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NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER
Bethesda, Maryland 20034

THE BANDIT COMPUTER PROGRAM FOR THE REDUCTION OF MATRIX BANDWIDTH FOR NASTRAN

Gordon C. Everstine

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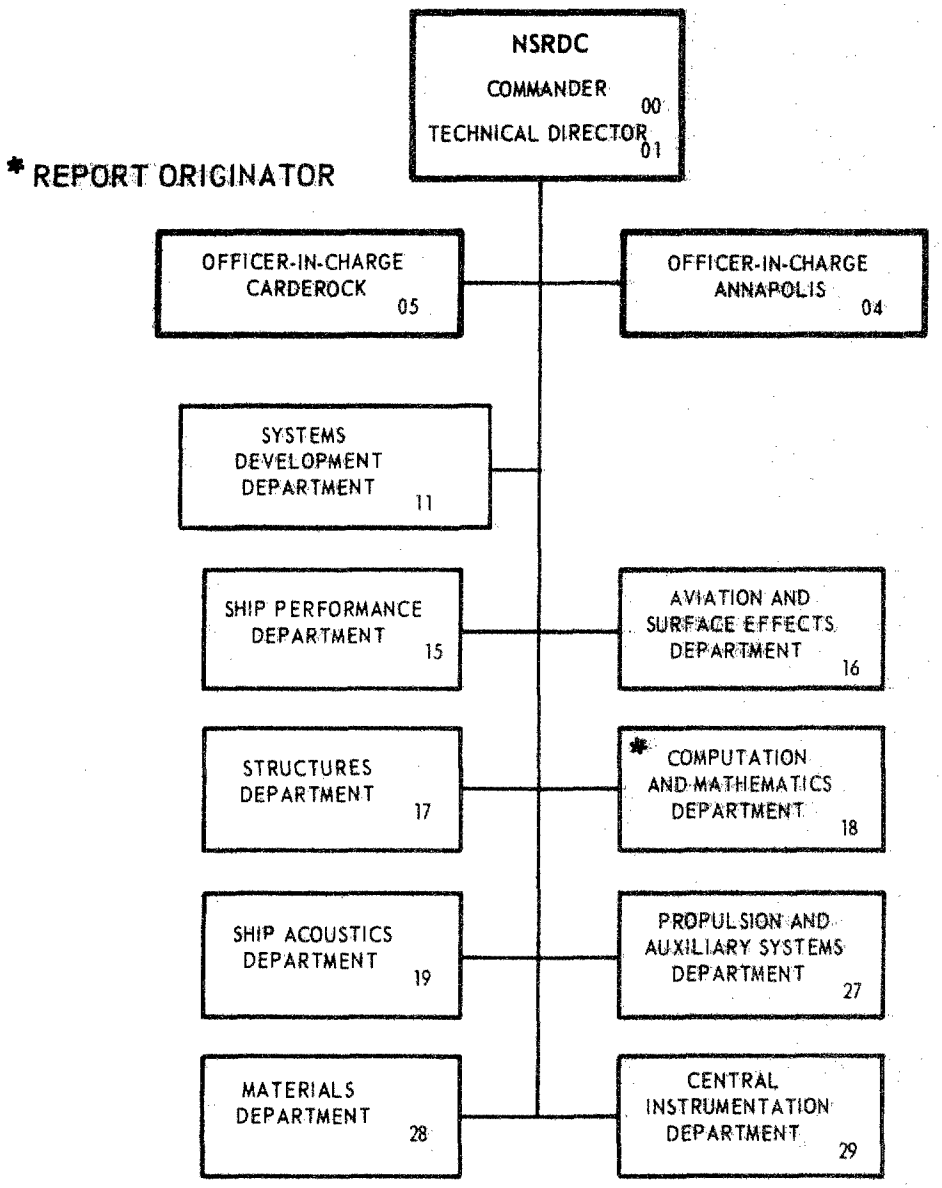

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ABSTRACT

This report describes a matrix bandwidth reduction preprocessor for use with the NASA structural analysis computer program, NASTRAN. Called BANDIT, the program is written in FORTRAN and uses the Cuthill-McKee strategy for resequencing grid points. Versions of the program for both CDC and other computers are presented.

ADMINISTRATIVE INFORMATION

The work reported herein was carried out under Task Area ZR 014 02 01.

I. INTRODUCTION

The NASA structural analysis computer program, NASTRAN, is a large general purpose program gaining wide acceptance in the Navy for the solution of both static and dynamic structural problems.

Since NASTRAN uses the finite element displacement method, the structural matrices which are formed are symmetric and sparse. With a suitable choice of the numbers (labels) assigned to the grid points, the matrices are also banded (i.e., the non-zero entries in each matrix are clustered about the main diagonal). For this reason, many of the routines used by NASTRAN for the solution of linear equations and for the extraction of eigenvalues operate most efficiently when the bandwidths of the structural matrices are minimum. Indeed, the number of calculations required in such routines is $O(n\,b^2)$, where n is the matrix order and b is the matrix bandwidth.

Although it is essential to the NASTRAN user to have matrices with small bandwidth, NASTRAN currently places the burden on the user to number his structure so as to provide such a bandwidth. The inherent difficulties in sequencing nodal labels manually and the increasing use of automatic data generators make this an excessive and unnecessary burden for most structural analysts.

NASTRAN currently allows the user to include in his input data deck a set of cards referred to as SEQGP cards. These cards define a look-up table giving the correspondence between the original grid numbers used in defining the problem and a new set of numbers to be used internally for all calculations.

This report describes a FORTRAN computer program called BANDIT which can be used as a preprocessor to the NASTRAN program to automatically resequence the grid point numbers for reduced bandwidth. Using a standard NASTRAN data deck as input, BANDIT resequences the numbering for reduced bandwidth, if possible, and generates a set of SEQGP punch cards for insertion into the NASTRAN deck.

The renumbering strategy used in BANDIT is that developed by Cuthill and McKee[1]. The need to resort to "strategies" becomes evident when one considers that n grid points (or nodes)[2] can be sequenced in n! distinct ways. Thus, with any strategy, there is no guarantee that an optimum numbering (i.e., one yielding minimum bandwidth) will be achieved. However, of several strategies tested[3] to date, the Cuthill-McKee approach[1] appears to be the most consistent for the reduction of matrix bandwidth for the classes of structures of prime interest to the Navy.

The computer program described herein was developed primarily for use on CDC 6400/6600 computers and hence has some machine-dependent features. However, for use on other computers, a machine-independent (and slightly less versatile) version of BANDIT is also described.

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1 Cuthill, E.H. and J.M. McKee, "Reducing the Bandwidth of Sparse Symmetric Matrices," Proceedings of the 24th National Conference ACM 1969, pp. 157-172.

2 Throughout this report, "grid point" and "node" are used interchangeably.

3 "Sparse Matrices and Their Applications," Edited by D. J. Rose and R. A. Willoughby, Plenum Press, New York (1972), "Several Strategies for Reducing the Bandwidth of Matrices," (E. H. Cuthill), pp. 157-166.

II. USE OF THE BANDIT PROGRAM

Throughout this and subsequent sections, it is assumed that the reader is familiar with the use of the NASTRAN structural analysis computer program[4].

BANDIT's primary reason for existence is the generation of the NASTRAN SEQGP data cards to effect low matrix bandwidth. As a by-product, BANDIT can also be used to right-adjust the NASTRAN bulk data. In either case, following the execution of BANDIT, the complete right-adjusted data deck is available on disk file. In addition, the user can elect to have punch card output for either the entire deck or the SEQGP cards alone.

The input data deck for BANDIT consists of a standard NASTRAN data deck (ID card through ENDDATA card, inclusive) with the addition of appropriate BANDIT option cards somewhere before the BEGIN BULK card. These cards, called $-option cards, indicate to BANDIT the user's choice of options, i.e., what the user wants BANDIT to do. The $-option cards are listed and described in detail in the next section.

On CDC machines, BANDIT functions as a variable-core program. Hence it is essentially open-ended with respect to the number of grid points that can be handled. During execution, the system is interrogated to determine the field length (amount of core). The dimensions of key arrays are then set so as to fill the available core. As a result, BANDIT must be executed on CDC machines with "NOREDUCE." in effect in order to prevent the automatic reduction of field length after the program is loaded.

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4 "The NASTRAN User's Manual," edited by C.W. McCormick, NASA SP-222, September 1970.

BANDIT will load and execute in less than 50000_8[5] words of core. With this field length, typical structures with less than 500 grid points can be handled. For larger structures, more core may be needed, in which case BANDIT so informs the user. It has been our experience, however, that rarely are more than 60000_8 words needed. A more detailed discussion of core requirements appears in Section V.

Although BANDIT will accept an entire NASTRAN deck as input, resequencing requires only the following NASTRAN cards: BEGIN BULK, ENDDATA, and all "connection" cards. In particular, GRID cards are not used by BANDIT. The current list of connection cards which BANDIT recognizes is given in Table 1.

BANDIT will accept data on either short or long field data cards. The only restriction to the data concerns sorting. Since BANDIT does not sort the bulk data deck, each continuation to a connection card must immediately follow the parent card. Normally, however, unless long field cards are being used, each logical connection card consists of only one physical card.

If the user so indicates, BANDIT will process all multi-point constraint (MPC) cards present. While NASTRAN MPC's refer to individual degrees of freedom, BANDIT considers only grid points. Thus, each dependent point appearing in an MPC relation is eliminated from the connection table. Additional connections are also generated between each independent point in the constraint equation and every other point to which the dependent point was previously connected.

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5 The subscript "8" in this context means "base 8".

TABLE 1 - CONNECTION CARDS RECOGNIZED BY BANDIT

CBAR	CIS2D4	CQUAD2
CCONEAX	CIS2D8	CQUAD3
CDAMP1	CIS3D8	CROD
CDAMP2	CIS3D20	CSHEAR
CDAMP3	CISH8	CTETRA
CDAMP4	CISH16	CTORDRG
CELAS1	CMASS1	CTRAPRG
CELAS2	CMASS2	CTRBSC
CELAS3	CMASS3	CTRIA1
CELAS4	CMASS4	CTRIA2
CFLUID2	CONM1	CTRIARG
CFLUID3	CONM2	CTRMEM
CFLUID4	CONROD	CTRPLT
CHEXA1	CQDMEM	CTUBE
CHEXA2	CQDPLT	CTWIST
CHTTRI2	CQUAD1	CVISC

It should be emphasized that only in rare cases would it make sense to let BANDIT process MPC's. The main reasons for this are that BANDIT does not consider individual degrees of freedom and, in addition, cannot distinguish one MPC "set" from another. Moreover, the effects of MPC's might be better handled by NASTRAN's active column feature.

The whole question of NASTRAN active columns complicates the bandwidth reduction problem, since there are clearly cases in which certain grid points should be relegated to active columns. An example might be the grid points common to both the fuselage and a wing on an airplane. If the user is able to identify such points, he can indicate them to BANDIT using the $IGNORE card described in the next section. This BANDIT feature, like the MPC feature, will probably find only occasional use.

Following the successful completion of a BANDIT run, whether resequencing was performed or not, the entire NASTRAN deck is contained on a file called TAPE8 (logical unit 8 on some machines). If resequencing has been performed, this file includes the SEQGP cards generated. These cards are inserted into the bulk data deck before the first card whose mnemonic would alphabetically follow "SEQGP". Thus, for a NASTRAN deck already properly sorted, the block of SEQGP cards will be inserted into its proper place. On machines such as the IBM 360, whose collating sequence is opposite to that on the CDC 6400, modification of the coding is needed for proper placement.

III. THE $-OPTION CARDS

The input data deck for BANDIT consists of a standard NASTRAN data deck (ID card through ENDDATA card, inclusive) with the addition of appropriate BANDIT option cards somewhere before the BEGIN BULK card. These option cards take the form of NASTRAN comment cards, i.e., a card with a dollar sign ($) in card column #1.

The BANDIT $-option cards may appear in any order and any location as long as they precede the BEGIN BULK card. There are two general formats for these cards,

$KEYWORD1 KEYWORD2

or

$KEYWORD1 N1 N2 N3 ... ,

where the Ni's are positive integers separated by one or more blanks. In order to qualify as a NASTRAN comment card, the $ must appear in card column #1.

Additional restrictions on the $-option cards are as follows:

(1) KEYWORD1 must start in card column #2.

(2) There may be no imbedded blanks in either keyword.

(3) Keywords (or integers) must be separated by one or more blanks.

(4) At least the first two letters of each keyword are required for proper identification.

A complete list of the $-option cards, along with a summary of the use of each card, appears in Table 2. In the absence of any card listed, the underlined option is chosen by default.

TABLE 2 - SUMMARY OF BANDIT $-OPTION CARDS

(Underline denotes default; only the first two letters of each keyword are required)

$SEQUENCE	NO	Resequencing not desired
	YES	Resequencing is desired
$RIGHTADJUST	NO	No right-adjusting desired
	YES	Bulk data is to be right-adjusted
$PUNCH	NONE	No punch output desired
	SEQGP	Only SEQGP cards are to be punched
	ALL	The entire NASTRAN deck is to be punched
$GRID	N1	The integer N1 is an upper bound on the number of grid points. (The default limits the maximum nodal degree to approximately 19.)
$PRINT	MIN	Basic printed output
	MAX	Extensive printed output
$MPC	NO	MPC cards are not to be processed
	YES	MPC cards are to be processed
$IGNORE	N1 N2 N3 ...	Grid numbers Ni appearing here are ignored during resequencing

The $SEQUENCE card is required to resequence the grid point labels and generate the SEQGP cards. For resequencing purposes, the only other data cards required are BEGIN BULK, ENDDATA, and all connection cards.

The right-adjusting of the bulk data is performed automatically if resequencing ($SEQUENCE YES) is elected. The user can then elect to have this deck punched by using $PUNCH ALL. In any case, it can be accessed on TAPE8.

The standard printed output consists of a title page, a listing of the SEQGP cards generated (if resequencing is requested), and a user summary. Use of the $PRINT MAX card results in the printing of additional tables as well as information on the flow of calculations during the actual resequencing. However, because of the additional work involved in generating several of the tables, the user pays a penalty in the form of increased execution time. A detailed explanation of BANDIT output appears in the next section.

Use of the $MPC YES card results in the processing of all MPC cards in the NASTRAN deck, regardless of their identifying set numbers. During processing, all dependent grid points on all MPC cards will be eliminated from the connection table after the additional connections due to the constraint relations are accounted for. For this reason, the user would normally decline to use this feature.

Although BANDIT is a variable-core program, the specific way in which the available core is partitioned depends on both the number of grid points and the maximum nodal degree. Nodal degree is defined in Section IV. B. Based on the space available, BANDIT computes default values for the dimensions of various arrays. This partitioning can be

optimized for larger problems by declaring to BANDIT the number of grid points present. The appropriate $-option card is $GRID N1. Here, N1 is an upper bound (preferably least upper bound) on the number of grid points. In the absence of this card, the default values computed by BANDIT result in a limit of approximately 19 on the maximum nodal degree.

The $IGNORE card (Table 2) can be used to designate those grid points Ni which should be ignored completely by BANDIT during resequencing. This normally results (in NASTRAN) in those points being placed into active columns. Any number of $IGNORE cards may appear, although the total number of ignored points may not exceed 100. Ignored points are renumbered last by the SEQGP cards.

IV. PRINTED OUTPUT

A. DESCRIPTION

There are two levels of BANDIT printed output: maximum printing (obtained by using the $PRINT MAX card), or minimum printing (obtained by default or by using $PRINT MIN). The latter is a subset of the former.

If resequencing is elected, the basic (minimum) output consists of a listing of the SEQGP cards generated and a user summary. The user summary contains the following information:

(1) original matrix semi-bandwidth

(2) new matrix semi-bandwidth

(3) central processor (CP) time in BANDIT, in seconds

(4) original matrix profile

(5) new matrix profile

(6) number of grid points

(7) number of elements

(8) number of components

(9) maximum nodal degree

(10) number of points of zero degree

(11) punch output requested

(12) field length (FL), octal

(13) the FORTRAN variables MAXGRD, MAXDEG, & KORE (defined below)

(14) date and time

In the "machine-independent" version of BANDIT (Appendix B), items 3 and 14 and KORE are omitted, since the determination of these quantities involves machine-dependent coding.

B. DEFINITIONS

For a matrix A, we follow the notation of Cuthill[6] and define θ_i as the difference between i and the column index of the first non-zero element of row i of A. Then the semi-bandwidth B is given by

$$B = \max_i \theta_i \tag{1}$$

This value is listed in 1 and 2 above. We note that the relationship between B and the "NASTRAN bandwidth" B_N is

$$B_N = (B+1)\,k\ , \tag{2}$$

6 Cuthill, E.C., op. cit.

where k is the average number of degrees-of-freedom per grid point. This formula assumes zero NASTRAN active columns.

The profile P of the matrix A is defined as

$$P = \sum_{i=1}^{N} \theta_i \tag{3}$$

where N is the matrix order. These values are listed in 4 and 5 of the user summary. They provide some measure of the space which would be required to store the matrix A if profile storage were employed instead of band storage. Since NASTRAN does make use of active columns in its routines, the matrix profile may be of interest to some users.

The number of grid points counted by BANDIT (and listed in the user summary) includes only those points appearing on recognizable elements (Table 1). The NASTRAN GRID cards are not processed.

The number of components of a structure is the number of independent substructures, each of which has no connections with grid points of any other substructure. In the event MPC's are processed, each dependent point is eliminated from the connection table and hence becomes its own component.

The degree of a grid point (node) is defined as the number of other grid points to which it is connected. The user summary lists both the maximum nodal degree and the number of grid points of zero degree.

The variables MAXGRD and MAXDEG are the upper bounds on the number of grid points and maximum nodal degree, respectively, for a given BANDIT run. The variable KORE (given in both octal and decimal) refers to the length of blank common in words. It is included in the summary to aid the user in determining his core requirements for very large structures. (See Section V.)

If the user elects maximum printing, the printed output also includes an internal/external grid point correspondence table, three connection tables, and a set of informational messages concerning the renumbering strategy.

The correspondence table lists, for each internal number, the original grid number to which it corresponds. These internal numbers are simply the integers 1 to N for a structure containing N grid points.

The three connection tables supply connectivity information in terms of internal numbers, original grid point numbers, and renumbered numbers (new numbers assigned by the SEQGP cards). For each node label i, the connection table lists its component index, the "distance" from the first non-zero entry in row i (of the matrix) to the diagonal (θ_i), the degree of node i, and the labels of the adjacent nodes.

V. CORE REQUIREMENTS ON THE CDC COMPUTERS

For a given structure, the core requirements depend on two parameters: the number of grid points NN, and the maximum nodal degree MM.

It is not intended that the user should normally have to calculate the required core in order to use BANDIT. A field length of about 55000_8 words should be sufficient for most structures. However, to cover situations in which either NN or MM is unusually large, the user can estimate his core requirements using the algorithm briefly described here.

The length of blank common storage during any given run is denoted KORE. This space is partitioned among several arrays whose dimensions are given in terms of the variables MAXGRD and MAXDEG, which are upper bounds on NN and MM, respectively. The approximate relationship between these variables is

$$\text{KORE} = (\text{MAXGRD}/\text{K}+3)*\text{MAXDEG} + 8*\text{MAXGRD}\ , \tag{4}$$

where K, the number of integers packed per word, is given by

$$\text{K} = \begin{cases} 6 & , \text{MAXGRD} < 510 \\ 4 & , \text{MAXGRD} > 2045 \\ 5 & , \text{otherwise.} \end{cases} \tag{5}$$

In the absence of a $GRID card in the NASTRAN deck, BANDIT assigns default values to MAXGRD and MAXDEG such that MAXDEG is approximately 19. Thus, whenever the user anticipates a maximum nodal degree MM greater than 19, he must make use of the $GRID card.

Using Equation (4), structures for which KORE $< 8500_{10}$ can be run in a field length (FL) of 55000_8 words. Thus, for larger values of KORE, the user need only increase the FL accordingly.

VI. THE RENUMBERING STRATEGY

Although most of the FORTRAN coding in BANDIT is devoted to the task of developing the connection table, the heart of the program is the strategy used for renumbering. BANDIT uses the bandwidth-reduction

approach developed by E. H. Cuthill and J. M. McKee[7]. The resequencing subroutines were written during their early research in this area. Here, for completeness, we present a brief summary of the main ideas of the strategy. A complete discussion, including comparison with other methods, appears in the Cuthill-McKee paper.[7] A recent survey article by Cuthill[8] compares algorithms developed for reducing matrix bandwidth, wavefront, or profile. Extensive bibliographies appear in both these papers and hence need not be cited here.

For the purposes of this discussion, a starting node (or grid point) is one given the new label 1. The Cuthill-McKee method[7] is direct rather than iterative. It involves first the selection of one or more possible starting nodes. Although these nodes are normally of low degree, the one eventually chosen to be the starting node need not be of minimum degree.

For each possible starting node, the remaining nodes are relabeled according to the following prescription: The nodes adjacent to the starting node are labeled in sequence in the order of their increasing degree. In the terminology of graph theory, these nodes are said to be at the first level. Next, for each node of level 1 and in sequence, the numbering continues with those nodes as yet unnumbered and adjacent, in the order of their increasing degree. The set of all nodes (other than 1) adjacent to level 1 nodes thus constitute level 2. The numbering continues in this fashion, level-by-level, until all nodes have been numbered. If several nodes could receive a given label, the first node to qualify is chosen.

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7 Cuthill, E. H. and J. M. McKee, op. cit.

8 Cuthill, E. H., op. cit.

This procedure is carried out for each possible starting node previously selected. The sequence yielding the lowest bandwidth is finally chosen.

It is apparent that, in the absence of ties for a given label, the relabeling sequence is independent of the original numbering once a starting node has been selected. Thus the original nodal numbering has almost no effect on the final numbering.

A secondary criterion used by BANDIT in the renumbering is the matrix profile P. (The definitions of P and the semi-bandwidth B were given in Section IV.) The BANDIT criterion is that, of those nodal numberings which yield the lowest B, the one resulting in the lowest P is chosen. This often has a beneficial effect because NASTRAN uses active columns in matrix factoring.

Accordingly, all nodes of zero degree are numbered last. A node of zero degree occurs in BANDIT either when selected directly by the user (on $IGNORE cards) or from MPC equations, in which case the dependent nodes are "eliminated" and thus given zero degree.

A final attempt at reducing the profile still further is made by reversing the previous best numbering; i.e., the nodes labeled 1, 2,..., n are relabeled n, n-1, ...,1. As pointed out by George[9], this frequently results in a lower profile P.

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9 George, J.A., "Computer Implementation of the Finite Element Method," Ph.D. Thesis, Computer Science Department, Stanford University, 1971.

VII. DESCRIPTION OF THE CODING

The CDC 6400/6600 version of BANDIT consists of a main program, 20 FORTRAN subroutines, six FORTRAN functions, and two routines written in the COMPASS assembly language. The complete program listing is given in Appendix A.

A second version of BANDIT, listed in Appendix B, is essentially the same as the CDC version except that all aspects of the program which are unique to the CDC machines have been deleted. For example, the COMPASS routines, upon which the integer packing and variable-core features depend, and all timing routines have been removed. Thus, this version is slightly less general than the CDC version. On the other hand, the integer packing is less necessary on IBM and Univac machines whose word length is shorter than the 60-bit word length on CDC.

In this brief description of the coding for CDC machines, the differences between the two BANDIT versions are indicated, where appropriate.

The main program, called BANDIT in the CDC version, handles preliminary chores and controls some of the output printing and punching. CORSIZ is called to determine the amount of core available for blank common. GOOGAN is called to learn the user's choice of $-options and, if necessary, to right-adjust the NASTRAN bulk data deck. The partitioning of blank common is accomplished by a call from GOOGAN to GRID. BANDIT then calls NASNUM, which controls the complete processing of the NASTRAN deck as directed by the $-options chosen by the user. BANDIT's final duty is to control the listing of the NASTRAN deck, the punching of cards, and the printing of the user summary. BANDIT output was described in Section IV.

Subroutine NASNUM is the executive for the formal processing of the NASTRAN deck and is executed in its entirety only if resequencing is requested. NASNUM first reads the deck and forms the connection table IG. A temporary set of node numbers (denoted Set B) is first assigned in the order in which grid points are encountered. The user's original grid numbers constitute Set A. After all cards have been read, a permanent set of internal numbers (Set C) is assigned such that the user's original grid point numbers are arranged in ascending numerical order. If elected by the user, the connection table IG is then updated by subroutine TIGER to reflect the presence of MPC equations. Here, the new connections caused by MPC's are generated and the list of dependent grid points is saved. Then, with subroutine MORRIS, all dependent nodes and others chosen by the user on $IGNORE cards are deleted from IG. With the connection table IG now complete, the actual renumbering is performed by SCHEME, which generates a correspondence table between the Set C numbers and a new set of nodal numbers, Set D. The correspondence between the user's original numbers (Set A) and the new nodal numbers (Set D) appears on the SEQGP cards listed.

Subroutine FLIP converts an array of original grid point numbers to the internal numbers used by BANDIT. Only unique non-zero integers are retained in the list.

Subroutine GOOGAN reads a NASTRAN data deck (ID card through ENDDATA card, inclusive) and right-adjusts all bulk data. It optionally converts all cards with 8-column field widths to 16-column widths. It is used here to filter a data deck so as to retain only those cards associated with the structure geometry. Finally, it reads the user's $-option cards and sets the appropriate parameters.

Subroutine GRID sets up the dimensions of all those arrays whose lengths depend on either the number of grid points or the maximum nodal degree. The upper bounds on these two quantities are stored in MAXGRD and MAXDEG, respectively. Since the entries in the connection table IG are packed with either four, five, or six integers per word, the packing density is also determined here.

Subroutine READIT is called by GOOGAN whenever a $ card containing integer data is encountered. This routine interprets and stores in IP all positive integers on the data card. The variable NIP contains the number of integers stored in IP. A(I) contains the alphabetic representation of the character in card column I.

Subroutine BOMBIT is called whenever a fatal error is detected. This routine writes an appropriate error message onto both the output file, if necessary, and the CDC dayfile. The job is then aborted in order to suppress the execution of NASTRAN following that of BANDIT.

Subroutine SCAT is called once for each grid point appearing on a connection card. The routine supplies a fast way of determining for a grid point whether that point has been encountered before and, if so, which temporary internal number has been assigned to it. This is accomplished with the array INV(I, J), where INV(I, 1) contains an original grid number and INV(I, 2) contains the internal number assigned to it. The location I chosen for grid point N is given by

$$I = \mathrm{MOD}\ (N-1,\ KMOD) + 1\ . \tag{6}$$

If that location has previously been selected for some other point, the first available location following I is used instead. The row dimension of INV is approximately 2*MAXGRD, where MAXGRD is the upper bound on the number of grid points.

Subroutine BRIGIT is called after all connection cards have been read and the connection table is complete. Prior to the call, the internal numbers were assigned to the original grid numbers in order of their occurrence. BRIGIT performs a sort of the original numbers, assigns new sequential internal numbers, and converts the connection table IG and the array NORIG to the new set of internal numbers. Here, NORIG(I) contains the original grid point number corresponding to the internal number I.

Subroutine SORT sorts a list of length NL. The routine operates fastest on those lists not badly out of order.

Subroutine SETIG makes additions to the connection table IG. For example, if KG1 and KG2 are two connected grid points, this routine sets IG(KG1, J) = KG2 and IG(KG2, K) = KG1, for some J and K, if this connection has not already been set.

Subroutine TIGER makes additions to the connection table IG required by the presence of MPC's. The dependent grid points (those appearing first in each equation) are stored in array LIST for later removal from IG. This routine is called by NASNUM and executed only if the user elects to take the MPC's into account by inserting the card $MPC YES into the NASTRAN deck.

Subroutine SWITCH generates a new connection table IG according to a correspondence table KT which is set up prior to the call. Here KT(I) contains the new designation to be assigned to the grid number currently labeled I, i.e., KT(old) = new.

Subroutine MORRIS deletes all reference in the connection table IG to those points stored in an array LIST of length NL.

Subroutine FIXIT compresses out zeroes and multiple entries in an array LIST originally of length NL. A corrected length NL is returned

to the calling program.

Subroutine SCHEME is the executive for the actual renumbering strategy. The principal quantities required before the call are the number of nodes NN, an upper bound MM on the maximum nodal degree, and the connection table IG. IG is an NN x MM matrix such that a typical element IG(I, J) contains the label of the Jth node adjacent to node I. The node labels referred to here are the permanent (sorted) set of internal numbers assigned by BANDIT.

SCHEME first determines the degree of each node, the most prevalent nodal degree, the number of components, the maximum nodal degree, and the original bandwidth. Then, for each component, a list of starting nodes is supplied by DIAM followed by a resequencing by RELABL for each starting node. The numbering sequence yielding the lowest bandwidth and profile is eventually chosen as the new numbering sequence. The output from SCHEME includes an array ILD, where ILD(I) contains the new label corresponding to the original internal label I.

Subroutine STACK is called by SCHEME after the basic renumbering has been completed. This routine determines all points of zero degree and places them last in the numbering sequence.

Subroutine REVERS reverses the numbering of the first NN-KT grid points, where NN is the total number of grid points and KT is the number of points of zero degree. The variable KT is set in subroutine STACK prior to any calls to REVERS.

Subroutine DEGREE sets up the IDEG array containing in location I the degree of node I.

Function MODE has as its value the most prevalent nodal degree. If several degrees are equally prevalent, the lowest is chosen.

Function COMPNT has as its value the number of components stored in the array IG. This function also sets up arrays IC, in which the Ith element contains a component index for the node labeled I, and ICC, in which the Ith element contains an index indicating the starting position to be used for labels for component I. Thus, the number of elements in component I is given by

$$ICC(I+1) - ICC(I) .$$

Function MAXDGR has as its value the maximum degree of any node of component NC > 0. If the formal parameter NC ≤ 0, all components are considered.

Function MAXBND has as its value the maximum difference between node labels of connected nodes for nodes of component NC > 0. If the parameter NC ≤ 0, all components are considered and hence the bandwidth is computed. This routine also computes IH, the matrix profile.

Function MINDEG has as its value the minimum degree of any node of component NC > 0. If NC ≤ 0, all components are considered.

Subroutine DIAM determines NL starting nodes and stores the list in the array NODESL.

Subroutine RELABL generates a relabeling scheme starting with NS nodes whose labels are stored in the array NODES. Although this routine allows for multiple starting nodes, BANDIT currently considers only one starting node at a time (corresponding to NS = 1). The relabeling permutation developed by RELABL is stored in ILD and NEW. ILD(I) contains the new label for the node labeled I in the original numbering scheme. The NEW array is the inverse of ILD.

Function IDIST has as its value the maximum distance of any node in component IC(NS) from the node NS. The distance of each node in

this component is stored in the array IDIS. The maximum number of nodes at the same distance from NS is stored in ML.

The COMPASS routine PCUP has three entry points used by BANDIT: PACK, IUNPK, and ABT. The first two are for integer packing and unpacking, respectively. Since most of the BANDIT variables are integer, the CDC 60-bit word length is wasteful of available core. Thus, to reduce the overall core requirements, the connection table IG is packed with four, five, or six integers per word. For example, instead of the FORTRAN statement

```
IG(I, J) = L ,                                          (7)
```

we have

```
CALL PACK(IG, MAXGRD*(J-1)+I, NBITIN, L).               (8)
```

Similarly, instead of

```
M = IG(I, J) ,                                          (9)
```

we have

```
M = IUNPK(IG, MAXGRD*(J-1)+I, NBITIN).                  (10)
```

Here, the first three arguments refer to the function name, the location, and the number of bits per integer, respectively, and MAXGRD is the row-dimension of IG. Statements of these types appear throughout the coding of the CDC version of BANDIT.

Subroutine ABT causes an abnormal termination of BANDIT.

The other COMPASS routine, CORSIZ, provides BANDIT with its variable-core feature by interrogating the system during execution to determine the field length (FL) and the distance from the first word of blank common to the end of the FL. These values are returned to the calling program through common block /K/ .

The BANDIT listing in Appendix B was prepared for machines other than CDC machines and omits the routines written in the COMPASS assembly language. Hence this version of BANDIT has no integer packing and is a fixed-core program. Additional changes were made in BANDIT, NASNUM, GRID, and BOMBIT and given new end-punching (JJ).

The following disk files are used by this version of BANDIT: TAPE5 (input), TAPE6 (output), TAPE7 (punch), TAPE9 (scratch), TAPE11 (scratch), and TAPE8. The latter is a BCD file which, after a successful BANDIT run, contains the complete NASTRAN data deck.

The Appendix B version of BANDIT could easily be converted into a variable-core program for any machine for which an assembly language routine could be written to determine the length of blank common storage.

