NBS TECHNICAL NOTE 734

OMNITAB II
Segmentation Structure for the SCOPE Operating System

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OMNITAB II Segmentation Structure for the SCOPE Operating System

Sally T. Peavy and Ruth N. Varner

OMNITAB II is an interpretive system developed and maintained by the National Bureau of Standards to enable scientists to use a large computer easily, effectively and accurately for numerical, statistical and data analysis without prior computer experience. The system is as machine independent as possible, making implementation relatively easy. Since OMNITAB II has a large memory requirement, segmentation and overlay are virtually essential.

Overlay procedures are dependent upon the operating system of the computer. Changes are necessary to the OMNITAB II program when the overlay procedure requires specific overlay CALL statements to external procedures in other overlay links. This Technical Note describes a method of segmentation and overlay for a particular operating system (CDC-6000 series). The method can readily be adapted to other operating systems with modifications to the control statements.

Key words: ANSI FORTRAN, general-purpose computer program, implementation of OMNITAB II, links, OMNITAB II, overlay procedures, SCOPE operating system, segmentation.

OMNITAB II is an interpretive computing system which permits easy use of a computer without prior computing experience. The system was developed and is maintained by the National Bureau of Standards to enable scientists to use a computer easily, effectively and accurately for numerical, statistical and data analysis without the necessity of becoming professional programmers. OMNITAB was envisioned by Joseph Hilsenrath and developed by him and his co-workers. A complete description of the first version of OMNITAB was given in Hilsenrath et al. (1966). Hogben et al. (1970 and 1971) documents OMNITAB II version 5.0, the present version.

The OMNITAB II system was designed with the systems programmer in mind, as well as the user. All the subprograms in the system are written in the American National Standards Institute (ANSI) FORTRAN. Every effort has been made to produce a virtually machine independent program which could be easily transported and implemented on any large computer. However, a minimum number of modifications are necessary in the implementation of the OMNITAB II system, due to the variability of hardware and software features of computers. The modifications are limited to a small number of subprograms and are fully documented in Peavy, Varner and Bremer (1970).

The OMNITAB II version 5.0 system requires approximately 90K storage units of central memory, assuming each real (floating point) number and a machine instruction occupy one storage unit. The OMNITAB system consists of one main program, one-hundred-seventy-two procedure subprograms and four specification subprograms. To make the program operable on a smaller computer configuration, the OMNITAB II system has been segmented into twenty-one segments or groups. Certain of these segments may overlay each other (i.e., share the same storage units in central memory). This reduces the storage units required to approximately 49K, plus the storage units needed by the operating system library subprograms (i.e., SIN, LOG, I/O routines, etc., approximately 4K). The amount of storage needed may be further reduced by decreasing the size of the worksheet and scratch areas as described in Peavy, Varner and Bremer (1970). Segmentation and overlay may not be necessary for a computer with a large central memory if the OMNITAB II program is permitted to utilize the full memory.

Much thought has been put into the segmentation structure of the OMNITAB II program in order to minimize the swapping of segments in and out of the computer's central memory. Subprograms which read, scan and interpret the OMNITAB instructions are in the main segment which is in residence at all times during execution of the OMNITAB system. The error checking subroutines are also included in this segment as well as a few of the subprograms which execute the most often used instructions (GENERATE, INCREMENT, RESET, etc.) as determined from statistics gathered over a three month period. The other segments contain subprograms which execute related instructions, such as the statistical, input-output, matrix and array operations. In order to maintain a minimum number of subprograms in the main segment, it was sometimes necessary to duplicate a subroutine in another segment under a different subprogram name. This was avoided as much as possible.

The overlay procedure is very dependent upon the operating system of the computer. Since standards have not been defined in regards to overlay, the method of overlaying is at the discretion of the systems programmers or the software manufacturers. Some systems make great demands on the user or programmer, while others require a minimum amount of effort. From the authors' experience and knowledge of overlay procedures, there appear to be three main categories for third generation computers. In all three types the user must provide the following information to the operating system (1) how the subprograms are to be grouped, (2) which subprograms comprise the main segment and are in memory at all times, (3) which groups may overlay what other groups and (4) what other groups or segments are necessary with a particular group. Furthermore, some overlay procedures have restrictions of the use of the FORTRAN labeled and unlabeled COMMON statements, of which the user must be aware to take proper action.

One type of overlay procedure places no restrictions on the programmer when a problem is being programmed. During the programming stage of the problem no thought of overlay and segmentation structure are necessary. The programmer programs the problem as though the whole program will be able to reside in the computer at execution time. The operating system does not require the subprograms to be arranged in the order in which they are grouped when overlaid at execution time. Nor is it necessary to precede each subprogram with control cards for the operating system. The only prerequisite is that at execution time, the operating system must be provided with either a set of control statements or a routine outlining the segmentation and overlay structure. This is the overlay procedure that was used in implementing OMNITAB II version 5.0 for the NBS computer configuration. For complete details see Peavy, Varner and Bremer (1970).

The second form of overlay procedure also does not restrict the programmer when the problem is being programmed. However, before execution the program units must be arranged in order of the overlay setup. Furthermore system control cards must precede each of the grouped procedures or segments. If OMNITAB II version 5.0 is being implemented on a computer whose operating system allows this procedure for overlaying, the systems programmer should check Peavy, Varner and Bremer (1970) for details in deck setup.

The third form of overlay procedure requires the programmer to keep in mind that the program will have to be segmented and overlaid because of its size. He must plan the

overlay structure and links at the same time he is programming the problem. The writer must be able to judge the amount of storage units required by each subprogram in order to group them properly. If the programs are written in FORTRAN, CALL statements to bring in the proper overlay group must be added to the segment which references external procedures in another overlay link. These statements may be of the form CALL LINK (NAME), or CALL OVERLAY (a1, a2, a3, a4), where NAME is a name of a particular segment and a's are arguments to the subroutine OVERLAY. Furthermore at execution time, the program units must be organized in a specific manner. All the subprograms in a particular segment must be grouped together preceded by operating system control statement(s).

This paper describes the changes necessary to overlay the OMNITAB II program under a computer operating system where the overlay structure is of the third type. The material is divided into five parts: (I) changes necessary to specified subprograms; (II) addition of new program units; (III) the deck setup organization; (IV) flow chart of the overlay structure and; (V) changes necessary if the worksheet and scratch area sizes are changed. This information is on cards and appears in this publication as a computer listing.

Part I lists the changes that must be a made to four subprograms BESSEL, OMNIT, ORTHO and XECUTE. The three letter subprogram identification and line numbers are shown on the extreme right, as in Peavy, Varner and Hogben (1970). The changes for each subprogram are divided into two parts. The first set of corrections are to replace the statements of the specified subprogram and the second set are additions to be inserted in the proper place. The additions should be made so that the numbers are in ascending order.

Part II consists of twenty new program units, one for each of the overlaying segments. The OMNITAB II program is segmented into twenty-one segments. The first segment (main segment) does not require any new program unit since it contains the main routine and is resident in memory throughout the execution of the OMNITAB II program. The first two lines of each program unit are control cards for one particular operating system (CDC-6000 - Scope system) for which the OMNITAB II system has been implemented. The first line OVERLAY (a1, a2, a3), indicates the start of a new segment. The argument a1 is the file name of the segment, a2 a numerical identifier or primary level number, and a3 the secondary level of the overlay within that particular file. The second card is a program identification for the program unit. Each program unit is written in FORTRAN and consists primarily of CALL statements which refer to subprograms in that particular segment.

The deck setup organization is described in part III. The segments may be stored on a magnetic tape file, disk file, drum file or card file. For convenience the twenty-one segments are labeled Group 1 through Group 21. The groups should be in the order listed (i.e. in ascending order), in order to minimize file searching. The setup for each group is documented in detail. Each group (except Group 1) must begin with one of the program units described in part II, followed by the OMNITAB II subprograms listed for that group. The order of the OMNITAB II subprograms within a particular group is insignificant.

Part IV is a flow diagram of the overlay structure. The approximate size of each segment is also indicated, assuming each real number (floating point) and machine instruction occupy one storage unit.

It was necessary to include some of the labeled common areas in the program units described in part II. If the size of the worksheet and scratch areas are to be increased or decreased, changes must be made in some of the program units as well as in the subprograms indicated in Peavy, Varner and Bremer (1970). Part V describes the changes pertinent to particular program units in part II.

