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A Systems Programmer's Guide for Implementing OMNITAB II

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A Systems Programmer's Guide For Implementing OMNITAB II

Sally T. Peavy, Ruth N. Varner, and Shirley G. Bremer

OMNITAB II is a general-purpose program which permits direct use of a computer without prior knowledge of computer languages. Every effort has been made to produce a system as machine independent as possible to make implementation on any large computer configuration relatively easy. However, there are a few modifications which may have to be made.

This Technical Note provides assistance to the systems programmer, with the task of implementing OMNITAB II, by pointing out where difficulties may occur and how to cope with them. It furthermore outlines a method for segmenting the OMNITAB II system which is very large. It is a partial documentation of the OMNITAB program.

OMNITAB II is a large system requiring a large computer. Overlay and segmentation are virtually essential. A method for segmenting OMNITAB II is outlined. The method should be useful for many computers.

Key words: ANSI FORTRAN, double precision, general-purpose computer program, implementation of OMNITAB II, labeled common, machine independent, OMNITAB II, overlay, segmentation, system parameters, transportable computer programs.

OMNITAB II is a general-purpose interpretive program which permits direct use of a computer without a prior knowledge of computer languages. The OMNITAB II system allows users to utilize a computer to solve their problems in an effective and accurate manner.

OMNITAB was first conceived by Joseph Hilsenrath in the early 1960's to permit scientists, engineers and laboratory technicians the use of a large high-speed computer in the solution of their problems without the assistance of computer programmers. The system was developed and implemented further by his co-workers, Hilsenrath et al. (1966), for a specific computer and therefore contained subprograms written in symbolic machine language and FORTRAN. With the advent of third generation computers, it became necessary to rewrite the OMNITAB program. Walter J. Gilbert, who undertook this task in 1966, initiated a number of major changes and new ideas. Since 1968 the Statistical Engineering Laboratory of the Applied Mathematics Division has been responsible for maintaining and developing OMNITAB. OMNITAB II (Hogben et al. (1970)) is the result of this effort.

This paper is one of four which constitute the documentation for OMNITAB II. A complete program listing is given in Peavy et al. (1970). A user's guide is given in Hogben et al. (1970). Test problems with results are given in Varner et al. (1970). The material in this note, without this introduction, is also stored on the magnetic tape which contains the OMNITAB II master program and is available from National Technical Information Service (formerly Clearinghouse), U.S. Department of Commerce, Springfield, Va. 22151. No attempt is made here to carefully define terms, such as worksheet, which are unique with OMNITAB. It is assumed the reader is familar with Hogben et al. (1970).

Extensive effort has been exerted to produce virtually machine independent subprograms in order to make OMNITAB II transportable. The OMNITAB II program has been rewritten in the

American National Standards Institute (ANSI) FORTRAN language. We have tried to avoid the use of any ANSI FORTRAN statement which can not be successfully compiled on any specific computer. All output is in 120 character per line format. The maximum number of alphanumeric characters per variable has been limited to three. In some instances, the steps taken have resulted in a loss of efficiency. For example, use of the UNIVAC FORTRAN V function FLD would have simplified the programming of the subroutine RFORMT. However, transportability was considered far more important than machine efficiency and a few compromises had to be made.

Special attention has been given to make it easy to change pertinent system parameters for implementation on computers with different memory size, word length and logical input-output units. All input-output FORTRAN statements use an integer variable in referencing an I/O unit rather than a specific logical unit. These variables are defined in one subprogram (SETUP) and only this subroutine needs modification if the present assigned values are not compatible with the user's particular computer configuration. There are a few instances where alphanumeric characters must be packed to the full capacity of the computer word length (six characters per word are assumed). Again, the systems programmer needs to modify only one subprogram (PREPAK), see XREF3, section 2. These features have enabled systems programmers to successfully implement the OMNITAB II system on many different large computers (e.g. IBM 360/50 up, GE 625, CDC 3800 and 6600, Burroughs 5500 and UNIVAC 1108) with a minimum of effort.

The OMNITAB II system is large and, therefore, segmentation is necessary. XREF3, section 3, contains an outline of the overlay plan used with the National Bureau of Standards computer. Careful attention was given to the segmentation in order to minimize the flip-flopping of segments in and out of the computer. Statistics showing the most frequently used commands, which were obtained over a three month period, were employed in determining what subprograms were to be in residence at all times. Furthermore, subprograms which execute related instructions, such as those for matrix and array operations, were grouped together. In some cases, in order to solve the overlay problem, it was necessary to duplicate a subroutine in another segment under a different subprogram name. This was avoided as much as possible and was kept to a minimum. Overlay and/or segmentation techniques vary greatly with different computer software systems. In some cases, systems programmers may have to expend considerable effort to segment OMNITAB on a particular computer, a problem which will be investigated soon. If the computer has a large memory storage and operation is in the batch mode, overlay may not be required. The present size of OMNITAB II, assuming a floating-point number occupies one memory location, is approximately 90K words.

Needless to say, such a large scale general-purpose program necessitates extensive documentation for the user as well as for the systems programmer implementing OMNITAB II. The purpose of the information presented in this publication is to assist in the implementation procedure. The documentation is in the form of FORTRAN comment statements. The last eight columns of each card contain the subprogram name, e.g. XR1, and the line number, e.g. 210, as in Peavy et al. (1970). This permits easy referencing and updating. This outline should help to solve most of the problems which arise in implementing OMNITAB II on a computer. This documentation was prepared as a preliminary guide rather than a definitive manual. A systems programmer's manual is being considered to complement this guide. Readers who experience any difficulties in the implementation of OMNITAB are asked to report their results to us so that improvements may be made and passed on to others.

OMNITAB II, Version 5.0 was designed for use in the batch processing mode. However, the very nature of OMNITAB makes it adaptable for remote batch processing or time-sharing. Walter J. Gilbert adapted an earlier version of OMNITAB for time-sharing which is being used at the University of Maryland and the University of Rome, Italy. One of the changes that has to be made in a time-sharing version is in the subroutine ERROR, see Peavy et al. (1970). The statement on line ERR 210 needs to be changed so that NERROR=0 instead of NERROR=NERROR+1. If a terminal having only 72 characters per line is used, major changes would have to be made in the subprograms which execute the instructions which have a comprehensive automatic printing. See Hogben et al. (1970) for a listing. Also, a change

would have to be made in the command PLOT, although the command PAGE PLOT could be modified and used to replace PLOT. When the necessary hardware and software are added to the NBS computer configuration, a time-sharing version of OMNITAB will be developed.

We thank David Hogben for his valuable assistance and suggestions.

The documentation is grouped as follows:

XREF Page 5

This gives an outline of the information contained in XREF1, XREF2, XREF3, XREF4, XREF5 and XREF6.

XREF1 Page 6

A complete list of all the labeled common statements and the subprograms in which they appear is given. A list of subprograms and the referencing subprograms is provided. Also included are the system library functions (e.g. SIN, COS, etc.) used in the OMNITAB II system and the subprograms which reference them. Enumerated are the subprograms which contain DOUBLE PRECISION statements along with the variables typed as double precision. EQUIVALENCE statements are used in a number of subprograms. The variables and their equivalent variables are listed along with the subprograms in which they appear. Hence, it should be easier to resolve any difficulties caused by the use of (or changes in the use of) DOUBLE PRECISION or EQUIVALENCE statements.

XREF2 Page 20

Each OMNITAB command is assigned two unique values for internal use. As the OMNITAB instruction is scanned, the values for that particular command are stored in the variables L1 and L2. These variables are used as switches by the subprogram XECUTE and others to control the flow of the program in executing the instructions. XREF2 contains a list of all the command names, appropriate values for L1 and L2, and the name of the subprogram used to execute the command.

XREF3 Page 24

The sizes of the memory spaces allocated in the OMNITAB II system for the worksheet and scratch areas are 12,500 and 13,500 words respectively. It may be necessary to decrease the size of these areas if a smaller computer is employed or segmentation is not used. In other instances, due to large amounts of input data, larger worksheet and scratch areas may be needed. Because of the limitations of ANSI FORTRAN, a number of changes are necessary if the worksheet and scratch areas are to be redimensioned. A complete set of instructions is included in this section which spell out the labeled common statements that must be modified, the subprograms which contain these labeled common statements, and a number of parameters that must be redefined in the subprogram SETUP.

The OMNITAB II program allows the user to provide headings for any fifty columns. Also, formats may be specified for user controlled input-output. If the number of characters per word is other than six, modifications are necessary before the FORMAT command can be used. Instructions for handling formats and for changing the number of headings permitted are given.

An outline of the segmentation used at NBS and the number of memory locations needed by each segment is described. There are fourteen segments, the last two containing subsegments. The segments are labeled as PART1, PART2, ... , PART14 and contain the names of all the subprograms and labeled common areas of each segment. The first segment is resident in the computer at all times while only one of the other segments, PART2 through PART14, is in memory storage at a particular moment. The size of each segment is an approximation and dependent on the fact that a floating-point number occupies one memory

location. The outline given may not necessarily be the ideal structure for overlay on other computer configurations. The sizes given are based on the use of a 36 binary bit word.

Four physical input-output units are used by OMNITAB II. These units are pre-assigned logical units in the subprogram SETUP which is called only once when OMNITAB first enters the operating system. The logical units may be reassigned, if necessary, for different installations.

XREF4 Page 34

Bounds are imposed by OMNITAB on the subprograms evaluating trigonometric, exponential, square root, and logarithmic functions. These bounds are defined in DATA statements that may need modification due to a different word length of other computers. Furthermore, the section indicates variables which must be altered if the number of significant digits for a real number is not eight or if the largest integer variable allowed is less than 2 to the 32nd power.

XREF5 Page 37

Four of the subprograms in the OMNITAB II system are BLOCK DATA subroutines. This section lists the variables and the values assigned to the variables by the DATA statements in the BLOCK DATA subprograms. Also included here, is the character set recognized and used by the OMNITAB II system.

XREF6 Page 39

As OMNITAB instructions are scanned by the program, a thorough check is made for errors and messages are printed whenever an error is detected. Messages are printed for fatal errors, arithmetic faults and informative diagnostics. A list of all the messages and their corresponding number which is used when a subprogram calls the ERROR routine are included. See also Hogben et al. (1970) for further details.

References

AMERICAN STANDARD FORTRAN (1966). American National Standards Institute, New York.

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PEAVY, S. T., VARNER, R. N. and HOGBEN, DAVID (1970). Source Listing Of OMNITAB II Program. NBS Special Publication 339. Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

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Listing Of XREF

```
C     XREF                                                              XRF   10
C     VERSION  5.00     XREF       5/15/70                              XRF   20
C                                                                       XRF   30
C     COMMENTS AND DOCUMENTATION                                        XRF   40
C                                                                       XRF   50
C     THESE-PROGRAMS-CONTAIN NO EXECUTABLE STATEMENTS.                  XRF   60
C                                                                       XRF   70
C     THE DOCUMENTATION IS GROUPED AS FOLLOWS                           XRF   80
C                                                                       XRF   90
C     XREF1                                                             XRF  100
C        1. CROSS REFERENCE TABLE                                       XRF  110
C             A.  LIST OF ALL LABELED COMMON                            XRF  120
C             B.  CROSS REFERENCE BETWEEN LABELED COMMON AND SUBPROGRAM  XRF  130
C             C.  CROSS REFERENCE BETWEEN SUBPROGRAMS                   XRF  140
C        2. SUBPROGRAMS WITH DOUBLE PRECISION VARIABLES                 XRF  150
C        3. EQUIVALENCE VARIABLES IN SUBPROGRAMS                        XRF  160
C                                                                       XRF  170
C     XREF2                                                             XRF  180
C        1. COMMAND NAMES AND THE SUBPROGRAM THAT PERFORMS THE          XRF  190
C           INSTRUCTION                                                 XRF  195
C                                                                       XRF  200
C     XREF3                                                             XRF  210
C        1. INCREASING OR DECREASING WORKSHEET                          XRF  220
C        2. CHANGING NO. OF HEADINGS PERMITTED AND PACKING FORMATS      XRF  230
C        3. OVERLAY OR SEGMENTATION                                     XRF  240
C        4. ASSIGNMENT OF INPUT-OUTPUT UNITS                            XRF  250
C        5. DIRECTIONS FOR THE USE OF DUMMY A-F                         XRF  260
C                                                                       XRF  290
C     XREF4                                                             XRF  300
C        1. CHANGES NEEDED FOR SYSTEM FUNCTIONS                         XRF  310
C        2. CHANGES NEEDED IN BLOCK DATA SUBPROGRAM                     XRF  320
C           WHICH DEFINES PHYSICAL CONSTANTS                            XRF  330
C        3. CHANGES NEEDED IF NUMBER OF SIGNIFICANT DIGITS IN FLOATING  XRF  340
C           POINT IS NOT EQUAL TO 8                                     XRF  345
C        4. CHANGES NEEDED IF INTEGER NUMBERS ARE LESS THAN 2**32       XRF  350
C                                                                       XRF  355
C     XREF5                                                             XRF  360
C        1. DESCRIPTION OF VARIABLES DEFINED IN BLOCK DATA SUBPROGRAMS  XRF  370
C          A. BLOCK                                                     XRF  380
C          B. LBCONS                                                    XRF  390
C          C. LOOKTB                                                    XRF  400
C          D. PHYSIC                                                    XRF  410
C                                                                       XRF  415
C     XREF6                                                             XRF  420
C        1. LISTING OF ALL OMNITAB ERROR MESSAGES                       XRF  430
C          A. FATAL ERROR MESSAGES                                      XRF  440
C          B. ARITHMETIC ERROR MESSAGES                                 XRF  450
C          C. INFORMATIVE DIAGNOSTIC MESSAGES                           XRF  460
C                                                                       XRF  470
      END                                                               XRF  480
```