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APPENDIX A

LISTING OF THE CDC VERSION OF BANDIT

```
      PROGRAM BANDIT(INPUT=601,OUTPUT=601,PUNCH=161,INSERT=161,
     1 TAPE5=INPUT,TAPE6=OUTPUT,TAPE7=PUNCH,TAPE12=INSERT,
     2 TAPE8=801,TAPE9=801,TAPE11=161)
C
C                    B A N D I T
C
C MAIN PROGRAM FOR THE RENUMBERING OF NASTRAN GRID POINTS FOR
C      REDUCED BANDWIDTH.
C THE NASTRAN DATA DECK MUST CONTAIN A BEGIN BULK CARD IN ITS
C      PROPER PLACE AND TERMINATE WITH AN ENDDATA CARD.
      DIMENSION A(20)
      COMMON KOM(1000)
      COMMON /S/ NN,MM,IH,IB
      COMMON /P/ IH0,IHE
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC
      COMMON /B/ IPARAM(20),IARG(5)
      COMMON /C/ IWARN,LINE,KORIG,KNEW
      COMMON /K/ II(7),KORE,IFL
      COMMON /BITS/ NBITIN,NBITEX,IPASS
      COMMON /TIME/ STIME,NCOMP
      COMMON /NEL/ NEL,TIM2
      COMMON /DOL/ ISTART(100),IGNORE(100),IFIRST(100)
      COMMON /DOLL/ IDIM,ISTA,IIG,IFIR,IGDEG,ISCH
      COMMON /ZERO/ KT
      COMMON /NG/ NGRID,CLOCK
      INTEGER EOF
      DATA BEGI,ENDD,SEQG/4HBEGI,4HENDD,4HSEQG/
      CALL SECOND(TIM1)
      CALL REMARK(40H== N A S T R A N    --    B A N D I T ==)
      CALL DATE(DAY)
      CALL TIME(CLOCK)
C DETERMINE KORE, THE DIMENSION OF THE KOM ARRAY, AND IFL, THE FL.
      CALL CORSIZ
C SET NGRID DEFAULT.
      NGRID=KORE/12
      IF(NGRID.GT.2045) NGRID=KORE/13
C SET SCHEME DEFAULTS.
      IARG(1)=80
      IARG(2)=1
      IARG(3)=2
      IARG(4)=2
      IARG(5)=0
C SET NUMBER OF BITS PER WORD FOR INTERNAL AND EXTERNAL
C          GRID NUMBERS.
      NBITIN=12
      NBITEX=60
    7 FORMAT(1H1,16(/),
     1 36X,57HBBBBBB      AAAAA    N     N   DDDDDD    IIIIIII   TTTTTTT/
     2 36X,57HB     B    A     A   NN    N   D     D      I         T   /
     3 36X,57HB     B    A     A   N N   N   D     D      I         T   /
     4 36X,57HBBBBBBB    A     A   N  N  N   D     D      I         T   /
     5 36X,57HB     B    AAAAAAA   N   N N   D     D      I         T   /
     6 36X,57HB     B    A     A   N    NN   D     D      I         T   /
     7 36X,57HBBBBBB     A     A   N     N   DDDDDD    IIIIIII      T   )
    8 FORMAT(22(/),48X,34HTHEORY OF STRUCTURES BRANCH (1844) /
     1      46X,38HCOMPUTATION AND MATHEMATICS DEPARTMENT  /
     2      44X,42HNAVAL SHIP RESEARCH AND DEVELOPMENT CENTER /
     3  53X,24HBETHESDA, MARYLAND 20034 )
    9 FORMAT(/61X,8HCDC 6700/57X,
     +  16HREV. 10 MAR 1972 )
   10 FORMAT(20A4)
   11 FORMAT(1H ,20A4)
   12 FORMAT(1H1)
   13 FORMAT(///26H TOTAL CP TIME IN BANDIT = ,F9.3,6H  SEC.)
      LINE=55
      KNEW=0
      REWIND 8
C PRINT TITLE PAGE.
      WRITE(6,7)
      WRITE(6,8)
      WRITE(6,9)
C INITIALIZE VARIABLES.
      DO 15 J=1,20
   15 IPARAM(J)=0
      IPARAM(12)=4
      IDIM=100
      ISTA=0
      IIG=0
      ISCH=0
      IFIR=0
      IGDEG=0
      DO 18 I=1,IDIM
      ISTART(I)=0
      IFIRST(I)=0
   18 IGNORE(I)=0
      IPASS=0
      NN=0
      MM=0
      MAXGRD=0
      MAXDEG=0
      KMOD=0
      KORIG=0
      KNEW=0
      STIME=0.
      NCOMP=0
      NEL=0
      KT=0
      TIM2=0.
      REWIND 9
C READ DECK FOR FIRST TIME.
```

```
      CALL GOOGAN(1,2,5,9)                                              BANDI102
C SLICE UP CORE ACCORDING TO SUBROUTINE GRID.                           BANDI103
      K2=II(1)*II(2)+1                                                  BANDI104
      K3=K2+II(3)*2                                                     BANDI105
      K4=K3+II(4)                                                       BANDI106
      K5=K4+II(5)                                                       BANDI107
      K6=K5+II(6)                                                       BANDI108
      K7=K6+II(7)                                                       BANDI109
C PROCESS DECK.                                                         BANDI110
      CALL NASNUM(KOM(1),II(1),KOM(K2),II(3),KOM(K3),KOM(K4),KOM(K5),   BANDI111
     + KOM(K6),KOM(K7),KOM(1),KOM(K2))                                  BANDI112
C       ARRAY STARTING AT LOCATION K7 HAS DIMENSION 2*MAXDEG            BANDI113
C PROCESS OUTPUT ACCORDING TO OUTPUT REQUESTS.                          BANDI114
C CHECK IF CONNECTION CARDS IN DECK.                                    BANDI115
      IF(IPARAM(9).EQ.3)GO TO 19                                        BANDI116
      REWIND 8                                                          BANDI117
      REWIND 9                                                          BANDI118
      FLAG=ENDD                                                         BANDI119
      J=0                                                               BANDI120
      K=9                                                               BANDI121
      GO TO 20                                                          BANDI122
   19 REWIND 8                                                          BANDI123
      J=0                                                               BANDI124
      K=8                                                               BANDI125
      FLAG=ENDD                                                         BANDI126
      IF(IPARAM(5).EQ.4)GO TO 20                                        BANDI127
      K=9                                                               BANDI128
      IF(IPARAM(6).EQ.3)FLAG=BEGI                                       BANDI129
   20 READ(K,10)A                                                       BANDI130
      IF(EOF(K).NE.0)CALL BOMBIT(1)                                     BANDI131
      J=J+1                                                             BANDI132
      IF(IPARAM(10).EQ.5.AND.A(1).NE.SEQG) J=J-1                        BANDI133
      IF(MOD(J,LINE).EQ.1)WRITE(6,12)                                   BANDI134
      IF(IPARAM(10).EQ.6) WRITE(6,11) A                                 BANDI135
      IF(IPARAM(10).EQ.5.AND.A(1).EQ.SEQG) WRITE(6,11)A                 BANDI136
      IF(IPARAM(1).EQ.2)WRITE(7,10)A                                    BANDI137
      IF(IPARAM(1).EQ.1.AND.A(1).EQ.SEQG) WRITE(7,10) A                 BANDI138
      IF(K.NE.8) WRITE(8,10) A                                          BANDI139
      IF(A(1).NE.FLAG)GO TO 20                                          BANDI140
      IF(FLAG.EQ.ENDD)GO TO 25                                          BANDI141
      FLAG=ENDD                                                         BANDI142
      K=5                                                               BANDI143
      GO TO 20                                                          BANDI144
   25 CALL SECOND(TIM2)                                                 BANDI145
      TIM2=TIM2-TIM1                                                    BANDI146
      IF(IPARAM(5).EQ.3)GO TO 60                                        BANDI147
      IF(IPARAM(7).EQ.4)GO TO 60                                        BANDI148
      IF(IPARAM(9).EQ.4)GO TO 60                                        BANDI149
C USER SUMMARY.                                                         BANDI150
      WRITE(6,50) KORIG,KNEW,TIM2                                       BANDI151
   50 FORMAT(23H1***BANDIT USER SUMMARY /                               BANDI152
     1 8X,25HORIGINAL SEMI-BANDWIDTH = ,I9/                             BANDI153
     2 8X,20HNEW SEMI-BANDWIDTH = ,I14/                                 BANDI154
     3    8X,19HCP TIME IN BANDIT = ,F9.3,6H  SEC. )                    BANDI155
      WRITE(6,117) IHO,IHE                                              BANDI156
  117 FORMAT(8X,18HORIGINAL PROFILE =,I16/8X,13HNEW PROFILE =,I21)      BANDI157
      WRITE(6,104) NN                                                   BANDI158
      WRITE(6,113) NEL                                                  BANDI159
      WRITE(6,112) NCOMP                                                BANDI160
      WRITE(6,107) MM                                                   BANDI161
  107 FORMAT(8X,22HMAXIMUM NODAL DEGREE = ,I12)                         BANDI162
      WRITE(6,116) KT                                                   BANDI163
      I=IPARAM(1)                                                       BANDI164
      IF(I.EQ.1) WRITE(6,101)                                           BANDI165
      IF(I.EQ.2) WRITE(6,102)                                           BANDI166
      IF(I.EQ.3) WRITE(6,103)                                           BANDI167
  101 FORMAT(8X,34HPUNCH OUTPUT            SEQGP CARDS )                BANDI168
  102 FORMAT(8X,34HPUNCH OUTPUT              ALL CARDS )                BANDI169
  103 FORMAT(8X,34HPUNCH OUTPUT                   NONE )                BANDI170
      WRITE(6,119) IFL                                                  BANDI171
      WRITE(6,105) MAXGRD,MAXDEG                                        BANDI172
  105 FORMAT(18X,8HMAXGRD =,I11/18X,8HMAXDEG = ,I11)                    BANDI173
      WRITE(6,109) KORE,KORE                                            BANDI174
  109 FORMAT(18X,6HKORE =,I13/18X,6HKORE =,6X,O6,1HB)                   BANDI175
      WRITE(6,111) DAY,CLOCK                                            BANDI176
  111 FORMAT(8X,14HDATE AND TIME ,2A10)                                 BANDI177
C IPASS=NUMBER OF PCUP CALLS.                                           BANDI178
  104 FORMAT(8X,23HNUMBER OF GRID POINTS = ,I11)                        BANDI179
  113 FORMAT(8X,20HNUMBER OF ELEMENTS = ,I14)                           BANDI180
  112 FORMAT(8X,22HNUMBER OF COMPONENTS = ,I12)                         BANDI181
  116 FORMAT(8X,28H# OF POINTS OF ZERO DEGREE = ,I6)                    BANDI182
  119 FORMAT(8X,19HFIELD LENGTH (FL) = ,8X,O6,1HB)                      BANDI183
      GO TO 70                                                          BANDI184
   60 IF(IPARAM(10).EQ.5) WRITE(6,12)                                   BANDI185
      WRITE(6,13) TIM2                                                  BANDI186
   70 CONTINUE                                                          BANDI187
      REWIND 8                                                          BANDI188
      IF(IPARAM(8).EQ.4) STOP 5                                         BANDI190
      STOP                                                              BANDI191
      END                                                               BANDI192
      SUBROUTINE NASNUM(IG,II1,INV,II3,INT,ICC,ILD,NORIG,IP,JG,JNV)     NASNUM 2
      DIMENSION A(8),KG(40),LG(40),LINE(10),B(20),ATEMP(4)              NASNUM 3
      DIMENSION IG(II1,1),INV(II3,2),JG(1),JNV(1)                       NASNUM 4
      DIMENSION INT(1),ICC(1),ILD(1),NORIG(1),IP(1)                     NASNUM 5
C IP HAS DIMENSION 2*MAXDEG.   JG AND JNV ARE EQUIV TO IG AND INV.      NASNUM 6
      COMMON /S/ NN,MM,IH,IB                                            NASNUM 7
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC                                NASNUM 8
      COMMON /B/ IPARAM(20),IARG(5)                                     NASNUM 9
      COMMON /C/ IWARN,NLINE,KORIG,KNEW                                 NASNUM10
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 NASNUM11
```

```
      COMMON /K/ II(7),KORE                                             NASNUM12      201
      COMMON /TIME/ TIM2,NCOMP                                          NASNUM13      202
      COMMON /NEL/ NEL                                                  NASNUM14      203
      COMMON /DOL/ ISTART(100),IGNORF(100),IFIRST(100)                  NASNUM15      204
      COMMON /DOLL/ IDIM,ISTA,IIG,IFIR,IGDEG,ISCH                       NASNUM16      205
C THE VARIABLE LINE DEFINED NEAR CARD NASNUM.300 IS NOT THE             NASNUM17      206
C       SAME AS THE VARIABLE LINE APPEARING IN COMMON                   NASNUM18      207
C            IN OTHER ROUTINES.                                         NASNUM19      208
      DIMENSION TYPE(50),WYPE(50)                                       NASNUM20      209
      DIMENSION F1A(2),F10A(2),F1B(2),F10B(2)                           NASNUM21      210
      DATA BEGI,FNOD,SEQG/4HBEGI,4HENOD,4HSEQG/                         NASNUM22      211
      DATA TYPE/4HCBAR,4HCELA,4HCELA,4HCONR,4HCQDM,4HCQDP,4HCQUA,       NASNUM23      212
     1   4HCQUA,4HCQUA,4HCROD,4HCSHE,4HCTRB,4HCTRI,4HCTRI,4HCTRM,       NASNUM24      213
     2   4HCTRP,4HCTUB,4HCTWI,4HENOD,4HMPC*,4HCDAM,4HCDAM,4HCMAS,       NASNUM25      214
     3   4HCMAS,4HCVIS,4HCDAM,4HCDAM,4HCELA,4HCELA,4HCMAS,4HCMAS,       NASNUM26      215
     4   4HCCON,4HCTOR,4HCTRA,4HCTRI,4HCONM,4HCONM,4HCHTT,4HCIS3,       NASNUM27      216
     5   4HCIS3,4HCIS2,4HCIS2,4HCISH,4HCISH,4HCFLU,4HCFLU,4HCFLU,       NASNUM28      217
     6   4HCTET,4HCHEX,4HCHEX/                                          NASNUM29      218
      DATA WYPE/4H*    ,4HS1* ,4HS2* ,4HOD* ,4HEM* ,4HLT* ,4HD1* ,      NASNUM30      219
     1   4HD2* ,4HD3* ,4H*   ,4HAR* ,4HSC* ,4HA1* ,4HA2* ,4HEM* ,       NASNUM31      220
     2   4HLT* ,4HE*  ,4HST* ,4HATA ,4H    ,4HP1* ,4HP2* ,4HS1* ,       NASNUM32      221
     3   4HS2* ,4HC*  ,4HP3* ,4HP4* ,4HS3* ,4HS4* ,4HS3* ,4HS4* ,       NASNUM33      222
     4   4HEAX*,4HDRG*,4HPRG*,4HARG*,4H1*  ,4H2*  ,4HRI2*,4HD8* ,       NASNUM34      223
     5   4HD20*,4HD4* ,4HD8* ,4H8*  ,4H16* ,4HID2*,4HID3*,4HID4*,       NASNUM35      224
     6   4HRA* ,4HA1* ,4HA2* /                                          NASNUM36      225
      NTYPE=50                                                          NASNUM37      226
      REWIND 8                                                          NASNUM38      227
      REWIND 9                                                          NASNUM39      228
      NMPC=40                                                           NASNUM40      229
      KMOD=2.*FLOAT(MAXGRD)-2.2715*SQRT(1.131*FLOAT(MAXGRD))            NASNUM41      230
      NFW=0                                                             NASNUM42      231
      IWARN=0                                                           NASNUM43      232
      NEQ=0                                                             NASNUM44      233
    2 FORMAT(29H1BANDIT INFORMATION MESSAGE -                           NASNUM45      234
     +19H      NO GRID POINTS/                                          NASNUM46      235
     +28H      RESEQUENCING SUPPRESSED)                                 NASNUM47      236
    4 FORMAT(     19H ***NEW BANDWIDTH =,I6)                            NASNUM48      237
    5 FORMAT(33H1THE WRONG CARD FOLLOWS THIS CARD/1X,2A4,1P4E16.7,2A4// NASNUM49      238
     2        40H THE CONTINUATION CARD IS REQUIRED NEXT ,              NASNUM50      239
     3      36HSINCE BANDIT DOES NOT SORT THE DECK.                     NASNUM51      240
     4 13H FATAL ERROR. )                                               NASNUM52      241
    6 FORMAT(1H1)                                                       NASNUM53      242
    7 FORMAT(54H1 ONE OR MORE SEQGP CARDS ALREADY APPEAR IN DATA DECK./ NASNUM54      243
     +  55H  RESEQUENCING CANNOT BE REQUESTED.        FATAL ERROR. )    NASNUM55      244
    8 FORMAT(5HSEQGP,3X,2I8,56X)                                        NASNUM56      245
    9 FORMAT(20A4)                                                      NASNUM57      246
   10 FORMAT(2A4,4F16.0,2A4)                                            NASNUM58      247
   11 FORMAT(1H ,5(I8,I11,7X))                                          NASNUM59      248
   12 FORMAT(5HSEQGP,3X,8I8,8X)                                         NASNUM60      249
   14 FORMAT(////26H ***BANDIT WARNING MESSAGE /                        NASNUM61      250
     1 11X,35HTHE WRONG CARD MAY FOLLOW THIS CARD /                     NASNUM62      251
     2  11X,2A4,1P4E16.7,2A4/                                           NASNUM63      252
     3      11X,47HCHECK INPUT DECK TO BE SURE THAT A CONTINUATION ,    NASNUM64      253
     4  42H CARD IS NEITHER MISSING NOR OUT OF SORT.   )                NASNUM65      254
   15 FORMAT(26H TOTAL CP TIME IN SCHEME = ,F9.3,6H  SEC. )             NASNUM66      255
   19 FORMAT(1H1,5(20HINTERNAL    ORIGINAL,6X)/                         NASNUM67      256
     11H ,5(20HGPID NO.    GRID PT.,6X))                                NASNUM68      257
C RETURN IF RESEQUENCING IS NOT DESIRED.                                NASNUM69      258
      IF(IPARAM(5).EQ.3)RETURN                                          NASNUM70      259
C CHECK IF SEQGP CARDS ALREADY APPEAR IN DECK.                          NASNUM71      260
      IF(IPARAM(7).EQ.3)GO TO 22                                        NASNUM72      261
C ABORT BANDIT SINCE SEQGP CARDS ALREADY APPEAR IN DECK.                NASNUM73      262
      WRITE(6,7)                                                        NASNUM74      263
      CALL BOMBIT(3)                                                    NASNUM75      264
C READ AND EXTRACT CONNECTION CARDS FROM DECK.                          NASNUM76      265
   22 CALL GOOGAN(2,1,9,8)                                              NASNUM77      266
      REWIND 8                                                          NASNUM78      267
      REWIND 9                                                          NASNUM79      268
C INITIALIZE EXPANDABLE CORE.                                           NASNUM80      269
      DO 30 I=1,KORE                                                    NASNUM81      270
   30 JG(I)=0                                                           NASNUM82      271
C READ CARD.                                                            NASNUM83      272
   40 READ(8,10)F1A,(A(I),I=1,4),F10A                                   NASNUM84      273
C DETERMINE CARD TYPE.                                                  NASNUM85      274
   45 ITYPE=0                                                           NASNUM86      275
      DO 50 I=1,NTYPE                                                   NASNUM87      276
   50 IF(F1A(1).EQ.TYPE(I).AND.F1A(2).EQ.WYPE(I)) ITYPE=I               NASNUM88      277
      IF(ITYPE.EQ.0)GO TO 40                                            NASNUM89      278
      IF(ITYPE.EQ.19)GO TO 500                                          NASNUM90      279
      IF(ITYPE.EQ.20.AND.IPARAM(4).EQ.3)GO TO 40                        NASNUM91      280
C READ CONTINUATION TO CARD JUST READ.                                  NASNUM92      281
      READ(8,10)F1B,(A(I),I=5,8),F10B                                   NASNUM93      282
C CHECK EACH LOGICAL CARD FOR PROPER SORT.                              NASNUM94      283
      IF(F1B(1).EQ.F10A(1).AND.F1B(2).EQ.F10A(2)) GO TO 60              NASNUM95      284
C--- IF FOLLOWING CARD TYPES ARE OUT OF SORT, NO ERROR                  NASNUM96      285
      IF(ITYPE.EQ.1.OR.ITYPE.EQ.4)GO TO 56                              NASNUM97      286
      IF(ITYPE.EQ.32)GO TO 56                                           NASNUM98      287
      IF(ITYPE.EQ.33)GO TO 56                                           NASNUM99      288
      IF(ITYPE.EQ.35)GO TO 56                                           NASNU100      289
      IF(ITYPE.EQ.36)GO TO 56                                           NASNU101      290
      IF(ITYPE.EQ.37)GO TO 56                                           NASNU102      291
      IF(ITYPE.EQ.45.OR.ITYPE.EQ.46) GO TO 56                           NASNU103      292
C--- IF FOLLOWING CARD TYPES ARE OUT OF SORT, POSSIBLE ERROR (GIVE      NASNU104      293
C---            WARNING MESSAGE)                                        NASNU105      294
      IWARN=IWARN+1                                                     NASNU106      295
      IF(MOD(IWARN,6).EQ.1)WRITE(6,6)                                   NASNU107      296
      IF(ITYPE.EQ. 2) GO TO 54                                          NASNU108      297
      IF(ITYPE.EQ. 3) GO TO 54                                          NASNU109      298
      IF(ITYPE.EQ.10) GO TO 54                                          NASNU110      299
      IF(ITYPE.EQ.17) GO TO 54                                          NASNU111      300
```

```
      IF(ITYPE.GE.21.AND.ITYPE.LE.31)GO TO 54                           NASNU112
C--- FOR OTHER CARD TYPES OUT OF SORT, ABORT BANDIT                     NASNU113
   52 WRITE(6,5)F1A,(A(I),I=1,4),F10A                                   NASNU114
      CALL BOMBIT(2)                                                    NASNU115
   54 WRITE(6,14)F1A,(A(I),I=1,4),F10A                                  NASNU116
C SAVE CONTENTS OF THE SECOND CARD OF THE PAIR.                         NASNU117
   55 DO 58 I=1,4                                                       NASNU118
      ATEMP(I)=A(I+4)                                                   NASNU119
   58 A(I+4)=0.                                                         NASNU120
C INITIALIZE KG AND LG.                                                 NASNU121
   60 DO 70 I=1,NMPC                                                    NASNU122
      KG(I)=0                                                           NASNU123
   70 LG(I)=0                                                           NASNU124
      LOOP=1                                                            NASNU125
      NCON=4                                                            NASNU126
C SET UP KG AND LG.  **                                                 NASNU127
      GO TO (160,220,220,200,120,120,120,120,120,180,120,140,140,        NASNU128
     1        140,140,140,180,120,500,230,220,220,220,220,180,180,       NASNU129
     2        180,180,180,180,180,160,160,110,114,118,118,140, 80,      NASNU130
     3         85,120, 90, 80, 95,200,114,110,120, 90, 90),ITYPE        NASNU131
C* CIS3D8,CISH8                                                         NASNU132
   80 DO 81 I=1,7                                                       NASNU133
   81 KG(I)=A(I+1)+0.5                                                  NASNU134
      NCON=8                                                            NASNU135
      READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A                           NASNU136
      IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100              NASNU137
      KG(8)=A(1)+0.5                                                    NASNU138
      GO TO 250                                                         NASNU139
C* CIS3D20                                                              NASNU140
   85 DO 86 I=1,7                                                       NASNU141
   86 KG(I)=A(I+1)+0.5                                                  NASNU142
      NCON=20                                                           NASNU143
      READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A                           NASNU144
      IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100              NASNU145
      READ(8,10) F1B,A(5),A(6),A(7),A(8),F10B                           NASNU146
      IF(F1B(1).NE.F10A(1).OR.F1B(2).NE.F10A(2)) GO TO 52               NASNU147
      DO 87 I=9,15                                                      NASNU148
   87 KG(I)=A(I-7)+0.5                                                  NASNU149
      READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A                           NASNU150
      IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100              NASNU151
      READ(8,10) F1B,A(5),A(6),A(7),A(8),F10B                           NASNU152
      IF(F1B(1).NE.F10A(1).OR.F1B(2).NE.F10A(2)) GO TO 52               NASNU153
      DO 88 I=16,20                                                     NASNU154
   88 KG(I)=A(I-15)+0.5                                                 NASNU155
      GO TO 250                                                         NASNU156
C* CIS2D8,CHEXA1,CHEXA2                                                 NASNU157
   90 DO 91 I=1,6                                                       NASNU158
   91 KG(I)=A(I+2)+0.5                                                  NASNU159
      NCON=8                                                            NASNU160
      READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A                           NASNU161
      IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100              NASNU162
      DO 92 I=7,8                                                       NASNU163
   92 KG(I)=A(I-6)+0.5                                                  NASNU164
      GO TO 250                                                         NASNU165
C* CISH16                                                               NASNU166
   95 DO 96 I=1,7                                                       NASNU167
   96 KG(I)=A(I+1)+0.5                                                  NASNU168
      NCON=16                                                           NASNU169
      READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A                           NASNU170
      IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100              NASNU171
      READ(8,10) F1B,A(5),A(6),A(7),A(8),F10B                           NASNU172
      IF(F1B(1).NE.F10A(1).OR.F1B(2).NE.F10A(2)) GO TO 52               NASNU173
      DO 97 I=9,15                                                      NASNU174
   97 KG(I)=A(I-7)+0.5                                                  NASNU175
      READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A                           NASNU176
      IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100              NASNU177
      KG(16)=A(1)+0.5                                                   NASNU178
      GO TO 250                                                         NASNU179
  100 F1A(1)=F1B(1)                                                     NASNU180
      F1A(2)=F1B(2)                                                     NASNU181
       DO 101 I=1,4                                                     NASNU182
  101 A(I)=A(I+4)                                                       NASNU183
      F10A(1)=F10B(1)                                                   NASNU184
      F10A(2)=F10B(2)                                                   NASNU185
      GO TO 52                                                          NASNU186
C* CTRAPRG,CFLUID4                                                      NASNU187
  110 DO 112 I=1,4                                                      NASNU188
  112 KG(I)=A(I+1)+0.5                                                  NASNU189
      GO TO 250                                                         NASNU190
C* CTRIARG,CFLUID3                                                      NASNU191
  114 DO 116 I=1,3                                                      NASNU192
  116 KG(I)=A(I+1)+0.5                                                  NASNU193
      GO TO 250                                                         NASNU194
C* CONM1, CONM2                                                         NASNU195
  118 KG(1)=A(2)+0.5                                                    NASNU196
      KG(2)=KG(1)                                                       NASNU197
      GO TO 250                                                         NASNU198
C* CQDMEM,CQDPLT,CQUAD1,CQUAD2,CQUAD3,CSHEAR,CTWIST,CIS2D4,CTETRA       NASNU199
  120 DO 130 I=1,4                                                      NASNU200
  130 KG(I)=A(I+2)+0.5                                                  NASNU201
      GO TO 250                                                         NASNU202
C* CTRBSC, CTRIA1, CTRIA2, CTRMEM, CTRPLT, CHTTRI2                      NASNU203
  140 DO 150 I=1,3                                                      NASNU204
  150 KG(I)=A(I+2)+0.5                                                  NASNU205
      GO TO 250                                                         NASNU206
C* CBAR, CCONEAX, CTORDRG                                               NASNU207
  160 DO 170 I=1,2                                                      NASNU208
  170 KG(I)=A(I+2)+0.5                                                  NASNU209
      GO TO 250                                                         NASNU210
C* CROD, CTUBE, CVISC, CDAMP3, CDAMP4, CELAS3, CELAS4, CMASS3, CMASS4   NASNU211
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  180 DO 190 I=1,2                                                    NASNU212
      KG(I)=A(I+2)+0.5                                                NASNU213
  190 LG(I)=A(I+6)+0.5                                                NASNU214
C SET LOOP=2 SINCE 2 ELEMENTS MAY BE DEFINED ON ONE CARD.             NASNU215
      LOOP=2                                                          NASNU216
      GO TO 250                                                       NASNU217
C* CONROD,CFLUID2                                                     NASNU218
  200 DO 210 I=1,2                                                    NASNU219
  210 KG(I)=A(I+1)+0.5                                                NASNU220
      GO TO 250                                                       NASNU221
C* CELAS1, CELAS2, CDAMP1, CDAMP2, CMASS1, CMASS2                      NASNU222
  220 KG(1)=A(3)+0.5                                                  NASNU223
      KG(2)=A(5)+0.5                                                  NASNU224
      GO TO 250                                                       NASNU225
C PROCESS MPC CARDS.                                                  NASNU226
  230 NCON=NMPC                                                       NASNU227
      KG(1)=A(2)+0.5                                                  NASNU228
      KG(2)=A(5)+0.5                                                  NASNU229
      I=2                                                             NASNU230
  240 READ(8,10)F1A,(A(J),J=1,4),F10A                                 NASNU231
      IF(F10B(1).NE.F1A(1).OR.F10B(2).NE.F1A(2)) GO TO 250            NASNU232
      I=I+1                                                           NASNU233
      IF(I.GT.NMPC)GO TO 245                                          NASNU234
      F10B(1)=F10A(1)                                                 NASNU235
      F10B(2)=F10A(2)                                                 NASNU236
      KK=2                                                            NASNU237
      IF(MOD(I,2).EQ.0)KK=1                                           NASNU238
      KG(I)=A(KK)+0.5                                                 NASNU239
      GO TO 240                                                       NASNU240
  245 WRITE(6,246) NMPC                                               NASNU241
  246 FORMAT(36H1 AN MPC EQUATION CONTAINS MORE THAN,I5,8H  TERMS./   NASNU242
     +  14H  FATAL ERROR. )                                           NASNU243
      CALL BOMBIT(5)                                                  NASNU244
C PROCESS KG (AND LG IF LOOP=2) ARRAY.                                NASNU245
  250 DO 480 KK=1,LOOP                                                NASNU246
      IF(KK.EQ.1)GO TO 300                                            NASNU247
      DO 260 I=1,4                                                    NASNU248
  260 KG(I)=LG(I)                                                     NASNU249
C SCATTER SEARCH AND CONVERT KG TO TEMPORARY SET OF INTERNAL NUMBERS. NASNU250
  300 CALL SCAT(KG,NCON,NEW,INV,II3,NORIG)                            NASNU251
      IF(ITYPE.NE.20)GO TO 420                                        NASNU252
C SAVE MPC GRID POINTS FOR LATER PROCESSING BY TIGER.                 NASNU253
      NEQ=NEQ+1                                                       NASNU254
      WRITE(11)KG                                                     NASNU255
      GO TO 45                                                        NASNU256
C FILL CONNECTION TABLE ARRAY IG.                                     NASNU257
  420 IEND=NCON-1                                                     NASNU258
      NEL=NEL+1                                                       NASNU259
      DO 450 I=1,IEND                                                 NASNU260
      L=I+1                                                           NASNU261
      DO 450 J=L,NCON                                                 NASNU262
  450  CALL SETIG(KG(I),KG(J),IG,II1,NORIG)                           NASNU263
  480 CONTINUE                                                        NASNU264
      IF(F1B(1).EQ.F10A(1).AND.F1B(2).EQ.F10A(2)) GO TO 40            NASNU265
      IF(NCON.GE.8) GO TO 40                                          NASNU266
      F1A(1)=F1B(1)                                                   NASNU267
      F1A(2)=F1B(2)                                                   NASNU268
      DO 495 I=1,4                                                    NASNU269
  495 A(I)=ATEMP(I)                                                   NASNU270
      F10A(1)=F10B(1)                                                 NASNU271
      F10A(2)=F10B(2)                                                 NASNU272
      GO TO 45                                                        NASNU273
  500 NN=NEW                                                          NASNU274
      IF(NEW.GT.0) GO TO 502                                          NASNU275
      WRITE(6,2)                                                      NASNU276
      IPARAM(9)=4                                                     NASNU277
      RETURN                                                          NASNU278
  502 IF(IPARAM(4).EQ.3)GO TO 505                                     NASNU279
C MODIFY CONNECTION TABLE TO ACCOUNT FOR MPC EQUATIONS.               NASNU280
      CALL TIGER(NEQ,IG,II1,ILD,NORIG)                                NASNU281
      NDEP=NN                                                         NASNU282
      CALL FIXIT(ILD,NDEP)                                            NASNU283
C GENERATE NEW IG AND NORIG ARRAYS.                                   NASNU284
  505 CALL BRIGIT(IG,II1,INV,II3,INT,ICC,NORIG,IP)                    NASNU285
C PRINT INTERNAL/EXTERNAL CORRESPONDENCE TABLE.                       NASNU286
      LEN=50                                                          NASNU287
      IF(IPARAM(10).EQ.5) GO TO 560                                   NASNU288
      J=0                                                             NASNU289
  510 WRITE(6,19)                                                     NASNU290
  520 J=J+1                                                           NASNU291
      KEND=0                                                          NASNU292
      DO 530 K=1,9,2                                                  NASNU293
      L=J+LEN*(K-1)/2                                                 NASNU294
      LINE(K)=L                                                       NASNU295
      IF(L.GT.NEW) GO TO 550                                          NASNU296
      KEND=K+1                                                        NASNU297
  530 LINE(K+1)=NORIG(L)                                              NASNU298
  550 CONTINUE                                                        NASNU299
      IF(KEND.EQ.0)GO TO 560                                          NASNU300
      WRITE(6,11)(LINE(K),K=1,KEND)                                   NASNU301
      IF(MOD(J,LEN).NE.0)GO TO 520                                    NASNU302
      J=J+4*LEN                                                       NASNU303
      IF(J.LT.NEW) GO TO 510                                          NASNU304
  560 CONTINUE                                                        NASNU305
C CONVERT ISTART,IGNORE,IFIRST FROM ORIGINAL TO INTERNAL NUMBERS.     NASNU306
      I=ISTA+IIG+IFIR                                                 NASNU307
      IF(I.LE.0) GO TO 570                                            NASNU308
      CALL FLIP(ISTART,ISTA,INV,II3,ICC)                              NASNU309
      CALL FLIP(IGNORE,IIG ,INV,II3,ICC)                              NASNU310
      CALL FLIP(IFIRST,IFIR,INV,II3,ICC)                              NASNU311
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      IF(IPARAM(10).EQ.5) GO TO 570                                     NASNU312
C PRINT INTERNAL NUMBERS FOR $-CARDS.                                   NASNU313
      WRITE(6,561)                                                      NASNU314
  561 FORMAT(30H1    $ CARDS (INTERNAL NUMBERS) /)                      NASNU315
      IF(ISTA.GT.0) WRITE(6,562) (ISTART(I),I=1,ISTA)                   NASNU316
      IF(IIG .GT.0) WRITE(6,564) (IGNORE(I),I=1,IIG )                   NASNU317
      IF(IFIR.GT.0) WRITE(6,566) (IFIRST(I),I=1,IFIR)                   NASNU318
  562 FORMAT(9H $START  ,20I5/100(9X,20I5/))                            NASNU319
  564 FORMAT(9H $IGNORE ,20I5/100(9X,20I5/))                            NASNU320
  566 FORMAT(9H $FIRST  ,20I5/100(9X,20I5/))                            NASNU321
  570  CONTINUE                                                         NASNU322
C SET UP LIST OF POINTS TO IGNORE IN INT ARRAY.                         NASNU323
      K=0                                                               NASNU324
      IF(IPARAM(4).EQ.3) GO TO 920                                      NASNU325
      IF(NDEP.LE.0) GO TO 920                                           NASNU326
C  MPC DEPENDENT POINTS FIRST.                                          NASNU327
      DO 915 I=1,NDEP                                                   NASNU328
      J=ILD(I)                                                          NASNU329
      IF(J.LE.0) GO TO 915                                              NASNU330
      K=K+1                                                             NASNU331
      INT(K)=ICC(J)                                                     NASNU332
      IF(K.GE.MAXGRD) CALL FIXIT(INT,K)                                 NASNU333
  915 CONTINUE                                                          NASNU334
  920 IF(IGDEG.LE.0) GO TO 940                                          NASNU335
C  GRID POINTS WITH DEGREE.GT.IGDEG SECOND.                             NASNU336
      IF(IGDEG.GE.MM) GO TO 940                                         NASNU337
      CALL DEGREE(IG,II1,INV)                                           NASNU338
C HERE, INV(I)=DEGREE OF GRID POINT I                                   NASNU339
      DO 930 I=1,NN                                                     NASNU340
      IF(JNV(I).LE.IGDEG) GO TO 930                                     NASNU341
      K=K+1                                                             NASNU342
      INT(K)=I                                                          NASNU343
      IF(K.GE.MAXGRD) CALL FIXIT(INT,K)                                 NASNU344
  930 CONTINUE                                                          NASNU345
  940 IF(IIG.LE.0) GO TO 960                                            NASNU346
C  $IGNORE POINTS THIRD.                                                NASNU347
      DO 950 I=1,IIG                                                    NASNU348
      J=IGNORE(I)                                                       NASNU349
      IF(J.LE.0) GO TO 950                                              NASNU350
      K=K+1                                                             NASNU351
      INT(K)=J                                                          NASNU352
      IF(K.GE.MAXGRD) CALL FIXIT(INT,K)                                 NASNU353
  950 CONTINUE                                                          NASNU354
C K=NUMBER OF POINTS TO BE IGNORED BEFORE COMPRESSING LIST.             NASNU355
  960 IF(K.LE.0) GO TO 970                                              NASNU356
C DELETE POINTS LISTED IN INT ARRAY FROM CONNECTION TABLE IG.           NASNU357
      CALL MORRIS(INT,K,IG,II1)                                         NASNU358
  970 CONTINUE                                                          NASNU359
C RENUMBER NODES WITH SUBROUTINE SCHEME.                                NASNU360
      IF(IPARAM(10).EQ.6) IARG(5)=1                                     NASNU361
      II8=II3/2                                                         NASNU362
      CALL SECOND(TIM1)                                                 NASNU363
      CALL SCHEME(IARG(1),IARG(2),IARG(3),IARG(4),IARG(5),IG,II1,       NASNU364
     + JNV(1),JNV(II8+1),JNV(2*II8+1),JNV(3*II8+1),INT,ICC,ILD,IP)      NASNU365
      CALL SECOND(TIM2)                                                 NASNU366
      TIM2=TIM2-TIM1                                                    NASNU367
      IF(IPARAM(10).EQ.5) GO TO 580                                     NASNU368
      WRITE(6,15)TIM2                                                   NASNU369
      WRITE(6,4)I9                                                      NASNU370
C WRITE NEW NASTRAN DATA DECK.                                          NASNU371
  580 READ(9,9)B                                                        NASNU372
      WRITE(8,9)B                                                       NASNU373
      IF(B(1).NE.BEGI)GO TO 580                                         NASNU374
  590 READ(9,9)B                                                        NASNU375
      IF(B(1).GE.SEQG.OR.B(1).EQ.ENDD)GO TO 600                         NASNU376
      WRITE(8,9)B                                                       NASNU377
      GO TO 590                                                         NASNU378
C WRITE SEQGP CARDS.                                                    NASNU379
  600 KREM=MOD(NEW,4)                                                   NASNU380
      IF(NEW.GE.4) GO TO 605                                            NASNU381
      KBEG=1                                                            NASNU382
      GO TO 612                                                         NASNU383
605   IEND=NEW-KREM-3                                                   NASNU384
      DO 610 K=1,IEND,4                                                 NASNU385
      L=K+3                                                             NASNU386
  610 WRITE(8,12) (NORIG(I),ILD(I),I=K,L)                               NASNU387
      IF(KREM.EQ.0)GO TO 620                                            NASNU388
      KBEG=IEND+4                                                       NASNU389
  612 DO 615 I=KBEG,NEW                                                 NASNU390
  615 WRITE(8,8) NORIG(I),ILD(I)                                        NASNU391
C WRITE THE REMAINDER OF THE NASTRAN DECK.                              NASNU392
  620 WRITE(8,9)B                                                       NASNU393
      IF(B(1).EQ.ENDD)GO TO 700                                         NASNU394
      READ(9,9)B                                                        NASNU395
      GO TO 620                                                         NASNU396
  700 CONTINUE                                                          NASNU397
      IF(IPARAM(10).EQ.5) GO TO 900                                     NASNU398
C PRINT ORIGINAL GRID POINT CONNECTION TABLE.                           NASNU399
      MAXD=MM                                                           NASNU400
      L=MAXD/11+1                                                       NASNU401
      L=LEN/L                                                           NASNU402
705   FORMAT(10H1      GRID,5X,5H  MAX,15X,13H*CONNECTIONS*,5X,         NASNU403
