A Northstar BASIC Cross-Reference Tool

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In the course of two years of micro computing, I cannot count the number of times friends and acquaintances have offered me copies of programs they have written, only to be disappointed because their BASIC and my BASIC were so vastly different. In many cases, when the offered programs were just too good to pass up, I have locked myself in the study for an evening and made the necessary conversions. It isn't a job that I relish. And while I haven't found an easy way to accomplish it, I have developed, over time, some tools to ease the burden.

This particular program accepts programs in BASIC on Northstar disks and compiles cross-reference lists for all variables, string variables, array variables, and line numbers. I have found this to be a valuable assist when converting programs from one BASIC to another and when compacting a program by placing multiple statements on a single line. Additionally, I have discovered that such lists, annotated with the purpose of each variable, are excellent pieces of documentation.

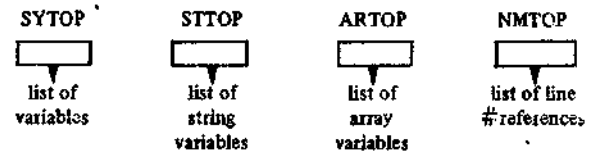
This program is written in 8080 assembly language and requires 13.4K of RAM to accommodate the program and the table space. The program itself requires 1.64K, and 12K is allocated for space in which to build the cross-reference tables. This latter space is more than sufficient for the largest programs I have. It could be reduced if necessary to save space by changing the allocation in line 5090 and changing the byte against which the high order byte of the address is compared at line 0945 to agree with the space allocated.

The program is designed to run at 2A00H and use the I/O and disk drivers currently in your Northstar DOS. References to these drivers are contained in the EQU vectors at the opening of the assembly language listing for ease in changing them if your drivers or your COS are not standard.

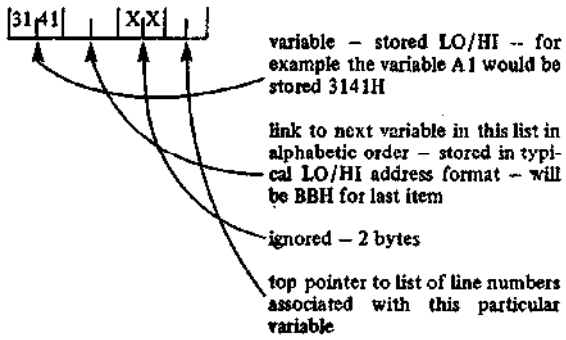
The program creates four separate lists:

1. Variables
2. String variables
3. Array variables
4. Line # references

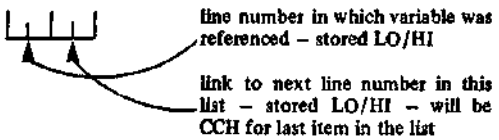
Each of these are supported as linear linked lists in alphabetic soft order. The storage areas SYTOP, STTOP, ARTOP, and NMTOP are the top pointers for these four lists, and the marker BBH is used to mark the end of each of these lists.



Each entry in each of the four lists has an accompanying top pointer for its associated list of line numbers. The mark CCH is used to mark the end of each line number list. A typical variable item looks like this:

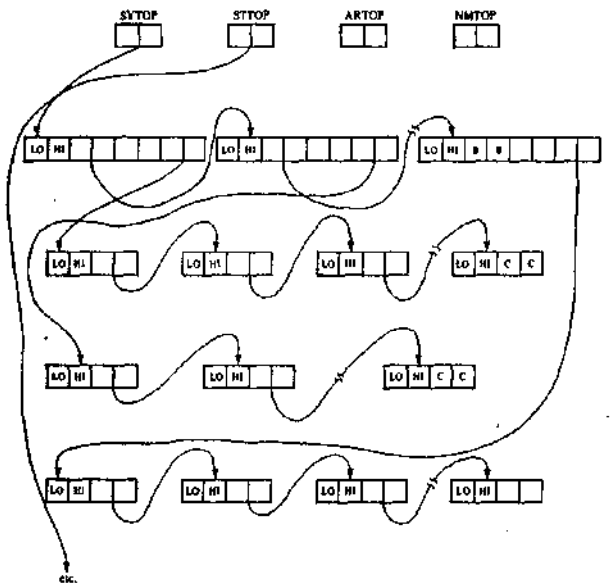


The list of line numbers associated with each variable in each list is constructed in a similar, but simpler, fashion:



The entire program is read from the disk, one 256 byte block at a time, and scanned for the purpose of constructing these lists. When this is completed, the lists are followed in order from beginning to end and the stored variables and line numbers are formated and printed to produce the cross-reference lists. Each list is printed with its own header, i.e. STRING VARIABLES. And the entry NULL LIST is printed for any list that is empty.

The diagram below represents the multi-list structure in somewhat stylized fashion:



The variables which were found in the program are stored in ASCII in the appropriate list so their conversion for printing is straightforward. The line numbers that are placed in the lists, however, are stored as two byte LO/HI binary values. The algorithm used to convert these to ASCII for printing is fairly simple, if somewhat bulky. Taking the binary value as an ordered 16 bit field, the program uses a 5 byte work area to construct the resulting decimal number. A table is provided (BASE:) which represents, as 5 single digits, the decimal number associated with each bit position of the 16 bit binary value. If a bit in the binary value is "on," then the five digits associated with that bit position are added to the five byte work area along with any necessary "carry's" from byte to byte. If, on the other hand, a bit in the binary value is "off," then the pointer into the table (BASE:) is bumped down 5 to point to the next series of 5 values. When this process is complete, 30H is added to each byte of the 5 byte work area to yield the desired ASCII value.

This program has proven useful in its own right. But it is worth mentioning that a modification of this same idea, directed solely at line number references, would be the basis for a program which would "compact" BASIC programs by removing unnecessary line numbers. Similarly, this sort of cross-reference compilation would form the basis of "pass one" of more sophisticated software such as a compiler. A compiler! Now there's an idea.

