

```

```
402 PUNCH 106
    PUNCH 105,ISYS,IDY,DT
    13 IF(NYX+9)700,70,700
    70 PRINT 102
102 FORMAT(16HREAD NEW PROBLEM)
    GO TO 90
700 IF(NYX+6)701,11,701
701 PUNCH 100,NYX
    GO TO 11
100 FORMAT(40H
132H                                     .12)
101 FORMAT(I4,I3,I4,I5,I2,2I3,F8.0,F7.2,F8.0,F7.2,18X,I2)
105 FORMAT(2I5,2X,E10.4)
106 FORMAT(6HSYSTEM,4H DAY,9H          TAU)
    END
```

TABLE XV DEAD OUT

SYSTEM	DAY	TAU
1	119	.2720E-05

ABLE XVI DECISION I SOURCE PROGRAM

```

DECISION I
DIMENSION X( 30,6)
202 FORMAT(16HLOAD DECISION II)
203 FORMAT(16HBKG INFO MISSING)
112 FORMAT(16HREAD NEW PROBLEM)
300 READ 200,NYX
    READ 201,PN,NRLM,    XL,XLAM2,XLAM3
    IF(NRLM-1)250,350,250
250 PRINT 202
    STOP
350 PUNCH 200,NYX
    PUNCH 201,PN,NRLM,    XL,XLAM2,XLAM3
210 READ 200,NYX
    PUNCH 200,NYX
    IF(NYX+1)210,211,210
211 LL=0
    KKK=0
221 READ 100,IC1,IC2,IC3,IC4,C5,C6,NYX
    IF(NYX+5)212,34,212
212 I=LL+1
    X(I,1)=IC1
    X(I,2)=IC2
    X(I,3)=IC3
    X(I,4)=IC4
    X(I,5)=C5
    X(I,6)=C6
    LL=LL+1
    GO TO 221
34 READ 102, IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,XLL,B6,NYX
    IF(KKK)4000,4004,4000
4004 KKK=1
4001 IG=IA6
    LRR=IA5
    ISM=IA1
    ID=0
    IT=0
    J=1
4000 IF(NYX+9)215,216,215
216 PRINT 112
    PUNCH 877,NYX
877 FORMAT(40X,32X,12)
    IF(LRR-7)7001,7002,7001
7002 PRINT 7004
7004 FORMAT(17HTHIS PROB TO DEAD)
7001 PAUSE

```

```

      GO TO 300
215 IF(NYX+6)4002,270,4002
4002 IF(IA5-IG)4001,6,4001
      6 IF(IA1-ISM)4001,53,4001
270 PUNCH 877,NYX
      GO TO 211
53 IF(ID)7,46,7
46 ID1=IA3
      IT1=IA4
      7 IF(IA5-1) 8,10,13
13 IF(IA5-2) 8,10,9
      8 PRINT 104
      PAUSE
      GO TO 34
      9 IF(B3) 11,12,11
11 IF(B4) 22,12,22
12 A3=IA3
      A4=IA4
      I=1
      GO TO 14
17 IF(I-LL)15,15,16
15 I=I+1
14 IF(A3-X(I,1)) 17,18,19
18 IF(A4-X(I,2)) 17,19,19
19 IF(A3-X(I,3)) 20,20,17
20 IF(A4-X(I,4)) 21,21,17
16 PRINT 109
      GO TO 10
21 B3=X(I,5)
      B4=X(I,6)
      IA3=A3
      IA4=A4
22 C=B1/B2-B3/B4
      GO TO 64
10 C=B1/B2
64 U=XL*B2
      IF(U-.01) 28,29,29
29 C=C+U/(1.0-EXP(-U))
      IA7=1
28 IF(IA3-ID) 30,31,32
30 PRINT 107
      GO TO 32
31 IF(IA4-IT) 30,32,32
32 IF(ID) 33,36,33
36 A=24*(IA3-ID)
      B=IA4-IT
      GO TO 37
33 A=24*(IA3-ID)

```

```

      B=IA4-IT1
37  D=0.
      K=1
      GO TO 38
41  D=D+100.
      K=K+1
38  IF(B-D) 39,40,41
40  BD=0.
      GO TO 42
61  D=D-100.
67  BD=B-D
      GO TO 42
39  IF(K-1) 60,60,61
60  D=-100.
65  IF(B-D) 66,40,67
66  D=D-100.
      GO TO 65
42  T=60.*A+.6*D+BD
      IF(XL*T-.01) 43,44,44
44  IA7=1
      GO TO 47
43  IA7=J
      J=J+1
49  PUNCH 102,IA1,IA2,ID1,IT1,IA5,IA6,IA7, C,B2,B3,B4,IB5,XL,B6,NYX
      ID=IA3
      IT=IA4
      GO TO 34
47  PUNCH 102,IA1,IA2,IA3,IA4,IA5,IA6,IA7, C,B2,B3,B4,IB5,XL,B6,NYX
      ID=IA3
      IT=IA4
      ID1=IA3
      IT1=IA4
      GO TO 34
100 FORMAT(I4,I5,I4,I5,F8.0,F7.2,39X,I2)
102 FORMAT(I4,I3,I4,I5,I2,2I3,F8.0,F7.2,F8.0,F7.2,I4,E9.3,F5.2,I2)
104 FORMAT(28HERROR, BKG SUBT DATA MISSING)
107 FORMAT(30HERROR, INCORRECT TIME SEQUENCE)
109 FORMAT(46HERROR, DATA CARD DOES NOT FIT GIVEN TIME RANGE)
201 FORMAT(I4,I2,3E9.3)
200 FORMAT(40H
132H
      END
      ,I2)

```


TABLE XVIIB OUTPUT DECISION I - INPUT CHISO

20 1 .100E-10 .000E-50 .000E-50										-2
1 11 119 855 1 11 1	3067.	2.00	.	.00	20	.100E-10	1.96 000	-3		
1 11 119 855 1 11 2	3016.	2.00	.	.00	20	.100E-10	1.96 000	-1		
1 11 119 855 1 11 3	3024.	2.00	.	.00	20	.100E-10	1.96 000			
1 11 119 855 1 11 4	3045.	2.00	.	.00	20	.100E-10	1.96 000			
1 11 119 855 1 11 5	2977.	2.00	.	.00	20	.100E-10	1.96 000			
1 11 119 855 1 11 6	2965.	2.00	.	.00	20	.100E-10	1.96 000			
1 11 119 855 1 11 7	3067.	2.00	.	.00	20	.100E-10	1.96 000			
1 11 119 855 1 11 8	3074.	2.00	.	.00	20	.100E-10	1.96 000			
1 11 119 855 1 11 9	3082.	2.00	.	.00	20	.100E-10	1.96 000			
1 11 119 855 1 11 10	3026.	2.00	.	.00	20	.100E-10	1.96 000	-9		
90 1 .000E-50 .000E-50 .000E-50										-2
1 2 119 900 3 1 1	12811.	1.00	1832.	60.00	90	.100E-10	1.96 000	-3		
1 2 119 900 3 1 2	12747.	1.00	1832.	60.00	90	.100E-10	1.96 000	-1		
1 2 119 900 3 1 3	12843.	1.00	1832.	60.00	90	.100E-10	1.96 000	-9		

TABLE XVIII DECISION II SOURCE PROGRAM

```

C      DECISION II
      DIMENSION X( 30,6)
200  FORMAT(40H
      132H
      202  FORMAT(15HLOAD DECISION I)
      203  FORMAT(16HKBG INFO MISSING)
      112  FORMAT(16HREAD NEW PROBLEM)
      NY=0
300  READ 200,NYX
      PUNCH 200,NYX
      READ 201,PN,NRLM,XLAM1,XLAM2,XLAM3
      PUNCH 201,PN,NRLM,XLAM1,XLAM2,XLAM3
      IF(NRLM-1)210,250,210
250  PRINT 202
      STOP
210  READ 200,NYX
      PUNCH 200,NYX
      IF(NYX+1)210,211,210
211  LL=0
      IY1=0
      ID=0
      IT=0
      K=2
      J=1
221  READ 100,IC1,IC2,IC3,IC4,C5,C6,NYX
      IF(NYX+5)212,34,212
212  I=LL+1
      X(I,1)=IC1
      X(I,2)=IC2
      X(I,3)=IC3
      X(I,4)=IC4
      X(I,5)=C5
      X(I,6)=C6
      LL=LL+1
      GO TO 221
83  IY1=IA1
      IY2=IA2
      IY3=IA3
      IY4=IA4
      IY5=IA5
      IY6=IA6
      IY7=IA7
      G1=C
      Y2=B2
      Y3=B3

```