     +      23H(ORIGINAL GRID NUMBERS) /5X,                             NASNU404
     +      20HPOINT COMP DIST DEGR ,11(8X,1H*) )                       NASNU405
710   FORMAT(I10,3I5,11I9/25(25X,11I9/))                                NASNU406
      DO 750 I=1,NN                                                     NASNU407
      IF(MOD(I,L).EQ.1) WRITE(6,705)                                    NASNU408
      DO 720 J=1,MAXD                                                   NASNU409
720   IP(J)=0                                                           NASNU410
C CALCULATE MOIST AND PRINT TABLE.                                      NASNU411
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      MDIST=0                                                           NASNU412
      DO 725 J=1,MAXD                                                   NASNU413
      K=IUNPK(IG,MAXGRD*(J-1)+I,NBITIN)                                 NASNU414
      IF(K.EQ.0) GO TO 725                                              NASNU415
      MDIST=MAX0(MDIST,IABS(I-K))                                       NASNU416
      IP(J)=NORIG(K)                                                    NASNU417
725   CONTINUE                                                          NASNU418
      K=NORIG(I)                                                        NASNU419
      IP1=INV(I,1)                                                      NASNU420
      IP2=INV(MAXGRD+I,1)                                               NASNU421
750   WRITE(6,710) K,IP1,MDIST,IP2,(IP(J),J=1,MAXD)                     NASNU422
C PRINT CONNECTION TABLE FOR RENUMBERED NUMBERS.                        NASNU423
      DO 780 I=1,NEW                                                    NASNU424
  780 ICC(I)=ILD(I)                                                     NASNU425
      CALL SWITCH(IG,II1,INT,ICC,IP(1),IP(MAXDEG+1))                    NASNU426
      CALL DEGREE(IG,II1,JNV(II8+1))                                    NASNU427
      L=COMPNT(IG,II1,JNV(1),JNV(II8+1),JNV(3*II8+1),ICC)               NASNU428
      L=MAXD/26+1                                                       NASNU429
      L=LEN/L                                                           NASNU430
805   FORMAT(37H1LABEL  COMP MDIST  DEGR  CONNECTIONS ,10X,             NASNU431
     +       20H(RENUMBERED) NUMBERS) )                                 NASNU432
  810 FORMAT(5I6,20I5/ 25(25X,21I5/))                                   NASNU433
      DO 850 I=1,NN                                                     NASNU434
      IF(MOD(I,L).EQ.1) WRITE(6,805)                                    NASNU435
      DO 820 J=1,MAXD                                                   NASNU436
820   IP(J)=0                                                           NASNU437
C CALCULATE MDIST AND PRINT TABLE.                                      NASNU438
      MDIST=0                                                           NASNU439
      DO 825 J=1,MAXD                                                   NASNU440
      K=IUNPK(IG,MAXGRD*(J-1)+I,NBITIN)                                 NASNU441
      IF(K.EQ.0) GO TO 825                                              NASNU442
      MDIST=MAX0(MDIST,IABS(I-K))                                       NASNU443
      IP(J)=K                                                           NASNU444
825   CONTINUE                                                          NASNU445
C INV(I,1)=IC(I)  BEFORE PACKING                                        NASNU446
C INV(MAXGRD+I,1)=IDEG(I)  BEFORE PACKING                               NASNU447
      IP1=INV(I,1)                                                      NASNU448
      IP2=INV(MAXGRD+I,1)                                               NASNU449
850   WRITE(6,810) I,IP1,MDIST,IP2,(IP(J),J=1,MAXD)                     NASNU450
900   RETURN                                                            NASNU451
      END                                                               NASNU452
      SUBROUTINE FLIP(LIST,N,INV,II3,ICC)                               FLIP   2
C CONVERT $-ARRAY LIST OF LENGTH N FROM ORIGINAL TO INTERNAL NUMBERS.   FLIP   3
      COMMON /A/ MAXGRD,MAXDEG,KMOD                                     FLIP   4
      DIMENSION LIST(1),INV(II3,2),ICC(1)                               FLIP   5
C CHECK FOR DUPLICATE AND ZERO ENTRIES AND REDUCE N IF NECESSARY.       FLIP   6
      CALL FIXIT(LIST,N)                                                FLIP   7
      IF(N.LE.0) RETURN                                                 FLIP   8
      DO 20 I=1,N                                                       FLIP   9
      J=LIST(I)                                                         FLIP  10
      IF(J.LE.0) GO TO 30                                               FLIP  11
      LOC=J-1                                                           FLIP  12
   10 LOC=MOD(LOC,KMOD)+1                                               FLIP  13
      IF(INV(LOC,1).EQ.0) GO TO 30                                      FLIP  14
      IF(INV(LOC,1).NE.J) GO TO 10                                      FLIP  15
      K=INV(LOC,2)                                                      FLIP  16
      LIST(I)=ICC(K)                                                    FLIP  17
   20 CONTINUE                                                          FLIP  18
      RETURN                                                            FLIP  19
C ABORT BANDIT DUE TO ILLEGAL GRID POINT REFERENCE ON $-CONTROL CARD.   FLIP  20
   30 WRITE(6,40) J                                                     FLIP  21
   40 FORMAT(11H1GRID POINT ,I10,30H  APPEARING ON A $ CARD IS NOT  ,   FLIP  22
     +  25H A STRUCTURAL GRID POINT.  /13H FATAL ERROR.  )              FLIP  23
      CALL BOMBIT(8)                                                    FLIP  24
      END                                                               FLIP  25
      SUBROUTINE GOOGAN(KA,KB,NIN,NOUT)                                 GOOGAN 2
C THIS ROUTINE READS A NASTRAN DATA DECK AND RIGHT-ADJUSTS ALL          GOOGAN 3
C       BULK DATA IN ITS FIELDS.                                        GOOGAN 4
C IN ADDITION, THE CALLING ARGUMENTS PROVIDE THE FOLLOWING OPTIONS -    GOOGAN 5
C       KA=1, PROCESS ALL CARDS IN THE NASTRAN DATA DECK, OR            GOOGAN 6
C         =2, PROCESS ONLY THOSE CARDS WITH A C OR G IN COLUMN 1,       GOOGAN 7
C                MPC CARDS, AND THOSE CONTINUATION CARDS WITH ALL       GOOGAN 8
C                NUMERIC FIELDS.  THE ENDDATA CARD IS WRITTEN IN ANY CASE.GOOGAN 9
C       KB = 1, CONVERT ALL 8 COLUMN FIELDS TO 16 COLUMN FIELDS, OR     GOOGAN10
C          = 2, THE FIELD WIDTHS REMAIN UNCHANGED.                      GOOGAN11
C       NIN = THE LOGICAL UNIT FROM WHICH THE INPUT DECK IS READ.       GOOGAN12
C       NOUT = THE LOGICAL UNIT ON WHICH THE OUTPUT IS WRITTEN.         GOOGAN13
C NEITHER NIN NOR NOUT ARE REWOUND IN THIS ROUTINE.                     GOOGAN14
C IF AN ASTERISK APPEARS IN FIELD 1 AFTER THE MNEMONIC, IT IS LEFT-     GOOGAN15
C       ADJUSTED AGAINST THE MNEMONIC.                                  GOOGAN16
C THE FOLLOWING TWO (2) CARDS ARE REQUIRED IN THE DATA DECK -           GOOGAN17
C       (1) A BEGIN BULK CARD TO INDICATE THE BEGINNING OF THE          GOOGAN18
C           BULK DATA DECK, AND                                         GOOGAN19
C       (2) AN ENDDATA CARD TO INDICATE THE END OF THE DATA DECK.       GOOGAN20
C ALL CARDS PRECEDING THE BEGIN BULK CARD ARE WRITTEN ON NOUT IFF KA=1. GOOGAN21
      DIMENSION ANUM(10)                                                GOOGAN22
      COMMON A(80),IP(40)                                               GOOGAN23
      COMMON IA,IB,ICARD,IFLAG,J,JNB,L,MKHOLD,MKINSR,MKNIN              GOOGAN24
      COMMON NBLANK,NFIELD,I,ICOL,IFIELD,IPROC,ITYPE                    GOOGAN25
      COMMON K,KAST,KBLK,MKI,MKJ,NCOL,NIP,NN                            GOOGAN26
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC                                GOOGAN27
      COMMON /B/ IPARAM(20),IARG(5)                                     GOOGAN28
      COMMON /DOL/ ISTART(100),IGNORE(100),IFIRST(100)                  GOOGAN29
      COMMON /DOLL/ IDIM,ISTA,IIG,IFIR,IGDEG,ISCH                       GOOGAN30
      COMMON /NG/ NGRID                                                 GOOGAN31
      REAL M,N,II,LL,JJ,KK                                              GOOGAN32
      INTEGER EOF                                                       GOOGAN33
C DATA CARDS FOR ALPHABET (ALLOWS FOR FUTURE ADDITIONS TO               GOOGAN34
C            USER OPTION LIST).                                         GOOGAN35
      DATA B,C,D,E,G,M,N,P/1HB,1HC,1HD,1HE,1HG,1HM,1HN,1HP/             GOOGAN36
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      DATA AA,II,LL,O,R/1HA,1HI,1HL,1HO,1HR/                            GOOGAN37   701
      DATA Q,S,T,U,Y/1HQ,1HS,1HT,1HU,1HY/                               GOOGAN38   702
      DATA F,H,JJ,KK/1HF,1HH,1HJ,1HK/                                   GOOGAN39   703
      DATA V,W,X,Z/1HV,1HW,1HX,1HZ/                                     GOOGAN40   704
      DATA ASTER,PLUS,BLANK,DOLLAR/1H*,1H+,1H ,1H$/                     GOOGAN41   705
      DATA ANUM/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/                GOOGAN42   706
      DATA LFLAG/0/                                                     GOOGAN43   707
      DATA IBOMB,IROM/0,0/                                              GOOGAN44   708
      LFLAG=LFLAG+1                                                     GOOGAN45   709
    9 FORMAT(1H1)                                                       GOOGAN46   710
   10 FORMAT(80A1)                                                      GOOGAN47   711
   11 FORMAT(8A1,4(8X,8A1),3H*XZ,I5/3H*XZ,I5,4(8X,8A1),8A1)             GOOGAN48   712
      ICARD=0                                                           GOOGAN49   713
      MKINSR=12                                                         GOOGAN50   714
      MKNIN=NIN                                                         GOOGAN51   715
C READ EXECUTIVE OR CASE CONTROL CARD.                                  GOOGAN52   716
   20 READ(NIN,10)A                                                     GOOGAN53   717
      IF(EOF(NIN).EQ.0)GO TO 21                                         GOOGAN54   718
      IF(NIN.EQ.MKNIN)CALL BOMBIT(1)                                    GOOGAN55   719
      MKHOLD=NIN                                                        GOOGAN56   720
      NIN=MKINSR                                                        GOOGAN57   721
      MKINSR=MKHOLD                                                     GOOGAN58   722
      GO TO 20                                                          GOOGAN59   723
   21 IFLAG=0                                                           GOOGAN60   724
      ICARD=ICARD+1                                                     GOOGAN61   725
C PROCESS OUTPUT OPTION CARD, IF PRESENT.                               GOOGAN62   726
      IF(A(1).NE.DOLLAR)GO TO 26                                        GOOGAN63   727
      IF(LFLAG.GT.1) GO TO 29                                           GOOGAN64   728
C LOOK FOR FIRST KEYWORD.                                               GOOGAN65   729
      ITYPE=0                                                           GOOGAN66   730
      IF(A(2).EQ.P.AND.A(3).EQ.U)ITYPE=1                                GOOGAN67   731
      IF(A(2).EQ.M.AND.A(3).EQ.P)ITYPE=4                                GOOGAN68   732
      IF(A(2).EQ.S.AND.A(3).EQ.E)ITYPE=5                                GOOGAN69   733
      IF(A(2).EQ.R.AND.A(3).EQ.II)ITYPE=6                               GOOGAN70   734
      IF(A(2).EQ.N.AND.A(3).EQ.AA)ITYPE=8                               GOOGAN71   735
      IF(A(2).EQ.P.AND.A(3).EQ.R)ITYPE=10                               GOOGAN72   736
      IF(A(2).EQ.S.AND.A(3).EQ.C)GO TO 1100                             GOOGAN73   737
      IF(A(2).EQ.S.AND.A(3).EQ.T) GO TO 1200                            GOOGAN74   738
      IF(A(2).EQ.D.AND.A(3).EQ.E) GO TO 1250                            GOOGAN75   739
      IF(A(2).EQ.F.AND.A(3).EQ.II) GO TO 1300                           GOOGAN76   740
      IF(A(2).EQ.II.AND.A(3).EQ.G) GO TO 1350                           GOOGAN77   741
      IF(A(2).EQ.G.AND.A(3).EQ.R) GO TO 1380                            GOOGAN78   742
      IF(A(2).EQ.AA.AND.A(3).EQ.T) ITYPE=12                             GOOGAN79   743
      IF(A(2).EQ.W.AND.A(3).EQ.AA) ITYPE=13                             GOOGAN80   744
      IF(A(2).NE.II.OR.A(3).NE.N)GO TO 1025                             GOOGAN81   745
C     INSERT CARDS FROM ALTERNATE FILE                                  GOOGAN82   746
      IPARAM(11)=1                                                      GOOGAN83   747
      MKHOLD=NIN                                                        GOOGAN84   748
      NIN=MKINSR                                                        GOOGAN85   749
      MKINSR=MKHOLD                                                     GOOGAN86   750
      DO 1021 MKI=2,80                                                  GOOGAN87   751
      MKJ=81-MKI                                                        GOOGAN88   752
 1021 A(MKJ+1)=A(MKJ)                                                   GOOGAN89   753
      IPARAM(6)=4                                                       GOOGAN90   754
 1025 IF(ITYPE.EQ.0)GO TO 26                                            GOOGAN91   755
C LOOK FOR SECOND KEYWORD.                                              GOOGAN92   756
      I=3                                                               GOOGAN93   757
   22 I=I+1                                                             GOOGAN94   758
      IF(I.GE.79)GO TO 26                                               GOOGAN95   759
      IF(A(I).NE.BLANK)GO TO 22                                         GOOGAN96   760
   24 I=I+1                                                             GOOGAN97   761
      IF(I.GE.80)GO TO 26                                               GOOGAN98   762
      IF(A(I).EQ.BLANK)GO TO 24                                         GOOGAN99   763
      J=0                                                               GOOGA100   764
      IF(A(I).EQ.S.AND.A(I+1).EQ.E)J=1                                  GOOGA101   765
      IF(A(I).EQ.AA.AND.A(I+1).EQ.LL)J=2                                GOOGA102   766
      IF(A(I).EQ.N.AND.A(I+1).EQ.O)J=3                                  GOOGA103   767
      IF(A(I).EQ.Y.AND.A(I+1).EQ.E)J=4                                  GOOGA104   768
      IF(A(I).EQ.M.AND.A(I+1).EQ.II) J=5                                GOOGA105   769
      IF(A(I).EQ.M.AND.A(I+1).EQ.AA) J=6                                GOOGA106   770
      IF(J.EQ.0)GO TO 26                                                GOOGA107   771
C SET PARAMETER.                                                        GOOGA108   772
      IPARAM(ITYPE)=J                                                   GOOGA109   773
      GO TO 26                                                          GOOGA110   774
C READ $SCHEME CARD.                                                    GOOGA111   775
 1100 CALL READIT(A,IP,NIP)                                             GOOGA112   776
      ISCH=1                                                            GOOGA113   777
      I=MIN0(NIP,5)                                                     GOOGA114   778
      IF(I.EQ.0) GO TO 29                                               GOOGA115   779
      DO 1110 J=1,I                                                     GOOGA116   780
 1110 IARG(J)=IP(J)                                                     GOOGA117   781
      GO TO 29                                                          GOOGA118   782
C READ $START CARD.                                                     GOOGA119   783
 1200 CALL READIT(A,IP,NIP)                                             GOOGA120   784
      I=ISTA                                                            GOOGA121   785
      ISTA=ISTA+NIP                                                     GOOGA122   786
      IF(ISTA.LE.IDIM) GO TO 1205                                       GOOGA123   787
      IBOM=2                                                            GOOGA124   788
      ISTA=IDIM                                                         GOOGA125   789
      GO TO 29                                                          GOOGA126   790
 1205 DO 1210 J=1,NIP                                                   GOOGA127   791
 1210 ISTART(I+J)=IP(J)                                                 GOOGA128   792
      GO TO 29                                                          GOOGA129   793
C READ $DEGREE CARD.                                                    GOOGA130   794
 1250 CALL READIT(A,IP,NIP)                                             GOOGA131   795
      IGDEG=IP(1)                                                       GOOGA132   796
      GO TO 29                                                          GOOGA133   797
C READ $FIRST CARD.                                                     GOOGA134   798
 1300 CALL READIT(A,IP,NIP)                                             GOOGA135   799
      I=IFIR                                                            GOOGA136   800
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      IFIR=IFIR+NIP                                                     GOOGA137
      IF(IFIR.LE.IDIM) GO TO 1308                                       GOOGA138
      IBOM=2                                                            GOOGA139
      IFIR=IDIM                                                         GOOGA140
      GO TO 29                                                          GOOGA141
 1308 DO 1310 J=1,NIP                                                   GOOGA142
 1310 IFIRST(I+J)=IP(J)                                                 GOOGA143
      GO TO 29                                                          GOOGA144
C READ $IGNORE CARD.                                                    GOOGA145
 1350 CALL READIT(A,IP,NIP)                                             GOOGA146
      I=IIG                                                             GOOGA147
      IIG=IIG+NIP                                                       GOOGA148
      IF(IIG.LE.IDIM) GO TO 1360                                        GOOGA149
      IBOM=2                                                            GOOGA150
      IIG=IDIM                                                          GOOGA151
      GO TO 29                                                          GOOGA152
 1360 DO 1365 J=1,NIP                                                   GOOGA153
 1365 IGNORE(I+J)=IP(J)                                                 GOOGA154
      GO TO 29                                                          GOOGA155
C READ $GRID CARD.                                                      GOOGA156
 1380 CALL READIT(A,IP,NIP)                                             GOOGA157
      NGRID=IP(1)                                                       GOOGA158
      GO TO 29                                                          GOOGA159
C LOOK FOR BEGIN BULK CARD.                                             GOOGA160
   26 I=0                                                               GOOGA161
   27 I=I+1                                                             GOOGA162
      IF(I.GT.75)GO TO 29                                               GOOGA163
      IF(A(I).EQ.BLANK)GO TO 27                                         GOOGA164
      IF(A(I).NE.B)GO TO 29                                             GOOGA165
      IF(A(I+1).NE.E)GO TO 29                                           GOOGA166
      IF(A(I+2).NE.G)GO TO 29                                           GOOGA167
      IF(A(I+3).NE.II)GO TO 29                                          GOOGA168
      IFLAG=1                                                           GOOGA169
C LEFT-ADJUST BEGIN BULK CARD.                                          GOOGA170
      K=73-I                                                            GOOGA171
      DO 28 J=1,72                                                      GOOGA172
      IF(J.LE.K)A(J)=A(J+I-1)                                           GOOGA173
   28 IF(J.GT.K)A(J)=BLANK                                              GOOGA174
      IF(LFLAG.GT.1) GO TO 29                                           GOOGA175
C REJECT ILLEGAL PARAMETERS AND SET TO DEFAULTS.                        GOOGA176
      IF(IPARAM(1).NE.2.AND.IPARAM(1).NE.3) IPARAM(1)=1                 GOOGA177
      DO 1450 I=2,9                                                     GOOGA178
 1450 IF(IPARAM(I).NE.4) IPARAM(I)=3                                    GOOGA179
      IF(IPARAM(10).NE.6) IPARAM(10)=5                                  GOOGA180
      IF(IPARAM(12).NE.3) IPARAM(12)=4                                  GOOGA181
      IF(IPARAM(13).NE.4) IPARAM(13)=3                                  GOOGA182
      CALL GRID(NGRID)                                                  GOOGA183
      I=ISTA+IIG+IFIR+ISCH+IGDEG                                        GOOGA184
      IF(I.LE.0) GO TO 29                                               GOOGA185
C CHECK FOR ILLEGAL SCHEME ARGUMENTS.                                   GOOGA186
      DO 1460 I=1,3                                                     GOOGA187
 1460 IF(IARG(I).LT.1.OR.IARG(I).GT.MAXGRD) IBOMB=1                     GOOGA188
      IF(IARG(4).LT.2.OR.IARG(4).GT.3) IBOMB=1                          GOOGA189
      IF(IARG(5).LT.0.OR.IARG(5).GT.1) IBOMB=1                          GOOGA190
      WRITE(6,9)                                                        GOOGA191
      IF(ISCH.GT.0) WRITE(6,1500) (IARG(I),I=1,5)                       GOOGA192
 1500 FORMAT(//,9H $SCHEME ,10I10/200(9X,10I10/))                       GOOGA193
      IF(ISTA.GT.0) WRITE(6,1505) (ISTART(I),I=1,ISTA)                  GOOGA194
 1505 FORMAT(//,9H $START  ,10I10/200(9X,10I10/))                       GOOGA195
      IF(IGDEG.GT.0) WRITE(6,1510) IGDEG                                GOOGA196
 1510 FORMAT(//,9H $DEGREE ,10I10/200(9X,10I10/))                       GOOGA197
      IF(IFIR.GT.0) WRITE(6,1515) (IFIRST(I),I=1,IFIR)                  GOOGA198
 1515 FORMAT(//,9H $FIRST  ,10I10/200(9X,10I10/))                       GOOGA199
      IF(IIG.GT.0) WRITE(6,1520) (IGNORE(I),I=1,IIG)                    GOOGA200
 1520 FORMAT(//,9H $IGNORE ,10I10/200(9X,10I10/))                       GOOGA201
      IF(IBOMB.EQ.1) CALL BOMBIT(4)                                     GOOGA202
      IF(IBOM.EQ.2) CALL BOMBIT(9)                                      GOOGA203
   29 IF(KA.EQ.1)WRITE(NOUT,10)A                                        GOOGA204
      IF(IFLAG.EQ.0)GO TO 20                                            GOOGA205
C RETURN IF RIGHT-ADJUSTING OF CARDS IS NOT NEEDED.                     GOOGA206
      IF(IPARAM(5).EQ.3.AND.IPARAM(6).EQ.3)RETURN                       GOOGA207
C READ BULK DATA CARD.                                                  GOOGA208
   30 READ(NIN,10)A                                                     GOOGA209
      IF(EOF(NIN).EQ.0)GO TO 31                                         GOOGA210
      IF(NIN.EQ.MKNIN) CALL BOMBIT(1)                                   GOOGA211
C     SWITCH INPUT FILES                                                GOOGA212
      MKHOLD=NIN                                                        GOOGA213
      NIN=MKINSR                                                        GOOGA214
      MKINSR=MKHOLD                                                     GOOGA215
      GO TO 30                                                          GOOGA216
   31 ICARD=ICARD+1                                                     GOOGA217
C LEFT-ADJUST FIRST FIELD.                                              GOOGA218
      DO 1600 I=1,8                                                     GOOGA219
      IF(A(I).NE.BLANK)  GO TO 1610                                     GOOGA220
 1600 CONTINUE                                                          GOOGA221
      GO TO 30                                                          GOOGA222
 1610 IF(I.EQ.1) GO TO 1650                                             GOOGA223
      J=I-1                                                             GOOGA224
      K=8-J                                                             GOOGA225
      DO 1620 I=1,K                                                     GOOGA226
      A(I)=A(I+J)                                                       GOOGA227
 1620 A(I+J)=BLANK                                                      GOOGA228
 1650 CONTINUE                                                          GOOGA229
C LOOK FOR SEQGP CARD.                                                  GOOGA230
      IF(A(1).EQ.S.AND.A(2).EQ.E.AND.A(3).EQ.Q.AND.A(4).EQ.G)IPARAM(7)=4GOOGA231
C LOOK FOR COMMENT CARD.                                                GOOGA232
      IF(A(1).EQ.DOLLAR.AND.KA.EQ.1)GO TO 35                            GOOGA233
C LOOK FOR ENDDATA CARD.                                                GOOGA234
      I=0                                                               GOOGA235
   32 I=I+1                                                             GOOGA236
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      IF(I.GT.75)GO TO 35                                               GOOGA237
      IF(A(I).EQ.BLANK)GO TO 32                                         GOOGA238
      IF(A(I).NE.E)GO TO 40                                             GOOGA239
      IF(A(I+1).NE.N)GO TO 40                                           GOOGA240
      IF(A(I+2).NE.D)GO TO 40                                           GOOGA241
      IF(A(I+3).NE.D)GO TO 40                                           GOOGA242
C LEFT-ADJUST ENDDATA CARD.                                             GOOGA243
      K=73-I                                                            GOOGA244
      DO 33 J=1,72                                                      GOOGA245
      IF(J.LE.K)A(J)=A(J+I-1)                                           GOOGA246
   33 IF(J.GT.K)A(J)=BLANK                                              GOOGA247
      WRITE(NOUT,10)A                                                   GOOGA248
      RETURN                                                            GOOGA249
   35 WRITE(NOUT,10)A                                                   GOOGA250
      GO TO 30                                                          GOOGA251
C DETERMINE IF CARD IS TO BE PROCESSED.                                 GOOGA252
   40 IF(KA.EQ.1)GO TO 150                                              GOOGA253
      IF(A(1).EQ.C.OR.A(1).EQ.G)GO TO 150                               GOOGA254
      IF(A(1).EQ.M.AND.A(2).EQ.P)GO TO 150                              GOOGA255
      NCOL=8                                                            GOOGA256
      IF(A(1).EQ.ASTER)GO TO 50                                         GOOGA257
      IF(A(1).EQ.PLUS)GO TO 60                                          GOOGA258
      GO TO 30                                                          GOOGA259
   50 NCOL=16                                                           GOOGA260
   60 NFIELD=64/NCOL                                                    GOOGA261
      I=0                                                               GOOGA262
   70 I=I+1                                                             GOOGA263
      IF(I.GT.NFIELD)GO TO 150                                          GOOGA264
      IPROC=0                                                           GOOGA265
      IFLAG=0                                                           GOOGA266
      J=0                                                               GOOGA267
   80 J=J+1                                                             GOOGA268
      IF(IPROC.EQ.1)GO TO 70                                            GOOGA269
      IF(J.LE.NCOL)GO TO 90                                             GOOGA270
      IF(IFLAG.EQ.1)GO TO 30                                            GOOGA271
      GO TO 70                                                          GOOGA272
   90 ICOL=8+NCOL*(I-1)+J                                               GOOGA273
      IF(A(ICOL).EQ.BLANK)GO TO 80                                      GOOGA274
      IFLAG=1                                                           GOOGA275
      DO 100 L=1,10                                                     GOOGA276
  100 IF(A(ICOL).EQ.ANUM(L))IPROC=1                                     GOOGA277
      GO TO 80                                                          GOOGA278
C PROCESS FIRST FIELD.                                                  GOOGA279
  150 NCOL=8                                                            GOOGA280
      KAST=8                                                            GOOGA281
      KBLK=8                                                            GOOGA282
      DO 160 I=1,8                                                      GOOGA283
      IF(A(I).NE.BLANK.AND.A(I).NE.ASTER.AND.A(I+1).EQ.BLANK)KBLK=I+1   GOOGA284
      IF(A(I).EQ.ASTER)KAST=I                                           GOOGA285
  160 IF(A(I).EQ.ASTER)NCOL=16                                          GOOGA286
      IF(A(1).EQ.PLUS)NCOL=8                                            GOOGA287
      IF(NCOL.EQ.16)GO TO 170                                           GOOGA288
      IF(KB.EQ.2)GO TO 200                                              GOOGA289
      IF(A(1).NE.PLUS)A(KBLK)=ASTER                                     GOOGA290
      IF(A(1).EQ.PLUS)A(1)=ASTER                                        GOOGA291
      GO TO 200                                                         GOOGA292
  170 IF(A(1).EQ.ASTER)GO TO 200                                        GOOGA293
      IA=MIN0(KAST,KBLK)                                                GOOGA294
      IB=MAX0(KAST,KBLK)                                                GOOGA295
      A(IB)=BLANK                                                       GOOGA296
      A(IA)=ASTER                                                       GOOGA297
C RIGHT-ADJUST ALL BULK DATA WHICH IS TO BE PROCESSED.                  GOOGA298
  200 NFIELD=64/NCOL                                                    GOOGA299
      IFIELD=0                                                          GOOGA300
  210 IFIELD=IFIELD+1                                                   GOOGA301
      IF(IFIELD.GT.NFIELD)GO TO 300                                     GOOGA302
      I=0                                                               GOOGA303
  220 I=I+1                                                             GOOGA304
      IF(I.GT.NCOL)GO TO 210                                            GOOGA305
      ICOL=9+NCOL*IFIELD-I                                              GOOGA306
      IF(A(ICOL).EQ.BLANK)GO TO 220                                     GOOGA307
      NBLANK=I-1                                                        GOOGA308
      NN=NCOL-NBLANK                                                    GOOGA309
      DO 230 I=1,NCOL                                                   GOOGA310
      J=9+NCOL*IFIELD-I                                                 GOOGA311
      JNB=J-NBLANK                                                      GOOGA312
      IF(I.LE.NN)A(J)=A(JNB)                                            GOOGA313
      IF(I.GT.NN)A(J)=BLANK                                             GOOGA314
  230 CONTINUE                                                          GOOGA315
      GO TO 210                                                         GOOGA316
C WRITE NEW CARD.                                                       GOOGA317
  300 IF(KB.EQ.1) A(73)=ASTER                                           GOOGA318
      IF(NCOL.EQ.8.AND.KB.EQ.1)GO TO 310                                GOOGA319
      WRITE(NOUT,10)A                                                   GOOGA320
      GO TO 30                                                          GOOGA321
  310 WRITE(NOUT,11)(A(I),I=1,40),ICARD,ICARD,(A(I),I=41,80)            GOOGA322
      GO TO 30                                                          GOOGA323
      END                                                               GOOGA324
      SUBROUTINE GRID(NGRID)                                            GRID   2
C PARTITION EXPANDABLE CORE.                                            GRID   3
      COMMON /BITS/ NBITIN,NBITEX                                       GRID   4
      COMMON /A/ MAXGRD,MAXDEG                                          GRID   5
      COMMON /K/ II(7),KOR                                              GRID   6
      MAX=16384                                                         GRID   7
      N=NGRID                                                           GRID   8
      IF(N.GT.2045) NBITIN=15                                           GRID   9
      IF(N.LE.510) NBITIN=10                                            GRID  10
      IF(N.LT.100) N=100                                                GRID  11
      IF(N.GT.MAX) GO TO 40                                             GRID  12
C CALCULATE WIDTH II(2) OF IG MATRIX.                                   GRID  13
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20    L=60/NBITIN                                                       GRID  14        1001
      M=60/NBITEX                                                       GRID  15        1002
      N=N+L*M-1                                                         GRID  16        1003
      N=N-MOD(N,L*M)                                                    GRID  17        1004
      MAXGRO=N                                                          GRID  18        1005
C  I=PACKED LENGTH FOR INTERNAL NUMBER.                                 GRID  19        1006
C  J=PACKED LENGTH FOR ORIGINAL NUMBER.                                 GRID  20        1007
      I=N/L                                                             GRID  21        1008
      J=N/M                                                             GRID  22        1009
C SET UP DIMENSIONS IN II ARRAY, WHERE IG(II1,II2),INV(II3,2),          GRID  23        1010
C   INT(II4),ICC(II5),ILD(II6),NORIG(II7)                                GRID  24        1011
      II(1)=I                                                           GRID  25        1012
      II(3)=2*J                                                         GRID  26        1013
      II(4)=J                                                           GRID  27        1014
      II(5)=J                                                           GRID  28        1015
      II(6)=J                                                           GRID  29        1016
      II(7)=J                                                           GRID  30        1017
      I=2*II(3)+II(4)+II(5)+II(6)+II(7)                                 GRID  31        1018
      II(2)=(KOR-I)/(II(1)+2)                                           GRID  32        1019
C DENOMINATOR CONTAINS A 2 TO ALLOW FOR 2 SCRATCH ARRAYS, EACH OF       GRID  33        1020
C          LENGTH MAXDEG.                                               GRID  34        1021
      II(2)=MIN0(II(2),N-1)                                             GRID  35        1022
      MAXDEG=II(2)                                                      GRID  36        1023
      RETURN                                                            GRID  37        1024
C SUBSTITUTE MAX IF NGRID TOO LARGE.                                    GRID  38        1025
40    N=MAX                                                             GRID  39        1026
      WRITE(6,50) NGRID,N                                               GRID  40        1027
   50 FORMAT(23H1BANDIT WARNING MESSAGE/10X,6H$GRID ,I10,5X,            GRID  41        1028
     +      9HTOO LARGE /10X,6H$GRID ,I10,5X,12HSUBSTITUTED. )          GRID  42        1029
      GO TO 20                                                          GRID  43        1030
      END                                                               GRID  44        1031
      SUBROUTINE READIT(A,IP,NIP)                                       READIT 2        1032
C THIS ROUTINE READS AND STORES (IN IP) NUMERIC DATA APPEARING ON       READIT 3        1033
C    $-CONTROL CARDS UP TO COLUMN 72.                                   READIT 4        1034
      DIMENSION ANUM(10)                                                READIT 5        1035
      DIMENSION A(1),IP(1)                                              READIT 6        1036
      DATA ANUM/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/                READIT 7        1037
C INITIALIZE ARRAY.                                                     READIT 8        1038
      NIP=0                                                             READIT 9        1039
      DO 10 I=1,40                                                      READIT10        1040
   10 IP(I)=0                                                           READIT11        1041
      I=3                                                               READIT12        1042
      DO 70 KOUNT=1,40                                                  READIT13        1043
      NUM=0                                                             READIT14        1044
      NUMFL=0                                                           READIT15        1045
   20 I=I+1                                                             READIT16        1046
      IF(I.LE.72) GO TO 30                                              READIT17        1047
      IF(NUMFL.EQ.1) GO TO 60                                           READIT18        1048
      RETURN                                                            READIT19        1049
   30 K=99                                                              READIT20        1050
      DO 40 J=1,10                                                      READIT21        1051
   40 IF(A(I).EQ.ANUM(J)) K=J-1                                         READIT22        1052
      IF(K.NE.99) GO TO 50                                              READIT23        1053
      IF(NUMFL) 60,20,60                                                READIT24        1054
   50 NUMFL=1                                                           READIT25        1055
      NUM=10*NUM+K                                                      READIT26        1056
      GO TO 20                                                          READIT27        1057
   60 NIP=KOUNT                                                         READIT28        1058
      IP(NIP)=NUM                                                       READIT29        1059
   70 CONTINUE                                                          READIT30        1060
      NIP=40                                                            READIT31        1061
      RETURN                                                            READIT32        1062
      END                                                               READIT33        1063
      SUBROUTINE BOMBIT(IERR)                                           BOMBIT 2        1064
C BOMB BANDIT TO SUPPRESS THE EXECUTION OF NASTRAN.                     BOMBIT 3        1065
      COMMON /B/ IPARAM(20)                                             BOMBIT 4        1066
      COMMON /K/ II(7),KORE,IFL                                         BOMBIT 5        1067
    3 FORMAT(*-CURRENT FIELD LENGTH (FL) =  *,O6,*B*/                   BOMBIT 6        1068
     + * THIS BANDIT JOB MAY REQUIRE A LARGER FIELD LENGTH (FL)*/       BOMBIT 7        1069
     + *-THEREFORE, MAKE THE FOLLOWING CHANGES*/                        BOMBIT 8        1070
     + *       1.  INCREASE THE FL*/                                    BOMBIT 9        1071
     + *       2.  INSERT A NOREDUCE. CARD IMMEDIATELY BEFORE THE *,    BOMBIT10        1072
     + *BANDIT. CARD*/                                                  BOMBIT11        1073
     + *       3.  INSERT A $GRID N CARD SOMEWHERE BEFORE THE BEGIN*,   BOMBIT12        1074
     + * BULK CARD, WHERE THE INTEGER N IS AN UPPER BOUND (PREFERABLY*/ BOMBIT13        1075
     + *            LEAST UPPER BOUND) ON THE NUMBER OF GRID POINTS*)   BOMBIT14        1076
    5 FORMAT(200(1H+,130X/))                                            BOMBIT15        1077
      CALL REMARK(40H   ************************************ )         BOMBIT16        1078
      GO TO (10,20,30,40,50,60,70,80,90), IERR                          BOMBIT17        1079
  EOF ENCOUNTERED.                                                      BOMBIT18        1080
   10 WRITE(6,12)                                                       BOMBIT19        1081
   12 FORMAT(55H1BANDIT FATAL ERROR -     MISSING BEGIN BULK OR ENDDATA,BOMBIT20        1082
     +    6H CARD. )                                                    BOMBIT21        1083
      CALL REMARK(39H   **MISSING BEGIN BULK OR ENDDATA CARD )          BOMBIT22        1084
      GO TO 500                                                         BOMBIT23        1085
C BULK DATA CARD OUT OF SORT.                                           BOMBIT24        1086
   20 CALL REMARK(31H   **BULK DATA CARD OUT OF SORT )                  BOMBIT25        1087
      GO TO 500                                                         BOMBIT26        1088
C SEQGP CARDS IN DECK AND RESEQUENCING REQUESTED.                       BOMBIT27        1089
   30 CALL REMARK(32H   **SEQGP CARDS ALREADY IN DECK )                 BOMBIT28        1090
      GO TO 500                                                         BOMBIT29        1091
C $SCHEME ILLEGAL ARGUMENTS.                                            BOMBIT30        1092
   40 WRITE(6,42)                                                       BOMBIT31        1093
   42 FORMAT(46H1BANDIT FATAL ERROR -     ILLEGAL ARGUMENTS ON,         BOMBIT32        1094
     +   14H $SCHEME CARD. )                                            BOMBIT33        1095
      CALL REMARK(30H   **ILLEGAL $SCHEME ARGUMENTS )                   BOMBIT34        1096
      GO TO 500                                                         BOMBIT35        1097
C  TOO MANY TERMS IN MPC EQUATION.                                      BOMBIT36        1098
   50 CALL REMARK(36H   **MPC EQUATION HAS TOO MANY TERMS )             BOMBIT37        1099
      GO TO 500                                                         BOMBIT38        1100
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C MAXDEG EXCEEDED.                                                      BOMBIT39
   60 CALL REMARK(28H    **MAXIMUM DEGREE EXCEEDED )                    BOMBIT40
      WRITE(6,3) IFL                                                    BOMBIT41
      GO TO 500                                                         BOMBIT42
C MAXGRD EXCEEDED.                                                      BOMBIT43
   70 CALL REMARK(39H    **MAX NUMBER OF GRID POINTS EXCEEDED )         BOMBIT44
      WRITE(6,3) IFL                                                    BOMBIT45
