PRODUCT CODE:	MAINDEC-8E-DØMB-D
PRODUCT TEST:	KE8-E (EAE) INSTRUCTION TEST 2 MULTIPLY AND DIVIDE
DATE CREATED:	FEBRUARY 9, 1972
MAINTAINER:	DIAGNOSTIC GROUP
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1. ABSTRACT

THE PDP-8/E EAE (KE8-E) MULTIPLY-DIVIDE TEST, TESTS AND EXERCISES THE MULTIPLY AND DIVIDE HARDWARE OF THE KE8-E OPTION. FIXED NUMBERS WITH PREDETERMINED SOLUTIONS, AND RANDOM NUMBERS WITH SIMULATED SOLUTIONS ARE USED. THE ABILITY TO OPERATE WITH THE INTERRUPT ENABLED IS ALSO TESTED.

2. REQUIREMENTS

2.1 EQUIPMENT

PDP-8/E OR /M PROCESSOR, KE8-E OPTION, AND AN ASR 33/35 TELETYPE ARE REQUIRED.

2.2 STORAGE

LOCATIONS 0000 THROUGH 7570 ARE USED.

2.3 PRELIMINARY PROGRAMS

ALL PROCESSOR RELATED TEST PROGRAMS MUST HAVE BEEN RUN SUCCESSFULLY. THIS PROGRAM ASSUMES THAT THE PROCESSOR AND TELETYPE ARE OPERATING CORRECTLY, AND THAT ALL OTHER KE8-E INSTRUCTIONS OTHER THAN "MUY" AND "DVI" HAVE BEEN TESTED AND OPERATE CORRECTLY.

3. LOADING PROCEDURE

3.1 METHOD

THE BINARY LOADER IS USED TO LOAD THE PROGRAM INTO ANY DESIRED FIELD.

4. STARTING PROCEDURE

4.1 CONTROL SWITCH SETTINGS

SR0=1 HALT AFTER CURRENT ROUTINE. PROGRAM HALTS AT THE COMPLETION OF THE CURRENT TEST ROUTINE. THE COMPLETED ROUTINE NUMBER IS DISPLAYED IN THE AC.

SR1=0 SELECT MODE OF OPERATION ACCORDING TO SR10 AND SR11.

SR1=1 SELECT THE ROUTINE NUMBER WHICH IS IN SR9-11. IF WHILE RUNNING THE PROGRAM SR1 IS SET TO A "1", THE PROGRAM WILL HALT WITH THE CURRENT ROUTINE NUMBER DISPLAYED IN THE AC. TO SELECT A NEW ROUTINE AT THIS POINT, PLACE THE NEW DESIRED ROUTINE IN SR9-11 AND PRESS CONTINUE. THE NEW ROUTINE NUMBER WILL NOW BE DISPLAYED IN THE AC.

SR2=1 LOOP ROUTINE, CURRENT ROUTINE IS REPEATED,

SR3=1 LOOP PROGRAM, ENTIRE PROGRAM IS REPEATED,

SR4=1 LOCK ON TEST, THE TEST CURRENTLY BEING EXECUTED IS REPEATED,

SR5=0 PRINT ON ERROR,

SR5=1 HALT ON ERROR,

SR6=1 HALT AFTER PRINT, PROGRAM HALTS AFTER ERROR PRINTOUT,

SR7=1 PRINT FAILURE RATE, THE PROGRAM PRINTS THE NUMBER OF FAILURES PER HUNDRED REPETITIONS OF THE SAME TEST, PROGRAM HALTS AFTER THE PRINTOUT, SR5 MUST BE SET FOR THE PRINTOUT TO OCCUR,

SR8=1 PRINT SIMULATION AND/OR ENTER SCOPE LOOP, FOR ROUTINES 0 AND 1 PROGRAM PRINTS MULTIPLY SIMULATION AND ENTERS MULTIPLY SCOPE LOOP, FOR ROUTINES 2 AND 3 THE PROGRAM PRINTS DIVIDE SIMULATION AND ENTERS THE DIVIDE SCOPE LOOP, FOR ROUTINES 4 THROUGH 7 PROGRAM ENTERS THE EXERCISER SCOPE LOOP FOR THE INDIVIDUAL ROUTINE, SR5 MUST BE SET TO 0 FOR THIS OPTION TO BECOME ACTIVE,

SR9-11 WITH SR1=0	SR9	SR10	SR11	
	X	0	0	EXECUTE EACH ROUTINE IN "A" AND "B" MODES,
	X	0	1	EXECUTE EACH ROUTINE IN "A" AND "B" MODES,
	X	1	0	SELECT "A" MODE,
	X	1	1	SELECT "B" MODE,

SR9-11 WITH SR1=1	SR9	SR10	SR11	
	0	0	0	SELECT ROUTINE 0, FIXED MULTIPLY TEST,
	0	0	1	SELECT ROUTINE 1, RANDOM MULTIPLY TEST,
	0	1	0	SELECT ROUTINE 2, FIXED DIVIDE TEST,
	0	1	1	SELECT ROUTINE 3, RANDOM DIVIDE TEST,
	1	0	0	SELECT ROUTINE 4, MULTIPLY/DIVIDE EXERCISE TEST,
	1	0	1	SELECT ROUTINE 5, MULTIPLY/DIVIDE EXERCISE TEST,
	1	1	0	SELECT ROUTINE 6, MULTIPLY/DIVIDE EXERCISE TEST,
	1	1	1	SELECT ROUTINE 7, MULTIPLY/DIVIDE EXERCISE TEST,

4.2 STARTING ADDRESS

THIS PROGRAM STARTS AT LOCATION 0200.

4.3 PROGRAM AND/OR OPERATOR ACTION

WITH THE PROGRAM LOADED IN CORE PROCEED AS FOLLOWS:

A. INSURE TELETYPE IS ON-LINE.

B. LOAD ANY PAPER TAPE IN THE TELETYPE READER AND TURN IT ON.
IF AN ERROR OCCURS, TURN THE TELETYPE READER OFF TO DETERMINE IF THE CAUSE WAS FROM INTERRUPT INTERACTION.

C. LOAD ADDRESS 0200. PRESS CLEAR AND CONTINUE.

D. PROGRAM HALTS AT LOCATION 0201.

E. SET ANY DESIRED OPTIONS IN SR AND PRESS CONTINUE.
IF SR1 WAS SET THE PROGRAM WILL HALT AT LOCATION 4574 WITH THE SELECTED ROUTINE NUMBER IN THE AC.
SET SR1=0 AND SELECT THE DESIRED MODE OF OPERATION IN SR10 AND 11, THEN PRESS CONTINUE.

F. THE PROGRAM WILL HALT AT PROGRAM END HALT (LOCATION 0250) AFTER THE LAST ROUTINE HAS BEEN EXECUTED, PROVIDED NO LOOP OPTIONS HAVE BEEN SET.

NOTE:
FOR A NORMAL PROGRAM RUN, SET SR SWITCHES TO 0000. PROGRAM WILL RUN FROM START TO FINISH, EXECUTING EACH ROUTINE IN "A" AND "B" MODES, PRINTING ALL ERRORS AS THEY OCCUR.

5, OPERATING PROCEDURE

5,1 PROGRAM AND/OR OPERATOR ACTION

5,1,1 NORMAL PROGRAM HALTS

LOCATION 0201 START HALT, THIS HALT OCCURS AT THE START OF THE PROGRAM TO PERMIT SETTING OF SR OPTIONS, SET ANY DESIRED OPTIONS IN THE SR AND PRESS CONTINUE,

LOCATION 0251 PROGRAM END HALT, THIS HALT OCCURS UPON COMPLETION OF LAST ROUTINE, IF THE LOOP PROGRAM OPTION IS NOT SET, SET ANY DESIRED OPTIONS IN THE SR AND PRESS CONTINUE,

LOCATION 0301 ROUTINE HALT, THIS HLT OCCURS AT THE COMPLETION OF THE CURRENT ROUTINE IF SR0 IS SET, PRESSING CONTINUE RESUMES THE PROGRAM,

LOCATION 0320 ROUTINE SELECT HALT, THIS HALT OCCURS IF WHILE RUNNING THE PROGRAM SR1 IS SET, THE ROUTINE PRESENTLY BEING EXECUTED IS DISPLAYED IN THE AC, IF A NEW ROUTINE IS TO BE SELECTED LEAVE SR1 SET AND PLACE THE NEW ROUTINE NUMBER IN SR9-11 AND PRESS CONTINUE, IF NO NEW ROUTINE IS DESIRED SET SR1=0 AND THE DESIRED MODE OF OPERATION IN SR10 AND 11 AND PRESS CONTINUE, THE PROGRAM WILL START EXECUTION WITH ROUTINE 0,

LOCATION 4574 MODE SELECTION HALT, THIS HALT OCCURS AS THE RESULT OF SELECTING A ROUTINE, SET SR1=0 AND SELECT THE DESIRED MODE OF OPERATION IN SR10 AND 11, PRESS CONTINUE,

6, ERRORS

6,1 PROGRAM AND/OR OPERATOR ACTION

THE PURPOSE OF THIS PROGRAM IS TO DETECT OPERATION ERRORS IN THE MULTIPLY-DIVIDE HARDWARE, UPON DETECTION OF AN ERROR, THE PROGRAM EITHER HALTS, OR GIVES AN ERROR PRINTOUT DEPENDING ON THE SETTING OF SR5,
IN ORDER TO AID IN PINPOINTING THE CAUSE OF AN ERROR, ADDITIONAL SR OPTIONS ARE AVAILABLE TO THE USER,

SR6, HALT AFTER PRINT OPTION, HALTS THE PROGRAM TO PERMIT USER TO EXAMINE THE LATEST ERROR AND DETERMINE IF IT IS THE ONE HE WISHES TO TROUBLESHOOT,

SR7, PRINT FAILURE RATE OPTION, INFORMS THE USER OF THE FREQUENCY OF AN ERROR. A HIGH RATE OF FAILURE ERROR SHOULD BE EASIER TO TROUBLE SHOOT THAN AN INTERMITTENT ERROR. IF THE USER WISHES TO TROUBLESHOOT USING THE PRESENT SET OF SYMPTOMS, HE CAN THEN SET SR8.

SR8, PRINT SIMULATON AND ENTER SCOPE LOOP OPTION, CAUSES PRINTOUT OF THE CORRECT CONTENTS OF THE LINK, AND OF THE AC AND MQ REGISTERS FOR EACH COUNT OF THE STEP COUNTER. FOLLOWING THE SIMULATION PRINTOUT THE PROGRAM ENTERS A MULTIPLY OR DIVIDE SCOPE LOOP, DEPENDING ON THE ROUTINE CURRENTLY IN EXECUTION. ROUTINES 4 THROUGH 7 DO NOT GIVE A SIMULATION PRINTOUT, BUT MERELY ENTER THEIR RESPECTIVE SCOPE LOOPS.

NO PRINTOUTS WILL OCCUR UNLESS SR5 IS SET TO 0.

IF SR5 IS SET TO HALT ON ERROR, AND THE USER WISHES TO OBTAIN PRINTOUT FOR THE CURRENT FAILURE HE MAY OBTAIN THEM BY SETTING SR5 TO 0. (TO PRINT POSITION).

6,2 ERROR HALTS AND DESCRIPTION

LOC 1310 — MULTIPLY ERROR HALT. THE AC DISPLAYS NUMBER OF ROUTINE WHERE FAILURE OCCURRED. (ROUTINE 0 OR 1.) PRESS CONTINUE TO RESUME TESTING, OR SET SR5 TO 0 TO OBTAIN ERROR PRINTOUTS.

LOC 1511 — DIVIDE ERROR HALT. THE AC DISPLAYS NUMBER OF ROUTINE WHERE FAILURE OCCURRED. (ROUTINE 2 OR 3.) PRESS CONTINUE TO RESUME TESTING, OR SET SR5 TO 0 TO OBTAIN ERROR PRINTOUTS.

LOC 4327 — MULTIPLY/DIVIDE EXERCISE ERROR HALT. THE AC DISPLAYS NUMBER OF ROUTINE WHERE FAILURE OCCURED (ROUTINES 4,5,6,OR 7). PRESS CONTINUE TO RESUME TESTING, OR SET SR5 TO 0 TO OBTAIN ERROR PRINTOUT.

LOC 1044 — UNEXPECTED INTERRUPT HALT. A DEVICE OTHER THAN TELETYPE READER OR PRINTER HAS INTERRUPTED. TURN OFF DEVICE. PRESS CONTINUE.

6,3 ERROR PRINTOUTS

6,3,1 MULTIPLICATION FAILURE ERROR PRINTOUTS

MUYERR	L	C(AC)	C(MQ)	C(MB)	MODE "X"
PROB	3	000000000000	101000100001	111100000110	
A-					
GOOD	0	100110000010	101111000110	111100000110	
BAD	3	100101000010	101111000110	111100000110	
SCA		000000001100			

```
B-  ERRORS PER HUNDRED! 0100

    SCCNT   L          C(AC)          C(MQ)

    SC0     0      000000000000   101000100001
    SC1     0      011110000011   101000010000
    SC2     0      001111000001   101010001000
    SC3     0      000111100000   011010100010
    SC4     0      000011110000   011010100010
C-  SC5     0      000001111000   001101010001
    SC6     0      011110111111   000110101000
    SC7     0      001111010000   100011010100
    SC8     0      000111101111   110001101010
    SC9     0      000011110111   111000110101
    SC10    0      011111111110   111100011010
    SC11    0      001111111111   011110001101

    FNRSLT  0      100110000010   101111000110
```

PRINTOUTS A,B,AND C ARE SHOWN IN THE ORDER IN WHICH THEY OCCUR. PRINTOUTS B AND C DO NO OCCUR WITHOUT PRINTOUT A.

PRINTOUT A OCCURS AFTER A MULTIPLICATION FAILURE IF SR5 IS OFF. OTHERWISE, THE PROGRAM STOPS AT MUYERR HALT. THIS PRINTOUT OCCURS IN ROUTINES 0 AND 1 ONLY.

```
MUYERR          =MULTIPLICATION ERROR; MODE OF OPERATION
PROB            =ORIGINAL C(L), C(AC), C(MQ), C(MB)
GOOD            =CORRECT C(L), C(AC), C(MQ), C(MB) RESULTS
BAD             =INCORRECT C(L), C(AC), C(MQ), C(MB) RESULTS
SCA             =CONTENTS OF STEP COUNTER AFTER EXECUTION OF
                 MUY INSTRUCTION.
```

PRINTOUT B INDICATES THE NUMBER OF ERRORS PER 100 TRIES. SR7 MUST BE ON TO OBTAIN THIS PRINTOUT.

PRINTOUT C IS A STEP BY STEP DISPLAY OF WHAT THE CORRECT CONTENTS OF THE LINK, AC AND MQ SHOULD BE DURING EXECUTION OF EACH FAILING MULTIPLY OPERATION. EACH LINE DISPLAYS THE CONTENTS OF THE REGISTERS AT THE START OF EACH STEP COUNTER COUNT. AN ADDITIONAL LINE LABELED FNRSLT IS PRINTED AFTER SC11 TO DISPLAY THE FINAL REGISTER CONTENTS AT END OF STEP COUNT 11. SR8 MUST BE ON TO OBTAIN THIS PRINTOUT.

UPON TERMINATION OF THE PRINTOUT, THE PROGRAM ENTERS A SCOPE LOOP THAT CONTINUOUSLY EXECUTES THE FAILING MULTIPLY OPERATION, IN ORDER TO PERMIT SCOPING OF THE REGISTERS.

6,3,2 DIVISION FAILURE ERROR PRINTOUTS

```
        DIVERR  L          C(AC)           C(MQ)           C(MB)        MODE "X"

        PROB    0       000000000111    000111000111    000000001000
A-
        GOOD    0       000000000111    111000111000    000000001000
        BAD     0       000000000111    111000111000    000000001000

        SCA             000000001101

B-      ERRORS PER HUNDRED!  0100

        SCCNT   L          C(AC)           C(MB)

        SC0     0       000000000111    000111000111
        SC1     0       000000000001    001110001110
        SC2     0       000000001100    011100011101
        SC3     1       111111110111    111000111011
C-      SC4     1       111111111110    110001110111
        SC5     0       000000001100    100011101110
        SC6     1       111111110111    000111011100
        SC7     1       111111111110    001110111000
        SC8     0       000000001100    011101110001
        SC9     1       111111110111    111011100011
        SC10    1       111111111110    110111000111
        SC11    0       000000001100    101110001110
        SC12    1       111111110111    011100011100
        SC13    1       111111111111    111000111000

        FNRST   2       000000000111    111000111000
```

PRINTOUTS A,B, AND C ARE SHOWN IN THE ORDER IN WHICH THEY OCCUR. PRINTOUTS B AND C DO NOT OCCUR WITHOUT PRINTOUT A.

PRINTOUT A OCCURS AFTER A DIVISION FAILURE IF SR5 IF OFF, OTHERWISE, THE PROGRAM STOPS AT DIVERR HALT. THIS PRINTOUT OCCURS IN ROUTINES 2 AND 3 ONLY.

```
DIVERR          =DIVISION ERROR; MODE OF OPERATION
PROB            =ORIGINAL C(L), C(AC), C(MQ), C(MB)
GOOD            =CORRECT C(L), C(AC), C(MQ), C(MB) RESULTS
BAD             =INCORRECT C(L), C(AC), C(MQ), C(MB) RESULTS
SCA             =CONTENTS OF STEP COUNTER AFTER EXECUTION
                 OF DVI INSTRUCTION.
```

PRINTOUT B INDICATES THE NUMBER OF ERRORS PER 100 TRIES. SR7 MUST BE ON TO OBTAIN THIS PRINTOUT.