```

      Y4=B4
      JY5=IB5
      Y6=B6
34  READ 102, IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,D,B6,NYX
      IF(IA1)53,1000,53
1000 K=3
      GO TO 84
701  PUNCH 115,NYX
115  FORMAT(40X,32X,12)
      IF(NYX+9)211,216,211
216  PRINT 112
      PAUSE
      GO TO 300
53   IF(ID)7,46,7
46   ID1=IA3
      IT1=IA4
7    IF(IA5-1) 8,10,13
13   IF(IA5-2) 8,10,9
8    PRINT 104
      PAUSE
      GO TO 34
9    IF(B3) 11,12,11
11   IF(B4) 22,12,22
12   A3=IA3
      A4=IA4
      I=1
      GO TO 14
17   IF(I-LL)15,15,16
15   I=I+1
14   IF(A3-X(I,1)) 17,18,19
18   IF(A4-X(I,2)) 17,19,19
19   IF(A3-X(I,3)) 20,20,17
20   IF(A4-X(I,4)) 21,21,17
16   PRINT 109
      GO TO 10
21   B3=X(I,5)
      B4=X(I,6)
      IA3=A3
      IA4=A4
22   C=B1/B2-B3/B4
      GO TO 23
10   C=B1/B2
23   IF(K-2)1001,57,1001
57   K=1
      NMU=0
      GO TO 83
1001 IF(IY1-IA1)1003,1002,1003
1002 IF(IY6-IA6)1003,58,1003

```

```

1003 K=2
      GO TO 84
      58 W=24*(IA3-IY3)
        Y=IA4-IY4
        Z=0.
        J=1
        GO TO 59
      62 Z=Z+100.
        J=J+1
      59 IF(Y-Z) 60,61,62
      61 YZ=0.
        GO TO 63
      91 Z=Z-100.
      94 YZ=Y-Z
        GO TO 63
      60 IF(J-1) 90,90,91
      90 Z=-100.
      92 IF(Y-Z) 93,61,94
      93 Z=Z-100.
        GO TO 92
      63 T=60.*W+.6*Z+YZ
        XXL=LOG(G1)/T-LOG(C)/T
      84 V=XXL*Y2
        IF(V-0.1) 65,66,66
      66 G1=G1*V/(1.0-EXP(-V))
        J=1
      65 IF(IY3-ID) 67,68,69
      67 PRINT 107
        PAUSE
        GO TO 84
      68 IF(IY4-IT) 67,69,69
      69 IF(ID) 70,71,70
      71 A=24*(IY3-ID)
        B=IY4-IT
        GO TO 72
      70 A=24*(IY3-ID1)
        B=IY4-IT1
      72 D=100.
        GO TO 73
      76 D=D+100.
      73 IF(B-D) 74,75,76
      75 BD=0.
        GO TO 77
      74 D=D-100.
        BD=B-D
      77 T=60.*A+.6*D+BD
        IF(XXL*T-.01) 78,79,79
      79 IY7=1

```

```

      GO TO 80
78  IY7=NMU+1
      NMU=NMU+1
      PUNCH 102, IY1,IY2,ID1,IT1,IY5,IY6,IY7,G1,Y2,Y3,Y4,JY5,XXL,Y6,NY
      ID=IY3
      IT=IY4
      GO TO 1009
80  PUNCH 102, IY1,IY2,IY3,IY4,IY5,IY6,IY7,G1,Y2,Y3,Y4,JY5,XXL,Y6,NY
      NMU=1
      ID=IY3
      IT=IY4
      ID1=IY3
      IT1=IY4
1009 IF(K-1)1007,83,1007
1007 IF(K-2)701,1008,701
1008 ID=0
      IT=0
      GO TO 53
100 FORMAT(I4,I5,I4,I5,F8.0,F7.2,39X,I2)
102 FORMAT(I4,I3,I4,I5,I2,2I3,F8.0,F7.2,F8.0,F7.2,I4,E9.3,F5.2,I2)
103 FORMAT(17HERROR, MIXED DATA)
104 FORMAT(28HERROR, BKG SUBT DATA MISSING)
105 FORMAT(I4,E9.3)
107 FORMAT(30HERROR, INCORRECT TIME SEQUENCE)
109 FORMAT(46HERROR, DATA CARD DOES NOT FIT GIVEN TIME RANGE)
114 FORMAT(45HUSE SAME DECAY CONST FOR LAST AND 2ND TO LAST,1X4HCARD)
201 FORMAT(I4,I2,3E9.3)
      END

```

TABLE XIX OUTPUT DECISION II - INPUT DECAY II-III

7 2 .400E-04 .400E-05 .000E-50													-2	
2	7												0	
1	7												0	
2	7												0	
													-3	
													-1	
1	2	220	823	4	1	1	9685.	1.00	1800.	60.00	7	.000	1.96	0
1	2	224	816	4	1	1	8666.	1.00	1822.	60.00	7	.000	1.96	0
1	2	229	841	4	1	1	6708.	1.00	1818.	60.00	7	.000	1.96	0
1	2	233	835	4	1	1	5130.	1.00	1798.	60.00	7	.000	1.96	0
2	2	222	832	4	1	1	9083.	1.00	1792.	60.00	7	.000	1.96	0
2	2	228	833	4	1	1	7155.	1.00	1803.	60.00	7	.000	1.96	0
2	2	231	823	4	1	1	5870.	1.00	1801.	60.00	7	.000	1.96	0
0	0	0	0	0	0	0	.	.00	.	.00	0	.000	.00-9	
10 3 .400E-03 .400E-04 .400E-05													-2	
2	10												0	
1	10												0	
2	10												0	
													-3	
													0	
													-1	
220	830	10											0	
1	11	220	851	4	11	1	11739.	1.00	1821.	60.00	10	.000	1.96	0
1	11	224	820	4	11	1	5401.	1.00	1798.	60.00	10	.000	1.96	0
1	11	229	855	4	11	1	3750.	1.00	1831.	60.00	10	.000	1.96	0
1	11	233	840	4	11	1	3215.	1.00	1801.	60.00	10	.000	1.96	0
1	11	235	835	4	11	1	2983.	1.00	1821.	60.00	10	.003	1.96	0
1	11	235	843	4	11	1	2908.	1.00	1821.	60.00	10	.003	1.96	0
2	11	222	841	4	11	1	7069.	1.00	1803.	60.00	10	.000	1.96	0
2	11	228	839	4	11	1	3818.	1.00	1821.	60.00	10	.000	1.96	0
2	11	231	829	4	11	1	3468.	1.00	1792.	60.00	10	.000	1.96	0
2	11	231	829	4	11	2	3011.	1.00	1821.	60.00	10	-.005	1.96	0
2	11	235	841	4	11	1	3204.	1.00	1821.	60.00	10	.015	1.96	0
2	11	235	845	4	11	1	3016.	1.00	1821.	60.00	10	.015	1.96	0
41	11	225	835	4	11	1	58522.	1.00	1791.	60.00	10	.000	1.96	0

41	11	226	841	4	11	1	51600.	1.00	1800.	60.00	10	.000	1.96	0
41	11	234	829	4	11	1	35103.	1.00	1816.	60.00	10	.000	1.96	0
41	11	235	830	4	11	1	33895.	1.00	1821.	60.00	10	.000	1.96	0
0	0	0	0	0	0	0	.	.00	.	.00	0	.000	.00-9	

TABLE XX CHISO SOURCE PROGRAM