Listing Of XREF1

```
C     XREF1                                                              XR1   10
C     VERSION  5.00      XREF1      5/15/70                              XR1   20
C                                                                        XR1   30
C     THIS IS A CROSS-REFERENCE TABLE SHOWING WHICH SUBPROGRAMS          XR1   40
C     REFERENCE PARTICULAR BLOCKS OF COMMON AND PARTICULAR SUBPROGRAMS.   XR1   50
C                                                                        XR1   80
C     OMNITAB USES NO BLANK COMMON.                                      XR1   90
C                                                                        XR1  100
C                                                                        XR1  110
C                                                                        XR1  120
C                                                                        XR1  130
C  1.A      ********THIS IS LABELED COMMON AS USED IN OMNITAB**********  XR1  140
C                                                                        XR1  150
C     COMMON /ABCDEF/ L(48)                                              XR1  160
C     COMMON/BLOCKA/MODE,M,KARD(83),KARG,ARG,ARG2,NEWCD(80),KRDEND       XR1  170
C     COMMON/BLOCKB/NSTMT,NSTMTX,NSTMTH,NCOM,LCOM,IOVFL,COM(2000)        XR1  180
C     COMMON/BLOCKC/KIO,INUNIT,ISCRAT,KBDOUT,KRDKNT,LLIST                XR1  190
C     COMMON/BLOCKD/  IARGS(100),KIND(100),ARGTAB(100),NRMAX,            XR1  200
C    1 NROW,NCOL,NARGS,VWXYZ(8),NERROR                                   XR1  210
C     COMMON/BLOCKE/ NAME(4),L1,L2,ISRFLG                                XR1  220
C     COMMON/BLOCRC/NRC,RC(12600)                                        XR1  230
C     DIMENSION ARGS(100)                                                XR1  240
C     EQUIVALENCE (ARGS(1),RC(12501))                                    XR1  250
C     COMMON/BLOCKX/ INDEX(6,8),LEVEL                                    XR1  260
C     COMMON/CODE/IALPH(6),NALPH(5),ID(9,3),IR(300,4),IRD(30,6)          XR1  270
C     COMMON/CONLB2/ER,ISIGD                                             XR1  275
C     COMMON/CONSLB/XTRIG,XEXP                                           XR1  280
C     COMMON/CONSTS/PI,E,HALFPI,DEG,RAD,XALOG                            XR1  290
C     COMMON/DCONL2/TRRTPI,NBC,NBM                                       XR1  295
C     COMMON/DCONLB/DSNCOS,DXEXP                                         XR1  300
C     DOUBLE PRECISION DSNCOS,DXEXP                                      XR1  310
C     COMMON/FMAT/IFMTX( 6),IOSWT,IFMTS( 6),LHEAD(96)                    XR1  320
C     COMMON/HEADER/NOCARD(80),ITLE(60,6),LNCNT,IPRINT,NPAGE,IPUNCH      XR1  330
C     COMMON/ICODE/NIR,NID,NIRD,LIR,LID,LIRD                             XR1  340
C     COMMON/KFMT/KFMT(100)                                              XR1  350
C     COMMON/NOTE/NOTE(120)                                              XR1  355
C     COMMON/PCONST/JPC,P(40),N(40)                                      XR1  360
C     COMMON/PKSWT/IHCNT,IHTP                                            XR1  370
C     COMMON/QRS/NDROW,IFLAG,J,NNARG                                     XR1  380
C     COMMON/SCRAT/NS,NS2,A(13500)                                       XR1  390
C     COMMON/SPRV/NERCON,NERR,ISWERR                                     XR1  400
C***THIS LABELED COMMON IS USED ONLY BY THE TAPE OPERATION SUBPROGRAMS*   XR1  410
C                                                                        XR1  420
C     COMMON/CODETP/ITP(10,4)                                            XR1  430
C     COMMON/ICODTP/NITP,LITP                                            XR1  440
C     COMMON/TAPE/NAME4(2),NTPCT,IPUNCP,INUNIP,L1TP                      XR1  450
C                                                                        XR1  460
C************THIS LABELED COMMON IS USED ONLY BY BESSEL SUBPROGRAMS****  XR1  470
C                                                                        XR1  480
C     COMMON/ABEKI/X,Y,P,Q,S,T                                           XR1  490
C     DOUBLE PRECISION X,Y,P,Q,S,T                                       XR1  500
C                                                                        XR1  510
```

```
C  1.B     ***CROSS REFERENCE BETWEEN LABELED COMMON AND SUBPROGRAMS***  XR1  515
C                                                                       XR1  520
C   LABELED COMMON              SUBPROGRAMS                             XR1  525
C                                                                       XR1  530
C                                                                       XR1  535
C     ABCDEF                                                            XR1  540
C             APRINT BLOCK  FIXFLO HEADS  HISTGM                        XR1  545
C             OMCONV ONEWAY ORTHO  ORTPLT PACK   PREPAK                 XR1  550
C             RFORMT RPRINT TAPOP  TWOWAY XHEAD  XOMNIT                XR1  560
C     ABEKI                                                             XR1  570
C             BESSEL CBEI   CBEK                                        XR1  580
C     BLOCKA                                                            XR1  590
C             AARGS  ASTER  BEGIN  INPUT  NNAME  NONBLA                 XR1  600
C             NOTEPR OMNIT  OUTPUT PHYCON PREPAK READQ                  XR1  610
C             READX  SET                                                XR1  620
C             SETQ   SETUP  STMT   STORE  TAPOP  VARCON                 XR1  630
C             XFORMT XHEAD  XOMNIT                                      XR1  640
C     BLOCKB                                                            XR1  650
C             BEGIN  INPUT  LOCATE OMNIT  OUTPUT  REPINC                XR1  660
C             STORE  XOMNIT                                             XR1  670
C     BLOCKC                                                            XR1  680
C             AERR   ERROR  INFERR INPUT  INTERP INVERT                 XR1  690
C             LIST   OMNIT  OUTPUT PREPAK READQ  READX                  XR1  700
C             RNDOWN SET    SETQ   SETUP  TAPOP2 XOMNIT                 XR1  710
C             XSTOP                                                     XR1  720
C     BLOCKD                                                            XR1  730
C             ABRIDG ADRESS ALLSUB APRINT ARITH  ARYVEC                 XR1  740
C             BEGIN  BESSEL CHANGE CHKCOL CKIND  CMSEPA                 XR1  750
C             COALES COMPLX CORREL DEFINE DIMENS                        XR1  760
C             ERASE  ERROR  EXCHNG                                      XR1  770
C             EXPAND EXPCON EXTREM FIXFLO FLIP                          XR1  780
C             FNEC   FNEIC  FNKC   FPROB                                XR1  790
C             FRDIST FUNCT  GENER  GQUAD  HISTGM                        XR1  800
C             IFS    INTERP INVERT ITERAT LIST   MATRIX                 XR1  810
C             MDAMAD MEIGEN MISC2  MIST                                 XR1  820
C             MKRON  MMULT  MOP                                         XR1  830
C             MOVE   MPROP  MRAISE MSCROW MTRIAN MTXCHK                 XR1  840
C             MXTX   OANOVA OCOEFF OCOVAR OMNIT  ONEWAY                 XR1  850
C             OPONE  ORTHO  ORTPLT OUTPUT PDMOTE PLOT                   XR1  860
C             PRINTX PROROW PUNCH  RANKS  READQ  READX                  XR1  870
C             REPINC RESET  RPRINT                                      XR1  880
C             SELECT SET    SETQ   SETUP  SORDER                        XR1  890
C             SPACE  STATIS STORE  TAPOP2 THERMO TRANSF                 XR1  900
C             TWOWAY VECTOR XHEAD  XOMNIT                               XR1  910
C             XPND   XSTOP                                              XR1  920
C     BLOCKE                                                            XR1  930
C             ABRIDG ALLSUB APRINT ARITH  ARYVEC BEGIN                  XR1  940
C             BESSEL CMSEPA COALES COMPLX CORREL                        XR1  950
C             EXPAND EXPCON EXTREM FIXFLO FNEC                          XR1  960
C             FNEIC  FNKC   FRDIST FUNCT  HISTGM IFS                    XR1  970
C             INVERT ITERAT LOOKUP MATRIX MDAMAD MISC2                  XR1  980
C             MOP    MPROP  MSCROW MXTX   OANOVA OCOEFF                 XR1  990
C             OCOVAR OMNIT  ONEWAY OPONE  ORTHO                         XR1 1000
C             PDMOTE PLOT   PRINTX PROROW PUNCH  RANKS                  XR1 1010
C             READX  REPINC RESET  RPRINT SELECT SET                    XR1 1020
C             SORDER STATIS STORE  TAPOP  TAPOP2 THERMO                 XR1 1030
C             TRANSF XECUTE                                             XR1 1040
C     BLOCRC                                                            XR1 1050
C             ABRIDG ADRESS ALLSUB APRINT ARITH  ARYVEC                 XR1 1060
C             BEGIN  BESSEL CHANGE CHKCOL CKIND  CMSEPA                 XR1 1070
```

```
C            COALES COMPLX CORREL DEFINE DIMENS ERASE                   XR1 1080
C            ERROR  EXCHNG EXPAND EXPCON EXTREM FIXFLO                  XR1 1090
C            FLIP   FNEC   FNEIC  FNKC   FPROB                          XR1 1100
C            FRDIST FUNCT  GENER  GQUAD  HISTGM                         XR1 1110
C            IFS    INTERP INVERT ITERAT LIST   MATRIX                  XR1 1120
C            MDAMAD MEIGEN MISC2  MKRON  MMULT  MOP                     XR1 1130
C            MOVE   MPROP  MRAISE MSCROW MTRIAN                         XR1 1140
C            MXTX   OMNIT  ONEWAY OPONE                                 XR1 1150
C            ORTHO  ORTPLT OUTPUT PDMOTE PLOT                           XR1 1160
C            PRINTX PROROW PUNCH  RANKS  READQ  READX                   XR1 1170
C            REPINC RESET  RPRINT                                       XR1 1180
C            SELECT SET    SETQ   SETUP  SORDER                         XR1 1190
C            SPACE  STATIS STORE  THERMO TRANSF TWOWAY                  XR1 1200
C            VECTOR XOMNIT XPND   XSTOP                                 XR1 1210
C     BLOCKX                                                            XR1 1230
C            AERR   ERROR  IFS    REPINC RNDOWN  SETUP                  XR1 1240
C            XECUTE XOMNIT                                              XR1 1250
C     CODE                                                              XR1 1260
C            LOOKTB LOOKUP TAPOP                                        XR1 1270
C     CODETP                                                            XR1 1280
C            LOOKTB LOOKUP TAPOP                                        XR1 1290
C     CONLB2                                                            XR1 1300
C            CSPINV FIXFLO INFERR LBCONS                                XR1 1310
C     CONSLB                                                            XR1 1320
C            BESSEL FCOS   FEXP   FSIN   FTANH  LBCONS                  XR1 1330
C     CONSTS                                                            XR1 1340
C            AARGS  COMPLX FUNCT  LBCONS ORTPLT SETUP                   XR1 1350
C     DCONL2                                                            XR1 1360
C            ERRINT LBCONS                                              XR1 1370
C     DCONLB                                                            XR1 1380
C            BESSEL DBEJ   FDCOS  FDEXP  FDSIN  LBCONS                  XR1 1390
C     FMAT                                                              XR1 1400
C            ABRIDG APRINT BLOCK  FIXFLO HEADS                          XR1 1410
C            OPONE  ORTHO  ORTPLT PLOT                                  XR1 1420
C            PRINTX PUNCH  RPRINT XOMNIT                                XR1 1430
C     HEADER                                                            XR1 1440
C            ABRIDG APRINT BLOCK  CORREL HEADS  HISTGM                  XR1 1450
C            MIST   MPROP  NOTEPR OANOVA OCOEFF OCOVAR                  XR1 1460
C            OMNIT  ONEWAY OPONE  ORTHO  ORTPLT                         XR1 1470
C            PAGE   PLOT   PRINTX PUNCH  RPRINT SETUP                   XR1 1480
C            SPACE  STATIS TAPOP2 TWOWAY XOMNIT XSTOP                   XR1 1490
C     ICODE                                                             XR1 1500
C            LOOKTB LOOKUP SETUP                                        XR1 1510
C     ICODTP                                                            XR1 1520
C            LOOKTB LOOKUP SETUP                                        XR1 1530
C     KFMT                                                              XR1 1540
C            ABRIDG APRINT OPONE  ORTHO                                 XR1 1550
C            PRINTX PUNCH  READQ  READX  TWOWAY                         XR1 1555
C     NOTE                                                              XR1 1560
C            NOTEPR                                                     XR1 1565
C     PCONST                                                            XR1 1570
C            PHYCON PHYSIC SETUP  XOMNIT                                XR1 1580
C     PKSWT                                                             XR1 1590
C            PREPAK SETUP  XOMNIT                                       XR1 1600
C     QRS                                                               XR1 1610
C            READQ  READX  SET    SETQ                                  XR1 1620
C     SCRAT                                                             XR1 1630
C            ALLSUB APRINT ARYVEC BESSEL CBEK   CMSEPA                  XR1 1640
C            COALES COMPLX CORREL DBEJ   EXPCON                         XR1 1650
C            FNEC   FNEIC  FNKC   FUNCT                                 XR1 1660
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C            HISTGM INTERP INVERT ITERAT                                    XR1 1670
C            MATRIX MDAMAD MEIGEN MISC2  MKRON                              XR1 1680
C            MMULT  MOP    MPROP  MRAISE MTRIAN MXTX                        XR1 1690
C            OANOVA OCOEFF OCOVAR ONEWAY OPONE  ORTHO                       XR1 1700
C            ORTPLT PLOT   PREPAK PROROW RANKS                              XR1 1710
C            RPRINT SELECT SETUP  SORDER SORTSM STATIS                      XR1 1720
C            TAPOP2 THERMO TRANSF TWOWAY XSTOP                              XR1 1730
C     SPRV                                                                  XR1 1740
C            AERR   ERROR  XOMNIT                                           XR1 1750
C     TAPE                                                                  XR1 1760
C            LOOKUP OMNIT  PUNCH  READQ  READX                              XR1 1770
C            SET    SETQ   SETUP  TAPOP  TAPOP2                             XR1 1780
C                                                                           XR1 1790
C                                                                           XR1 1800
C                                                                           XR1 1810
C                                                                           XR1 1820
C                                                                           XR1 1830
C***************************************************************************XR1 1840
C                                                                           XR1 1850
C   1.C    ************CROSS REFERENCE BETWEEN SUBPROGRAMS************       XR1 1860
C                                                                           XR1 1870
C   SUBPROGRAM       REFERENCING SUBPROGRAMS                                XR1 1890
C                                                                           XR1 1900
C     AARGS                                                                 XR1 1920
C            ASTER  OMNIT  XHEAD                                            XR1 1930
C     ABRIDG                                                                XR1 1940
C            XECUTE                                                         XR1 1950
C     ACCDIG                                                                XR1 1960
C            ARITH                                                          XR1 1970
C     ADRESS                                                                XR1 1980
C            ARITH  ALLSUB BESSEL CHANGE CHKCOL                             XR1 1985
C            COMPLX DEFINE EXCHNG FNEC                                      XR1 1990
C            FNEIC  FNKC   FPROB  FRDIST FUNCT                              XR1 2000
C            GENER  GQUAD  HISTGM IFS    INVERT MEIGEN                      XR1 2010
C            MISC2  MOP    MOVE   MPROP  MSCROW ORTHO                       XR1 2020
C            PROROW RANKS  READX  RPRINT SELECT SET                         XR1 2030
C            THERMO TWOWAY XPND                                             XR1 2040
C     AERR                                                                  XR1 2050
C            ERROR  OMNIT  SETUP  XECUTE                                    XR1 2060
C     ALLSUB                                                                XR1 2070
C            XECUTE                                                         XR1 2080
C     APRINT                                                                XR1 2090
C            XECUTE                                                         XR1 2100
C     ARITH                                                                 XR1 2110
C            XECUTE                                                         XR1 2120
C     ARYVEC                                                                XR1 2130
C            XECUTE                                                         XR1 2140
C     ASTER                                                                 XR1 2150
C            OMNIT                                                          XR1 2160
C     BEGIN                                                                 XR1 2170
C            XECUTE                                                         XR1 2180
C     BEJN                                                                  XR1 2190
C            BESSEL BINTJ0 STRUVE                                           XR1 2200
C     BESSEL                                                                XR1 2210
C            XECUTE                                                         XR1 2220
C     BEZERO                                                                XR1 2230
C            BESSEL                                                         XR1 2240
C     BEZONE                                                                XR1 2250
C            BESSEL                                                         XR1 2260
C     BINTJ0                                                                XR1 2270
```

```
C           BESSEL                                                  XR1 2280
C     BJORCK                                                        XR1 2290
C           CORREL                                                  XR1 2300
C     CBEI                                                          XR1 2310
C           BESSEL                                                  XR1 2320
C     CBEK                                                          XR1 2330
C           BESSEL                                                  XR1 2340
C     CHANGE                                                        XR1 2350
C           XECUTE                                                  XR1 2360
C     CHKCOL                                                        XR1 2370
C           ABRIDG CMSEPA                                           XR1 2380
C           CORREL ERASE  EXTREM FLIP   INTERP ITERAT               XR1 2390
C           MISC2  ONEWAY PDMOTE PLOT   PRINTX PROROW               XR1 2400
C           PUNCH  READX  RPRINT SELECT SORDER STATIS               XR1 2410
C           TWOWAY                                                  XR1 2420
C     CKIND                                                         XR1 2430
C           APRINT ARYVEC CMSEPA                                    XR1 2440
C           COALES EXPCON INTERP                                    XR1 2450
C           INVERT MATRIX MDAMAD MEIGEN MISC2  MKRON                XR1 2460
C           MMULT  MOP    MPROP  MRAISE MXTX                        XR1 2470
C           STATIS TAPOP2 THERMO TRANSF                             XR1 2480
C     CMPARA                                                        XR1 2490
C           CMSEPA                                                  XR1 2500
C     CMSEPA                                                        XR1 2510
C           XECUTE                                                  XR1 2520
C     COALES                                                        XR1 2530
C           XECUTE                                                  XR1 2540
C     COMELL                                                        XR1 2550
C           BESSEL                                                  XR1 2560
C     COMPLX                                                        XR1 2570
C           XECUTE                                                  XR1 2580
C     CORREL                                                        XR1 2590
C           XECUTE                                                  XR1 2600
C     CSPINV                                                        XR1 2610
C           INVCOR                                                  XR1 2620
C     DBEJ                                                          XR1 2630
C           BESSEL BINTJ0 STRUVE                                    XR1 2640
C     DEFINE                                                        XR1 2650
C           XECUTE                                                  XR1 2660
C     DETRNK                                                        XR1 2670
C           MPROP                                                   XR1 2680
C     DHRND                                                         XR1 2690
C           FNEIC                                                   XR1 2700
C     DIMENS                                                        XR1 2710
C           XECUTE                                                  XR1 2720
C     DUMMY A-F                                                     XR1 2730
C           XECUTE                                                  XR1 2740
C     ERASE                                                         XR1 2750
C           XECUTE                                                  XR1 2760
C     ERRINT                                                        XR1 2770
C           FNEC                                                    XR1 2780
C     ERROR                                                         XR1 2790
C           AARGS  ABRIDG ALLSUB APRINT ARITH  ARYVEC               XR1 2795
C           BEGIN  BEJN   BESSEL CBEK   CHANGE CMSEPA               XR1 2800
C           COALES COMELL COMPLX CORREL DEFINE DIMENS               XR1 2810
C           ERASE  EXCHNG EXPAND EXPCON EXTREM                      XR1 2820
C           FCOS   FDCOS  FDEXP  FDLOG  FDSIN  FDSQRT              XR1 2830
C           FEXP   FIXFLO FLIP   FLOG   FLOG10 FNEC                 XR1 2840
C           FNEIC  FNKC   FPROB  FRDIST FSIN   FSQRT                XR1 2850
C           FUNCT  GENER  GQUAD  HISTGM                             XR1 2860
```

```
C            IFS    INTERP INVERT ITERAT MATRIX                    XR1 2880
C            MDAMAD MEIGEN MISC2  MKRON  MMULT  MOP                XR1 2890
C            MOVE   MPROP  MRAISE MSCROW MTRIAN MXTX               XR1 2900
C            OMNIT  ONEWAY ORTHO  PDMOTE PLOT   PREPAK             XR1 2910
C            PRINTX PROB   PROROW PUNCH  RANKS                     XR1 2920
C            READQ  READX  REPINC RESET  RPRINT                    XR1 2930
C            SELECT SET    SETQ   SORDER SPACE                     XR1 2940
C            STATIS STORE  TAPOP2 THERMO                           XR1 2950
C            TRANSF TWOWAY XFORMT XHEAD                            XR1 2960
C     EXCHNG                                                       XR1 2970
C            XECUTE                                                XR1 2980
C     EXPAND                                                       XR1 2990
C            OMNIT  REPINC                                         XR1 3000
C     EXPCON                                                       XR1 3010
C            XECUTE                                                XR1 3020
C     EXTREM                                                       XR1 3030
C            XECUTE                                                XR1 3040
C     FCOS                                                         XR1 3050
C            FUNCT                                                 XR1 3060
C     FDCOS                                                        XR1 3070
C            BESSEL CBEI   CBEK   COMPLX DBEJ   FOURIA             XR1 3080
C            PROB                                                  XR1 3090
C     FDEXP                                                        XR1 3100
C            BESSEL CBEI   CBEK   DBEJ   ERRINT PROB               XR1 3110
C            THERMO                                                XR1 3120
C     FDLOG                                                        XR1 3130
C            CBEK   COMELL DBEJ   PROB   THERMO                    XR1 3140
C     FDPCON                                                       XR1 3150
C            COMPLX DHRND  FNEC   GQUAD                            XR1 3160
C     FDSIN                                                        XR1 3165
C            CBEI   CBEK   COMPLX DBEJ   FOURIA PROB               XR1 3170
C     FDSQRT                                                       XR1 3180
C            BEZERO BEZONE CBEI   CBEK   COMELL                    XR1 3190
C            COMPLX DBEJ          ORTHO  TWOWAY                    XR1 3200
C     FEXP                                                         XR1 3210
C            FEXP2  FPPT   FUNCT                                   XR1 3220
C     FEXP2                                                        XR1 3230
C            AARGS  ARITH  MATRIX MISC2                            XR1 3240
C     FIXFLO                                                       XR1 3250
C            XECUTE                                                XR1 3260
C     FLIP                                                         XR1 3270
C            XECUTE                                                XR1 3280
C     FLOG                                                         XR1 3290
C            CORREL FEXP2  FUNCT  ONEWAY THERMO                    XR1 3300
C     FLOG10                                                       XR1 3310
C            ACCDIG DHRND  FREQCY FUNCT  ORTHO  RFORMT             XR1 3320
C            RPRINT                                                XR1 3330
C     FNEC                                                         XR1 3340
C            XECUTE                                                XR1 3350
C     FNEIC                                                        XR1 3360
C            XECUTE                                                XR1 3370
C     FNKC                                                         XR1 3380
C            XECUTE                                                XR1 3390
C     FOURIA                                                       XR1 3400
C            BESSEL                                                XR1 3410
C     FPPT                                                         XR1 3420
C            ONEWAY                                                XR1 3430
C     FPROB                                                        XR1 3440
C            XECUTE                                                XR1 3450
C     FRDIST                                                       XR1 3460
```

```
C           XECUTE                                                      XR1 3470
C     FREQCY                                                            XR1 3480
C           FRDIST                                                      XR1 3490
C     FSIN                                                              XR1 3500
C           FUNCT                                                       XR1 3510
C     FSQRT                                                             XR1 3520
C           BJORCK CORREL FPPT   FUNCT  HDIAG  INTERP                   XR1 3530
C           INVCHK INVCOR MSCROW MTRIAN OCOEFF ONEWAY                   XR1 3540
C           OPONE  ORTHO  ORTPLT PROB   STATIS TWOWAY                   XR1 3550
C     FTANH                                                             XR1 3560
C           CORREL FUNCT                                                XR1 3570
C     FUNCT                                                             XR1 3580
C           XECUTE                                                      XR1 3590
C     GENER                                                             XR1 3600
C           XECUTE                                                      XR1 3610
C     GQUAD                                                             XR1 3620
C           XECUTE                                                      XR1 3630
C     HDIAG                                                             XR1 3640
C           MEIGEN                                                      XR1 3650
C     HEADS                                                             XR1 3660
C           PLOT   PRINTX RPRINT                                        XR1 3670
C     HISTGM                                                            XR1 3680
C           XECUTE                                                      XR1 3690
C     IFS                                                               XR1 3700
C           XECUTE                                                      XR1 3710
C     INFERR                                                            XR1 3720
C           ERROR                                                       XR1 3730
C     INPUT                                                             XR1 3740
C           OMNIT                                                       XR1 3750
C     INTERP                                                            XR1 3760
C           XECUTE                                                      XR1 3770
C     INTRP                                                             XR1 3780
C           INTERP                                                      XR1 3790
C     INVCHK                                                            XR1 3800
C           INVERT MPROP                                                XR1 3810
C     INVCOR                                                            XR1 3820
C           CORREL                                                      XR1 3830
C     INVERT                                                            XR1 3840
C           XECUTE                                                      XR1 3850
C     ITERAT                                                            XR1 3860
C           XECUTE                                                      XR1 3870
C     LIST                                                              XR1 3880
C           XECUTE                                                      XR1 3890
C     LOCATE                                                            XR1 3900
C           REPINC STORE                                                XR1 3910
C     LOOKUP                                                            XR1 3920
C           OMNIT                                                       XR1 3930
C     MATRIX                                                            XR1 3940
C           XECUTE                                                      XR1 3950
C     MDAMAD                                                            XR1 3960
C           XECUTE                                                      XR1 3970
C     MEIGEN                                                            XR1 3980
C           XECUTE                                                      XR1 3990
C     MISC2                                                             XR1 4000
C           XECUTE                                                      XR1 4010
C     MIST                                                              XR1 4030
C           CORREL                                                      XR1 4040
C     MKRON                                                             XR1 4050
C           XECUTE                                                      XR1 4060
C     MMULT                                                             XR1 4070
```

```
C             XECUTE                                                    XR1 4080
C     MOP                                                               XR1 4090
C             XECUTE                                                    XR1 4100
C     MOVE                                                              XR1 4110
C             MISC2  XECUTE                                             XR1 4120
C     MPROP                                                             XR1 4130
C             XECUTE                                                    XR1 4140
C     MRAISE                                                            XR1 4150
C             XECUTE                                                    XR1 4160
C     MSCROW                                                            XR1 4170
C             XECUTE                                                    XR1 4180
C     MTRIAN                                                            XR1 4190
C             XECUTE                                                    XR1 4200
C     MTXCHK                                                            XR1 4210
C             APRINT ARYVEC EXPCON INVERT MATRIX MDAMAD                 XR1 4220
C             MEIGEN MKRON  MMULT  MOP    MPROP  MRAISE                 XR1 4230
C             MTRIAN MXTX   TRANSF                                      XR1 4240
C     MXTX                                                              XR1 4250
C             XECUTE                                                    XR1 4260
C     MXTXP                                                             XR1 4270
C             MXTX   ORTHRV                                             XR1 4280
C     NNAME                                                             XR1 4290
C             ASTER  OMNIT  TAPOP                                       XR1 4300
C     NONBLA                                                            XR1 4310
C             ASTER                                                     XR1 4320
C     NOTEPR                                                            XR1 4330
C             OMNIT  XECUTE XOMNIT                                      XR1 4340
C     OANOVA                                                            XR1 4350
C             ORTHO                                                     XR1 4360
C     OCOEFF                                                            XR1 4370
C             ORTHO                                                     XR1 4380
C     OCOVAR                                                            XR1 4390
C             ORTHO                                                     XR1 4400
C     OMCONV                                                            XR1 4410
C             INPUT                                                     XR1 4420
C     OMNIT                                                             XR1 4430
C             MNITAB OMNSYM                                             XR1 4440
C     ONEWAY                                                            XR1 4450
C             XECUTE                                                    XR1 4460
C     OPONE                                                             XR1 4470
C             ORTHO                                                     XR1 4480
C     ORTHO                                                             XR1 4490
C             XECUTE                                                    XR1 4500
C     ORTHRV                                                            XR1 4510
C             MPROP  PROCHK                                             XR1 4520
C     ORTPLT                                                            XR1 4530
C             ORTHO                                                     XR1 4540
C     OUTPUT                                                            XR1 4550
C             OMNIT                                                     XR1 4560
C     PACK                                                              XR1 4570
C             PREPAK                                                    XR1 4580
C     PAGE                                                              XR1 4590
C             ABRIDG APRINT CORREL HISTGM MIST   MPROP                  XR1 4600
C             NOTEPR OMNIT  ONEWAY ORTHO  ORTPLT PLOT                   XR1 4610
C             PRINTX RPRINT STATIS TWOWAY XECUTE XSTOP                  XR1 4620
C     PDMOTE                                                            XR1 4630
C             XECUTE                                                    XR1 4640
C     PHYCON                                                            XR1 4670
C             ASTER  XECUTE                                             XR1 4680
C     PLOT                                                              XR1 4690
```

```
C           XECUTE                                                      XR1 4700
C     PREPAK                                                            XR1 4710
C           ABRIDG APRINT HEADS  ORTHO  PRINTX PUNCH                    XR1 4720
C           READX  XFORMT XHEAD  XOMNIT                                 XR1 4730
C     PRINTX                                                            XR1 4740
C           XECUTE                                                      XR1 4750
C     PROB                                                              XR1 4760
C           CORREL FPPT   FPROB  OANOVA ONEWAY                          XR1 4770
C           STATIS TWOWAY                                               XR1 4780
C     PROCHK                                                            XR1 4790
C           MPROP                                                       XR1 4800
C     PROROW                                                            XR1 4810
C           XECUTE                                                      XR1 4820
C     PUNCH                                                             XR1 4830
C           TAPOP2 XECUTE                                               XR1 4840
C     PVTRI                                                             XR1 4850
C           MPROP                                                       XR1 4860
C     RANKO                                                             XR1 4870
C           ONEWAY                                                      XR1 4880
C     RANKS                                                             XR1 4890
C           XECUTE                                                      XR1 4900
C     RANKX                                                             XR1 4910
C           CORREL RANKS                                                XR1 4920
C     RCSUM                                                             XR1 4930
C           MPROP                                                       XR1 4940
C     READQ                                                             XR1 4950
C           OMNIT                                                       XR1 4960
C     READX                                                             XR1 4970
C           TAPOP2 XECUTE                                               XR1 4980
C     REPINC                                                            XR1 4990
C           XECUTE                                                      XR1 5000
C     RESET                                                             XR1 5010
C           XECUTE                                                      XR1 5020
C     RFORMT                                                            XR1 5030
C           APRINT HISTGM OANOVA OCOEFF OCOVAR OPONE                    XR1 5040
C           ORTHO  RPRINT TWOWAY                                        XR1 5050
C     RNDOWN                                                            XR1 5060
C           AERR   ERROR                                                XR1 5070
C     RNJBK                                                             XR1 5080
C           FNKC                                                        XR1 5090
C     RPRINT                                                            XR1 5100
C           ABRIDG PRINTX                                               XR1 5110
C     SELECT                                                            XR1 5120
C           XECUTE                                                      XR1 5130
C     SET                                                               XR1 5140
C           TAPOP2 XECUTE                                               XR1 5150
C     SETQ                                                              XR1 5160
C           OMNIT                                                       XR1 5170
C     SETUP                                                             XR1 5180
C           OMNIT                                                       XR1 5190
C     SKSYMV                                                            XR1 5200
C           PROCHK                                                      XR1 5210
C     SORDER                                                            XR1 5220
C           XECUTE                                                      XR1 5230
C     SORTSM                                                            XR1 5240
C           ARYVEC MMULT  MRAISE MTRIAN MXTXP  TRANSF                   XR1 5250
C     SPACE                                                             XR1 5260
C           XECUTE                                                      XR1 5270
C     SPINV                                                             XR1 5280
C           INVCHK                                                      XR1 5290
```

```
C     STATIS                                                          XR1 5300
C             XECUTE                                                  XR1 5310
C     STMT                                                            XR1 5320
C             OMNIT                                                   XR1 5330
C     STORE                                                           XR1 5340
C             OMNIT                                                   XR1 5350
C     STORMT                                                          XR1 5360
C             MXTX                                                    XR1 5370
C     STRUVE                                                          XR1 5380
C             BESSEL                                                  XR1 5390
C     SYMV                                                            XR1 5400
C             MTRIAN PROCHK                                           XR1 5410
C     TAPOP                                                           XR1 5420
C             OMNIT                                                   XR1 5430
C     TAPOP2                                                          XR1 5440
C             XECUTE                                                  XR1 5450
C     THERMO                                                          XR1 5460
C             XECUTE                                                  XR1 5470
C     TPCTPT                                                          XR1 5480
C             FPPT   ONEWAY                                           XR1 5490
C     TRANSF                                                          XR1 5500
C             MXTX                                                    XR1 5510
C     TWOWAY                                                          XR1 5520
C             XECUTE                                                  XR1 5530
C     VARCON                                                          XR1 5540
C             ASTER                                                   XR1 5550
C     VECTOR                                                          XR1 5560
C             DEFINE ERASE  EXTREM FUNCT  MISC2  MSCROW               XR1 5570
C     XECUTE                                                          XR1 5580
C             OMNIT                                                   XR1 5590
C     XFORMT                                                          XR1 5600
C             OMNIT                                                   XR1 5610
C     XHEAD                                                           XR1 5620
C             OMNIT                                                   XR1 5630
C     XOMNIT                                                          XR1 5640
C             OMNIT                                                   XR1 5650
C     XPND                                                            XR1 5660
C             EXPAND REPINC                                           XR1 5670
C     XSTOP                                                           XR1 5680
C             OMNIT  XOMNIT                                           XR1 5690
C                                                                     XR1 5700
C*****************CROSS REFERENCING OF SYSTEM FUNCTIONS***************** XR1 5705
C                                                                     XR1 5710
C  FUNCTION   REFERENCED BY                                           XR1 5715
C                                                                     XR1 5720
C     *ALOG                                                           XR1 5730
C             FLOG                                                    XR1 5740
C     *ALOG10                                                         XR1 5750
C             FLOG10                                                  XR1 5760
C     *ATAN                                                           XR1 5770
C             FUNCT  PROB                                             XR1 5780
C     *COS                                                            XR1 5790
C             FCOS                                                    XR1 5800
C     *DATAN2                                                         XR1 5810
C             COMPLX                                                  XR1 5820
C     *DCOS                                                           XR1 5830
C             FDCOS                                                   XR1 5840
C     *DEXP                                                           XR1 5850
C             FDEXP                                                   XR1 5860
C     *DLOG                                                           XR1 5870
```

```
C            FDLOG                                                          XR1 5880
C      *DSIN                                                                XR1 5890
C            FDSIN                                                          XR1 5900
C      *DSQRT                                                               XR1 5910
C            FDSQRT                                                         XR1 5920
C      *EXP                                                                 XR1 5930
C            FEXP                                                           XR1 5940
C      *SIN                                                                 XR1 5950
C            FSIN                                                           XR1 5960
C      *SQRT                                                                XR1 5970
C            FSQRT                                                          XR1 5980
C      *TANH                                                                XR1 5990
C            FTANH                                                          XR1 6000
C                                                                           XR1 6010
C    2.   **********DOUBLE PRECISION VARIABLES DEFINED IN SUBPROGRAMS**     XR1 6020
C                                                                           XR1 6030
C  SUBPROGRAM    DOUBLE PRECISION VARIABLES                                 XR1 6040
C                                                                           XR1 6050
C      ARYVEC                                                               XR1 6060
C            SUM     X                                                      XR1 6070
C      BEJN                                                                 XR1 6080
C            A       B       C       D       E       F                     XR1 6090
C            G       P       Q       R       X       Y                     XR1 6100
C            Z                                                              XR1 6105
C      BESSEL                                                               XR1 6110
C            AA      B       BINTJO  COMELL  DBEJ    DSNCOS                XR1 6120
C            DXEX    DXEXP   E       FDCOS   FDEXP   P                     XR1 6130
C            Q       S       T       W       X       XEX                   XR1 6140
C            Y       Z                                                      XR1 6145
C      BEZERO                                                               XR1 6150
C            A       AA      AB      AC      B       FDSQRT                XR1 6160
C            X       Y                                                      XR1 6165
C      BEZONE                                                               XR1 6170
C            A       B       FDSQRT  R       S       T                     XR1 6180
C            X       Y                                                      XR1 6190
C      BINTJ0                                                               XR1 6200
C            A       B       BINTJO  C       DBEJ    X                     XR1 6210
C            Z                                                              XR1 6220
C      BJORCK                                                               XR1 6223
C            C       D       FDSQRT  R       Y                             XR1 6225
C      CBEI                                                                 XR1 6230
C            A       AA      B       C       D       E                     XR1 6240
C            F       FDCOS   FDEXP   FDSIN   FDSQRT  G                     XR1 6250
C            H       P       Q       R       S       T                     XR1 6260
C            U       V       W       X       Y       Z                     XR1 6270
C      CBEK                                                                 XR1 6280
C            A       AA      AB      AC      AD      AE                    XR1 6290
C            B       C       D       E       F       FDCOS                 XR1 6300
C            FDEXP   FDLOG   FDSIN   FDSQRT  G       H                     XR1 6310
C            P       Q       R       S       T       U                     XR1 6320
C            V       W       X       Y       Z                             XR1 6330
C      COMELL                                                               XR1 6340
C            A       B       C       COMELL  D       E                     XR1 6350
C            FDLOG   FDSQRT  P       Q       X       Z                     XR1 6360
C      COMPLX                                                               XR1 6370
C            D       FDCOS   FDSIN   FDSQRT  X       Y                     XR1 6380
C      DBEJ                                                                 XR1 6390
C            A       B       C       D       DBEJ    DSNCOS                XR1 6400
C            DXEXP   E       FDCOS   FDEXP   FDLOG   FDSIN                 XR1 6410
C            FDSQRT  H       S       T       X       Y                     XR1 6420
```

```
C     DHRND                                                          XR1 6430
C           Z                                                        XR1 6440
C     ERRINT                                                         XR1 6450
C           AN        BN        C1        CONS      DN        ERF  XR1 6460
C           ERFC      F         FDEXP     FN        FNM1      FNM2 XR1 6470
C           FOUR      GN        GNM1      GNM2      ONE       P    XR1 6480
C           PREV      RNBC      SCF       SUM       TN        TOLER XR1 6490
C           TRRTPI    TWO       ULCF      ULCPS     WN        X    XR1 6500
C           Y         YSQ                                          XR1 6510
C     FDCOS                                                          XR1 6520
C           DCOS      DSNCOS    DXEXP     FDCOS     X             XR1 6530
C     FDEXP                                                          XR1 6550
C           DEXP      DSNCOS    DXEXP     FDEXP     X             XR1 6560
C     FDLOG                                                          XR1 6570
C           DLOG      FDLOG     X                                  XR1 6580
C     FDPCON                                                         XR1 6590
C           D         X                                            XR1 6600
C     FDSIN                                                          XR1 6610
C           DSIN      DSNCOS    DXEXP     FDSIN     X             XR1 6620
C     FDSQRT                                                         XR1 6630
C           DSQRT     FDSQRT    X                                  XR1 6640
C     FOURIA                                                         XR1 6650
C           A         AA        AB        AC        AD        BA   XR1 6660
C           BB        FDCOS     FDSIN     R         Y             XR1 6670
C     FNEC                                                           XR1 6680
C           Y         Z                                            XR1 6690
C     GQUAD                                                          XR1 6693
C           B         BMA       BPA       C         DELGQ     STORE1 XR1 6695
C           STORE2                                                   XR1 6697
C     LBCONS                                                         XR1 6700
C           DSNCOS    DXEXP     TRRTPI                             XR1 6710
C     MMULT                                                          XR1 6720
C           SUM       X                                            XR1 6730
C     MRAISE                                                         XR1 6740
C           SUM       X                                            XR1 6750
C     MTRIAN                                                         XR1 6760
C           SUM       X                                            XR1 6770
C     MXTX                                                           XR1 6780
C           AP                                                     XR1 6790
C     MXTXP                                                          XR1 6800
C           SUM       XP                                           XR1 6810
C     OANOVA                                                         XR1 6820
C           YSUM                                                   XR1 6830
C     OCOEFF                                                         XR1 6840
C           YSUM                                                   XR1 6850
C     ORTHO                                                          XR1 6860
C           DK2       FDSQRT    SUM       YSUM                     XR1 6870
C     ORTHRV                                                         XR1 6873
C           XP                                                     XR1 6875
C     PROB                                                           XR1 6880
C           A         B         C         FDCOS     FDEXP     FDLOG XR1 6890
C           FDSIN     G         ONE       TA        TB        W    XR1 6900
C           X                                                      XR1 6910
C     RFORMT                                                         XR1 6920
C           Z                                                      XR1 6930
C     SORTSM                                                         XR1 6940
C           SAVE      SUM       X                                  XR1 6950
C     STRUVE                                                         XR1 6960
C           A         B         C         DBEJ      P         Q    XR1 6970
C           R         S         X         Z                        XR1 6980
```

```
C     THERMO                                                          XR1 6990
C             EXDIF   EXX     FDEXP   FDLOG   G       Q0            XR1 7000
C             Q1      Q2      QQ      X                             XR1 7010
C     TRANSF                                                          XR1 7020
C             SUM     X                                             XR1 7030
C     TWOWAY                                                          XR1 7040
C             DK2     FDSQRT SUM                                    XR1 7050
C                                                                   XR1 7060
C                                                                   XR1 7070
C    3.   ***VARIABLES EQUIVALENCED TO EACH OTHER**********************XR1 7080
C                                                                   XR1 7090
C SUBPROGRAM  VARIABLE      EQUIVALENCE     VARIABLE      EQUIVALENCE XR1 7100
C                                                                   XR1 7105
C     ALLSUB                                                        XR1 7110
C             SCRA          A               L11           LL1       XR1 7120
C             L22           LL2                                     XR1 7130
C     ARITH                                                         XR1 7140
C             I1            II(1)           I2            II(2)     XR1 7150
C             I3            II(3)           I4            II(4)     XR1 7160
C             I5            II(5)                                   XR1 7170
C     ARYVEC                                                        XR1 7180
C             X             A                                       XR1 7190
C     BESSEL                                                        XR1 7200
C             A(1)          AA              A(2001)       B         XR1 7210
C             A(4001)       W               R             RC        XR1 7220
C             IA            IARGS           KI            KIND      XR1 7230
C             NR            NRMAX                                   XR1 7240
C     CBEK                                                          XR1 7250
C             SCRAT(1700)   AA              SCRAT(1800)   AB        XR1 7260
C     COMPLX                                                        XR1 7270
C             I1            IARGS(1)        I2            IARGS(2)  XR1 7280
C             I3            IARGS(3)        I4            IARGS(4)  XR1 7290
C             I5            IARGS(5)        I6            IARGS(6)  XR1 7300
C     CORREL                                                        XR1 7310
C             A(13301)      AVG(1)          A(13401)      SD(1)     XR1 7320
C             A(13401)      T(1)                                    XR1 7330
C     DBEJ                                                          XR1 7340
C             SCRAT(1201)   S               SCRAT(1451)   T         XR1 7350
C     FLIP                                                          XR1 7360
C             I             IARGS(100)      J             IARGS(99) XR1 7370
C             K             IARGS(98)       KK            IARGS(97) XR1 7380
C             M             IARGS(96)       MM            IARGS(95) XR1 7390
C             MMM           IARGS(94)       N             IARGS(93) XR1 7400
C             NN            IARGS(92)       A             ARGS(1)   XR1 7410
C     FUNCT                                                         XR1 7420
C             I1            II(1)           I2            II(2)     XR1 7430
C             I3            II(3)           I4            II(4)     XR1 7440
C     IFS                                                           XR1 7450
C             I1            II(1)           I2            II(2)     XR1 7460
C             I3            II(3)                                   XR1 7470
C     MMULT                                                         XR1 7480
C             X             A                                       XR1 7490
C     MRAISE                                                        XR1 7500
C             X             A                                       XR1 7510
C     MTRIAN                                                        XR1 7520
C             X             A                                       XR1 7530
C     MXTX                                                          XR1 7540
C             A             AP                                      XR1 7550
C     ONEWAY                                                        XR1 7560
C             BLANK         L(45)           SLO           L(22)     XR1 7570
```

