

Argonne National Laboratory

MULTIGROUP CALCULATIONS OF
EFFECTIVE DELAYED-NEUTRON
FRACTIONS, PROMPT-NEUTRON
LIFETIME, AND RELATED KINETICS
PARAMETERS.

IBM-704 PROGRAM 1188/RE

by

L. C. Kvitek

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ANL-6511
Reactor Technology
(TID-4500, 17th Ed.)
AEC Research and
Development Report

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue
Argonne, Illinois

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Reactor Engineering Division

March 1962

Operated by The University of Chicago
under

Contract W-31-109-eng-38

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ABSTRACT

In the course of a recent study of kinetics parameters,(1) it was found that RE-185,(2) because of its limitations, was inadequate to handle the problems involved with the reactors considered. Program 1188/RE was written entirely independent of and is intended to make RE-185 obsolete. The multigroup calculations of primary interest performed by the code are as follows:

1. the total effective delayed-neutron fraction and its distribution into six "families" which are characterized by their periods;
2. the prompt-neutron lifetime;
3. the worth of delayed and prompt neutrons in the core and blanket regions for all fissionable materials.

Fluxes used in these calculations are taken directly from the real and adjoint solutions as obtained by RE-122.(3)

I. LIST OF SYMBOLS

The symbols in the list below are those used in later discussions on input, output, and mathematical analysis.

<u>Symbol</u>	<u>Definition</u>	<u>Restrictions</u>
M	Total number of fissionable species present.	≤ 5
N1	Number of the group of highest energy into which delayed fission neutrons are emitted	$N1 \leq N2$
N2	Number of the group of lowest energy into which delayed fission neutrons are emitted.	

<u>Symbol</u>	<u>Definition</u>	<u>Restrictions</u>
N3	Number of the group of highest energy into which prompt fission neutrons are emitted.	$\left. \begin{array}{l} \\ \\ \end{array} \right\} N3 \leq N4$
N4	Number of the group of lowest energy into which prompt fission neutrons are emitted.	
NR	Total number of regions for which pointwise values of the flux are to be input.	≤ 25
NP1	Option for printing values of $A(I, N, L)$ and $S(I, L)$ as defined in Section III D.	$\left. \begin{array}{l} = 0 \text{ omits printing.} \\ = 1 \text{ prints.} \end{array} \right\}$
NP2	Option for printing values of $B(I, N, L)$ and $T(I, L)$ as defined in Section III D.	$\left. \begin{array}{l} = 0 \text{ omits printing.} \\ = 1 \text{ prints.} \end{array} \right\}$
NOPT	Option for input of fluxes.	$\left. \begin{array}{l} = 0 \text{ uses F122.} \\ = 1 \text{ uses FLIB.} \end{array} \right\}$
MOPT	Option for input of material properties.	$\left. \begin{array}{l} = 0 \text{ if all material properties are to be input.} \\ = 1 \text{ if only values of } N_{eff,k}^m \text{ are to be input.} \end{array} \right\}$
JOPT	Option for input of neutron velocities and prompt neutron fission spectrum.	$\left. \begin{array}{l} = 0 \text{ if values for } v_j \text{ and } \chi_j \text{ are to be input.} \\ = 1 \text{ if they are not to be input.} \end{array} \right\}$
JMAX	Number of energy groups for which flux values are to be input..	≤ 20
J(m)	Number of the group of lowest energy for which values of σ_{fj}^m and v_j^m are to be input for material m.	$\leq J MAX$
v_j	Average velocity of neutrons in the j th energy group.	
χ_j	Fraction of prompt fission neutrons emitted into energy group j.	$\left. \begin{array}{l} \text{Assumed identical for all fissionable species.} \\ N4 \\ \sum_{j=N3}^4 \chi_j = 1 \end{array} \right\}$

<u>Symbol</u>	<u>Definition</u>	<u>Restrictions</u>
k	Regional indexing parameter. Regions are numbered in consecutive order beginning at the center.	$\leq \text{NR}$
MP(k)	Number of mesh points in region k, numerically equal to the number of intervals + 1.	$\sum_{k=1}^{\text{NR}} \text{MP}(k) \leq 100$
R(k)	Outer radius of region k.	
Δr_k	Radial increment between mesh points in region k.	Constant within a given region. $\left\{ \begin{array}{l} = 0 \text{ if material is not present.} \\ = 1 \text{ if material is present.} \end{array} \right.$
MPAR(k,m)	Parameter indicating presence of material m in region k.	
$\beta_{d,j}^m$	Fraction of delayed fission neutrons emitted into energy group j by material m.	For a given m, $\sum_{j=N_1}^{N_2} \beta_{d,j}^m = 1$
β_i^m	Fraction which the family i constitutes of the total (delayed and prompt) fission neutrons emitted by material m.	$\sum_{i=1}^6 \beta_i^m = \beta^m$
β^m	Total fraction of delayed fission neutrons emitted by material m.	
$\sigma_{f,j}^m$	Microscopic fission cross section of material m for energy group j.	
ν_j^m	Number of neutrons emitted per fission of material m in energy group j.	
$N_{\text{eff},k}^m$	Effective atomic density ($\times 10^{-24}$) of material m in region k.	$= 0$ when material is not present.
$\Sigma_{f,j}^m$	Macroscopic fission cross section of material m for energy group j.	$= N_{\text{eff},k}^m \sigma_{f,j}^m$ for region k.
$\Phi_{j,\ell}$	Real flux for energy group j at mesh point number ℓ .	
$\Phi_{j,\ell}^*$	Adjoint flux for energy group j at mesh point number ℓ .	

<u>Symbol</u>	<u>Definition</u>	<u>Restrictions</u>
β_{eff}	Total effective delayed-neutron fraction.	
$\beta_{\text{eff},i}$	The fraction of β_{eff} which the family i constitutes.	$\sum_{i=1}^6 \beta_{\text{eff},i} = \beta_{\text{eff}}$
λ_p	Prompt-neutron lifetime.	
$w_{d,k}^m$	Worth of a delayed fission neutron in region k for material m.	
$w_{p,k}^m$	Worth of a prompt fission neutron in region k for material m.	
F_k^m	Fissions of material m in region k.	

II. MATHEMATICAL ANALYSIS

A. Geometry and Mesh Description

The geometry used in the analysis is spherical. As for the mesh description, the innermost region contains a point at the center and another at the edge, with all interior points being equally spaced. Each other region has a point at the interface and another at the outerface, with all interior points again being equally spaced. Consequently, there are 2 points at each interior boundary, one at the center and one at the outermost edge. All points in a given region are equally spaced, but the interval may vary from one region to the next.

B. Formulae

The definitions presented below in Eqs. (1), (3), (4), and (5) are essentially those employed in Ref. 6 and 7. The total effective delayed-neutron fraction is calculated according to the expression:

$$\beta_{\text{eff}} = \frac{\sum_{m=1}^M \int_V \left[\sum_{j=1}^{J(m)} (\nu \Sigma_f)_j^m \Phi_j \right] \left[\beta^m \sum_{j=N1}^{N2} \beta_{d,j}^m \Phi_j^* \right] dV}{\sum_{m=1}^M \int_V \left[\sum_{j=1}^{J(m)} (\nu \Sigma_f)_j^m \Phi_j \right] \left[\beta^m \sum_{j=N1}^{N2} \beta_{d,j}^m \Phi_j^* + (1 - \beta^m) \sum_{j=N3}^{N4} \chi_j \Phi_j^* \right] dV}. \quad (1)$$

All integration is performed over the volume of the entire reactor. Regional values of β_{eff} are also calculated, the only variation from Eq. (1) being that the numerator is evaluated over the volume of the particular region, V_k .

To obtain the contribution $\beta_{\text{eff},i}$ to β_{eff} made by the family i , we simply replace β^m in the numerator of Eq. (1) with β_i^m . The relation between these values is such that, for a given material m ,

$$\sum_{i=1}^6 \beta_i^m = \beta^m .$$

Hence, whether we are considering a particular region or the entire reactor, it must be true that

$$\sum_{i=1}^6 \beta_{\text{eff},i} = \beta_{\text{eff}} . \quad (2)$$

Although the program is set up for 6 families, it is obvious that a lesser number I may be considered by setting $\beta_i^m = 0$ for $I < i \leq 6$.

The defining expression for the prompt-neutron lifetime is

$$\ell_p = \frac{\int_V \sum_{j=1}^{J \text{ MAX}} \left(\Phi_j \Phi_j^* / v_j \right) dV}{\sum_{m=1}^M \int_V \left[\sum_{j=1}^{J(m)} (\nu \Sigma_f)_j^m \Phi_j \right] \left[\sum_{j=N3}^{N4} \chi_j \Phi_j^* \right] dV} . \quad (3)$$

The integration is performed over the volume of the entire reactor. Hence, there will be a contribution in the numerator from regions not containing fissionable materials, such as the reflectors in the sample problems. The denominator of Eq. (3) is the importance-weighted integral of the source of fission neutrons. Since it is of use in calculations of danger coefficients as a normalization factor,(8) it appears in the printout as DCNF (see Section III D).

The worth of a delayed fission neutron for material m in region k is taken to be

$$w_{d,k}^m = \frac{\int_{V_k} \left[\sum_{j=1}^{J(m)} (\nu \Sigma_f)_j^m \Phi_j \right] \left[\sum_{j=N1}^{N2} \beta_{d,j}^m \Phi_j^* \right] dV_k}{\int_{V_k} \left[\sum_{j=1}^{J(m)} (\nu \Sigma_f)_j^m \Phi_j \right] dV_k} . \quad (4)$$

The worth of a prompt fission neutron for material m is

$$w_{p,k}^m = \frac{\int_{V_k} \left[\sum_{j=1}^{J(m)} (\nu \Sigma_f)_j^m \phi_j \right] \left[\sum_{j=N_3}^{N_4} \chi_j \phi_j^* \right] dV_k}{\int_{V_k} \left[\sum_{j=1}^{J(m)} (\nu \Sigma_f)_j^m \phi_j \right] dV_k} . \quad (5)$$

Both Eqs. (4) and (5) are evaluated for each fissionable material in every region.

There are 3 worth ratios calculated in each region:

$$w_{d,k}^1/w_{p,k}^2 , \quad w_{d,k}^2/w_{p,k}^2 , \quad \text{and} \quad w_{p,k}^1/w_{p,k}^2 . \quad (6)$$

As indicated by the superscripts, these ratios are calculated for materials numbered 1 and 2 only. Therefore, the order of input of material properties should be carefully noted. In the sample problems, material number one refers to U²³⁸ and number two refers to Pu²³⁹.

The number of fissions of each material is calculated and normalized such that

$$\sum_{k=1}^{NR} \sum_{m=1}^M F_k^m = 1 . \quad (7)$$

Hence, for material m in region k,

$$F_k^m = \frac{\int_{V_k} \left[\sum_{j=1}^{J(m)} \Sigma_{f,j}^m \phi_j \right] dV_k}{\sum_{k=1}^{NR} \sum_{m=1}^M \int_{V_k} \left[\sum_{j=1}^{J(m)} \Sigma_{f,j}^m \phi_j \right] dV_k} . \quad (8)$$

C. Method of Integration

Let y represent any of the quantities A(I,m,l) or S(I,l) as defined in Section III-D. Furthermore, in an attempt to be consistent with the assumptions employed in RE-122, let yr² be linear between any two mesh points l and l + 1 in a given region k. Then

$$\int_{V_\ell} y \, dV_\ell = 4\pi \int_{r_\ell}^{r_{\ell+1}} \left[y_\ell r_\ell^2 + (r - r_\ell) \left(\frac{y_{\ell+1} r_{\ell+1}^2 - y_\ell r_\ell^2}{r_{\ell+1} - r_\ell} \right) \right] dr \\ = 2\pi \Delta r_k \left(y_\ell r_\ell^2 + y_{\ell+1} r_{\ell+1}^2 \right) . \quad (9)$$

The integral over a region is then obtained by summing Eq. (9) over all intervals in the region. Although it is not altogether obvious that this method of integration will produce the most accurate results, it is certainly true that, if the interval is chosen small enough, any other method will produce only negligible changes in the end results.

III. DESCRIPTION OF THE PROGRAM

A. Limitations

1. Spherical geometry
2. Fissionable species ≤ 5
3. Energy groups ≤ 20
4. Regions ≤ 25
5. Mesh points ≤ 100
6. Radial distribution of fluxes is taken directly from tape 6 as written by RE-122.

B. Input

All data, with the exception of the real and adjoint fluxes, are read from cards according to the list below. The formats used therein may be defined as follows:

<u>Format</u>	<u>Description</u>
F9.5	Write the problem number in fixed-point form with a decimal point in the first 9 columns.
12A6	This format will accept any information in columns 1-72.
12I6	As many as 12 integers may be entered on this card. Each has a field width of 6 columns. A blank space is read as zero, so each integer should be entered at the extreme right of its field.
6E12.5	As many of 6 floating-point numbers may be entered on this card. Each has a field width of 12 columns and should be written in decimal form. If an exponent field is used, it should appear at the extreme right of the main field in one of the

FormatDescription

6E12.5
(Cont'd.)

following forms, which all indicate that the decimal number to which each pertains is to be multiplied by 100: E2, E02, + 2, E 02, E+02. The magnitude of a number thus expressed must lie between 10^{-38} and 10^{38} or be zero.

I6, 2E12.5

There will be 3 numbers on this card. The first is to be an integer with a field width of 6 columns. The second 2 are to be in floating-point form as described above, each with a field width of 12 columns.

General
Comments:

If the list of information is too long for one card, simply continue in the same format to the next card until the list is expended. If the list is shorter than indicated by the format for the card, fill in the data until expended in consecutive fields, and proceed to the next card. The card number is used for identification purposes only. It appears in columns 73-80, which are not processed by Fortran.

CARD INPUT DATA

<u>Card ID No.</u>	<u>Format</u>	<u>Information</u>
1001	F9.5	Problem number.
1002	12A6	Description of problem.
1003	12I6	M,N1,N2,N3,N4,NR,NP1,NP2,NOPT,MOPT,JOPT
1004	12I6	JMAX,J(1),J(2),...,J(M)
2001	6E12.5	$\nu_1, \nu_2, \dots, \nu_{J\text{MAX}}$
3001	6E12.5	$X_{N3}X_{N3+1}\dots X_{N4}$
4001	I6, 2E12.5	1,MP(1),R(I)
.	.	.
400(NR)	I6, 2E12.5	NR,MP(NR),R(NR)
5101	12I6	MPAR(1,1), MPAR(2,1), ..., MPAR(NR,1)
5201	6E12.5	$\beta_{d,N1}^1, \beta_{d,N1+1}^1, \dots, \beta_{d,N2}^1$
5301	6E12.5	$\beta_1^1, \beta_2^1, \dots, \beta_6^1$
5401	6E12.5	β^1
5501	6E12.5	$\sigma_{f,1}^1, \sigma_{f,2}^1, \dots, \sigma_{f,J(1)}^1$
5601	6E12.5	$\nu_1^1, \nu_2^1, \dots, \nu_{J(1)}^1$
5701	6E12.5	$N_{eff,1}^1, N_{eff,2}^1, \dots, N_{eff,NR}^1$
.	.	.
(M+4)101	12I6	MPAR(1,M),MPAR(2,M),...,MPAR(NR,M)
(M+4)201	6E12.5	$\beta_{d,N1}^M, \beta_{d,N1+1}^M, \dots, \beta_{d,N2}^M$
(M+4)301	6E12.5	$\beta_1^M, \beta_2^M, \dots, \beta_6^M$
(M+4)401	6E12.5	β^M
(M+4)501	6E12.5	$\sigma_{f,1}^M, \sigma_{f,2}^M, \dots, \sigma_{f,J(M)}^M$
(M+4)601	6E12.5	$\nu_1^M, \nu_2^M, \dots, \nu_{J(M)}^M$
(M+4)701	6E12.5	$N_{eff,1}^M, N_{eff,2}^M, \dots, N_{eff,NR}^M$

The radial distribution of the fluxes will be read from BCD tape according to the option NOPT which appears on card 1003. The indication NOPT = 0 causes Subroutine F122 to read the real fluxes from tape unit 4 and the adjoint fluxes from tape unit 5. The notation NOPT = 1 causes Subroutine FLIB to read the fluxes from tape unit 3, whereupon the real solution precedes the adjoint. In either case, the fluxes for a given solution as obtained by RE-122 appear after the first 4 words on records 4 - (J MAX+3). They are normalized to yield one fission neutron per cubic centimeter of core. (This fact should be kept in mind when analyzing results which are not ratios.)

Any number of problems may be run in succession without reloading the binary program deck. There are 2 options on card 1003, which will facilitate the preparation of input in such cases. If the information to which they pertain is identical with that used in the previous problem, enter the integer 1. If not (in which case new data is to be input), enter the integer 0. If MOPT = 1, omit the cards containing the following data: MPAR(k,m), $\beta_{d,j}^m$, β_i^m , β_f^m , $\sigma_{f,j}^m$, and ν_j^m . Then only cards containing values of $N_{eff,k}^m$ shall be input after the 4000 series. If JOPT = 1, omit cards containing data on ν_j and χ_j , i.e., the 2000 and 3000 series cards. The second sample problem is intended to exemplify these two options.