```

C      CHI SQUARE SECTION
      DIMENSION T(30),SN(30),B(4),C(4)
      B(1)=21.5
      B(2)=14.6
      B(3)=4.00
      B(4)=2.00
      C(1)=40.0
      C(2)=27.2
      C(3)=11.6
      C(4)=7.50
      I=1
302  READ 205,NYX
      KK=1
      READ 201,PN,NRLM,XLAM1,XLAM2,XLAM3
      IF(NRLM-1)301,300,301
301  PRINT 304
304  FORMAT(30)THIS DATA WITH DECAY II OR III)
      PAUSE
      GO TO 302
300  READ 205,NYX
      IF(NYX+1,300,305,300)
305  READ 800,IA1,IA2,IA3,IA4,IA5,IA7,IA8,B1,B2,B3,B4,IB5,D,B6,NYX
      GO TO(102,100,102,100),IA5
100  PRINT 309
309  FORMAT(27)HNOT CHISO DATA,LOAD DECAY I)
      PAUSE
      GO TO 302
      80 READ 800,IA1,IA2,IA3,IA4,IA5,IA7,IA8,B1,B2,B3,B4,IB5,D,B6,NYX
      IF(NYX+9)311,315,311
311  IF(NYX+6)313,316,313
313  IF(KEP-IA1)12,81,12
      81 IF(KEP1-IA2) 12,82,12
      82 IF(KEP2-IA3) 12,83,12
      83 IF(KEP3-IA4) 12,84,12
      84 IF(KEP4-IA7) 12,85,12
      85 IF(KEP5-IB5) 12,1,12
      1 SN(I)=B1
      T(I)=B2
      I=I+1
      GO TO 80
102  KEP=IA1
      KEP1=IA2
      KEP2=IA3
      KEP3=IA4
      KEP4=IA7

```

```

      KEP5=IB5
      GO TO 1
12  MA=I-1
      IF(MA-2)500,13,13
13  DO 40 I=2,MA
      IF(T(I)-T(I))41,40,41
41  PRINT 104
      GO TO 102
40  CONTINUE
500 MT=MA/10+1
      DO 70 I=1,MT
      N=10*I
      IF(N-MA)51,51,50
50  N=MA
      L=1
      GO TO 52
51  L=N-9
52  SSN=0.
      SSNS=0.
      MM=N-L+1
      EM=MM
      DO 55 J=L,N
      SSN=SSN+SN(J)
55  SSNS=SSNS+SN(J)**2
      CHIS=(EM*SSNS/SSN-SSN)*T(1)
      DO 60 J=1,4
      IF(EM-10.)56,57,56
57  P=B(J)
      GO TO 58
56  P=(EM-10.)/10.*(C(I)-B(I))+B(I)
58  IF(P-CHIS)61,60,60
60  CONTINUE
      J=5
61  GO TO(71,70,69,70,71),J
70  CONTINUE
      GO TO 71
69  PUNCH 200
      PUNCH 6,KEP1,KEP2,KEP3,CHIS,MM
      I=1
      IF(KK-9)317,319,317
71  PUNCH 200
      PUNCH 7,KEP1,KEP2,KEP3,CHIS,MM
      I=1
      IF(KK-9)317,319,317
317 IF(KK-6)102,300,102
319 PRINT 320
320 FORMAT(16HREAD NEW PROBLEM)
      PAUSE

```

```

      GO TO 302
315 KK=9
      GO TO 12
316 KK=5
      GO TO 12
      ; FORMAT(2X14,1X14,1X15,1XE10.4,18HSAMPLE REJECTED ON15.4H OBS)
300 FORMAT(28HSYSTEM DAY TIME CHIS)
      ; FORMAT(2X14,1X14,1X15,1XE10.4,18HSAMPLE ACCEPTED ON15.4H OBS)
304 FORMAT(21H*TIMES* ARE NOT EQUAL)
300 FORMAT(40H
      132H
      ,12)
301 FORMAT(14,12,3E9.3)
300 FORMAT(14,13,14,15,12,213,F8.0,F7.2,F8.0,F7.2,14,E9.3,F5.2,12)
      END

```

TABLE XXI OUTPUT CHISQ

SYSTEM	DAY	TIME	CHIS	
11	119	855	.9688E 01	SAMPLE ACCEPTED ON 010 OBS
SYSTEM	DAY	TIME	CHIS	
2	119	900	.3720E 00	SAMPLE REJECTED ON 003 OBS

TABLE XXII DECAY 1 SOURCE PROGRAM

```

      DECA: 1
220 READ 100,NYX
      PUNCH 100,NYX
      READ 101,IP,NRLM,XL,XLAM2,XLAM3
      PUNCH 101,IP,NRLM,XL,XLAM2,XLAM3
      IF(NRLM-1)340,300,340
300 READ 100,NYX
      PUNCH 100,NYX
      IF(NYX+3)300,301,300
301 READ 102,LD,LT,IPM,NYX
      PUNCH 102,LD,LT,IPM,NYX
      IF(NYX+1)10,302,10
      10 READ 100,NYX
      PUNCH 100,NYX
      GO TO 11
303 READ 105, IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,D,B6,NYX
      IF(XL)304,500,304
500 XL=D
304 ISM=IA1
      IGD=IA5
      IG=IA6
      IF(LD)20,305,20
305 LD=IA3
      LT=IA4
      20 IA4=IA4-40*(IA4/100)-LT+40*(LT/100)
      XUA1=IA3-LD
      XUA2=IA4
      25 T=XUA1*1440.+XUA2
      ATO=B1*EXP(XL*T)
      PUNCH 104,IA1,IA2,LD,LT,IA5,IA6,IA7,IB5,ATO,B2,B3,B4,XL,B6,NYX
      READ 105, IA1,IA2,IA3,IA4,IA5,IA6,IA7,B1,B2,B3,B4,IB5,D,B6,NYX
      IF(NYX+9)310,309,310
310 IF(NYX+6)312,311,312
312 IF(ISM-IA1)304,313,304
313 IF(IG-IA6)304,20,304
309 PUNCH 100,NYX
      IF(IGD-3)501,502,502
502 PRINT 304
304 FORMAT(27HLOAD THIS PROBLEM WITH BKTH)
501 PRINT 320
320 FORMAT(16HLOAD NEW PROBLEM)
      PAUSE
      GO TO 300
311 PUNCH 100,NYX
      GO TO 10

```

```
340 PRINT 333
333 FORMAT(20HLOAD DECAY 11 OR 111)
    PAUSE
    GO TO 320
104 FORMAT(14,13,14,15,12,313,E9.3,F7.2,F8.0,F7.2,E9.3,F5.2,12)
105 FORMAT(14,13,14,15,12,213,F8.2,F7.2,F8.0,F7.2,14,E9.3,F5.2,12)
101 FORMAT(14,12,3E9.3)
102 FORMAT(14,15,14.59X,12)
100 FORMAT(40H
    132H
    END
    ,12)
```


90 1 .000E-50 .000E-50 .000E-50

-2

0 0 0

-3

1 2 119 900 4

-1

1 1 90 .128E 05

1.00

60.00 .100E-10 1.96 000

1 2 119 900 4

1 2 90 .127E 05

1.00

60.00 .100E-10 1.96 000

1 2 119 900 4

1 3 90 .128E 05

1.00

60.00 .100E-10 1.96 000

-9

TABLE XXIV DECAY 11 SOURCE PROGRAM

```

C      DECAY 11
      DIMENSION SST(3,30)
502   FORMAT(3F10.2)
      DO 503 I=1,30
503   READ 502,SST(1,I),SST(2,I),SST(3,I)
      DIMENSION SN(60),T(60),X1(60),X2(60),KK(60)
      1 READ 200,NYX
      PUNCH 200,NYX
      READ 219,NP,NI,XLAM1,XLAM2,XLAM3
      PUNCH 219,NP,NI,XLAM1,XLAM2,XLAM3
      IF(NI-2)217,202,217
217   PRINT 218
218   FORMAT(17HNOT DECAY 11 DATA)
      PAUSE
      GO TO 1
202   READ 200,NYX
      PUNCH 200,NYX
      IF(NYX+3)202,602,202
502   READ 203,LD,LT,NP,NYX
      PUNCH 203,LD,LT,NP,NYX
206   READ 200,NYX
      PUNCH 200,NYX
      IF(NYX+1)206,207,206
207   READ 704,IA1,IA2,IA3,IA4,IA5,IA6,IA7,SNBAR,B2,YT,B4,IB5,D,B6,NYX
215   IF(LD)209,208,209
208   LD=IA3
      LT=IA4
209   I=1
      ISMP=IA1
      IG=IA6
      IX2=IA2
      IX5=IA5
      XX2=B2
      YYT=YT
      X4=B4
      IY5=IB5
      X6=B6
      GO TO 20
      3 READ 704,IA1,IA2,IA3,IA4,IA5,IA6,IA7,SNBAR,B2,YT,B4,IB5,D,B6,NYX
      IF(NYX+6)210,16,210
210   IF(NYX+9)212,16,212
212   IF(IA1-ISMP)16,213,16
213   IF(IA6-IG)16,20,16
      20 IA4=IA4-40*(IA4/100)-LT+40*(LT/100)
      XUA1=IA3-LD

```