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C             HIGH          L(18)         A2(1)         A(2701)       XR1 7580
C             A3(1)         A(5401)       A4(1)         A(8101)       XR1 7590
C             A5(1)         A(10801)      B1(1)         A(1)          XR1 7600
C             B2(1)         A(541)        B3(1)         A(1081        XR1 7610
C             B4(1)         A(1621)       B5(1)         A(2161)       XR1 7620
C             B6(1)         A(2701)       B7(1)         A(3241)       XR1 7630
C             B8(1)         A(3781)       B9(1)         A(4321)       XR1 7640
C             B10(1)        A(4861)                                   XR1 7650
C      OPONE                                                          XR1 7660
C             IIRGS(1)      KFMT(1)                                   XR1 7670
C      ORTHO                                                          XR1 7680
C             IIRGS(1)      KFMT(1)       B(1)          IB          XR1 7690
C      ORTPLT                                                         XR1 7700
C             IU            A                                         XR1 7710
C      PLOT                                                           XR1 7720
C             TIT           ITLE(1,6)     TITX          ITLE(1,5)   XR1 7730
C             RC(1)         X(1)          PRINT         A           XR1 7740
C             X0            XMIN          X1            XMAX        XR1 7750
C             Y0            YMIN          Y1            YMAX        XR1 7760
C             LHEAD         IH            IPR           A(200)      XR1 7770
C      PREPAK                                                         XR1 7780
C             A             IAA                                       XR1 7790
C      RFORMT                                                         XR1 7800
C             C(1)          L(1)          BLANK         L(45)       XR1 7810
C             PERIOD        L(38)         CPLUS         L(40)       XR1 7820
C             CMINUS        L(39)         CASTER        L(41)       XR1 7830
C      RPRINT                                                         XR1 7840
C             NWIDTH(1)     A(1001)       NDECS(1)      A(1101)     XR1 7850
C             NBLANK(1)     A(1201)       IRGS(1)       A(1301)     XR1 7860
C             NCOUNT(1)     A(1401)                                   XR1 7870
C             NWMAX(1)      A(1601)       NSIGDS(1)     A(1701)     XR1 7880
C             AL(1)         L(1)          NF(1)         A(1801)     XR1 7890
C             NWM(1)        A(1901)                                   XR1 7900
C      SORTSM                                                         XR1 7910
C             X             A                                         XR1 7920
C      STATIS                                                         XR1 7930
C             A(101)        ISA           A(3226)       SA          XR1 7940
C      THERMO                                                         XR1 7950
C             A(1)          QQ1                                       XR1 7960
C      TRANSF                                                         XR1 7970
C             X             A                                         XR1 7980
C      TWOWAY                                                         XR1 7990
C             KFMT          IIRGS         ND1           KIND(100)   XR1 8000
C             ND2           KIND(99)      ND3           KIND(98)    XR1 8010
C             ND4           KIND(97)      ND5           KIND(96)    XR1 8020
C             ND6           KIND(95)      ND7           KIND(94)    XR1 8030
C             ND8           KIND(93)      ND9           KIND(92)    XR1 8040
C             ND10          KIND(91)      ND11          KIND(90)    XR1 8050
C             ND12          KIND(89)      ND13          KIND(88)    XR1 8060
C             ND14          KIND(87)      ND16          KIND(86)    XR1 8070
C             ND17          KIND(85)      ND18          KIND(84)    XR1 8080
C             ND19          KIND(83)                                  XR1 8090
C      XSTOP                                                          XR1 8100
C             ITEMP(1)      A(1)                                      XR1 8110
       END                                                           XR1 8120
```

Listing Of XREF2

