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**THE FLOSS IV COMPATIBLE PROGRAMS, INCLUDING
PROCEDURES FOR THE REAL GASDYNAMIC,
ONE-DIMENSIONAL PERFORMANCE ANALYSES
OF NUCLEAR RAMJET AND ROCKET ENGINES**

RELEASED FOR ANNOUNCEMENT
IN NUCLEAR SCIENCE ABSTRACTS

Livermore, California

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Lawrence Radiation Laboratory
Livermore, California
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ABSTRACT

The aerothermodynamic behavior of compact heat exchangers as applied to vehicle propulsion systems is analyzed in terms of compatible one-dimensional models of the various system components. The methods of calculation are presented by means of simple logic flow diagrams which are based upon real gas properties and processes. The described methods are incorporated in a versatile digital computer program which computes total system aerothermodynamic performance, subject to a number of input options relating to overall system boundary conditions and heat exchanger design criteria. A complete FORTRAN II code listing and instructions for operation are presented for this program. The code is memory-contained and has been run on both the IBM 7090 series and CDC 3600 and 6600 digital computers.

I. INTRODUCTION

Efforts relating to the design and operation of a nuclear ramjet propulsion system (Project Pluto) are found to depend, in no small way, upon a detailed understanding of the aerothermodynamic processes inherent in such a device. In order to study this area of interest, several generations of digital computer codes for calculating ramjet performance have been developed during the course of the past nine years (see, for example, ref. 1). The present report describes the most recent of these. The particular advantage of the FLOSS IV compatible programs compared to previous performance codes is that assumptions regarding idealization of gas properties have been completely eliminated. As a result, one-dimensional correlations implicit in the code are valid over wider ranges of application, and the accuracy and consistency of its results are thereby enhanced.

The FLOSS IV compatible programs currently employ the equilibrium gas property tables for both air and argon.² However, a simple exchange of these data for those of another gas is the only modification required to analyze systems utilizing other propellants.

The basic physical reasoning behind each of the processes treated in these programs is presented in some detail in UCRL-7530.³ The logic flow diagrams presented in the present report are merely specialized applications of the procedures reported in this earlier work. The friction factor and heat transfer coefficient correlations for

circular channels are those suggested in ref. 4 and apply to turbulent flow (i. e., Reynolds numbers in excess of 2×10^3). All input and output parameters of the FLOSS IV compatible programs are in engineering units. The internal calculations are based upon the NBS nondimensionalized units for air.²

It is the purpose of the present report to communicate the FLOSS IV compatible codes and to demonstrate their use. While the codes were specifically designed to deal with the analyses of gas-cooled nuclear reactors, the reader will undoubtedly find many other applications which are not explicitly treated in this report.

The author wishes to acknowledge the valuable assistance of Dr. Duane Jordan in developing the basic real gasdynamic process calculations. Thanks also go to Mrs. Leota Barr for her efforts in improving the property table lookup program and to Mr. Stuart Stone for making the codes compatible with both IBM and CDC digital computer equipment.

II. FEATURES OF THE FLOSS IV COMPATIBLE PROGRAMS

The FLOSS IV compatible programs are divided into three interrelated sections designated by the code names FLOSS, NOMAC, and DASH-N. Each of these is characterized by a specialized input format and is associated with several logical options, as described below. Figure 1 is a block diagram of the entire system of programs. Each block indicated in this diagram corresponds to an individual subroutine. The basic logic of these subroutines (with the exception of input-output and table lookup routines) is described in section III of this report.

Fig. 1. Logic flow diagram for FLOSS IV compatible digital computer programs. Termination of flow path by diamond implies normal FORTRAN call sequence return along same path. Circled numbers relate to sequence of multiple calls.

FLOSS

The section of the program designated by this code name deals with the one-dimensional fluid dynamics of a single circular or equivalent hydraulic channel of specified geometry and longitudinal power distribution, subject to the four boundary condition options presented in Table 1. Options 2 through 4 have the additional feature of an inlet dynamic head loss calculation.

Table 1. Boundary condition input options for FLOSS section of the FLOSS IV compatible digital computer programs. For a given option, variables designated by x are input. Unmarked variables are calculated by the code.

Option	Input variables					
	T_1^o	P_1^o	w	Power	P_2	T_2^o
1	x	x	x	x		
2	x	x		x	x	
3	x	x			x	x
4	x	x			x	x

The FLOSS calculation simultaneously satisfies the conditions for continuity, energy conservation, and momentum conservation for arbitrary flow channel length, axial diameter variation, and axial power distribution. The calculation is limited to subsonic flow within the channel and automatically limits channel flow rate should choking occur at any point within the channel.

The friction factor currently employed in the FLOSS IV code is obtained from the Karman-Nikuradse relation.

$$\frac{1}{\sqrt{4f}} = 2 \log_{10} (Re \sqrt{4f}) - 0.8.$$

The local heat transfer coefficient including entrance effects is

$$h = 0.021 \frac{k}{D} Re^{0.8} Pr^{0.4} \left(\frac{T_w}{T} \right)^{-0.5} \left[1 + \left(\frac{x}{D} \right)^{-0.7} \right].$$

Both of these correlations are considered to be accurate to within $\pm 10\%$ for Reynolds numbers in excess of 2000.

NOMAC

This section of the program performs a simultaneous FLOSS analysis for up to 20 varieties of parallel flow channels. The upstream boundary conditions, total pressure and enthalpy, are considered equal for all channels. The downstream static pressures for each channel is determined on the basis of the downstream plenum geometry and a

specified grouping of component channels which share the same or equivalent exit planes. Up to 20 exit planes may be specified. The relationship between flow conditions at each exit plane is determined on the basis of the laws of conservation of mass flow, energy, and momentum, and the assumption that the fluid is completely mixed and expanded into the available plenum area at the exit plane in question.

The throat area of an exit nozzle of specified efficiency characteristics is determined from the flow conditions at a plane which is downstream of the last flow channel exit plane. Both choked and unchoked nozzle operations are considered. Convergence of the calculated exit nozzle throat area to an input value of this parameter is obtained by an iterative modification of the exit static pressure condition at the first flow channel exit plane. Supersonic expansion to the exit nozzle boattail is optionally analyzed on the basis of an input value of the boattail area or expansion to a specified ambient pressure.

The input requirement for the flow channel descriptions is quite flexible, permitting these descriptions to appear in the input card deck in an arbitrary order. However, the first channel described, regardless of its exit plane, is treated by the code as a critical design component. The input options noted in Tables 2 and 3 refer to this flow channel.

Table 2. Input options for NOMAC section of the FLOSS IV compatible digital computer programs. For a given option, variables designated by x are input. Unmarked variables are calculated by the code.

Option	Overall flow channel assembly				Critical design component	
	T_1^o	P_1^o	$\dot{w}$	Power	$T_{w\max}$	T_2^o
1	x	x		x		
2	x	x			x	
3	x	x				x
4	x		x	x		
5	x		x		x	
6	x		x			x

The NOMAC calculation includes a determination of the gross thrust of the expanded gas at the exit nozzle boattail. An inlet diffuser calculation is also performed to determine flow conditions in the propellant supply duct. This section of the program is, therefore, suitable for analysis of rocket performance of compact heat exchanger systems.

DASH-N

The DASH-N or ramjet performance section of the FLOSS IV compatible programs is identical to the NOMAC section except that inlet boundary conditions are determined from the performance characteristics of a flight-type inlet diffuser and specified flight

conditions, including flight Mach number, ambient pressure, and ambient temperature. Net jet thrust and thrust coefficient are calculated for the system as a whole. Table 3 presents the input options for the DASH-N calculation.

Table 3. Input options for DASH-N section of the FLOSS IV compatible digital computer programs. For a given option, variables designated by x are input. Unmarked variables are calculated by the code. All options require input data for flight Mach number and ambient pressure and temperature.

Option	Inlet diffuser	Overall flow channel assembly		Critical design component	
	Pressure recovery	$\dot{w}$	Power	$T_{w\max}$	T_2^o
1	x		x		
2	x			x	
3	x				x
4		x	x		
5		x		x	
6		x			x

III. THE FLOSS IV COMPATIBLE SUBROUTINES

As previously mentioned, Fig. 1 is a logic flow diagram for the entire system of FLOSS IV compatible programs. The basic logic for subroutines which involve physical process analysis (i. e., other than mathematical or computer logical procedures) is presented in the logic flow diagrams of Figs. 2 through 14. Table 4 presents the nomenclature of both the logic flow diagrams and the FORTRAN code listing. The latter will be found in Appendix 3. Input and computed variables are tabulated in Table 5.

Because of the random manner in which the various subroutines are called during execution of the program, there is no particular logical basis for their order of presentation. Hence, the reader should not attempt to place any significance upon the sequence as it appears in this report.

Table 4. Nomenclature and FORTRAN COMMON and DIMENSION definitions for the FLOSS IV compatible programs. FORTRAN "COMMON" and "DIMENSION" definitions noted by * are input quantities for NOMAC and/or DASH-N codes.

Variable	FORTRAN COM & DIM	Definition
a	-	Speed of sound (NBS)
α	ALPHA*	Exit nozzle divergence factor (dimensionless)
$\tilde{A}_{BT}$	AN	Exit nozzle boattail area, iteration variable (in ²)
A_{BT}	AREABT*	Exit nozzle boattail area (in ²)
A_{DP}	AREADP*	Diffuser exit plenum area and component upstream plenum area (assumed identical) (in ²)
A_{DT}	AREADT*	Diffuser throat area (in ²)

Table 4 (Continued).

Variable	FORTTRAN COM & DIM	Definition
A_{DU}	AREADU*	Supply line area upstream of diffuser (in ²)
A_{NT}	AREANT*	Component exit plane plenum areas (in ²)
$\tilde{A}_{NT}$	AT	Exit nozzle throat area iteration variable (in ²)
$DB/\dot{w}_B$	BDRAG	Gross bleed penalty per unit bleed flow rate (lb _f /lb _m -sec ⁻¹)
<u>Net Thrust</u>		
AC_f	CFA	Ratio of net thrust to flight dynamic head (in ²)
N_j	CMPNTS(20)*	Number of similar components of the j th kind (dimensionless)
-	CODNAM(10)*	Problem name, input designation
-	DAT(50, 20, 6)	Equivalent memory block for X, G, R, POR, TWT, and TWTT
C_{wN}	DIS*	Exit nozzle discharge coefficient (dimensionless)
C_{wD}	DISD*	Diffuser discharge coefficient (dimensionless)
Δt	DT	Time step increment (sec)
C_{cont_j}	EIK(20)*	j th component inlet stagnation pressure loss co- efficient (dimensionless)
C_{exp_j}	EXK(20)*	j th component exit stagnation pressure loss co- efficient (dimensionless)
ρ	ENTRNS(20)*	j th component entrance heat transfer effect (1. with boundary layer buildup, 0 with fully developed vel- ocity profile) (dimensionless)
f_i	F(100)	Flow channel local friction factor (dimensionless)
η_N	FI*	Exit nozzle isentropic kinetic energy coefficient (dimensionless)
η_D	FID*	Diffuser isentropic kinetic energy coefficient (dimensionless)
$g_{i,j}$	G(50, 20)*	j th component normalized axial power distribution $\left(\frac{1}{x_2 - x_1} \int_{x_1}^{x_2} g(x) dx = 1. \right)$
h_i	HG(100)	Flow channel local heat transfer coefficient (w/in ² -°K)
H_1^0	H01	Flow channel upstream gas stagnation enthalpy (NBS)
H_2^0	H02	Flow channel exit gas stagnation enthalpy (NBS)
i	-	Subscript referring to component internal station
-	IC	Exit nozzle critical condition flag (IC = 1), choked nozzle; IC = 2, unchoked nozzle)
-	ID	Diffuser critical condition flag (ID = 1, choked diffuser; ID = 2, unchoked diffuser)
i_{ex}	-	Subscript referring to exit plane number designation
-	INPT	Logical input tape designation (defined in main program)
-	IOUT	Logical output tape designation (defined in main program)

Table 4 (Continued)

Variable	FORTTRAN COM & DIM	Definition
-	ITT*	Iteration output flag (ITT+1 = 1, no output during FLOSS iterations; ITT+1 = 2, output following each basic FLOSS calculation)
j	JX	Subscript referring to the component number designation (i. e., the <u>j</u> th component)
-	NAME(3, 20)*	Component BCD identification
-	NCODE*	Program code selector flag (NCODE = 1, FLOSS; NCODE = 2, NOMAC; NCODE = 3, DASH-N)
N _{Plane_j}	NPLANE(20)*	<u>j</u> th component exit plane designation
-	NTYPE	FLOSS boundary condition selector flag (NTYPE = 1, FLOSS; NTYPE = 2, BNDARY; NTYPE = 3, PKWALL; NTYPE = 4, PKGAS)
p _i	P(100)	Flow channel local static pressure (atm)
p _{amb}	PAMB*	Ambient pressure (atm)
p _D	PD	Supply duct static pressure (atm)
p _{DT}	PDT	Diffuser throat static pressure (atm)
p _{ex_iex}	PEX(21)	Exit plane static pressure (atm)
p _N	PN	Exit nozzle boattail exhaust static pressure (atm)
p _{NT}	PNT	Exit nozzle throat static pressure (atm)
T _{i, j}	POR(50, 20)*	<u>j</u> th component local porosity (flow area/total area)
POWER	POWER*	Total power of all components (watts)
Pwr	PWR	Flow channel thermal power (watts)
C _{Pwr_j}	PWRCE(20)*	<u>j</u> th component relative power coefficient (PWR/POWER)
<u>POWER</u>	PWRP	Total power of all components, iteration variable (watts)
p _i ^o	PO(100)	Flow channel local stagnation pressure (atm)
p _D ^o	POD	Supply duct stagnation pressure (atm)
p _{DT} ^o	PODT	Diffuser throat stagnation pressure (atm)
p _{i_{ex}} ^o	POEX(21)	Exit plane stagnation pressure (atm)
p _{flt} ^o	POFLT	Flight condition isentropic stagnation pressure (atm)
p _i ^o	POI	Flow channel equivalent inlet stagnation pressure after inlet loss process (atm)
p _{inlt} ^o	POINLT	Upstream plenum stagnation pressure after inlet diffuser recovery (atm)
p _N ^o	PON	Exit nozzle boattail exhaust stagnation pressure (atm)
p _{NT} ^o	PONT	Exit nozzle throat stagnation pressure (atm)
p _i ^o	PO1	Flow channel inlet plenum stagnation pressure (atm)

Table 4 (Continued)

Variable	FORTTRAN COM & DIM	Definition
p_2^o	PO2	Flow channel exit stagnation pressure (atm)
p_{2j}^o	PO2CP(20)	j th component exit stagnation pressure (atm)
p_1	P1	Component inlet plenum static pressure (atm)
p_2	P2	Flow channel exit static pressure (atm)
q/p_i^o	QP(100)	Flow channel local ratio of dynamic head to stagnation pressure (dimensionless)
q_0	Q0	Flight condition dynamic head (atm)
$r_{i,j}$	R(50, 20)	Component local equivalent radius (in.)
(p_1^o/p_{flt}^o)	RECO	Inlet diffuser recovery coefficient, iteration variable (dimensionless)
(p_1^o/p_{fli}^o)	RECOV*	Inlet diffuser recovery coefficient (dimensionless)
N_{Re_i}, Re	REY(100)	Flow channel local Reynolds number (dimensionless)
$\left(\frac{\text{Length}_{\text{effec.}}}{\text{Length}_{\text{true}}}\right)$	RGHNS(20)	j th component roughness coefficient (dimensionless)
T_i	T(100)	Flow channel local static temperature (°K)
T_{amb}	TAMB*	Ambient temperature (°K)
T_D	TD	Supply duct static temperature (°K)
T_{DT}	TDT	Diffuser throat static temperature (°K)
$T_{\text{ex}_i}, T_{\text{ex}}$	TEX(21)	Exit plane static temperature (°K)
Thrust	THRST	Gross thrust (lb _f)
Net thrust	THRUST	Net thrust (lb _f)
Thrust _{P_{amb}}	THST	Gross thrust for nozzle boattail expansion to ambient pressure (lb _f)
T_N	TN	Exit nozzle boattail exhaust static temperature (°K)
T_{NT}	TNT	Exit nozzle throat static temperature (°K)
T_{wav}	TWA	Flow channel average wall temperature (°K)
T_{wav_j}	TWACP(20)	j th component average wall temperature (°K)
T_{wmax}	TWM	Flow channel peak wall temperature (°K)
T_{wmax}	TWMAX*	Critical component ($j = 1$) peak wall temperature (°K)
T_{wmax_j}	TWMXP(20)	j th component peak wall temperature (°K)
$\tilde{T}_{\text{wmax}}$	TWMXP	Critical component ($j = 1$) peak wall temperature, iteration variable (°K)
T_{wi_j}	TWT(50, 20)	j th component local wall temperature (present time) (°K)

Table 4 (Continued).

Variable	FORTTRAN COM & DIM	Definition
$T_{w_i, j, t-\Delta t}$	TWTT(50, 20)	j th component local wall temperature (previous time step) ($^{\circ}$ K)
T_1°	TO(100)	Flow channel local stagnation temperature ($^{\circ}$ K)
T_D°	TOD	Supply duct stagnation temperature ($^{\circ}$ K)
T_{DT}°	TODT	Diffuser throat stagnation temperature ($^{\circ}$ K)
$T_{i_{ex}}^{\circ}$	TOEX(21)	Exit plane mixed-mean stagnation temperature ($^{\circ}$ K)
T_N°	TON	Exit nozzle boattail exhaust stagnation temperature ($^{\circ}$ K)
T_{NT}°	TONT	Exit nozzle throat stagnation temperature ($^{\circ}$ K)
T_1°	TO1	Flow channel inlet plenum stagnation temperature ($^{\circ}$ K)
T_2°	TO2	Flow channel exit stagnation temperature ($^{\circ}$ K)
T_{2j}°	TO2CP(20)	j th component exit stagnation temperature ($^{\circ}$ K)
T_{flt}°	TOFLT	Flight condition stagnation temperature ($^{\circ}$ K)
$T_{2_{max}}^{\circ}$	TO2MAX*	Critical component ($j = 1$) exit stagnation temperature ($^{\circ}$ K)
$\tilde{T}_{2_{max}}^{\circ}$	TO2MXP	Critical component exit stagnation temperature, iteration variable ($^{\circ}$ K)
T_1	T1	Component inlet plenum static temperature ($^{\circ}$ K)
T_2	T2	Flow channel exit static temperature ($^{\circ}$ K)
T_{2j}	T2CP(20)	j th component exit static temperature ($^{\circ}$ K)
V_{ex}	VEXH	Exit nozzle boattail exhaust velocity (NBS)
V_0	V0	Missile flight velocity (NBS)
V_2	V2	Flow channel exit gas velocity (NBS)
$\dot{w}_j$	W(20)	j th component flow rate (lb_m/sec)
$\dot{w}_{i_{ex}}$	WEX(21)	Exit plane total flow rate (lb_m/sec)
$\tilde{\dot{w}}_{tot}$	WTOT	Total of component flow rates, iteration variable (lb_m/sec)
$\dot{w}_{tot}$	WTOTAL*	Total of component flow rates (lb_m/sec)
$x_{i, j}$	X(50, 20)*	Component axial station designations, arbitrary origin (in.)
M_i	XM(100)	Flow channel local Mach number (dimensionless)
M_{2j}	XMCP(20)	j th component exit Mach number (dimensionless)
M_D	XMD	Supply duct Mach number (dimensionless)

Table 4 (Continued)

Variable	FORTTRAN COM & DIM	Definition
M_{DT}	XMDT	Diffuser throat Mach number (dimensionless)
$M_{i_{ex}}$	XMEX(21)	Exit plane Mach number (dimensionless)
M_{flt}	XMFLT	Missile flight Mach number (dimensionless)
M_N	XMN	Exit nozzle boattail exhaust Mach number (dimensionless)
M_{NT}	XMNT	Exit nozzle throat Mach number (dimensionless)
M_1	XM1	Component inlet plenum Mach number (dimensionless)
M_2	XM2	Flow channel exit Mach number (dimensionless)

Table 5. FLOSS IV compatible subroutines - a tabulation of input and computed variables and discussion of purpose. Primary input variables are those available at time of initial subroutine call. Secondary input variables are those produced by another subroutine, called by the designated subroutine. Secondary input variables noted by an asterisk (*) are read from input tape. Variables mentioned as both input and computed may be modified by the routine.

Subroutine name and purpose	Primary input variables	Secondary input variables	Computed variables
MAIN PROGRAM			
Prepares gas thermodynamic property data for use by code. Sets up LRL Monitor system trap modes. Initiates calling sequence. Produces instruction tape.		Gas thermodynamic property data	INPT, IOUT
MASTER			
Performs tasks of a main program during operation. Reads and interprets input, designating section of code to be used.		(NCODE, ITT)*	ITT
CNTROL			
Starting point for FLOSS section of code. Reads input boundary conditions and geometry data and interprets FLOSS option to be used.		(NAME, NTYPE, H01, P01, W, PWR, P2, TWMAX, T02MAX, X, G, R, POR)*	JX, PWRCE, P01, T01, H01, P0I, P2, TWMAX, T02MAX
FLOSS			
Computes thermodynamic conditions along length of single, circular conduit subject to given boundary conditions.	H0IN, P0IN, WIN, PWRIN, XIN, RIN, PORIN, GIN, TWIN, ENTRNS, RGH, ITT		WIN, XMOUT, P0OUT, POUT, T0OUT, TOUT, TWOUT, QPOUT, REOUT, FOUT, HQOUT
BNDARY			
Iterates FLOSS calculation, modifying flow rate until input exit static pressure, p_2 , agrees with value obtained by FLOSS for last station. Computes peak and average conduit wall temperature.	JX, X, W, R, P01, H01, P0I, PWRP, PWRCE, PWR, POR, G, TWTT, ENTRNS, RGHNS, P3		W, T0Z, XM, P0, P, T0, T, TWT, QP, V2, REY, F, HG, H02, P02, T02, T2, XM2, TWM, TWA
INLOSS			
Computes effective conduit inlet stagnation pressure due to sudden contraction losses.	EIK, W, R, P01, H01		P0I
PKWALL			
Iterates BNDARY calculation, modifying conduit power until input maximum wall temperature agrees with corresponding value determined by BNDARY.	H01, P01, X, W, R, TWMAX, P2, PWRCE, JX	TWM	PWRP, PWR, W

Table 5 (Continued)

Subroutine name and purpose	Primary input variables	Secondary input variables	Computed variables
PKGAS			
Iterates BNDARY calculation, modifying conduit power until input exit gas stagnation temperature agrees with corresponding value determined by BNDARY	H01, P01, X, W, R, T02MAX, P2	T0(i _{MAX})	PWRP, PWR, W
NOMAC 4			
Analyzes system of parallel conduits with common upstream boundary conditions. Matches downstream conditions with component exit plane, plenum areas, and exit nozzle flow conditions.	PEX, P01, POWER, TWMAX, PWRCE, CMPNTS, T02MAX, EXK, AREAP, PAMB, AREANT, ALPH, AREADP, NPLANE, AREABT, FI, DIS, V0, Q0, NCODE	TWA, TWM, W, V2, H02, T02, T2, P02, XM2, PWRP	PEX, IOP, WTOT, PWRP, T02MAX, TWMXP, P2, JX, PWR, TWACP, TWMCP, T02CP, T2CP, P02CP, XMCP, H03, P0EX, T0EX, TEX, XMEX, WEX, AN, TN, PN, XMN, AT XMNT, TNT, THRUST, THRST, CFA, BDRAG, VEXH, P0N, T0N, P0NT, T0NT, IC
DFFUSR			
Determines upstream and throat conditions for a diffuser given the downstream conditions, total flow rate, and geometry	WTOT, AREADP, P01, H01, FID, AREADT, DISD, AREADU	T1, P1, T01	P0D, T0D, ID, T0DT, XMD, XM1, TD, PD, TDT, PDT, XMDT
FLWRT			
Iterates NOMAC 4 calculation, modifying inlet plenum stagnation pressure, P01, until computed total flow rate agrees with input value.	POWER, NCODE, P01, P0FLT, WTOTAL	W, WTOT, PWRP, PEX	P01, PWRP, W, PEX, RECO
NOMAC			
Starting point for basic NOMAC 4 calculation. Reads input boundary conditions, calls for input geometry through subroutine NOMIN, and selects NOMAC 4 or FLWRT code options.		(P0INLT, WTOTAL, H01, POWER, TWMAX, T02MAX, PAMB),* CMPNTS	P0INLT, P01, T01, H01, PAMB, POWER, TWMAX, T02MAX
DASH-N			
Starting point for ramjet performance code. Reads input flight conditions and other pertinent boundary conditions. Evaluates conduit upstream boundary conditions through subroutine FLTCON. Calls for input geometry through subroutine NOMIN. Selects NOMAC 4 or FLWRT code options.		(XMFLT, PAMB, TAMB, POWER, TWMAX, T02MAX, WTOTAL, RECOV)* P0INLT, CMPNTS	PAMB, TAMB, POWER, TWMAX, T02MAX, RECO, P01

Table 5 (Continued)

Subroutine name and purpose	Primary input variables	Secondary input variables	Computed variables
NOMIN			
Reads input geometrical description of system of parallel conduits in duct consisting of supply or flight-type inlet diffuser, variable area exit plenum and exit nozzle		(AREADU, AREADT, AREADP, FID, DISD, AREAP, AREANT, AREABT, FI, DIS, ALPH, NAME, NPLANE, CMPNTS, PWRCE, RGHNS, EIK, EXK, ENTRNS, X, G, R, POR, TWT, TWTT)*	G, PWRCE
FLTCON			
Determines isentropic stagnation conditions for given flight Mach number and ambient conditions.	TAMB, PAMB, XMFLT		V0, H01, P0FLT, T01, Q0, T0FLT
ISN1			
Determines isentropic static conditions for given stagnation enthalpy and pressure and Mach number.	P0I, H0I, XMI		PJ, T0J, TJ, R, V,
ISN2			
Determines subsonic isentropic conditions for given stagnation enthalpy and pressure and flow density.	P0I, H0I, RVI		PJ, T0J, TJ, RJ, V, XMJ
HOOKUP			
General two-dimensional gas property table lookup and interpolation routine.	X, P, KIND		(Dependent lookup variable)
HOOKUP Entries			
ENTHLP Enthalpy lookup, given T and p	T, p		KIND=1, H
ENTROP Entropy lookup, given T and p	T, p		KIND 3, S
DENSTY Density lookup, given T and p	T, p		KIND=5, R
VELCTY Speed of sound lookup, given T and p	T, p		KIND-7, V
SPHEAT Specific heat lookup, given T and p	T, p		KIND=9, CP
TEMP Temperature lookup, given enthalpy and p	H, p		KIND=2, T
TEMPSR Temperature lookup, given entropy and p	S, p		KIND=4, T
TEMPRO Temperature lookup, given density and p	R, p		KIND=6, T
TEMPC Temperature lookup, given speed of sound and p	V, p		KIND=8, T

Table 5 (Continued)

Subroutine name and purpose	Primary input variables	Secondary input variables	Compound variables
OUTPUT			
Output routine for variables computed by FLOSS.			
SYNOPS			
Output routine for variables computed by NOMAC, DASH- N, and NOMAC 4.			
RESTR			
Produces and interprets restart card decks which may be used to pick up in middle of problem or provide initial guesses (NOMAC and DASH-N only).			
OUTERR			
Produces computer memory dump and returns control of code to MASTER when various subroutines determine that in- put conditions cannot be satisfied.

Fig. 2. Logic flow diagram for basic features of subroutine FLOSS.

Fig. 3. Logic flow diagram for basic features of subroutine BNDARY.

Fig. 4. Logic flow diagram for basic features of subroutine INLOSS.

Fig. 5. Logic flow diagram for basic features of subroutine PKWALL.

Fig. 6. Logic flow diagram for basic features of subroutine ISN1.

Fig. 7. Logic flow diagram for basic features of subroutine NOMAC 4.

Fig. 7 (Contd.). Subroutine NOMAC 4.

Fig. 8. Logic flow diagram for basic features of subroutine DFFUSR.

Fig. 9. Logic flow diagram for basic features of subroutine FLWRT.

Fig. 10. Logic flow diagram for basic features of subroutine NOMAC.

Fig. 11. Logic flow diagram for basic features of subroutine DASH-N.

Fig. 12. Logic flow diagram for basic features of subroutine FLTCON.

Fig. 13. Logic flow diagram for basic features of subroutine ISN1.

Fig. 14. Logic flow diagram for basic features of subroutine ISN2.

IV. USING THE CODE

The FLOSS IV compatible programs are written in basic FORTRAN II language. Hence, relatively little trouble should be encountered in assembling them on systems other than the LRL Monitor system. The gas property data are supplied through assembly of subroutines consisting of "DATA" definition statements. The "DATA" statement is peculiar to the LRL Monitor system, and use of the codes at other facilities will undoubtedly require either substitution of an equivalent statement or reading the data cards as input by means of appropriate FORTRAN format definitions.

Following interpretation of the gas property data, the main program produces a restartable binary chain tape which becomes the instruction tape for subsequent runs of the FLOSS IV compatible programs. The logical tape units employed for input and output operations are designated by the variables INPT and IOUT, respectively, as defined in the main program.

Preparation of input data for the various code sections and options will be facilitated by using the input data forms supplied on pages 25 through 29 of this report. Notice that the first card associated with a given set of problem data designates the code section to be used. Comments written in columns 11 through 71 of this card appear at the top of each output page resulting from the requested calculation.

The input for certain variable lists may be abbreviated when a repetition of values occurs. This is accomplished by leaving those fields blank which should contain the nonzero value specified in the nearest preceding filled field. Notice, however, that if the last field in a card specifying such a list is blank, it is assumed that no further data is forthcoming for that list. Blank fields will be filled to the extent of the number of axial stations specified in the x-list for that channel description.

The FLOSS subroutine uses the x-list as a guide in determining the incremental spatial steps of its finite difference relationships. Hence, the user is cautioned to select these stations carefully. In general, solutions resulting in large conduit Mach numbers should be represented by a more detailed spatial input description than those giving low conduit Mach numbers.

All numerical variables with the exception of ITT, IG, "Exit Plane," and those already specified on the data input forms must be written in floating point format with decimal point. The noted exceptions to this rule are written as indices and should be right-shifted within their respective fields.

The inlet and exit loss parameters, C_{in} and C_{ex} , respectively represent the loss in stagnation pressure, in units of local dynamic head. If C_{in} is nonzero an additional dynamic head loss of 1 minus the inlet porosity squared is also taken. Other references to porosity in the codes pertain to transient operation and are not covered in this report.

The parameter h/h_{0in} is set to unity if inlet effects on the heat transfer coefficient are to be considered to zero if no entrance effects are present. f/f_0 is a

roughness factor and for all intents and purposes may be considered as nothing more than a length (x-list) multiplier. It will usually have a value of unity.

Other coefficients mentioned relate to diffuser or nozzle efficiency and have well-defined conventional meanings.

If senseswitch 1 is depressed during a NOMAC or DASH-N problem, the program continues to the end of the current NOMAC 4 "PEX" iteration. A restart deck is then produced. This deck may be placed immediately ahead of the original input deck for the problem thus initializing a subsequent run at its previous terminating condition. A similar restart deck is produced following completion of NOMAC and DASH-N problems. This deck too may be used to initialize subsequent calculations.

As a final guide to use of the FLOSS IV compatible programs, Appendix 2 contains completed data forms and final output pages for sample problems, representative of each major section of the code.

FLOSS IV INPUT DATA FORM

Card 1

FLOSS
code
control

ITT(1)
1 2 3 4 5 6 7 8 9 10
1 1 1 1 1 1 1 1 1 1

Card 2

Boundary
conditions
Option
1

Problem name $T_1^0(^{\circ}\text{F})$ $p_1^0(\text{psia})$ $\dot{w}(\text{lb/sec})$ $P_{wr}(\text{watts})$ C_{in} f/f_0 $\frac{h}{h_{0in}}IG^{(2)}$
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72

Option
2

Problem name $p_2(\text{psia})$ $P_{wr}(\text{watts})$
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72

Option
3

Problem name $p_2(\text{psia})$ $T_{wmax}(^{\circ}\text{F})$
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72

Option
4

Problem name $p_2(\text{psia})$ $T_2^0(^{\circ}\text{F})$
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72

Cards 3.1-3.14

Axial
position (3)

$x(\text{in.})$
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70

Cards 4.1-4.14

Power
distri-
bution (3)

$G(x)$ (arbitrary dimensions)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70

Card 5

Hydraulic
radius (4)

$R(\text{in.})$
1 2 3 4 5 6 7 8 9 10
1 1 1 1 1 1 1 1 1 1

Card 6

Material
porosity (4)

Γ (dimensionless)
1 2 3 4 5 6 7 8 9 10
1 1 1 1 1 1 1 1 1 1

NOTES

- (1) If $ITT \neq 0$, output will be produced following each basic FLOSS calculation.
- (2) If $IG \neq 0$, problem input is considered complete. Geometry of previous problem is used.
- (3) Up to 98 axial positions may be designated using as many consecutive fields and cards as necessary. A blank in the last field of a card indicates that it is the last data card for the variable.
- (4) If hydraulic radius and/or material porosity vary with axial position, omit corresponding card(s) and use FLOSS IV Supplemental Data Input Form.

Hydraulic
radius Material
porosity

A blank in the last field of a card indicates that it is the last data card for the variable.

NOMAC IV/DASH-N IV GEOMETRY DATA INPUT FORM

Pressure Vessel Geometry

Card 3

Diffuser
data

$A_{duct}(in^2)$										$A_{throat}(in^2)$										$A_{plenum}(in^2)$										Velocity coef.										Discharge coef.									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

Cards 4.1-4.3

Exit
plane
plenum
areas

$A_{ex}(in^2)$																																																																					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70

Up to 21 exit plane plenum areas may be specified in consecutive fields and cards.
A blank in the last field of a card indicates completion of data for the variable.

Card 5

Nozzle
data

$A_{throat}(in^2)$										$A_{boattail}^*(in^2)$										Velocity coef.										Discharge coef.										Divergence factor									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50

* If $A_{boattail}$ is unspecified, expansion to ambient pressure is implied.

NOMAC IV/DASH-N IV GEOMETRY DATA INPUT FORM

Component Geometry

Card 6.N

Characteristic coefs.	Exit		No. of components	Relative power	f/f_0	C_{in}	C_{ex}	$\frac{h}{h_{0in}}$
	Component name	plane						
	1	2	3	4	5	6	7	8
	9	10	11	12	13	14	15	16
	17	18	19	20	21	22	23	24
	25	26	27	28	29	30	31	32
	33	34	35	36	37	38	39	40
	41	42	43	44	45	46	47	48
	49	50	51	52	53	54	55	56
	57	58	59	60	61	62	63	64
	65	66	67	68	69	70	71	72

Cards 7.N.1-7.N.7

Axial
position

$x(\text{in.})$
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
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63
64
65
66
67
68
69
70

Cards 8.N.1-8.N.7

Power
distri-
bution

$G(x)$ (arbitrary units)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
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60
61
62
63
64
65
66
67
68
69
70

Cards 9.N.1-9.N.7

Hydraulic
radius

$R(x)$ (in.)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
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57
58
59
60
61
62
63
64
65
66
67
68
69
70

Cards 10.N.1-10.N.7

Material
porosity

$\Gamma(x)$ (dimensionless)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
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61
62
63
64
65
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69
70

Up to 49 axial positions and corresponding position-dependent variables may be specified in consecutive fields and cards (7 through 10). Blanks within dimension of variable data blocks specified by axial position data will be set equal to first nonzero value of the variable encountered previously in list. A blank in last field of a card indicates end of data for that variable.

