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DOMINO, A GENERAL PURPOSE CODE FOR COUPLING DISCRETE ORDINATES AND MONTE CARLO RADIATION TRANSPORT CALCULATIONS

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MATHEMATICS DIVISION

DOMINO, A GENERAL PURPOSE CODE
FOR COUPLING DISCRETE ORDINATES
AND MONTE CARLO RADIATION TRANSPORT CALCULATIONS

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ABSTRACT

A method of coupling two-dimensional discrete ordinates calculations with Monte Carlo calculations is incorporated in the DOMINO code. In particular, DOT, a two-dimensional discrete ordinates code, has been coupled with MORSE, a Monte Carlo code.

The discrete ordinates calculation is limited to an r-z geometry. Either the DOT boundary angular fluxes or the angular fluxes at internal surfaces may be input to DOMINO. Any amount of surface may be used in DOMINO; i.e., from all mesh intervals down to a portion of one interval. The radii, axes, and quadrature set must be read into DOMINO. Appropriate cumulative probability distributions are calculated from the angular fluxes and written on a DOMINO tape. Four different types of DOMINO tapes may be written for use in Monte Carlo codes -- upward from a disk, downward from a disk, inward from a cylindrical surface, and outward from a cylindrical surface. The DOMINO tape contains all necessary coupling information for use by the Monte Carlo code. The MORSE calculation may utilize this data in four ways: (1) as a source for a forward MORSE case; (2) as a scoring function for an adjoint MORSE case; (3) as a source for an adjoint MORSE case; or (4) as a scoring function for a forward MORSE case.

A detailed discussion of the coupling operation as well as a sample problem are included in the appendices. Logical flow charts of the routines are also presented.

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I. INTRODUCTION AND GENERAL DESCRIPTION

DOMINO[†] is a code to implement the coupling of discrete ordinates (S_n) calculations with Monte Carlo calculations. In particular DOT¹ calculations in r-z geometry may be coupled with MORSE²⁻⁴ calculations of arbitrary geometric complexity. DOMINO is essentially a data processor for the angular flux tape produced by the discrete ordinates calculation. DOMINO requires as input the spatial mesh, angular quadrature and number of groups used in the discrete ordinates calculation. In addition, the surface (either top, bottom or side) or the boundary number of the internal disk or cylindrical surface and the direction (in, out, up or down) must be specified. DOMINO transforms the angular flux as a function of energy group, mesh interval and discrete angle into current and subsequently into normalized probability distributions. The DOMINO output tape contains all necessary coupling information for use by the Monte Carlo code.

The DOT to MORSE coupling may be performed in several ways as illustrated in Fig. 1. The problem of interest may lend itself to easier solution by one method than another.

	FORWARD DOT	ADJOINT DOT
FORWARD MORSE	DOMINO tape used as <u>source</u> for MORSE calculation	DOMINO tape used as <u>scoring function</u> for MORSE calculation
ADJOINT MORSE	DOMINO tape used as <u>scoring function</u> for MORSE calculation	DOMINO tape used as <u>source</u> for MORSE calculation

Fig. 1. Methods of Coupling.

[†]DOMINO is an acronym for Discrete Ordinates Monte Carlo Interface Operation.

The angular dependence of the flux is given in terms of the quadrature set used in the discrete ordinates calculation. An asymmetric quadrature set is given in Table 1. It consists of two cosines, η and μ , and a weight W . These cosines are defined as follows: $\cos^{-1}\eta$ is the angle between the discrete direction and a unit vector in the z direction, and $\cos^{-1}\mu$ is the angle between the discrete direction and a unit vector in the inward radial direction. The weight W is the fraction of solid angle associated with the discrete direction. Thus the weights sum to unity. The DOT angular fluxes are given in units of (particles/cm²/group/unit weight).

The quadrature set can be visualized as forming an "igloo" such that the discrete directions are represented as vectors from the center of the floor to points on the hemispherical shell. Consider the z -direction pointed upward and the negative radial direction pointed out of the page (see Fig. 2). The weights determine the size of the blocks associated with the discrete directions. For convenience the discrete directions may be grouped by polar angle such that a variable number of azimuthal segments exist for each polar angle level. Polar angle levels are denoted by ℓ , and azimuthal segments are denoted by m . Thus the quadrature set consists of η_{ℓ} , $\mu_{\ell m}$, and $W_{\ell m}$.

The energy, spatial and angular dependent flux is represented by ϕ_{gilm} where g is the energy group number and i is the spatial mesh index. The flux is assumed to be constant over spatial intervals and igloo blocks. The particle current through the top or bottom of the cylinder

Table 1. Asymmetric Quadrature Set

MUS	ETAS	WEIGHTS	MUS	ETAS	WEIGHTS
-2.5298E-02	-9.9968E-01	0.0	2.2494E-01	-9.3937E-01	2.7907E-03
-1.6595E-02	-9.9968E-01	1.9755E-04	-5.0167E-01	-8.6506E-01	0.0
1.6595E-02	-9.9968E-01	1.9755E-04	-4.3340E-01	-8.6506E-01	2.4447E-02
-5.7248E-02	-9.9836E-01	0.0	-1.4888E-01	-8.6506E-01	1.2924E-02
-3.7554E-02	-9.9836E-01	4.6261E-04	1.4888E-01	-8.6506E-01	1.2924E-02
3.7554E-02	-9.9836E-01	4.6261E-04	4.3340E-01	-8.6506E-01	2.4447E-02
-8.9576E-02	-9.9598E-01	0.0	-7.3377E-01	-6.7940E-01	0.0
-5.8760E-02	-9.9598E-01	7.2768E-04	-6.7942E-01	-6.7940E-01	2.7017E-02
5.8760E-02	-9.9598E-01	7.2768E-04	-4.3340E-01	-6.7940E-01	8.5519E-03
-1.2192E-01	-9.9254E-01	0.0	-1.4888E-01	-6.7940E-01	1.9214E-02
-7.9977E-02	-9.9254E-01	9.9024E-04	1.4888E-01	-6.7940E-01	1.9214E-02
7.9977E-02	-9.9254E-01	9.9024E-04	4.3340E-01	-6.7940E-01	8.5519E-03
-1.5413E-01	-9.8805E-01	0.0	6.7942E-01	-6.7940E-01	2.7017E-02
-1.0111E-01	-9.8805E-01	1.2528E-03	-9.0121E-01	-4.3339E-01	0.0
1.0111E-01	-9.8805E-01	1.2528E-03	-8.6507E-01	-4.3339E-01	2.4447E-02
-1.8621E-01	-9.8251E-01	0.0	-6.7941E-01	-4.3339E-01	8.5519E-03
-1.2215E-01	-9.8251E-01	1.5129E-03	-4.3340E-01	-4.3339E-01	2.7474E-02
1.2215E-01	-9.8251E-01	1.5129E-03	-1.4887E-01	-4.3339E-01	6.8585E-03
-2.1808E-01	-9.7593E-01	0.0	1.4887E-01	-4.3339E-01	6.8585E-03
-1.4306E-01	-9.7593E-01	1.7729E-03	4.3340E-01	-4.3339E-01	2.7474E-02
1.4306E-01	-9.7593E-01	1.7729E-03	6.7941E-01	-4.3339E-01	8.5519E-03
-2.4971E-01	-9.6832E-01	0.0	8.6507E-01	-4.3339E-01	2.4447E-02
-1.6381E-01	-9.6832E-01	2.0305E-03	-9.8886E-01	-1.4887E-01	0.0
1.6381E-01	-9.6832E-01	2.0305E-03	-9.7391E-01	-1.4887E-01	1.6672E-02
-2.8110E-01	-9.5968E-01	0.0	-8.6506E-01	-1.4887E-01	1.2924E-02
-1.8439E-01	-9.5968E-01	2.2856E-03	-6.7941E-01	-1.4887E-01	1.9215E-02
1.8439E-01	-9.5968E-01	2.2856E-03	-4.3340E-01	-1.4887E-01	6.8586E-03
-3.1216E-01	-9.5003E-01	0.0	-1.4887E-01	-1.4887E-01	1.8229E-02
-2.0477E-01	-9.5003E-01	2.5406E-03	1.4887E-01	-1.4887E-01	1.8229E-02
2.0477E-01	-9.5003E-01	2.5406E-03	4.3340E-01	-1.4887E-01	6.8586E-03
-3.4291E-01	-9.3937E-01	0.0	6.7941E-01	-1.4887E-01	1.9215E-02
-2.2494E-01	-9.3937E-01	2.7907E-03	8.6506E-01	-1.4887E-01	1.2924E-02

Table 1. (cont'd)

MUS	ETAS	WEIGHTS	MUS	ETAS	WEIGHTS
9.7391E-01	-1.4887E-01	1.6672E-02	-6.7941E-01	4.3339E-01	8.5519E-03
-2.2698E-01	9.7390E-01	0.0	-4.3340E-01	4.3339E-01	2.7474E-02
-1.4889E-01	9.7390E-01	1.6672E-02	-1.4887E-01	4.3339E-01	6.8585E-03
1.4889E-01	9.7390E-01	1.6672E-02	1.4887E-01	4.3339E-01	6.8585E-03
-5.0167E-01	8.6506E-01	0.0	4.3340E-01	4.3339E-01	2.7474E-02
-4.3340E-01	8.6506E-01	2.4447E-02	6.7941E-01	4.3339E-01	8.5519E-03
-1.4888E-01	8.6506E-01	1.2924E-02	8.6507E-01	4.3339E-01	2.4447E-02
1.4888E-01	8.6506E-01	1.2924E-02	-9.8886E-01	1.4887E-01	0.0
4.3340E-01	8.6506E-01	2.4447E-02	-9.7391E-01	1.4887E-01	1.6672E-02
-7.3377E-01	6.7940E-01	0.0	-8.6506E-01	1.4887E-01	1.2924E-02
-6.7942E-01	6.7940E-01	2.7017E-02	-6.7941E-01	1.4887E-01	1.9215E-02
-4.3340E-01	6.7940E-01	8.5519E-03	-4.3340E-01	1.4887E-01	6.8586E-03
-1.4888E-01	6.7940E-01	1.9214E-02	-1.4887E-01	1.4887E-01	1.8229E-02
1.4888E-01	6.7940E-01	1.9214E-02	1.4887E-01	1.4887E-01	1.8229E-02
4.3340E-01	6.7940E-01	8.5519E-03	4.3340E-01	1.4887E-01	6.8586E-03
6.7942E-01	6.7940E-01	2.7017E-02	6.7941E-01	1.4887E-01	1.9215E-02
-9.0121E-01	4.3339E-01	0.0	8.6506E-01	1.4887E-01	1.2924E-02
-8.6507E-01	4.3339E-01	2.4447E-02	9.7391E-01	1.4887E-01	1.6672E-02

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Fig. 2. The "Igloo" Formed by the Quadrature Set.

is $I_{gilm} = \varphi_{gilm} |\eta_l|$. The current through the side is $I_{gilm} = \varphi_{gilm} |\mu_{lm}|$. The arrays calculated by DOMINO are as follows:

$$E_{gilm}^* = I_{gilm}$$

$$D_{gil}^* = \sum_m E_{gilm}^* W_{lm}$$

$$C_{gi}^* = \sum_l D_{gil}^*$$

$$B_g^* = \sum_i C_{gi}^* \Delta S_i$$

$$A = \sum_g B_g^*$$

where ΔS_i is the area of a spatial mesh interval; i.e.,

$$\Delta S_i = 2\pi R(Z_{i+1} - Z_i) \text{ for the side and}$$

$$\Delta S_i = \pi(r_{i+1}^2 - r_i^2) \text{ for top or bottom.}$$

The summations are only over the directions and spatial intervals of interest. These arrays are normalized to form probability distributions as follows:

$$E_{gilm} = E_{gilm}^* W_{lm} / D_{gil}^*$$

$$D_{gil} = D_{gil}^* / C_{gi}^*$$

$$C_{gi} = C_{gi}^* \Delta S_i / B_g^*$$

$$B_g = B_g^* / A.$$

The quantity A is the total number of particles crossing the surface. The array B_g is the normalized energy spectrum. The array C_{gi} is the spatial distribution for each energy group. The array D_{gil} is the polar angle distribution for each energy group and spatial mesh. The array E_{gilm} is the azimuthal distribution for each energy group, spatial mesh and polar angle level. These arrays are made cumulative before being written on tape.

Several routines compatible with the MORSE SAMBO analysis package have been written. The DOMINO tape is read by subroutine INSCOR. If the DOMINO tape data is to be used as a source for a MORSE calculation, subroutine SOURCE is utilized to select the starting energy group, position and direction. Starting positions are smeared over the chosen spatial mesh interval, and starting directions over the solid angle segment associated with the discrete direction chosen. If next-flight estimation is used, subroutine SDATA estimates the uncollided flux at point detectors. If the DOMINO tape data is to be used as a scoring function for a MORSE calculation, subroutine BDRYX is utilized to make an estimate of the quantity of interest as the particle crosses the coupling surface. In this case, a media boundary must exist on the interface surface.

The amount of data necessary to perform coupling may be quite large. Storage requirements for such cases may well exceed computer capacity. Therefore, only the necessary energy groups, mesh points and angles are included in the distributions on the DOMINO tape. Also both DOMINO and the routines for MORSE have been flexibly dimensioned. DOMINO has only one group of boundary angular fluxes in core at a time. In the MORSE routines a check is made on amount of storage allocated; and if storage requirements for DOMINO data exceed this, the large E array is stored on direct access devices or large core storage depending on the machine being used.

Except for a title card, the input data for DOMINO is in Free-Form Fido format. A description of this format appears in Appendix B while

the input instructions are in Appendix A. A sample problem is described in Appendix D.

This code was written in FORTRAN-IV for the IBM 360, but an effort was made to avoid using features of this FORTRAN which are not available in other FORTRAN compilers, the direct access feature being the notable exception. It has been used on the CDC-6600 and the IBM 360 system.

II. THE DOMINO ROUTINES

DOMINO Main Program

The main program reads card input, initializes storage areas, sets dimension of large storage area in COMMON/WEAL/,^T prints out input data, calls routines to calculate all necessary data, writes part of the DOMINO output tape and prints calculated arrays on standard output tape.

Routines Called: FIDO, AZIPOL, OUTPUT, ADDEM

Variables Required: None yet defined

^TNOTE: This dimension is set at 15000 at present, but users must determine whether this is sufficient for a particular problem. The equation to calculate the storage needed is $NEED \leq 18 + IM + JM + NP*NAZ + MM*(9+IJM) + IP + IGG*(IRG*(NP+1) + 1)$

where IM is number radial intervals in DOT calculation

JM is number axial intervals in DOT calculation

MM is number of directions in quadrature set

NP is number polar angle levels in quadrature set

NAZ is maximum number azimuthal angles for any polar angle level

IJM is the larger of IM or JM

IP is the larger of IJM or MM

IGG is the number of energy groups used by DOMINO

IRG is number of mesh intervals on the coupling surface.

If the user allows insufficient room, an error message is written specifying the amount actually needed; and the job is terminated.

Variables Modified: LOGICAL TAPE UNITS (1) for standard I/O

NIN,NOU(=5,6), (2) for DOT tape (=4), (3) for
DOMINO output tape (=9), (4) for temporary storage
of data (scratch disk) (=1).

All input parameters - see Appendix A.

Locations of arrays in COMMON WEAL - see Table 2.

The flags IPOS, IFLG, ICASE indicating type of case.

LNXT - the index of the last storage cell used
in COMMON WEAL.

NPOS - the number of positive angles if ISIDES $\neq$ 0,
unused otherwise.

Commons Required: WEAL, TNO

DOMINO Main Program

Subroutine ANIPOL (IPOS,MM,POL,AZI,NAU,NP,IAU,NPOL,NAZP,IAN,NAZ,W)

This routine uses the DOT quadrature set to determine the number of polar and azimuthal angles to be used in DCMINO. It selects the indices of the discrete angles to be used in a particular case and determines polar angle numbers, number of azimuthal angles per polar angle and the azimuthal angle number.

Called From: MAIN

Variables Required: IPOS - flag indicating which case
 = 0, either up or to the left side
 = 1, down or to the right side
 MM - number angles in quadrature set
 POL - direction cosines of discrete angles -
 η 's if IBOT $\neq$ 0, μ 's if ISIDES $\neq$ 0
 W - weights associated with each direction
 AZI - direction cosines of discrete angles (η 's)

Variables Modified: NAU - number of discrete angles used
 NP - number of polar angles used
 NAZ - maximum number of azimuthal angles for
 any polar angle level
 IAU - indices of discrete angles used
 NPOL - polar angle numbers
 NAZP - number of azimuthal angles per polar angle
 IAN - azimuthal angle numbers

Commons Required: None

Subroutine AZIPOL

Subroutine ADDEM (IFLG, ILCW, IUP, IRG, ML, NAU, NP, NAZ, IAU, NPOL, NAZP, IAN,
RAD, AXII, ETA, W, E, D, C, B, A, B4, DELA, IL)

This routine calls subroutine RANR to read the DOT tape and calculates the cumulative probability distributions. Values resulting from a preliminary calculation of E are written on a scratch disk or tape for temporary storage. It also writes the E array on the DOMINO tape and rewinds the DOT tape.

Called From: MAIN

Routines Called: RANR and library routine ABS

Variables Required:

IGGG	- number of energy groups being used
IL	- number of radial (if IBOT $\neq$ 0) or axial bins (if ISIDES $\neq$ 0)
MM	- number of angles in quadrature set
ILOW, IUP	- upper and lower indices of radial or axial bins
NAU	- number of angles being used
ETA	- direction cosines of quadrature set - μ 's if ISIDES $\neq$ 0 or η 's if IBOT $\neq$ 0
W	- weights associated with each direction
IAU	- indices of angles being used
NPOL	- array of polar angle numbers
IFLG	- flag indicating which case = 0 side = 1 top or bottom
RAD	- limits of radial intervals
AXII	- limits of axial intervals
NAZP	- number of azimuthal angles per polar angle

- IAN - indices of azimuthal angles
- ITP - logical unit number of scratch disk or tape
 (presently set = 1 in main program)
- IOT - logical unit number of DOMINO output tape
 (presently set = 9 in main program)
- IDOT - logical unit number of DOT flux tape
 (presently set = 4 in main program)

Variables Modified:

- E - cumulative probability distribution (c.p.d.) for
 azimuthal angle selection
- D - c.p.d. for polar angle selection
- C - c.p.d. for spatial selection
- B - c.p.d. for energy group selection
- A - total leakage
- DELA - surface area for each spatial mesh interval

Commons Required: WEAL, TNO

Subroutine ADDEM

Subroutine RANr. (IFLG, IL, ML, KEY, B4, B4TMP)

This subroutine reads the required data from the DOT tape and if ISIDES $\neq$ 0 reorders this data so cosines go from -1 to 0 to +1.

Called From: ADDEM

Routines Called: ERROR

Variables Required:

- ITYPE - the type of the DOT tape written by the DOT-III code
 = 1, means DOT tape contains either B2† or B4 array
 = 2, means DOT tape contains both B2 and B4 arrays
 = 3, means DOT tape contains A1, B2 and B4 arrays
- IFLG - flag indicating which case (top, bottom or side)
- ML - the number of angles in the quadrature
- IL - either the number of axial intervals (IFLG=0) or
 the number of radial intervals (IFLG=1) to be used
- JM - the number of axial intervals on tape
- IM - the number of radial intervals on tape
- MM - the number of angles in quadrature set
- IA03 - maximum order of the Legendre expansion of scattering
 cross sections in DOT calculation
- IFP - the index of the first positive angle if ISIDES $\neq$ 0
- KEY - array in COMMON WEAL containing key to indices for
 reordering data by angle (if ISIDES $\neq$ 0)

†NOTE: The B2 array contains the angular fluxes at the left and right system boundaries of the DOT calculation. The B4 array contains the angular fluxes at the top and bottom system boundaries of the DOT calculation. The A1 array includes the scalar fluxes and the moments.

Variables Modified:

- B4 - the array in COMMON WEAL in which data from DCT tape
 is stored
- B4TMP - the array in COMMON WEAL in which part of B4 is stored
 temporarily (if ISIDES $\neq$ 0)

Commons Required: WEAL, TWO

Subroutine RANR

Subroutine OUTPUT (IRG, ILOW, IUP, IAU, NP, IAU, RAD, NAZP, NPOL, WT, BND, EWTS)

This routine writes some data on the DOMINC output tape.

Called From: MAEN

Variables Required:

ILOW, IUP - lower and upper indices of axial or radial intervals

IRG - number axial or radial intervals being used

IAU - number angles used

NP - number polar angles

BND - limit of boundary where interface occurs

RAD - limits of radial or axial intervals

NAZP - number azimuthal angles per polar angle

NPOL - indices of polar angles used

WT - weights corresponding to each direction
 $(\frac{1}{4\pi} * \text{solid angle})$

Commons Required: TWO

Subroutine OUTPUT

Table 2. Definition and Location of Variables in COMMON WEAL

<u>Location</u>	<u>Variable</u>	<u>Definition and/or Size</u>
1	Q(1)	Unused except as reference point
2	LS1D	Starting location of 1\$ array
3	LS2S	Starting location of 2* array
4	LS3S	Last location of 2* array
5	LS4S	Starting location of 4* array
6	LS5S	Last location of 4* array
7	LS6S	Starting location of 6* array
8	LS7S	Starting location of 7* array
9	LAPA	Starting location of IAU array
10	LOCA	Starting location of NPOL array
11	IAZL	Starting location of NAZP array
12	LANL	Starting location of IAN array
13	LKEY	Starting location of KEY array
14	LE	Starting location of E array
15	LD	Starting location of D array
16	LC	Starting location of C array
17	LB	Starting location of B array
18	LA	Starting location of A array
19	LB4	Starting location of B4 array
20	LDELA	Starting location of DELA array

Table 2. (cont'd)

<u>Location</u>	<u>Variable</u>	<u>Definition and/or Size</u>
LS1S	INTGR	10 cells - number of groups, IGGG; number of radial points, IM; number angles, MM; number axial points, JM; maximum order of Legendre expansion of scattering cross section (this is necessary to calculate the length of the "A1" array on the DOT tape if it is present), IA03; type of DOT tape, ITYPE; signal, ISIDES; signal, IBOT; 2 unused variables, IB5, IB6.
LS1S+10	ALR	Lower and upper limits of radial intervals used
LS1S+12	AUD	Lower and upper limits of axial intervals used
LS2S	Q(LS2S)	Axial intervals, JM + 1
LS3S	Unused	0
LS4S	Q(LS4S)	Radial intervals, IM + 1
LS5S	Unused	0
LS6S	Q(LS6S)	Weights, MM
LS7S	Q(LS7S)	Polar angles, μ 's, and azimuthal, η 's 2*MM
LAPA	IQ(LAPA)	Index of discrete angles used MM
LOCA	IQ(LOCA)	Index of polar angles used MM
LAZL	IQ(LAZL)	Number azimuthal angles/polar angle MM
LANL	IQ(LANL)	Azimuthal angle number MM
LKEY	IQ(LKEY)	Key (angle indices) for reordering angles from -1 to 0 to +1 if ISIDES $\neq$ 0. NPOS If ISIDES=0, 0 size.