PRINTOUT C IS A STEP BY STEP DISPLAY OF WHAT THE CORRECT CONTENTS OF THE LINK, AC, AND MQ SHOULD BE DURING EXECUTION OF THE FAILING DIVIDE OPERATION, EACH LINE DISPLAYS THE CONTENTS OF THE REGISTERS AT THE START OF EACH STEP COUNTER COUNT, AN ADDITIONAL LINE LABELED FNRSLT IS PRINTED AFTER SC0 IN CASE OF DIVIDE OVERFLOW, OR AFTER SC13 IN CASE OF A NORMAL DIVIDE OPERATION TO DISPLAY THE FINAL CONTENTS OF THE REGISTERS AT END OF LAST STEP COUNT, SR8 MUST BE ON TO OBTAIN THIS PRINTOUT

UPON TERMINATION OF THE PRINTOUT, THE PROGRAM ENTERS A SCOPE LOOP THAT CONTINUALLY EXECUTES THE FAILING DIVIDE OPERATION, IN ORDER TO PERMIT SCOPING OF THE REGISTERS,

6.3.3 MULTIPLY DIVIDE EXERCISER ERROR PRINTOUTS

```
        PROB    AXB\B=A

        A=7243          B=1130
        EXERR           L       C(AC)           C(MQ)           MODE "X"
A=
        GOOD            0       000000000000    111010100011
        BAD             1       011111000011    101110710010

B=  ERRORS PER HUNDRED:  0100

        PROB            AXB\BXB\A=B

        A=7243          B=1130
        EXERR           L       C(AC)           C(MQ)           MODE "X"
C=
        GOOD            0       000000000000    001001011000
        BAD             0       100011100111    000100100011

D=  ERRORS PER HUNDRED:  0000

        PROB            AXB\BXB\AXA\A=B

        A=7243          B=1130
        EXERR           L       C(AC)           C(MQ)           MODE "X"
E=
        GOOD            0       000000000000    001001011000
        BAD             0       001001010110    000111110011

F=  ERRORS PER HUNDRED:  0100

        PROB            AXB\BXB\AXA\AXA\B=A

        A=7243          B=1130
        EXERR           L       C(AC)           C(MQ)           MODE "X"

G=
        GOOD            0       000000000000    111010100011
        BAD             0       011010001100    101110101101

H=  ERRORS PER HUNDRED:  0100
```

PRINTOUTS B,D,F, AND H DO NOT OCCUR WITHOUT THEIR PRECEDING PRINTOUTS. SR7 MUST BE ON FOR THESE PRINTOUTS TO OCCUR. THEY INDICATE THE NUMBER OF TIMES A PROBLEM FAILED PER 100 TRIES.

PRINTOUT A OCCURS DURING EXECUTION OF ROUTINE 4.

PRINTOUT C OCCURS DURING EXECUTION OF ROUTINE 5.

PRINTOUT E OCCURS DURING EXECUTION OF ROUTINE 6.

PRINTOUT G OCCURS DURING EXECUTION OF ROUTINE 7.

SR5 MUST BE OFF FOR PRINTOUTS A,C,E, OR G TO OCCUR.

PRINTOUTS A,C,E, AND G HAVE THE FOLLOWING FORMAT:

PROB	DESCRIPTION OF MULTIPLY-DIVIDE EXERCISE USED.
A=XXXX B=XXXX	VALUES FOR A AND B USED DURING THE EXERCISE.
EXERR	MULTIPLY-DIVIDE EXERCISER ERROR AND THE MODE THAT FAILED. ("A" OR "B")
GOOD	CORRECT C(L),C(AC), AND C(MQ) RESULTS.
BAD	INCORRECT C(L),C(AC), AND C(MQ) RESULTS.

7. RESTRICTIONS

7.1 STARTING RESTRICTIONS

ONLY THOSE ADDRESSES GIVEN IN SECTION 4.2 SHOULD BE USED.

8. MISCELLANEOUS

8.1 EXECUTION TIME

THE TELETYPE BELL WILL RING AT THE END OF 7 PROGRAM PASSES WHICH IS APPROXIMATELY EVERY MINUTE AND "KE8 2" WILL BE PRINTED OUT APPROXIMATELY EVERY 10 MINUTES.

8,2 OSCILLOSCOPE SETUP

THE FOLLOWING OSCILLOSCOPE SETUP IS RECOMMENDED FOR VIEWING REGISTER BITS FOR A MULTIPLY OR DIVIDE PROBLEM.

```
TIME BASE =      ,5 US/DIV
SYNC = DRAWING M8340-0-1
       MODULE TYPE = M8340
       IC            E24
       PIN            6
       FUNCTION      SC=0L
```

NOTE: SYNC ON NEGATIVE SLOPE.
PROBE A = SAME AS SYNC.
PROBE B = LINK, AC, AND MQ FLIP-FLOPS.

9, PROGRAM DESCRIPTION

9,1 PROGRAM ORGANIZATION

THE PDP-8/E EAE (KE8-E) MULTIPLY-DIVIDE TEST IS ORGANIZED AS FOLLOWS:

A. CONTROL ROUTINE. THIS ROUTINE CONTROLS PROGRAM SEQUENCES BY HONORING OPTIONS SET IN SR0 THROUGH SR4, AND SR9 THROUGH SR11.

B. SUBROUTINES

C. TEST ROUTINES, EIGHT ROUTINES. ONE PROGRAM PASS CONSISTS OF 7 PASSES THROUGH THESE ROUTINES.

9,2 MAJOR SUBROUTINES

THERE ARE THREE MAJOR SUBROUTINES. EACH OF THESE SUBROUTINES IS CALLED ON BY ONE OR MORE TEST ROUTINES. THESE SUBROUTINES CONTROL TESTING, ERROR DETECTION, ERROR PRINTOUTS, SIMULATION, AND SCOPE LOOPS.

A. MULTIPLY TEST SUBROUTINE. CALLED ON BY TEST ROUTINES 0 AND 1. THE CALLING ROUTINE PROVIDES THE ADDRESS OF A TABLE CONTAINING MULTIPLICATION OPERANDS AND THE EXPECTED RESULTS, AND THE NUMBER OF TESTS IN THE TABLE.

B. DIVIDE TEST SUBROUTINE. CALLED ON BY TEST ROUTINES 2 AND 3. THE CALLING ROUTINE PROVIDES THE ADDRESS OF A TABLE CONTAINING DIVISION OPERANDS AND THE EXPECTED RESULTS, AND THE NUMBER OF TESTS IN THE TABLE.

C. MULTIPLY-DIVIDE EXERCISER TEST SUBROUTINE. CALLED ON BY TEST ROUTINES 4, 5, 6, AND 7. THE CALLING ROUTINE MOVES 2 OPERANDS TO SYMBOLIC LOCATIONS A AND B, PROVIDES THE SUBROUTINE WITH THE ADDRESS OF EXERCISE TO USE, AND THE ADDRESS OF THE CORRECT RESULT.

9.3 TEST ROUTINES

THE PROGRAM CONTAINS EIGHT TEST ROUTINES NUMBERED FROM 0 THROUGH 7.

TEST ROUTINE 0, FIXED MULTIPLY TEST, MUY INSTRUCTION IS TESTED USING 55 FIXED TESTS.

TEST ROUTINE 1, RANDOM MULTIPLY TEST, MUY INSTRUCTION IS TESTED USING 500 TESTS WHOSE OPERANDS ARE DETERMINED AT RANDOM. THE RESULTS OF THESE TESTS ARE DETERMINED THROUGH SIMULATION.

TEST ROUTINE 2, FIXED DIVIDE TEST, DVI INSTRUCTION IS TESTED USING 40 FIXED TESTS.

TEST ROUTINE 3, RANDOM DIVIDE TEST, DVI INSTRUCTION IS TESTED USING 333 TESTS WHOSE OPERANDS ARE DETERMINED AT RANDOM. THE RESULTS OF THESE TESTS ARE DETERMINED THROUGH SIMULATION.

TEST ROUTINE 4, MULTIPLY/DIVIDE EXERCISE TEST, THE ROUTINE GENERATES 700 SETS OF TWO NON-ZERO RANDOM NUMBERS, EACH SET OF NUMBERS IS USED TO TEST THE ABILITY OF THE HARDWARE TO PERFORM SUCCESSIVE MULTIPLY AND DIVIDE OPERATIONS, THIS ROUTINE CHECKS FOR CORRECT RESULTS USING THE PROBLEM AXB/B=A.

TEST ROUTINE 5, MULTIPLY/DIVIDE EXERCISE TEST, USING THE NUMBER SET GENERATED BY ROUTINE 4, THIS ROUTINE CHECKS FOR CORRECT RESULTS USING THE PROBLEM AXB/BXB/A=B.

TEST ROUTINE 6, MULTIPLY/DIVIDE EXERCISE TEST, USING THE NUMBER SET GENERATED BY ROUTINE 4, THIS ROUTINE CHECKS FOR CORRECT RESULTS USING THE PROBLEM AXB/BXB/AXA/A=B.

TEST ROUTINE 7, MULTIPLY/DIVIDE EXERCISE TEST, USING THE NUMBER SET GENERATED BY ROUTINE 4, THIS ROUTINE CHECKS FOR CORRECT RESULTS USING THE PROBLEM AXB/BXB/AXA/AXA/B=A.

NOTE: IF THROUGH PROGRAM SEQUENCE MODIFICATION EITHER OF ROUTINES 5 THROUGH 7 IS EXECUTED PRIOR TO EXECUTION OF ROUTINE 4, THE ROUTINE CURRENTLY BEING EXECUTED WILL GENERATE A NUMBER SET, AND THE ROUTINE FOLLOWING WILL USE THIS NUMBER SET FOR THEIR TESTS.

IN NORMAL OPERATION, ROUTINE 4 GENERATES A NUMBER SET EVERY TIME IT IS EXECUTED, AND THE ROUTINES FOLLOWING USE THE NUMBER SET GENERATED BY ROUTINE 4. THE REASON THIS IS TO PERMIT EASIER ISOLATION OF A FAILURE.