Although the write-up is for a particular computer and computer operating system, the deck setup can be easily modified for other operating systems. In part I the CALL statements (CALL OVERLAY (a1, a2, a3, a4)) in the subprograms BESSEL, OMNIT, ORTHO and XECUTE must be changed to the proper CALL statements of the specific operating system used. It may be necessary to modify the program units in part II as subprograms rather than main programs. The first two control cards of each program unit must be exchanged for the proper

control statement(s) of the operating system. Also in some cases, control statement(s) may be required for part III.

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PART I

CHANGES NECESSARY TO SPECIFIC SUBPROGRAMS

SEGMENTING OMNITAB II FOR THE CDC-6000 SERIES UNDER THE SCOPE SYSTEM
THIS SEGMENTATION STRUCTURE IS FOR OMNITAB II VERSION 5.00

THE FOLLOWING SUBPROGRAMS MUST BE CHANGED: BESSEL, OMNIT, ORTHO AND XECUTE

THE CHANGES THAT ARE NECESSARY ARE LISTED FOR EACH OF THE SUBPROGRAMS
ALONG WITH THE APPROPRIATE LINE NOS IN COLS 73 THROUGH 79

A. CHANGES FOR SUBPROGRAM BESSEL

REPLACE THE APPROPRIATE CARDS (LINE NOS. IN COLS 73-79)
WITH THE FOLLOWING CARDS

```
      DOUBLE PRECISION X,Y,E,P,Q,S,T,Z,DXEX,XEX                    BES  90
40    CALL OVERLAY(4HWORK,3,1,6HRECALL)                            BES 870
90    CALL OVERLAY(4HWORK,3,1,6HRECALL)                            BES1130
      IF(M.NE.2) GO TO 145                                         BES1580
145   IF(M.NE.1) GO TO 148                                         BES1660
      CALL OVERLAY(4HWORK,3,2,6HRECALL)                            BES1670
      ICDC=2                                                       BES2310
      ICDC=3                                                       BES2410
330   DBEJX=Z                                                      BES2540
335   IF(L2.NE.38) IF(L2-39)338,460,338                            BES2560
      CALL OVERLAY(4HWORK,3,1,6HRECALL)                            BES2570
338   DO 340 N=1,K                                                 BES2580
      ICDC=4                                                       BES2740
360   ICDC=5                                                       BES2770
      ICDC=5                                                       BES3020
      R(J)=DBEJX                                                   BES3050
      CALL OVERLAY(4HWORK,3,2,6HRECALL)                            BES3280
470   ICDC=1                                                       BES3370
      AA(1)=DBEJX                                                  BES3380
```

INSERT THE FOLLOWING CARDS IN THE APPROPRIATE PLACES
(LINE NOS. IN COLS 73-79)

```
C     CDC  VERSION 5.00  BESSEL                                    BES  25
      COMMON/CDC/ICDC,ICDCK,ICDCN,DBEJX,BES2                       BES 192
      DOUBLE PRECISION DBEJX,BES2                                  BES 194
      ICDC=1                                                       BES 522
      ICDCK=N                                                      BES 524
      ICDCN=M                                                      BES 526
      R(J)=Y*DBEJX                                                 BES 875
      X=Y*DBEJX                                                    BES1135
      ICDC=1                                                       BES1582
      CALL OVERLAY(4HWORK,3,2,6HRECALL)                            BES1584
      ICDC=2                                                       BES1665
148   Z=X*FDCOS(Y)                                                 BES1675
      DBEJX=Z                                                      BES2312
      CALL OVERLAY(4HWORK,3,1,6HRECALL)                            BES2314
      R(J)=BES2                                                    BES2316
      ICDCK=K                                                      BES2412
      CALL OVERLAY(4HWORK,3,2,6HRECALL)                            BES2414
      R(J)=BES2                                                    BES2416
      IF(L2.NE.32) GO TO 335                                       BES2542
      ICDC=3                                                       BES2544
```

```
      CALL OVERLAY(4HWORK,3,1,6HRECALL)                          BES2546
      GO TO 338                                                  BES2548
      ICDC=4                                                     BES2565
      ICDCK=L                                                    BES2742
      CALL OVERLAY(4HWORK,3,2,6HRECALL)                          BES2744
      ICDCK=L                                                    BES2772
      CALL OVERLAY(4HWORK,3,2,6HRECALL)                          BES2774
      CALL OVERLAY(4HWORK,3,1,6HRECALL)                          BES3024
      ICDCK=K                                                    BES3276
      ICDCN=L                                                    BES3277
      ICDC=6                                                     BES3279
      ICDCK=0                                                    BES3372
      ICDCN=7                                                    BES3374
      CALL OVERLAY(4HWORK,3,1,6HRECALL)                          BES3376
      ICDCK=1                                                    BES3382
      CALL OVERLAY(4HWORK,3,1,6HRECALL)                          BES3384
      AA(2)=DBEJX                                                BES3386
```

B. CHANGES FOR SUBPROGRAM OMNIT

REPLACE THE APPROPRIATE CARDS (LINE NOS. IN COLS 73-79)
WITH THE FOLLOWING CARDS

```
      CALL OVERLAY (5HOMNIT,1,0,6HRECALL)                        OMN 460
      CALL OVERLAY(5HOMNIT,1,0,6HRECALL)                         OMN 810
65    ICDCK=LETSGO                                               OMN1030
      ICDC=5                                                     OMN1170
      ICDC=1                                                     OMN1273
      ICDC=6                                                     OMN1320
      ICDC=8                                                     OMN1840
      ICDC=7                                                     OMN3190
      ICDC=9                                                     OMN3400
```

INSERT THE FOLLOWING CARDS IN THE APPROPRIATE PLACES
(LINE NOS. IN COLS 73-79)

```
C     VERSION  5.00  CDC OVERLAY OMNIT                           OMN  25
      COMMON/CDC/ ICDC,ICDCK,ICDCN,DBEJX,BES2                    OMN 185
      DOUBLE PRECISION DBEJX,BES2                                OMN 186
      ICDC=2                                                     OMN 455
50    ICDC=3                                                     OMN 805
      ICDC=4                                                     OMN1033
      CALL OVERLAY(5HOMNIT,1,0,6HRECALL)                         OMN1036
      LETSGO=ICDCK                                               OMN1038
      CALL OVERLAY(5HOMNIT,1,0,6HRECALL)                         OMN1175
95    ICDCK=K                                                    OMN1272
      CALL OVERLAY(5HOMNIT,1,0,6HRECALL)                         OMN1274
      CALL OVERLAY(5HOMNIT,1,0,6HRECALL)                         OMN1325
      CALL OVERLAY(5HOMNIT,1,0,6HRECALL)                         OMN1845
      CALL OVERLAY(5HOMNIT,1,0,6HRECALL)                         OMN3195
      ICDCK=J                                                    OMN3404
      CALL OVERLAY(5HOMNIT,1,0,6HRECALL)                         OMN3406
      J=ICDCK                                                    OMN3408
```

C. CHANGES FOR SUBPROGRAM ORTHO

REPLACE THE APPROPRIATE CARDS (LINE NOS. IN COLS 73-79)
WITH THE FOLLOWING CARDS

```
      CALL OVERLAY(6HSTATIS,1,4,6HRECALL)                        ORT7110
```

```
1590  CALL OVERLAY(6HSTATIS,1,5,6HRECALL)                              ORT7160
1610  CALL OVERLAY(6HSTATIS,1,3,6HRECALL)                              ORT7190
      CALL OVERLAY(6HSTATIS,1,1,6HRECALL)                              ORT7210
1650  CALL OVERLAY(6HSTATIS,1,2,6HRECALL)                              ORT7470
C                                                                      ORT7480
```

INSERT THE FOLLOWING CARDS IN THE APPROPRIATE PLACES
(LINE NOS. IN COLS 73-79)

```
C     VERSION  5.00  CDC OVERLAY  ORTHO                                ORT  21
      COMMON/CDCORT/N,M,MX,NX,ND2,ND3,ND19,B,SSQ,IX,    IXA,ND7,MD1,IHC, ORT  22
     1IHT,YSUM,SU,ND9,FM,NSU,M1,ND18,ND17,IND19S,IND18S,IND7S,SS,SSOLD  ORT  24
```