C. Operating Instructions

Reader: Standard.

Punch: Not used.

Printer: Not used.

UF Switch: Not used.

Tapes:

Input:
$$\begin{cases} \text{If NOPT} = 0, \text{ real solution is on tape unit 4 and} \\ \text{adjoint solution is on tape unit 5.} \\ \text{If NOPT} = 1, \text{ real solution precedes adjoint} \\ \text{solution on tape unit 3.} \end{cases}$$

Output: On tape unit 2. (Use a long tape when running problems in succession.)

Running Procedure:

1. Ready tapes as indicated above.
2. Clear and load cards.
3. Start.
4. Problem stops with end of file in card reader.

Running time: ~40 sec/problem.

D. Output

The results appear in 2, 3, or 4 sections according to the print options on card 1003. If NP1=1, values are printed according to the list, below, of quantities calculated at each mesh point ℓ for every material m. Replacing the printout parameters of N and L with m and ℓ , respectively,

$$A(1,m,\ell) = \sum_{j=1}^{J(m)} \Sigma_f^m \Phi_{j,\ell}$$

$$A(2,m,\ell) = \sum_{j=1}^{J(m)} (\nu \Sigma_f)_j^m \Phi_{j,\ell}$$

$$A(3,m,\ell) = \left[\sum_{j=1}^{J(m)} (\nu \Sigma_f)_j^m \Phi_{j,\ell} \right] \left[\sum_{j=N1}^{N2} \beta_{d,j}^m \Phi_{j,\ell}^* \right]$$

$$A(4,m,\ell) = \left[\sum_{j=1}^{J(m)} (\nu \Sigma_f)_j^m \Phi_{j,\ell} \right] \left[\sum_{j=N3}^{N4} \chi_j \Phi_{j,\ell}^* \right]$$

$$A(5,m,\ell) = \sum_{j=N1}^{N2} \beta_{d,j}^m \Phi_{j,\ell}^*$$

$$S(1,\ell) = \sum_{j=N3}^{N4} \chi_j \Phi_{j,\ell}^*$$

$$S(2,\ell) = \sum_{j=1}^{J \text{ MAX}} \frac{\Phi_{j,\ell} \Phi_{j,\ell}^*}{v_j}$$

If NP1 = 0, these values are not printed.

If NP2 = 1, the integrals of the above quantities between successive mesh points within each region are printed as

$$B(I,m,\ell) = \int_{\ell}^{\ell+1} A(I,m,\ell) dV_{\ell} \quad (I=1,2, \dots, 5)$$

and

$$T(I,\ell) = \int_{\ell}^{\ell+1} S(I,\ell) dV_{\ell} \quad (I=1,2)$$

If NP2=0, these values are not printed.

The third section contains regionwise calculations according to the following list, in which we replace the printout parameters N and K with m and k, respectively:

$$WD(m,k) = W_{d,k}^m$$

$$WP(m,k) = W_{p,k}^m$$

$$WD(1,k)/WP(2,k) = W_{d,k}^1/W_{p,k}^2$$

$$WD(2,k)/WP(2,k) = W_{d,k}^2/W_{p,k}^2$$

$$WP(1,k)/WP(2,k) = W_{p,k}^1/W_{p,k}^2$$

$$FIS(m,k) = F_k^m \text{ (normalized)}$$

$$FIS(k) = \sum_{m=1}^M F_k^m \text{ (normalized)}$$

$D(i,k) = D_{i,k}$ the numerator of the expression defining $\beta_{eff,i}$ as evaluated over region k.

$BEFF(i,k) = \beta_{eff,i}$ evaluated for region k.

$BEFF(k) = \beta_{eff}$ evaluated for region k.

If material 2 does not appear in region k, the worth ratios above are printed as zero.

The last section contains evaluations over the entire reactor of the following quantities:

D = the numerator of equation (1)

$D + P$ = the denominator of equation (1)

$BEFF(i) = \beta_{eff,i}$

$LP = \ell_p$

$TOT\ FISS = \sum_{k=1}^{NR} \sum_{m=1}^M F_k^m$ (before normalization to unity)

$FISS(m) = F^m = \sum_{k=1}^{NR} F_k^m$ (normalized)

$DCNF =$ the denominator of (3)

IV. SAMPLE PROBLEMS

A. Sample Problem No. 1

In Sample Problem No. 1 calculations were made for a 1500-liter, spherical reactor with Plutonium-C Oxide fuel. A composition problem was run with RE-122 according to the following specifications:

Region	Divisions	Standard		Outerbound	Initial Source
		Configuration			
1	24	0.265		71	1.00
2	15	-		116	0.02
3	6	-		146	0.00

VOLUME FRACTIONS

Region	Pu ²³⁹	Pu ²⁴⁰	Pu ²⁴¹	Pu ²⁴²	U ²³⁸	O	Na	Fe
IF	0.039	0.00975	0.024375	0.024375	-	0.0975	0.5	0.25
ID	-	-	-	-	0.0975	0.0975	0.5	0.25
2	-	-	-	-	0.6	-	0.2	0.2
3	-	-	-	-	-	-	0.4	0.6

The criticality and convergence criteria were both 10^{-6} with boundary conditions at the inner and outer edges of $\Phi' = 0$ and $\Phi = 0$, respectively. A 16-group macroscopic cross-section set was used, based on Ref. 4. The result was a value $C = 0.92977$.

Assume the real and adjoint solutions are on separate tapes. Then the input for 1188/RE is as given below, in which materials 1, 2, 3, 4, and 5 are taken to be U²³⁸, Pu²³⁹, Pu²⁴⁰, Pu²⁴¹, and Pu²⁴², respectively.

704 INPUT DATA
FORM II

PROBLEM Sample Prob. No. 11 ORIGINATOR L. C. Kvitek

DATA I.D. 36

DATE 8/7/61

PAGE 1 OF 3

1	2	3	4	5	6	7	8
1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9
3 6. 0 0 0 2 3,							1,0,0,1
,1 5. 0. 0, LITER., P U - C O X I D E .	REF NOS.	1 5 4 / 5 2 , 2 , 5 5 3 , 5 5 4 , 3 6 . 0 0 , 0 8 . 1					1,0,0,2
5 6 7 1 9 3 1 0 0 0							1,0,0,3
1 6 4 1 6 7 1 6 8 0							1,0,0,4
3 2. 1 E + 0 8 2 2. 9 E + 0 8 1 7. 8 E + 0 8 1 3. 9 E + 0 8 1 0. 9 E + 0 8 8. 4 E + 0 8 2 0,0,1							
6. 5 E + 0 8 5. 1 E + 0 8 4. 0 E + 0 8 3. 1 E + 0 8 2. 2 4. E + 0 8 1. 9 E + 0 8 2,0,0,2							
1. 5 E + 0 8 1. 1 E + 0 8 0. 8 E + 0 8 0. 4 E + 0 8							2,0,0,3
0. 1 3 2 0. 2 1 3 0. 2 3 2 0. 1 7 9 0. 1 1 6 0. 0 6 7 3,0,1							
0. 0 3 4 0. 0 1 7 0. 0 1 0							3,0,0,2
1 2. 5 7. 1. 0							4,0,0,1
2 1. 6 1 1 6. 0							4,0,0,2
3 7 1 4 6. 0							4,0,0,3
1 1 0							5,1,0,1
0. 9 8 7 0 1 0. 0 1 2 9 9							5,2,0,1
0. 0 0 0 2 0 4 0. 0 0 2 1 5 1 0. 0 0 2 5 4 3 0. 0 0 6 0 9 2 0. 0 0 3 5 3 3 0. 0 0 1 1 7 8 5,3,0,1							
0. 0 1 5 7 0 1							5,4,0,1
0. 6 0 9 0. 5 8 1 0. 4 3 0 0. 0 2 4							5,5,0,1
3. 2 0 2. 8 7 2. 6 8 2. 5 6							5,6,0,1
3. 5 2 6 9 E - 3 0. 0 2 8 8							5,7,0,1
1 0 0							6,1,0,1
1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0	1	2	3	4	5	6	7
							8

**704 INPUT DATA
FORM II**

PROBLEM Sample Prob. No. 1 ORIGINATOR L. C. Kvitek

DATA I.D. 36

DATE 8/7/61

PAGE 2 OF 3

704 INPUT DATA
FORM II

PROBLEM Sample Prob. No. 1 ORIGINATOR L. C. Kvitek

DATA I.D. 36

DATE 8/7/61

PAGE 3 OF 3

1	2	3	4	5	6	7	8
1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9
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,0.,5,3,3,6,8,7,E,-2,							,8,4,0,1,
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,1,0,1							,9,1,0,1,
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,0.,7,9,9,9,9,6,E,-2,							,9,4,0,1,
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,3.,0,7,	,3.,0,6,						,9,6,0,2,
,2.,8,8,2,8,E,-4,							,9,7,0,1,
1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5 6 7 8 9
1	2	3	4	5	6	7	8

1188/RE

PROBLEM NUMBER 36.00023

1500 LITER, PU-C OXIDE. REF NOS 154/522,553,554,36.0008.

RESULTS OF POINTWISE SUMMING OVER ENERGY GROUPS.

L	N	A(1,N,L)	A(2,N,L)	A(3,N,L)	A(4,N,L)	A(5,N,L)	S(1,L)	S(2,L)
1	1	5.78833E-02	1.63549E-01	2.76770E-01	3.05485E-01	1.69227E 00	1.86785E 00	1.42653E-06
1	2	2.89209E-01	8.53671E-01	1.44454E 00	1.59453E 00	1.69215E 00	1.86785E 00	1.42653E-06
1	3	1.39244E-02	4.57783E-02	7.74663E-02	8.55069E-02	1.69221E 00	1.86785E 00	1.42653E-06
1	4	2.47098E-01	7.46865E-01	1.26391E 00	1.39503E 00	1.69229E 00	1.86785E 00	1.42653E-06
1	5	3.38831E-02	1.11189E-01	1.88146E-01	2.07683E-01	1.69214E 00	1.86785E 00	1.42169E-06
2	1	5.77836E-02	1.63268E-01	2.75816E-01	3.04439E-01	1.68935E 00	1.86466E 00	1.42169E-06
2	2	2.88715E-01	8.52214E-01	1.43958E 00	1.58909E 00	1.68923E 00	1.86466E 00	1.42169E-06
2	3	1.39003E-02	4.56990E-02	7.71984E-02	8.52133E-02	1.68928E 00	1.86466E 00	1.42169E-06
2	4	2.46679E-01	7.45597E-01	1.25959E 00	1.39029E 00	1.68937E 00	1.86466E 00	1.42169E-06
2	5	3.38244E-02	1.10996E-01	1.87495E-01	2.06970E-01	1.68921E 00	1.86466E 00	1.42169E-06
2	6	5.75072E-02	1.62487E-01	2.73178E-01	3.01549E-01	1.68812E 00	1.85584E 00	1.40830E-06
3	1	2.87346E-01	8.48172E-01	1.42588E 00	1.57407E 00	1.68112E 00	1.85584E 00	1.40830E-06
3	2	1.38334E-02	4.54790E-02	7.64578E-02	8.44016E-02	1.68117E 00	1.85584E 00	1.40830E-06
3	3	2.45516E-01	7.42081E-01	1.24763E 00	1.37718E 00	1.68125E 00	1.85584E 00	1.40830E-06
3	4	3.36615E-02	1.10462E-01	1.85696E-01	2.04999E-01	1.68110E 00	1.85584E 00	1.40830E-06
3	5	5.70273E-02	1.61131E-01	2.68630E-01	2.96565E-01	1.66715E 00	1.84052E 00	1.38522E-06
4	1	2.84971E-01	8.41115E-01	1.40224E 00	1.54817E 00	1.66704E 00	1.84052E 00	1.38522E-06
4	2	1.37172E-02	4.50970E-02	7.51807E-02	8.30019E-02	1.66709E 00	1.84052E 00	1.38522E-06
4	3	2.43498E-01	7.35981E-01	1.22701E 00	1.35459E 00	1.66717E 00	1.84052E 00	1.38522E-06
4	4	3.33787E-02	1.09534E-01	1.82594E-01	2.01599E-01	1.66702E 00	1.84052E 00	1.35295E-06
4	5	5.63490E-02	1.59215E-01	2.662270E-01	2.89595E-01	1.64727E 00	1.81889E 00	1.35295E-06
5	1	2.81616E-01	8.31252E-01	1.36920E 00	1.51196E 00	1.64715E 00	1.81889E 00	1.35295E-06
5	2	1.35529E-02	4.45572E-02	7.33947E-02	8.10447E-02	1.64720E 00	1.81889E 00	1.35295E-06
5	3	2.40649E-01	7.27366E-01	1.19818E 00	1.32300E 00	1.64729E 00	1.81889E 00	1.35295E-06
5	4	3.29790E-02	1.08222E-01	1.78256E-01	1.96845E-01	1.64713E 00	1.81889E 00	1.35295E-06

6	1	5.54775E-02	1.56753E-01	2.54214E-01	2.80767E-01	1.62175E 00	1.79114E 00	1.31208E-06
6	2	2.77309E-01	8.18538E-01	1.32736E 00	1.46612E 00	1.62162E 00	1.79114E 00	1.31208E-06
6	3	1.33419E-02	4.38636E-02	7.11327E-02	7.85659E-02	1.62168E 00	1.79114E 00	1.31208E-06
6	4	2.36992E-01	7.16312E-01	1.16169E 00	1.28301E 00	1.62176E 00	1.79114E 00	1.31208E-06
6	5	3.24654E-02	1.06538E-01	1.72762E-01	1.90824E-01	1.62161E 00	1.79114E 00	1.31208E-06
7	1	5.44185E-02	1.53762E-01	2.44599E-01	2.70232E-01	1.59077E 00	1.75747E 00	1.26331E-06
7	2	2.72083E-01	8.03108E-01	1.27746E 00	1.11144E 00	1.59065E 00	1.75747E 00	1.26331E-06
7	3	1.30854E-02	4.30208E-02	6.84331E-02	7.56079E-02	1.59070E 00	1.75747E 00	1.26331E-06
7	4	2.32556E-01	7.02899E-01	1.11816E 00	1.23533E 00	1.59079E 00	1.75747E 00	1.26331E-06
7	5	3.18413E-02	1.04490E-01	1.66205E-01	1.83639E-01	1.59063E 00	1.75747E 00	1.26331E-06
8	1	5.31780E-02	1.50258E-01	2.33583E-01	2.58163E-01	1.55455E 00	1.71813E 00	1.20745E-06
8	2	2.65973E-01	7.85065E-01	1.22032E 00	1.34885E 00	1.55442E 00	1.71813E 00	1.20745E-06
8	3	1.27850E-02	4.20335E-02	6.53401E-02	7.22192E-02	1.55448E 00	1.71813E 00	1.20745E-06
8	4	2.27370E-01	6.87219E-01	1.06833E 00	1.18073E 00	1.55457E 00	1.71813E 00	1.20745E-06
8	5	3.11104E-02	1.02092E-01	1.58693E-01	1.75409E-01	1.55440E 00	1.71813E 00	1.20745E-06
9	1	5.17629E-02	1.46261E-01	2.21339E-01	2.44751E-01	1.51332E 00	1.67339E 00	1.14537E-06
9	2	2.59017E-01	7.64528E-01	1.15687E 00	1.27935E 00	1.51319E 00	1.67339E 00	1.14537E-06
9	3	1.24424E-02	4.09075E-02	6.19031E-02	6.84541E-02	1.51325E 00	1.67339E 00	1.14537E-06
9	4	2.21470E-01	6.69378E-01	1.01299E 00	1.12013E 00	1.51334E 00	1.67339E 00	1.14537E-06
9	5	3.02767E-02	9.93574E-02	1.50344E-01	1.66263E-01	1.51317E 00	1.67339E 00	1.14537E-06
10	1	5.01806E-02	1.41791E-01	2.08058E-01	2.30204E-01	1.46735E 00	1.62354E 00	1.07806E-06
10	2	2.51262E-01	7.41628E-01	1.08813E 00	1.20406E 00	1.46722E 00	1.62354E 00	1.07806E-06
10	3	1.20594E-02	3.96488E-02	5.81757E-02	6.13714E-02	1.46728E 00	1.62354E 00	1.07806E-06
10	4	2.14893E-01	6.49494E-01	9.53045E-01	1.05448E 00	1.46737E 00	1.62354E 00	1.07806E-06
10	5	2.93448E-02	9.63001E-02	1.41291E-01	1.56347E-01	1.46720E 00	1.62354E 00	1.07806E-06
11	1	4.84392E-02	1.36873E-01	1.93940E-01	2.14744E-01	1.41694E 00	1.56893E 00	1.00653E-06
11	2	2.42756E-01	7.16510E-01	1.01515E 00	1.12416E 00	1.41680E 00	1.56893E 00	1.00653E-06
11	3	1.16381E-02	3.82640E-02	5.42148E-02	6.00336E-02	1.41686E 00	1.56893E 00	1.00653E-06
11	4	2.07682E-01	6.27688E-01	8.89410E-01	9.84801E-01	1.41696E 00	1.56893E 00	1.00653E-06
11	5	2.83195E-02	9.29367E-02	1.31671E-01	1.45811E-01	1.41678E 00	1.56893E 00	1.00653E-06
12	1	4.65467E-02	1.31528E-01	1.79195E-01	1.98598E-01	1.36241E 00	1.50993E 00	9.31826E-07
12	2	2.33553E-01	6.89331E-01	9.39052E-01	1.04084E 00	1.36227E 00	1.50993E 00	9.31826E-07
12	3	1.11180E-02	3.67603E-02	5.00796E-02	5.55055E-02	1.36233E 00	1.50993E 00	9.31826E-07
12	4	1.99884E-01	6.04107E-01	8.23055E-01	9.12161E-01	1.36243E 00	1.50993E 00	9.31826E-07
12	5	2.72063E-02	8.92845E-02	1.21627E-01	1.34814E-01	1.36224E 00	1.50993E 00	9.31826E-07
13	1	4.45118E-02	1.25781E-01	1.64032E-01	1.81998E-01	1.30411E 00	1.44694E 00	8.55010E-07