Listing

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                        0005 ; THIS PROGRAM PROVIDES SOFTWARE SUPPORT FOR
                        0010 ; PROGRAMS WRITTEN IN NORTHSTAR BASIC. IT COMPILES
                        0015 ; AND PRINTS FOUR LISTS: 1)A LIST OF VARIABLE NAMES
                        0020 ; USED AND LINES IN WHICH EACH OF THEM OCCURS. 2)A
                        0025 ; LIST OF STRING VARIABLE NAMES USED AND LINES IN
                        0030 ; WHICH EACH OCCURS, 3)A LIST OF ARRAY VARIABLE
                        0035 ; NAMES AND LINES IN WHICH EACH OCCURS, AND 4)A
                        0040 ; LIST OF LINE NUMBERS REFERENCED IN GOTO AND GOSUB
                        0045 ; STATEMENTS AND LINE NUMBERS IN WHICH THEY ARE
                        0050 ; REFERENCED.
                        0055 ;
2A00                    0060        ORG   2A00H
2A00 210233             0065        LXI   H,STACK+49
2A03 F9                 0070        SPHL
2018 =                  0075 CIN:   EQU   2018H
200D =                  0080 COUT:  EQU   200DH
201C =                  0085 DIRCK: EQU   201CH
2022 =                  0090 RDDSK: EQU   2022H
2028 =                  0095 EXIT:  EQU   2028H
                        0100 ;
                        0105 ; PRINT HEADER
                        0110 ;
2A04 0E1F               0115 START: MVI   C,31
2A06 211B3B             0120        LXI   H,HDR1
2A09 CD5E3B             0125        CALL  PRINT
2A0C CD6B3B             0130        CALL  CRLF
                        0135 ;
                        0140 ; PRINT FILE NAME PROMPT
                        0145 ;
2A0F 0E11               0150 ASKFL: MVI   C,17
2A11 21A63B             0155        LXI   H,HDR2
2A14 CD5E3B             0160        CALL  PRINT
2A17 0E0A               0165        MVI   C,10
2A19 216731             0170        LXI   H,PNAME
                        0175 ;
                        0180 ; BLANK PROGRAM NAME AREA
                        0185 ;
2A1C 3620               0190 BLNAM: MVI   M,20H
2A1E 23                 0195        INX   H
2A1F 0D                 0200        DCR   C
2A20 C21C2A             0205        JNZ   BLNAM
2A23 0E09               0210        MVI   C,9
2A25 216731             0215        LXI   H,PNAME
                        0220 ;
                        0225 ; ACCEPTS FILE NAME. USES REG C AS COUNTER AND
                        0230 ; ACCEPTS UP TO 8 CHARACTERS. TAKES CARE OF
                        0235 ; BLANKING CHAR IN RESPONSE TO BACKSPACE (5FH).
                        0240 ; ROUTINE TERMINATES WHEN CR (0DH) IS ENCOUNTERED.
                        0245 ;
2A28 CD1820             0250 INFIL: CALL  CIN
2A2B 32B232             0255        STA   HOLDT
2A2E FE0D               0260        CPI   0DH
2A30 CA6F2A             0265        JZ    INUNT
2A33 FE5F               0270        CPI   5FH
2A35 C2542A             0275        JNZ   STORE
2A38 3E09               0280        MVI   A,9
2A3A B9                 0285        CMP   C
2A3B CA282A             0290        JZ    INFIL
2A3E 3AB232             0295        LDA   HOLDT
2A41 2B                 0300        DCX   H
2A42 0C                 0305        INR   C
2A43 47                 0310        MOV   B,A
2A44 CD0D20             0315        CALL  COUT
2A47 0620               0320        MVI   B,20H
2A49 CD0D20             0325        CALL  COUT
2A4C 065F               0330        MVI   B,5FH
2A4E CD0D20             0335        CALL  COUT
2A51 C3282A             0340        JMP   INFIL
                        0345 ;
                        0350 ; PLACES CHARACTERS FROM INFIL: SEQUENTIALLY
                        0355 ; INTO AREA CALLED 'PNAME' TO BUILD INPUT
                        0360 ; FILE NAME. PRINTS 'NAME TOO LONG' ERROR
                        0365 ; IF 8 CHARACTERS ARE EXCEEDED.
                        0370 ;
2A54 77                 0375 STORE: MOV   M,A
2A55 47                 0380        MOV   B,A
2A56 CD0D20             0385        CALL  COUT
2A59 23                 0390        INX   H
2A5A 0D                 0395        DCR   C
2A5B C2282A             0400        JNZ   INFIL
2A5E CD6B3B             0405        CALL  CRLF
2A61 0E10               0410        MVI   C,16
2A63 211B31             0415        LXI   H,HDR7
2A66 CD5E3B             0420        CALL  PRINT
2A69 CD6B3B             0425        CALL  CRLF
2A6C C30F2A             0430        JMP   ASKFL
                        0435 ;
                        0440 ; ACCEPTS DISK UNIT NUMBER. CHECKS TO MAKE
                        0445 ; SURE INPUT IS ASCII 1, 2, OR 3.
                        0450 ;
2A6F 0E0C               0455 INUNT: MVI   C,12
2A71 213B3B             0460        LXI   H,HDR3
2A74 CD6B3B             0465        CALL  CRLF
2A77 CD5E3B             0470        CALL  PRINT
2A7A 219131             0475        LXI   H,DRIVE
2A7D CD1820             0480        CALL  CIN
2A80 47                 0485        MOV   B,A
2A81 CD0D20             0490        CALL  COUT
2A84 FE31               0495        CPI   31H
2A86 CAA42A             0500        JZ    GETCR
2A89 FE32               0505        CPI   32H
2A8B CAA42A             0510        JZ    GETCR
2A8E FE33               0515        CPI   33H
2A90 CAA42A             0520        JZ    GETCR
                        0525 ;
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                        0530 ; PRINTS 'INVALID UNIT' ERROR IF INPUT
                        0535 ; IS NOT EQUAL TO ASCII 1, 2, OR 3.
                        0540 ;
2A93 CD6830     0545 ERUNT: CALL  CRLF
2A96 0E0C       0550        MVI   C,12
2A98 212B31     0555        LXI   H,MSG0
2A9B CD5E30     0560        CALL  PRINT
2A9E CD6830     0565        CALL  CRLF
2AA1 C36F2A     0570        JMP   INUNT
                        0575 ;
                        0580 ; TRIMS ASCII INPUT UNIT # TO BINARY VALUE
                        0585 ; AND STORES IT IN AREA CALLED 'DRIVE'. ACCEPTS
                        0590 ; CR TO CONTINUE. ANY OTHER INPUT CAUSES
                        0595 ; 'INVALID UNIT' ERROR. PUTS ADDRESS OF PROGRAM
                        0600 ; NAME IN REG H/L AND VALUE OF DRIVE # IN REG
                        0605 ; A. CALLS DOS DIRECTORY LOOKUP ROUTINE
                        0610 ; AT 201CH. IF CARRY BIT IS SET ON RETURN
                        0615 ; 'NO PROGRAM' ERROR IS PRINTED.
                        0620 ;
2AA4 E60F       0625 GETCR: ANI   0FH
2AA6 77         0630        MOV   M,A
2AA7 CD1020     0635        CALL  CIN
2AAA 47         0640        MOV   B,A
2AAB CD0C20     0645        CALL  COUT
2AAE FE0D       0650        CPI   0DH
2AB0 C2932A     0655        JNZ   ERUNT
2AB3 060A       0660        MVI   B,0AH
2AB5 CD0C20     0665        CALL  COUT
2AB8 3A9131     0670        LDA   DRIVE
2ABB 218731     0675        LXI   H,PNAME
2ABE 37         0680        STC
2ABF 3F         0685        CMC
2AC0 CD1C20     0690        CALL  DIRCK
2AC3 D2D42A     0695        JNC   CKTYP
2AC6 0E19       0700        MVI   C,25
2AC8 21C330     0705        LXI   H,MSG8
2ACB CD5E30     0710        CALL  PRINT
2ACE CD6830     0715        CALL  CRLF
2AD1 C30F2A     0720        JMP   ASKFL
                        0725 ;
                        0730 ; CHECKS FILE TYPE TO INSURE IT IS TYPE 2.
                        0735 ;
2AD4 0600       0740 CKTYP: MVI   B,0
2AD6 0E04       0745        MVI   C,4
2AD8 09         0750        DAD   B
2AD9 3E02       0755        MVI   A,2
2ADB BE         0760        CMP   M
2ADC CAED2A     0765        JZ    STADD
2ADF 0E12       0770        MVI   C,18
2AE1 21DC30     0775        LXI   H,MSG5
2AE4 CD5E30     0780        CALL  PRINT
2AE7 CD6830     0785        CALL  CRLF
2AEA C30F2A     0790        JMP   ASKFL
                        0795 ;
                        0800 ; STORES DATA FROM DISK DIRECTORY FOR THE FILE
                        0805 ; IN AREA CALLED 'DIR'.
                        0810 ;
2AED 2B         0815 STADD: DCX   H
2AEE 2B         0820        DCX   H
2AEF 2B         0825        DCX   H
2AF0 2B         0830        DCX   H
2AF1 0E08       0835        MVI   C,8
2AF3 110900     0840        LXI   D,DIR
2AF6 7E         0845 STAD1: MOV   A,M
2AF7 12         0850        STAX  D
2AF8 23         0855        INX   H
2AF9 13         0860        INX   D
2AFA 0D         0865        DCR   C
2AFB C2F62A     0870        JNZ   STAD1
                        0875 ;
                        0880 ; SETS LINKS IN AREA CALLED 'TABLE', INITIALIZES
                        0885 ; THE TOP POINTERS FOR THE FOUR LISTS 'SYTOP',
                        0890 ; 'STTOP', 'ARTOP', AND 'NMTOP', INITIALIZES THE
                        0895 ; AVAILABILITY POINTER 'AVAIL';
                        0900 ;
2AFE 2688       0905        MVI   H,88
2B00 2E00       0910        MVI   L,0
2B02 224333     0915        SHLD  ADDR
2B05 0600       0920        MVI   B,0
2B07 0E04       0925        MVI   C,4
2B09 118F33     0930        LXI   D,TABLE+2
2B0C 2A4333     0935 SLINK: LHLD  ADDR
2B0F 23         0940        INX   H
2B10 3E0C       0945        MVI   A,0CH
2B12 BC         0950        CMP   H
2B13 CA232B     0955        JZ    STOPS
2B16 224333     0960        SHLD  ADDR
2B19 62         0965        MOV   H,D
2B1A 6B         0970        MOV   L,E
2B1B 09         0975        DAD   B
2B1C EB         0980        XCHG
2B1D 73         0985        MOV   M,E
2B1E 23         0990        INX   H
2B1F 72         0995        MOV   M,D
2B20 C30C2B     1000        JMP   SLINK
2B23 3EFF       1005 STOPS: MVI   A,0FFH
2B25 23         1010        INX   H
2B26 77         1015        MOV   M,A
2B27 26BB       1020        MVI   H,0BBH
2B29 2EBB       1025        MVI   L,0BBH
2B2B 22A632     1030        SHLD  SYTOP
2B2E 22A832     1035        SHLD  STTOP
2B31 22AA32     1040        SHLD  ARTOP
2B34 22AC32     1045        SHLD  NMTOP
2B37 218F33     1050        LXI   H,TABLE+2
2B3A 22AE32     1055        SHLD  AVAIL
2B3D CD2F30     1060        CALL  RELBLK
                        1065 ;
                        1070 ; BEGINS PROCESSING FOR A LINE OF BASIC CODE.
                        1075 ; STORES LINE NUMBER AND LINE LENGTH.
                        1080 ;