D. CHANGES FOR SUBPROGRAM XECUTE

REPLACE THE APPROPRIATE CARDS (LINE NOS. IN COLS 73-79)
WITH THE FOLLOWING CARDS

```
200   ICDC=13                                                          XEC 270
300   ICDC=14                                                          XEC 300
400   ICDC=11                                                          XEC 330
600   ICDC=10                                                          XEC 390
700   GO TO 400                                                        XEC 420
C                                                                      XEC 440
800   GO TO 200                                                        XEC 450
C                                                                      XEC 460
1303  ICDC=12                                                          XEC 720
1305  CALL OVERLAY (5HOMNIT,2,0,6HRECALL)                              XEC 770
1306  GO TO 1305                                                       XEC 800
C                                                                      XEC 810
1313  ICDC=1                                                           XEC 990
1314  CALL OVERLAY (5HOMNIT,2,0,6HRECALL)                              XEC1020
1500  CALL OVERLAY (6HMATRIX,1,0,6HRECALL)                             XEC1470
1600  CALL OVERLAY (6HMATRIX,2,0,6HRECALL)                             XEC1500
1701  CALL OVERLAY (6HMATRIX,1,0,6HRECALL)                             XEC1550
1702  CALL OVERLAY (6HMATRIX,1,0,6HRECALL)                             XEC1580
1703  CALL OVERLAY(6HMATRIX,1,0,6HRECALL)                              XEC1610
1704  CALL OVERLAY(6HMATRIX,1,0,6HRECALL)                              XEC1640
1705  CALL OVERLAY(6HMATRIX,3,0,6HRECALL)                              XEC1670
      CALL OVERLAY(6HMATRIX,1,0,6HRECALL)                              XEC1720
1809  CALL OVERLAY(6HMATRIX,3,0,6HRECALL)                              XEC1750
1900  CALL OVERLAY(4HWORK,1,0,6HRECALL)                                XEC1780
2000  CALL OVERLAY(4HWORK,2,0,6HRECALL)                                XEC1810
2101  CALL OVERLAY(4HWORK,1,0,6HRECALL)                                XEC1870
2103  CALL OVERLAY(4HWORK,2,0,6HRECALL)                                XEC1920
2105  CALL OVERLAY(4HWORK,2,0,6HRECALL)                                XEC1970
2108  CALL OVERLAY(4HWORK,1,0,6HRECALL)                                XEC2040
2110  CALL OVERLAY(4HWORK,2,0,6HRECALL)                                XEC2090
2111  CALL OVERLAY(4HWORK,1,0,6HRECALL)                                XEC2120
2112  CALL OVERLAY(4HWORK,1,0,6HRECALL)                                XEC2150
2113  CALL OVERLAY(4HWORK,1,0,6HRECALL)                                XEC2180
2118  CALL OVERLAY(5HOMNIT,2,0,6HRECALL)                               XEC2330
2200  CALL OVERLAY(6HSTATIS,1,0,6HRECALL)                              XEC2390
2301  CALL OVERLAY(4HWORK,2,0,6HRECALL)                                XEC2450
2306  CALL OVERLAY(4HWORK,2,0,6HRECALL)                                XEC2560
2310  CALL OVERLAY(4HWORK,2,0,6HRECALL)                                XEC2650
2401  CALL OVERLAY(6HSTATIS,2,0,6HRECALL)                              XEC2760
2403  CALL OVERLAY(6HSTATIS,3,0,6HRECALL)                              XEC2810
2404  CALL OVERLAY(4HWORK,2,0,6HRECALL)                                XEC2840
2405  CALL OVERLAY(6HSTATIS,2,0,6HRECALL)                              XEC2870
```

```
2406  CALL OVERLAY(6HSTATIS,4,0,6HRECALL)                              XEC2900
2407  GO TO 2406                                                       XEC2930
C                                                                      XEC2940
2408  CALL OVERLAY(6HSTATIS,2,0,6HRECALL)                              XEC2960
2409  GO TO 2408                                                       XEC2990
C                                                                      XEC3000
2410  CALL OVERLAY(6HSTATIS,2,0,6HRECALL)                              XEC3020
2411  CALL OVERLAY(6HSTATIS,3,0,6HRECALL)                              XEC3050
2412  GO TO 2411                                                       XEC3080
C                                                                      XEC3090
2413  CALL OVERLAY(6HMATRIX,3,0,6HRECALL)                              XEC3110
2415  CALL OVERLAY(5HOMNIT,2,0,6HRECALL)                               XEC3160
      CALL OVERLAY(4HWORK,1,0,6HRECALL)                                XEC3200
2504  CALL OVERLAY(4HWORK,1,0,6HRECALL)                                XEC3220
2600  CALL OVERLAY(6HMATRIX,1,0,6HRECALL)                              XEC3250
2700  CALL OVERLAY(6HMATRIX,2,0,6HRECALL)                              XEC3280
2800  CALL OVERLAY(4HWORK,1,0,6HRECALL)                                XEC3310
2900  CALL OVERLAY(4HWORK,1,0,6HRECALL)                                XEC3340
3000  CALL OVERLAY(4HWORK,3,0,6HRECALL)                                XEC3370
3100  CALL OVERLAY(5HOMNIT,2,0,6HRECALL)                               XEC3400
3200  CALL OVERLAY(4HWORK,2,0,6HRECALL)                                XEC3430
4500  ICDC=15                                                          XEC3720
5100  CALL OVERLAY(6HMATRIX,1,0,6HRECALL)                              XEC3860
5200  CALL OVERLAY(6HMATRIX,1,0,6HRECALL)                              XEC3890
5300  CALL OVERLAY(6HMATRIX,1,0,6HRECALL)                              XEC3920
5402  CALL OVERLAY(4HWORK,4,0,6HRECALL)                                XEC4000
5403  CALL OVERLAY(4HWORK,4,0,6HRECALL)                                XEC4030
5404  CALL OVERLAY(4HWORK,4,0,6HRECALL)                                XEC4060
5405  CALL OVERLAY(4HWORK,4,0,6HRECALL)                                XEC4090
5406  CALL OVERLAY(4HWORK,4,0,6HRECALL)                                XEC4120
5407  CALL OVERLAY(4HWORK,4,0,6HRECALL)                                XEC4150
```

INSERT THE FOLLOWING CARDS IN THE APPROPRIATE PLACES
(LINE NOS. IN COLS 73-79)

```
C     VERSION  5.00  CDC OVERLAY XECUTE                                XEC  25
      COMMON/CDC/ICDC,ICDCK,ICDCN,DBEJX,BES2                           XEC  45
      DOUBLE PRECISION DBEJX,BES2                                      XEC  46
      CALL OVERLAY(5HOMNIT,1,0,6HRECALL)                               XEC 275
      CALL OVERLAY (5HOMNIT,1,0,6HRECALL)                              XEC 305
      CALL OVERLAY (5HOMNIT,1,0,6HRECALL)                              XEC 335
      CALL OVERLAY (5HOMNIT,1,0,6HRECALL)                              XEC 395
      CALL OVERLAY (5HOMNIT,1,0,6HRECALL)                              XEC 725
      ICDCK=3                                                          XEC 992
      CALL OVERLAY (5HOMNIT,1,0,6HRECALL)                              XEC 994
      CALL OVERLAY(5HOMNIT,1,0,6HRECALL)                               XEC3725
```