```

      XUA2=IA4
25  T(I)=XUA1*1440.+XUA2
      KK(I)=IA7
      SN(I)=SNBAR
      I=I+1
      GO TO 3
16  N=I-1
      PRINT 120,N
      DO 57 I=1,N
        X1(I)=EXP(-XLAM1*T(I))
57  X2(I)=EXP(-XLAM2*T(I))
        X1SQ=0.
        X12=0.
        X2SQ=0.
        DO 30 I=1,N
          X1SQ=X1SQ+X1(I)*X1(I)
          X2SQ=X2SQ+X2(I)*X2(I)
30  X12=X12+X1(I)*X2(I)
        C11=X2SQ/(X1SQ*X2SQ-X12*X12)
        C12=-(C11*X12)*X2SQ
        C22=X1SQ/(X1SQ*X2SQ-X12*X12)
        C12=-(C22*X12)/X1SQ
        Z1=0.
        Z2=0.
        DO 40 I=1,N
          Z1=Z1+SN(I)*X1(I)
40  Z2=Z2+SN(I)*X2(I)
        A01=C11*Z1+C12*Z2
        A02=C12*Z1+C22*Z2
        SMSQ=0.
        DO 50 I=1,N
          SNBR=A01*X1(I)+A02*X2(I)
50  SMSQ=SMSQ+(SN(I)-SNBR)*(SN(I)-SNBR)
        N=N-2
        EN=N
        IF(X6-1.96)403,402,403
402  I=2
        GO TO 410
403  IF(X6-1.65)405,404,405
404  I=1
        GO TO 410
405  I=3
410  J=N
        IF(N-30)407,407,408
408  J=30
407  ST=SST(I,J)
      XLA01=A01-ST*SQR(C11*SMSQ/EN)
      XUA01=A01+ST*SQR(C11*SMSQ/EN)

```

```

XLA02=A02-ST*SQRT(C22*SMSQ/EN)
XUA02=A02-ST*SQRT(C22*SMSQ/EN)
NY=6
PUNCH 513,NY
PUNCH 501,A01,XLA01,XUA01
PUNCH 501,A02,XLA02,XUA02
NY=7
PUNCH 513,NY
N=N+2
DO 400 I=1,N
E1=-XLAM1*T(I)
E2=-XLAM2*T(I)
ABOX=A01*EXP(E1)+A02*EXP(E2)
RATIO=SN(I)/ABOX
A01C=RATIO*A01
A02C=RATIO*A02
M=ISMP
NY=0
PUNCH 204,M,IX2,LD,LT,IX5,IG,KK(I),IY5,A01C,XX2,YYT,X4,XLAM1,X6,NY
400 PUNCH 204,M,IX2,LD,LT,IX5,IG,KK(I),IY5,A02C,XX2,YYT,X4,XLAM2,X6,NY
IF(NYX+6)240,250,240
240 IF(NYX+9)215,230,215
230 PRINT 231
PUNCH 200,NYX
231 FORMAT(13HREAD NEW DATA)
IF(IX5-5)701,702,702
702 PRINT 705
705 FORMAT(14HLOAD WITH BKTH)
701 GO TO 1
250 PUNCH 200,NYX
GO TO 207
513 FORMAT(40X,32X,12)
501 FORMAT(3E12.5)
200 FORMAT(40H
132H
,12)
219 FORMAT(14,12,3E9.3)
203 FORMAT(14,15,14,40X,19X,12)
120 FORMAT(3HN =,14)
204 FORMAT(14,13,14,15,12,313,E9.3,F7.2,F8.0,F7.2,E9.3,F5.2,12)
704 FORMAT(14,13,14,15,12,213,F8.2,F7.2,F8.0,F7.2,14,E9.3,F5.2,12)
END

```

2

23

7-1

27

000

0

•83836E 04 •28785E 04 •13888E 05

• 16077E 04 - • 26357E 04 • 58512E 04

1	2	220	823	4	1	1	7	.812E	04	1.00	1800.	60.00	.400E-04	1.96	000
1	2	220	823	4	1	1	7	.155E	04	1.00	1800.	60.00	.400E-05	1.96	000
1	2	220	823	4	1	1	7	.882E	04	1.00	1800.	60.00	.400E-04	1.96	000
1	2	220	823	4	1	1	7	.169E	04	1.00	1800.	60.00	.400E-05	1.96	000
1	2	220	823	4	1	1	7	.863E	04	1.00	1800.	60.00	.400E-04	1.96	000
1	2	220	823	4	1	1	7	.165E	04	1.00	1800.	60.00	.400E-05	1.96	000
1	2	220	823	4	1	1	7	.788E	04	1.00	1800.	60.00	.400E-04	1.96	000
1	2	220	823	4	1	1	7	.151E	04	1.00	1800.	60.00	.400E-05	1.96	000

•.83750E 04 -•.81295E 04 •.24879E 05

• 17080E 04 - • 10326E 05 • 13742E 05

2	2	220	823	4	1	1	7	.831E	04	1.00	1792.	60.00	.400E-04	1.96	000
2	2	220	823	4	1	1	7	.169E	04	1.00	1792.	60.00	.400E-05	1.96	000
2	2	220	823	4	1	1	7	.866E	04	1.00	1792.	60.00	.400E-04	1.96	000
2	2	220	823	4	1	1	7	.176E	04	1.00	1792.	60.00	.400E-05	1.96	000
2	2	220	823	4	1	1	7	.812E	04	1.00	1792.	60.00	.400E-04	1.96	000
2	2	220	823	4	1	1	7	.165E	04	1.00	1792.	60.00	.400E-05	1.96	000

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TABLE XXVI DECAY III SOURCE PROGRAM

```

C      DECAY III
      DIMENSION SST(30),XLM(3),XLA(3),XUA(3),AO(2)
      DIMENSION X3(20),A(3,3)
      DIMENSION SN(20),T(20),X1(20),X2(20)
502  FORMAT(F10.2,
      DO 503 I=1,30
503  READ 502,SST(I)
      I READ 200,NYX
      I=1
      PUNCH 200,NYX
      READ 219,NP,NI,XLM(1),XLM(2),XLM(3)
      PUNCH 219,NP,NI,XLM(1),XLM(2),XLM(3)
206  READ 200,NYX
      PUNCH 200,NYX
      IF(NYX+1)517,3,517
517  IF(NYX-3)206,202,206
202  READ 203,LD,LT,NP,NYX
      PUNCH 203,LD,LT,NP,NYX
      GO TO 206
215  IF(LD)209,208,209
208  LD=IA3
      LT=IA4
209  ISMP=IA1
      I=1
      IG=IA6
      IX2=IA2
      IX5=IA5
      KK=IA7
      XX2=B2
      YYT=YT
      X4=B4
      IY5=IB5
      X6=B6
      GO TO 20
      I READ 904,IA1,IA2,IA3,IA4,IA5,IA6,IA7,SNBAR,B2,YT,B4,IB5,B6,BB,BB2
      IF(I-1)560,215,560
560  IF(NYX+5)210,16,210
210  IF(NYX+9)212,16,212
212  IF(IA1-ISMP)16,213,16
213  IF(IA6-IG)16,20,16
21  IA4=IA4-40*((IA4/100)-LT+40*(LT/100))
      XUA(1)=IA3-LD
      XUA(2)=IA4
      T(I)=XUA(1)*1440.+XUA(2)
      SN(I)=SNBAR

```