      GO TO 500                                                         BOMBIT46
C NON-EXISTENT GRID POINT REFERENCE ON $-CARD                           BOMBIT47
   80 CALL REMARK(32H    **ILLEGAL REFERENCE ON $-CARD )                BOMBIT48
      GO TO 500                                                         BOMBIT49
C TOO MANY GRID POINTS ON $-CARD.                                       BOMBIT50
   90 WRITE(6,92)                                                       BOMBIT51
   92 FORMAT(51H1BANDIT FATAL ERROR -      TOO MANY POINTS ON $-CARD)   BOMBIT52
      CALL REMARK(30H    **TOO MANY POINTS ON $-CARD )                 BOMBIT53
      GO TO 500                                                         BOMBIT54
C ABORT BANDIT.                                                         BOMBIT55
  500 CALL REMARK(17H    **BANDIT ABORT )                               BOMBIT56
      CALL REMARK(23H    **NASTRAN SUPPRESSED )                         BOMBIT57
      CALL REMARK(40H    ************************************ )         BOMBIT58
      WRITE(6,5)                                                        BOMBIT59
      CALL ABT                                                          BOMBIT65
      STOP                                                              BOMBIT66
      END                                                               BOMBIT67
      SUBROUTINE SCAT(KG,NCON,NEW,INV,II3,NORIG)                        SCAT   2
C THIS ROUTINE USES SCATTER SORT TECHNIQUES FOR EACH GRID POINT         SCAT   3
C          ENCOUNTERED TO DETERMINE WHETHER OR NOT THE POINT HAS        SCAT   4
C          BEEN SEEN BEFORE.  IF NOT, INV, NORIG, AND NEW ARE UPDATED.  SCAT   5
C INV(I,1) CONTAINS AN ORIGINAL GRID POINT NUMBER                       SCAT   6
C INV(I,2) CONTAINS THE INTERNAL NUMBER ASSIGNED TO IT (BEFORE SORTING) SCAT   7
      DIMENSION INV(II3,2),NORIG(1)                                     SCAT   8
      COMMON /A/ MAXGRD,MAXDEG,KMOD                                     SCAT   9
      DIMENSION KG(1)                                                   SCAT  10
      DO 100 I=1,NCON                                                   SCAT  11
      NOLD=KG(I)                                                        SCAT  12
      IF(NOLD.EQ.0)GO TO 100                                            SCAT  13
      LOC=NOLD-1                                                        SCAT  14
   10 LOC=MOD(LOC,KMOD)+1                                               SCAT  15
20    IF(INV(LOC,1).NE.0) GO TO 30                                      SCAT  16
      INV(LOC,1)=NOLD                                                   SCAT  17
      NEW=NEW+1                                                         SCAT  18
      IF(NEW.GT.MAXGRD) GO TO 150                                       SCAT  19
      NORIG(NEW)=NOLD                                                   SCAT  20
      INV(LOC,2)=NEW                                                    SCAT  21
      GO TO 40                                                          SCAT  22
30    IF(INV(LOC,1).NE.NOLD) GO TO 10                                   SCAT  23
40    KG(I)=INV(LOC,2)                                                  SCAT  24
  100 CONTINUE                                                          SCAT  25
      RETURN                                                            SCAT  26
  150 WRITE(6,160) MAXGRD                                               SCAT  27
  160 FORMAT(35H1 THIS STRUCTURE CONTAINS MORE THAN,I6,                 SCAT  28
     + 14H  GRID POINTS. /14H  FATAL ERROR. )                           SCAT  29
      CALL BOMBIT(7)                                                    SCAT  30
      END                                                               SCAT  31
      SUBROUTINE BRIGIT(IG,II1,INV,II3,INT,ICC,NORIG,IP)                BRIGIT 2
C THIS ROUTINE GENERATES A NEW INTERNAL/EXTERNAL CORRESPONDENCE         BRIGIT 3
C       TABLE NORIG AND CONNECTION TABLE IG SUCH THAT THE NEW INTERNAL  BRIGIT 4
C       NUMBERS CORRESPOND TO A SORT OF THE ORIGINAL NUMBERS INTO       BRIGIT 5
C       ASCENDING ORDER.                                                BRIGIT 6
C INPUT - IG,INV,NORIG                                                  BRIGIT 7
C OUTPUT - IG,NORIG,ICC                                                 BRIGIT 8
C SCRATCH - INT,IP                                                      BRIGIT 9
      DIMENSION IG(II1,1),INV(II3,2)                                    BRIGIT10
      DIMENSION INT(1),ICC(1),NORIG(1),IP(1)                            BRIGIT11
      COMMON /S/ NN,MM,IH,IB                                            BRIGIT12
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC                                BRIGIT13
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 BRIGIT14
      REWIND 8                                                          BRIGIT15
C PERFORM A ROUGH SORT OF THE ORIGINAL GRID NUMBERS.                    BRIGIT16
      L=0                                                               BRIGIT17
      KFAC=-1                                                           BRIGIT18
   20 KFAC=KFAC+1                                                       BRIGIT19
      MIN=2147483647                                                    BRIGIT20
      DO 50 I=1,KMOD                                                    BRIGIT21
      IF(INV(I,1).GT.(KFAC*KMOD))                                       BRIGIT22
     +       MIN=MIN0(MIN,INV(I,1))                                     BRIGIT23
   50 CONTINUE                                                          BRIGIT24
      KFAC=(MIN-1)/KMOD                                                 BRIGIT25
      DO 80 I=1,KMOD                                                    BRIGIT26
      IS=INV(I,1)                                                       BRIGIT27
      IF(IS.LE.(KFAC*KMOD).OR.IS.GT.(KFAC+1)*KMOD)GO TO 80              BRIGIT28
      L=L+1                                                             BRIGIT29
      INT(L)=INV(I,1)                                                   BRIGIT30
   80 CONTINUE                                                          BRIGIT31
      IF(L.LT.NN)GO TO 20                                               BRIGIT32
C COMPLETE THE SORTING OF THE ORIGINAL GRID NUMBERS.                    BRIGIT33
      CALL SORT(INT,NN)                                                 BRIGIT34
C DETERMINE CORRESPONDENCE (ICC) BETWEEN NORIG AND INT ARRAYS.          BRIGIT35
      DO 130 I=1,NN                                                     BRIGIT36
      L=INT(I)                                                          BRIGIT37
      LOC=L-1                                                           BRIGIT38
  110 LOC=MOD(LOC,KMOD)+1                                               BRIGIT39
120   IF(INV(LOC,1).NE.L) GO TO 110                                     BRIGIT40
      M=INV(LOC,2)                                                      BRIGIT41
      ICC(M)=I                                                          BRIGIT42
  130 CONTINUE                                                          BRIGIT43
C TRANSFER INT ARRAY TO NORIG ARRAY.                                    BRIGIT44
      DO 220 I=1,NN                                                     BRIGIT45
  220 NORIG(I)=INT(I)                                                   BRIGIT46
C CHANGE IG MATRIX ACCORDING TO CORRESPONDENCE TABLE ICC.               BRIGIT47
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      CALL SWITCH(IG,II1,INT,ICC,IP(1),IP(MAXDEG+1))                    BRIGIT48
      REWIND 8                                                          BRIGIT49
      RETURN                                                            BRIGIT50
      END                                                               BRIGIT51
      SUBROUTINE SORT(LIST,NL)                                          SORT   2
C THIS SUBROUTINE SORTS A LIST OF LENGTH NL AND IS BIASED TOWARDS THOSE SORT   3
C   LISTS NOT BADLY OUT OF SORT.                                        SORT   4
      DIMENSION LIST(1)                                                 SORT   5
      IF(NL.LE.1) RETURN                                                SORT   6
      NL1=NL-1                                                          SORT   7
      DO 20 I=1,NL1                                                     SORT   8
      K=NL-I                                                            SORT   9
      KFLAG=0                                                           SORT  10
      DO 10 J=1,K                                                       SORT  11
      IF(LIST(J).LE.LIST(J+1)) GO TO 10                                 SORT  12
      KFLAG=1                                                           SORT  13
      L=LIST(J)                                                         SORT  14
      LIST(J)=LIST(J+1)                                                 SORT  15
      LIST(J+1)=L                                                       SORT  16
   10 CONTINUE                                                          SORT  17
      IF(KFLAG.EQ.0) RETURN                                             SORT  18
   20 CONTINUE                                                          SORT  19
      RETURN                                                            SORT  20
      END                                                               SORT  21
      SUBROUTINE SETIG(KG1,KG2,IG,II1,NORIG)                            SETIG  2
C THIS ROUTINE SETS IG(KG1,-)=KG2 AND IG(KG2,-)=KG1 IF THIS             SETIG  3
C          CONNECTION HAS NOT ALREADY BEEN SET.                         SETIG  4
      DIMENSION IG(II1,1),NORIG(1)                                      SETIG  5
      COMMON /S/ NN,MM,IH,IB                                            SETIG  6
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC                                SETIG  7
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 SETIG  8
      IF(KG1.EQ.0)RETURN                                                SETIG  9
      IF(KG2.EQ.0)RETURN                                                SETIG 10
      IF(KG1.EQ.KG2)RETURN                                              SETIG 11
      DO 50 LOOP=1,2                                                    SETIG 12
      L=KG1                                                             SETIG 13
      K=KG2                                                             SETIG 14
      IF(LOOP.EQ.1) GO TO 20                                            SETIG 15
      L=KG2                                                             SETIG 16
      K=KG1                                                             SETIG 17
   20 M=0                                                               SETIG 18
   30 M=M+1                                                             SETIG 19
      IF(M.GT.MAXDEG) GO TO 60                                          SETIG 20
      IS=IUNPK(IG,MAXGRD*(M-1)+L,NBITIN)                                SETIG 21
      IF(IS.EQ.0) GO TO 40                                              SETIG 22
      IF(IS.NE.K) GO TO 30                                              SETIG 23
      GO TO 50                                                          SETIG 24
   40 CALL PACK(IG,MAXGRD*(M-1)+L,NBITIN,K)                             SETIG 25
      MM=MAX0(MM,M)                                                     SETIG 26
   50 CONTINUE                                                          SETIG 27
      RETURN                                                            SETIG 28
   60 WRITE(6,70) NORIG(L),MAXDEG                                       SETIG 29
   70 FORMAT(12H1 GRID POINT,I12,26H   HAS DEGREE GREATER THAN,I6/      SETIG 30
     + 14H  FATAL ERROR. )                                              SETIG 31
      CALL BOMBIT(6)                                                    SETIG 32
      END                                                               SETIG 33
      SUBROUTINE TIGER(NEQ,IG,II1,LIST,NORIG)                           TIGER  2
C THIS ROUTINE MAKES ADDITIONS TO THE CONNECTION TABLE IG TO REFLECT    TIGER  3
C      THE PRESENCE OF MPC'S AND STORES THE DEPENDENT POINTS IN LIST.   TIGER  4
C NEQ=NUMBER OF MPC EQUATIONS.                                          TIGER  5
      DIMENSION IG(II1,1),LIST(1),NORIG(1)                              TIGER  6
      COMMON /S/ NN,MM,IH,IB                                            TIGER  7
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC                                TIGER  8
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 TIGER  9
      DIMENSION KG(40)                                                  TIGER 10
      IF(NEQ.EQ.0)RETURN                                                TIGER 11
      REWIND 11                                                         TIGER 12
C INITIALIZE LIST.                                                      TIGER 13
      DO 20 I=1,NN                                                      TIGER 14
   20 LIST(I)=0                                                         TIGER 15
C GENERATE NEW CONNECTIONS.                                             TIGER 16
      DO 100 II=1,NEQ                                                   TIGER 17
      READ(11)KG                                                        TIGER 18
      IGRID=KG(1)                                                       TIGER 19
      LIST(IGRID)=IGRID                                                 TIGER 20
      DO 100 I=1,MAXDEG                                                 TIGER 21
      L=IUNPK(IG,MAXGRD*(I-1)+IGRID,NBITIN)                             TIGER 22
      DO 100 J=2,NMPC                                                   TIGER 23
  100 CALL SETIG(L,KG(J),IG,II1,NORIG)                                  TIGER 24
      REWIND 11                                                         TIGER 25
      RETURN                                                            TIGER 26
      END                                                               TIGER 27
      SUBROUTINE SWITCH(IG,II1,IFLAG,KT,KA,KB)                          SWITCH 2
C THIS SUBROUTINE GENERATES A NEW IG MATRIX ACCORDING TO THE            SWITCH 3
C      CORRESPONDENCE TABLE KT, WHICH MUST BE SET UP                    SWITCH 4
C      PRIOR TO THE CALL.    ONLY INTERNAL NUMBERS ARE ALLOWED          SWITCH 5
C      AS VALUES OF KT.                                                 SWITCH 6
C                                                                       SWITCH 7
C INPUT - IG,KT                                                         SWITCH 8
C OUTPUT - IG                                                           SWITCH 9
C SCRATCH - IFLAG,KA,KB                                                 SWITCH10
C                                                                       SWITCH11
      DIMENSION IG(II1,1),IFLAG(1),KT(1),KA(1),KB(1)                    SWITCH12
      COMMON /S/ NN,MM,IH,IB                                            SWITCH13
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC                                SWITCH14
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 SWITCH15
C KT=CORRESPONDENCE TABLE.  KT(OLD) = NEW.                              SWITCH16
C KA,KB = TEMPORARY STORAGE ROWS.                                       SWITCH17
      DO 100 I=1,NN                                                     SWITCH18
      DO 90 J=1,MM                                                      SWITCH19
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      L=IUNPK(IG,MAXGRD*(J-1)+I,NBITIN)                                 SWITCH20
      IF(L.LE.0) GO TO 100                                              SWITCH21
      IS=KT(L)                                                          SWITCH22
      CALL PACK(IG,MAXGRD*(J-1)+I,NBITIN,IS)                            SWITCH23
   90 CONTINUE                                                          SWITCH24
  100 CONTINUE                                                          SWITCH25
C INITIALIZE FLAGS.                                                     SWITCH26
      DO 120 I=1,NN                                                     SWITCH27
  120 IFLAG(I)=0                                                        SWITCH28
C INITIALIZE TEMPORARY STORAGE ROWS.                                    SWITCH29
      DO 130 I=1,MM                                                     SWITCH30
      KA(I)=0                                                           SWITCH31
  130 KB(I)=0                                                           SWITCH32
C RE-ORDER ROWS OF IG MATRIX.                                           SWITCH33
      DO 200 IROW=1,NN                                                  SWITCH34
      IF(IFLAG(IROW).EQ.1) GO TO 200                                    SWITCH35
      IF(KT(IROW).EQ.IROW) GO TO 200                                    SWITCH36
      IFLAG(IROW)=1                                                     SWITCH37
      DO 140 J=1,MM                                                     SWITCH38
140    KB(J)=IUNPK(IG,MAXGRD*(J-1)+IROW,NBITIN)                         SWITCH39
      L=KT(IROW)                                                        SWITCH40
150   IFLAG(L)=1                                                        SWITCH41
      DO 160 J=1,MM                                                     SWITCH42
      KA(J)=IUNPK(IG,MAXGRD*(J-1)+L,NBITIN)                             SWITCH43
      CALL PACK(IG,MAXGRD*(J-1)+L,NBITIN,KB(J))                         SWITCH44
  160 KB(J)=KA(J)                                                       SWITCH45
      M=KT(L)                                                           SWITCH46
      IF(IFLAG(M).EQ.1) GO TO 170                                       SWITCH47
      L=M                                                               SWITCH48
      GO TO 150                                                         SWITCH49
  170 DO 180 J=1,MM                                                     SWITCH50
  180 CALL PACK(IG,MAXGRD*(J-1)+M,NBITIN,KB(J))                         SWITCH51
  200 CONTINUE                                                          SWITCH52
      RETURN                                                            SWITCH53
      END                                                               SWITCH54
      SUBROUTINE MORRIS(LIST,NL,IG,II1)                                 MORRIS 2
C THIS ROUTINE DELETES ALL REFERENCE IN THE CONNECTION TABLE IG         MORRIS 3
C       TO THOSE POINTS IN A LIST OF LENGTH NL.                         MORRIS 4
      DIMENSION IG(II1,1),LIST(1)                                       MORRIS 5
      COMMON /S/ NN,MM                                                  MORRIS 6
      COMMON /A/ MAXGRD                                                 MORRIS 7
      COMMON /BITS/ NBITIN,NBITEX                                       MORRIS 8
C COMPRESS OUT DUPLICATE ENTRIES IN LIST.                               MORRIS 9
      CALL FIXIT(LIST,NL)                                               MORRIS10
      IF(NL.LE.0) RETURN                                                MORRIS11
      MM1=MM-1                                                          MORRIS12
      DO 60 IJ=1,NL                                                     MORRIS13
      I=LIST(IJ)                                                        MORRIS14
      DO 50 J=1,MM                                                      MORRIS15
      L=IUNPK(IG,MAXGRD*(J-1)+I,NBITIN)                                 MORRIS16
      IF(L.EQ.0) GO TO 60                                               MORRIS17
      K=0                                                               MORRIS18
   20 K=K+1                                                             MORRIS19
      M=IUNPK(IG,MAXGRD*(K-1)+L,NBITIN)                                 MORRIS20
      IF(M.NE.I) GO TO 20                                               MORRIS21
      IF(K.GE.MM) GO TO 40                                              MORRIS22
      DO 30 N=K,MM1                                                     MORRIS23
      IS=IUNPK(IG,MAXGRD*N+L,NBITIN)                                    MORRIS24
   30 CALL PACK(IG,MAXGRD*(N-1)+L,NBITIN,IS)                            MORRIS25
   40 CALL PACK(IG,MAXGRD*MM1+L,NBITIN,0)                               MORRIS26
      CALL PACK(IG,MAXGRD*(J-1)+I,NBITIN,0)                             MORRIS27
   50 CONTINUE                                                          MORRIS28
   60 CONTINUE                                                          MORRIS29
      RETURN                                                            MORRIS30
      END                                                               MORRIS31
      SUBROUTINE FIXIT(LIST,NL)                                         FIXIT  2
C THIS ROUTINE COMPRESSES OUT ZEROES AND MULTIPLE ENTRIES IN A LIST     FIXIT  3
C   ORIGINALLY OF LENGTH NL.    A CORRECTED LENGTH NL IS RETURNED TO    FIXIT  4
C   THE CALLING PROGRAM.                                                FIXIT  5
      DIMENSION LIST(1)                                                 FIXIT  6
      IF(NL.LE.0) RETURN                                                FIXIT  7
      IF(NL.EQ.1) GO TO 110                                             FIXIT  8
      NL1=NL-1                                                          FIXIT  9
C DELETE DUPLICATE ENTRIES.                                             FIXIT 10
      DO 20 I=1,NL1                                                     FIXIT 11
      IF(LIST(I).EQ.0) GO TO 20                                         FIXIT 12
      I1=I+1                                                            FIXIT 13
      DO 10 J=I1,NL                                                     FIXIT 14
      IF(LIST(I).NE.LIST(J)) GO TO 10                                   FIXIT 15
      LIST(I)=0                                                         FIXIT 16
      GO TO 20                                                          FIXIT 17
10    CONTINUE                                                          FIXIT 18
20    CONTINUE                                                          FIXIT 19
C DELETE ZEROES.                                                        FIXIT 20
      DO 40 I=1,NL1                                                     FIXIT 21
      K=0                                                               FIXIT 22
25    IF(LIST(I).NE.0) GO TO 40                                         FIXIT 23
      K=K+1                                                             FIXIT 24
      DO 30 J=I,NL1                                                     FIXIT 25
30    LIST(J)=LIST(J+1)                                                 FIXIT 26
      LIST(NL)=0                                                        FIXIT 27
      IF(K.GE.(NL-I+1)) GO TO 70                                        FIXIT 28
      GO TO 25                                                          FIXIT 29
40    CONTINUE                                                          FIXIT 30
C CALCULATE NEW LENGTH NL.                                              FIXIT 31
   70 DO 80 I=1,NL                                                      FIXIT 32
      J=NL-I+1                                                          FIXIT 33
      IF(LIST(J).NE.0) GO TO 90                                         FIXIT 34
   80 CONTINUE                                                          FIXIT 35
   90 NL=NL-I+1                                                         FIXIT 36
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      RETURN                                                            FIXIT 37        1401
  110 IF(LIST(1).EQ.0) NL=0                                             FIXIT 38        1402
      RETURN                                                            FIXIT 39        1403
      END                                                               FIXIT 40        1404
      SUBROUTINE SCHEME(NT,NUM,NOM,IO,IP,IG,II1,IC,IDEG,IDIS,IW,        SCHEME 2        1405
     + NEW,ICC,ILD,IPP)                                                 SCHEME 3        1406
C  IO IS VALID IFF 2.LE.IO.LE.3                                         SCHEME 4        1407
      DIMENSION IG(II1,1),IC(1),IDEG(1),IDIS(1),IW(1)                   SCHEME 5        1408
      DIMENSION NEW(1),ICC(1),ILD(1),IPP(1)                             SCHEME 6        1409
C IPP HAS DIMENSION 2*MAXDEG                                            SCHEME 7        1410
      COMMON /S/ NN,MM,IH,IB                                            SCHEME 8        1411
      COMMON /P/ IH0,IHE                                                SCHEME 9        1412
      COMMON /A/ MAXGRD                                                 SCHEME10        1413
      COMMON /C/ IWARN,LINE,KORIG,KNEW                                  SCHEME11        1414
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 SCHEME12        1415
      COMMON /TIME/ STIME,NCM                                           SCHEME13        1416
      COMMON /B/ IPARAM(20)                                             SCHEME14        1417
      COMMON /DOL/ ISTART(100),IGNORE(100),IFIRST(100)                  SCHEME15        1418
      COMMON /DOLL/ IDIM,ISTA,IIG,IFIR                                  SCHEME16        1419
      DIMENSION NODESL(100)                                             SCHEME17        1420
      EQUIVALENCE (IH,ATIME)                                            SCHEME18        1421
C     DETERMINE THE DEGREE OF EACH NODE.                                SCHEME19        1422
      CALL DEGREE(IG,II1,IDEG)                                          SCHEME20        1423
C DETERMINE MODD, THE MOST PREVALENT NODAL DEGREE.                      SCHEME21        1424
      MODD=MODE(IDEG,IPP)                                               SCHEME22        1425
C     DETERMINE THE NUMBER OF COMPONENTS, NCM.                          SCHEME23        1426
      NCM=COMPNT(IG,II1,IC,IDEG,IW,ICC)                                 SCHEME24        1427
C     DETERMINE THE MAXIMUM DEGREE OF ANY NODE.                         SCHEME25        1428
      MAXD=MAXDGR(0,IC,IDEG)                                            SCHEME26        1429
      MM=MAXD                                                           SCHEME27        1430
C     DETERMINE THE ORIGINAL BANDWIDTH,IS.                              SCHEME28        1431
      DO 30 I=1,NN                                                      SCHEME29        1432
      NEW(I)=I                                                          SCHEME30        1433
   30 ILD(I)=I                                                          SCHEME31        1434
      IS=MAXBND(0,IG,II1,IC,IDEG,NEW,ILD)                               SCHEME32        1435
      KORIG=IS                                                          SCHEME33        1436
      IH0=IH                                                            SCHEME34        1437
C     INITIALIZE  NEW  AND  ILD  ARRAYS.                                SCHEME35        1438
      DO 35 I=1,NN                                                      SCHEME36        1439
      NEW(I)=0                                                          SCHEME37        1440
   35 ILD(I)=0                                                          SCHEME38        1441
C     IF IP IS NOT EQUAL TO 0, THEN PRINT COMPONENT NUMBER,DEGREE,      SCHEME39        1442
C     AND CONNECTIONS FOR EACH NODE.                                    SCHEME40        1443
      IF(IP.EQ.0) GO TO 31                                              SCHEME41        1444
C PRINT INTERNAL NUMBER CONNECTION TABLE.                               SCHEME42        1445
      DO 60 I=1,NN                                                      SCHEME43        1446
      IF(MOD(I,LINE).EQ.1)WRITE(6,19)                                   SCHEME44        1447
   19 FORMAT(37H1LABEL  COMP MDIST  DEGR  CONNECTIONS ,10X,             SCHEME45        1448
     1   18H(INTERNAL NUMBERS) )                                        SCHEME46        1449
      MDIST=0                                                           SCHEME47        1450
      DO 65 J=1,MAXD                                                    SCHEME48        1451
      IS1=IUNPK(IG,MAXGRD*(J-1)+I,NBITIN)                               SCHEME49        1452
      IF(IS1.EQ.0)GO TO 65                                              SCHEME50        1453
      MDIST=MAXD(MDIST,IABS(I-IS1))                                     SCHEME51        1454
   65 CONTINUE                                                          SCHEME52        1455
      IPP(1)=IC(I)                                                      SCHEME53        1456
      IPP(2)=IDEG(I)                                                    SCHEME54        1457
      DO 610 IP1=1,MAXD                                                 SCHEME55        1458
610   IPP(IP1+2)=IUNPK(IG,MAXGRD*(IP1-1)+I,NBITIN)                      SCHEME56        1459
      IS1=MAXD+2                                                        SCHEME57        1460
   60 WRITE(6,61)I,IPP(1),MDIST,(IPP(J),J=2,IS1)                        SCHEME58        1461
   61 FORMAT(5I6,20I5/ 25(25X,21I5/))                                   SCHEME59        1462
      WRITE(6,700)                                                      SCHEME60        1463
  700 FORMAT(1H1,//,32X,31HPROGRAMMER INFORMATION MESSAGES /)           SCHEME61        1464
      WRITE(6,29) IS,IH                                                 SCHEME62        1465
   29 FORMAT(19H ORIGINAL BANDWIDTH,I7,10H   PROFILE,I10)               SCHEME63        1466
      WRITE(6,27) MODD                                                  SCHEME64        1467
   27 FORMAT(30H MODE OF DEGREE DISTRIBUTION =,I5)                      SCHEME65        1468
      IF(ISTA.LE.0) GO TO 31                                            SCHEME66        1469
      WRITE(6,701)                                                      SCHEME67        1470
  701 FORMAT(34H STARTING NODES SUPPLIED BY USER -)                     SCHEME68        1471
      WRITE(6,100) (ISTART(I),I=1,ISTA)                                 SCHEME69        1472
C     TEST TIMER.                                                       SCHEME70        1473
   31 CALL SECOND(TBEG)                                                 SCHEME71        1474
      IF(IO.EQ.3) IS=IH                                                 SCHEME72        1475
C     GENERATE NUMBERING SCHEME FOR EACH COMPONENT, NC.                 SCHEME73        1476
      DO 500 NC=1,NCM                                                   SCHEME74        1477
C     DETERMINE THE RANGE OF DEGREES (MI  TO  MAD) OF NODES OF INTEREST.SCHEME75        1478
      MI=MINDEG(NC,IC,IDEG)                                             SCHEME76        1479
      MAD=MI                                                            SCHEME77        1480
      IF(NOM) 90,87,90                                                  SCHEME78        1481
   90 MA=MAXDGR(NC,IC,IDEG)                                             SCHEME79        1482
      MAD=MI+((MA-MI)*NUM)/NOM                                          SCHEME80        1483
C MAKE SURE THAT MAD IS LESS THAN MODD.                                 SCHEME81        1484
      MAD=MIN0(MAD,MODD-1)                                              SCHEME82        1485
      MAD=MAX0(MAD,MI)                                                  SCHEME83        1486
C     DETERMINE BANDWIDTH OR SUM CRITERION FOR EACH NODE MEETING SPECI- SCHEME84        1487
C              FIED CONDITION.                                          SCHEME85        1488
   87 IF(IP.EQ.0) GO TO 91                                              SCHEME86        1489
      WRITE(6,162) NC                                                   SCHEME87        1490
  162 FORMAT(22H *******      COMPONENT,I5,12H      *******)            SCHEME88        1491
      IF(IO.EQ.2) WRITE(6,169)                                          SCHEME89        1492
  169 FORMAT(43H OPTION 2 SELECTED  (CRITERION - BANDWIDTH ,            SCHEME90        1493
     +  57HMINIMIZATION;  CONDITION - MINMAX NUMBER OF NODES/LEVEL) )   SCHEME91        1494
      IF(IO.EQ.3) WRITE(6,179)                                          SCHEME92        1495
  179 FORMAT(52H OPTION 3 SELECTED (CRITERION - MINIMIZATION OF SUM;,   SCHEME93        1496
     +  44H   CONDITION - MINMAX NUMBER OF NODES/LEVEL) )               SCHEME94        1497
   91 CALL DIAM(NC,MAD,NL,NODESL,MAXLEV,IG,II1,IC,IDEG,IDIS,IW,ICC)     SCHEME95        1498
      IF(IP.EQ.0) GO TO 67                                              SCHEME96        1499
      WRITE(6,39) NC,MAD                                                SCHEME97        1500
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      WRITE(6,59) MAXLEV                                                SCHEME98
      WRITE(6,100) (NODESL(J),J=1,NL)                                   SCHEME99
   67 CONTINUE                                                          SCHEM100
      IF(ISTA.LE.0) GO TO 760                                           SCHEM101
      M=0                                                               SCHEM102
      DO 750 I=1,ISTA                                                   SCHEM103
      J=ISTART(I)                                                       SCHEM104
      IF(IC(J).NE.NC) GO TO 750                                         SCHEM105
      M=M+1                                                             SCHEM106
      DO 755 K=1,99                                                     SCHEM107
      L=101-K                                                           SCHEM108
  755 NODESL(L)=NODESL(L-1)                                             SCHEM109
      NODESL(1)=J                                                       SCHEM110
  750 CONTINUE                                                          SCHEM111
      NL=MIN0(NL+M,100)                                                 SCHEM112
      CALL FIXIT(NODESL,NL)                                             SCHEM113
  760 CONTINUE                                                          SCHEM114
      IF(IP.EQ.0) GO TO 63                                              SCHEM115
      IF(ISTA.LE.0) GO TO 63                                            SCHEM116
      WRITE(6,730)                                                      SCHEM117
  730 FORMAT(48H MERGED LIST OF STARTING NODES SUPPLIED BY USER ,       SCHEM118
     +  15HAND BY BANDIT -)                                             SCHEM119
      WRITE(6,100) (NODESL(I),I=1,NL)                                   SCHEM120
   39 FORMAT(10H COMPONENT,I5,19H    MAX DEGREE USED,I5)                SCHEM121
   59 FORMAT(52H STARTING NODES FOR MINMAX NUMBER OF NODES PER LEVEL,I5)SCHEM122
  100 FORMAT(4X,20I5)                                                   SCHEM123
   63 CONTINUE                                                          SCHEM124
      JMAX=MIN0(NT,NL)                                                  SCHEM125
      IM=900000000                                                      SCHEM126
      IMM=IM                                                            SCHEM127
      DO 400 J=1,JMAX                                                   SCHEM128
      CALL RELABL(1,NODESL(J ),IG,II1,IC,IDEG,IDIS,IW,NEW,ICC,ILD)      SCHEM129
      IB=MAXBND(NC,IG,II1,IC,IDEG,NEW,ILD)                              SCHEM130
      IF(IP.NE.0) WRITE(6,69) NODESL(J),IB,IH                           SCHEM131
   69 FORMAT(14H STARTING NODE,I6,4X,9HBANDWIDTH,I6,3X,7HPROFILE,I8)    SCHEM132
      IF(IO.EQ.3) IB=IH                                                 SCHEM133
      IE=ICC(NC+1)-1                                                    SCHEM134
      IF(IM-IB) 400,350,300                                             SCHEM135
  300 IM=IB                                                             SCHEM136
      IMM=IH                                                            SCHEM137
      IJ=J                                                              SCHEM138
      GO TO 400                                                         SCHEM139
  350 IF(IMM.LE.IH) GO TO 400                                           SCHEM140
      IMM=IH                                                            SCHEM141
      IJ=J                                                              SCHEM142
400   CONTINUE                                                          SCHEM143
      CALL RELABL(1,NODESL(IJ),IG,II1,IC,IDEG,IDIS,IW,NEW,ICC,ILD)      SCHEM144
  500 CONTINUE                                                          SCHEM145
      CALL STACK(IDEG,NEW,ILD,IW)                                       SCHEM146
      IB=MAXBND(0,IG,II1,IC,IDEG,NEW,ILD)                               SCHEM147
      IF(IP.EQ.0) GO TO 710                                             SCHEM148
      WRITE(6,705)                                                      SCHEM149
  705 FORMAT(21H0 ORIGINAL LABELING -)                                  SCHEM150
      WRITE(6,708) KORIG,IH0                                            SCHEM151
      WRITE(6,707)                                                      SCHEM152
  707 FORMAT(21H  STD CM RELABELING -)                                  SCHEM153
      WRITE(6,708) IB,IH                                                SCHEM154
  708 FORMAT(1H+,26X,9HBANDWIDTH,I7,10X,7HPROFILE,I10)                  SCHEM155
  709 FORMAT(21H  REV CM RELABELING -)                                  SCHEM156
  710 IF(IO.EQ.3) IB=IH                                                 SCHEM157
C PROFILE = SUM CRIT                                                    SCHEM158
C IS=ORIGINAL BANDWIDTH (OR SUM CRIT IF IO.EQ.3)                        SCHEM159
C IB=CURRENT BANDWIDTH (OR SUM CRIT IF IO.EQ.3)                         SCHEM160
C IH=CURRENT PROFILE, IH0=ORIGINAL PROFILE                              SCHEM161
      IF(IB-IS) 715,742,744                                             SCHEM162
  742 IF(IH.LT.IH0) GO TO 715                                           SCHEM163
  744 DO 712 I=1,NN                                                     SCHEM164
      ILD(I)=I                                                          SCHEM165
  712 NEW(I)=I                                                          SCHEM166
      CALL STACK(IDEG,NEW,ILD,IW)                                       SCHEM167
      IB=IS                                                             SCHEM168
      IH=IH0                                                            SCHEM169
      IF(IP.EQ.0) GO TO 715                                             SCHEM170
      WRITE(6,713)                                                      SCHEM171
  713 FORMAT(21H ORIG CM RELABELING -)                                  SCHEM172
      WRITE(6,708) IB,IH                                                SCHEM173
  715 IHE=IH                                                            SCHEM174
      CALL REVERS(NEW,ILD)                                              SCHEM175
      IB=MAXBND(0,IG,II1,IC,IDEG,NEW,ILD)                               SCHEM176
      IF(IP.EQ.0) GO TO 717                                             SCHEM177
      WRITE(6,709)                                                      SCHEM178
      WRITE(6,708) IB,IH                                                SCHEM179
  717 IF(IH.LT.IHE) GO TO 720                                           SCHEM180
      CALL REVERS(NEW,ILD)                                              SCHEM181
      IB=MAXBND(0,IG,II1,IC,IDEG,NEW,ILD)                               SCHEM182
  720 IHE=IH                                                            SCHEM183
      KNEW=IB                                                           SCHEM184
      IF(IP.EQ.0) GO TO 508                                             SCHEM185
      WRITE(6,722)                                                      SCHEM186
  722 FORMAT(21H  ** FINAL LABELING -)                                  SCHEM187
      WRITE(6,708) KNEW,IHE                                             SCHEM188
  508 CALL SECOND(ATIME)                                                SCHEM189
      ATIME=ATIME-TBEG                                                  SCHEM190
      IF(IP.EQ.0) GO TO 600                                             SCHEM191
      WRITE(6,89)ATIME                                                  SCHEM192
   89 FORMAT(7H TIME =,F9.3,6H  SEC.)                                   SCHEM193
  600 RETURN                                                            SCHEM194
      END                                                               SCHEM195
      SUBROUTINE STACK(IDEG,NEW,ILD,IW)                                 STACK  2
C STACK POINTS OF ZERO DEGREE AT END OF THE NUMBERING.                  STACK  3
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      DIMENSION IDEG(1),NEW(1),ILD(1),IW(1)                             STACK  4        1601
C IW IS SCRATCH STORAGE.                                                STACK  5        1602
      COMMON /S/ NN                                                     STACK  6        1603
      COMMON /ZERO/ KT                                                  STACK  7        1604
      KT=0                                                              STACK  8        1605
      NN1=NN-1                                                          STACK  9        1606
C LIST POINTS OF ZERO DEGREE AND INCREMENT COUNTER KT.                  STACK 10        1607
      DO 10 I=1,NN                                                      STACK 11        1608
      IF(IDEG(I).GT.0) GO TO 10                                         STACK 12        1609
      KT=KT+1                                                           STACK 13        1610
      IW(KT)=ILD(I)                                                     STACK 14        1611
   10 CONTINUE                                                          STACK 15        1612
      IF(KT.LE.0) GO TO 70                                              STACK 16        1613
C SORT LIST OF RENUMBERED NUMBERS TO BE STACKED.                        STACK 17        1614
      CALL SORT(IW,KT)                                                  STACK 18        1615
C STACK POINTS OF ZERO DEGREE AT END OF NEW.                            STACK 19        1616
      DO 40 L=1,KT                                                      STACK 20        1617
      I=IW(L)-L+1                                                       STACK 21        1618
      K=NEW(I)                                                          STACK 22        1619
      IF(I.GE.NN) GO TO 30                                              STACK 23        1620
      DO 20 J=I,NN1                                                     STACK 24        1621
   20 NEW(J)=NEW(J+1)                                                   STACK 25        1622
   30 NEW(NN)=K                                                         STACK 26        1623
   40 CONTINUE                                                          STACK 27        1624
C CORRECT ILD, THE INVERSE OF NEW.                                      STACK 28        1625
   70 DO 80 I=1,NN                                                      STACK 29        1626
      K=NEW(I)                                                          STACK 30        1627
   80 ILD(K)=I                                                          STACK 31        1628