ROUTINE 4 PERFORMS ONE MUY, AND ONE DVI INSTRUCTION, ROUTINE 5 PERFORMS THE SAME MUY AND DVI INSTRUCTION, PLUS ANOTHER MUY AND DVI INSTRUCTION. BY USING THE SAME DATA, SHOULD A FAILURE OCCUR IN ROUTINE 5, THE FAILURE IS THEN LOCALIZED TO THE SECOND MUY OR SECOND DVI INSTRUCTION.

```
                    /KE8 EAE MULTIPLY/DIVIDE TEST  MAINDEC-8E-D0MB
                    /COPYRIGHT 1972, DIGITAL EQUIPMENT CORPORATION, MAYNARD, MASS, 01754
                    /
                    /PROGRAMMER:  ED FORTMILLER
                    /
          0000      *0
0000      0000                0000
0001      5001                JMP 1
0002      0002                2
0003      0003                3
0004      0000                OPEN
0005      0000                OPEN
          0006      *6
0006      0000      ZMB,      OPEN
0007      0000      ADDA,     OPEN
                    /
          7407      DVI=7407
          7411      NMI=7411
          7413      SHL=7413
          7415      ASR=7415
          7417      LSR=7417
          7421      MQL=7421
          7405      MUY=7405
          7501      MQA=7501
          7621      CAM=7621
          7441      SCA=7441
          7403      SCL=7403
          6001      ION=6001
          7402      HLT=7402

          0000      OPEN=0000               /PROGRAM MODIFIABLE.
          7447      AMODE=7447              /"OLD" INSTRUCTION SET
          7431      BMODE=7431              /"NEW" INSTRUCTION SET
                    /
          0020      *20
0020      0000      MODE,     OPEN          /0 = "AMODE";  NON 0 = "B MODE"
0021      4400      KSTART,   TST0
0022      0234      CHAIN,    CHAINN
0023      0274      SHLT,     SHALT
0024      1565      SETCTR,   STCTR
0025      0200      SRST,     SRSET
0026      0400      XTYPST,   TYPSTG
0027      0326      RANDNO,   RANGEN
0030      1200      UMUYT,    MUYT
0031      1400      UDIVT,    DIVT
0032      1650      UMOVE,    MOVE
0033      1676      UCOMP,    COMP
0034      1600      USR4T,    SR4T
0035      1610      USR5T,    SR5T
0036      1620      USR6T,    SR6T
0037      1630      USR7T,    SR7T
0040      1640      USATET,   SATET

0041      2464      UMUYSM,   MUYSM
```



```
0042      2600      UDIVSM,   DIVSM
0043      1726      UPRT0,    PRT0
0044      1732      UPRT1,    PRT1
0045      1736      UPSPC,    PSPC
0046      1753      UCRLF,    CRLF
0047      2000      UMSG1,    MSG1
0050      1771      UMSG1A,   MSG1A
0051      2064      UMSG2,    MSG2
0052      2200      UPL,      PL
0053      2145      UPREG,    PREG
0054      2014      UERPSB,   ERPSB
0055      2230      UPLRGS,   PLRGS
0056      2400      UHDSC0,   HDSC0
0057      2256      UF1TEL,   F1TEL
0060      2423      UP1213,   P1213
0061      2215      UPFR,     PFR
0062      3000      UADAC,    ADAC
0063      3012      UADNAC,   ADNAC
0064      3025      UADSB,    ADSB
0065      2542      UMQROT,   MQROT
0066      2563      UMQRTA,   MQRTA
0067      2741      UMVR,     MVR
0070      2567      UZMQ11,   ZMQ11
0071      5000      UTAB,     TAB
0072      4150      UFBRM,    FBRM
0073      4200      UMDEXR,   MDEXR
0074      1000      UPUNCH,   PUNCH
0075      1046      UEXERP,   EXERP

0076      3756      UTYMOD,   TYMOD
0077      0000      TEMP,     0
0100      0000      TEMP1,    0
0101      0000      CURTST,   0
0102      0000      RTNNO,    0
0103      0000      NXTST,    0
0104      0000      A,        0
0105      0000      B,        0
0106      0000      L,        0
0107      0000      AC,       0
0110      0000      MQ,       0
0111      0000      MB,       0
0112      0000      LSB,      0
0113      0000      ACSB,     0
0114      0000      MQSB,     0
0115      0000      MBSB,     0
0116      0000      LR,       0
0117      0000      ACR,      0
0120      0000      MQR,      0
0121      0000      MBR,      0
0122      0000      LB,       0
0123      0000      ACB,      0
0124      0000      MQB,      0
0125      0000      MBB,      0
0126      0000      LF,       0
0127      0000      ACF,      0
```

```
0130  0000  MQF,    0
0131  0000  MBF,    0
0132  0000  SCS,    0
0133  0000  MQ0S,   0
0134  0000  OFLO,   0
0135  0000  TABF,   0
0136  7776  R11Z,   7776
0137  0002  MQ10M,  0002
0140  0000  FCTR,   0              /FAILURES COUNTER
0141  0000  FRCTR,  0
0142  7766  LCNT,   -12            /DESIRED TEST LOOP COUNT
0143  0000  LCTR,   0              /TEST LOOP COUNTER
0144  0000  TCTR,   0              /NUMBER OF TESTS COUNTER
0145  7771  BELCNT, -7             /DESIRED PASSES BEFORE RINGING THE BELL
0146  0000  SHORT,  OPEN           /TEST LOOP COUNT FOR RINGING THE BELL
0147  0002  K2,     2
0150  0003  K3,     3
0151  0004  K4,     4
0152  0006  K6,     6
0153  0000  TEXR,   0
0154  0707  K0707,  2707
0155  6060  K6060,  6060
0156  7700  K7700,  7700
0157  0000  LINK,   OPEN

0160  0000  HOMEDF, OPEN
0161  0000        OPEN             /TO CONTAIN A CHG, DF INSTRUCTION,
0162  5560        JMP I HOMEDF     /EXIT,

0163  4446  ENDTYP, JMS I UCRLF
0164  7777        -1
0165  4426        JMS I XTYPST
0166  4372        KE8SP2
0167  5777'       JMP GETRDY-5

0170  4426  BELTYP, JMS I XTYPST
0171  2175        BELL
0172  5776'       JMP GETRDY-3



      0200  *200
0200  6032  SRSET,  KCC            /SET READER RUN,
0201  7402        HLT              /HALT TO SET SR SWITCHES TO
                                   /ANY DESIRED OPTION
0202  4777'       JMS INTLD        /SET UP FOR INTERRUPTS,
0203  1142        TAD LCNT
0204  3143        DCA LCTR
0205  1145        TAD BELCNT
0206  3146        DCA SHORT
0207  6001        ION
0210  7200  GETRDY, CLA
0211  1021        TAD KSTART       /SET ADDRESS OF 1ST ROUTINE
0212  3103        DCA NXTST              /STORE AT NXTST
```



```
0213  4260        JMS FORWD
0214  7604        LAS
0215  7004        RAL
0216  7500        SMA              /ROUTINE SELECT?
0217  5776'       JMP SELECT       /NO,  START WITH 1ST RTN
0220  7604  FINDIT, LAS           /YES
0221  0175        AND C7
0222  7041        CIA
0223  1102        TAD RTNNO
0224  7650        SNA CLA          /IS IT THIS RTN?
0225  5775'       JMP LOPSEL       /YES,  GO DO IT
0226  1103        TAD NXTST              /NO
0227  7001        IAC              /IS THIS LAST RTN?
0230  7640        SZA CLA
0231  5213        JMP GETRDY+3     /NO
0232  7402  INCRTN, HLT           /YES, INCORRECT ROUTINE NO,
0233  5210        JMP GETRDY
0234  4274  CHAINN, JMS SHALT            /HALT ? (SR0)
0235  5774'       JMP DETMOD             /MODE DETERMINER
0236  7510        SPA              /LOOP ROUTINE (SR2)
0237  5303        JMP SELMOD       /YES,  GO DO IT
0240  3100        DCA TEMP1              /NO,  SAVE AC
0241  1103        TAD NXTST        /GET NEXT RTN ADDR
0242  7001        IAC
0243  7640        SZA CLA          /LAST ROUTINE?
0244  5213        JMP GETRDY+3     /NO
0245  1100        TAD TEMP1
0246  7004        RAL
0247  7510        SPA              /LOOP PROGRAM
0250  5253        JMP .+3          /YES
0251  7402        HLT              /END OF PROGRAM HALT,  SR 3=1,
0252  5234        JMP CHAINN
0253  2146        ISZ SHORT
0254  5210        JMP GETRDY       /REPEAT TEST WITHOUT ANY BELL OR PRINT-OUT,
0255  2143        ISZ LCTR
0256  5170        JMP BELTYP       /GO RING THE BELL,
0257  5163        JMP ENDTYP       /GO PRINT,


0260  0000  FORWD,  0
0261  1503        TAD I NXTST      /GET NEXT RTN NO
0262  3102        DCA RTNNO              /STORE AT RTNNO
0263  2103        ISZ NXTST
0264  1103        TAD NXTST              /GET CURRENT
0265  3077        DCA TEMP               /ROUTINE NUMBER
0266  2103        ISZ NXTST
0267  1103        TAD NXTST              /SET CURRENT
0270  3101        DCA CURTST       /ROUTINE ADDRESS
0271  1477        TAD I TEMP       /GET NEXT ROUTINE
0272  3103        DCA NXTST              /ADDR, STORE AT NXTST
0273  5660        JMP I FORWD      /EXIT
0274  0000  SHALT,  0
0275  7604        LAS              /READ SR
0276  7700        SMA CLA          /HALT ? (SR0)
0277  5674        JMP I SHALT      /NO,  EXIT
```

```
0300  1102            TAD RTNNO
                      /
0301  7402            HLT               /UNCONDITIONAL HALT (SR0 = 1)
                      /
0302  5674            JMP I SHALT       /EXIT

0303  7200  SELMOD,   CLA               /
0304  1020            TAD MODE          /
0305  7640            SZA CLA           /WHICH MODE IS TO BE SELECTED?
0306  5312            JMP CHGTOB        /"B" MODE,
0307  3773            DCA ABLSR         /SET ABLSR IN "MUL SIM" FOR "A" MODE,
0310  7447            AMODE             /CHANGE TO "A" MODE NOW,
0311  5501            JMP I CURTST      /START TEST,
0312  7201  CHGTOB,   CLA IAC           /0001,
0313  3773            DCA ABLSR         /SET ABLSR IN "MUL SIM" FOR "B" MODE,
0314  7431            BMODE             /CHANGE TO "B" MODE NOW,
0315  5501            JMP I CURTST      /START TEST,

0316  7300  SW1SET,   CLA CLL
0317  1102            TAD RTNNO
0320  7402            HLT               /SR 1 IS SET!  ROUTINE JUST EXECUTED IS
                                        /DISPLAYED IN THE AC, LEAVE SR 1 SET
                                        /AND SELECT NEW DESIRED ROUTINE BY
                                        /PLACING DESIRED ROUTINE NUMBER IN
                                        /SR 9-11 ,  PRESS CONTINUE.
0321  7300            CLA CLL           /
0322  1021            TAD KSTART
0323  3103            DCA NXTST
0324  4260            JMS FORWD
0325  5220            JMP FINDIT



                      /RANDOM NUMBER GENERATOR SUBROUTINE
0326  0000  RANGEN,   0
0327  7200            CLA
0330  1371            TAD RANTND
0331  1356            TAD RANDEX
0332  7640            SZA CLA
0333  5343            JMP RANTAD
0334  1360            TAD RANTBL
0335  3356            DCA RANDEX
0336  1357            TAD RANCON
0337  7104            CLL RAL
0340  7430            SZL
0341  7001            IAC
0342  3357            DCA RANCON
0343  1357  RANTAD,   TAD RANCON
0344  1756            TAD I RANDEX
0345  3756            DCA I RANDEX
0346  1372            TAD RANSAV
0347  7010            RAR
0350  1756            TAD I RANDEX
0351  2356            ISZ RANDEX
```



```
0352  7000            NOP
0353  3372            DCA RANSAV
0354  1372            TAD RANSAV
0355  5726            JMP I RANGEN
0356  0371  RANDEX,   RANTND
0357  6543  RANCON,   6543
0360  0361  RANTBL,   .+1
0361  6543            6543
0362  3210            3210
0363  0765            0765
0364  5432            5432
0365  2107            2107
0366  7654            7654
0367  4321            4321
0370  1076            1076
0371  7407  RANTND,   .,
0372  0000  RANSAV,   OPEN


0373  2455
0374  4721
0375  4572
0376  1360
0377  4750
      0400  *400
0400  0000  TYPSTG,   0
0401  7200            CLA
0402  1600            TAD I TYPSTG      /GET INITIAL ADDRESS
0403  3262            DCA TEMQ                /STORE INITIAL ADDRESS
0404  3264            DCA FLAG                /CLEAR FLAG
0405  2200            ISZ TYPSTG        /PRESETUP EXIT
0406  1662  TSC1,     TAD I TEMQ        /PICK UP DATA
0407  7012            RTR               /ROTATE 6 BITS RIGHT
0410  7012            RTR
0411  7012            RTR
0412  4217            JMS TSC2                /GO TYPE FIRST CHAR
0413  1662            TAD I TEMQ        /PICK UP DATA
0414  4217            JMS TSC2                /GO TYPE 2ND CHARACTER
0415  2262            ISZ TEMQ                /EVEN STRING ADDRESS
0416  5206            JMP TSC1                /GO BACK FOR MORE
0417  0000  TSC2,     0
0420  0265            AND K77           /MASK OFF 6 BITS
0421  3263            DCA TEMR                /SAVE CHARACTER
0422  1264            TAD FLAG                /TEST "SPECIAL" FLAG
0423  7640            SZA CLA
0424  5234            JMP TYPSP               /SET! TYPE SPECIAL
0425  1263            TAD TEMR                /NO,  REGULAR CHAR
0426  7450            SNA               /ZERO?
0427  5232            JMP .+3           /YES,  SET FLAG
0430  4253  TYPAT,    JMS PRINT               /NO,  PRINT IT
0431  5617            JMP I TSC2        /RETURN
0432  2264            ISZ FLAG                /SET "SPECIAL" FLAG
0433  5617            JMP I TSC2        /EXIT
0434  3264  TYPSP,    DCA FLAG                /CLEAR FLAG
0435  1263            TAD TEMR                /TEST FOR "0"
```

```
0436  7041           CIA
0437  7450           SNA
0440  5230           JMP TYPAT              /01 TYPE "0"
0441  7001           IAC                 /TEST FOR 01
0442  7650           SNA CLA
0443  5620           JMP I TYPSTG              /YES! EXIT CODE
0444  1271           TAD SKIPMA          /ALTER INSTRUCTION
0445  3255           DCA SWITCH          /TO BE "SMA"
0446  1263           TAD TEMR                  /TYPE CHAR
0447  4253           JMS PRINT
0450  1272           TAD SKIPPA          /ALTER INSTRUCTION
0451  3255           DCA SWITCH          /TO BE "SPA"
0452  5617           JMP I TSC2          /RETURN

0453  0000    PRINT, 0
0454  1266           TAD M40             /COMPARE WITH 40
0455  7510    SWITCH, SPA                /OR SMA FOR SPECIAL CODES
0456  1267           TAD C100
0457  1270           TAD C240
0460  4474           JMS I UPUNCH
0461  5653           JMP I PRINT
0462  0000    TEMQ,  0
0463  0000    TEMR,  0
0464  0000    FLAG,  0
0465  0077    K77,   77
0466  7740    M40,   -40
0467  0100    C100,  100
0470  0240    C240,  240
0471  7500    SKIPMA, SMA
0472  7510    SKIPPA, SPA


0473  0000    L0,    0
0474  0000           0
0475  0000           0

0476  0000    L1,    0
0477  0000           0
0500  0000           0

0501  0000    L2,    0
0502  0000           0
0503  0000           0

0504  0000    L3,    0
0505  0000           0
0506  0000           0

0507  0000    L4,    0
0510  0000           0
0511  0000           0

0512  0000    L5,    0
0513  0000           0
```



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0514  0000           0

0515  0000    L6,    0
0516  0000           0
0517  0000           0

0520  0000    L7,    0
0521  0000           0
0522  0000           0

0523  0000    LATE,  0
0524  0000           0
0525  0000           0

0526  0000    LNINE, 0
0527  0000           0
0530  0000           0

0531  0000    L10,   0
0532  0000           0
0533  0000           0

0534  0000    L11,   0
0535  0000           0
0536  0000           0


0537  0000    L12,   0
0540  0000           0
0541  0000           0

0542  0000    L13,   0
0543  0000           0
0544  0000           0

0545  6000    ZERO,  6000    /0
0546  0100           0100

0547  6100    ONE,   6100    /1
0550  0100           0100
0551  1525    MUYERR, 1525   /MUYERR
0552  3105           3105
0553  2222           2222
0554  0001           0001

0555  0411    DIVERR, 0411   /DIVERR
0556  2605           2605
0557  2222           2222
0560  0001           0001

0561  2303    SC0,   2303    /SC0
0562  6000           6000
0563  0100           0100

0564  2303    SC1,   2303    /SC1
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0565  6100            6100
0566  0100            0100

0567  2303    SC2,    2303    /SC2
0570  6200            6200
0571  0100            0100

0572  2303    SC3,    2303    /SC3
0573  6300            6300
0574  0100            0100

0575  2303    SC4,    2303    /SC4
0576  6400            6400
0577  0100            0100


0600  2303    SC5,    2303    /SC5
0601  6500            6500
0602  0100            0100

0603  2303    SC6,    2303    /SC6
0604  6600            6600
0605  0100            0100

0606  2303    SC7,    2303    /SC7
0607  6700            6700
0610  0100            0100

0611  2303    SCATE,  2303    /SC8
0612  7000            7000
0613  0100            0100

0614  2303    SCNINE, 2303    /SC9
0615  7100            7100
0616  0100            0100

0617  2303    SC10,   2303    /SC10
0620  6160            6160
0621  0001            0001

0622  2303    SC11,   2303    /SC11
0623  6161            6161
0624  0001            0001

0625  2303    SC12,   2303    /SC12
0626  6162            6162
0627  0001            0001

0630  2303    SC13,   2303    /SC13
0631  6163            6163
0632  0001            0001

0633  2303    SCCNT,  2303    /SCCNT
0634  0316            0316
0635  2400            2400
```



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0636  0100            0100

0637  0616    FNRSLT, 0616    /FNRSLT
0640  2223            2223
0641  1424            1424
0642  0001            0001


0643  2022    PROB,   2022    /PROB
0644  1702            1702
0645  0001            0001

0646  0717    GOOD,   0717    /GOOD
0647  1704            1704
0650  0001            0001

0651  0201    BAD,    0201    /BAD
0652  0400            0400
0653  7100            0100

0654  2303    SCAT,   2303    /SCA
0655  0100            0100
0656  0100            0100

0657  1400    LT,     1400    /L
0660  0100            0100

0661  0350    CAC,    0350    /C(AC)
0662  0103            0103
0663  5100            5100
0664  0100            0100

0665  0350    CMQ,    0350    /C(MQ)
0666  1521            1521
0667  5100            5100
0670  0100            0100

0671  0350    CMB,    0350    /C(MB)
0672  1502            1502
0673  5100            5100
0674  0100            0100

0675  0522    ERPER,  0522    /ERRORS PER
0676  2217            2217    /HUNDRED!
0677  2223            2223
0700  4020            4020
0701  0522            0522
0702  4010            4010
0703  2516            2516
0704  0422            0422
0705  0504            0504
0706  7240            7240
0707  0001            0001

0710  0530    EXERR,  0530            /E,X
```

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0711  0522            0522            /E,R
0712  2200            2200            /R,
0713  0100            0100            /END CODE


0714  0130    PRB1,   0130            /A,X
0715  0234            0234            /B,/
0716  0240            0240            /B,SPC
0717  7540            7540            /*,SPC
0720  0140            0140            /A,SPC
0721  0001            0001            /END CODE,
0722  0130    PRB2,   0130            /A,X
0723  0234            0234            /B,/
0724  0230            0230            /B,X
0725  0234            0234            /B,/
0726  0140            0140            /A,SPC
0727  7540            7540            /*,SPC
0730  0240            0240            /B,SPC
0731  0001            0001            /END CODE
0732  0130    PRB3,   0130            /A,X
0733  0234            0234            /B,/