```
C     XREF2                                                                  XR2    10
C     VERSION  5.00      XREF2      5/15/70                                  XR2    20
C                                                                            XR2    30
C     1.**COMMAND NAMES, CORRESPONDING L1,L2 VALUES AND SUBPROGRAM THAT      XR2    40
C        EXECUTES THE INSTRUCTION**************************************      XR2    50
C                                                                            XR2    60
C*** FOLLOWING COMMANDS ARE EXECUTED IN OMNIT AND L1,L2 ARE NOT DEFINED      XR2    70
C                                                                            XR2    80
C     FINISH         FORMAT A       FORMAT B       FORMAT C                  XR2    90
C     FORMAT D       FORMAT E       FORMAT F       HEAD                      XR2   100
C     NOTE           NOTE1          NOTE2          OMNITA                    XR2   110
C     STOP           TITLE  1       TITLE  2       TITLE  3                  XR2   120
C     TITLE 4        TITLE  X       TITLE  Y                                 XR2   130
C                                                                            XR2   140
C**** FORMAT  CALLS   XFORMT                                                 XR2   150
C                                                                            XR2   160
C                                                                            XR2   170
C*** COMMAND        L1   L2  CALLING       COMMAND        L1   L2  CALLING  XR2   180
C     NAMES                    SUB         NAMES                    SUB     XR2   190
C                                                                            XR2   200
C     AADD          18    4   MATRIX       AAVERA         18   10  COALES  XR2   210
C     ABRIDG         6    1   ABRIDG       ABRIDG A        6    2  ABRIDG  XR2   220
C     ABRIDG B       6    3   ABRIDG       ABRIDG C        6    4  ABRIDG  XR2   230
C     ABRIDG D       6    5   ABRIDG       ABRIDG E        6    6  ABRIDG  XR2   240
C     ABRIDG F       6    7   ABRIDG       ABS            12   31  FUNCT   XR2   250
C     ABSOLU        12   31    FUNCT       ACCURA         11    6  ARITH   XR2   260
C     ACOALES       18    9   COALES       ACOS           12    6  FUNCT   XR2   270
C     ACOSD         12   14    FUNCT       ACOSH          12   28  FUNCT   XR2   280
C     ACOT          12    8    FUNCT       ACOTD          12   16  FUNCT   XR2   290
C     ACOTH         12   30    FUNCT       ADD            11    1  ARITH   XR2   300
C     ADEFIN        15    1      MOP       ADIV           18    7  MATRIX  XR2   310
C     ADIVID        18    7   MATRIX       AERASE         15    2     MOP  XR2   320
C     AMOVE         23    6     MOVE       AMULT          18    6  MATRIX  XR2   330
C     AMULTI        18    6   MATRIX       ANTILO         12   22  FUNCT   XR2   340
C     APRINT         4    1   APRINT       APRINT A        4    2  APRINT  XR2   350
C     APRINT B       4    3   APRINT       APRINT C        4    4  APRINT  XR2   360
C     APRINT D       4    5   APRINT       APRINT E        4    6  APRINT  XR2   370
C     APRINT F       4    7   APRINT       APROPE         27    2  MPROP   XR2   380
C     ARAISE        18    8   MATRIX       ASIN           12    5  FUNCT   XR2   390
C     ASIND         12   13    FUNCT       ASINH          12   27  FUNCT   XR2   400
C     ASUB          18    5   MATRIX       ASUBTR         18    5  MATRIX  XR2   410
C     ATAN          12    7    FUNCT       ATAND          12   15  FUNCT   XR2   420
C     ATANH         12   29    FUNCT       ATOMIC         31    3  THERMO  XR2   430
C     ATRANS        18    3   MATRIX       AVERAG         20    4  MSCROW  XR2   440
C     AZERO         15    2      MOP       BACKSPACE TAPE50    1  TAPOP2  XR2   450
C     BEGIN         14    1    BEGIN       BESIN          30   38  BESSEL  XR2   460
C     BESJN         30   32   BESSEL       BESKN          30   39  BESSEL  XR2   470
C     BIONE         30    6   BESSEL       BIZERO         30    5  BESSEL  XR2   480
C     BJONE         30    2   BESSEL       BJZERO         30    1  BESSEL  XR2   490
C     BKONE         30    8   BESSEL       BKZERO         30    7  BESSEL  XR2   500
C     BOLDIS        31    9   THERMO       BYONE          30    4  BESSEL  XR2   510
C     BYZERO        30    3   BESSEL       CADD           32    1  COMPLX  XR2   520
```

C*** COMMAND NAMES	L1	L2	CALLING SUB	COMMAND NAMES	L1	L2	CALLING SUB	
C								
C CDIVID	32	4	COMPLX	CEIONE	30	26	BESSEL XR2	530
C CEIZER	30	25	BESSEL	CEKONE	30	28	BESSEL XR2	540
C CEKZER	30	27	BESSEL	CENSOR	25	3	SELECT XR2	550
C CERF	21	19	FNEC	CGS	13	10	PHYCON XR2	560
C CHANGE	21	13	CHANGE	CIONE	30	22	BESSEL XR2	570
C CIZERO	30	21	BESSEL	CKONE	30	24	BESSEL XR2	580
C CKZERO	30	23	BESSEL	CLOSE UP	23	1	MISC2 XR2	590
C CMULTI	32	3	COMPLX	COMPAR	14	15	IFS XR2	600
C CORREL	24	11	CORREL	COS	12	2	FUNCT XR2	610
C COSD	12	10	FUNCT	COSH	12	24	FUNCT XR2	620
C COT	12	4	FUNCT	COTD	12	12	FUNCT XR2	630
C COTH	12	26	FUNCT	COUNT	23	2	MISC2 XR2	640
C CPOLAR	32	6	COMPLX	CREAD TAPE	46	1	TAPOP2 XR2	650
C CREAD TAPE A	46	2	TAPOP2	CREAD TAPE B	46	3	TAPOP2 XR2	660
C CREAD TAPE C	46	4	TAPOP2	CREAD TAPE D	46	5	TAPOP2 XR2	670
C CREAD TAPE E	46	6	TAPOP2	CREAD TAPE F	46	7	TAPOP2 XR2	680
C CRECTA	32	5	COMPLX	CSET TAPE	49	1	TAPOP2 XR2	690
C CSUBTR	32	2	COMPLX	CTOF	31	1	THERMO XR2	700
C DEFINE	21	3	DEFINE	DEMOTE	23	11	PDMOTE XR2	710
C DIM	23	12	DIMENS	DIMENS	23	12	DIMENS XR2	720
C DIV	11	4	ARITH	DIVIDE	11	4	ARITH XR2	730
C DUMMY A	54	2	DUMMYA	DUMMY B	54	3	DUMMYB XR2	740
C DUMMY C	54	4	DUMMYC	DUMMY D	54	5	DUMMYD XR2	750
C DUMMY E	54	6	DUMMYE	DUMMY F	54	7	DUMMYF XR2	760
C DUPLIC	23	5	MISC2	EINSTE	31	5	THERMO XR2	770
C ELLIPT FIRST	30	30	BESSEL	ELLIPT SECOND	30	31	BESSEL XR2	780
C ENDFIL TAPE	50	1	TAPOP2	ERASE	21	10	ERASE XR2	790
C ERROR	21	18	FNEC	EXCHAN	21	11	EXCHNG XR2	800
C EXECUT	14	3	REPINC	EXIONE	30	10	BESSEL XR2	810
C EXIZER	30	9	BESSEL	EXKONE	30	12	BESSEL XR2	820
C EXKZER	30	11	BESSEL	EXP	12	18	FUNCT XR2	830
C EXPAND	23	4	MISC2	EXPONE	12	18	FUNCT XR2	840
C EXTREM	29	4	CMSEPA	F PROBAB	24	5	FPROB XR2	850
C FIT	22	3	ORTHO	FIXED	13	3	FIXFLO XR2	860
C FLEXIB	13	12	FIXFLO	FLIP	21	12	FLIP XR2	870
C FLOATI	13	4	FIXFLO	FRACTI	12	33	FUNCT XR2	880
C FREQUE	24	10	FRDIST	FTOC	31	2	THERMO XR2	890
C GAUSS QUADRA	24	4	GQUAD	GENERA	13	1	GENER XR2	900
C HARMON	30	37	BESSEL	HERMIT	19	3	ALLSUB XR2	910
C HIERAR	21	14	SORDER	HISTOG	24	8	HISTGM XR2	920
C IFEQ	14	10	IFS	IFGE	14	12	IFS XR2	930
C IFGT	14	11	IFS	IFLE	14	14	IFS XR2	940
C IFLT	14	9	IFS	IFNE	14	13	IFS XR2	950
C INCREM	14	6	REPINC	INSERT	29	3	CMSEPA XR2	960
C INTEGE	12	32	FUNCT	INTERP	25	4	INTERP XR2	970
C INTJO	30	29	BESSEL	INVERT	16	1	INVERT XR2	980
C ISETUP	28	2	ITERAT	ISOLAT	28	3	ITERAT XR2	990
C ITERAT	28	1	ITERAT	KBIONE	30	14	BESSEL XR2	1000
C KBIZER	30	13	BESSEL	KBKONE	30	16	BESSEL XR2	1010
C KBKZER	30	15	BESSEL	KEXION	30	18	BESSEL XR2	1020
C KEXIZE	30	17	BESSEL	KEXKON	30	20	BESSEL XR2	1030
C KEXKZE	30	19	BESSEL	LAGUER	19	2	ALLSUB XR2	1040
C LEGEND	19	5	ALLSUB	LIST	21	15	LIST XR2	1050
C LOG	12	20	FUNCT	LOGE	12	20	FUNCT XR2	1060
C LOGTEN	12	21	FUNCT	MADD	18	1	MATRIX XR2	1070
C MATCH	25	5	SELECT	MAX	21	5	EXTREM XR2	1080
C MAXIMU	21	5	EXTREM	MAXMIN	29	4	CMSEPA XR2	1090

C*** COMMAND NAMES	L1	L2	CALLING SUB	COMMAND NAMES	L1	L2	CALLING SUB
C							
C MDEFIN	15	1	MOP	MDIAGO	15	4	MOP XR2 1100
C MEIGEN	17	5	MEIGEN	MERASE	15	2	MOP XR2 1110
C MIDENT	15	3	MOP	MIN	21	6	EXTREM XR2 1120
C MINIMU	21	6	EXTREM	MINVER	16	1	INVERT XR2 1130
C MKRON	17	3	MKRON	MMATVE	26	3	EXPCON XR2 1140
C MMOVE	23	6	MOVE	MMULT	17	1	MMULT XR2 1150
C MMULTI	17	1	MMULT	MOLWT	31	4	THERMO XR2 1160
C MORTHO	22	5	ORTHO	MOVE	23	6	MOVE XR2 1170
C MPRINT	7	1	APRINT	MPRINT A	7	2	APRINT XR2 1180
C MPRINT B	7	3	APRINT	MPRINT C	7	4	APRINT XR2 1190
C MPRINT D	7	5	APRINT	MPRINT E	7	6	APRINT XR2 1200
C MPRINT F	7	7	APRINT	MPROPE	27	1	MPROP XR2 1210
C MRAISE	17	2	MRAISE	MSCALA	18	6	MATRIX XR2 1220
C MSUB	18	2	MATRIX	MSUBTR	18	2	MATRIX XR2 1230
C MTRANS	18	3	MATRIX	MTRIAN	17	4	MTRIAN XR2 1240
C MULT	11	3	ARITH	MULTIP	11	3	ARITH XR2 1250
C MVECDI	26	1	EXPCON	MVECMA	26	2	EXPCON XR2 1260
C MZERO	15	2	MOP	M(AD)	52	1	MDAMAD XR2 1270
C M(AV)	53	1	ARYVEC	M(DA)	52	2	MDAMAD XR2 1280
C M(V'A)	53	2	ARYVEC	M(XAX')	51	3	MXTX XR2 1290
C M(X'AX)	51	2	MXTX	M(XX')	51	1	MXTX XR2 1300
C M(X'X)	51	2	MXTX	NEGEXP	12	19	FUNCT XR2 1310
C NEW PAGE	13	8	PAGE	NHISTO	24	9	HISTGM XR2 1320
C NO LIST	21	16	LIST	NORMLA	19	1	ALLSUB XR2 1330
C NPRINT	8	1	PRINTX	NPRINT A	8	2	PRINTX XR2 1340
C NPRINT B	8	3	PRINTX	NPRINT C	8	4	PRINTX XR2 1350
C NPRINT D	8	5	PRINTX	NPRINT E	8	6	PRINTX XR2 1360
C NPRINT F	8	7	PRINTX	NULL	21	17	XECUTE XR2 1370
C ONEWAY	24	13	ONEWAY	ORDER	21	9	SORDER XR2 1380
C PAGE PLOT	13	6	PLOT	PARPRO	20	2	MSCROW XR2 1390
C PARSUM	20	1	MSCROW	PARTFU	31	8	THERMO XR2 1400
C PERFOR	14	3	REPINC	PFATOM	31	7	THERMO XR2 1410
C PFTRAN	31	6	THERMO	PLOT	13	5	PLOT XR2 1420
C POLYFI	22	1	ORTHO	PRINT	2	1	PRINTX XR2 1430
C PRINT A	2	2	PRINTX	PRINT B	2	3	PRINTX XR2 1440
C PRINT C	2	4	PRINTX	PRINT D	2	5	PRINTX XR2 1450
C PRINT E	2	6	PRINTX	PRINT F	2	7	PRINTX XR2 1460
C PRINT NOTE	13	13	NOTEPR	PRODUC	21	2	PROROW XR2 1470
C PROMOT	23	10	PDMOTE	PUNCH	3	1	PRINTX XR2 1480
C PUNCH A	3	2	PRINTX	PUNCH B	3	3	PRINTX XR2 1490
C PUNCH C	3	4	PRINTX	PUNCH D	3	5	PRINTX XR2 1500
C PUNCH E	3	6	PRINTX	PUNCH F	3	7	PRINTX XR2 1510
C RAISE	11	5	ARITH	RANKS	24	3	RANKS XR2 1520
C READ	5	1	READX	READ A	5	2	READX XR2 1530
C READ B	5	3	READX	READ C	5	4	READX XR2 1540
C READ D	5	5	READX	READ E	5	6	READX XR2 1550
C READ X	5	7	READX	READ TAPE	45	1	TAPOP2 XR2 1560
C READ TAPE A	45	2	TAPOP2	READ TAPE B	45	3	TAPOP2 XR2 1570
C READ TAPE C	45	4	TAPOP2	READ TAPE D	45	5	TAPOP2 XR2 1580
C READ TAPE E	45	6	TAPOP2	READ TAPE F	45	7	TAPOP2 XR2 1590
C REPEAT	14	3	REPINC	RESET	1	1	RESET XR2 1600
C RESET V	1	3	RESET	RESET W	1	4	RESET XR2 1610
C RESET X	1	5	RESET	RESET Y	1	6	RESET XR2 1620
C RESET Z	1	7	RESET	RESTOR	14	8	REPINC XR2 1630
C REWIND TAPE	50	1	TAPOP2	RMS	20	3	MSCROW XR2 1640
C ROUND	13	14	FNEIC	ROW SUM	21	1	PROROW XR2 1650
C ROWSUM	21	1	PROROW	SAPROP	27	4	MPROP XR2 1660