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PART II

ADDITION OF NEW PROGRAM UNITS

THE FOLLOWING NEW PROGRAMS MUST ALSO BE INCLUDED. THESE PROGRAMS ARE LISTED BELOW.

```
      OVERLAY (OMNIT,1,0)
      PROGRAM GRP2
C     VERSION  5.00  CDC  OVERLAY  GROUP 2                                  GP2  20
      COMMON/CDC/ ICDC,ICDCK,ICDCN,DBEJX,BES2                               GP2  50
      DOUBLE PRECISION DBEJX,BES2                                           GP2  55
      COMMON /BLOCKB/ NSTMT,NSTMTX,NSTMTH,NCOM,LCOM,IOVFL,COM(2000)         GP2  60
      GO TO (10,20,30,40,50,60,70,80,90,100,110,120,130,140,150),ICDC       GP2  75
10    CALL NOTEPR(ICDCK)                                                    GP2  80
      GO TO 1000                                                            GP2  90
20    CALL SETUP                                                            GP2 100
30    CALL STMT(NSTMT)                                                      GP2 110
      GO TO 1000                                                            GP2 120
40    CALL XOMNIT(ICDCK)                                                    GP2 130
      GO TO 1000                                                            GP2 140
50    CALL XFORMT                                                           GP2 150
      GO TO 1000                                                            GP2 160
60    CALL XHEAD                                                            GP2 170
      GO TO 1000                                                            GP2 180
70    CALL SETQ                                                             GP2 190
      GO TO 1000                                                            GP2 200
80    CALL TAPOP                                                            GP2 210
      GO TO 1000                                                            GP2 220
90    CALL STORE (ICDCK)                                                    GP2 230
      GO TO 1000                                                            GP2 240
100   CALL ABRIDG                                                           GP2 250
      GO TO 1000                                                            GP2 260
110   CALL APRINT                                                           GP2 270
      GO TO 1000                                                            GP2 280
120   CALL FIXFLO                                                           GP2 290
      GO TO 1000                                                            GP2 300
130   CALL PRINTX                                                           GP2 310
      GO TO 1000                                                            GP2 320
140   CALL PUNCH                                                            GP2 330
      GO TO 1000                                                            GP2 340
150   CALL TAPOP2                                                           GP2 350
1000  RETURN                                                                GP2 360
      END                                                                   GP2 370

      OVERLAY(OMNIT,2,0)
      PROGRAM GRP3
C     VERSION  5.00   CDC  OVERLAY   GROUP 3                                GP3  20
      COMMON/BLOCKE/ NAME(4),L1,L2,ISRFLG                                   GP3  30
      IF(L1.EQ.31) GO TO 40                                                 GP3  40
      IF(L1.EQ.24.AND.L2.EQ.15) GO TO 30                                    GP3  50
      IF(L1.EQ.21.AND.(L2.EQ.18.OR.L2.EQ.19)) GO TO 20                      GP3  60
      IF(L2.EQ.14) GO TO 10                                                 GP3  70
      CALL PLOT                                                             GP3  80
      GO TO 50                                                              GP3  90
10    CALL FNEIC                                                            GP3 100
      GO TO 50                                                              GP3 110
20    CALL FNEC                                                             GP3 120
      GO TO 50                                                              GP3 130
30    CALL FNKC                                                             GP3 140
```

```
      GO TO 50                                                    GP3 150
40    CALL THERMO                                                 GP3 160
50    RETURN                                                      GP3 170
      END                                                         GP3 180

      OVERLAY(MATRIX,1,0)
      PROGRAM GRP4
C     VERSION 5.00 CDC OVERLAY GROUP 4                            GP4  20
      COMMON/BLOCKE/ NAME(4),L1,L2,ISRFLG                         GP4  30
      IF (L1-52) 10,90,100                                        GP4  40
10    IF (L1.EQ.51) GO TO 80                                      GP4  50
      IF (L1.EQ.26) GO TO 70                                      GP4  60
      IF (L1.EQ.18) GO TO 60                                      GP4  70
      IF (L1.EQ.17) GO TO (20,30,40,50),L2                        GP4  80
      CALL MOP                                                    GP4  90
      GO TO 120                                                   GP4 100
20    CALL MMULT                                                  GP4 110
      GO TO 120                                                   GP4 120
30    CALL MRAISE                                                 GP4 130
      GO TO 120                                                   GP4 140
40    CALL MKRON                                                  GP4 150
      GO TO 120                                                   GP4 160
50    CALL MTRIAN                                                 GP4 170
      GO TO 120                                                   GP4 180
60    CALL MATRIX                                                 GP4 190
      GO TO 120                                                   GP4 200
70    CALL EXPCON                                                 GP4 210
      GO TO 120                                                   GP4 220
80    CALL MXTX                                                   GP4 230
      GO TO 120                                                   GP4 240
90    CALL MDAMAD                                                 GP4 250
      GO TO 120                                                   GP4 260
100   CALL ARYVEC                                                 GP4 270
120   RETURN                                                      GP4 280
      END                                                         GP4 290

      OVERLAY(MATRIX,2,0)
      PROGRAM GRP5
C     VERSION 5.00 CDC OVERLAY GROUP 5                            GP5  20
      COMMON/BLOCKE/ NAME(4),L1,L2,ISRFLG                         GP5  30
      IF(L1.EQ.27) GO TO 10                                       GP5  40
      CALL INVERT                                                 GP5  50
      GO TO 20                                                    GP5  60
10    CALL MPROP                                                  GP5  70
20    RETURN                                                      GP5  80
      END                                                         GP5  90

      OVERLAY(MATRIX,3,0)
      PROGRAM GRP6
C     VERSION 5.00 CDC OVERLAY GROUP 6                            GP6  20
      COMMON/BLOCKE/ NAME(4),L1,L2,ISRFLG                         GP6  30
      IF(L1.EQ.24) GO TO 20                                       GP6  40
      IF(L1.EQ.18) GO TO 10                                       GP6  50
      CALL MEIGEN                                                 GP6  60
      GO TO 30                                                    GP6  70
10    CALL COALES                                                 GP6  80
      GO TO 30                                                    GP6  90
20    CALL ONEWAY                                                 GP6 100
30    RETURN                                                      GP6 110
      END                                                         GP6 120
```

```
      OVERLAY(STATIS,1,0)
      PROGRAM GRP7
C     VERSION 5.00 CDC OVERLAY  GROUP 7                                  GP7  20
      CALL ORTHO                                                         GP7  30
      RETURN                                                             GP7  40
      END                                                                GP7  50

      OVERLAY(STATIS,1,1)
      PROGRAM GRP8
C     VERSION 5.00  CDC OVERLAY  GROUP 8                                 GP8  20
      COMMON/CDCORT/N,M,MX,NX,ND2,ND3,ND19,B,SSQ,IX,    IXA,ND7,MD1,IHC, GP8  30
     1IHT,YSUM,SU,ND9,FM,NSU,M1,ND18,ND17,IND19S,IND18S,IND7S,SS,SSOLD  GP8  31
      DIMENSION B(120),IHC(4),IHT(8),IIRGS(100)                          GP8  40
      DOUBLE PRECISION YSUM                                              GP8  50
      COMMON/KFMT/KFMT(100)                                              GP8  60
      EQUIVALENCE (IIRGS,KFMT)                                           GP8  70
      CALL OANOVA(YSUM,SU,ND9,FM,M,N,ND7,SSQ,IHC,NSU,B)                  GP8  80
      RETURN                                                             GP8  90
      END                                                                GP8  95

      OVERLAY(STATIS,1,2)
      PROGRAM GPR9
C     VERSION 5.00  CDC OVERLAY  GROUP 9                                 GP9  20
      COMMON/CDCORT/N,M,MX,NX,ND2,ND3,ND19,B,SSQ,IX,    IXA,ND7,MD1,IHC, GP9  30
     1IHT,YSUM,SU,ND9,FM,NSU,M1,ND18,ND17,IND19S,IND18S,IND7S,SS,SSOLD  GP9  31
      DIMENSION B(120),IHC(4),IHT(8),IIRGS(100)                          GP9  40
      DOUBLE PRECISION YSUM                                              GP9  50
      COMMON/KFMT/KFMT(100)                                              GP9  60
      EQUIVALENCE (IIRGS,KFMT)                                           GP9  70
      CALL OCOEFF(M1,N,ND18,ND17,IND19S,IND18S,IHC,B,IND7S,NSU,SS,SSOLD,GP9  80
     1YSUM)                                                             GP9  81
      RETURN                                                             GP9  90
      END                                                                GP9  95

      OVERLAY(STATIS,1,3)
      PROGRAM GRP10
C     VERSION 5.00   CDC OVERLAY   GROUP 10                              GP10 20
      COMMON/CDCORT/N,M,MX,NX,ND2,ND3,ND19,B,SSQ,IX,    IXA,ND7,MD1,IHC, GP10 30
     1IHT,YSUM,SU,ND9,FM,NSU,M1,ND18,ND17,IND19S,IND18S,IND7S,SS,SSOLD  GP10 31
      DIMENSION B(120),IHC(4),IHT(8),IIRGS(100)                          GP10 40
      DOUBLE PRECISION YSUM                                              GP10 50
      COMMON/KFMT/KFMT(100)                                              GP10 60
      EQUIVALENCE (IIRGS,KFMT)                                           GP10 70
      CALL OCOVAR(M,ND7,MD1,IHC,B,IHT)                                   GP10 80
      RETURN                                                             GP10 90
      END                                                                GP10 95

      OVERLAY(STATIS,1,4)
      PROGRAM GRP11
C     VERSION 5.00  CDC OVERLAY GROUP 11                                 GP11 20
      COMMON/CDCORT/N,M,MX,NX,ND2,ND3,ND19,B,SSQ,IX,    IXA,ND7,MD1,IHC, GP11 30
     1IHT,YSUM,SU,ND9,FM,NSU,M1,ND18,ND17,IND19S,IND18S,IND7S,SS,SSOLD  GP11 31
      DIMENSION B(120),IHC(4),IHT(8),IIRGS(100)                          GP11 40
      DOUBLE PRECISION YSUM                                              GP11 50
      COMMON/KFMT/KFMT(100)                                              GP11 60
      EQUIVALENCE (IIRGS,KFMT)                                           GP11 70
      CALL OPONE(N,M,MX,NX,ND2,ND3,ND19,B,SSQ,IX)                        GP11 80
      RETURN                                                             GP11 90
      END                                                                GP11 95
```

```
      OVERLAY(STATIS,1,5)
      PROGRAM GRP12
C     VERSION 5.00   CDC OVERLAY     GROUP 12                                  GP12 20