```

      I=I+1
      GO TO 3
16  N=I-1
      PRINT 120,N
702 DO 57 I=1,N
      X1(I)=EXP(-XLM(1)*T(I))
      X2(I)=EXP(-XLM(2)*T(I))
57  X3(I)=EXP(-XLM(3)*T(I))
      DO 600 I=1,3
      DO 600 J=1,3
600 A(I,J)=0.
      DO 30 I=1,N
      A(1,1)=A(1,1)+X1(I)*X1(I)
      A(2,2)=A(2,2)+X2(I)*X2(I)
      A(3,3)=A(3,3)+X3(I)*X3(I)
      A(1,2)=A(1,2)+X1(I)*X2(I)
      A(1,3)=A(1,3)+X1(I)*X3(I)
30  A(2,3)=A(2,3)+X2(I)*X3(I)
      A(2,1)=A(1,2)
      A(3,1)=A(1,3)
      A(3,2)=A(2,3)
      DO 170 I=1,3
      DUMP=A(I,I)
      A(I,I)=1.
      IF(DUMP)130,110,130
110 PUNCH 131
131 FORMAT(20HOCAN,T INVERT MATRIX)
      STOP
130 DO 140 J=1,3
140 A(I,J)=A(I,J)/DUMP
      DO 170 K=1,3
      IF(K=I)150,170,150
150 DUMP=A(K,I)
      A(K,I)=0.
      DO 160 J=1,3
160 A(K,J)=A(K,J)-DUMP*A(I,J)
170 CONTINUE
      Z1=0.
      Z2=0.
      Z3=0.
      DO 40 I=1,N
      Z1=Z1+SN(I)*X1(I)
      Z2=Z2+SN(I)*X2(I)
40  Z3=Z3+SN(I)*X3(I)
      A0(1)=A(1,1)*Z1+A(2,1)*Z2+A(3,1)*Z3
      A0(2)=A(1,2)*Z1+A(2,2)*Z2+A(3,2)*Z3
      A0(3)=A(1,3)*Z1+A(2,3)*Z2+A(3,3)*Z3
      SMSQ=0.

```

```

DO 30 I=1,N
SNBR=A0(I)*X1(I)+A0(2)*X2(I)+A0(3)*X3(I)
RELER=ABS(SNBR-SN(I))/SNBR-1.2
IF (RELER) 50,50,100
50 SMSQ=SMSQ+((SN(I)-SNBR)*(SN(I)-SNBR))
N=N+3
EN=N
410 J=N
IF (N-30) 407,407,408
408 J=30
407 ST=SST(J)
DO 571 J=1,3
A(I,J)=ST*SORT(A(I,J))+SMSQ/EN
XLA(J)=A0(J)-A(I,J)
571 XUA(J)=A0(J)+A(I,J)
NY=5
PUNCH 513,NY
DO 572 J=1,3
572 PUNCH 501,A0(J),XLA(J),XUA(J)
NY=7
PUNCH 513,NY
N=N-2
DO 400 I=1,N
ABOX=A0(I)*X1(I)+A0(2)*X2(I)+A0(3)*X3(I)
RATIO=SN(I)/ABOX
M=ISMP
NY=0
DO 400 J=1,3
A(I,J)=RATIO*A0(J)
400 PUNCH 204,M,IX2,LD,LT,IX5,IG,KK,IY5,A(I,J),XX2,YYT,X4,XLM(J),X6,M
IF (NYX+6) 240,250,240
240 IF (NYX+9) 215,230,215
230 PRINT 231
PUNCH 200,NYX
231 FORMAT(13HREAD NEW DATA)
IF (IX5-5) 901,902,902
902 PRINT 905
905 FORMAT(14HLOAD WITH BKTH)
901 GO TO 1
250 PUNCH 200,NYX
I=1
GO TO 3
900 NP=N-1
DO 701 J=1,NP
SN(J)=SN(N-1)
701 T(J)=T(J+1)
N=N-1
GO TO 702

```

513 FORMAT(40X,32X,12)

501 FORMAT(3E12.5)

200 FORMAT(40H

132H

,12)

219 FORMAT(14,12,3E9.3)

203 FORMAT(14,15,14,40X,19X,12)

120 FORMAT(3HN =,14)

204 FORMAT(14,13,14,15,12,313,E9.3,F7.2,F8.0,F7.2,E9.3,F5.2,12)

904 FORMAT(14,13,14,15,12,213,F8.~,F7.2,F8.0,F7.2,14,E9.3,F5.2,12)

END

2 11 220	830 4 11	1 10	.219E 04	1.00	1803.	60.00	.400E-04	1.96 000
2 11 220	830 4 11	1 10	.232E 04	1.00	1803.	60.00	.400E-05	1.96 000
2 11 220	830 4 11	1 10	.929E 04	1.00	1803.	60.00	.400E-03	1.96 000
2 11 220	830 4 11	1 10	.226E 04	1.00	1803.	60.00	.400E-04	1.96 000
2 11 220	830 4 11	1 10	.240E 04	1.00	1803.	60.00	.400E-05	1.96 000
2 11 220	830 4 11	1 10	.927E 04	1.00	1803.	60.00	.400E-03	1.96 000
2 11 220	830 4 11	1 10	.226E 04	1.00	1803.	60.00	.400E-04	1.96 000
2 11 220	830 4 11	1 10	.239E 04	1.00	1803.	60.00	.400E-05	1.96 000
2 11 220	830 4 11	1 10	.804E 04	1.00	1803.	60.00	.400E-03	1.96 000
2 11 220	830 4 11	1 10	.196E 04	1.00	1803.	60.00	.400E-04	1.96 000
2 11 220	830 4 11	1 10	.208E 04	1.00	1803.	60.00	.400E-05	1.96 000
2 11 220	830 4 11	1 10	.941E 04	1.00	1803.	60.00	.400E-03	1.96 000
2 11 220	830 4 11	1 10	.229E 04	1.00	1803.	60.00	.400E-04	1.96 000
2 11 220	830 4 11	1 10	.243E 04	1.00	1803.	60.00	.400E-05	1.96 000
2 11 220	830 4 11	1 10	.886E 04	1.00	1803.	60.00	.400E-03	1.96 000
2 11 220	830 4 11	1 10	.216E 04	1.00	1803.	60.00	.400E-04	1.96 000
2 11 220	830 4 11	1 10	.229E 04	1.00	1803.	60.00	.400E-05	1.96 000

.21592E 06 .73059E 05 .35878E 06
 .34457E 05 .99214E 04 .58992E 05
 .21184E 05 .91790E 04 .33189E 05

41 11 220	830 4 11	1 10	.215E 06	1.00	1791.	60.00	.400E-03	1.96 000
41 11 220	830 4 11	1 10	.344E 05	1.00	1791.	60.00	.400E-04	1.96 000
41 11 220	830 4 11	1 10	.211E 05	1.00	1791.	60.00	.400E-05	1.96 000
41 11 220	830 4 11	1 10	.215E 06	1.00	1791.	60.00	.400E-03	1.96 000
41 11 220	830 4 11	1 10	.344E 05	1.00	1791.	60.00	.400E-04	1.96 000
41 11 220	830 4 11	1 10	.211E 05	1.00	1791.	60.00	.400E-05	1.96 000
41 11 220	830 4 11	1 10	.216E 06	1.00	1791.	60.00	.400E-03	1.96 000
41 11 220	830 4 11	1 10	.345E 05	1.00	1791.	60.00	.400E-04	1.96 000
41 11 220	830 4 11	1 10	.212E 05	1.00	1791.	60.00	.400E-05	1.96 000
41 11 220	830 4 11	1 10	.215E 06	1.00	1791.	60.00	.400E-03	1.96 000
41 11 220	830 4 11	1 10	.343E 05	1.00	1791.	60.00	.400E-04	1.96 000
41 11 220	830 4 11	1 10	.211E 05	1.00	1791.	60.00	.400E-05	1.96 000

TABLE XXVIII VAR I SOURCE PROGRAM

```

C      VAR I
      DIMENSION T(3,31),X(200)
      DO 1 I=1,31
1      READ 103,T(1,I),T(2,I),T(3,I)
103    FORMAT(3E10.5)
10     READ 100,NYX
      IF(NYX+1)10,11,10
11     READ 101, IA1,IA2,IA3,IA4,IA5,IA6,IA7,IB5,B1,B2,B3,B4,XLL,B6,NY)
12     N=1
      ISMP=IA1
      JGD=IA5
      IG=IA6
      X(N)=B1
      IPROB=IB5
      ISY=IA2
      XEP=B6
17     READ 101, IA1,IA2,IA3,IA4,IA5,IA6,IA7,IB5,B1,B2,B3,B4,XLL,B6,NY)
      IF(NYX+6)13,50,13
13     IF(NYX+9)14,50,14
14     IF(IA6-IG)50,15,50
15     IF(IA1-ISMP)50,16,50
16     N=N+1
      X(N)=B1
      GO TO 17
50     M=N-1
      XBAR=0.
      SXSQ=0.
      DO 18 I=1,N
      XBAR=XBAR+X(I)
18     SXSQ=SXSQ+(X(I)*X(I))
      XN=N
      SSX=XBAR*XBAR/XN
      XBAR=XBAR/XN
      IF(N-1)20,70,20
20     SIGWG=(SXSQ-SSX)/(XN-1.)
      SIGWG=SQRT(SIGWG)
      SXBR=SIGWG/SQRT(XN)
      IF(M-31)72,72,21
21     M=31
72     IF(XEP-1.65)63,62,63
62     I=1
      GO TO 22
63     IF(XEP-1.96)65,64,65
64     I=2
      GO TO 22

```