```
C***  COMMAND        L1   L2   CALLING        COMMAND        L1   L2   CALLING
C      NAMES                    SUB           NAMES                    SUB
C
C     SCAN           14    2     BEGIN       SCORRE         24   12   CORREL XR2 1670
C     SEARCH         25    2    SELECT       SELECT         25    1   SELECT XR2 1680
C     SEPARA         29    2    CMSEPA       SET            13    2      SET XR2 1690
C     SET     TAPE   48    1    TAPOP2       SFIT           22    4    ORTHO XR2 1700
C     SHORTE         23    3     MISC2       SI             13   11   PHYCON XR2 1710
C     SIN            12    1     FUNCT       SIND           12    9    FUNCT XR2 1720
C     SINH           12   23     FUNCT       SKIP    TAPE   50    1   TAPOP2 XR2 1730
C     SMPROP         27    3     MPROP       SOLVE          16    2   INVERT XR2 1740
C     SONEWA         24   14    ONEWAY       SORT           21    8   SORDER XR2 1750
C     SPACE          13    9     SPACE       SPOLYF         22    2    ORTHO XR2 1760
C     SQRT           12   17     FUNCT       SQUARE         12   34    FUNCT XR2 1770
C     SSTATI         24    2    STATIS       STATIS         24    1   STATIS XR2 1780
C     STRUVE ONE     30   36    BESSEL       STRUVE ZERO    30   35   BESSEL XR2 1790
C     STWOWA         24    7    TWOWAY       SUB            11    2    ARITH XR2 1800
C     SUBTRA         11    2     ARITH       SUM            20    5   MSCROW XR2 1810
C     TAN            12    3     FUNCT       TAND           12   11    FUNCT XR2 1820
C     TANH           12   25     FUNCT       TCHEBY         19    6   ALLSUB XR2 1830
C     TWOWAY         24    6    TWOWAY       UCHEBY         19    4   ALLSUB XR2 1840
C     UNIFOR RANDOM  24   15       FNKC      WRITE TAPE     47    1   TAPOP2 XR2 1850
C     WRITE TAPE A   47    2    TAPOP2       WRITE TAPE B   47    3   TAPOP2 XR2 1860
C     WRITE TAPE C   47    4    TAPOP2       WRITE TAPE D   47    5   TAPOP2 XR2 1870
C     WRITE TAPE E   47    6    TAPOP2       WRITE TAPE F   47    7   TAPOP2 XR2 1880
C     ZEROS  BJONE   30   34    BESSEL       ZEROS  BJZERO 30   33   BESSEL XR2 1890
C                                                                      XR2 1900
      END                                                              XR2 1910
```

```
C     XREF3                                                              XR3   10
C     VERSION  5.00      XREF3      5/15/70                              XR3   20
C                                                                        XR3   30
C     THE COMMENTS CONTAINED IN THIS SECTION ARE FOR SYSTEM              XR3   40
C     IMPLEMENTATION.                                                    XR3   50
C    1.**CHANGES NEEDED IF WORK SHEET AND SCRATCH AREAS ARE TO BE        XR3   60
C        MODIFIED*************************************************      XR3   70
C                                                                        XR3   80
C     OMNITAB HAS A WORK SHEET OF 12500 MACHINE WORDS.  IF THIS IS TO    XR3   90
C     BE INCREASED OR DECREASED, THE FOLLOWING CORRECTIONS WILL BE       XR3  100
C     NECESSARY.                                                         XR3  110
C                                                                        XR3  120
C           LET  NSIZRC BE THE SIZE OF WORK SHEET REQUIRED. (NSIZRC      XR3  130
C           MUST BE A CONSTANT AND NOT A VARIABLE.)                      XR3  135
C                                                                        XR3  140
C           THEN LET                                                     XR3  141
C                                                                        XR3  142
C           NSIZR2 = INTEGRAL PART OF (NSIZRC + 1000)/2                  XR3  143
C                                                                        XR3  144
C           NSIZR4 = INTEGRAL PART OF NSIZRC/4                           XR3  145
C                                                                        XR3  146
C           NSIZR5 = INTEGRAL PART OF (NSIZRC + 1000)/5                  XR3  147
C                                                                        XR3  148
C           NSIZR6 = INTEGRAL PART OF NSIZRC/5                           XR3  149
C                                                                        XR3  150
C                                                                        XR3  160
C   I THE STATEMENTS                                                     XR3  170
C                                                                        XR3  180
C     COMMON/BLOCRC/NRC,RC(12600)                                        XR3  190
C     EQUIVALENCE(ARGS(1),RC(12501))                                     XR3  200
C                                                                        XR3  210
C     MUST BE CHANGED TO                                                 XR3  220
C                                                                        XR3  230
C     COMMON/BLOCRC/NRC,RC(NSIZRC+100)                                   XR3  240
C     EQUIVALENCE(ARGS(1),RC(NSIZRC+1))                                  XR3  250
C                                                                        XR3  260
C     IN THE FOLLOWING SUBPROGRAMS:                                      XR3  270
C                                                                        XR3  280
C     ABRIDG ADRESS ALLSUB APRINT ARITH  ARYVEC BEGIN  BESSEL CHANGE     XR3  290
C     CHKCOL CKIND  CMSEPA COALES COMPLX CORREL DEFINE DIMENS ERASE      XR3  300
C     ERROR  EXCHNG EXPAND EXPCON EXTREM FIXFLO FLIP   FPROB  FNEC      XR3  310
C     FNEIC  FNKC   FRDIST FUNCT  GENER  GQUAD  HISTGM IFS    INTERP    XR3  320
C     INVERT ITERAT LIST   MATRIX MDAMAD MEIGEN MISC2  MKRON  MMULT     XR3  330
C     MOP    MOVE   MPROP  MRAISE MSCROW MTRIAN MXTX   OMNIT  ONEWAY    XR3  340
C     OPONE  ORTHO  ORTPLT OUTPUT PDMOTE PLOT   PRINTX PROROW PUNCH     XR3  350
C     RANKS  READQ  READX  REPINC RESET  RPRINT SELECT SET    SETQ      XR3  360
C     SETUP  SORDER SPACE  STATIS STORE  THERMO TRANSF TWOWAY VECTOR    XR3  370
C     XOMNIT XPND   XSTOP                                              XR3  380
C                                                                        XR3  390
C  II THE STATEMENT                                                      XR3  400
C                                                                        XR3  410
C     COMMON/SCRAT/NS,NS2,A(13500)                                       XR3  420
```