      COMMON/CDCORT/N,M,MX,NX,ND2,ND3,ND19,B,SSQ,IX,   IXA,ND7,MD1,IHC,       GP12 30
     1IHT,YSUM,SU,ND9,FM,NSU,M1,ND18,ND17,IND19S,IND18S,IND7S,SS,SSOLD         GP12 31
      DIMENSION B(120),IHC(4),IHT(8),IIRGS(100)                                GP12 40
      DOUBLE PRECISION YSUM                                                    GP12 50
      COMMON/KFMT/KFMT(100)                                                    GP12 60
      EQUIVALENCE (IIRGS,KFMT),(B,IB)                                          GP12 70
      CALL ORTPLT(ND19,ND2,N,SSQ,ND3,IB,IIRGS(IXA),IIRGS(2))                   GP12 80
      RETURN                                                                   GP12 90
      END                                                                      GP12 95

      OVERLAY(STATIS,2,0)
      PROGRAM GRP13
C     VERSION 5.00   CDC   OVERLAY    GROUP 13                                 GP13 20
      COMMON/BLOCKE/ NAME(4),L1,L2,ISRFLG                                      GP13 30
      IF (L2.EQ.10) GO TO 30                                                   GP13 40
      IF (L2.EQ.8.OR.L2.EQ.9) GO TO 20                                         GP13 50
      IF (L2.EQ.5) GO TO 10                                                    GP13 60
      CALL STATIS                                                              GP13 70
      GO TO 40                                                                 GP13 80
10    CALL FPROB                                                               GP13 90
      GO TO 40                                                                 GP13100
20    CALL HISTGM                                                              GP13120
      GO TO 40                                                                 GP13130
30    CALL FRDIST                                                              GP13135
40    RETURN                                                                   GP13140
      END                                                                      GP13150

      OVERLAY(STATIS,3,0)
      PROGRAM GRP14
C     VERSION 5.00   CDC   OVERLAY   GROUP 14                                  GP14 20
      COMMON/BLOCKE/ NAME(4),L1,L2,ISRFLG                                      GP14 30
      IF (L2.EQ.11.OR.L2.EQ.12) GO TO 10                                       GP14 40
      CALL RANKS                                                               GP14 50
      GO TO 20                                                                 GP14 60
10    CALL CORREL                                                              GP14 70
20    RETURN                                                                   GP14 80
      END                                                                      GP14 90

      OVERLAY(STATIS,4,0)
      PROGRAM GRP15
C     VERSION 5.00   CDC   OVERLAY    GROUP 15                                 GP15 20
      COMMON/BLOCKE/ NAME(4),L1,L2,ISRFLG                                      GP15 30
      CALL TWOWAY(L2)                                                          GP15 40
      RETURN                                                                   GP15 50
      END                                                                      GP15 60

      OVERLAY (WORK,1,0)
      PROGRAM GRP16
C     VERSION 5.00  CDC  OVERLAY   GROUP 16                                    GP16 20
      COMMON/BLOCKE/ NAME(4),L1,L2,ISRFLG                                      GP16 30
      IF(L1.EQ.29) GO TO 110                                                   GP16 35
      IF (L1.EQ.28) GO TO 100                                                  GP16 40
      IF(L1.EQ.25)  IF(L2-3) 80,80,90                                          GP16 50
      IF (L1.EQ.19) GO TO 70                                                   GP16 60
      IF(L2-2) 60,60,10                                                        GP16 70
10    LL2=L2-7                                                                 GP16 80
      GO TO (20,20,120,30,40,50,20),LL2                                        GP16 90
```

```
20    CALL SORDER                                                    GP16110
      GO TO 120                                                      GP16120
30    CALL EXCHNG                                                    GP16130
      GO TO 120                                                      GP16140
40    CALL FLIP                                                      GP16150
      GO TO 120                                                      GP16160
50    CALL CHANGE                                                    GP16170
      GO TO 120                                                      GP16180
60    CALL PROROW                                                    GP16190
      GO TO 120                                                      GP16200
70    CALL ALLSUB                                                    GP16210
      GO TO 120                                                      GP16220
80    CALL SELECT                                                    GP16230
      GO TO 120                                                      GP16240
90    IF(L2.EQ.5) GO TO 80                                           GP16245
      CALL INTERP                                                    GP16250
      GO TO 120                                                      GP16260
100   CALL ITERAT                                                    GP16270
      GO TO 120                                                      GP16280
110   CALL CMSEPA                                                    GP16290
120   RETURN                                                         GP16300
      END                                                            GP16310

      OVERLAY(WORK,2,0)
      PROGRAM GRP17
C     VERSION  5.00   CDC  OVERLAY   GROUP 17                        GP17 20
      COMMON/BLOCKE/ NAME(4),L1,L2,ISRFLG                            GP17 30
      IF (L1.EQ.32) GO TO 100                                        GP17 40
      IF (L1.EQ.24) GO TO 90                                         GP17 45
      IF (L1.EQ.23) IF (L2-6) 70,80,60                               GP17 50
      IF (L1.EQ.21) IF (L2-3)110,30,20                               GP17 70
      IF(L1.EQ.20) GO TO 25                                          GP17 75
20    IF (L2-6) 40,40,50                                             GP17 80
25    CALL MSCROW                                                    GP17 90
      GO TO 110                                                      GP17100
30    CALL DEFINE                                                    GP17110
      GO TO 110                                                      GP17120
40    CALL EXTREM                                                    GP17130
      GO TO 110                                                      GP17140
50    CALL ERASE                                                     GP17150
      GO TO 110                                                      GP17160
60    CALL PDMOTE                                                    GP17170
      GO TO 110                                                      GP17180
70    CALL MISC2                                                     GP17190
      GO TO 110                                                      GP17200
80    CALL MOVE                                                      GP17210
      GO TO 110                                                      GP17220
90    CALL GQUAD                                                     GP17230
      GO TO 110                                                      GP17240
100   CALL COMPLX                                                    GP17250
110   RETURN                                                         GP17260
      END                                                            GP17270

      OVERLAY(WORK,3,0)
      PROGRAM GRP18
C     VERSION  5.00   CDC  OVERLAY   GROUP 18                        GP18 20
      CALL BESSEL                                                    GP18 30
      RETURN                                                         GP18 40
      END                                                            GP18 50
```

```
      OVERLAY (WORK,3,1)
      PROGRAM GRP19
C     VERSION 5.00 CDC OVERLAY   GROUP 19                          GP19 20
      COMMON/ABEKI/X,Y,P,Q,S,T                                     GP19 30
      DOUBLE PRECISION X,Y,P,Q,S,T,DBEJ,DBEJX,BES2,BINTJO          GP19 40
      COMMON/CDC/ ICDC,ICDCK,ICDCN,DBEJX,BES2                      GP19 50
      COMMON/SCRAT/NS,NS2,A(13500)                                 GP19 60
      DOUBLE PRECISION W(100)                                      GP19 70
      EQUIVALENCE(A(4001),W)                                       GP19 80
      GO TO (10,20,30,40,50),ICDC                                  GP19 90
10    DBEJX=DBEJ(X,ICDCK,ICDCN)                                    GP19100
      GO TO 60                                                     GP19110
20    BES2=BINTJO(X,W,DBEJX)                                       GP19120
      GO TO 60                                                     GP19130
30    CALL BEJN(0,W,DBEJX)                                         GP19140
      GO TO 60                                                     GP19150
40    CALL BEJN(1,W,DBEJX)                                         GP19160
      GO TO 60                                                     GP19170
50    CALL STRUVE(X,Y,DBEJX,W)                                     GP19180
60    RETURN                                                       GP19190
      END                                                          GP19200

      OVERLAY(WORK,3,2)
      PROGRAM GRP20
C     VERSION 5.00 CDC OVERLAY GROUP 20                            GP20 20
      COMMON/ABEKI/X,Y,P,Q,S,T                                     GP20 30
      DOUBLE PRECISION X,Y,P,Q,S,T,DBEJX,BES2,COMELL               GP20 40
      COMMON/CDC/ ICDC,ICDCK,ICDCN,DBEJX,BES2                      GP20 50
      COMMON/SCRAT/NS,NS2,A(13500)                                 GP20 60
      DOUBLE PRECISION AA(1000),B(1000)                            GP20 70
      EQUIVALENCE (A(1),AA),(A(2001),B)                            GP20 80
      GO TO (10,20,30,40,50,60),ICDC                               GP20 90
10    CALL CBEK                                                    GP20100
      GO TO 70                                                     GP20110
20    CALL CBEI                                                    GP20120
      GO TO 70                                                     GP20130
30    BES2=COMELL(X,ICDCK)                                         GP20140
      GO TO 70                                                     GP20150
40    CALL BEZONE(AA,B,1,ICDCK)                                    GP20160
      GO TO 70                                                     GP20170
50    CALL BEZERO(AA,B,1,ICDCK)                                    GP20180
      GO TO 70                                                     GP20190
60    CALL FOURIA(AA,B(1),B(2),ICDCK,ICDCN)                        GP20200
70    RETURN                                                       GP20210
      END                                                          GP20220

      OVERLAY(WORK,4,0)
      PROGRAM GRP21
C     VERSION 5.00   CDC OVERLAY    GROUP 21                       GP21 20
      COMMON/BLOCKE/ NAME(4),L1,L2,ISRFLG                          GP21 30
      L2A=L2-1                                                     GP21 40
      GO TO (10,20,30,40,50,60),L2A                                GP21 45
10    CALL DUMMYA                                                  GP21 50
      GO TO 70                                                     GP21 60
20    CALL DUMMYB                                                  GP21 70
      GO TO 70                                                     GP21 80
30    CALL DUMMYC                                                  GP21 90
      GO TO 70                                                     GP21100
40    CALL DUMMYD                                                  GP21110
      GO TO 70                                                     GP21120
```