      RETURN                                                            STACK 32        1629
      END                                                               STACK 33        1630
      SUBROUTINE REVERS(NEW,ILD)                                        REVERS 2        1631
C REVERSE THE NUMBERING OF THE FIRST NN-KT GRID POINTS.                 REVERS 3        1632
C NN=NUMBER OF GRID POINTS.                                             REVERS 4        1633
C KT=THE NUMBER OF POINTS OF ZERO DEGREE (STACKED AT END OF NEW         REVERS 5        1634
C        BY STACK)                                                      REVERS 6        1635
      DIMENSION NEW(1),ILD(1)                                           REVERS 7        1636
      COMMON /S/ NN                                                     REVERS 8        1637
      COMMON /ZERO/ KT                                                  REVERS 9        1638
C REVERSE NEW ARRAY.                                                    REVERS10        1639
      J=(NN-KT)/2                                                       REVERS11        1640
      LL=NN-KT+1                                                        REVERS12        1641
      DO 10 I=1,J                                                       REVERS13        1642
      L=LL-I                                                            REVERS14        1643
      K=NEW(L)                                                          REVERS15        1644
      NEW(L)=NEW(I)                                                     REVERS16        1645
   10 NEW(I)=K                                                          REVERS17        1646
C CORRECT ILD, THE INVERSE OF NEW.                                      REVERS18        1647
      DO 20 I=1,NN                                                      REVERS19        1648
      K=NEW(I)                                                          REVERS20        1649
   20 ILD(K)=I                                                          REVERS21        1650
      RETURN                                                            REVERS22        1651
      END                                                               REVERS23        1652
      SUBROUTINE DEGREE(IG,II1,IDEG)                                    DEGREE 2        1653
C SET UP THE IDEG ARRAY CONTAINING THE DEGREE OF EACH NODE STORED       DEGREE 3        1654
C     IN THE IG ARRAY.                                                  DEGREE 4        1655
C   IDEG(I)=DEGREE OF NODE I                                            DEGREE 5        1656
      DIMENSION IG(II1,1),IDEG(1)                                       DEGREE 6        1657
      COMMON /S/ NN,MM,IH,IB                                            DEGREE 7        1658
      COMMON /A/ MAXGRD                                                 DEGREE 8        1659
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 DEGREE 9        1660
      DO 100 I=1,NN                                                     DEGREE10        1661
      IDEG(I)=0                                                         DEGREE11        1662
      DO 80 J=1,MM                                                      DEGREE12        1663
      IF(IUNPK(IG,MAXGRD*(J-1)+I,NBITIN)) 100,100,50                    DEGREE13        1664
   50 IDEG(I)=IDEG(I)+1                                                 DEGREE14        1665
   80 CONTINUE                                                          DEGREE15        1666
  100 CONTINUE                                                          DEGREE16        1667
      RETURN                                                            DEGREE17        1668
      END                                                               DEGREE18        1669
      FUNCTION MODE(IDEG,MODD)                                          MODE   2        1670
C COMPUTE MODE, THE MOST PREVALENT NODAL DEGREE.    IF SEVERAL DEGREES  MODE   3        1671
C      ARE EQUALLY PREVALENT, THE LOWEST IS CHOSEN.                     MODE   4        1672
      COMMON /S/ NN,MM                                                  MODE   5        1673
      DIMENSION IDEG(1),MODD(1)                                         MODE   6        1674
C IDEG(I)=DEGREE OF NODE I                                              MODE   7        1675
C  MODD(I)=NUMBER OF NODES OF DEGREE I                                  MODE   8        1676
      DO 10 I=1,MM                                                      MODE   9        1677
   10 MODD(I)=0                                                         MODE  10        1678
      DO 20 I=1,NN                                                      MODE  11        1679
      K=IDEG(I)                                                         MODE  12        1680
   20 MODD(K)=MODD(K)+1                                                 MODE  13        1681
      MODE=0                                                            MODE  14        1682
      MAX=0                                                             MODE  15        1683
      DO 30 I=1,MM                                                      MODE  16        1684
      K=MODD(I)                                                         MODE  17        1685
      IF(K.LE.MAX) GO TO 30                                             MODE  18        1686
      MAX=K                                                             MODE  19        1687
      MODE=I                                                            MODE  20        1688
   30 CONTINUE                                                          MODE  21        1689
      RETURN                                                            MODE  22        1690
      END                                                               MODE  23        1691
      FUNCTION COMPNT(IG,II1,IC,IDEG,IW,ICC)                            COMPNT 2        1692
C THIS FUNCTION HAS AS ITS VALUE THE NUMBER OF COMPONENTS STORED        COMPNT 3        1693
C     IN THE CONNECTION ARRAY IG.                                       COMPNT 4        1694
C ALSO, IC AND ICC ARE SET UP.                                          COMPNT 5        1695
C   IC(I)=COMPONENT INDEX FOR NODE I                                    COMPNT 6        1696
C   ICC(I)=THE STARTING POSITION TO BE USED FOR LABELS IN COMPONENT I   COMPNT 7        1697
C THUS, ICC(I+1)-ICC(I)= THE NUMBER OF NODES IN COMPONENT I             COMPNT 8        1698
      DIMENSION IG(II1,1),IC(1),IDEG(1),IW(1),ICC(1)                    COMPNT 9        1699
      COMMON /S/ NN,MM,IH,IB                                            COMPNT10        1700
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      COMMON /A/ MAXGRD                                                 COMPNT11    1701
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 COMPNT12    1702
C INITIALIZE ARRAYS.                                                    COMPNT13    1703
      DO 100 I=1,NN                                                     COMPNT14    1704
      ICC(I)=0                                                          COMPNT15    1705
      IC(I)=0                                                           COMPNT16    1706
  100 CONTINUE                                                          COMPNT17    1707
      NC=0                                                              COMPNT18    1708
      ICC(1)=1                                                          COMPNT19    1709
C CHECK IF IC IS COMPLETE.                                              COMPNT20    1710
  105 DO 110 I=1,NN                                                     COMPNT21    1711
      IF(IC(I)) 110,120,110                                             COMPNT22    1712
  110 COMPNT=NC                                                         COMPNT23    1713
      RETURN                                                            COMPNT24    1714
  120 NC=NC+1                                                           COMPNT25    1715
      KI=0                                                              COMPNT26    1716
      KO=1                                                              COMPNT27    1717
      IW(1)=I                                                           COMPNT28    1718
      IC(I)=NC                                                          COMPNT29    1719
      IF(NC-1)130,125,125                                               COMPNT30    1720
125   IS=ICC(NC)+1                                                      COMPNT31    1721
      ICC(NC+1)=IS                                                      COMPNT32    1722
  130 KI=KI+1                                                           COMPNT33    1723
      II=IW(KI)                                                         COMPNT34    1724
      N=IDEG(II)                                                        COMPNT35    1725
      IF(N)140,105,140                                                  COMPNT36    1726
  140 DO 200 I=1,N                                                      COMPNT37    1727
      IA=IUNPK(IG,MAXGRD*(I-1)+II,NBITIN)                               COMPNT38    1728
      IF(IC(IA)) 200,150,200                                            COMPNT39    1729
150   IC(IA)=NC                                                         COMPNT40    1730
      KO=KO+1                                                           COMPNT41    1731
      IW(KO)=IA                                                         COMPNT42    1732
      IS=ICC(NC+1)+1                                                    COMPNT43    1733
      ICC(NC+1)=IS                                                      COMPNT44    1734
  200 CONTINUE                                                          COMPNT45    1735
      IF(KO-KI)105,105,130                                              COMPNT46    1736
      END                                                               COMPNT47    1737
      FUNCTION MAXDGR(NC,IC,IDEG)                                       MAXDGR 2    1738
C THIS FUNCTION HAS AS ITS VALUE THE MAXIMUM DEGREE OF ANY NODE OF      MAXDGR 3    1739
C       COMPONENT NC IF NC.GT.0                                         MAXDGR 4    1740
C IF NC.LE.0, ALL COMPONENTS ARE CONSIDERED.                            MAXDGR 5    1741
      DIMENSION IC(1),IDEG(1)                                           MAXDGR 6    1742
      COMMON /S/ NN,MM,IH,IB                                            MAXDGR 7    1743
      M=0                                                               MAXDGR 8    1744
      DO 100 I=1,NN                                                     MAXDGR 9    1745
      IF(NC)40,50,40                                                    MAXDGR10    1746
40    IF(IC(I)-NC) 100,50,100                                           MAXDGR11    1747
50    IF(IDEG(I)-M) 100,100,60                                          MAXDGR12    1748
60    M=IDEG(I)                                                         MAXDGR13    1749
  100 CONTINUE                                                          MAXDGR14    1750
      MAXDGR=M                                                          MAXDGR15    1751
      RETURN                                                            MAXDGR16    1752
      END                                                               MAXDGR17    1753
      FUNCTION MAXBND(NC,IG,II1,IC,IDEG,NEW,ILD)                        MAXBND 2    1754
C THIS FUNCTION HAS AS ITS VALUE THE MAXIMUM DIFFERENCE BETWEEN NODE    MAXBND 3    1755
C     LABELS OF CONNECTED NODES FOR NODES OF COMPONENT NC.GT.0          MAXBND 4    1756
C IF NC.LE.0, ALL COMPONENTS ARE CONSIDERED.                            MAXBND 5    1757
C THE NODAL RENUMBERING DEFINED BY ILD AND NEW MUST BE SET UP PRIOR     MAXBND 6    1758
C       TO THE FUNCTION CALL.                                           MAXBND 7    1759
C COMPUTE IH, THE SUM CRIT (PROFILE).                                   MAXBND 8    1760
      DIMENSION IG(II1,1),IC(1),IDEG(1),NEW(1),ILD(1)                   MAXBND 9    1761
      COMMON /S/ NN,MM,IH,IB                                            MAXBND10    1762
      COMMON /A/ MAXGRD                                                 MAXBND11    1763
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 MAXBND12    1764
      IH=0                                                              MAXBND13    1765
      M=0                                                               MAXBND14    1766
      DO 100 I=1,NN                                                     MAXBND15    1767
      MX=0                                                              MAXBND16    1768
      IA=NEW(I)                                                         MAXBND17    1769
      IF(NC)40,50,40                                                    MAXBND18    1770
40    IF(IA.EQ.0)GO TO 100                                              MAXBND19    1771
      IF(NC-IC(IA)) 100,50,100                                          MAXBND20    1772
50    N=IDEG(IA)                                                        MAXBND21    1773
      IF(N)100,100,150                                                  MAXBND22    1774
150   DO 90 J=1,N                                                       MAXBND23    1775
      II=IUNPK(IG,MAXGRD*(J-1)+IA,NBITIN)                               MAXBND24    1776
      IB=MAX0(0,I-ILD(II))                                              MAXBND25    1777
      IF(IB.GT.MX) MX=IB                                                MAXBND26    1778
90    CONTINUE                                                          MAXBND27    1779
      IF(MX.GT.M) M=MX                                                  MAXBND28    1780
      IH=IH+MX                                                          MAXBND29    1781
100   CONTINUE                                                          MAXBND30    1782
      MAXBND=M                                                          MAXBND31    1783
      RETURN                                                            MAXBND32    1784
      END                                                               MAXBND33    1785
      FUNCTION MINDEG(NC,IC,IDEG)                                       MINDEG 2    1786
C THIS FUNCTION HAS AS ITS VALUE THE MINIMUM DEGREE OF ANY NODE OF      MINDEG 3    1787
C       COMPONENT NC IF NC.GT.0                                         MINDEG 4    1788
C IF NC.LE.0, ALL COMPONENTS ARE CONSIDERED.                            MINDEG 5    1789
      DIMENSION IC(1),IDEG(1)                                           MINDEG 6    1790
      COMMON /S/ NN,MM,IH,IB                                            MINDEG 7    1791
      M=10000                                                           MINDEG 8    1792
      DO 100 I=1,NN                                                     MINDEG 9    1793
      IF(NC)40,50,40                                                    MINDEG10    1794
40    IF(IC(I)-NC) 100,50,100                                           MINDEG11    1795
50    IF(M-IDEG(I)) 100,100,60                                          MINDEG12    1796
60    M=IDEG(I)                                                         MINDEG13    1797
  100 CONTINUE                                                          MINDEG14    1798
      MINDEG=M                                                          MINDEG15    1799
      RETURN                                                            MINDEG16    1800
```

```
      END                                                               MINDEG17        1801
      SUBROUTINE DIAM(NC,MAXDEG,NL,NODESL,MAXLEV,                       DIAM   2        1802
     + IG,II1,IC,IDEG,IDIS,IW,ICC)                                      DIAM   3        1803
C DETERMINE NL STARTING POINTS AND STORE IN NODESL.                     DIAM   4        1804
      DIMENSION IG(II1,1),IDIS(1),IW(1),ICC(1),IC(1),IDEG(1)            DIAM   5        1805
      COMMON /S/ NN,MM,IH,IB                                            DIAM   6        1806
      COMMON /A/ MAXGRD                                                 DIAM   7        1807
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 DIAM   8        1808
      DIMENSION NODESL(1)                                               DIAM   9        1809
      NL=0                                                              DIAM  10        1810
      MAXLEV=10000                                                      DIAM  11        1811
      DO 100 I=1,NN                                                     DIAM  12        1812
      IF(NC-IC(I)) 100,40,100                                           DIAM  13        1813
40    IF(MAXDEG-IDEG(I)) 100,105,105                                    DIAM  14        1814
  105 MD=IDIST(I,ML,MAXLEV,IG,II1,IC,IDEG,IDIS,IW,ICC)                  DIAM  15        1815
      IF(MD) 115,115,56                                                 DIAM  16        1816
   56 IF(ML-MAXLEV)58,64,100                                            DIAM  17        1817
   58 MAXLEV=ML                                                         DIAM  18        1818
      NL=1                                                              DIAM  19        1819
      NODESL(1)=I                                                       DIAM  20        1820
      GO TO 100                                                         DIAM  21        1821
   64 IF(NL.GE.100) GO TO 100                                           DIAM  22        1822
      NL=NL+1                                                           DIAM  23        1823
      NODESL(NL)=I                                                      DIAM  24        1824
  100 CONTINUE                                                          DIAM  25        1825
  110 RETURN                                                            DIAM  26        1826
  115 ML=1                                                              DIAM  27        1827
      NODESL(1)=I                                                       DIAM  28        1828
      MAXLEV=0                                                          DIAM  29        1829
      RETURN                                                            DIAM  30        1830
      END                                                               DIAM  31        1831
      SUBROUTINE RELABL(NS,NODES,IG,II1,IC,IDEG,IDIS,IW,NEW,ICC,ILD)    RELABL 2        1832
C GENERATE A RELABELING SCHEME STARTING WITH NS NODES FOR WHICH         RELABL 3        1833
C       LABELS HAVE BEEN STORED IN ARRAY NODES.                         RELABL 4        1834
C SET UP ILD AND NEW.                                                   RELABL 5        1835
C     ILD(OLD)=NEW                                                      RELABL 6        1836
C      NEW(NEW)=OLD,   THE INVERSE OF ILD                               RELABL 7        1837
      DIMENSION IG(II1,1),IC(1),IDEG(1),IDIS(1),IW(1),NEW(1),ICC(1)     RELABL 8        1838
      DIMENSION ILD(1)                                                  RELABL 9        1839
      COMMON /S/ NN,MM,IH,IB                                            RELABL10        1840
      INTEGER X                                                         RELABL11        1841
      COMMON /A/ MAXGRD                                                 RELABL12        1842
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 RELABL13        1843
      DIMENSION NODES( 1),IAJ(50)                                       RELABL14        1844
      I=NODES(1)                                                        RELABL15        1845
      ICN=IC(I)                                                         RELABL16        1846
      NT=ICC(ICN)-1                                                     RELABL17        1847
      DO 50 I=1,NN                                                      RELABL18        1848
      IF(IC(I)-ICN) 50,40,50                                            RELABL19        1849
40    IDIS(I)=0                                                         RELABL20        1850
50    CONTINUE                                                          RELABL21        1851
      DO 100 J=1,NS                                                     RELABL22        1852
      JJ=NODES(J)                                                       RELABL23        1853
      IDIS(JJ)=-1                                                       RELABL24        1854
      JT=J+NT                                                           RELABL25        1855
      NEW(JT)=JJ                                                        RELABL26        1856
100   ILD(JJ)=JT                                                        RELABL27        1857
      KI=NT                                                             RELABL28        1858
      KO=NS+NT                                                          RELABL29        1859
      LL=KO                                                             RELABL30        1860
      L=1                                                               RELABL31        1861
      J=KO                                                              RELABL32        1862
      NNC=ICC(ICN+1)-1                                                  RELABL33        1863
130   KI=KI+1                                                           RELABL34        1864
      IF(KI-LL)135,132,135                                              RELABL35        1865
132   L=L+1                                                             RELABL36        1866
      LL=KO+1                                                           RELABL37        1867
135   II=NEW(KI)                                                        RELABL38        1868
      N=IDEG(II)                                                        RELABL39        1869
      IF(N)140,255,140                                                  RELABL40        1870
140   IJ=0                                                              RELABL41        1871
      DO 200 I=1,N                                                      RELABL42        1872
      IA=IUNPK(IG,MAXGRD*(I-1)+II,NBITIN)                               RELABL43        1873
      IF(IDIS(IA)) 200,150,200                                          RELABL44        1874
150   IJ=IJ+1                                                           RELABL45        1875
      IDIS(IA)=L                                                        RELABL46        1876
      KO=KO+1                                                           RELABL47        1877
      IAJ(IJ)=IA                                                        RELABL48        1878
      IW(IJ)=IDEG(IA)                                                   RELABL49        1879
200   CONTINUE                                                          RELABL50        1880
      IF(IJ-1)250,210,220                                               RELABL51        1881
210   J=KO                                                              RELABL52        1882
      IZ=IAJ(1)                                                         RELABL53        1883
      NEW(KO)=IZ                                                        RELABL54        1884
      ILD(IZ)=KO                                                        RELABL55        1885
      GO TO 250                                                         RELABL56        1886
220   X=0                                                               RELABL57        1887
221   DO 230 I=2,IJ                                                     RELABL58        1888
      IF(IW(I)-IW(I-1))224,230,230                                      RELABL59        1889
224   CONTINUE                                                          RELABL60        1890
      X=IW(I)                                                           RELABL61        1891
      IW(I)=IW(I-1)                                                     RELABL62        1892
      IW(I-1)=X                                                         RELABL63        1893
225   X=IAJ(I)                                                          RELABL64        1894
      IAJ(I)=IAJ(I-1)                                                   RELABL65        1895
      IAJ(I-1)=X                                                        RELABL66        1896
230   CONTINUE                                                          RELABL67        1897
      IF(X)235,235,220                                                  RELABL68        1898
235   DO 240 I=1,IJ                                                     RELABL69        1899
      J=J+1                                                             RELABL70        1900
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      IZ=IAJ(I)                                                         RELABL71      1901
      NEW(J)=IZ                                                         RELABL72      1902
      ILD(IZ)=J                                                         RELABL73      1903
240   CONTINUE                                                          RELABL74      1904
250   IF(KO-NNC)130,255,255                                             RELABL75      1905
255   CONTINUE                                                          RELABL76      1906
      RETURN                                                            RELABL77      1907
      END                                                               RELABL78      1908
      FUNCTION IDIST(NS,ML,MAXLEV,IG,II1,IC,IDEG,IDIS,IW,ICC)           IDIST  2      1909
C THIS FUNCTION HAS AS ITS VALUE THE MAXIMUM DISTANCE OF ANY NODE       IDIST  3      1910
C      IN COMPONENT IC(NS) FROM THE NODE NS.                            IDIST  4      1911
C THE DISTANCE OF EACH NODE IN THIS COMPONENT IS STORED IN THE ARRAY    IDIST  5      1912
C            IDIS.                                                      IDIST  6      1913
C THE MAXIMUM NUMBER OF NODES AT THE SAME DISTANCE FROM NS IS           IDIST  7      1914
C       STORED IN ML.                                                   IDIST  8      1915
      DIMENSION IG(II1,1),IC(1),IDEG(1),IDIS(1),IW(1),ICC(1)            IDIST  9      1916
      COMMON /S/ NN,MM,IH,IB                                            IDIST 10      1917
      COMMON /A/ MAXGRD                                                 IDIST 11      1918
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 IDIST 12      1919
      ICN=IC(NS)                                                        IDIST 13      1920
      NNC=ICC(ICN+1)-ICC(ICN)                                           IDIST 14      1921
      DO 50 I=1,NN                                                      IDIST 15      1922
      IF(IC(I)-IC(NS)) 50,40,50                                         IDIST 16      1923
40    IDIS(I)=0                                                         IDIST 17      1924
   50 CONTINUE                                                          IDIST 18      1925
      LL=1                                                              IDIST 19      1926
      L=0                                                               IDIST 20      1927
      KI=0                                                              IDIST 21      1928
      KO=1                                                              IDIST 22      1929
      ML=0                                                              IDIST 23      1930
      IW(1)=NS                                                          IDIST 24      1931
      IDIS(NS)=-1                                                       IDIST 25      1932
  130 KI=KI+1                                                           IDIST 26      1933
      IF(KI-LL)135,132,135                                              IDIST 27      1934
  132 L=L+1                                                             IDIST 28      1935
      LL=KO+1                                                           IDIST 29      1936
      K=KO-KI+1                                                         IDIST 30      1937
      IF(K-ML) 135,135,133                                              IDIST 31      1938
  133 ML=K                                                              IDIST 32      1939
      IF(ML-MAXLEV) 135,135,220                                         IDIST 33      1940
135    II=IW(KI)                                                        IDIST 34      1941
      N=IDEG(II)                                                        IDIST 35      1942
      IF(N)140,215,140                                                  IDIST 36      1943
  140 DO 200 I=1,N                                                      IDIST 37      1944
      IA=IUNPK(IG,MAXGRD*(I-1)+II,NBITIN)                               IDIST 38      1945
      IF(IDIS(IA))200,150,200                                           IDIST 39      1946
150   IDIS(IA)=L                                                        IDIST 40      1947
      KO=KO+1                                                           IDIST 41      1948
      IW(KO)=IA                                                         IDIST 42      1949
  200 CONTINUE                                                          IDIST 43      1950
      IF(KO-NNC)130,205,205                                             IDIST 44      1951
  205 IDIST=L                                                           IDIST 45      1952
      IDIS(NS)=0                                                        IDIST 46      1953
      K=KO-KI                                                           IDIST 47      1954
      IF(K-ML) 206,206,207                                              IDIST 48      1955
  207 ML=K                                                              IDIST 49      1956
  206 CONTINUE                                                          IDIST 50      1957
      RETURN                                                            IDIST 51      1958
  215 L=0                                                               IDIST 52      1959
      GO TO 205                                                         IDIST 53      1960
  220 IDIST=1                                                           IDIST 54      1961
      RETURN                                                            IDIST 55      1962
      END                                                               IDIST 56      1963
          IDENT  PCUP                                                   PCUP   2      1964
          LIST   D,M,A                                                  PCUP   3      1965
          ENTRY  PACK,IPACK,UNPK,IUNPK,ABT                              PCUP   4      1966
          EXT    CPC                                                    PCUP   5      1967
          USE    /BITS/                                                 PCUP   6      1968
         BSS     2                                                      PCUP   7      1969
IPASS     BSS    1                                                      PCUP   8      1970
          USE    0                                                      PCUP   9      1971
SIXTY     DATA   60.                                                    PCUP  10      1972
 PACK     BSSZ   1                                                      PCUP  11      1973
 IPACK    EQU    PACK                                                   PCUP  12      1974
*  SET FLAG TO INDICATE A PACK INSTRUCTION REQUIRED                     PCUP  13      1975
          SB1    1                                                      PCUP  14      1976
*  LOAD A0 WITH THE ADDRESS OF THE ARGUMENT LIST                        PCUP  15      1977
 INIT     SB7    A0                                                     PCUP  16      1978
          SA0    A1                                                     PCUP  17      1979
*  INCREASE ITERATION INDEX BY ONE                                      PCUP  18      1980
          SA5    IPASS                                                  PCUP  19      1981
          SX6    1                                                      PCUP  20      1982
          IX6    X5+X6                                                  PCUP  21      1983
          SA6    A5+B0                                                  PCUP  22      1984
*  LOAD X6  WITH THE ADDRESS OF ARGUMENT LIST FOR LATER LOADING OF      PCUP  23      1985
*  PACKED WORD                                                          PCUP  24      1986
          BX6    X1                                                     PCUP  25      1987
*  LOAD X1 WITH THE SUBSCRIPT OF THE ARRIY                              PCUP  26      1988
          SA1    A0+1                                                   PCUP  27      1989
          SA1    X1                                                     PCUP  28      1990
*  CONVERT SUBSCRIPT FROM INTEGER TO REAL                               PCUP  29      1991
          PX1    B0,X1                                                  PCUP  30      1992
          NX1    X1                                                     PCUP  31      1993
*  LOAD X2 WITH THE NUMBER OF BITS PER WORD                             PCUP  32      1994
          SA2    SIXTY                                                  PCUP  33      1995
*  LOAD X3 WITH THE NUMBER OF BITS TO BE DEVOTED TO EACH PACKED WORD    PCUP  34      1996
          SA3    A0+2                                                   PCUP  35      1997
          SA3    X3                                                     PCUP  36      1998
*  LOAD B6 WITH THE NUMBER OF BITS IN WORD NOT DEVOTED TO THE PACKED     PCUP  37      1999
*  WORD                                                                 PCUP  38      2000
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         SB6     X3-60                                          PCUP  39        2001
         S96     -B6                                            PCUP  40        2002
*  CONVERT THE NUMBER OF BITS PER PACKED WORD FROM INTEGER TO REAL  PCUP  41        2003
         PX3     B0,X3                                          PCUP  42        2004
         NX3     X3                                             PCUP  43        2005
*  LOAD X2 WITH THE NUMBER OF PACKED WORDS THAT CAN EXIST PER 60 BIT  PCUP  44        2006
*  WORD                                                          PCUP  45        2007
         FX2     X2/X3                                          PCUP  46        2008
*  TRUNCATE X2 TO LOSE ANY FRACTIONAL PART                       PCUP  47        2009
         UX2     B2,X2                                          PCUP  48        2010
         LX2     B2,X2                                          PCUP  49        2011
         PX2     B0,X2                                          PCUP  50        2012
         NX2     X2                                             PCUP  51        2013
*  LOAD X5 WITH THE NUMBER OF 60 BIT WORDS NECESSARY TO LOCATE THE  PCUP  52        2014
*  POSITION IN ABSOLUTE CORE THAT THE VARIABLE ADDRESSED         PCUP  53        2015
         FX5     X1/X2                                          PCUP  54        2016
*  CONVERT X5 TO INTEGER BRIEFLY FOR AN INTEGER ADD OPERATION    PCUP  55        2017
         UX5     B2,X5                                          PCUP  56        2018
         LX5     B2,X5                                          PCUP  57        2019
*  X6 NOW POINTS TO THE ABSOLUTE LOCATION IN CORE CONTAINING THE  PCUP  58        2020
*  VARIABLE DESIRED                                              PCUP  59        2021
         IX6     X5+X6                                          PCUP  60        2022
         PX5     B0,X5                                          PCUP  61        2023
         NX5     X5                                             PCUP  62        2024
*  LOAD X4 WITH THE NUMBER OF WHOLE 60 BIT WORDS TO FIND THE LOCATION  PCUP  63        2025
*  DESIRED                                                       PCUP  64        2026
         FX4     X2*X5                                          PCUP  65        2027
*  X4 NOW CONTAINS OFFSET WITHIN THE LOCATION FOR PACKED VALUE   PCUP  66        2028
         FX4     X1-X4                                          PCUP  67        2029
         NX4     X4                                             PCUP  68        2030
*  CONVERT X4 TO INTEGER BRIEFLY FOR COMPARISON PURPOSES         PCUP  69        2031
         UX4     B2,X4                                          PCUP  70        2032
         LX4     B2,X4                                          PCUP  71        2033
*  SET X6 TO ITSELF - 1 FOR A ZERO X4 VALUE                      PCUP  72        2034
*  X4 = 0 INDICATES THAT THE PACKED VARIABLE ENDS ON A WORD BOUNDARY  PCUP  73        2035
         NZ      X4,BR                                          PCUP  74        2036
         SX6     X6-1                                           PCUP  75        2037
*  LOAD X1 WITH THE NUMBER OF BITS TO BE SHIFTED                 PCUP  76        2038
BR       PX4     B0,X4                                          PCUP  77        2039
         NX4     X4                                             PCUP  78        2040
         FX1     X3*X4                                          PCUP  79        2041
*  CONVERT X1 TO INTEGER AND SAVE IN B2 FOR LATER USE            PCUP  80        2042
         UX1     B2,X1                                          PCUP  81        2043
         LX1     B2,X1                                          PCUP  82        2044
         SB2     X1                                             PCUP  83        2045
*  LOAD THE VARIABLE OF CORE CONCERNED                           PCUP  84        2046
         SA2     X6                                             PCUP  85        2047
*  SHIFT THE WORD TO ALIGN PROPERLY FOR MASK                     PCUP  86        2048
         LX2     B2,X2                                          PCUP  87        2049
*  COMPLEMENT B2                                                 PCUP  88        2050
         SB2     -B2                                            PCUP  89        2051
*  FORM A 59 BIT MASK IN THE LOWER 59 BITS OF X4                 PCUP  90        2052
         MX4     59                                             PCUP  91        2053
         LX4     59                                             PCUP  92        2054
*  B2 NOW HAS THE NUMBER OF BITS PER PACKED WORD                 PCUP  93        2055
         SB2     B2+60                                          PCUP  94        2056
*  LOAD X4 WITH A MASK OF 1'S WHOSE LENGTH EQUALS THE THIRD ARGUMENT - 1PCUP  95        2057
         AX4     B6,X4                                          PCUP  96        2058
         SX5     1                                              PCUP  97        2059
*  X6 HAS A MASK FOR SIGN AND VALUE                              PCUP  98        2060
         IX5     X4+X5                                          PCUP  99        2061
         IX6     X4+X5                                          PCUP 100        2062
*  +0 TO UPK IF AN UNPACK IS DESIRED                             PCUP 101        2063
         EQ      B1,UPK                                         PCUP 102        2064
*  LOAD X1 WITH THE VALUE TO BE LOADED INTO CORE                 PCUP 103        2065
         SA1     A0+3                                           PCUP 104        2066
         SA1     X1                                             PCUP 105        2067
*  INSURE THAT VALUE IS NOT TOO LARGE FOR PROPER PACKING         PCUP 106        2068
         BX0     X1                                             PCUP 107        2069
         PL      X0,CHK                                         PCUP 108        2070
         BX0     -X0                                            PCUP 109        2071
CHK      IX0     X0-X4                                          PCUP 110        2072
         PL      X0,DMP                                         PCUP 111        2073
*  IF VALUE IS NEGATIVE, SET SIGN MASK TO ZERO                   PCUP 112        2074
         NG      X1,SCH                                         PCUP 113        2075
         SX5     B0                                             PCUP 114        2076
*  AND OUT THE VALUE TO BE PACKED INTO X1                        PCUP 115        2077
SCH      BX1     X1*X4                                          PCUP 116        2078
*  OR THE SIG5 INTO X1                                           PCUP 117        2079
         BX1     X1+X5                                          PCUP 118        2080
*  COMPLEMENT X6                                                 PCUP 119        2081
         BX6     -X6                                            PCUP 120        2082
*  ZERO OUT THE BITS INTO WHICH THE PACKED VALUE IS TO BE INSERTED  PCUP 121        2083
         BX2     X2*X6                                          PCUP 122        2084
*  OR THE PACKED VALUE INTO A 60 BIT WORD AT THE PROPER LOCATION PCUP 123        2085
         BX2     X1+X2                                          PCUP 124        2086
*  SHIFT THE 60 BIT WORD TO REALIGN WITH CORE                    PCUP 125        2087
         LX6     B2,X2                                          PCUP 126        2088
*  STORE THE 60 BIT PACKED WORD IN CORE                          PCUP 127        2089
*  THE FUNCTION RETURNS A 60 BIT PACKED VALUE                    PCUP 128        2090
         SA6     A2                                             PCUP 129        2091
*  RESTORE A0                                                    PCUP 130        2092
         SA0     B7                                             PCUP 131        2093
*  BRANCH OUT OF THE ROUTINE                                     PCUP 132        2094
         ZR      PACK                                           PCUP 133        2095
UNPK     BSSZ    1                                              PCUP 134        2096
IUNPK    EQU     UNPK                                           PCUP 135        2097
*  SET FLAG TO INDICATE AN  UNPACK INSTRUCTION IS DESIRED        PCUP 136        2098
         SB1     B0                                             PCUP 137        2099
         ZR      INIT                                           PCUP 138        2100
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*  OR THE 60 BIT WORD OF CORE TO REMOVE 1 PACKED VALUE INTO X6
 UPK      BX6    X2*X4
*  OR A 60 BIT WORD TO REMOVE SIGN OF PACKED WORD INTO X5
          BX5    X5*X2
*  COMPLEMENT VALUE IF SIGN MASK INDICATES A NEGATIVE VALUE
          ZR     X5,SC
          BX4    -X4
          BX6    X4+X6
*  RESTORE A0
 SC       SA0    B7
*  BRANCH OUT OF THE ROUTINE
          ZR     UNPK
*  GENERATE A DAYFILE MESSAGE AND ABORT JOB IF AN INTEGER TO BE
*  PACKED IS TOO LARGE FOR THE SPECIFIED BIT PATTERN
PKMSS     DATA   C*VALUE TOO LARGE TO PACK*
DMP       MESSAGE PKMSS,,1
AB        ABORT
*  ENTRY POINT TO ABORT JOB AND EXECUTE EXIT CONTROL CARDS.
ABT       DATA   0
          EQ     AB
          END
          IDENT  CORS
          ENTRY  CORSIZ
          VFD    36/6HCORSIZ,24/0
          USE    //
A         BSS    1
          USE    /K/
          BSS     7
KORE      BSS    1
CM        BSS    1
          USE    0
CORSIZ    DATA   0
          MEMORY CM,STATUS,1
          SX0    1B
          SA3    STATUS
          IX6    X3-X0
          LX6    30
          SA6    CM
          SX5    A
          IX6    X6-X5
          SA6    KORE
          EQ     CORSIZ
STATUS    DATA   0
          END
```

