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PDP-15
SYSTEM SOFTWARE
PROGRAM SOLUTIONS

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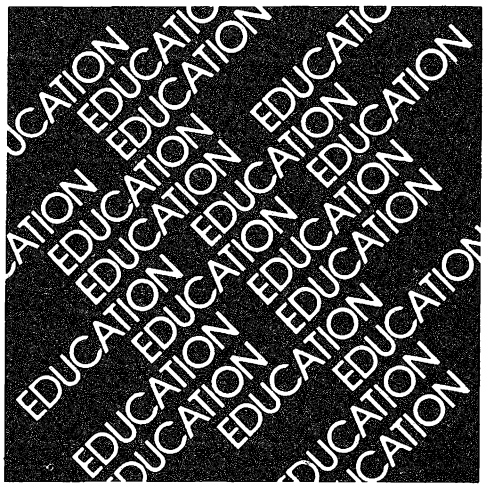

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```
                        .TITLE PROGRAM (#1) COUNTS # OF BITS SET IN DSW
                       /PROGRAM COUNTS THE NUMBER OF BITS SET TO 1 IN THE DATA
                       /SWITCH REGISTER,  BY ROTATING THE VALUE THROUGH THE
                       /AC AND CHECKING TO SEE IF BIT 17 IS SET.  THE RESULT
                       /IS PLACED IN THE ACCUMULATOR SO THAT IT IS DISPLAYED
                       /ON THE CONSOLE LIGHTS WHEN THE PROGRAM HALTS.
                       /
                       /RELOCATABLE PROGRAM
                       /
00000 R 740040 A       START   HLT             /HOW FAST ARE YOU?
00001 R 750004 A               LAS             /READ DATA SWITCHES INTO AC.
00002 R 040022 R               DAC TEST        /SAVE VALUE IN TEST.
                       /
00003 R 777756 A               LAW -22         /PUT -18 DECIMAL INTO AC
00004 R 040024 R               DAC COUNT       /AND STORE IT IN COUNT.
00005 R 140023 R               DZM BITS        /CLEAR LOCATION BITS TO ZERO.
                       /
00006 R 200022 R       NEXT    LAC TEST        /LOAD AC WITH TEST.
00007 R 500025 R               AND (1          /GET RID OF ALL BUT BIT 17.
                       /
00010 R 740200 A               SZA             /SKIP IF AC=0.
00011 R 440023 R               ISZ BITS        /BIT 17=1, SO ADD 1 TO BITS.
00012 R 200022 R               LAC TEST        /GET TEST
00013 R 740020 A               RAR             /ROTATE 1 PLACE TO THE RIGHT.
00014 R 040022 R               DAC TEST        /REPLACE VALUE OF TEST.
                       /
00015 R 440024 R               ISZ COUNT       /SEE IF DONE 18 TIMES YET.
00016 R 600006 R               JMP NEXT        /NOT DONE, GO BACK FOR NEXT BIT.
                       /
00017 R 200023 R               LAC BITS        /DISPLAY BIT COUNT IN AC.
00020 R 740040 A               HLT             /AND HALT. HIT CONTINUE TO GO
00021 R 600000 R               JMP START       /BACK AND GET ANOTHER VALUE.
                       /
00022 R 000000 A       TEST    0
00023 R 000000 A       BITS    0
00024 R 000000 A       COUNT   0
                       /         ****** POINTS TO BE NOTED ******
                       /
                       /*1. WHY DO WE NEED THE HALT INSTRUCTION IN LOCATION 0?
                       /
                       /*2. WHY IS THERE A "LAW -22" IN LOCATION 3? WHAT ARE TH
                       /ADVANTAGES OF USING A "LAW -22" INSTRUCTION INSTEAD OF
                       /"LAC (-22" ?
                       /
                       /*3. WHEN THIS PROGRAM IS LOADED, LOCATION "BITS"
                       /LOCATION 23) IS SET TO 0.  BUT THE PROGRAM ZEROES IT
                       /ANYWAY WITH A "DZM BITS" INSTRUCTION IN LOCATION 5.WHY?
                       /WHAT WOULD HAPPEN ON A SECONG RUN OF THE PROGRAM
                       /(WITH A NON-ZERO VALUE IN THE DSW) WITHOUT LOADING
                       /A FRESH COPY OF IT INTO CORE?
                       /
       000000 R                .END START
00025 R 000001 A *L
            SIZE=00026      NO ERROR LINES
```

```
                                .TITLE COUNT1 EXCEPT CHECKS FOR 0 AC INSTEAD OF
                        /
00000 R 740040 A    START   HLT
00001 R 750004 A            LAS
00002 R 040021 R            DAC TEST
                        /
00003 R 140022 R            DZM BITS
                        /
00004 R 200021 R    NEXT    LAC TEST
                        /
00005 R 741200 A            SNA             /IS THE AC=0? IF SO, DONE
00006 R 600016 R            JMP DONE        /YES
00007 R 500023 R            AND (1          /SOME BIT SET. IS IT BIT 17?
                        /
00010 R 740200 A            SZA             /SKIP IF 0,I.E. IF NOT BIT 17.
                        /
00011 R 440022 R            ISZ BITS        /OTHERWISE, ADD 1 TO BITS.
                        /
00012 R 200021 R            LAC TEST        /GET TEST
00013 R 744020 A            RCR             /CLEAR LINK BEFORE ROTATING.
                                            /CHECKING FOR AN ALL ZERO AC
                                            /DEPENDS UPON ROTATING 0S
                                            /INTO THE AC.
00014 R 040021 R            DAC TEST
                        /
00015 R 600004 R            JMP NEXT
                        /
00016 R 200022 R    DONE    LAC BITS
00017 R 740040 A            HLT
00020 R 600000 R            JMP START
                        /
00021 R 000000 A    TEST    0
00022 R 000000 A    BITS    0
                        /
      000000 R              .END START
00023 R 000001 A *L
          SIZE=00024        NO ERROR LINES
```

```
                        .TITLE PROGRAM (#2) COUNTS # OF BITS SET IN DSW
                    /PROGRAM COUNTS THE NUMBER OF BITS SET TO 1 IN THE DATA
                    /SWITCH REGISTER, MAKING USE OF THE MQ REGISTER.  THE
                    /RESULT IS PLACED IN THE ACCUMULATOR SO THAT IT IS
                    /DISPLAYED ON THE CONSOLE LIGHTS WHEN PROGRAM HALTS.
                    /
                        .ABS
50000                   .LOC 50000
                    /
50000   740040      START   HLT             /HALT AND ENTER VALUE FROM
50001   750004              LAS             /DATA SWITCHES.
50002   652000              LMQ             /PUT VALUE INTO MQ.
                    /
50003   150017              DZM BITS        /CLEAR BITS TO ZERO.
                    /
50004   777756              LAW -22         /LOAD AC WITH -18 DECIMAL
50005   050020              DAC COUNT       /AND STORE IN COUNT.
                    /
50006   750000              CLA             /CLEAR AC FOR FIRST TIME THRU.
50007   640601      NXT     LLS 1           /GET 1 BIT FROM THE MQ.
                    /
50010   750200              SZA!CLA         /SKIP IF AC=0, CLEAR AC.
50011   450017              ISZ BITS        /AC NOT 0 SO ADD 1 TO BITS.
50012   450020              ISZ COUNT       /TEST TO SEE IF DONE 18 TIMES.
                    /
                    /
50013   610007              JMP NXT         /NOT DONE, GO BACK FOR NEXT BIT.
                    /
50014   210017              LAC BITS        /DISPLAY RESULT IN AC.
50015   740040              HLT             /AND GO BACK FOR ANOTHER VALUE.
50016   610000              JMP START       /DEPRESS CONTINUE KEY.
                    /
50017   000000      BITS    0
50020   000000      COUNT   0
                    /         ****** POINTS TO BE NOTED ******
                    /
                    /*1. NOTE THAT THE LMQ INSTRUCTION IN 50002 MAKES USE
                    /OF THE MQ REGISTER EVEN THOUGH NO MULTIPLICATION NOR
                    /DIVISION WILL BE PERFORMED.  THE MQ REGISTER IS VERY
                    /CONVENIENT FOR TEMPORARY STORAGE (WHY USE  CORE
                    /LOCATION WHEN THE MQ IS ALWAYS THERE?)AND ALLOWS FOR
                    /LONG SHIFTS INTO THE AC.  YOU'LL FIND THE USE OF THE
                    /MQ REGISTER HANDY FOR CERTAIN TYPES OF CONVERSIONS.
                    /
                    /*2. NOTE THAT WHETHER OR NOT A SKIP IS PERFORMED WHEN
                    /LOCATION 50010 IS EXECUTED, THE AC IS CLEARED.
                    /    WHAT IS IT ABOUT THE CONTENTS OF LOCATION 50010
                    /MAKES THIS SO?  ALSO--WHY IS THIS NECESSARY? (WHAT
                    /CAN HAPPEN ON THE SECOND TIME THRU AFTER LOOPING BACK
                    /TO NXT IF THE AC IS NOT FIRST CLEARED?)
                    /
050000                  .END START
    SIZE=50021      NO ERROR LINES
```

```
                .TITLE COMMENTARY ON MOVE1
/
/                  **************************
/                  *                        *
/                  *  POINTS TO BE NOTED    *
/                  *                        *
/                  **************************
/
/*1. WHEN THE SUBROUTINE IS CALLED--
/       THE ACCUMULATOR SHOULD CONTAIN THE NUMBER OF
/LOCATIONS TO BE MOVED,I.E. THE SIZE OF THE TABLE.
/       THE LOCATION FOLLOWING THE "JMS" CALL SHOULD
/CONTAIN THE FIRST LOCATION TO BE MOVED (THE FIRST
/ADDRESS OF THE ORIGINAL TABLE),I.E. THE SOURCE ADDRESS.
/       THE NEXT LOCATION SHOULD CONTAIN THE ADDRESS TO
/WHICH THE TABLE IS TO BE MOVED (THE FIRST ADDRESS OF
/OF THE NEW TABLE), I.E. THE DESTINATION ADDRESS.
/
/CALLING SEQUENCE:      LAC (TABLE SIZE)
/                       JMS MOVE1
/                       (SOURCE ADDRESS)
/                       (DESTINATION ADDRESS)
/
/FOR EXAMPLE--  LAC (200            /STATES THAT WE WANT
/               JMS MOVE1           /TO MOVE CONTENTS
/               1450    )TRAILING   /OF LOCS 1450-1647
/               3120    )ARGUMENTS  /TO LOCS 3120-3317.
/
/THAT IS, A TABLE 200 LOCATIONS LONG: THE ORIGINAL TABLE
/STARTS AT LOCATION 1450, THE NEW TABLE STARTS AT 3120.
/
/*2. THE RETURN "PC" (THE ADDRESS OF THE LOCATION
/FOLLOWING THE JMS INSTRUCTION) IS STORED BY THE CPU
/IN THE FIRST LOCATION OF THE SUBROUTINE (MOVE1).
/
/*3. THE SUBROUTINE USES THIS POINTER TO PICK UP VALUES
/WHICH FOLLOW THE JMS CALL (KNOWN AS TRAILING ARGUMENTS)
/
/*4. THE "ISZ" INSTRUCTION MAKES IT VERY NICE TO USE
/NEGATIVE COUNTERS FOR LOOPING (SET COUNTER TO 2'S
/COMPLEMENT OF # OF TIMES A PROCESS IS TO BE PERFORMED).
/EACH TIME A LOOP OF PROCESSING IS COMPLETED, INCREMENT
/THE COUNTER BY 1.  WHEN THE COUNTER GETS INCREMENTED TO
/0, THE "ISZ" ALSO SKIPS AN INSTRUCTION ALLOWING THE
/PROGRAM TO GET OUT OF THE LOOP--THUS DETERMINING
/WHEN THE ENTIRE PROCESS IS COMPLETED.
/
/*5. IT IS THE SUBROUTINE'S RESPONSABILITY TO UPDATE THE
/POINTER,MOVE1, ENOUGH TIMES TO POINT PAST THE TRAILING
/ARGUMENTS BACK IN THE CALLING ROUTINE (HERE VIA "ISZ").
/
/*6. THE SUBROUTINE RETURNS TO THE CALLING ROUTINE VIA A
/"JMP*" THRU THE FIRST LOCATION (MOVE1).
```

```
                                .TITLE SUBROUTINE (#1) MOVES BLOCKS OF CORE
                        /
                        /
                        /EXAMPLE OF MOVE SUBROUTINE WHICH MOVES
                        /BLOCKS OF CORE LOCATIONS (TABLES).
                        /
                        /CALLING SEQUENCE:      LAC (TABLE SIZE)
                        /                       JMS MOVE1
                        /                       (SOURCE ADDRESS)
                        /                       (DESTINATION ADDRESS)
                        /
                        /
                        /
00000 R 000000 A        MOVE1   0
                        /
00001 R 740031 A                TCA             /DEVELOP NEGATIVE SIZE
00002 R 040020 R                DAC TABLSZ      /FOR A LOOP.
                        /
00003 R 220000 R                LAC* MOVE1      /GET SOURCE ADDRESS.
00004 R 040021 R                DAC SOURCE      /STORE IN A POINTER.
                        /
00005 R 440000 R                ISZ MOVE1       /ADD 1 TO RETURN "PC" SO THAT
                                                /IT NOW POINTS TO NEXT ARGUMENT
00006 R 220000 R                LAC* MOVE1      /GET DESTINATION ADDRESS.
00007 R 040022 R                DAC DESTIN      /STORE IN POINTER.
                        /
00010 R 220021 R        MORE    LAC* SOURCE     /MOVE1 TABLES!!!
00011 R 060022 R                DAC* DESTIN
                                                /ADD 1 TO LOCATIONS SOURCE AND
00012 R 440021 R                ISZ SOURCE      /DESTIN SO THEY POINT TO NEXT
00013 R 440022 R                ISZ DESTIN      /LOCATIONS IN OLD AND NEW TABLES
                        /
00014 R 440020 R                ISZ TABLSZ      /ADD 1 TO NEGATIVE COUNT
                                                /ARE WE DONE?
00015 R 600010 R                JMP MORE        /NO--GO BACK FOR MORE
                        /
00016 R 440000 R                ISZ MOVE1       /DONE! MOVE1 SHOULD POINT
                                                /TO LOCATION AFTER ARGUMENTS
                        /
00017 R 620000 R                JMP* MOVE1      /EXIT--RETURN TO CALLING ROUTINE
                                                /VIA THE ADDRESS STORED IN MOVE1
                        /
00020 R 000000 A        TABLSZ  0
00021 R 000000 A        SOURCE  0
00022 R 000000 A        DESTIN  0
                        /
        000000 A                .END
            SIZE=00023      NO ERROR LINES
```