2B40 AF         1085 NEWLN: XRA   A
2B41 329732     1090        STA   MARK
2B44 3C         1095        INR   A
2B45 EB         1100        XCHG
2B46 BE         1105        CMP   M
2B47 CABC2B     1110        JZ    PRTRN
2B4A EB         1115        XCHG
2B4B CD7330     1120        CALL  NXTCR
2B4E 1A         1125        LDAX  D
2B4F 32A232     1130        STA   LOLIN
2B52 CD7330     1135        CALL  NXTCR
2B55 1A         1140        LDAX  D
2B56 32A332     1145        STA   HILIN
2B59 AF         1150        XRA   A
2B5A 32A132     1155        STA   LNTAB
2B5D CD7330     1160        CALL  NXTCR
2B60 62         1165 NEWL1: MOV   H,D
2B61 6B         1170        MOV   L,E
2B62 3E20       1175        MVI   A,20H
2B64 BE         1180        CMP   M
2B65 CA6E2B     1185        JZ    NEWL6
2B68 3E6F       1190        MVI   A,6FH
2B6A BE         1195        CMP   M
2B6B C27D2B     1200        JNZ   NEWL2
2B6E 3E01       1205        MVI   A,1
2B70 329732     1210        STA   MARK
2B73 3E22       1215 NEWL2: MVI   A,22H
2B75 BE         1220        CMP   M
2B76 C2902B     1225        JNZ   NEWL4
2B79 3A9732     1230        LDA   MARK
2B7C FE02       1235        CPI   02H
2B7E C2882B     1240        JNZ   NEWL3
2B81 AF         1245        XRA   A
2B82 329732     1250        STA   MARK
2B85 C3B62B     1255        JMP   NEWL6
2B88 3E02       1260 NEWL3: MVI   A,2
2B8A 329732     1265        STA   MARK
2B8D C3B62B     1270        JMP   NEWL6
2B90 3A9732     1275 NEWL4: LDA   MARK
2B93 FE04       1280        CPI   04
2B95 C29E2B     1285        JNZ   NEWL6
2B98 3E9A       1290        MVI   A,9AH
2B9A BE         1295        CMP   M
2B9B C2A42B     1300        JNZ   NEWL5
2B9E CDC82B     1305        CALL  STNUM
2BA1 C3B62B     1310        JMP   NEWL6
2BA4 3E40       1315 NEWL5: MVI   A,40H
2BA6 BE         1320        CMP   M
2BA7 D2B62B     1325        JNC   NEWL6
2BAA 3E5A       1330        MVI   A,5AH
2BAC BE         1335        CMP   M
2BAD DA662B     1340        JC    NEWL6
2BB0 CDEA2B     1345        CALL  GETSY
2BB3 C3B92B     1350        JMP   NEWL7
2BB6 CD7330     1355 NEWL6: CALL  NXTCR
2BB9 3E0D       1360 NEWL7: MVI   A,0DH
2BBB 21A132     1365        LXI   H,LNTAB-
2BBE BE         1370        CMP   M
2BBF C2662B     1375        JNZ   NEWL1
2BC2 CD7330     1380        CALL  NXTCR
2BC5 C3402B     1385        JMP   NEWLN
                        1390 ;
                        1395 ; EXTRACTS A LINE NUMBER REFERENCE
                        1400 ; AND PLACES IT IN 'VALHI' AND 'VALLO'
                        1405 ; THEN CALLS THE SEARCH AND INSERT
                        1410 ; NODE ROUTINES
                        1415 ;
2BC8 CD7330     1420 STNUM: CALL  NXTCR
2BCB 1A         1425        LDAX  D
2BCC 32A532     1430        STA   VALLO
2BCF CD7330     1435        CALL  NXTCR
2BD2 1A         1440        LDAX  D
2BD3 32A432     1445        STA   VALHI
2BD6 AF         1450        XRA   A
2BD7 32A132     1455        STA   LNTAB
2BDA 2AAC32     1460        LHLD  NMTOP
2BDD 22B032     1465        SHLD  TOP
2BE0 CD7A2C     1470        CALL  SERCH
2BE3 2AB032     1475        LHLD  TOP
2BE6 22AC32     1480        SHLD  NMTOP
2BE9 C9         1485        RET
                        1490 ;
                        1495 ; EXTRACT A SYMBOL AND DETERMINE WHICH
                        1500 ; LIST IT BELONGS IN.  CALLS THE
                        1505 ; SEARCH AND INSERT NODE ROUTINES.
                        1510 ;
2BEA 3E20       1515 GETSY: MVI   A,20H
2BEC 32A532     1520        STA   VALLO
2BEF 32A432     1525        STA   VALHI
2BF2 1A         1530        LDAX  D
2BF3 32A432     1535        STA   VALHI
2BF6 CD7330     1540        CALL  NXTCR
2BF9 3E8D       1545        MVI   A,0DH
2BFB 21A132     1550        LXI   H,LNTAB
2BFE BE         1555        CMP   M
2BFF C2082C     1560        JNZ   GETS1
2C02 C94A2C     1565        CALL  STRSY
2C05 C3492C     1570        JMP   GETS5
2C08 62         1575 GETS1: MOV   H,D
2C09 6B         1580        MOV   L,E
2C0A 3E2F       1585        MVI   A,2FH
2C0C BE         1590        CMP   M
2C0D D22C2C     1595        JNC   GETS2
2C10 3E39       1600        MVI   A,39H
2C12 BE         1605        CMP   M
2C13 DA2C2C     1610        JC    GETS2
2C16 1A         1615        LDAX  D
2C17 32A532     1620        STA   VALLO
2C1A CD7330     1625        CALL  NXTCR
2C1D 3E0D       1630        MVI   A,0DH
2C1F 21A132     1635        LXI   H,LNTAB
2C22 BE         1640        CMP   M
2C23 C2202C     1645        JNZ   GETS2
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2C26 CD4A2C     1650            CALL    STRSY
2C29 C3492C     1655            JMP     GETS5
2C2C 62         1660 GETS2:     MOV     H,D
2C2D 6B         1665            MOV     L,E
2C2E 3E24       1670            MVI     A,24H
2C30 BE         1675            CMP     M
2C31 C23A2C     1680            JNZ     GETS3
2C34 CD5A2C     1685            CALL    STRST
2C37 C3492C     1690            JMP     GETS5
2C3A 3EE0       1695 GETS3:     MVI     A,0E0H
2C3C BE         1700            CMP     M
2C3D C2462C     1705            JNZ     GETS4
2C40 CD6A2C     1710            CALL    STRAR
2C43 C3492C     1715            JMP     GETS5
2C46 CD4A2C     1720 GETS4:     CALL    STRSY
2C49 C9         1725 GETS5:     RET
                1730 ;
                1735 ; SETS SYMBOL LIST TOP POINTER AND CALLS
                1740 ; SEARCH AND INSERT NODE ROUTINES.
                1745 ;
2C4A 2AA632     1750 STRSY:     LHLD    SYTOP
2C4D 22B032     1755            SHLD    TOP
2C50 CD7A2C     1760            CALL    SERCH
2C53 2AB032     1765            LHLD    TOP
2C56 22A632     1770            SHLD    SYTOP
2C59 C9         1775            RET
                1780 ;
                1785 ; SETS TOP POINTER TO STRING LIST TOP AND
                1790 ; CALLS SEARCH AND INSERT NODE ROUTINES.
                1795 ;
2C5A 2AA832     1800 STRST:     LHLD    STTOP
2C5D 22B032     1805            SHLD    TOP
2C60 CD7A2C     1810            CALL    SERCH
2C63 2AB032     1815            LHLD    TOP
2C66 22A832     1820            SHLD    STTOP
2C69 C9         1825            RET
                1830 ;
                1835 ; SETS TOP POINTER TO ARRAY LIST TOP AND
                1840 ; CALLS SEARCH AND INSERT NODE ROUTINES.
                1845 ;
2C6A 2AAA32     1850 STRAR:     LHLD    ARTOP
2C6D 22B032     1855            SHLD    TOP
2C70 CD7A2C     1860            CALL    SERCH
2C73 2AB032     1865            LHLD    TOP
2C76 22AA32     1870            SHLD    ARTOP
2C79 C9         1875            RET
                1880 ;
                1885 ; SEARCH AND STORE ROUTINE
                1890 ;
2C7A 229C32     1895 SERCH:     SHLD    NEXT
2C7D EB         1900            XCHG
2C7E 229E32     1905            SHLD    POINT
2C81 3EBB       1910            MVI     A,0BBH
2C83 329B32     1915            STA     LAST
2C86 329932     1920            STA     LAST+1
2C89 2AAE32     1925            LHLD    AVAIL
2C8C 229A32     1930            SHLD    PRSNT
2C8F 2B         1935            DCX     H
2C90 3AA432     1940            LDA     VALHI
2C93 77         1945            MOV     M,A
2C94 2B         1950            DCX     H
2C95 3AA532     1955            LDA     VALLO
2C98 77         1960            MOV     M,A
2C99 23         1965            INX     H
2C9A 23         1970            INX     H
2C9B 3EBB       1975            MVI     A,0BBH
2C9D 77         1980            MOV     M,A
2C9E 23         1985            INX     H
2C9F 77         1990            MOV     M,A
2CA0 23         1995            INX     H
2CA1 23         2000            INX     H
2CA2 23         2005            INX     H
2CA3 7E         2010            MOV     A,M
2CA4 32AE32     2015            STA     AVAIL
2CA7 3ECC       2020            MVI     A,0CCH
2CA9 77         2025            MOV     M,A
2CAA 23         2030            INX     H
2CAB 7E         2035            MOV     A,M
2CAC 32AF32     2040            STA     AVAIL+1
2CAF 3ECC       2045            MVI     A,0CCH