APPENDIX B
LISTING OF THE MACHINE-INDEPENDENT VERSION OF BANDIT

```
C                                                                       BANDIT 5
C                    B A N D I T                                        BANDIT 6
C                                                                       BANDIT 7
C MAIN PROGRAM FOR THE RENUMBERING OF NASTRAN GRID POINTS FOR           BANDIT 8
C      REDUCED BANDWIDTH.                                               BANDIT 9
C THE NASTRAN DATA DECK MUST CONTAIN A BEGIN BULK CARD IN ITS           BANDIT10
C      PROPER PLACE AND TERMINATE WITH AN ENDDATA CARD.                 BANDIT11
      DIMENSION A(20)                                                   BANDIT12
      COMMON KOM(25000)                                                 DD     1
      COMMON /S/ NN,MM,IH,IB                                            BANDIT14
      COMMON /P/ IHD,IHE                                                BANDIT15
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC                                BANDIT16
      COMMON /B/ IPARAM(20),IARG(5)                                     BANDIT17
      COMMON /C/ IWARN,LINE,KORIG,KNEW                                  BANDIT18
      COMMON /K/ II(7),KORE,IFL                                         BANDIT19
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 BANDIT20
      COMMON /TIME/ STIME,NCOMP                                         BANDIT21
      COMMON /NEL/ NEL,TIM2                                             BANDIT22
      COMMON /DDL/ ISTART(100),IGNORE(100),IFIRST(100)                  BANDIT23
      COMMON /DDLL/ IDIM,ISTA,IIG,IFIR,IGDEG,ISCH                       BANDIT24
      COMMON /ZERO/ KT                                                  BANDIT25
      COMMON /NG/ NGRID,CLOCK                                           BANDIT26
      INTEGER EOF                                                       BANDIT27
      DATA BEGI,ENDD,SEQG/4HBEGI,4HENDD,4HSEQG/                         BANDIT28
C SET NGRID DEFAULT.                                                    BANDIT35
      KORE=25000                                                        DD     2
      NGRID = KORE/28                                                   DD     3
C SET SCHEME DEFAULTS.                                                  BANDIT38
      IARG(1)=80                                                        BANDIT39
      IARG(2)=1                                                         BANDIT40
      IARG(3)=2                                                         BANDIT41
      IARG(4)=2                                                         BANDIT42
      IARG(5)=0                                                         BANDIT43
C SET NUMBER OF BITS PER WORD FOR INTERNAL AND EXTERNAL                 BANDIT44
C          GRID NUMBERS.                                                BANDIT45
      NBITIN=12                                                         BANDIT46
      NBITEX=60                                                         BANDIT47
    7 FORMAT(141,16(/),                                                 BANDIT48
     1 36X,57HBBBBBB     AAAAA    N     N   DDDDDD    IIIIIII   TTTTTTT/BANDIT49
     2 36X,57HB     B   A     A   NN    N   D     D      I         T   /BANDIT50
     3 36X,57HB     B   A     A   N N   N   D     D      I         T   /BANDIT51
     4 36X,57HBBBBBB    A     A   N  N  N   D     D      I         T   /BANDIT52
     5 36X,57HB     B   AAAAAAA   N   N N   D     D      I         T   /BANDIT53
     6 36X,57HB     B   A     A   N    NN   D     D      I         T   /BANDIT54
     7 36X,57HBBBBBB    A     A   N     N   DDDDDD    IIIIIII      T   )BANDIT55
    8 FORMAT(22(/),48X,34HTHEORY OF STRUCTURES BRANCH - 1844 /          DD     4
     1      46X,38HCOMPUTATION AND MATHEMATICS DEPARTMENT  /            BANDIT57
     2      44X,42HNAVAL SHIP RESEARCH AND DEVELOPMENT CENTER /         BANDIT58
     3  53X,24HBETHESDA, MARYLAND 20034 )                               BANDIT59
    9 FORMAT(/37X,                                                      DD     5
     +  16HREV. 10 MAR 1972 )                                           BANDIT61
   10 FORMAT(20A4)                                                      BANDIT62
   11 FORMAT(1H ,20A4)                                                  BANDIT63
   12 FORMAT(1H1)                                                       BANDIT64
   13 FORMAT(///26H TOTAL CP TIME IN BANDIT    ,F9.3,6H  SEC.)          DD     6
      LINE=55                                                           BANDIT66
      KNEW=0                                                            BANDIT67
      REWIND 8                                                          BANDIT68
C PRINT TITLE PAGE.                                                     BANDIT69
      WRITE(6,7)                                                        BANDIT70
      WRITE(6,8)                                                        BANDIT71
      WRITE(6,9)                                                        BANDIT72
C INITIALIZE VARIABLES.                                                 BANDIT73
      DO 15 J=1,20                                                      BANDIT74
   15 IPARAM(J)=0                                                       BANDIT75
      IPARAM(12)=4                                                      BANDIT76
      IDIM=100                                                          BANDIT77
      ISTA=0                                                            BANDIT78
      IIG=0                                                             BANDIT79
      ISCH=0                                                            BANDIT80
      IFIR=0                                                            BANDIT81
      IGDEG=0                                                           BANDIT82
      DO 18 I=1,IDIM                                                    BANDIT83
      ISTART(I)=0                                                       BANDIT84
      IFIRST(I)=0                                                       BANDIT85
   18 IGNORE(I)=0                                                       BANDIT86
      IPASS=0                                                           BANDIT87
      NN=0                                                              BANDIT88
      MM=0                                                              BANDIT89
      MAXGRD=0                                                          BANDIT90
      MAXDEG=0                                                          BANDIT91
      KMOD=0                                                            BANDIT92
      KORIG=0                                                           BANDIT93
      KNEW=0                                                            BANDIT94
      STIME=0.                                                          BANDIT95
      NCOMP=0                                                           BANDIT96
      NEL=0                                                             BANDIT97
      KT=0                                                              BANDIT98
      TIM2=0.                                                           BANDIT99
      REWIND 9                                                          BANDIT100
C READ DECK FOR FIRST TIME.                                             BANDIT101
      CALL GOOGAN(1,2,5,9)                                              BANDIT102
C SLICE UP CORE ACCORDING TO SUBROUTINE GRID.                           BANDIT103
      K2=II(1)*II(2)+1                                                  BANDIT104
      K3=K2+II(3)*2                                                     BANDIT105
      K4=K3+II(4)                                                       BANDIT106
      K5=K4+II(5)                                                       BANDIT107
      K6=K5+II(6)                                                       BANDIT108
      K7=K6+II(7)                                                       BANDIT109
C PROCESS DECK.                                                         BANDIT110
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      CALL NASNUM(KOM(1),II(1),KOM(K2),II(3),KOM(K3),KOM(K4),KOM(K5),   BANDI111      101
     + KOM(K6),KOM(K7),KOM(1),KOM(K2))                                  BANDI112      102
C       ARRAY STARTING AT LOCATION K7 HAS DIMENSION 2*MAXDEG            BANDI113      103
C PROCESS OUTPUT ACCORDING TO OUTPUT REQUESTS.                          BANDI114      104
C CHECK IF CONNECTION CARDS IN DECK.                                    BANDI115      105
      IF(IPARAM(9).EQ.3)GO TO 19                                        BANDI116      106
      REWIND 8                                                          BANDI117      107
      REWIND 9                                                          BANDI118      108
      FLAG=ENDD                                                         BANDI119      109
      J=0                                                               BANDI120      110
      K=9                                                               BANDI121      111
      GO TO 20                                                          BANDI122      112
   19 REWIND 8                                                          BANDI123      113
      J=0                                                               BANDI124      114
      K=8                                                               BANDI125      115
      FLAG=ENDD                                                         BANDI126      116
      IF(IPARAM(5).EQ.4)GO TO 20                                        BANDI127      117
      K=9                                                               BANDI128      118
      IF(IPARAM(6).EQ.3)FLAG=BEGI                                       BANDI129      119
   20 READ(K,10)A                                                       BANDI130      120
      IF(EOF(K).NE.0)CALL BOMBIT(1)                                     BANDI131      121
      J=J+1                                                             BANDI132      122
      IF(IPARAM(10).EQ.5.AND.A(1).NE.SEQG) J=J-1                        BANDI133      123
      IF(MOD(J,LINE).EQ.1)WRITE(6,12)                                   BANDI134      124
      IF(IPARAM(10).EQ.6) WRITE(6,11) A                                 BANDI135      125
      IF(IPARAM(10).EQ.5.AND.A(1).EQ.SEQG) WRITE(6,11)A                 BANDI136      126
      IF(IPARAM(1).EQ.2)WRITE(7,10)A                                    BANDI137      127
      IF(IPARAM(1).EQ.1.AND.A(1).EQ.SEQG) WRITE(7,10) A                 BANDI138      128
      IF(K.NE.8) WRITE(8,10) A                                          BANDI139      129
      IF(A(1).NE.FLAG)GO TO 20                                          BANDI140      130
      IF(FLAG.EQ.ENDD)GO TO 25                                          BANDI141      131
      FLAG=ENDD                                                         BANDI142      132
      K=5                                                               BANDI143      133
      GO TO 20                                                          BANDI144      134
   25 CONTINUE                                                          JJ     7      135
      IF(IPARAM(5).EQ.3)GO TO 60                                        BANDI147      136
      IF(IPARAM(7).EQ.4)GO TO 60                                        BANDI148      137
      IF(IPARAM(9).EQ.4)GO TO 60                                        BANDI149      138
C USER SUMMARY.                                                         BANDI150      139
      WRITE(6,50) KORIG,KNEW                                            JJ     8      140
   50 FORMAT(23H1***BANDIT USER SUMMARY /                               BANDI152      141
     1 8X,25HORIGINAL SEMI-BANDWIDTH    ,I9/                           JJ     9      142
     2 8X,20HNEW SEMI-BANDWIDTH    ,I14)                               JJ    10      143
      WRITE(6,117) IHO,IHE                                              BANDI156      144
  117 FORMAT(8X,18HORIGINAL PROFILE  ,I16/8X,13HNEW PROFILE   ,I21)     JJ    11      145
      WRITE(6,104) NN                                                   BANDI158      146
      WRITE(6,113) NEL                                                  BANDI159      147
      WRITE(6,112) NCOMP                                                BANDI160      148
      WRITE(6,107) MM                                                   BANDI161      149
  107 FORMAT(8X,22HMAXIMUM NODAL DEGREE    ,I12)                        JJ    12      150
      WRITE(6,116) KT                                                   BANDI163      151
      I=IPARAM(1)                                                       BANDI164      152
      IF(I.EQ.1) WRITE(6,101)                                           BANDI165      153
      IF(I.EQ.2) WRITE(6,102)                                           BANDI166      154
      IF(I.EQ.3) WRITE(6,103)                                           BANDI167      155
  101 FORMAT(8X,34HPUNCH OUTPUT            SEQGP CARDS )                BANDI168      156
  102 FORMAT(8X,34HPUNCH OUTPUT              ALL CARDS )                BANDI169      157
  103 FORMAT(8X,34HPUNCH OUTPUT                   NONE )                BANDI170      158
      WRITE(6,105) MAXGRD,MAXDEG                                        BANDI172      159
  105 FORMAT(18X,8HMAXGRD  ,I11/18X,8HMAXDEG    ,I11)                   JJ    13      160
  111 FORMAT(8X,14HDATE AND TIME ,2A10)                                 BANDI177      161
C IPASS=NUMBER OF PSUP CALLS.                                           BANDI178      162
  104 FORMAT(8X,23HNUMBER OF GRID POINTS    ,I11)                       JJ    14      163
  113 FORMAT(8X,23HNUMBER OF ELEMENTS    ,I14)                          JJ    15      164
  112 FORMAT(8X,22HNUMBER OF COMPONENTS    ,I12)                        JJ    16      165
  116 FORMAT(8X,23HNO. OF POINTS OF ZERO DEGREE ,I6)                    JJ    17      166
      GO TO 70                                                          BANDI184      167
   60 IF(IPARAM(10).EQ.5) WRITE(6,12)                                   BANDI185      168
   70 CONTINUE                                                          BANDI187      169
      REWIND 8                                                          BANDI188      170
      IF(IPARAM(8).EQ.4) STOP 5                                         BANDI190      171
      STOP                                                              BANDI191      172
      END                                                               BANDI192      173
      SUBROUTINE NASNUM(IG,III,INV,III3,INT,ICC,ILD,NORIG,IP,JG,JNV)    NASNUM 2      174
      DIMENSION A(8),KG(40),LG(40),LINE(10),B(20),ATEMP(4)              NASNUM 3      175
      DIMENSION IG(III1,1),INV(III3,2),JG(1),JNV(1)                     NASNUM 4      176
      DIMENSION INT(1),ICC(1),ILD(1),NORIG(1),IP(1)                     NASNUM 5      177
C IP HAS DIMENSION 2*MAXDEG.   JG AND JNV ARE EQUIV TO IG AND INV.      NASNUM 6      178
      COMMON /S/ NN,MM,IH,IB                                            NASNUM 7      179
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC                                NASNUM 8      180
      COMMON /B/ IPARAM(20),IARG(5)                                     NASNUM 9      181
      COMMON /C/ IWARN,NLINE,KORIG,KNEW                                 NASNUM10      182
      COMMON /ITS/ NSITIN,NSITEX,IPASS                                  NASNUM11      183
      COMMON /X/ II(7),KORE                                             NASNUM12      184
      COMMON /TIME/ TIM2,NCOMP                                          NASNUM13      185
      COMMON /NEL/ NEL                                                  NASNUM14      186
      COMMON /JOL/ ISTART(100),IGNORE(100),IFIRST(100)                  NASNUM15      187
      COMMON /JOLL/ IDIM,ISTA,IIG,IFIR,IGDEG,ISCH                       NASNUM16      188
C THE VARIABLE LINE DEFINED NEAR CARD NASNUM.300 IS NOT THE             NASNUM17      189
C       SAME AS THE VARIABLE LINE APPEARING IN COMMON                   NASNUM18      190
C            IN OTHER ROUTINES.                                         NASNUM19      191
      DIMENSION TYPE(50),MTYPE(50)                                      NASNUM20      192
      DIMENSION F1A(2),F10A(2),F1B(2),F10B(2)                           NASNUM21      193
      DATA BLGI,ENDD,SEQG/4HBEGI,4HENDD,4HSEQG/                         NASNUM22      194
      DATA TYPE/4HCBAR,4HCELA,4HCELA,4HCONR,4HCQDM,4HCQDP,4HCQUA,       NASNUM23      195
     1   4HCQUA,4HCQUA,4HCROD,4HCSHE,4HCTRB,4HCTRI,4HCTRI,4HCTRM,       NASNUM24      196
     2   4HCTRP,4HCTUB,4HCTWI,4HENDD,4HMPC*,4HCDAM,4HCDAM,4HCMAS,       NASNUM25      197
     3   4HCMAS,4HCVIS,4HCDAM,4HCDAM,4HCELA,4HCELA,4HCMAS,4HCMAS,       NASNUM26      198
     4   4HCCON,4HCTOR,4HCTRA,4HCTRI,4HCDAM,4HCONM,4HCHIT,4HCIS3,       NASNUM27      199
     5   4HCIS3,4HCIS2,4HCIS2,4HCISH,4HCISH,4HCFLU,4HCFLU,4HCFLU,       NASNUM28      200
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     6   4HCTET,4HCHEX,4HCHEX/                                          NASNUM29
      DATA WYPE/4H*    ,4HS1* ,4HS2* ,4HOD* ,4HEM* ,4HLT* ,4HD1* ,      NASNUM30
     1   4HD2* ,4HD3* ,4H*    ,4HAR* ,4HSC* ,4HA1* ,4HA2* ,4HEM* ,      NASNUM31
     2   4HLT* ,4HE*  ,4HST* ,4HATA ,4H     ,4HP1* ,4HP2* ,4HS1* ,      NASNUM32
     3   4HS2* ,4HS*  ,4HP3* ,4HP4* ,4HS3* ,4HS4* ,4HS3* ,4HS4* ,      NASNUM33
     4   4HEAX*,4HORG*,4HPRG*,4HARG*,4H1*  ,4H2*  ,4HRI2*,4HD8* ,      NASNUM34
     5   4HD20*,4HD4* ,4HD8* ,4H8*  ,4H16* ,4HID2*,4HID3*,4HID4*,      NASNUM35
     6   4HRA* ,4HA1* ,4HA2* /                                          NASNUM36
      NTYPE=50                                                          NASNUM37
      REWIND 8                                                          NASNUM38
      REWIND 9                                                          NASNUM39
      NMPC=40                                                           NASNUM40
      KMOD=2.*FLOAT(MAXGRD)-2.2715*SQRT(1.131*FLOAT(MAXGRD))            NASNUM41
      NEW=0                                                             NASNUM42
      IWARN=0                                                           NASNUM43
      NEQ=0                                                             NASNUM44
    2 FORMAT(29H1BANDIT INFORMATION MESSAGE - /                         NASNUM45
     +19H      NO GRID POINTS/                                          NASNUM46
     +28H      RESEQUENCING SUPPRESSED)                                 NASNUM47
    4 FORMAT(     19H ***NEW BANDWIDTH =,I6)                            NASNUM48
    5 FORMAT(33H1THE WRONG CARD FOLLOWS THIS CARD/1X,2A4,1P4E16.7,2A4// NASNUM49
     2        40H THE CONTINUATION CARD IS REQUIRED NEXT ,              NASNUM50
     3     36HSINCE BANDIT DOES NOT SORT THE DECK. /                    NASNUM51
     4 13H FATAL ERROR. )                                               NASNUM52
    6 FORMAT(1H1)                                                       NASNUM53
    7 FORMAT(54H1 ONE OR MORE SEQGP CARDS ALREADY APPEAR IN DATA DECK./ NASNUM54
     +  55H  RESEQUENCING CANNOT BE REQUESTED.          FATAL ERROR. )  NASNUM55
    8 FORMAT(5HSEQGP,3X,2I8,56X)                                        NASNUM56
    9 FORMAT(20A4)                                                      NASNUM57
   10 FORMAT(2A4,4F16.0,2A4)                                            NASNUM58
   11 FORMAT(1H ,5(I8,I11,7X))                                          NASNUM59
   12 FORMAT(5HSEQGP,3X,8I8,8X)                                         NASNUM60
   14 FORMAT(////26H ***BANDIT WARNING MESSAGE /                        NASNUM61
     1 11X,35HTHE WRONG CARD MAY FOLLOW THIS CARD /                     NASNUM62
     2  11X,2A4,1P4E16.7,2A4/                                           NASNUM63
     3      11X,47HCHECK INPUT DECK TO BE SURE THAT A CONTINUATION ,    NASNUM64
     4  42H CARD IS NEITHER MISSING NOR OUT OF SORT.    )               NASNUM65
   15 FORMAT(26H TOTAL CP TIME IN SCHEME = ,F9.3,6H  SEC. )             NASNUM66
   19 FORMAT(1H1,5(20HINTERNAL    ORIGINAL,6X)/                         NASNUM67
     11H ,5(20HGRID NO.    GRID PT.,6X))                                NASNUM68
C RETURN IF RESEQUENCING IS NOT DESIRED.                                NASNUM69
      IF(IPARAM(5).EQ.3)RETURN                                          NASNUM70
C CHECK IF SEQGP CARDS ALREADY APPEAR IN DECK.                          NASNUM71
      IF(IPARAM(7).EQ.3)GO TO 22                                        NASNUM72
C ABORT BANDIT SINCE SEQGP CARDS ALREADY APPEAR IN DECK.                NASNUM73
      WRITE(6,7)                                                        NASNUM74
      CALL BOMBIT(3)                                                    NASNUM75
C READ AND EXTRACT CONNECTION CARDS FROM DECK.                          NASNUM76
   22 CALL GOOGAN(2,1,9,8)                                              NASNUM77
      REWIND 8                                                          NASNUM78
      REWIND 9                                                          NASNUM79
C INITIALIZE EXPANDABLE CORE.                                           NASNUM80
      DO 30 I=1,KORE                                                    NASNUM81
   30 JG(I)=0                                                           NASNUM82
C READ CARD.                                                            NASNUM83
   40 READ(8,10)F1A,(A(I),I=1,4),F10A                                   NASNUM84
C DETERMINE CARD TYPE.                                                  NASNUM85
   45 ITYPE=0                                                           NASNUM86
      DO 50 I=1,NTYPE                                                   NASNUM87
   50 IF(F1A(1).EQ.TYPE(I).AND.F1A(2).EQ.WYPE(I)) ITYPE=I               NASNUM88
      IF(ITYPE.EQ.0)GO TO 40                                            NASNUM89
      IF(ITYPE.EQ.19)GO TO 500                                          NASNUM90
      IF(ITYPE.EQ.20.AND.IPARAM(4).EQ.3)GO TO 40                        NASNUM91
C READ CONTINUATION TO CARD JUST READ.                                  NASNUM92
      READ(8,10)F1B,(A(I),I=5,8),F10B                                   NASNUM93
C CHECK EACH LOGICAL CARD FOR PROPER SORT.                              NASNUM94
      IF(F1B(1).EQ.F10A(1).AND.F1B(2).EQ.F10A(2)) GO TO 60              NASNUM95
C--- IF FOLLOWING CARD TYPES ARE OUT OF SORT, NO ERROR                  NASNUM96
      IF(ITYPE.EQ.1.OR.ITYPE.EQ.4)GO TO 56                              NASNUM97
      IF(ITYPE.EQ.32)GO TO 56                                           NASNUM98
      IF(ITYPE.EQ.33)GO TO 56                                           NASNUM99
      IF(ITYPE.EQ.35)GO TO 56                                           NASNU100
      IF(ITYPE.EQ.36)GO TO 56                                           NASNU101
      IF(ITYPE.EQ.37)GO TO 56                                           NASNU102
      IF(ITYPE.EQ.45.OR.ITYPE.EQ.46) GO TO 56                           NASNU103
C--- IF FOLLOWING CARD TYPES ARE OUT OF SORT, POSSIBLE ERROR (GIVE      NASNU104
C---              WARNING MESSAGE)                                      NASNU105
      IWARN=IWARN+1                                                     NASNU106
      IF(MOD(IWARN,6).EQ.1)WRITE(6,6)                                   NASNU107
      IF(ITYPE.EQ. 2) GO TO 54                                          NASNU108
      IF(ITYPE.EQ. 3) GO TO 54                                          NASNU109
      IF(ITYPE.EQ.10) GO TO 54                                          NASNU110
      IF(ITYPE.EQ.17) GO TO 54                                          NASNU111
      IF(ITYPE.GE.21.AND.ITYPE.LE.31)GO TO 54                           NASNU112
C--- FOR OTHER CARD TYPES OUT OF SORT, ABORT BANDIT                     NASNU113
   52 WRITE(6,5)F1A,(A(I),I=1,4),F10A                                   NASNU114
      CALL BOMBIT(2)                                                    NASNU115
   54 WRITE(6,14)F1A,(A(I),I=1,4),F10A                                  NASNU116
C SAVE CONTENTS OF THE SECOND CARD OF THE PAIR.                         NASNU117
   56 DO 58 I=1,4                                                       NASNU118
      ATEMP(I)=A(I+4)                                                   NASNU119
   58 A(I+4)=0.                                                         NASNU120
C INITIALIZE KG AND LG.                                                 NASNU121
   60 DO 70 I=1,NMPC                                                    NASNU122
      KG(I)=0                                                           NASNU123
   70 LG(I)=0                                                           NASNU124
      LOOP=1                                                            NASNU125
      NCON=4                                                            NASNU126
C SET UP KG AND LG.  **                                                 NASNU127
      GO TO (160,220,220,200,120,120,120,120,120,180,120,140,140,        NASNU128
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     1        140,140,140,180,120,500,230,220,220,220,220,180,180,
     2        180,180,180,180,180,160,160,110,114,118,118,140, 80,
     3         85,120, 90, 80, 95,200,114,110,120, 90, 90),ITYPE
C* CIS3D8,CISH8
   80 DO 81 I=1,7
   81 KG(I)=A(I+1)+0.5
      NCON=8
      READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A
      IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100
      KG(8)=A(1)+0.5
      GO TO 250
C* CIS3D20
   85 DO 86 I=1,7
   86 KG(I)=A(I+1)+0.5
      NCON=20
      READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A
      IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100
      READ(8,10) F1B,A(5),A(6),A(7),A(8),F10B
      IF(F1B(1).NE.F10A(1).OR.F1B(2).NE.F10A(2)) GO TO 52
      DO 87 I=8,15
   87 KG(I)=A(I-7)+0.5
      READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A
      IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100
      READ(8,10) F1B,A(5),A(6),A(7),A(8),F10B
      IF(F1B(1).NE.F10A(1).OR.F1B(2).NE.F10A(2)) GO TO 52
      DO 88 I=16,20
   88 KG(I)=A(I-15)+0.5
      GO TO 250
C* CIS2D8,CHEXA1,CHEXA2
   90 DO 91 I=1,6
   91 KG(I)=A(I+2)+0.5
      NCON=8
      READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A
      IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100
      DO 92 I=7,8
   92 KG(I)=A(I-6)+0.5
      GO TO 250
C* CISH16
   95 DO 96 I=1,7
   96 KG(I)=A(I+1)+0.5
      NCON=16
      READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A
      IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100
      READ(8,10) F1B,A(5),A(6),A(7),A(8),F10B
      IF(F1B(1).NE.F10A(1).OR.F1B(2).NE.F10A(2)) GO TO 52
      DO 97 I=9,15
   97 KG(I)=A(I-7)+0.5
      READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A
      IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100
      KG(16)=A(1)+0.5
      GO TO 250
  100 F1A(1)=F1B(1)
      F1A(2)=F1B(2)
       DO 101 I=1,4
  101 A(I)=A(I+4)
      F10A(1)=F10B(1)
      F10A(2)=F10B(2)
      GO TO 52
C* CTRAPRG,CFLUID4
  110 DO 112 I=1,4
  112 KG(I)=A(I+1)+0.5
      GO TO 250
C* CTRIARG,CFLUID3
  114 DO 116 I=1,3
  116 KG(I)=A(I+1)+0.5
      GO TO 250
C* CONM1, CONM2
  118 KG(1)=A(2)+0.5
      KG(2)=KG(1)
      GO TO 250
C* CQDMEM,CQDPLT,CQUAD1,CQUAD2,CQUAD3,CSHEAR,CTWIST,CIS2D4,CTETRA
  120 DO 130 I=1,4
  130 KG(I)=A(I+2)+0.5
      GO TO 250
C* CTRBSC, CTRIA1, CTRIA2, CTRMEM, CTRPLT, CHTTRI2
  140 DO 150 I=1,3
  150 KG(I)=A(I+2)+0.5
      GO TO 250
C* CBAR, CCONEAX, CTORDRG
  160 DO 170 I=1,2
  170 KG(I)=A(I+2)+0.5
      GO TO 250
C* CROD, CTUBE, CVISC, CDAMP3, CDAMP4, CELAS3, CELAS4, CMASS3, CMASS4
  180 DO 190 I=1,2
      KG(I)=A(I+2)+0.5
  190 LG(I)=A(I+6)+0.5
C SET LOOP=2 SINCE 2 ELEMENTS MAY BE DEFINED ON ONE CARD.
      LOOP=2
      GO TO 250
C* CONROD,CFLUID2
  200 DO 210 I=1,2
  210 KG(I)=A(I+1)+0.5
      GO TO 250
C* CELAS1, CELAS2, CDAMP1, CDAMP2, CMASS1, CMASS2
  220 KG(1)=A(3)+0.5
      KG(2)=A(5)+0.5
      GO TO 250
C PROCESS MPC CARDS.
  230 NCON=NMPC
      KG(1)=A(2)+0.5
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      KG(2)=A(5)+0.5                                                    NASNU229        401
      I=2                                                               NASNU230        402
  240 READ(8,10)F1A,(A(J),J=1,4),F10A                                   NASNU231        403
      IF(F10B(1).NE.F1A(1).OR.F10B(2).NE.F1A(2)) GO TO 250              NASNU232        404
      I=I+1                                                             NASNU233        405
      IF(I.GT.NMPC)GO TO 245                                            NASNU234        406
      F10B(1)=F10A(1)                                                   NASNU235        407
      F10B(2)=F10A(2)                                                   NASNU236        408
      KK=2                                                              NASNU237        409
      IF(MOD(I,2).EQ.0)KK=1                                             NASNU238        410
      KG(I)=A(KK)+0.5                                                   NASNU239        411
      GO TO 240                                                         NASNU240        412
  245 WRITE(6,246) NMPC                                                 NASNU241        413
  246 FORMAT(36H1 AN MPC EQUATION CONTAINS MORE THAN,I5,8H  TERMS./     NASNU242        414
     + 14H  FATAL ERROR. )                                              NASNU243        415
      CALL BOMBIT(5)                                                    NASNU244        416
C PROCESS KG (AND LG IF LOOP=2) ARRAY.                                  NASNU245        417
  250 DO 480 KK=1,LOOP                                                  NASNU246        418
      IF(KK.EQ.1)GO TO 300                                              NASNU247        419
      DO 260 I=1,4                                                      NASNU248        420
  260 KG(I)=LG(I)                                                       NASNU249        421
C SCATTER SEARCH AND CONVERT KG TO TEMPORARY SET OF INTERNAL NUMBERS.   NASNU250        422
  300 CALL SCAT(KG,NCON,NEW,INV,II3,NORIG)                              NASNU251        423
      IF(ITYPE.NE.20)GO TO 420                                          NASNU252        424
C SAVE MPC GRID POINTS FOR LATER PROCESSING BY TIGER.                   NASNU253        425
      NEQ=NEQ+1                                                         NASNU254        426
      WRITE(11)KG                                                       NASNU255        427
      GO TO 45                                                          NASNU256        428
C FILL CONNECTION TABLE ARRAY IG.                                       NASNU257        429
  420 IEND=NCON-1                                                       NASNU258        430
      NEL=NEL+1                                                         NASNU259        431
      DO 450 I=1,IEND                                                   NASNU260        432
      L=I+1                                                             NASNU261        433
      DO 450 J=L,NCON                                                   NASNU262        434
  450  CALL SETIG(KG(I),KG(J),IG,II1,NORIG)                             NASNU263        435
  480 CONTINUE                                                          NASNU264        436
      IF(F1B(1).EQ.F10A(1).AND.F1B(2).EQ.F10A(2)) GO TO 40              NASNU265        437
      IF(NCON.GE.8) GO TO 40                                            NASNU266        438
      F1A(1)=F1B(1)                                                     NASNU267        439
      F1A(2)=F1B(2)                                                     NASNU268        440
      DO 495 I=1,4                                                      NASNU269        441
  495 A(I)=ATEMP(I)                                                     NASNU270        442
      F10A(1)=F10B(1)                                                   NASNU271        443
      F10A(2)=F10B(2)                                                   NASNU272        444
      GO TO 45                                                          NASNU273        445
  500 NN=NEW                                                            NASNU274        446
      IF(NEW.GT.0) GO TO 502                                            NASNU275        447
      WRITE(6,2)                                                        NASNU276        448
      IPARAM(9)=4                                                       NASNU277        449
      RETURN                                                            NASNU278        450
  502 IF(IPARAM(4).EQ.3)GO TO 505                                       NASNU279        451
C MODIFY CONNECTION TABLE TO ACCOUNT FOR MPC EQUATIONS.                 NASNU280        452
      CALL TIGER(NEQ,IG,II1,ILD,NORIG)                                  NASNU281        453
      NDEP=NN                                                           NASNU282        454
      CALL FIXIT(ILD,NDEP)                                              NASNU283        455
C GENERATE NEW IG AND NORIG ARRAYS.                                     NASNU284        456
  505 CALL BRIGIT(IG,II1,INV,II3,INT,ICC,NORIG,IP)                      NASNU285        457
C PRINT INTERNAL/EXTERNAL CORRESPONDENCE TABLE.                         NASNU286        458
      LEN=50                                                            NASNU287        459
      IF(IPARAM(10).EQ.5) GO TO 560                                     NASNU288        460
      J=0                                                               NASNU289        461
  510 WRITE(6,19)                                                       NASNU290        462
  520 J=J+1                                                             NASNU291        463
      KEND=0                                                            NASNU292        464
      DO 530 K=1,9,2                                                    NASNU293        465
      L=J+LEN*(K-1)/2                                                   NASNU294        466
      LINE(K)=L                                                         NASNU295        467
      IF(L.GT.NEW) GO TO 550                                            NASNU296        468
      KEND=K+1                                                          NASNU297        469
  530 LINE(K+1)=NORIG(L)                                                NASNU298        470
  550 CONTINUE                                                          NASNU299        471
      IF(KEND.EQ.0)GO TO 560                                            NASNU300        472
      WRITE(6,11)(LINE(K),K=1,KEND)                                     NASNU301        473
      IF(MOD(J,LEN).NE.0)GO TO 520                                      NASNU302        474
      J=J+4*LEN                                                         NASNU303        475
      IF(J.LT.NEW) GO TO 510                                            NASNU304        476
  560 CONTINUE                                                          NASNU305        477
C CONVERT ISTART,IGNORE,IFIRST FROM ORIGINAL TO INTERNAL NUMBERS.       NASNU306        478
      I=ISTA+IIG+IFIR                                                   NASNU307        479
      IF(I.LE.0) GO TO 570                                              NASNU308        480
      CALL FLIP(ISTART,ISTA,INV,II3,ICC)                                NASNU309        481
      CALL FLIP(IGNORE,IIG ,INV,II3,ICC)                                NASNU310        482
      CALL FLIP(IFIRST,IFIR,INV,II3,ICC)                                NASNU311        483
      IF(IPARAM(10).EQ.5) GO TO 570                                     NASNU312        484
C PRINT INTERNAL NUMBERS FOR $-CARDS.                                   NASNU313        485
      WRITE(6,561)                                                      NASNU314        486
  561 FORMAT(30H1   $ CARDS (INTERNAL NUMBERS) /)                       NASNU315        487
      IF(ISTA.GT.0) WRITE(6,562) (ISTART(I),I=1,ISTA)                   NASNU316        488
      IF(IIG .GT.0) WRITE(6,564) (IGNORE(I),I=1,IIG )                   NASNU317        489
      IF(IFIR.GT.0) WRITE(6,566) (IFIRST(I),I=1,IFIR)                   NASNU318        490
  562 FORMAT(9H $START  ,20I5/100(9X,20I5/))                            NASNU319        491
  564 FORMAT(9H $IGNORE ,20I5/100(9X,20I5/))                            NASNU320        492
  566 FORMAT(9H $FIRST  ,20I5/100(9X,20I5/))                            NASNU321        493
  570  CONTINUE                                                         NASNU322        494
C SET UP LIST OF POINTS TO IGNORE IN INT ARRAY.                         NASNU323        495
      K=0                                                               NASNU324        496
      IF(IPARAM(4).EQ.3) GO TO 920                                      NASNU325        497
      IF(NDEP.LE.0) GO TO 920                                           NASNU326        498
C  MPC DEPENDENT POINTS FIRST.                                          NASNU327        499
      DO 915 I=1,NDEP                                                   NASNU328        500
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      J=ILD(I)                                                          NASNU329
      IF(J.LE.0) GO TO 915                                              NASNU330
      K=K+1                                                             NASNU331
      INT(K)=ICC(J)                                                     NASNU332
      IF(K.GE.MAXGRD) CALL FIXIT(INT,K)                                 NASNU333
  915 CONTINUE                                                          NASNU334
  920 IF(IGDEG.LE.0) GO TO 940                                          NASNU335
C  GRID POINTS WITH DEGREE.GT.IGDEG SECOND.                             NASNU336
      IF(IGDEG.GE.MM) GO TO 940                                         NASNU337
      CALL DEGREE(IG,II1,INV)                                           NASNU338
C HERE, INV(I)=DEGREE OF GRID POINT I                                   NASNU339
      DO 930 I=1,NN                                                     NASNU340
      IF(JNV(I).LE.IGDEG) GO TO 930                                     NASNU341
      K=K+1                                                             NASNU342
      INT(K)=I                                                          NASNU343
      IF(K.GE.MAXGRD) CALL FIXIT(INT,K)                                 NASNU344
  930 CONTINUE                                                          NASNU345
  940 IF(IIG.LE.0) GO TO 960                                            NASNU346
C  $IGNORE POINTS THIRD.                                                NASNU347
      DO 950 I=1,IIG                                                    NASNU348
      J=IGNORE(I)                                                       NASNU349
      IF(J.LE.0) GO TO 950                                              NASNU350
      K=K+1                                                             NASNU351
      INT(K)=J                                                          NASNU352
      IF(K.GE.MAXGRD) CALL FIXIT(INT,K)                                 NASNU353
  950 CONTINUE                                                          NASNU354
C K=NUMBER OF POINTS TO BE IGNORED BEFORE COMPRESSING LIST.             NASNU355
  960 IF(K.LE.0) GO TO 970                                              NASNU356
C DELETE POINTS LISTED IN INT ARRAY FROM CONNECTION TABLE IG.           NASNU357
      CALL MORRIS(INT,K,IG,II1)                                         NASNU358
  970 CONTINUE                                                          NASNU359
C RENUMBER NODES WITH SUBROUTINE SCHEME.                                NASNU360
      IF(IPARAM(10).EQ.6) IARG(5)=1                                     NASNU361
      II8=II3/2                                                         NASNU362
      CALL SCHEME(IARG(1),IARG(2),IARG(3),IARG(4),IARG(5),IG,II1,       NASNU364
     + JNV(1),JNV(II8+1),JNV(2*II8+1),JNV(3*II8+1),INT,ICC,ILD,IP)      NASNU365
      IF(IPARAM(10).EQ.5) GO TO 580                                     NASNU368
      WRITE(6,4)IB                                                      NASNU370
C WRITE NEW NASTRAN DATA DECK.                                          NASNU371
  580 READ(9,9)B                                                        NASNU372
      WRITE(8,9)B                                                       NASNU373
      IF(B(1).NE.BEGI)GO TO 580                                         NASNU374
  590 READ(9,9)B                                                        NASNU375
      IF(B(1).GE.SEQG.OR.B(1).EQ.ENDD)GO TO 600                         NASNU376
      WRITE(8,9)B                                                       NASNU377
      GO TO 590                                                         NASNU378
C WRITE SEQGP CARDS.                                                    NASNU379
  600 KREM=MOD(NEW,4)                                                   NASNU380
      IF(NEW.GE.4) GO TO 605                                            NASNU381
      KBEG=1                                                            NASNU382
      GO TO 612                                                         NASNU383
605   IEND=NEW-KREM-3                                                   NASNU384
      DO 610 K=1,IEND,4                                                 NASNU385
      L=K+3                                                             NASNU386
  610 WRITE(8,12) (NORIG(I),ILD(I),I=K,L)                               NASNU387
      IF(KREM.EQ.0)GO TO 620                                            NASNU388
      KBEG=IEND+4                                                       NASNU389
  612 DO 615 I=KBEG,NEW                                                 NASNU390
  615 WRITE(8,8) NORIG(I),ILD(I)                                        NASNU391
C WRITE THE REMAINDER OF THE NASTRAN DECK.                              NASNU392
  620 WRITE(8,9)B                                                       NASNU393
      IF(B(1).EQ.ENDD)GO TO 700                                         NASNU394
      READ(9,9)B                                                        NASNU395
      GO TO 620                                                         NASNU396
  700 CONTINUE                                                          NASNU397
      IF(IPARAM(10).EQ.5) GO TO 900                                     NASNU398
C PRINT ORIGINAL GRID POINT CONNECTION TABLE.                           NASNU399
      MAXD=MM                                                           NASNU400
      L=MAXD/11+1                                                       NASNU401
      L=LEN/L                                                           NASNU402
705   FORMAT(10H1      GRID,5X,5H  MAX,15X,13H*CONNECTIONS*,5X,         NASNU403
     +      23H(ORIGINAL GRID NUMBERS) /5X,                             NASNU404
     +      20HPOINT COMP DIST DEGR ,11(8X,1H*) )                       NASNU405
710   FORMAT(I10,3I5,11I9/25(25X,11I9/))                                NASNU406
      DO 750 I=1,NN                                                     NASNU407
      IF(MOD(I,L).EQ.1) WRITE(6,705)                                    NASNU408
      DO 720 J=1,MAXD                                                   NASNU409
720   IP(J)=0                                                           NASNU410
C CALCULATE MDIST AND PRINT TABLE.                                      NASNU411
      MDIST=0                                                           NASNU412
      DO 725 J=1,MAXD                                                   NASNU413
      K=IG(I,J)                                                         JJ    18
      IF(K.EQ.0) GO TO 725                                              NASNU415
      MDIST=MAX0(MDIST,IABS(I-K))                                       NASNU416
      IP(J)=NORIG(K)                                                    NASNU417
725   CONTINUE                                                          NASNU418
      K=NORIG(I)                                                        NASNU419
      IP1=INV(I,1)                                                      NASNU420
      IP2=INV(MAXGRD+I,1)                                               NASNU421
750   WRITE(6,710) K,IP1,MDIST,IP2,(IP(J),J=1,MAXD)                     NASNU422
C PRINT CONNECTION TABLE FOR RENUMBERED NUMBERS.                        NASNU423
      DO 780 I=1,NEW                                                    NASNU424
  780 ICC(I)=ILD(I)                                                     NASNU425
      CALL SWITCH(IG,II1,INT,ICC,IP(1),IP(MAXDEG+1))                    NASNU426
      CALL DEGREE(IG,II1,JNV(II8+1))                                    NASNU427
      L=COMPNT(IG,II1,JNV(1),JNV(II8+1),JNV(3*II8+1),ICC)               NASNU428
      L=MAXD/26+1                                                       NASNU429
      L=LEN/L                                                           NASNU430
805   FORMAT(37H1LABEL  COMP MDIST  DEGR  CONNECTIONS ,10X,             NASNU431
     +        20H(RENUMBERED NUMBERS) )                                 NASNU432
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  810 FORMAT(5I6,20I6/ 25(25X,21I5/))                                   NASNU433        601
      DO 850 I=1,NN                                                     NASNU434        602
      IF(MOD(I,L).EQ.1) WRITE(6,805)                                    NASNU435        603
      DO 820 J=1,MAXD                                                   NASNU436        604
820   IP(J)=0                                                           NASNU437        605
C CALCULATE MDIST AND PRINT TABLE.                                      NASNU438        606
      MDIST=0                                                           NASNU439        607
      DO 825 J=1,MAXD                                                   NASNU440        608
      K=IG(I,J)                                                         JJ    19        609
      IF(K.EQ.J) GO TO 825                                              NASNU442        610
      MDIST=MAXD(MDIST,IABS(I-K))                                       NASNU443        611
      IP(J)=K                                                           NASNU444        612
825   CONTINUE                                                          NASNU445        613
C INV(I,1)=ICC(I)  BEFORE PACKING                                       NASNU446        614
C INV(MAXGRD+I,1)=IDEG(I)  BEFORE PACKING                               NASNU447        615
      IP1=INV(I,1)                                                      NASNU448        616
      IP2=INV(MAXGRD+I,1)                                               NASNU449        617
850   WRITE(6,810) I,IP1,MDIST,IP2,(IP(J),J=1,MAXD)                     NASNU450        618
900   RETURN                                                            NASNU451        619
      END                                                               NASNU452        620
      SUBROUTINE FLIP(LIST,N,INV,II3,ICC)                               FLIP    2       621
C CONVERT B-ARRAY LIST OF LENGTH N FROM ORIGINAL TO INTERNAL NUMBERS.   FLIP    3       622
      COMMON /A/ MAXGRD,MAXDEG,KMOD                                     FLIP    4       623
      DIMENSION LIST(1),INV(II3,2),ICC(1)                               FLIP    5       624
C CHECK FOR DUPLICATE AND ZERO ENTRIES AND REDUCE N IF NECESSARY.       FLIP    6       625
      CALL FIXIT(LIST,N)                                                FLIP    7       626
      IF(N.LE.0) RETURN                                                 FLIP    8       627
      DO 20 I=1,N                                                       FLIP    9       628
      J=LIST(I)                                                         FLIP   10       629
      IF(J.LE.0) GO TO 30                                               FLIP   11       630
      LOC=J-1                                                           FLIP   12       631
   10 LOC=MOD(LOC,KMOD)+1                                               FLIP   13       632
      IF(INV(LOC,1).EQ.0) GO TO 30                                      FLIP   14       633
      IF(INV(LOC,1).NE.J) GO TO 10                                      FLIP   15       634
      K=INV(LOC,2)                                                      FLIP   16       635
      LIST(I)=ICC(K)                                                    FLIP   17       636
   20 CONTINUE                                                          FLIP   18       637
      RETURN                                                            FLIP   19       638
C ABORT BANDIT DUE TO ILLEGAL GRID POINT REFERENCE ON $-CONTROL CARD.   FLIP   20       639
   30 WRITE(6,40) J                                                     FLIP   21       640
   40 FORMAT(11H1GRID POINT ,I10,30H  APPEARING ON A $ CARD IS NOT  ,   FLIP   22       641
     + 25H A STRUCTURAL GRID POINT.  /13H FATAL ERROR.  )               FLIP   23       642
      CALL BOMBIT(8)                                                    FLIP   24       643
      END                                                               FLIP   25       644
      SUBROUTINE GOOGAN(KA,KB,NIN,NOUT)                                 GOOGAN 2       645
C THIS ROUTINE READS A NASTRAN DATA DECK AND RIGHT-ADJUSTS ALL          GOOGAN 3       646
C       BULK DATA IN ITS FIELDS.                                        GOOGAN 4       647
C IN ADDITION, THE CALLING ARGUMENTS PROVIDE THE FOLLOWING OPTIONS -    GOOGAN 5       648
C       KA=1, PROCESS ALL CARDS IN THE NASTRAN DATA DECK, OR            GOOGAN 6       649
C         =2, PROCESS ONLY THOSE CARDS WITH A C OR G IN COLUMN 1,       GOOGAN 7       650
C               MPC CARDS, AND THOSE CONTINUATION CARDS WITH ALL        GOOGAN 8       651
C               NUMERIC FIELDS.  THE ENDDATA CARD IS WRITTEN IN ANY CASE.GOOGAN 9       652
C       KB = 1, CONVERT ALL 8 COLUMN FIELDS TO 16 COLUMN FIELDS, OR     GOOGAN10       653
C          = 2, THE FIELD WIDTHS REMAIN UNCHANGED.                      GOOGAN11       654
C       NIN = THE LOGICAL UNIT FROM WHICH THE INPUT DECK IS READ.       GOOGAN12       655
C       NOUT = THE LOGICAL UNIT ON WHICH THE OUTPUT IS WRITTEN.         GOOGAN13       656
C NEITHER NIN NOR NOUT ARE REWOUND IN THIS ROUTINE.                     GOOGAN14       657
C IF AN ASTERISK APPEARS IN FIELD 1 AFTER THE MNEMONIC, IT IS LEFT-     GOOGAN15       658
C       ADJUSTED AGAINST THE MNEMONIC.                                  GOOGAN16       659
C THE FOLLOWING TWO (2) CARDS ARE REQUIRED IN THE DATA DECK -           GOOGAN17       660
C       (1) A BEGIN BULK CARD TO INDICATE THE BEGINNING OF THE          GOOGAN18       661
C           BULK DATA DECK, AND                                         GOOGAN19       662
C       (2) AN ENDDATA CARD TO INDICATE THE END OF THE DATA DECK.       GOOGAN20       663
C ALL CARDS PRECEDING THE BEGIN BULK CARD ARE WRITTEN ON NOUT IFF KA=1. GOOGAN21       664
      DIMENSION ANUM(10)                                                GOOGAN22       665
      COMMON A(80),IP(40)                                               GOOGAN23       666
      COMMON IA,IB,ICARD,IFLAG,J,JNB,L,MKHOLD,MKINSR,MKNIN              GOOGAN24       667
      COMMON NBLANK,NFIELD,I,ICOL,IFIELD,IPROC,ITYPE                    GOOGAN25       668
      COMMON K,KAST,KBLK,MKI,MKJ,NCOL,NIP,NN                            GOOGAN26       669
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC                                GOOGAN27       670
      COMMON /3/ IPARAM(20),IARG(5)                                     GOOGAN28       671
      COMMON /DOL/ ISTART(100),IGNORE(100),IFIRST(100)                  GOOGAN29       672
      COMMON /DOLL/ IDIM,ISTA,IIG,IFIR,IGDEG,ISCH                       GOOGAN30       673
      COMMON /NG/ NGRID                                                 GOOGAN31       674
      REAL M,N,II,LL,JJ,KK                                              GOOGAN32       675
      INTEGER EOF                                                       GOOGAN33       676
C DATA CARDS FOR ALPHABET (ALLOWS FOR FUTURE ADDITIONS TO               GOOGAN34       677
C             USER OPTION LIST).                                        GOOGAN35       678
      DATA B,C,D,E,G,M,N,P/1HB,1HC,1HD,1HE,1HG,1HM,1HN,1HP/             GOOGAN36       679
      DATA AA,II,LL,O,R/1HA,1HI,1HL,1HO,1HR/                            GOOGAN37       680
      DATA Q,S,T,U,Y/1HQ,1HS,1HT,1HU,1HY/                               GOOGAN38       681
      DATA F,H,JJ,KK/1HF,1HH,1HJ,1HK/                                   GOOGAN39       682
      DATA V,W,X,ZZ/1HV,1HW,1HX,1HZ/                                    GOOGAN40       683
      DATA ASTER,PLUS,BLANK,DOLLAR/1H*,1H+,1H ,1H$/                     GOOGAN41       684
      DATA ANUM/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/                GOOGAN42       685
      DATA LFLAG/0/                                                     GOOGAN43       686
      DATA IBOMB,IBOM/0,0/                                              GOOGAN44       687
      LFLAG=LFLAG+1                                                     GOOGAN45       688
    9 FORMAT(1H1)                                                       GOOGAN46       689
   10 FORMAT(80A1)                                                      GOOGAN47       690
   11 FORMAT(8A1,4(8X,8A1),3H*XZ,I5/3H*XZ,I5,4(8X,8A1),8A1)             GOOGAN48       691
      ICARD=0                                                           GOOGAN49       692
      MKINSR=12                                                         GOOGAN50       693
      MKNIN=NIN                                                         GOOGAN51       694
C READ EXECUTIVE OR CASE CONTROL CARD.                                  GOOGAN52       695
   20 READ(NIN,10)A                                                     GOOGAN53       696
      IF(EOF(NIN).EQ.0)GO TO 21                                         GOOGAN54       697
      IF(NIN.EQ.MKNIN)CALL BOMBIT(1)                                    GOOGAN55       698
      MKNINJ=NIN                                                        GOOGAN56       699
      NIN=MKINSR                                                        GOOGAN57       700
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      MKINSR=MKHOLD                                                     GOOGAN58
      GO TO 20                                                          GOOGAN59