Table 2. (cont'd)

<u>Location</u>	<u>Variable</u>	<u>Definition and/or Size</u>
LE	E	Cumulative probability for azimuthal angle distribution for each polar angle NP*NAZ
LD	D	Cumulative probability for polar angle distribution for each spatial interval and energy group. IGGG*IRG*NP
LC	C	Cumulative probability for spatial distribution for each energy group. IGGG*IRG
LB	B	Cumulative probability for energy group. IGGG
LA	A	Integral leakage over specified surface. 1
LB4	B4	Fluxes from DOT tape. MM*IJM Where IJM is either JM or IM
LDELA	DELA	In subroutine ADDEM, this is segment area. IRG In subroutine RANR, it is temporary storage for B4 array if ISIDES≠0. NPOS
LNXT1	WTU	Used in subroutine OUTPUT for temporary storage of weights associated with particular angles used. NAU

III. THE MORSE ROUTINES USED WITH DOMINO OUTPUT TAPE

Subroutine INSCOR

This routine sets up locations in blank common for arrays from DOMINO tape, reads the DOMINO tape and calculates polar and azimuthal angle limits for use in the random walk.

The angular limits of the igloo blocks are calculated utilizing only the weights $W_{\ell m}$. By summing the weights over azimuthal intervals for each polar angle level, numbers proportional to the $\Delta\eta_{\ell}$ may be obtained:

$$\Delta\eta_{\ell} \sim \sum_m W_{\ell m}$$

This proportionality constant depends on the surface being considered.

The azimuthal intervals are proportional to $W_{\ell m}/\Delta\eta_{\ell}$.

Called From: SCORIN

Routines Called: DIRACC - if direct access device is used

Variables Required:

- LMAX - last storage address in blank common used by SCORIN
 (SAMBO analysis package)
- NLAST - last storage address in blank common used before
 SCORIN called
- NLEFT - number of storage cells still unused in blank common

Variables Modified:

Addresses in blank common for all DOMINO data arrays

All arrays defined on DOMINO tape

- THETA - limits of polar angle cosine bins
- THETAD - width of polar angle cosine bins

PHI - limits of azimuthal angle bins (radians)

NLFT - number of unused locations remaining in blank common
 after DOMINO arrays are stored

Commons Required: Blank, PDET, USER, SOURC

Subroutine INSCOR

Table 3. Location of DOMINO

Data in Blank Common for MORSE Runs

<u>Location</u>	<u>Information</u>	<u>Sizes</u>
^T LNAX+1	Limits of radial or axial bins	IRG+1
LAZ	Number azimuthal angles/polar angle	NP
LPOL	Indices of polar angles used	NAU
LWT	Weights associated with each direction used ($\frac{1}{4\pi}$ * solid angle)	NAU
LTD	Width of polar angle cosine bins	NP
LT	Theta - limits of polar angle cosine bins	NP+1
LP	Phi - limits of azimuthal angle bins (radians)	NAU
LC	C array - cumulative probability distribution (c.p.d.) for spatial selection for given energy group	IGGG*IRG
LB	B array - c.p.d. for energy group selection	IGGG
LA	A - total leakage	1
LD	D array - c.p.d. for polar angle selection for given spatial interval and energy group	IGGG*IRG*NP
LE	E array - c.p.d. for azimuthal angle selection for given polar angle, spatial interval and energy group if no direct access usage	IGGG*IRG*NAU
or		
	E array - for 1 spatial interval and 1 energy group if direct access usage	NAU

^T LMAX is last location used by analysis routines.

Subroutine DIRACC (TDM)

This routine reads the E array from DOMINO tape and writes it on direct access device if such a device is being used.

Called From: INSCOR

Routines Called: ERROR

Variables Required:

IGGG - number of energy groups

IRG - number of mesh points

NAU - number of discrete angles used

LE - storage location of E(1) in blank common

Variables Modified:

E - cumulative probability distribution for azimuthal angle selection

Commons Required: SCURC

The DEFINE FILE N(NREC,NBYT,L,IASV) must have values of N,NREC,NBYT corresponding to the particular problem and, hence, must be changed when the case being run changes.

N is logical unit number (set to 1 at present)

NREC is number of records to be put on Direct Access = IGGG*IRG

NBYT is number of bytes per record (=NAU*4)

Subroutine DIRACC

Subroutine SOURCE (IG,U,V,W,X,Y,Z,W8,MED,AG,ISOUR,ITSTR,NQT3,DDF,
ISB,NMTG)

This routine randomly selects a source energy group number from B, a spatial interval from C, a polar angle bin from D, and an azimuthal angle bin from E. The position (X,Y,Z) of the source point is uniformly distributed over the surface of the spatial interval selected above. The direction cosines (U,V,W) are chosen based on the polar and azimuthal angles selected above. These angles are uniformly distributed over the solid angle segments calculated in INSCOR.

Called From: MSOUR

Routines Called: FLTRNF, AZIRN, and library routines ERROR, SQRT,
COS, ABS, SIGN

Variables Required:

IGCG	
IRG	
NP	
NAU	
END	
LRAD	} see definitions of COMMON SOURC in Table 4.
LAZ	
LE	
LTD	
LT	
LP	

E, D, C, B arrays - see definitions in BLANK COMMON description
in Table 3.

THETA, THETAD, PHI, RAD, NAZP - see definitions in BLANK COMMON
description

Variables Modified:

IG	- source group number
IR	- spatial interval

X - position of source particle
Y - position of source particle
Z - position of source particle
U - direction cosine of source particle (X-direction)
V - direction cosine of source particle (Y-direction)
W - direction cosine of source particle (Z-direction)

Commons Required: SOURC

Subroutine SOURCE

Table 4. Definition of Variables in Common SOURCE

LASA	- Location of last cell of blank common previously used.
IGGG	- Number of energy groups.
IRG	- Number of mesh points.
NAU	- Number of discrete angles used.
NP	- Number of polar angles.
BND	- If IBOT $\neq$ 0, the axial boundary at which the source is located; if ISIDES $\neq$ 0, the radial boundary at which the source is located.
LRAD	- Location of cell zero of mesh points.
LAZ	- Location of cell zero of azimuthal angles per polar angle.
LPOL	- Location of cell zero of polar angle numbers.
LWT	- Location of cell zero of weights.
LE	- Location of cell zero of E array.
LD	- Location of cell zero of D array.
LC	- Location of cell zero of C array.
LB	- Location of cell zero of B array.
LA	- Location of cell zero of A array.
LTD	- Location of cell zero of THETAD array.
LT	- Location of cell zero of THETA array.
LP	- Location of cell zero of PHI array.
IBOT	- Flag indicating interface at top of surface if = + 1, flag indicating interface at bottom of surface if = - 1, flag indicating interface not at top or bottom if = 0.

Table 4. (cont'd)

ISIDES	- Flag indicating interface at right side of surface if = + 1, flag indicating interface at left side of surface if = - 1, flag indicating interface not at side of surface if = 0.
IR	- Mesh point number for current particle.
ISIGN	- Flag = ± 1 used in calculating direction cosines.
IASV	- If using direct access devices, the associated variable indicating the number of the record following the one just processed; otherwise, set to 0.

Subroutine SDATA

If next flight estimation is used, this routine estimates the uncollided fluence at each point detector for each source particle and calls FLUXST to store the estimate in appropriate bins.

Using the starting coordinates and detector location, the direction to the detector is determined. The "igloo" segment through which the particle must exit to hit the point detector is then determined. The estimate of the uncollided fluence is

$$\text{CON} = \frac{(\text{WATE}) \Delta E_{\text{gil}} \Delta D_{\text{gil}} e^{-\beta}}{\Delta \Omega_{\ell m} 4\pi R^2}$$

where R is the distance to the detector in cm, β is the number of mean free paths of material between the source point and the detector, $\Delta \Omega_{\ell m}$ is the solid angle in the igloo block in steradians, and ΔE and ΔD are the probabilities corresponding to the cumulative distributions E and D.
Called From: BANKR(1)

Routines Called: EUCLID, FLUXST and library routines SQRT, ABS, SIGN, ARCCOS

Variables Required:

ND	- number of detectors
XD, YD, ZD	- detector locations
ISIDES, IBOT	- flags indicating type of case
X, Y, Z, AGE, WATE, NMED, NREG, IG	- source parameters (see definition of NUTRON Common)
THETA, PHI, NAZP, WT, E, D, VEL	- see definitions of blank common in

Table 3.

Significant Internal Variables:

TA - chronological age at detector
COSTH - cosine of angle of interest
COSPFI - cosine of angle measured from inward vector
CON - uncollided fluence estimate

Commons Required: USER, PDET, NUTRON, SOURC, BLANK

Subroutine SDATA

Subroutine BDRYX

This routine may be called either when a particle escapes from the system or when a change of media is encountered. It is used when the DOMINO data is used as a scoring function.

For this type of coupling, the subroutines SOURCE and SDATA previously discussed are not used. Particles in the MORSE calculation are started from the "SOURCE" (volume, surface, or point of interest); and as they cross the surface for which the DOMINO tape was written, an estimate of the quantity of interest is calculated by this routine. This estimate is

$$\text{CON} = \frac{(\text{WTBC}) \Delta E_{gilm} \Delta D_{gil} \Delta C_{gi} \Delta B_g^A}{\Delta \Omega_{lm} (\text{DELA}) |\bar{n} \cdot \bar{\Omega}|}$$

where $\bar{n}$ is a normal to the surface, $\bar{\Omega}$ is the particle direction, and the Δ 's are probabilities corresponding to the cumulative distributions E, D, C, B.

Called From: User written BANKR(3) or PANKR(7)

Routines Called: FLUXST and library routines SQRT, ABS, ARCOS, SIGN

Variables Required:

ISIDES, IBOT - flags for type of case

END	}	see common SOURC definitions in Table 4
IRG		
NP		
NAU		
LRAD		
LAZ		

NMTG - total number energy groups

X, Y, Z, U, V, W, AGE, WTBC from NUTRON common

RAD	}	arrays from blank COMMON
LWT		
THETA		
PHI		
NAZP		
E, D, C, B, A		

IR - index of mesh point

Significant Internal Variables:

IF	- the energy group number
COSTH	- direction cosine
COSPFI	- cosine of angle measured from inward vector
DELA	- area of spatial mesh interval
CON	- flux estimate for particular detector

Subroutine BDRYX

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3. V. R. Cain, "SAMBO, A Collision Analysis Package for Monte Carlo Codes," ORNL-TM-3203 (September 1, 1970).
4. E. A. Straker and M. B. Emmett, "MORSEC, A Revised Cross-Section Module for the MORSE Multigroup Monte Carlo Code," ORNL-4716 (1971).
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APPENDIX A

Input Instructions for DOMINO

Card A - TITLE(20) 20A4

TITLE - title describing the problem

Card B - the 1\$ or 1\$\$ array (see Appendix B, the description of FIDO input data)

IGGG, IM, MM, JM, IAO3, ITYPE, ISIDES, IBOT, IB5, IB6

IGGG	- the number of groups to be processed
IM	- the number of radial intervals on the
DOT tape
MM	- the number of angles in the DOT quadrature
JM	- the number of axial intervals on the
DOT tape
IAO3	- the order of the Legendre expansion of
the scattering cross section
ITYPE	- type of DOT angular flux tape
= 1 means DOT tape contains either B2 or
B4 array
= 2 means DOT tape contains both B2 and
B4 array
= 3 means DOT tape contains 3 arrays -
A1, B2, and B4 (A1 will not be used by
DOMINO)

BLANK PAGE

ISIDES - signal
 = 0 if not using sides of surface for interface
 = +1 if using right side
 = -1 if using left side (use of this is unlikely)

IBOT - signal
 = 0 if not using top or bottom of surface
 = +1 if using top
 = -1 if using bottom

IB5 - unused at present

IB6 - unused at present

Card C - 3* or 3** array ALR(1),ALR(2),AUF(1),AUD(2)

ALR(1) - lowest radial boundary to be used

ALR(2) - highest radial boundary to be used

AUD(1) - lowest axial boundary to be used

AUD(2) - highest axial boundary to be used

Card D - terminator for 1\$ and 3* arrays - a T in column 3.

NOTE: See Appendix B - the "T" can be placed on Card C after last value.

Cards E - the 2* or 2** array - (AX(I),I=1,JM+1)

AX - limits of axial bins

Cards F - the 4* or 4** array - (RAD(I),I=1,JM+1)

RAD - limits of radial bins

Cards G - the 6* or 6** array - (WT(I),I=1,MM)

WT - weights associated with each direction

Cards H - the 7* or 7** array (ANG(I), I=1, 2*MM)

ANG(I), I=1, MM - the μ 's (cosines)

ANG(I), I=MM+1, 2*MM - the η 's (cosines)

Card I = terminator for 2*, 4*, 6*, and 7* arrays - all are read with one call to FIDO -

a "1" in column 3 or it can be placed after last value on Cards H above.

APPENDIX B

FIDO Input

The input to DOMINO is written in the FIDO format. All data with the exception of the title card are read using the same format. The free-form version of FIDO has been slightly altered to make it machine independent except for having to change 2 cards in subroutine FFREAD. The necessary changes are indicated on comment cards.

Old Format (Fixed Form)

Each card is divided into six 12-digit data fields which are in turn divided into 3 subfields. The first subfield is a two-digit integer; the second subfield contains either a \$, *, R, I, T, S, F, A, E, Z, Q, L, N, M, U, V, +, -, or a blank. The third subfield contains either a fixed or floating point number. The contents of the first two subfields will define the operation to be performed on the third field.

Blank fields are ignored. One can use any or all fields on a card. For example, a box of blank cards sandwiched anywhere in a data array would be completely ignored.

Each data array is identified by a two-digit integer in a first subfield. There are both fixed and floating point arrays; a fixed point array is designated by a \$ in the second subfield, a floating point array by an *.

The second subfield contains an operator which specifies the type of operation to be performed on the data. The possible operators are listed below.

Array Operators

\$ indicates the beginning of an integer array. The first subfield contains a one- or two-digit number identifying the array.

* indicates the beginning of a floating point array. The first subfield identifies the array.

R indicates that the entry in the third subfield is to be repeated the number of times specified in the first subfield.

I indicates linear interpolation between the entry in the third subfield and the entry in the third subfield of the next data field. The number in the first subfield gives the number of points to be placed equally spaced in the specified range.

T indicates termination of data reading for a block. A block can contain any number of arrays. Data on a card after a T will be ignored.

S indicates skip. The first subfield defines the number of entries to be skipped. The third field can contain the first entry following the skips. A blank third subfield would be ignored.

F is used to fill the remainder of an array with the item given in the third subfield.

A is used to address a particular location in an array. This location is specified in the third subfield; the first subfield is blank.

E may be used to end specifying data for an array. This option is particularly useful when it is desired to replace only some items in a particular array. The items in question are replaced, and the use of an E prevents having to count and skip to the end of the array.

Z indicates that a zero is repeated the number of times specified in the first subfield.

Q is used to repeat sequences of numbers. The length of the sequence is defined in the third subfield. The number of times to repeat the sequence is given in the first subfield.

L is similar to I except that a logarithmic interpolation is performed between the entry points. This option is particularly useful for defining energy structures equally spaced in lethargy.

N is used to repeat a sequence of numbers in reverse order. The length of the sequence is defined in the third subfield.

M is used to negate and repeat an inverted sequence. The length of the sequence is given in the third subfield.

U is used to replace the ANISN input format for an array. The array number is given in the first subfield. The format, written in normal FORTRAN, is specified on the card immediately following the card containing a U. The parentheses normally encapsulating a format should be included.

V specifies that the array identified in the first subfield will be read according to the last variable format read in.

+ or - indicates exponentiation. The + may be either a 12 punch or a 12-8-6 punch. The data in the third field is multiplied by $10^{\pm N}$, where N is an integer in the first subfield. This option allows one to specify a number in up to nine significant digits.

Integer data in the third subfield must be right adjusted. Floating point data may be written with or without an exponent. If the decimal is omitted, it is assumed to be immediately to the left of the exponent field. If there is no exponent, the decimal point is assumed to be to the extreme right of the nine-column subfield.

Input Restrictions

The following restrictions must be observed when using the FIDO input format:

- (1) Blank data fields are ignored.
- (2) If the interpolation option (I) is used, the next data field may not be either blank or an A entry.
- (3) The third subfield of a data field containing a \$ or an * may contain an integer, N. The next data entry is assumed to be the (N+1)th member of the array. Normally the third subfield is blank and is ignored.
- (4) All data arrays must be filled with the correct number of entries. A data array is ended by either starting a new data array or by ending a data block.

The sample data sheet which follows illustrates possible uses of many of the FIDO input options. This is shown for illustrative purposes only and should not be construed to represent meaningful data.

New Format (Free Form)

The transferral of input data to input forms or punched cards for a code requiring significant amounts of input is always a time consuming, distasteful and error-prone process. The original ANISN formats were designed to help reduce these difficulties. The options are convenience features. The usefulness of the "F" option which fills an array is obvious, but it is somewhat harder to see the practical uses for some of the more obscure ones like N, M, and Q; however, frequent use will

Name _____ Charge _____ Date _____ Page _____

		IDENTIFICATION	REMARKS (DO NOT PUNCH)
1	1 \$		Begin the 1\$ array
13	F		Fill the 1\$ array with 11's
25	2 *		Begin the 2* array
37	0 . 0		The first data item of the 2* array is 0.0
49	9 9 I 0 . 0		Put in 99 equally spaced points between 0.0 and 100.0 (1.0, 2.0, 3.0, ..., 99.0)
61	1 0 0 . 0		
1	4 R 2 5 . 0		Repeat 25.0 four times
13	4 S		Skip four data locations
25	1 0 . 0		The next data item is 10.0
37	1 5 \$		Begin 15\$ array
49			
61			
1			
13			
25	Q		Repeat the previous three data items
37	Q		Repeat the previous 6 data items. The 15\$ array now has the sequence 1, 2, 3 four times
49	T		Terminate a data block,
61			
1	1 . 2 3 4		
13	1 2 . 3 4 - 1		
25	1 2 . 3 4 E - 0 1		
37	5 - 1 2 3 4 . 0 + 2		
49	3 - 1 2 3 4		
61			

R - REPEAT I - INTERPOLATE S - SKIP T - TERMINATE

Sample Data Sheet

turn up situations where these options are invaluable. For example, the S_n cosines are negated and reflected about 90', a fact which suggests the use of the M option.

There are justifiable complaints with the input formats; for example, one being that data, where convenience options are not applicable, can be hard to write, because of the manner in which the data fields are spread on the card. This is especially true of integer arrays, where the data are right adjusted in 12-column fields. The FIDO input forms help to some extent, but the actual keypunching is still troublesome for the layman.

The awkwardness of the input format described in the preceding paragraph has been eliminated by Ward Engle who has designed and implemented an all-FORTRAN free-form FIDO input scheme which has data items separated by blanks (as others do), but still allows all of the important convenience features of the earlier formats. The restrictions on the use of this input are essentially that the user write the data in a form that he can interpret within the context of the FIDO options. Data is easily written and keypunched, since there is no worry about which type character falls in which column or how many blanks are left between entries.

The free-form input can be interspersed with the fixed form input. To select free-form, an array is identified as either a \$\$ or an ** array, for integer and floating point arrays, respectively.

The restrictions are:

- (1) Any third subfield (data entry) must be followed by one or more blanks. This is an obvious restriction, otherwise data interpretation would be impossible.
- (2) Only columns 1-72 are used.
- (3) Numbers with exponents must not have imbedded blanks; e.g., use 1.0E+4, not 1.0 +E+4 or 1.0E+ 04.
- (4) The old + or - options (2nd subfield) are not operational. Significance requirements which led to the development of this option can be had directly.
- (5) Never enter more than 9 digits in a number. The exponent is not counted; e.g., 9234+09, 923400000+1 will work, 9234000000 will not work. Nine-digit accuracy is clearly beyond the significance available for single precision IBM 360 floating point operations.
- (6) Do not use a blank between items which fall in the first and second subfields with the old format, e.g., 24R, not 24 R. Note that the 99 restriction on the number of repeats, interpolations, etc., has been eliminated.
- (7) The Z-entry must be entered as 738Z, not Z 738. The old format allowed either.
- (8) The Q, M, N entries must be specified as Q4, not 4Q. The old format allows either. An entry like 3Q4 accomplishes the same as Q4 Q4 Q4. This is now true for either format.

Any character other than the digits 0 - 9, +, -, ., A, C, E, F, N, M, O, Q, T, or blank in column 1 of a card will cause the contents of the card to be listed as comments, while the data is read in.

Column 2 should contain the proper carriage control character, e.g., blank, 0, 1, 2, etc. This card is ignored as a data card. This option is also available with the old formats.

Some examples of the new format are given below:

```
1$$25R1_0_4_3Q3_2$$_3R42_F_T
```

The first 25 entries of the 1\$ array are 1's followed by 0 and 4 and then the sequence 1 0 4 is repeated three times. The 2\$ array has three 42's and then data input to the array ends. The T terminates a data block.

```
42**_0.0_0.1666667_0.3333333_N2
```

```
43**_-1.0_-0.8819171_0.3333333+M2
```

This example puts 0.0, 0.1666667, 0.3333333, 0.333333, 0.1666667 in the 42* array and -1.0, -0.8819171, -0.3333333, 0.3333333, 0.8819171 in the 43* array.

APPENDIX C

Arrangement of Data on DOMINO Tape

Record 1	TITLE (20), IGGG, ISIDES, IBOT
Record 2	IRG, NAU, NP, BND
Record 3	(IRG+1) values of mesh points, NP values of number of azimuthal angles/polar angle, NAU indices of polar angles used, NAU weights
Record 4 through record $(4 + \text{IRG} * \text{IGGG})$	NAU values of E array
Record $(4 + \text{IRG} * \text{IGGG}) + 1$	$\text{NP} * \text{IRG} * \text{IGGG}$ values of D array
Record $(4 + \text{IRG} * \text{IGGG} + 1) + 1$	$\text{IRG} * \text{IGGG}$ values of C array
Record $(4 + \text{IRG} * \text{IGGG} + 2) + 1$	IGGG values of B array
Record $(4 + \text{IRG} * \text{IGGG} + 3) + 1$	Value of A

APPENDIX D

Sample Problem for DOMINO

A sample problem illustrating the use of DOMINO to couple a DOT discrete ordinates calculation to a MORSE Monte Carlo calculation has been set up. The DOT calculation used the top 12 neutron groups of a 21 neutron group case, 5 radial intervals and 40 angles, and the resulting angular fluxes were punched on cards for use in DOMINO. Because the DOT data is on cards,[†] a special version of subroutine RANR is required for the sample problem. Listings of the DOMINO input data, subroutine RANR and the results of the DOMINO run follow.