REFERENCES

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APPENDIX 1. HYDRAULIC EQUIVALENT MODEL FOR NONCIRCULAR FLOW-CHANNEL GEOMETRIES

In order to conform to the input limitations of the FLOSS IV fluid dynamic code it is necessary to describe noncircular flow-channels in terms of some equivalent aerodynamic model. It is the purpose of this discussion to develop such a model and to provide a guide to its application by means of a specific example.

The typical approach to the problem of noncircular geometries is to express the flow-channel dimensions in terms of a number of similar circular passages, the lengths of which are the same as the actual length and the radii, determined from the relationship*

$$r_H = \frac{ZA}{P}, \quad (1)$$

where r_H is the hydraulic radius, A , the local cross-sectional flow area, and P , the wetted perimeter. The number of such equivalent passages is obtained from the requirement that both the flow density and total mass flow are preserved in the transformation. Hence

$$N_H = \frac{A}{\pi r_H^2}. \quad (2)$$

While the implied model is adequate for channels of constant cross-sectional shape and area, Eq. (2) cannot be satisfied if these factors change along its length.

In an effort to understand the restrictions on a meaningful general transformation, let us look carefully at the differential equation for the generalized flow process,

$$-dp = 2q \left[f \frac{dx}{r_H} + \frac{dq}{q} + \frac{dA}{A} \right], \quad (3)$$

where q is the dynamic head, dx the differential distance along the channel, and dp the change in pressure. A convenient expression for the friction factor, f , is obtained by considering the Blasius correlation

$$f = \frac{0.046}{\left(\frac{2\rho V r_H}{\mu} \right)^{0.2}} \quad (4)$$

where ρ , V , and μ refer to the gas density, velocity, and viscosity, respectively. By substituting Eq. (4) into (3), it will be noted that we may formulate a transformation which preserves the meaning of Eq. (3) provided that:

* E. R. G. Eckert and R. M. Drake, Jr., Heat and Mass Transfer (McGraw-Hill Book Company, Inc., New York, 1959).

- 1) Gas properties including temperature, pressure, and dynamic head are preserved in the transformation.
- 2) The cross-sectional area, A , is unaffected by the transformation.
- 3) The length variable $\frac{dx}{r_H^{1.2}}$ is conserved in the transformation.

The second of these conditions implies the existence of an equivalent radius, r_e , defined by the expression

$$r_e = \sqrt{\frac{A}{\pi}} \quad (5)$$

but this relationship is inconsistent with the definition of equivalent hydraulic radius represented by Eq. (1). Hence we are required to express the hydraulic equivalence in terms of a length modification, subject to the restrictions of condition (3). Thus

$$\frac{dx_H}{r_e^{1.2}} = \frac{dx}{r_H^{1.2}} \quad (6)$$

Since flow rate is conserved by virtue of Eq. (5) and condition (1), the number N_H no longer has meaning. By substituting Eqs. (1) and (5) into (6) we obtain

$$dx_H = \left(\frac{P}{2\sqrt{\pi A}} \right)^{1.2} dx \quad (7)$$

which is the desired length transformation.

Finally, it is necessary to assure that temperature is properly treated at each axial position. This is accomplished by appropriately modifying the power distribution, $Pwr(x)$, such that

$$Pwr_e(x_H) = \frac{dx}{dx_H} Pwr(x) \quad (8)$$

where

$$x_H = \int_0^x \left(\frac{dx_H}{dx} \right) dx. \quad (9)$$

Substituting from (7), these expressions become

$$Pwr_e(x_H) = \left(\frac{P}{2\sqrt{\pi A}} \right)^{-1.2} Pwr(x) \quad (8')$$

and

$$x_H = \int_0^x \left(\frac{P}{2\sqrt{\pi A}} \right)^{1.2} dx. \quad (9')$$

Where normalized power distributions and axial positions are desired, the following definitions apply.

$$g(\epsilon) = \frac{1}{Pwr} Pwr_H(\epsilon) \quad (10)$$

where

$$\overline{Pwr} = \int_0^L Pwr(x) dx$$

$$\epsilon = \frac{x_H}{L_H}, \quad d\epsilon = \frac{dx_H}{L_H}$$

$$L_H = \left[x_H \right]_{x=L} \quad (\text{From Eq. (9').})$$

Equations (5), (8), and (9) define a geometrical transformation which satisfies the stated conditions. However, we must investigate the effect of this transformation on the film temperature drop as determined by the FLOSS calculation. A relationship between real and equivalent film drop may be determined from the heat transfer equivalence

$$h \cdot P \cdot dx \cdot \Delta T_{\text{film}} = h_e \cdot P_e \cdot dx_H \cdot \Delta T_{\text{film}_e} \quad (11)$$

where

$$P_e = 2\pi r_e$$

By substitution

$$\frac{\Delta T_{\text{film}_e}}{\Delta T_{\text{film}}} = \left(\frac{P}{2\sqrt{\pi A}} \right)^{-0.2} \frac{h}{h_e} \quad (12)$$

The heat transfer coefficient relationship employed in FLOSS is dependent upon geometrical effects only to the extent of $r_H^{-0.2}$ (neglecting entrance effects — see section II of this report). Hence,

$$\frac{h}{h_e} = \left(\frac{r_H}{r_e} \right)^{-0.2} = \left(\frac{2A/P}{\sqrt{A/\pi}} \right)^{-0.2} = \left(\frac{2\sqrt{\pi A}}{P} \right)^{-0.2} \quad (13)$$

Substituting (13) into Eq. (12), we obtain the fortuitous result

$$\frac{\Delta T_{\text{film}_e}}{\Delta T_{\text{film}}} = 1 \quad (12')$$

In other words, the wall temperature resulting from a FLOSS calculation based upon the described transformation is unaffected by the transformation.

Example

Consider a square flow channel which opens to a circular channel the dimensions of which are defined in Fig. 15, and which has a power distribution that is constant over the entire length. From (5) we obtain

$$r_{e1} = \frac{b}{\sqrt{\pi}},$$

and from (7),

$$L_{H1} = \left(\frac{2}{\sqrt{\pi}}\right)^{1.2} \ell_1.$$

Fig. 15. Flow channel treated in example.

Since the second section of this flow channel is circular, no transformations are necessary. The total length used for calculations is therefore

$$L_e = \left(\frac{2}{\sqrt{\pi}}\right)^{1.2} \ell_1 + \ell_2,$$

and the radius

$$r_e = \frac{b}{\sqrt{\pi}}, \quad 0 \leq x_e < \left(\frac{2}{\sqrt{\pi}}\right)^{1.2} \ell_1,$$

$$r_e = \frac{d}{2}, \quad \left(\frac{2}{\sqrt{\pi}}\right)^{1.2} \ell_1 < x_e \leq L_e.$$

Care must be exercised in applying (8') and (10) since our example involves a partial transformation. Rewriting (10) in terms of a two-part geometry,

$$g_1(\epsilon) = \frac{\frac{\ell_1}{L_{H1}} \cdot L_e \cdot \text{Pwr}_1(\epsilon)}{\int_0^{\ell_1} \text{Pwr}_1(x) dx + \int_{\ell_1}^{(\ell_1 + \ell_2)} \text{Pwr}_2(x) dx}, \quad 0 \leq \epsilon < \frac{L_{H1}}{L_e},$$

$$g_2(\epsilon) = \frac{L_e \cdot \text{Pwr}_2(\epsilon)}{\int_0^{\ell_1} \text{Pwr}_1(x) dx + \int_{\ell_1}^{(\ell_1 + \ell_2)} \text{Pwr}_2(x) dx}, \quad \frac{L_{H1}}{L_e} < \epsilon \leq 1.$$

In terms of our example the power distribution is therefore

$$g_1(\epsilon) = \frac{\ell_1 + \left(\frac{\sqrt{\pi}}{2}\right)^{1.2} \cdot \ell_2}{\ell_1 + \ell_2}, \quad 0 \leq \epsilon < \left(\frac{2}{\sqrt{\pi}}\right)^{1.2} \cdot \frac{\ell_1}{L_e},$$

$$g_2(\epsilon) = \frac{\left(\frac{2}{\sqrt{\pi}}\right)^{1.2} \cdot \ell_1 + \ell_2}{\ell_1 + \ell_2}, \quad \left(\frac{2}{\sqrt{\pi}}\right)^{1.2} \cdot \frac{\ell_1}{L_e} \leq \epsilon \leq 1.$$

Verification of Transform Equivalence

If we may rely upon the validity of the "hydraulic radius" to accurately account for the frictional effects in noncircular flow channels, we see that it becomes necessary to qualify the $dx/r^{1.2}$ parameter dependence, particularly since a slightly different friction factor correlation was employed in the derivation of this parameter than that implicit in the FLOSS calculation. This has been done by running a group of FLOSS IV problems in which a large range of this parameter was investigated for several different lengths, L , temperature, and pressure changes. The results of this study confirm that the flow density, Mach number, and gas properties are almost completely dependent upon $dx/r^{1.2}$ for a given set of inlet and exit boundary pressures and total temperatures. Hence, use of this parameter in determining the "equivalent hydraulic length" is well justified.

Summary

The effects of changes in the shape and dimensions of flow channel cross section may be analyzed by FLOSS IV calculations by performing certain transformations on the local geometry and power deposition as follows:

Local radius:

$$r_e = \sqrt{\frac{A}{\pi}} \quad (5)$$

Length of section:

$$dx_H = \left(\frac{P}{2\sqrt{\pi}A}\right)^{1.2} dx, \quad (7)$$

$$x_H = \int_0^x \left(\frac{P}{2\sqrt{\pi}A}\right)^{1.2} dx. \quad (9')$$

Local power deposition:

$$Pwr_e(x_H) = \frac{dx}{dx_H} \cdot Pwr(x). \quad (8)$$

APPENDIX 2. SAMPLE PROBLEMS (INPUT AND OUTPUT) DONE WITH
FLOSS IV COMPATIBLE PROGRAMS

Card 1

FLOSS
code
control

					ITT ⁽¹⁾				
1	2	3	4	5	6	7	8	9	10
				1					

Card 2

Boundary
conditions
Option

Problem name																												$T_1^0(^{\circ}\text{F})$	$p_1^0(\text{psia})$	$\dot{w}(\text{lb/sec})$	$P_{\text{wr}}(\text{watts})$	C_{in}	t/t_0	$\frac{h}{h_{0\text{in}}}IG^{(2)}$																																																																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

Option
2

[illegible]

Option
3

Problem name		p_2 (psia)	T_{wmax} (°F)
1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16
17	18	19	20
21	22	23	24
25	26	27	28
29	30	31	32
33	34	35	36
37	38	39	40
41	42	43	44
45	46	47	48
49	50	51	52
53	54	55	56
57	58	59	60
61	62	63	64
65	66	67	68
69	70	71	72

Option
4

Problem name	p_2 (psia)										T_2 (°F)																																																												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72

Cards 3.1-3.14

Axial
position⁽³⁾

Cards 4.1-4.14

Power
distrib-
ution⁽³⁾

A large grid representing $G(x)$ in arbitrary dimensions, with columns numbered 1 to 69. The grid contains sparse data points, including zeros and other numerical values, indicating a sparse matrix structure.

Card 5

Hydraulic
radius⁽⁴⁾

R(in.)

1	2	3	4	5	6	7	8	9	10
				0	.	3	5		

Card 6

Material
porosity⁽⁴⁾

[illegible]

NOTES

- (1) If $ITT \neq 0$, output will be produced following each basic FLOSS calculation.
- (2) If $IG \neq 0$, problem input is considered complete. Geometry of previous problem is used.
- (3) Up to 98 axial positions may be designated using as many consecutive fields and cards as necessary. A blank in the last field of a card indicates that it is the last data card for the variable.
- (4) If hydraulic radius and/or material porosity vary with axial position, omit corresponding card(s) and use FLOSS IV Supplemental Data Input Form.

1 FLOSS-IV FLOSS-IV FLOSS-IV FLOSS-IV 12.41E09/23 FLOSS-IV FLOSS-IV FLOSS-IV FLOSS-IV FLOSS-IV FLOSS-IV FLOSS-IV FLOSS-IV FLOSS-IV

FLOSS TEST PROC.

T01 (DEG-F)	P01 (PSIA)	P01 (PSIA)	P2 (PSIA)	W (LB-M/SEC)	PWR (KW)	TW-MAX (DEG-F)	T02 (DEG-F)
800.0	350.00	329.46	250.00 (250.00)	1.047402	70.24388	2000.0 (2000.0)	-459.7 (1043.3)

ENTRANCE HEAT TRANSFER (1=YES)	F/F-SMOOTH= M/H-SMOOTH	INLET DYNAMIC HEAD LOSS	EXIT DYNAMIC HEAD LOSS	EXIT REYNOLDS NUMBER (RE2)	EXIT FRICTION FACTOR (F2)	EXIT HEAT TRANS COEF. (H2)
0.	1.000	0.750	0.	9.353E+05	2.945E-03	2.244E+00

X	R	POR	S	M	PO	P	TD	T	TW(T)	TW(T-DT)	Q/PO	RE/RE2	F/F2	M/H2	H0
0.	0.35000.	0.	.3461	329.46	303.57	800.0	772.7	796.8	-459.7	.0763	1.107	0.	0.967	9.1034	
5.00	0.35000.	0.	.3439	327.21	301.09	800.0	772.3	796.8	-459.7	.0774	1.108	0.983	0.967	9.1034	
10.00	0.35000.	0.3333	.3524	324.83	298.43	803.2	774.8	943.3	-459.7	.0788	1.106	0.983	0.916	9.1276	
15.00	0.35000.	0.6667	.3573	322.25	295.42	812.7	783.4	1111.2	-459.7	.0808	1.101	0.983	0.870	9.2001	
20.00	0.35000.	1.0000	.3639	319.63	292.03	828.5	797.8	1300.1	-459.7	.0834	1.093	0.984	0.829	9.3211	
25.00	0.35000.	1.3333	.3717	316.64	288.21	850.5	818.1	1508.9	-459.7	.0866	1.082	0.986	0.794	9.4903	
30.00	0.35000.	1.6667	.3814	313.37	283.94	878.7	844.1	1735.8	-459.7	.0906	1.068	0.988	0.763	9.7080	
35.00	0.35000.	2.0000	.3930	310.00	279.16	913.1	875.7	1978.4	-459.7	.0954	1.052	0.990	0.737	9.9740	
40.00	0.35000.	2.0000	.4058	306.14	273.99	950.5	909.9	2000.0	-459.7	.1010	1.036	0.993	0.748	10.2641	
45.00	0.35000.	1.6667	.4185	302.33	268.73	984.7	940.6	1809.4	-459.7	.1066	1.021	0.995	0.792	10.5301	
50.00	0.35000.	1.3333	.4307	298.39	263.57	1012.4	965.3	1636.8	-459.7	.1120	1.010	0.997	0.834	10.7478	
55.00	0.35000.	1.0000	.4421	294.60	258.54	1034.0	983.9	1478.0	-459.7	.1171	1.002	0.999	0.876	10.9170	
60.00	0.35000.	0.0000	.4511	290.99	254.05	1043.3	990.9	1037.3	-459.7	.1218	0.999	1.000	1.001	10.9996	
65.00	0.35000.	0.0000	.4581	287.56	250.00	1043.3	989.3	1037.1	-459.7	.1245	1.000	1.000	1.000	10.9996	

T4-AV=1404.1
END OF PROBLEM

NOTE: CDC 3600 running time, about 0.54 minutes.

Card 1

ITT									
1	2	3	4	5	6	7	8	9	10
				2					

If $ITT \neq 0$, output will be produced following each basic FLOSS calculation.

Card 2

[illegible]

If IG $\neq$ 0, problem input is considered complete. Geometry of previous problem is used.
For geometry input, see NOMAC IV/DASH-N IV Geometry Data Input Forms.

Note: CDC 3600 running time, about 10.92 minutes.

Pressure Vessel Geometry

Diffuser
data[illegible]

Exit
plane
plenum
areas

[illegible]

Up to 21 exit plane plenum areas may be specified in consecutive fields and cards. A blank in the last field of a card indicates completion of data for the variable.

Nozzle
data

$A_{throat} \text{ (in}^2\text{)}$					$A_{boattail}^* \text{ (in}^2\text{)}$	Velocity coef.	Discharge coef.	Divergence factor
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50				

If $A_{\text{boat tail}}$ is unspecified, expansion to ambient pressure is implied.

Component Geometry

Characteristic
coefs.

		Exit	No. of	Relative				
		plane	components	power	f/r_0	C_{in}	C_{ex}	$\frac{h}{h_{0in}}$
Component	name							
1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18
19	20	21	22	23	24	25	26	27
28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45
46	47	48	49	50	51	52	53	54
55	56	57	58	59	60	61	62	63
64	65	66	67	68	69	70	71	72
73	74	75	76	77	78	79	80	81
82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99
100	101	102	103	104	105	106	107	108
109	110	111	112	113	114	115	116	117
118	119	120	121	122	123	124	125	126
127	128	129	130	131	132	133	134	135
136	137	138	139	140	141	142	143	144
145	146	147	148	149	150	151	152	153
154	155	156	157	158	159	160	161	162
163	164	165	166	167	168	169	170	171
172	173	174	175	176	177	178	179	180
181	182	183	184	185	186	187	188	189
190	191	192	193	194	195	196	197	198
199	200	201	202	203	204	205	206	207
208	209	210	211	212	213	214	215	216
217	218	219	220	221	222	223	224	225
226	227	228	229	230	231	232	233	234
235	236	237	238	239	240	241	242	243
244	245	246	247	248	249	250	251	252
253	254	255	256	257	258	259	260	261
262	263	264	265	266	267	268	269	270
271	272	273	274	275	276	277	278	279
280	281	282	283	284	285	286	287	288
289	290	291	292	293	294	295	296	297
298	299	300	301	302	303	304	305	306
307	308	309	310	311	312	313	314	315
316	317	318	319	320	321	322	323	324
325	326	327	328	329	330	331	332	333
334	335	336	337	338	339	340	341	342
343	344	345	346	347	348	349	350	351
352	353	354	355	356	357	358	359	360
361	362	363	364	365	366	367	368	369
370	371	372	373	374	375	376	377	378
379	380	381	382	383	384	385	386	387
388	389	390	391	392	393	394	395	396
397	398	399	400	401	402	403	404	405
406	407	408	409	410	411	412	413	414
415	416	417	418	419	420	421	422	423
424	425	426	427	428	429	430	431	432
433	434	435	436	437	438	439	440	441
442	443	444	445	446	447	448	449	450
451	452	453	454	455	456	457	458	459
460								

Axial
position

Power
distri-
bution

Graph of $G(x)$ (arbitrary units) versus x . The x-axis ranges from 1 to 69, and the y-axis ranges from 0 to 11. The graph shows a series of peaks and valleys. The peaks are labeled with their values: 6 at $x=5$, 11 at $x=17$, 8 at $x=26$, 2 at $x=34$, 3 at $x=44$, 4 at $x=54$, and 5 at $x=64$. The valleys are labeled with their values: 5 at $x=4$, 0 at $x=16$, 0 at $x=25$, 9 at $x=33$, 8 at $x=43$, 7 at $x=53$, and 6 at $x=63$.

Hydraulic
radius[illegible]Material
porosity

$\Gamma(x)$ (dimensionless)

x	Γ(x)
1	0.500
5	0.650
10	0.750
15	0.810
20	0.850
25	0.880
30	0.900
35	0.915
40	0.930
45	0.940
50	0.950
55	0.960
60	0.970
65	0.980
70	0.990

Up to 49 axial positions and corresponding position-dependent variables may be specified in consecutive fields and cards (7 through 10). Blanks within dimension of variable data blocks specified by axial position data will be set equal to first nonzero value of the variable encountered previously in list. A blank in last field of a card indicates end of data for that variable.

Component Geometry

Characteristic coefs.	Component name		Exit plane	No. of components	Relative power	f/f_0	C_{in}	C_{ex}	$\frac{h}{h_{0in}}$
	1	2	3	4	5	6	7	8	9
	1	2	3	4	5	6	7	8	9
	10	11	12	13	14	15	16	17	18
	19	20	21	22	23	24	25	26	27
	28	29	30	31	32	33	34	35	36
	37	38	39	40	41	42	43	44	45
	46	47	48	49	50	51	52	53	54
	55	56	57	58	59	60	61	62	63
	64	65	66	67	68	69	70	71	72
	73	74	75	76	77	78	79	80	81
	82	83	84	85	86	87	88	89	90
	91	92	93	94	95	96	97	98	99
	100	101	102	103	104	105	106	107	108
	109	110	111	112	113	114	115	116	117
	118	119	120	121	122	123	124	125	126
	127	128	129	130	131	132	133	134	135
	136	137	138	139	140	141	142	143	144
	145	146	147	148	149	150	151	152	153
	154	155	156	157	158	159	160	161	162
	163	164	165	166	167	168	169	170	171
	172	173	174	175	176	177	178	179	180
	181	182	183	184	185	186	187	188	189
	190	191	192	193	194	195	196	197	198
	199	200	201	202	203	204	205	206	207
	208	209	210	211	212	213	214	215	216
	217	218	219	220	221	222	223	224	225
	226	227	228	229	230	231	232	233	234
	235	236	237	238	239	240	241	242	243
	244	245	246	247	248	249	250	251	252
	253	254	255	256	257	258	259	260	261
	262	263	264	265	266	267	268	269	270
	271	272	273	274	275	276	277	278	279
	280	281	282	283	284	285	286	287	288
	289	290	291	292	293	294	295	296	297
	298	299	300	301	302	303	304	305	306
	307	308	309	310	311	312	313	314	315
	316	317	318	319	320	321	322	323	324
	325	326	327	328	329	330	331	332	333
	334	335	336	337	338	339	340	341	342
	343	344	345	346	347	348	349	350	351
	352	353	354	355	356	357	358	359	360
	361	362	363	364	365	366	367	368	369
	370	371	372	373	374	375	376	377	378
	379	380	381	382	383	384	385	386	387
	388	389	390	391	392	393	394	395	396
	397	398	399	400	401	402	403	404	405
	406	407	408	409	410	411	412	413	414

[illegible]

Power distribution

1-9.N.7

Hydraulic radius

R(x) (in.)

N.1-10.N.7

Material porosity

$\Gamma(x)$ (dimensionless)

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70

.7

Up to 49 axial positions and corresponding position-dependent variables may be specified in consecutive fields and cards (7 through 10). Blanks within dimension of variable data blocks specified by axial position data will be set equal to first nonzero value of the variable encountered previously in list. A blank in last field of a card indicates end of data for that variable.

Component Geometry

[illegible][illegible][illegible]

Graph of $R(x)$ (in.) vs x (in.). The function is 0 for x from 1 to 25, and 1 for x from 26 to 70. A dashed line at $y=1$ and a solid line at $y=0$ are shown. A horizontal arrow points to the right above the x-axis.

Up to 49 axial positions and corresponding position-dependent variables may be specified in consecutive fields and cards (7 through 10). Blanks within dimension of variable data blocks specified by axial position data will be set equal to first nonzero value of the variable encountered previously in list. A blank in last field of a card indicates end of data for that variable.

NGMAC

GROSS THRUST = 117123. (B-F)
EXHAUST VELOCITY = 3238. (FT/SEC)

EXIT NOZZLE BOAT TAIL
CONDITIONS

```

M = 1.7401
PO = 34.05 (PSIA)
P = 13.12 (PSIA)
TO = 1956.1 (DEG-F)
T = 1021.2 (DEG-F)
AREA = 2000.0 (SQ-IN)
DIVERGENCE FACTOR
      = 0.9000

```

1
1
1
1
1
1
1

090606070809101112131415161718192021222324252627282930313233343536373839404142434445464748495051525354555657585960616263646566676869707172737475767778798081828384858687888990919293949596979899

CHOKED INLET DIFFUSER
CHOKED EXIT NOZZLE

00.543E09/25

EXIT PLANE 1	FREE FLOW AREA (SQ-IN)	M	P0 (PSIA)	P (PSIA)	T0 (DEG-F)	T (DEG-F)	FREE FLOW RATE (PPS)
	0.	0.	0.	172.30	-459.7	-459.7	0.

COMPONENT	NUMBER OF	POWER PER (KW)	M2	P02	T02	T2	TW-MAX	TW-AV	FLOW RATE PER (PPS)	PERCENT TOTAL FLOW
VARIETY 1	15000.	24.92	0.3302	184.95	1980.5	1939.4	2593.3	1824.6	0.0730905	0.913642

EXIT PLANE 2	FREE FLOW AREA (SQ-IN)	M	P0 (PSIA)	P (PSIA)	T0 (DEG-F)	T (DEG-F)	FREE FLOW RATE (PPS)
	2200.0	0.1573	178.39	175.53	1980.6	1971.2	1096.4

COMPONENT	NUMBER OF	POWER PER (KW)	M2	P02	T02	T2	TW-MAX	TW-AV	FLOW RATE PER (PPS)	PERCENT TOTAL FLOW
VARIETY 2	200.	124.61	0.3949	194.17	2013.3	1954.3	3212.9	2859.9	0.3550391	0.059174

EXIT PLANE 3	FREE FLOW AREA (SQ-IN)	M	P0 (PSIA)	P (PSIA)	T0 (DEG-F)	T (DEG-F)	FREE FLOW RATE (PPS)
	2400.0	0.1530	178.91	176.19	1982.6	1973.7	1167.4

COMPONENT	NUMBER OF	POWER PER (KW)	M2	P02	T02	T2	TW-MAX	TW-AV	FLOW RATE PER (PPS)	PERCENT TOTAL FLOW
VARIETY 3	100.	12.46	0.3844	194.67	939.5	903.3	1081.7	1009.4	0.3262077	0.027184

EXIT PLANE 4	FREE FLOW AREA (SQ-IN)	M	P0 (PSIA)	P (PSIA)	T0 (DEG-F)	T (DEG-F)	FREE FLOW RATE (PPS)
	2600.0	0.1440	179.06	176.65	1955.3	1947.6	1200.0

END OF PROBLEM

Card 1

ITT									
1	2	3	4	5	6	7	8	9	10
			3						

If $ITT \neq 0$, output will be produced following each basic FLOSS calculation.

Card 2

Boundary conditions

[illegible]

If IG $\neq$ 0, problem input is considered complete. Geometry of previous problem is used.
For geometry input, see NOMAC IV/DASH-N IV Geometry Data Input Forms.

Note: CDC 3600 running time about 3.18 minutes. Geometry for this problem is identical to that of the preceding NOMAC problem.

DASH-N

DASH-N

00.725E09/25
DASH-N

DASH-N

DASH-N

DASH-N

TOTAL REACTOR POWER = 379.1 (MW)
 TOTAL FLOW RATE = 1398.9 (FPS)
 PEAK MATERIAL TEMP. = 2721.2 (DEG-F)
 MAXIMUM EXIT GAS TEMP. = 1681.8 (DEG-F)

GROSS THRUST = 138479. (LB-F)
 NET THRUST = 9022. (LB-F)
 NET THRUST/Q-FLT = 138.8 (SQ-IN)
 FLIGHT VELOCITY = 2977. (FT/SEC)
 EXHAUST VELOCITY = 3007. (FT/SEC)

FLIGHT
 CONDITIONS
 M = 3.0000
 PO = 378.79 (PSIA)
 P = 10.30 (PSIA)
 TO = 675.1 (DEG-F)
 T = -30.0 (DEG-F)

REACTOR INLET
 CONDITIONS
 M = 0.0843
 PO = 246.21 (PSIA)
 P = 245.00 (PSIA)
 TO = 675.0 (DEG-F)
 T = 673.5 (DEG-F)
 AREA = 2500.0 (SQ-IN)

EXIT NOZZLE THROAT
 CONDITIONS
 M = 1.0000
 PO = 194.13 (PSIA)
 P = 104.82 (PSIA)
 TO = 1635.1 (DEG-F)
 T = 1336.8 (DEG-F)
 AREA = 700.0 (SQ-IN)
 DISCHARGE COEF. = 0.9000
 VELOCITY COEF. = 0.9000

EXIT NOZZLE BOAT TAIL
 CONDITIONS
 M = 1.9338
 PO = 101.12 (PSIA)
 P = 14.17 (PSIA)
 TO = 1635.6 (DEG-F)
 T = 808.2 (DEG-F)
 AREA = 2000.0 (SQ-IN)
 DIVERGENCE FACTOR = 0.9000

REACTOR EXIT PLANE
 CONDITIONS

CHOKED INLET DIFFUSER
 CHOKED EXIT NOZZLE

00.725E09/25

EXIT PLANE 1	FREE FLOW AREA (SQ-IN)	M	P0 (PSIA)	P (PSIA)	T0 (DEG-F)	T (DEG-F)	FREE FLOW RATE (PPS)
	0.	0.	0.	186.76	-459.7	-459.7	0.

COMPONENT	NUMBER OF	POWER PER (KW)	M2	P02	T02	T2	TW-MAX	TW-AV	FLOW RATE PER (PPS)	PERCENT TOTAL FLO
VARIETY 1	15000.	23.62	0.3292	200.64	1655.7	1619.1	2200.0	1543.2	0.0852334	0.913923

EXIT PLANE 2	FREE FLOW AREA (SQ-IN)	M	P0 (PSIA)	P (PSIA)	T0 (DEG-F)	T (DEG-F)	FREE FLOW RATE (PPS)
	2200.0	0.1569	193.41	190.27	1655.7	1647.3	1278.5

COMPONENT	NUMBER OF	POWER PER (KW)	M2	P02	T02	T2	TW-MAX	TW-AV	FLOW RATE PER (PPS)	PERCENT TOTAL FLO
VARIETY 2	200.	118.11	0.3940	210.75	1681.8	1629.1	2721.2	2424.8	0.4145566	0.059268

EXIT PLANE 3	FREE FLOW AREA (SQ-IN)	M	P0 (PSIA)	P (PSIA)	T0 (DEG-F)	T (DEG-F)	FREE FLOW RATE (PPS)
	2400.0	0.1526	193.97	190.99	1657.3	1649.4	1361.4

COMPONENT	NUMBER OF	POWER PER (KW)	M2	P02	T02	T2	TW-MAX	TW-AV	FLOW RATE PER (PPS)	PERCENT TOTAL FLO
VARIETY 3	100.	11.81	0.3840	211.27	791.9	758.7	915.7	854.5	0.3750300	0.026809

EXIT PLANE 4	FREE FLOW AREA (SQ-IN)	M	P0 (PSIA)	P (PSIA)	T0 (DEG-F)	T (DEG-F)	FREE FLOW RATE (PPS)
	2600.0	0.1436	194.13	191.49	1635.1	1628.1	1398.9

END OF PROBLEM

APPENDIX 3. CODE LISTINGS FOR THE FLOSS IV COMPATIBLE PROGRAMS,
INCLUDING GAS PROPERTY DATA FOR NBS AIR

IBM 7094 Main Program

```

* CARDS COLUMN
C LIST8
* FORTRAN MP
C MAIN FLOSS 2V PROGRAM WITH EDIT OF TABLES
C INITIALIZING PROGRAM FOR FLOSS-IV COMPATIBLE PROGRAMS
COMMON XT(120,11,5),HDG(6600)
EQUIVALENCE (XT,HDG)
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADU,AREANT,AREAP(21),AT,
2BDRAG,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),FI,FID,G(50,20),HG(100),H01,H02,IC,ID,INPT,
4 IOUT,ITT,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PO(100),POD,
6 PODT,POEX( 21),POFLT,POI,POINLT,PON,PONT,PO1,PO2,PO2CP(20),P1,P2,
7 QP(100),QO,R(50,20),RECD,RECDV,REY(100),RGHNS(20),T(100),TAMB,
8 TD,TDI,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,TO1,TO2,TO2CP(20),TOFLT,TO2MAX,TO2MXP,T1,T2,
2 T2CP(20),VEXH,VO,V2,W(20),WEX(21),WJDT,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLT,XMV,XMNT,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
1 (DAT(3001),PUR), (DAT(4001), TWTT), (DAT(5001), TWT)
900 FORMAT(6H1FLOSS,50X,10HTABLE EDIT,10X,A6,10X,A6,6H PAGE ,13,///)
901 FORMAT(48X,24HCOMPRESSIBILITY FACTOR X,///)
902 FORMAT(50X,20HENTHALOPY (H-E0)/RT0,///)
903 FORMAT(54X,12HENTROPY S/R,///)
904 FORMAT(50X,21HSPEED OF SOUND (A/A0),///)
905 FORMAT(50X,20HSPECIFIC HEAT (CP/Z),///)
906 FORMAT(54X,12HLOGE DENSITY,///)
907 FORMAT(53X,14HLOGE ENTHALOPY,///)
908 FORMAT(54X,11HLOGE (A/A0),///)
909 FORMAT(54X,11HLOGE (CP/R),///)
910 FORMAT(51H TEMP,48X,14HPRESSURE (ATM))
911 FORMAT(8H DEG K ,11F10.3,///)
912 FORMAT(1X,F6.1,2X,11F10.6)
922 FORMAT(23X,4(F8.4,1X))
923 FORMAT(6X,7(F8.4,1X))
924 FORMAT(23X,4(F8.5,1X))
925 FORMAT(6X,7(F8.5,1X))
IP=0
CALL CLOCK (T1,T2)
P(1)=.01
P(2)=.1
P(3)=.4
P(4)=.7
P(5)=1.
P(6)=4.
P(7)=7.
P(8)=10.
P(9)=40.
P(10)=70.
P(11)=100.

```

```

      T(1)=50.
      DO 100 L=2,76
100   T(L)=T(L-1)+10.
      DO 102 L=77,120
102   T(L)=T(L-1)+50.
C 7094 READ INPUT TAPE FOR TABLES
      K=0
110   K=K+1
      IF (K-3) 112,122,112
112   DO 120 J=1,11
      READ INPUT TAPE 2,922,(XT(L,J,K),L=1,4)
      DO 114 N=5,60,7
      NN=N+6
114   READ INPUT TAPE 2,923,(XT(L,J,K),L=N,NN)
      READ INPUT TAPE 2,922,(XT(L,J,K),L=61,64)
      DO 116 N=65,120,7
      NN=N+6
116   READ INPUT TAPE 2,923,(XT(L,J,K),L=N,NN)
120   CONTINUE
      IF (K-5) 110,200,200
122   DO 130 J=1,11
      READ INPUT TAPE 2,924,(XT(L,J,K),L=1,4)
      DO 124 N=5,60,7
      NN=N+6
124   READ INPUT TAPE 2,925,(XT(L,J,K),L=N,NN)
      READ INPUT TAPE 2,924,(XT(L,J,K),L=61,64)
      DO 126 N=65,120,7
      NN=N+6
126   READ INPUT TAPE 2,925,(XT(L,J,K),L=N,NN)
130   CONTINUE
      GO TO 110
C EDIT RAW DATA
200   KK=0
202   KK=KK+1
      L4=0
203   IP=IP+1
      WRITE OUTPUT TAPE 3,900,T1,T2,IP
      GO TO (204,206,208,210,212,214,216,208,218,220),KK
204   WRITE OUTPUT TAPE 3,901
      K=3
      GO TO 230
206   WRITE OUTPUT TAPE 3,902
      K=1
      GO TO 230
208   WRITE OUTPUT TAPE 3,903
      K=2
      GO TO 230
210   WRITE OUTPUT TAPE 3,904
      K=4
      GO TO 230
212   WRITE OUTPUT TAPE 3,905
      K=5

```



```

      GO TO 230
214 WRITE OUTPUT TAPE 3,906
      K=3
      GO TO 230
216 WRITE OUTPUT TAPE 3,907
      K=1
      GO TO 230
218 WRITE OUTPUT TAPE 3,908
      K=4
      GO TO 230
220 WRITE OUTPUT TAPE 3,909
      K=5
      GO TO 230
230 WRITE OUTPUT TAPE 3,910
      WRITE OUTPUT TAPE 3,911,(P(J),J=1,11)
      L3=L4+1
      L4=L3+39
      DO 234 I=L3,L4
234 WRITE OUTPUT TAPE 3,912,T(I),(XT(I,J,K),J=1,11)
      IF (L4-120) 203,235,235
235 IF (KK-5) 202,300,236
236 IF (KK-10) 202,400,400
CONVERT DATA
300 C1=272.99974
      DO 302 L=1,11
302 W(L)=P(L)*C1
      DO 314 L=1,1320
314 DAT(L)=XT(L)
      DO 317 J=1,11
        DO 317 I=1,120
          XT(I,J,1)=T(I)*XT(I,J,3)
          IF (XT(I,J,1)) 315,315,316
315 XT(I,J,3)=0.
      GO TO 317
316 XT(I,J,3)=LOGF(W(J)/XT(I,J,1))
317 CONTINUE
      DO 340 L=1,1320
        IF (DAT(L)) 332,332,330
332 XT(L)=0.
      GO TO 340
330 XT(L)=LOGF(DAT(L))
340 CONTINUE
      DO 390 J=1,11
        DO 390 I=1,120
          IF (XT(I,J,4)) 384,384,385
385 XT(I,J,4)=LOGF(XT(I,J,4))
384 IF (XT(I,J,5)) 386,386,387
386 GO TO 390
387 XT(I,J,5)=LOGF(XT(I,J,5))
390 CONTINUE
      GO TO 202
400 DO 402 L=1,7480

```

402 DAT(L)=0.

C (INPUT TAPE DESIGNATION = A2)
INPT=2

C (OUTPUT TAPE DESIGNATION = A3)

IOUT=3

E=ENTHLP (1500.,10.)