```
                .TITLE COMMENTARY ON MOVE2
/
/
/                  **************************
/                  *                        *
/                  *  POINTS TO BE NOTED    *
/                  *                        *
/                  **************************
/
/
/*1. THERE ARE TWO MAJOR DIFFERENCES BETWEEN
/SUBROUTINES MOVE1 AND MOVE2:
/
/                           A)TYPE OF PROGRAM--
/                               RELOCATABLE VS. ABSOLUTE.
/
/                           B)TYPE OF ADDRESSING USED--
/                               INDIRECT VS. AUTO-INCREMENT.
/
/*2. MOVE1 IS  RELOCATABLE PROGRAM (RECALL THE ABSENCE
/OF .ABS AND .LOC STATEMENTS).  LOCATIONS USED STARTED
/WITH RELOCATABLE 0.
/     MOVE2 IS AN ABSOLUTE PROGRAM (NOTE THE USE OF
/.ABS AND .LOC STATEMENTS).  LOCATIONS USED START WITH
/ABSOLUTE 100.
/
/*3. MOVE1 MAKES USE OF INDIRECT ADDRESSING.  IT SETS UP
/LOCATIONS SOURCE AND DESTIN WITHIN ITSELF.  ALSO, TO
/UPDATE THESE POINTERS IT MAKES USE OF "ISZ SOURCE" AND
/"ISZ DESTIN" INSTRUCTIONS.
/     MOVE2 MAKES USE OF AUTO-INCREMENT ADDRESSING.  IT
/SETS UP ABSOLUTE LOCATIONS 10 AND 11 AS SOURCE AND
/DESTIN RESPRECTIVELY.  THIS MAKES FOR A SMALLER PROGRAM
/BECAUSE LOCATIONS 10-17 ARE "RESERVED" FOR AUTO-
/INCREMENT ADDRESSING ANYWAY (I.E. THEY ARE NOT NORMALLY
/USED TO HOLD EXECUTABLE INSTRUCTIONS), SO WHY NOT MAKE
/USE OF THEM TO HOLD VALUES (RATHER THAN TAKING UP SPACE
/WITHIN THE SUBROUTINE).
/ALSO,  BECAUSE THEY ARE AUTO-INCREMENT LOCATIONS, MOVE2
/DOESN'T NEED "ISZ SOURCE" AND "ISZ DESTIN" INSTRUCTIONS
/LOCATIONS SOURCE & DESTIN ARE AUTOMATICALLY INCREMENTED
/BY 1 BEFORE BEING USED AS POINTERS (SUCH IS THE FATE
/OF AUTO-INCREMENT REGISTERS WHEN USED WITH INDIRECT
/ADDRESSING).  MAKE SURE YOU UNDERSTAND THE PURPOSE OF
/THE "LAW -1" INSTRUCTION USED IN LOCATIONS 103 AND 107.
```

```
                        .TITLE SUBROUTINE (#2) MOVES BLOCKS OF CORE
                    /
                    /EXAMPLE OF MOVE SUBROUTINE WHICH MOVES
                    /BLOCKS OF CORE LOCATIONS (TABLES).
                    /
                    /CALLING SEQUENCE:      LAC (TABLE SIZE)
                    /                       JMS MOVE2
                    /                       (SOURCE ADDRESS)
                    /                       (DESTINATION ADDRESS)
                    /
                    /!!!!!ALSO SEE EXPLANATORY NOTES ON PREVIOUS PAGES
                    /!!!!!FOR SUBROUTINE MOVE1.
                    /
                            .ABS
00100                       .LOC 100
                    /
00100   000000      MOVE2   0
                    /
00101   740031              TCA             /DEVELOP NEGATIVE SIZE
00102   040120              DAC TABLSZ      /FOR LOOP.
                    /
00103   777777              LAW -1
00104   360100              TAD* MOVE2      /GET SOURCE ADDRESS
00105   040010              DAC SOURCE      /STORE IN A POINTER.
                    /
00106   440100              ISZ MOVE2       /ADD 1 TO RETURN "PC" SO THAT
                                            /IT POINTS TO NEXT ARGUMENT.
                    /
00107   777777              LAW -1
00110   360100              TAD* MOVE2      /GET DESTINATION ADDRESS
00111   040011              DAC DESTIN      /STORE IN POINTER.
                    /
00112   220010      MORE    LAC* SOURCE     /MOVE TABLES!!!
00113   060011              DAC* DESTIN
                    /
00114   440120              ISZ TABLSZ      /ADD 1 TO NEGATIVE COUNT
                                            /ARE WE DONE?
00115   600112              JMP MORE        /NO--GO BACK FOR MORE
                    /
00116   440100              ISZ MOVE2       /DONE--MOVE2 SHOULD POINT
                                            /TO LOCATIONAFTER ARGUMENTS
                    /
00117   620100              JMP* MOVE2      /EXIT--RETURN TO CALLING ROUTINE
                                            /VIA THE ADDRESS STORED IN MOVE2
00120   000000      TABLSZ  0
                    /
                    /
00010                       .LOC 10
00010   000000      SOURCE  0
00011   000000      DESTIN  0
                    /
        000000              .END
            SIZE=00121      NO ERROR LINES
```

```
                                .TITLE PROGRAM (#1) TO READ AND REVERSE OCTAL DI
                        /
                        / GET A SIX PLACE OCTAL NUMBER FROM THE DATA SWITCHES
                        / AND REVERSE THE OCTAL NUMBER.
                        / EXAMPLE: VALUE FROM SWITCHES = 123456
                        /          RESULTANT VALUE     = 654321
                        /
                                .ABS
00100                           .LOC 100
                        /
00100   740040          START   HLT
                        /
00101   750004                  LAS             / GET VALUE FROM SWITCHES
                                                / ASSUME VALUE IS 123456
00102   742030                  SWHA            / 456123
00103   040122                  DAC TEMP#       / 456123
                        /
00104   500123                  AND (70070      / 050020
00105   040121                  DAC FINAL#      / 050020
                        /
00106   200122                  LAC TEMP        / 456123
00107   640506                  LRS 6           / 004561
00110   500124                  AND (7007       / 004001
00111   340121                  TAD FINAL       / 054021
00112   040121                  DAC FINAL       / 054021
                        /
00113   200122                  LAC TEMP        / 456123
00114   640606                  LLS 6           / 612323
00115   500125                  AND (700700     / 600300
00116   340121                  TAD FINAL       / 654321
                        /
00117   740040                  HLT             /DISPLAY RESULT IN AC
                        /
00120   600100                  JMP START       /HIT CONTINUE TO GET BACK TO
                                                /BEGINNING FOR ANOTHER VALUE.
                        /
        000100                  .END START
00123   070070    *L
00124   007007    *L
00125   700700    *L
            SIZE=00126      NO ERROR LINES
```

```
                                .TITLE PROGRAM (#2) TO READ AND REVERSE OCTAL DI
                        /
                        /
                        /
                        /
                        /
00000 R 740040 A    REVRC2  HLT             /ALLOW SETTING OF DATA SWITCHES
00001 R 777772 A            LAW -6          /SET 6 DIGITS
00002 R 040016 R            DAC DIGITS#
00003 R 750004 A            LAS             /READ IN DATA SWITCHES
                        /
00004 R 742020 A            RTR             /MOVE 2 POSITIONS RIGHT SO THAT
                                            /FIRST OCTAL DIGIT IS 6 BITS OFF
00005 R 742010 A    LOOP    RTL             /ROTATE 6 LEFT TO BRING
00006 R 742010 A            RTL             /MOST SIGNIF. CHAR TO LEAST
00007 R 742010 A            RTL             /SIGNIFICANT END OF AC
00010 R 640503 A            LRS 3           /PLACE IN MQ
                        /
00011 R 440016 R            ISZ DIGITS      /TEST END
00012 R 600005 R            JMP LOOP        /NOT DONE YET--GO BACK FOR MORE
00013 R 641002 A            LACQ            /DISPLAY
                        /
00014 R 740040 A            HLT             /ON HALT
                        /
00015 R 600000 R            JMP REVRC2      /START AGAIN
                        /
        000000 R            .END REVRC2
            SIZE=00017      NO ERROR LINES
```

```
                                .TITLE UNSIGNED MULTIPLY ROUTINE
                        /
                                .ABS
                        /
00000   740040          START   HLT             /HALT TO ALLOW ENTRY OF
00001   750004                  LAS             /VALUE FOR A ON SWITCHES.
00002   040047                  DAC   A         /STORE IN LOCATION A.
00003   740040                  HLT             /HALT TO ALLOW ENTRY OF
00004   750004                  LAS             /VALUE FOR B ON SWITCHES.
00005   040050                  DAC   B         /STORE IN LOCATION B.
00006   140053                  DZM   PROD#     /CLEAR RESULT AREA.
00007   200047                  LAC   A#
00010   040051                  DAC   MCAND#    /ASSUME A>B, HENCE
00011   200050                  LAC   B#        /SMALLER NUMBER BECOMES
00012   040052                  DAC   MPLIER#   /MULTIPLIER
00013   740031                  TCA             /NEGATE B AND ADD A.
00014   340047                  TAD   A
00015   740100                  SMA             /IF SUM MINUS, REVERSE A,B
00016   600023                  JMP   ABOK      /A>B, OK AS IS
00017   200050                  LAC   B         /SINCE B>A REVERSE FUNCTION
00020   040051                  DAC   MCAND     /OF A AND B AS MPLIER AND MCAND.
00021   200047                  LAC   A         /
00022   040052                  DAC   MPLIER
                        /
00023   200052          ABOK    LAC   MPLIER    /GET MULTIPLIER
00024   741200                  SNA             /IF MPLIER=0, ALL DONE
00025   600044                  JMP   DONE
00026   500054                  AND   (1        /GET BIT 17 OF MPLIER
00027   740200                  SZA             /AND SEE IF IT IS 0.
00030   600040                  JMP   ADD       /GO ADD IN MCAND TO PROD
                        /
00031   200051          SHIFT   LAC   MCAND     /GET MCAND AND SHIFT ONE PLACE
00032   744010                  RCL             /LEFT FOR NEXT TIME THRU
00033   040051                  DAC   MCAND
00034   200052                  LAC   MPLIER    /GET MPLIER AND SHIFT ONE PLACE
00035   744020                  RCR             /RIGHT FOR NEXT TIME THRU.
00036   040052                  DAC   MPLIER    /
00037   600023                  JMP   ABOK      /GO BACK FOR NEXT BIT IN MPLIER.
                        /
00040   200053          ADD     LAC   PROD      /BIT 17 OF MPLIER WAS NOT 0,
00041   340051                  TAD   MCAND     /ADD MCAND AND STORE IN PROD.
00042   040053                  DAC   PROD
00043   600031                  JMP   SHIFT     /GO SHIFT MPLIER AND MCAND.
                        /
00044   200053          DONE    LAC   PROD
00045   740040                  HLT             /STOP TO EXAMINE RESULT IN AC.
00046   600000                  JMP   START     /CHANGE A AND B AND DO AGAIN.
                        /
        000000                  .END START
00054   000001  *L
            SIZE=00055      NO ERROR LINES
```

```
                                .TITLE ODD SEARCH PROBLEM
                        /
                        /A PROGRAM TO SEARCH 120-150 FOR
                        /ODD NUMBERS IN THE RANGE OF
                        /XXXX51 TO XXXX57, TOTAL STORED IN AC
                        /ADDRESS OF EACH STORED IN A TABLE
                        /STARTING AT 200
                        /
                                .ABS
                        /
00400                           .LOC 400
                        /
00400   100416          START   JMS SETUP       /SET UP VARIABLES
        000010          PTR1=10
        000011          PTR2=11
00401   220010                  LAC* PTR1       /GET A NUMBER
00402   500431                  AND (71         /LOOK FOR ODD BIT
00403   540432                  SAD (51         /AND THE NUMBER "50"
00404   100411                  JMS FOUND
00405   440427                  ISZ COUNT       /DONE WITH SEARCH?
00406   600401                  JMP .-5         /NO
00407   200430                  LAC HITS#       /YES
00410   740040                  HLT
                        /
                        /SUBROUTINES
                        /
00411   000000          FOUND   0
00412   200010                  LAC PTR1        /GET ADDRESS
00413   060011                  DAC* PTR2       /STORE IN TABLE
00414   440430                  ISZ HITS        /UPDATE HITS
00415   620411                  JMP* FOUND
                        /
00416   000000          SETUP   0
00417   140430                  DZM HITS        /PRESET HITS TO ZERO
00420   200433                  LAC (117
00421   040010                  DAC PTR1        /SETUP SOURCE TABLE
00422   200434                  LAC (177
00423   040011                  DAC PTR2        /SET UP TABLE OF RESULTS
00424   777747                  LAW -31
00425   040427                  DAC COUNT       /SET UP TABLE SIZE
00426   620416                  JMP* SETUP
00427   777747          COUNT   -31
        000400                  .END START
00431   000071  *L
00432   000051  *L
00433   000117  *L
00434   000177  *L
            SIZE=00435      NO ERROR LINES
```

```
                                .TITLE TABLE SEARCH PROBLEM
                        /A PROGRAM TO ACCEPT A NUMBER
                        /FROM THE DATA SWITCHES,
                        /SEARCH FOR THE 1ST WORD<O.S.
                        /IN LOCATIONS 400-477
                        /
                                .ABS
                        /
00100                           .LOC 100
                        /
00100   740040          STOP    HLT             /ALLOW OPERATOR TIME TO
00101   750004                  LAS             /SET THE DATA SWITCHES
00102   740031                  TCA             /SET UP ALPHA [-A]
00103   040121                  DAC ALPHA#      /EXAMPLE OF ASSIGNED VARIABLE "#
00104   200123                  LAC (377        /EXAMPLE OF A LITERAL "("
00105   040010                  DAC PTR         /SET UP AUTO-INCREMENT
        000010          PTR=10                  /EXAMPLE OF A DIRECT ASSIGNMENT
00106   777700                  LAW -100
00107   040122                  DAC TALLY#      /SET UP TABLE SIZE TALLY
00110   220010          ANG     LAC* PTR        /GET ANUMBER FROM TABLE
00111   340121                  TAD ALPHA       /(TABLE)+-(A)=RESULT
00112   751100                  SPA!CLA         /RESULT=(+) A<OR=(TABLE)
00113   600117                  JMP FOUND       /RESULT=(-) A>(TABLE)
00114   440122                  ISZ TALLY       /SEARCHED WHOLE TABLE?
00115   600110                  JMP ANG         /NO
00116   740040                  HLT             /YES
00117   200010          FOUND   LAC PTR
00120   740040                  HLT
        000100                  .END STOP
00123   000377    *L
            SIZE=00124      NO ERROR LINES
```

```
                .TITLE COMMENTARY ON SQUARE
/
/                  **************************
/                  *                        *
/                  *  POINTS TO BE NOTED    *
/                  *                        *
/                  **************************
/
/
/*1. NOTE THAT THE PROGRAM IS LOADED AT 20000.  THIS IS
/SO THAT IS DOES NOT GET LOADED OVER (HENCE,OVERLAY,--
/COLLOQUALLY KNOWN AS CLOBBERING) THE MONITOR.  AT THE
/END OF THE PROGRAM WE JUST RETURN TO THE MONITOR USING
/"CAL CODE 15" (THE MONITOR HAS A ROUTINE TO DETERMINE
/WHICH "CAL ROUTINE" IS BEING REQUESTED.  IN THIS CASE,
/MONITOR ROUTINE 15 IS AN EXIT ROUTINE).
/
/*2.THIS PROGRAM MAKES USE OF AUTO-INCREMENT REGISTER 10
/ONCE A SQUARE IS COMPUTED, IT IS STORED IN A TABLE VIA
/INDIRECT ADDRESSING ON LOCATION 10 (NOTE "DAC* 10" IN
/LOCATION 20012).  THIS TABLE STARTS AT LOCATION 20200.
/BUT WHEN AUTO-INCREMENT REGISTERS ARE USED INDIRECTLY,
/THEY ARE PRE-INCREMENTED.  HENCE, WE MUST SET UP
/ABSOLUTE LOC 10 TO CONTAIN "20177".  FIRST, WE LOAD
/"20177" INTO THE ACCUMULATOR (THE "LAC (20177"  IN
/LOCATION 20004).
/
/     NOW THE PROBLEM IS TO STORE THIS VALUE IN ABSOLUTE
/LOCATION 10.  WHERE WOULD THE VALUE "20177" BE STORED
/IF THE INSTRUCTION IN LOCATION 20005 READ "DAC 10"?
/(HINT: WHAT BANK WOULD IT BE IN?)
/
/     NOW LET'S LOOK AT THE "DAC* (10" INSTRUCTION IN
/LOCATION 20005.  THE ASSEMBLER SETS UP LOCATION 20304
/TO CONTAIN A "10" (WHY?).  THE INSTRUCTION "DAC* (10"
/IS ASSEMBLED AS 060304 (000 110 000 011 000 100):
/ DAC INTO THE LOCATION POINTED TO BY LOCATION
/20304, I.E. ABSOLUTE LOCATION 10.
/
/000 1XX XXX XXX XXX XXX          = DAC
/XXX X1X XXX XXX XXX XXX          = INDIRECT ADDRESSING
/XXX XX0 000 011 000 100          = VIA LOC 304 IN THIS
/                                    BANK.
/
/
```