The DOMINO output tape was then used as the source for a MORSE calculation of the fast flux ($E > 0.1$ MeV) at a point 238.1 cm below the source ($X = 0.0$, $Y = 105.26$). The geometric system consists of a neutron shield of LiH (57.658 cm high) with 4 right circular cylinders of NaK (6.020 cm in diameter) passing through the shield. This geometry was mocked up in combinatorial geometry⁵ format. The interface is at the surface $Z = 0$, with radial intervals extending from 0 to 23.79 cm. User routines RELCOL, BANKR and DIREC were required and are listed below in addition to the main program. The special MORSE routines INSCOR, SOURCE, SDATA and DIRACC for use with DOMINO tapes were also required. Input data for the MORSE calculation is listed as are the results of the MORSE calculations.

[†]NOTE: It is necessary to include a control card for the DOT tape (logical tape 4) even though the DOT data is on cards for the sample problem. This is because the program rewinds this tape. It can be specified as a dummy unit. Users should refer to Section II of this report for information on other I/O devices required for DOMINO.

Fig. 3. Neutron Shield.

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Fig. 4. Looking Down on Top of Shield.

SUBROUTINE RANR(IFLG, I1, M1, KEY, B4, B4TMP)	RANR 10
DIMENSION KEY(1), B4(M1, 1), B4TMP(1)	RANR 20
COMMON /WEAL/O(1), LS1D, LS2S, LS3S, LS4S, LS5S, LS6S, LS7S, LAPA,	PANR 30
1 LOCA, LAZL, LANL, LKEY, LE, LD, LC, LB, LA, LB4, LDELA,	PANR 31
2IGGG, IM, MM, JM, IA03, ITYPE	RANR 32
COMMON/TNO/IDOT, ITP, IOT, NOU, IFP	RANR 40
IF(ITYPE-2) 10, 20, 40	RANR 50
C **THE FOLLOWING 2 CARDS ARE SPECIAL FOR SAMPLE PROBLEM ****	RANR 54
10 READ(5, 1010)((B4(M, I), M=1, M1), I=1, I1)	RANR 60
1010 FORMAT(6E12.5)	RANR 70
GO TO 45	RANR 110
20 IF(IFLG-1) 10, 30, 25	RANR 120
25 CALL ERROR	PANR 130
30 NSKIP= JM*MM	RANR 140
35 READ(ICOT)(DUM, I=1, NSKIP), ((B4(M, I), M=1, MM), I=1, I1)	RANR 150
GO TO 45	RANR 160
40 NSKIP= IM*JM*(IA03*(IA03+3)/2+1)	RANR 170
IF(IFLG.EQ.1) NSKIP=NSKIP+MM*JM	RANR 180
GO TO 35	RANR 190
45 IF(IFLG.EC.1) RETURN	RANR 200
DO 60 I=1, I1	RANR 210
DO 50 M=IFP, M1	RANR 220
50 B4TMP(M-IFP+1) = B4(M, I)	RANR 230
DO 55 M=IFP, M1	RANR 240
IS= KEY(M-IFP+1)	RANR 250
55 B4(IS, I) = B4TMP(M-IFP+1)	RANR 260
60 CONTINUE	RANR 270
RETURN	RANR 280
END	PANR 290

DOMINO SAMPLE PROBLEM

1\$\$

12 5 40 0 1 0 -1 0 0

3**

0.0 29.0 0.0 0.0

T

2**

0.0

4**

0.0 5.32 9.70 13.21 18.08 23.79

6**

2R.0253 .0356 2R.02 2R.0356 .0162 2R.0266 .0162 .0356 .0253 .02 .0266

2R.0188 .0266 .02 .0253

2R.0253 .0356 2R.02 2R.0356 .0162 2R.0266 .0162 .0356 .0253 .02 .0266

2R.0188 .0266 .02 .0253

7**

-.1834 .1834 -.5255 -.1834 .1834 .5255 -.7967 -.5255 -.1834 .1834

.5255 .7967 -.9603 -.7967 -.5255 -.1834 .1834 .5255 .7967 .9603

-.1834 .1834 -.5255 -.1834 .1834 .5255 -.7967 -.5255 -.1834 .1834

.5255 .7967 -.9603 -.7967 -.5255 -.1834 .1834 .5255 .7967 .9603

2R-.9603 4R-.7967 6R-.5255 8R-.1834 2R.9603 4R.7967 6R.5255 8R.1834

T

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 0.22256E 09 0.12880E 09 0.38688E 08 0.50807E 09 0.17336E 10 0.27901E 11
 0.13582E 09 0.18665E 09 0.18867E 09 0.77738E 08 0.70745E 08 0.53367E 09
 0.40866E 10 0.77067E 10 0.13327E 09 0.96799E 08 0.44073E 08 0.14682E 09
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 0.53667E 08 0.48402E 08 0.85224E 08 0.14452E 09 0.25362E 09 0.10256E 09
 0.32823E 07 0.18439E 09 0.63553E 09 0.11770E 10 0.18547E 09 0.10733E 09
 0.32240E 08 0.42339E 09 0.14447E 10 0.23250E 11 0.62294E 08 0.11268E 10
 0.12911E 08 0.46763E 08 0.19249E 09 0.35674E 10 0.11318E 09 0.15554E 09
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 -0.71020E 08 0.12043E 09 0.21135E 09 0.85467E 08 0.27352E 07 0.15365E 09
 0.52961E 09 0.98086E 09 0.14838E 09 0.85867E 08 0.25792E 08 0.33871E 09
 0.11558E 10 0.18600E 11 0.90544E 08 0.12443E 09 0.12578E 09 0.51825E 08
 0.47164E 08 0.35578E 09 0.49835E 08 0.90142E 09 0.10329E 08 0.37410E 08
 0.15400E 09 0.28539E 10 0.27244E 10 0.51378E 10 0.88847E 08 0.64532E 08
 -0.29382E 08 0.97880E 08 0.45410E 08 0.47211E 08 0.13314E 09 0.61192E 08
 0.85823E 08 0.14311E 08 0.35778E 08 0.32268E 08 0.56816E 08 0.96346E 08
 0.16908E 09 0.68373E 08 0.21882E 07 0.12292E 09 0.42368E 09 0.78469E 09
 0.11128E 09 0.64400E 08 0.19344E 08 0.25403E 09 0.86681E 09 0.13950E 11
 0.67908E 08 0.93324E 08 0.94333E 08 0.38869E 08 0.35373E 08 0.26683E 09
 0.20433E 10 0.38533E 10 0.66635E 08 0.48399E 08 0.22037E 08 0.73410E 08
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 -0.26834E 08 0.24201E 08 0.42612E 08 0.72260E 08 0.12681E 09 0.51280E 08
 0.16411E 07 0.92193E 08 0.31776E 09 0.58851E 09 0.35778E 09 0.32268E 09
 -0.56816E 09 0.96346E 09 0.16908E 10 0.68374E 09 0.14838E 10 0.85968E 09
 -0.25792E 09 0.33872E 10 0.11558E 11 0.18600E 12 0.90544E 09 0.12443E 10
 0.12578E 10 0.51826E 09 0.47164E 09 0.35578E 10 0.27244E 11 0.51378E 11
 0.88846E 09 0.64532E 09 0.29382E 09 0.97880E 09 0.45410E 09 0.47212E 09
 -0.13314E 10 0.61192E 09 0.85824E 09 0.14311E 09 0.49836E 09 0.90142E 10
 0.10329E 09 0.37410E 09 0.15400E 10 0.28540E 11 0.21882E 08 0.12292E 10
 0.42368E 10 0.78468E 10

0.93040E	09	0.22205E	10	0.52355E	09	0.71855E	09	0.11700E	10	0.67083E	10
0.42964E	09	0.47302E	09	0.61152E	09	0.80706E	09	0.19878E	10	0.29330E	11
0.24335E	09	0.32447E	09	0.43974E	09	0.53548E	09	0.10487E	10	0.93355E	09
0.30365E	10	0.22648E	10	0.22652E	09	0.25651E	09	0.84091E	08	0.26786E	09
0.26577E	09	0.15316E	09	0.20140E	08	0.26716E	09	0.33732E	09	0.28904E	09
0.21839E	09	0.16877E	09	0.24726E	09	0.40793E	09	0.51487E	09	0.46032E	09
0.29758E	09	0.41256E	09	0.86753E	09	0.13210E	10	0.99200E	09	0.18505E	10
0.43629E	09	0.59879E	09	0.97496E	09	0.55503E	10	0.35803E	09	0.39418E	09
0.50960E	09	0.67255E	09	0.16565E	10	0.24442E	11	0.20280E	09	0.27056E	09
0.36645E	09	0.44957E	09	0.87392E	09	0.77796E	09	0.25304E	10	0.18873E	10
0.18877E	09	0.21376E	09	0.70076E	08	0.22322E	09	0.22147E	09	0.12763E	09
0.16784E	08	0.22264E	09	0.28110E	09	0.24087E	09	0.18199E	09	0.14064E	09
0.20605E	09	0.33994E	09	0.42906E	09	0.38360E	09	0.24798E	09	0.34380E	09
0.72294E	09	0.11008E	10	0.95360E	09	0.14804E	10	0.34903E	09	0.47903E	09
0.77997E	09	0.44722E	10	0.28642E	09	0.31535E	09	0.40768E	09	0.53804E	09
0.13252E	10	0.19553E	11	0.16224E	09	0.21645E	09	0.29316E	09	0.35966E	09
0.69913E	09	0.62237E	09	0.20244E	10	0.15098E	10	0.15102E	09	0.17101E	09
0.56061E	08	0.17857E	09	0.17718E	09	0.10210E	09	0.13427E	08	0.17811E	09
0.22488E	09	0.19269E	09	0.14559E	09	0.11251E	09	0.16484E	09	0.27195E	09
0.34325E	09	0.30688E	09	0.19839E	09	0.27504E	09	0.57835E	09	0.88067E	09
0.61520E	09	0.11103E	10	0.26177E	09	0.35928E	09	0.58498E	09	0.33542E	10
0.21482E	09	0.23651E	09	0.30576E	09	0.40353E	09	0.99392E	09	0.14665E	11
0.12168E	09	0.16234E	09	0.21987E	09	0.26974E	09	0.52435E	09	0.46678E	09
0.15183E	10	0.11324E	10	0.11326E	09	0.12825E	09	0.42046E	08	0.13393E	09
0.13288E	09	0.76578E	08	0.10070E	08	0.13358E	09	0.16866E	09	0.14452E	09
0.10919E	09	0.84385E	08	0.12363E	09	0.20396E	09	0.25744E	09	0.23016E	09
0.14879E	09	0.20628E	09	0.43376E	09	0.66051E	09	0.17590E	11	0.21650E	11
0.66062E	10	0.85054E	10	0.25500E	11	0.10564E	12	0.55360E	10	0.14804E	11
0.34904E	10	0.47904E	10	0.77998E	10	0.44722E	11	0.28642E	10	0.31534E	10
0.40768E	10	0.53804E	10	0.13252E	11	0.19553E	12	0.16224E	10	0.21644E	10
0.29316E	10	0.35966E	10	0.69914E	10	0.62236E	10	0.20244E	11	0.15098E	11
0.15102E	10	0.17101E	10	0.56060E	09	0.17857E	10	0.17718E	10	0.10210E	10
0.13427E	09	0.17811E	10	0.22488E	10	0.19269E	10	0.14559E	10	0.11251E	10
0.16484E	10	0.27196E	10								
0.99194E	08	0.13752E	09	0.28918E	09	0.44034E	09	0.0		0.0	
0.85903E	09	0.21649E	10	0.66063E	09	0.85054E	09	0.25501E	10	0.10564E	11
0.53770E	09	0.58173E	09	0.75347E	09	0.85552E	09	0.59037E	10	0.24445E	11
0.38947E	09	0.45296E	09	0.54283E	09	0.63635E	09	0.10299E	10	0.11998E	10
0.62093E	10	0.78408E	10	0.36587E	09	0.35944E	09	0.25749E	09	0.40915E	09
0.26216E	09	0.23882E	09	0.25773E	09	0.43294E	09	0.48519E	09	0.38776E	09
0.34262E	09	0.40553E	09	0.48982E	09	0.59412E	09	0.56775E	09	0.74926E	09
0.10510E	10	0.13513E	10	0.0		0.0		0.99919E	09	0.18041E	10
0.55052E	09	0.70878E	09	0.21251E	10	0.88036E	10	0.44808E	09	0.48477E	09
0.62789E	09	0.71293E	09	0.49198E	10	0.20371E	11	0.32456E	09	0.37747E	09
0.45236E	09	0.53029E	09	0.85826E	09	0.95987E	09	0.51744E	10	0.65340E	10
0.30489E	09	0.29953E	09	0.21457E	09	0.34095E	09	0.30180E	09	0.19902E	09
0.21478E	09	0.36078E	09	0.40433E	09	0.32313E	09	0.28552E	09	0.33795E	09
0.40818E	09	0.49510E	09	0.47313E	09	0.62438E	09	0.87580E	09	0.11261E	10
0.0		0.0		0.63935E	09	0.14433E	10	0.44042E	09	0.56703E	09
0.17001E	10	0.70429E	10	0.35847E	09	0.38782E	09	0.50231E	09	0.57034E	09
0.39358E	10	0.16297E	11	0.25964E	09	0.30197E	09	0.36189E	09	0.42423E	09
0.68662E	09	0.79990E	09	0.41395E	10	0.52272E	10	0.24391E	09	0.23962E	09
0.17166E	09	0.27276E	09	0.24144E	09	0.15921E	09	0.17182E	09	0.28662E	09
0.32346E	09	0.25851E	09	0.22842E	09	0.27036E	09	0.32655E	09	0.39608E	09
0.37850E	09	0.49951E	09	0.70064E	09	0.90085E	09	0.0		0.0	
0.26885E	09	0.29086E	09	0.37673E	09	0.42776E	09	0.29519E	10	0.12222E	11

0.19473E	09	0.22648E	09	0.27142E	09	0.31817E	09	0.51497E	09	0.59992E	09
0.31047E	10	0.39204E	10	0.18293E	09	0.17972E	09	0.12874E	09	0.20457E	09
0.18108E	09	0.11941E	09	0.12887E	09	0.21647E	09	0.24260E	09	0.19388E	09
0.17131E	09	0.20277E	09	0.24451E	09	0.25706E	09	0.32426E	09	0.30193E	09
0.28388E	09	0.37463E	09	0.52548E	09	0.67554E	09	0.63936E	10	0.14433E	11
0.44042E	10	0.56702E	10	0.17001E	11	0.70428E	11	0.35846E	10	0.33782E	10
0.50232E	10	0.57034E	10	0.39358E	11	0.16297E	12	0.25964E	10	0.30198E	10
0.36188E	10	0.42424E	10	0.68662E	10	0.79990E	10	0.41396E	11	0.52272E	11
0.24392E	10	0.23962E	10	0.17166E	10	0.27276E	10	0.24144E	10	0.15921E	10
0.17182E	10	0.28962E	10	0.32346E	10	0.25850E	10	0.22842E	10	0.27036E	10
0.32654E	10	0.39608E	10	0.43234E	10	0.40258E	10	0.37850E	10	0.49950E	10
0.70064E	10	0.90086E	10								
0.12937E	10	0.42460E	10	0.53651E	09	0.11520E	10	0.30274E	10	0.32250E	10
0.76900E	09	0.83722E	09	0.10193E	10	0.15202E	10	0.20805E	10	0.20003E	11
0.59024E	09	0.67387E	09	0.76965E	09	0.89392E	09	0.86987E	09	0.28787E	10
0.61643E	10	0.70539E	10	0.60235E	09	0.57013E	09	0.59341E	09	0.65827E	09
0.59881E	09	0.50394E	09	0.65085E	09	0.75000E	09	0.76631E	09	0.69280E	09
0.55795E	09	0.58993E	09	0.86826E	09	0.90901E	09	0.93481E	09	0.93733E	09
0.81454E	09	0.84299E	09	0.11552E	10	0.14376E	10	0.10781E	10	0.35383E	10
0.78043E	09	0.96004E	09	0.25228E	10	0.26875E	10	0.64083E	09	0.69768E	09
0.84940E	09	0.12669E	10	0.17338E	10	0.16669E	11	0.49187E	09	0.56153E	09
0.64137E	09	0.74493E	09	0.72489E	09	0.23989E	10	0.51369E	10	0.58782E	10
0.50196E	09	0.47511E	09	0.49451E	09	0.54856E	09	0.49901E	09	0.41995E	09
0.54237E	09	0.62500E	09	0.63859E	09	0.57733E	09	0.46495E	09	0.49161E	09
0.72355E	09	0.75751E	09	0.77901E	09	0.78111E	09	0.67878E	09	0.70249E	09
0.56271E	09	0.11980E	10	0.86244E	09	0.28307E	10	0.62434E	09	0.76803E	09
0.20183E	10	0.21500E	10	0.51266E	09	0.55814E	09	0.67952E	09	0.10135E	10
0.13870E	10	0.13335E	11	0.39349E	09	0.44924E	09	0.51310E	09	0.59595E	09
0.57991E	09	0.19191E	10	0.41096E	10	0.47026E	10	0.40156E	09	0.38008E	09
0.39561E	09	0.43885E	09	0.39921E	09	0.33596E	09	0.43390E	09	0.50000E	09
0.51087E	09	0.46187E	09	0.37196E	09	0.39329E	09	0.57884E	09	0.60601E	09
0.62320E	09	0.62489E	09	0.54303E	09	0.56199E	09	0.77017E	09	0.95843E	09
0.64683E	09	0.21230E	10	0.46826E	09	0.57602E	09	0.15137E	10	0.16125E	10
0.38450E	09	0.41861E	09	0.50964E	09	0.76012E	09	0.10403E	10	0.10001E	11
0.29512E	09	0.33693E	09	0.38482E	09	0.44696E	09	0.43493E	09	0.14393E	10
0.30822E	10	0.35269E	10	0.30117E	09	0.28506E	09	0.29670E	09	0.32914E	09
0.29941E	09	0.25197E	09	0.32542E	09	0.37500E	09	0.38315E	09	0.34640E	09
0.27897E	09	0.29496E	09	0.43413E	09	0.45450E	09	0.46740E	09	0.46867E	09
0.40727E	09	0.42149E	09	0.57762E	09	0.71882E	09	0.86244E	10	0.28306E	11
0.62434E	10	0.76802E	10	0.20182E	11	0.21500E	11	0.51266E	10	0.55814E	10
0.67952E	10	0.10135E	11	0.13870E	11	0.13335E	12	0.39350E	10	0.44924E	10
0.51310E	10	0.59594E	10	0.57992E	10	0.19191E	11	0.41096E	11	0.47026E	11
0.40156E	10	0.38008E	10	0.39560E	10	0.43884E	10	0.39920E	10	0.33596E	10
0.43390E	10	0.50000E	10	0.51088E	10	0.46186E	10	0.37196E	10	0.39328E	10
0.57884E	10	0.60600E	10	0.62320E	10	0.62488E	10	0.54302E	10	0.56200E	10
0.77016E	10	0.95844E	10								
0.18747E	10	0.67591E	10	0.12512E	10	0.16570E	10	0.22987E	10	0.10506E	11
0.10287E	10	0.11024E	10	0.14512E	10	0.19156E	10	0.28238E	10	0.38343E	11
0.79164E	09	0.87373E	09	0.98317E	09	0.12087E	10	0.59665E	09	0.36944E	10
0.11798E	11	0.12829E	11	0.76145E	09	0.65085E	09	0.77451E	09	0.84382E	09
0.70439E	09	0.73323E	09	0.84513E	09	0.99279E	09	0.10021E	10	0.83498E	09
0.91339E	09	0.10036E	10	0.11153E	10	0.12177E	10	0.12820E	10	0.12834E	10
0.13091E	10	0.13972E	10	0.20460E	10	0.25096E	10	0.15622E	10	0.56326E	10
0.10427E	10	0.13808E	10	0.19156E	10	0.87549E	10	0.85726E	09	0.91870E	09
0.12094E	10	0.15963E	10	0.23532E	10	0.31953E	11	0.65970E	09	0.72811E	09
0.81931E	09	0.10073E	10	0.49721E	09	0.30787E	10	0.98314E	10	0.10691E	11