```
C                                                                       XR3  430
C     MUST BE CHANGED TO                                                XR3  440
C                                                                       XR3  450
C     COMMON/SCRAT/NS,NS2,A(NSIZRC+1000)                                XR3  460
C                                                                       XR3  470
C     IN THE FOLLOWING SUBPROGRAMS:                                     XR3  480
C                                                                       XR3  490
C     ALLSUB APRINT ARYVEC BESSEL CBEK   CMSEPA COALES COMPLX CORREL    XR3  500
C     DBEJ   EXPCON FNEC   FNEIC  FNKC   FUNCT  HISTGM INTERP INVERT    XR3  510
C     ITERAT MATRIX MDAMAD MEIGEN MISC2  MKRON  MMULT  MOP    MPROP     XR3  520
C     MRAISE MTRIAN MXTX   OANOVA OCOEFF OCOVAR ONEWAY OPONE  ORTHO     XR3  530
C     ORTPLT PLOT   PREPAK PROROW RANKS  RPRINT SELECT SETUP  SORDER    XR3  540
C     SORTSM STATIS TAPOP2 THERMO TRANSF TWOWAY XSTOP                   XR3  550
C                                                                       XR3  560
C                                                                       XR3  570
C     THE STATEMENT                                                     XR3  580
C                                                                       XR3  590
C     COMMON/SCRAT/ NS,NS2,SCRAT(13500)                                 XR3  600
C                                                                       XR3  610
C     MUST BE CHANGED TO                                                XR3  620
C                                                                       XR3  630
C     COMMON/SCRAT/NS,NS2,SCRAT(NSIZRC+1000)                            XR3  640
C                                                                       XR3  650
C     IN THE FOLLOWING SUBPROGRAMS:                                     XR3  660
C                                                                       XR3  670
C     CBEK   DBEJ                                                       XR3  680
C                                                                       XR3  690
C     ( THE VARIABLE A WAS CHANGED TO SCRAT BECAUSE A WAS USED          XR3  700
C     IN THE SUBPROGRAMS)                                               XR3  710
C                                                                       XR3  720
C III THE STATEMENTS                                                    XR3  730
C                                                                       XR3  735
C     NS=13500                                                          XR3  740
C     NRC=12500                                                         XR3  750
C                                                                       XR3  760
C     MUST BE CHANGED TO                                                XR3  770
C                                                                       XR3  780
C     NS=NSIZRC+1000                                                    XR3  790
C     NRC=NSIZRC                                                        XR3  800
C                                                                       XR3  810
C     IN THE SUBPROGRAM  SETUP.                                         XR3  820
C                                                                       XR3  830
C  IV THE STATEMENTS                                                    XR3  840
C                                                                       XR3  850
C     DIMENSION SA(3125,3),ISA(3125)                                    XR3  860
C     EQUIVALENCE (A(101),ISA),(A(3226),SA),(NRMAX,NARMAX)              XR3  870
C                                                                       XR3  880
C     MUST BE CHANGED TO                                                XR3  890
C                                                                       XR3  900
C     DIMENSION SA(NSIZ4,3),ISA(NSIZR4)                                 XR3  910
C     EQUIVALENCE (A(101),ISA),(A(NSIZR4+101),SA),(NRMAX,NARMAX)        XR3  920
C                                                                       XR3  930
C     IN THE SUBPROGRAM STATIS.                                         XR3  940
C                                                                       XR3  950
C   V THE STATEMENTS                                                    XR3  960
C                                                                       XR3  970
C     NROW=201                                                          XR3  980
C     NCOL=62                                                           XR3  990
C                                                                       XR3 1000
C     MUST BE CHANGED TO                                                XR3 1010
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C                                                                       XR3 1020
C     NROW=KROW                                                         XR3 1030
C     NCOL=KCOL                                                         XR3 1040
C     WHERE KCOL*KROW IS LESS THAN OR EQUAL TO NSIZRC                   XR3 1050
C                                                                       XR3 1060
C     IN THE SUBPROGRAM XOMNIT                                          XR3 1070
C                                                                       XR3 1075
C  VI THE STATEMENT                                                     XR3 1080
C                                                                       XR3 1090
C     EQUIVALENCE (A(13301),AVG(1)),(A(13401),SD(1),T(1))               XR3 1100
C                                                                       XR3 1110
C     MUST BE CHANGED TO                                                XR3 1120
C                                                                       XR3 1130
C     EQUIVALENCE (A(NSIZRC+801),AVG(1)),(A(NSIZRC+901),SD(1),T(1))     XR3 1140
C                                                                       XR3 1150
C     IN THE SUBPROGRAM CORREL                                          XR3 1160
C                                                                       XR3 1165
CVII THE STATEMENT                                                      XR3 1170
C                                                                       XR3 1180
C     DIMENSION QQ(6750)                                                XR3 1190
C                                                                       XR3 1200
C     MUST BE CHANGED TO                                                XR3 1210
C                                                                       XR3 1220
C     DIMENSION QQ(NSIZR2)                                              XR3 1230
C                                                                       XR3 1240
C     IN THE SUBPROGRAM THERMO                                          XR3 1250
C                                                                       XR3 1260
CVIII THE STATEMENTS                                                    XR3 1270
C                                                                       XR3 1280
C     DIMENSION A2(2700),A3(2700),A4(2700),A5(2700)                     XR3 1290
C     EQUIVALENCE (A2(1),A(2701))                                       XR3 1300
C     EQUIVALENCE (A3(1),A(5401)),(A4(1),A(8101)),(A5(1),A(10801))      XR3 1310
C     DIMENSION B1(540),B2(540),B3(540),B4(540),B5(540),B6(540),        XR3 1320
C    1B7(540),B8(540),B9(540),B10(540)                                  XR3 1330
C     EQUIVQLENCE (B1(1),A(1)),(B2(1),A(541)),(B3(1),A(1081)),          XR3 1340
C    1(B4(1),A(1621)),(B5(1),A(2161)),(B6(1),A(2701)),(B7(1),A(3241)),  XR3 1350
C    2(B8(1),A(3781)),(B9(1),A(4321)),(B10(1),A(4861))                  XR3 1360
C                                                                       XR3 1370
C     MUST BE CHANGED TO                                                XR3 1380
C                                                                       XR3 1395
C     DIMENSION A2(NSIZR5),A3(NSIZR5),A4(NSIZR5),A5(NSIZR5)             XR3 1400
C     EQUIVALENCE (A2(1),A(NSIZR5+1))                                   XR3 1410
C     EQUIVALENCE (A3(1),A(2*NSIZR5+1)),(A4(1),A(3*NSIZR5+1)),(A5(1),   XR3 1420
C    1A(4*NSIZR5+1))                                                    XR3 1430
C     DIMENSION B1(NSIZR6),B2(NSIZR6),B3(NSIZR6),B4(NSIZR6),B5(NSIZR6), XR3 1440
C    1B6(NSIZR6),B7(NSIZR6),B8(NSIZR6),B9(NSIZR6),B10(NSIZR6)           XR3 1450
C     EQUIVALENCE (B1(1),A(1)),(B2(1),A(NSIZR6+1)),(B3(1),A(2*NSIZR6+1))XR3 1460
C    1,(B4(1),A(3*NSIZR6+1)),(B5(1),A(4*NSIZR6+1)),(B6(1),A(5*NSIZR6+1))XR3 1470
C    2,(B7(1),A(6*NSIZR6+1)),(B8(1),A(7*NSIZR6+1)),(B9(1),A(8*NSIZR6+1))XR3 1480
C    3,(B10(1),A(9*NSIZR6+1))                                           XR3 1490
C                                                                       XR3 1500
C     IN THE SUBPROGRAM ONEWAY                                          XR3 1510
C                                                                       XR3 1520
C    2.**CHANGING THE NUMBER OF HEADINGS PERMITTED AND PACKING OF       XR3 1530
C       FORMATS************************************************        XR3 1540
C                                                                       XR3 1550
C    2.A INCREASING OR DECREASING THE NUMBER OF HEADINGS FOR COLUMNS.   XR3 1560
C                                                                       XR3 1570
C    2.A.1  THE VERSION DISTRIBUTED ALLOWS HEADINGS FOR 50 COLUMNS. ANY XR3 1580
C           50 COLUMNS MAY BE HEADED. IF MORE THAN 50 COLUMNS ARE       XR3 1590
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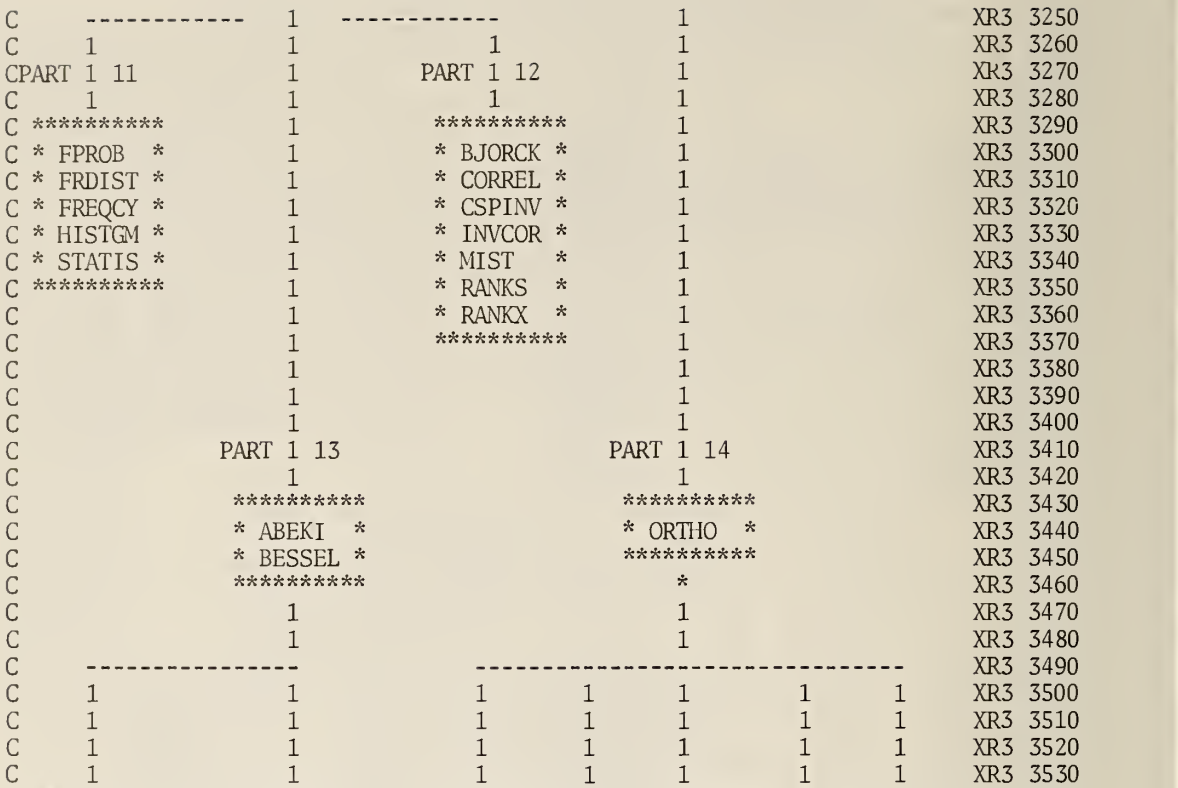
```
C           HEADED, THE HEADINGS OF THE COLUMNS HEADED EARLIEST WILL BE XR3 1600
C           DELETED. (I.E. HEADS ARE STORED IN A PUSH DOWN TABLE WITH  XR3 1610
C           END OF TABLE PUSHED OUT.  THIS APPLIES NO MATTER HOW MANY  XR3 1620
C           HEADINGS AN INSTALLATION PERMITS.)                         XR3 1630
C                                                                      XR3 1640
C     2.A.2 LET  NHEAD= NUMBER OF COLUMN HEADINGS PERMITTED. THEN THE  XR3 1650
C           FOLLOWING CHANGES HAVE TO BE MADE IN THE SUBPROGRAM PREPAK. XR3 1660
C                                                                      XR3 1665
C              I    DIMENSION IFMT(12,6),IHEAD(5,50)                   XR3 1670
C                                                                      XR3 1675
C                   MUST BE CHANGED TO                                 XR3 1680
C                                                                      XR3 1685
C                   DIMENSION IFMT(12,6),IHEAD(5,NHEAD)                XR3 1690
C                                                                      XR3 1695
C              II   DATA II/12/,LA/50/                                 XR3 1700
C                                                                      XR3 1705
C                   MUST BE CHANGED TO                                 XR3 1710
C                                                                      XR3 1715
C                   DATA II/12/,LA/NHEAD/                              XR3 1720
C                                                                      XR3 1730
C              (NOTE: NHEAD STANDS FOR A INTEGER CONSTANT)             XR3 1740
C                                                                      XR3 1750
C     2.B FORMATS MODIFICATION FOR COMPUTER SYSTEMS WHICH DO NOT PACK  XR3 1760
C         SIX CHARACTERS PER MACHINE WORD                              XR3 1770
C                                                                      XR3 1780
C     2.B.1 FORMATS MUST BE PACKED TO THE MAXIMUM NUMBER OF CHARACTERS XR3 1790
C           PER WORD IN ORDER FOR THE NH CONVERSION TO WORK            XR3 1800
C                                                                      XR3 1810
C     2.B.2 LET NCHAR=NUMBER OF CHARACTERS THAT CAN BE PACKED PER WORD XR3 1820
C           FOR A PARTICULAR  CONFIGURATION. THEN THE FOLLOWING CHANGES XR3 1830
C           HAVE TO BE MADE IN THE SUBPROGRAM PREPAK, WHERE K IS       XR3 1840
C           DEFINED AS.                                                XR3 1850
C                                                                      XR3 1860
C                     K=72/NCHAR+M    M=0  IF 72/NCHAR HAS NO REMAINDER XR3 1870
C                                     M=1  IF 72/NCHAR HAS A REMAINDER XR3 1880
C                                                                      XR3 1885
C              I    DIMENSION IFMT(12,6),IHEAD(5,50)                   XR3 1890
C                                                                      XR3 1895
C                   MUST BE CHANGED TO                                 XR3 1900
C                                                                      XR3 1905
C                   DIMENSION IFMT(K, 6),IHEAD(5,50)                   XR3 1910
C                                                                      XR3 1915
C              II   DATA II/12/,LA/50/                                 XR3 1920
C                                                                      XR3 1925
C                   MUST BE CHANGED TO                                 XR3 1930
C                                                                      XR3 1935
C                   DATA II/K/, LA/50/                                 XR3 1940
C                                                                      XR3 1945
C              III  230 FORMAT (12A6)                                  XR3 1950
C                                                                      XR3 1955
C                   MUST BE CHANGED TO                                 XR3 1960
C                                                                      XR3 1965
C                   230 FORMAT (KA=NCHAR)                              XR3 1970
C                                                                      XR3 1980
C              (NOTE: NHEAD AND K STAND FOR AN INTEGER CONSTANT)       XR3 1990
C                                                                      XR3 2000
C     2.B.3    BECAUSE A FORMAT COMMAND IS TREATED THE WAY ALL OTHER   XR3 2010
C              OMNITAB COMMANDS ARE TREATED, THE FORMAT COMMAND IS     XR3 2020
C              DUMPED ON THE SCRATCH TAPE (OR OTHER I/O) AND REREAD    XR3 2030
C              IN THE PACK MODE USING THE FORMAT 230.  THIS IS         XR3 2040
```

```
C              NECESSARY IN ORDER TO MAINTAIN MACHINE INDEPENDENCE.      XR3 2050
C                                                                        XR3 2060
C     .**OVERLAY OR SEGMENTATION**************************************** XR3 2070
C                                                                        XR3 2080
C     3.A    SEGMENTATION AS USED ON THE NBS  UNIVAC 1108.             XR3 2090
C                                                                        XR3 2100
C            I       PART 1 IS RESIDENT IN MEMORY AT ALL TIMES,        XR3 2110
C                    CONTAINS MOST OFTEN USED ROUTINES, SUBPROGRAMS    XR3 2120
C                    NEEDED BY MORE THAN ONE OF THE OTHER PARTS, AND   XR3 2130
C                    ALL OF LABELED COMMON (EXCLUDING LABELED COMMON   XR3 2140
C                    FOR BESSEL SUBPROGRAMS.)                          XR3 2150
C                                                                      XR3 2160
C            II      ONLY ONE OF THE OTHER PARTS  (PART 2 THRU PART 14) XR3 2170
C                    IS IN MEMORY AT A PARTICULAR MOMENT.              XR3 2180
C                                                                      XR3 2190
C     3.B    OUTLINE OF SEGMENTATION                                   XR3 2200
C                                                                      XR3 2210
C                          PART  1                                     XR3 2220
C                                                                      XR3 2230
C                  ************************************                XR3 2240
C                  * AARGS  ACCDIG ADRESS AERR   ARITH  *               XR3 2250
C                  * ASTER  BEGIN  CHKCOL CKIND  DIMENS *               XR3 2260
C                  * ERROR  EXPAND FCOS   FDCOS  FDEXP  *               XR3 2270
C                  * FDLOG  FDPCON FDSIN  FDSQRT FEXP   *               XR3 2280
C                  * FEXP2                             *               XR3 2290
C                  * FLOG   FLOG10 FSIN   FSQRT FTANH  **              XR3 2300
C                  * FUNCT  GENER  HEADS  IFS    INFERR *              XR3 2310
C                  * INPUT  LIST   LOCATE        LOOKUP *              XR3 2320
C                  *        MTXCHK MXTXP  NNAME  NONBLA *              XR3 2330
C                  * OMCONV OMNIT  OMNSYM OUTPUT PACK   *              XR3 2340
C                  * PAGE   PHYCON PREPAK PROB   READQ  *              XR3 2350
C                  * READX  REPINC RESET  RFORMT RNDOWN *              XR3 2360
C                  * RPRINT SET    SORTSM SPACE  SYMV   *              XR3 2370
C                  * VARCON VECTOR XECUTE XPND   XSTOP  *              XR3 2380
C                  *                                   *              XR3 2390
C                  *  PLUS LIBRARY FUNCTIONS (SIN,ETC)  *             XR3 2400
C                  *                                   *              XR3 2410
C                  *                                   *              XR3 2420
C                  *       ALL OF LABELED COMMON        *             XR3 2430
C                  *                                   *              XR3 2440
C                  * ABCDEF BLOCKA BLOCKB BLOCKC BLOCKD *              XR3 2450
C                  * BLOCKE BLOCKX BLOCRC CODE   CODETP *              XR3 2460
C                  * CONLB2 CONSLB CONSTS DCONL2 DCONLB *              XR3 2470
C                  * FMAT   HEADER ICODE  ICODTP KFMT   *              XR3 2480
C                  * PCONST PKSWT  QRS    SCRAT  SPRV   *              XR3 2490
C                  * TAPE                              *              XR3 2500
C                  *                                   *              XR3 2510
C                  *                                   *              XR3 2520
C                  * THERE ARE 4 BLOCK DATA PROCEDURES. *              XR3 2530
C                  * THE COMMENT OR 2ND CARD HAS THE    *              XR3 2540
C                  * LABEL NAME. THE 4 PROCEDURES ARE   *              XR3 2550
C                  *                                   *              XR3 2560
C                  * BLOCK  LBCONS LOOKTB PHYSIC        *              XR3 2570
C                  *                                   *              XR3 2580
C                  ************************************                XR3 2590
C                                  *                                   XR3 2600
C                                  *                                   XR3 2610
C                                  *                                   XR3 2620
C                                  *                                   XR3 2630
C                                  *                                   XR3 2640
```

```
C     ************************************************************      XR3 2650
C     *      1 * 1    1    1   1     *      1       1       * 1     *     XR3 2660
CPART * 2    1 * 1    1    1   1PART *  3   1       1       * 1PART * 4   XR3 2670
C     *      1 * 1    1    1   1     *      1       1       * 1     *     XR3 2680
C **********1 * 1    1    1   1 **********1       1       * 1 **********XR3 2690
C * ARYVEC * 1 * 1    1    1   1 * ALLSUB * 1       1       * 1 * DETRNK *XR3 2700
C * EXPCON * 1 * 1    1    1   1 * CHANGE * 1       1       * 1 * INVCHK *XR3 2710
C * MATRIX * 1 * 1    1    1   1 * CMSEPA * 1       1       * 1 * INVERT *XR3 2720
C * MDAMAD * 1 * 1    1    1   1 * CMPARA * 1       1       * 1 * MPROP  *XR3 2730
C * MKRON  * 1 * 1    1    1   1 * EXCHNG * 1       1       * 1 * ORTHRV *XR3 2740
C * MMULT  * 1 * 1    1    1   1 * FLIP   * 1       1       * 1 * PROCHK *XR3 2750
C * MOP    * 1 * 1    1    1   1 * INTERP * 1       1       * 1 * PVTRI  *XR3 2760
C * MRAISE * 1 * 1    1    1   1 * INTRP  * 1       1       * 1 * RCSUM  *XR3 2770
C * MTRIAN * 1 * 1    1    1   1 * ITERAT * 1       1       * 1 * SPINV  *XR3 2780
C * MXTX   * 1 * 1    1    1   1 * PROROW * 1       1       * 1 * SKSYMV *XR3 2790
C * STORMT * 1 * 1    1    1   1 * SELECT * 1       1       * 1 **********XR3 2800
C * TRANSF * 1 * 1    1    1   1 * SORDER * 1       1       * 1          XR3 2810
C **********1 * 1    1    1   1 **********1       1       * 1          XR3 2820
C           1 * 1    1    1   1           1       1       * 1          XR3 2830
C           1 * 1    1    1   1           1       1       * 1          XR3 2840
C     -------1 * 1    1    1   -------     1       1       * -------    XR3 2850
C     1      * 1    1    1       1       1       1       *      1     XR3 2860
C     1      * 1    1    1       1       1       1       *      1     XR3 2870
C     1      * 1    1    1       1       1       1       *      1     XR3 2880
CPART 1 5    * 1    1    1    PART 1 6   1       1       *  PART 1 7  XR3 2890
C **********  * 1    1    1    **********1       1       *  **********XR3 2900
C * ABRIDG *  * 1    1    1    * COMPLX *1       1       *  * DUMMYA *XR3 2910
C * APRINT *  * 1    1    1    * DEFINE *1       1       *  * DUMMYB *XR3 2920
C * FIXFLO *  * 1    1    1    * ERASE  *1       1       *  * DUMMYC *XR3 2930
C * NOTEPR *  * 1    1    1    * EXTREM *1       1       *  * DUMMYD *XR3 2940
C * PRINTX *  * 1    1    1    * GQUAD  *1       1       *  * DUMMYE *XR3 2950
C * PUNCH  *  * 1    1    1    * MISC2  *1       1       *  * DUMMYF *XR3 2960
C * SETQ   *  * 1    1    1    * MSCROW *1       1       *  **********XR3 2970
C * SETUP  *  * 1    1    1    * MOVE   *1       1       *           XR3 2980
C * STMT   *  * 1    1    1    * PDMOTE *1       1       *           XR3 2990
C * STORE  *  * 1    1    1    **********1       1       *           XR3 3000
C * TAPOP  *  * 1    1    1                 1       1       *           XR3 3010
C * TAPOP2 *  * 1    1    1                 1       1       *           XR3 3020
C * XFORMT *  * 1    1    1                 1       1       *           XR3 3030
C * XHEAD  *  * 1    1    1                 1       1       *           XR3 3040
C * XOMNIT *  * 1    1    1                 1       1       *           XR3 3050
C **********  * 1    1    1                 1       1       *           XR3 3060
C             * 1    1    1                 1       1       *           XR3 3070
C             * 1    1    1                 1       1       *           XR3 3080
C     ********** 1    1    1       --------  1       1       *********   XR3 3090
C     *          1    1    1       1         1       1            *      XR3 3100
CPART * 8        1    1    1    PART 1 9     1       1          PART * 10 XR3 3110
C     *          1    1    1       1         1       1            *      XR3 3120
C **********     1    1    1    **********   1       1          **********XR3 3130
C * COALES *     1    1    1    * TWOWAY *   1       1          * DHRND  *XR3 3140
C * FPPT   *     1    1    1    **********   1       1          * ERRINT *XR3 3150
C * HDIAG  *     1    1    1                 1       1          * FNEC   *XR3 3160
C * MEIGEN *     1    1    1                 1       1          * FNEIC  *XR3 3170
C * ONEWAY *     1    1    1                 1       1          * FNKC   *XR3 3180
C * RANKO  *     1    1    1                 1       1          * PLOT   *XR3 3190
C * TPCTPT *     1    1    1                 1       1          * RNJBK  *XR3 3200
C **********     1    1    1                 1       1          * THERMO *XR3 3210
C                1    1    1                 1       1          **********XR3 3220
C                1    1    1                 1       1                     XR3 3230
C                1    1    1                 1       1                     XR3 3240
```