13	2	2.23710E-01	6.60260E-01	8.60950E-01	9.55359E-01	1.30396E 00	1.44694E 00	8.55010E-07
13	3	1.06892E-02	3.51451E-02	4.58300E-02	5.08529E-02	1.30402E 00	1.44694E 00	8.55010E-07
13	4	1.91547E-01	5.78895E-01	7.54957E-01	8.37629E-01	1.30413E 00	1.44694E 00	8.55010E-07
13	5	2.60107E-02	8.53617E-02	1.11306E-01	1.23514E-01	1.30393E 00	1.44694E 00	8.55010E-07
14	1	4.23427E-02	1.19655E-01	1.48661E-01	1.65172E-01	1.24241E 00	1.38040E 00	7.77131E-07
14	2	2.13286E-01	6.29472E-01	7.81962E-01	8.68923E-01	1.24225E 00	1.38040E 00	7.77131E-07
14	3	1.01663E-02	3.34261E-02	4.15260E-02	4.61414E-02	1.24232E 00	1.38040E 00	7.77131E-07
14	4	1.82723E-01	5.52209E-01	6.86085E-01	7.62269E-01	1.24244E 00	1.38040E 00	7.77131E-07
14	5	2.47385E-02	8.11873E-02	1.00853E-01	1.12071E-01	1.24222E 00	1.38040E 00	7.77131E-07
15	1	4.00474E-02	1.13173E-01	1.33285E-01	1.48342E-01	1.17771E 00	1.31076E 00	6.99197E-07
15	2	2.02345E-01	5.97154E-01	7.03170E-01	7.82725E-01	1.17753E 00	1.31076E 00	6.99197E-07
15	3	9.61429E-03	3.16115E-02	3.77261E-02	4.14350E-02	1.17761E 00	1.31076E 00	6.99197E-07
15	4	1.73466E-01	5.24209E-01	6.17380E-01	6.87112E-01	1.17774E 00	1.31076E 00	6.99197E-07
15	5	2.33956E-02	7.67807E-02	9.04098E-02	1.00641E-01	1.17751E 00	1.31076E 00	6.99197E-07
16	1	3.76331E-02	1.06355E-01	1.18098E-01	1.31722E-01	1.11041E 00	1.23851E 00	6.22163E-07
16	2	1.90952E-01	5.63497E-01	6.25607E-01	6.97897E-01	1.11022E 00	1.23851E 00	6.22163E-07
16	3	9.03573E-03	2.97092E-02	3.29863E-02	3.67952E-02	1.11031E 00	1.23851E 00	6.22163E-07
16	4	1.63829E-01	4.95062E-01	5.49736E-01	6.13140E-01	1.11044E 00	1.23851E 00	6.22163E-07
16	5	2.19882E-02	7.21618E-02	8.01135E-02	8.93732E-02	1.11019E 00	1.23851E 00	6.22163E-07
17	1	3.51059E-02	9.92184E-02	1.03281E-01	1.15508E-01	1.04094E 00	1.16417E 00	5.46910E-07
17	2	1.79172E-01	5.28693E-01	5.50232E-01	6.15491E-01	1.04074E 00	1.16417E 00	5.46910E-07
17	3	8.43310E-03	2.777274E-02	2.88595E-02	3.22795E-02	1.04083E 00	1.16417E 00	5.46910E-07
17	4	1.53869E-01	4.61932E-01	4.83981E-01	5.41262E-01	1.04097E 00	1.16417E 00	5.46910E-07
17	5	2.05225E-02	6.73503E-02	7.00920E-02	7.84076E-02	1.04071E 00	1.16417E 00	5.46910E-07
18	1	3.24703E-02	9.17758E-02	8.89980E-02	9.98787E-02	9.69733E-01	1.08829E 00	4.74229E-07
18	2	1.67073E-01	4.92938E-01	4.77912E-01	5.36460E-01	9.69517E-01	1.08829E 00	4.74229E-07
18	3	7.80895E-03	2.56742E-02	2.48940E-02	2.79109E-02	9.69121E-01	1.08829E 00	4.74229E-07
18	4	1.43639E-01	4.33983E-01	4.20862E-01	4.72299E-01	9.69766E-01	1.08829E 00	4.74229E-07
18	5	1.90047E-02	6.23664E-02	6.04631E-02	6.78728E-02	9.69482E-01	1.08829E 00	4.74229E-07
19	1	2.97286E-02	8.40335E-02	7.53963E-02	8.49936E-02	8.97218E-01	1.01143E 00	4.04813E-07
19	2	1.54720E-01	4.56426E-01	4.09408E-01	4.61641E-01	8.96988E-01	1.01143E 00	4.04813E-07
19	3	7.16579E-03	2.35576E-02	2.11333E-02	2.38268E-02	8.97089E-01	1.01143E 00	4.04813E-07
19	4	1.33192E-01	4.02374E-01	3.61032E-01	4.06972E-01	8.97253E-01	1.01143E 00	4.04813E-07
19	5	1.74410E-02	5.72299E-02	5.13324E-02	5.78839E-02	8.96951E-01	1.01143E 00	4.04813E-07
20	1	2.68805E-02	7.59897E-02	6.26022E-02	7.09882E-02	8.23825E-01	9.34182E-01	3.39256E-07
20	2	1.42176E-01	4.19342E-01	3.45363E-01	3.91792E-01	8.23582E-01	9.34182E-01	3.39256E-07
20	3	6.50618E-03	2.13857E-02	1.76151E-02	1.99781E-02	8.23689E-01	9.34182E-01	3.39256E-07
20	4	1.22576E-01	3.70252E-01	3.05036E-01	3.45882E-01	8.23862E-01	9.34182E-01	3.39256E-07

20	5	1.58378E-02	5.19608E-02	4.27920E-02	4.85408E-02	8.23543E-01	9.34182E-01	3.39256E-07
21	1	2.39218E-02	6.76323E-02	5.07219E-02	5.79734E-02	7.49965E-01	8.57184E-01	2.78061E-07
21	2	1.29501E-01	3.81863E-01	2.86288E-01	3.27327E-01	7.49714E-01	8.57184E-01	2.78061E-07
21	3	5.83271E-03	1.91664E-02	1.43714E-02	1.64291E-02	7.49825E-01	8.57184E-01	2.78061E-07
21	4	1.11835E-01	3.37746E-01	2.53311E-01	2.89511E-01	7.50004E-01	8.57184E-01	2.78061E-07
21	5	1.42017E-02	4.65793E-02	3.49193E-02	3.99270E-02	7.49674E-01	8.57184E-01	2.78061E-07
22	1	2.08441E-02	5.89361E-02	3.98422E-02	4.60349E-02	6.76023E-01	7.81097E-01	2.21665E-07
22	2	1.16751E-01	3.44150E-01	2.32566E-01	2.68815E-01	6.75770E-01	7.81097E-01	2.21665E-07
22	3	5.14809E-03	1.69080E-02	1.14278E-02	1.32068E-02	6.75881E-01	7.81097E-01	2.21665E-07
22	4	1.01003E-01	3.04963E-01	2.06174E-01	2.38205E-01	6.76062E-01	7.81097E-01	2.21665E-07
22	5	1.25394E-02	4.11065E-02	2.77768E-02	3.21082E-02	6.75729E-01	7.81097E-01	2.21665E-07
23	1	1.76332E-02	4.98598E-02	3.00323E-02	3.52322E-02	6.02336E-01	7.06625E-01	1.70490E-07
23	2	1.03972E-01	3.06338E-01	1.84443E-01	2.16466E-01	6.02091E-01	7.06625E-01	1.70490E-07
23	3	4.45527E-03	1.46194E-02	8.80377E-03	1.03304E-02	6.02199E-01	7.06625E-01	1.70490E-07
23	4	9.01038E-02	2.71970E-01	1.63827E-01	1.92181E-01	6.02374E-01	7.06625E-01	1.70490E-07
23	5	1.08586E-02	3.55651E-02	2.14120E-02	2.51312E-02	6.02052E-01	7.06625E-01	1.70490E-07
24	1	1.42685E-02	4.03421E-02	2.13482E-02	2.55979E-02	5.29179E-01	6.34521E-01	1.25031E-07
24	2	9.11982E-02	2.68526E-01	1.42039E-01	1.70385E-01	5.28957E-01	6.34521E-01	1.25031E-07
24	3	3.75759E-03	1.23102E-02	6.51276E-03	7.81107E-03	5.29055E-01	6.34521E-01	1.25031E-07
24	4	7.91411E-02	2.38783E-01	1.26367E-01	1.51513E-01	5.29213E-01	6.34521E-01	1.25031E-07
24	5	9.16809E-03	2.99810E-02	1.58576E-02	1.90236E-02	5.28922E-01	6.34521E-01	1.25031E-07
25	1	1.07211E-02	3.02983E-02	1.38383E-02	1.71368E-02	4.56735E-01	5.65602E-01	8.60172E-08
25	2	7.84447E-02	2.30759E-01	1.05355E-01	1.30518E-01	4.56558E-01	5.65602E-01	8.60172E-08
25	3	3.05904E-03	9.99206E-03	4.56274E-03	5.65153E-03	4.56636E-01	5.65602E-01	8.60172E-08
25	4	6.80945E-02	2.05343E-01	9.37929E-02	1.16142E-01	4.56763E-01	5.65602E-01	8.60172E-08
25	5	7.47835E-03	2.43853E-02	1.11326E-02	1.37924E-02	4.56530E-01	5.65602E-01	8.60172E-08
26	1	8.75468E-02	2.47410E-01	1.13001E-01	1.39936E-01	4.56735E-01	5.65602E-01	8.60172E-08
26	2	0.	0.	0.	0.	0.	5.65602E-01	8.60172E-08
26	3	0.	0.	0.	0.	0.	5.65602E-01	8.60172E-08
26	4	0.	0.	0.	0.	0.	5.65602E-01	8.60172E-08
26	5	0.	0.	0.	0.	0.	5.65602E-01	8.60172E-08
27	1	4.98034E-02	1.40416E-01	4.97073E-02	6.45516E-02	3.54000E-01	4.59717E-01	4.25438E-08
27	2	0.	0.	0.	0.	0.	4.59717E-01	4.25438E-08
27	3	0.	0.	0.	0.	0.	4.59717E-01	4.25438E-08
27	4	0.	0.	0.	0.	0.	4.59717E-01	4.25438E-08
27	5	0.	0.	0.	0.	0.	4.59717E-01	4.25438E-08

28	1	2.84346E-02	7.99945E-02	2.17141E-02	2.94257E-02	2.71445E-01	3.67846E-01	2.17040E-08
28	2	0.	0.	0.	0.	0.	3.67846E-01	2.17040E-08
28	3	0.	0.	0.	0.	0.	3.67846E-01	2.17040E-08
28	4	0.	0.	0.	0.	0.	3.67846E-01	2.17040E-08
28	5	0.	0.	0.	0.	0.	3.67846E-01	2.17040E-08
29	1	1.62916E-02	4.57403E-02	9.42600E-03	1.32982E-02	2.06076E-01	2.90733E-01	1.11762E-08
29	2	0.	0.	0.	0.	0.	2.90733E-01	1.11762E-08
29	3	0.	0.	0.	0.	0.	2.90733E-01	1.11762E-08
29	4	0.	0.	0.	0.	0.	2.90733E-01	1.11762E-08
29	5	0.	0.	0.	0.	0.	2.27478E-01	5.75427E-09
30	1	9.36664E-03	2.62479E-02	4.06867E-03	5.97082E-03	1.55009E-01	2.27478E-01	5.75427E-09
30	2	0.	0.	0.	0.	0.	2.27478E-01	5.75427E-09
30	3	0.	0.	0.	0.	0.	2.27478E-01	5.75427E-09
30	4	0.	0.	0.	0.	0.	2.27478E-01	5.75427E-09
30	5	0.	0.	0.	0.	0.	1.76468E-01	2.94971E-09
31	1	5.40353E-03	1.511152E-02	1.74736E-03	2.66733E-03	1.15603E-01	1.76468E-01	2.94971E-09
31	2	0.	0.	0.	0.	0.	1.76468E-01	2.94971E-09
31	3	0.	0.	0.	0.	0.	1.76468E-01	2.94971E-09
31	4	0.	0.	0.	0.	0.	1.76468E-01	2.94971E-09
31	5	0.	0.	0.	0.	0.	1.35879E-01	1.50254E-09
32	1	3.12768E-03	8.73420E-03	7.47068E-04	1.18679E-03	8.55337E-02	1.35879E-01	1.50254E-09
32	2	0.	0.	0.	0.	0.	1.35879E-01	1.50254E-09
32	3	0.	0.	0.	0.	0.	1.35879E-01	1.50254E-09
32	4	0.	0.	0.	0.	0.	1.35879E-01	1.50254E-09
32	5	0.	0.	0.	0.	0.	1.03934E-01	7.59940E-10
33	1	1.81634E-03	5.06407E-03	3.18142E-04	5.26328E-04	6.28234E-02	1.03934E-01	7.59940E-10
33	2	0.	0.	0.	0.	0.	1.03934E-01	7.59940E-10
33	3	0.	0.	0.	0.	0.	1.03934E-01	7.59940E-10
33	4	0.	0.	0.	0.	0.	1.03934E-01	7.59940E-10
33	5	0.	0.	0.	0.	0.	1.03934E-01	7.59940E-10
34	1	1.05822E-03	2.94588E-03	1.35014E-04	2.32791E-04	4.58316E-02	7.90226E-02	3.81547E-10
34	2	0.	0.	0.	0.	0.	7.90226E-02	3.81547E-10
34	3	0.	0.	0.	0.	0.	7.90226E-02	3.81547E-10
34	4	0.	0.	0.	0.	0.	7.90226E-02	3.81547E-10
34	5	0.	0.	0.	0.	0.	7.90226E-02	3.81547E-10
35	1	6.18504E-04	1.71926E-03	5.71274E-05	1.02726E-04	3.32279E-02	5.97502E-02	1.90193E-10
35	2	0.	0.	0.	0.	0.	5.97502E-02	1.90193E-10
35	3	0.	0.	0.	0.	0.	5.97502E-02	1.90193E-10

35	4	0.	0.	0.	0.	0.	5.97502E-02	1.90193E-10
35	5	0.	0.	0.	0.	0.	5.97502E-02	1.90193E-10
36	1	3.62624E-04	1.00656E-03	2.41112E-05	4.52380E-05	2.39540E-02	4.49430E-02	9.41669E-11
36	2	0.	0.	0.	0.	0.	4.49430E-02	9.41669E-11
36	3	0.	0.	0.	0.	0.	4.49430E-02	9.41669E-11
36	4	0.	0.	0.	0.	0.	4.49430E-02	9.41669E-11
36	5	0.	0.	0.	0.	0.	4.49430E-02	9.41669E-11
37	1	2.13239E-04	5.91092E-04	1.01559E-05	1.98805E-05	1.71816E-02	3.36335E-02	4.63398E-11
37	2	0.	0.	0.	0.	0.	3.36335E-02	4.63398E-11
37	3	0.	0.	0.	0.	0.	3.36335E-02	4.63398E-11
37	4	0.	0.	0.	0.	0.	3.36335E-02	4.63398E-11
37	5	0.	0.	0.	0.	0.	3.36335E-02	4.63398E-11
38	1	1.25737E-04	3.48067E-04	4.27168E-06	8.71441E-06	1.22726E-02	2.50366E-02	2.26904E-11
38	2	0.	0.	0.	0.	0.	2.50366E-02	2.26904E-11
38	3	0.	0.	0.	0.	0.	2.50366E-02	2.26904E-11
38	4	0.	0.	0.	0.	0.	2.50366E-02	2.26904E-11
38	5	0.	0.	0.	0.	0.	2.50366E-02	2.26904E-11
39	1	7.43049E-05	2.05397E-04	1.79542E-06	3.80419E-06	8.74120E-03	1.85211E-02	1.10758E-11
39	2	0.	0.	0.	0.	0.	1.85211E-02	1.10758E-11
39	3	0.	0.	0.	0.	0.	1.85211E-02	1.10758E-11
39	4	0.	0.	0.	0.	0.	1.85211E-02	1.10758E-11
39	5	0.	0.	0.	0.	0.	1.85211E-02	1.10758E-11
40	1	4.39530E-05	1.21279E-04	7.54753E-07	1.64739E-06	6.22327E-03	1.35835E-02	5.40759E-12
40	2	0.	0.	0.	0.	0.	1.35835E-02	5.40759E-12
40	3	0.	0.	0.	0.	0.	1.35835E-02	5.40759E-12
40	4	0.	0.	0.	0.	0.	1.35835E-02	5.40759E-12
40	5	0.	0.	0.	0.	0.	1.35835E-02	5.40759E-12
41	1	2.59484E-05	7.13780E-05	3.17587E-07	7.01041E-07	4.44936E-03	9.82152E-03	2.65727E-12
41	2	0.	0.	0.	0.	0.	9.82152E-03	2.65727E-12
41	3	0.	0.	0.	0.	0.	9.82152E-03	2.65727E-12
41	4	0.	0.	0.	0.	0.	9.82152E-03	2.65727E-12
41	5	0.	0.	0.	0.	0.	9.82152E-03	2.65727E-12
42	1	0.	0.	0.	0.	0.	9.82152E-03	2.65727E-12
42	2	0.	0.	0.	0.	0.	9.82152E-03	2.65727E-12
42	3	0.	0.	0.	0.	0.	9.82152E-03	2.65727E-12
42	4	0.	0.	0.	0.	0.	9.82152E-03	2.65727E-12