```
                                .TITLE BUILDING A TABLE OF SQUARES
                        /
                        /THIS PROGRAM WILL BUILD A TABLE OF SQUARES
                        /FROM 1 TO 100 (OCTAL).
                        /THE TABLE STARTS AT LOCATION 20200.
                        /
                        /THE BUILDING OF THE TABLE OF SQUARES IS BASED UPON THE
                        /FACT THAT:
                        /
                        /THE NTH SQUARE = THE (N-1)TH SQUARE + THE NTH ODD #
                        /        2
                        /       1        =       0       +       1       =1
                        /        2
                        /       2        =       1       +       3       =4
                        /        2
                        /       3        =       4       +       5       =9
                        /                                .
                        /                                .
                        /                               ETC
                                .ABS
20000                           .LOC 20000
                        /
20000   750000          START   CLA
20001   040301                  DAC NXT#
                        /
20002   740030                  IAC
20003   040302                  DAC ODD#        /ODD STARTS AT 1.
                        /
20004   200303                  LAC (20177      /STORE TABLE AT LOC 20200
20005   060304                  DAC* (10        /VIA AUTO INC REGISTER 10
                        /
20006   777700                  LAW -100        /SET UP COUNTER
20007   040300                  DAC COUNT#      /COUNT 100 TIMES THRU LOOP.
                        /
20010   200301          SQR     LAC NXT         /         0          1          4
20011   340302                  TAD ODD         /         1     1+3=4     4+5=9
20012   060010                  DAC* 10         /(20200)=1 (20201)=4 (20202)=9
                        /
20013   040301                  DAC NXT         /    NXT=1      NXT=4      NXT=9
                        /
20014   200302                  LAC ODD         /         1          3          5
20015   340305                  TAD (2          /         3          5          7
20016   040302                  DAC ODD         /    ODD=3      ODD=5      ODD=7
                        /
20017   440300                  ISZ COUNT       /ARE WE DONE?
20020   600010                  JMP SQR         /NO--GO BACK FOR MORE.
20021   740040                  HLT             /YES--CHECK TABLE VIA CONSOLE.
20022   000000                  CAL             /GO BACK TO THE MONITOR BY
20023   000015                  15              /HITTING CONTINUE SWITCH
                        /
20200                           .LOC 20200
20200                           .BLOCK 100      /RESERVE ROOM FOR THE TABLE.
        020000                  .END START
20303   020177  *L
20304   000010  *L
20305   000002  *L
            SIZE=20306      NO ERROR LINES
```

```
 1      SORT   SRC      SORT ROUTINE

                                .TITLE SORT ROUTINE
                        /
                        /**SUBROUTINE SORTS VALUES INTO ASCENDING ORDER
                        /**AT TIME OF ENTRY, (AC)= THE NUMBER OF WORDS TO BE SOR
                        /                   (MQ)= ADDRESS OF BUFFER TO BE SORTE
                        /
                                .GLOBL SORT
                        /
00000 R 030000 A        SORT    0
00001 R 340047 R                TAD (-1         /HAVE (NUMBER OF WDS)-1 CHECKS
00002 R 040041 R                DAC COUNT#
00003 R 200041 R        AGAIN   LAC COUNT
00004 R 740031 A                TCA
00005 R 040046 R                DAC WDCNT#
00006 R 140042 R                DZM FLAG
00007 R 641002 A                LACQ            /PICK UP BUFFER ADDRESS FROM MQ
00010 R 040043 R                DAC PT1#        /PLACE IN PT1 FOR LATER REFERENC
00011 R 740030 A                IAC
00012 R 040044 R                DAC PT2#        /USE TO POINT TO NEXT WORD
                        /
00013 R 220043 R        LOOP    LAC* PT1
00014 R 740031 A                TCA             /-A
00015 R 350044 R                TAD* PT2        /B-A
00016 R 741100 A                SPA             /B-A>=0 OK B>A SO ORDER OK
00017 R 100030 R                JMS SWITCH      /B-A<0 MEANS A>B SO SWITCH ORDER
                        /
00020 R 440043 R                ISZ PT1         /PT1 NOW POINTS TO NEXT WORD
00021 R 440044 R                ISZ PT2         /PT2 NOW POINTS TO NEXT WORD
00022 R 440046 R                ISZ WDCNT       /ARE WE DONE?
00023 R 600013 R                JMP LOOP        /NO--GO BACK FOR MORE CHECKS
00024 R 200042 R                LAC FLAG#
00025 R 740200 A                SZA             /WERE CHANGES MADE ON LAST TIME
00026 R 600003 R                JMP AGAIN
00027 R 620000 R                JMP* SORT       /NO --WE'RE COMPLETELY DONE
                        /
00030 R 000000 A        SWITCH  0
00031 R 220043 R                LAC* PT1        /GET LARGER VALUE
00032 R 040045 R                DAC TEMP#       /HOLD TEMPORARILY
00033 R 220044 R                LAC* PT2        /GET SMALLER VALUE
00034 R 050043 R                DAC* PT1        /PLACE IN EARLIER ENTRY
00035 R 200045 R                LAC TEMP
00036 R 050044 R                DAC* PT2        /PLACE LARGER IN 2ND ENTRY
00037 R 440042 R                ISZ FLAG        /SET FLAG TO SHOW
                                                /SWITCH TOOK PLACE
                        /
00040 R 620030 R                JMP* SWITCH
                        /
                        /
      000000 A                  .END
00047 R 777777 A *L
          SIZE=00050      NO ERROR LINES
```

```
                                .TITLE LINE EDITOR
                            /
                            /
                                .ABSP
                            /
                    700401  TSF=700401
                    700406  TLS=700406
                    700301  KSF=700301
                    700312  KRB=700312
                            /
00100                       .LOC 100
                            /
00100   700416      START   TLS+10
00101   707762              DBA
00102   100160              JMS CRLF
00103   100141              JMS SETUP       /INITIALIZE XR AND LR
00104   100146      MORE    JMS LISN        /WAIT FOR CHAR. FROM KBRD
00105   540276              SAD (225        /CHECK FOR SPECIAL CHARACTERS
00106   600130              JMP LOLT        /AU:  ERASE ENTIRE LINE
00107   540277              SAD (377
00110   600133              JMP RUBOUT      /RUBOUT LAST CHAR.
00111   050166              DAC BUFF,X      /STORE CHARACTER IN BUFFER
00112   540300              SAD (215        /IS CHAR. A C.R.?
00113   600116              JMP OUTPUT      /YES - END OF INPUT LINE
00114   725001              AXS 1           /NO - INCREMENT XR, IF <
00115   600104              JMP MORE        /72 CHARS, GET NEXT CHAR.
00116   100160      OUTPUT  JMS CRLF        /ECHO A CR, LF
00117   100141              JMS SETUP       /RE-INITIALIZE
00120   210166      PRINT   LAC BUFF,X      /ECHO ONE CHAR. AT A TIME
00121   100153              JMS TYPE
00122   540300              SAD (215
00123   600126              JMP .+3
00124   725001              AXS 1
00125   600120              JMP PRINT
00126   100160              JMS CRLF        /DONE WITH ENTIRE LINE
00127   600103              JMP MORE-1      /READ IN NEXT LINE
                            /
00130   760300      LOLT    LAW 300         /ECHO "@"
00131   100153              JMS TYPE
00132   600103              JMP MORE-1
                            /
00133   760334      RUBOUT  LAW 334         /ECHO A REVERSE SLASH
00134   100153              JMS TYPE
00135   724000              PXA             /IF RUBOUT IS FIRST CHAR.
00136   740200              SZA             /DONT BACKUP BUFFER POINTER
00137   737777              AXR -1
00140   600104              JMP MORE
                                .EJECT
```

```
                        /
                        /SUBROUTINES
                        /
00141   000000  SETUP   0
00142   200301          LAC (110
00143   722000          PAL
00144   735000          CLX
00145   620141          JMP* SETUP
                        /
00146   000000  LISN    0
00147   700301          KSF
00150   600147          JMP .-1
00151   700312          KRB
00152   620146          JMP* LISN
                        /
00153   000000  TYPE    0
00154   700401          TSF
00155   600154          JMP .-1
00156   700406          TLS
00157   620153          JMP* TYPE
                        /
00160   000000  CRLF    0
00161   760215          LAW 215
00162   100153          JMS TYPE
00163   760212          LAW 212
00164   100153          JMS TYPE
00165   620160          JMP* CRLF
                        /
00166           BUFF    .BLOCK 110
        000100          .END START
00276   000225  *L
00277   000377  *L
00300   000215  *L
00301   000110  *L
            SIZE=00302      NO ERROR LINES
```

```
                                .TITLE PROGRAM TO COPY PAPER TAPE
                        /
                                .ABSP
00100                           .LOC 100
                        /
            700204      PSA=700204
            700104      RSA=700104
            700201      PSF=700201
            700112      RRB=700112
            700101      RSF=700101
                        /
00100   740040      A.1     HLT             /HALT TO INSERT TAPE TO COPY
00101   707762              DBA             /ENTER PAGE MODE
00102   200661              LAC (500        /PUT 500 IN LIMIT REGISTER
00103   722000              PAL
                        /
00104   700214              PSA+10          /PREPARE TO SET PUNCH FLAG
                        /
00105   140657      A.2     DZM RDFLAG#
00106   140660              DZM RDINDX#
00107   140656              DZM PCINDX#
                        /
00110   200660      A.3     LAC RDINDX      /GET READ INDEX REGISTER VALUE
00111   721000              PAX             /PUT INTO XR
00112   700104              RSA             /READ A CHARACTER
00113   700101              RSF             /WAIT FOR READ FLAG
00114   600113              JMP .-1         /TO GO UP
                        /
00115   700314      A.4     IORS            /GET I/O STATUS REGISTER
00116   500662              AND (1000       /SEE IF READER OUT OF TAPE.
00117   740200              SZA             /IF 0, NOT OUT
00120   600152              JMP A.17        /READER OUT OF TAPE
                        /
00121   700112      A.5     RRB             /GET CHAR INTO AC
00122   050156              DAC BUFF,X      /STORE IT IN BUFF,X
                        /
00123   725001      A.6     AXS 1           /UPDATE INDEX
00124   600127              JMP A.8 /BUFF NOT FULL
                        /
                        /
00125   200663      A.7     LAC (1          /BUFF FULL SO SET RDFLAG=1
00126   040657              DAC RDFLAG
                        /
00127   724000      A.8     PXA             /SAVE READ INDEX
00130   040660              DAC RDINDX      /IN RDINDX
                        /
00131   200656      A.85    LAC PCINDX      /GET PUNCH INDEX
00132   721000              PAX             /AND STORE IN XR
                        /
00133   700201      A.9     PSF             /SEE IF PUNCH READY
00134   600144              JMP A.15        /NOT READY, SEE IF CAN READ
                        /
```

```
00135  210156        A.10    LAC BUFF,X      /GET CHAR FROM BUFF
00136  741100        A.11    SPA             /AND SEE IF IT IS NEGATIVE
00137  740040        A.12    HLT             /IT WAS, SO HALT
00140  700204        A.13    PSA             /START PUNCHING NEXT CHARACTER
00141  725001        A.14    AXS 1           /IF SKIP, PUNCH BUFF EMPTY
00142  741000                SKP
00143  600105                JMP A.2         /BUFF EMPTY, GO READ MORE
00144  200657        A.15    LAC RDFLAG      /SEE IF READ BUFF FULL
00145  740200                SZA             /IF 0, NOT FULL, GO READ
00146  600133                JMP A.9         /READ FULL, SO LOOP IN PUNCH
00147  724000        A.16    PXA
00150  040656                DAC PCINDX      /SAVE PUNCH INDEX
00151  600110                JMP A.3         /READ BUFF NOT FULL--GO READ
00152  777777        A.17    LAW -1
00153  050156                DAC BUFF,X      /PUT TERMINAL CHARACTER IN BUFFE
00154  040657                DAC RDFLAG      /SET RDFLAG TO NON 0
00155  600131                JMP A.85
                       /
00156                  BUFF   .BLOCK 500
                       /
       000100                 .END A.1
00661  000500    *L
00662  001000    *L
00663  000001    *L
           SIZE=00664      NO ERROR LINES
```

```
                .TITLE COMMENTARY ON DUMP
/
/                  **************************
/                  *                        *
/                  *  POINTS TO BE NOTED    *
/                  *                        *
/                  **************************
/
/*1. NOTE THAT MOST "IOT" INSTRUCTIONS ARE NOT DEFINED
/WITHIN MACRO'S SYMBOL TABLES.  THEREFORE, THEY MUST
/BE DEFINED BY THE USER.  USUALLY ONE DOES THIS BY
/DIRECT ASSIGNMENT STATEMENTS AT THE BEGINNING OF THE
/PROGRAM--AS IS DONE IN THIS PROGRAM FOR "TSF","TLS",
/"KSF", AND "KRB".
/
/*2. NOTE THAT THE TELEPRINTER IS AN OUTPUT DEVICE AND
/AS SUCH, WE WANT TO CHECK ITS "READY FLAG" BEFORE DOING
/ANY OUTPUT,BUT ALL FLAGS ARE CLEARED BEFORE THE PROGRAM
/IS STARTED (THE ABSOLUTE LOADER CLEARS ALL FLAGS AND SO
/DOES THE RESET SWITCH ON THE CONSOLE).  THEREFORE, WE
/MUST SET THE FLAG OURSELVES.  CONSIDER HOW LONG WE
/WILL STAY IN THE LOOP:  TSF
/                        JMP .-1
/
/IF WE DO NOT TAKE CARE OF SETTING THE FLAG.  THIS IS
/DONE WITH THE "TLS+10" INSTRUCTION IN LOCATION 2.
/GO OVER THE IOT FORMAT TO MAKE SURE YOU UNDERSTAND WHAT
/THIS DOES FOR US.  TLS+10 = 700416.  BIT 14 IS SET.
/THIS CLEARS THE ACCUMULATOR BEFORE THE OUTPUT
/OPERATION IS PERFORMED.  ALL ZEROES IS THE ASCII CODE
/FOR THE NULL CHARACTER...AND THAT'S EXACTLY
/WHAT IS OUTPUT TO THE TELEPRINTER (LISTEN CAREFULLY).
/THE IMPORTANT THING IS THAT 100 MILLISECONDS AFTER THE
/PRINTING OF THIS CHARACTER IS INITIATED, THE "READY
/FLAG" IS RAISED.  FROM HERE ON IN THEN, WE'RE ALL SET
/TO DO OUTPUT.
/
/*3. RECALL THAT WHEN A CHARACTER COMES IN FROM THE KEY-
/BOARD, THE CODE STORED IN THE KEYBOARD BUFFER TO
/REPRESENT THE CHARACTER = THE 7-BIT ASCII CODE + 200.
/WHEN CHECKING FOR A SPECIFIC CHARACTER, MAKE SURE YOU
/TAKE THIS INTO ACCOUNT.  FOR EXAMPLE, WHEN CHECKING
/FOR A FORWARD SLASH "/" WHICH HAS A 7-BIT ASCII CODE
/OF 57, WE MUST NOTE THAT THE KEYBOARD BUFFER CONTAINS
/A "257" (57+200).  WE READ THE CONTENT OF THE KEYBOARD
/BUFFER INTO THE ACCUMULATOR WITH A "KRB" INSTRUCTION.
/THEN WE CAN COMPARE THE ACCUMULATOR WITH THE VALUE 257,
/<SAD (257>, OR WE CAN MASK OUT EVERYTHING EXCEPT
/FOR THE LEAST SIGNIFICANT 7 BITS IN THE AC,
/<AND (177>, AND LOOK FOR A 57.
/
```