CALL OFFMON

500 CALL MASTER

GO TO 500

END

CDC 3600 Main Program

```

*      CARDS COLUMN
C      LIST8
*      FORTRAN          MAIN
C 3600 FLOSS MAIN PROGRAM
COMMONS FOR STANDARD ERROR PROCEDURE HANDLING
COMMON /ERRCOM/ ERRS(6)
COMMON /00000000/ IFLAG(7)
BANK AAA(1)
COMMON /AAA/ XT(120,11,5)
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADU,AREANT,AREAP(21),AT,
2BDRAG,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),FI,FID,G(50,20),HG(100),HO1,HO2,IC,ID,INPT,
4 IOUT,ITI,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PO(100),POD,
6 PODT,POEX( 21),POFLT,POI,POINLT,PON,PONT,PO1,PO2,PO2CP(20),P1,P2,
7 QP(100),QO,R(50,20),RECO,RECOV,REY(100),RGHNS(20),T(100),TAMB,
8 TD,TDT,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TQ(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,T01,T02,T02CP(20),TOFLT,T02MAX,T02MXP,T1,T2,
2 T2CP(20),VEXH,VO,V2,W(20),WEX(21),WTOT,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLT,XMV,XMNT,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
1 (DAT(3001),POR), (DAT(4001),TWTT), (DAT(5001),TWT)
C
C FORMATS
930 FORMAT(2X,A8,2X,A8,4H AT ,016)
931 FORMAT(25H FLOSS WILL DUMP AND EXIT)
932 FORMAT(1H1)
933 FORMAT(17H PROBLEM REJECTED)
ASSIGN 600 TO JCON1
ASSIGN 620 TO JCON2
ASSIGN 630 TO JCON15
ASSIGN 640 TO JCON24
CALL ERRORS
CALL CONTRS (1,JCON1,2,JCON2,15,JCON15,24,JCON24)
UNLOAD 6
CALL TABL1
CALL TABL2
CALL TABL3
CALL TABL4
CALL TABL5
P(1)=.01
P(2)=.1
P(3)=.4
P(4)=.7
P(5)=1.
P(6)=4.
P(7)=7.
P(8)=10.
P(9)=40.
P(10)=70.

```

```

      P(11)=100.
      T(1)=50.
      DO 100 L=2,76
----- 100 T(L)=T(L-1)+10.
      DO 102 L=77,120
      102 T(L)=T(L-1)+50.
CONVERT DATA
      300 C1=272.99974
      DO 302 L=1,11
----- 302 W(L)=P(L)*C1
      DO 314 L=1,1320
      314 DAT(L)=XT(L)
      DO 317 J=1,11
      DO 317 I=1,120
      XT(I,J,1)=T(1)*XT(I,J,3)
      IF (XT(I,J,1)) 315,315,316
----- 315 XT(I,J,3)=0.
      GO TO 317
      316 XT(I,J,3)=LOGF(W(J)/XT(I,J,1))
      317 CONTINUE
      DO 340 L=1,1320
      IF (DAT(L)) 332,332,330
----- 332 XT(L)=0.
      GO TO 340
      330 XT(L)=LOGF(DAT(L))
      340 CONTINUE
      DO 390 J=1,11
      DO 390 I=1,120
----- IF (XT(I,J,4)) 384,384,385
      385 XT(I,J,4)=LOGF(XT(I,J,4))
      384 IF (XT(I,J,5)) 386,386,387
      386 GO TO 390
      387 XT(I,J,5)=LOGF(XT(I,J,5))
----- 390 CONTINUE
      CALL CRTID(2H MJ,1,0)
      CALL FRAME
      DO 402 L=1,13300
      402 DAT(L)=0.
      INPT=2
      IOUT=3
      E=ENTHLP(1500.,10.)
----- 410 CALL MASTER
      GO TO 410
C ERRORS
      600 CC1=6H DIVIDE
      I=1
      CC2=5H CHECK
      601 WRITE OUTPUT TAPE 3,930,CC1,CC2,IFLAG(17)
      WRITE OUTPUT TAPE 3,931
      WRITE OUTPUT TAPE 3,932
      602 IF (UNIT,61) 602,604,604,604
      604 CALL PDUMP

```

```
NCODE=0
PRINT 933
608 CALL RESTRT
  IF (I-15) 610,610,610
610 CALL EXIT
620 CC1=4HOWER
  I=2
  CC2=4HFLOW
  GO TO 601
630 CC1=6HMANUAL
  I=15
  CC2=6HINTERR
  GO TO 601
640 CC1=7HENDFILE
  CC2=5HINPUT
  WRITE OUTPUT TAPE 3,930,CC1,CC2,IFLAG(17)
  WRITE OUTPUT TAPE 3,932
642 IF (UNIT,61) 642,644,644,644
644 CALL EXIT
END
```

```

* CARDS COLUMN
* LIST 8
* FORTRAN MASTER
SUBROUTINE MASTER
C CODE SELECTION. OPTIONS = FLOSS IV, NOMAC, DASH-N
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADU,AREANT,AREAP(21),AT,
2BDRAG,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),F1,FID,G(50,20),HG(100),HO1,HO2,IC,ID,INPT,
4 IQUT,ITT,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDI,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PO(100),POD,
6 PODT,POEX( 21),POFLT,P01,P0INIT,PON,PONT,P01,P02,P02CP(20),P1,P2,
7 QP(100),QO,R(50,20),RECO,RECOV,REY(100),RGHNS(20),T(100),TAMB,
8 TD,TDI,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,T01,T02,T02CP(20),TOFLT,T02MAX,T02MXP,T1,T2,
2 T2CP(20),VEXH,V0,V2,W(20),WEX(21),WTDI,WTDAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLT,XMN,XMNI,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
1 (DAT(3001),POR), (DAT(4001),TWTT), (DAT(5001),TWT)
100 FORMAT(215,10A6)
1 NCODE1=NCODE
101 FORMAT(1H1)
WRITEOUTPUTTAPE IQUT,101
READ INPUT TAPE INPT,100,NCODE,ITT,(CODNAM(I),I=1,8 )
CALL CLOCK (CODNAM(9),CODNAM(10))
WRITEOUTPUTTAPE IQUT,100,NCODE,ITT,(CODNAM(I),I=1,10)
IF(NCODE1)10, 9,9
9 DO 6 I=1,20
6 W(I)=0.
PO1=0.
PEX(I)=0.
10 ITT=ITT+1
IF(NCODE)8,8,7
8 CALL RESTRT
GO TO 1
7 IF(NCODE-2)2,3,4
2 CALL CNTRL
GO TO 1
3 CALL NOMAC
GO TO 1
4 CALL DASHN
IF(ITT)5,1,1
5 RETURN
END

```

```

* CARDS COLUMN
* LIST 8
* FORTRAN          CNTROL
SUBROUTINE CNTROL
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADU,AREANT,AREAP(21),AT,
2BDRAG,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),FI,FID,G(50,20),HG(100),H01,H02,IC,ID,INPT,
4 IDUT,ITT,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PQ(100),POD,
6 PODT,POEX(21),POFLT,POI,POINTLT,PON,PONT,PO1,PO2,PO2CP(20),P1,P2,
7 QP(100),QO,R(50,20),RECO,RECDV,REY(100),RGHNS(20),T(100),TAMB,
8 TD,TDI,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,TO1,TO2,TO2CP(20),TOFLT,TO2MAX,TO2MXP,T1,T2,
2 T2CP(20),VEXH,VO,V2,W(20),WEX(21),WTDI,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDI,XMEX(21),XMFLT,XMN,XMNT,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
1 (DAT(3001),POR), (DAT(4001),TWTT), (DAT(5001),TWT)
C FLOSS-IV INPUT BOUNDARY CONDITION OPTION SELECTION
100 FORMAT(3A6,I2,4F 9.4,2F5.3,F4.2,I2)
200 FORMAT(7F10.4)
JX=1
PWRCE=1.
READ INPUT TAPE INPT,100,(NAME(J,1),J=1,3),NTYPE,X1,X2,X3,X4,
1 EIK(1),RGHNS(1),ENTRNS(1),IG
WRITEOUTPUTTAPE IDUT,100,(NAME(J,1),J=1,3),NTYPE,X1,X2,X3,X4,
1 EIK(1),RGHNS(1),ENTRNS(1),IG
IF(IG)5,1,5
1 DO 20 I=1,4000
20 DAT (I,1,1)=0.
KO=1
JO=1
DO 4 I=1,140
KM=KO+6
READ INPUT TAPE INPT, 200, (DAT (K,1,JO),K=KO,KM)
WRITEOUTPUTTAPE IDUT, 200, (DAT (K,1,JO),K=KO,KM)
IF(DAT (KM,1,JO))2,2,3
2 IF(JO-1)11,11,12
11 KMM=KM
GO TO 15
12 DO 14 K=2,KMM
IF(DAT (K,1,JO))13,13,14
13 DAT (K,1,JO)=DAT (K-1,1,JO)
14 CONTINUE
15 JO=JO+1
KO=-6
IF(JO-4)4,4,5
3 IF(KM-98)4,2,2
4 KO=KO+7
5 PO1=X2/14.696
T01=(X1+459.69)/1.8

```

```

H01=ENTHLP(T01,PO1)
GBAR=0.
DO 16 IK=2,100
  IF(X(IK,1))16,17,16
16 GBAR=GBAR+(G(IK,1)+G(IK-1,1))*(X(IK,1)-X(IK-1,1))
17 GBAR=GBAR*.5/(X(IK-1,1)-X(1,1))
  DO 18 IK=1,100
18 G(IK,1)=G(IK,1)/GBAR
  GO TO (6,7,8,9),NTYPE
6 POI=PO1
  W=X3
  PWR=X4
  CALL FLOSS(H01,POI,W(1),PWR,DT,X(1,1),R(1,1),PDR(1,1),G(1,1),
1 IWT(1,1),XM,PO,P,TO,T,TWT(1,1),QP,REY,F,HG,ENTRNS(1),RGHNS(1),
2 ITT,IOUT)
  GO TO 10
7 P2=X3/14.696
  PWR=X4
  CALL BNDARY
  GO TO 10
8 P2=X3/14.696
  TWMAX=(X4+459.69)/1.8
  CALL PKWALL
  GO TO 10
9 P2=X3/14.696
  T02MAX=(X4+459.69)/1.8
  CALL PKGAS
10 CALL OUTPUT
101 FORMAT(15H END OF PROBLEM)
  WRITEOUTPUTTAPE IOUT,101
  PRINT 101
  RETURN
  END

```


* CARDS COLUMN

* LIST 8

* FORTRAN FLOSS

**

SUBROUTINE FLOSS(HOIN,POIN,WIN,PWRIN,DTIN,XIN,RIN,PORIN,GIN,TWIN,
1 XMOUT,POOUT,POUT,TOOUT,TOUT,TWOUT,QPOUT,REOUT,FOUT,HQOUT,ENTRNS,
2 RGH,ITF,IOUT)

DIMENSION XIN(100),RIN(100),PORIN(100),GIN(100),TWIN(100),
1 XMOUT(100),POOUT(100),POUT(100),TOOUT(100),TOUT(100),TWOUT(100),
2 QPOUT(100),REOUT(100),FOUT(100),HQOUT(100)

C GIVEN - HOIN,POIN,W,PWR,G(X),R(X),POR(X),TW(X,T-DT),DT

C FIND - M(X,T),PO(X,T),P(X,T),TO(X,T),T(X,T),TW(X,T)

IERR=0

IERR=1

XO=XIN

XL=0.

STEP=1.

DO 1 I=2,100

IF(XIN(I))2,2,1

1 CONTINUE

2 IMAX=I-1

XL=XIN(IMAX)-XO

99 ISS=1.

F=0.

HO=HOIN

PO=POIN

W=WIN

PWR=PWRIN

DT=DTIN

I=1

R=RIN

X=XO

G=GIN

POR=PORIN

TWDT=TWIN

TW=TWDT

INLET STATE CONDITION

C

C GIVEN - HO,PO,w,R

C FIND - T,P,V,Q

RHOV=1.6404976*W/(3.1415926*R**2)

98 TO=TEMP(HO,PO)

S=ENTROP(TO,PO)

CP=1.

IP=0

PI=0.

P=.999*PO

3 T=TEMPSR(S,P)

RHO=DENSTY(T,P)

V2=(RHOV/RHO)**2

4 H=ENTHLP(T,P)

IF(H)100,100,5

5 V2P=1.4274256*(HO-H)

DV=V2P-V2.

```

      IF(ABS(DV/V2)-1.E-6)15,15,6
6  IF(CP-.5)101,101,7
7  DP=(P-P1)*DV/(DV1-DV)*CP
      IF(P1)8,8,9
8  DP=-.001*P
      GO TO 10
9  IF(ABS(DP/P)-5.E-8)15,15,10
10 IF(-(P+DP-P0)*(1.3*P0-P-DP))11,11,12
11 DP=.5*DP
      GO TO 9
12 P1=P
      P=P+DP
      DV1=DV
      IP=IP+1
      IF(IP-10)14,14,13
13 IP=0
      CP=.9*CP
14 GO TO (3,22),ISS
15 GO TO (16,36),ISS
16 C=VELCTY(T,P)
17 V=V2**0.5
      XM=V/C
      Q=0.70097317*RHO*V2
      ISS=2

```

C STATION MATERIAL TEMPERATURE CALCULATION

C GIVEN - T, TO, RHOV, PWR, R, POR, XL, G, DT, TW(T-DT), TW, X)

C FIND - TW(T), TAW

```

18 XMU=VISCOS(T)
   CP=SPHEAT(T,P)
   XK=CONDCT(T)
   PR=XMU*CP/XK*.204029
   REYN=2.*R*RHOV/XMU*6.3441334E+5
   TAW=T+PR**0.33333333*(TO-T)
   HTO=0.0105*6.13156E-4*XK/R*REYN**0.3*PR**0.4*(1.+(2.*K/(K-XO+1.E-6))
1  **0.7*FNTRNS)*RGH
   IF(DT)19,19,20

```

C STEADY STATE WALL TEMPERATURE CALCULATION

```

19 R=PWR/G/(2.*3.1415926*R*XL*HTO*1**0.5)
   TW=((B+(L**2+4.*TAW)**0.5)**0.5)**2

```

GO TO 25

C TRANSIENT MATERIAL TEMPERATURE CALCULATION

```

20 TWTB=.5*(TW+TWDT)
   CPR=SPHTM(TWTB)
21 B=2.*HTO*T**0.5*POR*DT/(CPR*R*(1.-POR))
   C=-PWR*G*POR*DT/(3.1415926*R**2*XL*CPR*(1.-POR))-TWDT
   D=-B*1AW
   TRY=TWDT**0.5
22 FNTN=TRY**3+B*TRY**2+C*TRY+D
   DFDTRY=3.*TRY**2+2.*B*TRY+C
   DTRY=FNTN/DFDTRY
   TRY=1RY-DTRY
   TWP=TRY**2

```

```

      IF (ABS(TW/TWP-1.)-1.E-6) 24, 24, 23
23  TW=TWP
    TRY=TW**.5
    GO TO 20
24  GO TO(25,30),ISS
C      ADVANCE SPACIAL STEP
25  XMOUT(I)=XM
    POOUT(I)=PO
    POUT(I)=P
    TOOUT(I)=TO
    TOUT(I)=T
    TWOUT(I)=TW
    REOUT(I)=REYN
    FOUT(I)=F
    HQOUT(I)=HTO*(T/TW)**.5
    QPOUT(I)=Q/PO
    IF (STEP-.5) 26, 26, 125
125  I=I+1
    IF (I-IMAX) 26, 26, 43
126  STEP=.5
    DX=.5*DX
    X=X1+DX
    R=RB
    RB=.5*(R1+R)
    POR=.5*(POR+PORIN(I-1))
    G=GB
    GB=.5*(G1+G)
    RHOV=RHOV1*(R1/R)**2
    RHOVB=.5*(RHOV1+RHOV)
    TWDI=.5*(TWDI+TWIN(I-1))
    P=PA
    GO TO 28
26  X1=X
    DX1=DX
    X=XIN(I)
    DX=X-X1
    R1=R
    R=RIN(I)
    RB=.5*(R+R1)
    POR=PORIN(I)
    G1=G
    G=GIN(I)
    GB=.5*(G+G1)
    RHOV1=RHOV
    RHOV=RHOV*(R1/R)**2
    RHOVB=.5*(RHOV+RHOV1)
    IF (DT) 128, 128, 127
127  TWDI=TWIN(I)
    TW=TWDI
128  H01=H0
    PB=PA
    PA=P

```

```

S1=S
P01=P0
TW1=TW
TAW1=TAW
T1=T
TB=T
HOP=0.
HOT1=HOT
Q1=Q
STEP=1.

```

STATION TO STATION CALCULATION

C

GIVEN

C

FIND

```

IF(I-2)28,28,27
27 IF(DX/DX1-2.)48,28,28
48 P=PA-(PB-PA)*DX/DX1
28 IP=0
CP=1.
PI=0.
TWB=.5*(TW1+TW)
IF(DT)29,29,30

```

C

STEADY STATE ENTHALPY INCREASE

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29 DHO=PWR*GB*DX/(XL*W)*2.8124378E-5
GO TO 31

```

C

TRANSIENT ENTHALPY INCREASE

```

30 TAWB=.5*(TAW1+TAW)
HOTB=.5*(HOT+HOT1)
DHO=2.*3.1415926*RB*HOTB*(TB/TWB)**.5*DX*(TWB-TAWB)/W*2.8116880
31 HO=H01+DHO
32 XMU=VISCOS(TB)
REY=2.*RB*RHOVB/XMU*6.3441334E+5
FP=0.046/REY**.2
33 F=.25/(.86858896*LOGF(REY*(4.*FP)**.5)-.8)**2
IF(ABS(F/FP-1.))-5.E-8)35,35,34
34 FP=F
GO TO 33
35 F=F*RGH
49 DP=P-PA
Q=(Q1*(2.-DX*F/RB-(R**2-R1**2)/RB**2)-DP)/(2.+DX*F/RB+(R**2-R1**2)
2 /RB**2)
IF(Q)101,101,55
55 V=Q/RHOV*1.4265881
V2=V**2
RHO=RHOV/V
T=TEMPRO(RHO,P)
IF(T)50,50,51
50 P=PA+.5*DP
IF(ABS(.5*DP/PA)-5.E-8)52,52,49
51 TB=.5*(T+T1)
C=VELCTY(T,P)
XM=V/C
IF(XM-.025)36,36,53

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```

53 IF(XM-1.)4,4,102
36 IF(DT)39,39,37
37 IF(ABSF(HOP/HO-1.)-1.E-6)39,39,38
38 HOP=HO
   GO TO 18
39 PO=PO*P/PA
   S=ENTROP(T,P)
   IF((S-S1)*DX)52,52,40
52 S=S1
40 TO=TEMP(HO,PO)
   SO=ENTROP(TO,PO)
   IF(SO)101,101,54
54 IF(ABSF(SO/S -1.)-1.E-6)42,42,41
41 PO=PO*EXP(SO-S)
   GO TO 40
42 IF(DT)18,18,25
43 GO TO (47,44),ITT
44 CALL OUTPUT
47 RETURN
46 CALL OUTERR
   RETURN
100 WRITE OUTPUT TAPE IOUT,200
   PWRIN=.95*PWR
   GO TO 105
101 WRITE OUTPUT TAPE IOUT,201
   GO TO 126
102 WRITE OUTPUT TAPE IOUT,202
   WIN=.75*W
105 IERR=IERR+1
   IF(IERR-10)106,106,46
106 GO TO ( 99,103),ITT
103 CALL OUTPUT
   GO TO 99
200 FORMAT(46H1EXCEEDED PROPERTY TABLE IN FLOSS CALCULATION.)
201 FORMAT(48H1CONVERGENCE FAILURE IN FLOSS STATE CALCULATION.)
202 FORMAT(44H1MACH NO EXCEEDS UNITY IN FLOSS CALCULATION.)
   END

```

```

* CARDS COLUMN
* LIST 8
* FORTRAN BNDARY
SUBROUTINE BNDARY
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADU,AREANT,AREAP(21),AT,
2BDRAG,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),FI,FID,G(50,20),HG(100),H01,H02,IC,ID,INPT,
4 IOUT,ITT,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PO(100),POD,
6 PODT,POEX(21),POFLT,POI,POINLT,PON,PONT,PO1,PO2,PO2CP(20),P1,P2,
7 QP(100),QO,R(50,20),RECO,RECOV,KEY(100),RGHNS(20),I(100),IAMB,
8 TD,TDT,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,T01,T02,T02CP(20),TOFLT,T02MAX,T02MXP,T1,T2,
2 T2CP(20),VEXH,V0,V2,W(20),WEX(21),WTOT,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLI,XMN,XMNT,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
1 (DAT(3001),POR), (DAT(4001),TWTT), (DAT(5001),TWT)
C GIVEN - H01,PO1,P2,PWR,GEOMETRY
C FIND - W,INTERNAL AND EXIT STATE CONDITIONS
J=JX
IERR=0
1 DO 2 I=1,100
  IF(X(I+1,J))3,3,2
2 CONTINUE
  I=I-1
3 IMAX=I
  XL=X(IMAX,J)-X(1,J)
  P21=0.
  IF(W(J))4,4,5
C FLOW RATE GUESS
4 RP=0.
  DO 15 I=2,IMAX
15 RP=RP+(R(I,J)+R(I-1,J))*(X(I,J)-X(I-1,J))
  RP=.5*RP/XL
  CALL ISNI(PO1,H01,0.2,P,T01,I,R1,V1,IOUT)
  W(J)=1.915*RP**2*R1*V1
13 T02=T01+PWRP*PWRCE(J)/(520.*W(J))
  IF(T02-2500.)5,5,14
14 W(J)=1.1*W(J)
  GO TO 13
5 CALL INLOSS
6 CALL FLOSS(H01,PO1,W(J),PWR,DT,X(1,J),R(1,J),POR(1,J),G(1,J),
1 TWTT(1,J),XM,PO,P,T0,T,TWT(1,J),QP,REY,F,HG,ENTRNS(J),RGHNS(J),
2 ITT,IOUT)
  IERR=IERR+1
  IF(IERR-10)18,18,19
19 WRITE OUTPUT TAPE IOUT,100
100 FORMAT(41H CONVERGENCE FAILURE IN SUBROUTINE BNDARY)
  CALL OUTPUT
  CALL OUTERR

```

```

18 J=JX
   IMAX=IMAX
   IF(ABS(P(IMAX)/P2-1.)-1.E-5)10,10,7
7 IF(P21)8,8,9
8 W1=W(J)
   P21=P(IMAX)
   W(J)=W1*((P01-P2)/(P01-P21))*0.5
   GO TO 5
9 WP=W(J)
   W(J)=W1+(WP-W1)*(P2-P21)/(P(IMAX)-P21)
   IF(W(J))16,16,17
16 W(J)=-W(J)
17 W1=WP
   P21=P(IMAX)
   IF(ABS(W(J)-W1)/W1-5.E-8)10,10,5
10 V2=XM(IMAX)*VELCTY(T(IMAX),P2)
   H02=ENTHLP(TO(IMAX),P0(IMAX))
   P02=P0(IMAX)
   T02=TO(IMAX)
   T2=T(IMAX)
   XM2=XM(IMAX)
   J=JX
   TWM=TWT(1,J)
   TWA=0.
   DO 12 I=2, IMAX
   TWA=TWA+.5*(TWT(I,J)+TWT(I-1,J))*(X(I,J)-X(I-1,J))
   IF(TWM-TWT(I,J))11,12,12
11 TWM=TWT(I,J)
12 CONTINUE
   TWA=TWA/XL
   RETURN
   END

```

```

* CARDS COLUMN
* LIST 8
* FORTRAN          INLOSS
  SUBROUTINE INLOSS
  COMMON DAT (50,20,6)
  COMMON ALPH, AN, AREABT, AREADP, AREADT, AREADU, AREANT, AREAP(21), AT,
2 BDRAG, CFA, CMPNTS(21), CODNAM(10), DIS, DISD, DT, EIK(20), EXK(20),
3 ENTRNS(20), F(100), FI, FID, G(50,20), HG(100), H01, H02, IC, ID, INPT,
4 IOUT, IFT, JX, NAME(3,20), NCODE, NPLANE(20), NTYPE, P(100), PAMB, PD, PDT,
5 PEX(21), PN, PNT, POR(50,20), POWER, PWR, PWRCE(20), PWRP, PO(100), POD,
6 PODT, POEX( 21), POFLT, POI, POINLT, PON, PONT, PO1, PO2, PO2CP(20), P1, P2,
7 QP(100), Q0, R(50,20), RECO, RECOV, REY(100), RGHNS(20), T(100), TAMB,
8 TD, TOT, TEX(21), THRST, THRUST, THST, TN, TNT, TWA, TWACP(20), TWM, TWMAX,
9 TWMCP(20), TWMXP, TWT(50,20), TWTT(50,20), TO(100), TOD, TODT, TOEX(21)
  COMMON TON, TONT, TO1, TO2, TO2CP(20), TOFLT, TO2MAX, TO2MXP, T1, T2,
2 T2CP(20), VEXH, V0, V2, W(20), WEX(21), WTOT, WTOTAL, X(50,20), XM(100),
3 XMCP(20), XMD, XMDT, XMEX(21), XMFLT, XMN, XMNT, XM1, XM2
  EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
1 (DAT(3001),POR), (DAT(4001), TWTT), (DAT(5001), TWT)
C GIVEN - H01, PO1, W, GEOMETRY, ENTRANCE LOSS COEF.
C FIND - POI
  J=JX
  IF(EIK(J))3,3,1
1 RHOV=W(J)/(3.1415926*R(1,J)**2)*1.6404976
  CALL ISN2(PO1,H01,RHOV,P,TO,T,RHO,V,XM,IOUT)
  IF(P)4,4,2
4 CALL ISN1(PO1,H01,0.2,P,TO1,T,RHO,V,IOUT)
  RHOV=RHO*V
  W(J)=RHOV*3.1415926*R(1,J)**2/1.6404976
2 Q=.5*RHOV*V*.70097317
  PO1=PO1-Q*(1.-POR(1,J)**2+EIK(J))
  RETURN
3 PO1=PO1
  RETURN
  END

```



```

* CARDS COLUMN
* LIST 8
* FORTRAN PKWALL
SUBROUTINE PKWALL
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADD,AREANT,AREAP(21),AT,
2BDRAG,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),FI,FID,G(50,20),HG(100),H01,H02,IC,ID,INPT,
4 IQUT,ITT,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PO(100),POD,
6 PODT,POEX(21),POFLT,PO1,POINLT,PON,POVT,PO1,P02,P02CP(20),P1,P2,
7 QP(100),QO,R(50,20),RECO,RECOV,REY(100),RGHNS(20),T(100),TAMB,
8 TD,TDT,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,T01,T02,T02CP(20),TOFLT,T02MAX,T02MXP,T1,T2,
2 T2CP(20),VEXH,V0,V2,W(20),WEX(21),WTOT,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLT,XMN,XMNT,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
1 (DAT(3001),POR), (DAT(4001),TWTT), (DAT(5001),TWT)
C GIVEN - H01,P01,P2,TWMAX,GEOMETRY
C FIND - PWR,W,INTERNAL AND EXIT STATE CONDITIONS
J=JX
T01=TEMP(H01,P01)
1 DO 2 I=1,100
IF(X(I+1,J))3,3,2
2 CONTINUE
I=I-1
3 IMAX=I
PWRP1=0.
IF(W(J))4,4,5
C POWER AND FLOW GUESS
4 XL=X(IMAX,J)-X(1,J)
RP=0.
DO 15 I=2,IMAX
15 RP=RP+(R(I,J)+R(I-1,J))*(X(I,J)-X(I-1,J))
RP=.5*RP/XL
T02=T01+.8*(TWMAX-T01)
P02=P2
H02=ENTHLP(T02,P02)
CALL ISN1(P02,H02,0.4,PP,T02,T2,R2,V2,IQUT)
W(J)=1.915*RP**2*R2*V2
5 IF(PWRP)6,6,7
6 PWRP=.6*(TWMAX-T01)*W(J)*520./PWRCE(J)
7 PWR=PWRP*PWRCE(J)
8 CALL BNDARY
IF(ABSF(TWM/TWMAX-1.)-1.E-5)14,14,11
11 IF(PWRP1)12,12,13
12 TWM1=TWM
PWRP1=PWRP
PWRP=PWRP*(TWMAX-T01)/(TWM-T01)
GO TO 7
13 PWRPP=PWRP

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```
PWRP=PWRP1+(PWRP-PWRP1)*(TWMAX-TWM1)/(TWM-TWM1)
PWRP1=PWRPP
TWM1=TWM
GO TO 7
14 RETURN
END
```

```

* CARDS COLUMN
* LIST 8
* FORTRAN          PKGAS
SUBROUTINE PKGAS
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADU,AREANT,AREAP(21),AT,
2BDRAG,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),FI,FID,G(50,20),HG(100),H01,H02,IC,ID,INPT,
4 IOUT,ITT,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PQ(100),POD,
6 PODT,POEX( 21),POFLT,POI,POINLT,PON,PONT,PO1,PO2,PO2CP(20),P1,P2,
7 QP(100),QO,R(50,20),RECD,RECDV,REY(100),RGHNS(20),T(100),TAMB,
8 TD,TDI,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,TO1,TO2,TO2CP(20),TOFLT,TO2MAX,TO2MXP,T1,T2,
2 T2CP(20),VEXH,V0,V2,W(20),WEX(21),WTDI,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLT,XMN,XMNT,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
2 (DAT(3001),POR), (DAT(4001),TWTT), (DAT(5001),TWT)
C GIVEN - H01,P01,P2,TO2MAX,GEOMETRY
C FIND - PWR,W,INTERNAL AND EXIT STATE CONDITIONS
J=JX
T01=TEMP(H01,P01)
1 DO 2 I=1,100
  IF(X(I+1,J))3,3,2
2 CONTINUE
  I=I-1
3 IMAX=1
  PWRP1=0.
  IF(W(J))4,4,5
C POWER AND FLOW GUESS
4 XL=X(IMAX,J)-X(1,J)
  RP=0.
  DO 15 I=2,IMAX
15 RP=RP+(R(I,J)+R(I-1,J))*(X(I,J)-X(I-1,J))
  RP=.5*RP/XL
  P02=P2
  T02=TO2MAX
  H02=ENTHLP(T02,P02)
  CALL ISN1(P02,H02,0.4,PP,T02,T2,R2,V2,IOUT)
  W(J)=1.915*RP**2*R2*V2
5 IF(PWRP)6,6,7
6 PWRP=(TO2MAX-T01)*W(J)*520./PWRCE(J)
7 PWR=PWRP*PWRCE(J)
8 CALL BNDARY
  IF(ABSF(TO(IMAX)/TO2MAX-1.)-1.E-5)12,12,9
9 IF(PWRP1)10,10,11
10 T021=TO(IMAX)
  PWRP1=PWRP
  PWRP=PWRP*(TO2MAX-T01)/(TO(IMAX)-T01)
  GO TO 7
11 PWRPP=PWRP

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```
PWRP=PWRP1+(PWRP-PWRP1)*(T02MAX-T021)/(T01MAX-T021)
PWRP1=PWRPP
T021=T01MAX)
GO TO 7
12 RETURN
END
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```

* CARDS COLUMN
* LIST 8
* FORTRAN NOMC4
SUBROUTINE NOMAC4
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADJ,AREANT,AREAP(21),AT,
2BDRAG,CFA,COMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),FI,FID,G(50,20),HG(100),H01,H02,IC,ID,INPT,
4 IOUT,ITT,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PO(100),POD,
6 PODT,POEX( 21),POFLT,POI,POINLT,PON,PONT,PO1,PO2,PO2CP(20),P1,P2,
7 QP(100),QO,R(50,20),RECU,RECOV,REY(100),RGHNS(20),T(100),TAMB,
8 TD,TDI,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,TO1,TO2,TO2CP(20),TOFLT,TO2MAX,TO2MXP,T1,T2,
2 T2CP(20),VEXH,VO,V2,W(20),WEX(21),WTDI,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLT,XMN,XMNT,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
1 (DAT(3001),POR), (DAT(4001), TWTT), (DAT(5001), TWT)
C GIVEN - PO1,H01,POWER OR TWMAX OR TO2MAX,PAMB,GEOMETRY(NOMIN)
C FIND - WTOTAL,TWMAX OR TO2MAX OR POWER
PWRPP=0.
PEX1=0.
KSTART=-1
C FIRST EXIT PLANE STATIC PRESSURE GUESS
IF(PEX(1))1,1,2
1 PEX(1)=.6*PO1
C CRITICAL COMPONENT LIMIT OPTION SELECTION (COMPONENT NO 1 ONLY)
2 IF(POWER)4,4,3
3 IOP=1
PWRP=POWER
GO TO 8
4 IF(TWMAX)6,6,5
5 IOP=2
GO TO 8
6 IF(TO2MAX)3,3,7
7 IOP=3
8 IEX=1
WTOT=0.
SUMWV=0.
SUMHOW=0.
TWMXP=0.
TO2MXP=0.
IF(KSTART)9,69,69
69 CALL RESTRT
C INDIVIDUAL COMPONENT FLOSS IV CALCULATIONS
9 P2=PEX(IEX)
DO 19 J=1,20
JX=J
JEX=NPLANE(J)
IF(IEX-JEX)19,10,19
10 IF(J-1)12,11,12