0.63458E	09	0.54237E	09	0.64543E	09	0.70318E	09	0.58699E	09	0.61103E	09
0.70427E	09	0.82732E	09	0.83510E	09	0.65582E	09	0.76116E	09	0.83636E	09
0.92939E	09	0.10147E	10	0.10683E	10	0.10695E	10	0.10909E	10	0.11643E	10
0.17050E	10	0.20914E	10	0.12498E	10	0.45041E	10	0.83416E	09	0.11046E	10
0.15325E	10	0.70039E	10	0.68581E	09	0.73496E	09	0.96748E	09	0.12771E	10
0.18825E	10	0.25562E	11	0.52776E	09	0.58249E	09	0.65545E	09	0.80581E	09
0.39177E	09	0.24629E	10	0.78651E	10	0.85528E	10	0.50766E	09	0.43390E	09
0.51634E	09	0.56254E	09	0.46959E	09	0.48882E	09	0.56342E	09	0.66186E	09
0.66808E	09	0.55665E	09	0.60893E	09	0.66909E	09	0.74351E	09	0.81178E	09
0.85465E	09	0.85559E	09	0.87275E	09	0.93146E	09	0.13640E	10	0.16731E	10
0.93734E	09	0.33796E	10	0.62562E	09	0.82848E	09	0.11494E	10	0.52529E	10
0.51435E	09	0.55122E	09	0.72561E	09	0.55780E	09	0.14119E	10	0.19172E	11
0.39582E	09	0.43687E	09	0.49158E	09	0.60436E	09	0.29833E	09	0.18472E	10
0.58988E	10	0.64146E	10	0.38075E	09	0.32542E	09	0.38726E	09	0.42191E	09
0.35219E	09	0.36662E	09	0.42256E	09	0.49639E	09	0.50106E	09	0.41749E	09
0.45670E	09	0.50181E	09	0.55763E	09	0.60883E	09	0.64099E	09	0.64169E	09
0.65457E	09	0.69860E	09	0.10230E	10	0.12548E	10	0.12498E	11	0.45060E	11
0.83416E	10	0.11046E	11	0.15325E	11	0.70040E	11	0.68580E	10	0.73496E	10
0.96748E	10	0.12771E	11	0.18825E	11	0.25562E	12	0.52776E	10	0.58248E	10
0.65544E	10	0.80580E	10	0.39776E	10	0.24630E	11	0.78650E	11	0.85528E	11
0.50766E	10	0.43390E	10	0.51634E	10	0.56254E	10	0.46960E	10	0.48882E	10
0.56342E	10	0.66186E	10	0.66808E	10	0.55666E	10	0.60892E	10	0.66908E	10
0.74352E	10	0.81178E	10	0.85464E	10	0.85560E	10	0.87276E	10	0.93146E	10
0.13640E	11	0.16731E	11								
0.18190E	10	0.27885E	10	0.13579E	10	0.16507E	10	0.41192E	10	0.38121E	10
0.11555E	10	0.11578E	10	0.15268E	10	0.17809E	10	0.46171E	10	0.30050E	11
0.10119E	10	0.10159E	10	0.11274E	10	0.12919E	10	0.20860E	10	0.58157E	10
0.58223E	10	0.57392E	10	0.91671E	09	0.80892E	09	0.10141E	10	0.98883E	09
0.95233E	09	0.84970E	09	0.11802E	10	0.12164E	10	0.11572E	10	0.11445E	10
0.10690E	10	0.10382E	10	0.14843E	10	0.15247E	10	0.15385E	10	0.15066E	10
0.15031E	10	0.14721E	10	0.19659E	10	0.22470E	10	0.15158E	10	0.23237E	10
0.11316E	10	0.13755E	10	0.34326E	10	0.31767E	10	0.96294E	09	0.96483E	09
0.12723E	10	0.14841E	10	0.38476E	10	0.25042E	11	0.84327E	09	0.84657E	09
0.93953E	09	0.10766E	10	0.17383E	10	0.48465E	10	0.48520E	10	0.47827E	10
0.76393E	09	0.67410E	09	0.84508E	09	0.82402E	09	0.79361E	09	0.70808E	09
0.98353E	09	0.10137E	10	0.96436E	09	0.95375E	09	0.89081E	09	0.86519E	09
0.12369E	10	0.12706E	10	0.12821E	10	0.12555E	10	0.12526E	10	0.12267E	10
0.16382E	10	0.18725E	10	0.12126E	10	0.18590E	10	0.90525E	09	0.11004E	10
0.27461E	10	0.25414E	10	0.77035E	09	0.77186E	09	0.10178E	10	0.11872E	10
0.30781E	10	0.20034E	11	0.67462E	09	0.67726E	09	0.75162E	09	0.86125E	09
0.13907E	10	0.38772E	10	0.38816E	10	0.38261E	10	0.61114E	09	0.53928E	09
0.67606E	09	0.65922E	09	0.63489E	09	0.56647E	09	0.78682E	09	0.81096E	09
0.77149E	09	0.76300E	09	0.71265E	09	0.69216E	09	0.98955E	09	0.10165E	10
0.10257E	10	0.10044E	10	0.10021E	10	0.59138E	09	0.13106E	10	0.14980E	10
0.90948E	09	0.13942E	10	0.67894E	09	0.82533E	09	0.20596E	10	0.19060E	10
0.57777E	09	0.57890E	09	0.76338E	09	0.89043E	09	0.23086E	10	0.15025E	11
0.50596E	09	0.50794E	09	0.56372E	09	0.64594E	09	0.10430E	10	0.29079E	10
0.29112E	10	0.28696E	10	0.45836E	09	0.40446E	09	0.50705E	09	0.49441E	09
0.47617E	09	0.42485E	09	0.59012E	09	0.60822E	09	0.57861E	09	0.57225E	09
0.53449E	09	0.51912E	09	0.74216E	09	0.76234E	09	0.76927E	09	0.75329E	09
0.75154E	09	0.73603E	09	0.98293E	09	0.11235E	10	0.12126E	11	0.18590E	11
0.90526E	10	0.11004E	11	0.27462E	11	0.25414E	11	0.77036E	10	0.77186E	10
0.10178E	11	0.11872E	11	0.30780E	11	0.20034E	12	0.67462E	10	0.67726E	10
0.75162E	10	0.86124E	10	0.13957E	11	0.38772E	11	0.38816E	11	0.38262E	11
0.61114E	10	0.53928E	10	0.57606E	10	0.65922E	10	0.63488E	10	0.56646E	10
0.78682E	10	0.81096E	10	0.77148E	10	0.76300E	10	0.71264E	10	0.69216E	10

0.98954E	10	0.10165E	11	0.10257E	11	C.10044E	11	0.10021E	11	0.98138E	10
0.13106E	11	C.14980E	11								
0.23276E	10	C.31189E	10	0.16547E	10	0.2C893E	10	0.14200E	10	0.57057E	10
0.14843E	10	0.15721E	10	0.18811E	10	0.2C704E	10	0.23174E	10	0.30763E	11
0.13183E	10	0.13640E	10	0.15341E	10	0.17168E	10	0.14576E	10	0.52043E	10
0.56910E	10	0.39796E	10	0.14365E	10	0.13333E	10	C.16046E	10	0.15637E	10
0.14428E	10	0.13862E	10	0.18722E	10	0.18705E	10	0.18232E	10	0.17019E	10
0.17786E	10	0.19609E	10	0.21957E	10	J.21548E	10	0.22169E	10	0.22586E	10
0.22382E	10	0.25229E	10	0.31107E	10	C.35988E	10	0.19396E	10	0.25991E	10
0.13789E	10	0.17411E	10	0.11833E	10	J.47548E	10	0.12369E	10	0.13101E	10
0.15676E	10	0.17254E	10	0.19312E	10	0.25636E	11	0.10986E	10	0.11367E	10
0.12784E	10	0.14307E	10	0.12147E	10	0.43369E	10	0.47425E	10	0.33164E	10
0.11971E	10	0.11111E	10	0.13372E	10	0.13731E	10	0.12024E	10	0.11551E	10
0.15602E	10	0.15588E	10	0.15193E	10	0.14182E	10	0.14822E	10	0.16341E	10
0.18298E	10	0.18290E	10	0.18474E	10	0.18822E	10	0.18651E	10	0.21024E	10
0.25923E	10	0.29990E	10	0.15517E	10	0.2C793E	10	0.11031E	10	0.13929E	10
0.9466E	09	0.38038E	10	0.98955E	09	0.10481E	10	0.12541E	10	0.13803E	10
0.15449	10	0.20509E	11	0.87885E	09	0.90974E	09	0.10227E	10	0.11446E	10
0.97176E	09	0.34695E	10	0.37940E	10	0.26531E	10	0.95768E	09	0.88885E	09
0.10698E	10	0.10425E	10	0.96189E	09	0.92411E	09	0.12482E	10	0.12470E	10
0.12155E	10	0.11346E	10	0.11857E	10	0.13072E	10	0.14638E	10	0.14632E	10
0.14779E	10	0.15058E	10	0.14921E	10	0.16820E	10	0.20738E	10	0.23992E	10
0.11638E	10	0.15595E	10	0.82735E	09	0.1C446E	10	0.71001E	09	0.28529E	10
0.74216E	09	0.78605E	09	0.94055E	09	0.10352E	10	0.11587E	10	0.15382E	11
0.65914E	09	0.68200E	09	0.76705E	09	0.85842E	09	0.72882E	09	0.26021E	10
0.28455E	10	0.19898E	10	0.71826E	09	0.66663E	09	0.80232E	09	0.78186E	09
0.72142E	09	0.69308E	09	0.93612E	09	0.93527E	09	0.91160E	09	0.85093E	09
0.88930E	09	0.98043E	09	0.10979E	10	0.10974E	10	0.11084E	10	0.11293E	10
0.11191E	10	0.12615E	10	0.15554E	10	0.17994E	10	0.15517E	11	0.20792E	11
0.11031E	11	0.13929E	11	0.94668E	10	0.38038E	11	0.98954E	10	0.10481E	11
0.12541E	11	C.13803E	11	0.15449E	11	0.20508E	12	0.87886E	10	0.90934E	10
0.10227E	11	0.11446E	11	0.97176E	10	0.34696E	11	0.37940E	11	0.26530E	11
0.95768E	10	0.88884E	10	0.10698E	11	0.10425E	11	0.96188E	10	0.92410E	10
0.12482E	11	0.12470E	11	0.12155E	11	0.11346E	11	0.11857E	11	0.13072E	11
C.14638E	11	0.14632E	11	0.14779E	11	0.15058E	11	0.14921E	11	0.16820E	11
0.20738E	11	0.23992E	11								
0.23832E	10	0.35396E	10	0.16735E	10	0.21064E	10	0.56991E	10	0.74659E	10
0.13108E	10	0.14775E	10	0.18799E	10	0.29360E	10	0.44747E	10	0.17002E	11
0.11033E	10	0.11753E	10	0.14097E	10	0.16213E	10	0.80246E	09	0.45501E	10
0.13062E	11	0.10272E	11	0.15148E	10	0.14725E	10	0.17018E	10	0.16371E	10
0.16143E	10	0.14065E	10	0.19911E	10	0.19447E	10	0.18972E	10	0.17415E	10
0.17683E	10	0.15325E	10	0.22481E	10	0.22443E	10	0.22656E	10	0.23425E	10
0.23672E	10	0.26280E	10	0.31020E	10	0.34744E	10	0.19860E	10	0.29496E	10
0.13946E	10	0.17553E	10	0.47493E	10	0.62216E	10	0.10924E	10	0.12313E	10
0.15666E	10	0.24467E	10	0.37290E	10	0.14168E	11	0.91941E	09	0.97944E	09
0.11748E	10	0.13511E	10	0.66872E	09	C.37917E	10	0.10885E	11	0.85600E	10
0.12623E	10	0.12271E	10	0.14181E	10	C.13642E	10	0.13453E	10	0.11721E	10
0.16593E	10	C.16206E	10	0.15810E	10	0.14513E	10	0.14736E	10	0.16104E	10
0.18734E	10	0.18703E	10	0.18880E	10	0.15521E	10	0.19726E	10	0.21900E	10
0.25850E	10	0.28954E	10	0.15888E	10	0.23597E	10	0.11156E	10	0.14042E	10
0.37994E	10	0.49773E	10	0.87388E	09	0.98502E	09	0.12532E	10	0.19573E	10
0.29832E	10	0.11334E	11	0.73553E	09	0.78355E	09	0.93983E	09	0.10809E	10
0.53497E	09	0.30334E	10	0.87030E	10	0.68480E	10	0.10099E	10	0.98169E	09
0.11345E	10	0.10914E	10	0.10762E	10	0.53769E	09	0.13274E	10	0.12965E	10
0.12648E	10	0.11610E	10	C.11789E	10	0.12883E	10	0.14987E	10	0.14962E	10
0.15104E	10	0.15616E	10	0.15781E	10	0.17520E	10	0.20680E	10	0.23163E	10

0.11916E	10	0.17698E	10	0.83673E	09	0.10532E	10	0.28496E	10	0.37330E	10
0.65541E	09	0.73877E	09	0.53994E	09	0.14680E	10	0.22374E	10	0.85008E	10
0.55165E	09	0.58767E	09	0.70487E	09	0.81066E	09	0.40123E	09	0.22750E	10
0.65310E	10	0.51360E	10	0.75739E	09	0.73627E	09	0.85088E	09	0.81854E	09
0.80717E	09	0.70327E	09	0.99557E	09	0.57237E	09	0.94861E	09	0.87077E	09
0.88416E	09	0.96624E	09	0.11240E	10	0.11222E	10	0.11328E	10	0.11712E	10
0.11836E	10	0.13140E	10	0.15510E	10	0.17372E	10	0.15888E	11	0.23598E	11
0.11156E	11	0.14042E	11	0.37994E	11	0.45772E	11	0.87388E	10	0.98502E	10
0.12532E	11	0.19573E	11	0.29832E	11	0.11334E	12	0.73552E	10	0.78356E	10
0.93982E	10	0.10809E	11	0.53498E	10	0.30334E	11	0.87080E	11	0.68480E	11
0.10099E	11	0.98170E	10	0.11345E	11	0.10914E	11	0.10762E	11	0.93768E	10
0.13274E	11	0.12965E	11	0.12648E	11	0.11610E	11	0.11789E	11	0.12883E	11
0.14987E	11	0.14962E	11	0.15104E	11	0.15610E	11	0.15781E	11	0.17520E	11
0.20680E	11	0.23162E	11								
0.80683E	09	0.12066E	10	0.56800E	09	0.71047E	09	0.12157E	10	0.17986E	10
0.43346E	09	0.48537E	09	0.62993E	09	0.19102E	10	0.12038E	10	0.10264E	11
0.36476E	09	0.38189E	09	0.43784E	09	0.54209E	09	0.37210E	09	0.81275E	09
0.29327E	10	0.49665E	10	0.44429E	09	0.42411E	09	0.48895E	09	0.49076E	09
0.48129E	09	0.50317E	09	0.56708E	09	0.57545E	09	0.59173E	09	0.61487E	09
0.67851E	09	0.76404E	09	0.66478E	09	0.68023E	09	0.70689E	09	0.76120E	09
0.89278E	09	0.10180E	10	0.12197E	10	0.13867E	10	0.67235E	09	0.10055E	10
0.47333E	09	0.59206E	09	0.10131E	10	0.14588E	10	0.36122E	09	0.40448E	09
0.52494E	09	0.15919E	10	0.10032E	10	0.85537E	10	0.30397E	09	0.31824E	09
0.36487E	09	0.45174E	09	0.31008E	09	0.67729E	09	0.24439E	10	0.41387E	10
0.37024E	09	0.35342E	09	0.40746E	09	0.40897E	09	0.40107E	09	0.41931E	09
0.47257E	09	0.48288E	09	0.49311E	09	0.51239E	09	0.56542E	09	0.63670E	09
0.55398E	09	0.56666E	09	0.58907E	09	0.63433E	09	0.74398E	09	0.84830E	09
0.10155E	10	0.11556E	10	0.53788E	09	0.80442E	09	0.37866E	09	0.47365E	09
0.81046E	09	0.11991E	10	0.28598E	09	0.32358E	09	0.41995E	09	0.12735E	10
0.80254E	09	0.68430E	10	0.24318E	09	0.25459E	09	0.29189E	09	0.36139E	09
0.24807E	09	0.54183E	09	0.19551E	10	0.33110E	10	0.29619E	09	0.28274E	09
0.32597E	09	0.32718E	09	0.32086E	09	0.33545E	09	0.37805E	09	0.38630E	09
0.39449E	09	0.40991E	09	0.45234E	09	0.50536E	09	0.44318E	09	0.45349E	09
0.47126E	09	0.50747E	09	0.59519E	09	0.67864E	09	0.81316E	09	0.92449E	09
0.40341E	09	0.60332E	09	0.28400E	09	0.35523E	09	0.60784E	09	0.89930E	09
0.21673E	09	0.24269E	09	0.31496E	09	0.95512E	09	0.60190E	09	0.51322E	10
0.18238E	09	0.19094E	09	0.21892E	09	0.27104E	09	0.18605E	09	0.40637E	09
0.14664E	10	0.24832E	10	0.22214E	09	0.21205E	09	0.24448E	09	0.24538E	09
0.24064E	09	0.25159E	09	0.28354E	09	0.28973E	09	0.29586E	09	0.30743E	09
0.33925E	09	0.38202E	09	0.33239E	09	0.34012E	09	0.35344E	09	0.38060E	09
0.44639E	09	0.50898E	09	0.60987E	09	0.65337E	09	0.53788E	10	0.80442E	10
0.37866E	10	0.47364E	10	0.81046E	10	0.11991E	11	0.28898E	10	0.32358E	10
0.41996E	10	0.12735E	11	0.80254E	10	0.68430E	11	0.24318E	10	0.25460E	10
0.29190E	10	0.36140E	10	0.24806E	10	0.54184E	10	0.19551E	11	0.33110E	11
0.29620E	10	0.28274E	10	0.32596E	10	0.32718E	10	0.32086E	10	0.33544E	10
0.37806E	10	0.38630E	10	0.39448E	10	0.40992E	10	0.45234E	10	0.50936E	10
0.44318E	10	0.45348E	10	0.47126E	10	0.50746E	10	0.59518E	10	0.67864E	10
0.81316E	10	0.92448E	10								
0.48204E	10	0.10909E	11	0.36374E	10	0.42921E	10	0.55317E	10	0.28317E	11
0.25310E	10	0.31115E	10	0.38372E	10	0.10127E	11	0.18984E	11	0.51861E	10
0.24048E	10	0.23867E	10	0.26898E	10	0.33762E	10	0.34350E	10	0.12906E	11
0.32812E	10	0.14294E	11	0.19846E	10	0.20432E	10	0.21655E	10	0.21748E	10
0.22727E	10	0.23270E	10	0.24661E	10	0.24997E	10	0.25688E	10	0.27833E	10
0.28855E	10	0.29365E	10	0.28225E	10	0.28430E	10	0.29500E	10	0.32207E	10
0.37246E	10	0.39061E	10	0.39655E	10	0.41248E	10	0.40170E	10	0.90912E	10
0.30312E	10	0.35768E	10	0.46097E	10	0.23598E	11	0.21092E	10	0.25929E	10

0.31977E	10	0.84390E	10	0.15820E	11	0.43217E	10	0.20040E	10	0.19889E	10
0.22415E	10	0.28135E	10	0.28625E	10	0.10755E	11	0.27343E	10	0.11912E	11
0.16539E	10	0.17027E	10	0.18046E	10	0.18123E	10	0.18939E	10	0.19392E	10
0.20717E	10	0.20831E	10	0.21406E	10	0.23194E	10	0.24046E	10	0.24471E	10
0.23521E	10	0.23691E	10	0.24583E	10	0.26839E	10	0.31038E	10	0.32551E	10
0.33046E	10	0.34374E	10	0.32136E	10	0.72729E	10	0.24250E	10	0.28614E	10
0.36878E	10	0.18878E	11	0.16874E	10	0.20743E	10	0.25582E	10	0.67512E	10
0.12656E	11	0.34574E	10	0.16032E	10	0.15911E	10	0.17932E	10	0.22508E	10
0.22900E	10	0.86043E	10	0.21875E	10	0.55296E	10	0.13231E	10	0.13621E	10
0.14437E	10	0.14499E	10	0.15151E	10	0.15513E	10	0.16574E	10	0.16665E	10
0.17125E	10	0.18555E	10	0.19237E	10	0.15577E	10	0.18817E	10	0.18953E	10
0.19666E	10	0.21471E	10	0.24830E	10	0.26041E	10	0.26437E	10	0.27499E	10
0.24102E	10	0.54547E	10	0.18187E	10	0.21461E	10	0.27658E	10	0.14159E	11
0.12655E	10	0.15557E	10	0.19186E	10	0.50634E	10	0.94918E	10	0.25930E	10
0.12024E	10	0.11933E	10	0.13449E	10	0.16881E	10	0.17175E	10	0.64532E	10
0.16406E	10	0.71472E	10	0.99231E	09	0.10216E	10	0.10827E	10	0.10874E	10
0.11363E	10	0.11635E	10	0.12430E	10	0.12499E	10	0.12844E	10	0.13916E	10
0.14427E	10	0.14682E	10	0.14112E	10	0.14215E	10	0.14750E	10	0.16103E	10
0.18623E	10	0.19530E	10	0.19827E	10	0.20624E	10	0.32136E	11	0.72730E	11
0.24250E	11	0.28614E	11	0.36878E	11	0.18878E	12	0.16874E	11	0.20744E	11
0.25582E	11	0.67512E	11	0.12656E	12	0.34574E	11	0.16032E	11	0.15911E	11
0.17932E	11	0.22508E	11	0.22900E	11	0.85044E	11	0.21874E	11	0.95296E	11
0.13231E	11	0.13621E	11	0.14437E	11	0.14499E	11	0.15151E	11	0.15513E	11
0.16574E	11	0.16665E	11	0.17125E	11	0.18555E	11	0.19237E	11	0.19577E	11
0.18817E	11	0.18953E	11	0.19666E	11	0.21472E	11	0.24830E	11	0.26040E	11
0.26436E	11	0.27499E	11								
0.12663E	11	0.25110E	11	0.90827E	10	0.11432E	11	0.14029E	11	0.25672E	11
0.74855E	10	0.83970E	10	0.10105E	11	0.15304E	11	0.11440E	11	0.95215E	10
0.62951E	10	0.63672E	10	0.69516E	10	0.90896E	10	0.28234E	10	0.16845E	11
0.12091E	11	0.28402E	11	0.50436E	10	0.50989E	10	0.56038E	10	0.54414E	10
0.55062E	10	0.54257E	10	0.64377E	10	0.63636E	10	0.62647E	10	0.63812E	10
0.61939E	10	0.61977E	10	0.76334E	10	0.76488E	10	0.76931E	10	0.77659E	10
0.76232E	10	0.72529E	10	0.76766E	10	0.87294E	10	0.10553E	11	0.20925E	11
0.75689E	10	0.95265E	10	0.11691E	11	0.21394E	11	0.62379E	10	0.69975E	10
0.84209E	10	0.16087E	11	0.95336E	10	0.79346E	10	0.52459E	10	0.53060E	10
0.57930E	10	0.75747E	10	0.23529E	10	0.14038E	11	0.10076E	11	0.23669E	11
0.42030E	10	0.42490E	10	0.46698E	10	0.45345E	10	0.45885E	10	0.45214E	10
0.53647E	10	0.53030E	10	0.52206E	10	0.53177E	10	0.51615E	10	0.51648E	10
0.63612E	10	0.63740E	10	0.64109E	10	0.64749E	10	0.63527E	10	0.60441E	10
0.63971E	10	0.72745E	10	0.84421E	10	0.16740E	11	0.60551E	10	0.76212E	10
0.93530E	10	0.17115E	11	0.49904E	10	0.50980E	10	0.67367E	10	0.12869E	11
0.76268E	10	0.63476E	10	0.41967E	10	0.42443E	10	0.46344E	10	0.60597E	10
0.18823E	10	0.11230E	11	0.80606E	10	0.18935E	11	0.33624E	10	0.33992E	10
0.37359E	10	0.36276E	10	0.36708E	10	0.36171E	10	0.42918E	10	0.42424E	10
0.41764E	10	0.42541E	10	0.41292E	10	0.41318E	10	0.50889E	10	0.50992E	10
0.51287E	10	0.51799E	10	0.50821E	10	0.48353E	10	0.51177E	10	0.58196E	10
0.63316E	10	0.12555E	11	0.45414E	10	0.57159E	10	0.70147E	10	0.12836E	11
0.37428E	10	0.41985E	10	0.50526E	10	0.56521E	10	0.57201E	10	0.47607E	10
0.31476E	10	0.31836E	10	0.34758E	10	0.45448E	10	0.14117E	10	0.84225E	10
0.60454E	10	0.14201E	11	0.25218E	10	0.25494E	10	0.28019E	10	0.27207E	10
0.27531E	10	0.27128E	10	0.32188E	10	0.31818E	10	0.31323E	10	0.31906E	10
0.30969E	10	0.30989E	10	0.38167E	10	0.38244E	10	0.38465E	10	0.38850E	10
0.38116E	10	0.36265E	10	0.38383E	10	0.43647E	10	0.84422E	11	0.16740E	12
0.60552E	11	0.76212E	11	0.93530E	11	0.17115E	12	0.49904E	11	0.55980E	11
0.67368E	11	0.12869E	12	0.76268E	11	0.63476E	11	0.41968E	11	0.42448E	11
0.46344E	11	0.60598E	11	0.18823E	11	0.11230E	12	0.80606E	11	0.18935E	12