```
                                .TITLE OCTAL DUMP PROBLEM
                        /
                        /PROGRAM ACCEPTS A LEGAL OCTAL ADDRESS FROM
                        /THE KEYBOARD, AND TYPES OUT ITS CONTENTS.
                        /
                        /THIS IS A RELOCATABLE PROGRAM WHICH WILL BE LOADED
                        /BY THE LINKING LOADER.  THE LINKING LOADER WORKS
                        /UNDER THE DOS SYSTEM AND, THEREFORE, INTERRUPT
                        /SYSTEMS WILL BE ON WHEN THE PROGRAM IS LOADED AND
                        /STARTED.  IF WE DO NOT TAKE CARE OF THIS, THE
                        /PROGRAM WON'T WORK BECAUSE IT USES DEDICATED I/O.
                        /THE INTERRUPT SYSTEM WILL PICK UP THE DEVICE FLAGS
                        /RATHER THAN THE "KSF" AND "TSF" INSTRUCTIONS IN THE
                        /PROGRAM.  THE FIRST THREE INSTRUCTIONS IN THE
                        /PROGRAM TURN OFF THE INTERRUPT SYSTEMS (PI & API).
                        /
          700401 A      TSF=700401
          700406 A      TLS=700406
          700301 A      KSF=700301
          700312 A      KRB=700312
                        /
00000 R 700002 A        START   IOF             /TURN OFF PI
00001 R 705514 A                ISA+10          /AND API INTERRUPT SYSTEMS
00002 R 700416 A                TLS+10
                        /
00003 R 100065 R                JMS CRLF
00004 R 100047 R                JMS SETUP
                        /
00005 R 100060 R        MORE    JMS LISTEN
                        /
00006 R 440074 R                ISZ DIGIT       /IS THIS THE 6TH DIGIT?
00007 R 540077 R                SAD (257        /IF NOT, IS IT A FORWARD SLASH?
00010 R 600021 R                JMP DONE        /YES IN EITHER CASE!
                        /
                        /GET HERE IF NOT  "/" OR 6TH CHARACTER
                        /
00011 R 500100 R                AND (7          /GET DIGIT
00012 R 040075 R                DAC SAVE#
                        /
00013 R 200073 R                LAC ADDSS       /GET ADDRESS
00014 R 744010 A                RAL!CLL         /ROTATE 3 POSITIONS LEFT TO
00015 R 742010 A                RTL             /MAKE ROOM FOR NEW DIGIT.
00016 R 340075 R                TAD SAVE        /UPDATE ADDRESS
00017 R 040073 R                DAC ADDSS
00020 R 600005 R                JMP MORE
                        /
00021 R 100047 R        DONE    JMS SETUP
00022 R 220073 R                LAC* ADDSS      /GET CONTENT
00023 R 744010 A                RAL!CLL         /ROTATE 4 POSITIONS FIRST TIME
00024 R 740010 A        LOOP    RAL     /3 POSITIONS AFTER THAT
00025 R 742010 A                RTL
00026 R 040073 R                DAC ADDSS       /SAVE CURRENT POSITIONS
```

```
00027 R 500100 R            AND (7          /GET OCTAL DIGIT
00030 R 340101 R            TAD (260        /MANUFACTURE ASCII CODE
00031 R 100053 R            JMS TYPE
                      /
00032 R 200073 R            LAC ADDSS
00033 R 440074 R            ISZ DIGIT       /ARE WE DONE??
00034 R 600024 R            JMP LOOP        /NO!--BACK FOR MORE
00035 R 140073 R            DZM ADDSS       /YES!-CLEAR ADDSS FOR NEXT TIME
00036 R 750004 A            LAS             /WANT TO CONTINUE?
00037 R 740200 A            SZA             /0 DSW SAYS GO BACK TO MONITOR
00040 R 600004 R            JMP START+4     /DON'T NEED TLS+10 ANYMORE.
00041 R 200102 R            LAC (1
00042 R 040076 R            DAC TIMER#
00043 R 440076 R            ISZ TIMER
00044 R 600043 R            JMP .-1
00045 R 000000 A            CAL
00046 R 000015 A            15
                      /
                      /SUBROUTINES
                      /
00047 R 000000 A      SETUP 0
00050 R 777772 A            LAW -6
00051 R 040074 R            DAC DIGIT
00052 R 620047 R            JMP* SETUP
                      /
00053 R 000000 A      TYPE  0
00054 R 700401 A            TSF
00055 R 600054 R            JMP .-1
00056 R 700406 A            TLS
00057 R 620053 R            JMP* TYPE
                      /
00060 R 000000 A      LISTEN 0
00061 R 700301 A            KSF
00062 R 600061 R            JMP .-1
00063 R 700312 A            KRB
00064 R 620060 R            JMP* LISTEN
                      /
00065 R 000000 A      CRLF  0
00066 R 760215 A            LAW 215
00067 R 100053 R            JMS TYPE
00070 R 760212 A            LAW 212
00071 R 100053 R            JMS TYPE
00072 R 620065 R            JMP* CRLF
                      /
00073 R 000000 A      ADDSS 0
00074 R 777772 A      DIGIT -6
                      /
      000000 R              .END START
00077 R 000257 A *L
00100 R 000007 A *L
00101 R 000260 A *L
00102 R 000001 A *L
          SIZE=00103      NO ERROR LINES
```

```
                                .TITLE PROGRAM TO AVERAGE DECIMAL VALUES
                        /
                        /000000000000000000000000000000000000000000000000000000000000
                        /
                        / PROGRAM ACCEPTS DECIMAL VALUES FROM THE KEYBOARD,
                        / SUMS THEM AND PRINTS OUT THE DECIMAL AVERAGE (GIVEN
                        / TO THE TENTHS PLACE) ON THE TELEPRINTER.
                        / USER SHOULD FOLLOW EACH VALUE WITH A COMMA; TERMINATE
                        / THE LINE WITH CR.  FOR EXAMPLE:  3,18,29,4,(CR)
                        /
                        /000000000000000000000000000000000000000000000000000000000000
                        /
          700301  A     KSF=700301
          700406  A     TLS=700406
          700401  A     TSF=700401
          700312  A     KRB=700312
                        /
00000  R 707762  A     BEGIN   DBA             /RUN IN PAGE MODE
00001  R 700002  A             IOF             /TURN OFF PI
00002  R 705514  A             ISA+10          /AND API INTERRUPT SYSTEMS
                        /
00003  R 700416  A             TLS+10          /INITIATE PRINT--GET FLAG
00004  R 140126  R             DZM COUNT#      /COUNT= # OF VALUES
00005  R 140127  R             DZM FINAL#      /FINAL= SUM OF VALUES
00006  R 100120  R             JMS CRLF
00007  R 140130  R     NXT     DZM NUMB#       /TEMPORARY LOCATION
                        /
00010  R 700301  A     NEXT    KSF
00011  R 600010  R             JMP .-1
00012  R 700312  A             KRB
00013  R 540134  R             SAD (215
00014  R 600035  R             JMP ALLDUN      /CR MEANS LAST VALUE
00015  R 540135  R             SAD (254        /"," SEPARATES VALUES
00016  R 600030  R             JMP DUN
00017  R 500136  R             AND (17         /GET OCTAL NUMBER
00020  R 040133  R             DAC TEMP#
                        /
00021  R 200130  R             LAC NUMB
00022  R 653122  A             MUL
00023  R 000012  A             12
00024  R 641002  A             LACQ            /RESULT SMALL..IN MQ
00025  R 340133  R             TAD TEMP        /ADD ON LAST DIGIT
00026  R 040130  R             DAC NUMB        /SAVE IN NUMB
00027  R 600010  R             JMP NEXT
                        /
00030  R 200130  R     DUN     LAC NUMB        /GET THIS VALUE
00031  R 340127  R             TAD FINAL       /ADD IT TO THE SUM
00032  R 040127  R             DAC FINAL
                        /
00033  R 440126  R             ISZ COUNT       /KEEP TRACK OF HOW MANY VALUES
00034  R 600007  R             JMP NXT
                        /
```

```
                        /
00035 R 200126 R    ALLDUN  LAC COUNT       /GET # OF VALUES
00036 R 040041 R            DAC .+3         /STORE FOR DIVISION
00037 R 200127 R            LAC FINAL       /GET SUM
00040 R 653323 A            IDIV
00041 R 000000 A            0
00042 R 040132 R            DAC REMAIN#     /REMAINDER RETURNED IN AC
00043 R 641002 A            LACQ            /GET QUOTIENT IN MQ
00044 R 040131 R            DAC QUOT#
                        /
00045 R 735000 A            CLX
00046 R 200131 R            LAC QUOT
00047 R 653323 A    NEXXT   IDIV
00050 R 000012 A            12
00051 R 050106 R            DAC DIGIT,X     /STORE IN TABLE
00052 R 641002 A            LACQ            /PICK UP QUOTIENT
00053 R 741200 A            SNA             /CONTINUE IF NOT 0
00054 R 600057 R            JMP DUNN        /STOP WHEN QUOTIENT = 0
00055 R 737001 A            AXR 1           /PUT IN TABLE FOR LATER OUTPUT
00056 R 600047 R            JMP NEXXT
                        /
                        /
00057 R 100120 R    DUNN    JMS CRLF        /ISSUE CR AND LF
                        /
00060 R 210106 R    DUNNN   LAC DIGIT,X
00061 R 340137 R            TAD (260        /TO MAKE ASCII
00062 R 100113 P            JMS PRINT
00063 R 737777 A            AXR -1          /GET NEXT CHARACTER--WORK
                                            /WAY BACK UP TALBE
00064 R 724000 A            PXA             /ARE WE DONE--WHEN XR=0, YES
00065 R 740100 A            SMA
00066 R 600060 R            JMP DUNNN
                        /
00067 R 200140 R            LAC (256        /ISSUE DECIMAL POINT "."
00070 R 100113 R            JMS PRINT
                        /
00071 R 200126 R            LAC COUNT
00072 R 040100 R            DAC REM
00073 R 200132 R            LAC REMAIN
00074 R 653122 A            MUL
00075 R 000012 A            12
00076 R 641002 A            LACQ
00077 R 653323 A            IDIV
00100 R 000000 A    REM     0
00101 R 641002 A            LACQ
00102 R 340137 R            TAD (260
00103 R 100113 R            JMS PRINT
00104 R 100120 R            JMS CRLF
00105 R 600000 R            JMP BEGIN
                        /
00106 R         A   DIGIT   .BLOCK 5
                        /
```

```
                                /
00113 R 000000 A        PRINT   0
00114 R 700401 A                TSF
00115 R 600114 R                JMP .-1
00116 R 700406 A                TLS
00117 R 620113 R                JMP* PRINT
                                /
00120 R 000000 A        CRLF    0
00121 R 760215 A                LAW 215
00122 R 100113 R                JMS PRINT
00123 R 760212 A                LAW 212
00124 R 100113 R                JMS PRINT
00125 R 620120 R                JMP* CRLF
                                /
        000000 R                .END BEGIN
00134 R 000215 A *L
00135 R 000254 A *L
00136 R 000017 A *L
00137 R 000260 A *L
00140 R 000256 A *L
            SIZE=000141     NO ERROR LINES
```

```
                                .TITLE OTOASC-OCTAL TO ASCII TRANSLATOR
                        /
                        /PROGRAM TRANSLATES ONE 18 BIT WORD TO SIX
                        /OCTAL ASCII CHARACTERS.  THE CHARACTERS ARE
                        /STORED IN A BUFFER POINTED TO BY THE WORD
                        /FOLLOWING THE JMS TO OTOASC.
                        /
                        /CALLING SEQUENCE:
                        /
                        /               LAC (WORD TO BE TRANSLATED)
                        /               JMS* OTOASC
                        /               BUFFER ADDRESS  /WHERE FIRST ASCII CHAR
                        /                               /IS TO BE STORED.
                        /
                        /
                                .GLOBL OTOASC
                        /
00000 R 000000 A        OTOASC  0
00001 R 652000 A                LMQ             /STORE 18 BITS TO BE TRANSLATED
00002 R 220000 R                LAC* OTOASC     /PICK UP STORAGE BUFFER ADDRESS
00003 R 040020 R                DAC PTR#
                        /
00004 R 440000 R                ISZ OTOASC      /SET UP FOR EXIT
00005 R 777772 A                LAW -6          /KEEP TRACK OF 6 CHARACTERS
00006 R 040017 R                DAC COUNT#
                        /
                        /DO CONVERSION
                        /
00007 R 750000 A        MORE    CLA             /CLEAR AC
00010 R 640603 A                LLS 3           /MOVE 3 BITS FROM MQ
00011 R 340021 R                TAD (60         /ADD 60 TO MAKE ASCII
00012 R 060020 R                DAC* PTR        /STORE IT AWAY
                        /
00013 R 440020 R                ISZ PTR         /POINT TO NEXT BUFFER LOCATION
00014 R 440017 R                ISZ COUNT       /ARE WE DONE?
00015 R 600007 R                JMP MORE        /NO--GO BACK FOR NEXT 3 BITS
00016 R 620000 R                JMP* OTOASC     /YES--RETURN TO CALLING ROUTINE
                        /
      000000 A                  .END
00021 R 000060 A *L
            SIZE=00022      NO ERROR LINES
```

```
PAGE   1     IA26B  SRC     TRANSLATES IMAGE ALPHA TO SIX-BIT ASCII

                                .TITLE TRANSLATES IMAGE ALPHA TO SIX-BIT ASCII
                            /
                            /PROGRAM TRANSLATES IMAGE ALPHA CHARACTERS TO SIX-BIT
                            /ASCII CHARACTERS.
                            /
                            /CALLING SEQUENCE:
                            /
                            /               LAC (ADDRESS OF FIRST IMAGE ALPHA CHAR)
                            /               JMS* IA26B
                            /               2                   /# OF SIX-BIT WORDS
                            /               BUF                 /SIXBT BUFFER ADDRESS
                            /
          642000 A          OAC=642000        /OR AC TO MQ...RESULT LEFT IN MQ
                            /
                                .GLOBL IA26B
                            /
     00000 R 000000 A       IA26B   0
     00001 R 040035 R               DAC IMGPTR#       /POINTER TO IMAGE CHARS TO BE CO
     00002 R 220000 R               LAC* IA26B        /PICK UP # OF SIXBT WORDS
     00003 R 740031 A               TCA               /MAKE IT NEGATIVE (2'S COMPLEMEN
     00004 R 040034 R               DAC COUNT#
     00005 R 440000 R               ISZ IA26B
     00006 R 220000 R               LAC* IA26B        /PICK UP ADDRESS OF WHERE TO STO
     00007 R 040036 R               DAC SXBPTR#       /6 BIT CHARS AND  SAVE IT
     00010 R 440000 R               ISZ IA26B         /SET UP FOR EXIT
                            /
     00011 R 744000 A       AGAIN   CLL               /CLEAR LINK
     00012 R 650000 A               CLQ               /CLEAR MQ
     00013 R 777775 A               LAW -3            /SET UP COUNTER OF 3
     00014 R 040033 R               DAC CNT3#         /BECAUSE 3 SIXBT CHARS PER WORD
                            /
     00015 R 640606 A       MORE    LLS 6             /GET MQ IN CORRECT POSITION
     00016 R 220035 R               LAC* IMGPTR       /PICK UP CHAR TO BE CONVERTED
     00017 R 500037 R               AND (77           /EXTRACT LOWER 6 BITS
     00020 R 642000 A               OAC               /OR THE MQ AND AC...RESULT LEFT
     00021 R 440035 R               ISZ IMGPTR        /POINT TO NEXT IMAGE CHARACTER
     00022 R 440033 R               ISZ CNT3#         /HAVE WE CONVERTED 3 IMAGE CHARS
     00023 R 600015 R               JMP MORE          /NO--GO BACK FOR MORE
                            /
     00024 R 641002 A               LACQ              /PICK UP SIXBT VALUE IN MQ
     00025 R 060036 R               DAC* SXBPTR       /STORE IT AWAY
     00026 R 440034 R               ISZ COUNT         /ARE WE DONE?
     00027 R 741000 A               SKP               /NO--
     00030 R 620000 R               JMP* IA26B        /YES--RETURN TO CALLING PROGRAM
     00031 R 440036 R               ISZ SXBPTR        /INCREMENT SIXBT BUFFER POINTER
     00032 R 600011 R               JMP AGAIN
                            /
          000000 A                  .END
     00037 R 000077 A *L
                SIZE=00040      NO ERROR LINES
```