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11 IF(IOP-2)12,13,14
12 PWR=PWRCE(J)*PWKP
   CALL BNDARY
   GO TO 18
13 CALL PKWALL
   GO TO 15
14 CALL PKGAS
15 IF(JEX-1)16,18,16
16 IF(ABSF(PWRPP/PWRP-1.))-1.E-6)18,18,17
17 PWRPP=PWRP
   GO TO 8
C   EXIT PLANE MOMENT, ENERGY, AND FLOW RATE SUMMATIONS
18 CALL OUTPUT
   WTOT=WTOT+CMPTS(J)*W(J)
   SUMWV=SUMWV+CMPTS(J)*W(J)*V2*(1.-.5*EXK(J))
   SUMH0W=SUMH0W+H02*CMPTS(J)*W(J)
   TWACP(J)=TWA
   TWMCP(J)=TWM
   T02CP(J)=T02
   T2CP(J)=T2
   P02CP(J)=P02
   XMCP(J)=XM2
   IF(KSTAR)68,67,67
68 IF(SENSE SWITCH 1)66,67
66 KSTAR=1
   PRINT 100
100 FORMAT(89H SENSE SWITCH 1 DETECTED AND MAY BE RESTORED.  EXECUTION
      2 WILL TERMINATE WITHIN 5 MINUTES.//////)
67 IF(TWM-TWXP)64,64,63
63 TWXP=TWM
64 IF(T02-T02XP)19,19,65
65 T02XP=T02
19 CONTINUE
   H03=SUMH0W/WTOT
C   EXIT PLANE STATE CALCULATION
   P31=0.
   IF(ABSF(PEX(1EX+1)/P2-1.))-0.2)21,21,20
20 P3=P2
   GO TO 22
21 P3=PEX(1EX+1)
22 V3=(SUMWV-(P3-P2)*AREAP(1EX+1)*.43482537)/WTOT
   IF(V3)61,61,62
61 P3=.95*P3
   GO TO 22
62 H3-H03-.70056191*V3**2
   T3=TEMP(H3,P3)
   R3=DENSTY(T3,P3)
   WTP=R3*V3*AREAP(1EX+1)*.60957114
   IF(ABSF(WTP/WTOT-1.))-1.E-6)26,26,23
23 IF(P31)24,24,25
24 P31=P3
   DTW=WTOT-WTP

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P3=P3*(WTP/WTOT)**.5
GO TO 22
25 DTW1=DTW
DTW=WTOT-WTP
P3P=P3
P3=P3+(P3-P31)*DTW/(DTW1-DTW)
P31=P3P
IF(ABS((P3-P31)/P3)-5.E-8)26,26,22
26 SR=ENTROP(T3,P3)
P03=P3
27 T03=TEMP(H03,P03)
SRO=ENTROP(T03,P03)
IF(ABS((SR/SRO-1.))-1.E-6)29,29,28
28 P03=P03*EXP(SRO-SR)
GO TO 27
C ADVANCE TO NEXT EXIT PLANE AND ASSOCIATED COMPONENT CALCULATIONS.
29 IEX=IEX+1
PEX(IEX)=P3
POEX(IEX)=P03
TOEX(IEX)=T03
TEX(IEX)=T3
XMEX(IEX)=V3/VELCTY(T3,P3)
WEX(IEX)=WTOT
IF(IEX-21)30,32,32
30 IF(AREAP(IEX+1))32,32,31
31 SUMWV=WTOT*V3
GO TO 9
C EXIT NOZZLE CALCULATIONS
C BOAT TAIL CALCULATIONS
C INITIAL GUESS - EXPANSION TO AMBIENT PRESSURE
32 PN=PAMB
PNI=0.
CPN=1.
IPN=0
36 TI=TEMPSR(SR,PN)
HI=ENTHLP(TI,PN)
HN=H03-F1**2*(H03-HI)
TN=TEMP(HN,PN)
RN=DENSTY(TN,PN)
VN=(1.4274256*(H03-HN))**.5
AN=1.6404976*WTOT/(RN*VN)
XMN=VN/VELCTY(TN,PN)
IF(XMN-1.) 33,34,34
C UNCHOKED NOZZLE CONDITION
33 IC=2
AT=AREANT
GO TO 45
C CHOKED NOZZLE CONDITION
34 IC=1
37 IF(PN-PAMB)39,38,39
38 ABTAMB=AN
THST=WTOT*ALPH*VN*33.797476

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39 IF(AREABT)44,44,40
C   EXPANSION TO FIXED BOAT TAIL AREA (CHOKED NOZZLE)
40 IF(ABSF(AN/AREABT-1.)-1.E-6)44,44,41
41 IF(PN1)42,42,43
42 PN1=PN
   PN=PN*(AN/AREABT)**.5
   AN1=AN
   GO TO 36
43 DPN=(PN-PN1)*(AREABT-AN1)/(AN-AN1)*CPN
44 IF(ABSF(DPN/PN)-.2) 56,56,55
45 DPN=.5*DPN
   GO TO 54
46 PN1=PN
   PN=PN+DPN
   AN1=AN
   IF(ABSF(DPN/PN)-5.E-8) 44,44,57
47 IPN=IPN+1
   IF(IPN-10) 36,36,58
48 CPN=.9*CPN
   IPN=0
   IF(CPN-.5) 44,36,36
49 CALL ISN1(P03,H03,1.,PNT,T03,TNT,RC,VC,IOUT)
   AT=WTOT/(RC*VC*DIS)*1.6404976
   ATST=AT/AREANT
   XMNT=1.
   GO TO 72
50 ATST=AN/AREABT
C   THROAT CALCULATIONS
51 RVNT=WTOT/(AT*DIS)*1.6404976
   CALL ISN2(P03,H03,RVNT,PNT,T03,TNT,RNT,VNT,XMNT,IOUT)
   IF(PNT)34,34,72
72 PONT=P03
   TONT=T03
C   NOZZLE BOAT TAIL CALCULATIONS (CONCLUDED)
   SN=ENTROP(TN,PN)
   PON=P03
47 TON=TEMP(H03,PON)
   SNP=ENTROP(TON,PON)
   IF(ABSF(SNP/SN-1.)-1.E-6)49,49,48
48 PON=PON*EXP(SNP-SN)
   GO TO 47
C   PERFORMANCE CALCULATIONS
49 GO TO (53,60,59),NCODE
59 THRUST=WTOT*(ALPH*VN-V0)*33.797476-AN*(PAMB-PN)*14.696
   CFA=THRUST/(Q0*14.696)
   BDRAG=V0*33.797476
60 THRST=WTOT*ALPH*VN*33.797476-AN*(PAMB-PN)*14.696
   VEXH=ALPH*VN
C   REACTOR INLET CONDITIONS
   RHOV=WTOT/AREADP*1.6404976
   CALL ISN2(P01,H01,RHOV,P1,T01,T1,R1,V1,XM1,IOUT)
   GO TO (53,73,74),NCODE

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73 CALL DFFUSR
C   INTERIM OUTPUT
74 CALL SYNOPS
----- IF(ADSE(ATST-1.)-5.E-4)53,53,50
50 IF(PEX1)51,51,52
51 PEX1=PEX(1)
    AT1=ATST
    PEX(1)=PEX(1)*ATST
    GO TO 70
----- 52 PEXP=PEX(1)
    PEX(1)=PEX1+(PEX(1)-PEX1)*(1.-AT1)/(ATST-AT1)
    AT1=ATST
    PEX1=PEXP
70 IF(ABSF(PEX(1)/PEX1-1.)-.2)8,8,71
71 PEX(1)=.5*(PEX(1)+PEX1)
    GO TO 70
----- 53 RETURN
    END

```

```

* CARDS COLUMN
* LIST 8
* FORTRAN          DIFFUSR
SUBROUTINE DIFFUSR
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADU,AREANT,AREAP(21),AT,
2BDRAG,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),FI,FID,G(50,20),HG(100),HO1,H02,IC,ID,INPT,
4 IQUT,ITT,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PO(100),POD,
6 PODT,POEX( 21),POFLT,POI,POINLT,PON,PONT,PO1,PO2,PO2CP(20),P1,P2,
7 QP(100),QO,R(50,20),RECO,RECOV,KEY(100),RGHNS(20),T(100),TAMB,
8 TD,TDT,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,TO1,TO2,TO2CP(20),TOFLT,TO2MAX,TO2MXP,T1,T2,
2 T2CP(20),VEXH,VO,V2,W(20),WEX(21),WTOF,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLT,XMN,XMNT,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
1 (DAT(3001),POR), (DAT(4001),TWTT), (DAT(5001),TWT)
C GIVEN - WTOT,H01,PO1,AREADU,AREADT,AREADP,DISD,FID
C FIND - POD,TOD,PD,TD,XMD,PDT,TDT,XMDT,ID,T1,P1,XM1
POD1=0.
C PLENUM CALCULATION
RVP=WTOT/AREADP*1.6404976
CALL ISN2(PO1,H01,RVP,P1,TO1,T1,RP,VP,XM1,IQUT)
H=ENTHLP(T1,P1)
C SUPPLY DUCT CALCULATIONS FOR UNCHOKED DIFFUSER
ID=2
HI=H01-(H01-H)*FID**2
TI=TEMP(HI,P1)
SP=ENTROP(TI,P1)
POD=PO1
1 TOD=TEMP(H01,POD)
S=ENTROP(TOD,POD)
IF(ABSF(S/SP-1.)-1.E-6)3,3,2
2 POD=POD*EXP(S-SP)
GO TO 1
C DIFFUSER THROAT CALCULATIONS
C ISENTROPIC CRITICAL CONDITION (CHOKED DIFFUSER)
3 CALL ISN1(POD,H01,1.,PC,TOD,TC,RC,VC,IQUT)
RVDT=WTOT/(AREADT*DISD)*1.6404976
IF(RVDT-.999*RC*VC)9,4,4
C CHOKED CONDITION
4 ID=1
IP=0
CP=1.
XMDT=1.
5 CALL ISN1(POD,H01,1.,PDT,TODT,TDT,RC,VC,IQUT)
ATD=WTOT/(RC*VC*DISD)*1.6404976
IF(ABS(ATD/AREADT-1.)-1.E-6)10,10,6
6 IF(POD1)7,7,8
7 POD1=POD

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```

      AT1=ATD
      POD=POD*ATD/AREADT
      GO TO 5
      8. PODP=POD
      POD=POD1+(POD-POD1)*(AREADT-AT1)/(ATD-AT1)*CP
      AT1=ATD
      POD1=PODP
      IP=IP+1
      IF(IP-10)5,5,12
      12 CP=.9*CP
      IP=0
      IF(CP-.5)10,10,5
      C   ISENTROPIC THROAT CONDITION
      9 CALL ISN2(POD,H01,RVDT,POT,TOT,TDT,RDT,V,XMDT,IOUT)
      C   SUPPLY DUCT CALCULATIONS CONCLUDED
      10 RVD =WTOT/AREADU*1.6404976
      CALL ISN2(POD,H01,RVD,PD,TOD,TD,RD,V,XMD,IOUT)
      11 RETURN
      END

```

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* CARDS COLUMN
* LIST 8
* FORTRAN FLWRT.
SUBROUTINE FLWRT
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADU,AREANT,AREAP(21),AT,
2HBRAG,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),FI(100),FI,FID,G(50,20),HG(100),H01,H02,IC,ID,INPT,
4 IOUT,ITT,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PO(100),POD,
6 PODT,POEX( 21),POFLT,POI,POINTL,PON,PONT,PO1,PO2,PO2CP(20),P1,P2,
7 QP(100),QQ,R(50,20),RECO,RECOV,REY(100),RGHNS(20),T(100),TAMB,
8 TD,TDI,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,TO1,TO2,TO2CP(20),TOFLT,TO2MAX,TO2MXP,T1,T2,
2 T2CP(20),VEXH,VO,V2,W(20),WEX(21),WTOT,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLT,XMV,XMNT,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
2 (DAT(3001),POR), (DAT(4001),TWTT), (DAT(5001),TWT)
C GIVEN - WTOTAL,H01,POWER OR TWMAX OR TO2MAX,PAMB,GEOMETRY
C FIND - CONSISTENT REACTOR OPERATING CONDITIONS
K=1
WTOT1=0.
IF(POWER)2,2,1
1 PPP=POWER-
POWER=0.
K=2
2 GO TO (10,10,9),NCODE
9 RECO=PO1/POFLT
10 CALL NOMAC4
IF(ABS(WTOT/WTOTAL-1.)-1.E-4)6,6,3
3 IF(WTOT1)4,4,5
4 PO11=PO1
WTOT1=WTOT
PO1=PO1*(WTOTAL/WTOT)
GO TO 11
5 PO1P=PO1
PO1=PO11+(PO1-PO11)*(WTOTAL-WTOT1)/(WTOT-WTOT1)
WTOT1=WTOT
PO11=PO1P
GO TO 2
6 GO TO (8,7),K
7 POWER=PPP
K=1
WTOT1=0.
11 PLX(1)=PLX(1)*PO1/PO11
DO 12 I=1,20
12 W(I)=W(I)*PO1/PO11
PWRP =PWRP *PO1/PO11
GO TO 2
8 RETURN
END

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* CARDS COLUMN
* LIST 8
* FORTRAN          NOMAC
SUBROUTINE NOMAC
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADU,AREANT,AREAP(21),AT,
2BDRAG,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),FI,FID,G(50,20),HG(100),H01,H02,IC,ID,INPT,
4 IDUT,ITT,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PO(100),POD,
6 PODT,POEX( 21),POFLT,POI,POINLT,PON,PONT,PO1,PO2,PO2CP(20),P1,P2,
7 QP(100),QO,R(50,20),RECO,RECV,REY(100),RGHNS(20),T(100),TAMB,
8 TD,TDI,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,TO1,TO2,TO2CP(20),TOFLT,TO2MAX,TO2MXP,T1,T2,
2 T2CP(20),VEXH,VO,V2,W(20),WEX(21),WTOT,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLT,XMN,XMNT,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
1 (DAT(3001),PUR), (DAT(4001),TWTT), (DAT(5001),TWT)
C GIVEN - POINLT OR WTOTAL,H01,POWER OR TWMAX OR TO2MAX,PAMB,GEOMETRY
C FIND - WTOTAL OR POINLT,TWMAX OR TO2MAX OR POWER
100 FORMAT(7F10.4,I2)
READ INPUT TAPE INPT,100,TO1,POINLT,WTOTAL,PAMB,POWER,TWMAX,TO2MAX
1 ,IG
WRITE OUTPUT TAPE IDUT,100,TO1,POINLT,WTOTAL,PAMB,POWER,TWMAX,TO2MAX
1 ,IG
POINLT=POINLT/14.696
TO1=(TO1+459.69)/1.8
PAMB=PAMB/14.696
POWER=POWER*1.E+6
IF(TWMAX)8,8,7
7 TWMAX=(TWMAX+459.69)/1.8
8 IF(TO2MAX)10,10,9
9 TO2MAX=(TO2MAX+459.69)/1.8
10 IF(IG)12,1,12
1 CALL NOMIN
GO TO 2
12 IF(CMPNTS(1))13,13,2
13 WRITE OUTPUT TAPE IDUT,102
PRINT 102
CALL EXIT
102 FORMAT(91H PROGRAM EXPECTS GEOMETRY DECK. FOLLOWING INPUT CARD SE
2 QUENCE IS SUSPECT. JOB TERMINATED.)
2 IF(WTOTAL)16,16,14
14 A=0.
DO 15 J=1,20
15 A=A+CMPTS(J)*3.1415926*R(1,J)**2
RHOV=WTOTAL/A*1.6404976
V=.2*VELCTY(TO1,10.)
POINLT=RHOV/V*TO1/273.
16 PO1=POINLT
H01=ENTHLP(TO1,POINLT)

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      IF(WTOTAL)3,3,4
3  CALL NOMAC4
   GO TO 5
4  CALL FLWRT
5  CALL DFFUSR
   DO 6 I=4001,5000
6  DAT (I)=DAT (I+1000)
   CALL SYNOPS
101 FORMAT(15H END OF PROBLEM)
   WRITEOUTPUTTAPE IOUT,101
   PRINT 101
   NCODE=0
   CALL RESTRT
   RETURN
END
```

```

* CARDS COLUMN
* LIST 8
* FORTRAN DASH-N
SUBROUTINE DASH N
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADU,AREANT,AREAP(21),AT,
2BDRAG,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),F1,FID,G(50,20),HG(100),H01,H02,IC,ID,INPT,
4 IOUT,ITT,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,PUR(50,20),POWER,PWR,PWRCE(20),PWRP,PO(100),POD,
6 PODT,POEX( 21),POFLT,POI,POINLT,PON,PONT,PO1,PO2,PO2CP(20),P1,P2,
7 QP(100),QO,R(50,20),RECO,RECOV,REY(100),RGHNS(20),T(100),TAMB,
8 TD,TDI,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,T01,T02,TO2CP(20),TOFLT,TO2MAX,TO2MXP,T1,T2,
2 I2CP(20),VEXH,V0,V2,W(20),WEX(21),WTOT,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLT,XMN,XMNT,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
1 (DAT(3001),PUR), (DAT(4001), TWTT), (DAT(5001), TWT)
C GIVEN - ALTITUDE,MACH NO,TAMB,POWER,TWMAX,TO2MAX,WTOTAL,RECOV
C FIND - CONSISTENT REACTOR OPERATING CONDITIONS
100 FORMAT(2F5.2,6F10.4,I2)
READ INPUT TAPE INPT,100,XMFLT,RECOV,TAMB,PAMB,WTOTAL,POWER,TWMAX,
2 TO2MAX,IG
WRITE OUTPUT TAPE IOUT,100,XMFLT,RECOV,TAMB,PAMB,WTOTAL,POWER,TWMAX,
2 TO2MAX,IG
PAMB=PAMB/14.696
TAMB=(TAMB+459.69)/1.8
POWER=POWER*1.E+6
IF(TWMAX)7,7,6
6 TWMAX=(TWMAX+459.69)/1.8
7 IF(TO2MAX)9,9,8
8 TO2MAX=(TO2MAX+459.69)/1.8
9 IF(IG)12,1,12
1 CALL NDMIN
GO TO 2
12 IF(CMPNTS(1))13,13,2
13 WRITE OUTPUT TAPE IOUT,102
PRINT 102
CALL EXIT
102 FORMAT(91H PROGRAM EXPECTS GEOMETRY DECK. FOLLOWING INPUT CARD SE
2QUENCE IS SUSPECT. JOB TERMINATED.)
2 CALL FLTCN
IF(WTOTAL)3,3,4
3 RECO=RECOV
PO1=POFLT*RECOV
CALL NOMAC4
GO TO 5
4 IF(PO1)10,10,11
10 PO1=POFLT*RECOV
11 CALL FLWRT
5 CALL SYNOPS

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```
101 FORMAT(15H END OF PROBLEM)
WRITEOUTPUTTAPE IOUT,101
PRINT 101
NCODE=0
CALL RESTRT
RETURN
END
```



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* CARDS COLUMN
* LIST 8
* FORTRAN NOMIN
SUBROUTINE NOMIN
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADU,AREANT,AREAP(21),AT,
2BDRAG,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),FI,FID,G(50,20),HG(100),H01,H02,IC,ID,INPT,
4 IOUT,ITT,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PQ(100),POD,
6 PODT,POEX(21),POFLT,POI,POINTLT,PON,PONT,PO1,PO2,PO2CP(20),P1,P2,
7 QP(100),QO,R(50,20),RECD,RECDV,REY(100),RGHNS(20),T(100),TAMB,
8 TD,TDI,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTI(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,TO1,TO2,TO2CP(20),TOFLT,TO2MAX,TO2MXP,T1,T2,
2 T2CP(20),VEXH,VO,V2,W(20),WEX(21),WTOT,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLT,XMN,XMNF,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
2 (DAT(3001),POR), (DAT(4001),TWTI), (DAT(5001),TWT)
C GEOMETRY INPUT ROUTINE FOR NOMAC AND DASH-N PROBLEMS
100 FORMAT(7F10.4)
200 FORMAT(3A6,I2,2F10.4,4F5.3)
DO 22 I=1,4000
22 DAT (I,1,1)=0.
C BLOWDOWN FACILITY DIFFUSER GEOMETRY (FOR NOMAC PROBLEMS)
READ INPUT TAPE INPT,100,AREADU,AREADT,AREADP,FID,DISD
WRITEOUTPUTTAPE IOUT,100,AREADU,AREADT,AREADP,FID,DISD
C REACTOR EXIT PLENUM, EXIT PLANE AREAS
I=1
1 IM=I+6
READ INPUT TAPE INPT,100,(AREAP(J),J=I,IM)
WRITEOUTPUTTAPE IOUT,100,(AREAP(J),J=I,IM)
IF(AREAP(IM))3,3,2
2 I=I+7
GO TO 1
C EXIT NOZZLE GEOMETRY AND CHARACTERISTIC PERFORMANCE COEFFICIENTS
3 READ INPUT TAPE INPT,100,AREANT,AREABT,FI,DIS,ALPH
WRITEOUTPUTTAPE IOUT,100,AREANT,AREABT,FI,DIS,ALPH
C COMPONENT GEOMETRIES, POWER DISTRIBUTIONS, AND INFLUENCE COEFS.
DO 8 J=1,20
READ INPUT TAPE INPT,200,(NAME(M,J),M=1,3),NPLANE(J),CMPNTS(J),
1 PWRCE(J),RGHNS(J),EIK(J),EXK(J),ENTRNS(J)
WRITEOUTPUTTAPE IOUT,200,(NAME(M,J),M=1,3),NPLANE(J),CMPNTS(J),
1 PWRCE(J),RGHNS(J),EIK(J),EXK(J),ENTRNS(J)
IF(CMPNTS(J))9,9,4
4 KO=1
L=1
DO 7 I=1,70
KM=KO+6
READ INPUT TAPE INPT,100,(DAT (K,J,L),K=KO,KM)
WRITEOUTPUTTAPE IOUT,100,(DAT (K,J,L),K=KO,KM)
IF(DAT (KM,J,L))5,5,6

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5 IF(L-1)13,13,14
13 KMM=KM
GO TO 17
14 DO 16 K=2,KMM
  IF(DAT (K,J,L))15,15,16
15 DAT (K,J,L)=DAT (K-1,J,L)
16 CONTINUE
17 L=L+1
  KO=-6
  IF(L-4)7,7,18
6 IF(KM-4)7,5,5
7 KO=KO+7
18 GBAR=0.
  DO 19 IK=2,50
    IF(X(IK,J))19,20,19
19 GBAR=GBAR+(G(IK,J)+G(IK-1,J))*(X(IK,J)-X(IK-1,J))
20 GBAR=GBAR*.5/(X(IK-1,J)-X(1,J))
  DO 21 IK=1,50
    C(IK,J)=G(IK,J)/GBAR
8 CONTINUE
C POWER COEFFICIENT NORMALIZATION
9 X1=0.
  DO 10 J=1,20
    X1=X1+CMPTS(J)*PWRCE(J)
    IF(CMPTS(J+1))11,11,10
10 CONTINUE
11 DO 12 J=1,20
12 PWRCE(J)=PWRCE(J)/X1
  RETURN
END

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* CARDS COLUMN
* LIST8
* FORTRAN          FLTCON
SUBROUTINE FLTCON
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADU,AREANT,AREAP(21),AT,
2BDRAG,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),FI,FID,G(50,20),HG(100),H01,H02,IC,ID,INPT,
4 IOUT,ITT,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PO(100),POD,
6 PODT,POEX( 21),POFLT,POI,POINLT,PON,PONT,P01,P02,PO2CP(20),P1,P2,
7 QP(100),QO,R(50,20),RECD,RECDV,REY(100),RGHNS(20),T(100),TAMB,
8 TD,TDI,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,TO1,TO2,TO2CP(20),TOFLT,TO2MAX,TO2MXP,T1,T2,
2 T2CP(20),VEXH,V0,V2,W(20),WEX(21),WTOT,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLT,XMN,XMNT,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
1 (DAT(3001),POR), (DAT(4001), TWTT), (DAT(5001), TWT)
C FLIGHT CONDITION DETERMINATION
C GIVEN -XMFLT,PAMB,TAMB
C FIND - POFLT,TOFLT,H01
S=ENTROP(TAMB,PAMB)
H1=ENTHLP(TAMB,PAMB)
V0=XMFLT*VELCTY(TAMB,PAMB)
H01=H1+V0**2/1.4274256
POFLT=(1.+2*XMFLT**2)**3.5*PAMB
1 TO1=TEMP(H01,POFLT)
SP=ENTROP(TO1,POFLT)
IF(ABSF(SP/S-1.)-1.E-6)3,3,2
2 POFLT=POFLT*EXPF(SP-S)
GO TO 1
3 QO=.5*DENSTY(TAMB,PAMB)*V0**2*1.4018576
TOFLT=TO1
RETURN
END
* SERVICE(FLUOCHART)

```

```

*      CARDS COLUMN
*      LIST 8
*      FORTRAN      ISN1
SUBROUTINE ISN1(POI,HOI,XMI,PJ,TOJ,TJ,R,V,IOUT)
C      ISENTROPIC, POINT PROCESS
C      GIVEN - PO,HO,M
C      FIND - P,TO,T,R,V
      PO=POI
      HO=HOI
      XM2=XMI**2
      TO =TEMP(HO,PO)
      TOJ=TO
      S=ENTROP(TO,PO)
      CP=1.
      IP=0
      P=PO/((1.+.2*XM2)**3.5)
1     T=TEMPSR(S,P)
      H=ENTHLP(T,P)
      C=VELCTY(T,P)
      IF(C)9,9,2
2     V2=1.4274256*(HO-H)
      XMT=XM2*C**2/V2-1.
      IF(ABSF(XMT)-1.E-6)8,8,3
3     DP=.7*PO/((1.+.2*XM2)**4.5*(V2/C**2-XM2)*CP
      IF(ABSF(DP/P)-5.E-8)8,8,4
4     P=P+DP
      IF(PO-P)5,6,6
5     P=PO
6     IP=IP+1
      IF(IP-10)1,7,7
7     IP=0
      CP=.9*CP
      GO TO 1
8     PJ=P
      TOJ=TO
      TJ=T
      R=DENSTY(T,P)
      V=V2**.5
      RETURN
9     WRITE OUTPUT TAPE IOUT,100
100  FORMAT(47H EXCEEDED TABLE ENCOUNTERED IN SUBROUTINE ISN1.)
      CALL OUTERR
      RETURN
      END

```

```

*      CARDS COLUMN
*      LIST 8
*      FORTRAN          ISN2
SUBROUTINE ISN2(POI,HOI,RVI,PJ,TOJ,TJ,RJ,V,XMJ,IOUTI)
C      ISENTROPIC, POINT PROCESS
C      GIVEN - PO,HO,RHOV
C      FIND - P,TO,T,RHO,V,M
      IOUT=IOUTI
      PO=POI
      HO=HOI
      RV=RVI
      IERR=1
      CP=1.
      IP=0
      TO=TEMP(HO,PO)
      S=ENTROP(TO,PO)
      P=.6*PO
      P1=0.
2  IF(P-PO)4,3,3
3  P=.98*P
   GO TO 2
4  T=TEMPSR(S,P)
   R=DENSITY(T,P)
   IF(R)14,14,5
5  H=ENTHLP(T,P)
   V2=1.4274256*(HO-H)
   XM=V2**.5/VELCTY(T,P)
   IF(XM-1.)6,15,15
6  V2P=(RV/R)**2
   DV=V2-V2P
   IF(ABSF(DV/V2P)-1.E-6)13,13,7
7  IF(P1)9,8,9
8  P1=P
   DV1=DV
   DP=P*((V2/V2P)**.25-1.)
   GO TO 20
9  DP=(P-P1)*DV/(DV1-DV)*CP
20 IF(ABSF(DP/PO)-.1)22,22,21
21 DP=.5*DP
   GO TO 20
22 IF(ABSF(DP/P)-5.E-8)13,13,10
10 IP=IP+1
   IF(IP-10)12,12,11
11 IP=0
   CP=CP*.9
   IF(CP-.5)16,12,12
12 P1=P
   DV1=DV
   P=P+DP
18 IF(P-.45*PO)19,19,2
19 DP=.5*DP
   P=P-DP

```

**

```
GO TO 18
13 PJ=P
TOJ=TO
IJ=I
RJ=R
V=V2**0.5
XMJ=XM
RETURN
14 WRITE OUTPUT TAPE IOUT,100
GO TO 17
15 WRITE OUTPUT TAPE IOUT,101
PJ=0.
RETURN
16 WRITE OUTPUT TAPE IOUT,102
17 CALL OUTERR
RETURN
100 FORMAT(37H1 EXCEEDED TABLE ENCOUNTERED IN ISN2.)
101 FORMAT(36H1 MACH NUMBER EXCEEDS UNITY IN ISN2.)
102 FORMAT(30H1 CONVERGENCE FAILURE IN ISN2.)
END
```

```

*      CARDS COLUMN
*      LIST
*      FORTRAN      HMM
-----
FUNCTION  HOOKUP(XH,PH,KINDP,YX)
BANK AAA (1)
COMMON /AAA/ XT(120,11,5)
DIMENSION PK(11),P5(11),ILAST(4),P(11),XK(6)
KIND=KINDP
IXJ=1
IXK=1
XX=XH
PXP=PH
IF (PXP) 9000,9000,9001
9000 CALL OUTERR
9001 IF (P) 101,100,101
100 P(1)=LOGF(.01)
P(2)=LOGF(.1)
P(3)=LOGF(.4)
P(4)=LOGF(.7)
P(5)=LOGF(1.)
P(6)=LOGF(4.)
P(7)=LOGF(7.)
P(8)=LOGF(10.)
P(9)=LOGF(40.)
P(10)=LOGF(70.)
P(11)=LOGF(100.)
DO 97 J=2,10
97 P5(J)=1./ ( P(J)-P(J-1) )
101 PL=LOGF(PXP)
IF (XX) 50,50,99
99 IF (PL-PLAST) 54,29,54
54 PLAST=PL
IF ((PL-P)*(P(11)-PL)) 50,52,52
52 DO 10 J=3,10
IF (P(J)-PL) 10,11,11
10 CONTINUE
J=10
11 J1=J
K=J-2
L=J-1
M=J
DO 20 JJ=1,6
XK(JJ)=(PL-P(L))*(PL-P(M))/((P(K)-P(L))*(P(K)-P(M)))
I=K
K=L
L=M
M=I
IF (JJ-3) 20,21,20
21 K=J1-1
L=J1
M=J1+1
20 CONTINUE

```

**

```

      IF (P(2)-PL) 22,22,23
23  C1=XK(1)
      C2=XK(2)
      C3=XK(3)
      C4=0.
      IXJ=2
      GO TO 29
22  IF (P(10)-PL) 24,24,25
24  C1=0.
      C2=XK(4)
      C3=XK(5)
      C4=XK(6)
      IXJ=2
      GO TO 29
25  C7=(PL-P(J1-1))*P5(J1)
      C6=(P(J1)-PL)*P5(J1)
      C1=XK(1)*C6
      C2=XK(2)*C6+XK(4)*C7
      C3=XK(3)*C6+XK(5)*C7
      C4=XK(6)*C7
      IXJ=1
29  J=J1
      K=(KIND+1)/2
      GO TO (30,40,30,40,30,40,30,40,30),KIND
30  IF ((XX-50.)*(3000.-XX)) 50,53,53
53  IF (XX-800.) 28,28,31
28  I=.1*XX-3.
      T=10*(I+4)
      TT=T-10.
      GO TO 87
31  I=.02*XX+61.
      T=50*(I-76)+800
      TT=T-50.
87  GO TO (60,40,61,40,62,40,63,40,60),KIND
60  TR=(T-XX)/(T-TT)
      GO TO 32
61  TR= LOGF(T/XX)/LOGF(T/TT)
      GO TO 32
62  TR=TT*(T-XX)/(XX*(T-TT))
      GO TO 32
63  TR=(1.-SQRTF(XX/T))/(1.-SQRTF(TT/T))
32  KK=I+120*(J-1)+1320*(K-1)
      GO TO (249,51),IXK
249  IXK=2
      IF (XT(KK-120)*XT(KK-121)*XT(KK)*XT(KK-1)) 253,50,253
253  GO TO (252, 254),IXJ
254  IF (XT(KK-240)*XT(KK+120)*XT(KK-241)*XT(KK+119)) 51,50,51
252  IF (XT(KK-240)*XT(KK+120)*XT(KK-241)*XT(KK+119)) 51,250,51
250  IF (XT(KK-240)*XT(KK-241)) 251,24,251
251  IF (XT(KK+119)*XT(KK+120)) 51,23,51
51  GO TO (34,40,33,40,34,40,34,40,34),KIND
33  QJ=XT(KK-240)*C1+XT(KK-120)*C2+XT(KK)*C3+XT(KK+120)*C4

```



```

36 QJ1=XT(KK-241)*C1+XT(KK-121)*C2+XT(KK-1)*C3+XT(KK+119)*C4
GO TO(35,43,35,43,35,43,35,43,35),KIND
34 QJ=EXP(XT(KK-240)*C1+XT(KK-120)*C2+XT(KK)*C3+XT(KK+120)*C4)
37 QJ1=EXP(XT(KK-241)*C1+XT(KK-121)*C2+XT(KK-1)*C3+XT(KK+119)*C4)
GO TO(35,43,35,43,35,43,35,43,35),KIND
35 HOOKUP=QJ-(QJ-QJ1)*TR
RETURN
40 IF(K-2)401,400,401
400 XLG=XX
GO TO 402
401 XLG=LOGF(XX)
402 KK1=1320*(K-1)+120*(J-1)
GO TO (335,336,337,338),K
335 T= 50.* XX +120.
GO TO 339
336 T=.70*EXP(.2437*XX+.25*PL)+80.
GO TO 339
337 T= 250.* PXP/XX+100.
GO TO 339
338 T= (17.1*XX)**2+ 30.
339 IF ((T-50.)*(3000.-T)) 343,343,340
340 IF ( T-800.) 341,341,342
341 I= .1* T-2.
GO TO 344
342 I= .02*T +60.
GO TO 344
343 I=60
344 KK=KK1+I
409 IF (XT(KK-240)*XT(KK+120)) 410,411,410
410 C1P=C1
C2P=C2
C3P=C3
C4P=C4
GO TO 414
411 IF(XT(KK-240)) 413,412,413
412 C1P=0.
C2P=XK(4)
C3P=XK(5)
C4P=XK(6)
GO TO 414
413 C1P=XK(1)
C2P=XK(2)
C3P=XK(3)
C4P=0.
414 QJ=C1P*XT(KK-240)+C2P*XT(KK-120)+C3P*XT(KK)+C4P*XT(KK+120)
IF(K-3)320,321,320
320 KD=1
XKD=KD
GOTO322
321 KD=-1
XKD=-KD
322 IF(XLG-QJ)323,324,324

```

```

323 KD=-KD
    XKD=-XKD
324 KK=KK+KD
    I=KK-KK1
    IF(I*(121-I))50,50,319
319 IF(XT(KK-120)*XT(KK)) 325,50,325
325 IF(XT(KK-240)*XT(KK+120)) 331,328,331
328 IF (XT(KK-240)) 330,329,330
329 C1=0.
    C2=XK(4)
    C3=XK(5)
    C4=XK(6)
    GOTO331
330 C1=XK(1)
    C2=XK(2)
    C3=XK(3)
    C4=0.
331 QJ=C1*XT(KK-240)+C2*XT(KK-120)+C3*XT(KK)+C4*XT(KK+120)
    IF((XLG-QJ)*XKC)332,332,324
332 IF(KD)333,50,334
333 KK=KK+1
    I=I+1
334 GO TO(30,34,30,33,30,34,30,34),KIND
43 IF (I-76) 48,48,49
48 T=10*(I+4)
    TT=T-10.
    GO TO 81
49 T=50*(I-76)+800
    TT= T-50.
81 GO TO (30,70,30,71,30,72,30,73),KIND
70 HOOKUP=T-(T-TT)*(QJ-XX)/(QJ-QJ1)
    RETURN
71 HOOKUP=T*EXPF((QJ-XX)/(QJ-QJ1)*LOGF(TT/T))
    RETURN
72 HOOKUP=T*TT/((T-TT)*(QJ-XX)/(QJ-QJ1)+TT)
    RETURN
73 HOOKUP=T*(1.-(QJ-XX)/(QJ-QJ1)*(1.-SQRTF(TT/T)))*2.
    RETURN
50 HOOKUP=0.
    RETURN
END

```