2CB1 77         2050            MOV     M,A
2CB2 2A9C32     2055            LHLD    NEXT
2CB5 3EBB       2060            MVI     A,0BBH
2CB7 BC         2065            CMP     H
2CB8 C2C92C     2070            JNZ     SERC2
2CBB BD         2075            CMP     L
2CBC C2C92C     2080            JNZ     SERC2
2CBF 2A9A32     2085 SERC1:     LHLD    PRSNT
2CC2 229B32     2090            SHLD    TOP
2CC5 CD752D     2095            CALL    LNNUM
2CC8 C9         2100            RET
2CC9 2B         2105 SERC2:     DCX     H
2CCA 56         2110            MOV     D,M
2CCB 3AA432     2115            LDA     VALHI
2CCE BA         2120            CMP     D
2CCF CA322D     2125            JZ      DEQUA
2CD2 D2FB2C     2130            JNC     DLESA
                2135 ;
                2140 ; SETS THE LINKS IN THE APPROPRIATE LIST
                2145 ; TO REFLECT THE PROPER SEQUENCE FOR THE
                2150 ; CURRENT ITEM.
                2155 ;
2CD5 2A9A32     2160 DGRTA:     LHLD    PRSNT
2CD8 3A9C32     2165            LDA     NEXT
2CDB 77         2170            MOV     M,A
2CDC 23         2175            INX     H
2CDD 3A9D32     2180            LDA     NEXT+1
2CE0 77         2185            MOV     M,A
2CE1 2A9B32     2190            LHLD    LAST
2CE4 3EBB       2195            MVI     A,0BBH
2CE6 BC         2200            CMP     H
2CE7 C2EEEC     2205            JNZ     DGRT1
2CEA BD         2210            CMP     L
2CEB CABF2C     2215            JZ      SERC1
2CEE 3A9A32     2220 DGRT1:     LDA     PRSNT
2CF1 77         2225            MOV     M,A
2CF2 23         2230            INX     H
2CF3 3A9B32     2235            LDA     PRSNT+1
2CF6 77         2240            MOV     M,A
2CF7 CD752D     2245            CALL    LNNUM
2CFA C9         2250            RET
                2255 ;
                2260 ; CONTINUES TO SEARCH THE APPROPRIATE
                2265 ; LIST FOR THE PROPER PLACE IN WHICH
                2270 ; TO INSERT THE CURRENT ITEM.
                2275 ;
2CFB 3EBB       2280 DLESA:     MVI     A,0BBH
2CFD 2A9C32     2285            LHLD    NEXT
2D00 BC         2290            CMP     H
2D01 C2162D     2295            JNZ     DLES2
2D04 BD         2300            CMP     L
2D05 C2162D     2305            JNZ     DLES2
2D08 2A9B32     2310 DLES1:     LHLD    LAST
2D0B 3A9A32     2315            LDA     PRSNT
2D0E 77         2320            MOV     M,A
2D0F 23         2325            INX     H
2D10 3A9B32     2330            LDA     PRSNT+1
2D13 77         2335            MOV     M,A
2D14 CD752D     2340            CALL    LNNUM
2D17 C9         2345            RET
2D18 2A9C32     2350 DLES2:     LHLD    NEXT
2D1B 229B32     2355            SHLD    LAST
2D1E 5E         2360            MOV     E,M
2D1F 23         2365            INX     H
2D20 56         2370            MOV     D,M
2D21 EB         2375            XCHG
2D22 229C32     2380            SHLD    NEXT
2D25 3EBB       2385            MVI     A,0BBH
2D27 BC         2390            CMP     H
2D28 C2C92C     2395            JNZ     SERC2
2D2B BD         2400            CMP     L
2D2C C2C92C     2405            JNZ     SERC2
2D2F C3082D     2410            JMP     DLES1
                2415 ;
                2420 ; CHECKS TO SEE IF THE CURRENT ITEM IS
                2425 ; IS ALREADY IN THE APPROPRIATE LIST.
                2430 ;
2D32 2B         2435 DEQUA:     DCX     H
2D33 56         2440            MOV     D,M
2D34 3AA532     2445            LDA     VALLO
2D37 BE         2450            CMP     M
2D38 CA412D     2455            JZ      DEQU1
2D3B D2FB2C     2460            JNC     DLESA
2D3E C3D52C     2465            JMP     DGRTA
2D41 2AAE32     2470 DEQU1:     LHLD    AVAIL
2D44 2B         2475            DCX     H
2D45 2B         2480            DCX     H
2D46 2B         2485            DCX     H
2D47 3AAF32     2490            LDA     AVAIL+1
2D4A 77         2495            MOV     M,A
2D4B 2B         2500            DCX     H
2D4C 3AAE32     2505            LDA     AVAIL
2D4F 77         2510            MOV     M,A
2D50 2B         2515            DCX     H
2D51 2B         2520            DCX     H
2D52 2B         2525            DCX     H
2D53 EB         2530            XCHG
2D54 2AAE32     2535            LHLD    AVAIL
2D57 2B         2540            DCX     H
2D58 2B         2545            DCX     H
2D59 2B         2550            DCX     H
2D5A 2B         2555            DCX     H
2D5B 22AE32     2560            SHLD    AVAIL
2D5E EB         2565            XCHG
2D5F 3AAF32     2570            LDA     AVAIL+1
2D62 77         2575            MOV     M,A
2D63 2B         2580            DCX     H
2D64 3AAE32     2585            LDA     AVAIL
2D67 77         2590            MOV     M,A
2D68 22AE32     2595            SHLD    AVAIL
2D6B 2A9C32     2600            LHLD    NEXT
2D6E 229A32     2605            SHLD    PRSNT
2D71 CD752D     2610            CALL    LNNUM
2D74 C9         2615            RET
                2620 ;
                2625 ; INSERTS THE LINE NUMBER FOR THE
                2630 ; CURRENT ITEM IN THE LINE NUMBER
                2635 ; LIST FOR THAT ITEM.  THE NEW
                2640 ; LINE NUMBER IS ADDED AT THE END
                2645 ; OF THE LIST SINCE THEY ARE ENCOUNTERED
                2650 ; IN ORDER.
                2655 ;
2D75 2A9A32     2660 LNNUM:     LHLD    PRSNT
2D78 23         2665            INX     H
2D79 23         2670            INX     H
2D7A 23         2675            INX     H
2D7B 23         2680            INX     H
2D7C 3ECC       2685 LNNU1:     MVI     A,0CCH
2D7E BE         2690            CMP     M
2D7F C2852D     2695            JNZ     LNNU2
2D82 23         2700            INX     H
2D83 BE         2705            CMP     M
2D84 C2842D     2710            JNZ     LNNU2
2D87 2B         2715            DCX     H
2D88 3AAE32     2720            LDA     AVAIL
2D8B 77         2725            MOV     M,A
2D8C 23         2730            INX     H
2D8D 3AAF32     2735            LDA     AVAIL+1
2D90 77         2740            MOV     M,A
2D91 2AAE32     2745            LHLD    AVAIL
2D94 2B         2750            DCX     H
2D95 2B         2755            DCX     H
2D96 3AA232     2760            LDA     LOLIN
2D99 77         2765            MOV     M,A
2D9A 23         2770            INX     H
2D9B 3AA332     2775            LDA     HILIN
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2D9E 77          2780          MOV   M,A
2D9F 23          2785          INX   H
2DA0 7E          2790          MOV   A,M
2DA1 32AE32      2795          STA   AVAIL
2DA4 3ECC        2800          MVI   A,0CCH
2DA6 77          2805          MOV   M,A
2DA7 23          2810          INX   H
2DA8 7E          2815          MOV   A,M
2DA9 32AF32      2820          STA   AVAIL+1
2DAC 3ECC        2825          MVI   A,0CCH
2DAE 77          2830          MOV   M,A
2DAF 2A9E32      2835          LHLD  POINT
2DB2 EB          2840          XCHG
2DB3 C9          2845          RET
2DB4 2B          2850 LNNU2:   DCX   H
2DB5 5E          2855 LNNU3:   MOV   E,M
2DB6 23          2860          INX   H
2DB7 56          2865          MOV   D,M
2DB8 EB          2870          XCHG
2DB9 C37C2D      2875          JMP   LNNU1
                 2880 ;
                 2885 ; PRINTS THE NECESSARY HEADERS AND
                 2890 ; LOADS THE APPROPRIATE LIST TOP POINTERS
                 2895 ; FOR USE BY THE SEARCH AND PRINT ROUTINES.
                 2900 ;
2DBC 0E12        2905 PRTRN:   MVI   C,18
2DBE 214131      2910          LXI   H,HDR11
2DC1 CD6B3D      2915          CALL  CRLF
2DC4 CD5E3D      2920          CALL  PRINT
2DC7 CD6B3D      2925          CALL  CRLF
2DCA 2AA632      2930          LHLD  SYTOP
2DCD 229D32      2935          SHLD  TOP
2DD0 3E01        2940          MVI   A,1
2DD2 329732      2945          STA   MARK
2DD5 CD2F2E      2950          CALL  FNDSY
2DD8 CD6B3D      2955          CALL  CRLF
2DDB 0E10        2960          MVI   C,16
2DDD 215331      2965          LXI   H,HDR12