```
                                .TITLE CLOCK DIAGNOSTIC--SKIP ON FLAG
                        /
                        / LIGHT IN AC AND LINK WILL MOVE 2 POSITIONS LEFT
                        / EVERY SECOND WHEN CLOCK IS RUNNING PROPERLY.
                        / AC=1 AT OUTSET OF PROGRAM.
                        / AC=1 IF CLOCK NOT OPERATIVE WHEN PROGRAM STARTS.
                        / IF CLOCK DISABLED FROM CONSOLE WITH CLOCK SWITCH,
                        / AC AND LINK ARE FROZEN.  WHEN CLOCK REENABLED
                        / FROM CONSOLE SWITCH, LIGHT STARTS MOVING AGAIN.
                        /
                        /
          700044 A      CLON=700044
          700001 A      CLSF=700001
                        /
    10100 A                     .LOC 10100
                        /
    10100 A 700002 A    START   IOF                 /TURN OFF PI AND
    10101 A 705514 A            ISA+10              /API SYSTEMS
    10102 A 754030 A            CLA!CLL!IAC         /AC=1
    10103 A 170117 A            DZM* (7
                        /
    10104 A 050116 A    AGAIN   DAC ACSAVE#         /SAVE AC WHILE TENDING CLOCK
    10105 A 777704 A            LAW -74             /60 TICKS PER SECOND(74 BASE 8)
    10106 A 370117 A            TAD* (7             /ADD IN ANY RUNOVER
    10107 A 070117 A            DAC* (7             /SET CLOCK REGISTER--LOC. 000007
    10110 A 210116 A            LAC ACSAVE          /GET AC BACK
    10111 A 700044 A            CLON                /TURN CLOCK ON AND CLEAR FLAG
    10112 A 700001 A            CLSF                /CHECK FOR CLOCK FLAG SET
    10113 A 610112 A            JMP .-1             /IF NOT, WE WAIT
    10114 A 742010 A            RTL                 /WHEN SET...ROTATE AC
    10115 A 610104 A            JMP AGAIN           /GO BACK FOR MORE
                        /
          010100 A              .END START
    10117 A 000007 A *L
                SIZE=10120      NO ERROR LINES
```

```
                                .TITLE PRINT "1" AFTER 5 SECONDS-DEDICATED I/O
                        /
                        /
                        / PROGRAM USES DEDICATED I/O WITH THE REAL TIME CLOCK
                        / TO PRINT A "1" ON THE TELEPRINTER EVERY 5 SECONDS.
                        / AS LONG AS THE DATA SWITCHES ARE NOT 0,
                        / THE PROGRAM CONTINUES.  WHEN THE DSW ARE 0, CONTROL
                        / IS RETURNED TO THE MONITOR.
                        /
          700001 A      CLSF=700001
          700044 A      CLON=700044
          700406 A      TLS=700406
          700402 A      TCF=700402
                        /
  10500 A                       .LOC 10500          /HIGH ENOUGH TO AVOID MONITOR
                        /
  10500 A 700002 A      START   IOF                 /LOADED BY DOS--THAT MEANS
  10501 A 705514 A              ISA+10              /INTERRUPTS WERE ON;SO TURN OFF
                        /
  10502 A 170524 A              DZM* (7             /ZERO LOC 7
                        /
  10503 A 777324 A      MORE    LAW -454            /ADD -5 SECONDS IN TICKS
  10504 A 370524 A              TAD* (7             /TO CLOCK COUNTER
  10505 A 070524 A              DAC* (7             /RESTORE TO CLOCK COUNTER
                        /
  10506 A 700044 A              CLON                /TURN CLOCK ON
  10507 A 700001 A      CLKTST  CLSF                /CHECK IF 5 SECONDS HAVE PASSED
  10510 A 610513 A              JMP DSWTST
  10511 A 110520 A              JMS PRINT           /YES--PRINT A "1"
  10512 A 610503 A              JMP MORE            /GO BACK FOR MORE TIMING
                        /
  10513 A 750004 A      DSWTST  LAS                 /CHECK DATA SWITCHES FOR 0
  10514 A 740200 A              SZA
  10515 A 610507 A              JMP CLKTST          /NOT 0, KEEP TESTING CLOCK FLAG
                                .EXIT               /0, GO BACK TO MONITOR
  10516 A 000000 A *G           CAL
  10517 A 000015 A *G           15
                        /
  10520 A 000000 A      PRINT   0
  10521 A 760061 A              LAW 61              /ASCII CODE FOR "1"
  10522 A 700406 A              TLS                 /PRINT IT
  10523 A 630520 A              JMP* PRINT          /RETURN
                        /
          010500 A              .END START
  10524 A 000007 A *L
              SIZE=10525      NO ERROR LINES
```

```
                        .TITLE PRINT "1" AFTER 5 SECONDS--USING PI
                    /
                    /
                    / PROGRAM USES PI WITH THE REAL TIME CLOCK
                    / TO PRINT A "1" ON THE TELEPRINTER EVERY 5 SECONDS.
                    / WHILE CLOCK IS TICKING, THE LINK IS BLINKED AS A
                    / BACKGROUND PROGRAM.
                    /
                    /
          700001    CLSF=700001
          700044    CLON=700044
          700406    TLS=700406
          700402    TCF=700402
                    /
                        .ABS
                    /
    00000               .LOC 0
                    /
    00000   000000      0
    00001   620002      JMP* .+1
    00002   010512      INT
                    /
    10500               .LOC 10500
                    /
    10500   700042  START   ION             /TURN PI ON
    10501   170535          DZM* (7         /CLEAR CLOCK COUNTER
                    /
    10502   777324  MORE    LAW -454        /ADD -5 SECONDS IN TICKS
    10503   370535          TAD* (7         /TO CLOCK COUNTER
    10504   070535          DAC* (7         /RESTORE TO CLOCK COUNTER
                    /
    10505   700044          CLON            /START CLOCK AND CLEAR FLAG
    10506   450533          ISZ COUNT#      /START BLINKING THE LINK
    10507   610506          JMP .-1         /WHEN COUNT OVERFLOWS.
    10510   740002          CML             /COMPLEMENT LINK
    10511   610506          JMP .-3
                    /
    10512   230536  INT     LAC* (0         /PICK UP RETURN PC
    10513   050534          DAC RET#        /SET UP FOR RETURN
    10514   700001          CLSF            /CHECK IF INTERRUPT FROM CLOCK
    10515   610527          JMP CLR         /IF NOT CLOCK--THEN JUST RETURN
    10516   760061          LAW 61          /IT IS, SO GET CODE FOR 1
    10517   700406          TLS             /AND PRINT
                    /
                        .EJECT
```

```
                        /
10520   777324                  LAW -454        /RESTORE CLOCK COUNTER AS BEFORE
10521   370535                  TAD* (7
10522   070535                  DAC* (7
                        /
10523   700044                  CLON            /CLEAR CLOCK FLAG
10524   700042                  ION             /TURN PI BACK ON
10525   707742                  RES             /SET UP TO RESTORE LINK,PAGE/BAN
10526   630534                  JMP* RET        /RETURN TO INTERRUPTED PROGRAM
10527   703302          CLR     CAF             /CLEAR ALL FLAGS--WAS NOT CLOCK
10530   700042                  ION
10531   707742                  RES             /SET UP TO RESTORE LINK,PAGE/BAN
10532   630534                  JMP* RET                /RETURN
                        /
        010500                  .END START
10535   000007    *L
10536   000000    *L
            SIZE=10537      NO ERROR LINES
```

```
                                        .TITLE CLOCK DIAGNOSTIC WITH PI ENABLED
                              /
                              /ØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØ
                              /
                              /PROGRAM PERFORMS ROTATION OF AC WHEN CLOCK AND PI ARE
                              /ENABLED. WHILE THIS IS GOING ON, THE LINK CONTINUALLY
                              /BLINKS (WHETHER OR NOT THE CLOCK AND PI ARE ENABLED).
                              /
                              /IF WHEN PROGRAM STARTS, CLOCK IS NOT WORKING OR PI IS
                              /DISABLED THEN AC=1.
                              /IF CLOCK AND PI ARE ENABLED AND WORKING, THEN THE AC
                              /IS ROTATED ONE BIT POSITION TO THE LEFT ONCE A SECOND
                              /UNTIL THE AC=400000.  THEN THE AC IS ROTATED ONE BIT
                              /POSITION TO THE RIGHT EVERY SECOND UNTIL THE AC=000001.
                              /IF AT ANY POINT WHILE THIS IS GOING ON, THE CLOCK OR PI
                              /ARE DISABLED FROM THE CONSOLE, THE DISPLAYED CONTENT
                              /OF THE AC IS FROZEN UNTIL THEY ARE ENABLED.
                              /
                              /USER MAY RETURN TO THE MONITOR BY SETTING DATA SWITCHES
                              /TO ZERO.
                              /
                              /ØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØØ
                              /
          700044 A            CLON=700044
          700001 A            CLSF=700001
                              /
00000 A                                 .LOC 0
00000 A 000000 A              PI        0
00001 A 600500 A                        JMP SKPCHN        /JUMP TO SKIP CHAIN
                              /
00500 A                                 .LOC 500
00500 A 700001 A              SKPCHN    CLSF              /WAS IT THE CLOCK THAT INTERRUPT
00501 A 600524 A                        JMP CLR           /IF NOT CLOCK, THEN ILLEGAL
00502 A 040615 A                        DAC ACSAVE        /SAVE THE AC FOR ROTATION
00503 A 540617 A                        SAD (400000       /CHECK IF AC NOW AT EXTREME LEFT
00504 A 600530 A                        JMP CHANGE        /YES--CHANGE TO ROTATING RIGHT
00505 A 540620 A                        SAD (000001       /NO--IS IT AT EXTREME RIGHT?
00506 A 600530 A                        JMP CHANGE        /YES--CHANGE TO ROTATING LEFT
                              /
                              /*******************************************************
                              /BEFORE ROTATING THE AC, CHECK TO SEE IF USER WANTS TO
                              /TO RETURN TO MONITOR.  IF  DATA SWITCHES ARE ZERO, GO
                              /BACK TO MONITOR. IF DATA SWITCHES ARE NON 0, CONTINUE
                              /ON WITH THE PROGRAM.
                              /*******************************************************
                              /
00507 A 750004 A              CHECK     LAS               /READ THE DATA SWITCHES
00510 A 741200 A                        SNA               /IF NOT 0 CONTINUE ON
00511 A 600613 A                        JMP MONTOR        /IF 0, GO TO .EXIT
                              /
                                        .EJECT
```

```
                        /
                        /*************************************************************
                        /GET AC VALUE BACK AND ROTATE RIGHT OR LEFT ACCORDING
                        /TO THE INSTRUCTION IN LOCATION ROTATE (THIS MAY BE
                        /MODIFIED IN THE CHANGE SECTION).
                        /THEN SET THE CLOCK TO TICK FOR ANOTHER SECOND BEFORE
                        /INTERRUPTING....THEN RETURN TO THE INTERRUPTED PROGRAM.
                        /*************************************************************
                        /
00512 A 200615 A        GETAC   LAC ACSAVE      /GET AC VALUE TO BE ROTATED
00513 A 744020 A        ROTATE  RCR
00514 A 040615 A                DAC ACSAVE#
00515 A 777704 A                LAW -74
00516 A 040007 A                DAC 7
00517 A 200615 A                LAC ACSAVE#
00520 A 700044 A                CLON
00521 A 707742 A                RES
00522 A 700042 A                ION
00523 A 620000 A                JMP* 0
                        /
                        /*************************************************************
                        /GET HERE FROM LOCATION 501 WHEN  INTERRUPT IS NOT FROM
                        /THE CLOCK.  ALL WE DO IS CLEAR ALL FLAGS AND RETURN TO
                        /THE INTERRUPTED PROGRAM.
                        /*************************************************************
                        /
00524 A 703302 A        CLR     CAF
00525 A 707742 A                RES
00526 A 700042 A                ION
00527 A 620000 A                JMP* 0
                        /
                        /*************************************************************
                        /GET HERE FROM 504 OR 506 WHEN WE WANT TO CHANGE THE
                        /DIRECTION OF ROTATION.  THE CHANGE IS SIMPLY DONE:
                        /RCR=744020 WHILE RCL=744010. NOTICE THAT IF YOU XOR ONE
                        /INSTRUCTION WITH THE VALUE 000030, YOU GET THE OTHER
                        /INSTRUCTION.
                        /*************************************************************
                        /
00530 A 200513 A        CHANGE  LAC ROTATE
00531 A 240621 A                XOR (000030
00532 A 040513 A                DAC ROTATE
00533 A 600507 A                JMP CHECK
                        /
                                .EJECT
```

```
                        /
                        /**************************************************
                        /MAIN SECTION OF PROGRAM
                        /SET UP THE CLOCK INITIALLY
                        /PLACE 000001 IN AC
                        /BLINK THE LINK
                        /**************************************************
                        /
00600 A                         .LOC 600
                        /
00600 A 750000 A        START   CLA
00601 A 705504 A                ISA
00602 A 777704 A                LAW -74
00603 A 040007 A                DAC 7
00604 A 754030 A                CLA!CLL!IAC
00605 A 700042 A                ION
00606 A 700044 A                CLON
00607 A 440616 A        COMPL   ISZ COUNT#
00610 A 600607 A                JMP .-1
00611 A 740002 A                CML
00612 A 600607 A                JMP COMPL
                        /
                        /**************************************************
                        /GO BACK TO THE MONITOR WITH .EXIT
                        /**************************************************
                        /
00613 A                 MONTOR  .EXIT
00613 A 000000 A *G             CAL
00614 A 000015 A *G             15
                        /
                        /
                        /**************************************************
                        /NOTE THAT IN ORDER FOR THIS PROGRAM TO BE LOADED
                        /BY THE LINKING LOADER, API MUST BE ENABLED.
                        /THIS IS BECAUSE AS SOON AS LOCATION 1 IS LOADED,
                        /THE SYSTEM'S USE OF PI FOR LOADING IS CORRUPTED.
                        /
                        /$API ON
                        /
                        /$GLOAD
                        /LOADER VXX
                        /R←PICLK
                        /
                        /**************************************************
                        /
        000600 A                .END START
00617 A 400000 A *L
00620 A 000001 A *L
00621 A 000030 A *L
            SIZE=00622      NO ERROR LINES
```