```

* CARDS COLUMN
* LIST
* FORTRAN          H1
FUNCTION ENTHLP(T,P)
ENTHLP=HOOKUP(T, P,1,XX)
RETURN
END
* CARDS COLUMN
* LIST
* FORTRAN          TH2
FUNCTION TEMP( H,P)
TEMP=HOOKUP( H,P,2,XX)
RETURN
END
* CARDS COLUMN
* LIST
* FORTRAN          SR3
FUNCTION ENTROP(T,P)
ENTROP=HOOKUP( T,P,3,XX)
RETURN
END
* CARDS COLUMN
* LIST
* FORTRAN          TSR4
FUNCTION TEMPSR(SR, P)
TEMPSR=HOOKUP (SR,P,4,XX)
RETURN
END
* CARDS COLUMN
* LIST
* FORTRAN          DEN5
FUNCTION DENSTY( T,P)
DENSTY=HOOKUP( T,P,5,XX)
RETURN
END
* CARDS COLUMN
* LIST
* FORTRAN          TR6
FUNCTION TEMPRO(RHO,P)
TEMPRO=HOOKUP( RHO,P,6,XX)
RETURN
END
* CARDS COLUMN
* LIST
* FORTRAN          VEL7
FUNCTION VELCTY(T,P)
VELCTY=HOOKUP( T,P,7,XX)
RETURN
END
* CARDS COLUMN
* LIST
* FORTRAN          TV8

```

```
FUNCTION TEMPC(V,P)  
  TEMPC=HOOKUP( V,P,8,XX)  
  RETURN  
END
```

```

* CARDS COLUMN
* LIST 8
* FORTRAN          VISCUS
-----
FUNCTION VISCUS(TX)
T=TX
VISCUS=145.8*(T**.5)**3/((T+110.4)*1716.)
RETURN
END
* CARDS COLUMN
* LIST 8
* FORTRAN          CONDUCT
-----
FUNCTION CONDUCT(TX)
T=TX
CONDUCT=.6325/5.77*T**.5/(1.+245.4/T*10.**(-12./T))
RETURN
END
* CARDS COLUMN
* LIST 8
* FORTRAN          SPHEAT
-----
FUNCTION SPHEAT(T,P)
SPHEAT=HOOKUP(T,P,0,XX)
RETURN
END
* CARDS COLUMN
* LIST 8
* FORTRAN          SPHTM
-----
FUNCTION          SPHTM(X)
X=1.
SPHTM=X
RETURN
END
* CARDS COLUMN
* LIST 8
* FORTRAN          OUTERR
-----
SUBROUTINE          OUTERR
CALL PDUMP
CALL MASTER
RETURN
END

```

```

* CARDS COLUMN
* LIST 8
* FORTRAN OUTPUT
SUBROUTINE OUTPUT
COMMON DAT (50,20,6)
COMMON ALPH,AN,AREABT,AREADP,AREADT,AREADU,AREANT,AREAP(21),AT,
2BDRAG,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),FI,FID,G(50,20),HG(100),H01,H02,IC,ID,INPT,
4 IOUT,ITT,JX,NAME(3,20),NCODE,NPLAVE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PO(100),POD,
6 PODT,POEX( 21),POFLT,POI,POINLT,PON,PONT,P01,P02,P02CP(20),P1,P2,
7 QP(100),Q0,R(50,20),RECO,RECUV,KEY(100),RGHNS(20),T(100),TAMB,
8 TD,TDT,TEX(21),THRST,THRUST,THST,TN,TNT,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON TON,TONT,T01,T02,T02CP(20),TOFLT,T02MAX,T02MXP,T1,T2,
2 T2CP(20),VEXH,V0,V2,W(20),WEX(21),WTOT,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLT,XMN,XMNT,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
2 (DAT(3001),POR), (DAT(4001),TWTT), (DAT(5001),TWT)
1 FORMAT(1H1,10A6/10(4X,8HFLOSS-IV)//3A6//)
J=JX
WRITE OUTPUT TAPE IOUT,1,(CODNAM(K),K=1,10),(NAME(K,J),K=1,3)
2 FORMAT(6X,3HT01,10X,3HP01,11X,3HP01,11X,2HP2,14X,1HW,13X,3HPWR,10X
2,6HTW-MAX,8X,3HT02/4X,7H(DEG-F),6X,3(6H(PSIA),8X),10H(LB-M/SEC),8X
3,4H(KW),10X,2(7H(DEG-F),6X))/F10.1,3F14.2,F15.6,F16.5,2F13.1/44X,1H
4(,F7.2,1H),36X,2(1H(,F6.1,1H),5X)///4X,13HENTRANCE HEAT,6X,11HF/F-
5SMOOTH=,5X,13HINLET DYNAMIC,6X,62HEXIT DYNAMIC EXIT REYNOLDS EX
6IT FRICTION EXIT HEAT TRANSFER/2X,16HTRANSFER (1=YES),5X,10HH/H-SM
7OOTH,8X,9HHEAD LOSS,9X,9HHEAD LOSS,5X,26HNUMBER (RE2) FACTOR (F2
8),6X, 9HCOEF. (H2)//F12.0,F18.3,F18.3,F19.3,1PE17.3,1PE14.3,1PE17.3
9/////
3 FORMAT(5X,1HX,6X,1HR,5X,3HPOR,4X,1HG,6X,1HM,6X,2HP0,6X,1HP,6X,2HT0
2,5X,1HT,3X,43HTW(T) TW(T-DT) Q/PO RE/RE2 F/F2 H/H2 HO//)
4 FORMAT(F9.2,F7.4,1X,F5.4,F7.4,1X,F5.4,2F8.2,4F7.1,1X,F5.4,3F6.3,F8
2.4)
AA=T01*1.8-459.69
AB=P01*14.696
AC=P01*14.696
AD=P2*14.696
AE=PWR*1.E-3
AF=TWMAX*1.8-459.69
AG=T02MAX*1.8-459.69
AH=TWM*1.8-459.69
AI=T02*1.8-459.69
DO 5 I=2,100
IF(X(I,J))5,6,5
5 IMAX=I
6 AJ=P(IMAX)*14.696
WRITE OUTPUT TAPE IOUT,2,AA,AB,AC,AD,W(J),AE,AF,AG,AJ,AH,AI,
2ENTRNS(J),RGHNS(J),EIK(J),EXK(J),REY(IMAX),F(IMAX),HG(IMAX)
WRITE OUTPUT TAPE IOUT,3
DO 7 I=1,IMAX

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```

AA=PO(I)*14.696
AB=P(I)*14.696
AC=TO(I)*1.8-459.69
AD=T(I)*1.8-459.69
AE=TWT(I,J)*1.8-459.69
AF=TWTT(I,J)*1.8-459.69
AG=REY(I)/REY(IMAX)
AH=F(I)/F(IMAX)
AI=HG(I)/HG(IMAX)
AJ=ENTHLP(TO(I),PO(I))
7 WRITE OUTPUT TAPE IOUT,4,X(I,J),R(I,J),POR(I,J),G(I,J),XM(I),AA,AB
  2,AC,AD,AE,AF,QP(I),AG,AH,AI,AJ
  AA=TWA*1.8-459.69
8 FORMAT(/,7H TW-AV=,F6.1)
  WRITE OUTPUT TAPE IOUT,8,AA
  CALL FLGRPH
  RETURN
  END

```

* CARDS COLUMN

* LIST 8

* FORTRAN

SYNOPSIS

SUBROUTINE SYNOPSIS

COMMON DAT (50,20,6)

```

COMMON ALPH, AN, AREABT, AREADP, AREADT, AREADU, AREANT, AREAP(21), AT,
2BDRAG, CFA, CMPNTS(21), CODNAM(10), DIS, DISD, DT, EIK(20), EXK(20),
3 ENTRNS(20), F(100), FI, FID, G(50,20), HG(100), H01, H02, IC, ID, INPT,
4 IOUT, ITT, JX, NAME(3,20), NCODE, VPLANE(20), NTYPE, P(100), PAMB, PD, PDT,
5 PEX(21), PN, PNT, POR(50,20), POWER, PWR, PWRCE(20), PWRP, PO(100), POD,
6 PODT, POEX( 21), POFLT, POI, POINLT, PON, PONT, PO1, PO2, PO2CP(20), P1, P2,
7 QP(100), QO, R(50,20), RECD, RECDV, REY(100), RGHNS(20), T(100), TAMB,
8 TD, TDT, TEX(21), THRST, THRUST, THST, TN, TNT, TWA, TWACP(20), TWM, TWMAX,
9 TWMCP(20), TWMXP, TWT(50,20), TWTT(50,20), TO(100), TOD, TODT, TOEX(21)
COMMON TON, TONT, TO1, TO2, TO2CP(20), TOFLT, TO2MAX, TO2MXP, T1, T2,
2 T2CP(20), VEXH, VO, V2, W(20), WEX(21), WTOT, WTOTAL, X(50,20), XM(100),
3 XMCP(20), XMD, XMDT, XMEX(21), XMFLT, XMN, XMNT, XM1, XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
1 (DAT(3001),PUR), (DAT(4001), TWT), (DAT(5001), TWT)
5 FORMAT(1H1,10A6)
WRITE OUTPUT TAPE IOUT,5,(CODNAM(K),K=1,10)
IF(NCODE - 2) 95, 400, 500
1 FORMAT( 6X,5HNOMAC,5(16X,5HNOMAC),///,6X,19HTOTAL REACTOR POWER
1,4X,2H= ,F6.1,1X,4H(MW),27X,12HGGROSS THRUST, 5X, 2H= ,F8.0,1X,
25H(B-F), /,6X, 15HTOTAL FLOW RATE, 8X,2H= ,F6.1, 1X,5H(PPS), 26X,
31HHEXHAUST VELOCITY = , F8.0, 1X, 8H(FT/SEC), /, 6X,19HPEAK MAT
4ERIAL TEMP., 4X, 2H= ,F6.1,1X, 7H(DEG-F), /,
56X,25HMAXIMUM EXIT GAS TEMP. = ,F6.1,1X,7H(DEG-F),///,
66X,11HSUPPLY DUCT,12X,15HDIFFUSER THROAT, 9X,13HREACTOR INLET, 9X,
71HEXIT NOZZLE THROAT, 5X,21HEXIT NOZZLE BOAT TAIL,/,
86X,10HCONDITIONS,14X,10HCONDITIONS,13X,10HCONDITIONS,2(15X,10HCOND
9ITIONS))
2 FORMAT(/,3X,4(4HM = ,F6.4,14X),4HM = ,F6.4, /,
13X,4(4HPO= ,F6.2,1X,6H(Psia),7X),4HPO= ,F6.2,1X,6H(Psia),/,
23X,4(4HP = ,F6.2,1X,6H(Psia),7X),4HP = ,F6.2,1X,6H(Psia),/,
33X,4(4HTO= ,F6.1,1X,7H(DEG-F),6X),4HTO= ,F6.1,1X,7H(DEG-F), /,
43X,4(4HT = ,F6.1,1X,7H(DEG-F),6X),4HT = ,F6.1,1X,7H(DEG-F), /,
53X,4(6HAREA= ,F6.1,1X,7H(SQ-IN),4X),6HAREA= ,F6.1,1X,7H(SQ-IN),/,
611X,1H1,15X,17HDISCHARGE COEF.= ,F6.4,3X,1H/,21X,17HDISCHARGE COEF
7.= ,F6.4,1X,17H DIVERGENCE FACTOR,/, 11X,1H1,15X,17HVELOCITY COEF.
8= ,F6.4,2X,1H/,22X,17HVELOCITY COEF. = ,F6.4,11X,2H= ,F6.4, /,
911X,1H1,19X,1H1,19X,1H/,27X,1H1,25X,1H/)
3 FORMAT(11X,1H1,19X,1H1,18X,1H/,28X,1H1,12X,1H-,11X,1H/, /,11X,1H1,
119X,1H1,17X,1H1,29X,1H1,9X,3H---,11X,1H/,/, 11X,1H1,19X,1H1,13X,
230(1H-),4X,1HV,6X,4(1H-),12X,1H/, /,11X,1H1,19X,1H1,10X,3H---,2X,
324(1H0),3X,3H---,6X,3H---,15X,1H/,/,11X,1HV,19X,1HV,7X,4H---,4X,
45(1H0),18(1H*),1H0,5X,7H---,17X,1H/, /, 9X,19(1H-),8X,4H---,
57X,5(1H0),18(1H*),1H0,7X,2H---,19X,1H/, /,27X, 9H---,11X,5(1H
60),18(1H*),1H0,27X,1H/,/, 30X,4H---,13X,5(1H0),18(1H*),1H0,26X,
71H/, /,47X,5(1H0),18(1H*),1H0,25X,1H/,/,47X,5(1H0),18(1H*),1H0,24X
8,1H1,/, 47X,5(1H0),18(1H*),1H0,/, 30X,4H---,13X,5(1H0),18(1H*),
91H0,/,27X,10H---,10X,5(1H0),18(1H*),1H0)

```



```

4  FORMAT(9X,19(1H-),8X,4(1H-),7X,5(1HO),18(1H*),1HO,7X,2H--, /,
140X,3H---,4X,5(1HO),18(1H*),1HO,5X,7H---, /, 42X,5H---,24(1HO
2),3X,3H---,6X,3H---,/,45X, 30(1H-),11X,4H---,/,71X,1H/,18X,2H--,
3/,70X,1H/,21X,1H-,/,69X,1H/,/,68X,1H/,/,67X,1H/,/,51X,18HREACTOR E
4XIT PLANE,/,55X,10HCONDITIONS)
100 FORMAT( 6X,6HDASH-N,5(15X,6HDASH-N), ///,6X, 25HTOTAL REACTOR P
1OWER = ,F6.1,1X,4H(MW),27X,19HGROSS THRUST = ,F8.0,1X,6H(LB
2-F), /, 6X,25HTOTAL FLOW RATE = ,F6.1,1X,5H(PPS),26X,19HNET
3 THRUST = ,F8.0,1X,6H(LB-F),/, 6X,25HPEAK MATERIAL TEMP.
4= ,F6.1,1X,7H(DEG-F),24X,19HNET THRUST/Q-FLT = ,F7.1,2X,7H(SQ-IN),
5 /,6X,25HMAXIMUM EXIT GAS TEMP. = ,F6.1,1X,7H(DEG-F),24X,19HFLIGHT
6 VELOCITY = ,F8.0,1X,8H(FT/SEC), /,69X,19HEXHAUST VELOCITY = ,F8.
70,1X,8H(FT/SEC), ///,12X,6HFLIGHT,21X,13HREACTOR INLET,14X,18HEXIT
8 NOZZLE THROAT,10X,21HEXIT NOZZLE BOAT TAIL, /,10X,3(10HCONDITIONS
9,20X),10HCONDITIONS,/)
101 FORMAT(6X,3(4HM = ,F6.4,20X),4HM = ,F6.4,/,6X,3(4HPO= ,F6.2,1X,6H(
1PSIA),13X),4HPO= ,F6.2,1X,6H(PSIA),/,6X,3(4HP = ,F6.2,1X,6H(PSIA),
213X),4HP = ,F6.2,1X,6H(PSIA),/,6X,3(4HTO= ,F6.1,1X,7H(DEG-F),12X),
34HTO= ,F6.1,1X,7H(DEG-F),/,6X,3(4HT = ,F6.1,1X,7H(DEG-F),12X),4HT
4= ,F6.1,1X,7H(DEG-F),/,13X,1H1,22X,2(6HAREA= ,F6.1,1X,7H(SQ-IN),10
5X),6HAREA= ,F6.1,1X,7H(SQ-IN),/,13X,1H1,32X,1H1,19X,18HDISCHARGE C
6DEF. = ,F6.4,6X,18H DIVERGENCE FACTOR= ,F6.4,/,13X,1H1,32X,1H1,19X,1
7HVELOCITY COEF. = ,F6.4,10X,1H/,/,13X,1H1,32X,1H1,32X,1H1,12X,1H
8-,6X,1H/,/,13X,1H1,32X,1HV,32X,1H1,10X,2H--,6X,1H/,/,13X,1H1,4X,57
9(1H-),4X,1H1,6X,4H---,7X,1H/)
102 FORMAT(13X,1H1,5X,3H---,20X,3H---,2X,24(1HO),3X,3H---,2X,1HV,3X,
13H---,10X,1H/,/,13X,1H1,7X,3H---,15X,4H---,4X,5(1HO),18(1H*),1HO,
25X,7H---,12X,1H/,/,13X,1HV,10X,4H---,8X,4H---,7X,5(1HO),18(1
3H*),1HO,7X,3H---,13X,1H/,/, 27X,10H---,10X,5(1HO),18(1H*),
41HO,22X,1H1, /,15X,10(1H-),5X,4(1H-),13X,5(1HO),18(1H*),1HO,22X,
51H1,/, 12X,3H---,1,10X,1H1,21X,5(1HO),18(1H*),1HO,22X,1HV,/,7X,5H---
6=1,14X,1H1,20X,5(1HO),18(1H*),1HO,/,12X,3H---,1,10X,1H1,21X,5(1HJ),
718(1H*),1HO,/,15X,10(1H-),5X,4(1H-),13X,5(1HO),18(1H*),1HO,/,27X,
84(1H-),2X,4(1H-),10X,5(1HO),18(1H*),1HO,/, 24X,4(1H-),8X,4(1H-),
97X,5(1HO),18(1H*),1HO,7X,2H--)
103 FORMAT(21X,3H---,15X,4H---,4X,5(1HO),18(1H*),1HO,5X,7(1H-),/,19X,
13H---,20X,3H---,2X,24(1HO),3X,3H---,6X,3H---, /,18X,57(1H-),11X,
24H---, /,71X,1H/,18X,2H--, /,70X,1H/,21X,1H-, /,69X,1H/,/,68X,1H/
3, /,67X,1H/,/,51X,18HREACTOR EXIT PLANE,/,55X,10HCONDITIONS)
203 FORMAT(20X,F6.1,9X,F6.4,7X,F6.2,8X,F6.2,9X,2(F6.1,7X),F6.1)
207 FORMAT(/,1X,11HEXIT PLANE ,12,2X,14HFREE FLOW AREA,7X,1HM,12X,2HPO
1,12X,1HP,13X,2HTO,12X,1HT,7X,14HFREE FLOW RATE, /,19X,7H(SQ-IN),
222X,6H(PSIA),8X,6H(PSIA),8X,7H(DEG-F),6X,7H(DEG-F),8X,5H(PPS),/)
204 FORMAT(/,5X,9HCOMPONENT,6X,20HNUMBER OF POWER PER,4X,2HM2,8X,
13HPO2,7X,3HTO2,7X,2HT2,6X,6HTW-MAX,5X,5HTW-AV,2X,18HFLOW RATE PERC
2ENT, /,33X,4H(KW),63X,20HPER (PPS) TOTAL FLOW, /)
206 FORMAT(1X,3A6,2X,F7.0,4X,F6.2,4X,F6.4,4X,F6.2,4(4X,F6.1),2X,F9.7,
12X,F8.6)
400 AA = PWRP * 1.E-6
AB = VEXH * 1087.4
AC = TWMXP * 1.8 - 459.69
AD = TO2MXP * 1.8 - 459.69

```

```

WRITE OUTPUT TAPE IOUT,1,AA,THRST,WTOT,AB,AC,AD
AA = POD * 14.696
AB=POD*14.696
AC = PO1 * 14.696
AD = PONT * 14.696
AE = PON * 14.696
AF = PD * 14.696
AG = PDT * 14.696
AH = P1 * 14.696
AI = PNT * 14.696
AJ = PN * 14.696
AK = TOD * 1.8 - 459.69
AL = TODT * 1.8 - 459.69
AM = TO1 * 1.8 - 459.69
AU = TONT * 1.8 - 459.69
AO = TON * 1.8 - 459.69
AP = TU * 1.8 - 459.69
AQ = TDT * 1.8 - 459.69
AR = T1 * 1.8 - 459.69
AS = TNT * 1.8 - 459.69
AV = TN * 1.8 - 459.69
WRITE OUTPUT TAPE IOUT,2,XMD,XMDT,XM1,XMNT,XMN,AA,AB,AC,AD,AE,AF,
LAG,AH,AI,AJ,AK,AL,AM,AU,AO,AP,AQ,AR,AS,AV,AREADU,AREADT,AREADP,
2AT,AN,DISD,DIS,FID,FI,ALPH
WRITE OUTPUT TAPE IOUT,3
WRITE OUTPUT TAPE IOUT,4
GO TO 600
500 AA = PWRP * 1.E-6
AB = TWMXP * 1.8 - 459.69
AC = TO2MXP * 1.8 - 459.69
AD = VO * 1087.4
AE = VEXH * 1087.4
WRITE OUTPUT TAPE IOUT,100,AA,THRST,WTOT,THRUST,AB,CFA,AC,AD,AE
AA = POFLT * 14.696
AB = PO1 * 14.696
AC=PONT*14.696
AD = PON * 14.696
AE = PAMB * 14.696
AF = P1 * 14.696
AG = PNT * 14.696
AH = PN * 14.696
AI = TOFLT * 1.8 - 459.69
AJ = TO1 * 1.8 - 459.69
AK = TONT * 1.8 - 459.69
AL = TON * 1.8 - 459.69
AM = TAMB * 1.8 - 459.69
AU = T1 * 1.8 - 459.69
AO = TNT * 1.8 - 459.69
AP = TN * 1.8 - 459.69
WRITE OUTPUT TAPE IOUT,101,XMFLT,XM1,XMNT,XMN,AA,AB,AC,AD,AE,AF,
LAG,AH,AI,AJ,AK,AL,AM,AU,AO,AP,AREADP,AT,AN,DIS,ALPH,FI
WRITE OUTPUT TAPE IOUT,102

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      WRITE OUTPUT TAPE IOUT,103
104  FORMAT(22H CHOKED INLET DIFFUSER)
105  FORMAT(19H CHOKED EXIT NOZZLE)
106  FORMAT(24H UNCHOKED INLET DIFFUSER)
107  FORMAT(21H UNCHOKED EXIT NOZZLE)
600  IF(ID-2)402,401,402
401  WRITE OUTPUT TAPE IOUT,106
      GO TO 501
402  WRITE OUTPUT TAPE IOUT,104
501  IF(IC-2)503,502,503
502  WRITE OUTPUT TAPE IOUT,107
      GO TO 300
503  WRITE OUTPUT TAPE IOUT,105
300  DO 304 J=1,20
      IF(J-1)307,301,307
307  IF(AKEAP(J))303,95,303
301  WRITE OUTPUT TAPE IOUT,5,(CODNAM(K),K=1,10)
303  WRITE OUTPUT TAPE IOUT,207,J
306  AA = POEX(J) * 14.696
      AB = PEX(J) * 14.696
      AC = TOEX(J) * 1.8 - 459.69
      AD=TEX(J)*1.8-459.69
      WRITE OUTPUT TAPE IOUT,203,AREAP(J),XMEX(J),AA,AB,AC,AD,WEX(J)
      DO 310 I=1,20
      IF(NPLANE(I)-J)310,315,310
310  CONTINUE
      GO TO 304
315  WRITE OUTPUT TAPE IOUT,204
      DO 302 I=1,20
      IF(NPLANE(I)-J)302,305,302
305  AB = P02CP(I) * 14.696
      AA = PWRCE(I) * PWRP * 1.E-3
      AC = T02CP(I) * 1.8 - 459.69
      AD = T2CP(I) * 1.8 - 459.69
      AE = TWMCP(I) * 1.8 - 459.69
      AF = TWACP(I) * 1.8 - 459.69
      AG = W(I) * CMPNTS(I) / WTOT
      WRITE OUTPUT TAPE IOUT,206,(NAME(K,I),K=1,3),CMPNTS(I),AA,XMCP(I),
      LAB,AC,AD,AE,AF,W(I),AG
302  CONTINUE
304  CONTINUE
95  RETURN
END