2DE0 CD5E3D      2970          CALL  PRINT
2DE3 CD6B3D      2975          CALL  CRLF
2DE6 2AA832      2980          LHLD  STTOP
2DE9 229D32      2985          SHLD  TOP
2DEC 3E02        2990          MVI   A,2
2DEE 329732      2995          STA   MARK
2DF1 CD2F2E      3000          CALL  FNDSY
2DF4 CD6B3D      3005          CALL  CRLF
2DF7 0E0F        3010          MVI   C,15
2DF9 216331      3015          LXI   H,HDR13
2DFC CD5E3D      3020          CALL  PRINT
2DFF CD6B3D      3025          CALL  CRLF
2E02 2AAA32      3030          LHLD  ARTOP
2E05 229D32      3035          SHLD  TOP
2E08 3E03        3040          MVI   A,3
2E0A 329732      3045          STA   MARK
2E0D CD2F2E      3050          CALL  FNDSY
2E10 CD6B3D      3055          CALL  CRLF
2E13 0E0C        3060          MVI   C,12
2E15 217231      3065          LXI   H,HDR14
2E18 CD5E3D      3070          CALL  PRINT
2E1B CD6B3D      3075          CALL  CRLF
2E1E 2AAC32      3080          LHLD  NMTOP
2E21 229D32      3085          SHLD  TOP
2E24 3E04        3090          MVI   A,4
2E26 329732      3095          STA   MARK
2E29 CD2F2E      3100          CALL  FNDSY
2E2C C32B20      3105          JMP   EXIT
                 3110 ;
                 3115 ; THIS SECTION USES THE CONTENTS OF 'TOP'
                 3120 ; AND FOLLOWS THE LINKS FOR THE APPROPRIATE
                 3125 ; LIST. AT EACH ELEMENT IT LOADS 'HOLDT'
                 3130 ; WITH THE LINE FOR THE LINE NUMBER
                 3135 ; REFERENCES AND FOLLOWS THAT LIST, PRINTING
                 3140 ; THE NUMBERS AS IT GOES.
                 3145 ;
2E2F 2A9D32      3150 FNDSY:   LHLD  TOP
2E32 3E88        3155          MVI   A,88H
2E34 BC          3160          CMP   H
2E35 C23B2E      3165          JNZ   FNDS1
2E38 BD          3170          CMP   L
2E39 C23B2E      3175          JNZ   FNDS1
2E3C 0E09        3180          MVI   C,9
2E3E 217E31      3185          LXI   H,HDR15
2E41 CD6B3D      3190          CALL  CRLF
2E44 CD5E3D      3195          CALL  PRINT
2E47 CD6B3D      3200          CALL  CRLF
2E4A C9          3205          RET
2E4B CD2120      3210 FNDS1:   CALL  BLKLN
2E4E 2A9D32      3215          LHLD  TOP
2E51 5E          3220          MOV   E,M
2E52 23          3225          INX   H
2E53 56          3230          MOV   D,M
2E54 2B          3235          DCX   H
2E55 EB          3240          XCHG
2E56 229C32      3245          SHLD  NEXT
2E59 3A9732      3250          LDA   MARK
2E5C FE04        3255          CPI   4
2E5E C26B2E      3260          JNZ   FNDS3
2E61 1B          3265          DCX   D
2E62 1A          3270          LDAX  D
2E63 32A432      3275          STA   VALHI
2E66 1B          3280          DCX   D
2E67 1A          3285          LDAX  D
2E68 32A532      3290          STA   VALLO
2E6B CD642F      3295          CALL  CONVR
2E6E 214533      3300          LXI   H,PLINE
2E71 EB          3305          XCHG
2E72 21B432      3310          LXI   H,NUMBR
2E75 0E05        3315          MVI   C,5
2E77 7E          3320 FNDS2:   MOV   A,M
2E78 12          3325          STAX  D
2E79 23          3330          INX   H
2E7A 13          3335          INX   D
2E7B 0D          3340          DCR   C
2E7C C2772E      3345          JNZ   FNDS2
2E7F 2A8032      3350          LHLD  TOP
2E82 EB          3355          XCHG
2E83 1B          3360          DCX   D
2E84 1B          3365          DCX   D
2E85 CDD92E      3370          CALL  LSTNM
2E88 C3C12E      3375          JMP   FNDS7
2E8B 214533      3380 FNDS3:   LXI   H,PLINE
2E8E 1B          3385          DCX   D
2E8F 1A          3390          LDAX  D
2E90 77          3395          MOV   M,A
2E91 23          3400          INX   H
2E92 1B          3405          DCX   D
2E93 1A          3410          LDAX  D
2E94 FE20        3415          CPI   20H
2E96 CA9B2E      3420          JZ    FNDS4
2E99 77          3425          MOV   M,A
2E9A 23          3430          INX   H
2E9B 3A9732      3435 FNDS4:   LDA   MARK
2E9E FE02        3440          CPI   2
2EA0 C2AC2E      3445          JNZ   FNDS5
2EA3 3E24        3450          MVI   A,24H
2EA5 77          3455          MOV   M,A
2EA6 CDDB2E      3460          CALL  LSTNM
2EA9 C3C12E      3465          JMP   FNDS7
2EAC FE03        3470 FNDS5:   CPI   3
2EAE C2BE2E      3475          JNZ   FNDS6
2EB1 3E28        3480          MVI   A,28H
2EB3 77          3485          MOV   M,A
2EB4 23          3490          INX   H
2EB5 3E29        3495          MVI   A,29H
2EB7 77          3500          MOV   M,A
2EB8 CDDB2E      3505          CALL  LSTNM
2EBB C3C12E      3510          JMP   FNDS7
2EBE CDDB2E      3515 FNDS6:   CALL  LSTNM
2EC1 2A9C32      3520 FNDS7:   LHLD  NEXT
2EC4 3E8B        3525          MVI   A,8BH
2EC6 BC          3530          CMP   H
2EC7 C2CF2E      3535          JNZ   FNDS8
2ECA BD          3540          CMP   L
2ECB C2CF2E      3545          JNZ   FNDS8
2ECE C9          3550          RET
2ECF CD6B3D      3555 FNDS8:   CALL  CRLF
2ED2 2A9C32      3560          LHLD  NEXT
2ED5 229D32      3565          SHLD  TOP
2ED8 C3ABE2      3570          JMP   FNDS1
                 3575 ;
                 3580 ; FOLLOWS EACH LINE NUMBER LIST AND PRINTS
                 3585 ; THE FORMATED NUMBERS.
                 3590 ;
2EDB 13          3595 LSTNM:   INX   D
2EDC 13          3600          INX   D
2EDD 13          3605          INX   D
2EDE 13          3610          INX   D
2EDF 13          3615          INX   D
2EE0 13          3620          INX   D
2EE1 13          3625          INX   D
2EE2 13          3630          INX   D
2EE3 13          3635          INX   D
2EE4 13          3640          INX   D
2EE5 AF          3645 LSTN1:   XRA   A
2EE6 329432      3650          STA   TAB
2EE9 3E06        3655          MVI   A,6
2EEB 329232      3660          STA   LINCT
2EEE 3E0C        3665          MVI   A,12
2EF0 329332      3670          STA   CHRCT
2EF3 215133      3675          LXI   H,PLINE+12
2EF6 229232      3680          SHLD  HOLDT
2EF9 1B          3690 LSTN2:   DCX   D
2EFA 1A          3695          LDAX  D
2EFB 32A432      3700          STA   VALHI
2EFE 1B          3705          DCX   D
2EFF 1A          3710          LDAX  D
2F00 32A532      3715          STA   VALLO
2F03 13          3720          INX   D
2F04 13          3725          INX   D
2F05 1A          3730          LDAX  D
2F06 329B32      3735          STA   LAST
2F09 13          3740          INX   D
2F0A 1A          3745          LDAX  D
2F0B 329C32      3750          STA   LAST+1
2F0E CD642F      3755          CALL  CONVR
2F11 2AB232      3760          LHLD  HOLDT
2F14 EB          3765          XCHG
2F15 21B432      3770          LXI   H,NUMBR
2F18 0E05        3775          MVI   C,5
2F1A 7E          3780 LSTN3:   MOV   A,M
2F1B 12          3785          STAX  D
2F1C 23          3790          INX   H
2F1D 13          3795          INX   D
2F1E 0D          3800          DCR   C
2F1F C21A2F      3805          JNZ   LSTN3
2F22 13          3810          INX   D
2F23 13          3815          INX   D
2F24 EB          3820          XCHG
2F25 229232      3825          SHLD  HOLDT
2F28 219332      3830          LXI   H,CHRCT
2F2B 3E07        3835          MVI   A,7
2F2D 86          3840          ADD   M
2F2E 329332      3845          STA   CHRCT
2F31 3A9232      3850          LDA   LINCT
2F34 3D          3855          DCR   A
2F35 CA4E2F      3860          JZ    LSTN4
2F38 329232      3865          STA   LINCT
2F3B 2A9B32      3870          LHLD  LAST
2F3E EB          3875          XCHG
2F3F 3ECC        3880          MVI   A,0CCH
2F41 BA          3885          CMP   D
2F42 C2F92E      3890          JNZ   LSTN2
2F45 BB          3895          CMP   E
2F46 C2F92E      3900          JNZ   LSTN2
2F49 3E01        3905          MVI   A,1
2F4B 329432      3910          STA   TAB
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2F4E 3A9332      LSTN4: LDA    CHRCT
2F51 4F                 MOV    C,A
2F52 214533             LXI    H,PLINE
2F55 CD5E30             CALL   PRINT
2F58 CD6830             CALL   CRLF