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C    3.C    APPROXIMATE SIZE OF EACH PART ON THE NBS COMPUTER
C           THE SIZE AS INDICATED BELOW ASSUMES THAT A MACHINE WORD
C           IS 36 BITS LONG, A FLOATING POINT NUMBER USES ONE MEMORY
C           WORD, AND EACH MACHINE INSTRUCTION IS ONE WORD LONG.
C
C         I       PART 1     44000 WORDS
C
C                 A.   ROUTINES       13000
C                 B.   LABELED COMMON 31000  (THIS INCLUDES A WORK
C                                             SHEET OF 12500 WORDS)
C                 C.   NOT COUNTED BUT MUST BE ADDED ARE
C                      LIBRARY FUNCTION ROUTINES (I. E. SIN,COS,ETC),
C                      AND INPUT OUTPUT ROUTINES. (FOR THE NBS UNIVAC
C                      1108 SYSTEM THIS IS ABOUT 4500 WORDS)
C
C         II      PART 2     4100  WORDS
C
C         III     PART 3     4300  WORDS
C
```

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C          IV      PART 4     4000  WORDS                                  XR3 3850
C                                                                           XR3 3860
C          V       PART 5     2900  WORDS                                  XR3 3870
C                                                                           XR3 3880
C          VI      PART 6     3000  WORDS                                  XR3 3890
C                                                                           XR3 3900
C          VII     PART 7     4400  WORDS                                  XR3 3910
C                                    (THIS SEGMENT IS WHERE THE USER MAY    XR3 3920
C                                     ADD HIS SUBROUTINES)                  XR3 3930
C                                                                           XR3 3940
C          VIII    PART 8     3700 WORDS                                   XR3 3950
C                                                                           XR3 3960
C          IX      PART 9     4000 WORDS                                   XR3 3970
C                                                                           XR3 3980
C          X       PART 10    3200 WORDS                                   XR3 3990
C                                                                           XR3 4000
C          XI      PART 11    3400 WORDS                                   XR3 4010
C                                                                           XR3 4020
C          XII     PART 12    3800 WORDS                                   XR3 4030
C                                                                           XR3 4040
C          XIII    PART 13    3300 WORDS                                   XR3 4050
C                                                                           XR3 4060
C          XIV     PART 14    4400 WORDS                                   XR3 4070
C                                                                           XR3 4080
C    4.**ASSIGNMENT OF INPUT AND OUTPUT UNITS**************************** XR3 4090
C                                                                           XR3 4100
C    4.A   I/O UNITS FOR OMNITAB SYSTEM                                     XR3 4110
C                                                                           XR3 4120
C          FOUR PHYSICAL I/O UNITS ARE USED BY OMNITAB. THROUGH OUT ALL     XR3 4130
C          THE ROUTINES THESE UNITS ARE REFERRED BY THE FOLLOWING           XR3 4140
C          VARIABLES                                                        XR3 4150
C             1.  INUNIT - THIS UNIT IS USED FOR READING THE OMNITAB        XR3 4170
C                          COMMANDS AND DATA. (USUALLY CARD READER)         XR3 4180
C             2.  IPRINT - THE OUTPUT UNIT-RESULTS AND COMMANDS             XR3 4190
C                          (USUALLY ON LINE PRINTER)                        XR3 4200
C                          (62 LINES/PAGE, 120 CHAR/LINE)                   XR3 4205
C             3.  IPUNCH - THE OUTPUT UNIT FOR GENERATING PUNCH CARDS       XR3 4210
C             4.  ISCRAT - A MAGNETIC TAPE, DRUM, OR DISC, WHICHEVER        XR3 4220
C                          IS AVAILABLE AND FASTER. (THIS I/O UNIT IS       XR3 4230
C                          USED BY OMNITAB.)                                XR3 4240
C                                                                           XR3 4250
C          THE I/O VARIABLES ARE ASSIGNED LOGICAL UNITS IN THE              XR3 4260
C          SUBPROGRAM CALLED SETUP.                                         XR3 4270
C          THEY MAY NEED TO BE REASSIGNED FOR DIFFERENT                     XR3 4280
C          CONFIGURATIONS.                                                  XR3 4290
C                                                                           XR3 4300
C          THE PRESENT ASSIGNMENT IS AS FOLLOWS                             XR3 4310
C                                                                           XR3 4320
C          INUNIT=5                                                         XR3 4330
C          IPRINT=6                                                         XR3 4340
C          IPUNCH=3                                                         XR3 4350
C          ISCRAT=45                                                        XR3 4360
C                                                                           XR3 4370
C    4.B   PHYSICAL TAPE ASSIGNMENTS FOR OMNITAB TAPE COMMANDS              XR3 4380
C          IN ADDITION USERS MAY REFERENCE 6 TAPE UNITS THROUGH OMNITAB     XR3 4400
C          COMMANDS (E.G. AS READ TAPE 'L', WRITE TAPE 'L',ETC, WHERE       XR3 4410
C          'L' IS EITHER A,B,C,D,E OR F). THE LOGICAL UNITS ASSIGNED TO     XR3 4420
C          THESE TYPES ARE 7 THRU 12, RESPECTIVELY. IF THESE LOGICAL        XR3 4430
C          UNITS HAVE TO BE CHANGED, THE FOLLOWING CORRECTIONS MUST BE      XR3 4440
C          MADE IN THE SUBPROGRAM TAPOP                                     XR3 4450
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C                                                                       XR3 4460
C          ITAPE=I+6                                                    XR3 4470
C                                                                       XR3 4480
C          MUST BE CHANGED TO                                           XR3 4490
C                                                                       XR3 4500
C          ITAPE=I+NEWTP (WHERE NEWTP IS THE FIRST LOGICAL I/O UNIT     XR3 4510
C                         AVAILABLE MINUS 1)                            XR3 4520
C                                                                       XR3 4530
C    5.**DIRECTIONS FOR THE USE OF DUMMY A-F**************************** XR3 5090
C                                                                       XR3 5100
C          THE OMNITAB COMMANDS DUMMY A THROUGH DUMMY F ENABLE THE USERXR3 5110
C          TO EXECUTE HIS OWN SUBPROGRAM(S) THROUGH OMNITAB. THE FIRST XR3 5120
C          STATEMENT OF THE SUBPROGRAM MUST BE ONE OF THE FOLLOWING     XR3 5130
C             SUBPROGRAM DUMMYA                                         XR3 5150
C             SUBPROGRAM DUMMYB                                         XR3 5160
C             SUBPROGRAM DUMMYC                                         XR3 5170
C             SUBPROGRAM DUMMYD                                         XR3 5180
C             SUBPROGRAM DUMMYE                                         XR3 5190
C             SUBPROGRAM DUMMYF                                         XR3 5200
C                                                                       XR3 5230
C          IN WRITING THE SUBPROGRAM(S) THE FOLLOWING INFORMATION       XR3 5240
C          SHOULD BE FOUND USEFUL.                                      XR3 5250
C                                                                       XR3 5260
C          THE FOLLOWING LABELED COMMON, DIMENSION AND EQUIVALENCE      XR3 5270
C          STATEMENTS SHOULD BE USED.                                   XR3 5280
C                                              ******************       XR3 5290
C          COMMON/BLOCRC/NRC,RC(NSIZRC+100)    **SEE XREF3 PART1**      XR3 5300
C          DIMENSION ARGS(100)                 **FOR DEFINITION **      XR3 5310
C          EQUIVALENCE ARGS(1),RC(NSIZRC+1)    **OF NSIZRC      **      XR3 5320
C          COMMON/SCRAT/NR,NS2,A(NSIZRC+1000)  ******************       XR3 5330
C          COMMON/BLOCKD/IARGS(100),KIND(100),ARGTAB(100),NRMAX,        XR3 5340
C         1 NROW,NCOL,NARGS,VWXYZ(8),NERROR                             XR3 5350
C                                                                       XR3 5360
C          **VARIABLE**                **MEANING OF VARIABLE**          XR3 5370
C                                                                       XR3 5380
C               RC          THE NAME OF THE WORKSHEET AREA              XR3 5390
C                                                                       XR3 5400
C               NRC         THE SIZE OF THE WORKSHEET AREA              XR3 5410
C                                                                       XR3 5420
C               NROW        THE NUMBER OF ROWS IN THE WORKSHEET         XR3 5430
C                                                                       XR3 5440
C               NCOL        THE NUMBER OF COLUMNS IN THE WORKSHEET      XR3 5450
C                                                                       XR3 5460
C               NRMAX       THE PRESENT NO. OF ROWS BEING USED          XR3 5470
C                                                                       XR3 5480
C               A           AVAILABLE SCRATCH AREA                      XR3 5490
C                                                                       XR3 5500
C               NS          SIZE OF THE SCRATCH AREA                    XR3 5510
C                                                                       XR3 5520
C               NS2         ONE-HALF THE SIZE OF THE SCRATCH AREA       XR3 5530
C                                                                       XR3 5540
C               IARGS       ALL INTEGER ARGUMENTS OF THE DUMMYA,...,OR  XR3 5550
C                           DUMMYF INSTRUCTION                          XR3 5560
C                                                                       XR3 5570
C               ARGS        ALL FLOATING ARGUMENTS OF THE DUMMYA,...,   XR3 5580
C                           OR DUMMYF INSTRUCTION                       XR3 5590
C                                                                       XR3 5600
C               NARGS       THE NUMBER OF ARGUMENTS OF THE DUMMYA,...,  XR3 5610
C                           OR DUMMYF INSTRUCTION                       XR3 5620
C                                                                       XR3 5630
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C              KIND       KIND(I)=0 IF ITH ARGUMENT IS AN INTEGER     XR3 5640
C                         KIND(I)=1 IF ITH ARGUMENT IS FLOATING       XR3 5650
C                                                                     XR3 5660
C              NERROR     NERROR=0 IF THERE HAVE BEEN NO FATAL ERRORS XR3 5670
C                         NERROR= NO. OF PREVIOUS FATAL ERRORS        XR3 5680
C                                                                     XR3 5690
C          THE FOLLOWING STATEMENTS SHOULD BE USED FOR CHECKING       XR3 5700
C          PURPOSES AND TO COMPUTE ADDRESSES OF COLUMNS IN THE        XR3 5710
C          WORKSHEET.                                                 XR3 5720
C                                                                     XR3 5730
C           CALL CKIND(J)                                             XR3 5740
C                                                                     XR3 5750
C             CKIND IS A SUBPROGRAM WHICH CHECKS THE KIND OF ARGUMENTS XR3 5760
C             (INTEGER OR FLOATING).J VALUES ARE CHECKED.             XR3 5770
C             UPON RETURN FROM THE SUBPROGRAM J IS SET TO THE FOLLOWINGXR3 5780
C                J=0 IF ALL ARGUMENTS ARE INTEGER                     XR3 5790
C                J=1 IF ALL ARGUMENTS ARE FLOATING                    XR3 5800
C                J=2 IF SOME ARE INTEGER AND SOME FLOATING            XR3 5810
C                                                                     XR3 5820
C           CALL ADRESS(I,J)                                          XR3 5830
C                                                                     XR3 5840
C             ADRESS IS A SUBPROGRAM WHICH COMPUTES THE STARTING      XR3 5850
C             ADDRESS IN THE WORKSHEET OF IARGS(I).                   XR3 5860
C             UPON RETURN FROM THE SUBPROGRAM J IS SET TO THE FOLLOWINGXR3 5870
C                J=-(I+NRC) IF ARGUMENT IS A FLOATING POINT NUMBER    XR3 5880
C                J=0 COLUMN NUMBER IS ILLEGAL                         XR3 5890
C                J= ADDRESS OF A LEGAL COLUMN                         XR3 5900
C                                                                     XR3 5910
C           CALL CHKCOL(J)                                            XR3 5920
C                                                                     XR3 5930
C             CHKCOL IS A SUBPROGRAM WHICH CHECKS THAT ALL NARGS      XR3 5940
C             ARGUMENTS ARE LEGAL COLUMN NUMBERS AND CONVERTS THESE   XR3 5950
C             COLUMN NUMBERS TO THEIR STARTING ADRESSES IN THE WORK-  XR3 5960
C             SHEET AND STORES THE ADDRESSES IN IARGS(I), I=1,...NARGS XR3 5970
C             UPON RETURN FROM THE SUBPROGRAM J IS SET TO THE FOLLOWINGXR3 5980
C                J=1 IF THERE ARE ANY ILLEGAL ARGUMENTS               XR3 5990
C                J=0 IF ALL ARGUMENTS ARE LEGAL COLUMN NUMBERS        XR3 6000
C                                                                     XR3 6010
C           CALL ERROR(I)                                             XR3 6020
C                                                                     XR3 6030
C             IF THERE ARE ERRORS IN THE USER'S CHECKING OF ARGUMENTS, XR3 6040
C             ERROR MESSAGES ARE PROVIDED BY CALLING SUBPROGRAM ERROR. XR3 6050
C             SEE XREF6 FOR EXISTING ERROR MESSAGES.                  XR3 6060
C                                                                     XR3 6070
C           IF(NERROR.NE.0) RETURN                                    XR3 6080
C                                                                     XR3 6090
C             THE USER SHOULD NOT PROCEED WITH HIS SUBPROGRAM IF NERRORXR3 6100
C             IS NOT ZERO, BECAUSE INFORMATION IN THE WORKSHEET MAY NOTXR3 6110
C             BE CORRECT.                                             XR3 6120
C                                                                     XR3 6130
C          **********WARNING**********                                XR3 6140
C                                                                     XR3 6150
C             THE USE OF DUMMYA,...DUMMYF IS NOT RECOMMENDED FOR NOVICEXR3 6160
C             USERS. THE INFORMATION GIVEN ABOVE IS PRIMARILY FOR THE XR3 6170
C             CONVENIENCE OF THE SYSTEM PROGRAMMER.                   XR3 6080
C                                                                     XR3 6190
C          ********************************************************** XR3 6200
C                                                                     XR3 6210
      END                                                             XR3 6220
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Listing Of XREF4

```
C     XREF4                                                              XR4   10
C     VERSION  5.00      XREF4       5/15/70                             XR4   20
C                                                                        XR4   30
C  1.**CHANGES THAT MAY BE NEEDED BECAUSE SYSTEM FUNCTIONS ARE USED****  XR4   40
C                                                                        XR4   50
C     DIFFERENT COMPUTERS HAVE DIFFERENT SIZE WORDS WHICH AFFECT THE     XR4   60
C     SIZE OF REAL AND DOUBLE PRECISION NUMBERS. BECAUSE OF THIS, AN     XR4   70
C     UPPER LIMIT  HAS TO BE PLACED FOR COMPUTING THE EXPONENTIAL, SINE, XR4   80
C     AND COSINE  FUNCTIONS. THESE LIMITS MAY HAVE TO BE CHANGED FOR     XR4   90
C     SOME COMPUTERS.                                                    XR4  100
C                                                                        XR4  110
C     IN ORDER TO MAKE OMNITAB AS SYSTEM FREE AS POSSIBLE, NONE OF THE   XR4  120
C     PROGRAMS MAKE DIRECT REFERENCE  TO THE FOLLOWING FUNCTIONS:        XR4  130
C       ALOG,ALOG10,COS,DCOS,DEXP,DLOG,DSIN,DSQRT,EXP,SIN,SQRT,TANH,     XR4  140
C       AND RAISING  A VARIABLE TO ANOTHER VARIABLE.                     XR4  150
C     INSTEAD THE OMNITAB SUBPROGRAMS CALL THE FOLLOWING FUNCTIONS:      XR4  160
C       FLOG,FLOG10,FCOS,FDCOS,FDEXP,FDLOG,FDSIN,FDSQRT,FEXP,FEXP2,     XR4  170
C       FSIN,FSQRT,FTANH,                                                XR4  180
C     WHICH CHECK TO SEE IF ARGUMENT OF THE FUNCTION IS ILLEGAL OR OUT   XR4  190
C     OF BOUNDS. IF THE FUNCTION CAN NOT BE EVALUATED INFORMATIVE        XR4  200
C     DIAGNOSTIC IS PRINTED AND VALUE OF ZERO IS RETURNED. IF THE        XR4  210
C     ARGUMENT IS VALID THE SYSTEM FUNCTIONS ARE USED.                   XR4  220
C                                                                        XR4  230
C     THE LIMITS ARE DEFINED IN BLOCK DATA SUBPROGRAM WHICH HAS THE      XR4  240
C     FOLLOWING CARD;                                                    XR4  250
C     BLOCK DATA LBCONS                                                  XR4  260
C     THESE VALUES MAY HAVE TO BE REDEFINED IN SOME CASES.               XR4  270
C                                                                        XR4  280
C     XTRIG IS NOW SET = 3.3E7  UPPER ABSOLUTE LIMIT FOR SIN, COS SINGLEXR4  290
C       PRECISION REAL NUMBER                                            XR4  300
C                                                                        XR4  310
C     XEXP IS NOW SET = 88.0 UPPER LIMIT FOR EXP SINGLE PREC. REAL NO.   XR4  320
C                                                                        XR4  330
C     DSNCOS IS NOW SET =3.5D16 UPPER ABSOLUTE LIMIT FOR SIN, COS        XR4  340
C       DOUBLE PRECISION REAL NO.                                        XR4  350
C                                                                        XR4  360
C     DXEXP IS NOW SET = 704.D0 UPPER LIMIT FOR EXP DOUBLE PREC. REAL NOXR4  370
C                                                                        XR4  380
C     ER IS NOW SET=1.E-8 COMPUTER ZERO.                                 XR4  390
C                                                                        XR4  400
C     NBC IS NOW SET=11 NUMBER OF BINARY BITS IN CHARACTERISTIC OF A     XR4  410
C       DOUBLE PRECISION NUMBER                                          XR4  420
C                                                                        XR4  430
C     NBM IS NOW SET=60 NUMBER OF BINARY BITS IN MANTISSA OF A DOUBLE    XR4  440
C       PRECISION NUMBER                                                 XR4  450
C                                                                        XR4  460
C     TRRTPI IS NOW SET=1.12837916709551257 4D0 THE VALUE OF 2.0/SQRT(PI)XR4  470
C       TO 19 DECIMAL PLACES                                             XR4  480
C                                                                        XR4  490
C                                                                        XR4  500
C                                                                        XR4  510
C                                                                        XR4  520
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C   I FLOG,FLOG10: IF X IS GREATER THAN ZERO, LOGE OR LOG10 IS COMPUTED XR4  530
C                  IF X IS ZERO OR NEGATIVE,INFORMATIVE DIAGNOSTIC IS   XR4  540
C                  PRINTED AND ZERO VALUE RETURNED                      XR4  550
C  II FDLOG:       SAME AS I EXCEPT RESULT IS DOUBLE PRECISION VALUE     XR4  560
C III FCOS,FSIN:   IF X IN ABSOLUTE VALUE IS LESS THAN OR EQUAL TO 3.3E7XR4  570
C                  COS OR SIN IS EVALUATED. OTHERWISE AN INFORMATIVE     XR4  580
C                  DIAGNOSTIC IS PRINTED AND ZERO VALUE RETURNED         XR4  590
C  IV FDCOS,FDSIN: IF X IN ABSOLUTE VALUE IS LESS THAN OR EQUAL TO       XR4  600
C                  3.5D16, COS OR SIN IS EVALUATED IN DOUBLE PREC.       XR4  610
C                  OTHERWISE AN  INFORMATIVE DIAGNOSTIC IS PRINTED AND   XR4  620
C                  ZERO VALUE RETURNED.                                  XR4  630
C   V FEXP:        IF X IS LESS OR EQUAL TO 88.0 THE EXP(X) IS COMPUTED XR4  640
C                  IF VALUE IS NOT EVALUATED, THEN AN INFORMATIVE        XR4  650
C                  DIAGNOSTIC IS PRINTED AND ZERO VALUE RETURNED         XR4  660
C  VI FDEXP:       EXP(X) IS COMPUTED IN DOUBLE PREC., IF X IS NOT       XR4  670
C                  GREATER THAN 704.D0. OTHERWISE ZERO VALUE IS RETURNEDXR4  680
C                  AND AN INFORMATIVE DIAGNOSTIC IS PRINTED              XR4  690
C VII FEXP2:       EVALUATES X**A. IF ABSOLUTE VALUE OF A IS             XR4  700
C                  GREATER THAN 60 OR NON INTEGER, FEXP2  CALLS FLOG.    XR4  710
CVIII FSQRT,FDSQRT:COMPUTES SQUARE ROOT OF SINGLE AND DOUBLE PREC.       XR4  720
C                  NO. RESPECTIVELY IF  X IS EQUAL OR GREATER THAN ZERO.XR4  730
C                  OTHERWISE AN  INFORMATIVE DIAGNOSTIC IS PRINTED AND   XR4  740
C                  ZERO VALUE RETURNED                                   XR4  750
C  IX FTANH:       IF ABSOLUTE VALUE OF 2*X IS LESS THAN OR EQUAL TO 88 XR4  760
C                  THE TANH IS COMPUTED. IF NOT, INFORMATIVE DIAGNOSTIC XR4  770
C                  IS PRINTED AND ZERO RETURNED.                         XR4  780
C                                                                        XR4  785
C  2.**CHANGES NEEDED IN BLOCK DATA SUBPROGRAM WHICH DEFINES THE         XR4  790
C      PHYSICAL CONSTANTS*********************************************** XR4  800
C                                                                        XR4  810
C     DUE TO THE DIFFERENCE IN THE SIZE OF WORDS IN DIFFERENT COMPUTERS XR4  820
C     THE VALUES OF THE PHYSICAL CONSTANTS MAY NEED TO BE CHANGED.       XR4  830
C     THESE VALUES ARE DEFINED IN THE BLOCK DATA SUBPROGRAM WHICH HAS    XR4  840
C     THE FOLLOWING CARD;                                                XR4  850
C     BLOCK DATA PHYSIC                                                  XR4  860
C                                                                        XR4  870
C  3.**NUMBER OF SIGNIFICANT DIGITS OF FLOATING POINT NOT EIGHT******** XR4  880
C                                                                        XR4  890
C           CHANGES MUST BE MADE IN SUBPROGRAMS ACCDIG AND LBCONS, IF    XR4  900
C           NUMBER OF SIGNIFICANT DIGITS OF A FLOATING POINT NUMBER IS   XR4  910
C           NOT 8.                                                       XR4  920
C                                                                        XR4  930
C           LET  SIGDIG= NUMBER OF SIGNIFICANT DIGITS FOR FLOATING POINTXR4  940
C                        NUMBER.                                         XR4  950
C                                                                        XR4  955
C           THEN THE FOLLOWING CHANGE MUST BE MADE IN ACCDIG             XR4  960
C                                                                        XR4  970
C           DATA ADMAC/8.0/                                              XR4  975
C                                                                        XR4  980
C           MUST BE CHANGED TO                                           XR4  985
C                                                                        XR4  990
C           DATA ADMAX/SIGDIG/  (WHERE SIGDIG IS A REAL CONSTANT)        XR4 1000
C                                                                        XR4 1010
C           LET JSIGD= NUMBER OF SIGNIFICANT DIGITS FOR FLOATING POINT   XR4 1020
C                      NUMBER                                            XR4 1030
C                                                                        XR4 1035
C           THEN THE FOLLOWING CHANGE MUST BE MADE IN LBCONS.            XR4 1040
C                                                                        XR4 1050
C           DATA ISIGD/8/                                                XR4 1055
C                                                                        XR4 1060
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C           MUST BE CHANGED TO                                              XR4 1065
C                                                                           XR4 1070
C           DATA ISIGD/JSIGD/  (WHERE JSIGD IS AN INTEGER CONSTANT)         XR4 1080
C                                                                           XR4 1090
C  4.**WARNING FOR COMPUTERS WHERE INTEGER NUMBERS MUST BE LESS THAN        XR4 1100
C      10.E9 OR 2**32.************************************************     XR4 1110
C                                                                           XR4 1120
C           CHANGES MUST BE MADE IN SUBPROGRAMS DHRND AND RPRINT, IF        XR4 1130
C           INTEGER NUMBERS ARE LESS THAN 2**32.                            XR4 1140
C                                                                           XR4 1150
C           CHANGES INVOLVE SCALING INTEGERS.                               XR4 1160
C                                                                           XR4 1170
      END                                                                   XR4 1180
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Listing Of XREF5