42	0.	0.	0.	0.	0.	9.82152E-03	2.65727E-12
43	0.	0.	0.	0.	0.	6.69676E-03	1.28719E-12
43	0.	0.	0.	0.	0.	6.69676E-03	1.28719E-12
43	0.	0.	0.	0.	0.	6.69676E-03	1.28719E-12
43	0.	0.	0.	0.	0.	6.69676E-03	1.28719E-12
43	0.	0.	0.	0.	0.	6.69676E-03	1.28719E-12
43	0.	0.	0.	0.	0.	4.50027E-03	5.99981E-13
44	0.	0.	0.	0.	0.	4.50027E-03	5.99981E-13
44	0.	0.	0.	0.	0.	4.50027E-03	5.99981E-13
44	0.	0.	0.	0.	0.	4.50027E-03	5.99981E-13
44	0.	0.	0.	0.	0.	4.50027E-03	5.99981E-13
44	0.	0.	0.	0.	0.	4.50027E-03	5.99981E-13
45	0.	0.	0.	0.	0.	2.91622E-03	2.57714E-13
45	0.	0.	0.	0.	0.	2.91622E-03	2.57714E-13
45	0.	0.	0.	0.	0.	2.91622E-03	2.57714E-13
45	0.	0.	0.	0.	0.	2.91622E-03	2.57714E-13
45	0.	0.	0.	0.	0.	1.73122E-03	9.21828E-14
46	0.	0.	0.	0.	0.	1.73122E-03	9.21828E-14
46	0.	0.	0.	0.	0.	1.73122E-03	9.21828E-14
46	0.	0.	0.	0.	0.	1.73122E-03	9.21828E-14
46	0.	0.	0.	0.	0.	7.95806E-04	1.96410E-14
47	0.	0.	0.	0.	0.	7.95806E-04	1.96410E-14
47	0.	0.	0.	0.	0.	7.95806E-04	1.96410E-14
47	0.	0.	0.	0.	0.	7.95806E-04	1.96410E-14
47	0.	0.	0.	0.	0.	0.	0.
48	0.	0.	0.	0.	0.	0.	0.
48	0.	0.	0.	0.	0.	0.	0.
48	0.	0.	0.	0.	0.	0.	0.
48	0.	0.	0.	0.	0.	0.	0.

1188/RE

PROBLEM NUMBER 36.00023

1500 LITER, PU-C OXIDE. REF NOS 154/522,553,554,36.0008.

RESULTS OF POINTWISE TRAPEZOIDAL INTEGRATION FROM L TO L+1.

L	N	B(1,N,L)	B(2,N,L)	B(3,N,L)	B(4,N,L)	B(5,N,L)	T(1,L)	T(2,L)
1	1	9.39996E 00	2.65596E 01	4.48683E 01	4.95247E 01	2.74815E 02	3.03335E 02	2.31274E-04
1	2	4.69668E 01	1.38634E 02	2.34185E 02	2.58506E 02	2.74795E 02	3.03335E 02	2.31274E-04
1	3	2.26123E 00	7.43409E 00	1.25583E 01	1.38621E 01	2.74804E 02	3.03335E 02	2.31274E-04
1	4	1.01285E 01	1.21290E 02	2.04903E 02	2.26165E 02	2.74818E 02	3.03335E 02	2.31274E-04
1	5	5.50238E 00	1.80563E 01	3.05008E 01	3.36689E 01	2.74792E 02	3.03335E 02	2.31274E-04
2	1	4.68199E 01	1.32290E 02	2.22626E 02	2.45743E 02	1.36879E 03	1.51093E 03	1.14766E-03
2	2	2.33943E 02	6.90540E 02	1.16200E 03	1.28275E 03	1.36870E 03	1.51093E 03	1.14766E-03
2	3	1.12626E 01	3.70273E 01	6.23094E 01	6.87822E 01	1.36874E 03	1.51093E 03	1.14766E-03
2	4	1.99886E 02	6.04163E 02	1.01673E 03	1.12230E 03	1.36881E 03	1.51093E 03	1.14766E-03
2	5	2.74059E 01	8.99336E 01	1.51334E 02	1.67062E 02	1.36886E 03	1.51093E 03	1.14766E-03
3	1	1.20912E 02	3.41638E 02	5.71052E 02	6.30411E 02	3.53482E 03	3.90225E 03	2.94446E-03
3	2	6.04195E 02	1.78343E 03	2.98080E 03	3.29088E 03	3.53457E 03	3.90225E 03	2.94446E-03
3	3	2.90843E 01	9.56187E 01	1.59821E 02	1.76441E 02	3.53468E 03	3.90225E 03	2.94446E-03
3	4	5.16257E 02	1.56040E 03	2.60826E 03	2.87935E 03	3.53486E 03	3.90225E 03	2.94446E-03
3	5	7.07724E 01	2.32243E 02	3.88165E 02	4.28549E 02	3.53453E 03	3.90225E 03	2.94446E-03
4	1	2.30158E 02	6.50313E 02	1.07593E 03	1.18795E 03	6.72836E 03	7.42887E 03	5.54953E-03
4	2	1.15021E 03	3.39510E 03	5.61673E 03	6.20196E 03	6.72787E 03	7.42887E 03	5.54953E-03
4	3	5.53585E 01	1.81999E 02	3.01102E 02	3.32464E 02	6.72808E 03	7.42887E 03	5.54953E-03
4	4	9.82860E 02	2.97072E 03	4.91506E 03	5.42672E 03	6.72843E 03	7.42887E 03	5.54953E-03
4	5	1.34707E 02	4.42047E 02	7.31299E 02	8.07504E 02	6.72779E 03	7.42887E 03	5.54953E-03
5	1	3.72286E 02	1.05190E 03	1.71649E 03	1.89560E 03	1.08830E 04	1.20186E 04	8.85752E-03
5	2	1.86077E 03	5.49248E 03	8.96196E 03	9.89784E 03	1.08822E 04	1.20186E 04	8.85752E-03
5	3	8.95353E 01	2.94362E 02	4.80320E 02	5.30461E 02	1.08825E 04	1.20186E 04	8.85752E-03

5	4	1.59018E 03	4.80634E 03	7.84308E 03	8.66137E 03	1.08831E 04	1.20186E 04	8.85752E-03
5	5	2.17871E 02	7.14958E 02	1.16657E 03	1.28841E 03	1.08820E 04	1.20186E 04	8.85752E-03
6	1	5.44312E 02	1.53797E 03	2.46631E 03	2.72441E 03	1.59115E 04	1.75767E 04	1.27344E-02
6	2	2.72119E 03	8.03214E 03	1.28794E 04	1.42283E 04	1.59103E 04	1.75767E 04	1.27344E-02
6	3	1.30892E 02	4.30331E 02	6.90053E 02	7.62301E 02	1.59108E 04	1.75767E 04	1.27344E-02
6	4	2.32574E 03	7.02954E 03	1.12727E 04	1.24523E 04	1.59117E 04	1.75767E 04	1.27344E-02
6	5	3.18506E 02	1.04520E 03	1.67595E 03	1.85151E 03	1.59101E 04	1.75767E 04	1.27344E-02
7	1	7.42577E 02	2.09819E 03	3.29435E 03	3.64040E 03	2.17074E 04	2.39877E 04	1.70230E-02
7	2	3.71394E 03	1.09611E 04	1.72085E 04	1.90176E 04	2.17057E 04	2.39877E 04	1.70230E-02
7	3	1.78543E 02	5.86995E 02	9.21596E 02	1.01845E 03	2.17065E 04	2.39877E 04	1.70230E-02
7	4	3.17431E 03	9.59427E 03	1.50640E 04	1.66462E 04	2.17077E 04	2.39877E 04	1.70230E-02
7	5	4.34456E 02	1.42572E 03	2.23830E 03	2.47364E 03	2.17054E 04	2.39877E 04	1.70230E-02
8	1	9.62800E 02	2.72074E 03	4.16631E 03	4.60599E 03	2.81469E 04	3.11174E 04	2.15949E-02
8	2	4.81677E 03	1.42175E 04	2.17717E 04	2.40714E 04	2.81445E 04	3.11174E 04	2.15949E-02
8	3	2.31451E 02	7.60949E 02	1.16532E 03	1.28836E 03	2.81456E 04	3.11174E 04	2.15949E-02
8	4	4.11815E 03	1.24469E 04	1.90622E 04	2.10736E 04	2.81472E 04	3.11174E 04	2.15949E-02
8	5	5.63200E 02	1.84822E 03	2.83022E 03	3.12920E 03	2.81442E 04	3.11174E 04	2.15949E-02
9	1	1.20013E 03	3.39109E 03	5.04591E 03	5.58148E 03	3.50903E 04	3.88149E 04	2.61300E-02
9	2	6.00748E 03	1.77319E 04	2.63824E 04	2.91852E 04	3.50872E 04	3.88149E 04	2.61300E-02
9	3	2.88444E 02	9.48336E 02	1.41105E 03	1.56089E 03	3.50885E 04	3.88149E 04	2.61300E-02
9	4	5.13734E 03	1.55272E 04	2.31045E 04	2.55564E 04	3.50907E 04	3.88149E 04	2.61300E-02
9	5	7.01883E 02	2.30335E 03	3.42702E 03	3.79114E 03	3.50867E 04	3.88149E 04	2.61300E-02
10	1	1.44920E 03	4.09492E 03	5.89644E 03	6.52668E 03	4.23849E 04	4.69155E 04	3.05790E-02
10	2	7.25984E 03	2.14280E 04	3.08519E 04	3.41528E 04	4.23809E 04	4.69155E 04	3.05790E-02
10	3	3.48227E 02	1.14490E 03	1.64850E 03	1.82480E 03	4.23827E 04	4.69155E 04	3.05790E-02
10	4	6.21005E 03	1.87691E 04	2.70265E 04	2.99148E 04	4.23855E 04	4.69155E 04	3.05790E-02
10	5	8.47355E 02	2.78077E 03	4.00371E 03	4.43213E 03	4.23803E 04	4.69155E 04	3.05790E-02
11	1	1.70420E 03	4.81553E 03	6.68215E 03	7.40250E 03	4.98673E 04	5.52437E 04	3.47155E-02
11	2	8.54623E 03	2.52244E 04	3.49980E 04	3.87779E 04	4.98622E 04	5.52437E 04	3.47155E-02
11	3	4.09399E 02	1.34604E 03	1.86769E 03	2.06915E 03	4.98645E 04	5.52437E 04	3.47155E-02
11	4	7.31294E 03	2.21020E 04	3.06692E 04	3.39749E 04	4.98681E 04	5.52437E 04	3.47155E-02
11	5	9.96210E 02	3.26930E 03	4.53630E 03	5.02562E 03	4.98614E 04	5.52437E 04	3.47155E-02
12	1	1.95891E 03	5.53540E 03	7.36971E 03	8.17249E 03	5.73663E 04	6.36160E 04	3.83706E-02
12	2	9.83763E 03	2.90353E 04	3.86520E 04	4.28671E 04	5.73599E 04	6.36160E 04	3.83706E-02
12	3	4.70472E 02	1.54686E 03	2.05933E 03	2.28379E 03	5.73627E 04	6.36160E 04	3.83706E-02
12	4	8.42150E 03	2.54518E 04	3.38858E 04	3.75763E 04	5.73673E 04	6.36160E 04	3.83706E-02
12	5	1.14483E 03	3.75707E 03	5.00144E 03	5.54697E 03	5.73588E 04	6.36160E 04	3.83706E-02
13	1	2.20679E 03	6.23601E 03	7.92949E 03	8.80425E 03	6.47056E 04	7.18450E 04	4.13938E-02

13	2	1.11041E 04	3.27722E 04	4.16657E 04	4.62680E 04	6.46975E 04	7.18450E 04	4.13938E-02
13	3	5.29889E 02	1.74223E 03	2.21521E 03	2.45976E 03	6.47011E 04	7.18450E 04	4.13938E-02
13	4	9.51049E 03	2.87421E 04	3.65469E 04	4.05780E 04	6.47068E 04	7.18450E 04	4.13938E-02
13	5	1.28942E 03	4.23163E 03	5.38002E 03	5.97440E 03	6.46962E 04	7.18450E 04	4.13938E-02
14	1	2.44098E 03	6.89801E 03	8.33669E 03	9.27071E 03	7.17070E 04	7.97427E 04	4.36584E-02
14	2	1.23153E 04	3.63454E 04	4.39179E 04	4.88452E 04	7.16969E 04	7.97427E 04	4.36584E-02
14	3	5.86037E 02	1.92687E 03	2.32856E 03	2.58965E 03	7.17014E 04	7.97427E 04	4.36584E-02
14	4	1.05543E 04	3.18954E 04	3.85467E 04	4.28645E 04	7.17085E 04	7.97427E 04	4.36584E-02
14	5	1.42607E 03	4.68011E 03	5.65531E 03	6.28993E 03	7.16953E 04	7.97427E 04	4.36584E-02
15	1	2.65433E 03	7.50124E 03	8.57230E 03	9.55107E 03	7.81936E 04	8.71245E 04	4.50658E-02
15	2	1.34408E 04	3.96649E 04	4.53185E 04	5.05010E 04	7.81812E 04	8.71245E 04	4.50658E-02
15	3	6.37270E 02	2.09532E 03	2.39429E 03	2.66790E 03	7.81867E 04	8.71245E 04	4.50658E-02
15	4	1.15273E 04	3.48343E 04	3.98061E 04	4.43502E 04	7.81955E 04	8.71245E 04	4.50658E-02
15	5	1.55077E 03	5.08936E 03	5.81496E 03	6.48010E 03	7.81792E 04	8.71245E 04	4.50658E-02
16	1	2.83942E 03	8.02473E 03	8.62371E 03	9.63157E 03	8.39930E 04	9.38138E 04	4.55484E-02
16	2	1.44508E 04	4.26424E 04	4.58127E 04	5.11764E 04	8.39778E 04	9.38138E 04	4.55484E-02
16	3	6.81920E 02	2.24212E 03	2.40921E 03	2.69105E 03	8.39485E 04	9.38138E 04	4.55484E-02
16	4	1.24040E 04	3.74822E 04	4.02767E 04	4.49828E 04	8.39954E 04	9.38138E 04	4.55484E-02
16	5	1.65947E 03	5.44605E 03	5.85128E 03	6.53650E 03	8.39753E 04	9.38138E 04	4.55484E-02
17	1	2.98851E 03	8.44660E 03	8.48518E 03	9.50590E 03	8.89400E 04	9.96458E 04	4.50709E-02
17	2	1.53162E 04	4.51919E 04	4.53824E 04	5.08527E 04	8.89215E 04	9.96458E 04	4.50709E-02
17	3	7.18319E 02	2.36173E 03	2.37219E 03	2.65787E 03	8.89296E 04	9.96458E 04	4.50709E-02
17	4	1.31608E 04	3.97649E 04	3.99413E 04	4.47450E 04	8.89429E 04	9.96458E 04	4.50709E-02
17	5	1.74813E 03	5.73683E 03	5.76153E 03	6.45618E 03	8.89185E 04	9.96458E 04	4.50709E-02
18	1	3.09343E 03	8.74380E 03	8.15797E 03	9.17535E 03	9.28796E 04	1.04473E 05	4.36313E-02
18	2	1.60094E 04	4.72313E 04	4.40467E 04	4.95522E 04	9.28573E 04	1.04473E 05	4.36313E-02
18	3	7.44808E 02	2.44867E 03	2.28421E 03	2.56942E 03	9.28671E 04	1.04473E 05	4.36313E-02
18	4	1.37730E 04	4.16107E 04	3.88148E 04	4.36544E 04	9.28830E 04	1.04473E 05	4.36313E-02
18	5	1.81273E 03	5.94844E 03	5.54812E 03	6.24178E 03	9.28537E 04	1.04473E 05	4.36313E-02
19	1	3.14548E 03	8.89168E 03	7.65025E 03	8.64857E 03	9.56691E 04	1.08169E 05	4.12594E-02
19	2	1.65041E 04	4.86829E 04	4.18602E 04	4.73369E 04	9.56428E 04	1.08169E 05	4.12594E-02
19	3	7.59765E 02	2.49753E 03	2.14833E 03	2.42906E 03	9.56544E 04	1.08169E 05	4.12594E-02
19	4	1.42185E 04	4.29511E 04	3.69423E 04	4.17624E 04	9.56732E 04	1.08169E 05	4.12594E-02
19	5	1.84935E 03	6.06784E 03	5.21855E 03	5.90146E 03	9.56385E 04	1.08169E 05	4.12594E-02
20	1	3.13517E 03	8.86339E 03	6.97683E 03	7.94116E 03	9.71800E 04	1.10638E 05	3.80165E-02
20	2	1.67760E 04	4.94740E 04	3.89105E 04	4.43045E 04	9.71494E 04	1.10638E 05	3.80165E-02