0.33624E	11	0.33992E	11	0.37358E	11	0.36276E	11	0.36708E	11	0.36172E	11
0.42918E	11	0.42424E	11	0.41764E	11	0.42542E	11	0.41292E	11	0.41318E	11
0.50890E	11	0.50992E	11	0.51288E	11	0.51800E	11	0.50822E	11	0.48352E	11
0.51178E	11	0.58196E	11								
0.26196E	11	0.39562E	11	0.19979E	11	0.23925E	11	0.30928E	11	0.52989E	11
0.14549E	11	0.17139E	11	0.21804E	11	0.15681E	11	0.49461E	11	0.33361E	11
0.12770E	11	0.14016E	11	0.15677E	11	0.17635E	11	0.36424E	11	0.38578E	11
0.37612E	11	0.42863E	11	0.10539E	11	0.10219E	11	0.11519E	11	0.11230E	11
0.10919E	11	0.13406E	11	0.13000E	11	0.12862E	11	0.12668E	11	0.12354E	11
0.15328E	11	0.14938E	11	0.15087E	11	0.15100E	11	0.15237E	11	0.15370E	11
0.18640E	11	0.17185E	11	0.17214E	11	0.17514E	11	0.21830E	11	0.32969E	11
0.16449E	11	0.19938E	11	0.25774E	11	0.44075E	11	0.12124E	11	0.14283E	11
0.18170E	11	0.13067E	11	0.41218E	11	0.27801E	11	0.10641E	11	0.11680E	11
0.13064E	11	0.14696E	11	0.30353E	11	0.32148E	11	0.31343E	11	0.35719E	11
0.87824E	10	0.85160E	10	0.95996E	10	0.93583E	10	0.90990E	10	0.11172E	11
0.10833E	11	0.10718E	11	0.10557E	11	0.10295E	11	0.12773E	11	0.12448E	11
0.12573E	11	0.12583E	11	0.12698E	11	0.12809E	11	0.15534E	11	0.14321E	11
0.14345E	11	0.14595E	11	0.17464E	11	0.26375E	11	0.13319E	11	0.15950E	11
0.20619E	11	0.35260E	11	0.96994E	10	0.11426E	11	0.14536E	11	0.10454E	11
0.32974E	11	0.22241E	11	0.85132E	10	0.93442E	10	0.10451E	11	0.11757E	11
0.24282E	11	0.25719E	11	0.25074E	11	0.28575E	11	0.70259E	10	0.68128E	10
0.76797E	10	0.74867E	10	0.72792E	10	0.89375E	10	0.86666E	10	0.85748E	10
0.84453E	10	0.82360E	10	0.10219E	11	0.99583E	10	0.10058E	11	0.10066E	11
0.10158E	11	0.10247E	11	0.12427E	11	0.11457E	11	0.11476E	11	0.11676E	11
0.13098E	11	0.19781E	11	0.99896E	10	0.11963E	11	0.15464E	11	0.26445E	11
0.72745E	10	0.85696E	10	0.10902E	11	0.78403E	10	0.24731E	11	0.16680E	11
0.63849E	10	0.70081E	10	0.78384E	10	0.88176E	10	0.18212E	11	0.19289E	11
0.18806E	11	0.21431E	11	0.52694E	10	0.51096E	10	0.57597E	10	0.56150E	10
0.54594E	10	0.67031E	10	0.64999E	10	0.64311E	10	0.63340E	10	0.61770E	10
0.76639E	10	0.74688E	10	0.75437E	10	0.75498E	10	0.76187E	10	0.76852E	10
0.93201E	10	0.85927E	10	0.86068E	10	0.87568E	10	0.17464E	12	0.26374E	12
0.13319E	12	0.15950E	12	0.20618E	12	0.35260E	12	0.96994E	11	0.11426E	12
0.14536E	12	0.10454E	12	0.32974E	12	0.22240E	12	0.85132E	11	0.93442E	11
0.10451E	12	0.11757E	12	0.2428							

DCMIND SAMPLE PROBLEM

15 ARRAY 10 ENTRIES READ

30 ARRAY 4 ENTRIES READ

07

IR5= 0 I86= 0 ISIDES= 0 ISOT= -1 ITYPE= 1

LOWER RADIAL BNDRY TO BE USED IS 0.0

UPPER RADIAL BNDRY TO BE USED IS 2.900E 01

20 ARRAY 1 ENTRIES READ

40 ARRAY 6 ENTRIES READ

60 ARRAY 40 ENTRIES READ

70 ARRAY 80 ENTRIES READ

07

NO. GROUPS = 12 NO. RADII = 5 NO. ANGLES = 40 NO. AXES = 0 IAO3 = 0

AXIAL BOUNDARIES

0.0

RADIAL BOUNDARIES

0.0 5.320E 00 9.700E 00 1.321E 01 1.808E 01 2.379E 01

MUS	ETAS	WEIGHTS
-1.8340E-01	-9.6030E-01	2.9300E-02
1.8340E-01	-9.6030E-01	2.9300E-02
-5.2550E-01	-7.9670E-01	3.5600E-02
-1.8340E-01	-7.9670E-01	2.0000E-02
1.8340E-01	-7.9670E-01	2.0000E-02
5.2550E-01	-7.9670E-01	3.5600E-02
-7.9670E-01	-5.2550E-01	3.5600E-02
-5.2550E-01	-1.8340E-01	1.6200E-02
-1.8340E-01	-5.2550E-01	2.6600E-02
1.8340E-01	-5.2550E-01	2.6600E-02
5.2550E-01	-5.2550E-01	1.6200E-02
7.9670E-01	-5.2550E-01	3.5600E-02
-9.6030E-01	-1.8340E-01	2.9300E-02
-7.9670E-01	-1.8340E-01	2.0000E-02
-5.2550E-01	-1.8340E-01	2.6600E-02
-1.8340E-01	-1.8340E-01	1.6800E-02
1.8340E-01	-1.8340E-01	1.6800E-02
5.2550E-01	-1.8340E-01	2.6600E-02
7.9670E-01	-1.8340E-01	2.0000E-02
9.6030E-01	-1.8340E-01	2.9300E-02
-1.8340E-01	9.6030E-01	2.9300E-02
1.8340E-01	9.6030E-01	2.9300E-02
-5.2550E-01	7.9670E-01	3.5600E-02
-1.8340E-01	7.9670E-01	2.0000E-02
1.8340E-01	7.9670E-01	2.0000E-02
5.2550E-01	7.9670E-01	3.5600E-02
-7.9670E-01	5.2550E-01	3.5600E-02
-5.2550E-01	5.2550E-01	1.6200E-02
-1.8340E-01	5.2550E-01	2.6600E-02
1.8340E-01	5.2550E-01	2.6600E-02
5.2550E-01	5.2550E-01	1.6200E-02
7.9670E-01	5.2550E-01	3.5600E-02

-9.6030E-01	1.8340E-01	2.5300E-02
-7.9670E-01	1.8340E-01	2.0000E-02
-5.2550E-01	1.8340E-01	2.6600E-02
-1.8340E-01	1.8340E-01	1.8800E-02
1.8340E-01	1.8340E-01	1.8800E-02
5.2550E-01	1.8340E-01	2.6600E-02
7.9670E-01	1.8340E-01	2.0000E-02
9.6030E-01	1.8340E-01	2.5300E-02

NO. POLAR ANGLES			4 NO. AZI ANGLES			8													
DISCRETE ANGLES USED																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
POLAR ANGLES USED																			
1	1	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	4	4	4
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AZI ANGLES PER POLAR ANGLE																			
2	4	6	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AZI ANGLE NO.																			
1	2	1	2	3	4	1	2	1	4	5	6	1	2	3	4	5	6	7	8
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

UNNORMALIZED B ARRAY

3.699E 12	5.899E 12	9.750E 12	4.834E 12	8.866E 12	6.423E 12	6.714E 12	6.417E 12	2.514E 12	1.232E 12
2.040E 13	4.214E 13								

B ARRAY FOR GROUP 1, MESH POINT 1

5.239E-02	1.000E 00	3.476E-03	1.055E-02	3.966E-02	1.000E 00	7.975E-03	9.570E-03	1.055E-02	2.348E-02
5.033E-02	1.000E 00	1.123E-02	7.344E-02	3.984E-02	4.462E-02	4.897E-02	9.438E-02	3.626E-01	1.000E 00

B ARRAY FOR GROUP 1, MESH POINT 2

6.334E-01	1.000E 00	1.325E-03	1.110E-02	4.446E-02	1.000E 00	1.497E-02	1.345E-01	1.368E-01	1.450E-01
1.654E-01	1.000E 00	1.123E-02	2.344E-02	3.984E-02	4.462E-02	4.897E-02	9.538E-02	3.626E-01	1.000E 00

B ARRAY FOR GROUP 1, MESH POINT 3

6.334E-01	1.000E 00	0.0	9.789E-03	4.319E-02	1.000E 00	1.378E-01	2.240E-01	3.670E-01	4.259E-01
4.586E-01	1.000E 00	0.0	6.402E-02	6.900E-02	6.900E-02	7.928E-02	3.449E-01	5.384E-01	1.000E 00

B ARRAY FOR GROUP 1, MESH POINT 4

6.334E-01	1.000E 00	0.0	9.789E-03	4.319E-02	1.000E 00	1.378E-01	2.240E-01	3.670E-01	4.259E-01
4.586E-01	1.000E 00	3.435E-01	8.956E-01	8.673E-01	8.734E-01	8.734E-01	8.864E-01	8.864E-01	1.000E 00

B ARRAY FOR GROUP 1, MESH POINT 5

0.0	1.000E 00	0.0	2.489E-01	6.856E-01	1.000E 00	7.983E-03	9.580E-03	9.580E-03	2.252E-02
4.940E-02	1.000E 00	1.123E-02	2.344E-02	3.984E-02	4.462E-02	4.897E-02	9.538E-02	3.626E-01	1.000E 00

D ARRAY FOR GROUP 1, POLAR ANGLE 1

4.521E-02	8.634E-03	9.165E-03	9.389E-03	1.910E-03
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D ARRAY FOR GROUP 1, POLAR ANGLE 2

2.101E-01	8.462E-01	8.970E-01	9.190E-01	1.694E-02
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D ARRAY FOR GROUP 1, POLAR ANGLE 3

9.260E-01	9.433E-01	9.168E-01	9.393E-01	9.089E-01
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D ARRAY FOR GROUP 1, POLAR ANGLE 4

1.000E 00	1.000E 00	1.000E 00	1.000E 00	1.000E 00
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C ARRAY
1.145E-02 6.453E-02 1.070E-01 1.459E-01 1.000E 00 1.425E-02 4.203E-02 6.937E-02 1.080E-01 1.000E 00
6.754E-03 2.298E-02 3.844E-02 6.911E-02 1.000E 00 1.566E-02 4.601E-02 7.568E-02 1.178E-01 1.000E 00
1.566E-02 4.601E-02 7.568E-02 1.178E-01 1.000E 00 1.566E-02 4.601E-02 7.568E-02 1.178E-01 1.000E 00
1.566E-02 4.601E-02 7.568E-02 1.178E-01 1.000E 00 1.566E-02 4.601E-02 7.568E-02 1.178E-01 1.000E 00
1.566E-02 4.601E-02 7.568E-02 1.178E-01 1.000E 00 1.566E-02 4.601E-02 7.568E-02 1.178E-01 1.000E 00

B ARRAY
2.933E-02 7.616E-02 1.219E-01 1.403E-01 2.307E-01 2.816E-01 3.349E-01 3.859E-01 4.056E-01 5.036E-01
6.655E-01 1.000E 00

A= 1.260E 14
INDICES OF RADII TO BE USED      1      5
IMC0021 STOP      0
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C * * THIS IS THE MAIN ROUTINE * * * * *
C * *
C * * THE FOLLOWING CARD DETERMINES THE SIZE ALLOWED FOR BLANK COMMON * * * * *
COMMON NC(10000)
C * * (REGION SIZE NEEDED IS ABOUT 150K + 4*(SIZE OF BLANK COMMON IN WORDS) ) *
C * * NOTE - THE ORDER OF COMMONS IN THIS ROUTINE IS IMPORTANT AND MUST CORRES-
C * * POND TO THE ORDER USED IN DUMP ROUTINES SUCH AS HELP, XSCHLP, AND USPHLP
C * *
C * * LABELLED COMMONS FOR WALK ROUTINES * * * * *
COMMON /APOLLC/ AGSTRT,DDF,DEADWT(26),ITOUT,ITIN
COMMON /FISBNK/ WFISTP
COMMON /NUTRON/ NAME
C * *
C * * LABELLED COMMONS FOR CROSS-SECTION ROUTINES * * * * *
COMMON /LOCSIG/ ISCCOG
COMMON /MEANS/ NM
COMMON /MOMENT/ NMOM
COMMON /OAL/ O
COMMON /RESULT/ POINT
C * *
C * * LABELLED COMMONS FOR GEOMETRY INTERFACE ROUTINES * * * * *
COMMON /GEOMC/ XTWO
COMMON /NORMAL/ UNORM
C * *
C * * LABELLED COMMONS FOR USER ROUTINES * * * * *
COMMON /PDET/ ND
COMMON /USER/ AGST
C * *
C * * COMMON /DUPHY/ WILL NOT BE FOUND ELSEWHERE IN THE PROGRAM * * * * *
COMMON /DUMMY/ DUM
C * *
DATA JUNK/248484848/
NLFT = (LOC(DUM) - LOC(NC(1)))/4
DO 10 I=1,NLFT
10 NC(I) = JUNK
ITOUT = 6
ITIN = 5
NLFT = (LOC(AGSTRT) - LOC(NC(1)))/4
CALL MORSE(NLFT)
STOP
END

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FUNCTION DIREC(F)
COMMON /NUTRON/ NAME,NAMEX,IG,IGO,NMEC,NEDOLC,NREG,U,V,W,UOLD,VOLDTESTW 20
1 ,WOLD,X,Y,Z,XOLD,YOLD,ZOLD,WATE,CLOWT,WTRC,BLZNT,BLZON,AGE,OLDAGETESTW 21
DIREC=-W
RETURN
END

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SUBROUTINE BANKR(NBNKID)
C DO NOT CALL EUCLID FROM BANKR(7)
COMMON /APOLL3/ AGSTRT,DDF,DEADWT(5),ETA,ETATH,ETAUSD,UTNP,VINP,
1 4INP,WTSTRT,XSTRT,YSTRT,ZSTRT,TCUT,XTRA(10),
2 10,11,MEDIA,IADJM,ISBIAS,ISOUR,ITERS,ITIME,ITSTR,LOCWTS,LOCFWL,BANKR 32
3 LJCPR,LOCNSC,LOCFSN,MAXGP,MAXTH,MEDIA,B,MGPREG,MXREG,NALB, BANKR 33
4 NDEAD(5),NEWMN,NGEOM,NGPOT1,NGPOT2,NGPOT3,NGPOTG,NGPOTN,NITS, BANKR 34
5 NKCALC,NKILL,NLAST,NMEM,NMGP,NMOST,NMTG,NOLEAK,NORMF,NPAST, BANKR 35
6 NPSCL(13),NQUIT,NSIGL,NSOUR,NSPLT,NSTRT,NXTRA(10)
COMMON /NUTRON/ NAME,NAMEX,IG,IGO,NMED,MEDOLD,NREG,U,V,W,UOLD,VOLDBANKR 40
1 ,4OLD,X,Y,Z,XOLD,YOLD,ZOLD,WATE,OLCWT,WTSC,BLZNT,BLZON,AGE,OLDAGEBANKR 41
NBNK = NBNKID
IF(NBNK)100,100,140
100 NBNK = NBNK & 5
GO TO (104,103,102,101),NBNK
101 CALL STRUN
C CALL HELPI4HSTRU,1,1,1,1)
RETURN
102 NBAT = NITS - ITERS
NSAVE = NMEN
CALL STBTCH(NBAT)
C NBAT IS THE BATCH NO. LESS ONE
RETURN
103 CALL NBATCH(NSAVE)
C NSAVE IS THE NO. OF PARTICLES STARTED IN THE LAST BATCH
RETURN
104 CALL MRUN(NITS,NQUIT)
C NITS IS THE NO. OF BATCHES COMPLETED IN THE RUN JUST COMPLETED
C NQUIT .GT. 1 IF MORE RUNS REMAIN
C .EQ. 1 IF THE LAST SCHEDULED RUN HAS BEEN COMPLETED
C IS THE NEGATIVE OF THE NO. OF COMPLETE RUNS, WHEN AN
C EXECUTION TIME KILL OCCURS
RETURN
140 GO TO (1,2,3,4,5,6,7,8,9,10,11,12,13),NBNK
C NBNKID COLL TYPE BANKR CALL NBNKID COLL TYPE BANKR CALL BANK 280
C 1 SOURCE YES (MSOUR) 2 SPLIT NO (TESTW)BANK 290
C 3 FISSION YES (FPROB) 4 GAMGEN YES (GSTORE)BANK 300
C 5 REAL COLL YES (MORSE) 6 ALBEDO YES (MORSE)BANK 310
C 7 BDRYX YES (NXTCOL) 8 ESCAPE YES (NXTCOL)BANK 320
C 9 E-CUT NO (MORSE) 10 TIME KILL NO (MORSE)BANK 330
C 11 R R KILL NO (TESTW) 12 R R SURV NC (TESTW)BANK 340
C 13 GAMLOST NO (GSTORE) BANK 350
1 CALL SDATA
RETURN
2 RETURN
3 RETURN
4 RETURN
5 CALL RELCOL
RETURN
6 RETURN
7 RETURN
8 RETURN
9 RETURN
10 RETURN
11 RETURN
12 RETURN
13 RETURN
END

```

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SUBROUTINE RELCCL
C
C THIS VERSION IS FOR POINT DETECTORS LOCATED AT (XD,YD,ZD)
C
COMMON /USER/ AGSTRT,WTSTRT,XSTRT,YSTRT,ZSTRT,OFF,EBOTN,EBOTG,
1 TCUT,IO,I1,IADJH,NGPOT1,NGPOT2,NGPOT3,NGPOTG,NGPOTN,NITS,NLAST,
2 NLEFT,NMGP,NMTG,NSTRT
COMMON /PDET/ ND,NNE,NE,NT,NA,NRESP,NEX,NEXND,NEND,NDNR,NTNR,NTNF,
1 NAME,NTNDNR,NTNEND,NANEND,LOCSP,LOCXC,LOCIB,LOCCO,LOCT,LOCUD,
2 LOCSD,LOCQE,LOCQT,LOCOTE,LOCQAF,LMAX,EFIRST,EGTOP
COMMON /NUTRON/ NAME,NAMEX,IG,IGO,NMED,MEDOLD,NRFG,U,V,W,UOLD,VOLD,
1 ,HOLD,X,Y,Z,XOLD,YOLD,ZOLD,WATE,CLOWT,WTBC,BLZNT,BLZON,AGE,OLDAGE
COMMON BL(1)
DIMENSION NL(1)
EQUIVALENCE (BL(1),NL(1))
DATA NEST /1/, FNEST /1./
C NEST + FNEST ARE THE NO. OF ESTIMATES TO BE MADE TO EACH DETECTOR
C * * * ISTAT MUST BE EQUAL TO 1.
C * * * NEX MUST BE AT LEAST 1
C * * * NEXND MUST BE AT LEAST 1
FNEST=1.0
DO 30 I=1,ND
IA=LOCXC+I
XE = BL(IA)
YE = BL(IA+ND)
ZE = BL(IA+2*ND)
A = XE - X
B = YE - Y
C = ZE - Z
SD2=A*A+B*B+C*C
DS=SQRT (SD2)
C * * * COS DEPENDS ON THE ANGLE OF INTEREST
COS=C/DS
THETA = (A*UOLD + B*VOLD + C*WOLD)/DS
IGOLD = IGO
IGO = NGPOT3
IF (IGO.LE.NGPOT1) IGO=NGPOT1
IA = LOCSP + NRESP*NMTG + 1
CALL PTHETA(NMED,IGOLD,IGO,THETA,BL(IA),NMTG)
NES = 0
PSUM = 0.
IA = IA - 1
DO 5 IL=IGOLD,IGO
5 PSUM = PSUM + ABS (BL(IA+IL))
10 R = FLTRNF(0) * PSUM
DO 15 IL=IGOLD,IGO
IF (R-ABS (BL(IA+IL))) 20,20,15
15 R = R - ABS (BL(IA+IL))
IL = IGO
20 MARK=1
IF (I1.GT.12) GO TO 25
AGED = AGE + DS/BL(NMTG+1)
MEDIUM=NMED
CALL EUCLID(MARK,X,Y,Z,XE,YE,ZE,DS,IL,ARG,0,MEDIUM,BLZNT,NREG)
IF (ARG.LT.-64.0) GO TO 25
C*****BEWARE THIS VERSION WILL NOT WORK IF ENERGY BIASING IS USED
CON = WATE*EXP (ARG)*SIGN (PSUM,BL(IA+IL))/SD2/FNEST
IF (ABS(CON).LT.1.E-40) GO TO 25
CALL FLUXST(I,IL,CON,AGED,COS,0)
NL(LOCXD+6*ND+I)=NL(LOCXD+6*ND+I)+1
25 NES = NES + 1
IF (NES-NEST) 10,30,30
30 CONTINUE
RETURN
END

```

DCMINO SAMPLE PROBLEM

100 150 50 1 12 0 21 21 0 0 0.5 2 0
 0 0 0 0 1.0000+00 0.0000+00 0.0000+00 0.0000+00 2.2000+05

BLANK CARD

1.0 1.0 1.0 1.0 1.0 1.0 1.0
 1.0 1.0 1.0 1.0 1.0 1.0 1.0
 1.0 1.0 1.0 1.0 1.0 1.0 1.0

3870838851E9

1 1 1 0 0 1 12
 0 0 0 0 0 0 1.0000+01 1.0000-01 1.0000+00 5.0000-01

-1

BLANK CARD

DCMINO SAMPLE PROBLEM

0 0
 RCC 20.892 -3.256 -0.85 -4.4823 -21.885 -50.902
 3.01
 RCC -20.892 -3.256 -0.85 4.4823 -21.885 -50.902
 3.01
 RCC -20.892 3.256 -0.85 4.4823 21.885 -50.902
 3.01
 RCC 20.892 3.256 -0.85 -4.4823 21.885 -50.902
 3.01
 SPH 0.0 0.0 -45.097 45.085
 SPH 0.0 0.0 -20.586 37.084
 TRC 0.0 0.0 -58.67 0.0 0.0 60.0
 32.254 23.682
 RPP -100.0 100.0 -150.0 100.0 -250.0 2.0
 END
 EXV 2000R 8 -70R 7 -6
 NAK OR 1 5 60R 2 5 60R 3 5 6
 OR 4 5 6
 LIH 7 5 6 -1 -2 -3 -4
 INV 7 -5
 END