0734  0230            0230            /B,X
0735  0234            0234            /B,/
0736  0130            0130            /A,X
0737  0134            0134            /A,/
0740  0140            0140            /A,SPC
0741  7540            7540            /*,SPC
0742  0240            0240            /B,SPC
0743  0001            0001            /END CODE
0744  0130    PRB4,   0130            /A,X
0745  0234            0234            /B,/
0746  0230            0230            /B,X
0747  0234            0234            /B,/
0750  0130            0130            /A,X
0751  0134            0134            /A,/
0752  0130            0130            /A,X
0753  0134            0134            /A,/
0754  0240            0240            /B,SPC
0755  7540            7540            /*,SPC
0756  0140            0140            /A,SPC
0757  0001            0001            /END CODE
0760  0140    ABVAL,  0140            /A,SPC
0761  7540            7540            /*,SPC
0762  4040    AVALUE, 4040            /SPC,SPC
0763  4040            4040            /SPC,SPC
0764  4040            4040            /SPC,SPC
0765  0240            0240            /B,SPC
0766  7540            7540            /*,SPC
0767  4040    BVALUE, 4040            /SPC,SPC
0770  4040            4040            /SPC,SPC
0771  0015            0015            /CR
0772  0012            0012            /LF
0773  0001            0001            /END CODE
```



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      1000            PAGE

1000  0000    PUNCH,  0
1001  2215            ISZ PFLAG               /SET PUNCH/PRINTER FLAG,
1002  6046            TLS             /PUNCH/PRINT
1003  7200            CLA
1004  1215            TAD PFLAG
1005  7640            SZA CLA         /PFLAG RESET?
1006  7410            SKP             /NO
1007  5212            JMP .+3         /YES
1010  6041            TSF             /PUNCH/PRINTER FLAG UP?
1011  5204            JMP .-5         /NO,REPEAT
1012  6042            TCF             /YES,CLEAR PUNCH/PRINTER FLAG
1013  3215            DCA PFLAG               /CLEAR PFLAG
1014  5600            JMP I PUNCH     /EXIT
1015  0000    PFLAG,  0
1016  0000    INTAC,  0

1017  3216    INTSVC, DCA INTAC               /SAVE AC
1020  7010            RAR
1021  3157            DCA LINK                /SAVE LINK
1022  6201            CDF 0
1023  1777            TAD I (0
1024  3000            DCA 0
1025  4160            JMS HOMEDF
1026  6041            TSF             /PUNCH/PRINTER?
1027  5233            JMP .+4         /NO,
1030  6042            TCF             /YES,CLEAR ITS FLAG
1031  3215            DCA PFLAG               /CLEAR PFLAG
1032  5236            JMP OUT
1033  6031            KSF             /READER/KYBD?
1034  5244            JMP UNXINT      /NO,ERROR
1035  6032            KCC             /YES,CLEAR FLAG, AC, ADVANCE
1036  7300    OUT,    CLA CLL
1037  1157            TAD LINK                /RESTORE LINK
1040  7004            RAL
1041  1216            TAD INTAC               /RESTORE AC
1042  6001            ION             /ENABLE INTERRUPT
1043  5400            JMP I 0         /EXIT
1044  7402    UNXINT, HLT             /UNEXPECTED INTERRUPT HALT',
1045  5236            JMP OUT

1046  0000    EXERP,  0
1047  4426            JMS I XTYPST    /PRINT EXERR
1050  0710            EXERR
1051  4445            JMS I UPSPC     /SPACE 5
1052  7773            -5
1053  4447            JMS I UMSG1
1054  4476            JMS I UTYMOD    /TYPE MODE
1055  4446            JMS I UCRLF     /CRLF
1056  7776            -2              /TWICE
1057  4426            JMS I XTYPST    /PRINT GOOD
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1060  0646          GOOD
1061  4445          JMS I UPSPC     /SPACE 6
1062  7772          -6
1063  4455          JMS I UPLRGS    /PRINT REGS
1064  0112          LSB
1065  7776          -2
1066  4426          JMS I XTYPST    /PRINT BAD
1067  0651          BAD
1070  4445          JMS I UPSPC     /SPACE 7
1071  7771          -7
1072  4455          JMS I UPLRGS    /PRINT REGS
1073  0116          LR
1074  7776          -2
1075  5646          JMP I EXERP     /EXIT


1076  0000    MLDZMB, OPEN
1077  1111          TAD MB          /GET THE MB
1100  3006          DCA ZMB         /ZMB=MB
1101  1020          TAD MODE        /"A" OR "B"
1102  7650          SNA CLA         /
1103  5676          JMP I MLDZMB    /"A" MODE,
1104  1776'         TAD MTADR       /GET MTADR
1105  7001          IAC             /+1 TO IT
1106  3006          DCA ZMB         /ADDRESS OF OPERAND
1107  5676          JMP I MLDZMB    /EXIT

1110  0000    MSMBR,  OPEN
1111  1775'         TAD MBM         /GET THE "MUL" MB
1112  3121          DCA MBR         /MBR=MBM
1113  1020          TAD MODE        /"A" OR "B"
1114  7650          SNA CLA         /
1115  5710          JMP I MSMBR     /"A" MODE
1116  1775'         TAD MBM         /"B" MODE, GET CONTENTS OF ADDRESS STORED IN MBM,
1117  3005          DCA 5
1120  1405          TAD I 5
1121  3121          DCA MBR         /STORE OPERAND IN MBR,
1122  5710          JMP I MSMBR     /EXIT,

1123  0000    DLDZMB, OPEN
1124  1111          TAD MB          /PUT C(MB)
1125  3006          DCA ZMB         /INTO AMB,
1126  1020          TAD MODE        /"A" OR "B" MODE?
1127  7650          SNA CLA         /
1130  5723          JMP I DLDZMB    /"A" MODE, EXIT WITH ZMB=MB, SET FOR BI,
1131  1774'         TAD DVADR       /"B" MODE, GET DVADR
1132  1147          TAD K2          /ADD 2 TO MAKE IT THE ADDRESS OF OPERAND
1133  3006          DCA ZMB         /ZMB = ADDRESS OF OPERAND
1134  5723          JMP I DLDZMB    /EXIT,  SET FOR "B" MODE,

1135  0000    DSMSB,  OPEN
1136  1773'         TAD MBD         /GET THE "DIVIDE" MB
1137  3121          DCA MBR         /MBR=MBD
1140  1020          TAD MODE        /"A" OR "B" MODE?
1141  7650          SNA CLA         /
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1142  5735          JMP I DSMSB     /"A" MODE, EXIT SET FOR "A" MODE,
1143  1773'         TAD MBD         /GET CONTENTS OF ADDRESS STORED IN MBD
1144  3005          DCA 5
1145  1405          TAD I 5
1146  3121          DCA MBR         /STORE OPERAND IN MBR
1147  5735          JMP I DSMSB     /EXIT SET FOR "B" MODE

1150  0000    WHATA,  OPEN
1151  7200          CLA
1152  1020          TAD MODE        /WHICH MODE? "A" OR "B"
1153  7640          SZA CLA         /SKIP IF "A" MODE
1154  5357          JMP .+3
1155  1104          TAD A           /GET "A" OPERAND,
1156  5750          JMP I WHATA     /EXIT WITH OPERAND IN AC
1157  1007          TAD ADDA        /TET ADDRESS OF "A"
1160  5750          JMP I WHATA     /EXIT IWTH ADDRESS OF OPERAND IN AC

1161  0000    WHATB,  OPEN
1162  7200          CLA
1163  1020          TAD MODE        /WHICH MODE?  "A" OR "B"
1164  7640          SZA CLA         /SKIP IF "A" MODE,
1165  5370          JMP .+3         /"B" MODE MODE
1166  1105          TAD B           /GET "B" OPERAND
1167  5761          JMP I WHATB     /EXIT WITH OPERAND IN AC
1170  1007          TAD ADDA        /GET ADDRESS OF "A"
1171  7001          IAC             /ADD 1 TO MAKE IT THE ADDRESS OF B
1172  5761          JMP I WHATB     /EXIT WITH ADDRESS OF OPERAND IN AC


              /MULTIPLY TEST ROUTINE
1173  1472
1174  1415
1175  1271
1176  1215
1177  0000
      1200    *, 177+1
1200  0000    MUYT,   0
1201  7200          CLA
1202  3106          DCA L
1203  4432          JMS I UMOVE
1204  0106          L
1205  0107          AC
1206  7752          -26
1207  1600          TAD I MUYT      /GET AND STORE ADDRESS
1210  3215          DCA MTADR               /OF TEST DATA
1211  2200          ISZ MUYT
1212  1600          TAD I MUYT      /SET AND STORE
1213  3144          DCA TCTR                /TEST COUNT
1214  4432          JMS I UMOVE     /GET AND STORE

1215  0000    MTADR,  0             /TEST PARAMETERS
1216  0110          MQ
1217  7776          -2
1220  4777'         JMS MLDZMB      /SET THE ZMB
1221  1215          TAD MTADR
```

```
1222  1147            TAD K2
1223  3225            DCA .+2
1224  4432            JMS I UMOVE     /GET AND STORE
1225  0000            0               /EXPECTED RESULTS
1226  0113            ACSB
1227  7776            -2
1230  1111            TAD MB
1231  3115            DCA MBSB
1232  3112            DCA LSB
1233  4263    HDM,    JMS MULT                /HARDWARE MULTIPLY
1234  4273            JMS MSTR                /STORE RESULTS
1235  4433            JMS I UCOMP     /CHECK RESULTS
1236  7774            -4
1237  5251            JMP MERR                /ERROR
1240  4434    MLT,    JMS I USR4T     /LOOK ON TEST? (SR4 ON)
1241  5233            JMP HDM         /YES
1242  2144            ISZ TCTR                /ALL TESTS DONE?
1243  5245            JMP .+2         /NO
1244  5422            JMP I CHAIN     /YES,  EXIT
1245  1215            TAD MTADR               /SET U FOR
1246  1151            TAD K4          /NEXT MULTIPLY
1247  3215            DCA MTADR               /TEST
1250  5214            JMP MTADR-1


1251  4435    MERR,   JMS I USR5T     /PRINT/HALT?
1252  5257            JMP .+5         /GO PRINT
1253  4305            JMS MEHLT               /GO HALT
1254  4435            JMS I USR5T     /PRINT?
1255  7410            SKP             /NO PRINT
1256  5240            JMP MLT
1257  4312            JMS MERPT               /PRINT MULT ERROR
1260  4325            JMS MFRP                /PRINT FAILURE RATE IF DESIRED
1261  4347            JMS MSMP                /PRINT SIMU AND GO INTO SCOPE LOOP
                                      /IF DESIRED
1262  5240            JMP MLT

1263  0000    MULT,   0
1264  7200            CLA
1265  1006            TAD ZMB         /ZMB TO MBM
1266  3271            DCA MBM
1267  1110            TAD MQ
1270  7425            MQL MUY         /LOAD MQ AND MULTIPLY
1271  0000    MBM,    0
1272  5663            JMP I MULT      /EXIT
                /
1273  0000    MSTR,   0
1274  3117            DCA ACR         /STORE AC RESULTS
1275  7004            RAL
1276  3116            DCA LR          /STORE LINK RESULT
1277  7501            MQA
1300  3120            DCA MQR         /STORE MQ RESULT
1301  4776            JMS MSMBR       /STORE MB RESULT
1302  7441            SCA
1303  3132            DCA SCS         /STORE CONTENTS OF STEP CTR
```



```
1304  5673            JMP I MSTR      /EXIT
                /
1305  0000    MEHLT,  0
1306  7230            CLA
1307  1102            TAD RTNNO               /GET ROUTINE NUMBER
1310  7402            HLT             /MULTIPLY ERROR HALT
1311  5705            JMP I MEHLT     /EXIT
                /
1312  0000    MERPT,  0
1313  4446            JMS I UCRLF     /CRLF
1314  7776            -2              /TWICE
1315  4426            JMS I XTYPST    /PRINT MUYERR
1316  7551            MUYERR
1317  4445            JMS I UPSPC     /SPACE 4
1320  7774            -4
1321  4454            JMS I UERPSB    /PRINT ERROR DATA
1322  4436            JMS I USR6T     /HALT AFTER PRINT?
1323  4305            JMS MEHLT               /YES
1324  5712            JMP I MERPT     /NO,  EXIT


1325  0000    MFRP,   0
1326  4437            JMS I USR7T     /PRINT FAILURE RATE?
1327  5725            JMP I MFRP      /NO,  EXIT
1330  4424            JMS I SETCTR    /SET FRCTR
1331  0141            FRCTR           /TO -100
1332  7634            -144
1333  3140            DCA FCTR                /CLEAR FCTR
1334  4263            JMS MULT                /MULTIPLY
1335  4273            JMS MSTR                /STORE RESULTS
1336  4433            JMS I UCOMP     /CHECK RESULTS
1337  7774            -4
1340  2140            ISZ FCTR                /ERROR, +1 TO FCTR
1341  2141            ISZ FRCTR               /DONE 100 TIMES?
1342  5335            JMP .-5         /NO,  REPEAT
1343  4451            JMS I UMSG2     /PRINT FAILURE RATE
1344  4436            JMS I USR6T     /HALT AFTER PRINT?
1345  4305            JMS MEHLT               /YES
1346  5725            JMP I MFRP      /NO,  EXIT
                /
1347  0000    MSMP,   0
1350  4440            JMS I USATET    /SIMULATION AND SCOPE LOOP?
1351  5747            JMP I MSMP      /NO,  EXIT
1352  4441            JMS I UMUYSM    /SIMULATE MULTIPLY
1353  4456            JMS I UHDSC0    /PRINT HEADIN AND SC0
1354  4457            JMS I UF1TEL    /PRINT SC1 THROUGH SC11
1355  4461            JMS I UPFR      /PRINT FINAL RESULT
1356  4263    MSLOOP, JMS MULT
1357  5356            JMP .-1

                /ROUTINE TO SET MODE INDICATOR

1360  7604    SELECT, LAS                                     8
1361  7012            RTR
1362  7420            SNL             /SR 10 SET?
```

```
1363  5366          JMP .+3         /NO,
1364  7710          SPA CLA         /YES,  SR11 SET?
1365  5371          JMP .+4         /YES,
1366  7300  SETA,   CLA CLL
1367  3020          DCA MODE        /MODE SET FOR "A"
1370  5775'         JMP SELMOD      /DO MODE SELECTION
1371  7240  SETB,   CLA CMA         /7777
1372  3020          DCA MODE        /MODE SET FOR "B"
1373  5775'         JMP SELMOD      /DO MODE SELECTION

                /TAPE 2 - KE8I
                /DIVIDE TEST ROUTINE
1375  0303
1376  1110
1377  1076
      1400    *. 177+1
1400  0000  DIVT,   0
1401  7200          CLA
1402  3106          DCA L
1403  4432          JMS I UMOVE
1404  0106          L
1405  0107          AC
1406  7752          -26
1407  1600          TAD I DIVT      /GET AND STORE ADDRESS
1410  3215          DCA DVADR               /OF TEST DATA
1411  2200          ISZ DIVT
1412  1600          TAD I DIVT      /GET AND STORE
1413  3144          DCA TCTR                /TEST COUNT
1414  4432          JMS I UMOVE     /GET AND STORE
1415  0000  DVADR,  0                       /TEST PARAMETERS
1416  0107          AC
1417  7775          -3
1420  4777'         JMS DLD2MB      /SET DLD2MB
1421  1215          TAD DVADR
1422  1150          TAD K3
1423  3225          DCA .+2
1424  4432          JMS I UMOVE     /GET AND STORE
1425  0000          0               /EXPECTED RESULTS,
1426  0112          LSB
1427  7775          -3
1430  1111          TAD MB
1431  3115          DCA MBSB
1432  4262  HDD,    JMS DIVD                /HARDWARE DIVIDE
1433  4274          JMS DSTR                /STORE DIVIDE RESULTS
1434  4433          JMS I UCOMP     /CHECK RESULTS
1435  7774          -4
1436  5250          JMP DERR                /ERRORS,
1437  4434  DLT,    JMS I USR4T     /LOCK ON TEST?(SR4 ON)
1440  5232          JMP HDD         /YES,
1441  2144          ISZ TCTR                /ALL TESTS DONE?
1442  5244          JMP .+2         /NO,
1443  5422          JMP I CHAIN     /YES, EXIT,
1444  1215          TAD DVADR               /SET UP FOR NEXT
1445  1152          TAD K6                  /DIVIDE TEST,
1446  3215          DCA DVADR
```



```
1447  5214          JMP DVADR+1

1450  4435  DERR,   JMS I USR5T     /PRINT/HALT?
1451  5256          JMP .+5         /GO PRINT
1452  4306          JMS DEHLT               /GO HALT
1453  4435          JMS I USR5T     /PRINT?
1454  7410          SKP             /GO PRINT
1455  5237          JMP DLT
1456  4313          JMS DERPT               /PRINT DIV ERROR
1457  4326          JMS DFRP                /PRINT FAILURE RATE IF DESIRED
1460  4350          JMS DSMP                /PRINT SIMU AND SCOPE LOOP OF DESIRED,
1461  5237          JMP DLT

1462  0000  DIVD,   0
1463  7200          CLA
1464  1006          TAD ZMB
1465  3272          DCA MBD         /MB TO MBD
1466  1110          TAD MQ
1467  7421          MQL             /LOAD MQ
1470  1107          TAD AC                  /LOAD AC
1471  7407          DVI             /DIVIDE
1472  0000  MBD,    0
1473  5662          JMP I DIVD      /EXIT,
                /
1474  0000  DSTR,   0
1475  3117          DCA ACR         /STORE AC RESULT
1476  7004          RAL
1477  3116          DCA LR                  /STORE LINK RESULT
1500  7501          MQA
1501  3120          DCA MQR         /STORE MQ RESULT
1502  4776'         JMS DSMSB       /STORE MB RESULT
1503  7441          SCA
1504  3132          DCA SCS         /STORE CONTENT OF STEP COUNTER
1505  5674          JMP I DSTR      /EXIT,
                /
1506  0000  DEHLT,  0
1507  7200          CLA
1510  1102          TAD RTNNO               /GET ROUTINE NUMBER
1511  7402          HLT             /DIVIDE ERROR HALT
1512  5706          JMP I DEHLT     /EXIT,
                /
1513  0000  DERPT,  0
1514  4446          JMS I UCRLF     /CRLF
1515  7776          -2              /TWICE
1516  4426          JMS I XTYPST    /PRINT DIVERR
1517  0555          DIVERR
1520  4445          JMS I UPSPC     /SPACE4
1521  7774          -4
1522  4454          JMS I UERPSB    /PRINT ERROR DATA
1523  4436          JMS I USR6T     /HALT AFTER PRINT?
1524  4306          JMS DEHLT               /YES,
1525  5713          JMP I DERPT     /NO, EXIT
                /
1526  0000  DFRP,   0
```

```
1527  4437          JMS I USR7T     /PRINT FAILURE RATE?
1530  5726          JMP I DFRP      /NO, EXIT,
1531  4424          JMS I SETCTR    /SET FRCTR
1532  0141          FRCTR           /TO -100
1533  7634          -144
1534  3140          DCA FCTR              /CLEAR FCTR
1535  4262          JMS DIVD              /DIVIDE
1536  4274          JMS DSTR              /STORE RESULTS
1537  4433          JMS I UCOMP     /CHECK RESULTS
1540  7774          -4
1541  2140          ISZ FCTR              /ERROR ,+1 TO FCTR

1542  2141          ISZ FRCTR             /DONE 100 TIMES?
1543  5336          JMP .-5         /NO, REPEAT
1544  4451          JMS I UMSG2     /PRINT FAILURE RATE
1545  4436          JMS I USR6T     /HALT AFTER PRINT?
1546  4306          JMS DEHLT             /YES,
1547  5726          JMP I DFRP      /NO, EXIT,
                    /
1550  0000    DSMP, 0
1551  4440          JMS I USATET    /SIMULATION AND SCOPE LOOP?
1552  5750          JMP I DSMP      /NO, EXIT
1553  4442          JMS I UDIVSM    /SIMULATE DIVIDE
1554  4456          JMS I UHDSC0    /PRINT HEADING AND SC0
1555  1134          TAD OFLO
1556  7640          SZA CLA         /OFLO?
1557  5362          JMP .+3         /YES,
1560  4457          JMS I UF1TEL    /NO, PRINT SC1 TO SC11
1561  4460          JMS I UP1213    /PRINT SC12 AND SC13,
1562  4461          JMS I UPFR      /PRINT FINAL RESULT,
1563  4262    DSLOOP, JMS DIVD              /DIVIDE,
1564  5363          JMP .-1         /REPEAT,

1565  0000    STCTR, OPEN
1566  7300          CLA CLL
1567  1765          TAD I STCTR     /SET CTR ADDRESS
1570  3077          DCA TEMP        /SAVE AT TEMP
1571  2365          ISZ STCTR       /
1572  1765          TAD I STCTR     /SET COUNT
1573  3477          DCA I TEMP      /STORE PER C(TEMP)
1574  2365          ISZ STCTR
1575  5765          JMP I STCTR



1576  1135
1577  1123
      1600    *, 177+1
1600  0000    SR4T, 0
1601  7604          LAS             /READ SR
1602  0207          AND SR4MSK
1603  7640          SZA CLA         /SR4 ON?
1604  5600          JMP I SR4T      /YES,
1605  2200          ISZ SR4T              /NO,
1606  5600          JMP I SR4T
```



```
1607  0200    SR4MSK, 0200
1610  0000    SR5T, 0
1611  7604          LAS             /READ SR
1612  0217          AND SR5MSK
1613  7650          SNA CLA         /SR5 ON?
1614  5610          JMP I SR5T      /NO,
1615  2210          ISZ SR5T              /YES,
1616  5610          JMP I SR5T
1617  0100    SR5MSK, 0100
1620  0000    SR6T, 0
1621  7604          LAS             /READ SR
1622  0227          AND SR6MSK
1623  7640          SZA CLA         /SR6 ON?
1624  5620          JMP I SR6T      /YES,
1625  2220          ISZ SR6T              /NO,
1626  5620          JMP I SR6T
1627  0040    SR6MSK, 0040
1630  0000    SR7T, 0
1631  7604          LAS             /READ SR
1632  0237          AND SR7MSK
1633  7650          SNA CLA         /SR7 ON?
1634  5630          JMP I SR7T      /NO,
1635  2230          ISZ SR7T              /YES,
1636  5630          JMP I SR7T
1637  0020    SR7MSK, 0020
1640  0000    SATET, 0
1641  7604          LAS             /READ SR
1642  0247          AND SATEMK
1643  7650          SNA CLA         /SR8 ON?
1644  5640          JMP I SATET     /NO,
1645  2240          ISZ SATET       /YES,
1646  5640          JMP I SATET
1647  0010    SATEMK, 0010
1650  0000    MOVE, 0
1651  7200          CLA
1652  1650          TAD I MOVE      /GET "FROM ADDR" AND
1653  3273          DCA FADDR             /STORE AT FADDR
1654  2250          ISZ MOVE
1655  1650          TAD I MOVE      /GET "TO ADDR" AND
1656  3274          DCA TADDR             /STORE AT TADDR
1657  2250          ISZ MOVE
1660  1650          TAD I MOVE      /GET "MOVE COUNT" AND
1661  3275          DCA MCTR              /STORE AT MCTR
1662  2250          ISZ MOVE              /SET UP EXIT ADDRESS

1663  7200    MOVEA, CLA
1664  1673          TAD I FADDR     /GET "FROM" WORD
1665  3674          DCA I TADDR     /STORE AT "TO" LOCATION
1666  2273          ISZ FADDR             /INCREMENT "FROM" ADDRESS
1667  2274          ISZ TADDR             /INCREMENT "TO" ADDRESS
1670  2275          ISZ MCTR              /ALL WORDS MOVED?
1671  5263          JMP MOVEA             /NO,
1672  5650          JMP I MOVE      /YES,
                    /
```

```
1673  0000  FADDR,  0
1674  0000  TADDR,  0
1675  0000  MCTR,   0
                    /

1676  0000  COMP,   0
1677  1676          TAD I COMP        /GET AND STORE NUMBER OF
1700  3325          DCA CMPCTR        /WORDS TO COMPARE
1701  2276          ISZ COMP
1702  1321          TAD C1            /LSB ADDRESS TO C1A
1703  3323          DCA C1A
1704  1322          TAD C2            /LR ADDRESS TO C2A
1705  3324          DCA C2A
1706  1723  COMPA,  TAD I C1A              /GET SHOULD BE WORD,
1707  7041          CIA               /2'S  COMPLEMENT IT
1710  1724          TAD I C2A              /ADD RESULT WORD
1711  7640          SZA CLA           /RESULT 0?
1712  5676          JMP I COMP        /NO,,L
1713  2323          ISZ C1A           /YES,16L
1714  2324          ISZ C2A           /FOR NEXT COMPARE
1715  2325          ISZ CMPCTR             /DONE COMPARING?
1716  5306          JMP COMPA              /NO,
1717  2276          ISZ COMP               /YES,16L
1720  5676          JMP I COMP        /EXIT,
1721  0112  C1,     LSB
1722  0116  C2,     LR
1723  0000  C1A,    0
1724  0000  C2A,    0
1725  0000  CMPCTR, 0

                    /
1726  0000  PRT0,   0
1727  4426          JMS I XTYPST      /PRINT A 0,
1730  0545          ZERO
1731  5726          JMP I PRT0

1732  0000  PRT1,   0
1733  4426          JMS I XTYPST      /PRINT A 1,
1734  0547          ONE
1735  5732          JMP I PRT1

                    /
1736  0000  PSPC,   0
1737  7200          CLA
1740  1736          TAD I PSPC        /GET NUMBER
1741  3352          DCA SPCTR              /OF SPACES
1742  2336          ISZ PSPC
1743  4426          JMS I XTYPST      /SPACE ONCE,
1744  1750          .+4
1745  2352          ISZ SPCTR              /ALL SPACES DONE?
1746  5343          JMP .-3           /NO, REPEAT
1747  5736          JMP I PSPC        /YES, EXIT,
1750  4000          4000
1751  0100          0100
1752  0000  SPCTR,  0
```



```
                    /
1753  0000  CRLF,   0
1754  7200          CLA
1755  1753          TAD I CRLF        /GET NUMBER
1756  3370          DCA CRCTR              /OF CRLF
1757  2353          ISZ CRLF
1760  4426          JMS I XTYPST      /CRLF ONCE
1761  1765          .+4
1762  2370          ISZ CRCTR              /ALL CRLF DONE?
1763  5360          JMP .-3           /NO, REPEAT
1764  5753          JMP I CRLF        /YES, EXIT,
1765  0015          0015
1766  0012          0012
1767  0001          0001
1770  0000          CRCTR,  0
                    /
1771  0000  MSG1A,  0
1772  4445          JMS I UPSPC       /SPACE 10,
1773  7766          -12
1774  4426          JMS I XTYPST      /PRINT C(MB)
1775  0671          CMB
1776  5771          JMP I MSG1A       /EXIT


      2000          *, 177+1
2000  0000  MSG1,   0
2001  4426          JMS I XTYPST      /PRINT L,
2002  0657          LT
2003  4445          JMS I UPSPC       /SPACE 7,
2004  7771          -7
2005  4426          JMS I XTYPST      /PRINT C(AC)
2006  0661          CAC
2007  4445          JMS I UPSPC       /SPACE 10,
2010  7766          -12
2011  4426          JMS I XTYPST      /PRINT C(MQ)
2012  0665          CMQ
2013  5600          JMP I MSG1        /EXIT
                    /
2014  0000  ERPSB,  0
2015  4447          JMS I UMSG1       /PRINT HEADINGS
2016  4450          JMS I UMSG1A
2017  4476          JMS I UTYMOD      /TYPE MODE
2020  4446          JMS I UCRLF       /CRLF
2021  7776          -2                /ONCE
2022  4426          JMS I XTYPST      /PRINT PROB
2023  0643          PROB
2024  4445          JMS I UPSPC       /SPACE 6
2025  7772          -6
2026  4455          JMS I UPLRGS      /PRINT 3 REGISTER
2027  0106          L
2030  7775          -3
2031  4446          JMS I UCRLF       /CRLF
2032  7777          -1                /ONCE,
2033  4426          JMS I XTYPST      /PRINT GOOD
2034  0646          GOOD
```

```
2035  4445          JMS I UPSPC     /SPACE 6
2036  7772          -6
2037  4455          JMS I UPLRGS    /PRINT 3 REGISTERS
2040  0112          LSB
2041  7775          -3
2042  4426          JMS I XTYPST    /PRINT BAD
2043  0651          BAD
2044  4445          JMS I UPSPC     /SPACE 7
2045  7771          -7
2046  4455          JMS I UPLRGS    /PRINT 3 REGISTERS
2047  0116          LR
2050  7775          -3
2051  4446          JMS I UCRLF     /CRLF
2052  7777          -1              /ONCE,
2053  4426          JMS I XTYPST    /PRINT SCA
2054  0654          SCAT
2055  4445          JMS I UPSPC     /SPACE 8
2056  7770          -10
2057  4453          JMS I UPREG     /PRINT 1 REGISTER
2060  0132          SCS
2061  4446          JMS I UCRLF     /CRLF
2062  7777          -1              /ONCE
2063  5614          JMP I ERPSB     /EXIT

2064  0000    MSG2, 0
2065  4446          JMS I UCRLF     /CRLF
2066  7776          -2              /TWICE
2067  4426          JMS I XTYPST    /PRINT ERRORS PER
2070  0675          ERPER           /HUNDRED!
2071  4277          JMS BDCNV       /PRINT FAILURE
2072  0140          FCTR            /COUNT IN DECIMAL
2073  4476          JMS I UTYMOD    /TYPE MODE
2074  4446          JMS I UCRLF     /CRLF
2075  7777          -1              /ONE
2076  5664          JMP I MSG2      /NED
2077  0000    BDCNV, 0
2100  4424          JMS I SETCTR    /SET CNVCTR
2101  2143          CNVCTR          /TO-4
2102  7774          -4
2103  1334          TAD ADDRZA
2104  3315          DCA ARROW       /INITIALIZE ARROW
2105  1677          TAD I BDCNV
2106  2277          ISZ BDCNV
2107  3342          DCA DIGIT
2110  1742          TAD I DIGIT
2111  3341          DCA VALUE
2112  3342          DCA DIGIT       /CLEAR DIGIT
2113  7100          CLL
2114  1341          TAD VALUE
2115  1335    ARROW, TAD TENPWR
2116  7420          SNL
2117  5323          JMP .+4
2120  2342          ISZ DIGIT               /DEVELOP DIGIT
2121  3341          DCA VALUE
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```
2122  5313          JMP ARROW-2
2123  7200          CLA
2124  1342          TAD DIGIT               /GET DIGIT
2125  1344          TAD K260                /ADD 260
2126  4474          JMS I UPUNCH    /PRINT
2127  7300          CLA CLL
2130  2315          ISZ ARROW               /POINT ARROW
2131  2343          ISZ CNVCTR      /DONE?
2132  5312          JMP ARROW-3     /NO, REPEAT
2133  5677          JMP I BDCNV     /YES,  EXIT
2134  1335    ADDRZA, TAD TENPWR
2135  6030    TENPWR, -1750
2136  7634          -144
2137  7766          -12
2140  7777          -1
2141  0000    VALUE, 0
2142  0000    DIGIT, 0
2143  0000    CNVCTR, 0
2144  0260    K260,  260

2145  0000    PREG,  0
2146  4445          JMS I UPSPC     /SPACE 3
2147  7775          -3
2150  4424          JMS I SETCTR    /SET PRCTR
2151  2174          PRCTR           /TO -12
2152  7764          -14
2153  1745          TAD I PREG      /GET ADDRESS
2154  3373          DCA PRB         /OF REGISTER
2155  2345          ISZ PREG
2156  1773          TAD I PRB       /GET CONTENTS OF REG,
2157  3373          DCA PRB
2160  1373          TAD PRB
2161  7004          RAL
2162  3373          DCA PRB
2163  7430          SZL             /BIT A 0?
2164  5367          JMP .+3         /NO
2165  4443          JMS I UPRT0     /YES PRINT A 0
2166  7410          SKP
2167  4444          JMS I UPRT1     /PRINT A 1,
2170  2374          ISZ PRCTR               /DONE?
2171  5360          JMP .-11                /NO
2172  5745          JMP I PREG      /YES, EXIT
2173  0000    PRB,   0
2174  0000    PRCTR, 0

2175  0007    BELL,  0007
2176  0001           0001

      2200          PAGE
2200  0000    PL,    0
2201  7200          CLA
2202  1600          TAD I PL                /GET ADDRESS OF
2203  3214          DCA PLB         /REGISTER
```