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C     XREF5                                                              XR5   10
C     VERSION  5.00     XREF5     5/15/70                                XR5   20
C                                                                        XR5   30
C  1.A     *VARIABLES DEFINED IN SUBPROGRAM BLOCK*********************** XR5   40
C                                                                        XR5   50
C               L  IS DEFINED IN LABELED COMMON ABCDEF.                  XR5   60
C                  IT CONTAINS THE ANSI FORTRAN CHARACTER SET:           XR5   70
C                     THE LETTERS A-Z                                    XR5   80
C                     THE NUMBERS 0-9                                    XR5   90
C                     THE CHARACTERS = + - * / ( ) , . $ AND BLANK       XR5  100
C                     THE CHARACTER ' IS ALSO INCLUDED                   XR5  110
C                                                                        XR5  120
C          NOCARD  IS DEFINED IN LABELED COMMON FMAT.                    XR5  130
C                  IT INITIALLY CONTAINS THE WORD OMNITAB                XR5  140
C                                                                        XR5  150
C                  ITS CONTENTS ARE CHANGED WHEN AN OMNITAB CARD IS      XR5  160
C                  ENCOUNTERED DURING EXECUTION.                         XR5  170
C                                                                        XR5  180
C           IFMTS  IS DEFINED IN LABELED COMMON FMAT.                    XR5  190
C                  IT CONTAINS THE STANDARD OMNITAB OUTPUT FORMAT.       XR5  200
C                  IFMTS(1)=1H(     IFMTS(2)=2H1P    IFMTS(3)=2H8E       XR5  210
C                  IFMTS(4)=3H15.   IFMTS(5)=1H6     IFMTS(6)=1H)        XR5  220
C                                                                        XR5  230
C                                                                        XR5  240
C  1.B     *VARIABLES DEFINED IN SUBPROGRAM LBCONS********************** XR5  250
C                                                                        XR5  260
C           XTRIG  IS DEFINED IN LABELED COMMON CONSLB.                  XR5  270
C                  XTRIG=3.3E7 AND IS USED BY FSIN AND FCOS SUBPROGRAMS.XR5  280
C                  SEE XREF4 FOR ADDITIONAL NOTES.                       XR5  290
C                                                                        XR5  300
C            XEXP  IS DEFINED IN LABELED COMMON CONSLB.                  XR5  310
C                  XEXP=88.0 AND IS USED BY FEXP SUBPROGRAM.             XR5  320
C                  SEE XREF4 FOR ADDITIONAL NOTES.                       XR5  330
C                                                                        XR5  340
C          DSNCOS  IS DEFINED IN LABELED COMMON DCONLB.                  XR5  350
C                  DSNCOS=3.5D16 AND IS USED BY FDSIN AND FDCOS SUBPROG XR5  360
C                  SEE XREF4 FOR ADDITIONAL NOTES                        XR5  370
C                                                                        XR5  380
C           DXEXP  IS DEFINED IN LABELED COMMON DCONLB.                  XR5  390
C                  DXEXP=704.0D0 AND IS USED BY FDEXP.                   XR5  400
C                  SEE XREF4 FOR ADDITIONAL NOTES.                       XR5  410
C                                                                        XR5  420
C              ER  IS DEFINED IN LABELED COMMON CONLB2.                  XR5  430
C                  ER=1.E-8 AND IS USED BY CSPINV.                       XR5  440
C                  SEE XREF4 FOR ADDITIONAL NOTES                        XR5  450
C                                                                        XR5  460
C             NBC  IS DEFINED IN LABELED COMMON DCONL2.                  XR5  470
C                  NBC=11 AND IS USED BY ERRINT.                         XR5  480
C                  SEE XREF4 FOR ADDITIONAL NOTES                        XR5  490
C                                                                        XR5  500
C             NBM  IS DEFINED IN LABELED COMMON DCONL2.                  XR5  510
C                  NBM=60 AND IS USED BY ERRINT.                         XR5  520
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C                 SEE XREF4 FOR ADDITIONAL NOTES                        XR5  530
C                                                                       XR5  540
C         TRRTPI  IS DEFINED IN LABELED COMMON DCONL2.                  XR5  550
C                 TRRTPI=1.12837916709551257 4D0 AND IS USED BY ERRINT  XR5  560
C                 SEE XREF4 FOR ADDITIONAL NOTES                        XR5  570
C                                                                       XR5  580
C          ISIGD  IS DEFINED IN LABELED COMMON CONLB2.                  XR5  590
C                 ISIGD=8 AND IS USED BY FIXFLO AND INFERR              XR5  600
C                 SEE XREF4 FOR ADDITIONAL NOTES                        XR5  610
C                                                                       XR5  620
C         THE FOLLOWING VARIABLES ARE DEFINED IN LABELED COMMON CONSTS. XR5  630
C                                                                       XR5  640
C             PI                                                        XR5  650
C                 PI=3.14159265 (THE VALUE OF PI)                       XR5  660
C              E                                                        XR5  670
C                 E=2.71821818  (BASE OF NATURAL LOGS)                  XR5  680
C         HALFPI                                                        XR5  690
C                 HALFPI=1.5707963 (VALUE OF PI/2)                      XR5  700
C            DEG                                                        XR5  710
C                 DEG=57.2957795 (NUMBER OF DEGREES IN ONE RADIAN)      XR5  720
C            RAD                                                        XR5  730
C                 RAD=.0174532925 (NUMBER OF RADIANS IN ONE DEGREE)     XR5  740
C           XALOG                                                       XR5  750
C                 XALOG=38. (EXPONENT BOUND)                            XR5  760
C                                                                       XR5  770
C        ***NOTE*** PI AND E ARE ALSO DEFINED IN PHYSIC SUBPROGRAM      XR5  780
C                                                                       XR5  790
C                                                                       XR5  800
C 1.C     *VARIABLES DEFINED IN SUBPROGRAM LOOKTB********************** XR5  810
C                                                                       XR5  820
C       **THE FOLLOWING VARIABLES ARE DEFINED BY LABELED COMMON CODE**  XR5  830
C                                                                       XR5  840
C         IALPHA                                                        XR5  850
C                 CONTAINS THE OMNITAB NUMERIC REPRESENTATION FOR THE   XR5  860
C                 CHARACTERS A,B,C,D,E, AND F                           XR5  870
C                 THESE CHARACTERS ARE USED BY THE INPUT OUTPUT COMMAND XR5  880
C                                                                       XR5  890
C         NALPHA                                                        XR5  900
C                 CONTAINS THE OMNITAB NUMERIC REPRESENTATION FOR THE   XR5  910
C                 CHARACTERS V,W,X,Y, AND Z                             XR5  920
C                 THESE CHARACTERS ARE USED BY THE RESET COMMAND        XR5  925
C                                                                       XR5  930
C                                                                       XR5  935
C 1.D     *VARIABLES DEFINED IN SUBPROGRAM PHYSIC********************** XR5  940
C                                                                       XR5  950
C       **THE LABELED COMMON PCONST DEFINES THE FOLLOWING VARIBLES**    XR5  960
C             P (I)                                                     XR5  970
C                 CONTAINS THE NUMERICAL VALUES FOR THE PHYSICAL        XR5  980
C                 CONSTANTS IN SI AND CGS UNITS.                        XR5  990
C             N (I)                                                     XR5 1000
C                 CONTAINS THE OMNITAB NUMERIC REPRESENTATION OF THE    XR5 1010
C                 PHYSICAL CONSTANT NAMES USED IN OMNITAB.              XR5 1020
C                                                                       XR5 1025
C       ***NOTE*** SEE SUBPROGRAM PHYSIC FOR ADDITIONAL DETAILS.        XR5 1030
      END                                                               XR5 1040
```

Listing Of XREF6

```
C     XREF6                                                              XR6   10
C     VERSION  5.00     XREF6     5/15/70                                XR6   20
C                                                                        XR6   30
C     THIS SECTION CONTAINS ALL OMNITAB ERROR MESSAGES                   XR6   40
C                                                                        XR6   50
C                                                                        XR6   60
C  1.A     **********FATAL ERROR MESSAGES*****************************  XR6   70
C                                                                        XR6   80
C     ERROR (1)                                                          XR6   90
C               NAME NOT FOUND IN LIBRARY                                XR6  100
C     ERROR (2)                                                          XR6  110
C               ILLEGAL STATEMENT NUMBER                                 XR6  120
C     ERROR (3)                                                          XR6  130
C               ILLEGAL ARGUMENT ON CARD                                 XR6  140
C     ERROR (5)                                                          XR6  150
C               COMMAND NOT ALLOWED IN REPEAT MODE                       XR6  160
C     ERROR (6)                                                          XR6  170
C               STATEMENT NUMBER MAY NOT BEGIN ANY CARD BETWEEN BEGIN    XR6  180
C               AND FINISH CARDS                                         XR6  190
C     ERROR (7)                                                          XR6  200
C               ILLEGAL *STATEMENT*                                      XR6  210
C     ERROR (9)                                                          XR6  240
C               NRMAX=0                                                  XR6  250
C     ERROR (10)                                                         XR6  260
C               I4,34H IS AN ILLEGAL NUMBER OF ARGUMENTS                 XR6  270
C     ERROR (11)                                                         XR6  280
C               COLUMN NUMBER TOO BIG OR LESS THAN 1                     XR6  290
C     ERROR (12)                                                         XR6  300
C               COMMAND STORAGE AREA OVERFLOW                            XR6  310
C     ERROR (13)                                                         XR6  320
C               STATEMENT NUMBER NOT FOUND                               XR6  330
C     ERROR (15)                                                         XR6  360
C               DIMENSIONED AREA EXCEEDS LIMIT                           XR6  370
C     ERROR (16)                                                         XR6  380
C               ILLEGAL SIZE ROW NUMBER                                  XR6  390
C     ERROR (17)                                                         XR6  400
C               DEFINED MATRIX OVERFLOWS WORKSHEET                       XR6  410
C     ERROR (18)                                                         XR6  420
C               INTEGER ARGUMENT LESS THAN -8191                         XR6  430
C     ERROR (19)                                                         XR6  440
C               STORED PERFORM STATEMENT WILL EXECUTE ITSELF             XR6  450
C     ERROR (20)                                                         XR6  460
C               IMPROPER TYPE OF ARGUMENT                                XR6  470
C     ERROR (21)                                                         XR6  480
C               COMMAND MUST BE STORED                                   XR6  490
C     ERROR (22)                                                         XR6  500
C               MATRIX IS (NEARLY) SINGULAR                              XR6  510
C     ERROR (23)                                                         XR6  520
C               INSUFFICIENT SCRATCH AREA                                XR6  530
C     ERROR (24)                                                         XR6  540
C               DEGREE IS LARGER THAN NO. OF NON-ZERO WEIGHTS            XR6  550
C     ERROR (25)                                                         XR6  560
```

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C              NEGATIVE WEIGHTS MAY NOT BE USED                          XR6  570
C     ERROR (26)                                                         XR6  580
C              NUMBER OF COLUMNS IS GREATER THAN NUMBER OF ROWS          XR6  590
C     ERROR (27)                                                         XR6  600
C              FORMAT NOT FOUND                                          XR6  610
C     ERROR (28)                                                         XR6  620
C              INCORRECT TAPE UNIT. COMMAND IS NOT EXECUTED.             XR6  630
C     ERROR (29)                                                         XR6  640
C              NUMBER OF ARGUMENTS SHOULD BE,I2                          XR6  650
C     ERROR (30)                                                         XR6  660
C              AN INCREMENT COMMAND CAN NOT INCREMENT ITSELF.            XR6  670
C                                                                        XR6  680
C 1.B     ***********ARITHMETIC ERROR MESSAGES************************  XR6  690
C                                                                        XR6  700
C     ERROR (101)                                                        XR6  710
C              NEGATIVE ARGUMENT TO SQRT,LOG OR RAISE                    XR6  720
C     ERROR (102)                                                        XR6  730
C              EVALUATION OF EXPONENT PRODUCES OVERFLOW                  XR6  740
C     ERROR (103)                                                        XR6  750
C              ARGUMENT OUT OF BOUNDS TO INVERSE FUNCTION                XR6  760
C     ERROR (104)                                                        XR6  770
C              ARGUMENT TOO LARGE FOR SIN OR COS, ZERO. RETURNED,I4,6H   XR6  780
C              TIMES                                                     XR6  790
C     ERROR (105)                                                        XR6  800
C              BESSEL ARGUMENTS SCALED TO AVOID OVER/UNDER FLOW.         XR6  810
C              RETURNED,I4,6H TIMES                                      XR6  820
C     ERROR (106)                                                        XR6  830
C              DIVISION BY ZERO, RESULT SET=0,I4,6H TIMES                XR6  840
C     ERROR (107)                                                        XR6  850
C              TRIG FUNCTION NOT DEFINED RESULTS SET=0,I4,6H TIMES       XR6  855
C     ERROR (108)                                                        XR6  860
C              ONE OF THE VALUES COMPARED IS ZERO, ABSOLUTE TOLERANCE    XR6  865
C              WAS USED,I4,6H TIMES                                      XR6  870
C     ERROR (109)                                                        XR6  873
C              X FOR ELLIPTICAL INTEGRALS IS = 1.0 OR GREATER. RESULT ISXR6  875
C              SET TO 0.0.,I4,6H TIMES                                   XR6  877
C                                                                        XR6  879
C 1.C     ***********INFORMATIVE DIAGNOSTIC MESSAGES******************  XR6  880
C                                                                        XR6  890
C     ERROR (201)                                                        XR6  900
C              TOO MUCH DATA IN SET, READ OR GENERATE, SPILL LOST        XR6  910
C     ERROR (202)                                                        XR6  920
C              COMMAND NOT ALLOWED IN REPEAT MODE. EXECUTED BUT NOT      XR6  930
C              STORED                                                    XR6  940
C     ERROR (203)                                                        XR6  950
C              VALUE REQUESTED IN SHORTEN, ACOALESCE OR AAVERAGE NOT     XR6  960
C              FOUND.                                                    XR6  970
C     ERROR (204)                                                        XR6  980
C              BAD HEAD. COLUMN GT 50 OR NO /                            XR6  990
C     ERROR (205)                                                        XR6 1000
C              THIS COMMAND WAS NOT EXECUTED BECAUSE ITS MEANING WAS     XR6 1010
C              QUESTIONABLE                                              XR6 1020
C     ERROR (206)                                                        XR6 1030
C              F LESS THAN 0, SET = 0                                    XR6 1040
C     ERROR (207)                                                        XR6 1050
C              NU1 OR NU2 LESS THAN 1                                    XR6 1060
C     ERROR (208)                                                        XR6 1070
C              NU1 OR NU2 TRUNCATED TO INTEGER                           XR6 1080
C     ERROR (209)                                                        XR6 1090
C              IMPROPER TITLE NUMBER, ASSUMED 1                          XR6 1100
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C     ERROR (210)                                                        XR6 1110
C               NO OF ROWS NOT = TO COLS. MATRIX USED LARGEST SQUARE     XR6 1120
C     ERROR (211)                                                        XR6 1130
C               ASTERISK STRING IMPLYING 'THRU' INCORRECT, IGNORED       XR6 1140
C     ERROR (212)                                                        XR6 1150
C               UNNECESSARY ARGUMENTS IN COMMAND IGNORED                 XR6 1160
C     ERROR (213)                                                        XR6 1170
C               PARTIAL STORAGE OF MATRIX                                XR6 1175
C     ERROR (214)                                                        XR6 1180
C               INSUFFICIENT SCRATCH AREA                                XR6 1185
C     ERROR (215)                                                        XR6 1190
C               NRMAX IS NOT LARGE ENOUGH TO ALLOW ITERATION             XR6 1200
C     ERROR (216)                                                        XR6 1210
C               1ST COLUMN OF ISETUP OR ISOLATE IS NOT MONOTONIC OR IS   XR6 1220
C               CONSTANT.                                                XR6 1230
C     ERROR (217)                                                        XR6 1240
C               ITERATION HAS FOUND NO VALUES.                           XR6 1250
C     ERROR (218)                                                        XR6 1260
C               WORKSHEET IS TOO SHORT TO ACCOMODATE ALL THE VALUES      XR6 1270
C               GENERATED BY THIS COMMAND.                               XR6 1280
C     ERROR (219)                                                        XR6 1290
C               MAXMIN HAS FOUND NO EXTREMA.                             XR6 1300
C     ERROR (220)                                                        XR6 1310
C               MAXMIN HAS FOUND AND IGNORED A TRIAD OF X'S WITH AT LEASTXR6 1320
C               TWO IDENTICAL VALUES.                                    XR6 1330
C     ERROR (221)                                                        XR6 1340
C               MORE THAN ONE ARGUMENT IN COMMAND. ONLY FIRST ONE IS USEDXR6 1350
C     ERROR (222)                                                        XR6 1360
C               FORMAT NOT FOUND. READABLE FORMAT IS USED                XR6 1370
C     ERROR (223)                                                        XR6 1380
C               ONE,SOME OR ALL WEIGHTS ARE NEGATIVE                     XR6 1390
C     ERROR (224)                                                        XR6 1400
C               ALL WEIGHTS ARE ZERO. COMMAND IS NOT EXECUTED            XR6 1410
C     ERROR (225)                                                        XR6 1420
C               ARG FOR BESIN,BESJN,BESKN GIVES A RESULT TOO LARGE/SMALL.XR6 1430
C               COMMAND NOT EXECUTED.                                    XR6 1440
C     ERROR (226)                                                        XR6 1450
C               COLUMN NOT LONG ENOUGH TO STORE ALL ELEMENTS. ONLY NROW  XR6 1460
C               WILL BE STORED.                                          XR6 1470
C     ERROR (227)                                                        XR6 1480
C               NOT ENOUGH DATA ON COL TO RESTORE MATRIX/ARRAY. DATA     XR6 1490
C               AVAILABLE WILL BE USED.                                  XR6 1500
C     ERROR (228)                                                        XR6 1510
C               SUM OF SQRS DO NOT ADD UP-ABS. VALUE OF (TOTAL-ROW-COL-  XR6 1520
C               RES.)/TOTAL EXCEEDS 5.E-7  )                             XR6 1530
C     ERROR (229)                                                        XR6 1540
C               MORE THAN 50 HEAD COLUMN COMMANDS HAVE BEEN USED.        XR6 1550
C     ERROR (230)                                                        XR6 1560
C               ATTEMPT TO PROMOTE FROM BELOW NRMAX. FIRST ARGUMENT IS   XR6 1570
C               RESET TO NRMAX.                                          XR6 1580
C     ERROR (231)                                                        XR6 1590
C               ATTEMPT TO DEMOTE OFF THE WORKSHEET. SPILL IS LOST.      XR6 1600
C     ERROR (233)                                                        XR6 1640
C               NEGATIVE VALUE(S) WERE ENCOUNTERED BY PARTITION FUNCTION.XR6 1650
C               ZEROES STORED.                                           XR6 1660
C     ERROR (234)                                                        XR6 1670
C               NEGATIVE ABSOLUTE TEMPERATURES CONVERTED.                XR6 1680
C     ERROR (235)                                                        XR6 1690
C               CAUTION, USE EXPERIMENTALLY ONLY. NOT OPTIMUM IN ORDER   XR6 1700
C               TO MAKE IT MACHINE INDEPENDENT. REFERENCES - J.B.KRUSKAL,XR6 1710
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C               ACM,12,92. AND J.H. HALTON,SIAM REV.,12,1.                XR6 1720
C       ERROR (236)                                                       XR6 1730
C               COMMAND IGNORED - S BEFORE COMMAND NAME MEANINGLESS IF    XR6 1740
C               NO STORAGE REQUESTED.                                     XR6 1750
C       ERROR (237)                                                       XR6 1760
C               NUMBER OF SIGNIFICANT DIGITS AFTER DECIMAL PT HAS BEEN    XR6 1770
C               SET TO,I3.                                                XR6 1780
        END                                                               XR6 1790
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