1 1 1 1
 0 1 2 1000
 NAK, LIH P3, 39C XSEC

21 21 0 0 39 42 4 2 2 2 4 2 1
 0

0	£59140-	7	0	£	0£	0	0	£27764-	6	0	£11379-	638R£	0£	0	0	£52085-	7	1	
0	£	0£	0	0	£32029-	6	0	£16574-	6	0	£21073-	737R£	0£	0	0	£39926-	7	2	
0	£	0£	0	0	£39519-	6	0	£25407-	6	0	£27359-	7	0	£17157-	736R£	0£	0	3	
0	£23827-	7	0	£	0£	0	0	£44911-	6	0	£34044-	6	0	£47472-	7	0	£19619-	7	4
0	£20284-	7357£	0£	0	0	£85498-	8	0	£	0£	0	0	£43088-	6	0	£35587-	6	5	
0	£51641-	7	0	£16980-	7	0	£19426-	7	0	£17693-	734R£	0£	0	0	£29396-	8	6		
0	£	0£	0	0	£33660-	6	0	£27912-	6	0	£61327-	7	0	£72997-	8	0	£14358-	7	7
0	£14971-	7	0	£12485-	733R£	0£	0	0	£58850-	9	0	£	0£	0	0	£31251-	6	8	
0	£24991-	6	0	£50809-	7	0	£23660-	9	0	£76753-	8	0	£99221-	8	0	£97008-	8	9	
0	£76146-	832R£	0£	0	0	£43082-	9	0	£	0£	0	0	£38663-	6	0	£33223-	6	10	
0	£54519-	7	0	£37390-	8	0	£11386-	8	0	£92507-	8	0	£69873-	8	0	£65159-	8	11	
0	£48937-	831R£	0£	0	0	£52068-	9	0	£	0£	0	0	£33276-	6	0	£29569-	6	12	
0	£46131-	7	0	£70996-	8	0	£	0£	0	0	£12926-	8	0	£50952-	8	0	£32254-	8	13
0	£29055-	8	0	£21130-	830R£	0£	0	0	£64514-	9	0	£	0£	0	0	£37816-	6	14	
0	£33489-	6	0	£36261-	7	0	£51813-	8	2P£	0£	0	0	£98112-	9	0	£22712-	8	15	
0	£13629-	8	0	£12018-	8	0	£85699-	929R£	0£	0	0	£80873-	9	0	£	0£	0	16	
0	£35017-	6	0	£31043-	6	0	£42626-	7	0	£	0£	0	£20906-	8	2R£	0£	0	17	
0	£61625-	9	0	£10453-	8	0	£54548-	9	0	£47452-	9	0	£33453-	928R£	0£	0	18		

0	£12857-	8	0	£	0£	0	0	£59018-	6	0	£56566-	6	0	£38935-	7	0	£	0£	0	19
0	£23198-	9	0	£56999-	9	2R£	0£	0	0	£68833-	9	0	£47072-	9	0	£29997-	9			20
0	£25867-	9	0	£18066-	9	27R£	0£	0	0	£11600-	8	0	£	0£	0	0	£38824-	6		21
0	£36488-	6	0	£23230-	7	2R£	0£	0	0	£48380-	10	3R£	0£	0	0	£15423-	9			22
0	£77749-	10	0	£35959-	10	0	£30784-	10	0	£21356-	10	26R£	0£	0	0	£60467-	8			23
0	£	0£	0	0	£21321-	5	0	£14654-	5	0	£22210-	7	3R£	0£	0	0	£67822-	11		24
3R£	0£	0	0	0	£27085-	10	0	£15065-	10	0	£30002-	11	0	£25620-	11	0	£17738-	11		25
25R£	0£	0	0	0	£23957-	8	0	£	0£	0	0	£22983-	5	0	£22836-	5	0	£66065-	6	26
4R£	0£	0	0	0	£14454-	11	3R£	0£	0	0	£52011-	11	0	£26685-	11	0	£25628-	12		27
0	£21837-	12	0	£14977-	12	24R£	0£	0	0	£18097-	8	0	£	0£	0	0	£28285-	6		28
0	£26859-	6	0	£12261-	7	5R£	0£	0	0	£16767-	12	3R£	0£	0	0	£64928-	12			29
0	£42816-	12	0	£70950-	14	0	£42911-	14	0	£26187-	14	23R£	0£	0	0	£37457-	8			30
0	£	0£	0	0	£30484-	6	0	£28875-	6	0	£12443-	7	6R£	0£	0	0	£16523-	13		31
3R£	0£	0	0	0	£69417-	13	0	£46304-	13	25R£	0£	0	0	£78964-	8	0	£	0£	0	32
0	£31438-	6	0	£29470-	6	0	£12349-	7	7R£	0£	0	0	£30708-	14	3R£	0£	0			33
0	£14068-	14	0	£10227-	13	24R£	0£	0	0	£16957-	7	0	£	0£	0	0	£32876-	6		34
0	£29854-	6	0	£11781-	7	8R£	0£	0	0	£68518-	15	3R£	0£	0	0	£22360-	15			35
0	£10537-	14	23R£	0£	0	0	£35312-	7	0	£	0£	0	0	£34875-	6	0	£30142-	6		36
0	£13265-	7	9R£	0£	0	0	£15289-	15	27R£	0£	0	0	£17967-	6	0	£	0£	0		37
0	£47888-	6	0	£29920-	6	0	£12020-	7	10R£	0£	0	0	£14500-	16	26R£	0£	0			38
0	£12814-	5	0	£	0£	0	0	£18867-	6	0	££2722-	8	0	£19309-	9	0	£37817-	10		39
0	£18127-	10	0	£84628-	11	0	£40176-	11	0	£19072-	11	0	£11778-	11	0	£70934-	11			40
0	£12961-	11	0	£14559-	11	0	£90550-	12	0	£73727-	12	0	£60903-	12	0	£47234-	12			41
0	£38169-	12	0	£32495-	12	0	£27684-	12	0	£23485-	12	0	£20251-	12	0	£17435-	12			42
0	£14834-	12	17R£	0£	0	0	£10573-	5	0	£	0£	0	0	£19448-	6	0	£46179-	8		43
0	£68248-	8	0	£76914-	8	0	£15064-	8	0	£72203-	9	0	£33711-	9	0	£16003-	9			44
0	£75969-	10	0	£46916-	10	0	£28255-	9	0	£51629-	10	0	£57991-	10	0	£36068-	10			45
0	£29369-	10	0	£24259-	10	0	£18815-	10	0	£15204-	10	0	£12944-	10	0	£11028-	10			46
0	£93549-	11	0	£80669-	11	0	£69447-	11	0	£59090-	11	16R£	0£	0	0	£91463-	6			47
0	£	0£	0	0	£20078-	6	0	£61100-	8	0	£96937-	8	0	£69970-	8	0	£85136-	8		48
0	£16924-	8	0	£81774-	9	0	£37754-	9	0	£17862-	9	0	£91263-	10	0	£31836-	9			49
0	£19920-	9	0	£47714-	10	0	£50048-	10	0	£32986-	10	0	£24121-	10	0	£17417-	10			50
0	£14004-	10	0	£10799-	10	0	£90557-	11	0	£77366-	11	0	£66245-	11	0	£59401-	11			51
0	£55677-	11	0	£55977-	11	15R£	0£	0	0	£77990-	6	0	£	0£	0	0	£21059-	6		52
0	£84627-	8	0	£12932-	7	0	£99283-	8	0	£73731-	8	0	£46309-	7	0	£90768-	8			53
0	£43527-	8	0	£20310-	8	0	£96400-	9	0	£45950-	9	0	£36046-	9	0	£16680-	8			54
0	£30809-	9	0	£34502-	9	0	£21514-	9	0	£17437-	9	0	£14330-	9	0	£11128-	9			55
0	£89775-	10	0	£76391-	10	0	£65086-	10	0	£55232-	10	0	£47695-	10	0	£41194-	10			56
0	£35301-	10	14R£	0£	0	0	£64897-	6	0	£	0£	0	0	£22503-	6	0	£12494-	7		57
0	£18118-	7	0	£13376-	7	0	£10562-	7	0	£80917-	8	0	£31855-	7	0	£62485-	8			58
0	£29975-	8	0	£13978-	8	0	£66337-	9	0	£31736-	9	0	£29542-	9	0	£11272-	8			59
0	£21025-	9	0	£23482-	9	0	£14675-	9	0	£11845-	9	0	£96896-	10	0	£75336-	10			60
0	£60681-	10	0	£51610-	10	0	£43976-	10	0	£37329-	10	0	£32277-	10	0	£27959-	10			61
0	£24116-	10	13R£	0£	0	0	£55284-	6	0	£	0£	0	0	£24019-	6	0	£92086-	8		62
0	£13507-	7	0	£93270-	8	0	£70926-	8	0	£57307-	8	0	£44961-	8	0	£34019-	7			63
0	£67070-	8	0	£32264-	8	0	£14988-	8	0	£71045-	9	0	£34874-	9	0	£68019-	9			64
0	£10483-	8	0	£21162-	9	0	£23140-	9	0	£14722-	9	0	£11502-	9	0	£90557-	10			65
0	£71114-	10	0	£56549-	10	0	£47898-	10	0	£40844-	10	0	£34758-	10	0	£30376-	10			66
0	£26957-	10	0	£24462-	10	12R£	0£	0	0	£48970-	6	0	£	0£	0	0	£25428-	6		67
0	£12172-	7	0	£19191-	7	0	£13715-	7	0	£97517-	8	0	£75778-	8	0	£62210-	8			68
0	£49594-	8	0	£22027-	7	0	£43338-	8	0	£20825-	8	0	£96890-	9	0	£45949-	9			69
0	£22324-	9	0	£34491-	9	0	£71946-	9	0	£14041-	9	0	£15491-	9	0	£97817-	10			70
0	£77480-	10	0	£62020-	10	0	£48492-	10	0	£38777-	10	0	£32905-	10	0	£28050-	10			71
0	£23844-	10	0	£20741-	10	0	£18214-	10	0	£16178-	10	11R£	0£	0	0	£42739-	6			72
0	£	0£	0	0	£27320-	6	0	£16833-	7	0	£25508-	7	0	£19397-	7	0	£14290-	7		73
0	£10490-	7	0	£83369-	8	0	£69538-	8	0	£56298-	8	0	£31690-	7	0	£62621-	8			74

0	£30160-	8	0	£13987-	8	0	£66266-	9	0	£32891-	9	0	£78334-	9	0	£91273-	9	75	
0	£19183-	9	0	£20762-	9	0	£13325-	9	0	£10243-	9	0	£79058-	10	0	£62414-	10	76	
0	£49291-	10	0	£41658-	10	0	£35538-	10	0	£30284-	10	0	£26618-	10	0	£23921-	10	77	
0	£22258-	10	10RE	0£	0	0	£36574-	6	0	£	0£	0	£30021-	6	0	£24785-	7	78	
0	£35529-	7	0	£25899-	7	0	£20305-	7	0	£15483-	7	0	£11760-	7	0	£95585-	8	79	
0	£80956-	8	0	£66491-	8	0	£52366-	7	0	£10286-	7	0	£49378-	8	0	£23004-	8	80	
0	£10913-	8	0	£52573-	9	0	£63524-	9	0	£17891-	8	0	£34033-	9	0	£37807-	9	81	
0	£23734-	9	0	£19001-	9	0	£15399-	9	0	£12001-	9	0	£96363-	10	0	£81879-	10	82	
0	£69781-	10	0	£59270-	10	0	£51379-	10	0	£44770-	10	0	£39113-	10	9RE	0£	0	83	
0	£30898-	6	0	£	0£	0	£33492-	6	0	£30856-	7	0	£42246-	7	0	£28916-	7	84	
0	£21950-	7	0	£17765-	7	0	£14007-	7	0	£10971-	7	0	£90900-	8	0	£77961-	8	85	
0	£64768-	8	0	£30849-	7	0	£60580-	8	0	£29079-	8	0	£13545-	8	0	£64282-	9	86	
0	£30933-	9	0	£35999-	9	0	£10600-	8	0	£20099-	9	0	£22347-	9	0	£14019-	9	87	
0	£11238-	9	0	£91212-	10	0	£71064-	10	0	£57092-	10	0	£48517-	10	0	£41347-	10	88	
0	£35115-	10	0	£30428-	10	0	£26487-	10	0	£23092-	10	8RE	0£	0	0	£25393-	6	89	
0	£	0£	0	£37986-	6	0	£49717-	7	0	£65018-	7	0	£42933-	7	0	£31132-	7	90	
0	£24655-	7	0	£20577-	7	0	£16721-	7	0	£13440-	7	0	£11308-	7	0	£97926-	8	91	
0	£82050-	8	0	£23098-	7	0	£45431-	8	0	£21827-	8	0	£10158-	8	0	£48173-	9	92	
0	£23370-	9	0	£34753-	9	0	£76043-	9	0	£14773-	9	0	£16318-	9	0	£10293-	9	93	
0	£81689-	10	0	£65533-	10	0	£51210-	10	0	£40981-	10	0	£34782-	10	0	£29649-	10	94	
0	£25200-	10	0	£21907-	10	0	£19211-	10	0	£17013-	10	7RE	0£	0	0	£20177-	6	95	
0	£	0£	0	£43939-	6	0	£65570-	7	0	£79259-	7	0	£49308-	7	0	£35157-	7	96	
0	£27059-	7	0	£22284-	7	0	£19091-	7	0	£15890-	7	0	£13021-	7	0	£11074-	7	97	
0	£96531-	8	0	£81329-	8	0	£11923-	7	0	£23352-	8	0	£11193-	8	0	£52258-	9	98	
0	£24809-	9	0	£11777-	9	0	£72729-	10	0	£43801-	9	0	£80036-	10	0	£89901-	10	99	
0	£55914-	10	0	£45527-	10	0	£37607-	10	0	£29187-	10	0	£23569-	10	0	£20066-	10	100	
0	£17095-	10	0	£14502-	10	0	£12505-	10	0	£10766-	10	0	£91602-	11	6RE	0£	0	101	
0	£14963-	6	0	£	0£	0	£51754-	6	0	£12124-	6	0	£13456-	6	0	£79870-	7	102	
0	£55848-	7	0	£43116-	7	0	£34964-	7	0	£29682-	7	0	£25905-	7	0	£21904-	7	103	
0	£18159-	7	0	£15536-	7	0	£13587-	7	0	£11475-	7	0	£66326-	7	0	£13045-	7	104	
0	£62667-	8	0	£29165-	8	0	£13832-	8	0	£67069-	9	0	£98294-	9	0	£21900-	8	105	
0	£42474-	9	0	£46939-	9	0	£29597-	9	0	£23505-	9	0	£18872-	9	0	£14744-	9	106	
0	£11802-	9	0	£10018-	9	0	£85392-	10	0	£72574-	10	0	£63076-	10	0	£55288-	10	107	
0	£48909-	10	5RE	0£	0	0	£10439-	6	0	£	0£	0	£62051-	6	0	£17471-	6	108	
0	£16560-	6	0	£91086-	7	0	£65724-	7	0	£58793-	7	0	£59088-	7	0	£64068-	7	109	
0	£72061-	7	0	£80720-	7	0	£93525-	7	0	£10864-	6	0	£12232-	6	0	£13593-	6	110	
0	£15435-	6	0	£19592-	7	0	£39313-	8	0	£19090-	8	0	£87526-	9	0	£41321-	9	111	
0	£22056-	9	0	£11242-	8	0	£29155-	9	0	£95938-	10	0	£94393-	10	0	£65714-	10	112	
0	£43183-	10	0	£26212-	10	0	£22201-	10	0	£15989-	10	0	£13092-	10	0	£11235-	10	113	
0	£97626-	11	0	£92766-	11	0	£96982-	11	0	£11496-	10	4RE	0£	0	0	£57671-	7	114	
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0	£10577-	6	0	£79260-	7	0	£61825-	7	0	£49516-	7	0	£41259-	7	0	£35343-	7	116	
0	£29172-	7	0	£23549-	7	0	£19739-	7	0	£16988-	7	0	£14096-	7	0	£14642-	8	117	
0	£28678-	9	0	£13746-	9	0	£64176-	10	0	£30466-	10	0	£14462-	10	0	£89314-	11	118	
0	£53791-	10	0	£98293-	11	0	£11040-	10	0	£68665-	11	0	£55910-	11	0	£46184-	11	119	
0	£35818-	11	0	£28945-	11	0	£24642-	11	0	£20994-	11	0	£17809-	11	0	£15358-	11	120	
0	£13221-	11	0	£11249-	11	3RE	0£	0	0	£41996-	7	0	£	0£	0	£10219-	5	121	
0	£55976-	6	0	£37290-	6	0	£11691-	6	0	£38038-	7	0	£65016-	8	11RE	0£	0	122	
0	£26067-	8	0	£51053-	9	0	£24471-	9	0	£11425-	9	0	£54237-	10	0	£25747-	10	123	
0	£15900-	10	0	£95758-	10	0	£17499-	10	0	£19654-	10	0	£12224-	10	0	£99529-	11	124	
0	£82219-	11	0	£63766-	11	0	£51529-	11	0	£43869-	11	0	£37373-	11	0	£31704-	11	125	
0	£27340-	11	0	£23537-	11	0	£20026-	11	2RE	0£	0	0	£67264-	7	0	£	0£	0	126
0	£16340-	5	0	£82710-	6	0	£36066-	6	0	£26591-	8	14RE	0£	0	0	£93838-	8	127	
0	£18988-	8	0	£92605-	9	0	£42201-	9	0	£19884-	9	0	£11018-	9	0	£70706-	9	128	
0	£67764-	10	0	£39979-	10	0	£36257-	10	0	£27083-	10	0	£15374-	10	0	£65806-	11	129	
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0 -60965- 7	0 -13941- 6	0 -13371- 6	0 -11048- 6	0 -91599- 7	0 -76558- 7	38
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0	£61412-	5	0	£44656-	5	0	£98363-	6	0	£21927-	6	0	£48301-	7	0	£11504-	7	42	
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0	£33485-	8	0	£51279-	9	0	£28957-	9	0	£13987-	9	0	£60612-10	0	£27631-10	58			
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28R£	0£	0	0	£20927-	6	0	£	0£	0	0	£45574-	6	0	£68009-	7	0	£82204-	7	78
0	£51142-	7	0	£36465-	7	0	£28065-	7	0	£23113-	7	0	£19801-	7	0	£16481-	7	79	
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0 £16556-	5 0	£47376-	6 0	-42179-	7 0	-10486-	6 0	-84039-	7 0	-52965-	7	11	
0 -30074-	731R£	0£	0 0	-45608-	5 0	£	0£	0 0	£75446-	6 0	£31181-	5	12
0 £20139-	5 0	£28171-	6 0	-10324-	6 0	-14091-	6 0	-10468-	6 0	-65645-	7	13	
0 -37272-	7 0	-20020-	730R£	0£	0 0	-58128-	5 0	£	0£	0 0	£24815-	5	14
0 £49064-	5 0	£26328-	5 0	£26108-	6 0	-16924-	6 0	-17883-	6 0	-12790-	6	15	
0 -78595-	7 0	-45217-	7 0	-24500-	7 0	-12797-	729R£	0£	0 0	-71694-	5	16	
0 £	0£	0 0	£72665-	6 0	£49295-	5 0	£33198-	5 0	£35136-	6 0	-22950-	6	17
0 -22002-	6 0	-15122-	6 0	-93183-	7 0	-53230-	7 0	-29412-	7 0	-15557-	7	18	
0 -80030-	828R£	0£	0 0	-95124-	5 0	£	0£	0 0	£58875-	6 0	£95297-	5	19
0 £45258-	5 0	-62756-	7 0	-72060-	6 0	-52834-	6 0	-31870-	6 0	-18918-	6	20	
0 -10812-	6 0	-59118-	7 0	-31810-	7 0	-16547-	7 0	-84198-	827R£	0£	0	21	
0 -12093-	4 0	£	0£	0 0	£59782-	6 0	£12576-	4 0	£23602-	5 0	-12970-	5	22
0 -90505-	6 0	-50835-	6 0	-25964-	6 0	-13608-	6 0	-75587-	7 0	-41499-	7	23	
0 -22118-	7 0	-11708-	7 0	-60251-	8 0	-30439-	826R£	0£	0 0	-13271-	4	24	
0 £	0£	0 0	£64215-	6 0	£14041-	4 0	£23967-	5 0	-14900-	5 0	-65420-	6	25
0 -34349-	6 0	-17001-	6 0	-81311-	7 0	-41177-	7 0	-22454-	7 0	-12181-	7	26	
0 -64408-	8 0	-33913-	8 0	-17352-	8 0	-87657-	925R£	0£	0 0	-13593-	4	27	
0 £	0£	0 0	£73076-	6 0	£14848-	4 0	£18744-	5 0	-20333-	5 0	-66233-	6	28
0 -22983-	6 0	-11483-	6 0	-55258-	7 0	-25997-	7 0	-13045-	7 0	-70770-	8	29	
0 -38264-	8 0	-20186-	8 0	-10613-	8 0	-54373-	9 0	-27386-	924R£	0£	0	30	
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0 £	0£	0 0	£20135-	5 0	£15530-	4 0	£11621-	5 0	-18461-	5 0	-51112-	6	38

0 -12723- 6 0 -34027- 7 0 -81707- 8 0 -26591- 8 0 -13071- 8 0 -62296- 9	39
0 -29139- 9 0 -14574- 9 0 -78519-10 0 -42616-10 0 -22463-10 0 -11804-10	40
0 -60454-11 0 -30440-1121R£ 0£ 0 0 -14283- 4 0 £ 0£ 0 0 £35671- 5	41
0 £15500- 4 0 £10261- 5 0 -18523- 5 0 -51778- 6 0 -11926- 6 0 -28678- 7	42
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0 -32520-10 0 -17610-10 0 -95091-11 0 -50124-11 0 -26338-11 0 -13489-11	44
0 -67922-1220R£ 0£ 0 0 -14652- 4 0 £ 0£ 0 0 £67747- 5 0 £16151- 4	45
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21R£ 0£ 0 0 £32129- 741R£ 0£ 0 0 £23737- 7 0 £34256- 740R£ 0£ 0	53
0 £31313- 7 0 £48720- 7 0 £33985- 739R£ 0£ 0 0 £43167- 7 0 £64245- 7	54
0 £47705- 7 0 £34196- 738R£ 0£ 0 0 £63210- 7 0 £88279- 7 0 £62195- 7	55
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0 £84447- 7 0 £12130- 6 0 £86021- 7 0 £58754- 7 0 £39933- 7 0 £30029- 7	59
0 £24024- 7 0 £18596- 734R£ 0£ 0 0 £12232- 6 0 £16231- 6 0 £10711- 6	60
0 £77747- 7 0 £54478- 7 0 £37954- 7 0 £28981- 7 0 £23410- 7 0 £18267- 7	61
33R£ 0£ 0 0 £15041- 6 0 £18408- 6 0 £10811- 5 0 £73147- 7 0 £54094- 7	62
0 £38576- 7 0 £27236- 7 0 £20911- 7 0 £16917- 7 0 £13183- 732R£ 0£ 0	63
0 £23269- 6 0 £26031- 6 0 £13706- 6 0 £81799- 7 0 £55667- 7 0 £41095- 7	64
0 £28990- 7 0 £20021- 7 0 £14999- 7 0 £11845- 7 0 £89382- 831R£ 0£ 0	65
0 £29647- 6 0 £27710- 6 0 £11620- 6 0 £58257- 7 0 £31831- 7 0 £19262- 7	66
0 £12327- 7 0 £67596- 8 0 £29056- 8 0 £57979- 9 0 -73974-10 0 -86432- 9	67
30R£ 0£ 0 0 £47890- 6 0 £34421- 6 0 £83968- 7 0 £98728- 8 0 -14749- 7	68
0 -24012- 7 0 -26867- 7 0 -27337- 7 0 -26371- 7 0 -24290- 7 0 -22142- 7	69
0 -20203- 7 0 -17783- 729R£ 0£ 0 0 £60005- 6 0 £19396- 6 0 -78682- 7	70
0 -10716- 6 0 -10280- 6 0 -91772- 7 0 -80313- 7 0 -70826- 7 0 -63115- 7	71
0 -54200- 7 0 -45364- 7 0 -38951- 7 0 -34102- 7 0 -28796- 728R£ 0£ 0	72
0 £61911- 6 0 -23686- 6 0 -29513- 6 0 -12136- 6 0 -44879- 7 0 -19632- 7	73
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0 £11549- 739R£ 0£ 0 0 £64958- 6 0 £10515- 637R£ 0£ 0	77
0 -26079-11 0 £ 0£ 0 0 £88310- 6 0 £14604- 538R£ 0£ 0 0 -34560-11	1
0 £ 0£ 0 0 £10291- 5 0 £17397- 5 0 £41307- 637R£ 0£ 0 0 -46720-11	2
0 £ 0£ 0 0 £12127- 5 0 £17287- 5 0 £47123- 6 0 -99326- 736R£ 0£ 0	3
0 -59068-11 0 £ 0£ 0 0 £11384- 5 0 £14499- 5 0 £56238- 6 0 -14886- 6	4
0 -16238- 635R£ 0£ 0 0 -74570-11 0 £ 0£ 0 0 £97808- 6 0 £13970- 5	5
0 £52284- 6 0 -30155- 6 0 -21997- 6 0 -12869- 634R£ 0£ 0 0 -97643-11	6
0 £ 0£ 0 0 £89198- 6 0 £15672- 5 0 £70244- 6 0 -39192- 6 0 -29214- 6	7
0 -17159- 6 0 -85188- 733R£ 0£ 0 0 -12810-10 0 £ 0£ 0 0 £83225- 6	8
0 -52107- 732R£ 0£ 0 0 -17341-10 0 £ 0£ 0 0 £69370- 6 0 £26066- 5	9
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0 -10247- 6 0 -46517- 7 0 -20317- 7 0 -86502- 829R£ 0£ 0 0 -12357- 9	16
0 £ 0£ 0 0 £72665- 6 0 £53047- 5 0 £11492- 5 0 -15477- 5 0 -97307- 6	17