```

65 I=3
22 XL=XBAR-SXBR*T(I,M)
   U=XBAR+SXBR*T(I,M)
   PCERR=(SXBR*T(I,M)/XBAR)*100.
   N1=100*N-N
   N2=100*N/4-N
   N3=100*N/9-N
   N4=100*N/16-N
   N5=100*N/25-N
   N6=100*N/36-N
   N7=100*N/49-N
   N8=100*N/64-N
   N9=100*N/81-N
   N10=0
   PUNCH 110
   PUNCH 105,IPROB,ISY,ISMP,IG,N
   PUNCH 111
   PUNCH 106,XBAR,SIGWG,SXBR,PCERR
   PUNCH 112
   PUNCH 107,XL,U
   PUNCH 113
   PUNCH 108,N1,N2,N3,N4,N5,N6,N7,N8,N9,N10
   IF(NYX+6)61,11,61
61 IF(NYX+9)507,80,507
61 IF(NYX+9)12,80,12
70 PUNCH 110
   PUNCH 105,IPROB,ISY,ISMP,IG,N
80 PRINT 200
   PAUSE
   GO TO 10
507 IF(JGD-8)509,508,509
508 PRINT 510
510 FORMAT(15HLOAD WITH CALIB)
   GO TO 12
509 IF(JGD-9)12,512,12
512 PRINT 513
513 FORMAT(14HLOAD WITH FLUX)
   GO TO 12
200 FORMAT(16HREAD NEW PROBLEM)
110 FORMAT(3X,7HPROBLEM,4X,6HSYSTEM,4X,6HSAMPLE,2X,8HGEOMETRY,4X,
16HNUMBER)
107 FORMAT(2F10.1)
108 FORMAT(10I6)
111 FORMAT(10HMEAN COUNT,7X,3HSIG,6X,4HSXBR,2X,11HPERCENT ERR)
105 FORMAT(4X,I6,4X,I6,4X,I6,4X,I6,4X,I6)
106 FORMAT(F10.0,F10.5,2F10.4)
101 FORMAT(I4,I3,I4,I5,I2,3I3,E9.3,F7.2,F8.0,F7.2,E9.3,F5.2,I2)
112 FORMAT(20H LOW LIMIT  UP LIMIT)

```

100 FORMAT(40H

132H

4121

113 FORMAT(3X,3H,1E,3X,3H,2E,3X,3H,3E,3X,3H,4E,3X,3H,5E,3X,3H,6E,3X,
13H,7E,3X,3H,8E,3X,3H,9E,3X3H,12E,

END

```

PUNCH 423,YMU,SIGMA,YES7,IS15
433 FORMAT(3E9.3,15)
PUNCH 734
734 FORMAT(16HSAMPLES IN GROUP)
PUNCH 735,1:1,1:2,1:3,1:4,1:5,1:6,1:7,1:8,1:9,1:10)
735 FORMAT(10I4)
PUNCH 407
407 FORMAT(13HPERCENT ERROR)
PUNCH 113,22(1,22(2,22(3,22(4,22(5,22(6,22(7,22(8,22(9
122(10)
PUNCH 409
409 FORMAT(15HNR SMPLS NEEDED)
S=0.
PUNCH 113,XM1,XM2,XM3,XM4,XM5,XM6,XM7,XM8,XM9,5
1F(NYX+6)700,300,700
700 CONTINUE
PRINT 255
255 FORMAT(16HLOAD NEW PROBLEM)
PAUSE
GO TO 41.
104 FORMAT(14,13,14,15,2X,12,3X,13,E9.3,22X,29.3,5X,12)
200 FORMAT(40H
132H
,12)
201 FORMAT(215,40X,22X,12)
105 FORMAT(14HR IS IMAGINARY)
113 FORMAT(10F7.1)
END

```

TABLE XXXI:1 OUTPUT VAR II

```

PROB DAY TIME GEO LAMDA
7 220 823 1 .400E-04
MU SIGMA YEST SYSTEM
.836E 04 .000E-50 .529E 01 002
SAMPLES IN GROUP
1 2 0 0 0 0 0 0
PERCENT ERROR
.0 .0 .0 .0 .0 .0 .0
NR SMPLS NEEDED
198.0 48.0 20.2 10.5 6.0 3.5 2.0 1.1 .4 .0

```

```

PROB DAY TIME GEO LAMDA
7 220 823 1 .400E-05
MU SIGMA YEST SYSTEM
.165E 04 .583E 02 .635E 03 002
SAMPLES IN GROUP
1 2 0 0 0 0 0 0
PERCENT ERROR
3.8 7.6 11.5 15.3 19.2 23.0 26.9 30.7 34.6 38.4
NR SMPLS NEEDED
198.0 48.0 20.2 10.5 6.0 3.5 2.0 1.1 .4 .0

```

TABLE XXX PREF VAR 11 SOURCE PROGRAM

```

C      FREE FOR VAR 11
C      MAX 25 GEOMETRIES
      DIMENSION EC1(9),EC2(9),EC3(9),IG(25),ST(9)
      DO 501 J=1,9
501    READ 210,EC1(J),EC2(J),EC3(J)
      DO 302 J=1,9
302    READ 303,ST(J)
303    FORMAT(10,*)
      1 K2=1
      DO 900 I=1,25
900    IG(I)=0
      NGOS=0
      70 READ 201,NYX
      PUNCH 201,NYX
      READ 200,IPROB,NRLAM
      PUNCH 200,IPROB,NRLAM
      READ 202,NGC
      PUNCH 202,NGC
221    READ 201,NYX
      PUNCH 201,NYX
      IF(NYX-7)221,21,221
      21 READ 204,IA6,NYX
      IF(NYX-6)400,401,400
401    READ 204,IA6,NYX
      IF(NYX-7)401,21,401
400    IF(NYX+6)50,81,50
      81 PUNCH 204,IA6,NYX
      GO TO 21
      50 IF(NYX+9)30,601,30
      30 GO TO(31,32,33),K2
      31 PUNCH 204,IA6,NYX
      READ 204,IA6,NYX
      GO TO(760,700,61),NRLAM
      61 READ 204,IA6,NYX
      GO TO 700
      32 READ 204,IA6,NYX
      PUNCH 204,IA6,NYX
      GO TO(760,21,61),NRLAM
      62 READ 204,IA6,NYX
      GO TO 21
      33 READ 204,IA6,NYX
      63 READ 204,IA6,NYX
      PUNCH 204,IA6,NYX
      GO TO 21
700    KK=1

```