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```
2224  2200            ISZ PL
2225  1614            TAD I PLB               /GET CONTENTS OF REG,
2226  7640            SZA CLA         /0?
2227  5212            JMP .+3         /NO,
2210  4443            JMS I UPRT0     /YES, PRINT 0
2211  5600            JMP I PL                /EXIT
2212  4444            JMS I UPRT1     /PRINT 1
2213  5600            JMP I PL                /EXIT
2214  0000    PLB,    0
              /
2215  0000    PFR,    0
2216  4446            JMS I UCRLF     /CRLF
2217  7777            -1              /ONCE
2220  4426            JMS I XTYPST    /PRINT FNRSLT
2221  0637            FNRSLT
2222  4445            JMS I UPSPC     /SPACE 4
2223  7774            -4
2224  4455            JMS I UPLRGS    /PRINT FINAL RESULTS
2225  0126            LF
2226  7776            -2
2227  5615            JMP I PFR               /EXIT
2230  0000    PLRGS,  0
2231  7200            CLA
2232  1630            TAD I PLRGS     /GET ADDRESS OF
2233  3244            DCA LADR                /LINK REGISTER
2234  1244            TAD LADR                /DEVELOP ADDRESS
2235  7001            IAC             /OF REGISTERS
2236  3246            DCA RADR
2237  2230            ISZ PLRGS
2240  1630            TAD I PLRGS     /GET NUMBERS OF
2241  3255            DCA PXCTR               /REGISTERS
2242  2230            ISZ PLRGS
2243  4452            JMS I UPL               /PRINT CONTENTS OF
2244  0000    LADR,   0               /LINK REGISTER
2245  4453            JMS I UPREG     /PRINT CONTENTS
2246  0000    RADR,   0               /OF REGISTERS
2247  2246            ISZ RADR                /SET UP FOR NEXT REG
2250  2255            ISZ PXCTR               /DONE?
2251  5245            JMP RADR-1      /NO, REPEAT
2252  4446            JMS I UCRLF     /YES, CRLF
2253  7777            -1              /ONCE
2254  5630            JMP I PLRGS     /EXIT
2255  0000    PXCTR,  0

              /
2256  0000    F1TEL,  0
2257  4426            JMS I XTYPST    /PRINT SC1
2260  0564            SC1
2261  4445            JMS I UPSPC     /SPACE 7
2262  7771            -7
2263  4455            JMS I UPLRGS    /PRINT SC1 RESULTS
2264  0476            L1
2265  7776            -2
2266  4426            JMS I XTYPST    /PRINT SC2
```



```
2267  0567            SC2
2270  4445            JMS I UPSPC     /SPACE 7
2271  7771            -7
2272  4455            JMS I UPLRGS    /PRINT SC2 RESULTS
2273  0501            L2
2274  7776            -2
2275  4426            JMS I XTYPST    /PRINT SC3
2276  0572            SC3
2277  4445            JMS I UPSPC     /SPACE 7
2300  7771            -7
2301  4455            JMS I UPLRGS    /PRINT SC3 RESULTS
2302  0504            L3
2303  7776            -2
2304  4426            JMS I XTYPST    /PRINT SC4
2305  0575            SC4
2306  4445            JMS I UPSPC     /SPACE 7
2307  7771            -7
2310  4455            JMS I UPLRGS    /PRINT SC4 RESULTS
2311  0507            L4
2312  7776            -2
2313  4426            JMS I XTYPST    /PRINT SC5
2314  0600            SC5
2315  4445            JMS I UPSPC     /SPACE 7
2316  7771            -7
2317  4455            JMS I UPLRGS    /PRINT SC5 RESULTS
2320  0512            L5
2321  7776            -2
2322  4426            JMS I XTYPST    /PRINT SC6
2323  0603            SC6
2324  4445            JMS I UPSPC     /SPACE 7
2325  7771            -7
2326  4455            JMS I UPLRGS    /PRINT SC6 RESULTS
2327  0515            L6
2330  7776            -2
2331  4426            JMS I XTYPST    /PRINT SC7

2332  0606            SC7
2333  4445            JMS I UPSPC     /SPACE 7
2334  7771            -7
2335  4455            JMS I UPLRGS    /PRINT SC7 RESULTS
2336  0520            L7
2337  7776            -2
2340  4426            JMS I XTYPST    /PRINT SC8
2341  0611            SCATE
2342  4445            JMS I UPSPC     /SPACE 7
2343  7771            -7
2344  4455            JMS I UPLRGS    /PRINT SC8 RESULTS
2345  0523            LATE
2346  7776            -2
2347  4426            JMS I XTYPST    /PRINT SC9
2350  0614            SCNINE
2351  4445            JMS I UPSPC     /SPACE 7
2352  7771            -7
2353  4455            JMS I UPLRGS    /PRINT SC9 RESULTS
```

```
2354  0526          LNINE
2355  7776          -2
2356  4426          JMS I XTYPST    /PRINT SC10
2357  0617          SC10
2360  4445          JMS I UPSPC     /SPACE 6
2361  7772          -6
2362  4455          JMS I UPLRGS    /PRINT SC10 RESULTS
2363  0531          L10
2364  7776          -2
2365  4426          JMS I XTYPST    /PRINT SC11
2366  0622          SC11
2367  4445          JMS I UPSPC     /SPACE 6
2370  7772          -6
2371  4455          JMS I UPLRGS    /PRINT SC11 RESULTS
2372  0534          L11
2373  7776          -2
2374  5656          JMP I F1TEL     /EXIT