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0 & 0& 0 0	£64215-	6 0	£10926-	4 0	-60500-	5 0	-26273-	5 0	-64259-	6		25
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0 & 0& 0 0	£73076-	6 0	£10447-	4 0	-79811-	5 0	-33088-	5 0	-51514-	6		28
0 -11133-	6 0	-43019-	7 0	-16069-	7 C	-58788-	8 0	-23447-	8 0	-10425-	8	29
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21R& 0& 0 0	£44427-	741R& 0& 0 0	£32934-	7 0	£46395-	740R& 0& 0						53
0 £43317-	7 0	£66076-	7 0	£44466-	739R& 0& 0 0	£59436-	7 0	£86101-	7			54
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0 £34986-	7 0	£26011-	7 0	£18624-	736R& 0& 0 0	£84256-	7 0	£12258-	6			57
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33R& 0& 0 0	£19773-	6 0	£21346-	6 0	£10171-	6 0	£56490-	7 0	£34441-	7		62
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0 668121-	7 0 656583-	7 0 647811-	7 0 641133-	7 0 633907-	7 0 627194-	7	74
0 622616-	7 0 619316-	7 0 615871-	727R6	06 0 0 623626-	6 0 614183-	8	75
0 622753-	7 0 -93816-	7 0 -35820-	737R6	06 0 0 617821-	6 0 -75710-	7	76
0 -13434-	739R6	06 0 0 654964-	7 0 -67850-	737R6	06 0		77

1 -1 1.0

2 -2 1.0

NEUTRON SHIELD ANALYSIS

1 0 0 0 0 1 1 1

0.0 105.262 -238.104

FAST NEUTRON FLUENCE (E.GT.0.1MEV)

FAST NEUTRON RESPONSE

1.0 1.0 1.0 1.0 1.0 1.0 1.0

1.0 1.0 1.0 1.0 1.0

BLANK CARD

DOMINO SAMPLE PROBLEM
THIS CASE WAS BEGUN ON MONDAY, APRIL 30, 1973

NSTRT	NMOST	NITS	NOUIT	NGPOTN	NGPOTG	NMGP	NMTG	NCOLTP	IADJM	MAXTIM	MEDIA	MEDALR
100	150	50	1	12	0	21	21	0	0	0.50	2	0
ISOUR	NGPFS	ISBIAS		WTSTRT		EROTN		FBOTG		TCUT		VFLTH
0	0	0		1.0000E 00	0.0		0.0	0.0				2.2000E 05
	XSTRT	YSTRT		ZSTRT		AGSTRT		UINP		VINP		WINP
	0.0	0.0		0.0		0.0		0.0		0.0		0.0

GROUP PARAMETERS. GROUP NUMBERS GREATER THAN 21 CORRESPOND TO SECONDARY PARTICLES

GROUP	UPPER EDGE (EV)	VELOCITY (CM/SEC)
1	1.0000E 00	1.3830E 06
2	1.0000E 00	1.3830E 06
3	1.0000E 00	1.3830E 06
4	1.0000E 00	1.3830E 06
5	1.0000E 00	1.3830E 06
6	1.0000E 00	1.3830E 06
7	1.0000E 00	1.3830E 06
8	1.0000E 00	1.3830E 06
9	1.0000E 00	1.3830E 06
10	1.0000E 00	1.3830E 06
11	1.0000E 00	1.3830E 06
12	1.0000E 00	1.3830E 06
13	1.0000E 00	1.3830E 06
14	1.0000E 00	1.3830E 06
15	1.0000E 00	1.3830E 06
16	1.0000E 00	1.3830E 06
17	1.0000E 00	1.3830E 06
18	1.0000E 00	1.3830E 06
19	1.0000E 00	1.3830E 06
20	1.0000E 00	1.3830E 06
21	1.0000E 00	2.2000E 05

INITIAL RANDOM NUMBER = 3870858251F9

NSPLT= 1 NKILL= 1 NPAST= 1 NLEAK= 0 IEBIAS= 0 MXREG= 1 MAXGP= 12

WEIGHT STANDARDS FOR SPLITTING AND RUSSIAN POULETTE AND PATHLENGTH STRETCHING PARAMETERS

NGP1	NDG	NGP2	NRG1	NORG	NRG2	WTHIHL	WTHLWL	WTAVEL	XMU
0	0	0	0	0	0	1.0000E 01	1.0000E-01	1.0000E 00	0.5000E 00
NSOUR= 0		MFISTP= 0		NKCALC= 0		NORMF= 0			

DOMINO SAMPLE PROBLEM

ILOPT = 0

IDBG = 0

BODY DATA

RCC	1	0.2089200D 02	-0.3256000D C1	-0.8500000D 00	-0.4482300D 01	-0.2188500D 02	-0.5090200D 02	3
		0.3010000D 01						
RCC	2	-0.2089200D 02	-0.3256000D C1	-0.8500000D 00	0.4482300D 01	-0.2188500D 02	-0.5090200D 02	12
		0.3010000D 01						
RCC	3	-0.2089200D 02	0.3256000D C1	-0.8500000D 00	0.4482300D 01	0.2188500D 02	-0.5090200D 02	21
		0.3010000D 01						
RCC	4	0.2089200D 02	0.3256000D 01	-0.8500000D 00	-0.4482300D 01	0.2188500D 02	-0.5090200D 02	30
		0.3010000D 01						
SPH	5	0.0	0.0	-0.4309700D 02	0.4508500D 02	0.0	0.0	39
SPH	6	0.0	0.0	-0.2058600D 02	0.3708400D 02	0.0	0.0	47
TRC	7	0.0	0.0	-0.5867000D 02	0.0	0.0	0.6000000D 02	55
		0.3225400D 02	0.2348200D 02					
RPP	8	-0.1000000D 03	0.1001000D 03	-0.1500000D 03	0.1000000D 03	-0.2500000D 03	0.2000000D 01	65
END	9	0.0	0.0	0.0	0.0	0.0	0.0	73

NUMBER OF BODIES 8
LENGTH OF FPC-ARRAY 78

INPUT ZONE DATA

EXV	2000R	8	-70R	7	-6	0	0	0	0	0	7	1
NAK	00R	1	5	60R	2	5	60R	3	5	6	7	3
	00R	4	5	6	0	0	0	0	0	0	7	6
LIN	0	7	5	6	-1	-2	-3	-4	0	0	7	7
INV	0	7	-5	0	0	0	0	0	0	0	7	8
END	0	0	0	0	0	0	0	0	0	0	7	9

NUMBER OF INPUT ZONES 4
NUMBER OF CODE ZONES 8
LENGTH OF INTEGER ARRAY 595

CODE ZONE	INPUT ZONE	ZONE DATA LOC.	NO. OF BODIES	REGION NO.	MEDIA NO.
1	1	57	2	1	0
2	1	66	2	1	0
3	2	75	3	1	1
4	2	88	3	1	1
5	2	101	3	1	1
6	2	114	3	1	1
7	3	127	7	1	2
8	4	156	2	1	1000

I	KR1(I)	KR2(I)
1	1	2
2	3	6
3	7	7
4	8	8

MORSE REGION IN INPUT ZONE(I) ARRAY MP1Z(I),I=1, 4)

1 1 1 1

MORSE MEDIA IN INPUT ZONE(I) ARRAY MM1Z(I),I=1, 4)

0 1 21000

OPTION 0 WAS USED IN CALCULATING VOLUMES, FOR 1 REGIONS
0-SET VOLUMES = 1, 1-CONCENTRIC SPHERES, 2-SLABS, 3-INPUTVOLUMES.

VOLUMES (CM**3) USED IN COLLISIONS DENSITY AND TRACK LENGTH ESTIMATORS.
REG 1
VOLUME 1.0000 00
NGEOM= 584. NGLAST= 1402

NAK.LIH P3.39G XSEC

NUMBER OF PRIMARY GROUPS (NGP)	21
NUMBER OF PRIMARY DOWNSCATTERS (NDS)	21
NUMBER OF SECONDARY GROUPS (NGG)	0
NUMBER OF SECONDARY DOWNSCATTERS (NDSG)	0
NUMBER OF PRIM+SEC GROUPS (INGP)	39
TABLE LENGTH (ITBL)	42
LOC OF WITHIN GROUP (SIG GG) (ISGG)	4
NUMBER OF MEDIA (NMED)	2
NUMBER OF INPUT ELEMENTS (NELEM)	2
NUMBER OF MIXING ENTRIES (NMIX)	2
NUMBER OF COEFFICIENTS (NCOEF)	4
NUMBER OF ANGLES (NSCT)	2
RESTORE COEFF (ISYAT)	1
ADJOINT SWITCH (FROM MORSE)	0

INPUT/OUTPUT OPTIONS

IRDSG (AS READ)	0
ISTR (AS STORE)	0
IFMU (MUS)	0
IMOM (MOMENTS)	0
IPRIN (ANGLES,PROB)	0
IPUN (IMPOSSIBLE COEF)	0
CARD FORMAT (IDTF)	0
INPUT TAPE (IXTAPE)	0
MORSEC TAPE (JXTAPE)	0
OCR TAPE (IOGRT)	0

STORAGE ALLOCATIONS

CROSS SECTIONS START AT	1403
LAST LOCATION USED (PERM)	5399
TEMP LOCATIONS USED	7648 TO 10000
EXCESS STORAGE (TEMP)	3635
START OF LEGENDRE COEFF	4013

MIXING TABLE

MEDIA	1	CONTAINS ELEMENT	1	WITH DENSITY	1.0000E 00
-------	---	------------------	---	--------------	------------

MEDIA	2	CONTAINS ELEMENT	2	WITH DENSITY	1.0000E 00
-------	---	------------------	---	--------------	------------

GROUP	CROSS SECTIONS FOR MEDIA						DOWNSCATTER PROBABILITY							
	SIGT	SIGST	PNUP	PNABS	GAMGEN	NUMPIS								
1	2.776E-02	2.185E-02	0.0	0.7870	0.0	0.0	0.5208	0.0964	0.0785	0.0928	0.0810	0.0571	0.0348	0.0224
							0.0097	0.0039	0.0015	0.0008	0.0001	0.0000	0.0000	0.0000
							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	3.203E-02	2.682E-02	0.0	0.8374	0.0	0.0	0.6180	0.1020	0.0731	0.0724	0.0538	0.0362	0.0243	0.0108
							0.0045	0.0018	0.0010	0.0001	0.0000	0.0000	0.0000	0.0
							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	3.952E-02	3.553E-02	0.0	0.8990	0.0	0.0	0.7152	0.1336	0.0478	0.0404	0.0279	0.0197	0.0091	0.0038
							0.0015	0.0008	0.0001	0.0000	0.0000	0.0000	0.0	0.0
							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	4.491E-02	4.253E-02	0.0	0.9470	0.0	0.0	0.9005	0.1214	0.0172	0.0190	0.0218	0.0120	0.0053	0.0025
							0.0011	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	4.309E-02	4.223E-02	0.0	0.9802	0.0	0.0	0.8426	0.1452	0.0006	0.0027	0.0031	0.0023	0.0015	0.0014
							0.0004	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0
							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	3.346E-02	3.337E-02	0.0	0.9913	0.0	0.0	0.8365	0.1523	0.0112	0.0	0.0	0.0	0.0	0.0
							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	3.125E-02	3.115E-02	0.0	0.9969	0.0	0.0	0.8022	0.1750	0.0228	0.0	0.0	0.0	0.0	0.0
							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	3.846E-02	3.842E-02	0.0	0.9989	0.0	0.0	0.9402	0.1194	0.0134	0.0054	0.0015	0.0	0.0	0.0
							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	3.328E-02	3.322E-02	0.0	0.9984	0.0	0.0	0.8900	0.1091	0.0	0.0007	0.0001	0.0000	0.0000	0.0000
							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	3.782E-02	3.775E-02	0.0	0.9983	0.0	0.0	0.8871	0.1129	0.0	0.0	0.0	0.0	0.0	0.0
							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11	3.502E-02	3.494E-02	0.0	0.9977	0.0	0.0	0.8886	0.1114	0.0	0.0	0.0	0.0	0.0	0.0
							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12	3.902E-02	3.889E-02	0.0	0.9978	0.0	0.0	0.9406	0.0394	0.0	0.0	0.0	0.0	0.0	0.0
							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13	3.882E-02	3.871E-02	0.0	0.9970	0.0	0.0	0.9426	0.0374	0.0	0.0	0.0	0.0	0.0	0.0
							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14	2.132E-01	2.126E-01	0.0	0.9972	0.0	0.0	0.6893	0.3107	0.0	0.0	0.0	0.0	0.0	0.0
15	2.298E-01	2.296E-01	0.0	0.9969	0.0	0.0	0.9947	0.0053	0.0	0.0	0.0	0.0	0.0	0.0
16	2.828E-02	2.810E-02	0.0	0.9936	0.0	0.0	0.9557	0.0443	0.0	0.0	0.0	0.0	0.0	0.0
17	3.048E-02	3.011E-02	0.0	0.9877	0.0	0.0	0.9590	0.0410	0.0	0.0	0.0	0.0	0.0	0.0
18	3.144E-02	3.043E-02	0.0	0.9749	0.0	0.0	0.9616	0.0384	0.0	0.0	0.0	0.0	0.0	0.0
19	3.288E-02	3.118E-02	0.0	0.9484	0.0	0.0	0.9575	0.0425	0.0	0.0	0.0	0.0	0.0	0.0
20	3.487E-02	3.134E-02	0.0	0.8988	0.0	0.0	0.9617	0.0383	0.0	0.0	0.0	0.0	0.0	0.0
21	4.789E-02	2.992E-02	0.0	0.6248	0.0	0.0	1.0000							

CROSS SECTIONS FOR MEDIA 2							DOWNSCATTER PROBABILITY							
GROUP	SIGT	SIGST	PNUP	PNABS	GAMGEN	NUFIS								
1	1.349E-01	1.358E-01	0.0	1.0064	0.0	0.0	0.3153	0.2984	0.1069	0.0927	0.0665	0.0438	0.0281	0.0209
							0.0118	0.0045	0.0038	0.0037	0.0012	0.0003	0.0001	0.0000
							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	1.646E-01	1.646E-01	0.0	1.0030	0.0	0.0	0.3150	0.3113	0.1167	0.0878	0.0584	0.0376	0.0297	0.0177
							0.0105	0.0041	0.0062	0.0021	0.0004	0.0001	0.0000	0.0000
							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	2.046E-01	2.042E-01	0.0	0.9981	0.0	0.0	0.2961	0.3532	0.1243	0.0671	0.0507	0.0437	0.0262	0.0155
							0.0092	0.0091	0.0042	0.0007	0.0002	0.0000	0.0000	0.0000
							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	2.244E-01	2.238E-01	0.0	0.9976	0.0	0.0	0.2761	0.3883	0.1353	0.0630	0.0532	0.0335	0.0200	0.0121
							0.0124	0.0044	0.0012	0.0004	0.0001	0.0000	0.0000	0.0000
							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5	2.395E-01	2.388E-01	0.0	0.9963	0.0	0.0	0.2628	0.3620	0.1492	0.0892	0.0542	0.0326	0.0197	0.0202
							0.0072	0.0021	0.0006	0.0001	0.0000	0.0000	0.0000	0.0000
							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	2.647E-01	2.658E-01	0.0	0.9964	0.0	0.0	0.2353	0.3478	0.1911	0.0888	0.0539	0.0327	0.0336	0.0120
							0.0034	0.0011	0.0002	0.0001	0.0000	0.0000	0.0000	0.0000
7	3.038E-01	3.024E-01	0.0	0.9940	0.0	0.0	0.2204	0.3866	0.1647	0.0937	0.0527	0.0545	0.0194	0.0056
							0.0017	0.0004	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
8	3.302E-01	3.487E-01	0.0	0.9956	0.0	0.0	0.2544	0.3503	0.1567	0.0948	0.0963	0.0340	0.0097	0.0030
							0.0007	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	4.403E-01	4.364E-01	0.0	0.9911	0.0	0.0	0.2371	0.3603	0.1605	0.1616	0.0575	0.0165	0.0051	0.0011
							0.0003	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	7.132E-01	7.043E-01	0.0	0.9876	0.0	0.0	0.3090	0.3746	0.2116	0.0748	0.0214	0.0067	0.0015	0.0003
							0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	6.462E-01	6.417E-01	0.0	0.9931	0.0	0.0	0.2499	0.5160	0.1670	0.0478	0.0149	0.0023	0.0007	0.0002
							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	8.199E-01	8.169E-01	0.0	0.9964	0.0	0.0	0.4251	0.4129	0.1136	0.0361	0.0080	0.0018	0.0004	0.0001
							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
13	1.027E 00	1.023E 00	0.0	0.9959	0.0	0.0	0.4547	0.3906	0.1202	0.0268	0.0060	0.0013	0.0003	0.0001
							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
14	1.126E 00	1.118E 00	0.0	0.9929	0.0	0.0	0.4602	0.4205	0.0926	0.0207	0.0046	0.0010	0.0002	0.0001
							0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
15	1.161E 00	1.143E 00	0.0	0.9862	0.0	0.0	0.5066	0.3843	0.0848	0.0184	0.0042	0.0009	0.0003	0.0000
16	1.197E 00	1.163E 00	0.0	0.9722	0.0	0.0	0.5083	0.3830	0.0845	0.0188	0.0042	0.0012	0.0000	0.0000
17	1.240E 00	1.172E 00	0.0	0.9453	0.0	0.0	0.5126	0.3794	0.0839	0.0187	0.0044	0.0012	0.0000	0.0000
18	1.323E 00	1.183E 00	0.0	0.9930	0.0	0.0	0.5157	0.3776	0.0829	0.0238	0.0044	0.0012	0.0000	0.0000
19	1.501E 00	1.211E 00	0.0	0.8049	0.0	0.0	0.5071	0.3837	0.1090	0.0238	0.0044	0.0012	0.0000	0.0000
20	1.853E 00	1.242E 00	0.0	0.6706	0.0	0.0	0.5174	0.4626	0.1090	0.0238	0.0044	0.0012	0.0000	0.0000
21	4.274E 00	2.410E 00	0.0	0.5640	0.0	0.0	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

BANKS START AT 5400
LAST LOCATION USED 7199

NEUTRON SHIELD ANALYSIS

ND= 1. NNE= 0. NE= 0. NT= 0. NA= 0. NRPSP= 1. NEX= 1. NEXNO= 1

DET X Y Z RAD TO
1 0.0 1.0474E 02 -2.3810E 02 2.6033E 02 1.0824E-04

GROUP RSP(11
1 1.0000E 00
2 1.0000E 00
3 1.0000E 00
4 1.0000E 00
5 1.0000E 00
6 1.0000E 00
7 1.0000E 00
8 1.0000E 00
9 1.0000E 00
10 1.0000E 00
11 1.0000E 00
12 1.0000E 00
13 0.0
14 0.0
15 0.0
16 0.0
17 0.0
18 0.0
19 0.0
20 0.0
21 0.0

NUMBER OF PRIMARY ENERGY BINS 0
TOTAL NUMBER OF ENERGY BINS 0

NUMBER OF TIME BINS 0

NUMBER OF ANGLE BINS 0
UPPER LIMITS OF COSINE BINS

175 CELLS USED BY ANALYSIS. 2676 CELLS REMAIN UNUSED.

NLPT = 1033

DEFINING SAMPLE PROBLEM

NO. GROUPS = 12 NO. MESH PTS = 9 TOTAL NO. ANGLES= 20 NO. POLAR ANGLES = 4 SVS SNORV = 0.0 A = 1.260E 14

THETA0

1.012E-01 2.224E-01 3.136E-01 3.628E-01

THETA

-1.000E 00 -0.908E-01 -0.764E-01 -3.628E-01 0.0

PHI

1.971E 00 3.142E 00 1.006E 00 1.971E 00 2.136E 00 3.142E 00 7.133E-01 1.038E 00 1.971E 00 3.142E 00
2.428E 00 3.142E 00 4.392E-01 7.849E-01 1.249E 00 1.971E 00 1.006E 00 2.357E 00 2.703E 00 3.142E 00

TIME REQUIRED FOR INPUT WAS 2 SECONDS.
YOU ARE USING THE DEFAULT VERSION OF STRUM WHICH DOES NOTHING.