```

      DO 701 I=1,25
      IF(IA6-IG(I))701,702,701
702  KK=0
701  CONTINUE
      IF(KK)704,21,704
704  DO 706 I=1,25
      IF(IG(I))706,705,706
706  CONTINUE
705  IG(I)=IA6
      NGOS=NGOS+1
      GO TO 21
601  PUNCH 204,IA6,NYX
      PUNCH 208,NGOS
208  FORMAT(13)
      IDF=NGC-1
      DF=IDF
      PUNCH 209,DF,EC1(IDF),EC2(IDF),EC3(IDF)
      DO 503 J=1,25,5
      I=J+1
      K=J+2
      L=J+3
      M=J+4
503  PUNCH 504,IG(J),IG(I),IG(K),IG(L),IG(M)
504  FORMAT(5I5)
      PUNCH 303,ST(IDF)
      IF(KZ-NRLAM)602,760,760
602  KZ=KZ+1
      PRINT 780
780  FORMAT(11HREREAD DATA)
      GO TO 70
760  PRINT 603
603  FORMAT(16HREAD NEW PROBLEM)
      PAUSE
      GO TO 1
209  FORMAT(4F10.6)
204  FORMAT(18H
      132H
      201  FORMAT(40H
      132H
200  FORMAT(14,12,34H
      132H
202  FORMAT(15,35H
      132H
210  FORMAT(3F10.3)
      END

```

,13,19H

,12)

,12)

,12)

,12)

•83836E 04	•28785E 04	•13888E 05	0
•16077E 04	•26357E 04	•58512E 04	0
1 2 220	823 4 1 1 7	•155E 04	7
1 2 220	823 4 1 1 7	•169E 04	0
1 2 220	823 4 1 1 7	•165E 04	0
1 2 220	823 4 1 1 7	•151E 04	0
2 2 220	823 4 1 1 7	•169E 04	0
2 2 220	823 4 1 1 7	•176E 04	0
2 2 220	823 4 1 1 7	•165E 04	0
1	0		-9
1.000000	•000660	•000066 6.640000	
1	0	0	
0	0	0	
0	0	0	
0	0	0	
0	0	0	
0	0	0	
12.7000			

-2

10 3	•400E-03	•400E-04	•400E-05
2	10		
1	10		
2	10		

220 830 10

-3

•60425E 04	•56520E 04	•64329E 04
•47236E 04	•40018E 04	•54454E 04
•10305E 04	•61331E 03	•14478E 04

1 11 220	830 4 11 1 10	•604E 04	1.00	1821.	60.00	•400E-03	1.96	0
1 11 220	830 4 11 1 10	•608E 04	1.00	1821.	60.00	•400E-03	1.96	0
1 11 220	830 4 11 1 10	•592E 04	1.00	1821.	60.00	•400E-03	1.96	0
1 11 220	830 4 11 1 10	•608E 04	1.00	1821.	60.00	•400E-03	1.96	0
1 11 220	830 4 11 1 10	•613E 04	1.00	1821.	60.00	•400E-03	1.96	0
1 11 220	830 4 11 1 10	•598E 04	1.00	1821.	60.00	•400E-03	1.96	0
2 11 220	830 4 11 1 10	•897E 04	1.00	1803.	60.00	•400E-03	1.96	0

-1

6

0

0

0

7

2 11 220	830 4 11	1 10	.929E 04	1.00	1803.	60.00	.400E-03	1.96 0
2 11 220	830 4 11	1 10	.927E 04	1.00	1803.	60.00	.400E-03	1.96 0
2 11 220	830 4 11	1 10	.804E 04	1.00	1803.	60.00	.400E-03	1.96 0
2 11 220	830 4 11	1 10	.941E 04	1.00	1803.	60.00	.400E-03	1.96 0
2 11 220	830 4 11	1 10	.885E 04	1.00	1803.	60.00	.400E-03	1.96 0
41 11 220	830 4 11	1 10	.215E 06	1.00	1791.	60.00	.400E-03	1.96 0
41 11 220	830 4 11	1 10	.215E 06	1.00	1791.	60.00	.400E-03	1.96 0
41 11 220	830 4 11	1 10	.216E 06	1.00	1791.	60.00	.400E-03	1.96 0
41 11 220	830 4 11	1 10	.215E 06	1.00	1791.	60.00	.400E-03	1.96 0

-9

1	1.000000	.000660	.000056	6.640000
11	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
12.7000				

-2

10 3 .400E-03 .400E-04 .00E-05

2 10
1 10
2 10

0

0

220 830 10

-3

0

-1

5

0

0

0

7

.60425E 04	.56520E 04	.64329E 04
.47236E 04	.40018E 04	.54454E 04
.10305E 04	.61331E 03	.14478E 04

1 11 220	830 4 11	1 10	.472E 04	1.00	1821.	60.00	.400E-04	1.96 0
1 11 220	830 4 11	1 10	.475E 04	1.00	1821.	60.00	.400E-04	1.96 0
1 11 220	830 4 11	1 10	.463E 04	1.00	1821.	60.00	.400E-04	1.96 0
1 11 220	830 4 11	1 10	.475E 04	1.00	1821.	60.00	.400E-04	1.96 0
1 11 220	830 4 11	1 10	.479E 04	1.00	1821.	60.00	.400E-04	1.96 0
1 11 220	830 4 11	1 10	.467E 04	1.00	1821.	60.00	.400E-04	1.96 0
2 11 220	830 4 11	1 10	.219E 04	1.00	1803.	60.00	.400E-04	1.96 0
2 11 220	830 4 11	1 10	.226E 04	1.00	1803.	60.00	.400E-04	1.96 0
2 11 220	830 4 11	1 10	.226E 04	1.00	1803.	60.00	.400E-04	1.96 0

2 11 220	830 4 11	1 10	.196E 04	1.00	1803.	60.00	.400E-04	1.96 0
2 11 220	830 4 11	1 10	.229E 04	1.00	1803.	60.00	.400E-04	1.96 0
2 11 220	830 4 11	1 10	.216E 04	1.00	1803.	60.00	.400E-04	1.96 0
41 11 220	830 4 11	1 10	.344E 05	1.00	1791.	60.00	.400E-04	1.96 0
41 11 220	830 4 11	1 10	.344E 05	1.00	1791.	50.00	.400E-04	1.96 0
41 11 220	830 4 11	1 10	.345E 05	1.00	1791.	60.00	.400E-04	1.96 0
41 11 220	830 4 11	1 10	.343E 05	1.00	1791.	60.00	.400E-04	1.96 C

-9

1	1.000000	.000660	.000066	6.640000
11	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
12.7000				

-2

10 3	.400E-03	.400E-04	.400E-05
2	10		
1	10		
2	10		

0

-3

220 830 10

-1

.60425E 04	.56520E 04	.64329E 04
.47236E 04	.40018E 04	.54454E 04
.10305E 04	.61331E 03	.14478E 04

6

1 11 220	830 4 11	1 10	.103E 04	1.00	1821.	60.00	.400E-05	1.96 0
1 11 220	830 4 11	1 10	.103E 04	1.00	1821.	60.00	.400E-05	1.96 0
1 11 220	830 4 11	1 10	.101E 04	1.00	1821.	60.00	.400E-05	1.96 0
1 11 220	830 4 11	1 10	.103E 04	1.00	1821.	60.00	.400E-05	1.96 0
1 11 220	830 4 11	1 10	.104E 04	1.00	1821.	60.00	.400E-05	1.96 0
1 11 220	830 4 11	1 10	.102E 04	1.00	1821.	60.00	.400E-05	1.96 0
2 11 220	830 4 11	1 10	.232E 04	1.00	1803.	60.00	.400E-05	1.96 0
2 11 220	830 4 11	1 10	.240E 04	1.00	1803.	60.00	.400E-05	1.96 0
2 11 220	830 4 11	1 10	.239E 04	1.00	1803.	60.00	.400E-05	1.96 0
2 11 220	830 4 11	1 10	.208E 04	1.00	1803.	60.00	.400E-05	1.96 0
2 11 220	830 4 11	1 10	.243E 04	1.00	1803.	60.00	.400E-05	1.96 0

2	11	220	830	4	11	1	10	.229E 04	1.00	1803.	60.00	.400E-05	1.96	0
41	11	220	830	4	11	1	10	.211E 05	1.00	1791.	60.00	.400E-05	1.96	0
41	11	220	830	4	11	1	10	.211E 05	1.00	1791.	60.00	.400E-05	1.96	0
41	11	220	830	4	11	1	10	.212E 05	1.00	1791.	60.00	.400E-05	1.96	0
41	11	220	830	4	11	1	10	.211E 05	1.00	1791.	60.00	.400E-05	1.96	0

1	1.000000	.000660	.000066	6.640000
11	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
0	0	0	0	
12.7000				

11111111 VAR 11 SOURCE PROGRAM

```

C      VAR 11
      DIMENSION IG(25),FV(9),I(10),SUM(10),SUMSQ(10),L(10),ZZ(10)
      DIMENSION FT(102),XNBAR(10)
41 READ 501,NGOS
      READ 502,DF,EC1,EC2,EC3
501 FORMAT(I3)
502 FORMAT(4F10.4)
      DO 503 J=1,25,5
        II=J+1
        K=J+2
        LL=J+3
        M=J+4
503 READ 504,IG(J),IG(II),IG(K),IG(LL),IG(M)
504 FORMAT(5I5)
      READ 303,ST
303 FORMAT(F10.4)
      IDF=DF
      DO 910 J=1,102
        READ 202,FV(1),FV(2),FV(3),FV(4),FV(5),FV(6),FV(7),FV(8),FV(9)
910 FT(J)=FV(IDF)
202 FORMAT(9F7.2)
      1 DO 700 KX=1,NGOS
        IF(KX-1)827,817,827
827 PRINT 254
254 FORMAT(11HREREAD DATA)
817 READ 200,NYX
      READ 940,IPROB,NLAM
940 FORMAT(I4,I2)
      READ 201,NGC,IPROB,NYX
      XM=NGC
      IF(NGC)211,212,211
212 PRINT 213
213 FORMAT(10HVAR 1 DATA)
      PAUSE
      GO TO 1
211 DO 215 J=1,NGC
215 READ 201,I(J),IPROB
216 READ 200,NYX
      IF(NYX-7)216,300,216
300 DO 230 J=1,10
      L(J)=0
      SUM(J)=0.
230 SUMSQ(J)=0.
      S=0.
      SSQ=0.

```