2F5B 3A9432             LDA    TAB
2F5E FE01               CPI    1
2F60 C26A2F             JNZ    LSTN6
2F63 2A9C32      LSTN5: LHLD   NEXT
2F66 22B032             SHLD   TOP
2F69 C9                 RET
2F6A 2A9832      LSTN6: LHLD   LAST
2F6D 3ECC               MVI    A,0CCH
2F6F BC                 CMP    H
2F70 C27A2F             JNZ    LSTN7
2F73 BD                 CMP    L
2F74 C27A2F             JNZ    LSTN7
2F77 C3632F             JMP    LSTN5
2F7A CD2130      LSTN7: CALL   BLKLN
2F7D 2A9832             LHLD   LAST
2F80 EB                 XCHG
2F81 C3E52E             JMP    LSTN1
                 ;
                 ; CONVERTS EACH NUMBER IN THE LINE NUMBER
                 ; LISTS FROM HEX TO DECIMAL (ASCII).  THIS IS
                 ; DONE BY INSPECTING EACH BIT OF THE STORED
                 ; LINE NUMBER BEGINNING WITH THE HIGH ORDER
                 ; BIT.  IF THE BIT IS ON, THE APPROPRIATE VALUE
                 ; (5 DIGITS) FROM THE DATA CALLED 'BASE:' ARE
                 ; ADDED DECIMALLY, ONE DIGIT AT A TIME, INTO
                 ; AN ACCUMULATOR AREA CALLED 'NUMBR:'.
                 ;
2F84 0E05        CONVR: MVI    C,5
2F86 AF                 XRA    A
2F87 21B432             LXI    H,NUMBR
2F8A 77          CONV1: MOV    M,A
2F8B 23                 INX    H
2F8C 0D                 DCR    C
2F8D C28A2F             JNZ    CONV1
2F90 AF                 XRA    A
2F91 329432             STA    TAB
2F94 210833             LXI    H,BASE+79
2F97 EB                 XCHG
2F98 3AA432             LDA    VALHI
2F9B 47          CONV2: MOV    B,A
2F9C 0E08               MVI    C,8
2F9E 78          CONV3: MOV    A,B
2F9F E680               ANI    80H
2FA1 C2AC2F             JNZ    CONV4
2FA4 1B                 DCX    D
2FA5 1B                 DCX    D
2FA6 1B                 DCX    D
2FA7 1B                 DCX    D
2FA8 1B                 DCX    D
2FA9 C3DD2F             JMP    CONV8
2FAC 21B832      CONV4: LXI    H,NUMBR+4
2FAF AF                 XRA    A
2FB0 329532             STA    CARRY
2FB3 3E05               MVI    A,5
2FB5 329632      CONV5: STA    COUNT
2FB8 1A                 LDAX   D
2FB9 86                 ADD    M
2FBA 77                 MOV    M,A
2FBB 3A9532             LDA    CARRY
2FBE 86                 ADD    M
2FBF FE0A               CPI    0AH
2FC1 CACC2F             JZ     CONV6
2FC4 D2CC2F             JNC    CONV6
2FC7 77                 MOV    M,A
2FC8 AF                 XRA    A
2FC9 C3D12F             JMP    CONV7
2FCC D60A        CONV6: SUI    0AH
2FCE 77                 MOV    M,A
2FCF 3E01               MVI    A,1
2FD1 329532      CONV7: STA    CARRY
2FD4 2B                 DCX    H
2FD5 1B                 DCX    D
2FD6 3A9632             LDA    COUNT
2FD9 3D                 DCR    A
2FDA C2B52F             JNZ    CONV5
2FDD 0D          CONV8: DCR    C
2FDE CAE72F             JZ     CONV9
2FE1 78                 MOV    A,B
2FE2 07                 RLC
2FE3 47                 MOV    B,A
2FE4 C39E2F             JMP    CONV3
2FE7 3A9432      CONV9: LDA    TAB
2FEA FE01               CPI    1
2FEC CAFA2F             JZ     CON10
2FEF 3E01               MVI    A,1
2FF1 329432             STA    TAB
2FF4 3AA532             LDA    VALLO
2FF7 C39B2F             JMP    CONV2
2FFA 0E05        CON10: MVI    C,5
2FFC 21B432             LXI    H,NUMBR
2FFF 7E          CON11: MOV    A,M
3000 C630               ADI    30H
3002 77                 MOV    M,A
3003 3A9432             LDA    TAB
3006 FE01               CPI    1
3008 C21B30             JNZ    CON13
300B 3E30               MVI    A,30H
300D BE                 CMP    M
300E C21730             JNZ    CON12
3011 3E20               MVI    A,20H
3013 77                 MOV    M,A
3014 C31B30             JMP    CON13
3017 AF          CON12: XRA    A
3018 329432             STA    TAB
301B 23          CON13: INX    H
301C 0D                 DCR    C
301D C2FF2F             JNZ    CON11
3020 C9                 RET
                 ;
                 ; FILLS THE PRINT LINE WITH SPACES (20H).
                 ;
3021 0E48        BLKLN: MVI    C,72
3023 214533             LXI    H,PLINE
3026 3E20               MVI    A,20H
3028 77          BLKL1: MOV    M,A
3029 23                 INX    H
302A 0D                 DCR    C
302B C22830             JNZ    BLKL1
302E C9                 RET
                 ;
                 ; THIS ROUTINE READS ONE 256 BYTE BLOCK
                 ; OF DATA FROM THE DISK INTO THE AREA
                 ; CALLED 'DATA'.
                 ;
302F 3E01        RDBLK: MVI    A,1
3031 0601               MVI    B,1
3033 219131             LXI    H,DRIVE
3036 4E                 MOV    C,M
3037 119231             LXI    D,DATA
303A 2A8933             LHLD   DIR
303D 23                 INX    H
303E 228933             SHLD   DIR
3041 2B                 DCX    H
3042 CD2220             CALL   RDDSK
3045 D25630             JNC    RDBL1
3048 0E0E               MVI    C,14
304A 213331             LXI    H,HDR10
304D CD5E30             CALL   PRINT
3050 CD6830             CALL   CRLF
3053 C32820             JMP    EXIT
3056 AF          RDBL1: XRA    A
3057 32A032             STA    BLKPT
305A 119231             LXI    D,DATA
305D C9                 RET
                 ;
                 ; PRINT STRING AT ADDRESS IN REG H/L FOR
                 ; NUMBER OF CHARACTERS IN REG C.
                 ;
305E 46          PRINT: MOV    B,M
305F CD0D20             CALL   COUT
3062 23                 INX    H
3063 0D                 DCR    C
3064 C25E30             JNZ    PRINT
3067 C9                 RET
                 ;
                 ; INSERT CR AND LF
                 ;
3068 060D        CRLF:  MVI    B,0DH
306A CD0D20             CALL   COUT
306D 060A               MVI    B,0AH
306F CD0D20             CALL   COUT
3072 C9                 RET
                 ;
                 ; CHECK BLOCK ROUTINE
                 ;
3073 13          NXTCR: INX    D
3074 21A032             LXI    H,BLKPT
3077 34                 INR    M
3078 CC2F30             CZ     RDBLK
307B 62                 MOV    H,D
307C 6B                 MOV    L,E
307D 3E0D               MVI    A,0DH
307F BE                 CMP    M
3080 C28630             JNZ    NXTC1
3083 32A132             STA    LNTAB
3086 C9          NXTC1: RET
                 ;
                 ; HEADERS
                 ;
3087 4E4F525448  HDR1:  DB     'NORTHSTAR BASIC PROGRAM SUPPORT'
30A6 4E414D4520  HDR2:  DB     'NAME OF PROGRAM: '
30B7 4F4E204452  HDR3:  DB     'ON DRIVE #: '
30C3 4E4F205052  HDR4:  DB     'NO PROGRAM WITH THAT NAME'
30DC 46494C4520  HDR5:  DB     'FILE IS NOT TYPE 2'
30EE 5441424C45  HDR6:  DB     'TABLE FULL - PARTIAL LIST SUPPLIED'
3110 4E414D4520  HDR7:  DB     'NAME IS TOO LONG'
3120 494E56414C  HDR8:  DB     'INVALID UNIT'
312C 4E4F20524F  HDR9:  DB     'NO ROOM'
3133 415247554D  HDR10: DB     'ARGUMENT ERROR'
3141 53594D424F  HDR11: DB     'SYMBOLIC VARIABLES'
3153 535452494E  HDR12: DB     'STRING VARIABLES'
3163 4152524159  HDR13: DB     'ARRAY VARIABLES'
3172 4C494E4520  HDR14: DB     'LINE NUMBERS'
317E 4E554C4C20  HDR15: DB     'NULL LIST'
3187             PNAME: DS     10
3191             DRIVE: DS     1
3192             DATA:  DS     256
3292             LINCT: DS     1
3293             CHRCT: DS     1
3294             TAB:   DS     1
3295             CARRY: DS     1
3296             COUNT: DS     1
3297             MARK:  DS     1
3298             LAST:  DS     2
329A             PRSNT: DS     2
329C             NEXT:  DS     2
329E             POINT: DS     2
32A0             BLKPT: DS     1
32A1             LNTAB: DS     1
32A2             LOLIN: DS     1
32A3             HILIN: DS     1
32A4             VALHI: DS     1
32A5             VALLO: DS     1
32A6             SYTOP: DS     2
32A8             STTOP: DS     2
32AA             ARTOP: DS     2
32AC             MMTOP: DS     2
32AE             AVAIL: DS     2
32B0             TOP:   DS     2
32B2             HOLDT: DS     2
32B4             NUMBR: DS     5
```