```
                                .TITLE INTERRUPT LINE EDITOR PROBLEM
                        /
                        /A PROGRAM TO ECHO AN EDITED LINE
                        /USING THE PROGRAM INTERRUPT CONTROL
                        /
                        / EMPLOY'S TWO SOFTWARE SWITCHES:
                        /
                        /  "CRLF" = CARRIAGE RETURN LINE FEED
                        /       (-1=CR,0=LF)
                        /  "MODE" = INPUT/OUTPUT CONTROL
                        /       (-1=OUTPUT,0=INPUT,+1=CRLF ONLY)
                        /
                                .ABSP
                        /
            700301      KSF=700301
            700312      KRS=700312
            700402      TCF=700402
            700401      TSF=700401
            700406      TLS=700406
                        /
    00000                       .LOC 0
    00000   000000      PIC     0
    00001   600112              JMP SEVINT
                        /
    00100                       .LOC 100
    00100   700042      START   ION             /TURN ON "PIC"
    00101   700416              TLS+10          /SET UP 1ST INTERRUPT
    00102   100217              JMS SETUP       /SET UP VARIABLES
    00103   750001              CLA!CMA         /SET -1 IN "AC"
    00104   040337              DAC CRLF#       /SET UP "CRLF"
    00105   440340              ISZ MODE#       /CRLF ONLY!
    00106   440342              ISZ TIME#
    00107   600106              JMP .-1
    00110   740002              CML
    00111   600106              JMP .-3
                        /
                        / INTERRUPT SKIP CHAIN
                        /
    00112   040341      SEVINT  DAC SAVAC#      /SAVE INTERRUPTED "AC"
    00113   700301              KSF             /KEYBOARD?
    00114   741000              SKP
    00115   600166              JMP KB          /YES
    00116   700401              TSF             /PRINTER?
    00117   741000              SKP
    00120   600126              JMP TP          /YES
    00121   740040              HLT             /ILLEGAL INTERRUPT!
                        /
    00122   200341      EXIT    LAC SAVAC       /RESTORE SAVED "AC"
    00123   700042              ION             /TURN INTERRUPT BACK ON
    00124   703344              DBR             /RESET LINK
    00125   620000              JMP* PIC        /RETURN TO INTERRUPTED PROGRAM
                        /
```

```
                        /
                        / TELETYPE SERVICE ROUTINE
                        /
00126   700402  TP      TCF                     /CLEAR INTERRUPTING FLAG
00127   200340          LAC MODE                /INPUT,OUTPUT OR CRLF?
00130   751200          SNA!CLA
00131   600122          JMP EXIT                /INPUT!..GET OUT!
00132   200337          LAC CRLF
00133   741200          SNA
00134   600156          JMP LF                  /0=LINE FEED
00135   751100          SPA!CLA
00136   600152          JMP CR                  /-1=CARRIAGE RETURN
00137   230226          LAC* BUFPTR,X
00140   700406          TLS                     /PRINT CHARACTER
00141   725001          AXS +1                  /ADVANCE XR,72 CHARACTERS?
00142   540343          SAD (215                /CARRIAGE RETURN?
00143   741000          SKP
00144   600122          JMP EXIT                /MORE TO GO!
00145   100217          JMS SETUP               /TERMINATE OUTPUT
00146   440340          ISZ MODE                /SWITCH TO INPUT
00147   750001          CLA!CMA
00150   040337          DAC CRLF
00151   600122          JMP EXIT
                        /
00152   760215  CR      LAW 215
00153   700406          TLS
00154   140337          DZM CRLF                /SET TO LINE FEED
00155   600122          JMP EXIT
                        /
00156   760212  LF      LAW 212
00157   700406          TLS
00160   200340          LAC MODE
00161   750100          SMA!CLA                 /+1=CRLF ONLY
00162   140340          DZM MODE                /SHUT OFF OUTPUT
00163   440337          ISZ CRLF                /SHUT OFF CRLF
00164   735000          CLx                     /RESET TABLE FOR OUTPUT OR INPUT
00165   600122          JMP EXIT
                        /
                        .EJECT
```

```
                        /
                        / KEYBOARD SERVICE ROUTINE
                        /
00166   700312  KB      KRB
00167   540344          SAD (225
00170   600205          JMP LNDLT       /YES
00171   540345          SAD (377        /RUBOUT?
00172   600211          JMP RUBDLT      /YES
00173   070226          DAC* BUFPTR,X   /STORE CHARACTER
00174   725001          AXS +1          /ADVANCE XR,72 CHARACTERS?
00175   540343          SAD (215        /CARRIAGE RETURN?
00176   741000          SKP             /TERMINATE!
00177   600122          JMP EXIT        /MORE TO COME!
00200   750001          CLA!CMA         /SET UP FOR OUTPUT
00201   040340          DAC MODE
00202   040337          DAC CRLF
00203   700416          TLS+10          /GENERATE INTERRUPT!
00204   600122          JMP EXIT
                        /
00205   735000  LNDLT   CLX
00206   760300          LAW 300
00207   700406          TLS
00210   600122          JMP EXIT
                        /
00211   724000  RUBDLT  PXA
00212   740200          SZA             /BEGINING OF LINE?
00213   737777          AXR -1          /NO!
00214   760334          LAW 334
00215   700406          TLS
00216   600122          JMP EXIT
                        /
00217   000000  SETUP   0
00220   140340          DZM MODE
00221   140337          DZM CRLF
00222   735000          CLX
00223   200346          LAC (110
00224   722000          PAL
00225   620217          JMP* SETUP
                        /
00226   000227  BUFPTR  BUFF
00227           BUFF    .BLOCK 110
        000100          .END START
00343   000215  *L
00344   000225  *L
00345   000377  *L
00346   000110  *L
            SIZE=00347      NO ERROR LINES
```

```
                                .TITLE INTERRUPT TEST ROUTINE
                        /
                                .ABSP
                        /
00000                           .LOC 0
                        /
00000   000000          INT     0
00001   041055                  DAC SAVE#
00002   700314                  IORS
00003   600100                  JMP CHECK
                        /
00100                           .LOC 100
                        /
                        /
00100   041056          CHECK   DAC SAVSTA#     /SAVE IORS WORD
00101   501060                  AND (300000     /MASK UNEXPECTED FLAGS
00102   541060                  SAD (300000     /CHECK FOR SIMULTANEOUS FLAGS
00103   600300                  JMP READ        /HANDLE READER FIRST
00104   541061                  SAD (200000     /CHECK FOR READER FLAG
00105   600300                  JMP READ
00106   541062                  SAD (100000     /CHECK FOR PUNCH FLAG
00107   600327                  JMP PUNCH
00110   201063                  LAC (7
00111   700406                  TLS             /RING BELL ON TTY
00112   201056                  LAC SAVSTA      /HALT WITH IORS DISPLAYED
00113   740040                  HLT             /IN AC ON UNEXPECTED INTERRUPT.
                        /
00200                           .LOC 200
                        /
00200   201064          INIT    LAC (500
00201   722000                  PAL             /SETUP LR
00202   141053                  DZM PINDX#
00203   141054                  DZM RINDX#
00204   141057                  DZM TEMP#
00205   707762                  DBA             /SETUP FOR INDEX MODE
00206   735000                  CLX
00207   700042                  ION             /TURN ON INTERRUPT
00210   750000                  CLA
00211   700204                  PSA
00212   700104                  RSA             /MOVE TAPE TO GET FIRST INTERRUP
00213   754030          MAIN    CLA!CLL!IAC
00214   740010                  RAL
00215   441052                  ISZ CNTR#
00216   600215                  JMP .-1
00217   740100                  SMA
00220   600214                  JMP MAIN+1
00221   740020          RIGHT   RAR
00222   441052                  ISZ CNTR
00223   600222                  JMP .-1
00224   541065                  SAD (1
00225   600214                  JMP MAIN+1
00226   600221                  JMP RIGHT
```

```
                        /
00300                   .LOC 300
                        /
00300   201054  READ    LAC RINDX       /GET READER INDEX
00301   721000          PAX             /SETUP XR
00302   700112          RRB             /READ READER BUFFER
00303   050352          DAC BUFF,X      /STORE IT!
00304   201056          LAC SAVSTA      /GET IORS WORD
00305   501066          AND (1000
00306   041057          DAC TEMP        /SAVE FOR CHECK WHEN PUNCH DONE
00307   541066          SAD (1000       /CHECK FOR READER NO TAPE
00310   600322          JMP SETLIM      /SETUP LR FOR PUNCH
00311   725001          AXS+1           /INCREMENT XR,SKIP IF = LR
00312   741000          SKP
00313   600325          JMP RESET
00314   724000          PXA             /GET READER INDEX
00315   041054          DAC RINDX       /SAVE IT
00316   700104          RSA             /MOVE TAPE YOU'RE NOT DONE YET
00317   201055  RET     LAC SAVE
00320   700042          ION
00321   620000          JMP* INT        /RETURN TO MAIN PROGRAM
                        /
00322   725777  SETLIM  AXS -1          /SETUP FINAL LIMIT FOR PUNCH
00323   726000          PXL
00324   600317          JMP RET
00325   141054  RESET   DZM RINDX       /REINITIALIZE READER INDEX
00326   600317          JMP RET
                        /
00327   201053  PUNCH   LAC PINDX
00330   721000          PAX
00331   210352          LAC BUFF,X
00332   700206          PSA +2          /PUNCH A CHARACTER
00333   725001          AXS +1          /INCREMENT XR,SKIP IF = LR
00334   741000          SKP
00335   600341          JMP RNT         /XR=LR,CHECK FOR RDR NO TAPE
00336   724000          PXA             /GET PUNCH INDEX
00337   041053          DAC PINDX       /SAVE IT!
00340   600317          JMP RET
00341   201057  RNT     LAC TEMP        /GET MASKED IORS WORD
00342   541066          SAD (1000       /CHECK FOR RDR NO TAPE
00343   600347          JMP AHEAD       /GET OUT OF INTERRUPT ROUTINES
                                        /YOU'RE DONE!
00344   141053          DZM PINDX       /REINITIALIZE PUNCH INDEX
00345   700104          RSA             /START THE READER
00346   600317          JMP RET
00347   703302  AHEAD   CAF             /CLEAR THE WORLD!
00350   400317          XCT RET         /RESTORE THE AC FOR MAIN
                                        /DON'T TURN INTERRUPT ON.
00351   620000          JMP* INT
                        /
00352           BUFF    .BLOCK 500
                        /
```

```
                        /
            700406      TLS=700406
            700204      PSA=700204
            700104      RSA=700104
            700112      RRB=700112
            000000              .END
  01060     300000    *L
  01061     200000    *L
  01062     100000    *L
  01063     000007    *L
  01064     000500    *L
  01065     000001    *L
  01066     001000    *L
          SIZE=01067      NO ERROR LINES
```

```
                                .TITLE PROGRAM TO CONVERT IOPS ASCII TO IMAGE AL
                        /
                        /PROGRAM INPUTS IN IOPS ASCII FROM THE TTY,
                        /UNPACKS AND STORES AS IMAGE ALPHA,
                        /SORTS THE CHARACTERS IN ASCENDING ORDER
                        /AND OUTPUTS ON WHATEVER DEVICE IS ATTACHED
                        /TO DAT SLOT 3--USUALLY THE TT OR LP.
                        /
                                .IODEV =2,3
                        /
                                .GLOBL SORT
                        /
00000 R                 GO      .INIT 3,1,RST   /TT OR LP FOR OUTPUT
                                .INIT =2,0,RST  /TT ONLY FOR INPUT
                        /
00010 R                 MORE    .READ =2,2,BUFFI,34
                                .WAIT =2
                        /
00010 R 100225 R                JMS UNPACK
00017 R 000041 R                BUFFI           /ADDRESS OF INPUT BUFFER
00020 R 000103 R                BUFFO           /ADDRESS OF OUTPUT BUFFER
                        /
00021 R 200336 R                LAC (BUFFO+2    /GET ADDRESS OF DATA NOT HEADER
00022 R 652000 A                LMQ             /SUB REQUIRES IT IN MQ REGISTER
00023 R 200331 R                LAC HDCNT       /GET WORD COUNT IN AC
00024 R 120335 E                JMS* SORT       /GO OFF TO SORTING ROUTINE
                        /
                        /
                                .WRITE 3,3,BUFFO,82
                                .WAIT 3
00033 R 600010 R                JMP MORE
                        /
00034 R                 RST     .CLOSE =2
                                .CLOSE 3
00040 R 600000 R                JMP GO
                        /
00041 R           A     BUFFI   .BLOCK 42
00103 R 000000 A      BUFFO   0
00104 R 000000 A              0
00105 R           A     BUFDT   .BLOCK 120
                        /
                        /
                        /       UNPACK ROUTINE--IOPS ASCII TO IMAGE ALPHA
                        /
                        /
00225 R 000000 A      UNPACK  0
00226 R 220225 R                LAC* UNPACK     /PICK UP BUFFI ADDRESS
00227 R 040330 R                DAC     FROM#
00230 R 440225 R                ISZ UNPACK
00231 R 220225 R                LAC* UNPACK     /PICK UP BUFFO ADDRESS
00232 R 040334 R                DAC TOP#
00233 R 723002 A                AAC +2          /GET AROUND HEADER WORDS
```

```
00234 R 040333 R            DAC TOW          /POINTER TO DATA AREA
00235 R 440225 R            ISZ UNPACK       /SET UP FOR EXIT
00236 R 220330 R            LAC* FROM        /GET HEADER WORD 0 OF INPUT
00237 R 500337 R            AND (377000      /GET WORD PAIR COUNT (BITS 1-8)
00240 R 340340 R            TAD (-1000       /SUBTRACT ONE (TO EXCLUDE
                                             /HEADER WORD PAIR
00241 R 742030 A            SWHA             /PLACE WD PR COUNT IN BITS 9-17
00242 R 740031 A            TCA              /-NWORD PAIR COUNT
00243 R 040327 R            DAC COUNT#       /SAVE FOR LATER IN UNPACK
                                             /AND FOR USE IN SORT ROUTINE.
00244 R 220330 R            LAC FROM         /PICK UP HW0 OF INPUT BUFFER
00245 R 723002 A            AAC +2           /GET AROUND HEADER WORDS
00246 R 040330 R            DAC FROM         /FROM NOW POINTS TO FIRST DATA
                    /
00247 R 140331 R            DZM HOCNT#       /CLEAR IMAGE ALPHA CHAR. COUNTER
                    /
                    /DO THE ACTUAL UNPACKING
                    /
00250 R 220330 R    DO      LAC* FROM        /GET THE 1ST OF A WORD PAIR
00251 R 742030 A            SWHA
00252 R 742020 A            RTR
00253 R 100321 R            JMS STORE        /GET THE FIRST OF FIVE
00254 R 220330 R            LAC* FROM        /PICK UP FIRST WORD AGAIN
00255 R 742020 A            RTR      /MOVE 2ND CHARACTER INTO BITS 11-17
00256 R 742020 A            RTR
00257 R 100321 R            JMS STORE        /STORE THE 2ND OF FIVE
                    /
00260 R 220330 R            LAC* FROM
00261 R 742010 A            RTL
00262 R 740010 A            RAL
00263 R 500341 R            AND (170
00264 R 040332 R            DAC TEMP#
00265 R 440330 R            ISZ FROM
00266 R 220330 R            LAC* FROM        /PICK UP 2ND WORD OF PAIR
00267 R 742010 A            RTL              /MOVE 2ND HALF OF 3RD CHAR
00270 R 742010 A            RTL              /TO BITS 15-17
00271 R 500342 R            AND (7
00272 R 340332 R            TAD TEMP
00273 R 100321 R            JMS STORE        /FINALLY--STORE THE 3RD OF FIVE
                    /
00274 R 220330 R            LAC* FROM        /PICK UP 2ND WORD AGAIN TO GET
00275 R 740010 A            RAL              /AT THE 4TH OF FIVE--MOVE TO BIT
00276 R 742030 A            SWHA             /NOW TO BITS 11-17
00277 R 100321 R            JMS STORE        /STORE 4TH OF FIVE
                    /
00300 R 220330 R            LAC* FROM        /PICK UP WORD 2 FOR CHARACTER 5
00301 R 740020 A            RAR              /PLACE IN BITS 11-17
00302 R 100321 R            JMS STORE        /STORE LAST OF FIVE
                    /
                            .EJECT
```