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* CARDS COLUMN
* LIST 8
* FORTRAN          RESTRT
SUBROUTINE RESTRT
COMMON DAT (50,20,6)
COMMON ALPHA,AN,AREAHT,AREADP,AREADT,AREADU,AREANT,AREAP(21),AT,
2BDRAC,CFA,CMPNTS(21),CODNAM(10),DIS,DISD,DT,EIK(20),EXK(20),
3 ENTRNS(20),F(100),FI,FID,G(50,20),HG(100),H01,H02,IC,ID,INPT,
4 IQUT,ITT,JX,NAME(3,20),NCODE,NPLANE(20),NTYPE,P(100),PAMB,PD,PDT,
5 PEX(21),PN,PNT,POR(50,20),POWER,PWR,PWRCE(20),PWRP,PO(100),POD,
6 PODT,POEX( 21),POFLT,POI,POINLT,PON,PONT,P01,P02,P02CP(20),P1,P2,
7 QP(100),QO,R(50,20),RECO,RECOV,REY(100),RGHNS(20),T(100),TAMB,
8 TD,TDI,TEX(21),THRST,THRUST,THST,IN,INI,TWA,TWACP(20),TWM,TWMAX,
9 TWMCP(20),TWMXP,TWT(50,20),TWTT(50,20),TO(100),TOD,TODT,TOEX(21)
COMMON ION,TONT,TO1,TO2,TO2CP(20),TOFLT,TO2MAX,TO2MXP,T1,T2,
2 T2CP(20),VEXH,V0,V2,W(20),WEX(21),WTDI,WTOTAL,X(50,20),XM(100),
3 XMCP(20),XMD,XMDT,XMEX(21),XMFLT,XMN,XMNT,XM1,XM2
EQUIVALENCE (DAT(1),X), (DAT(1001),G), (DAT(2001),R),
1 (DAT(3001),POR), (DAT(4001),TWTT), (DAT(5001),TWT)
100 FORMAT(5(1PE14.7))
101 FORMAT( 79H1 EXECUTION TERMINATED BY SENSE SWITCH 1. THE FOLLOWIN
2G RESTART DECK PRODUCED.)
102 FORMAT(2I5,10A6)
IF(NCODE)1,2,2
1 READ INPUT TAPE INPT,100,PEX(1),P01,PWRP,(W(I),I=1,20)
WRITEOUTPUTTAPE IQUT,100,PEX(1),P01,PWRP,(W(I),I=1,20)
RETURN
2 WRITEOUTPUTTAPE IQUT,101
NCODE=-NCODE
ITT=ITT-1
PUNCH 102,NCODE,ITT,(CODNAM(I),I=1,10)
WRITEOUTPUTTAPE IQUT,102,NCODE,ITT,(CODNAM(I),I=1,10)
PUNCH 100,PEX(1),P01,PWRP,(W(I),I=1,20)
WRITEOUTPUTTAPE IQUT,100,PEX(1),P01,PWRP,(W(I),I=1,20)
IF(NCODE)3,4,3
3 CALL EXIT
4 RETURN
END

```

* CARDS COLUMN

**

* LIST8

* FORTRAN

TABL1

* SUBROUTINE

TABL1

C

C XT(I,J,K) FOR I=1....120, FOR J=1..11, FOR K=1

C

BANK AAA(1)

COMMON /AAA/ XT(120,11,5)

DATA(XT(1,1,1)=	0.6346,	0.7625,	0.8905,	1.0185,		ETH	1
1 1.1464,	1.2742,	1.4021,	1.5299,	1.6577,	1.7855,	ETH	2
2 2.0412,	2.1690,	2.2968,	2.4246,	2.5525,	2.6804,	ETH	3
3 2.9362,	3.0641,	3.1920,	3.3199,	3.4479,	3.5759,	ETH	4
4 3.8321,	3.9603,	4.0885,	4.2169,	4.3453,	4.4738,	ETH	5
5 4.7312,	4.8601,	4.9891,	5.1182,	5.2476,	5.3771,	ETH	6
6 5.6366,	5.7667,	5.8969,	6.0274,	6.1581,	6.2891,	ETH	7
7 6.5517,	6.6833,	6.8153,	6.9475,	7.0799,	7.2127,	ETH	8
8 7.4790,	7.6126,	7.7465,	7.8807,	8.0152,	8.1500,	ETH	9
DATA(XT(61,1,1)=	8.4205,	8.5562,	8.6922,	8.8285,		ETH	10
1 8.9651,	9.1021,	9.2393,	9.3768,	9.5147,	9.6528,	ETH	11
2 9.9301,	10.0692,	10.2085,	10.3482,	10.4880,	11.1920,	ETH	12
3 12.6230,	13.3480,	14.0790,	14.8170,	15.5610,	16.3100,	ETH	13
4 17.8260,	18.5920,	19.3640,	20.1420,	20.9260,	21.7170,	ETH	14
5 23.3210,	24.1360,	24.9620,	25.8020,	26.6600,	27.5410,	ETH	15
6 29.4030,	30.4080,	31.4850,	32.6490,	33.9130,	35.2920,	ETH	16
7 0. ,	0. ,	0. ,	0. ,	0. ,	0. ,	ETH	17
8 0. ,	0. ,	0. ,	0. ,	0. ,	0. ,	ETH	18
DATA(XT(1,2,1)=	0. ,	0. ,	0. ,	1.0160,		ETH	19
1 1.1444,	1.2725,	1.4006,	1.5286,	1.6566,	1.7845,	ETH	20
2 2.0404,	2.1683,	2.2962,	2.4240,	2.5520,	2.6798,	ETH	21
3 2.9357,	3.0637,	3.1916,	3.3195,	3.4475,	3.5756,	ETH	22
4 3.8318,	3.9600,	4.0883,	4.2167,	4.3451,	4.4736,	ETH	23
5 4.7310,	4.8599,	4.9889,	5.1180,	5.2475,	5.3770,	ETH	24
6 5.6365,	5.7666,	5.8968,	6.0273,	6.1580,	6.2890,	ETH	25
7 6.5517,	6.6833,	6.8153,	6.9475,	7.0799,	7.2127,	ETH	26
8 7.4790,	7.6126,	7.7465,	7.8807,	8.0152,	8.1500,	ETH	27
DATA(XT(61,2,1)=	8.4205,	8.5562,	8.6922,	8.8285,		ETH	28
1 8.9651,	9.1021,	9.2393,	9.3768,	9.5147,	9.6528,	ETH	29
2 9.9301,	10.0692,	10.2085,	10.3482,	10.4880,	11.1920,	ETH	30
3 12.6230,	13.3480,	14.0790,	14.8170,	15.5610,	16.3100,	ETH	31
4 17.8260,	18.5920,	19.3630,	20.1400,	20.9220,	21.7100,	ETH	32
5 23.3050,	24.1130,	24.9280,	25.7510,	26.5840,	27.4280,	ETH	33
6 29.1620,	30.0590,	30.9790,	31.9280,	32.9130,	33.9430,	ETH	34
7 36.1760,	37.3960,	38.7040,	40.1160,	41.6360,	43.2810,	ETH	35
8 47.0290,	49.1490,	51.4500,	0. ,	0. ,	0. ,	ETH	36
DATA(XT(1,3,1)=	0. ,	0. ,	0. ,	0. ,		ETH	37
1 1.1376,	1.2667,	1.3958,	1.5244,	1.6530,	1.7813,	ETH	38
2 2.0378,	2.1659,	2.2940,	2.4221,	2.5502,	2.6782,	ETH	39
3 2.9342,	3.0623,	3.1904,	3.3184,	3.4465,	3.5746,	ETH	40
4 3.8309,	3.9592,	4.0875,	4.2159,	4.3444,	4.4730,	ETH	41
5 4.7305,	4.8594,	4.9885,	5.1176,	5.2470,	5.3766,	ETH	42
6 5.6362,	5.7663,	5.8965,	6.0270,	6.1577,	6.2888,	ETH	43

7	6.5515,	6.6831,	6.8151,	6.9473,	7.0798,	7.2126,	7.3456,	ETH	44
8	7.4789,	7.6125,	7.7464,	7.8807,	8.0151,	8.1500,	8.2851)	ETH	45
	DATA(XT(61, 3,1)=	8.4205,	8.5562,	8.6922,	8.8285,			ETH	46
1	8.9651,	9.1022,	9.2394,	9.3769,	9.5148,	9.6528,	9.7914,	ETH	47
2	9.9302,	10.0693,	10.2086,	10.3483,	10.4880,	11.1920,	11.9040,	ETH	48
3	12.6230,	13.3480,	14.0790,	14.8170,	15.5610,	16.3100,	17.0650,	ETH	49
4	17.8260,	18.5920,	19.3630,	20.1400,	20.9220,	21.7100,	22.5040,	ETH	50
5	23.3040,	24.1100,	24.9220,	25.7410,	26.5680,	27.4030,	28.2480,	ETH	51
6	29.1040,	29.9730,	30.8560,	31.7560,	32.6770,	33.6230,	34.6000,	ETH	52
7	35.6110,	36.6610,	37.7580,	38.9090,	40.1210,	41.3970,	42.7450,	ETH	53
8	44.1710,	45.6820,	47.2850,	0.	0.	0.	0.)	ETH	54
	DATA(XT(1, 4,1)=	0.	0.	0.	0.			ETH	55
1	1.1307,	1.2611,	1.3909,	1.5202,	1.6493,	1.7781,	1.9066,	ETH	56
2	2.0352,	2.1636,	2.2919,	2.4201,	2.5483,	2.6765,	2.8047,	ETH	57
3	2.9328,	3.0610,	3.1891,	3.3172,	3.4454,	3.5736,	3.7018,	ETH	58
4	3.8301,	3.9584,	4.0867,	4.2152,	4.3438,	4.4724,	4.6011,	ETH	59
5	4.7299,	4.8589,	4.9880,	5.1172,	5.2466,	5.3762,	5.5059,	ETH	60
6	5.6358,	5.7660,	5.8962,	6.0267,	6.1574,	6.2885,	6.4197,	ETH	61
7	6.5512,	6.6830,	6.8150,	6.9472,	7.0796,	7.2124,	7.3455,	ETH	62
8	7.4788,	7.6125,	7.7464,	7.8806,	8.0151,	8.1499,	8.2851)	ETH	63
	DATA(XT(61, 4,1)=	8.4205,	8.5562,	8.6922,	8.8285,			ETH	64
1	8.9652,	9.1022,	9.2394,	9.3769,	9.5149,	9.6529,	9.7915,	ETH	65
2	9.9304,	10.0695,	10.2087,	10.3485,	10.4880,	11.1920,	11.9040,	ETH	66
3	12.6230,	13.3480,	14.0790,	14.8170,	15.5610,	16.3100,	17.0650,	ETH	67
4	17.8260,	18.5920,	19.3630,	20.1400,	20.9220,	21.7100,	22.5040,	ETH	68
5	23.3040,	24.1100,	24.9220,	25.7400,	26.5650,	27.3980,	28.2390,	ETH	69
6	29.0900,	29.9510,	30.8240,	31.7110,	32.6150,	33.5400,	34.4890,	ETH	70
7	35.4660,	36.4740,	37.5190,	38.6060,	39.7390,	40.9210,	42.1570,	ETH	71
8	43.4530,	44.8160,	46.2480,	0.	0.	0.	0.)	ETH	72
	DATA(XT(1, 5,1)=	0.	0.	0.	0.			ETH	73
1	0.	1.2552,	1.3859,	1.5156,	1.6455,	1.7746,	1.9036,	ETH	74
2	2.0325,	2.1612,	2.2897,	2.4181,	2.5465,	2.6748,	2.8031,	ETH	75
3	2.9314,	3.0597,	3.1879,	3.3161,	3.4443,	3.5726,	3.7009,	ETH	76
4	3.8292,	3.9576,	4.0860,	4.2145,	4.3431,	4.4717,	4.6005,	ETH	77
5	4.7296,	4.8584,	4.9875,	5.1167,	5.2462,	5.3758,	5.5055,	ETH	78
6	5.6355,	5.7657,	5.8959,	6.0265,	6.1571,	6.2883,	6.4195,	ETH	79
7	6.5510,	6.6828,	6.8148,	6.9470,	7.0795,	7.2123,	7.3454,	ETH	80
8	7.4787,	7.6124,	7.7463,	7.8805,	8.0150,	8.1499,	8.2851)	ETH	81
	DATA(XT(61, 5,1)=	8.4205,	8.5562,	8.6922,	8.8285,			ETH	82
1	8.9652,	9.1023,	9.2395,	9.3770,	9.5150,	9.6530,	9.7916,	ETH	83
2	9.9305,	10.0696,	10.2088,	10.3486,	10.4890,	11.1920,	11.9040,	ETH	84
3	12.6230,	13.3480,	14.0790,	14.8170,	15.5610,	16.3100,	17.0650,	ETH	85
4	17.8260,	18.5920,	19.3630,	20.1400,	20.9220,	21.7100,	22.5040,	ETH	86
5	23.3040,	24.1100,	24.9220,	25.7400,	26.5650,	27.3970,	28.2370,	ETH	87
6	29.0860,	29.9440,	30.8130,	31.6950,	32.5920,	33.5070,	34.4430,	ETH	88
7	35.4040,	36.3930,	37.4130,	38.4700,	39.5680,	40.7130,	41.9120,	ETH	89
8	43.1720,	44.4990,	45.9010,	47.3850,	48.9600,	50.6310,	52.4030)	ETH	90
	DATA(XT(1, 6,1)=	0.	0.	0.	0.			ETH	91
1	0.	0.	1.3331,	1.4712,	1.6067,	1.7410,	1.8736,	ETH	92
2	2.0056,	2.1369,	2.2677,	2.3980,	2.5281,	2.6579,	2.7875,	ETH	93
3	2.9169,	3.0462,	3.1754,	3.3045,	3.4335,	3.5625,	3.6915,	ETH	94
4	3.8204,	3.9494,	4.0784,	4.2074,	4.3364,	4.4655,	4.5947,	ETH	95

5	4.7240,	4.8534,	4.9829,	5.1125,	5.2422,	5.3721,	5.5021,	ETH	96				
6	5.6322,	5.7626,	5.8932,	6.0240,	6.1550,	6.2862,	6.4176,	ETH	97				
7	6.5492,	6.6811,	6.8133,	6.9457,	7.0784,	7.2113,	7.3445,	ETH	98				
8	7.4780,	7.6118,	7.7459,	7.8803,	8.0150,	8.1499,	8.2851,	ETH	99				
DATA(XT(61, 6,1))=								8.4206,	8.5564,	8.6925,	8.8289,	ETH	100
1	8.9656,	9.1027,	9.2401,	9.3778,	9.5158,	9.6541,	9.7927,	ETH	101				
2	9.9316,	10.0708,	10.2103,	10.3501,	10.4900,	11.1920,	11.9060,	ETH	102				
3	12.6250,	13.3500,	14.0810,	14.8190,	15.5630,	16.3120,	17.0670,	ETH	103				
4	17.8280,	18.5940,	19.3650,	20.1420,	20.9240,	21.7120,	22.5060,	ETH	104				
5	23.3060,	24.1120,	24.9230,	25.7400,	26.5630,	27.3920,	28.2280,	ETH	105				
6	29.0710,	29.9220,	30.7810,	31.6490,	32.5270,	33.4160,	34.3180,	ETH	106				
7	35.2350,	36.1690,	37.1210,	38.0930,	39.0880,	40.1100,	41.1620,	ETH	107				
8	42.2460,	43.3650,	44.5280,	45.7320,	46.9850,	48.2920,	49.6550,	ETH	108				
DATA(XT(1, 7,1))=								0.	0.	0.	0.	ETH	109
1	0.	0.	1.2731,	1.4220,	1.5653,	1.7057,	1.8421,	ETH	110				
2	1.9776,	2.1118,	2.2450,	2.3775,	2.5094,	2.6408,	2.7718,	ETH	111				
3	2.9025,	3.0329,	3.1631,	3.2931,	3.4229,	3.5526,	3.6822,	ETH	112				
4	3.8118,	3.9413,	4.0708,	4.2003,	4.3298,	4.4593,	4.5889,	ETH	113				
5	4.7185,	4.8482,	4.9780,	5.1079,	5.2379,	5.3681,	5.4984,	ETH	114				
6	5.6288,	5.7594,	5.8902,	6.0212,	6.1524,	6.2838,	6.4154,	ETH	115				
7	6.5473,	6.6794,	6.8117,	6.9443,	7.0771,	7.2102,	7.3436,	ETH	116				
8	7.4773,	7.6112,	7.7454,	7.8799,	8.0147,	8.1498,	8.2852,	ETH	117				
DATA(XT(61, 7,1))=								8.4209,	8.5569,	8.6931,	8.8296,	ETH	118
1	8.9664,	9.1035,	9.2409,	9.3786,	9.5166,	9.6549,	9.7935,	ETH	119				
2	9.9324,	10.0716,	10.2111,	10.3509,	10.4910,	11.1960,	11.9080,	ETH	120				
3	12.6270,	13.3520,	14.0840,	14.8220,	15.5660,	16.3160,	17.0710,	ETH	121				
4	17.8320,	18.5980,	19.3700,	20.1470,	20.9290,	21.7170,	22.5110,	ETH	122				
5	23.3100,	24.1160,	24.9270,	25.7440,	26.5660,	27.3940,	28.2290,	ETH	123				
6	29.0700,	29.9180,	30.7740,	31.6380,	32.5100,	33.3920,	34.2860,	ETH	124				
7	35.1870,	36.1070,	37.0420,	37.9940,	38.9640,	39.9550,	40.9690,	ETH	125				
8	42.0080,	43.0750,	44.1730,	45.3050,	46.4740,	47.6850,	48.9400,	ETH	126				
DATA(XT(1, 8,1))=								0.	0.	0.	0.	ETH	127
1	0.	0.	1.2013,	1.3674,	1.5219,	1.6680,	1.8112,	ETH	128				
2	1.9502,	2.0871,	2.2226,	2.3571,	2.4908,	2.6238,	2.7562,	ETH	129				
3	2.8881,	3.0196,	3.1508,	3.2817,	3.4124,	3.5429,	3.6732,	ETH	130				
4	3.8034,	3.9335,	4.0635,	4.1935,	4.3235,	4.4535,	4.5835,	ETH	131				
5	4.7135,	4.8436,	4.9737,	5.1039,	5.2342,	5.3646,	5.4952,	ETH	132				
6	5.6259,	5.7567,	5.8877,	6.0189,	6.1503,	6.2819,	6.4137,	ETH	133				
7	6.5457,	6.6779,	6.8104,	6.9431,	7.0761,	7.2093,	7.3428,	ETH	134				
8	7.4766,	7.6106,	7.7449,	7.8795,	8.0144,	8.1496,	8.2850,	ETH	135				
DATA(XT(61, 8,1))=								8.4207,	8.5567,	8.6930,	8.8296,	ETH	136
1	8.9665,	9.1037,	9.2412,	9.3790,	9.5171,	9.6555,	9.7942,	ETH	137				
2	9.9332,	10.0725,	10.2121,	10.3520,	10.4920,	11.1970,	11.9090,	ETH	138				
3	12.6280,	13.3540,	14.0860,	14.8240,	15.5680,	16.3180,	17.0730,	ETH	139				
4	17.8340,	18.6010,	19.3730,	20.1500,	20.9320,	21.7200,	22.5140,	ETH	140				
5	23.3130,	24.1180,	24.9290,	25.7460,	26.5680,	27.3960,	28.2310,	ETH	141				
6	29.0720,	29.9200,	30.7750,	31.6380,	32.5090,	33.3890,	34.2790,	ETH	142				
7	35.1800,	36.0930,	37.0200,	37.9610,	38.9190,	39.8950,	40.8920,	ETH	143				
8	41.9110,	42.9550,	44.0260,	45.1270,	46.2620,	47.4350,	48.6500,	ETH	144				
DATA(XT(1, 9,1))=								0.	0.	0.	0.	ETH	145
1	0.	0.	0.	0.	0.	0.	0.	ETH	146				
2	1.5895,	1.7887,	1.9671,	2.1334,	2.2922,	2.4455,	2.5949,	ETH	147				

3	2.7413,	2.8852,	3.0274,	3.1677,	3.3067,	3.4454,	3.5829,	ETH	148				
4	3.7194,	3.8554,	3.9909,	4.1258,	4.2603,	4.3944,	4.5281,	ETH	149				
5	4.6618,	4.7954,	4.9289,	5.0623,	5.1956,	5.3289,	5.4621,	ETH	150				
6	5.5952,	5.7282,	5.8613,	5.9945,	6.1279,	6.2614,	6.3951,	ETH	151				
7	6.5289,	6.6628,	6.7969,	6.9311,	7.0655,	7.2002,	7.3350,	ETH	152				
8	7.4700,	7.6053,	7.7408,	7.8765,	8.0125,	8.1488,	8.2853,	ETH	153				
DATA(XT(61, 9, 1))=								8.4220,	8.5590,	8.6963,	8.8338,	ETH	154
1	8.9716,	9.1096,	9.2479,	9.3865,	9.5254,	9.6646,	9.8040,	ETH	155				
2	9.9437,	10.0837,	10.2240,	10.3645,	10.5050,	11.2130,	11.9280,	ETH	156				
3	12.6490,	13.3770,	14.1110,	14.8510,	15.5960,	16.3470,	17.1040,	ETH	157				
4	17.8660,	18.6340,	19.4070,	20.1850,	20.9680,	21.7570,	22.5510,	ETH	158				
5	23.3510,	24.1560,	24.9670,	25.7840,	26.6060,	27.4340,	28.2680,	ETH	159				
6	29.1080,	29.9540,	30.8060,	31.6650,	32.5300,	33.4020,	34.2820,	ETH	160				
7	35.1700,	36.0670,	36.9730,	37.8880,	38.8130,	39.7500,	40.6990,	ETH	161				
8	41.6610,	42.6380,	43.6300,	44.6390,	45.6660,	46.7140,	47.7840,	ETH	162				
DATA(XT(1, 10, 1))=								0.	0.	0.	0.	ETH	163
1	0.	0.	0.	0.	0.	0.	0.	ETH	164				
2	0.	0.	1.6603,	1.8828,	2.0794,	2.2605,	2.4315,	ETH	165				
3	2.5952,	2.7540,	2.9078,	3.0567,	3.2059,	3.3536,	3.4985,	ETH	166				
4	3.6411,	3.7826,	3.9233,	4.0632,	4.2023,	4.3407,	4.4783,	ETH	167				
5	4.6156,	4.7524,	4.8890,	5.0252,	5.1612,	5.2970,	5.4325,	ETH	168				
6	5.5680,	5.7033,	5.8386,	5.9738,	6.1090,	6.2442,	6.3795,	ETH	169				
7	6.5149,	6.6504,	6.7860,	6.9218,	7.0575,	7.1936,	7.3296,	ETH	170				
8	7.4658,	7.6022,	7.7388,	7.8757,	8.0127,	8.1499,	8.2874,	ETH	171				
DATA(XT(61, 10, 1))=								8.4251,	8.5630,	8.7011,	8.8395,	ETH	172
1	8.9780,	9.1168,	9.2559,	9.3952,	9.5349,	9.6748,	9.8149,	ETH	173				
2	9.9553,	10.0959,	10.2368,	10.3779,	10.5190,	11.2300,	11.9470,	ETH	174				
3	12.6700,	13.4000,	14.1360,	14.8770,	15.6240,	16.3760,	17.1340,	ETH	175				
4	17.8970,	18.6660,	19.4400,	20.2190,	21.0030,	21.7920,	22.5870,	ETH	176				
5	23.3870,	24.1930,	25.0040,	25.8210,	26.6440,	27.4720,	28.3060,	ETH	177				
6	29.1460,	29.9920,	30.8440,	31.7020,	32.5660,	33.4370,	34.3150,	ETH	178				
7	35.2000,	36.0920,	36.9920,	37.9010,	38.8180,	39.7440,	40.6800,	ETH	179				
8	41.6270,	42.5850,	43.5560,	44.5400,	45.5390,	46.5530,	47.5830,	ETH	180				
DATA(XT(1, 11, 1))=								0.	0.	0.	0.	ETH	181
1	0.	0.	0.	0.	0.	0.	0.	ETH	182				
2	0.	0.	1.3546,	1.6361,	1.8734,	2.0838,	2.2771,	ETH	183				
3	2.4583,	2.6319,	2.7972,	2.9580,	3.1156,	3.2695,	3.4211,	ETH	184				
4	3.5699,	3.7173,	3.8632,	4.0078,	4.1512,	4.2935,	4.4348,	ETH	185				
5	4.5753,	4.7150,	4.8540,	4.9926,	5.1311,	5.2692,	5.4071,	ETH	186				
6	5.5446,	5.6820,	5.8192,	5.9563,	6.0933,	6.2302,	6.3670,	ETH	187				
7	6.5038,	6.6408,	6.7777,	6.9148,	7.0518,	7.1891,	7.3264,	ETH	188				
8	7.4637,	7.6013,	7.7390,	7.8769,	8.0149,	8.1531,	8.2914,	ETH	189				
DATA(XT(61, 11, 1))=								8.4298,	8.5684,	8.7073,	8.8464,	ETH	190
1	8.9858,	9.1253,	9.2655,	9.4058,	9.5463,	9.6870,	9.8278,	ETH	191				
2	9.9688,	10.1099,	10.2512,	10.3926,	10.5340,	11.2480,	11.9680,	ETH	192				
3	12.6930,	13.4240,	14.1610,	14.9040,	15.6520,	16.4050,	17.1640,	ETH	193				
4	17.9280,	18.6970,	19.4710,	20.2510,	21.0360,	21.8260,	22.6210,	ETH	194				
5	23.4220,	24.2280,	25.0400,	25.8570,	26.6800,	27.5090,	28.3430,	ETH	195				
6	29.1830,	30.0290,	30.8810,	31.7390,	32.6030,	33.4730,	34.3490,	ETH	196				
7	35.2320,	36.1230,	37.0210,	37.9270,	38.8410,	39.7640,	40.6960,	ETH	197				
8	41.6380,	42.5900,	43.5540,	44.5300,	45.5180,	46.5200,	47.5370,	ETH	198				

RETURN

END

* CARDS COLUMN

* LIST8

* FORTRAN

TABL2

* SUBROUTINE

TABL2

C

C XT(I,J,K) FOR I=1....120, FOR J=1..11, FOR K=2

C

BANK AAA(1)

COMMON /AAA/ XT(120,11,5)

DATA(XT(1, 1,2)= 22.2660, 22.9030, 23.4410, 23.9080,

ENT 1

1 24.3190, 24.6890, 25.0200, 25.3240, 25.6030, 25.8620, 26.1030,

ENT 2

2 26.3280, 26.5400, 26.7400, 26.9290, 27.1080, 27.2780, 27.4400,

ENT 3

3 27.5960, 27.7450, 27.8870, 28.0240, 28.1560, 28.2830, 28.4060,

ENT 4

4 28.5250, 28.6400, 28.7510, 28.8590, 28.9640, 29.0650, 29.1640,

ENT 5

5 29.2600, 29.3540, 29.4460, 29.5350, 29.6220, 29.7070, 29.7910,

ENT 6

6 29.8730, 29.9530, 30.0310, 30.1070, 30.1820, 30.2560, 30.3290,

ENT 7

7 30.4000, 30.4700, 30.5380, 30.6060, 30.6720, 30.7380, 30.8020,

ENT 8

8 30.8650, 30.9270, 30.9890, 31.0500, 31.1100, 31.1690, 31.2270)

ENT 9

DATA(XT(61, 1,2)= 31.2840, 31.3400, 31.3960, 31.4510,

ENT 10

1 31.5060, 31.5600, 31.6130, 31.6650, 31.7170, 31.7680, 31.8190,

ENT 11

2 31.8690, 31.9190, 31.9680, 32.0170, 32.0650, 32.2990, 32.5210,

ENT 12

3 32.7330, 32.9360, 33.1310, 33.3180, 33.4990, 33.6740, 33.8420,

ENT 13

4 34.0050, 34.1630, 34.3160, 34.4650, 34.6100, 34.7510, 34.8890,

ENT 14

5 35.0240, 35.1570, 35.2880, 35.4170, 35.5450, 35.6730, 35.8020,

ENT 15

6 35.9340, 36.0700, 36.2120, 36.3620, 36.5210, 36.6900, 36.8700,

ENT 16

7 0. , 0. , 0. , 0. , 0. , 0. , 0. ,

ENT 17

8 0. , 0. , 0. , 0. , 0. , 0. , 0.)

ENT 18

DATA(XT(1, 2,2)= 0. , 0. , 0. , 21.6000,

ENT 19

1 22.0140, 22.3820, 22.7150, 23.0200, 23.2990, 23.5580, 23.7990,

ENT 20

2 24.0250, 24.2370, 24.4360, 24.6250, 24.8040, 24.9750, 25.1380,

ENT 21

3 25.2930, 25.4420, 25.5840, 25.7210, 25.8530, 25.9800, 26.1030,

ENT 22

4 26.2220, 26.3370, 26.4480, 26.5560, 26.6610, 26.7630, 26.8620,

ENT 23

5 26.9580, 27.0520, 27.1440, 27.2330, 27.3200, 27.4050, 27.4880,

ENT 24

6 27.5700, 27.6500, 27.7280, 27.8050, 27.8800, 27.9540, 28.0260,

ENT 25

7 28.0970, 28.1670, 28.2360, 28.3030, 28.3690, 28.4340, 28.4990,

ENT 26

8 28.5630, 28.6250, 28.6860, 28.7470, 28.8070, 28.8660, 28.9240)

ENT 27

DATA(XT(61, 2,2)= 28.9810, 29.0380, 29.0940, 29.1490,

ENT 28

1 29.2030, 29.2570, 29.3100, 29.3630, 29.4150, 29.4660, 29.5170,

ENT 29

2 29.5670, 29.6170, 29.6680, 29.7140, 29.7620, 29.9960, 30.2180,

ENT 30

3 30.4300, 30.6330, 30.8280, 31.0160, 31.1970, 31.3710, 31.5390,

ENT 31

4 31.7020, 31.8600, 32.0130, 32.1620, 32.3070, 32.4480, 32.5860,

ENT 32

5 32.7210, 32.8530, 32.9820, 33.1090, 33.2340, 33.3570, 33.4790,

ENT 33

6 33.6000, 33.7210, 33.8420, 33.9640, 34.0880, 34.2140, 34.3440,

ENT 34

7 34.4790, 34.6190, 34.7660, 34.9220, 35.0860, 35.2610, 35.4480,

ENT 35

8 35.6470, 35.8600, 36.0860, 0. , 0. , 0. , 0.)

ENT 36

DATA(XT(1, 3,2)= 0. , 0. , 0. , 0. ,

ENT 37

1 20.6130, 20.9860, 21.3210, 21.6270, 21.9080, 22.1680, 22.4100,

ENT 38

2 22.6360, 22.8480, 23.0480, 23.2370, 23.4160, 23.5870, 23.7500,

ENT 39

3 23.9050, 24.0540, 24.1970, 24.3340, 24.4660, 24.5930, 24.7160,

ENT 40

4 24.8350, 24.9500, 25.0610, 25.1690, 25.2740, 25.3760, 25.4750,

ENT 41

5 25.5710, 25.6650, 25.7570, 25.8460, 25.9330, 26.0180, 26.1010,

ENT 42

6 26.1830, 26.2630, 26.3410, 26.4180, 26.4930, 26.5670, 26.6400,

ENT 43

7	26.7110,	26.7810,	26.8490,	26.9170,	26.9830,	27.0480,	27.1130,	ENT	44
8	27.1760,	27.2380,	27.3000,	27.3610,	27.4200,	27.4790,	27.5370)	ENT	45
	DATA(XT(61,	3,2)=	27.5940,	27.6510,	27.7070,	27.7620,		ENT	46
1	27.8170,	27.8710,	27.9240,	27.9760,	28.0280,	28.0790,	28.1300,	ENT	47
2	28.1800,	28.2300,	28.2790,	28.3280,	28.3760,	28.6100,	28.8320,	ENT	48
3	29.0440,	29.2470,	29.4420,	29.6300,	29.8110,	29.9850,	30.1530,	ENT	49
4	30.3160,	30.4740,	30.6270,	30.7760,	30.9210,	31.0620,	31.2000,	ENT	50
5	31.3340,	31.4650,	31.5940,	31.7200,	31.8440,	31.9660,	32.0860,	ENT	51
6	32.2040,	32.3210,	32.4370,	32.5530,	32.6690,	32.7850,	32.9020,	ENT	52
7	33.0210,	33.1420,	33.2660,	33.3930,	33.5240,	33.6590,	33.7990,	ENT	53
8	33.9450,	34.0960,	34.2530,	0.	0.	0.	0.)	ENT	54
	DATA(XT(1,	4,2)=	0.	0.	0.	0.		ENT	55
1	20.0320,	20.4160,	20.7540,	21.0610,	21.3430,	21.6040,	21.8460,	ENT	56
2	22.0730,	22.2860,	22.4860,	22.6750,	22.8550,	23.0260,	23.1890,	ENT	57
3	23.3440,	23.4930,	23.6360,	23.7740,	23.9060,	24.0330,	24.1560,	ENT	58
4	24.2750,	24.3900,	24.5010,	24.6090,	24.7140,	24.8160,	24.9150,	ENT	59
5	25.0110,	25.1050,	25.1970,	25.2860,	25.3730,	25.4580,	25.5410,	ENT	60
6	25.6230,	25.7030,	25.7810,	25.8580,	25.9330,	26.0070,	26.0800,	ENT	61
7	26.1510,	26.2210,	26.2890,	26.3570,	26.4230,	26.4890,	26.5530,	ENT	62
8	26.6160,	26.6790,	26.7400,	26.8010,	26.8610,	26.9200,	26.9780)	ENT	63
	DATA(XT(61,	4,2)=	27.0350,	27.0920,	27.1480,	27.2030,		ENT	64
1	27.2570,	27.3110,	27.3640,	27.4170,	27.4690,	27.5200,	27.5710,	ENT	65
2	27.6210,	27.6710,	27.7200,	27.7690,	27.8170,	28.0500,	28.2720,	ENT	66
3	28.4840,	28.6870,	28.8820,	29.0700,	29.2510,	29.4250,	29.5930,	ENT	67
4	29.7560,	29.9140,	30.0670,	30.2160,	30.3610,	30.5020,	30.6400,	ENT	68
5	30.7740,	30.9050,	31.0340,	31.1600,	31.2840,	31.4050,	31.5240,	ENT	69
6	31.6410,	31.7570,	31.8720,	31.9860,	32.1000,	32.2130,	32.3270,	ENT	70
7	32.4420,	32.5580,	32.6760,	32.7960,	32.9190,	33.0450,	33.1740,	ENT	71
8	33.3070,	33.4440,	33.5850,	0.	0.	0.	0.)	ENT	72
	DATA(XT(1,	5,2)=	0.	0.	0.	0.		ENT	73
1	0.	20.0490,	20.3890,	20.6980,	20.9810,	21.2430,	21.4860,	ENT	74
2	21.7130,	21.9260,	22.1270,	22.3170,	22.4970,	22.6680,	22.8310,	ENT	75
3	22.9860,	23.1350,	23.2780,	23.4160,	23.5480,	23.6750,	23.7980,	ENT	76
4	23.9170,	24.0320,	24.1440,	24.2520,	24.3570,	24.4590,	24.5580,	ENT	77
5	24.6540,	24.7480,	24.8400,	24.9290,	25.0160,	25.1010,	25.1850,	ENT	78
6	25.2670,	25.3470,	25.4240,	25.5010,	25.5760,	25.6500,	25.7230,	ENT	79
7	25.7940,	25.8640,	25.9330,	26.0000,	26.0670,	26.1320,	26.1960,	ENT	80
8	26.2590,	26.3210,	26.3830,	26.4440,	26.5040,	26.5630,	26.6210)	ENT	81
	DATA(XT(61,	5,2)=	26.6780,	26.7350,	26.7910,	26.8460,		ENT	82
1	26.9000,	26.9540,	27.0070,	27.0600,	27.1120,	27.1630,	27.2140,	ENT	83
2	27.2640,	27.3140,	27.3630,	27.4120,	27.4600,	27.6930,	27.9150,	ENT	84
3	28.1270,	28.3300,	28.5250,	28.7130,	28.8940,	29.0680,	29.2360,	ENT	85
4	29.3990,	29.5570,	29.7110,	29.8600,	30.0050,	30.1460,	30.2840,	ENT	86
5	30.4180,	30.5490,	30.6780,	30.8040,	30.9270,	31.0480,	31.1670,	ENT	87
6	31.2840,	31.4000,	31.5140,	31.6270,	31.7400,	31.8520,	31.9640,	ENT	88
7	32.0770,	32.1910,	32.3060,	32.4230,	32.5420,	32.6630,	32.7880,	ENT	89
8	32.9170,	33.0500,	33.1880,	33.3310,	33.4810,	33.6370,	33.7990)	ENT	90
	DATA(XT(1,	6,2)=	0.	0.	0.	0.		ENT	91
1	0.	0.	18.9030,	19.2370,	19.5370,	19.8100,	20.0620,	ENT	92
2	20.2950,	20.5110,	20.7150,	20.9080,	21.0910,	21.2640,	21.4290,	ENT	93
3	21.5860,	21.7370,	21.8810,	22.0190,	22.1520,	22.2810,	22.4050,	ENT	94
4	22.5240,	22.6390,	22.7510,	22.8600,	22.9650,	23.0670,	23.1660,	ENT	95

5	23.2630,	23.3570,	23.4490,	23.5390,	23.6270,	23.7120,	23.7950,	ENT	96
6	23.8770,	23.9570,	24.0350,	24.1120,	24.1880,	24.2620,	24.3350,	ENT	97
7	24.4060,	24.4750,	24.5440,	24.6120,	24.6790,	24.7440,	24.8080,	ENT	98
8	24.8710,	24.9330,	24.9950,	25.0560,	25.1160,	25.1750,	25.2330,	ENT	99
DATA(XT(61, 6,2)= 25.2900, 25.3470, 25.4030, 25.4580,								ENT	100
1	25.5130,	25.5670,	25.6200,	25.6730,	25.7250,	25.7760,	25.8270,	ENT	101
2	25.8770,	25.9270,	25.9760,	26.0250,	26.0730,	26.3060,	26.5280,	ENT	102
3	26.7410,	26.9440,	27.1390,	27.3270,	27.5080,	27.6820,	27.8500,	ENT	103
4	28.0130,	28.1710,	28.3240,	28.4730,	28.6180,	28.7590,	28.8970,	ENT	104
5	29.0310,	29.1620,	29.2900,	29.4160,	29.5390,	29.6600,	29.7790,	ENT	105
6	29.8960,	30.0110,	30.1240,	30.2360,	30.3460,	30.4550,	30.5630,	ENT	106
7	30.6710,	30.7780,	30.8850,	30.9920,	31.1000,	31.2080,	31.3170,	ENT	107
8	31.4280,	31.5400,	31.6540,	31.7700,	31.8890,	32.0110,	32.1360,	ENT	108
DATA(XT(1, 7,2)= 0. , 0. , 0. , 0. ,								ENT	109
1	0. , 0. , 18.2550,	18.6100,	18.9240,	19.2060,	19.4650,	ENT			110
2	19.7040,	19.9260,	20.1340,	20.3290,	20.5130,	20.6880,	20.8540,	ENT	111
3	21.0120,	21.1630,	21.3080,	21.4480,	21.5830,	21.7130,	21.8380,	ENT	112
4	21.9580,	22.0740,	22.1860,	22.2950,	22.4000,	22.5020,	22.6020,	ENT	113
5	22.6990,	22.7940,	22.8860,	22.9760,	23.0630,	23.1490,	23.2330,	ENT	114
6	23.3150,	23.3950,	23.4730,	23.5500,	23.6260,	23.7000,	23.7730,	ENT	115
7	23.8440,	23.9140,	23.9820,	24.0500,	24.1170,	24.1830,	24.2470,	ENT	116
8	24.3100,	24.3720,	24.4340,	24.4950,	24.5550,	24.6140,	24.6720,	ENT	117