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50    CALL DUMMYE                                                    GP21130
      GO TO 70                                                       GP21140
60    CALL DUMMYF                                                    GP21150
70    RETURN                                                         GP21160
      END                                                            GP21170
```

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PART III

DECK SETUP ORGANIZATION

IN ORDER TO UTILIZE THE OVERLAY SCHEME DEVELOPED THE PROGRAMS LISTED ABOVE AND THE SUBPROGRAMS OF OMNITAB II MUST BE IN THE FOLLOWING ORDER:

I GROUP 1
MUST HAVE THE FOLLOWING THREE CARDS
OVERLAY(OMNIT,0,0)
PROGRAM OMNITAB (INPUT,OUTPUT,PUNCH,TAPE5=INPUT,TAPE6=OUTPUT,TAPE3
1=PUNCH,TAPE45)
FOLLOWED BY THE FOLLOWING SUBPROGRAMS:
OMNSYM, AARGS,ACCDIG,ADRESS, AERR, ARITH, ASTER, BEGIN,CHKCOL,
CKIND,DIMENS, ERROR,EXPAND, FCOS, FDCOS, FDEXP, FDLOG,FDPCON,
FDSIN,FDSQRT, FEXP, FEXP2, FLOG,FLOG10, FSIN, FSQRT, FTANH,
FUNCT, GENER, HEADS, IFS,INFERR, INPUT, LIST,LOCATE,LOOKUP,
MTXCHK, MXTXP, NNAME,NONBLA,OMCONV, OMNIT,OUTPUT, PACK, PAGE,
PHYCON,PREPAK, PROB, READQ, READX,REPINC, RESET,RFORMT,RNDOWN,
SET,SORTSM, SPACE, SYMV,VARCON,VECTOR,XECUTE, XPND, XSTOP,
BLOCK,LBCONS,LOOKTB,PHYSIC

II GROUP 2
PROGRAM STARTING WITH CARD
OVERLAY(OMNIT,1,0)
THROUGH THE CARD
END GP2 370
FOLLOWED BY THE FOLLOWING SUBPROGRAMS:
ABRIDG,APRINT,FIXFLO,NOTEPR,PRINTX, PUNCH,RPRINT, SETQ, SETUP
STMT, STORE, TAPOP,TAPOP2,XFORMT, XHEAD,XOMNIT

III GROUP 3
PROGRAM STARTING WITH CARD
OVERLAY (OMNIT,2,0)
THROUGH THE CARD
END GP3 180
FOLLOWED BY THE FOLLOWING SUBPROGRAMS:
DHRND,ERRINT, FNEC, FNEIC, FNKC, PLOT, RNJBK,THERMO

IV GROUP 4
PROGRAM STARTING WITH CARD
OVERLAY(MATRIX,1,0)
THROUGH THE CARD
END GP4 290
FOLLOWED BY THE FOLLOWING SUBPROGRAMS:
ARYVEC,EXPCON,MATRIX,MDAMAD, MKRON, MMULT, MOP,MRAISE,MTRIAN,
MXTX,STORMT,TRANSF

V GROUP 5
PROGRAM STARTING WITH CARD:
OVERLAY(MATRIX,2,0)

```
      THROUGH THE CARD
     END                                                          GP5  90
      FOLLOWED BY THE FOLLOWING SUBPROGRAMS:
     DETRNK,INVCHK,INVERT, MPROP,ORTHRV,PROCHK, PVTRI, RCSUM,SKSYMV,
      SPINV

  VI GROUP 6
      PROGRAM STARTING WITH CARD
     OVERLAY(MATRIX,3,0)
      THROUGH THE CARD
     END                                                          GP6 120
      FOLLOWED BY THE FOLLOWING SUBPROGRAMS:
     COALES,  FPPT, HDIAG,MEIGEN,ONEWAY, RANKO,TPCTPT

 VII GROUP 7
      PROGRAM STARTING WITH CARD
     OVERLAY(STATIS,1,0)
      THROUGH THE CARD
     END                                                          GP7  50
     FOLLOWED BY THE FOLLOWING SUBPROGRAM:
      ORTHO

VIII GROUP 8
      PROGRAM STARTING WITH CARD
     OVERLAY(STATIS,1,1)
      THROUGH THE CARD
     END                                                          GP8  95
      FOLLOWED BY THE FOLLOWING SUBPROGRAM:
     OANOVA

  IX GROUP 9
      PROGRAM STARTING WITH CARD
     OVERLAY(STATIS,1,2)
      THROUGH THE CARD
     END                                                          GP9  95
      FOLLOWED BY THE FOLLOWING SUBPROGRAM:
     OCOEFF

   X GROUP 10
      PROGRAM STARTING WITH CARD
     OVERLAY(STATIS,1,3)
      THROUGH THE CARD
     END                                                          GP10 95
      FOLLOWED BY THE FOLLOWING SUBPROGRAM:
     OCOVAR

  XI GROUP 11
      PROGRAM STARTING WITH CARD
     OVERLAY(STATIS,1,4)
      THROUGH THE CARD
     END                                                          GP11 95
      FOLLOWED BY THE FOLLOWING SUBPROGRAM:
      OPONE

 XII GROUP 12
      PROGRAM STARTING WITH CARD
     OVERLAY(STATIS,1,5)
      THROUGH THE CARD
     END                                                          GP12 95
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```
       FOLLOWED BY THE FOLLOWING SUBPROGRAM:
      ORTPLT

XIII GROUP 13
       PROGRAM STARTING WITH CARD
      OVERLAY(STATIS,2,0)
       THROUGH THE CARD
      END                                                          GP13150
       FOLLOWED BY THE FOLLOWING SUBPROGRAMS:
       FPROB,FRDIST,FREQCY,HISTGM,STATIS