                /KE8I - TAPE3
      2400      *, 177+1
2400  0000    HDSC0,  0
2401  4446          JMS I UCRLF     /CRLF
2402  7776          -2              /TWICE
2403  4426          JMS I XTYPST    /PRINT SCCNT
2404  0633          SCCNT
2405  4445          JMS I UPSPC     /SPACE 5
2406  7773          -5
2407  4447          JMS I UMSG1     /PRINT HEADINGS
2410  4476          JMS I UTYMOD    /TYPE MODE
2411  4446          JMS I UCRLF     /CRLF
2412  7776          -2              /TWICE
2413  4426          JMS I XTYPST    /PRINT SC0
2414  0561          SC0
2415  4445          JMS I UPSPC     /SPACE 7
2416  7771          -7
2417  4455          JMS I UPLRGS    /PRINT SC0 RESULTS
2420  0473          L0
2421  7776          -2
2422  5600          JMP I HDSC0     /EXIT
2423  0000    P1213,  0
2424  4426          JMS I XTYPST    /PRINT SC12
2425  0625          SC12
2426  4445          JMS I UPSPC     /SPACE 6
2427  7772          -6
2430  4455          JMS I UPLRGS    /PRINT SC12 RESULTS
2431  0537          L12
2432  7776          -2
2433  4426          JMS I XTYPST    /PRINTSC13
2434  0630          SC13
2435  4445          JMS I UPSPC     /SPACE 6
2436  7772          -6
2437  4455          JMS I UPLRGS    /PRINT SC13 RESULTS
2440  0542          L13
2441  7776          -2
2442  5623          JMP I P1213     /EXIT
```



```
2443  0000    ADSFT,  0
2444  7300          CLA CLL
2445  1124          TAD MQB
2446  7010          RAR
2447  7630          SZL CLA         /MQ11(1)?
2450  4462          JMS I UADAC     /YES, MEM ADD TO AC
2451  1124          TAD MQB         /NO, MBQ TO MQ
2452  7421          MQL
2453  1123          TAD ACB         /ACB TO AC
2454  7417          LSR             /SHIFT RIGHT ONCE
2455  0000    ABLSR,  OPEN          /CONTAINS 0 WHEN IN "A" MODE AND 1 WHEN IN "B" MODE
2456  1122          TAD LB          /LB TO AC0
2457  3123          DCA ACB         /STORE AC
2460  3122          DCA LB          /0 TO LB
2461  7701          CLA MQA         /MQ TO AC
2462  3124          DCA MQB         /STORE AT MQB
2463  5643          JMP I ADSFT     /EXIT,

2464  0000    MUYSM,  0
2465  4432          JMS I UMOVE             /MOVE INITIAL
2466  0106          L                       /MUY PARAMETERS
2467  0122          LB
2470  7774          -4
2471  3122          DCA LB                  /CLEAR LB
2472  3123          DCA ACB                 /CLEAR ACB
2473  4467          JMS I UMVR              /REGS TO L0
2474  0473          L0
2475  4243          JMS ADSFT
2476  4467          JMS I UMVR              /REGS TO L1
2477  0476          L1
2500  4243          JMS ADSFT
2501  4467          JMS I UMVR              /REGS TO L2
2502  0501          L2
2503  4243          JMS ADSFT
2504  4467          JMS I UMVR              /REGS TO L3
2505  0504          L3
2506  4243          JMS ADSFT
2507  4467          JMS I UMVR              /REGS TO L4
2510  0507          L4
2511  4243          JMS ADSFT
2512  4467          JMS I UMVR              /REGS TO L5
2513  0512          L5
2514  4243          JMS ADSFT
2515  4467          JMS I UMVR              /REGS TO L6
2516  0515          L6
2517  4243          JMS ADSFT
2520  4467          JMS I UMVR              /REGS TO L7
2521  0520          L7
2522  4243          JMS ADSFT
2523  4467          JMS I UMVR              /REGS TO LATE
2524  0523          LATE
2525  4243          JMS ADSFT
2526  4467          JMS I UMVR              /REGS TO LNINE
2527  0526          LNINE
2530  4243          JMS ADSFT
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2531  4467          JMS I UMVR              /REGS TO L10
2532  0531          L10
2533  4243          JMS ADSFT
2534  4467          JMS I UMVR              /REGS TO L11
2535  0534          L11
2536  4243          JMS ADSFT
2537  4467          JMS I UMVR              /REGS TO LF
2540  0126          LF
2541  5664          JMP I MUYSM             /EXIT


                    /
2542  0000    MQROT,  0
2543  7320          CLA CLL CML     /ROTATE MQB LEFT,
2544  1124          TAD MQB         /SET 1 IN MQB11
2545  7004          RAL             /AND SAVE MBQ0 AT
2546  3124          DCA MQB         /MQB5,
2547  7010          RAR
2550  3133          DCA MQ0S
2551  5742          JMP I MQROT     /EXIT,
                    /
2552  0000    DM11,   0             /IF MQ10=LB0,
2553  1124          TAD MQB         /GO TO ZMQ11 TO
2554  0137          AND MQ10M               /MAKE MQ11=0,
2555  7112          CLL RTR
2556  7010          RAR
2557  1122          TAD LB
2560  7640          SZA CLA
2561  4367          JMS ZMQ11
2562  5752          JMP I DM11      /EXIT,
                    /
2563  0000    MQRTA,  0
2564  4342          JMS MQROT               /ROTATE LEFT MQB,
2565  4352          JMS DM11                /0 TO MQB11 IF REQUIRED,
2566  5763          JMP I MQRTA     /EXIT,
                    /
2567  0000    ZMQ11,  0
2570  7300          CLA CLL         /0 TO MQB11,
2571  1124          TAD MQB
2572  0136          AND R11Z
2573  3124          DCA MQB
2574  5767          JMP I ZMQ11     /EXIT,