20	3	7.61615E 02	2.50305E 03	1.96961E 03	2.24227E 03	9.71629E 04	1.10638E 05	3.80165E-02
20	4	1.44755E 04	4.37205E 04	3.43964E 04	3.91507E 04	9.71847E 04	1.10638E 05	3.80165E-02
20	5	1.85419E 03	6.08235E 03	4.78519E 03	5.44865E 03	9.71445E 04	1.10638E 05	3.80165E-02
21	1	3.05194E 03	8.62890E 03	6.15874E 03	7.07486E 03	9.72980E 04	1.11813E 05	3.39957E-02
21	2	1.68024E 04	4.95371E 04	3.53130E 04	4.05839E 04	9.72635E 04	1.11813E 05	3.39957E-02
21	3	7.48857E 02	2.46014E 03	1.75498E 03	2.01650E 03	9.72787E 04	1.11813E 05	3.39957E-02
21	4	1.45231E 04	4.38551E 04	3.12738E 04	3.59273E 04	9.73033E 04	1.11813E 05	3.39957E-02
21	5	1.82368E 03	5.97988E 03	4.26490E 03	4.90148E 03	9.72579E 04	1.11813E 05	3.39957E-02
22	1	2.88369E 03	8.15376E 03	5.22285E 03	6.07652E 03	9.59225E 04	1.11672E 05	2.93257E-02
22	2	1.65619E 04	4.88086E 04	3.12063E 04	3.63281E 04	9.58851E 04	1.11672E 05	2.93257E-02
22	3	7.20108E 02	2.36403E 03	1.51299E 03	1.76082E 03	9.59015E 04	1.11672E 05	2.93257E-02
22	4	1.43403E 04	4.32914E 04	2.76897E 04	3.22201E 04	9.59282E 04	1.11672E 05	2.93257E-02
22	5	1.75453E 03	5.74918E 03	3.67857E 03	4.28213E 03	9.58790E 04	1.11672E 05	2.93257E-02
23	1	2.61622E 03	7.39734E 03	4.20171E 03	4.97683E 03	9.29633E 04	1.10240E 05	2.41830E-02
23	2	1.60343E 04	4.72274E 04	2.67452E 04	3.17059E 04	9.29250E 04	1.10240E 05	2.41830E-02
23	3	6.74144E 02	2.21041E 03	1.25362E 03	1.48555E 03	9.29419E 04	1.10240E 05	2.41830E-02
23	4	1.39048E 04	4.19620E 04	2.37735E 04	2.81698E 04	9.29692E 04	1.10240E 05	2.41830E-02
23	5	1.64391E 03	5.38023E 03	3.05050E 03	3.61578E 03	9.29188E 04	1.10240E 05	2.41830E-02
24	1	2.23245E 03	6.31062E 03	3.13378E 03	3.80856E 03	8.83350E 04	1.07601E 05	1.88194E-02
24	2	1.51984E 04	4.47304E 04	2.20950E 04	2.68922E 04	8.82994E 04	1.07601E 05	1.88194E-02
24	3	6.09994E 02	1.99562E 03	9.87989E 02	1.20174E 03	8.83151E 04	1.07601E 05	1.88194E-02
24	4	1.31910E 04	3.97893E 04	1.96630E 04	2.39211E 04	8.83405E 04	1.07601E 05	1.88194E-02
24	5	1.48696E 03	4.86495E 03	2.40777E 03	2.92944E 03	8.82936E 04	1.07601E 05	1.88194E-02
26	1	1.34595E 04	3.80028E 04	1.58682E 04	1.99598E 04	7.99392E 04	1.01196E 05	1.25648E-02
26	2	0.	0.	0.	0.	0.	1.01196E 05	1.25648E-02
26	3	0.	0.	0.	0.	0.	1.01196E 05	1.25648E-02
26	4	0.	0.	0.	0.	0.	1.01196E 05	1.25648E-02
26	5	0.	0.	0.	0.	0.	1.01196E 05	1.25648E-02
27	1	8.31853E 03	2.343339E 04	7.55754E 03	9.95162E 03	6.68763E 04	8.85621E 04	6.81699E-03
27	2	0.	0.	0.	0.	0.	8.85621E 04	6.81699E-03
27	3	0.	0.	0.	0.	0.	8.85621E 04	6.81699E-03
27	4	0.	0.	0.	0.	0.	8.85621E 04	6.81699E-03
27	5	0.	0.	0.	0.	0.	8.85621E 04	6.81699E-03
28	1	5.14319E 03	1.44581E 04	3.56387E 03	4.89285E 03	5.51968E 04	7.61834E 04	3.77388E-03
28	2	0.	0.	0.	0.	0.	7.61834E 04	3.77388E-03
28	3	0.	0.	0.	0.	0.	7.61834E 04	3.77388E-03
28	4	0.	0.	0.	0.	0.	7.61834E 04	3.77388E-03
28	5	0.	0.	0.	0.	0.	7.61834E 04	3.77388E-03

29	1	3.18168E 03	8.92639E 03	1.66546E 03	2.37960E 03	4.49891E 04	6.46123E 04	2.09548E-03
29	2	0.	0.	0.	0.	0.	6.46123E 04	2.09548E-03
29	3	0.	0.	0.	0.	0.	6.46123E 04	2.09548E-03
29	4	0.	0.	0.	0.	0.	6.46123E 04	2.09548E-03
29	5	0.	0.	0.	0.	0.	6.46123E 04	2.09548E-03
30	1	1.96961E 03	5.51563E 03	7.71937E 02	1.14719E 03	3.62450E 04	5.41406E 04	1.15844E-03
30	2	0.	0.	0.	0.	0.	5.41406E 04	1.15844E-03
30	3	0.	0.	0.	0.	0.	5.41406E 04	1.15844E-03
30	4	0.	0.	0.	0.	0.	5.41406E 04	1.15844E-03
30	5	0.	0.	0.	0.	0.	5.41406E 04	1.15844E-03
31	1	1.22030E 03	3.41130E 03	3.55144E 02	5.49053E 02	2.88872E 04	4.48893E 04	6.35564E-04
31	2	0.	0.	0.	0.	0.	4.48893E 04	6.35564E-04
31	3	0.	0.	0.	0.	0.	4.48893E 04	6.35564E-04
31	4	0.	0.	0.	0.	0.	4.48893E 04	6.35564E-04
31	5	0.	0.	0.	0.	0.	4.48893E 04	6.35564E-04
32	1	7.56768E 02	2.11201E 03	1.62300E 02	2.61169E 02	2.27938E 04	3.68696E 04	3.45583E-04
32	2	0.	0.	0.	0.	0.	3.68696E 04	3.45583E-04
32	3	0.	0.	0.	0.	0.	3.68696E 04	3.45583E-04
32	4	0.	0.	0.	0.	0.	3.68696E 04	3.45583E-04
32	5	0.	0.	0.	0.	0.	3.68696E 04	3.45583E-04
33	1	4.69805E 02	1.30908E 03	7.37255E 01	1.23574E 02	1.78198E 04	3.00250E 04	1.86150E-04
33	2	0.	0.	0.	0.	0.	3.00250E 04	1.86150E-04
33	3	0.	0.	0.	0.	0.	3.00250E 04	1.86150E-04
33	4	0.	0.	0.	0.	0.	3.00250E 04	1.86150E-04
33	5	0.	0.	0.	0.	0.	3.00250E 04	1.86150E-04
34	1	2.91991E 02	8.12384E 02	3.33101E 01	5.81984E 01	1.38120E 04	2.42597E 04	9.93386E-05
34	2	0.	0.	0.	0.	0.	2.42597E 04	9.93386E-05
34	3	0.	0.	0.	0.	0.	2.42597E 04	9.93386E-05
34	4	0.	0.	0.	0.	0.	2.42597E 04	9.93386E-05
34	5	0.	0.	0.	0.	0.	2.42597E 04	9.93386E-05
35	1	1.81695E 02	5.04786E 02	1.49780E 01	2.72952E 01	1.06213E 04	1.94585E 04	5.25377E-05
35	2	0.	0.	0.	0.	0.	1.94585E 04	5.25377E-05
35	3	0.	0.	0.	0.	0.	1.94585E 04	5.25377E-05
35	4	0.	0.	0.	0.	0.	1.94585E 04	5.25377E-05
35	5	0.	0.	0.	0.	0.	1.94585E 04	5.25377E-05
36	1	1.13201E 02	3.14056E 02	6.70676E 00	1.27517E 01	8.10891E 03	1.54989E 04	2.75544E-05

36	2	0.	0.	0.	0.	0.	1.54989E 04	2.75544E-05
36	3	0.	0.	0.	0.	0.	1.54989E 04	2.75544E-05
36	4	0.	0.	0.	0.	0.	1.54989E 04	2.75544E-05
36	5	0.	0.	0.	0.	0.	1.54989E 04	2.75544E-05
37	1	7.06096E 01	1.95626E 02	2.99242E 00	5.93382E 00	6.15146E 03	1.22602E 04	1.43444E-05
37	2	0.	0.	0.	0.	0.	1.22602E 04	1.43444E-05
37	3	0.	0.	0.	0.	0.	1.22602E 04	1.43444E-05
37	4	0.	0.	0.	0.	0.	1.22602E 04	1.43444E-05
37	5	0.	0.	0.	0.	0.	1.22602E 04	1.43444E-05
38	1	4.40826E 01	1.21963E 02	1.33136E 00	2.74830E 00	4.64221E 03	9.62740E 03	7.42295E-06
38	2	0.	0.	0.	0.	0.	9.62740E 03	7.42295E-06
38	3	0.	0.	0.	0.	0.	9.62740E 03	7.42295E-06
38	4	0.	0.	0.	0.	0.	9.62740E 03	7.42295E-06
38	5	0.	0.	0.	0.	0.	9.62740E 03	7.42295E-06
39	1	2.75265E 01	7.60376E 01	5.91160E-01	1.26417E 00	3.49157E 03	7.49370E 03	3.82771E-06
39	2	0.	0.	0.	0.	0.	7.49370E 03	3.82771E-06
39	3	0.	0.	0.	0.	0.	7.49370E 03	3.82771E-06
39	4	0.	0.	0.	0.	0.	7.49370E 03	3.82771E-06
39	5	0.	0.	0.	0.	0.	7.49370E 03	3.82771E-06
40	1	1.71606E 01	4.72950E 01	2.62214E-01	5.74323E-01	2.62641E 03	5.76053E 03	1.97554E-06
40	2	0.	0.	0.	0.	0.	5.76053E 03	1.97554E-06
40	3	0.	0.	0.	0.	0.	5.76053E 03	1.97554E-06
40	4	0.	0.	0.	0.	0.	5.76053E 03	1.97554E-06
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42	1	0.	0.	0.	0.	0.	7.23213E 03	1.71537E-06
42	2	0.	0.	0.	0.	0.	7.23213E 03	1.71537E-06
42	3	0.	0.	0.	0.	0.	7.23213E 03	1.71537E-06
42	4	0.	0.	0.	0.	0.	7.23213E 03	1.71537E-06
42	5	0.	0.	0.	0.	0.	7.23213E 03	1.71537E-06
43	1	0.	0.	0.	0.	0.	5.32480E 03	8.91302E-07
43	2	0.	0.	0.	0.	0.	5.32480E 03	8.91302E-07
43	3	0.	0.	0.	0.	0.	5.32480E 03	8.91302E-07
43	4	0.	0.	0.	0.	0.	5.32480E 03	8.91302E-07
43	5	0.	0.	0.	0.	0.	5.32480E 03	8.91302E-07
44	1	0.	0.	0.	0.	0.	3.81677E 03	4.38187E-07
44	2	0.	0.	0.	0.	0.	3.81677E 03	4.38187E-07
44	3	0.	0.	0.	0.	0.	3.81677E 03	4.38187E-07
44	4	0.	0.	0.	0.	0.	3.81677E 03	4.38187E-07

44	5	0.	0.	0.	0.	0.	3.81677E 03	4.38187E-07
45	1	0.	0.	0.	0.	0.	2.57818E 03	1.92505E-07
45	2	0.	0.	0.	0.	0.	2.57818E 03	1.92505E-07
45	3	0.	0.	0.	0.	0.	2.57818E 03	1.92505E-07
45	4	0.	0.	0.	0.	0.	2.57818E 03	1.92505E-07
45	5	0.	0.	0.	0.	0.	2.57818E 03	1.92505E-07
46	1	0.	0.	0.	0.	0.	1.50300E 03	6.58319E-08
46	2	0.	0.	0.	0.	0.	1.50300E 03	6.58319E-08
46	3	0.	0.	0.	0.	0.	1.50300E 03	6.58319E-08
46	4	0.	0.	0.	0.	0.	1.50300E 03	6.58319E-08
46	5	0.	0.	0.	0.	0.	1.50300E 03	6.58319E-08
47	1	0.	0.	0.	0.	0.	4.97044E 02	1.22674E-08
47	2	0.	0.	0.	0.	0.	4.97044E 02	1.22674E-08
47	3	0.	0.	0.	0.	0.	4.97044E 02	1.22674E-08
47	4	0.	0.	0.	0.	0.	4.97044E 02	1.22674E-08
47	5	0.	0.	0.	0.	0.	4.97044E 02	1.22674E-08

PROBLEM NUMBER 36.00023

1500 LITER, PU-C OXIDE. REF NOS 154/522,553,554,36.0008.

REGIONAL TOTALS.

K	N	WD(N,K)	WP(N,K)	FIS(N,K)
1	1	1.01253E 00	1.13807E 00	7.94444E-02
1	2	9.90357E-01	1.11505E 00	4.23614E-01
1	3	1.00533E 00	1.13067E 00	1.94141E-02
1	4	9.88935E-01	1.11331E 00	3.64539E-01
1	5	1.00497E 00	1.13043E 00	4.72688E-02
2	1	3.03083E-01	3.96746E-01	6.57201E-02
2	2	0.	0.	0.
2	3	0.	0.	0.
2	4	0.	0.	0.
2	5	0.	0.	0.
3	1	0.	0.	0.
3	2	0.	0.	0.
3	3	0.	0.	0.
3	4	0.	0.	0.
3	5	0.	0.	0.

K	WD(1,K)/WP(2,K)	WD(2,K)/WP(2,K)	WP(1,K)/WP(2,K)	FIS(K)
1	9.08051E-01	8.88169E-01	1.02064E 00	9.34280E-01
2	0.00000E-40	0.	0.00000E-40	6.57201E-02
3	0.	0.	0.	0.

K	D(1,K)	D(2,K)	D(3,K)	D(4,K)	D(5,K)	D(6,K)	D(K)
1	1.07991E 02	1.55646E 03	1.25040E 03	2.72609E 03	1.28315E 03	2.67192E 02	7.19128E 03
2	6.13598E 00	6.46985E 01	7.64893E 01	1.83237E 02	1.06267E 02	3.54323E 01	4.72260E 02
3	0.	0.	0.	0.	0.	0.	0.

K	BEFF(1,K)	BEFF(2,K)	BEFF(3,K)	BEFF(4,K)	BEFF(5,K)	BEFF(6,K)	BEFF(K)
1	6.30198E-05	9.08298E-04	7.29692E-04	1.59085E-03	7.48801E-04	1.55924E-04	4.19659E-03
2	3.58075E-06	3.77559E-05	4.46365E-05	1.06931E-04	6.20137E-05	2.06771E-05	2.75595E-04
3	0.	0.	0.	0.	0.	0.	0.

1188/RE

PROBLEM NUMBER 36.00023

1500 LITER, PU-C OXIDE. REF NOS 154/522,553,554,36.0008.

REACTOR TOTALS

D= 7.66354E 03 , P= 1.70594E 06 , D+P= 1.71360E 06

BEFF(1)	BEFF(2)	BEFF(3)	BEFF(4)	BEFF(5)	BEFF(6)	BEFF
6.66006E-05	9.46053E-04	7.74329E-04	1.69778E-03	8.10814E-04	1.76601E-04	4.47218E-03
LP	TOT FISS	FISS(1)	FISS(2)	FISS(3)	FISS(4)	FISS(5)
3.95176E-07	5.36603E 05	1.45164E-01	4.23614E-01	1.94141E-02	3.64539E-01	4.72688E-02

DCNF= 1.71465E 06

B. Sample Problem No. 2

In Sample Problem No. 2 calculations were made for an 800-liter, spherical reactor with Plutonium-A Metal fuel. The specifications for the RE-122 real and adjoint composition problems were as follows:

Region	Divisions	Standard Configuration	Outerbound	Initial Source
1	20	0.123	57.59	1.00
2	15	-	102.59	0.02
3	6	-	132.59	-

VOLUME FRACTIONS

Region	Pu ²³⁹	Pu ²⁴⁰	Pu ²⁴¹	Pu ²⁴²	U ²³⁸	O	Na	Fe
IF	0.25	-	-	-	-	-	0.5	0.25
ID	-	-	-	-	0.25	-	0.5	0.25
2	-	-	-	-	0.6	-	0.2	0.2
3	-	-	-	-	-	-	0.4	0.6

The comments mentioned in Sample Problem No. 1 at this point also apply here with a new value $C = 0.92278$. Both of these problems were run in connection with Ref. 1. They were also studied, but with looser convergence and criticality criteria, in Ref. 5.