   21 IFLAG=0                                                           GOOGAN60
      ICARD=ICARD+1                                                     GOOGAN61
C PROCESS OUTPUT OPTION CARD, IF PRESENT.                               GOOGAN62
      IF(A(1).NE.DOLLAR)GO TO 26                                        GOOGAN63
      IF(LFLAG.GT.1) GO TO 29                                           GOOGAN64
C LOOK FOR FIRST KEYWORD.                                               GOOGAN65
      ITYPE=0                                                           GOOGAN66
      IF(A(2).EQ.P.AND.A(3).EQ.U)ITYPE=1                                GOOGAN67
      IF(A(2).EQ.M.AND.A(3).EQ.P)ITYPE=4                                GOOGAN68
      IF(A(2).EQ.S.AND.A(3).EQ.E)ITYPE=5                                GOOGAN69
      IF(A(2).EQ.R.AND.A(3).EQ.II)ITYPE=6                               GOOGAN70
      IF(A(2).EQ.N.AND.A(3).EQ.AA)ITYPE=8                               GOOGAN71
      IF(A(2).EQ.P.AND.A(3).EQ.R)ITYPE=10                               GOOGAN72
      IF(A(2).EQ.S.AND.A(3).EQ.C)GO TO 1100                             GOOGAN73
      IF(A(2).EQ.S.AND.A(3).EQ.T) GO TO 1200                            GOOGAN74
      IF(A(2).EQ.D.AND.A(3).EQ.E) GO TO 1250                            GOOGAN75
      IF(A(2).EQ.F.AND.A(3).EQ.II) GO TO 1300                           GOOGAN76
      IF(A(2).EQ.II.AND.A(3).EQ.G) GO TO 1350                           GOOGAN77
      IF(A(2).EQ.G.AND.A(3).EQ.R) GO TO 1380                            GOOGAN78
      IF(A(2).EQ.AA.AND.A(3).EQ.T) ITYPE=12                             GOOGAN79
      IF(A(2).EQ.M.AND.A(3).EQ.AA) ITYPE=13                             GOOGAN80
      IF(A(2).NE.II.OR.A(3).NE.N)GO TO 1025                             GOOGAN81
C     INSERT CARDS FROM ALTERNATE FILE                                  GOOGAN82
      IPARAM(11)=1                                                      GOOGAN83
      MKHOLD=NIN                                                        GOOGAN84
      NIN=MKINSR                                                        GOOGAN85
      MKINSR=MKHOLD                                                     GOOGAN86
      DO 1021 MKI=2,80                                                  GOOGAN87
      MKJ=81-MKI                                                        GOOGAN88
 1021 A(MKJ+1)=A(MKJ)                                                   GOOGAN89
      IPARAM(6)=4                                                       GOOGAN90
 1025 IF(ITYPE.EQ.0)GO TO 26                                            GOOGAN91
C LOOK FOR SECOND KEYWORD.                                              GOOGAN92
      I=3                                                               GOOGAN93
   22 I=I+1                                                             GOOGAN94
      IF(I.GE.79)GO TO 26                                               GOOGAN95
      IF(A(I).NE.BLANK)GO TO 22                                         GOOGAN96
   24 I=I+1                                                             GOOGAN97
      IF(I.GE.80)GO TO 26                                               GOOGAN98
      IF(A(I).EQ.BLANK)GO TO 24                                         GOOGAN99
      J=0                                                               GOOGA100
      IF(A(I).EQ.S.AND.A(I+1).EQ.E)J=1                                  GOOGA101
      IF(A(I).EQ.AA.AND.A(I+1).EQ.LL)J=2                                GOOGA102
      IF(A(I).EQ.N.AND.A(I+1).EQ.O)J=3                                  GOOGA103
      IF(A(I).EQ.Y.AND.A(I+1).EQ.E)J=4                                  GOOGA104
      IF(A(I).EQ.M.AND.A(I+1).EQ.II) J=5                                GOOGA105
      IF(A(I).EQ.M.AND.A(I+1).EQ.AA) J=6                                GOOGA106
      IF(J.EQ.0)GO TO 26                                                GOOGA107
C SET PARAMETER.                                                        GOOGA108
      IPARAM(ITYPE)=J                                                   GOOGA109
      GO TO 26                                                          GOOGA110
C READ $SCHEME CARD.                                                    GOOGA111
 1100 CALL READIT(A,IP,NIP)                                             GOOGA112
      ISCH=1                                                            GOOGA113
      I=MIN0(NIP,5)                                                     GOOGA114
      IF(I.EQ.0) GO TO 29                                               GOOGA115
      DO 1110 J=1,I                                                     GOOGA116
 1110 IARG(J)=IP(J)                                                     GOOGA117
      GO TO 29                                                          GOOGA118
C READ $START CARD.                                                     GOOGA119
 1200 CALL READIT(A,IP,NIP)                                             GOOGA120
      I=ISTA                                                            GOOGA121
      ISTA=ISTA+NIP                                                     GOOGA122
      IF(ISTA.LE.IDIM) GO TO 1205                                       GOOGA123
      IBOM=2                                                            GOOGA124
      ISTA=IDIM                                                         GOOGA125
      GO TO 29                                                          GOOGA126
 1205 DO 1210 J=1,NIP                                                   GOOGA127
 1210 ISTART(I+J)=IP(J)                                                 GOOGA128
      GO TO 29                                                          GOOGA129
C READ $DEGREE CARD.                                                    GOOGA130
 1250 CALL READIT(A,IP,NIP)                                             GOOGA131
      IGDEG=IP(1)                                                       GOOGA132
      GO TO 29                                                          GOOGA133
C READ $FIRST CARD.                                                     GOOGA134
 1300 CALL READIT(A,IP,NIP)                                             GOOGA135
      I=IFIR                                                            GOOGA136
      IFIR=IFIR+NIP                                                     GOOGA137
      IF(IFIR.LE.IDIM) GO TO 1308                                       GOOGA138
      IBOM=2                                                            GOOGA139
      IFIR=IDIM                                                         GOOGA140
      GO TO 29                                                          GOOGA141
 1308 DO 1310 J=1,NIP                                                   GOOGA142
 1310 IFIRST(I+J)=IP(J)                                                 GOOGA143
      GO TO 29                                                          GOOGA144
C READ $IGNORE CARD.                                                    GOOGA145
 1350 CALL READIT(A,IP,NIP)                                             GOOGA146
      I=IIG                                                             GOOGA147
      IIG=IIG+NIP                                                       GOOGA148
      IF(IIG.LE.IDIM) GO TO 1360                                        GOOGA149
      IBOM=2                                                            GOOGA150
      IIG=IDIM                                                          GOOGA151
      GO TO 29                                                          GOOGA152
 1360 DO 1365 J=1,NIP                                                   GOOGA153
 1365 IGNORE(I+J)=IP(J)                                                 GOOGA154
      GO TO 29                                                          GOOGA155
C READ $GRID CARD.                                                      GOOGA156
1380  CALL READIT(A,IP,NIP)                                             GOOGA157
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      NGRID=IP(1)                                                       GOOGA158
      GO TO 29                                                          GOOGA159
C LOOK FOR BEGIN BULK CARD.                                             GOOGA160
   26 I=0                                                               GOOGA161
   27 I=I+1                                                             GOOGA162
      IF(I.GT.75)GO TO 29                                               GOOGA163
      IF(A(I).EQ.BLANK)GO TO 27                                         GOOGA164
      IF(A(I).NE.B)GO TO 29                                             GOOGA165
      IF(A(I+1).NE.E)GO TO 29                                           GOOGA166
      IF(A(I+2).NE.G)GO TO 29                                           GOOGA167
      IF(A(I+3).NE.II)GO TO 29                                          GOOGA168
      IFLAG=1                                                           GOOGA169
C LEFT-ADJUST BEGIN BULK CARD.                                          GOOGA170
      K=73-I                                                            GOOGA171
      DO 28 J=1,72                                                      GOOGA172
      IF(J.LE.K)A(J)=A(J+I-1)                                           GOOGA173
   28 IF(J.GT.K)A(J)=BLANK                                              GOOGA174
      IF(LFLAG.GT.1) GO TO 29                                           GOOGA175
C REJECT ILLEGAL PARAMETERS AND SET TO DEFAULTS.                        GOOGA176
      IF(IPARAM(1).NE.2.AND.IPARAM(1).NE.3) IPARAM(1)=1                 GOOGA177
      DO 1450 I=2,9                                                     GOOGA178
 1450 IF(IPARAM(I).NE.4) IPARAM(I)=3                                    GOOGA179
      IF(IPARAM(10).NE.6) IPARAM(10)=5                                  GOOGA180
      IF(IPARAM(12).NE.3) IPARAM(12)=4                                  GOOGA181
      IF(IPARAM(13).NE.4) IPARAM(13)=3                                  GOOGA182
      CALL GRID(NGRID)                                                  GOOGA183
      I=ISTA+IIG+IFIR+ISCH+IGDEG                                        GOOGA184
      IF(I.LE.0) GO TO 29                                               GOOGA185
C CHECK FOR ILLEGAL SCHEME ARGUMENTS.                                   GOOGA186
      DO 1460 I=1,3                                                     GOOGA187
 1460 IF(IARG(I).LT.1.OR.IARG(I).GT.MAXGRD) IBOMB=1                     GOOGA188
      IF(IARG(4).LT.2.OR.IARG(4).GT.3) IBOMB=1                          GOOGA189
      IF(IARG(5).LT.0.OR.IARG(5).GT.1) IBOMB=1                          GOOGA190
      WRITE(6,3)                                                        GOOGA191
      IF(ISCH.GT.0) WRITE(6,1500) (IARG(I),I=1,5)                       GOOGA192
 1500 FORMAT(//,9H $SCHEME ,10I10/200(9X,10I10/))                       GOOGA193
      IF(ISTA.GT.0) WRITE(6,1505) (ISTART(I),I=1,ISTA)                  GOOGA194
 1505 FORMAT(//,9H $START  ,10I10/200(9X,10I10/))                       GOOGA195
      IF(IGDEG.GT.0) WRITE(6,1510) IGDEG                                GOOGA196
 1510 FORMAT(//,9H $DEGREE ,10I10/200(9X,10I10/))                       GOOGA197
      IF(IFIR.GT.0) WRITE(6,1515) (IFIRST(I),I=1,IFIR)                  GOOGA198
 1515 FORMAT(//,9H $FIRST  ,10I10/200(9X,10I10/))                       GOOGA199
      IF(IIG.GT.0) WRITE(6,1520) (IGNORE(I),I=1,IIG)                    GOOGA200
 1520 FORMAT(//,9H $IGNORE ,10I10/200(9X,10I10/))                       GOOGA201
      IF(IBOMB.EQ.1) CALL BOMBIT(4)                                     GOOGA202
      IF(IBOM.EQ.2) CALL BOMBIT(9)                                      GOOGA203
   29 IF(KA.EQ.1)WRITE(NOUT,10)A                                        GOOGA204
      IF(IFLAG.EQ.1)GO TO 20                                            GOOGA205
C RETURN IF RIGHT-ADJUSTING OF CARDS IS NOT NEEDED.                     GOOGA206
      IF(IPARAM(5).EQ.3.AND.IPARAM(6).EQ.3)RETURN                       GOOGA207
C READ BULK DATA CARD.                                                  GOOGA208
   30 READ(NIN,10)A                                                     GOOGA209
      IF(EOF(NIN).EQ.0)GO TO 31                                         GOOGA210
      IF(NIN.EQ.MKNIN) CALL BOMBIT(1)                                   GOOGA211
C     SWITCH INPUT FILES                                                GOOGA212
      MKHOLD=NIN                                                        GOOGA213
      NIN=MKINSR                                                        GOOGA214
      MKINSR=MKHOLD                                                     GOOGA215
      GO TO 30                                                          GOOGA216
   31 ICARD=ICARD+1                                                     GOOGA217
C LEFT-ADJUST FIRST FIELD.                                              GOOGA218
      DO 1600 I=1,8                                                     GOOGA219
      IF(A(I).NE.BLANK)  GO TO 1610                                     GOOGA220
 1600 CONTINUE                                                          GOOGA221
      GO TO 30                                                          GOOGA222
 1610 IF(I.EQ.1) GO TO 1650                                             GOOGA223
      J=I-1                                                             GOOGA224
      K=8-J                                                             GOOGA225
      DO 1620 I=1,K                                                     GOOGA226
      A(I)=A(I+J)                                                       GOOGA227
 1620 A(I+J)=BLANK                                                      GOOGA228
 1650 CONTINUE                                                          GOOGA229
C LOOK FOR SEQGP CARD.                                                  GOOGA230
      IF(A(1).EQ.S.AND.A(2).EQ.E.AND.A(3).EQ.Q.AND.A(4).EQ.G)IPARAM(7)=4GOOGA231
C LOOK FOR COMMENT CARD.                                                GOOGA232
      IF(A(1).EQ.DOLLAR.AND.KA.EQ.1)GO TO 35                            GOOGA233
C LOOK FOR ENDDATA CARD.                                                GOOGA234
      I=0                                                               GOOGA235
   32 I=I+1                                                             GOOGA236
      IF(I.GT.75)GO TO 35                                               GOOGA237
      IF(A(I).EQ.BLANK)GO TO 32                                         GOOGA238
      IF(A(I).NE.E)GO TO 40                                             GOOGA239
      IF(A(I+1).NE.N)GO TO 40                                           GOOGA240
      IF(A(I+2).NE.D)GO TO 40                                           GOOGA241
      IF(A(I+3).NE.D)GO TO 40                                           GOOGA242
C LEFT-ADJUST ENDDATA CARD.                                             GOOGA243
      K=73-I                                                            GOOGA244
      DO 33 J=1,72                                                      GOOGA245
      IF(J.LE.K)A(J)=A(J+I-1)                                           GOOGA246
   33 IF(J.GT.K)A(J)=BLANK                                              GOOGA247
      WRITE(NOUT,10)A                                                   GOOGA248
      RETURN                                                            GOOGA249
   35 WRITE(NOUT,10)A                                                   GOOGA250
      GO TO 30                                                          GOOGA251
C DETERMINE IF CARD IS TO BE PROCESSED.                                 GOOGA252
   40 IF(KA.EQ.1)GO TO 150                                              GOOGA253
      IF(A(1).EQ.C.OR.A(1).EQ.G)GO TO 150                               GOOGA254
      IF(A(1).EQ.M.AND.A(2).EQ.P)GO TO 150                              GOOGA255
      NCOL=8                                                            GOOGA256
      IF(A(1).EQ.ASTER)GO TO 50                                         GOOGA257
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      IF(A(1).EQ.PLUS)GO TO 60                                          GOOGA258
      GO TO 30                                                          GOOGA259
   50 NCOL=16                                                           GOOGA260
   60 NFIELD=64/NCOL                                                    GOOGA261
      I=0                                                               GOOGA262
   70 I=I+1                                                             GOOGA263
      IF(I.GT.NFIELD)GO TO 150                                          GOOGA264
      IPROC=0                                                           GOOGA265
      IFLAG=0                                                           GOOGA266
      J=0                                                               GOOGA267
   80 J=J+1                                                             GOOGA268
      IF(IPROC.EQ.1)GO TO 70                                            GOOGA269
      IF(J.LE.NCOL)GO TO 90                                             GOOGA270
      IF(IFLAG.EQ.1)GO TO 30                                            GOOGA271
      GO TO 70                                                          GOOGA272
   90 ICOL=8+NCOL*(I-1)+J                                               GOOGA273
      IF(A(ICOL).EQ.BLANK)GO TO 80                                      GOOGA274
      IFLAG=1                                                           GOOGA275
      DO 100 L=1,10                                                     GOOGA276
  100 IF(A(ICOL).EQ.ANUM(L))IPROC=1                                     GOOGA277
      GO TO 80                                                          GOOGA278
C PROCESS FIRST FIELD.                                                  GOOGA279
  150 NCOL=8                                                            GOOGA280
      KAST=8                                                            GOOGA281
      KBLK=8                                                            GOOGA282
      DO 160 I=1,8                                                      GOOGA283
      IF(A(I).NE.BLANK.AND.A(I).NE.ASTER.AND.A(I+1).EQ.BLANK)KBLK=I+1   GOOGA284
      IF(A(I).EQ.ASTER)KAST=I                                           GOOGA285
  160 IF(A(I).EQ.ASTER)NCOL=16                                          GOOGA286
      IF(A(1).EQ.PLUS)NCOL=8                                            GOOGA287
      IF(NCOL.EQ.16)GO TO 170                                           GOOGA288
      IF(KB.EQ.2)GO TO 200                                              GOOGA289
      IF(A(1).NE.PLUS)A(KBLK)=ASTER                                     GOOGA290
      IF(A(1).EQ.PLUS)A(1)=ASTER                                        GOOGA291
      GO TO 200                                                         GOOGA292
  170 IF(A(1).EQ.ASTER)GO TO 200                                        GOOGA293
      IA=MIN0(KAST,KBLK)                                                GOOGA294
      IB=MAX0(KAST,KBLK)                                                GOOGA295
      A(IB)=BLANK                                                       GOOGA296
      A(IA)=ASTER                                                       GOOGA297
C RIGHT-ADJUST ALL BULK DATA WHICH IS TO BE PROCESSED.                  GOOGA298
  200 NFIELD=64/NCOL                                                    GOOGA299
      IFIELD=0                                                          GOOGA300
  210 IFIELD=IFIELD+1                                                   GOOGA301
      IF(IFIELD.GT.NFIELD)GO TO 300                                     GOOGA302
      I=0                                                               GOOGA303
  220 I=I+1                                                             GOOGA304
      IF(I.GT.NCOL)GO TO 210                                            GOOGA305
      ICOL=9+NCOL*IFIELD-I                                              GOOGA306
      IF(A(ICOL).EQ.BLANK)GO TO 220                                     GOOGA307
      NBLANK=I-1                                                        GOOGA308
      NN=NCOL-NBLANK                                                    GOOGA309
      DO 230 I=1,NCOL                                                   GOOGA310
      J=9+NCOL*IFIELD-I                                                 GOOGA311
      JNB=J-NBLANK                                                      GOOGA312
      IF(I.LE.NN)A(J)=A(JNB)                                            GOOGA313
      IF(I.GT.NN)A(J)=BLANK                                             GOOGA314
  230 CONTINUE                                                          GOOGA315
      GO TO 210                                                         GOOGA316
C WRITE NEW CARD.                                                       GOOGA317
  300 IF(KB.EQ.1) A(73)=ASTER                                           GOOGA318
      IF(NCOL.EQ.8.AND.KB.EQ.1)GO TO 310                                GOOGA319
      WRITE(NOUT,10)A                                                   GOOGA320
      GO TO 30                                                          GOOGA321
  310 WRITE(NOUT,11)(A(I),I=1,40),ICARD,ICARD,(A(I),I=41,80)            GOOGA322
      GO TO 30                                                          GOOGA323
      END                                                               GOOGA324
      SUBROUTINE GRID(NGRID)                                            GRID   2
C PARTITION EXPANDABLE CORE.                                            GRID   3
      COMMON /BITS/ NBITIN,NBITEX                                       GRID   4
      COMMON /A/ MAXGRD,MAXDEG                                          GRID   5
      COMMON /K/ II(7),KOR                                              GRID   6
      MAX=16384                                                         GRID   7
      N=NGRID                                                           GRID   8
      NBITIN = 60                                                       JJ    20
      IF(N.LT.100) N=100                                                GRID  11
      IF(N.GT.MAX) GO TO 40                                             GRID  12
C CALCULATE WIDTH II(2) OF IG MATRIX.                                   GRID  13
20    L=60/NBITIN                                                       GRID  14
      M=60/NBITEX                                                       GRID  15
      N=N+L*M-1                                                         GRID  16
      N=N-MOD(N,L*M)                                                    GRID  17
      MAXGRD=N                                                          GRID  18
C  I=PACKED LENGTH FOR INTERNAL NUMBER.                                 GRID  19
C  J=PACKED LENGTH FOR ORIGINAL NUMBER.                                 GRID  20
      I=N/L                                                             GRID  21
      J=N/M                                                             GRID  22
C SET UP DIMENSIONS IN II ARRAY, WHERE IG(II1,II2),INV(II3,2),          GRID  23
C   INT(II4),ICC(II5),ILD(II6),NORIG(II7)                               GRID  24
      II(1)=I                                                           GRID  25
      II(3)=2*J                                                         GRID  26
      II(4)=J                                                           GRID  27
      II(5)=J                                                           GRID  28
      II(6)=J                                                           GRID  29
      II(7)=J                                                           GRID  30
      I=2*II(3)+II(4)+II(5)+II(6)+II(7)                                 GRID  31
      II(2)=(KOR-I)/(II(1)+2)                                           GRID  32
C DENOMINATOR CONTAINS A 2 TO ALLOW FOR 2 SCRATCH ARRAYS, EACH OF       GRID  33
C          LENGTH MAXDEG.                                               GRID  34
      II(2)=MIN0(II(2),N-1)                                             GRID  35
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      MAXDEG=II(2)                                                      GRID  36        1001
      RETURN                                                            GRID  37        1002
C SUBSTITUTE MAX IF NGRID TOO LARGE.                                    GRID  38        1003
40    N=MAX                                                             GRID  39        1004
      WRITE(6,50) NGRID,N                                               GRID  40        1005
   50 FORMAT(23H1BANDIT WARNING MESSAGE/10X,6H$GRID ,I10,5X,            GRID  41        1006
     +       9HTOO LARGE /10X,6H$GRID ,I10,5X,12HSUBSTITUTED. )         GRID  42        1007
      GO TO 20                                                          GRID  43        1008
      END                                                               GRID  44        1009
      SUBROUTINE READIT(A,IP,NIP)                                       READIT 2        1010
C THIS ROUTINE READS AND STORES (IN IP) NUMERIC DATA APPEARING ON       READIT 3        1011
C    $-CONTROL CARDS UP TO COLUMN 72.                                   READIT 4        1012
      DIMENSION ANUM(10)                                                READIT 5        1013
      DIMENSION A(1),IP(1)                                              READIT 6        1014
      DATA ANUM/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/                READIT 7        1015
C INITIALIZE ARRAY.                                                     READIT 8        1016
      NIP=0                                                             READIT 9        1017
      DO 10 I=1,40                                                      READIT10        1018
   10 IP(I)=0                                                           READIT11        1019
      I=3                                                               READIT12        1020
      DO 70 KOUNT=1,40                                                  READIT13        1021
      NUM=0                                                             READIT14        1022
      NUMFL=0                                                           READIT15        1023
   20 I=I+1                                                             READIT16        1024
      IF(I.LE.72) GO TO 30                                              READIT17        1025
      IF(NUMFL.EQ.1) GO TO 60                                           READIT18        1026
      RETURN                                                            READIT19        1027
   30 K=99                                                              READIT20        1028
      DO 40 J=1,10                                                      READIT21        1029
   40 IF(A(I).EQ.ANUM(J)) K=J-1                                         READIT22        1030
      IF(K.NE.99) GO TO 50                                              READIT23        1031
      IF(NUMFL) 60,20,60                                                READIT24        1032
   50 NUMFL=1                                                           READIT25        1033
      NUM=10*NUM+K                                                      READIT26        1034
      GO TO 20                                                          READIT27        1035
   60 NIP=KOUNT                                                         READIT28        1036
      IP(NIP)=NUM                                                       READIT29        1037
   70 CONTINUE                                                          READIT30        1038
      NIP=40                                                            READIT31        1039
      RETURN                                                            READIT32        1040
      END                                                               READIT33        1041
      SUBROUTINE BOMBIT(IERR)                                           BOMBIT 2        1042
C BOMB BANDIT TO SUPPRESS THE EXECUTION OF NASTRAN.                     BOMBIT 3        1043
      COMMON /B/ IPARAM(20)                                             BOMBIT 4        1044
      COMMON /K/ II(7),KORE,IFL                                         BOMBIT 5        1045
    3 FORMAT(43H1INSUFFICIENT CORE OR $GRID N CARD REQUIRED)            JJ    21        1046
    5 FORMAT(200(1H+,130X/))                                            BOMBIT15        1047
      CALL REMARK(40H   ************************************ )         BOMBIT16        1048
      GO TO (10,20,30,40,50,60,70,80,90), IERR                          BOMBIT17        1049
C EOF ENCOUNTERED.                                                      BOMBIT18        1050
   10 WRITE(6,12)                                                       BOMBIT19        1051
   12 FORMAT(55H1BANDIT FATAL ERROR -     MISSING BEGIN BULK OR ENDDATA,BOMBIT20        1052
     +    6H CARD. )                                                    BOMBIT21        1053
      CALL REMARK(39H   **MISSING BEGIN BULK OR ENDDATA CARD )          BOMBIT22        1054
      GO TO 500                                                         BOMBIT23        1055
C BULK DATA CARD OUT OF SORT.                                           BOMBIT24        1056
   20 CALL REMARK(31H   **BULK DATA CARD OUT OF SORT )                  BOMBIT25        1057
      GO TO 500                                                         BOMBIT26        1058
C SEQGP CARDS IN DECK AND RESEQUENCING REQUESTED.                       BOMBIT27        1059
   30 CALL REMARK(32H   **SEQGP CARDS ALREADY IN DECK )                 BOMBIT28        1060
      GO TO 500                                                         BOMBIT29        1061
C $SCHEME ILLEGAL ARGUMENTS.                                            BOMBIT30        1062
   40 WRITE(6,42)                                                       BOMBIT31        1063
   42 FORMAT(46H1BANDIT FATAL ERROR -     ILLEGAL ARGUMENTS ON,         BOMBIT32        1064
     +   14H $SCHEME CARD. )                                            BOMBIT33        1065
      CALL REMARK(30H   **ILLEGAL $SCHEME ARGUMENTS )                   BOMBIT34        1066
      GO TO 500                                                         BOMBIT35        1067
C  TOO MANY TERMS IN MPC EQUATION.                                      BOMBIT36        1068
   50 CALL REMARK(36H   **MPC EQUATION HAS TOO MANY TERMS )             BOMBIT37        1069
      GO TO 500                                                         BOMBIT38        1070
C MAXDEG EXCEEDED.                                                      BOMBIT39        1071
   60 CALL REMARK(28H   **MAXIMUM DEGREE EXCEEDED )                     BOMBIT40        1072
      WRITE(6,3)                                                        JJ    22        1073
      GO TO 500                                                         BOMBIT42        1074
C MAXGRD EXCEEDED.                                                      BOMBIT43        1075
   70 CALL REMARK(39H   **MAX NUMBER OF GRID POINTS EXCEEDED )          BOMBIT44        1076
      WRITE(6,3)                                                        JJ    23        1077
      GO TO 500                                                         BOMBIT46        1078
C NON-EXISTENT GRID POINT REFERENCE ON $-CARD                           BOMBIT47        1079
   80 CALL REMARK(32H   **ILLEGAL REFERENCE ON $-CARD )                 BOMBIT48        1080
      GO TO 500                                                         BOMBIT49        1081
C TOO MANY GRID POINTS ON $-CARD.                                       BOMBIT50        1082
   90 WRITE(6,92)                                                       BOMBIT51        1083
   92 FORMAT(51H1BANDIT FATAL ERROR -     TOO MANY POINTS ON $-CARD)    BOMBIT52        1084
      CALL REMARK(30H   **TOO MANY POINTS ON $-CARD ).                  BOMBIT53        1085
      GO TO 500                                                         BOMBIT54        1086
C ABORT BANDIT.                                                         BOMBIT55        1087
  500 CALL REMARK(17H   **BANDIT ABORT )                                BOMBIT56        1088
      CALL REMARK(23H   **NASTRAN SUPPRESSED )                          BOMBIT57        1089
      CALL REMARK(40H   ************************************ )         BOMBIT58        1090
      WRITE(6,5)                                                        BOMBIT59        1091
      STOP                                                              BOMBIT66        1092
      END                                                               BOMBIT67        1093
      SUBROUTINE SCAT(KG,NCON,NEW,INV,II3,NORIG)                        SCAT   2        1094
C THIS ROUTINE USES SCATTER SORT TECHNIQUES FOR EACH GRID POINT         SCAT   3        1095
C          ENCOUNTERED TO DETERMINE WHETHER OR NOT THE POINT HAS        SCAT   4        1096
C          BEEN SEEN BEFORE.  IF NOT, INV, NORIG, AND NEW ARE UPDATED.  SCAT   5        1097
C INV(I,1) CONTAINS AN ORIGINAL GRID POINT NUMBER                       SCAT   6        1098
C INV(I,2) CONTAINS THE INTERNAL NUMBER ASSIGNED TO IT (BEFORE SORTING) SCAT   7        1099
      DIMENSION INV(II3,2),NORIG(1)                                     SCAT   8        1100
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      COMMON /A/ MAXGRD,MAXDEG,KMOD                                     SCAT   9        1101
      DIMENSION KG(1)                                                   SCAT  10        1102
      DO 100 I=1,NCON                                                   SCAT  11        1103
      NOLD=KG(I)                                                        SCAT  12        1104
      IF(NOLD.EQ.0)GO TO 100                                            SCAT  13        1105
      LOC=NOLD-1                                                        SCAT  14        1106
   10 LOC=MOD(LOC,KMOD)+1                                               SCAT  15        1107
20    IF(INV(LOC,1).NE.0) GO TO 30                                      SCAT  16        1108
      INV(LOC,1)=NOLD                                                   SCAT  17        1109
      NEW=NEW+1                                                         SCAT  18        1110
      IF(NEW.GT.MAXGRD) GO TO 150                                       SCAT  19        1111
      NORIG(NEW)=NOLD                                                   SCAT  20        1112
      INV(LOC,2)=NEW                                                    SCAT  21        1113
      GO TO 40                                                          SCAT  22        1114
30    IF(INV(LOC,1).NE.NOLD) GO TO 10                                   SCAT  23        1115
40    KG(I)=INV(LOC,2)                                                  SCAT  24        1116
  100 CONTINUE                                                          SCAT  25        1117
      RETURN                                                            SCAT  26        1118
  150 WRITE(6,160) MAXGRD                                               SCAT  27        1119
  160 FORMAT(35H1 THIS STRUCTURE CONTAINS MORE THAN,I6,                 SCAT  28        1120
     + 14H  GRID POINTS. /14H  FATAL ERROR. )                           SCAT  29        1121
      CALL BOMBIT(7)                                                    SCAT  30        1122
      END                                                               SCAT  31        1123
      SUBROUTINE BRIGIT(IG,II1,INV,II3,INT,ICC,NORIG,IP)                BRIGIT 2        1124
C THIS ROUTINE GENERATES A NEW INTERNAL/EXTERNAL CORRESPONDENCE         BRIGIT 3        1125
C       TABLE NORIG AND CONNECTION TABLE IG SUCH THAT THE NEW INTERNAL  BRIGIT 4        1126
C       NUMBERS CORRESPOND TO A SORT OF THE ORIGINAL NUMBERS INTO       BRIGIT 5        1127
C       ASCENDING ORDER.                                                BRIGIT 6        1128
C INPUT - IG,INV,NORIG                                                  BRIGIT 7        1129
C OUTPUT - IG,NORIG,ICC                                                 BRIGIT 8        1130
C SCRATCH - INT,IP                                                      BRIGIT 9        1131
      DIMENSION IG(II1,1),INV(II3,2)                                    BRIGIT10        1132
      DIMENSION INT(1),ICC(1),NORIG(1),IP(1)                            BRIGIT11        1133
      COMMON /S/ NN,MM,IH,I3                                            BRIGIT12        1134
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC                                BRIGIT13        1135
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 BRIGIT14        1136
      REWIND 8                                                          BRIGIT15        1137
C PERFORM A ROUGH SORT OF THE ORIGINAL GRID NUMBERS.                    BRIGIT16        1138
      L=0                                                               BRIGIT17        1139
      KFAC=-1                                                           BRIGIT18        1140
   20 KFAC=KFAC+1                                                       BRIGIT19        1141
      MIN=2147483647                                                    BRIGIT20        1142
      DO 50 I=1,KMOD                                                    BRIGIT21        1143
      IF(INV(I,1).GT.(KFAC*KMOD))                                       BRIGIT22        1144
     +       MIN=MIN0(MIN,INV(I,1))                                     BRIGIT23        1145
   50 CONTINUE                                                          BRIGIT24        1146
      KFAC=(MIN-1)/KMOD                                                 BRIGIT25        1147
      DO 80 I=1,KMOD                                                    BRIGIT26        1148
      IS=INV(I,1)                                                       BRIGIT27        1149
      IF(IS.LE.(KFAC*KMOD).OR.IS.GT.(KFAC+1)*KMOD)GO TO 80              BRIGIT28        1150
      L=L+1                                                             BRIGIT29        1151
      INT(L)=INV(I,1)                                                   BRIGIT30        1152
   80 CONTINUE                                                          BRIGIT31        1153
      IF(L.LT.NN)GO TO 20                                               BRIGIT32        1154
C COMPLETE THE SORTING OF THE ORIGINAL GRID NUMBERS.                    BRIGIT33        1155
      CALL SORT(INT,NN)                                                 BRIGIT34        1156
C DETERMINE CORRESPONDENCE (ICC) BETWEEN NORIG AND INT ARRAYS.          BRIGIT35        1157
      DO 130 I=1,NN                                                     BRIGIT36        1158
      L=INT(I)                                                          BRIGIT37        1159
      LOC=L-1                                                           BRIGIT38        1160
  110 LOC=MOD(LOC,KMOD)+1                                               BRIGIT39        1161
120   IF(INV(LOC,1).NE.L) GO TO 110                                     BRIGIT40        1162
      M=INV(LOC,2)                                                      BRIGIT41        1163
      ICC(M)=I                                                          BRIGIT42        1164
  130 CONTINUE                                                          BRIGIT43        1165
C TRANSFER INT ARRAY TO NORIG ARRAY.                                    BRIGIT44        1166
      DO 220 I=1,NN                                                     BRIGIT45        1167
  220 NORIG(I)=INT(I)                                                   BRIGIT46        1168
C CHANGE IG MATRIX ACCORDING TO CORRESPONDENCE TABLE ICC.               BRIGIT47        1169
      CALL SWITCH(IG,II1,INT,ICC,IP(1),IP(MAXDEG+1))                    BRIGIT48        1170
      REWIND 8                                                          BRIGIT49        1171
      RETURN                                                            BRIGIT50        1172
      END                                                               BRIGIT51        1173
      SUBROUTINE SORT(LIST,NL)                                          SORT   2        1174
C THIS SUBROUTINE SORTS A LIST OF LENGTH NL AND IS BIASED TOWARDS THOSE SORT   3        1175
C   LISTS NOT BADLY OUT OF SORT.                                        SORT   4        1176
      DIMENSION LIST(1)                                                 SORT   5        1177
      IF(NL.LE.1) RETURN                                                SORT   6        1178
      NL1=NL-1                                                          SORT   7        1179
      DO 20 I=1,NL1                                                     SORT   8        1180
      K=NL-I                                                            SORT   9        1181
      KFLAG=0                                                           SORT  10        1182
      DO 10 J=1,K                                                       SORT  11        1183
      IF(LIST(J).LE.LIST(J+1)) GO TO 10                                 SORT  12        1184
      KFLAG=1                                                           SORT  13        1185
      L=LIST(J)                                                         SORT  14        1186
      LIST(J)=LIST(J+1)                                                 SORT  15        1187
      LIST(J+1)=L                                                       SORT  16        1188
   10 CONTINUE                                                          SORT  17        1189
      IF(KFLAG.EQ.0) RETURN                                             SORT  18        1190
   20 CONTINUE                                                          SORT  19        1191
      RETURN                                                            SORT  20        1192
      END                                                               SORT  21        1193
      SUBROUTINE SETIG(KG1,KG2,IG,II1,NORIG)                            SETIG  2        1194
C THIS ROUTINE SETS IG(KG1,-)=KG2 AND IG(KG2,-)=KG1 IF THIS             SETIG  3        1195
C          CONNECTION HAS NOT ALREADY BEEN SET.                         SETIG  4        1196
      DIMENSION IG(II1,1),NORIG(1)                                      SETIG  5        1197
      COMMON /S/ NN,MM,IH,IB                                            SETIG  6        1198
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC                                SETIG  7        1199
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 SETIG  8        1200
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      IF(KG1.EQ.0)RETURN                                                SETIG  9        1201
      IF(KG2.EQ.0)RETURN                                                SETIG 10        1202
      IF(KG1.EQ.KG2)RETURN                                              SETIG 11        1203
      DO 50 LOOP=1,2                                                    SETIG 12        1204
      L=KG1                                                             SETIG 13        1205
      K=KG2                                                             SETIG 14        1206
      IF(LOOP.EQ.1) GO TO 20                                            SETIG 15        1207
      L=KG2                                                             SETIG 16        1208
      K=KG1                                                             SETIG 17        1209
   20 M=0                                                               SETIG 18        1210
   30 M=M+1                                                             SETIG 19        1211
      IF(M.GT.MAXDEG) GO TO 60                                          SETIG 20        1212
      IS = IG(L,M)                                                      JJ    24        1213
      IF(IS.EQ.0) GO TO 40                                              SETIG 22        1214
      IF(IS.NE.K) GO TO 30                                              SETIG 23        1215
      GO TO 50                                                          SETIG 24        1216
   40 IG(L,M) = K                                                       JJ    25        1217
      MM=MAX0(MM,M)                                                     SETIG 26        1218
   50 CONTINUE                                                          SETIG 27        1219
      RETURN                                                            SETIG 28        1220
   60 WRITE(6,70) NORIG(L),MAXDEG                                       SETIG 29        1221
   70 FORMAT(12H1 GRID POINT,I12,26H   HAS DEGREE GREATER THAN,I6/      SETIG 30        1222
     + 14H  FATAL ERROR. )                                              SETIG 31        1223
      CALL BOMBIT(6)                                                    SETIG 32        1224
      END                                                               SETIG 33        1225
      SUBROUTINE TIGER(NEQ,IG,II1,LIST,NORIG)                           TIGER  2        1226
C THIS ROUTINE MAKES ADDITIONS TO THE CONNECTION TABLE IG TO REFLECT    TIGER  3        1227
C     THE PRESENCE OF MPC'S AND STORES THE DEPENDENT POINTS IN LIST.    TIGER  4        1228
C NEQ=NUMBER OF MPC EQUATIONS.                                          TIGER  5        1229
      DIMENSION IG(II1,1),LIST(1),NORIG(1)                              TIGER  6        1230
      COMMON /S/ NN,MM,IH,IB                                            TIGER  7        1231
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC                                TIGER  8        1232
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 TIGER  9        1233
      DIMENSION KG(40)                                                  TIGER 10        1234
      IF(NEQ.EQ.0)RETURN                                                TIGER 11        1235
      REWIND 11                                                         TIGER 12        1236
C INITIALIZE LIST.                                                      TIGER 13        1237
      DO 20 I=1,NN                                                      TIGER 14        1238
   20 LIST(I)=0                                                         TIGER 15        1239
C GENERATE NEW CONNECTIONS.                                             TIGER 16        1240
      DO 100 II=1,NEQ                                                   TIGER 17        1241
      READ(11)KG                                                        TIGER 18        1242
      IGRID=KG(1)                                                       TIGER 19        1243
      LIST(IGRID)=IGRID                                                 TIGER 20        1244
      DO 100 I=1,MAXDEG                                                 TIGER 21        1245
      L = IG(IGRID,I)                                                   JJ    26        1246
      DO 100 J=2,NMPC                                                   TIGER 23        1247
  100 CALL SETIG(L,KG(J),IG,II1,NORIG)                                  TIGER 24        1248
      REWIND 11                                                         TIGER 25        1249
      RETURN                                                            TIGER 26        1250
      END                                                               TIGER 27        1251
      SUBROUTINE SWITCH(IG,II1,IFLAG,KT,KA,KB)                          SWITCH 2        1252
C THIS SUBROUTINE GENERATES A NEW IG MATRIX ACCORDING TO THE            SWITCH 3        1253
C      CORRESPONDENCE TABLE KT, WHICH MUST BE SET UP                    SWITCH 4        1254
C      PRIOR TO THE CALL.    ONLY INTERNAL NUMBERS ARE ALLOWED          SWITCH 5        1255
C      AS VALUES OF KT.                                                 SWITCH 6        1256
C                                                                       SWITCH 7        1257
C INPUT - IG,KT                                                         SWITCH 8        1258
C OUTPUT - IG                                                           SWITCH 9        1259
C SCRATCH - IFLAG,KA,KB                                                 SWITCH10        1260
C                                                                       SWITCH11        1261
      DIMENSION IG(II1,1),IFLAG(1),KT(1),KA(1),KB(1)                    SWITCH12        1262
      COMMON /S/ NN,MM,IH,IB                                            SWITCH13        1263
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC                                SWITCH14        1264
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 SWITCH15        1265
C KT=CORRESPONDENCE TABLE.  KT(OLD) = NEW.                              SWITCH16        1266
C KA,KB = TEMPORARY STORAGE ROWS.                                       SWITCH17        1267
      DO 100 I=1,NN                                                     SWITCH18        1268
      DO 90 J=1,MM                                                      SWITCH19        1269
      L = IG(I,J)                                                       JJ    27        1270
      IF(L.LE.0) GO TO 100                                              SWITCH21        1271
      IS=KT(L)                                                          SWITCH22        1272
      IG(I,J) = IS                                                      JJ    28        1273
   90 CONTINUE                                                          SWITCH24        1274
  100 CONTINUE                                                          SWITCH25        1275
C INITIALIZE FLAGS.                                                     SWITCH26        1276
      DO 120 I=1,NN                                                     SWITCH27        1277
  120 IFLAG(I)=0                                                        SWITCH28        1278
C INITIALIZE TEMPORARY STORAGE ROWS.                                    SWITCH29        1279
      DO 130 I=1,MM                                                     SWITCH30        1280
      KA(I)=0                                                           SWITCH31        1281
  130 KB(I)=0                                                           SWITCH32        1282
C RE-ORDER ROWS OF IG MATRIX.                                           SWITCH33        1283
      DO 200 IROW=1,NN                                                  SWITCH34        1284
      IF(IFLAG(IROW).EQ.1) GO TO 200                                    SWITCH35        1285
      IF(KT(IROW).EQ.IROW) GO TO 200                                    SWITCH36        1286
      IFLAG(IROW)=1                                                     SWITCH37        1287
      DO 140 J=1,MM                                                     SWITCH38        1288
  140 KB(J) = IG(IROW,J)                                                JJ    29        1289
      L=KT(IROW)                                                        SWITCH40        1290
150   IFLAG(L)=1                                                        SWITCH41        1291
      DO 160 J=1,MM                                                     SWITCH42        1292
      KA(J) = IG(L,J)                                                   JJ    30        1293
      IG(L,J) = KB(J)                                                   JJ    31        1294
  160 KB(J)=KA(J)                                                       SWITCH45        1295
      M=KT(L)                                                           SWITCH46        1296
      IF(IFLAG(M).EQ.1) GO TO 170                                       SWITCH47        1297
      L=M                                                               SWITCH48        1298
      GO TO 150                                                         SWITCH49        1299
  170 DO 180 J=1,MM                                                     SWITCH50        1300
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  180 IG(M,J) = KB(J)                                                   JJ    32
  200 CONTINUE                                                          SWITCH52
      RETURN                                                            SWITCH53
      END                                                               SWITCH54
      SUBROUTINE MORRIS(LIST,NL,IG,II1)                                 MORRIS 2
C THIS ROUTINE DELETES ALL REFERENCE IN THE CONNECTION TABLE IG         MORRIS 3
C       TO THOSE POINTS IN A LIST OF LENGTH NL.                         MORRIS 4
      DIMENSION IG(II1,1),LIST(1)                                       MORRIS 5
      COMMON /S/ NN,MM                                                  MORRIS 6
      COMMON /A/ MAXGRD                                                 MORRIS 7
      COMMON /BITS/ NBITIN,NBITEX                                       MORRIS 8
C COMPRESS OUT DUPLICATE ENTRIES IN LIST.                               MORRIS 9
      CALL FIXIT(LIST,NL)                                               MORRIS10
      IF(NL.LE.0) RETURN                                                MORRIS11
      MM1=MM-1                                                          MORRIS12
      DO 60 IJ=1,NL                                                     MORRIS13
      I=LIST(IJ)                                                        MORRIS14
      DO 50 J=1,MM                                                      MORRIS15
      L=IG(I,J)                                                         JJ    33
      IF(L.EQ.0) GO TO 60                                               MORRIS17
      K=0                                                               MORRIS18
   20 K=K+1                                                             MORRIS19
      M=IG(L,K)                                                         JJ    34
      IF(M.NE.I) GO TO 20                                               MORRIS21
      IF(K.GE.MM) GO TO 40                                              MORRIS22
      DO 30 N=K,MM1                                                     MORRIS23
      IS=IG(L,N+1)                                                      JJ    35
   30 IG(L,N) = IS                                                      JJ    36
   40 IG(L,MM) = 0                                                      JJ    37
      IG (I,J) = 0                                                      JJ    38
   50 CONTINUE                                                          MORRIS28
   60 CONTINUE                                                          MORRIS29
      RETURN                                                            MORRIS30
      END                                                               MORRIS31
      SUBROUTINE FIXIT(LIST,NL)                                         FIXIT  2