  XIV GROUP 14
       PROGRAM STARTING WITH CARD
      OVERLAY(STATIS,3,0)
       THROUGH THE CARD
      END                                                          GP14 90
       FOLLOWED BY THE FOLLOWING SUBPROGRAMS:
      BJORCK,CORREL,CSPINV,INVCOR,  MIST, RANKS RANKX

   XV GROUP 15
       PROGRAM STARTING WITH CARD
      OVERLAY(STATIS,4,0)
       THROUGH THE CARD
      END                                                          GP15 60
       FOLLOWED BY THE FOLLOWING SUBPROGRAM:
      TWOWAY

  XVI GROUP 16
       PROGRAM STARTING WITH CARD
      OVERLAY(WORK,1,0)
       THROUGH THE CARD
      END                                                          GP16310
       FOLLOWED BY THE FOLLOWING SUBPROGRAMS:
      ALLSUB,CHANGE,CMPARA,CMSEPA,EXCHNG,  FLIP,INTERP, INTRP,ITERAT,
      PROROW,SELECT,SORDER

 XVII GROUP 17
       PROGRAM STARTING WITH CARD
      OVERLAY(WORK,2,0)
       THROUGH THE CARD
      END                                                          GP17270
       FOLLOWED BY THE FOLLOWING SUBPROGRAMS:
      COMPLX,DEFINE,ERASE,EXTREM, GQUAD, MISC2,  MOVE,MSCROW,PDMOTE

XVIII GROUP 18
       PROGRAM STARTING WITH CARD
      OVERLAY(WORK,3,0)
       THROUGH THE CARD
      END                                                          GP18 50
       FOLLOWED BY THE FOLLOWING SUBPROGRAM:
      BESSEL

  XIX GROUP 19
       PROGRAM STARTING WITH CARD
      OVERLAY(WORK,3,1)
       THROUGH THE CARD
      END                                                          GP19200
       FOLLOWED BY THE FOLLOWING SUBPROGRAMS:
        BEJN,BINTJO,  DBEJ,STRUVE
```

```
 XX GROUP 20
     PROGRAM STARTING WITH CARD
    OVERLAY(WORK,3,2)
     THROUGH THE CARD
    END                                                          GP20220
     FOLLOWED BY THE FOLLOWING SUBPROGRAMS:
    BEZERO,BEZONE,  CBEI,  CBEK,COMELL,FOURIA

 XXI GROUP 21
     PROGRAM STARTING WITH CARD
    OVERLAY(WORK,4,0)
     THROUGH THE CARD
    END                                                          GP21170
     FOLLOWED BY THE FOLLOWING SUBPROGRAMS:
    DUMMYA,DUMMYB,DUMMYC,DUMMYD,DUMMYE,DUMMYF
```

****

PART IV

FLOW CHART OF OVERLAY STRUCTURE

GROUP 1 IS RESIDENT IN MEMORY AT ALL TIMES, CONTAINS MOST OFTEN USED ROUTINES, SUBPROGRAMS NEEDED BY MORE THAN ONE OF THE OTHER GROUPS, AND ALL OF LABELED COMMON (EXCLUDING LABELED COMMON FOR BESSEL SUBPROGRAMS).

ONLY ONE OF THE OTHER GROUPS (GROUP 2 THROUGH GROUP 7, GROUP 13 THROUGH GROUP 18 AND GROUP 21) IS IN MEMORY AT A PARTICULAR TIME.

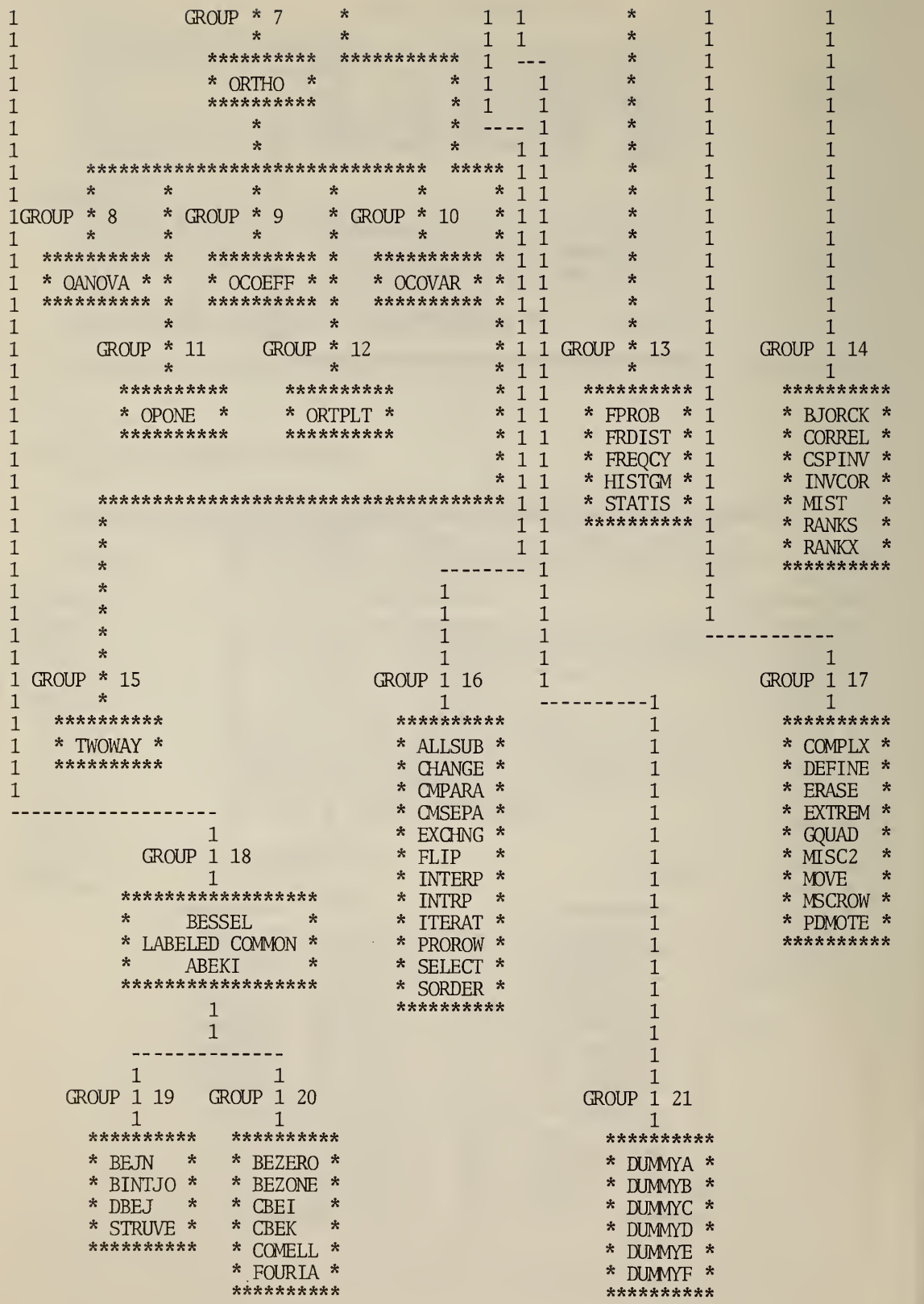
GROUPS 7 AND 18 EACH CONTAIN SUB-SEGMENTS. ONLY ONE OF THE SEGMENTS (GROUP 8 THROUGH GROUP 12) WILL BE IN RESIDENCE WITH GROUP 7. EITHER GROUP 19 OR GROUP 20 WILL BE LOADED WITH GROUP 18.

OUTLINE OF SEGMENTATION

GROUP 1