To exemplify the use of the input options on card 1003, we shall assume that the real solution precedes the adjoint solution on a single tape and that Sample Problem No. 1 has just been completed. We shall define materials 1 and 2 as U²³⁸ and Pu²³⁹, respectively. Then the card input data need consist only of that given below.

**704 INPUT DATA
FORM II**

PROBLEM Sample Prob. No. 2 ORIGINATOR L. C. Kvitek

DATA I.D. 36

DATE 8/7/61

PAGE 1 OF 1

1188/RE

PROBLEM NUMBER 36.00028

800 LITER, PU-A METAL. REF NOS 154/501,569,570,36.00013.

RESULTS OF POINTWISE SUMMING OVER ENERGY GROUPS.

L	N	A(1,N,L)	A(2,N,L)	A(3,N,L)	A(4,N,L)	A(5,N,L)	S(1,L)	S(2,L)
1	1	1.15507E-01	3.27102E-01	5.20713E-01	6.02742E-01	1.59190E 00	1.84267E 00	5.46675E-07
1	2	5.21028E-01	1.54334E 00	2.45467E 00	2.84388E 00	1.59049E 00	1.84267E 00	5.46675E-07
2	1	1.15230E-01	3.26317E-01	5.18211E-01	5.99862E-01	1.58806E 00	1.83828E 00	5.4079E-07
2	2	5.19787E-01	1.53967E 00	2.44292E 00	2.83034E 00	1.58665E 00	1.83828E 00	5.4079E-07
3	1	1.14461E-01	3.24141E-01	5.11308E-01	5.91917E-01	1.57742E 00	1.82611E 00	5.36918E-07
3	2	5.16348E-01	1.52948E 00	2.41049E 00	2.79299E 00	1.57602E 00	1.82611E 00	5.36918E-07
4	1	1.13129E-01	3.20370E-01	4.99452E-01	5.78272E-01	1.55899E 00	1.80502E 00	5.24621E-07
4	2	5.10389E-01	1.51182E 00	2.35482E 00	2.72886E 00	1.55760E 00	1.80502E 00	5.24621E-07
5	1	1.11251E-01	3.15051E-01	4.82977E-01	5.59313E-01	1.53301E 00	1.77531E 00	5.07540E-07
5	2	5.01996E-01	1.48695E 00	2.27749E 00	2.63980E 00	1.53164E 00	1.77531E 00	5.07540E-07
6	1	1.08845E-01	3.08240E-01	4.62290E-01	5.35509E-01	1.49977E 00	1.73731E 00	4.86104E-07
6	2	4.91262E-01	1.45515E 00	2.18044E 00	2.52805E 00	1.49843E 00	1.73731E 00	4.86104E-07
7	1	1.05932E-01	2.99994E-01	4.37869E-01	5.07413E-01	1.45959E 00	1.69141E 00	4.60817E-07
7	2	4.78293E-01	1.41672E 00	2.06597E 00	2.39625E 00	1.45828E 00	1.69141E 00	4.60817E-07
8	1	1.02536E-01	2.90380E-01	4.10259E-01	4.75653E-01	1.41284E 00	1.63804E 00	4.32255E-07
8	2	4.63213E-01	1.37203E 00	1.93670E 00	2.24744E 00	1.41156E 00	1.63804E 00	4.32255E-07
9	1	9.86825E-02	2.79470E-01	3.80056E-01	4.40918E-01	1.35992E 00	1.57769E 00	4.01046E-07
9	2	4.46161E-01	1.32150E 00	1.79548E 00	2.08492E 00	1.35867E 00	1.57769E 00	4.01046E-07
10	1	9.43982E-02	2.67342E-01	3.47891E-01	4.03937E-01	1.30130E 00	1.51094E 00	3.67860E-07
10	2	4.27294E-01	1.26558E 00	1.64538E 00	1.91222E 00	1.30009E 00	1.51094E 00	3.67860E-07
11	1	8.97112E-02	2.54074E-01	3.14414E-01	3.65458E-01	1.23749E 00	1.43839E 00	3.33383E-07
11	2	4.06786E-01	1.20479E 00	1.48952E 00	1.73297E 00	1.23633E 00	1.43839E 00	3.33383E-07
12	1	8.46492E-02	2.39745E-01	2.80273E-01	3.26228E-01	1.16904E 00	1.36073E 00	2.98300E-07

12	2	3.84822E-01	1.13968E 00	1.33107E 00	1.55080E 00	1.16792E 00	1.36073E 00	2.98300E-07
13	1	7.92378E-02	2.24428E-01	2.46095E-01	2.86971E-01	1.09654E 00	1.27868E 00	2.63275E-07
13	2	3.61604E-01	1.07085E 00	1.17308E 00	1.36927E 00	1.09547E 00	1.27868E 00	2.63275E-07
14	1	7.34988E-02	2.08184E-01	2.12473E-01	2.48367E-01	1.02060E 00	1.19302E 00	2.28933E-07
14	2	3.37344E-01	9.98905E-01	1.01845E 00	1.19171E 00	1.01957E 00	1.19302E 00	2.28933E-07
15	1	6.74468E-02	1.91054E-01	1.79945E-01	2.11032E-01	9.41857E-01	1.10457E 00	1.95838E-07
15	2	3.12265E-01	9.24514E-01	8.69845E-01	1.02119E 00	9.40867E-01	1.10457E 00	1.95838E-07
16	1	6.10869E-02	1.73050E-01	1.48989E-01	1.75510E-01	8.60961E-01	1.01422E 00	1.64481E-07
16	2	2.86597E-01	8.48348E-01	7.29590E-01	8.60409E-01	8.60012E-01	1.01422E 00	1.64481E-07
17	1	5.44088E-02	1.54142E-01	1.20010E-01	1.42254E-01	7.78568E-01	9.22874E-01	1.35265E-07
17	2	2.60577E-01	7.71102E-01	5.99654E-01	7.11630E-01	7.77658E-01	9.22874E-01	1.35265E-07
18	1	4.73819E-02	1.34240E-01	9.33406E-02	1.11622E-01	6.95325E-01	8.31513E-01	1.08496E-07
18	2	2.34446E-01	6.93476E-01	4.81587E-01	5.76634E-01	6.94453E-01	8.31513E-01	1.08496E-07
19	1	3.99468E-02	1.13169E-01	6.92436E-02	8.38767E-02	6.11859E-01	7.41162E-01	8.43797E-08
19	2	2.08443E-01	6.16169E-01	3.76494E-01	4.56680E-01	6.11024E-01	7.41162E-01	8.43797E-08
20	1	3.20049E-02	9.06403E-02	4.79269E-02	5.91805E-02	5.28759E-01	6.52916E-01	6.30275E-08
20	2	1.82805E-01	5.39860E-01	2.85024E-01	3.52483E-01	5.27960E-01	6.52916E-01	6.30275E-08
21	1	2.34049E-02	6.62087E-02	2.95658E-02	3.76036E-02	4.46555E-01	5.67955E-01	4.44821E-08
21	2	1.57756E-01	4.65193E-01	2.07380E-01	2.64208E-01	4.45794E-01	5.67955E-01	4.44821E-08
22	1	6.33635E-02	1.79245E-01	8.00428E-02	1.01803E-01	4.46555E-01	5.67955E-01	4.44821E-08
22	2	0.	0.	0.	0.	0.	5.67955E-01	4.44821E-08
23	1	3.57708E-02	1.00930E-01	3.40897E-02	4.55260E-02	3.37756E-01	4.51066E-01	2.42893E-08
23	2	0.	0.	0.	0.	0.	4.51066E-01	2.42893E-08
24	1	2.02819E-02	5.70913E-02	1.44666E-02	2.02012E-02	2.53394E-01	3.53840E-01	1.30665E-08
24	2	0.	0.	0.	0.	0.	3.53840E-01	1.30665E-08
25	1	1.15479E-02	3.24348E-02	6.11839E-03	8.91407E-03	1.88637E-01	2.74831E-01	6.92179E-09
25	2	0.	0.	0.	0.	0.	2.74831E-01	6.92179E-09
26	1	6.60162E-03	1.85042E-02	2.57954E-03	3.91739E-03	1.39403E-01	2.11703E-01	3.61408E-09
26	2	0.	0.	0.	0.	0.	2.11703E-01	3.61408E-09
27	1	3.78876E-03	1.05995E-02	1.08443E-03	1.71624E-03	1.02310E-01	1.61918E-01	1.86226E-09
27	2	0.	0.	0.	0.	0.	1.61918E-01	1.86226E-09
28	1	2.18270E-03	6.09534E-03	4.54723E-04	7.50124E-04	7.46017E-02	1.23065E-01	9.48166E-10
28	2	0.	0.	0.	0.	0.	1.23065E-01	9.48166E-10
29	1	1.26211E-03	3.51855E-03	1.90241E-04	3.27255E-04	5.40681E-02	9.30084E-02	4.77569E-10
29	2	0.	0.	0.	0.	0.	9.30084E-02	4.77569E-10
30	1	7.32438E-04	2.03861E-03	7.94337E-05	1.42561E-04	3.89645E-02	6.99305E-02	2.38208E-10
30	2	0.	0.	0.	0.	0.	6.99305E-02	2.38208E-10
31	1	4.26549E-04	1.18540E-03	3.31112E-05	6.20283E-05	2.79325E-02	5.23268E-02	1.17781E-10

31	2	0.	0.	0.	0.	0.	5.23268E-02	1.17781E-10
32	1	2.49254E-04	6.91672E-04	1.37832E-05	2.69585E-05	1.99273E-02	3.89759E-02	5.77841E-11
32	2	0.	0.	0.	0.	0.	3.89759E-02	5.77841E-11
33	1	1.46122E-04	4.04911E-04	5.73154E-06	1.17020E-05	1.41550E-02	2.89001E-02	2.81586E-11
33	2	0.	0.	0.	0.	0.	2.89001E-02	2.81586E-11
34	1	8.59134E-05	2.37738E-04	2.38181E-06	5.06992E-06	1.00186E-02	2.13256E-02	1.36469E-11
34	2	0.	0.	0.	0.	0.	2.13256E-02	1.36469E-11
35	1	5.06282E-05	1.39893E-04	9.89570E-07	2.18860E-06	7.07374E-03	1.56448E-02	6.58988E-12
35	2	0.	0.	0.	0.	0.	1.56448E-02	6.58988E-12
36	1	2.98580E-05	8.23532E-05	4.11212E-07	9.37376E-07	4.99327E-03	1.13824E-02	3.18023E-12
36	2	0.	0.	0.	0.	0.	1.13824E-02	3.18023E-12
37	1	1.75595E-05	4.82825E-05	1.70878E-07	3.94314E-07	3.53912E-03	8.16681E-03	1.54221E-12
37	2	0.	0.	0.	0.	0.	8.16681E-03	1.54221E-12
38	1	0.	0.	0.	0.	0.	8.16681E-03	1.54221E-12
38	2	0.	0.	0.	0.	0.	8.16681E-03	1.54221E-12
39	1	0.	0.	0.	0.	0.	5.52154E-03	7.35154E-13
39	2	0.	0.	0.	0.	0.	5.52154E-03	7.35154E-13
40	1	0.	0.	0.	0.	0.	3.68131E-03	3.37735E-13
40	2	0.	0.	0.	0.	0.	3.68131E-03	3.37735E-13
41	1	0.	0.	0.	0.	0.	2.36851E-03	1.43219E-13
41	2	0.	0.	0.	0.	0.	2.36851E-03	1.43219E-13
42	1	0.	0.	0.	0.	0.	1.39731E-03	5.06613E-14
42	2	0.	0.	0.	0.	0.	1.39731E-03	5.06613E-14
43	1	0.	0.	0.	0.	0.	6.38987E-04	1.06928E-14
43	2	0.	0.	0.	0.	0.	6.38987E-04	1.06928E-14
44	1	0.	0.	0.	0.	0.	0.	0.
44	2	0.	0.	0.	0.	0.	0.	0.

1188/RE

PROBLEM NUMBER 36.00028

800 LITER, PU-A METAL. REF NOS 154/501,569,570,36.00013.

RESULTS OF POINTWISE TRAPEZOIDAL INTEGRATION FROM L TO L+1.

L	N	B(1,N,L)	B(2,N,L)	B(3,N,L)	B(4,N,L)	B(5,N,L)	T(1,L)	T(2,L)
1	1	1.72860E 01	4.89521E 01	7.77388E 01	8.99876E 01	2.38231E 02	2.75767E 02	8.16194E-05
1	2	7.79752E 01	2.30971E 02	3.66471E 02	4.24590E 02	2.38020E 02	2.75767E 02	8.16194E-05
2	1	8.59691E 01	2.43455E 02	3.84552E 02	4.45170E 02	1.18477E 03	1.37153E 03	4.03800E-04
2	2	3.87812E 02	1.14874E 03	1.81290E 03	2.10054E 03	1.18372E 03	1.37153E 03	4.03800E-04
3	1	2.21421E 02	6.27041E 02	9.81135E 02	1.13592E 03	3.05137E 03	3.53276E 03	1.03048E-03
3	2	9.98926E 02	2.95892E 03	4.62572E 03	5.36025E 03	3.04866E 03	3.53276E 03	1.03048E-03
4	1	4.19764E 02	1.18873E 03	1.83357E 03	2.12321E 03	5.78439E 03	6.69812E 03	1.92651E-03
4	2	1.89399E 03	5.61017E 03	8.64576E 03	1.00204E 04	5.77924E 03	6.69812E 03	1.92651E-03
5	1	6.75231E 02	1.91220E 03	2.89300E 03	3.35081E 03	9.30423E 03	1.07766E 04	3.04127E-03
5	2	3.04730E 03	9.02632E 03	1.36439E 04	1.58171E 04	9.29592E 03	1.07766E 04	3.04127E-03
6	1	9.80291E 02	2.77612E 03	4.09846E 03	4.74862E 03	1.35072E 04	1.56500E 04	4.31170E-03
6	2	4.42542E 03	1.31083E 04	1.93347E 04	2.24220E 04	1.34951E 04	1.56500E 04	4.31170E-03
7	1	1.32580E 03	3.75460E 03	5.38039E 03	6.23665E 03	1.82678E 04	2.11751E 04	5.66601E-03
7	2	5.98795E 03	1.77363E 04	2.53933E 04	2.94611E 04	1.82513E 04	2.11751E 04	5.66601E-03
8	1	1.70115E 03	4.81765E 03	6.66455E 03	7.72957E 03	2.34417E 04	2.71879E 04	7.02776E-03
8	2	7.68847E 03	2.27729E 04	3.14743E 04	3.65372E 04	2.34203E 04	2.71879E 04	7.02776E-03
9	1	2.09448E 03	5.93166E 03	7.87614E 03	9.14149E 03	2.88686E 04	3.35068E 04	8.32031E-03
9	2	9.47564E 03	2.80658E 04	3.72314E 04	4.32526E 04	2.88421E 04	3.35068E 04	8.32031E-03
10	1	2.49283E 03	7.05996E 03	8.94391E 03	1.03907E 04	3.43763E 04	3.99374E 04	9.47110E-03
10	2	1.12944E 04	3.34518E 04	4.23380E 04	4.92324E 04	3.43442E 04	3.99374E 04	9.47110E-03
11	1	2.88231E 03	8.16324E 03	9.80406E 03	1.14040E 04	3.97841E 04	4.62773E 04	1.04158E-02
11	2	1.30875E 04	3.87607E 04	4.65059E 04	5.41465E 04	3.97464E 04	4.62773E 04	1.04158E-02
12	1	3.24822E 03	9.19987E 03	1.04036E 04	1.21207E 04	4.49075E 04	5.23214E 04	1.11019E-02
12	2	1.47965E 04	4.38196E 04	4.95019E 04	5.77285E 04	4.48640E 04	5.23214E 04	1.11019E-02
13	1	3.57506E 03	1.01260E 04	1.07028E 04	1.24958E 04	4.95621E 04	5.78677E 04	1.14913E-02