```

EVS=0.
ETS=0.
T=0.
YMU1=0.
R2=0.
SIG1=0.
235 READ 104,IA1,IA2,IA3,IA4,IA6,IB5,B1,XLAM,N:
IF(NYX+9,225,219,225
225 IF(NYX+6,226,219,226
225 DO 232 J=1,NGC
IF(IA1-I(J),232,233,232
233 IF(IA6-IG(KX),235,224,235
232 CONTINUE
224 SUM(J)=SUM(J)+B1
SUMSQ(J)=SUMSQ(J)+B1*B1
L(J)=L(J)+1
IDY=IA3
ITEM=IA4
ISIS=IA2
ZIAM=XIAM
GO TO 235
219 DO 241 K=1,NGC
S=S+SUM(K)
SSQ=SSQ+SUMSQ(K)
XNI=L(K)
T=T+XNI
SIG1=SIG1+1./XNI
SQS=(SUM(K)*SUM(K))/XNI
EVS=EVS+(SUMSQ(K)-SQS)
XNBAR(K)=(1./XNI)*SUM(K)
YMU1=YMU1+XNBAR(K)
241 YMU=(1./XM)*YMU1
DO 16 K=1,NGC
16 R2=R2+(XNBAR(K)-YMU)*(XNBAR(K)-YMU)
C=S*S/T
ETS=SSQ-C
EHS=ETS-EVS
ETD=T-1.
EHD=XM-1.
EVD=ETD-EHD
EHM=EHS/EHD
EVM=EVS/EVD
ETM=ETS/ETD
EF=EHM/EVM
XMM=XM-XM-XM
R1=R2/XMM
IF(R1,11,12,12
11 PRINT 105

```

```

      GO TO 700
12  R=SQRT(R1)
      LOBS=EVD
      IF(LOBS-100)902,902,903
902 TC=FT(LOBS)
      GO TO 1000
903 IF(LOBS-400)904,904,905
904 TC=LOBS-100
      TC=TC*EC1
      TC=TC+FT(100)
      GO TO 1000
905 IF(LOBS-1000)906,906,907
906 TC=LOBS-400
      TC=TC*EC2
      TC=TC+FT(101)
      GO TO 1000
907 TC=EC3
1000 IF(EE-TC)100,101,101
101 PUNCH 340
340 FORMAT(8HVAR SMPS)
100 TC=ST
      YEST=R*TC
      Z=100.*(YEST/YMU)
      PQ=0.
      DO 271 K=1,10
      PQ=PQ+.1
271 ZZ(K)=PQ*Z
      XM1=XM/0.01-XM
      XM2=XM/0.04-XM
      XM3=XM/0.09-XM
      XM4=XM/0.16-XM
      XM5=XM/0.25-XM
      XM6=XM/0.36-XM
      XM7=XM/0.49-XM
      XM8=XM/0.64-XM
      XM9=XM/0.81-XM
      SIG2=(EVM/(XM*XM))*SIG1
      SIG3=XM*(R-R-SIG2)
      IF(SIG3) 14,15,15
14  SIGMA=0.
      GO TO 49
15  SIGMA=SQRT(SIG3)
49  PUNCH 109
109 FORMAT(5H PROB,5H DAY,5H TIME,5H GEO,7H LAMDA)
      PUNCH 110,1PROB,1DY,1TEM,1G(KX),ZLAM
110 FORMAT(15,E9.3)
      PUNCH 108
108 FORMAT(7X,2HMU,4X,5HSIGMA,5X,4HYEST,1X,6HSYSTEM)

```

```

      PUNCH 425,YMU,SIGMA,VEST,ISIS
433 FORMAT(3E9.3,IS)
      PUNCH 434
434 FORMAT(16HSAMPLES IN GROUP)
      PUNCH 735,I(1),I(2),I(3),I(4),I(5),I(6),I(7),I(8),I(9),I(10)
435 FORMAT(10I4)
      PUNCH 407
407 FORMAT(13HPERCENT ERROR)
      PUNCH 113,2Z(1),2Z(2),2Z(3),2Z(4),2Z(5),2Z(6),2Z(7),2Z(8),2Z(9)
      12Z(10)
      PUNCH 409
409 FORMAT(15HNR SMPLE NEEDED)
      S=0.
      PUNCH 113,XM1,XM2,XM3,XM4,XM5,XM6,XM7,XM8,XM9,S
      IF(NYX4E)200,300,700
700 CONTINUE
      PRINT 255
255 FORMAT(16HLOAD NEW PROBLEM)
      PAUSE
      GO TO 41
104 FORMAT(14,I3,I4,I5,2X,I2,3X,I3,E9.3,22X,I9,3,5X,I2)
200 FORMAT(40H
      132H
      ,I2)
201 FORMAT(2,5,40X,22X,I2)
105 FORMAT(14HR IS IMAGINARY)
113 FORMAT(10F7.1)
      END

```

TABLE XXXI:1 OUTPUT VAR II

```

PROB DAY TIME GEO LAMDA
7 220 823 1 .400E-04
MU SIGMA YEST SYSTEM
.836E 04 .000E-00 .529E 01 002
SAMPLES IN GROUP
1 2 0 0 0 0 0 0 0
PERCENT ERROR
.0 .0 .0 .0 .0 .0 .0 .0
NR SMPLS NEEDED
198.0 48.0 20.2 10.5 6.0 3.5 2.0 1.1 .4 .0

```

```

PROB DAY TIME GEO LAMDA
7 220 823 1 .400E-05
MU SIGMA YEST SYSTEM
.163E 04 .583E 02 .635E 03 002
SAMPLES IN GROUP
1 2 0 0 0 0 0 0 0
PERCENT ERROR
3.8 7.6 11.5 15.3 19.2 23.0 26.9 30.7 34.6 38.4
NR SMPLS NEEDED
198.0 48.0 20.2 10.5 6.0 3.5 2.0 1.1 .4 .0

```

TABLE XXXIV BAKTH SOURCE PROGRAM

C THICKNESS OF BACKING MATERIAL DETERMINATION

```

3 READ 100,EA,IGARD
100 FORMAT(F10.3,I4)
   IF(IGARD-999)300,304,300
300 PRINT 301
301 FORMAT(19HMAX BETA CARD CHECK)
   PAUSE
   GO TO 3
304 READ 110,NYX
   IF(NYX-1)304,305,304
305 READ 102,ISMP,ISYS,IA5,IG,IPOB,B1,NYX
602 ISMS=ISMP
   I=0
   J=0
   AA=0
   AO=0
400 IF(IA5-5)404,403,404
403 AO=B1+AO
   I=I+1
   GO TO 500
404 IF(IA5-6)406,405,406
405 AA=B1+AA
   J=J+1
   GO TO 500
406 IF(NYX+9)608,501,608
608 IF(NYX+6)609,501,609
609 PRINT 407
407 FORMAT(13HNOT BKTH DATA)
   PAUSE
   GO TO 3
500 READ 102,ISMP,ISYS,IA5,IG,IPOB,B1,NYX
   IF(ISMS-ISMP)501,400,501
501 X=I
   AO=AO/X
   X=J
   AA=AA/X
7 IF(IG=10) 10,11,11
10 ALPHA=33./(EA**1.33)
   GO TO 12
11 IF(EA=1.45) 13,14,14
13 ALPHA=60./(EA**1.54)
   GO TO 12
14 ALPHA=200./(EA**6.25)
12 XF=-LOG(AO)/ALPHA-LOG(AA)/ALPHA
9 PUNCH 105,ISMS,XF

```

```

      IF (NYX+9) 601, 901, 501
601  IF (NYX+6) 602, 305, 602
901  PRINT 902
902  FORMAT(16HREAD NEW PROBLEM)
      PAUSE
      GO TO 3
105  FORMAT(15HSAMPLE NUMBER =,14.3X,11HTHICKNESS =,F9.6)
102  FORMAT(14.13.9X,12.13.3X,13.E9.3.36X,12)
110  FORMAT(40H
132H                                ,12)
      END

```

TABLE XXXV OUTPUT BAKTH

SAMPLE NUMBER = 1 THICKNESS = .001826