***START BATCH 1 RANDOM=3870838851P9

SOURCE DATA									
WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGFAVE	
1.0000 02	9.00	-0.0013	-0.0943	-0.6525	-2.0197-01	-1.7407 00	0.0	0.0	

NUMBER OF COLLISIONS OF TYPE NCOLL										
SOURCE SPLIT(D)	FISHN	GAMGN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT TIMEKILL	R R KILL	R R SURV	GAMLOST
100	0	0	0	123	0	68	63	36	0	1

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 2 RANDOM=C8A7448C1CAD

SOURCE DATA									
WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGFAVE	
1.0000 02	8.97	-0.0046	-0.0708	-0.6534	-1.8958-01	-2.8688-01	0.0	0.0	

NUMBER OF COLLISIONS OF TYPE NCOLL										
SOURCE SPLIT(D)	FISHN	GAMGN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT TIMEKILL	R R KILL	R R SURV	GAMLOST
100	0	0	0	87	0	54	66	31	0	3

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 3 RANDOM=38C0AC0673AD

SOURCE DATA									
WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGFAVE	
1.0000 02	8.63	0.0398	0.0298	-0.6597	3.9127-01	8.4758-01	0.0	0.0	

NUMBER OF COLLISIONS OF TYPE NCOLL										
SOURCE SPLIT(D)	FISHN	GAMGN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT TIMEKILL	R R KILL	R R SURV	GAMLOST
100	0	0	0	100	0	49	66	33	0	1

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 4 RANDOM=C289E2A4FA6D

SOURCE DATA									
WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGFAVE	
1.0000 02	8.36	-0.0080	0.0348	-0.6222	1.7077 00	4.8977-01	0.0	0.0	

NUMBER OF COLLISIONS OF TYPE NCOLL										
SOURCE SPLIT(D)	FISHN	GAMGN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT TIMEKILL	R R KILL	R R SURV	GAMLOST
100	0	0	0	129	0	54	59	41	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 5 RANDOM=AC17728D6A25

SOURCE DATA									
WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGFAVE	
1.0000 02	8.42	-0.0494	0.0528	-0.6617	-3.7258-01	-2.0547-01	0.0	0.0	

NUMBER OF COLLISIONS OF TYPE NCOLL										
SOURCE SPLIT(D)	FISHN	GAMGN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT TIMEKILL	R R KILL	R R SURV	GAMLOST
100	0	0	0	108	0	62	58	41	0	1

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 6

RANDOM=58EA078858C1

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE
1.000E 02	8.84	0.0160	-0.0800	-0.6510	2.753E-01	-1.886E 00	0.0	0.0

NUMBER OF COLLISIONS OF TYPE NCOLL

SOURCE SPLIT(D)	FISHN	GAMGEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	B-CUT	TIMEKILL	R	P	KILL	P	R	SURV	GAMLOST
100	0	0	0	88	0	57	66	34	0	0	0	0	0	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 7

RANDOM=AFB88EC097621

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE
1.000E 02	9.21	0.0044	-0.0321	-0.6826	7.893E-02	-1.366E 00	0.0	0.0

NUMBER OF COLLISIONS OF TYPE NCOLL

SOURCE SPLIT(D)	FISHN	GAMGEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	B-CUT	TIMEKILL	R	P	KILL	P	R	SURV	GAMLOST
100	0	0	0	110	0	58	58	41	0	0	1	0	1	1	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 8

RANDOM=PBCE1932A285

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE
1.000E 02	8.23	-0.0326	0.0010	-0.6260	-4.785E-01	6.638E-02	0.0	0.0

NUMBER OF COLLISIONS OF TYPE NCOLL

SOURCE SPLIT(D)	FISHN	GAMGEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	B-CUT	TIMEKILL	R	P	KILL	P	R	SURV	GAMLOST
100	0	0	0	101	0	53	64	36	0	0	0	0	0	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 9

RANDOM=4CADD0D9E6799

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE
1.000E 02	9.32	-0.0230	0.0188	-0.6579	1.449E 00	-1.392E 00	0.0	0.0

NUMBER OF COLLISIONS OF TYPE NCOLL

SOURCE SPLIT(D)	FISHN	GAMGEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	B-CUT	TIMEKILL	R	P	KILL	P	R	SURV	GAMLOST
100	0	0	0	124	0	64	55	45	0	0	0	0	0	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 10

RANDOM=79EDD832BF79

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE
1.000E 02	8.71	-0.0385	0.0041	-0.6747	-1.395E 00	-8.957E-02	0.0	0.0

NUMBER OF COLLISIONS OF TYPE NCOLL

SOURCE SPLIT(D)	FISHN	GAMGEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	B-CUT	TIMEKILL	R	P	KILL	P	R	SURV	GAMLOST
100	0	0	0	143	0	72	57	43	0	0	0	0	0	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 11

RANDOM=90549EABC775

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE
1.000E 02	8.78	0.0852	0.0809	-0.6706	4.342E-01	1.480E 00	0.0	0.0

NUMBER OF COLLISIONS OF TYPE NCOLL															
SOURCE SPLIT(D)	FISHN	GAMGEN	REALCOLL	ALBEDO	BDRYX	ESCAPE	E-CUT	TIMEKILL	P	R	KILL	P	R	SURV	GAMLOST
100	0	0	0	123	0	72	63	35	0	2	0	0	0	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 12 RANDOM=A24A497F8CA9

SOURCE DATA									
WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE	
1.000E 02	8.41	-0.0753	0.0023	-0.6443	1.224E 00	-1.078E 00	0.0	0.0	

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NUMBER OF COLLISIONS OF TYPE NCOLL															
SOURCE SPLIT(D)	FISHN	GAMGEN	REALCOLL	ALBEDO	BDRYX	ESCAPE	E-CUT	TIMEKILL	P	R	KILL	P	R	SURV	GAMLOST
100	0	0	0	77	0	59	70	27	0	3	0	0	0	0	

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 13 RANDOM=BAC7D890A859

SOURCE DATA									
WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE	
1.000E 02	8.97	0.0287	0.0410	-0.6160	-1.910E 00	-1.584E 00	0.0	0.0	

NUMBER OF COLLISIONS OF TYPE NCOLL															
SOURCE SPLIT(D)	FISHN	GAMGEN	REALCOLL	ALBEDO	BDRYX	ESCAPE	E-CUT	TIMEKILL	P	R	KILL	P	R	SURV	GAMLOST
100	0	0	0	156	0	61	56	43	0	1	1	0	0	0	

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 14 RANDOM=08B466D10D1D

SOURCE DATA									
WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE	
1.000E 02	8.49	-0.0398	-0.0890	-0.6438	1.456E 00	7.293E-01	0.0	0.0	

NUMBER OF COLLISIONS OF TYPE NCOLL															
SOURCE SPLIT(D)	FISHN	GAMGEN	REALCOLL	ALBEDO	BDRYX	ESCAPE	E-CUT	TIMEKILL	P	R	KILL	P	R	SURV	GAMLOST
100	0	0	0	121	0	56	60	37	0	3	0	0	0	0	

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 15 RANDOM=2EC14C9E8881

SOURCE DATA									
WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE	
1.000E 02	8.79	-0.0227	0.0554	-0.6142	-2.224E 00	2.003E 00	0.0	0.0	

NUMBER OF COLLISIONS OF TYPE NCOLL															
SOURCE SPLIT(D)	FISHN	GAMGEN	REALCOLL	ALBEDO	BDRYX	ESCAPE	E-CUT	TIMEKILL	P	R	KILL	P	R	SURV	GAMLOST
100	0	0	0	77	0	53	71	28	0	1	0	0	0	0	

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 16 RANDOM=9T5C161447D9

SOURCE DATA									
WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE	
1.000E 02	8.77	0.0013	0.0097	-0.6004	1.813E 00	6.195E-01	0.0	0.0	

NUMBER OF COLLISIONS OF TYPE NCOLL															
SOURCE SPLIT(D)	FISHN	GAMGEN	REALCOLL	ALBEDO	BDRYX	ESCAPE	E-CUT	TIMEKILL	P	R	KILL	P	R	SURV	GAMLOST
100	0	0	0	77	0	53	71	28	0	1	0	0	0	0	

100 0 0 0 67 0 44 73 26 0 1 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.
 ***START BATCH 17 RANDOM=3530DF6CA74D

SOURCE DATA
 WTAVE IAVE UAVE VAVE WAVE XAVE YAVE ZAVE AGEAVE
 1.000E 02 8.71 0.0393 -0.0491 -0.6967 2.306E 00 -1.728E 00 0.0 0.0

NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANGEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL P R SURV GAMLOST
 100 0 0 0 136 0 81 52 46 0 2 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.
 ***START BATCH 18 RANDOM=FF5CCF393CF1

SOURCE DATA
 WTAVE IAVE UAVE VAVE WAVE XAVE YAVE ZAVE AGEAVE
 1.000E 02 8.86 -0.0369 -0.0817 -0.6637 -6.535E-02 5.849E-02 0.0 0.0

NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANGEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL P R SURV GAMLOST
 100 0 0 0 128 0 75 60 38 0 2 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.
 ***START BATCH 19 RANDOM=AF53D1CD2C59

SOURCE DATA
 WTAVE IAVE UAVE VAVE WAVE XAVE YAVE ZAVE AGEAVE
 1.000E 02 9.04 -0.0239 -0.0694 -0.6685 5.138E-01 -5.005E-02 0.0 0.0

NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANGEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL P R SURV GAMLOST
 100 0 0 0 91 0 65 56 43 0 1 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.
 ***START BATCH 20 RANDOM=CEC920787435

SOURCE DATA
 WTAVE IAVE UAVE VAVE WAVE XAVE YAVE ZAVE AGEAVE
 1.000E 02 8.73 -0.0314 -0.0466 -0.6933 -1.156E-01 -2.162E 00 0.0 0.0

NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANGEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL P R SURV GAMLOST
 100 0 0 0 159 0 74 57 43 0 0 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.
 ***START BATCH 21 RANDOM=FOAA35A79FC9

SOURCE DATA
 WTAVE IAVE UAVE VAVE WAVE XAVE YAVE ZAVE AGEAVE
 1.000E 02 8.90 -0.0097 -0.0410 -0.6099 -2.053E 00 -1.278E-01 0.0 0.0

NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANGEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL P R SURV GAMLOST
 100 0 0 0 94 0 58 66 33 0 1 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.
 ***START BATCH 22 RANDOM=D251622682A9

SOURCE DATA

WTAVE IAVE UAVE VAVE WAVE XAVE YAVE ZAVE AGEAVE
 1.000E 02 8.24 -0.0385 0.0042 -0.6138 -3.457E-01 -1.030E 00 0.0 0.0
 NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANGEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL R R SURV GAMLOST
 100 0 0 0 94 0 57 67 32 0 1 0 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 23 RANDOM=F8641FCC8835

SOURCE DATA
 WTAVE IAVE UAVE VAVE WAVE XAVE YAVE ZAVE AGEAVE
 1.000E 02 8.65 0.0050 -0.0153 -0.6160 -1.448E 00 -1.106E 00 0.0 0.0
 NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANGEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL R R SURV GAMLOST
 100 0 0 0 83 0 49 64 34 0 0 0 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 24 RANDOM=CC44707A86D9

SOURCE DATA
 WTAVE IAVE UAVE VAVE WAVE XAVE YAVE ZAVE AGEAVE
 1.000E 02 9.16 -0.0468 0.0109 -0.6830 1.644E-01 1.423E 00 0.0 0.0
 NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANGEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL R R SURV GAMLOST
 100 0 0 0 131 0 74 56 43 0 1 0 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 25 RANDOM=8A0F5DD834C1

SOURCE DATA
 WTAVE IAVE UAVE VAVE WAVE XAVE YAVE ZAVE AGEAVE
 1.000E 02 8.79 0.0641 0.0529 -0.6497 1.177E 00 -2.760E-01 0.0 0.0
 NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANGEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL R R SURV GAMLOST
 100 0 0 0 125 0 67 62 37 0 1 0 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 26 RANDOM=3D5541B3C919

SOURCE DATA
 WTAVE IAVE UAVE VAVE WAVE XAVE YAVE ZAVE AGEAVE
 1.000E 02 8.65 0.0243 0.0459 -0.6603 3.309E-01 1.668E 00 0.0 0.0
 NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANGEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL R R SURV GAMLOST
 100 0 0 0 117 0 68 60 39 0 1 0 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 27 RANDOM=DEA8997330F5

SOURCE DATA
 WTAVE IAVE UAVE VAVE WAVE XAVE YAVE ZAVE AGEAVE
 1.000E 02 8.41 -0.0066 -0.0019 -0.6534 -1.207E 00 6.140E-01 0.0 0.0
 NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANGEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL R R SURV GAMLOST
 100 0 0 0 108 0 59 66 33 0 1 0 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 28

RANDOM=FC0D487121F9

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGFAVE
1.000E 02	0.98	-0.1082	-0.0533	-0.6735	-2.333E 00	8.868E-01	0.0	0.0

NUMBER OF COLLISIONS OF TYPE NCOLL

SOURCE SPLIT(D)	FISHN	GANGEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT	TIMEKILL	R	R	KILL	P	R	SURV	GAMLOST
100	0	0	0	124	0	68	57	42	0	1	0	0	0	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 29

RANDOM=FA0B119D9849

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGFAVE
1.000E 02	0.88	-0.0208	-0.0579	-0.6418	1.631E-01	3.673E-01	0.0	0.0

NUMBER OF COLLISIONS OF TYPE NCOLL

SOURCE SPLIT(D)	FISHN	GANGEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT	TIMEKILL	R	R	KILL	P	R	SURV	GAMLOST
100	0	0	0	117	0	75	57	41	0	2	0	0	0	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 30

RANDOM=250F8895A525

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGFAVE
1.000E 02	0.66	-0.0125	0.1159	-0.6288	-7.324E-01	2.572E 00	0.0	0.0

NUMBER OF COLLISIONS OF TYPE NCOLL

SOURCE SPLIT(D)	FISHN	GANGEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT	TIMEKILL	R	R	KILL	P	R	SURV	GAMLOST
100	0	0	0	115	0	55	62	36	0	2	0	0	0	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 31

RANDOM=96357A457269

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGFAVE
1.000E 02	9.20	0.0292	0.0998	-0.6348	-2.987E-01	-9.094E-01	0.0	0.0

NUMBER OF COLLISIONS OF TYPE NCOLL

SOURCE SPLIT(D)	FISHN	GANGEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT	TIMEKILL	R	P	KILL	R	R	SURV	GAMLOST
100	0	0	0	102	0	63	59	40	0	1	0	0	0	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 32

RANDOM=287FEDA5027D

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGFAVE
1.000E 02	8.85	0.7096	-0.0509	-0.6463	-1.394E 00	-2.526E 00	0.0	0.0

NUMBER OF COLLISIONS OF TYPE NCOLL

SOURCE SPLIT(D)	FISHN	GANGEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT	TIMEKILL	R	P	KILL	R	R	SURV	GAMLOST
100	0	0	0	100	0	62	68	32	0	0	0	0	0	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 33

RANDOM=803CD361898D

SOURCE DATA

WTAVE 1.000E 0. IAVE 9.48 UAVE -0.0316 VAVE 0.0375 WAVE -0.6134 XAVE -1.875E 00 YAVE 1.643E-01 ZAVE 0.0 AGEAVE 0.0
 NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANSEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL R R SURV GAMLOST
 100 0 0 0 94 0 65 55 40 0 1 1 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 34 RANDOM=61986C9F1501

SOURCE DATA
 WTAVE 1.000E 02 IAVE 8.82 UAVE -0.0018 VAVE 0.0272 WAVE -0.6388 XAVE -2.744E-01 YAVE -2.258E-01 ZAVE 0.0 AGEAVE 0.0
 NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANSEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL R R SURV GAMLOST
 100 0 0 0 115 0 61 58 40 0 2 1 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 35 RANDOM=FC7D38C5F899

SOURCE DATA
 WTAVE 1.000E 02 IAVE 8.77 UAVE -0.0067 VAVE -0.0351 WAVE -0.6598 XAVE -1.452E 00 YAVE -3.740E 00 ZAVE 0.0 AGEAVE 0.0
 NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANSEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL R R SURV GAMLOST
 100 0 0 0 136 0 73 57 39 0 4 1 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 36 RANDOM=8926D1C86501

SOURCE DATA
 WTAVE 1.000E 02 IAVE 9.08 UAVE 0.0195 VAVE 0.0186 WAVE -0.6484 XAVE -6.039E-01 YAVE -1.189E 00 ZAVE 0.0 AGEAVE 0.0
 NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANSEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL R R SURV GAMLOST
 100 0 0 0 90 0 62 64 35 0 1 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 37 RANDOM=1FF0CBA0EE9

SOURCE DATA
 WTAVE 1.000E 02 IAVE 8.23 UAVE -0.0413 VAVE -0.0200 WAVE -0.6349 XAVE -6.104E-01 YAVE -1.059E 00 ZAVE 0.0 AGEAVE 0.0
 NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANSEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL R R SURV GAMLOST
 100 0 0 0 129 0 60 63 35 0 2 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 38 RANDOM=EE0A38FA3E11

SOURCE DATA
 WTAVE 1.000E 02 IAVE 8.36 UAVE -0.0605 VAVE 0.0049 WAVE -0.6508 XAVE -1.241E 00 YAVE -1.760E 00 ZAVE 0.0 AGEAVE 0.0
 NUMBER OF COLLISIONS OF TYPE NCOLL
 SOURCE SPLIT(D) FISHN GANSEN REALCOLL ALBEDO BDRYX ESCAPE E-CUT TIMEKILL R R KILL R R SURV GAMLOST
 100 0 0 0 96 0 51 71 28 0 1 0 0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 39

RANDOM=088D060C49B5

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE
1.000E 02	0.85	0.0188	-0.0413	-0.6643	9.268E-01	-1.500E 00	0.0	0.0

NUMBER OF COLLISIONS	OF TYPE	NCOLL													
SOURCE SPLIT(D)	FISHN	GAMSEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT	TIMEKILL	R	R	KILL	P	R	SURV	GAMLOST
100	0	0	0	135	0	60	63	35	0	0	2	0	0	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 40

RANDOM=137264362A49

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE
1.000E 02	0.63	0.0277	-0.0143	-0.6519	1.878E 00	3.947E-01	0.0	0.0

NUMBER OF COLLISIONS	OF TYPE	NCOLL													
SOURCE SPLIT(D)	FISHN	GAMSEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT	TIMEKILL	R	P	KILL	P	R	SURV	GAMLOST
100	0	0	0	106	0	45	67	33	0	0	0	0	0	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 41

RANDOM=943086639FD1

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE
1.000E 02	9.20	0.0147	0.0212	-0.6595	-1.890E 00	-9.783E-01	0.0	0.0

NUMBER OF COLLISIONS	OF TYPE	NCOLL													
SOURCE SPLIT(D)	FISHN	GAMSEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT	TIMEKILL	R	P	KILL	P	R	SURV	GAMLOST
100	0	0	0	91	0	64	65	34	0	0	1	0	0	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 42

RANDOM=D83E2B1DF121

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE
1.000E 02	9.00	-0.0303	-0.0500	-0.6222	-1.039E 00	-2.382E 00	0.0	0.0

NUMBER OF COLLISIONS	OF TYPE	NCOLL													
SOURCE SPLIT(D)	FISHN	GAMSEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT	TIMEKILL	R	R	KILL	P	R	SURV	GAMLOST
100	0	0	0	166	0	68	51	48	0	0	1	0	0	0	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 43

RANDOM=285876162E2D

SOURCE DATA

WTAVE	IAVE	UAVE	VAVE	WAVE	XAVE	YAVE	ZAVE	AGEAVE
1.000E 02	0.68	0.0677	0.0397	-0.6937	2.644E 00	-1.194E 00	0.0	0.0

NUMBER OF COLLISIONS	OF TYPE	NCOLL													
SOURCE SPLIT(D)	FISHN	GAMSEN	REALCOLL	ALBEDO	SDRYX	ESCAPE	E-CUT	TIMEKILL	R	R	KILL	P	R	SURV	GAMLOST
100	0	6	0	119	0	69	56	44	0	0	0	0	0	1	0

TIME REQUIRED FOR THE PRECEDING BATCH WAS LESS THAN ONE SECOND.

***START BATCH 44

RANDOM=FD16789FP9C9

SOURCE DATA

RUN TERMINATED BY EXECUTION TIME LIMIT
0 RUNS OF 50 BATCHES AND 1 RUN OF 40 BATCHES COMPLETED.

THIS CASE WAS RUN ON MONDAY, APRIL 30, 1973

FAST NEUTRON RESPONSE

DETECTOR	RESPONSES(DETECTOR) FAST NEUTRON FLUENCE (E.GT.0.1MEV)			
	UNCOLL RESPONSE	FSD UNCOLL	TOTAL RESPONSE	FSD TOTAL
1	3.8831E-07	0.05225	4.1590E-07	0.05018

EXTRA ARRAYS OF LENGTH NO

EXT1(1)
(1) 5420

TIME REQUIRED FOR THE PRECEDING 48 BATCHES WAS 30 SECONDS.

NEUTRON DEATHS	NUMBER	WEIGHT
KILLED BY RUSSIAN ROULETTE	52	0.31085E 01
ESCAPED	2964	0.29734E 04
REACHED ENERGY CUTOFF	1784	0.17646E 04
REACHED TIME CUTOFF	0	0.0

NUMBER OF SCATTERINGS

MEDIUM	NUMBER
1	55
2	9365
TOTAL	9420

REAL SCATTERING COUNTERS

ENERGY GROUP	REGION NUMBER	WEIGHT
1	33	4.83E 01
2	85	1.00E 02
3	58	1.16E 02
4	141	1.50E 02
5	209	2.26E 02
6	262	2.15E 02
7	262	2.74E 02
8	305	3.06E 02
9	222	2.42E 02
10	510	5.07E 02
11	923	9.34E 02
12	2430	2.42E 03
13	0	0.0
14	0	0.0
15	0	0.0
16	0	0.0
17	0	0.0
18	0	0.0
19	0	0.0
20	0	0.0
21	0	0.0

NUMBER OF SPLITTINGS

ENERGY GROUP	REGION NUMBER	WEIGHT
1	0	0.0
2	0	0.0
3	0	0.0
4	0	0.0
5	0	0.0
6	0	0.0
7	0	0.0
8	0	0.0
9	0	0.0
10	0	0.0
11	0	0.0
12	0	0.0

NUMBER OF SPLITTINGS PREVENTED BY LACK OF ROOM

ENERGY GROUP	REGION 1 NUMBER	WEIGHT
1	0	0.0
2	0	0.0
3	0	0.0
4	0	0.0
5	0	0.0
6	0	0.0
7	0	0.0
8	0	0.0
9	0	0.0
10	0	0.0
11	0	0.0
12	0	0.0

NUMBER OF RUSSIAN ROULETTE KILLS

ENERGY GROUP	REGION 1 NUMBER	WEIGHT
1	0	0.0
2	0	0.0
3	0	0.0
4	3	2.00E-01
5	1	6.28E-02
6	1	3.07E-02
7	3	1.64E-01
8	2	1.01E-01
9	3	1.82E-01
10	2	8.24E-02
11	10	7.33E-01
12	27	1.55E 00

NUMBER OF RUSSIAN ROULETTE SURVIVALS

ENERGY GROUP	REGION 1 NUMBER	WEIGHT
1	0	0.0
2	0	0.0
3	0	0.0
4	0	0.0
5	0	0.0
6	1	5.48E-02
7	0	0.0
8	0	0.0
9	0	0.0
10	1	6.35E-02
11	0	0.0
12	4	3.10E-01

** NEXT RANDOM NUMBER IS FC85C8980E29

TOTAL CPU TIME FOR THIS PROBLEM WAS 0.51 MINUTES. THE REGION USED WAS 242K.