```
**************************************
* AARGS  ACCDIG ADRESS AERR   ARITH  *
* ASTER  BEGIN  CHKCOL CKIND  DIMENS *
* ERROR  EXPAND FCOS   FDCOS  FDEXP  *
* FDLOG  FDPCON FDSIN  FDSQRT FEXP   *
* FEXP2  FLOG   FLOG10 FSIN   FSQRT  *
* FTANH  FUNCT  GENER  HEADS  IFS    *
* INFERR INPUT  LIST   LOCATE LOOKUP *
* MTXCHK MXTXP  NNAME  NONBLA        *
* OMCONV OMNIT  OMNSYM OUTPUT PACK   *
* PAGE   PHYCON PREPAK PROB   READQ  *
* READX  REPINC RESET  RFORMT RNDOWN *
* SET    SORTSM SPACE  SYMV   VARCON *
* VECTOR XECUTE XPND   XSTOP         *
*                                    *
*  PLUS LIBRARY FUNCTIONS (SIN,ETC)  *
*                                    *
*                                    *
```


ALL OF LABELED COMMON
ABCDEF BLOCKA BLOCKB BLOCKC BLOCKD
BLOCKE BLOCKX BLOCRC CODE CODETP
CONLB2 CONSLB CONSTS DCONL2 DCONLB
FMAT HEADER ICODE ICODTP KFMT
NOTE PCONST PKSWT QRS SCRAT
SPRV TAPE
THERE ARE 4 BLOCK DATA PROCEDURES.
THE COMMENT OR 2ND CARD HAS THE
LABEL NAME. THE 4 PROCEDURES ARE
BLOCK LBCONS LOOKTB PHYSIC
GROUP 2
ABRIDG
APRINT
FIXFLO
NOTEPR
PRINTX
PUNCH
RPRINT
SETQ
SETUP
STMT
STORE
TAPOP
TAPOP2
XFORMT
XHEAD
XOMNIT
GROUP 3
DHRND
ERRINT
FNEC
FNEIC
FNKC
PLOT
RNJBK
THERMO
GROUP 4
ARYVEC
EXPCON
MATRIX
MDAMAD
MKRON
MMULT
MOP
MRAISE
MTRIAN
MXTX
STORMT
TRANSF
GROUP 1 5
DETRNK
INVCHK
INVERT
MPROP
ORTHRV
PROCHK
PVTRI
RCSUM
SKSYMV
SPINV
GROUP 1 6
COALES
FPPT
HDIAG
MEIGEN
ONEWAY
RANKO
TPCTPT


GROUP * 7
* ORTHO *
GROUP * 8
* OANOVA *
GROUP * 9
* OCOEFF *
GROUP * 10
* OCOVAR *
GROUP * 11
* OPONE *
GROUP * 12
* ORTPLT *
GROUP * 13
* FPROB *
* FRDIST *
* FREQCY *
* HISTGM *
* STATIS *
GROUP 1 14
* BJORCK *
* CORREL *
* CSPINV *
* INVCOR *
* MIST *
* RANKS *
* RANKX *
GROUP * 15
* TWOWAY *
GROUP 1 16
* ALLSUB *
* CHANGE *
* CMPARA *
* CMSEPA *
* EXCHNG *
* FLIP *
* INTERP *
* INTRP *
* ITERAT *
* PROROW *
* SELECT *
* SORDER *
GROUP 1 17
* COMPLX *
* DEFINE *
* ERASE *
* EXTREM *
* GQUAD *
* MISC2 *
* MOVE *
* MSCROW *
* PDMOTE *
GROUP 1 18
* BESSEL *
* LABELED COMMON *
* ABEKI *
GROUP 1 19
* BEJN *
* BINTJO *
* DBEJ *
* STRUVE *
GROUP 1 20
* BEZERO *
* BEZONE *
* CBEI *
* CBEK *
* COMELL *
* FOURIA *
GROUP 1 21
* DUMMYA *
* DUMMYB *
* DUMMYC *
* DUMMYD *
* DUMMYE *
* DUMMYF *

APPROXIMATE SIZE OF EACH GROUP ON THE NBS COMPUTER
THE SIZE AS INDICATED BELOW ASSUMES THAT A MACHINE WORD IS 36 BITS LONG, A FLOATING POINT NUMBER USES ONE STORAGE UNIT, AND EACH MACHINE INSTRUCTION IS ONE STORAGE UNIT LONG.

I	GROUP 1	43000 STORAGE UNITS
	A. ROUTINES	12000
	B. LABELED COMMON	31000 (THIS INCLUDES A WORK SHEET OF 12500 STORAGE UNITS)
	C. NOT COUNTED BUT MUST BE ADDED ARE LIBRARY FUNCTION ROUTINES (I. E. SIN,COS,ETC), AND INPUT OUTPUT ROUTINES. (FOR THE NBS UNIVAC 1108 SYSTEM THIS IS ABOUT 4500 STORAGE UNITS)	
II	GROUP 2	2900 STORAGE UNITS
III	GROUP 3	3200 STORAGE UNITS
IV	GROUP 4	4100 STORAGE UNITS
V	GROUP 5	4000 STORAGE UNITS
VI	GROUP 6	3700 STORAGE UNITS
VII	GROUP 7	4400 STORAGE UNITS (THIS GROUP INCLUDES GROUPS 8 THROUGH 12)
VIII	GROUP 13	3400 STORAGE UNITS
IX	GROUP 14	3800 STORAGE UNITS
X	GROUP 15	4000 STORAGE UNITS
XI	GROUP 16	4300 STORAGE UNITS
XII	GROUP 17	3000 STORAGE UNITS
XIII	GROUP 18	3300 STORAGE UNITS (THIS GROUP INCLUDES GROUPS 19 AND 20)
XIV	GROUP 21	4400 STORAGE UNITS (THIS SEGMENT IS WHERE THE USER MAY ADD HIS SUBROUTINES)

****

PART V

CHANGES NECESSARY IF WORK SHEET AND SCRATCH AREAS ARE TO BE MODIFIED

IN ADDITION TO THE CHANGES LISTED ON PAGES 24 THROUGH 26 IN NBS TECHNICAL NOTE 550, THE FOLLOWING CHANGES WILL HAVE TO BE MADE:

LET NSIZRC BE THE SIZE OF WORK SHEET REQUIRED AND

NSIZR7=INTEGRAL PART OF (NSIZRC-200)/4

NSIZRC AND NSIZR7 MUST BE INTEGER CONSTANTS AND NOT VARIABLES.

A. THE STATEMENTS

```
DOUBLE PRECISION AA(1000),B(1000),W(100)
EQUIVALENCE (A(1),AA),(A(2001),B),(A(4001),W)
IF(NR.GT.1000) L=1000                                          BES2640*
IF(LNR.GT.1000) LNR=1000                                       BES3230*
```

MUST BE CHANGED TO

```
DOUBLE PRECISION AA(NSIZR7),B(NSIZR7),W(100)
EQUIVALENCE (A(1),AA),(A(2*NSIZR7+1),B),(A(4*NSIZR7+1),W)
IF(NR.GT.NSIZR7) L=NSIZR7                                      BES2640*
IF(LNR.GR.NSIZR7) LNR=NSIZR7                                   BES3230*
```

IN SUBROUTINE BESSEL

* IDENTIFICATION NUMBERS IN COLUMNS 73 THROUGH 79

B. THE STATEMENTS

```
COMMON/SCRAT/ NS,NS2,A(13500)
EQUIVALENCE (A(4001),W)
```

MUST BE CHANGED TO

```
COMMON/SCRAT/ NS,NS2,A(NSIZRC+1000)
EQUIVALENCE (A(4*NSIZR7+1),W)
```

IN PROGRAM UNIT LABELED PROGRAM GRP19

C. THE STATEMENTS

```
COMMON/SCRAT/ NS,NS2,A(13500)
DOUBLE PRECISION AA(1000),B(1000)
EQUIVALENCE (A(1),AA),(A(2001),B)
```

MUST BE CHANGED TO

```
COMMON/SCRAT/ NS,NS2,A(NSIZRC+1000)
DOUBLE PRECISION AA(NSIZR7),B(NSIZR7)
EQUIVALENCE (A(1),AA),(A(2*NSIZR7+1),B)
```

IN PROGRAM UNIT LABELED PROGRAM GRP20

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16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

OMNITAB II is an interpretive system developed and maintained by the National Bureau of Standards to enable scientists to use a large computer easily, effectively and accurately for numerical, statistical and data analysis without prior computer experience. The system is as machine independent as possible, making implementation relatively easy. Since OMNITAB II has a large memory requirement, segmentation and overlay are virtually essential.

Overlay procedures are dependent upon the operating system of the computer. Changes are necessary to the OMNITAB II program when the overlay procedure requires specific overlay CALL statements to external procedures in other overlay links. This Technical Note describes a method of segmentation and overlay for a particular operating system (CDC - 6000 series). The method can readily be adapted to other operating systems with modifications to the control statements.

17. KEY WORDS (Alphabetical order, separated by semicolons) ANSI FORTRAN; General-purpose computer program, Implementation of OMNITAB II; Links; OMNITAB II; Overlay procedures; SCOPE operating system; Segmentation.

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