```
32B9 0000000001 5045 BASE:  DB    0,0,0,0,1,0,0,0,0,2,0,0,0,0,4,0,0,0,0
32CC 0000000001 5050        DB    8,0,0,0,1,6,0,0,0,3,2,0,0,0,6,4,0,0,1
32DF 0200000002 5055        DB    2,8,0,0,2,5,6,0,0,5,1,2,0,1,0,2,4,0,2
3272 0004080004 5060        DB    0,4,8,0,4,0,9,6,0,0,1,9,2,1,6,3,8,4,3
3305 02070608   5065        DB    2,7,6,8
3309            5070 DIR:   DS    8
3311            5075 STACK: DS    50
3343            5080 ADDR:  DS    2
3345            5085 PLINE: DS    72
338D            5090 TABLE: DS    12288
638D            5095        END   2A00H

DH 2A00)33FF
       ?
>DH 2A00-33FFF?
>DH 2A00-33FF
2A00  21 42 33 F9  0E 1F 21 87  30 CD 5E 30  CD 68 30 0E
2A10  11 21 A6 30  CD 5E 30 0E  0A 21 87 31  36 20 23 0D
2A20  C2 1C 2A 0E  09 21 87 31  CD 10 20 32  B2 32 FE 0D
2A30  CA 6F 2A FE  5F C2 $4 2A  3E 09 B9 CA  28 2A 3A B2
2A40  32 2B 0C 47  CD 0D 20 06  20 CD 0D 20  06 5F CD 0D
2A50  20 C3 28 2A  77 47 CD 0D  20 23 0D C2  28 2A CD 68
2A60  30 0E 10 21  10 31 CD 5E  30 CD 68 30  C3 0F 2A 0E
2A70  0C 21 B7 30  CD 68 30 CD  5E 30 21 91  31 CD 10 20
2A80  47 CD 0D 20  FE 31 CA A4  2A FE 32 CA  A4 2A FE 33
2A90  CA A4 2A CD  68 30 0E 0C  21 20 31 CD  5E 30 CD 68
2AA0  30 C3 6F 2A  E6 0F 77 CD  10 20 47 CD  0D 20 FE 0D
2AB0  C2 93 2A 06  0A CD 0D 20  3A 91 31 21  87 31 37 3F
2AC0  CD 1C 20 D2  DA 2A 0E 19  21 C3 30 CD  5E 30 CD 68
2AD0  30 C3 0F 2A  06 00 0E 04  09 3E 02 BE  CA ED 2A 0E
2AE0  12 21 DC 30  CD 5E 30 CD  68 30 C3 0F  2A 2B 2B 2B
2AF0  2B 0E 08 11  09 33 7E 12  23 13 0D C2  F6 2A 26 00
2B00  2E 00 22 43  33 06 00 0E  04 11 8F 33  2A 43 33 23
2B10  3E 0C BC CA  23 2B 22 43  33 62 6B 09  EB 73 23 72
2B20  C3 0C 2B 3E  FF 23 77 26  BD 2E BB 22  A6 32 22 A8
2B30  32 22 AA 32  22 AC 32 21  8F 33 22 AE  32 CD 2F 30
2B40  AF 32 97 32  3C EB BE CA  BC 2D EB CD  73 30 1A 32
2B50  A2 32 CD 73  30 1A 32 A3  32 AF 32 A1  32 CD 73 30
2B60  62 6B 3E 20  BE CA B6 2B  3E 8F BE C2  73 2B 3E 01
2B70  32 97 32 3E  22 BE C2 90  2B 3A 97 32  FE 02 C2 88
2B80  2B AF 32 97  32 C3 B6 2B  3E 02 32 97  32 C3 B6 2B
2B90  3A 97 32 FE  00 C2 B6 2B  3E 9A BE C2  A4 2B CD C8
2BA0  2B C3 B6 2B  3E 40 BE D2  B6 2B 3E 5A  BE DA B6 2B
2BB0  CD EA 2B C3  B9 2B CD 73  30 3E 0D 21  A1 32 BE C2
2BC0  60 2B CD 73  30 C3 40 2B  CD 73 30 1A  32 A5 32 CD
2BD0  73 30 1A 32  A4 32 AF 32  A1 32 2A AC  32 22 B0 32
2BE0  CD 7A 2C 2A  B0 32 22 AC  32 C9 3E 20  32 A5 32 32
2BF0  A4 32 1A 32  A4 32 CD 73  30 3E 0D 21  A1 32 BE C2
2C00  08 2C CD 4A  2C C3 49 2C  62 6B 3E 2F  BE D2 2C 2C
2C10  3E 39 BE DA  2C 2C 1A 32  A5 32 CD 73  30 3E 0D 21
2C20  A1 32 BE C2  2C 2C CD 4A  2C C3 49 2C  62 6B 3E 24
2C30  BE C2 3A 2C  CD 5A 2C C3  49 2C 3E E0  BE C2 46 2C
2C40  CD 6A 2C C3  49 2C CD 4A  2C C9 2A A6  32 22 B0 32
2C50  CD 7A 2C 2A  B0 32 22 A6  32 C9 2A A8  32 22 B0 32
2C60  CD 7A 2C 2A  B0 32 22 A8  32 C9 2A AA  32 22 B0 32
2C70  CD 7A 2C 2A  B0 32 22 AA  32 C9 22 9C  32 EB 22 9E
2C80  32 3E BB 32  98 32 32 99  32 2A AE 32  22 9A 32 2B
2C90  3A A4 32 77  2B 3A A5 32  77 23 23 3E  BB 77 23 77
2CA0  23 23 23 7E  32 AE 32 3E  CC 77 23 7E  32 AF 32 3E
2CB0  CC 77 2A 9C  32 3E BB BC  C2 C9 2C BD  C2 C9 2C 2A
2CC0  9A 32 22 B0  32 CD 75 2D  C9 2B 56 3A  A4 32 BA CA
2CD0  32 2D D2 FB  2C 2A 9A 32  3A 9C 32 77  23 3A 9D 32
2CE0  77 2A 98 32  3E BB BC C2  EE 2C BD CA  BF 2C 3A 9A
2CF0  32 77 23 3A  9B 32 77 CD  75 2D C9 3E  BB 2A 9C 32
2D00  BC C2 18 2D  BD C2 18 2D  2A 98 32 3A  9A 32 77 23
2D10  3A 9B 32 77  CD 75 2D C9  2A 9C 32 22  98 32 5E 23
2D20  56 EB 22 9C  32 3E BB BC  C2 C9 2C BD  C2 C9 2C C3
2D30  06 2D 2B 56  3A A5 32 BE  CA 41 2D D2  FB 2C C3 D5
2D40  2C 2A AE 32  2B 2B 2B 3A  AF 32 77 2B  3A AE 32 77
2D50  2B 2B 2B EB  2A AE 32 2B  2B 2B 2B 22  AE 32 EB 3A
2D60  AF 32 77 2B  3A AE 32 77  22 AE 32 2A  9C 32 22 9A
2D70  32 CD 75 2D  C9 2A 9A 32  23 23 23 23  3E CC BE C2
2D80  B5 2D 23 BE  C2 B4 2D 2B  3A AE 32 77  23 3A AF 32
2D90  77 2A AE 32  2B 2B 3A A2  32 77 23 3A  A3 32 77 23
2DA0  7E 32 AE 32  3E CC 77 23  7E 32 AF 32  3E CC 77 2A
2DB0  9E 32 EB C9  2B 5E 23 56  EB C3 7C 2D  0E 12 21 41
2DC0  31 CD 68 30  CD 5E 30 CD  68 30 2A A6  32 22 B0 32
2DD0  3E 01 32 97  32 CD 2F 2E  CD 68 30 0E  10 21 53 31
2DE0  CD 5E 30 CD  68 30 2A A8  32 22 B0 32  3E 02 32 97
2DF0  32 CD 2F 2E  CD 68 30 0E  0F 21 63 31  CD 5E 30 CD
2E00  68 30 2A AA  32 22 B0 32  3E 03 32 97  32 CD 2F 2E
2E10  CD 68 30 0E  0C 21 72 31  CD 5E 30 CD  68 30 2A AC
2E20  32 22 B0 32  3E 04 32 97  32 CD 2F 2E  C3 28 20 2A
2E30  B0 32 3E BB  BC C2 4B 2E  BD C2 4B 2E  0E 09 21 7E
2E40  31 CD 68 30  CD 5E 30 CD  68 30 C9 CD  21 30 2A B0
2E50  32 5E 23 56  2B EB 22 9C  32 3A 97 32  FE 04 C2 8B
2E60  2E 1B 1A 32  A4 32 1B 1A  32 A5 32 CD  84 2F 21 45
2E70  33 EB 21 B4  32 0E 05 7E  12 23 13 0D  C2 77 2E 2A
2E80  B0 32 EB 1B  1B CD DB 2E  C3 C1 2E 21  45 33 1B 1A
2E90  77 23 1B 1A  FE 20 CA 9B  2E 77 23 3A  97 32 FE 02
2EA0  C2 AC 2E 3E  24 77 CD DB  2E C3 C1 2E  FE 03 C2 BE
2EB0  2E 3E 28 77  23 3E 29 77  CD DB 2E C3  C1 2E CD DB
2EC0  2E 2A 9C 32  3E BB BC C2  CF 2E BD C2  CF 2E C9 CD
2ED0  68 30 2A 9C  32 22 B0 32  C3 4B 2E 13  13 13 13 13
2EE0  13 13 13 13  13 AF 32 94  32 3E 08 32  92 32 3E 0C
2EF0  32 93 32 21  51 33 22 B2  32 1B 1A 32  A4 32 1B 1A
2F00  32 A5 32 13  13 1A 32 98  32 13 1A 32  99 32 CD 84
2F10  2F 2A B2 32  EB 21 B4 32  0E 05 7E 12  23 13 0D C2
2F20  1A 2F 13 13  EB 22 B2 32  21 93 32 3E  87 86 32 93
2F30  32 3A 92 32  3D CA 4E 2F  32 92 32 2A  98 32 EB 3E
2F40  CC BA C2 F9  2E BB C2 F9  2E 3E 01 32  94 32 3A 93