13	2	1.63638E 04	4.84570E 04	5.11609E 04	5.97915E 04	4.95127E 04	5.78677E 04	1.14913E-02
14	1	3.84648E 03	1.08954E 04	1.06775E 04	1.25016E 04	5.35677E 04	6.27231E 04	1.15622E-02
14	2	1.77339E 04	5.25078E 04	5.13959E 04	6.02384E 04	5.35125E 04	6.27231E 04	1.15622E-02
15	1	4.04499E 03	1.14585E 04	1.03197E 04	1.21289E 04	5.67532E 04	6.67103E 04	1.13099E-02
15	2	1.88550E 04	5.58176E 04	5.02017E 04	5.90672E 04	5.66921E 04	6.67103E 04	1.13099E-02
16	1	4.15136E 03	1.17606E 04	9.63767E 03	1.13871E 04	5.89598E 04	6.96745E 04	1.07464E-02
16	2	1.96806E 04	5.82474E 04	4.76548E 04	5.63706E 04	5.88929E 04	6.96745E 04	1.07464E-02
17	1	4.14368E 03	1.17395E 04	8.65550E 03	1.03023E 04	6.00449E 04	7.14910E 04	9.89836E-03
17	2	2.01712E 04	5.96780E 04	4.39075E 04	5.23285E 04	5.99721E 04	7.14910E 04	9.89836E-03
18	1	3.99578E 03	1.13204E 04	7.4.1224E 03	8.91606E 03	5.98842E 04	7.20731E 04	8.80495E-03
18	2	2.02954E 04	6.00135E 04	3.91780E 04	4.71961E 04	5.98058E 04	7.20731E 04	8.80495E-03
19	1	3.67482E 03	1.04092E 04	5.96103E 03	7.28170E 03	5.83740E 04	7.13824E 04	7.51448E-03
19	2	2.00310E 04	5.91846E 04	3.37348E 04	4.12854E 04	5.82901E 04	7.13824E 04	7.51448E-03
20	1	3.13765E 03	8.88151E 03	4.36959E 03	5.46134E 03	5.54307E 04	6.94390E 04	6.08242E-03
20	2	1.93660E 04	5.71502E 04	2.78794E 04	3.49427E 04	5.53418E 04	6.94390E 04	6.08242E-03
22	1	6.43659E 03	1.81901E 04	7.3.36299E 03	9.51476E 03	5.12896E 04	6.67201E 04	4.46168E-03
22	2	0.	0.	0.	0.	0.	6.67201E 04	4.46168E-03
23	1	4.02124E 03	1.13359E 04	3.46166E 03	4.69014E 03	4.26867E 04	5.81838E 04	2.67676E-03
23	2	0.	0.	0.	0.	0.	5.81838E 04	2.67676E-03
24	1	2.51113E 03	7.06260E 03	1.61406E 03	2.28483E 03	3.50810E 04	4.99415E 04	1.57450E-03
24	2	0.	0.	0.	0.	0.	4.99415E 04	1.57450E-03
25	1	1.56783E 03	4.40014E 03	7.46865E 02	1.10266E 03	2.84921E 04	4.22963E 04	9.08454E-04
25	2	0.	0.	0.	0.	0.	4.22963E 04	9.08454E-04
26	1	9.78938E 02	2.74192E 03	3.43181E 02	5.28060E 02	2.28871E 04	3.54075E 04	5.14875E-04
26	2	0.	0.	0.	0.	0.	3.54075E 04	5.14875E-04
27	1	6.11399E 02	1.70927E 03	1.56685E 02	2.51255E 02	1.81967E 04	2.93369E 04	2.87088E-04
27	2	0.	0.	0.	0.	0.	2.93369E 04	2.87088E-04
28	1	3.82022E 02	1.06613E 03	7.11235E 01	1.18891E 02	1.43296E 04	2.40828E 04	1.57720E-04
28	2	0.	0.	0.	0.	0.	2.40828E 04	1.57720E-04
29	1	2.38844E 02	6.65443E 02	3.21156E 01	5.59883E 01	1.11840E 04	1.96031E 04	8.54900E-05
29	2	0.	0.	0.	0.	0.	1.96031E 04	8.54900E-05
30	1	1.49438E 02	4.15689E 02	1.44333E 01	2.62548E 01	8.65674E 03	1.58326E 04	4.57763E-05
30	2	0.	0.	0.	0.	0.	1.58326E 04	4.57763E-05
31	1	9.35774E 01	2.59909E 02	6.45919E 00	1.22648E 01	6.64923E 03	1.26942E 04	2.42423E-05
31	2	0.	0.	0.	0.	0.	1.26942E 04	2.42423E-05
32	1	5.86492E 01	1.62661E 02	2.87985E 00	5.70875E 00	5.07141E 03	1.01070E 04	1.27122E-05

32	2	0.	0.	0.	0.	0.	1.01070E 04	1.27122E-05
33	1	3.67884E 01	1.01887E 02	1.27986E 00	2.64724E 00	3.84376E 03	7.99151E 03	6.60901E-06
33	2	0.	0.	0.	0.	0.	7.99151E 03	6.60901E-06
34	1	2.30882E 01	6.38533E 01	5.67273E-01	1.22195E 00	2.89811E 03	6.27225E 03	3.41206E-06
34	2	0.	0.	0.	0.	0.	6.27225E 03	3.41206E-06
35	1	1.44855E 01	3.99977E 01	2.50902E-01	5.60132E-01	2.17749E 03	4.87925E 03	1.75344E-06
35	2	0.	0.	0.	0.	0.	4.87925E 03	1.75344E-06
36	1	9.06560E 00	2.49748E 01	1.10777E-01	2.53472E-01	1.63562E 03	3.74815E 03	9.00506E-07
36	2	0.	0.	0.	0.	0.	3.74815E 03	9.00506E-07
38	1	0.	0.	0.	0.	0.	4.70826E 03	7.77267E-07
38	2	0.	0.	0.	0.	0.	4.70826E 03	7.77267E-07
39	1	0.	0.	0.	0.	0.	3.47402E 03	4.01846E-07
39	2	0.	0.	0.	0.	0.	3.47402E 03	4.01846E-07
40	1	0.	0.	0.	0.	0.	2.49494E 03	1.96716E-07
40	2	0.	0.	0.	0.	0.	2.49494E 03	1.96716E-07
41	1	0.	0.	0.	0.	0.	1.68859E 03	8.61333E-08
41	2	0.	0.	0.	0.	0.	1.68859E 03	8.61333E-08
42	1	0.	0.	0.	0.	0.	9.86505E 02	2.93872E-08
42	2	0.	0.	0.	0.	0.	9.86505E 02	2.93872E-08
43	1	0.	0.	0.	0.	0.	3.26795E 02	5.46856E-09
43	2	0.	0.	0.	0.	0.	3.26795E 02	5.46856E-09

1188/RE

PROBLEM NUMBER 36.00028

800 LITER, PU-A METAL. REF NOS 154/501,569,570,36.00013.

REGIONAL TOTALS.

K	N	WD(N,K)	WP(N,K)	FIS(N,K)
1	1	9.60418E-01	1.12906E 00	1.61359E-01
1	2	9.37462E-01	1.10480E 00	7.79460E-01
2	1	2.86371E-01	3.85475E-01	5.91803E-02
2	2	0.	0.	0.
3	1	0.	0.	0.
3	2	0.	0.	0.

K	WD(1,K)/WP(2,K)	WD(2,K)/WP(2,K)	WP(1,K)/WP(2,K)	FIS(K)
1	8.69317E-01	8.48539E-01	1.02197E 00	9.40820E-01
2	0.	0.	0.	5.91803E-02
3	0.	0.	0.	0.

K	D(1,K)	D(2,K)	D(3,K)	D(4,K)	D(5,K)	D(6,K)	D(K)
1	7.12515E 01	6.66204E 02	6.01613E 02	1.20371E 03	5.61209E 02	2.07978E 02	3.31196E 03
2	2.81819E 00	2.97153E 01	3.51307E 01	8.41589E 01	4.88072E 01	1.62737E 01	2.16904E 02
3	0.	0.	0.	0.	0.	0.	0.

K	BEFF(1,K)	BEFF(2,K)	BEFF(3,K)	BEFF(4,K)	BEFF(5,K)	BEFF(6,K)	BEFF(K)
1	7.87265E-05	7.36096E-04	6.64729E-04	1.32999E-03	6.20086E-04	2.29797E-04	3.65943E-03
2	3.11385E-06	3.28328E-05	3.88163E-05	9.29881E-05	5.39276E-05	1.79810E-05	2.39660E-04
3	0.	0.	0.	0.	0.	0.	0.

1188/RE

PROBLEM NUMBER 36.00028

800 LITER, PU-A METAL. REF NOS 154/501,569,570,36.00013.

REACTOR TOTALS

D= 3.52887E 03 , P= 9.01521E 05 , D+P= 9.05050E 05

BEFF(1)	BEFF(2)	BEFF(3)	BEFF(4)	BEFF(5)	BEFF(6)	BEFF
8.18404E-05	7.68929E-04	7.03545E-04	1.42298E-03	6.74014E-04	2.47778E-04	3.89909E-03
LP	TOT FISS	FISS(1)	FISS(2)	FISS(3)	FISS(4)	FISS(5)
1.66689E-07	2.89507E 05	2.20540E-01	7.79460E-01			

DCNF= 9.05711E 05

APPENDIX
FORTRAN STATEMENTS
and
STORAGE LOCATIONS

1. For Main Program

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C IBM 704 PROGRAM 1188/RE. SEPTEMBER 1961.
C MAIN PROGRAM.
DIMENSION SF(20,5),ANU(20,5),ANE(25,5),FLUX(100,20),
1ADJ(100,20),R1(20),BJD(20),CHI(20),VEL(20),NO(25),
2DR(25),RI(25),RO(25),A(5,5),B(5,5),C(5,5),S(5,5),
3S(2,100),T(2,100),U(2,25),W(5,25),WP(5,25),DIP(25),
4D2P2(25),PIP2(25),RTC(4,5),TWD(5),TWP(5),TD(7,25),MP(25),
5TC1(25),BEF(7,25),(7,5,25),R(100),RECORD(12),BE(7),JM(5)
90 READ 60,PROB
READ 61,(RECORD(I),I=1,12)
READ 62, M1,N1,N2,N3,N4,NR,NP1,NP2,NOPT,MOPT,JOPT
READ 62, JMAX, (JM(N),N=1,M)
J=JMAX
IF (JOPT) 2,2,3
2 READ 64, (VEL(I), I=1,J)
READ 64, (CHI(I), I=N3,N4)
3 READ 63, (K,MP(K),RO(K),K=1,NR)
DO 4 N=1,M
IF (MOPT) 96,96,4
96 CONTINUE
JE(MIN)
READ 62, (MPAR(K,N),K=1,NR)
READ 62, (BJD(I,N),I=N1,N2)
READ 64, (BT(I,N),I=1,7)
READ 64, (SF(I,N),I=1,J)
READ 64, (ANE(I,N),I=1,J)
4 READ 64, (ANE(K,N),K=1,NR)
NO(1)=MP(1)
EMP=MP(1)-1
DR(1)=RO(1)/EMP
DO 98 K=2,NR
NO(K)=NO(K-1)+MP(K)
EMP=MP(K)-1
98 DR(K)=(RO(K)-RO(K-1))/EMP
J=JMAX
LNR=NO(NR)
IF (NOPT) 5,5,91
5 CALL F122 (FLUX,ADJ,JMAX,LNR)
GO TO 92
91 CALL FLIB (FLUX,ADJ,JMAX,LNR)
92 DO 18 K=1,NR
IF(K-1)6,6,7
6 NIK=1
RIK=0.
GOTO 98
7 NIK=NO(K-1)+1
RIK=RO(K-1)
8 NOK=NO(K)
DO 18 L=NIK,NOK
S(1,L)=0.
S(2,L)=0.
DL=L-NIK
R(L)=RIK+DL*DR(K)
DO 18 I=N3,N4
9 S(1,I)=S(1,L)+CHI(I)*APJ(L,I)
DO 10 I=1,JMAX

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10 S(2,L)=S(2,L)+FLUX(L,I)*ADJ(L,I)/VEL(I)
D018N=1,M
IF (MPAR(K,N)) 11,11,13
11 D012I=1,5
A(I,N,L)=0.
B(I,N,L)=0.
GOTC18
13 SUM1=0.
SUM2=0.
J=JM(N)
D016I=1,J
SUM1=SUM1+(SF(I,N)*FLUX(L,I))
16 SUM2=SUM2+(SF(I,N)*FLUX(L,I))*ANU(I,N)
A(1,N,L)=SUM1*ANE(1,N)
A(2,N,L)=SUM2*ANE(K,N)
SUM=0.
D017I=N1,N2
SUM3=SUM3+BUD(I,N)*ADJ(L,I)
A(3,N,L)=SUM3*A(2,N,L)
A(4,N,L)=S(1,L)*A(2,N,L)
A(5,N,L)=SUM3
18 CONTINUE
IF (1-NP1)19,19,21
19 WRITE OUTPUT TAPE 2, 65,PROB,(RECORD(I),I=1,12)
WRITE OUTPUT TAPE 2, 66
WRITE OUTPUT TAPE 2, 67
D020L=1,LNR
20 WRITE OUTPUT TAPE 2, 68,(L,N,(A(I,N,L),I=1,5),S(1,L),S(2,L),N=1,M)
21 D029K=1,NR
IF (K-1)22,22,23
22 NIK=1
GOTO24
23 NIK=NO(K-1)+1
24 NOK=NO(K)-1
D029L=NIK,NOK
D027N=1,M
IF (MPAR(K,N)) 27,27,25
25 D026I=1,5
B(I,N,L)=A(I,N,L)*R(L)**2+A(I,N,L+1)*R(L+1)**2
26 B(I,N,L)=B(I,N,L)*DR(K)*6.283185
27 CONTINUE
D028I=1,2
T(I,L)=S(I,L)*R(L)**2+S(I,L+1)*R(L+1)**2
28 T(I,L)=T(I,L)*DR(K)*6.283185
29 CONTINUE
IF (1-NP2)30,30,32
30 WRITE OUTPUT TAPE 2, 65,PROB,(RECORD(I),I=1,12)
WRITE OUTPUT TAPE 2, 69
WRITE OUTPUT TAPE 2, 70
DO 31 K=1,NR
T(I,K-1)=93,93,94
31 L=NIK,NOK
93 NIK=1
GO TO 05
94 NIK=NO(K-1)+1
95 NOK=NO(K)-1
DO 31 L=NIK,NOK

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31 WRITE OUTPUT TAPE 2, 68,(L,N,(B(I,N,L),I=1,5),T(1,L),T(2,L),N=1,M)
32 DO46N=1,NR
33   DO47N=1,M
34     I=MPAR(K,N)  33,33,35
35     DO39I=1,N
36       C(I,N,K)=0.
37     GOTO38
38     IF(K=1)36,36,37
39     NIK=N0(K-1)+1
40     NOK=N0(K)-1
41     DO40I=1,4
42       SUM=0.
43       DO39L=NOK,NOK
44       SUM=SUM+B(I,N,L)
45       C(I,N,K)=SUM
46     CONTINUE
47     IF(K=1)42,42,43
48     NIK=1
49     GOTO44
50     NIK=N0(K-1)+1
51     NOK=N0(K)-1
52     SUM=0.
53     DO45I=NIK,NOK
54     SUM=SUM+U(2,L)
55     U(2,K)=SUM
56     CONTINUE
57     DO48I=1,N
58     DO48N=1,M
59     SUM=0.
60     DO47K=1,NR
61     SUM=SUM+C(I,N,K)
62     RTC(I,N)=SUM
63     SUM=0.
64     DO49K=1,NR
65     SUM=SUM+U(2,K)
66     RTU2=SUM
67     RD=0.
68     P=0.
69     RTC1=0.
70     RTC4=0.
71     DO50N=1,M
72       RTC1=RTC1+RTC(1,N)
73       RTC4=RTC4+RTC(4,N)
74       P=P+RTC(4,N)*(1.-BI(7,N))
75       RD=RD+RTC(3,N)*BI(1,N)
76       TWD(N)=RTC(3,N)/RTC(2,N)
77       TWP(N)=RTC(4,N)/RTC(2,N)
78     DO50K=1,NR
79       WD(N,K)=C(3,N,K)/C(2,N,K)
80       WP(N,K)=C(4,N,K)/(2,N,K)
81     DO50I=1,7
82       D(I,N,K)=C(3,N,K)*BI(I,N)
83       RLP=RTU2/RTC4
84     DO 97 N=1,M

```