```
00303 R 440330 R            ISZ FROM          /SETUP TO DO IT WITH NEXT 2 WDS
00304 R 440327 R            ISZ COUNT         /ARE WE DONE WITH ALL 5/7 WR
00305 R 000250 R            JMP DO            /NO--GO BACK FOR MORE
                      /
00306 R 200331 R            LAC HDCNT         /YES,DONE-INCLUDE HEADER WORD PA
00307 R 723003 A            AAC +3            /AND ONE FOR GOOD LUCK
00310 R 742030 A            SWHA              /DIVIDE BY 2 AND POSITION IN
00311 R 740020 A            RAR               /BITS 1-8
00312 R 500337 R            AND (377000
00313 R 723003 A            AAC +3            /SET DATA MODE TO IMAGE
00314 R 050334 R            DAC* TOP
00315 R 440334 R            ISZ TOP
00316 R 160334 R            DZM* TOP
00317 R 160333 R            DZM* TO
00320 R 620225 R            JMP* UNPACK
                      /
                      /
00321 R 000000 A     STORE  0
00322 R 500343 R            AND (177
00323 R 050333 R            DAC* TO
00324 R 440333 R            ISZ TO
00325 R 440331 R            ISZ HDCNT
00326 R 620321 R            JMP* STORE
                      /
       000000 R             .END GO
00335 R 000335 E *E
00336 R 000105 R *L
00337 R 377000 A *L
00340 R 777000 A *L
00341 R 000170 A *L
00342 R 000007 A *L
00343 R 000177 A *L
          SIZE=00344     NO ERROR LINES
```

```
                                .TITLE SOURCE FILE LISTER
                        /
                        /oooooooooooooooooooooooooooooooooooooooooooooooooooooooooo
                        /
                        /LAB PROBLEM - DEVISE A PROGRAM TO LIST A "SRC" FILE OF
                        /ANY LENGTH ON A GIVEN OUTPUT DEVICE
                        /
                        /EXAMPLE OF A GLOBAL CALL
                        /
                        /INPUT DEVICE IS .DAT -15 (DISK OR DT)
                        /OUTPUT DEVICE IS .DAT 3 (TT OR LP)
                        /COMMAND STRING IS .DAT -2 (MUST BE TTY)
                        /
                        /NAME IS AN INTERNAL GLOBAL
                        /FILNAM IS AN EXTERNAL GLOBAL
                        /
                        /oooooooooooooooooooooooooooooooooooooooooooooooooooooooooo
                        /
                                .GLOBL NAME,FILNAM
                        /
                                .IODEV -2,3,-15
                        /
00000 R                 START   .INIT -2,0,RST
                                .INIT 3,1,0
                                .INIT -15,0,0
                        /
                                .WRITE -3,2,MESS1,34
                                .WRITE -3,2,MESS2,34
                                .WRITE -3,2,MESS3,34
                                .WAIT -3
                        /
                                .READ -2,2,ANS,6
                                .WAIT -2
                                .CLOSE -2
                        /
00042 R 200167 R                LAC ANS+2               /FIRST PART OF 5/7 ASCII
00043 R 040050 R                DAC AUG1
00044 R 200170 R                LAC ANS+3               /SECOND PART OF 5/7 ASCI
00045 R 040051 R                DAC AUG2
00046 R 200171 R                LAC ANS+4               /LAST PART OF 5/7 ASCII
00047 R 120263 E                JMS* FILNAM             /GO CONVERT 5/7 TO SIXBT
00050 R 000000 A        AUG1    0
00051 R 000000 A        AUG2    0
                        /
                                .FSTAT -15,NAME         /FILENAME ON DEVICE?
00055 R 741200 A                SNA                     /FILE PRESENT?
00056 R 600111 R                JMP RST                 /NO GO RESTART
                                .SEEK -15,NAME          /YES OPEN AND READ FIRST
                        /
00062 R                 MORE    .READ -15,2,BUFF,255    /GET ONE LINE OF TEXT
                                .WAIT -15
                        /
```

```
GE   2     FILLST SRC      SOURCE FILE LISTER

                           /
00070 R 200120 R                   LAC BUFF
00071 R 500264 R                   AND (7
00072 R 540265 R                   SAD (5                          /DONE?
00073 R 600103 R                   JMP DONE                        /YES
                                   .WRITE 3,2,BUFF,34                          /NO - CO
                                   .WAIT 3                         /AND OUTPUT THE LINE
00102 R 600062 R                   JMP MORE                        /GO BACK FOR ANOTHER LIN
                           /
00103 R                    DONE    .WRITE -3,2,MESS4,34
                                   .WAIT -3
00111 R                    RST     .CLOSE -3
                                   .CLOSE -2
                                   .CLOSE -15
00117 R 600000 R                   JMP START
00120 R          A         BUFF    .BLOCK 42
                           /
                           /
00162 R 000000 A           NAME    .SIXBT "@@@@@@SRC"
00163 R 000000 A
00164 R 232203 A
                           /
00165 R          A         ANS     .BLOCK 10
                           /
00175 R 010002 A           MESS1   MESS2-MESS1/2*1000+2
00176 R 000000 A                   0
00177 R 445012 A                   .ASCII "I WILL RETRIEVE ANY 'SRC' FILE"<15>
00200 R 744630 A
00201 R 461012 A
00202 R 242650 A
00203 R 512230 A
00204 R 553212 A
00205 R 202031 A
00206 R 654500 A
00207 R 236472 A
00210 R 241516 A
00211 R 202151 A
00212 R 146212 A
00213 R 064000 A
00214 R 000000 A
00215 R 012002 A           MESS2   MESS3-MESS2/2*1000+2
00216 R 000000 A                   0
00217 R 522632 A                   .ASCII "TYPE IN A FULL SIX CHARACTER "
00220 R 042500 A
00221 R 446344 A
00222 R 340500 A
00223 R 432531 A
00224 R 446100 A
00225 R 516233 A
00226 R 020206 A
00227 R 442032 A
00230 R 240606 A
```

```
00231 R 522132 A
00232 R 220000 A
00233 R 432231 A              .ASCII "FILE NAME."<015>
00234 R 442500 A
00235 R 472031 A
00236 R 542534 A
00237 R 064000 A
00240 R 000000 A
00241 R 006002 A     MESS3    MESS4-MESS3/2*1000+2
00242 R 000000 A              0
00243 R 426610 A              .ASCII "EXAMPLE** ECHO@@<CR>"<015>
00244 R 146640 A
00245 R 462125 A
00246 R 225100 A
00247 R 426071 A
00250 R 047600 A
00251 R 401710 A
00252 R 351174 A
00253 R 064000 A
00254 R 000000 A
00255 R 003002 A     MESS4    ENDM=MESS4/2*1000+2
00256 R 000000 A              0
00257 R 422371 A              .ASCII "DONE!"<015>
00260 R 642502 A
00261 R 064000 A
00262 R 000000 A
        000263 R     ENDM=.
        000000 R              .END START
00263 R 000263 E *E
00264 R 000007 A *L
00265 R 000005 A *L
            SIZE=00266      NO ERROR LINES
```

```
                        .TITLE ROUTINE TO CONVERT 5/7 ASCII TO SIXBIT AS
                    /
                    /ROUTINE TO CONVERT 5/7 PACKED ASCII NAME TO SIXBIT NAME
                    /FILE NAME IS "ABCDEF" FOR COMMENTS
                    /"X"IS A DON'T CARE POSITION
                    /"0" IS A POSITION KNOWN TO BE ZERO
                    /BIT POSITIONS ARE GIVEN BY CHARACTER LETTERS A-F OF FIL
                    /
                    /
                    /       CALL SEQUENCE
                    /       JMS* FILNAM
                    /       AUG1                    /XAAAAAAXBBBBBBXCCC
                    /       AUG2                    /CCCXDDDDDDXEEEEEE0
                    /       AC=AUG3                 /XFFFFFF000000000000
                    /
                    /
                    /"NAME" IS AN EXTERNAL GLOBL
                    /"FILNAM" IS AN INTERNAL GLOBL
                    /
                        .GLOBL NAME,FILNAM
00000 R 000000 A    FILNAM  0
00001 R 040046 R            DAC SAVAC               /SAVE AUG3
00002 R 200050 E            LAC NAME
00003 R 723001 A            AAC 1
00004 R 040047 R            DAC NAME1
00005 R 775767 A            LAW 15767               / "B"&"C" 7TH BITS TO 0
00006 R 520000 R            AND* FILNAM             /AC=XAAAAAA0BBBBBB0CCC
00007 R 744010 A            CLLIRAL                 /AC=AAAAAA0BBBBBB0CCC0
00010 R 744000 A            CLL
00011 R 100037 R            JMS LFTPK               /MOVE "B"&"C" ONE LEFT
00012 R 003756 A            3756                    /AC=AAAAAABBBBBB0CCC00
00013 R 100037 R            JMS LFTPK               /MOVE "C" ONE  LEFT
00014 R 003734 A            34                      /AC=AAAAAABBBBBBCCC000
00015 R 060050 E            DAC* NAME
00016 R 440000 R            ISZ FILNAM
00017 R 220000 R            LAC* FILNAM             /AC=CCCXDDDDDDXEEEEEE0
00020 R 640517 A            LRS 17                  /AC=000000000000000CCC
00021 R 360050 E            TAD* NAME               /AC=AAAAAABBBBBBCCCCCC
00022 R 060050 E            DAC* NAME
00023 R 640623 A            LLS 23                  /AC=DDDDDDXEEEEEE000000
00024 R 500051 R            AND (773777             /FORCE AC 6 TO 0
00025 R 100037 R            JMS LFTPK               /MOVE "E" ONE  LEFT
00026 R 003740 A            3740                    /AC=DDDDDDEEEEEE000000
00027 R 060047 R            DAC* NAME1
00030 R 200046 R            LAC SAVAC               /AC=XFFFFFF000000000000
00031 R 640513 A            LRS 13                  /AC=000000000000XFFFFFF
00032 R 500052 R            AND (77                 /FORCE AC 11 TO 0
00033 R 360047 R            TAD* NAME1              /AC=DDDDDDEEEEEEFFFFFF
00034 R 060047 R            DAC* NAME1
00035 R 440000 R            ISZ FILNAM
00036 R 620000 R            JMP* FILNAM
                            .EJECT
```

```
00037 R 000000 A     LFTPK    0
00040 R 040045 R              DAC T1
00041 R 520037 R              AND* LFTPK
00042 R 340045 R              TAD T1
00043 R 440037 R              ISZ LFTPK
00044 R 620037 R              JMP* LFTPK
                      /
00045 R 000000 A     T1       0
00046 R 000000 A     SAVAC    0
00047 R 000000 A     NAME1    0
        000000 A              .END
00050 R 000050 E *E
00051 R 773777 A *L
00052 R 000077 A *L
            SIZE=00053      NO ERROR LINES
```

```
                        .TITLE "A SUBROUTINE TO CONVERT 5/7 ASCII TO 6 B
                    /
                        .GLOBL NAME,FILNAM
                    /
00000 R 000000 A    FILNAM  0
00001 R 040061 R            DAC SAVAC#      /SAVE LAST ARGUMENT
00002 R 220000 R            LAC* FILNAM     /GET FIRST
                    /
                    /GET 2 AND 1/2 SIXBIT CHARACTERS
                    /
00003 R 740010 A            RAL
00004 R 040062 R            DAC TEMP#
00005 R 500064 R            AND (770000
00006 R 060063 E            DAC* NAME
00007 R 200062 R            LAC TEMP
00010 R 740010 A            RAL
00011 R 040062 R            DAC TEMP
00012 R 500065 R            AND (007700
00013 R 360063 E            TAD* NAME
00014 R 060063 E            DAC* NAME
00015 R 200062 R            LAC TEMP
00016 R 740010 A            RAL
00017 R 500066 R            AND (000070
00020 R 040062 R            DAC TEMP
00021 R 440000 R            ISZ FILNAM
00022 R 220000 R            LAC* FILNAM     /GET SECOND
                    /
                    /COMPLETE 5 SIX BIT CHARACTERS
                    /
00023 R 500067 R            AND (700000
00024 R 744000 A            CLL
00025 R 742010 A            RTL
00026 R 742010 A            RTL
00027 R 340062 R            TAD TEMP
00030 R 360063 E            TAD* NAME
00031 R 060063 E            DAC* NAME
00032 R 220000 R            LAC* FILNAM
00033 R 742010 A            RTL
00034 R 742010 A            RTL
00035 R 040062 R            DAC TEMP
00036 R 500064 R            AND (770000
00037 R 440063 E            ISZ NAME
00040 R 060063 E            DAC* NAME
00041 R 200062 R            LAC TEMP
00042 R 740010 A            RAL
00043 R 500065 R            AND (007700
00044 R 360063 E            TAD* NAME
00045 R 060063 E            DAC* NAME
00046 R 200061 R            LAC SAVAC       /ASSEMBLE LAST SIX BIT
00047 R 742030 A            SWHA            /CHARACTER
00050 R 742020 A            RTR
00051 R 500070 R            AND (000077
```

```
GE   2      FILENM SRC      "A SUBROUTINE TO CONVERT 5/7 ASCII TO 6 BIT"

 00052 R 360063 E             TAD* NAME
 00053 R 060063 E             DAC* NAME
 00054 R 777777 A             LAW -1
 00055 R 340063 E             TAD NAME          /RESTORE CONTENT OF NAME
 00056 R 040063 E             DAC NAME
 00057 R 440000 R             ISZ FILNAM
 00060 R 620000 R             JMP* FILNAM
                      /
         000000 A             .END
 00063 R 000063 F *E
 00064 R 770000 A *L
 00065 R 007700 A *L
 00066 R 000070 A *L
 00067 R 700000 A *L
 00070 R 000077 A *L
             SIZE=000071      NO ERROR LINES
```