DATA(XT(61, 7,2)= 24.7300, 24.7870, 24.8430, 24.8980,								ENT	118
1	24.9520,	25.0060,	25.0590,	25.1120,	25.1640,	25.2150,	25.2660,	ENT	119
2	25.3160,	25.3660,	25.4150,	25.4640,	25.5120,	25.5600,	25.6080,	ENT	120
3	26.1810,	26.3840,	26.5790,	26.7670,	26.9470,	27.1220,	27.2900,	ENT	121
4	27.4530,	27.6110,	27.7640,	27.9130,	28.0580,	28.1990,	28.3370,	ENT	122
5	28.4710,	28.6020,	28.7300,	28.8560,	28.9790,	29.1000,	29.2190,	ENT	123
6	29.3350,	29.4500,	29.5630,	29.6740,	29.7840,	29.8920,	29.9990,	ENT	124
7	30.1060,	30.2120,	30.3170,	30.4220,	30.5270,	30.6320,	30.7380,	ENT	125
8	30.8440,	30.9510,	31.0590,	31.1680,	31.2790,	31.3920,	31.5070,	ENT	126
DATA(XT(1, 8,2)= 0. , 0. , 0. , 0. ,								ENT	127
1	0. , 0. , 17.7860,	18.1720,	18.5050,	18.8010,	19.0690,	ENT			128
2	19.3140,	19.5410,	19.7530,	19.9520,	20.1390,	20.3160,	20.4840,	ENT	129
3	20.6440,	20.7970,	20.9440,	21.0840,	21.2190,	21.3480,	21.4730,	ENT	130
4	21.5940,	21.7100,	21.8230,	21.9320,	22.0380,	22.1410,	22.2410,	ENT	131
5	22.3380,	22.4330,	22.5260,	22.6160,	22.7030,	22.7890,	22.8730,	ENT	132
6	22.9550,	23.0360,	23.1140,	23.1910,	23.2670,	23.3410,	23.4140,	ENT	133
7	23.4850,	23.5550,	23.6240,	23.6920,	23.7590,	23.8250,	23.8890,	ENT	134
8	23.9520,	24.0150,	24.0770,	24.1380,	24.1980,	24.2570,	24.3150,	ENT	135
DATA(XT(61, 8,2)= 24.3720, 24.4290, 24.4850, 24.5400,								ENT	136
1	24.5950,	24.6490,	24.7020,	24.7550,	24.8070,	24.8580,	24.9090,	ENT	137
2	24.9590,	25.0090,	25.0580,	25.1070,	25.1550,	25.3880,	25.6100,	ENT	138
3	25.8220,	26.0250,	26.2210,	26.4080,	26.5880,	26.7630,	26.9310,	ENT	139
4	27.0930,	27.2510,	27.4040,	27.5530,	27.6980,	27.8390,	27.9770,	ENT	140
5	28.1110,	28.2420,	28.3700,	28.4960,	28.6190,	28.7400,	28.8580,	ENT	141
6	28.9740,	29.0880,	29.2010,	29.3120,	29.4210,	29.5290,	29.6360,	ENT	142
7	29.7420,	29.8470,	29.9510,	30.0550,	30.1590,	30.2630,	30.3670,	ENT	143
8	30.4710,	30.5760,	30.6810,	30.7870,	30.8950,	31.0040,	31.1140,	ENT	144
DATA(XT(1, 9,2)= 0. , 0. , 0. , 0. ,								ENT	145
1	0. , 0. , 0. , 0. , 0. , 0. , 0. ,	ENT			146				
2	17.4750,	17.8300,	18.0830,	18.3290,	18.5510,	18.7550,	18.9460,	ENT	147

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3 19.1230, 19.2900, 19.4490, 19.6000, 19.7430, 19.8800, 20.0130, ENT 148
4 20.1380, 20.2610, 20.3790, 20.4920, 20.6020, 20.7070, 20.8100, ENT 149
5 20.9110, 21.0080, 21.1030, 21.1940, 21.2840, 21.3720, 21.4580, ENT 150
6 21.5410, 21.6230, 21.7030, 21.7810, 21.8570, 21.9320, 22.0060, ENT 151
7 22.0790, 22.1500, 22.2200, 22.2890, 22.3560, 22.4220, 22.4870, ENT 152
8 22.5510, 22.6140, 22.6770, 22.7380, 22.7980, 22.8580, 22.9170, ENT 153
  DATA(XT(61, 9, 2)= 22.9750, 23.0320, 23.0880, 23.1440, ENT 154
1 23.1990, 23.2530, 23.3070, 23.3600, 23.4120, 23.4640, 23.5150, ENT 155
2 23.5660, 23.6160, 23.6650, 23.7140, 23.7620, 23.9960, 24.2190, ENT 156
3 24.4310, 24.6340, 24.8300, 25.0180, 25.1980, 25.3730, 25.5400, ENT 157
4 25.7020, 25.8600, 26.0130, 26.1620, 26.3060, 26.4470, 26.5850, ENT 158
5 26.7190, 26.8500, 26.9780, 27.1040, 27.2270, 27.3480, 27.4660, ENT 159
6 27.5820, 27.6960, 27.8080, 27.9180, 28.0270, 28.1340, 28.2400, ENT 160
7 28.3440, 28.4470, 28.5490, 28.6500, 28.7500, 28.8490, 28.9480, ENT 161
8 29.0460, 29.1440, 29.2420, 29.3400, 29.4380, 29.5360, 29.6340, ENT 162
  DATA(XT( 1, 10, 2)= 0. , 0. , 0. , 0. , ENT 163
1 0. , 0. , 0. , 0. , 0. , 0. , 0. , ENT 164
2 0. , 0. , 17.1640, 17.4920, 17.7670, 18.0090, 18.2270, ENT 165
3 18.4260, 18.6100, 18.7820, 18.9450, 19.0980, 19.2420, 19.3820, ENT 166
4 19.5130, 19.6410, 19.7640, 19.8820, 19.9940, 20.1020, 20.2090, ENT 167
5 20.3120, 20.4120, 20.5080, 20.6020, 20.6940, 20.7830, 20.8700, ENT 168
6 20.9550, 21.0380, 21.1190, 21.1990, 21.2770, 21.3530, 21.4280, ENT 169
7 21.5010, 21.5730, 21.6430, 21.7120, 21.7800, 21.8470, 21.9130, ENT 170
8 21.9780, 22.0420, 22.1040, 22.1660, 22.2270, 22.2870, 22.3460, ENT 171
  DATA(XT(61, 10, 2)= 22.4040, 22.4620, 22.5190, 22.5750, ENT 172
1 22.6300, 22.6850, 22.7390, 22.7920, 22.8440, 22.8960, 22.9470, ENT 173
2 22.9980, 23.0480, 23.0980, 23.1470, 23.1960, 23.4320, 23.6550, ENT 174
3 23.8670, 24.0710, 24.2670, 24.4540, 24.6350, 24.8090, 24.9760, ENT 175
4 25.1380, 25.2960, 25.4480, 25.5970, 25.7410, 25.8820, 26.0200, ENT 176
5 26.1550, 26.2870, 26.4160, 26.5420, 26.6650, 26.7850, 26.9030, ENT 177
6 27.0190, 27.1330, 27.2450, 27.3550, 27.4630, 27.5700, 27.6760, ENT 178
7 27.7800, 27.8830, 27.9840, 28.0840, 28.1830, 28.2810, 28.3790, ENT 179
8 28.4760, 28.5730, 28.6690, 28.7650, 28.8610, 28.9570, 29.0520, ENT 180
  DATA(XT( 1, 11, 2)= 0. , 0. , 0. , 0. , ENT 181
1 0. , 0. , 0. , 0. , 0. , 0. , 0. , ENT 182
2 0. , 0. , 16.4410, 16.8610, 17.1840, 17.4710, 17.7180, ENT 183
3 17.9380, 18.1380, 18.3240, 18.4960, 18.6580, 18.8120, 18.9600, ENT 184
4 19.0950, 19.2280, 19.3560, 19.4780, 19.5930, 19.7040, 19.8130, ENT 185
5 19.9180, 20.0210, 20.1190, 20.2140, 20.3080, 20.3990, 20.4870, ENT 186
6 20.5740, 20.6580, 20.7420, 20.8230, 20.9020, 20.9800, 21.0560, ENT 187
7 21.1300, 21.2020, 21.2720, 21.3410, 21.4090, 21.4760, 21.5420, ENT 188
8 21.6080, 21.6730, 21.7360, 21.7980, 21.8590, 21.9190, 21.9790, ENT 189
  DATA(XT(61, 11, 2)= 22.0380, 22.0960, 22.1530, 22.2090, ENT 190
1 22.2650, 22.3200, 22.3740, 22.4270, 22.4800, 22.5320, 22.5840, ENT 191
2 22.6350, 22.6850, 22.7350, 22.7840, 22.8330, 23.0640, 23.2930, ENT 192
3 23.5050, 23.7090, 23.9050, 24.0930, 24.2740, 24.4480, 24.6150, ENT 193
4 24.7770, 24.9350, 25.0870, 25.2360, 25.3800, 25.5210, 25.6590, ENT 194
5 25.7940, 25.9260, 26.0550, 26.1810, 26.3040, 26.4240, 26.5420, ENT 195
6 26.6580, 26.7720, 26.8840, 26.9940, 27.1020, 27.2090, 27.3140, ENT 196
7 27.4180, 27.5200, 27.6210, 27.7210, 27.8200, 27.9180, 28.0150, ENT 197
8 28.1110, 28.2070, 28.3020, 28.3970, 28.4910, 28.5850, 28.6780, ENT 198
RETURN

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END

* CARDS COLUMN

**

* LIST8

* FORTRAN

TABL3

* SUBROUTINE

TABL3

C

C XT(I,J,K) FOR I=1.....120, FOR J=1..11, FOR K=3

C

HANK AAA(1)

COMMON /AAA/ XT(120,11,5)

DATA(XT(1,1,3)= 0.99871, 0.99923, 0.99950, 0.99966,

Z

1

1 0.99975, 0.99981, 0.99986, 0.99989, 0.99991, 0.99993, 0.99994,

Z

2

2 0.99995, 0.99995, 0.99996, 0.99997, 0.99998, 0.99998, 0.99998,

Z

3

3 0.99999, 0.99999, 0.99999, 0.99999, 0.99999, 1.00000, 1.00000,

Z

4

4 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000,

Z

5

5 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000,

Z

6

6 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000,

Z

7

7 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000,

Z

8

8 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000,

Z

9

DATA(XT(61,1,3)= 1.00000, 1.00000, 1.00000, 1.00000,

Z

10

1 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000,

Z

11

2 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000,

Z

12

3 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000, 1.00000,

Z

13

4 1.00000, 1.00000, 1.00000, 1.00000, 1.00001, 1.00003, 1.00005,

Z

14

5 1.00008, 1.00011, 1.00016, 1.00025, 1.00041, 1.00068, 1.00109,

Z

15

6 1.00167, 1.00242, 1.00342, 1.00475, 1.00653, 1.00889, 1.01196,

Z

16

7 0. , 0. , 0. , 0. , 0. , 0. , 0. ,

Z

17

8 0. , 0. , 0. , 0. , 0. , 0. , 0.)

Z

18

DATA(XT(1,2,3)= 0. , 0. , 0. , 0.99657,

Z

19

1 0.99751, 0.99813, 0.99856, 0.99887, 0.99910, 0.99928, 0.99941,

Z

20

2 0.99751, 0.99960, 0.99967, 0.99972, 0.99977, 0.99980, 0.99984,

Z

21

3 0.99986, 0.99989, 0.99991, 0.99992, 0.99994, 0.99995, 0.99996,

Z

22

4 0.99997, 0.99998, 0.99999, 0.99999, 1.00000, 1.00000, 1.00001,

Z

23

5 1.00001, 1.00001, 1.00002, 1.00002, 1.00002, 1.00002, 1.00003,

Z

24

6 1.00003, 1.00003, 1.00003, 1.00003, 1.00003, 1.00003, 1.00003,

Z

25

7 1.00003, 1.00003, 1.00003, 1.00004, 1.00004, 1.00004, 1.00004,

Z

26

8 1.00004, 1.00004, 1.00004, 1.00004, 1.00004, 1.00004, 1.00004,

Z

27

DATA(XT(61,2,3)= 1.00004, 1.00004, 1.00004, 1.00004,

Z

28

1 1.00004, 1.00004, 1.00004, 1.00004, 1.00004, 1.00004, 1.00004,

Z

29

2 1.00004, 1.00004, 1.00004, 1.00004, 1.00004, 1.00004, 1.00004,

Z

30

3 1.00003, 1.00003, 1.00003, 1.00003, 1.00003, 1.00003, 1.00003,

Z

31

4 1.00003, 1.00003, 1.00003, 1.00003, 1.00003, 1.00004, 1.00004,

Z

32

5 1.00005, 1.00006, 1.00007, 1.00010, 1.00014, 1.00023, 1.00037,

Z

33

6 1.00054, 1.00077, 1.00111, 1.00156, 1.00215, 1.00283, 1.00371,

Z

34

7 1.00494, 1.00654, 1.00847, 1.01079, 1.01357, 1.01693, 1.02097,

Z

35

8 1.02572, 1.03118, 1.03741, 1.04444, 1.05228, 1.06086, 1.07007,

Z

36

DATA(XT(1,3,3)= 0. , 0. , 0. , 0. ,

Z

37

1 0.98992, 0.99248, 0.99423, 0.99548, 0.99640, 0.99709, 0.99763,

Z

38

2 0.99805, 0.99839, 0.99866, 0.99888, 0.99907, 0.99922, 0.99935,

Z

39

3 0.99945, 0.99954, 0.99962, 0.99969, 0.99975, 0.99980, 0.99984,

Z

40

4 0.99988, 0.99991, 0.99994, 0.99997, 0.99999, 1.00001, 1.00003,

Z

41

5 1.00004, 1.00005, 1.00007, 1.00008, 1.00009, 1.00010, 1.00010,

Z

42

6 1.00011, 1.00012, 1.00012, 1.00013, 1.00013, 1.00013, 1.00014,

Z

43

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7 1.00014, 1.00014, 1.00014, 1.00015, 1.00015, 1.00015, 1.00015, Z 44
8 1.00015, 1.00015, 1.00015, 1.00015, 1.00015, 1.00015, 1.00015) Z 45
  DATA(XT(61, 3, 3)= 1.00015, 1.00015, 1.00015, 1.00015, Z 46
1 1.00015, 1.00015, 1.00015, 1.00015, 1.00015, 1.00015, 1.00015, Z 47
2 1.00015, 1.00015, 1.00015, 1.00015, 1.00015, 1.00014, 1.00014, Z 48
3 1.00014, 1.00013, 1.00012, 1.00012, 1.00011, 1.00011, 1.00011, Z 49
4 1.00011, 1.00010, 1.00010, 1.00010, 1.00010, 1.00010, 1.00010, Z 50
5 1.00010, 1.00011, 1.00011, 1.00013, 1.00015, 1.00019, 1.00025, Z 51
6 1.00034, 1.00047, 1.00065, 1.00086, 1.00113, 1.00148, 1.00194, Z 52
7 1.00255, 1.00335, 1.00431, 1.00548, 1.00689, 1.00861, 1.01069, Z 53
8 1.01313, 1.01590, 1.01910, 1.02280, 1.02702, 1.03169, 1.03781) Z 54
  DATA(XT( 1, 4, 3)= 0. , 0. , 0. , 0. , Z 55
1 0.98220, 0.98672, 0.98985, 0.99206, 0.99368, 0.99490, 0.99585, Z 55
2 0.99659, 0.99718, 0.99766, 0.99805, 0.99837, 0.99863, 0.99886, Z 57
3 0.99905, 0.99921, 0.99934, 0.99946, 0.99956, 0.99965, 0.99972, Z 58
4 0.99979, 0.99985, 0.99990, 0.99994, 0.99998, 1.00001, 1.00004, Z 59
5 1.00007, 1.00010, 1.00012, 1.00014, 1.00015, 1.00017, 1.00018, Z 60
6 1.00019, 1.00020, 1.00021, 1.00022, 1.00022, 1.00023, 1.00024, Z 61
7 1.00024, 1.00025, 1.00025, 1.00026, 1.00026, 1.00026, 1.00026, Z 62
8 1.00027, 1.00027, 1.00027, 1.00027, 1.00027, 1.00027, 1.00027) Z 63
  DATA(XT(61, 4, 3)= 1.00027, 1.00027, 1.00027, 1.00027, Z 64
1 1.00027, 1.00027, 1.00027, 1.00027, 1.00027, 1.00027, 1.00026, Z 65
2 1.00026, 1.00026, 1.00026, 1.00026, 1.00026, 1.00025, 1.00025, Z 66
3 1.00024, 1.00023, 1.00023, 1.00022, 1.00021, 1.00021, 1.00020, Z 67
4 1.00019, 1.00019, 1.00018, 1.00018, 1.00018, 1.00017, 1.00017, Z 68
5 1.00017, 1.00017, 1.00017, 1.00019, 1.00020, 1.00023, 1.00027, Z 69
6 1.00033, 1.00044, 1.00058, 1.00072, 1.00091, 1.00119, 1.00155, Z 70
7 1.00202, 1.00261, 1.00333, 1.00422, 1.00530, 1.00661, 1.00821, Z 71
8 1.01008, 1.01220, 1.01468, 1.01756, 1.02089, 1.02476, 1.02920) Z 72
  DATA(XT( 1, 5, 3)= 0. , 0. , 0. , 0. , Z 73
1 0. , 0.98090, 0.98542, 0.98861, 0.99095, 0.99271, 0.99407, Z 74
2 0.99513, 0.99597, 0.99666, 0.99721, 0.99767, 0.99806, 0.99837, Z 75
3 0.99864, 0.99886, 0.99906, 0.99923, 0.99937, 0.99949, 0.99960, Z 76
4 0.99970, 0.99978, 0.99985, 0.99991, 0.99997, 1.00002, 1.00006, Z 77
5 1.00010, 1.00014, 1.00017, 1.00019, 1.00022, 1.00024, 1.00026, Z 78
6 1.00027, 1.00029, 1.00030, 1.00031, 1.00032, 1.00033, 1.00034, Z 79
7 1.00035, 1.00035, 1.00036, 1.00037, 1.00037, 1.00037, 1.00038, Z 80
8 1.00038, 1.00038, 1.00038, 1.00038, 1.00038, 1.00038, 1.00038) Z 81
  DATA(XT(61, 5, 3)= 1.00038, 1.00039, 1.00039, 1.00038, Z 82
1 1.00038, 1.00038, 1.00038, 1.00038, 1.00038, 1.00038, 1.00038, Z 83
2 1.00038, 1.00038, 1.00038, 1.00038, 1.00037, 1.00036, 1.00035, Z 84
3 1.00034, 1.00033, 1.00032, 1.00031, 1.00030, 1.00029, 1.00028, Z 85
4 1.00028, 1.00027, 1.00026, 1.00025, 1.00024, 1.00024, 1.00023, Z 86
5 1.00023, 1.00023, 1.00023, 1.00024, 1.00025, 1.00027, 1.00030, Z 87
6 1.00035, 1.00050, 1.00060, 1.00070, 1.00080, 1.00110, 1.00140, Z 88
7 1.00180, 1.00230, 1.00290, 1.00360, 1.00450, 1.00560, 1.00700, Z 89
8 1.00860, 1.01040, 1.01240, 1.01490, 1.01780, 1.02120, 1.02520) Z 90
  DATA(XT( 1, 6, 3)= 0. , 0. , 0. , 0. , Z 91
1 0. , 0. , 0.93853, 0.95268, 0.96277, 0.97022, 0.97591, Z 92
2 0.98030, 0.98378, 0.98656, 0.98882, 0.99067, 0.99221, 0.99347, Z 93
3 0.99454, 0.99546, 0.99624, 0.99690, 0.99748, 0.99798, 0.99841, Z 94
4 0.99879, 0.99912, 0.99940, 0.99966, 0.99989, 1.00008, 1.00025, Z 95

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5	1.00041,	1.00055,	1.00069,	1.00079,	1.00089,	1.00097,	1.00105,	Z	96
6	1.00111,	1.00116,	1.00121,	1.00126,	1.00130,	1.00134,	1.00137,	Z	97
7	1.00140,	1.00142,	1.00144,	1.00146,	1.00148,	1.00150,	1.00151,	Z	98
8	1.00152,	1.00152,	1.00152,	1.00153,	1.00153,	1.00154,	1.00154,	Z	99
DATA(XT(61, 6, 3)= 1.00154, 1.00154, 1.00154, 1.00153,								Z	100
1	1.00153,	1.00153,	1.00153,	1.00152,	1.00152,	1.00152,	1.00151,	Z	101
2	1.00151,	1.00150,	1.00149,	1.00149,	1.00148,	1.00144,	1.00140,	Z	102
3	1.00136,	1.00132,	1.00128,	1.00124,	1.00120,	1.00117,	1.00113,	Z	103
4	1.00110,	1.00107,	1.00104,	1.00101,	1.00098,	1.00096,	1.00094,	Z	104
5	1.00092,	1.00090,	1.00088,	1.00087,	1.00086,	1.00085,	1.00085,	Z	105
6	1.00085,	1.00090,	1.00100,	1.00100,	1.00100,	1.00110,	1.00130,	Z	106
7	1.00150,	1.00170,	1.00200,	1.00240,	1.00280,	1.00340,	1.00410,	Z	107
8	1.00480,	1.00580,	1.00680,	1.00810,	1.00960,	1.01130,	1.01330,	Z	108
DATA(XT(1, 7, 3)= 0. , 0. , 0. , 0. ,								Z	109
1	0. ,	0. ,	0.88550,	0.91360,	0.93300,	0.94670,	0.95716,	Z	110
2	0.96514,	0.97137,	0.97636,	0.98039,	0.98367,	0.98634,	0.98857,	Z	111
3	0.99045,	0.99205,	0.99352,	0.99469,	0.99570,	0.99656,	0.99732,	Z	112
4	0.99797,	0.99855,	0.99905,	0.99949,	0.99987,	1.00021,	1.00051,	Z	113
5	1.00078,	1.00102,	1.00122,	1.00141,	1.00157,	1.00172,	1.00185,	Z	114
6	1.00196,	1.00207,	1.00216,	1.00224,	1.00231,	1.00237,	1.00242,	Z	115
7	1.00247,	1.00251,	1.00255,	1.00258,	1.00261,	1.00263,	1.00265,	Z	116
8	1.00266,	1.00267,	1.00267,	1.00267,	1.00268,	1.00268,	1.00269,	Z	117
DATA(XT(61, 7, 3)= 1.00269, 1.00270, 1.00270, 1.00269,								Z	118
1	1.00269,	1.00268,	1.00268,	1.00267,	1.00266,	1.00265,	1.00264,	Z	119
2	1.00263,	1.00262,	1.00261,	1.00260,	1.00259,	1.00252,	1.00246,	Z	120
3	1.00239,	1.00231,	1.00225,	1.00218,	1.00211,	1.00205,	1.00199,	Z	121
4	1.00193,	1.00187,	1.00182,	1.00176,	1.00171,	1.00167,	1.00163,	Z	122
5	1.00160,	1.00157,	1.00154,	1.00152,	1.00149,	1.00146,	1.00143,	Z	123
6	1.00140,	1.00140,	1.00140,	1.00140,	1.00140,	1.00150,	1.00160,	Z	124
7	1.00180,	1.00190,	1.00210,	1.00240,	1.00270,	1.00310,	1.00360,	Z	125
8	1.00420,	1.00490,	1.00570,	1.00680,	1.00790,	1.00920,	1.01070,	Z	126
DATA(XT(1, 8, 3)= 0. , 0. , 0. , 0. ,								Z	127
1	0. ,	0. ,	0.82340,	0.87030,	0.90100,	0.92210,	0.93780,	Z	128
2	0.94960,	0.95880,	0.96607,	0.97191,	0.97666,	0.98058,	0.98383,	Z	129
3	0.98656,	0.98886,	0.99082,	0.99249,	0.99393,	0.99516,	0.99623,	Z	130
4	0.99717,	0.99798,	0.99869,	0.99932,	0.99987,	1.00035,	1.00078,	Z	131
5	1.00115,	1.00149,	1.00178,	1.00205,	1.00228,	1.00248,	1.00267,	Z	132
6	1.00283,	1.00297,	1.00310,	1.00321,	1.00331,	1.00340,	1.00348,	Z	133
7	1.00355,	1.00361,	1.00366,	1.00370,	1.00374,	1.00377,	1.00380,	Z	134
8	1.00382,	1.00384,	1.00385,	1.00386,	1.00387,	1.00388,	1.00388,	Z	135
DATA(XT(61, 8, 3)= 1.00388, 1.00388, 1.00388, 1.00387,								Z	136
1	1.00386,	1.00385,	1.00384,	1.00383,	1.00382,	1.00380,	1.00379,	Z	137
2	1.00378,	1.00376,	1.00374,	1.00373,	1.00371,	1.00361,	1.00351,	Z	138
3	1.00341,	1.00331,	1.00321,	1.00311,	1.00302,	1.00293,	1.00284,	Z	139
4	1.00275,	1.00267,	1.00259,	1.00252,	1.00245,	1.00239,	1.00233,	Z	140
5	1.00228,	1.00223,	1.00218,	1.00213,	1.00208,	1.00204,	1.00200,	Z	141
6	1.00196,	1.00190,	1.00190,	1.00190,	1.00190,	1.00190,	1.00200,	Z	142
7	1.00210,	1.00220,	1.00240,	1.00260,	1.00290,	1.00320,	1.00360,	Z	143
8	1.00410,	1.00460,	1.00530,	1.00610,	1.00710,	1.00820,	1.00950,	Z	144
DATA(XT(1, 9, 3)= 0. , 0. , 0. , 0. ,								Z	145
1	0. ,	0. ,	0. ,	0. ,	0. ,	0. ,	0.68320,	Z	146
2	0.76890,	0.82180,	0.85890,	0.88660,	0.90800,	0.92490,	0.93860,	Z	147

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3 0.94970, 0.95900, 0.96680, 0.97334, 0.97894, 0.98371, 0.98782, Z 148
4 0.99135, 0.99443, 0.99710, 0.99943, 1.00150, 1.00326, 1.00483, Z 149
5 1.00622, 1.00744, 1.00851, 1.00946, 1.01030, 1.01105, 1.01170, Z 150
6 1.01228, 1.01279, 1.01324, 1.01363, 1.01398, 1.01428, 1.01454, Z 151
7 1.01477, 1.01497, 1.01515, 1.01529, 1.01541, 1.01551, 1.01559, Z 152
8 1.01565, 1.01570, 1.01574, 1.01577, 1.01578, 1.01578, 1.01577, Z 153
  DATA(XT(61, 9, 3)= 1.01576, 1.01573, 1.01571, 1.01567, Z 154
1 1.01563, 1.01558, 1.01553, 1.01547, 1.01541, 1.01535, 1.01528, Z 155
2 1.01521, 1.01515, 1.01508, 1.01500, 1.01493, 1.01453, 1.01411, Z 156
3 1.01368, 1.01325, 1.01285, 1.01245, 1.01207, 1.01170, 1.01134, Z 157
4 1.01100, 1.01068, 1.01037, 1.01007, 1.00978, 1.00950, 1.00930, Z 158
5 1.00910, 1.00880, 1.00860, 1.00830, 1.00810, 1.00790, 1.00770, Z 159
6 1.00760, 1.00740, 1.00730, 1.00710, 1.00700, 1.00690, 1.00670, Z 160
7 1.00670, 1.00670, 1.00660, 1.00660, 1.00660, 1.00670, 1.00670, Z 161
8 1.00680, 1.00690, 1.00710, 1.00750, 1.00790, 1.00850, 1.00920, Z 162
  DATA(XT( 1,10,3)= 0. , 0. , 0. , 0. , Z 163
1 0. , 0. , 0. , 0. , 0. , 0. , 0. , Z 164
2 0. , 0. , 0.75500, 0.80870, 0.84810, 0.87830, 0.90200, Z 165
3 0.92120, 0.93680, 0.94980, 0.96060, 0.96980, 0.97760, 0.98420, Z 166
4 0.99000, 0.99490, 0.99920, 1.00290, 1.00620, 1.00900, 1.01150, Z 167
5 1.01370, 1.01560, 1.01730, 1.01880, 1.02010, 1.02120, 1.02220, Z 168
6 1.02310, 1.02390, 1.02460, 1.02520, 1.02570, 1.02610, 1.02650, Z 169
7 1.02680, 1.02710, 1.02740, 1.02760, 1.02770, 1.02790, 1.02800, Z 170
8 1.02810, 1.02810, 1.02810, 1.02810, 1.02810, 1.02810, 1.02800, Z 171
  DATA(XT(61,10,3)= 1.02800, 1.02790, 1.02780, 1.02770, Z 172
1 1.02760, 1.02750, 1.02740, 1.02730, 1.02720, 1.02710, 1.02700, Z 173
2 1.02690, 1.02670, 1.02660, 1.02650, 1.02630, 1.02560, 1.02480, Z 174
3 1.02400, 1.02330, 1.02250, 1.02180, 1.02110, 1.02050, 1.01980, Z 175
4 1.01920, 1.01870, 1.01810, 1.01760, 1.01710, 1.01660, 1.01620, Z 176
5 1.01580, 1.01540, 1.01500, 1.01460, 1.01420, 1.01380, 1.01350, Z 177
6 1.01320, 1.01290, 1.01260, 1.01240, 1.01210, 1.01190, 1.01160, Z 178
7 1.01150, 1.01130, 1.01110, 1.01100, 1.01090, 1.01080, 1.01070, Z 179
8 1.01070, 1.01070, 1.01080, 1.01090, 1.01110, 1.01150, 1.01190, Z 180
  DATA(XT( 1,11,3)= 0. , 0. , 0. , 0. , Z 181
1 0. , 0. , 0. , 0. , 0. , 0. , 0. , Z 182
2 0. , 0. , 0.69500, 0.76000, 0.81050, 0.84940, 0.88010, Z 183
3 0.90480, 0.92500, 0.94170, 0.95570, 0.96750, 0.97750, 0.98600, Z 184
4 0.99330, 0.99960, 1.00510, 1.00990, 1.01400, 1.01760, 1.02070, Z 185
5 1.02350, 1.02590, 1.02800, 1.02990, 1.03150, 1.03290, 1.03410, Z 186
6 1.03520, 1.03620, 1.03700, 1.03770, 1.03830, 1.03880, 1.03930, Z 187
7 1.03970, 1.04000, 1.04020, 1.04040, 1.04060, 1.04070, 1.04080, Z 188
8 1.04080, 1.04080, 1.04080, 1.04080, 1.04080, 1.04070, 1.04060, Z 189
  DATA(XT(61,11,3)= 1.04050, 1.04040, 1.04020, 1.04000, Z 190
1 1.03990, 1.03970, 1.03960, 1.03940, 1.03920, 1.03910, 1.03890, Z 191
2 1.03870, 1.03850, 1.03830, 1.03810, 1.03790, 1.03670, 1.03560, Z 192
3 1.03440, 1.03330, 1.03220, 1.03120, 1.03020, 1.02920, 1.02830, Z 193
4 1.02750, 1.02670, 1.02590, 1.02510, 1.02440, 1.02380, 1.02320, Z 194
5 1.02260, 1.02200, 1.02140, 1.02080, 1.02030, 1.01980, 1.01930, Z 195
6 1.01880, 1.01840, 1.01800, 1.01760, 1.01720, 1.01690, 1.01650, Z 196
7 1.01630, 1.01600, 1.01570, 1.01550, 1.01530, 1.01510, 1.01490, Z 197
8 1.01480, 1.01460, 1.01450, 1.01460, 1.01470, 1.01490, 1.01510, Z 198

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RETURN

END

* CARDS COLUMN
* LIST8
* FORTRAN
* SUBROUTINE

TABL4
TABL4

**

C
C
C

XT(I,J,K) FOR I=1....120, FOR J=1..11, FOR K=4

BANK AAA(1)

COMMON /AAA/ XT(120,11,5)

DATA(XT(1,1,4)=	0.4275,	0.4685,	0.5061,	0.5412,		VSD	1
1 0.5740,	0.6051,	0.6346,	0.6629,	0.6900,	0.7160,	0.7411,	VSD 2
2 0.7654,	0.7890,	0.8119,	0.8341,	0.8557,	0.8769,	0.8975,	VSD 3
3 0.9176,	0.9373,	0.9566,	0.9755,	0.9941,	1.0122,	1.0300,	VSD 4
4 1.0476,	1.0648,	1.0818,	1.0984,	1.1148,	1.1308,	1.1466,	VSD 5
5 1.1622,	1.1775,	1.1927,	1.2076,	1.2223,	1.2367,	1.2511,	VSD 6
6 1.2652,	1.2791,	1.2928,	1.3063,	1.3197,	1.3329,	1.3460,	VSD 7
7 1.3589,	1.3716,	1.3842,	1.3967,	1.4090,	1.4212,	1.4332,	VSD 8
8 1.4451,	1.4570,	1.4690,	1.4800,	1.4920,	1.5030,	1.5140,	VSD 9
DATA(XT(61,1,4)=	1.5250,	1.5360,	1.5470,	1.5580,			VSD 10
1 1.5690,	1.5800,	1.5900,	1.6010,	1.6110,	1.6220,	1.6320,	VSD 11
2 1.6420,	1.6520,	1.6620,	1.6720,	1.6820,	1.7310,	1.7780,	VSD 12
3 1.8240,	1.8680,	1.9120,	1.9540,	1.9950,	2.0360,	2.0760,	VSD 13
4 2.1140,	2.1520,	2.1890,	2.2250,	2.2610,	2.2950,	2.3290,	VSD 14
5 2.3620,	2.3940,	2.4240,	2.4540,	2.4820,	2.5080,	2.5320,	VSD 15
6 2.5530,	2.5740,	2.5930,	0.0000,	0.0000,	0.0000,	0.0000,	VSD 16
7 0.0000,	0.0000,	0.0000,	0.0000,	0.0000,	0.0000,	0.0000,	VSD 17
8 0.0000,	0.0000,	0.0000,	0.0000,	0.0000,	0.0000,	0.0000,	VSD 18
DATA(XT(1,2,4)=	0.0000,	0.0000,	0.0000,	0.5402,			VSD 19
1 0.5731,	0.6045,	0.6341,	0.6625,	0.6896,	0.7157,	0.7409,	VSD 20
2 0.7653,	0.7888,	0.8118,	0.8340,	0.8557,	0.8768,	0.8975,	VSD 21
3 0.9176,	0.9373,	0.9566,	0.9755,	0.9941,	1.0122,	1.0300,	VSD 22
4 1.0476,	1.0648,	1.0818,	1.0984,	1.1148,	1.1308,	1.1467,	VSD 23
5 1.1623,	1.1776,	1.1928,	1.2077,	1.2224,	1.2368,	1.2512,	VSD 24
6 1.2653,	1.2792,	1.2929,	1.3064,	1.3198,	1.3330,	1.3461,	VSD 25
7 1.3590,	1.3717,	1.3843,	1.3968,	1.4091,	1.4213,	1.4333,	VSD 26
8 1.4452,	1.4571,	1.4690,	1.4800,	1.4920,	1.5030,	1.5140,	VSD 27
DATA(XT(61,2,4)=	1.5260,	1.5370,	1.5470,	1.5580,			VSD 28
1 1.5690,	1.5800,	1.5900,	1.6010,	1.6110,	1.6220,	1.6320,	VSD 29
2 1.6420,	1.6520,	1.6620,	1.6720,	1.6820,	1.7310,	1.7780,	VSD 30
3 1.8240,	1.8680,	1.9120,	1.9540,	1.9950,	2.0360,	2.0760,	VSD 31
4 2.1140,	2.1520,	2.1890,	2.2250,	2.2610,	2.2960,	2.3300,	VSD 32
5 2.3630,	2.3960,	2.4280,	2.4590,	2.4900,	2.5180,	2.5460,	VSD 33
6 2.5740,	2.6000,	2.6240,	2.6480,	2.6700,	2.6920,	2.7140,	VSD 34
7 2.7350,	2.7560,	2.7770,	2.7970,	2.8190,	2.8420,	2.8670,	VSD 35
8 2.8940,	2.9230,	2.9530,	2.9860,	3.0210,	3.0570,	3.0950,	VSD 36
DATA(XT(1,3,4)=	0.0000,	0.0000,	0.0000,	0.0000,			VSD 37
1 0.5707,	0.6026,	0.6327,	0.6613,	0.6887,	0.7150,	0.7403,	VSD 38
2 0.7648,	0.7884,	0.8115,	0.8337,	0.8554,	0.8767,	0.8974,	VSD 39
3 0.9176,	0.9372,	0.9566,	0.9756,	0.9941,	1.0123,	1.0301,	VSD 40
4 1.0477,	1.0649,	1.0819,	1.0985,	1.1149,	1.1309,	1.1469,	VSD 41
5 1.1625,	1.1778,	1.1930,	1.2079,	1.2226,	1.2370,	1.2514,	VSD 42
6 1.2655,	1.2794,	1.2931,	1.3066,	1.3200,	1.3332,	1.3463,	VSD 43

7	1.3592,	1.3719,	1.3845,	1.3970,	1.4093,	1.4215,	1.4335,	VSD	44
8	1.4454,	1.4573,	1.4690,	1.4810,	1.4920,	1.5030,	1.5150,	VSD	45
DATA(XT(61, 3, 4)=									46
1	1.5260,	1.5370,	1.5480,	1.5590,				VSD	
1	1.5690,	1.5800,	1.5910,	1.6010,	1.6110,	1.6220,	1.6320,	VSD	47
2	1.6420,	1.6520,	1.6630,	1.6730,	1.6830,	1.7310,	1.7780,	VSD	48
3	1.8240,	1.8690,	1.9120,	1.9540,	1.9960,	2.0360,	2.0760,	VSD	49
4	2.1150,	2.1520,	2.1890,	2.2250,	2.2610,	2.2960,	2.3300,	VSD	50