```

97 RTC(1,N)=RTC(1,N)/RTC1
D052I=1,7
BE(I)=0.
D052K=1,NR
SUM=0.
D051N=1,M
51 SUM=SUM+D(I,N,K)
TD(I,K)=SUM
BEF(I,K)=TD(I,K)/(RD+P)
BE(I)=BE(I)+BEF(I,K)
D053K=1,NR
D1P2(K)=WD(1,K)/WP(2,K)
D2P2(K)=WD(2,K)/WP(2,K)
P1P2(K)=WP(1,K)/WP(2,K)
TC1(K)=0.
D053N=1,M
C1(N,K)=C(1,N,K)/RTC1
53 TC1(I)=TC1(K)+C(1,N,K)
CONTINUE
WRITE OUTPUT TAPE 2, 65,PROB,(RECORD(I),I=1,12)
WRITE OUTPUT TAPE 2, 71
WRITE OUTPUT TAPE 2, 72
D054K=1,NR
54 WRITE OUTPUT TAPE 2, 73,(K,N,WD(N,K),WP(N,K),C(1,N,K),N=1,M)
WRITE OUTPUT TAPE 2, 74
WRITE OUTPUT TAPE 2, 75,(K,D1P2(K),D2P2(K),P1P2(K),TC1(K),K=1,NR)
WRITE OUTPUT TAPE 2, 76
WRITE OUTPUT TAPE 2, 77,(K,(TD(I,K),I=1,7),K=1,NR)
WRITE OUTPUT TAPE 2, 78
WRITE OUTPUT TAPE 2, 77,(K,(BEF(I,K),I=1,7),K=1,NR)
WRITE OUTPUT TAPE 2, 65,PROB,(RECCRD(I),I=1,12)
WRITE OUTPUT TAPE 2, 84
X=RD+P
WRITE OUTPUT TAPE 2, 79,RD,P,X
WRITE OUTPUT TAPE 2, 80
WRITE OUTPUT TAPE 2, 81,(BE(I),I=1,7)
WRITE OUTPUT TAPE 2, 82
WRITE OUTPUT TAPE 2, 83,RLP,RTC1,(RTC(1,N),N=1,M)
WRITE OUTPUT TAPE 2, 85, RTC4
END FILE 2
60 FORMAT(F9.5)
61 FORMAT(12A6)
62 FORMAT(12I6)
63 FORMAT(2I6,E12.5)
64 FORMAT(6E12.5)
65 FORMAT(13H1,118H/RE //15H PROBLEM NUMBER F9.5//12A6///)
66 FORMAT(19H RESULTS OF POINTWISE SUMMING OVER ENERGY GROUPS //)
67 FORMAT(111H, L N A(1,N,L) A(2,N,L) A(3,N,L)
1 A(4,N,L) A(5,N,L) S(1,L) S(2,L)///)
68 FORMAT(2I5,1P7E15.5)
69 FORMAT(6CH RESULTS OF POINTWISE TRAPEZOIDAL INTEGRATION FROM L TO
1L+1.///)
70 FORMAT(111H, L N B(1,N,L) B(2,N,L) B(3,N,L)
1 B(4,N,L) B(5,N,L) T(1,L) T(2,L)///)
71 FORMAT(17H REGIONAL TOTALS ///)
72 FORMAT(52H K N WD(N,K) WP(N,K) FIS(N,K)///)

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```
73 FORMAT(2I5,1P3E15.5)
74 FORMAT(//73H      K      WD(1,K)/WP(2,K)      WD(2,K)/WP(2,K)      WP(1,K
1)/WP(2,K)      FIS(K)//)
75 FORMAT(19,1P3E19.5,1PE15.5)
76 FORMAT(//103H      D(1,K)      D(2,K)      D(3,K)
1      D(4,K)      D(5,K)      D(6,K)      D(K)///)
77 FORMAT(15,1P7E15.5)
78 FORMAT(//106H      K      BEFF(1,K)      BEFF(2,K)      BEFF(3,K)
1      BEFF(4,K)      BEFF(5,K)      BEFF(6,K)      BEFF(K)///)
79 FORMAT(3H D=1PE12.5SH * P=1PE12.5,7H * D+P=1PE12.5)
80 FORMAT(//95H BEFF(1)      BEFF(2)      BEFF(3)      BEFF(4)
1      BEFF(5)      BEFF(6)      BEFF///)
81 FORMAT(1PE12.5,1PE15.5)
82 FORMAT(//98H      LP      TOT FISS      FISS(1)      FISS(2)
1      FISS(3)      FISS(4)      FISS(5)///)
83 FORMAT(1PE12.5,1P6E15.5)
84 FORMAT(15H REACTOR TOTALS//)
85 FORMAT(//6H DCNF=1PE12.5)
GOT090
END(0,0,0,0,0)
```

EXTERNAL FORMULA NUMBERS WITH CORRESPONDING INTERNAL FORMULA NUMBERS AND OCTAL LOCATIONS

EFN	IFN	LOC									
90	2	00011	90	4	00023	2	23	00127	2	28	00147
3	40	00215	96	43	00277	4	75	00460	4	80	00477
5	91	00573	5	92	00574	91	94	00605	91	95	00606
6	98	00636	7	101	00643	8	103	00650	9	110	01041
11	115	01114	12	117	01117	13	119	01126	16	124	01162
18	133	01237	19	135	01326	19	141	01347	20	147	01414
21	156	01472	22	158	01516	23	160	01521	24	161	01524
21	167	01627	27	168	01641	28	171	01671	59	172	01702
30	180	01751	93	187	02007	94	189	02012	95	190	02015
31	200	02132	32	201	02153	33	204	02223	34	205	02223
36	208	02237	37	210	02243	38	211	02250	39	215	02311
41	217	02331	42	219	02360	43	221	02366	44	222	02373
46	227	02425	47	232	02477	48	233	02505	49	236	02526
97	256	02730	51	262	03016	52	255	03034	53	273	03123
54	292	03257	60	355	00000	61	356	00000	62	357	00000
64	359	00000	65	360	00000	66	361	00000	67	362	00000
69	364	00000	70	365	00000	71	366	00000	72	367	00000
74	369	00000	75	370	00000	76	371	00000	77	372	00000
79	374	00000	80	375	00000	81	376	00000	82	377	00000
84	379	00000	85	380	00000						

STORAGE NOT USED BY PROGRAM

DEC OCT
14818 34742

DEC OCT
32562 77462

LOCATIONS OF NAMES IN TRANSFER VECTOR

FLID (10H)0	DEC 3 00003	OCT 2 00002	F122 (LEV)	DEC 4 00004	OCT 8 00010	(CSH) (RTN)	DEC 6 00006	OCT 5 00005	(FIL) (STH)	DEC 0 00000	OCT 1 00001	(IOH)I	DEC 7 00007
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STORAGE LOCATIONS FOR VARIABLES APPEARING IN DIMENSION AND EQUIVALENCE SENTENCES

FLUX	DEC 14093	OCT 32415	DEC C 3743	OCT 07263	DEC D 3138	OCT 06102	DR	DEC 14752	OCT 34640	D2P2	DEC 14627	OCT 34443	D1P2	DEC 14677	OCT 34525
C	14112	34126	CHI	14817	34741	BEF	89917	210167	BJD	10958	23512	BI	10093	23555	
RE	14093	34126	BEF	89917	210167	AA	8923	210167	ANU	14318	33756	ANE	14218	33612	
ADJ	12093	27475	JM	14423	34152	MPAR	9023	210167	MP	14652	34474	NO	14777	34671	
P1P2	14603	34412	RECORD	14442	34152	RI	14757	34607	RO	14702	34556	R	14542	34316	
RTC	9256	22052	SF	14418	34122	S	9968	23346	TCT	14567	34347	TD	9238	22026	
T	9758	23036	TWD	14577	34361	TWP	14572	34354	U	9558	22526	VEL	14797	34715	
WD	9508	22444	WP	9383	22247										

STORAGE LOCATIONS FOR VARIABLES NOT APPEARING IN DIMENSION, EQUIVALENCE OR COMMON SENTENCES

EMP	DEC 2263	OCT 04327	DL	DEC 2262	OCT 04326	JMAX	DEC 2261	OCT 04325	JOPT	DEC 2260	OCT 04324	J	DEC 2259	OCT 04323
K	2258	04322	LNR	2257	04321	L	2256	04320	MOTP	2255	04317	M	22554	04316
N1	2253	04315	N2	2252	04314	N3	2251	04313	N4	2250	04312	NIK	22449	04311
NOK	2248	04310	NOPT	2247	04307	NP1	2246	04306	NP2	2245	04305	NR	2244	04304
N	2243	04303	PROB	2242	04302	P	2241	04301	RD	2240	04300	RIK	2239	04277

RLP	2238	04276	RTC1	2237	04275	RTC4	2236	04274	RTU2	X	2235	04273	SUM1	2234	04272
SUM2	2233	04271	SUM3	2232	04270	SUM	2231	04267			2230	04266			

STORAGE LOCATIONS FOR SYMBOLS NOT APPEARING IN SOURCE PROGRAM

	DEC	OCT	DEC	OCT	DEC	OCT	DEC	OCT	DEC	OCT	DEC	OCT		DEC	OCT
E)3G	1265	02363	E)35	1177	02231	E)28	904	01610	E)1F	597	01125	E)18	552	01050	
E)P	301	00455	D)1535	1543	03007	D)153U	1438	02636	D)162D	938	01652	D)1619	559	01057	
D)1616	324	01141	D)153D	1539	02327	D)151I	647	01207	D)1516	620	01154	D)143D	1240	02330	
D)162D	339	01153	D)141R	779	01413	D)141I	648	01210	D)1416	621	01155	D)1419	560	01060	
D)1417	514	01040	D)1416	525	01015	D)40P	303	00457	D)140J	231	00352	D)345	1544	03010	
D)23U	1439	02437	D)1320	1078	02066	D)131K	669	01235	D)31B	583	01107	D)23E	1255	02347	
D)338	1161	01547	D)1237	1186	02242	D)1220	1079	02067	D)122B	928	01640	D)229	905	01611	
D)227	899	01603	D)121K	670	01236	D)121B	584	01110	D)120Q	311	00467	D)1145	1545	03011	
D)13V	1447	02647	D)113U	1440	02640	D)13H	1274	02372	D)113G	1269	02365	D)1139	1219	02303	
D)131	1157	02217	D)111D	588	01114	C)20I	2229	04265	C)20G	2228	04264	C)20F	2227	04263	
C)20D	2226	01262	C)20B	2225	04261	C)209	2224	04260	C)208	2223	04257	C)207	2222	04256	
C)206	2221	01255	C)205	2220	04254	C)204	2219	04253	C)203	2218	04252	C)1G4	2217	04251	
C)1G3	2216	01250	C)11G2	2215	04247	C)1G1	2214	04246	C)1G0	2213	04245	C)10C	2212	04244	
C)10B	2211	01243	C)110A	2210	04242	C)109	2209	04241	C)108	2208	04240	C)106	2207	04237	
C)105	2206	01236	C)1104	2205	04235	C)103	2204	04234	C)102	2203	04233	C)101	2202	04232	
C)100	2201	01231	C)1G5	2200	04230	C)1G4	2199	04227	C)G2	2198	04226	C)G1	2197	04225	
C)G0	2196	01224	B)12L	1975	03667	B)12K	1979	03673	B)12J	1982	03676	B)12I	2001	03721	
8)2H	2004	03724	B)12G	2022	03746	B)2F	2030	03756	B)2E	2050	04002	B)2D	2053	04005	
8)2C	2073	04031	B)12B	2077	04035	B)2A	2091	04053	B)29	2094	04056	B)28	2104	04070	
8)27	2109	04075	B)126	2129	04121	B)25	2141	04135	B)24	2144	04140	B)23	2164	04164	
8)22	2174	04176	B)121	2183	04207	B)20	2185	04211	B)1V	2187	04213	B)1U	2188	04214	
8)1T	2189	04215	B)15	2190	04216	1)	2192	04220	2)	1955	03643	3)	1964	03654	
6)	1967	03657	7)	2191	04217										

SUBROUTINES NOT PUNCHED FROM LIBRARY

(LEV)	(IOH)I	(CSH)	(RTN)	F122	FLIB	(IOH)O	(STH)	(FIL)
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2. For Subroutine F122

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C IBM-704 PROGRAM 1188/RE. SEPTEMBER 1961.  
SUBROUTINE F122 (FL,AD,JMA,LN)  
DIMENSION FL(100,20),AD(100,20),F1(100,20),F2(100,20)  
READ TAPE 4  
READ TAPE 4  
READ TAPE 4  
READ TAPE 5  
READ TAPE 5  
READ TAPE 5  
LNE=LN+3  
DO 3 I=1,JMA  
READ TAPE 4, (F1(L,I), L=1, LNE)  
3 READ TAPE 5, (F2(L,I), L=1, LNE)  
DO 4 I=1,JMA  
DO 4 L=1, LN  
LE=L+3  
FL(L,I)= F1(LE, I)  
4 AD(L,I)=F2(LE, I)  
RETURN  
END (1,0,0,0,0)
```

EXTERNAL FORMULA NUMBERS WITH CORRESPONDING INTERNAL FORMULA NUMBERS AND OCTAL LOCATIONS

EFN 3	IFN 23	LOC 00164	EFN 3	IFN 28	LOC 00177	EFN 4	IFN 33	LOC 00241	EFN	IFN	LOC	EFN	IFN	LOC
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STORAGE NOT USED BY PROGRAM

DEC 4212	OCT 10164	DEC 32562	OCT 77462
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LOCATIONS OF NAMES IN TRANSFER VECTOR

(LEV)	DEC 1	OCT 000001	(RTN)	DEC 0	OCT 000000	DEC	OCT	DEC	OCT	DEC	OCT
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STORAGE LOCATIONS FOR VARIABLES APPEARING IN DIMENSION AND EQUIVALENCE SENTENCES

F2	DEC 2211	OCT 04243	F1	DEC 4211	OCT 10163	DEC	OCT	DEC	OCT	DEC	OCT
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STORAGE LOCATIONS FOR VARIABLES NOT APPEARING IN DIMENSION, EQUIVALENCE OR COMMON SENTENCES

I	DEC 211	OCT 00323	LE	DEC 210	OCT 00322	LNE	DEC 209	OCT 00321	L	DEC 208	OCT 00320
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STORAGE LOCATIONS FOR SYMBOLS NOT APPEARING IN SOURCE PROGRAM

C)202 2)	DEC 207	OCT 00317	C)101 6)	DEC 206	OCT 00316	A)101 183	DEC 188	OCT 00274	91	DEC 201	OCT 00311	11	DEC 202	OCT 00312
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SUBROUTINES NOT PUNCHED FROM LIBRARY

(LEV)	(RTN)
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3. For Subroutine FLIB

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C IBM-704 PROGRAM 1188/RE. SEPTEMBER 1961.
SUBROUTINE FLIB(FL,AD,JMA,LN)
DIMENSION FL(100,20),AD(100,20),F1(100,20),F2(100,20)
LNE=LN+3
READ TAPE 3
READ TAPE 3
READ TAPE 3
DO 3 I=1,JMA
3 READ TAPE 3, (F1(L,I),L=1,LNE)
READ TAPE 3
READ TAPE 3
READ TAPE 3
DO 4 I=1,JMA
4 READ TAPE 3, (F2(L,I),L=1,LNE)
DO 5 I=1,JMA
DO 5 L=1,LN
LE=L+3
FL(L,I)=F1(LE,I)
5 AD(L,I)=F2(LE,I)
RETURN
END (1,0,0,0,0)
```

EXTERNAL FORMULA NUMBERS WITH CORRESPONDING INTERNAL FORMULA NUMBERS AND OCTAL LOCATIONS

EFN 3	IFN 11	LOC 00103	EFN 3	IFN 16	LOC 00116	EFN 4	IFN 24	LOC 00175	EFN 4	IFN 29	LOC 00210	EFN 5	IFN 34	LOC 00247
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STORAGE NOT USED BY PROGRAM

DEC 4218	OCT 10172	DEC 32562	OCT 77462
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LOCATIONS OF NAMES IN TRANSFER VECTOR

(LEV)	DEC 1	OCT 00001	(RTN)	DEC 0	OCT 00000	DEC	OCT	DEC	OCT	DEC	OCT
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STORAGE LOCATIONS FOR VARIABLES APPEARING IN DIMENSION AND EQUIVALENCE SENTENCES

F2	DEC 2217	OCT 04251	F1	DEC 4217	OCT 10171	DEC	OCT	DEC	OCT	DEC	OCT
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STORAGE LOCATIONS FOR VARIABLES NOT APPEARING IN DIMENSION,EQUIVALENCE OR COMMON SENTENCES

I	DEC 217	OCT 00331	LE	DEC 216	OCT 00330	LNE	DEC 215	OCT 00327	L	DEC 214	OCT 00326	DEC	OCT
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STORAGE LOCATIONS FOR SYMBOLS NOT APPEARING IN SOURCE PROGRAM

C1201 2)	DEC 213	OCT 00325	C)101 6)	DEC 212	OCT 00324	A)101 189	DEC 194	OCT 00302	91	DEC 207	OCT 00317	11	DEC 208	OCT 00320
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SUBROUTINES NOT PUNCHED FROM LIBRARY

(LEV)	(RTN)
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REFERENCES

1. H. A. Sandmeier, Multigroup Calculations of Effective Neutron Fraction β_{eff} , Prompt Neutron Lifetime λ_p , and Related Kinetics Parameters for Large, Fast, Plutonium-fueled Reactors, ANL-6423 (Sept. 1961).
2. D. Meneghetti and C. Stevens, private communication.
3. M. Butler, private communication.
4. S. Yiftah, D. Okrent, and P. A. Moldauer, Fast Reactor Cross Sections, Pergamon Press, New York (1960).
5. S. Yiftah and D. Okrent, Some Physics Calculations on the Performance of Large Fast Breeder Power Reactors, ANL-6212 (Dec. 1960).
6. D. Meneghetti, Recent Advances and Problems in Theoretical Analysis of ZPR-III Fast Critical Assemblies, Seminar on the Physics of Fast and Intermediate Reactors, Vienna (Aug. 1961).
7. J. K. Long et al., Fast Neutron Power Reactor Studies with ZPR-III, Proceedings of the Second United Nations International Conference on the Peaceful Uses of Atomic Energy, Geneva, Switzerland (1958), 12, 119.
8. D. M. O'Shea, D. Okrent, and J. M. Chaumont, Some Calculations Pertaining to Fast Reactor Safety, ANL-6501 (Oct. 1961).

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