C THIS ROUTINE COMPRESSES OUT ZEROES AND MULTIPLE ENTRIES IN A LIST     FIXIT  3
C   ORIGINALLY OF LENGTH NL.    A CORRECTED LENGTH NL IS RETURNED TO    FIXIT  4
C   THE CALLING PROGRAM.                                                FIXIT  5
      DIMENSION LIST(1)                                                 FIXIT  6
      IF(NL.LE.0) RETURN                                                FIXIT  7
      IF(NL.EQ.1) GO TO 110                                             FIXIT  8
      NL1=NL-1                                                          FIXIT  9
C DELETE DUPLICATE ENTRIES.                                             FIXIT 10
      DO 20 I=1,NL1                                                     FIXIT 11
      IF(LIST(I).EQ.0) GO TO 20                                         FIXIT 12
      I1=I+1                                                            FIXIT 13
      DO 10 J=I1,NL                                                     FIXIT 14
      IF(LIST(I).NE.LIST(J)) GO TO 10                                   FIXIT 15
      LIST(I)=0                                                         FIXIT 16
      GO TO 20                                                          FIXIT 17
10    CONTINUE                                                          FIXIT 18
20    CONTINUE                                                          FIXIT 19
C DELETE ZEROES.                                                        FIXIT 20
      DO 40 I=1,NL1                                                     FIXIT 21
      K=0                                                               FIXIT 22
25    IF(LIST(I).NE.0) GO TO 40                                         FIXIT 23
      K=K+1                                                             FIXIT 24
      DO 30 J=I,NL1                                                     FIXIT 25
30    LIST(J)=LIST(J+1)                                                 FIXIT 26
      LIST(NL)=0                                                        FIXIT 27
      IF(K.GE.(NL-I+1)) GO TO 70                                        FIXIT 28
      GO TO 25                                                          FIXIT 29
40    CONTINUE                                                          FIXIT 30
C CALCULATE NEW LENGTH NL.                                              FIXIT 31
   70 DO 80 I=1,NL                                                      FIXIT 32
      J=NL-I+1                                                          FIXIT 33
      IF(LIST(J).NE.0) GO TO 90                                         FIXIT 34
   80 CONTINUE                                                          FIXIT 35
   90 NL=NL-I+1                                                         FIXIT 36
      RETURN                                                            FIXIT 37
  110 IF(LIST(1).EQ.0) NL=0                                             FIXIT 38
      RETURN                                                            FIXIT 39
      END                                                               FIXIT 40
      SUBROUTINE SCHEME(NT,NUM,NCM,IO,IP,IG,II1,IC,IDEG,IDIS,IW,        SCHEME 2
     + NEW,ICC,ILD,IPP)                                                 SCHEME 3
C  IO IS VALID IFF 2.LE.IO.LE.3                                         SCHEME 4
      DIMENSION IG(II1,1),IC(1),IDEG(1),IDIS(1),IW(1)                   SCHEME 5
      DIMENSION NEW(1),ICC(1),ILD(1),IPP(1)                             SCHEME 6
C IPP HAS DIMENSION 2*MAXDEG                                            SCHEME 7
      COMMON /S/ NN,MM,IM,IB                                            SCHEME 8
      COMMON /P/ IMO,IHE                                                SCHEME 9
      COMMON /A/ MAXGRD                                                 SCHEME10
      COMMON /C/ IWARN,LINE,KORIG,KNEW                                  SCHEME11
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 SCHEME12
      COMMON /TIME/ STIME,NCM                                           SCHEME13
      COMMON /J/ IPARAM(20)                                             SCHEME14
      COMMON /DOL/ ISTART(100),IGNORE(100),IFIRST(100)                  SCHEME15
      COMMON /DOLL/ IDIM,ISTA,IIG,IFIR                                  SCHEME16
      DIMENSION NODESL(100)                                             SCHEME17
      EQUIVALENCE (IM,ATIME)                                            SCHEME18
C     DETERMINE THE DEGREE OF EACH NODE.                                SCHEME19
      CALL DEGREE(IG,II1,IDEG)                                          SCHEME20
C DETERMINE MODD, THE MOST PREVALENT NODAL DEGREE.                      SCHEME21
      MODD=MODE(IDEG,IPP)                                               SCHEME22
C     DETERMINE THE NUMBER OF COMPONENTS, NCM.                          SCHEME23
      NCM=COMPNT(IG,II1,IC,IDEG,IW,ICC)                                 SCHEME24
C     DETERMINE THE MAXIMUM DEGREE OF ANY NODE.                         SCHEME25
      MAXD=MAXDGR(IO,IC,IDEG)                                           SCHEME26
      MM=MAXD                                                           SCHEME27
C     DETERMINE THE ORIGINAL BANDWIDTH,IS.                              SCHEME28
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      DO 30 I=1,NN                                                      SCHEME29        1401
      NEW(I)=I                                                          SCHEME30        1402
   30 ILD(I)=I                                                          SCHEME31        1403
      IS=MAXBND(0,IG,II1,IC,IDEG,NEW,ILD)                               SCHEME32        1404
      KORIG=IS                                                          SCHEME33        1405
      IH0=IH                                                            SCHEME34        1406
C     INITIALIZE  NEW  AND  ILD  ARRAYS.                                SCHEME35        1407
      DO 35 I=1,NN                                                      SCHEME36        1408
      NEW(I)=0                                                          SCHEME37        1409
   35 ILD(I)=0                                                          SCHEME38        1410
C     IF IP IS NOT EQUAL TO 0, THEN PRINT COMPONENT NUMBER,DEGREE,      SCHEME39        1411
C     AND CONNECTIONS FOR EACH NODE.                                    SCHEME40        1412
      IF(IP.EQ.0) GO TO 31                                              SCHEME41        1413
C PRINT INTERNAL NUMBER CONNECTION TABLE.                               SCHEME42        1414
      DO 60 I=1,NN                                                      SCHEME43        1415
      IF(MOD(I,LINE).EQ.1)WRITE(6,19)                                   SCHEME44        1416
   19 FORMAT(37H1LABEL  COMP MDIST  DEGR  CONNECTIONS ,10X,             SCHEME45        1417
     1   18H(INTERNAL NUMBERS) )                                        SCHEME46        1418
      MDIST=0                                                           SCHEME47        1419
      DO 65 J=1,MAXD                                                    SCHEME48        1420
      IS1 = IG(I,J)                                                     JJ    39        1421
      IF(IS1.EQ.0)GO TO 65                                              SCHEME50        1422
      MDIST=MAX0(MDIST,IABS(I-IS1))                                     SCHEME51        1423
   65 CONTINUE                                                          SCHEME52        1424
      IPP(1)=IC(I)                                                      SCHEME53        1425
      IPP(2)=IDEG(I)                                                    SCHEME54        1426
      DO 610 IP1=1,MAXD                                                 SCHEME55        1427
  610 IPP (IP1+2) = IG(I,IP1)                                           JJ    40        1428
      IS1=MAXD+2                                                        SCHEME57        1429
   60 WRITE(6,61) I,IPP(1),MDIST,(IPP(J),J=2,IS1)                       SCHEME58        1430
   61 FORMAT(5I6,20I5/ 25(25X,21I5/))                                   SCHEME59        1431
      WRITE(6,700)                                                      SCHEME60        1432
  700 FORMAT(1H1,//,32X,31HPROGRAMMER INFORMATION MESSAGES /)            SCHEME61        1433
      WRITE(6,29) IS,IH                                                 SCHEME62        1434
   29 FORMAT(19H ORIGINAL BANDWIDTH,I7,10H   PROFILE,I10)               SCHEME63        1435
      WRITE(6,27) MODD                                                  SCHEME64        1436
   27 FORMAT(30H MODE OF DEGREE DISTRIBUTION =,I5)                      SCHEME65        1437
      IF(ISTA.LE.0) GO TO 31                                            SCHEME66        1438
      WRITE(6,701)                                                      SCHEME67        1439
  701 FORMAT(34H STARTING NODES SUPPLIED BY USER -)                     SCHEME68        1440
      WRITE(6,100) (ISTART(I),I=1,ISTA)                                 SCHEME69        1441
   31 CONTINUE                                                          JJ    41        1442
      IF(IO.EQ.3) IS=IH                                                 SCHEME72        1443
C     GENERATE NUMBERING SCHEME FOR EACH COMPONENT, NC.                 SCHEME73        1444
      DO 500 NC=1,NCM                                                   SCHEME74        1445
C     DETERMINE THE RANGE OF DEGREES (MI  TO  MAD) OF NODES OF INTEREST.SCHEME75        1446
      MI=MINDEG(NC,IC,IDEG)                                             SCHEME76        1447
      MAD=MI                                                            SCHEME77        1448
      IF(NOM) 90,87,90                                                  SCHEME78        1449
   90 MA=MAXDGR(NC,IC,IDEG)                                             SCHEME79        1450
      MAD=MI+((MA-MI)*NUM)/NOM                                          SCHEME80        1451
C MAKE SURE THAT MAD IS LESS THAN MODD.                                 SCHEME81        1452
      MAD=MIN0(MAD,MODD-1)                                              SCHEME82        1453
      MAD=MAX0(MAD,MI)                                                  SCHEME83        1454
C     DETERMINE BANDWIDTH OR SUM CRITERION FOR EACH NODE MEETING SPECI- SCHEME84        1455
C               FIED CONDITION.                                         SCHEME85        1456
   87 IF(IP.EQ.0) GO TO 91                                              SCHEME86        1457
      WRITE(6,162) NC                                                   SCHEME87        1458
  162 FORMAT(22H *******      COMPONENT,I5,12H      *******)            SCHEME88        1459
      IF(IO.EQ.2) WRITE(6,169)                                          SCHEME89        1460
  169 FORMAT(43H OPTION 2 SELECTED  (CRITERION - BANDWIDTH ,            SCHEME90        1461
     +  57HMINIMIZATION;   CONDITION - MINMAX NUMBER OF NODES/LEVEL) )  SCHEME91        1462
      IF(IO.EQ.3) WRITE(6,179)                                          SCHEME92        1463
  179 FORMAT(52H OPTION 3 SELECTED (CRITERION - MINIMIZATION OF SUM;,   SCHEME93        1464
     +  44H   CONDITION - MINMAX NUMBER OF NODES/LEVEL) )               SCHEME94        1465
   91 CALL DIAM(NC,MAD,NL,NODESL,MAXLEV,IG,II1,IC,IDEG,IDIS,IW,ICC)     SCHEME95        1466
      IF(IP.EQ.0) GO TO 67                                              SCHEME96        1467
      WRITE(6,39) NC,MAD                                                SCHEME97        1468
      WRITE(6,59) MAXLEV                                                SCHEME98        1469
      WRITE(6,100) (NODESL(J),J=1,NL)                                   SCHEME99        1470
   67 CONTINUE                                                          SCHEM100        1471
      IF(ISTA.LE.0) GO TO 760                                           SCHEM101        1472
      M=0                                                               SCHEM102        1473
      DO 750 I=1,ISTA                                                   SCHEM103        1474
      J=ISTART(I)                                                       SCHEM104        1475
      IF(IC(J).NE.NC) GO TO 750                                         SCHEM105        1476
      M=M+1                                                             SCHEM106        1477
      DO 755 K=1,99                                                     SCHEM107        1478
      L=101-K                                                           SCHEM108        1479
  755 NODESL(L)=NODESL(L-1)                                             SCHEM109        1480
      NODESL(1)=J                                                       SCHEM110        1481
  750 CONTINUE                                                          SCHEM111        1482
      NL=MIN0(NL+M,100)                                                 SCHEM112        1483
      CALL FIXIT(NODESL,NL)                                             SCHEM113        1484
  760 CONTINUE                                                          SCHEM114        1485
      IF(IP.EQ.0) GO TO 63                                              SCHEM115        1486
      IF(ISTA.LE.0) GO TO 63                                            SCHEM116        1487
      WRITE(6,730)                                                      SCHEM117        1488
  730 FORMAT(48H MERGED LIST OF STARTING NODES SUPPLIED BY USER ,       SCHEM118        1489
     +  15HAND BY BANDIT -)                                             SCHEM119        1490
      WRITE(6,100) (NODESL(I),I=1,NL)                                   SCHEM120        1491
   39 FORMAT(10H COMPONENT,I5,19H    MAX DEGREE USED,I5)                SCHEM121        1492
   59 FORMAT(52H STARTING NODES FOR MINMAX NUMBER OF NODES PER LEVEL,I5)SCHEM122        1493
  100 FORMAT(4X,20I5)                                                   SCHEM123        1494
   63 CONTINUE                                                          SCHEM124        1495
      JMAX=MIN0(NT,NL)                                                  SCHEM125        1496
      IM=900000000                                                      SCHEM126        1497
      INMM=IM                                                           SCHEM127        1498
      DO 400 J=1,JMAX                                                   SCHEM128        1499
      CALL RELABL(1,NODESL(J ),IG,II1,IC,IDEG,IDIS,IW,NEW,ICC,ILD)      SCHEM129        1500
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      IB=MAXBND(NC,IG,II1,IC,IDEG,NEW,ILD)                              SCHEM130    1501
      IF(IP.NE.0) WRITE(6,69) NODESL(J),IB,IH                           SCHEM131    1502
   69 FORMAT(14H STARTING NODE,I6,4X,9HBANDWIDTH,I6,3X,7HPROFILE,I8)    SCHEM132    1503
      IF(IO.EQ.3) IB=IH                                                 SCHEM133    1504
      IE=ICC(NC+1)-1                                                    SCHEM134    1505
      IF(IM-IB) 400,350,300                                             SCHEM135    1506
  300 IM=IB                                                             SCHEM136    1507
      IMM=IH                                                            SCHEM137    1508
      IJ=J                                                              SCHEM138    1509
      GO TO 400                                                         SCHEM139    1510
  350 IF(IMM.LE.IH) GO TO 400                                           SCHEM140    1511
      IMM=IH                                                            SCHEM141    1512
      IJ=J                                                              SCHEM142    1513
400   CONTINUE                                                          SCHEM143    1514
      CALL RELABL(1,NODESL(IJ),IG,II1,IC,IDEG,IDIS,IW,NEW,ICC,ILD)      SCHEM144    1515
  500 CONTINUE                                                          SCHEM145    1516
      CALL STACK(IDEG,NEW,ILD,IW)                                       SCHEM146    1517
      IB=MAXBND(0,IG,II1,IC,IDEG,NEW,ILD)                               SCHEM147    1518
      IF(IP.EQ.0) GO TO 710                                             SCHEM148    1519
      WRITE(6,705)                                                      SCHEM149    1520
  705 FORMAT(21H0 ORIGINAL LABELING -)                                  SCHEM150    1521
      WRITE(6,708) KORIG,IH0                                            SCHEM151    1522
      WRITE(6,707)                                                      SCHEM152    1523
  707 FORMAT(21H  STD CM RELABELING -)                                  SCHEM153    1524
      WRITE(6,708) IB,IH                                                SCHEM154    1525
  708 FORMAT(1H#,26X,9HBANDWIDTH,I7,10X,7HPROFILE,I10)                  SCHEM155    1526
  709 FORMAT(21H  REV CM RELABELING -)                                  SCHEM156    1527
  710 IF(IO.EQ.3) IB=IH                                                 SCHEM157    1528
C PROFILE = SUM CRIT                                                    SCHEM158    1529
C IS=ORIGINAL BANDWIDTH (OR SUM CRIT IF IO.EQ.3)                        SCHEM159    1530
C IB=CURRENT BANDWIDTH (OR SUM CRIT IF IO.EQ.3)                         SCHEM160    1531
C IH=CURRENT PROFILE, IH0=ORIGINAL PROFILE                              SCHEM161    1532
      IF(IB-IS) 715,742,744                                             SCHEM162    1533
  742 IF(IH.LT.IH0) GO TO 715                                           SCHEM163    1534
  744 DO 712 I=1,NN                                                     SCHEM164    1535
      ILD(I)=I                                                          SCHEM165    1536
  712 NEW(I)=I                                                          SCHEM166    1537
      CALL STACK(IDEG,NEW,ILD,IW)                                       SCHEM167    1538
      IB=IS                                                             SCHEM168    1539
      IH=IH0                                                            SCHEM169    1540
      IF(IP.EQ.0) GO TO 715                                             SCHEM170    1541
      WRITE(6,713)                                                      SCHEM171    1542
  713 FORMAT(21H ORIG CM RELABELING -)                                  SCHEM172    1543
      WRITE(6,708) IB,IH                                                SCHEM173    1544
  715 IHE=IH                                                            SCHEM174    1545
      CALL REVERS(NEW,ILD)                                              SCHEM175    1546
      IB=MAXBND(0,IG,II1,IC,IDEG,NEW,ILD)                               SCHEM176    1547
      IF(IP.EQ.0) GO TO 717                                             SCHEM177    1548
      WRITE(6,709)                                                      SCHEM178    1549
      WRITE(6,708) IB,IH                                                SCHEM179    1550
  717 IF(IH.LT.IHE) GO TO 720                                           SCHEM180    1551
      CALL REVERS(NEW,ILD)                                              SCHEM181    1552
      IB=MAXBND(0,IG,II1,IC,IDEG,NEW,ILD)                               SCHEM182    1553
  720 IHE=IH                                                            SCHEM183    1554
      KNEW=IB                                                           SCHEM184    1555
      IF(IP.EQ.0) GO TO 508                                             SCHEM185    1556
      WRITE(6,722)                                                      SCHEM186    1557
  722 FORMAT(21H  ** FINAL LABELING -)                                  SCHEM187    1558
      WRITE(6,708) KNEW,IHE                                             SCHEM188    1559
  503 CONTINUE                                                          JJ    42    1560
  600 RETURN                                                            SCHEM194    1561
      END                                                               SCHEM195    1562
      SUBROUTINE STACK(IDEG,NEW,ILD,IW)                                 STACK  2    1563
C STACK POINTS OF ZERO DEGREE AT END OF THE NUMBERING.                  STACK  3    1564
      DIMENSION IDEG(1),NEW(1),ILD(1),IW(1)                             STACK  4    1565
C IW IS SCRATCH STORAGE.                                                STACK  5    1566
      COMMON /S/ NN                                                     STACK  6    1567
      COMMON /ZERO/ KT                                                  STACK  7    1568
      KT=0                                                              STACK  8    1569
      NN1=NN-1                                                          STACK  9    1570
C LIST POINTS OF ZERO DEGREE AND INCREMENT COUNTER KT.                  STACK 10    1571
      DO 10 I=1,NN                                                      STACK 11    1572
      IF(IDEG(I).GT.0) GO TO 10                                         STACK 12    1573
      KT=KT+1                                                           STACK 13    1574
      IW(KT)=ILD(I)                                                     STACK 14    1575
   10 CONTINUE                                                          STACK 15    1576
      IF(KT.LE.0) GO TO 70                                              STACK 16    1577
C SORT LIST OF RENUMBERED NUMBERS TO BE STACKED.                        STACK 17    1578
      CALL SORT(IW,KT)                                                  STACK 18    1579
C STACK POINTS OF ZERO DEGREE AT END OF NEW.                            STACK 19    1580
      DO 40 L=1,KT                                                      STACK 20    1581
      I=IW(L)-L+1                                                       STACK 21    1582
      K=NEW(I)                                                          STACK 22    1583
      IF(I.GE.NN) GO TO 30                                              STACK 23    1584
      DO 20 J=I,NN1                                                     STACK 24    1585
   20 NEW(J)=NEW(J+1)                                                   STACK 25    1586
   30 NEW(NN)=K                                                         STACK 26    1587
   40 CONTINUE                                                          STACK 27    1588
C CORRECT ILD, THE INVERSE OF NEW.                                      STACK 28    1589
   70 DO 80 I=1,NN                                                      STACK 29    1590
      K=NEW(I)                                                          STACK 30    1591
   80 ILD(K)=I                                                          STACK 31    1592
      RETURN                                                            STACK 32    1593
      END                                                               STACK 33    1594
      SUBROUTINE REVERS(NEW,ILD)                                        REVERS 2    1595
C REVERSE THE NUMBERING OF THE FIRST NN-KT GRID POINTS.                 REVERS 3    1596
C NN=NUMBER OF GRID POINTS.                                             REVERS 4    1597
C KT=THE NUMBER OF POINTS OF ZERO DEGREE (STACKED AT END OF NEW         REVERS 5    1598
C        BY STACK)                                                      REVERS 6    1599
      DIMENSION NEW(1),ILD(1)                                           REVERS 7    1600
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      COMMON /S/ NN                                                     REVERS 8        1601
      COMMON /ZERO/ KT                                                  REVERS 9        1602
C REVERSE NEW ARRAY.                                                    REVERS10        1603
      J=(NN-KT)/2                                                       REVERS11        1604
      LL=NN-KT+1                                                        REVERS12        1605
      DO 10 I=1,J                                                       REVERS13        1606
      L=LL-I                                                            REVERS14        1607
      K=NEW(L)                                                          REVERS15        1608
      NEW(L)=NEW(I)                                                     REVERS16        1609
   10 NEW(I)=K                                                          REVERS17        1610
C CORRECT ILD, THE INVERSE OF NEW.                                      REVERS18        1611
      DO 20 I=1,NN                                                      REVERS19        1612
      K=NEW(I)                                                          REVERS20        1613
   20 ILD(K)=I                                                          REVERS21        1614
      RETURN                                                            REVERS22        1615
      END                                                               REVERS23        1616
      SUBROUTINE DEGREE(IG,II1,IDEG)                                    DEGREE 2        1617
C SET UP THE IDEG ARRAY CONTAINING THE DEGREE OF EACH NODE STORED       DEGREE 3        1618
C     IN THE IG ARRAY.                                                  DEGREE 4        1619
C   IDEG(I)=DEGREE OF NODE I                                            DEGREE 5        1620
      DIMENSION IG(II1,1),IDEG(1)                                       DEGREE 6        1621
      COMMON /S/ NN,MM,IH,IB                                            DEGREE 7        1622
      COMMON /A/ MAXGRD                                                 DEGREE 8        1623
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 DEGREE 9        1624
      DO 100 I=1,NN                                                     DEGREE10        1625
      IDEG(I)=0                                                         DEGREE11        1626
      DO 80 J=1,MM                                                      DEGREE12        1627
      IF(IG(I,J)) 100,100,50                                            JJ    43        1628
   50 IDEG(I)=IDEG(I)+1                                                 DEGREE14        1629
   80 CONTINUE                                                          DEGREE15        1630
  100 CONTINUE                                                          DEGREE16        1631
      RETURN                                                            DEGREE17        1632
      END                                                               DEGREE18        1633
      FUNCTION MODE(IDEG,MODD)                                          MODE   2        1634
C COMPUTE MODE, THE MOST PREVALENT NODAL DEGREE.    IF SEVERAL DEGREES  MODE   3        1635
C       ARE EQUALLY PREVALENT, THE LOWEST IS CHOSEN.                    MODE   4        1636
      COMMON /S/ NN,MM                                                  MODE   5        1637
      DIMENSION IDEG(1),MODD(1)                                         MODE   6        1638
C IDEG(I)=DEGREE OF NODE I                                              MODE   7        1639
C  MODD(I)=NUMBER OF NODES OF DEGREE I                                  MODE   8        1640
      DO 10 I=1,MM                                                      MODE   9        1641
   10 MODD(I)=0                                                         MODE  10        1642
      DO 20 I=1,NN                                                      MODE  11        1643
      K=IDEG(I)                                                         MODE  12        1644
   20 MODD(K)=MODD(K)+1                                                 MODE  13        1645
      MODE=0                                                            MODE  14        1646
      MAX=0                                                             MODE  15        1647
      DO 30 I=1,MM                                                      MODE  16        1648
      K=MODD(I)                                                         MODE  17        1649
      IF(K.LE.MAX) GO TO 30                                             MODE  18        1650
      MAX=K                                                             MODE  19        1651
      MODE=I                                                            MODE  20        1652
   30 CONTINUE                                                          MODE  21        1653
      RETURN                                                            MODE  22        1654
      END                                                               MODE  23        1655
      FUNCTION COMPNT(IG,II1,IC,IDEG,IW,ICC)                            COMPNT 2        1656
C THIS FUNCTION HAS AS ITS VALUE THE NUMBER OF COMPONENTS STORED        COMPNT 3        1657
C     IN THE CONNECTION ARRAY IG.                                       COMPNT 4        1658
C ALSO, IC AND ICC ARE SET UP.                                          COMPNT 5        1659
C   IC(I)=COMPONENT INDEX FOR NODE I                                    COMPNT 6        1660
C   ICC(I)=THE STARTING POSITION TO BE USED FOR LABELS IN COMPONENT I   COMPNT 7        1661
C THUS, ICC(I+1)-ICC(I)= THE NUMBER OF NODES IN COMPONENT I             COMPNT 8        1662
      DIMENSION IG(II1,1),IC(1),IDEG(1),IW(1),ICC(1)                    COMPNT 9        1663
      COMMON /S/ NN,MM,IH,IB                                            COMPNT10        1664
      COMMON /A/ MAXGRD                                                 COMPNT11        1665
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 COMPNT12        1666
C INITIALIZE ARRAYS.                                                    COMPNT13        1667
      DO 100 I=1,NN                                                     COMPNT14        1668
      ICC(I)=0                                                          COMPNT15        1669
      IC(I)=0                                                           COMPNT16        1670
  100 CONTINUE                                                          COMPNT17        1671
      NC=0                                                              COMPNT18        1672
      ICC(1)=1                                                          COMPNT19        1673
C CHECK IF IC IS COMPLETE.                                              COMPNT20        1674
  105 DO 110 I=1,NN                                                     COMPNT21        1675
      IF(IC(I)) 110,120,110                                             COMPNT22        1676
  110 COMPNT=NC                                                         COMPNT23        1677
      RETURN                                                            COMPNT24        1678
  120 NC=NC+1                                                           COMPNT25        1679
      KI=0                                                              COMPNT26        1680
      KO=1                                                              COMPNT27        1681
      IW(1)=I                                                           COMPNT28        1682
      IC(I)=NC                                                          COMPNT29        1683
      IF(NC-1)130,125,125                                               COMPNT30        1684
125   IS=ICC(NC)+1                                                      COMPNT31        1685
      ICC(NC+1)=IS                                                      COMPNT32        1686
  130 KI=KI+1                                                           COMPNT33        1687
      II=IW(KI)                                                         COMPNT34        1688
      N=IDEG(II)                                                        COMPNT35        1689
      IF(N)140,105,140                                                  COMPNT36        1690
  140 DO 200 I=1,N                                                      COMPNT37        1691
      IA = IG(II,I)                                                     JJ    44        1692
      IF(IC(IA)) 200,150,200                                            COMPNT39        1693
150   IC(IA)=NC                                                         COMPNT40        1694
      KO=KO+1                                                           COMPNT41        1695
      IW(KO)=IA                                                         COMPNT42        1696
      IS=ICC(NC+1)+1                                                    COMPNT43        1697
      ICC(NC+1)=IS                                                      COMPNT44        1698
  200 CONTINUE                                                          COMPNT45        1699
      IF(KO-KI)105,105,130                                              COMPNT46        1700
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      END                                                               COMPNT47      1701
      FUNCTION MAXDGR(NC,IC,IDEG)                                       MAXDGR 2      1702
C THIS FUNCTION HAS AS ITS VALUE THE MAXIMUM DEGREE OF ANY NODE OF      MAXDGR 3      1703
C       COMPONENT NC IF NC.GT.0                                         MAXDGR 4      1704
C IF NC.LE.0, ALL COMPONENTS ARE CONSIDERED.                            MAXDGR 5      1705
      DIMENSION IC(1),IDEG(1)                                           MAXDGR 6      1706
      COMMON /S/ NN,MM,IH,IB                                            MAXDGR 7      1707
      M=0                                                               MAXDGR 8      1708
      DO 100 I=1,NN                                                     MAXDGR 9      1709
      IF(NC)40,50,40                                                    MAXDGR10      1710
40    IF(IC(I)-NC) 100,50,100                                           MAXDGR11      1711
50    IF(IDEG(I)-M) 100,100,60                                          MAXDGR12      1712
60    M=IDEG(I)                                                         MAXDGR13      1713
  100 CONTINUE                                                          MAXDGR14      1714
      MAXDGR=M                                                          MAXDGR15      1715
      RETURN                                                            MAXDGR16      1716
      END                                                               MAXDGR17      1717
      FUNCTION MAXBND(NC,IG,II1,IC,IDEG,NEW,ILD)                        MAXBND 2      1718
C THIS FUNCTION HAS AS ITS VALUE THE MAXIMUM DIFFERENCE BETWEEN NODE    MAXBND 3      1719
C     LABELS OF CONNECTED NODES FOR NODES OF COMPONENT NC.GT.0          MAXBND 4      1720
C IF NC.LE.0, ALL COMPONENTS ARE CONSIDERED.                            MAXBND 5      1721
C THE NODAL RENUMBERING DEFINED BY ILD AND NEW MUST BE SET UP PRIOR     MAXBND 6      1722
C       TO THE FUNCTION CALL.                                           MAXBND 7      1723
C COMPUTE IH, THE SUM CRIT (PROFILE).                                   MAXBND 8      1724
      DIMENSION IG(II1,1),IC(1),IDEG(1),NEW(1),ILD(1)                   MAXBND 9      1725
      COMMON /S/ NN,MM,IH,IB                                            MAXBND10      1726
      COMMON /A/ MAXGRD                                                 MAXBND11      1727
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 MAXBND12      1728
      IH=0                                                              MAXBND13      1729
      M=0                                                               MAXBND14      1730
      DO 100 I=1,NN                                                     MAXBND15      1731
      MX=0                                                              MAXBND16      1732
      IA=NEW(I)                                                         MAXBND17      1733
      IF(NC)40,50,40                                                    MAXBND18      1734
40    IF(IA.EQ.0)GO TO 100                                              MAXBND19      1735
      IF(NC-IC(IA)) 100,50,100                                          MAXBND20      1736
50    N=IDEG(IA)                                                        MAXBND21      1737
      IF(N)100,100,150                                                  MAXBND22      1738
150   DO 90 J=1,N                                                       MAXBND23      1739
      II = IG(IA,J)                                                     JJ    45      1740
      IB=MAX0(0,I-ILD(II))                                              MAXBND25      1741
      IF(IB.GT.MX) MX=IB                                                MAXBND26      1742
90    CONTINUE                                                          MAXBND27      1743
      IF(MX.GT.M) M=MX                                                  MAXBND28      1744
      IH=IH+MX                                                          MAXBND29      1745
100   CONTINUE                                                          MAXBND30      1746
      MAXBND=M                                                          MAXBND31      1747
      RETURN                                                            MAXBND32      1748
      END                                                               MAXBND33      1749
      FUNCTION MINDEG(NC,IC,IDEG)                                       MINDEG 2      1750
C THIS FUNCTION HAS AS ITS VALUE THE MINIMUM DEGREE OF ANY NODE OF      MINDEG 3      1751
C       COMPONENT NC IF NC.GT.0                                         MINDEG 4      1752
C IF NC.LE.0, ALL COMPONENTS ARE CONSIDERED.                            MINDEG 5      1753
      DIMENSION IC(1),IDEG(1)                                           MINDEG 6      1754
      COMMON /S/ NN,MM,IH,IB                                            MINDEG 7      1755
      M=10000                                                           MINDEG 8      1756
      DO 100 I=1,NN                                                     MINDEG 9      1757
      IF(NC)40,50,40                                                    MINDEG10      1758
40    IF(IC(I)-NC) 100,50,100                                           MINDEG11      1759
50    IF(M-IDEG(I)) 100,100,60                                          MINDEG12      1760
60    M=IDEG(I)                                                         MINDEG13      1761
  100 CONTINUE                                                          MINDEG14      1762
      MINDEG=M                                                          MINDEG15      1763
      RETURN                                                            MINDEG16      1764
      END                                                               MINDEG17      1765
      SUBROUTINE DIAM(NC,MAXDEG,NL,NODESL,MAXLEV,                       DIAM   2      1766
     + IG,II1,IC,IDEG,IDIS,IW,ICC)                                      DIAM   3      1767
C DETERMINE NL STARTING POINTS AND STORE IN NODESL.                     DIAM   4      1768
      DIMENSION IG(II1,1),IDIS(1),IW(1),ICC(1),IC(1),IDEG(1)            DIAM   5      1769
      COMMON /S/ NN,MM,IH,IB                                            DIAM   6      1770
      COMMON /A/ MAXGRD                                                 DIAM   7      1771
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                 DIAM   8      1772
      DIMENSION NODESL(1)                                               DIAM   9      1773
      NL=0                                                              DIAM  10      1774
      MAXLEV=10000                                                      DIAM  11      1775
      DO 100 I=1,NN                                                     DIAM  12      1776
      IF(NC-IC(I)) 100,40,100                                           DIAM  13      1777
40    IF(MAXDEG-IDEG(I)) 100,105,105                                    DIAM  14      1778
  105 MD=IDIST(I,ML,MAXLEV,IG,II1,IC,IDEG,IDIS,IW,ICC)                  DIAM  15      1779
      IF(MD) 115,115,56                                                 DIAM  16      1780
   56 IF(ML-MAXLEV)58,64,100                                            DIAM  17      1781
   58 MAXLEV=ML                                                         DIAM  18      1782
      NL=1                                                              DIAM  19      1783
      NODESL(1)=I                                                       DIAM  20      1784
      GO TO 100                                                         DIAM  21      1785
   64 IF(NL.GE.100) GO TO 100                                           DIAM  22      1786
      NL=NL+1                                                           DIAM  23      1787
      NODESL(NL)=I                                                      DIAM  24      1788
  100 CONTINUE                                                          DIAM  25      1789
  110 RETURN                                                            DIAM  26      1790
  115 ML=1                                                              DIAM  27      1791
      NODESL(1)=I                                                       DIAM  28      1792
      MAXLEV=0                                                          DIAM  29      1793
      RETURN                                                            DIAM  30      1794
      END                                                               DIAM  31      1795
      SUBROUTINE RELABL(NS,NODES,IG,II1,IC,IDEG,IDIS,IW,NEW,ICC,ILD)    RELABL 2      1796
C GENERATE A RELABELING SCHEME STARTING WITH NS NODES FOR WHICH         RELABL 3      1797
C       LABELS HAVE BEEN STORED IN ARRAY NODES.                         RELABL 4      1798
C SET UP ILD AND NEW.                                                   RELABL 5      1799
C     ILD(OLD)=NEW                                                      RELABL 6      1800
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C       NEW(NEW)=OLD,   THE INVERSE OF ILD                                RELABL 7        1801
      DIMENSION IG(II1,1),IC(1),IDEG(1),IDIS(1),IW(1),NEW(1),ICC(1)       RELABL 8        1802
      DIMENSION ILD(1)                                                    RELABL 9        1803
      COMMON /S/ NN,MM,IH,IB                                              RELABL10        1804
      INTEGER X                                                           RELABL11        1805
      COMMON /A/ MAXGRD                                                   RELABL12        1806
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                   RELABL13        1807
      DIMENSION NODES( 1),IAJ(50)                                         RELABL14        1808
      I=NODES(1)                                                          RELABL15        1809
      ICN=IC(I)                                                           RELABL16        1810
      NT=ICC(ICN)-1                                                       RELABL17        1811
      DO 50 I=1,NN                                                        RELABL18        1812
      IF(IC(I)-ICN) 50,40,50                                              RELABL19        1813
40    IDIS(I)=0                                                           RELABL20        1814
50    CONTINUE                                                            RELABL21        1815
      DO 100 J=1,NS                                                       RELABL22        1816
      JJ=NODES(J)                                                         RELABL23        1817
      IDIS(JJ)=-1                                                         RELABL24        1818
      JT=J+NT                                                             RELABL25        1819
      NEW(JT)=JJ                                                          RELABL26        1820
100   ILD(JJ)=JT                                                          RELABL27        1821
      KI=NT                                                               RELABL28        1822
      KO=NS+NT                                                            RELABL29        1823
      LL=KO                                                               RELABL30        1824
      L=1                                                                 RELABL31        1825
      J=KO                                                                RELABL32        1826
      NNC=ICC(ICN+1)-1                                                    RELABL33        1827
130   KI=KI+1                                                             RELABL34        1828
      IF(KI-LL)135,132,135                                                RELABL35        1829
132   L=L+1                                                               RELABL36        1830
      LL=KO+1                                                             RELABL37        1831
135   II=NEW(KI)                                                          RELABL38        1832
      N=IDEG(II)                                                          RELABL39        1833
      IF(N)140,255,140                                                    RELABL40        1834
140   IJ=0                                                                RELABL41        1835
      DO 200 I=1,N                                                        RELABL42        1836
      IA = IG(II,I)                                                       JJ    46        1837
      IF(IDIS(IA)) 200,150,200                                            RELABL44        1838
150   IJ=IJ+1                                                             RELABL45        1839
      IDIS(IA)=L                                                          RELABL46        1840
      KO=KO+1                                                             RELABL47        1841
      IAJ(IJ)=IA                                                          RELABL48        1842
      IW(IJ)=IDEG(IA)                                                     RELABL49        1843
200   CONTINUE                                                            RELABL50        1844
      IF(IJ-1)250,210,220                                                 RELABL51        1845
210   J=KO                                                                RELABL52        1846
      IZ=IAJ(1)                                                           RELABL53        1847
      NEW(KO)=IZ                                                          RELABL54        1848
      ILD(IZ)=KO                                                          RELABL55        1849
      GO TO 250                                                           RELABL56        1850
220   X=0                                                                 RELABL57        1851
221   DO 230 I=2,IJ                                                       RELABL58        1852
      IF(IW(I)-IW(I-1))224,230,230                                        RELABL59        1853
224   CONTINUE                                                            RELABL60        1854
      X=IW(I)                                                             RELABL61        1855
      IW(I)=IW(I-1)                                                       RELABL62        1856
      IW(I-1)=X                                                           RELABL63        1857
225   X=IAJ(I)                                                            RELABL64        1858
      IAJ(I)=IAJ(I-1)                                                     RELABL65        1859
      IAJ(I-1)=X                                                          RELABL66        1860
230   CONTINUE                                                            RELABL67        1861
      IF(X)235,235,220                                                    RELABL68        1862
235   DO 240 I=1,IJ                                                       RELABL69        1863
      J=J+1                                                               RELABL70        1864
      IZ=IAJ(I)                                                           RELABL71        1865
      NEW(J)=IZ                                                           RELABL72        1866
      ILD(IZ)=J                                                           RELABL73        1867
240   CONTINUE                                                            RELABL74        1868
250   IF(KO-NNC)130,255,255                                               RELABL75        1869
255   CONTINUE                                                            RELABL76        1870
      RETURN                                                              RELABL77        1871
      END                                                                 RELABL78        1872
      FUNCTION IDIST(NS,ML,MAXLEV,IG,II1,IC,IDEG,IDIS,IW,ICC)             IDIST  2        1873
C THIS FUNCTION HAS AS ITS VALUE THE MAXIMUM DISTANCE OF ANY NODE         IDIST  3        1874
C       IN COMPONENT IC(NS) FROM THE NODE NS.                             IDIST  4        1875
C THE DISTANCE OF EACH NODE IN THIS COMPONENT IS STORED IN THE ARRAY      IDIST  5        1876
C            IDIS.                                                        IDIST  6        1877
C THE MAXIMUM NUMBER OF NODES AT THE SAME DISTANCE FROM NS IS             IDIST  7        1878
C        STORED IN ML.                                                    IDIST  8        1879
      DIMENSION IG(II1,1),IC(1),IDEG(1),IDIS(1),IW(1),ICC(1)              IDIST  9        1880
      COMMON /S/ NN,MM,IH,IB                                              IDIST 10        1881
      COMMON /A/ MAXGRD                                                   IDIST 11        1882
      COMMON /BITS/ NBITIN,NBITEX,IPASS                                   IDIST 12        1883
      ICN=IC(NS)                                                          IDIST 13        1884
      NNC=ICC(ICN+1)-ICC(ICN)                                             IDIST 14        1885
      DO 50 I=1,NN                                                        IDIST 15        1886
      IF(IC(I)-IC(NS)) 50,40,50                                           IDIST 16        1887
40    IDIS(I)=0                                                           IDIST 17        1888
   50 CONTINUE                                                            IDIST 18        1889
      LL=1                                                                IDIST 19        1890
      L=0                                                                 IDIST 20        1891
      KI=0                                                                IDIST 21        1892
      KO=1                                                                IDIST 22        1893
      ML=0                                                                IDIST 23        1894
      IW(1)=NS                                                            IDIST 24        1895
      IDIS(NS)=-1                                                         IDIST 25        1896
  130 KI=KI+1                                                             IDIST 26        1897
      IF(KI-LL)135,132,135                                                IDIST 27        1898
  132 L=L+1                                                               IDIST 28        1899
      LL=KO+1                                                             IDIST 29        1900
```

```
      K=KO-KI+1                                                         IDIST 30        1901
      IF(K-ML) 135,135,133                                              IDIST 31        1902
  133 ML=K                                                              IDIST 32        1903
      IF(ML-MAXLEV) 135,135,220                                         IDIST 33        1904
135    II=IW(KI)                                                        IDIST 34        1905
      N=IDEG(II)                                                        IDIST 35        1906
      IF(N)140,215,140                                                  IDIST 36        1907
  140 DO 200 I=1,N                                                      IDIST 37        1908
      IA = IG(II,I)                                                     JJ    47        1909
      IF(IDIS(IA))200,150,200                                           IDIST 39        1910
150   IDIS(IA)=L                                                        IDIST 40        1911
      KO=KO+1                                                           IDIST 41        1912
      IW(KO)=IA                                                         IDIST 42        1913
  200 CONTINUE                                                          IDIST 43        1914
      IF(KO-NNC)130,205,205                                             IDIST 44        1915
  205 IDIST=L                                                           IDIST 45        1916
      IDIS(NS)=0                                                        IDIST 46        1917
      K=KO-KI                                                           IDIST 47        1918
      IF(K-ML) 206,206,207                                              IDIST 48        1919
  207 ML=K                                                              IDIST 49        1920
  206 CONTINUE                                                          IDIST 50        1921
      RETURN                                                            IDIST 51        1922
  215 L=0                                                               IDIST 52        1923
      GO TO 205                                                         IDIST 53        1924
  220 IDIST=1                                                           IDIST 54        1925
      RETURN                                                            IDIST 55        1926
      END                                                               IDIST 56        1927
      SUBROUTINE REMARK(A)                                              JJ    48        1928
      RETURN                                                            JJ    49        1929
      END                                                               JJ    50        1930
      FUNCTION EOF(I)                                                   JJ    51        1931
      INTEGER EOF                                                       JJ    52        1932
      EOF=0                                                             JJ    53        1933
      RETURN                                                            JJ    54        1934
      END                                                               JJ    55        1935
```

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13. ABSTRACT

This report describes a matrix bandwidth reduction preprocessor for use with the NASA structural analysis computer program, NASTRAN. Called BANDIT, the program is written in FORTRAN and uses the Cuthill-McKee strategy for resequencing grid points. Versions of the program for both CDC and other computers are presented.

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