2F50  32 4F 21 45  33 CD 5E 30  CD 68 30 3A  94 32 FE 01
2F60  C2 6A 2F 2A  9C 32 22 B0  32 C9 2A 98  32 3E CC BC
2F70  C2 7A 2F BD  C2 7A 2F C3  63 2F CD 21  30 2A 98 32
2F80  EB C3 E5 2E  0E 05 AF 21  B4 32 77 23  0D C2 8A 2F
2F90  AF 32 94 32  21 08 33 EB  3A A4 32 47  0E 08 78 E6
2FA0  80 C2 AC 2F  1B 1B 1B 1B  1B C3 DD 2F  21 B8 32 AF
2FB0  32 95 32 3E  05 32 96 32  1A 86 77 3A  95 32 86 FE
2FC0  0A CA CC 2F  D2 CC 2F 77  AF C3 D1 2F  D6 0A 77 3E
2FD0  01 32 95 32  2B 1B 3A 96  32 3D C2 B5  2F 0D CA E7
2FE0  2F 78 07 47  C3 9E 2F 3A  94 32 FE 01  CA FA 2F 3E
2FF0  01 32 94 32  3A A5 32 C3  9B 2F 0E 05  21 B4 32 7E
3000  C6 30 77 3A  94 32 FE 01  C2 1B 30 3E  30 BE C2 17
3010  30 3E 20 77  C3 1B 30 AF  32 94 32 23  0D C2 FF 2F
3020  C9 0E 48 21  45 33 3E 20  77 23 0D C2  28 30 C9 3E
3030  01 06 01 21  91 31 4E 11  92 31 2A 09  33 23 22 09
3040  33 2B CD 22  20 D2 56 30  0E 0E 21 33  31 CD 5E 30
3050  CD 68 30 C3  28 20 AF 32  A0 32 11 92  31 C9 46 CD
3060  0D 20 23 0D  C2 5E 30 C9  06 0D CD 0D  20 06 0A CD
3070  0D 20 C9 13  21 A0 32 34  CC 2F 30 62  6B 3E 0D BE
3080  C2 86 30 32  A1 32 C9 4E  4F 52 54 48  53 54 41 52
3090  20 42 41 53  49 43 20 50  52 4F 47 52  41 4D 20 53
30A0  55 50 50 4F  52 54 4E 41  4D 45 20 4F  46 20 50 52
30B0  4F 47 52 41  4D 3A 20 4F  4E 20 44 52  49 56 45 20
30C0  23 3A 20 4E  4F 20 50 52  4F 47 52 41  4D 20 57 49
30D0  54 48 20 54  48 41 54 20  4E 41 4D 45  46 49 AC 45
30E0  20 49 53 20  4E 4F 54 20  54 59 50 45  20 32 54 41
30F0  42 4C 45 20  46 55 4C 4C  20 2D 20 50  41 52 54 49
3100  41 4C 20 4C  49 53 54 20  53 55 50 50  4C 49 45 44
3110  4E 41 4D 45  20 49 53 20  54 4F 4F 20  4C 4F 4E 47
3120  49 4E 56 41  4C 49 44 20  55 4E 49 54  4E 4F 20 52
3130  4F 4F 4D 41  52 47 55 4D  45 4E 54 20  45 52 52 4F
3140  52 53 59 4D  42 4F 4C 49  43 20 56 41  52 49 41 42
3150  4C 45 53 53  54 52 49 4E  47 20 56 41  52 49 41 42
3160  4C 45 53 41  52 52 41 59  20 56 41 52  49 41 42 4C
3170  45 53 4C 49  4E 45 20 4E  55 4D 42 45  52 53 4E 55
3180  4C 4C 20 4C  49 53 54 54  41 42 4C 45  2B 32 0D 0A
3190  31 37 32 30  20 53 4C 49  4E 4B 3A 20  4C 4B 4C 44
31A0  20 20 41 44  44 52 0D 0A  31 37 33 30  20 20 20 20
31B0  20 20 20 20  49 4E S8 20  20 20 48 0D  0A 31 37 33
31C0  32 20 20 20  20 20 20 20  20 4D 56 49  20 20 20 41
31D0  2C 30 43 48  0D 0A 31 37  33 34 20 20  20 20 20 20
31E0  20 20 43 AD  50 20 20 20  48 0D 0A 31  37 33 36 20
31F0  20 20 20 20  20 20 20 4A  5A 20 20 20  20 53 54 4F
3200  50 53 0D 0A  31 37 33 37  20 20 20 20  20 20 20 20
3210  53 48 4C 44  20 20 41 44  44 52 0D 0A  31 37 33 38
3220  20 20 20 20  20 20 20 20  4D 4F 56 20  20 20 48 2C
3230  44 0D 0A 31  37 34 30 20  20 20 20 20  20 20 20 4D
3240  4F 56 20 20  20 4C 2C 45  0D 0A 31 37  35 30 20 20
3250  20 20 20 20  20 20 44 41  44 20 20 20  42 0D 0A 31
3260  37 36 30 20  20 20 20 20  20 20 20 58  43 48 47 0D
3270  0A 31 37 36  32 20 20 20  20 20 20 20  20 4D 4F 56
3280  20 20 20 4D  2C 45 0D 0A  31 37 36 34  20 20 20 20
3290  20 20 20 20  49 4E 58 20  20 20 48 0D  0A 31 37 36
32A0  36 20 20 20  20 20 20 20  20 4D 4F 56  20 20 20 4D
32B0  2C 44 0D 0A  31 37 36 38  20 00 00 00  00 01 00 00
32C0  00 00 02 00  00 00 00 04  00 00 00 00  08 00 00 00
32D0  01 06 00 00  00 03 02 00  00 00 06 04  00 00 01 02
32E0  08 00 00 02  05 06 00 00  05 01 02 00  01 00 02 04
32F0  00 02 00 04  08 00 04 00  09 06 00 08  01 09 02 01
3300  06 03 08 04  03 02 07 06  08 4F 56 20  20 20 4D 2C
3310  41 0D 0A 31  37 39 30 20  20 20 20 20  20 20 20 4D
3320  56 49 20 20  20 48 2C 30  42 42 48 0D  0A 31 38 30
3330  30 20 20 20  20 20 20 20  20 AD 56 49  20 20 20 4C
3340  2C 30 42 42  48 0D 0A 31  38 31 30 20  20 20 20 20
3350  20 20 20 53  48 4C 44 20  20 53 59 54  4F 50 0D 0A
3360  31 38 32 30  20 20 20 20  20 20 20 20  53 48 4C 44
3370  20 20 53 54  54 4F 50 0D  0A 31 38 33  30 20 20 20
3380  20 20 20 20  20 53 48 4C  44 20 20 41  52 54 4F 50
3390  0D 0A 31 38  34 30 20 20  20 20 20 20  20 20 53 48
33A0  4C 44 20 20  4E AD 54 4F  50 0D 0A 31  38 35 30 20
33B0  20 20 20 20  20 20 20 4C  58 49 20 20  20 48 2C 54
33C0  41 42 4C 45  2B 32 0D 0A  31 38 36 30  20 20 20 20
33D0  20 20 20 20  53 48 4C 44  20 20 41 56  41 49 4C 0D
33E0  0A 31 39 30  30 20 20 20  20 20 20 20  20 43 41 4C
33F0  4C 20 20 52  44 42 4C 4B  0D 0A 31 39  31 30 20 3B
```

```
SYMBOLIC VARIABLES
A                310   340   370   560   705
B                330   340   360   560   705
C                350   360   370   560   705
D                480   480   530   532   560
E                480   480   480   480   480   530   534   560
F                480   480   480   532   534   560
I                285   286   565   580   680   630
J                286   286   570   580   682   620
P                470   520   590   590   610   610   640   650
                 660   680
T                400   410   690   750
X                286   430   440   445   480   480   705   710
STRING VARIABLES
A$               50    80    820   830
ARRAY VARIABLES
Z()              305   560   560   560   560   560   560   580
                 580
LINE NUMBERS
  285            80
  290            830
  330            340
  350            360   370
  410            460   550
  450            440
  470            445
  540            530   532   534
  560            530
  620            580   600
  680            650
  690            670
  750            520   640
  820            740
```

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