5	2.3640,	2.3970,	2.4290,	2.4610,	2.4910,	2.5210,	2.5500,	VSD	51
6	2.5790,	2.6050,	2.6320,	2.6570,	2.6830,	2.7070,	2.7300,	VSD	52
7	2.7530,	2.7760,	2.7970,	2.8180,	2.8400,	2.8620,	2.8860,	VSD	53
8	2.9090,	2.9330,	2.9580,	2.9850,	3.0130,	3.0420,	3.0710,	VSD	54
DATA(XT(1, 4, 4)=									55
1	0.0000,	0.0000,	0.0000,	0.0000,				VSD	
1	0.5682,	0.6006,	0.6312,	0.6601,	0.6877,	0.7142,	0.7397,	VSD	56
2	0.7643,	0.7880,	0.8111,	0.8334,	0.8552,	0.8766,	0.8973,	VSD	57
3	0.9175,	0.9372,	0.9567,	0.9756,	0.9942,	1.0123,	1.0302,	VSD	58
4	1.0478,	1.0650,	1.0820,	1.0986,	1.1150,	1.1310,	1.1470,	VSD	59
5	1.1626,	1.1779,	1.1931,	1.2080,	1.2227,	1.2371,	1.2515,	VSD	60
6	1.2656,	1.2796,	1.2933,	1.3068,	1.3202,	1.3334,	1.3465,	VSD	61
7	1.3594,	1.3721,	1.3847,	1.3972,	1.4095,	1.4217,	1.4337,	VSD	62
8	1.4456,	1.4575,	1.4690,	1.4810,	1.4920,	1.5040,	1.5150,	VSD	63
DATA(XT(61, 4, 4)=									64
1	1.5260,	1.5370,	1.5480,	1.5590,				VSD	
1	1.5700,	1.5800,	1.5910,	1.6010,	1.6120,	1.6220,	1.6320,	VSD	65
2	1.6430,	1.6530,	1.6630,	1.6730,	1.6830,	1.7310,	1.7790,	VSD	66
3	1.8240,	1.8690,	1.9120,	1.9540,	1.9960,	2.0360,	2.0760,	VSD	67
4	2.1150,	2.1520,	2.1890,	2.2260,	2.2610,	2.2960,	2.3310,	VSD	68
5	2.3640,	2.3970,	2.4300,	2.4610,	2.4920,	2.5220,	2.5510,	VSD	69
6	2.5800,	2.6070,	2.6340,	2.6620,	2.6880,	2.7130,	2.7370,	VSD	70
7	2.7600,	2.7840,	2.8060,	2.8270,	2.8490,	2.8710,	2.8930,	VSD	71
8	2.9150,	2.9390,	2.9620,	2.9870,	3.0130,	3.0390,	3.0660,	VSD	72
DATA(XT(1, 5, 4)=									73
1	0.0000,	0.5987,	0.6296,	0.6589,	0.6868,	0.7134,	0.7391,	VSD	74
2	0.7638,	0.7875,	0.8108,	0.8332,	0.8550,	0.8764,	0.8972,	VSD	75
3	0.9175,	0.9371,	0.9567,	0.9757,	0.9943,	1.0124,	1.0303,	VSD	76
4	1.0479,	1.0652,	1.0821,	1.0989,	1.1152,	1.1313,	1.1471,	VSD	77
5	1.1628,	1.1782,	1.1933,	1.2082,	1.2229,	1.2375,	1.2518,	VSD	78
6	1.2659,	1.2798,	1.2935,	1.3070,	1.3204,	1.3336,	1.3467,	VSD	79
7	1.3596,	1.3724,	1.3850,	1.3974,	1.4098,	1.4219,	1.4340,	VSD	80
8	1.4459,	1.4577,	1.4690,	1.4810,	1.4920,	1.5040,	1.5150,	VSD	81
DATA(XT(61, 5, 4)=									82
1	1.5260,	1.5370,	1.5480,	1.5590,				VSD	
1	1.5700,	1.5800,	1.5910,	1.6020,	1.6120,	1.6220,	1.6330,	VSD	83
2	1.6430,	1.6530,	1.6630,	1.6730,	1.6830,	1.7320,	1.7790,	VSD	84
3	1.8250,	1.8690,	1.9120,	1.9550,	1.9960,	2.0370,	2.0760,	VSD	85
4	2.1150,	2.1530,	2.1900,	2.2260,	2.2610,	2.2960,	2.3310,	VSD	86
5	2.3640,	2.3980,	2.4300,	2.4610,	2.4920,	2.5230,	2.5520,	VSD	87
6	2.5810,	2.6080,	2.6360,	2.6640,	2.6910,	2.7170,	2.7410,	VSD	88
7	2.7650,	2.7890,	2.8110,	2.8320,	2.8540,	2.8760,	2.8980,	VSD	89
8	2.9200,	2.9430,	2.9660,	2.9900,	3.0150,	3.0400,	3.0660,	VSD	90
DATA(XT(1, 6, 4)=									91
1	0.0000,	0.0000,	0.6136,	0.6464,	0.6770,	0.7056,	0.7329,	VSD	92
2	0.7589,	0.7838,	0.8079,	0.8308,	0.8532,	0.8751,	0.8964,	VSD	93
3	0.9171,	0.9369,	0.9567,	0.9760,	0.9949,	1.0133,	1.0313,	VSD	94
4	1.0490,	1.0664,	1.0834,	1.1003,	1.1167,	1.1329,	1.1488,	VSD	95

5	1.1645,	1.1800,	1.1951,	1.2101,	1.2248,	1.2394,	1.2538,	VSD	96
6	1.2679,	1.2818,	1.2956,	1.3091,	1.3226,	1.3358,	1.3489,	VSD	97
7	1.3618,	1.3746,	1.3872,	1.3996,	1.4120,	1.4241,	1.4362,	VSD	98
8	1.4481,	1.4599,	1.4720,	1.4830,	1.4950,	1.5060,	1.5170,	VSD	99
	DATA(XT(61, 6, 4)=	1.5280,	1.5390,	1.5500,	1.5610,			VSD	100
1	1.5720,	1.5830,	1.5930,	1.6040,	1.6140,	1.6250,	1.6350,	VSD	101
2	1.6450,	1.6550,	1.6650,	1.6750,	1.6850,	1.7340,	1.7810,	VSD	102
3	1.8270,	1.8710,	1.9140,	1.9570,	1.9980,	2.0380,	2.0780,	VSD	103
4	2.1170,	2.1540,	2.1910,	2.2280,	2.2630,	2.2980,	2.3320,	VSD	104
5	2.3660,	2.3990,	2.4310,	2.4640,	2.4950,	2.5260,	2.5560,	VSD	105
6	2.5850,	2.6140,	2.6420,	2.6710,	2.6990,	2.7250,	2.7520,	VSD	106
7	2.7770,	2.8020,	2.8260,	2.8490,	2.8720,	2.8950,	2.9180,	VSD	107
8	2.9400,	2.9630,	2.9850,	3.0080,	3.0300,	3.0530,	3.0760,	VSD	108
	DATA(XT(1, 7, 4)=	0.0000,	0.0000,	0.0000,	0.0000,			VSD	109
1	0.0000,	0.0000,	0.5960,	0.6333,	0.6668,	0.6977,	0.7267,	VSD	110
2	0.7540,	0.7800,	0.8050,	0.8286,	0.8515,	0.8740,	0.8957,	VSD	111
3	0.9167,	0.9369,	0.9570,	0.9764,	0.9954,	1.0140,	1.0323,	VSD	112
4	1.0502,	1.0676,	1.0848,	1.1017,	1.1182,	1.1346,	1.1505,	VSD	113
5	1.1663,	1.1818,	1.1970,	1.2120,	1.2268,	1.2414,	1.2558,	VSD	114
6	1.2700,	1.2839,	1.2977,	1.3113,	1.3248,	1.3380,	1.3511,	VSD	115
7	1.3640,	1.3768,	1.3894,	1.4018,	1.4142,	1.4263,	1.4384,	VSD	116
8	1.4503,	1.4621,	1.4740,	1.4860,	1.4970,	1.5080,	1.5200,	VSD	117
	DATA(XT(61, 7, 4)=	1.5310,	1.5420,	1.5530,	1.5640,			VSD	118
1	1.5750,	1.5860,	1.5960,	1.6060,	1.6160,	1.6270,	1.6370,	VSD	119
2	1.6470,	1.6570,	1.6670,	1.6770,	1.6870,	1.7360,	1.7830,	VSD	120
3	1.8290,	1.8730,	1.9160,	1.9590,	2.0000,	2.0400,	2.0800,	VSD	121
4	2.1180,	2.1560,	2.1930,	2.2290,	2.2650,	2.3000,	2.3340,	VSD	122
5	2.3680,	2.4010,	2.4330,	2.4650,	2.4970,	2.5280,	2.5580,	VSD	123
6	2.5880,	2.6170,	2.6460,	2.6740,	2.7020,	2.7300,	2.7550,	VSD	124
7	2.7810,	2.8060,	2.8300,	2.8550,	2.8790,	2.9020,	2.9260,	VSD	125
8	2.9490,	2.9720,	2.9950,	3.0170,	3.0400,	3.0630,	3.0850,	VSD	126
	DATA(XT(1, 8, 4)=	0.0000,	0.0000,	0.0000,	0.0000,			VSD	127
1	0.0000,	0.0000,	0.5762,	0.6191,	0.6563,	0.6897,	0.7205,	VSD	128
2	0.7492,	0.7763,	0.8020,	0.8265,	0.8500,	0.8729,	0.8950,	VSD	129
3	0.9164,	0.9372,	0.9574,	0.9771,	0.9963,	1.0151,	1.0335,	VSD	130
4	1.0514,	1.0690,	1.0863,	1.1032,	1.1198,	1.1362,	1.1523,	VSD	131
5	1.1681,	1.1837,	1.1990,	1.2140,	1.2288,	1.2434,	1.2578,	VSD	132
6	1.2720,	1.2860,	1.2998,	1.3134,	1.3269,	1.3401,	1.3532,	VSD	133
7	1.3662,	1.3790,	1.3916,	1.4041,	1.4164,	1.4285,	1.4406,	VSD	134
8	1.4525,	1.4643,	1.4760,	1.4880,	1.4990,	1.5110,	1.5220,	VSD	135
	DATA(XT(61, 8, 4)=	1.5330,	1.5440,	1.5550,	1.5660,			VSD	136
1	1.5770,	1.5870,	1.5980,	1.6080,	1.6190,	1.6290,	1.6390,	VSD	137
2	1.6490,	1.6600,	1.6700,	1.6800,	1.6900,	1.7380,	1.7850,	VSD	138
3	1.8310,	1.8750,	1.9180,	1.9610,	2.0020,	2.0420,	2.0820,	VSD	139
4	2.1200,	2.1580,	2.1950,	2.2310,	2.2670,	2.3010,	2.3350,	VSD	140
5	2.3690,	2.4020,	2.4350,	2.4670,	2.4980,	2.5290,	2.5600,	VSD	141
6	2.5900,	2.6190,	2.6480,	2.6760,	2.7040,	2.7310,	2.7570,	VSD	142
7	2.7830,	2.8080,	2.8330,	2.8580,	2.8830,	2.9070,	2.9310,	VSD	143
8	2.9550,	2.9790,	3.0020,	3.0250,	3.0470,	3.0700,	3.0920,	VSD	144
	DATA(XT(1, 9, 4)=	0.0000,	0.0000,	0.0000,	0.0000,			VSD	145
1	0.0000,	0.0000,	0.0000,	0.0000,	0.0000,	0.0000,	0.6574,	VSD	146
2	0.7060,	0.7462,	0.7813,	0.8130,	0.8425,	0.8696,	0.8953,	VSD	147

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3 0.9198, 0.9431, 0.9655, 0.9871, 1.0080, 1.0282, 1.0476, VSD 148
4 1.0668, 1.0855, 1.1036, 1.1213, 1.1385, 1.1554, 1.1720, VSD 149
5 1.1883, 1.2042, 1.2198, 1.2351, 1.2503, 1.2651, 1.2797, VSD 150
6 1.2940, 1.3080, 1.3220, 1.3358, 1.3494, 1.3628, 1.3759, VSD 151
7 1.3889, 1.4018, 1.4144, 1.4268, 1.4392, 1.4514, 1.4635, VSD 152
8 1.4754, 1.4872, 1.4990, 1.5100, 1.5210, 1.5330, 1.5440, VSD 153
  DATA(XT(61, 9, 4)= 1.5550, 1.5660, 1.5770, 1.5880, VSD 154
1 1.5990, 1.6090, 1.6200, 1.6300, 1.6400, 1.6500, 1.6610, VSD 155
2 1.6710, 1.6810, 1.6910, 1.7010, 1.7110, 1.7600, 1.8070, VSD 156
3 1.8520, 1.8960, 1.9390, 1.9800, 2.0210, 2.0610, 2.1000, VSD 157
4 2.1390, 2.1760, 2.2130, 2.2490, 2.2840, 2.3190, 2.3520, VSD 158
5 2.3850, 2.4180, 2.4520, 2.4860, 2.5190, 2.5510, 2.5820, VSD 159
6 2.6120, 2.6420, 2.6710, 2.6990, 2.7260, 2.7540, 2.7810, VSD 160
7 2.8070, 2.8330, 2.8590, 2.8850, 2.9110, 2.9360, 2.9610, VSD 161
8 2.9870, 3.0110, 3.0350, 3.0590, 3.0810, 3.1040, 3.1250, VSD 162
  DATA(XT( 1, 10, 4)= 0.0000, 0.0000, 0.0000, 0.0000, VSD 163
1 0.0000, 0.0000, 0.0000, 0.0000, 0.0000, 0.0000, 0.0000, VSD 164
2 0.0000, 0.0000, 0.0000, 0.7988, 0.8294, 0.8593, 0.8863, 0.9127, VSD 165
3 0.9379, 0.9620, 0.9850, 1.0072, 1.0287, 1.0493, 1.0693, VSD 166
4 1.0888, 1.1077, 1.1261, 1.1440, 1.1615, 1.1787, 1.1954, VSD 167
5 1.2118, 1.2278, 1.2436, 1.2590, 1.2740, 1.2888, 1.3034, VSD 168
6 1.3178, 1.3320, 1.3460, 1.3598, 1.3732, 1.3866, 1.3998, VSD 169
7 1.4127, 1.4256, 1.4382, 1.4506, 1.4628, 1.4750, 1.4870, VSD 170
8 1.4989, 1.5107, 1.5220, 1.5330, 1.5450, 1.5560, 1.5670, VSD 171
  DATA(XT(61, 10, 4)= 1.5780, 1.5890, 1.6000, 1.6110, VSD 172
1 1.6220, 1.6320, 1.6420, 1.6520, 1.6630, 1.6730, 1.6830, VSD 173
2 1.6930, 1.7030, 1.7130, 1.7230, 1.7330, 1.7810, 1.8270, VSD 174
3 1.8720, 1.9160, 1.9580, 2.0000, 2.0410, 2.0800, 2.1190, VSD 175
4 2.1570, 2.1960, 2.2310, 2.2670, 2.3030, 2.3370, 2.3700, VSD 176
5 2.4030, 2.4360, 2.4690, 2.5020, 2.5340, 2.5650, 2.5950, VSD 177
6 2.6250, 2.6540, 2.6850, 2.7130, 2.7410, 2.7690, 2.7960, VSD 178
7 2.8230, 2.8490, 2.8760, 2.9010, 2.9270, 2.9520, 2.9770, VSD 179
8 3.0030, 3.0270, 3.0520, 3.0750, 3.0980, 3.1200, 3.1420, VSD 180
  DATA(XT( 1, 11, 4)= 0.0000, 0.0000, 0.0000, 0.0000, VSD 181
1 0.0000, 0.0000, 0.0000, 0.0000, 0.0000, 0.0000, 0.0000, VSD 182
2 0.0000, 0.0000, 0.0000, 0.0000, 0.9106, 0.9291, 0.9510, VSD 183
3 0.9732, 0.9951, 1.0166, 1.0378, 1.0584, 1.0784, 1.0979, VSD 184
4 1.1170, 1.1356, 1.1537, 1.1715, 1.1888, 1.2056, 1.2224, VSD 185
5 1.2387, 1.2545, 1.2701, 1.2852, 1.3002, 1.3147, 1.3292, VSD 186
6 1.3434, 1.3579, 1.3714, 1.3852, 1.3986, 1.4119, 1.4249, VSD 187
7 1.4377, 1.4503, 1.4628, 1.4752, 1.4874, 1.4994, 1.5113, VSD 188
8 1.5230, 1.5346, 1.5460, 1.5570, 1.5690, 1.5800, 1.5910, VSD 189
  DATA(XT(61, 11, 4)= 1.6020, 1.6130, 1.6230, 1.6340, VSD 190
1 1.6440, 1.6550, 1.6650, 1.6750, 1.6860, 1.6960, 1.7060, VSD 191
2 1.7160, 1.7260, 1.7350, 1.7450, 1.7540, 1.8020, 1.8470, VSD 192
3 1.8920, 1.9360, 1.9780, 2.0200, 2.0600, 2.1000, 2.1390, VSD 193
4 2.1770, 2.2140, 2.2500, 2.2860, 2.3210, 2.3550, 2.3890, VSD 194
5 2.4220, 2.4550, 2.4870, 2.5180, 2.5490, 2.5800, 2.6100, VSD 195
6 2.6390, 2.6670, 2.6970, 2.7250, 2.7530, 2.7810, 2.8080, VSD 196
7 2.8350, 2.8610, 2.8870, 2.9130, 2.9380, 2.9630, 2.9880, VSD 197
8 3.0130, 3.0380, 3.0620, 3.0860, 3.1090, 3.1310, 3.1520, VSD 198
RETURN

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END

* CARDS COLUMN

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* LIST8

* FORTRAN

TABL5

* SUBROUTINE

TABL5

C

C XT(I,J,K) FOR I=1....120, FOR J=1..11, FOR K=5

C

BANK AAA(1)

COMMON /AAA/ XT(120,11,5)

DATA(XT(1, 1, 5)=	3.5001,	3.4960,	3.4940,	3.4930,		W	1
1 3.4925,	3.4922,	3.4920,	3.4919,	3.4918,	3.4918,	3.4918,	W 2
2 3.4918,	3.4918,	3.4919,	3.4920,	3.4923,	3.4925,	3.4928,	W 3
3 3.4933,	3.4938,	3.4946,	3.4954,	3.4964,	3.4976,	3.4990,	W 4
4 3.5006,	3.5025,	3.5045,	3.5069,	3.5094,	3.5122,	3.5153,	W 5
5 3.5186,	3.5224,	3.5263,	3.5305,	3.5349,	3.5397,	3.5447,	W 6
6 3.5500,	3.5555,	3.5613,	3.5673,	3.5735,	3.5799,	3.5865,	W 7
7 3.5933,	3.6003,	3.6075,	3.6149,	3.6224,	3.6300,	3.6377,	W 8
8 3.6456,	3.6535,	3.6615,	3.6696,	3.6778,	3.6860,	3.6943,	W 9
DATA(XT(61, 1, 5)=	3.7027,	3.7111,	3.7195,	3.7279,		W	10
1 3.7363,	3.7447,	3.7531,	3.7614,	3.7698,	3.7782,	3.7865,	W 11
2 3.7947,	3.8030,	3.8112,	3.8194,	3.8280,	3.8680,	3.9060,	W 12
3 3.9440,	3.9790,	4.0130,	4.0460,	4.0780,	4.1090,	4.1400,	W 13
4 4.1710,	4.2010,	4.2320,	4.2650,	4.3010,	4.3390,	4.3800,	W 14
5 4.4270,	4.4790,	4.5460,	4.6320,	4.7430,	4.8880,	5.0760,	W 15
6 5.3260,	5.6700,	6.1100,	6.6200,	7.2100,	7.8700,	8.5700,	W 16
7 0. ,	0. ,	0. ,	0. ,	0. ,	0. ,	0. ,	W 17
8 0. ,	0. ,	0. ,	0. ,	0. ,	0. ,	0.)	W 18
DATA(XT(1, 2, 5)=	0. ,	0. ,	0. ,	0. ,		W	19
1 3.4937,	3.4935,	3.4935,	3.4935,	3.4936,	3.4938,	3.4942,	W 20
2 3.4946,	3.5030,	3.4998,	3.4979,	3.4965,	3.4955,	3.4948,	W 21
3 3.4944,	3.4940,	3.4953,	3.4960,	3.4970,	3.4981,	3.4995,	W 22
4 3.5010,	3.5030,	3.5050,	3.5073,	3.5098,	3.5126,	3.5156,	W 23
5 3.5189,	3.5227,	3.5266,	3.5308,	3.5352,	3.5399,	3.5449,	W 24
6 3.5502,	3.5557,	3.5615,	3.5675,	3.5737,	3.5801,	3.5867,	W 25
7 3.5935,	3.6005,	3.6077,	3.6150,	3.6225,	3.6301,	3.6378,	W 26
8 3.6457,	3.6536,	3.6616,	3.6697,	3.6779,	3.6861,	3.6944,	W 27
DATA(XT(61, 2, 5)=	3.7028,	3.7112,	3.7195,	3.7280,		W	28
1 3.7364,	3.7448,	3.7532,	3.7615,	3.7699,	3.7783,	3.7866,	W 29
2 3.7948,	3.8031,	3.8113,	3.8195,	3.8280,	3.8690,	3.9060,	W 30
3 3.9440,	3.9790,	4.0130,	4.0460,	4.0780,	4.1090,	4.1400,	W 31
4 4.1710,	4.2010,	4.2300,	4.2600,	4.2890,	4.3220,	4.3560,	W 32
5 4.3930,	4.4310,	4.4730,	4.5210,	4.5770,	4.6440,	4.7320,	W 33
6 4.8390,	4.9600,	5.0960,	5.2780,	5.4950,	5.7700,	6.0960,	W 34
7 6.4560,	6.8920,	7.4200,	8.0150,	8.6000,	9.4100,	10.2200,	W 35
8 11.1100,	12.0700,	13.0800,	0. ,	0. ,	0. ,	0.)	W 36
DATA(XT(1, 3, 5)=	0. ,	0. ,	0. ,	0. ,		W	37
1 3.5398,	3.5263,	3.5179,	3.5122,	3.5081,	3.5051,	3.5030,	W 38
2 3.5013,	3.5000,	3.4989,	3.4982,	3.4978,	3.4974,	3.4971,	W 39
3 3.4972,	3.4973,	3.4978,	3.4983,	3.4990,	3.5000,	3.5012,	W 40
4 3.5026,	3.5044,	3.5063,	3.5085,	3.5109,	3.5137,	3.5167,	W 41
5 3.5199,	3.5237,	3.5275,	3.5316,	3.5359,	3.5407,	3.5457,	W 42
6 3.5508,	3.5564,	3.5621,	3.5681,	3.5742,	3.5806,	3.5872,	W 43

7	3.5939,	3.6009,	3.6081,	3.6155,	3.6229,	3.6305,	3.6382,	W	44
8	3.6461,	3.6540,	3.6619,	3.6700,	3.6782,	3.6864,	3.6947)	W	45
DATA(XT(61, 3, 5)= 3.7031, 3.7115, 3.7198, 3.7282,									46
1	3.7366,	3.7450,	3.7534,	3.7617,	3.7701,	3.7785,	3.7868,	W	47
2	3.7950,	3.8032,	3.8114,	3.8196,	3.8280,	3.8690,	3.9060,	W	48
3	3.9440,	3.9790,	4.0130,	4.0460,	4.0780,	4.1090,	4.1400,	W	49
4	4.1710,	4.2010,	4.2300,	4.2600,	4.2890,	4.3210,	4.3520,	W	50
5	4.3870,	4.4210,	4.4570,	4.4970,	4.5390,	4.5860,	4.6430,	W	51
6	4.7110,	4.7840,	4.8660,	4.9730,	5.0950,	5.2500,	5.4250,	W	52
7	5.6250,	5.8590,	6.1300,	6.4540,	6.7900,	7.1600,	7.5700,	W	53
8	8.0200,	8.5000,	9.0200,	0.	0.	0.	0.)	W	54
DATA(XT(1, 4, 5)= 0., 0., 0., 0.,									55
1	3.5787,	3.5537,	3.5384,	3.5283,	3.5210,	3.5157,	3.5117,	W	56
2	3.5087,	3.5063,	3.5044,	3.5029,	3.5020,	3.5011,	3.5005,	W	57
3	3.5002,	3.5000,	3.5003,	3.5005,	3.5011,	3.5019,	3.5030,	W	58
4	3.5043,	3.5059,	3.5076,	3.5098,	3.5121,	3.5148,	3.5178,	W	59
5	3.5209,	3.5246,	3.5284,	3.5325,	3.5367,	3.5414,	3.5464,	W	60
6	3.5515,	3.5570,	3.5627,	3.5687,	3.5748,	3.5811,	3.5877,	W	61
7	3.5944,	3.6014,	3.6085,	3.6159,	3.6234,	3.6309,	3.6386,	W	62
8	3.6464,	3.6543,	3.6622,	3.6703,	3.6785,	3.6867,	3.6950)	W	63
DATA(XT(61, 4, 5)= 3.7033, 3.7117, 3.7201, 3.7285,									64
1	3.7369,	3.7453,	3.7536,	3.7619,	3.7703,	3.7787,	3.7870,	W	65
2	3.7952,	3.8034,	3.8116,	3.8198,	3.8280,	3.8690,	3.9060,	W	66
3	3.9440,	3.9790,	4.0130,	4.0460,	4.0780,	4.1090,	4.1400,	W	67
4	4.1710,	4.2010,	4.2300,	4.2600,	4.2890,	4.3210,	4.3520,	W	68
5	4.3860,	4.4190,	4.4530,	4.4900,	4.5290,	4.7530,	4.6210,	W	69
6	4.6760,	4.7380,	4.8060,	4.8900,	4.9930,	5.1140,	5.2560,	W	70
7	5.4190,	5.6040,	5.8160,	6.0640,	6.3200,	6.6000,	6.9100,	W	71
8	7.2600,	7.6300,	8.0200,	0.	0.	0.	0.)	W	72
DATA(XT(1, 5, 5)= 0., 0., 0., 0.,									73
1	0.	3.5824,	3.5596,	3.5447,	3.5340,	3.5263,	3.5205,	W	74
2	3.5161,	3.5126,	3.5099,	3.5078,	3.5062,	3.5049,	3.5038,	W	75
3	3.5032,	3.5028,	3.5027,	3.5028,	3.5031,	3.5038,	3.5047,	W	76
4	3.5059,	3.5074,	3.5091,	3.5112,	3.5134,	3.5160,	3.5188,	W	77
5	3.5219,	3.5255,	3.5292,	3.5333,	3.5376,	3.5422,	3.5471,	W	78
6	3.5523,	3.5577,	3.5634,	3.5693,	3.5754,	3.5817,	3.5882,	W	79
7	3.5949,	3.6019,	3.6090,	3.6163,	3.6238,	3.6313,	3.6390,	W	80
8	3.6468,	3.6547,	3.6626,	3.6707,	3.6788,	3.6870,	3.6953)	W	81
DATA(XT(61, 5, 5)= 3.7036, 3.7120, 3.7204, 3.7288,									82
1	3.7371,	3.7455,	3.7538,	3.7621,	3.7705,	3.7789,	3.7872,	W	83
2	3.7954,	3.8036,	3.8118,	3.8200,	3.8280,	3.8690,	3.9060,	W	84
3	3.9440,	3.9790,	4.0130,	4.0460,	4.0780,	4.1090,	4.1400,	W	85
4	4.1710,	4.2010,	4.2300,	4.2600,	4.2890,	4.3210,	4.3520,	W	86
5	4.3850,	4.4180,	4.4510,	4.4870,	4.5240,	4.5660,	4.6110,	W	87
6	4.6620,	4.7190,	4.7810,	4.8560,	4.9470,	5.0550,	5.1790,	W	88
7	5.3210,	5.4840,	5.6700,	5.8820,	6.1200,	6.4000,	6.7100,	W	89
8	7.0600,	7.4500,	7.8700,	8.3500,	8.8600,	9.4000,	9.9600)	W	90
DATA(XT(1, 6, 5)= 0., 0., 0., 0.,									91
1	0.	0.	3.8166,	3.7334,	3.6790,	3.6418,	3.6147,	W	92
2	3.5951,	3.5793,	3.5670,	3.5573,	3.5495,	3.5432,	3.5379,	W	93
3	3.5337,	3.5302,	3.5277,	3.5255,	3.5240,	3.5228,	3.5222,	W	94
4	3.5220,	3.5223,	3.5229,	3.5240,	3.5254,	3.5273,	3.5294,	W	95

5	3.5319,	3.5349,	3.5381,	3.5416,	3.5454,	3.5497,	3.5542,	W	96
6	3.5589,	3.5640,	3.5694,	3.5750,	3.5809,	3.5869,	3.5932,	W	97
7	3.5997,	3.6065,	3.6134,	3.6206,	3.6278,	3.6352,	3.6427,	W	98
8	3.6504,	3.6582,	3.6660,	3.6742,	3.6820,	3.6900,	3.6982,	W	99
DATA(XT(61, 6,5)=									
	3.7064,	3.7147,	3.7230,	3.7313,				W	100
1	3.7396,	3.7479,	3.7562,	3.7643,	3.7727,	3.7810,	3.7892,	W	101
2	3.7973,	3.8055,	3.8137,	3.8218,	3.8300,	3.8710,	3.9080,	W	102
3	3.9460,	3.9800,	4.0140,	4.0470,	4.0790,	4.1100,	4.1410,	W	103
4	4.1720,	4.2020,	4.2310,	4.2610,	4.2900,	4.3200,	4.3510,	W	104
5	4.3820,	4.4140,	4.4460,	4.4800,	4.5130,	4.5490,	4.5860,	W	105
6	4.6260,	4.6700,	4.7150,	4.7670,	4.8230,	4.8900,	4.9690,	W	106
7	5.0560,	5.1490,	5.2550,	5.3730,	5.5070,	5.6610,	5.8310,	W	107
8	6.0190,	6.2470,	6.4550,	6.7080,	6.9930,	7.2900,	7.6050,	W	108
DATA(XT(1, 7,5)=									
	0.	0.	0.	0.	0.	0.		W	109
1	0.	0.	4.1630,	3.9820,	3.8570,	3.7780,	3.7219,	W	110
2	3.6816,	3.6514,	3.6279,	3.6096,	3.5950,	3.5831,	3.5731,	W	111
3	3.5651,	3.5584,	3.5531,	3.5485,	3.5450,	3.5420,	3.5398,	W	112
4	3.5383,	3.5374,	3.5369,	3.5371,	3.5375,	3.5386,	3.5410,	W	113
5	3.5419,	3.5443,	3.5469,	3.5500,	3.5533,	3.5572,	3.5612,	W	114
6	3.5656,	3.5704,	3.5755,	3.5809,	3.5864,	3.5922,	3.5983,	W	115
7	3.6046,	3.6111,	3.6179,	3.6248,	3.6319,	3.6390,	3.6465,	W	116
8	3.6541,	3.6616,	3.6693,	3.6772,	3.6851,	3.6930,	3.7011,	W	117
DATA(XT(61, 7,5)=									
	3.7093,	3.7174,	3.7256,	3.7338,				W	118
1	3.7420,	3.7502,	3.7585,	3.7665,	3.7749,	3.7831,	3.7912,	W	119
2	3.7993,	3.8074,	3.8155,	3.8236,	3.8320,	3.8720,	3.9090,	W	120
3	3.9470,	3.9820,	4.0150,	4.0480,	4.0800,	4.1110,	4.1410,	W	121
4	4.1720,	4.2020,	4.2310,	4.2610,	4.2900,	4.3200,	4.3510,	W	122
5	4.3820,	4.4130,	4.4450,	4.4790,	4.5110,	4.5440,	4.5800,	W	123
6	4.6170,	4.6570,	4.6990,	4.7440,	4.7910,	4.8500,	4.9180,	W	124
7	4.9900,	5.0670,	5.1520,	5.2470,	5.3530,	5.4740,	5.6070,	W	125
8	5.7530,	5.9120,	6.0880,	6.2820,	6.4970,	6.7330,	6.9910,	W	126
DATA(XT(1, 8,5)=									
	0.	0.	0.	0.	0.	0.		W	127
1	0.	0.	4.8070,	4.3250,	4.0810,	3.9390,	3.8440,	W	128
2	3.7780,	3.7297,	3.6932,	3.6644,	3.6427,	3.6244,	3.6095,	W	129
3	3.5972,	3.5871,	3.5789,	3.5719,	3.5663,	3.5614,	3.5576,	W	130
4	3.5546,	3.5525,	3.5508,	3.5500,	3.5497,	3.5500,	3.5507,	W	131
5	3.5519,	3.5536,	3.5557,	3.5583,	3.5611,	3.5645,	3.5682,	W	132
6	3.5722,	3.5767,	3.5815,	3.5865,	3.5919,	3.5975,	3.6032,	W	133
7	3.6093,	3.6156,	3.6222,	3.6290,	3.6359,	3.6430,	3.6502,	W	134
8	3.6576,	3.6650,	3.6726,	3.6803,	3.6880,	3.6958,	3.7038,	W	135
DATA(XT(61, 8,5)=									
	3.7119,	3.7200,	3.7281,	3.7362,				W	136
1	3.7443,	3.7525,	3.7606,	3.7687,	3.7769,	3.7851,	3.7932,	W	137
2	3.8013,	3.8094,	3.8174,	3.8254,	3.8340,	3.8730,	3.9100,	W	138
3	3.9480,	3.9830,	4.0160,	4.0490,	4.0810,	4.1110,	4.1420,	W	139
4	4.1730,	4.2030,	4.2320,	4.2610,	4.2900,	4.3200,	4.3510,	W	140
5	4.3820,	4.4140,	4.4450,	4.4780,	4.5090,	4.5430,	4.5770,	W	141
6	4.6130,	4.6520,	4.6920,	4.7340,	4.7800,	4.8330,	4.8930,	W	142
7	4.9560,	5.0260,	5.1020,	5.1860,	5.2820,	5.3890,	5.5060,	W	143
8	5.6340,	5.7750,	5.9300,	6.1060,	6.3000,	6.5080,	6.7240,	W	144
DATA(XT(1, 9,5)=									
	0.	0.	0.	0.	0.	0.		W	145
1	0.	0.	0.	0.	0.	0.		W	146
2	5.8760,	5.0920,	4.6810,	4.4260,	4.2560,	4.1290,	4.0360,	W	147

3	3.9630,	3.9060,	3.8600,	3.8220,	3.7900,	3.7630,	3.7410,	W	148				
4	3.7220,	3.7060,	3.6920,	3.6800,	3.6710,	3.6620,	3.6560,	W	149				
5	3.6500,	3.6460,	3.6420,	3.6400,	3.6380,	3.6370,	3.6370,	W	150				
6	3.6370,	3.6380,	3.6400,	3.6420,	3.6450,	3.6480,	3.6520,	W	151				
7	3.6560,	3.6600,	3.6650,	3.6700,	3.6750,	3.6800,	3.6860,	W	152				
8	3.6920,	3.6980,	3.7050,	3.7110,	3.7180,	3.7250,	3.7320,	W	153				
DATA(XT(61, 9,5)=								3.7390,	3.7460,	3.7530,	3.7600,	W	154
1	3.7680,	3.7750,	3.7830,	3.7900,	3.7980,	3.8050,	3.8130,	W	155				
2	3.8200,	3.8280,	3.8350,	3.8430,	3.8510,	3.8900,	3.9240,	W	156				
3	3.9600,	3.9930,	4.0250,	4.0570,	4.0880,	4.1180,	4.1480,	W	157				
4	4.1790,	4.2080,	4.2360,	4.2660,	4.2940,	4.3240,	4.3540,	W	158				
5	4.3850,	4.4160,	4.4470,	4.4470,	4.5080,	4.5400,	4.5710,	W	159				
6	4.6030,	4.6380,	4.6740,	4.7090,	4.7450,	4.7850,	4.8280,	W	160				
7	4.8740,	4.9220,	4.9730,	5.0280,	5.0870,	5.1520,	5.2200,	W	161				
8	5.2950,	5.3770,	5.4670,	5.5630,	5.6680,	5.7820,	5.9060,	W	162				
DATA(XT(1,10,5)=								0.	0.	0.	0.	W	163
1	0.	0.	0.	0.	0.	0.	0.	W	164				
2	0.	0.	6.6210,	5.6560,	5.1320,	4.7900,	4.5590,	W	165				
3	4.3920,	4.2650,	4.1660,	4.0900,	4.0250,	3.9700,	3.9260,	W	166				
4	3.8890,	3.8570,	3.8310,	3.8080,	3.7880,	3.7710,	3.7560,	W	167				
5	3.7440,	3.7320,	3.7240,	3.7170,	3.7100,	3.7050,	3.7010,	W	168				
6	3.6980,	3.6960,	3.6950,	3.6950,	3.6950,	3.6950,	3.6970,	W	169				
7	3.6990,	3.7010,	3.7040,	3.7080,	3.7110,	3.7150,	3.7200,	W	170				
8	3.7240,	3.7290,	3.7350,	3.7400,	3.7460,	3.7510,	3.7570,	W	171				
DATA(XT(61,10,5)=								3.7640,	3.7700,	3.7770,	3.7830,	W	172
1	3.7900,	3.7970,	3.8030,	3.8100,	3.8170,	3.8240,	3.8310,	W	173				
2	3.8380,	3.8450,	3.8520,	3.8590,	3.8670,	3.9020,	3.9360,	W	174				
3	3.9700,	4.0030,	4.0340,	4.0650,	4.0950,	4.1250,	4.1540,	W	175				
4	4.1840,	4.2130,	4.2410,	4.2700,	4.2980,	4.3270,	4.3570,	W	176				
5	4.3880,	4.4190,	4.4490,	4.4790,	4.5090,	4.5400,	4.5720,	W	177				
6	4.6040,	4.6370,	4.6700,	4.7030,	4.7380,	4.7750,	4.8140,	W	178				
7	4.8550,	4.8970,	4.9410,	4.9870,	5.0360,	5.0880,	5.1430,	W	179				
8	5.2030,	5.2700,	5.3410,	5.4160,	5.4960,	5.5830,	5.6780,	W	180				
DATA(XT(1,11,5)=								0.	0.	0.	0.	W	181
1	0.	0.	0.	0.	0.	0.	0.	W	182				
2	0.	0.	8.4600,	6.9800,	6.0790,	5.4780,	5.0930,	W	183				
3	4.8210,	4.6190,	4.4630,	4.3440,	4.2480,	4.1670,	4.1010,	W	184				
4	4.0460,	4.0000,	3.9600,	3.9270,	3.8970,	3.8720,	3.8490,	W	185				
5	3.8310,	3.8140,	3.8000,	3.7880,	3.7770,	3.7680,	3.7610,	W	186				
6	3.7550,	3.7500,	3.7460,	3.7430,	3.7410,	3.7400,	3.7390,	W	187				
7	3.7390,	3.7400,	3.7410,	3.7430,	3.7450,	3.7480,	3.7510,	W	188				
8	3.7550,	3.7580,	3.7630,	3.7670,	3.7720,	3.7770,	3.7820,	W	189				
DATA(XT(61,11,5)=								3.7870,	3.7930,	3.7990,	3.8040,	W	190
1	3.8100,	3.8170,	3.8230,	3.8290,	3.8350,	3.8420,	3.8480,	W	191				
2	3.8540,	3.8610,	3.8680,	3.8740,	3.8820,	3.9150,	3.9470,	W	192				
3	3.9800,	4.0120,	4.0420,	4.0720,	4.1030,	4.1300,	4.1590,	W	193				
4	4.1890,	4.2170,	4.2450,	4.2730,	4.3020,	4.3310,	4.3610,	W	194				
5	4.3910,	4.4210,	4.4510,	4.4810,	4.5110,	4.5420,	4.5730,	W	195				
6	4.6050,	4.6380,	4.6710,	4.7020,	4.7340,	4.7690,	4.8060,	W	196				
7	4.8450,	4.8860,	4.9280,	4.9710,	5.0160,	5.0620,	5.1150,	W	197				
8	5.1720,	5.2330,	5.2970,	5.3630,	5.4340,	5.5120,	5.6020,	W	198				

RETURN

END

FLOSS IV Test Problem Input Deck. Skipped line indicates blank card.

**

1
FLOSS TEST PROB. 3 800. 350. 250. 2000. .75 1.
0. 5. 10. 15. 20. 25. 30.
35. 40. 45. 50. 55. 60. 65.
0. 0. 1. 2. 3. 4. 5.
6. 5. 3. .0001
0.35

2
800. 1200. 15.0 400.
1000. 2500. .95 .990
2200. 2400. 2600.
700. 2000. .90 .90 .90
VARIETY 1 1 15000. 1. 1. .5 .5 1.
0. 5. 10. 15. 20. 25. 30.
35. 40. 45. 50. 55. 60. 65.
70. 75.
1. 2. 3. 4. 5.
6. 7. 8. 7. 6.
5. .0001

0.15

0.5

VARIETY 2 2 200. 5. 1.
0. 5. 10. 15. 20. 25. 30.
35. 40. 45. 50. 55. 60. 65.
70. 75. 80. 85.

1.

.35

.35

.30

.7

VARIETY 3 3 100. .5 1.
0. .5 .6 5. 10. 15. 20.
25. 30. 35. 40. 45. 50. 55.
60. 65. 70. 1.
1. 1.

1.

.25

.0001

.1

3

3. .65 -50. 10.3

2200.

1

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