```
PAGE    1       FILALO SRC      PROGRAM TO ALLOCATE SPACE FOR RANDOM ACCESS FILE

                                        .TITLE PROGRAM TO ALLOCATE SPACE FOR RANDOM ACCE
                                /
                                /000000000000000000000000000000000000000000000000000000000000
                                /
                                /WHEN STARTED, THE PROGRAM EXPECTS TO FIND THE NAME
                                /AND DESIRED LENGTH OF THE FILE IN THE DATA SWITCH
                                /REGISTER.  THE PROGRAM HALTS 3 TIMES
                                /       1)PLACE FIRST 3 CHARS (6 BIT) OF NAME IN DSR
                                /       2)PLACE SECOND 3 CHARS (6 BIT) OF NAME IN DSR
                                /       3)PLACE 3 CHARS (6 BIT) OF EXTENSION IN DSR
                                /       4)PLACE DESIRED LENGTH OF FILE IN BLOCKS IN DSR
                                /
                                /WHEN OPERATOR HITS THIRD CONTINUE, PROGRAM CREATES
                                /THE DUMMY FILE 1 BLOCK LONGER THAN SPECIFIED IN THE DSR
                                /NOTE THAT THE EXTRA BLOCK IS USED TO HOLD THE "RIB",
                                /RETRIEVAL INFORMATION BLOCK, WHICH IS NECESSARY FOR
                                /RANDOM ACCESS OPERATIONS. DON'T TRY TO FOOL THE PROGRAM
                                /BY PLACING A VALUE 1 LESS THAN THE DESIRED LENGTH IN
                                /THE DATA SWITCH REGISTER.
                                /
                                /000000000000000000000000000000000000000000000000000000000000
                                /
                                        .IODEV 4
                                /
        000001  A               OUT=1
                                /
00000 R                         START   .INIT 4,OUT,0           /INITIALIZE OUTPUT DEVIC
                                /
 00004 R 740040  A                      HLT             /HALT TO
00005 R 750004  A                       LAS             /PICK UP FIRST 3 CHARACTERS
00006 R 040042  R                       DAC NAME        /OF NAME AND SAVE
                                /
00007 R 740040  A                       HLT             /HALT TO
00010 R 750004  A                       LAS             /PICK UP SECOND 3 CHARACTERS
00011 R 040043  R                       DAC NAME+1      /OF NAME AND SAVE
                                /
00012 R 740040  A                       HLT             /HALT TO
00013 R 750004  A                       LAS             /PICK UP 3 CHARACTER EXTENSION
00014 R 040044  R                       DAC EXT         /AND SAVE
                                /
00015 R 740040  A                       HLT             /HALT TO
00016 R 750004  A                       LAS             /PICK UP DESIRED FILE LENGTH
00017 R 741300  A                       SPA!SNA         /LEGAL ONLY IF STRICTLY POSITIVE
00020 R 600040  R                       JMP EXIT        /OTHERWISE EXIT
00021 R 740031  A                       TCA             /MAKE IT A NEGATIVE COUNT
00022 R 040443  R                       DAC COUNT#
                                /
                                        .EJECT
```

```
                        /
                        /
                                .ENTER 4,NAME           /GET DIRECTORY ENTRY FOR
00026 R                 OUTPUT  .WRITE 4,3,BUFF,254     /WRITE IT OUT--ONE BLOCK
                                .WAIT 4
00034 R 440443 R                ISZ COUNT               /ARE WE DONE?
00035 R 600026 R                JMP OUTPUT              /NO--BACK FOR MORE
                                .CLOSE 4                /YES--CLOSE FILE
00040 R                 EXIT    .EXIT                   /BYE....
                        /
                        /
                        /
00042 R 000000 A        NAME    0
00043 R 000000 A                0
00044 R 000000 A        EXT     0
                        /
00045 R 177000 A        BUFF    177000
00046 R 000000 A                0
                                .REPT 374
00047 R 000005 A                5
                        /
        000000 R                .END START
            SIZE=00444      NO ERROR LINES
```

```
                                .TITLE PROGRAM TO LIST BLOCKS USED BY A FILE
                        /
                        /oooooooooooooooooooooooooooooooooooooooooooooooooooooooo
                        /
                        /PROGRAM ASKS FOR THE NAME OF A FILE WHICH IS STORED
                        /ON THE DEVICE ASSOCIATED WITH DAT 3 (DISK OR DECTAPE).
                        /IF THE FILE EXISTS, THE BLOCKS USED BY THE FILE ARE
                        /LISTED ON THE DEVICE ASSOCIATED WITH DAT 12 (TT OR LP).
                        /IF THE FILE DOES NOT EXIST ON THE DEVICE, A MESSAGE
                        /TO THAT EFFECT IS PRINTED ON THE TT.
                        /
                        /oooooooooooooooooooooooooooooooooooooooooooooooooooooooo
                        /
                                .GLOBL IA26B,OTOASC
                        /
                                .IODEV 3,12
            000000 A    IN=0
            000001 A    OUT=1
                        /
    00000 R             START   .INIT 3,IN,0    /SETUP 3 FOR INPUT (FILE)
                                .INIT =2,OUT,0

                                .INIT 12,OUT,0  / SETUP 12 FOR OUTPUT (TT OR LP)
                                .INIT =3,IN,OVER
                        /
                        /**************************************************
                        /  GET FILE NAME AND EXTENSION
                        /**************************************************
                        /
                                .WRITE =2,2,MESS1,34    /TYPE
                                .WRITE =2,2,MESS1A,34
                                .WRITE =2,2,MESS2,34    /EXAMPLE
    00034 R             LIST    .WRITE =2,2,MESS3,34    /NAME=
                                .WAIT =2
                        /       /READ IN NAME
                                .READ =3,3,BUFFN,8
                                .WAIT =3
                                .WRITE =2,2,MESS4,34    /EXT=
                                .WAIT =2
                                .READ =3,3,BUFFE,5      /READ IN EXTENSION
                        /
    00062 R 201107 R            LAC (BUFFN+2            /WHILE READING EXTENSION
    00063 R 121105 E            JMS* IA26B              /TRANSLATE NAME
    00064 R 000002 A            2               /NUMBER OF SIX= BIT WORDS

    00065 R 000647 R            NAME
                        /
                                .WAIT =3                /WAIT FOR EXTENSION READ
                        /
    00070 R 201110 R            LAC (BUFFE+2
    00071 R 121105 E            JMS* IA26B
    00072 R 000001 A            1               /NUMBER OF SIX= BIT WORDS
    00073 R 000651 R            EXT
                        /
```

```
                        /************************************************************
                        /  FIND OUT IF FILE EXISTS
                        /************************************************************
                        /
00074 R 100174 R                JMS WRNAME
                        /
                                .FSTAT 3,NAME
00100 R 741200 A                SNA                     /DID IT GIVE START BLOCK #?
00101 R 600227 R                JMP NEXIST              /NO--SO DOESN'T EXIST
00102 R 040123 R        BLKNUM  DAC TRAN+2
                        /
                        /************************************************************
                        /
                        /  GET BLOCK #S AND PRINT OUT
                        /
                        /************************************************************
                        /
00103 R 121106 F                JMS* OTOASC
00104 R 000240 R                BUFASC
                                .WRITE 12,2,CRLF,4
                                .WAIT 12
                                .WRITE 12,3,BLKHD,8
                                .WAIT 12
00121 R                 TRAN    .TRAN 3,IN,0,BUFF,256
                                .WAIT 3
00130 R 200646 R                LAC BUFF+377
00131 R 541111 R                SAD (777777
00132 R 600134 R                JMP ENDFIL
00133 R 600102 R                JMP BLKNUM
                        /
                        /************************************************************
                        /
                        /  GET HERE WHEN HAVE PRINTED ALL BLOCK #S
                        /
                        /************************************************************
                        /
                        /
00134 R                 ENDFIL  .WRITE 12,2,CRLF,4
                                .WRITE 12,2,MESS6,34
00144 R                 ANOTHER .WRITE -2,2,CRLF,4
                                .WRITE -2,2,MESS7,34    /WANT ANOTHER FILE?
                                .READ -2,3,BUFMR,3
                                .WAIT -2
00162 R 200654 R                LAC BUFMR+2
00163 R 541112 R                SAD (131                /131=YES
00164 R 600167 R                JMP OVER                /START OVER
                                .EXIT
                        /
00167 R                 OVER    .WRITE -2,2,CRLF,4
00173 R 600034 R                JMP LIST
                        /
                        /
```

```
                        /
                        /
00174 R 000000 A    WRNAME  0                                                   1
                            .WRITE 12,2,CRLF,4
                            .WAIT 12
00203 R 200671 R            LAC BUFFE
00204 R 341113 R            TAD (1000
00205 R 040667 R            DAC BUFEHD
00206 R 201114 R            LAC (20
00207 R 040671 R            DAC BUFFE
00210 R 201115 R            LAC (11
00211 R 040672 R            DAC BUFFE+1
                            .WRITE 12,3,BUFFN,10
                            .WAIT 12
                            .WRITE 12,3,BUFEHD,8
                            .WAIT 12
00226 R 520174 R            JMP* WRNAME
                        /
00227 R             NEXIST  .WRITE 12,2,MESS8,34
                            .WAIT 12
00235 R 600144 R            JMP ANOTHER
                        /
                        /
                        /*****************************************************
                        /
                        /  BUFFERS
                        /
                        /*****************************************************
                        /
00236 R 004003 A    BLKHD   004003
00237 R 000000 A            0
00240 R         A    BUFASC  .BLOCK 6
00246 R 000015 A            15
                        /
00247 R         A    BUFF    .BLOCK 400      /SET UP FOR TRAN OF BLOCK
                        /
00647 R 000000 A    NAME    0
00650 R 000000 A            0
00651 R 000000 A    EXT     0
                        /
00652 R         A    BUFMR   .BLOCK 4
                        /
00656 R 000000 A    BUFFN   0
00657 R 000000 A            0
00660 R         A            .BLOCK 6
00666 R 000175 A            175
00667 R 000003 A    BUFEHD  000003
00670 R 000000 A            0
00671 R 000000 A    BUFFE   0
00672 R 000000 A            0
00673 R         A            .BLOCK 3
00676 R 000015 A            15
```

```
                                .TITLE MESSAGE PAGE
                        /
                        /
00677 R 017000 A        MESS1   MESS1A-MESS1/2*1000
00700 R 000000 A                0
00701 R 522632 A                .ASCII /TYPE IN A FULL 6 CHARACTER NAME /
00702 R 042500 A
00703 R 446344 A
00704 R 040500 A
00705 R 432531 A
00706 R 446100 A
00707 R 331010 A
00710 R 344202 A
00711 R 512030 A
00712 R 352212 A
00713 R 511011 A
00714 R 640632 A
00715 R 425000 A
00716 R 000000 A
00717 R 406350 A                .ASCII /AND THREE CHARACTER EXTENSION./<15>
00720 R 420250 A
00721 R 442450 A
00722 R 542500 A
00723 R 416210 A
00724 R 151202 A
00725 R 416510 A
00726 R 551100 A
00727 R 426612 A
00730 R 442634 A
00731 R 516231 A
00732 R 747134 A
00733 R 064000 A
00734 R 000000 A
                        /
00735 R 006000 A        MESS1A  MESS2-MESS1A/2*1000
00736 R 000000 A                0
00737 R 432231 A                .ASCII /FILL IN NULLS WITH "0"/<15>
00740 R 446100 A
00741 R 446344 A
00742 R 047252 A
00743 R 462312 A
00744 R 320256 A
00745 R 446511 A
00746 R 020104 A
00747 R 401041 A
00750 R 500000 A
                        /
00751 R 010000 A        MESS2   MESS3-MESS2/2*1000
00752 R 000000 A                0
00753 R 432372 A                .ASCII /FOR EXAMPLE:/
00754 R 220212 A
00755 R 542031 A
```

```
00756 R 550230 A
00757 R 425640 A
00760 R 000000 A
00761 R 472031 A                .ASCII /NAME=SORT@@/<11>/EXT=SRC/<15>
00762 R 542572 A
00763 R 516372 A
00764 R 252200 A
00765 R 400230 A
00766 R 554250 A
00767 R 366472 A
00770 R 241432 A
                        /
00771 R 003000 A        MESS3   MESS4=MESS3/2*1000
00772 R 000000 A                0
00773 R 372350 A                .ASCII />NAME=/<175>
00774 R 146612 A
00775 R 367720 A
00776 R 000000 A
                        /
00777 R 003000 A        MESS4   MESS5=MESS4/2*1000
01000 R 000000 A                0
01001 R 046133 A                .ASCII <11>/EXT=/<175>
01002 R 052172 A
01003 R 764000 A
01004 R 000000 A
                        /
01005 R 002000 A        MESS5   MESS6=MESS5/2*1000
01006 R 000000 A                0
01007 R 201004 A                .ASCII /    /<15>
01010 R 006400 A
                        /
01011 R 006000 A        MESS6   MESS7=MESS6/2*1000
01012 R 000000 A                0
01013 R 522210 A                .ASCII /THAT'S ALL THERE IS!/<15>
01014 R 152116 A
01015 R 515010 A
01016 R 146230 A
01017 R 202511 A
01020 R 042644 A
01021 R 425011 A
01022 R 151502 A
01023 R 064000 A
01024 R 000000 A
                        /
01025 R 017000 A        MESS7   MESS8=MESS7/2*1000
01026 R 000000 A                0
01027 R 422364 A                .ASCII /DO YOU WANT ANOTHER FILE?/
01030 R 054636 A
01031 R 525012 A
01032 R 740634 A
01033 R 521010 A
01034 R 147236 A
```

```
01035 R 522210 A
01036 R 551100 A
01037 R 432231 A
01040 R 442576 A
01041 R 406352 A                .ASCII /ANSWER Y FOR YES./
01042 R 353612 A
01043 R 511013 A
01044 R 120214 A
01045 R 476444 A
01046 R 054612 A
01047 R 515340 A
01050 R 000000 A
01051 R 265330 A                .ASCII /--ANYTHING ELSE FOR NO/<15>
01052 R 147262 A
01053 R 522211 A
01054 R 147216 A
01055 R 202131 A
01056 R 451612 A
01057 R 202151 A
01060 R 751100 A
01061 R 472361 A
01062 R 500000 A
                        /
01063 R 007000 A        MESS8   CRLF-MESS8/2*1000
01064 R 000000 A                0
01065 R 202111 A                .ASCII / DOES NOT EXIST ON DEVICE/<15>
01066 R 742646 A
01067 R 202351 A
01070 R 752100 A
01071 R 426611 A
01072 R 151650 A
01073 R 202371 A
01074 R 620210 A
01075 R 426551 A
01076 R 141612 A
01077 R 064000 A
01100 R 000000 A
                        /
01101 R 002000 A        CRLF    002000
01102 R 000000 A                0
01103 R 064000 A                .ASCII <15>
01104 R 000000 A
      000000 R                  .END START
01105 R 001105 E *E
01106 R 001106 E *E
01107 R 000660 R *L
01110 R 000673 R *L
01111 R 777777 A *L
01112 R 000131 A *L
01113 R 001000 A *L
01114 R 000020 A *L
01115 R 000011 A *L
            SIZE=01116      NO ERROR LINES
```

```
$L
     EXAMPLE OF FILBLK USE----


     TO THE TELETYPE

$A TT 12

$GLOAD

LOADER V3A000
>←FILBLK,OTOASC,IA26B


TYPE IN A FULL 6 CHARACTER NAME AND THREE CHARACTER EXTENSION.
FILL IN NULLS WITH "@"
FOR EXAMPLE: NAME=SORT@@ EXT=SRC
>NAME=MAIN1@     EXT=SRC
MAIN1@  SRC
000520
000522
THAT'S ALL THERE IS!

DO YOU WANT ANOTHER FILE?  ANSWER Y FOR YES--ANYTHING ELSE FOR NO
N

DOS-15 V3A000
$L
     TO THE LINEPRINTER

$A LP 12

$GLOAD

LOADER V3A000
>←FILBLK,OTOASC,IA26B


TYPE IN A FULL 6 CHARACTER NAME AND THREE CHARACTER EXTENSION.
FILL IN NULLS WITH "@"
FOR EXAMPLE: NAME=SORT@@ EXT=SRC
>NAME=MAIN1@     EXT=SRC
DO YOU WANT ANOTHER FILE?  ANSWER Y FOR YES--ANYTHING ELSE FOR NO
N

DOS-15 V3A000
$
```

```
MAIN1@  SRC

000520

000522

THAT'S ALL THERE IS!
```

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