      2600    *, 177+1

2600  0000    DIVSM,  0
2601  4432          JMS I UMOVE             /MOVE INITIAL
2602  0106          L                       /DIVIDE PARAMETERS
2603  0122          LB
2604  7774          -4
2605  3134          DCA OFLO                        /CLEAR OFLO
2606  3122          DCA LB                  /CLEAR LB
2607  4341          JMS MVR                 /REGS TO L0
2610  0473          L0
2611  4463          JMS I UADNAC            /MEM ADD TO NOT AC
```



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2612  1122          TAD LB
2613  7640          SZA CLA                 /DIV OFLO?
2614  5227          JMP DVOFLO              /YES
2615  4465          JMS I UMQROT            /NO, ROTATE MQ
2616  4470          JMS I UZMQ11            /0 TO MQ11
2617  1133          TAD MQ0S                /ROTATE L AND AC
2620  7004          RAL                     /NOT MQ0 TO AC11
2621  1123          TAD ACB
2622  7024          CML RAL
2623  3123          DCA ACB                 /STORE AC
2624  7010          RAR
2625  3122          DCA LB                  /STORE L
2626  5241          JMP DSC1
2627  7201    DVOFLO, CLA IAC               /SIMULATED LINK RESULTS
2630  3126          DCA LF                  /STORE IN LINK FINAL
2631  7320          CLA CLL CML             /L=1 AC=0
2632  1110          TAD MQ                  /GET GOOD MQ
2633  7004          RAL                     /SIMULATE EAE
2634  3130          DCA MQF                 /STORE IN MQ FINAL
2635  1107          TAD AC                  /GET GOOD AC
2636  3127          DCA ACF                 /STORE IN AC FINAL
2637  2134          ISZ OFLO                        /SET OFLO IND,
2640  5600          JMP I DIVSM
2641  4341    DSC1,   JMS MVR               /REGS TO L1
2642  0476          L1
2643  4463          JMS I UADNAC            /MEM ADD TO NOT AC
2644  4466          JMS I UMQRTA            /MQ ROTATE
2645  4360          JMS LACRT                       /L AND AC ROTATE
2646  4341          JMS MVR                 /REGS TO L2
2647  0501          L2
2650  4353          JMS SCDVS                       /SC2-11 SEQUENCE
2651  4341          JMS MVR                 /REGS TO L3
2652  0504          L3
2653  4353          JMS SCDVS                       /SC2-11 SEQUENCE
2654  4341          JMS MVR                 /REGS TO L4
2655  0507          L4
2656  4353          JMS SCDVS       /SC2-11 SEQUENCE
2657  4341          JMS MVR                 /REGS TO L5
2660  0512          L5
2661  4353          JMS SCDVS                       /SC2-11 SEQUENCE

2662  4341          JMS MVR         /REGS TO L6
2663  0515          L6
2664  4353          JMS SCDVS               /SC2-11 SEQUENCE
2665  4341          JMS MVR         /REGS TO L7
2666  0520          L7
2667  4353          JMS SCDVS               /SC2-11 SEQUENCE
2670  4341          JMS MVR         /REGS TO LATE
2671  0523          LATE
2672  4353          JMS SCDVS               /SC2-11 SEQUENCE
2673  4341          JMS MVR         /REGS TO LNINE
2674  0526          LNINE
2675  4353          JMS SCDVS               /SC2-11 SEQUENCE
2676  4341          JMS MVR         /REGS TO L10
2677  0531          L10
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2720  4353          JMS SCDVS           /SC2-11 SEQUENCE
2721  4341          JMS MVR             /REGS TO L11
2722  0534          L11
2723  4353          JMS SCDVS           /SC2-11 SEQUENCE
2724  4341          JMS MVR             /REGS TO L12
2725  0537          L12
2726  4464          JMS I UADSB         /ADD/SUBTRACT?
2727  4466          JMS I UMQRTA        /ROTATE MQ
2730  4341          JMS MVR             /REGS TO L13
2731  0542          L13
2732  7300          CLA CLL
2733  1124          TAD MQB
2734  7012          RTR
2735  7430          SZL
2736  5323          JMP .+5
2737  7710          SPA CLA             /MQ10(0),MQ11(0)=MEM ADD
2740  5336          JMP STF             /TO AC
2741  4462          JMS I UADAC
2742  5336          JMP STF             /MQ10(0),MQ11(1)= AC TO AC
2743  7710          SPA CLA
2744  5327          JMP .+3             /MQ10(1),MQ11(0)=MEM ADD
2745  4463          JMS I UADNAC        /TO NOT AC
2746  5336          JMP STF
2747  1122          TAD LB              /MQ10(1),MQ11(1)= NOT AC TO AC
2750  7104          RAL CLL
2751  1123          TAD ACB
2752  7060          CMA CML
2753  3123          DCA ACB             /STORE AC
2754  7004          RAL
2755  3122          DCA LB              /STORE LINK
2756  4341  STF,    JMS MVR             /REGS TO LF
2757  0126          LF
2760  5600          JMP I DIVSM         /EXIT,

2761  0000  MVR,    0
2762  7200          CLA
2763  1741          TAD I MVR           /MOVE LB, ACB, AND
2764  3347          DCA .+3             /MQB TO LOC SPECIFIED
2765  4432          JMS I UMOVE         /AT CALL(+1)
2766  0122          LB
2767  0000          0
2770  7775          -3
2771  2341          ISZ MVR
2772  5741          JMP I MVR           /EXIT
              /
2773  0000  SCDVS,  0
2774  4464          JMS I UADSB         /SUBROUTINE CALL
2775  4466          JMS I UMQRTA        /SEQUENCE FOR
2776  4360          JMS LACRT           /DSC2-11
2777  5753          JMP I SCDVS         /EXIT
              /
3000  0000  LACRT,  0
3001  7200          CLA                 /ROTATE LEFT LB AND ACB,
3002  1124          TAD MQB             /IF MQB10=0, MQ0S GOES
3003  7012          RTR                 /TO ACB11, IF MQB10=1,
```



```
3004  7630          SZL CLA             /NOT MQ0S GOES TO ACB11
3005  7040          CMA
3006  1133          TAD MQ0S
3007  7004          RAL
3010  7200          CLA
3011  1123          TAD ACB
3012  7004          RAL
3013  3123          DCA ACB
3014  7010          RAR
3015  3122          DCA LB
3016  5760          JMP I LACRT

      3000    *, 177+1

3000  0000  ADAC,   0
3001  7300          CLA CLL             /ADD C(MBB)
3002  1122          TAD LB              /TO C(ACB) AND C(LB),
3003  7004          RAL                 /AND STORE RESULT BACK
3004  1123          TAD ACB             /IN ACB AND LB,
3005  1125          TAD MBB
3006  3123          DCA ACB
3007  7010          RAR
3010  3122          DCA LB
3011  5600          JMP I ADAC
              /
3012  0000  ADNAC,  0
3013  7300          CLA CLL             /ADD C(MBB)TO
3014  1122          TAD LB              /NOT C(ACB) AND C(LB),
3015  7004          RAL                 /STORE RESULT IN ACB AND LB
3016  1123          TAD ACB
3017  7060          CMA CML
3020  1125          TAD MBB
3021  3123          DCA ACB
3022  7010          RAR
3023  3122          DCA LB
3024  5612          JMP I ADNAC
              /
3025  0000  ADSB,   0
3026  7300          CLA CLL             /IF MQB10=MQB11
3027  1124          TAD MQB             /GO TO ADAC SUB,
3030  7012          RTR                 /IF NOT TO ADNAC SUB,
3031  7010          RAR
3032  0174          AND [6000
3033  1174          TAD [6000
3034  7500          SMA
3035  5240          JMP .+3
3036  4200          JMS ADAC
3037  5625          JMP I ADSB
3040  4212          JMS ADNAC
3041  5625          JMP I ADSB
              /

3042  0000  FMFCT,  0                   /0X0=0000 0000
3043  0000          0
```

```
3044  0000  0
3045  0000  0
3046  0001  1              /1X0=0000 0000
3047  0000  0
3050  0000  0
3051  0000  0
3052  0000  0              /0X1=0000 0000
3053  0001  1
3054  0000  0
3055  0000  0
3056  0001  1              /1X1= 0000 0001
3057  0001  1
3060  0000  0
3061  0001  1
3062  0001  1              /1X3=0000 0003
3063  0003  3
3064  0000  0
3065  0003  3
3066  0001  1              /1X7=0000 0007
3067  0007  7
3070  0000  0

3071  0007  7
3072  0001  1              /1X17=0000 0017
3073  0017  17
3074  0000  0
3075  0017  17
3076  0001  1              /1X37=0000 0037
3077  0037  37
3100  0000  0
3101  0037  37
3102  0001  1              /1X77=0000 0077
3103  0077  77
3104  0000  0
3105  0077  77
3106  0001  1              /1X177=0000 0177
3107  0177  177
3110  0000  0
3111  0177  177
3112  0001  1              /1X377=0000 0377
3113  0377  377
3114  0000  0
3115  0377  377
3116  0001  1              /1X777=0000 0777
3117  0777  777
3120  0000  0
3121  0777  777

3122  0001  1              /1X1777=0000 1777
3123  1777  1777
3124  0000  0
3125  1777  1777
3126  0001  1              /1X3777=0000 3777
3127  3777  3777
3130  0000  0
```



```
3131  3777  3777
3132  0001  1              /1X7777=0000 7777
3133  7777  7777
3134  0000  0
3135  7777  7777
3136  0003  3              /3X1=0000 0003
3137  0001  1
3140  0000  0
3141  0003  3
3142  0007  7              /7X1=0000 0007
3143  0001  1
3144  0000  0
3145  0007  7
3146  0017  17             /17X1=0000 0017

3147  0001  1
3150  0000  0
3151  0017  17
3152  0037  37             /37X1=0000 0037
3153  0001  1
3154  0000  0
3155  0037  37
3156  0077  77             /77X1=0000 0077
3157  0001  1
3160  0000  0
3161  0077  77
3162  0177  177            /177X1=0000 0177
3163  0001  1
3164  0000  0
3165  0177  177
3166  0377  377            /377X1=0000 0377
3167  0001  1
3170  0000  0
3171  0377  377
3172  0777  777            /777X1=0000 0777
3173  0001  1
3174  0000  0
3175  0777  777
3176  1777  1777           /1777X1=0000 1777
3177  0001  1
3200  0000  0
3201  1777  1777

3202  3777  3777           /3777X1=0000 3777
3203  0001  1
3204  0000  0
3205  3777  3777
3206  7777  7777           /7777X1=0000 7777
3207  0001  1
3210  0000  0
3211  7777  7777
3212  0003  3              /3X7777=0002 7775
3213  7777  7777
3214  0002  2
3215  7775  7775
```

```
3216  0007          7               /7X7777=0006 7771
3217  7777          7777
3220  0006          6
3221  7771          7771
3222  0017          17              /17X7777=0016 7761
3223  7777          7777
3224  0016          16

3225  7761          7761
3226  0037          37              /37X7777=0036 7741
3227  7777          7777
3230  0036          36
3231  7741          7741
3232  0077          77              /77X7777=0076 7701
3233  7777          7777
3234  0076          76
3235  7701          7701
3236  0177          177             /177X7777=0176 7601
3237  7777          7777
3240  0176          176
3241  7601          7601
3242  0377          377             /377X7777=0376 7401
3243  7777          7777
3244  0376          376
3245  7401          7401
3246  0777          777             /777X7777=0776 7001
3247  7777          7777
3250  0776          776
3251  7001          7001
3252  1777          1777            /1777X7777=1776 6001
3253  7777          7777
3254  1776          1776
3255  6001          6001
3256  3777          3777            /3777X7777=3776 4001
3257  7777          7777
3260  3776          3776
3261  4001          4001

3262  7777          7777            /7777X7777=7776 0001
3263  7777          7777
3264  7776          7776
3265  0001          0001
3266  7777          7777            /7777X2=0002 7775
3267  0003          3
3270  0002          2
3271  7775          7775
3272  7777          7777            /7777X7=0006 7771
3273  0007          7
3274  0006          6
3275  7771          7771
3276  7777          7777            /7777X17=0016 7761
3277  0017          17
3300  0016          16
3301  7761          7761
3302  7777          7777            /7777X37=0036 7741
```



```
3303  0037          37
3304  0036          36
3305  7741          7741
3306  7777          7777            /7777X77=0076 7701
3307  0077          77
3310  0076          76
3311  7701          7701
3312  7777          7777            /7777X177=0176 7601
3313  0177          177
3314  0176          176
3315  7601          7601
3316  7777          7777            /7777X377=0376 7401
3317  0377          377
3320  0376          376
3321  7401          7401
3322  7777          7777            /7777X777=0776 7001
3323  0777          777
3324  0776          776
3325  7001          7001
3326  7777          7777            /7777X1777=1776 6001
3327  1777          1777
3330  1776          1776
3331  6001          6001
3332  7777          7777            /7777X3777=3776 4001
3333  3777          3777
3334  3776          3776
3335  4001          4001
3336  0001          1               /1X4000=0000 4000
3337  4000          4000
3340  0000          0
3341  4000          4000

3342  4000          4000            /4000X1=0000 4000
3343  0001          1
3344  0000          0
3345  4000          4000
3346  0001          1               /1X5252=0000 5252
3347  5252          5252
3350  0000          0
3351  5252          5252
3352  0001          1               /1X2525=0000 2525
3353  2525          2525
3354  0000          0
3355  2525          2525
3356  5252          5252            /5252X1=0000 5252
3357  0001          1
3360  0000          0

3361  5252          5252
3362  2525          2525            /2525X1=0000 2525
3363  0001          1
3364  0000          0
3365  2525          2525
3366  5252          5252            /5252X2525=1615 6162
```

```
3367  2525          2525
3370  1615          1615
3371  6162          6162
3372  2525          2525            /2525X5252=1615 6162
3373  5252          5252
3374  1615          1615
3375  6162          6162

3376  0000    FDOPR, 0                       /00000000/0000=1 0000 0001
3377  0000          0
3400  0000          0
3401  0001          1
3402  0000          0000
3403  0001          1
3404  7777          7777                     /77770000/7777=1 7777 0001
3405  0000          0
3406  7777          7777
3407  0001          1
3410  7777          7777
3411  0001          1
3412  0000          0                        /0000 0000 /0001=0 0000 0000
3413  0000          0
3414  0001          1
3415  0000          0
3416  0000          0
3417  0000          0
3420  0000          0                        /0000 0000/0003=0 0000 0000
3421  0000          0
3422  0003          3
3423  0000          0
3424  0000          0
3425  0000          0
3426  0000          0                        /0000 0000/0007=0 0000 0000
3427  0000          0
3430  0007          7
3431  0000          0
3432  0000          0
3433  0000          0
3434  0000          0                        /0000 0000/0017=0 0000 0000
3435  0000          0
3436  0017          17
3437  0000          0
3440  0000          0
3441  0000          0
3442  0000          0                        /0000 0000/0037=0 0000 0000

3443  0000          0
3444  0037          37

3445  0000          0
3446  0000          0
3447  0000          0

3450  0000          0                        /0000 0000/0077=0 0000 0000
```



```
3451  0000          0
3452  0077          77
3453  0000          0
3454  0000          0
3455  0000          0
3456  0000          0                        /0000 0000/0177=0 0000 0000
3457  0000          0
3460  0177          177
3461  0000          0
3462  0000          0
3463  0000          0
3464  0000          0                        /0000 0000/0377=0 0000 0000
3465  0000          0
3466  0377          377
3467  0000          0
3470  0000          0
3471  0000          0
3472  0000          0                        /0000 0000/0777=0 0000 0000
3473  0000          0
3474  0777          777
3475  0000          0
3476  0000          0
3477  0000          0
3500  0000          0                        /0000 0000/1777=0 0000 0000
3501  0000          0
3502  1777          1777
3503  0000          0
3504  0000          0
3505  0000          0
3506  0000          0                        /0000 0000/3777=0 0000 0000
3507  0000          0
3510  3777          3777
3511  0000          0
3512  0000          0
3513  0000          0
3514  0000          0                        /0000 0000/7777=0 0000 0000
3515  0000          0
3516  7777          7777
3517  0000          0
3520  0000          0
3521  0000          0
3522  0000          0                        /0000 0001/7777=0 0001 0000
3523  0001          1
3524  7777          7777
3525  0000          0
3526  0001          1
3527  0000          0
3530  0000          0                        /0000 0003/7777=0 0003 0000
3531  0003          3

3532  7777          7777
3533  0000          0
3534  0003          3
3535  0000          0
```

```
3536  0000          0                       /0000 0007/7777=0 0007 0000
3537  0007          7
3540  7777          7777
3541  0000          0
3542  0007          7
3543  0000          0
3544  0000          0                       /0000 0017/7777=0 0017 0000
3545  0017          17
3546  7777          7777
3547  0000          0
3550  0017          17
3551  0000          0
3552  0000          0                       /0000 0037/7777=0 0037 0000
3553  0037          37
3554  7777          7777
3555  0000          0
3556  0037          37
3557  0000          0
3560  0000          0                       /0000 0077/7777=0 0077 0000
3561  0077          77
3562  7777          7777
3563  0000          0
3564  0077          77
3565  0000          0
3566  0000          0                       /0000 0377/7777=0 0377 0000
3567  0377          377
3570  7777          7777
3571  0000          0
3572  0377          377
3573  0000          0
3574  0000          0                       /0000 0777/7777=0 0777 0000
3575  0777          777
3576  7777          7777
3577  0000          0
3600  0777          777
3601  0000          0
3602  0000          0                       /0000 1777/7777=0 1777 0000
3603  1777          1777
3604  7777          7777
3605  0000          0
3606  1777          1777
3607  0000          0

3610  0000          0                       /0000 3777/7777=03777 0000
3611  3777          3777
3612  7777          7777
3613  0000          0
3614  3777          3777
3615  0000          0
3616  0001          1                       /0001 0000/7777=0 0001 0001
3617  0000          0
3620  7777          7777
3621  0000          0
3622  0001          1
```



```
3623  0001          1
3624  0003          3                       /0003 0000/7777=0 0003 0003
3625  0000          0
3626  7777          7777
3627  0000          0
3630  0003          3
3631  0003          3
3632  0007          7                       /0007 0000/7777=0 0007 0007
3633  0000          0
3634  7777          7777
3635  0000          0
3636  0007          7
3637  0007          7
3640  0017          17                      /0017 0000/7777=0 0017 0017
3641  0000          0
3642  7777          7777
3643  0000          0
3644  0017          17
3645  0017          17
3646  0037          37                      /0037 0000/7777=0 0037 0037
3647  0000          0
3650  7777          7777
3651  0000          0
3652  0037          37
3653  0037          37
3654  0077          77                      /0077 0000/7777=0 0077 0077
3655  0000          0
3656  7777          7777
3657  0000          0
3660  0077          77
3661  0077          77
3662  0177          177                     /0177 0000/7777=0 0177 0177
3663  0000          0
3664  7777          7777
3665  0000          0

3666  0177          177
3667  0177          177

3670  0377          377                     /0377 0000/7777=0 0377 0377
3671  0000          0
3672  7777          7777
3673  0000          0
3674  0377          377
3675  0377          377
3676  0777          777                     /0777 0000/7777=0 0777 0777
3677  0000          0
3700  7777          7777
3701  0000          0
3702  0777          777
3703  0777          777
3704  1777          1777                    /1777 0000/7777=0 1777 1777
3705  0000          0
3706  7777          7777
3707  0000          0
```

```
3710  1777          1777
3711  1777          1777
3712  3777          3777                    /3777 0000/7777=0 3777 3777
3713  0000          0
3714  7777          7777
3715  0000          0
3716  3777          3777
3717  3777          3777
3720  0000          0                       /0000 7777/0001=0 0000 7777
3721  7777          7777
3722  0001          1
3723  0000          0
3724  0000          0
3725  7777          7777
3726  0001          1                       /0001 2525/0002=0 0001 5252
3727  2525          2525
3730  0002          2
3731  0000          0
3732  0001          1
3733  5252          5252
3734  0000          0                       /0000 5252/0002=0 0000 2525
3735  5252          5252
3736  0002          2
3737  0000          0
3740  0000          0
3741  2525          2525
3742  0007          7                       /0007 0707/0010=0 0007 7070
3743  0707          0707
3744  0010          10
3745  0000          0
3746  0007          7
3747  7070          7070
3750  0000          0                       /0000 7070/0010=0 0000 0707
3751  7070          7070
3752  0010          10
3753  0000          0
3754  0000          0
3755  0707          0707

                    /ROUTINE TO PRINT FAILURE MODE

3756  0000    TYMOD,  OPEN
3757  7300            CLA CLL
3760  1020            TAD MODE
3761  7040            CMA
3762  1377            TAD (4002
3763  3373            DCA MODEX+2             /STORE A "SPACE" + THE MODE THAT FAILED.
3764  4445            JMS I UPSPC
3765  7774            -4
3766  4426            JMS I XTYPST            /MODE "X"
3767  3771            MODEX
3770  5756            JMP I TYMOD             /EXIT

3771  1517    MODEX,  1517
3772  0405            0405
```



```
3773  0000            OPEN
3774  0001            0001


                    /KE8I  -  TAPE 4
                    /
3777  4002
      4000    *, 177+1
4000  0000    EX1ST,  0               /SET UP OPERANDS IN
                                      /EX1 EXERCISER
4001  4777'           JMS WHATB               /SET "B"
4002  3212            DCA ,+10
4003  4777'           JMS WHATB               /SET "B"
4004  3214            DCA ,+10
4005  5600            JMP I EX1ST
4006  0000    EX1,    0               /EXERCISE:
4007  7200            CLA             /AXB/B=A
4010  1104            TAD A
4011  7425            MQL MUY
4012  0000            0
4013  7407            DVI
4014  0000            0
4015  5606            JMP I EX1
4016  0000    EX2ST,  0               /SET UP OPERANDS IN
                                      /EX2 EXERCISER
4017  4777'           JMS WHATB               /SET "B"
4020  3234            DCA ,+14
4021  4777'           JMS WHATB               /SET "B"
4022  3236            DCA ,+14
4023  4777'           JMS WHATB               /SET "B"
4024  3240            DCA ,+14
4025  4776'           JMS WHATA               /SET "A"
4026  3242            DCA ,+14
4027  5616            JMP I EX2ST
4030  0000    EX2,    0               /EXERCISE:
4031  7200            CLA             /AXB/BXB/A=B
4032  1104            TAD A
4033  7425            MQL MUY
4034  0000            0
4035  7407            DVI
4036  0000            0
4037  7405            MUY
4040  0000            0
4041  7407            DVI
4042  0000            0
4043  5630            JMP I EX2

4044  0000    EX3ST,  0               /SET UP OPERANDS IN
                                      /EX3 EXERCISER
4045  4777'           JMS WHATB       /SET "B"
4046  3266            DCA ,+20
4047  4777'           JMS WHATB       /SET "B"
4050  3270            DCA ,+20
4051  4777'           JMS WHATB       /SET "B"
4052  3272            DCA ,+20
```

```
4053  4776'          JMS WHATA       /SET "A"
4054  3274           DCA .+20
4055  4776'          JMS WHATA       /SET "A"
4056  3276           DCA .+20
4057  4776'          JMS WHATA       /SET "A"
4060  3300           DCA .+20
4061  5644           JMP I EX3ST

4062  0000    EX3,   0               /EXERCISE:
4063  7200           CLA             /AXB/BXB/AXA/A=B
4064  1104           TAD A
4065  7425           MQL MUY
4066  0000           0
4067  7407           DVI
4070  0000           0
4071  7405           MUY
4072  0000           0
4073  7407           DVI
4074  0000           0
4075  7405           MUY
4076  0000           0
4077  7407           DVI
4100  0000           0
4101  5662           JMP I EX3
4102  0000    EX4ST, 0               /SET UP OPERANDS IN
                                     /EX4 EXERCISER
4103  4777'          JMS WHATB       /SET "B"
4104  3330           DCA .+24
4105  4777'          JMS WHATB       /SET "B"
4106  3332           DCA .+24
4107  4777'          JMS WHATB       /SET "B"
4110  3334           DCA .+24
4111  4776'          JMS WHATA       /SET "A"
4112  3336           DCA .+24
4113  4776'          JMS WHATA       /SET "A"
4114  3340           DCA .+24
4115  4776'          JMS WHATA       /SET "A"
4116  3342           DCA .+24
4117  4776'          JMS WHATA       /SET "A"
4120  3344           DCA .+24
4121  4777'          JMS WHATB       /SET "B"
4122  3346           DCA .+24
4123  5702           JMP I EX4ST

4124  0000    EX4,   0               /EXERCISE:
4125  7200           CLA             /AXB/BXB/AXA/AXA/B=A
4126  1104           TAD A
4127  7425           MQL MUY
4130  0000           0
4131  7407           DVI
4132  0000           0
4133  7405           MUY
4134  0000           0
4135  7407           DVI
```



```
4136  0000           0
4137  7405           MUY
4140  0000           0
4141  7407           DVI
4142  0000           0
4143  7405           MUY
4144  0000           0
4145  7407           DVI
4146  0000           0
4147  5724           JMP I EX4
                     /
                     /FILL 2K BUFFER WITH RANDOM NON-ZERO NUMBERS
4150  0000    FBRM,  0
4151  4424           JMS I SETCTR    /SET FBCTR
4152  4167           FBCTR           /TO -1400
4153  5210           -2570
4154  1071           TAD UTAB
4155  3370           DCA FBRT        /STORE TABLE ADDRESS,
4156  4427           JMS I RANDNO    /GENERATE RANDOM NUMBER
4157  7450           SNA             /IS IT ZERO?
4160  5356           JMP .+2         /YES, SET ANOTHER NUMBER
4161  3770           DCA I FBRT      /NO, STORE PER FBRT
4162  2370           ISZ FBRT                /+1 TO FBRT
4163  2367           ISZ FBCTR               /ALL CHARACTERS GENERATED?
4164  5356           JMP .-6         /NO, REPEAT
4165  2135           ISZ TABF                /YES, SET TABLE FULL INDICATOR
4166  5750           JMP I FBRM      /EXIT
4167  0000    FBCTR, 0
4170  0000    FBRT,  0


4176  1150
4177  1161
      4200     *, 177+1
4200  0000    MDEXR, 0
4201  3106           DCA L
4202  4432           JMS I UMOVE     /CLEAR REGISTERS
4203  0106           L
4204  0107           AC
4205  7752           -26
4206  1600           TAD I MDEXR
4207  3323           DCA TSTP                /STORE SETUP ADDRESS
4210  2200           ISZ MDEXR
4211  1600           TAD I MDEXR
4212  3153           DCA TEXR
4213  2200           ISZ MDEXR
4214  1600           TAD I MDEXR
4215  3114           DCA MQSB
4216  1514           TAD I MQSB
4217  3114           DCA MQSB                /STORE EXPECTED RESULT
4220  2200           ISZ MDEXR
4221  1600           TAD I MDEXR
4222  3262           DCA PRBX                /STORE PRB PRINTOUT ADDRESS
4223  2200           ISZ MDEXR               /SET UP EXIT
4224  4723           JMS I TSTP      /SET UP EXERCISE
```

```
4225  4227          JMS EX          /GO DO EXERCISE
4226  5237          JMP EXCMP
4227  0000    EX,   0
4230  4553          JMS I TEXR      /DO EXERCISE
4231  3117          DCA ACR         /STORE AC RESULT
4232  7010          RAR
4233  3116          DCA LR          /STORE LINK RESULT
4234  7501          MQA
4235  3120          DCA MQR         /STORE MQ RESULT
4236  5627          JMP I EX

4237  4433    EXCMP, JMS I UCOMP    /COMPARE RESULTS AND
4240  7775          -3              /EXPECTED RESULTS (3 WORDS)
4241  5245          JMP EXER              /ERROR
4242  4434    EXLT,  JMS I USR4T    /LOCK ON TEST? (SR4 ON)
4243  5225          JMP EX+2              /YES,
4244  5600          JMP I MDEXR     /YES, EXIT,
4245  4435    EXER,  JMS I USR5T    /PRINT/HALT?
4246  5253          JMP .+5         /YES, GO PRINT
4247  4324          JMS EXEHLT      /GO HALT
4250  4435          JMS I USR5T     /PRINT?
4251  7410          SKP             /GO PRINT
4252  5242          JMP EXLT              /NO PRINT
4253  4446          JMS I UCRLF     /CRLF TWICE
4254  7776          -2
4255  4426          JMS I XTYPST    /PRINT PROB
4256  0643          PROB
4257  4445          JMS I UPSPC     /SPACE TWICE
4260  7776          -2
4261  4426          JMS I XTYPST    /PRINT PROBLEM DESCRIPTION

4262  0000    PRBX,  0
4263  4446          JMS I UCRLF     /CRLF TWICE
4264  7776          -2
4265  4331          JMS ASCCN
4266  0104          A
4267  0762          AVALUE
4270  4331          JMS ASCCN

4271  0105          B
4272  0767          BVALUE
4273  4426          JMS I XTYPST
4274  0760          ABVAL
4275  4475          JMS I UEXERP
4276  4436          JMS I USR6T     /HALT AFTER PRINT?
4277  4324          JMS EXEHLT      /YES GO HALT
4300  4437          JMS I USR7T     /PRINT FAILURE RATE?
4301  5317          JMP EXLOP+2     /NO
4302  4424          JMS I SETCTR    /SET FRCTR
4303  0141          FRCTR           /TO -100
4304  7634          -144
4305  3140          DCA FCTR              /CLEAR FAILURES COUNTER
4306  4227          JMS EX          /DO EXERCISE
4307  4433          JMS I UCOMP     /COMPARE RESULTS
4310  7775          -3
```



```
4311  2140          ISZ FCTR              /ERROR +1 TO FCTR
4312  2141          ISZ FRCTR             /DONE 100 TIMES?
4313  5306          JMP .+3         /NO REPEAT
4314  4451          JMS I UMSG2     /YES, PRINT FAILURE RATE
4315  4436          JMS I USR6T     /HALT AFTER PRINT?
4316  4324          JMS EXEHLT      /YES GO HALT
4317  4440          JMS I USATET    /SCOPE LOOP? (SR8)
4320  5242          JMP EXLT              /NO

4321  4553    EXLOP, JMS I TEXR     /DO EXERCISE
4322  5321          JMP .+1         /REPEAT
4323  0000    TSTP,  0
4324  0000    EXEHLT, 0
4325  7200          CLA
4326  1102          TAD RTNNO             /GET ROUTINE NUMBER
4327  7402          HLT             /MUY/DVI EXR ERR HALT
4330  5724          JMP I EXEHLT    /EXIT

4331  0000    ASCCN, 0              /CONVERT TO OCTAL PACKED ASCII
4332  1731          TAD I ASCCN
4333  3367          DCA WASC              /STORE ADDRESS OF WORD TO CONVERT
4334  2331          ISZ ASCCN
4335  1731          TAD I ASCCN     /STORE ADDRESS OF LOCATION
4336  3370          DCA SASC              /TO STORE CONVERTED DATA
4337  2331          ISZ ASCCN             /SET UP EXIT
4340  1156          TAD K7700
4341  0767          AND I WASC      /GET 2 HIGH ORDER DIGITS
4342  7112          RTR CLL
4343  7012          RTR             /SHIFT TO 2 LOW ORDER
4344  7012          RTR             /POSITIVES
4345  4354          JMS CNV         /GO DO CONVERSION
4346  2370          ISZ SASC              /+1 TO STORE ADDRESS
4347  1156          TAD K7700
4350  7040          CMA
4351  0767          AND I WASC      /GET 2 LOW ORDER DIGITS
4352  4354          JMS CNV         /GO DO CONVERSION
4353  5731          JMP I ASCCN     /EXIT
4354  0000    CNV,   0
4355  3371          DCA ASCT              /SAVE DIGITS

4356  1371          TAD ASCT              /SET DIGITS BACK AC=00XX
4357  7006          RTL
4360  7004          RAL             /AC=0XX0
4361  0154          AND K0707             /AC=0X00
4362  1371          TAD ASCT              /AC=0XXX
4363  0154          AND K0707             /AC=0X0X
4364  1155          TAD K6060             /AC=6X6X
4365  3770          DCA I SASC      /STORE PER STORE ADDRESS
4366  5754          JMP I CNV             /EXIT
4367  0000    WASC,  0
4370  0000    SASC,  0
4371  0000    ASCT,  0

4372  0007    KE8SP2, 0007          /BELL
4373  1305          1305            /KIE
```

```
4374  7040            7040            /8)SPACE
4375  6200            6200            /2)END
4376  0100            0100            /CODE


      4400    *, 177+1
4400  0000    TST0,   0
4401  4405            TST1
4402  4430            JMS I UMUYT
4403  3042            FMFCT
4404  7711            -67
4405  0001    TST1,   1
4406  4461            TST2
4407  4424            JMS I SETCTR    /SET RMCTR
4410  4457            RMCTR           /TO-1400
4411  5210            -2570
4412  1071            TAD UTAB                /GET AND STORE
4413  3260            DCA RMAD
4414  4427    RMSTP,  JMS I RANDNO    /GENERATE RANDOM NO,
4415  3660            DCA I RMAD              /STORE
4416  2260            ISZ RMAD
4417  2257            ISZ RMCTR
4420  5214            JMP .+4
4421  3136            DCA L           /YES CLEAR REGISTERS',
4422  4432            JMS I UMOVE
4423  0136            L
4424  0137            AC
4425  7751            -27
4426  4424            JMS I SETCTR    /SET RMCTR
4427  4457            RMCTR           /TO -350
4430  7242            -536
4431  1071            TAD UTAB                /GET AND STORE
4432  3234            DCA .+2         /TABLE ADDRESS,
4433  4432            JMS I UMOVE     /MOVE 2 FACTORS
4434  0000    RMSTPA, 0               /TO MQ AND MB,
4435  0110            MQ
4436  7776            -2
4437  4441            JMS I UMUYSM    /SIMULATE MULTIPLY',
4440  1234            TAD RMSTPA
4441  1147            TAD K2
4442  3245            DCA .+3
4443  4432            JMS I UMOVE     /STORE RESULTS,
4444  0127            ACF
4445  0000            0
4446  7776            -2
4447  1245            TAD .+2         /SET UP FOR NEXT
4450  1147            TAD K2          /2 FACTORS,
4451  3234            DCA RMSTPA
4452  2257            ISZ RMCTR               /DONE SIMULATING?
4453  5233            JMP RMSTPA+1    /NO, REPEAT,
4454  4430            JMS I UMUYT     /YES GO DO MULTIPLY TEST',
4455  5000            TAB
4456  7242            -536
4457  0000    RMCTR,  0
4460  0000    RMAD,   0
```



```
4461  0002    TST2,   2
4462  4466            TST3
4463  4431            JMS I UDIVT
4464  3376            FDOPR
4465  7730            -50
4466  0003    TST3,   3
4467  4542            TST4
4470  4424            JMS I SETCTR    /SET RDCTR
4471  4540            RDCTR           /TO-1400
4472  5210            -2570
4473  1071            TAD UTAB                /GET AND STORE
4474  3341            DCA RDAD                /TABLE ADDRESS',
4475  4427    RDSTP,  JMS I RANDNO    /GENERATE RANDOM NO,
4476  3741            DCA I RDAD              /STORE
4477  2341            ISZ RDAD
4500  2340            ISZ RDCTR
4501  5275            JMP .+4
4502  3136            DCA L           /YES, CLEAR REGISTERS
4503  4432            JMS I UMOVE
4504  0136            L
4505  0137            AC
4506  7751            -27
4507  4424            JMS I SETCTR    /SET RDCTR
4510  4540            RDCTR           /TO -233
4511  7427            -351
4512  1071            TAD UTAB        /GET TABLE ADDR
4513  3315            DCA .+2         /AND STORE,
4514  4432            JMS I UMOVE
4515  0000    RDSTPA, 0               /MOVE DIVIDE OPERANDS TO
4516  0127            AC              /AC, MQ, AND MB,
4517  7775            -3
4520  4442            JMS I UDIVSM    /SIMULATE DIVIDE,
4521  1315            TAD RDSTPA
4522  1150            TAD K3
4523  3326            DCA .+3
4524  4432            JMS I UMOVE     /STORE RESULTS
4525  0126            LF
4526  0000            0
4527  7775            -3
4530  1326            TAD .+2         /SET UP FOR NEXT
4531  1150            TAD K3          /SIMULATION,
4532  3315            DCA RDSTPA
4533  2340            ISZ RDCTR               /DONE SIMULATING?
4534  5314            JMP RDSTPA+1    /NO, REPEAT,
4535  4431            JMS I UDIVT     /YES, GO DO DIVIDE TEST,
4536  5000            TAB
4537  7427            -351
4540  0000    RDCTR,  0
4541  0000    RDAD,   0
```



```
4542  0004    TST4,   4
```

```
4543  4630            TST5
4544  4472            JMS I UFBRM     /FILL 2K BUFFER WITH RANDOM NUMBERS,
4545  4424            JMS I SETCTR    /SET TCTR
4546  0144            TCTR            /TO -700
4547  6504            -1274
4550  1071            TAD UTAB
4551  3353            DCA ADR1                /STORE TABLE ADDRESS
4552  4432            JMS I UMOVE     /MOVE 2 OPERANDS TO A AND B,
4553  0000    ADR1,   0
4554  0104            A
4555  7776            -2
4556  1353            TAD ADR1        /SET ADDA TO
4557  3007            DCA ADDA        /TO ADDRESS OF A,
4560  4473            JMS I UMDEXR    /GO DO MUY/DVI EXERCISE TEST,
4561  4000            EX1ST           /EXERCISE SET UP ADDRESS,
4562  4006            EX1             /EXERCISE ADDRESS,
4563  0104            A               /CONVERT RESULT ADDRESS
4564  0714            PRB1            /PROBLEM PRINTOUT ADDRESS,
4565  2353            ISZ ADR1                /+2 TO ADR1
4566  2353            ISZ ADR1
4567  2144            ISZ TCTR                /ALL TESTS DONE?
4570  5352            JMP ADR1-1      /NO, REPEAT
4571  5422            JMP I CHAIN     /YES, CHAIN,

4572  7300    LOPSEL, CLA CLL
4573  1102            TAD RTNNO       /ROUTINE NUMBER
4574  7402            HLT             /RTN NUMBER IN AC,  SET SR TO
                                      /DESIRED MODE OF OPERATION AND PRESS
                                      /CONTINUE,
4575  5777            JMP SELECT      /GO DO THE SELECTION ACCORDING TO SR,

4577  1360
      4600            PAGE
                    /
4600  0005    TST5,   5
4601  4633            TST6
4602  7200            CLA
4603  1135            TAD TABF
4604  7650            SNA CLA
4605  4472            JMS I UFBRM
4606  4424            JMS I SETCTR
4607  0144            TCTR
4610  6504            -1274
4611  1071            TAD UTAB
4612  3214            DCA ADR2
4613  4432            JMS I UMOVE
4614  0000    ADR2,   0
4615  0104            A
4616  7776            -2
4617  1214            TAD ADR2
4620  3007            DCA ADDA
4621  4473            JMS I UMDEXR
4622  4016            EX2ST
4623  4030            EX2
4624  0105            B
```



```
4625  0722            PRB2
4626  2214            ISZ ADR2
4627  2214            ISZ ADR2
4630  2144            ISZ TCTR
4631  5213            JMP ADR2-1
4632  5422            JMP I CHAIN     /YES, CHAIN,


4633  0006    TST6,   6
4634  4666            TST7
4635  7200            CLA
4636  1135            TAD TABF
4637  7650            SNA CLA
4640  4472            JMS I UFBRM
4641  4424            JMS I SETCTR
4642  0144            TCTR
4643  6504            -1274
4644  1071            TAD UTAB
4645  3247            DCA ADR3
4646  4432            JMS I UMOVE
4647  0000    ADR3,   0
4650  0104            A
4651  7776            -2
4652  1247            TAD ADR3
4653  3007            DCA ADDA
4654  4473            JMS I UMDEXR
4655  4044            EX3ST
4656  4062            EX3
4657  0105            B
4660  0732            PRB3
4661  2247            ISZ ADR3
4662  2247            ISZ ADR3
4663  2144            ISZ TCTR
4664  5246            JMP ADR3-1
4665  5422            JMP I CHAIN     /YES, CHAIN,
                    /
4666  0007    TST7,   7
4667  7777            7777
4670  7200            CLA
4671  1135            TAD TABF
4672  7650            SNA CLA
4673  4472            JMS I UFBRM
4674  4424            JMS I SETCTR
4675  0144            TCTR
4676  6504            -1274
4677  1071            TAD UTAB
4700  3302            DCA ADR4
4701  4432            JMS I UMOVE
4702  0000    ADR4,   0
4703  0104            A
4704  7776            -2
4705  1302            TAD ADR4
4706  3007            DCA ADDA
4707  4473            JMS I UMDEXR
4710  4102            EX4ST
```

```
4711  4124          EX4
4712  0104          A
4713  0744          PRB4
4714  2302          ISZ ADR4
4715  2302          ISZ ADR4
4716  2144          ISZ TCTR
4717  5301          JMP ADR4+1
4720  5422          JMP I CHAIN

                /ROUTINE TO DETERMINE MODE OF OPERATION.

4721  7604    DETMOD, LAS             /READ SR.
4722  7132            CLL CML RTR     /SR 11 TO AC0; SR 10 TO LINK; LINK TO AC 11.
4723  7430            SZL             /SR 10=1? 0L=NO; 1L=YES.
4724  5336            JMP ADRB        /SR 10=1, NOW LOOK AT SW 11.
4725  0020            AND MODE        /AC NOT 0=B; AC=0=A.
4726  7650            SNA CLA         /WHICH MODE?
4727  5777'           JMP SETB        /WAS "A", SO SET TO "B", AND REPEAT ROUTINE.
4730  3020            DCA MODE        /WAS "B", SO SET TO "A".
4731  7604    RDSW1,  LAS             /READ SR.
4732  7106            CLL RTL         /SR 1 TO LINK; SR 2 TO AC0.
4733  7430            SZL             /
4734  5776'           JMP SW1SET      /SR 1 WAS SET.
4735  5775'           JMP CHAINN+2    /

4736  7510    ADRB,   SPA             /SW 11 = 1?
4737  5344            JMP .+5         /YES.
4740  0020            AND MODE        /NO,  0 AC=COMPLETED "A" MODE.
4741  7450            SNA             /REPEAT OR LOOK AT SW 1?
4742  5331            JMP RDSW1       /LOOK AT SW 1.
4743  5774'           JMP SETA        /SET TO "A" AND REPEAT ROUTINE.
4744  0020            AND MODE        /NON 0 AC = COMPLETED "B" MODE.
4745  7650            SNA CLA         /REPEAT OR LOOK AT SW1?
4746  5777'           JMP SETB        /SET TO "B" AND REPEAT ROUTINE.
4747  5331            JMP RDSW1       /LOOK AT SW1.


4750  0000    INTLD,  OPEN
4751  7300            CLA CLL
4752  6224            RIF
4753  1173            TAD CDF
4754  3161            DCA HOMEDF+1
4755  6201            CDF 0
4756  1373            TAD (RMF
4757  3772            DCA I (1
4760  1371            TAD (5403
4761  3770            DCA I (2
4762  1367            TAD (INTSVC
4763  3766            DCA I (3
4764  4160            JMS HOMEDF
4765  5750            JMP I INTLD



4766  0003
```



```
4767  1017
4770  0002
4771  5403
4772  0001
4773  6244
4774  1366
4775  0236
4776  0316
4777  1371
```

```
                5000    *, 177*1
                        /
          5000  0000    TAB,    0
                7570    *, +2567
                                $

          0173  6201
          0174  6000
          0175  0007
          0176  0205
          0177  0203
```



```
0000  11111111  00000000  1111?111  1111111?  ?1111111  11111111  ?111?1?1  11?11111
0100  11111111  11111111  11111111  11111111  11111111  11111111  ?111?1?1  11?11111

0200  11111111  1111111?  11?11111  11111111  11111111  11111111  ?1111?11  1?111111
0300  11111111  11111111  11111111  11111111  11111111  11111111  ?111?111  11?11111

0400  11111111  1111111?  11111111  11111111  11111111  11111111  ?1111?11  1?111111
0500  11111111  1111111?  11111111  11?11111  11111111  11111111  ?1111?11  1?111111

0600  11111111  1111111?  11111111  1111111?  11111111  11111111  ?1111?1?  1?111111
0700  11111111  11111111  11?11111  11111111  11111111  11111111  ?1111?11  1?1?0000


1000  11111111  11111111  11111111  11111111  11111111  11111111  ?1111?1?  11?11111
1100  11111111  11111111  11111111  11111111  11111111  11111111  ?1111111  11?11111

1200  11111111  1111111?  11111111  11111111  11111111  11111111  ?1111?1?  11?11111
1300  11111111  11111111  11111?11  11111111  11111111  11111111  ?1111?11  11?10111

1400  11111111  1111111?  11111111  11111111  11111111  11111111  ?1111?1?  11?11111
1500  11111111  11111111  11111111  11111111  11111111  11111111  ?1111?1?  11?11111

1600  11111111  11111111  11111111  11111111  11111111  11111111  11111?11  11?11111
1700  11111111  11111111  11111111  11111111  11111111  11111111  ?1111?11  11?11110

2000  11111111  11111111  11?11111  11111111  11111111  11111111  ?1111?1?  11?11111
2100  11111111  1111111?  11111111  11111111  11111111  11111111  ?1111?11  11?11110

2200  11111111  11111111  11111111  11111111  11111111  11111111  ?1111?11  11?11111
2300  11111111  11111111  11111111  11111111  11111111  11111111  ?1111111  11?11000

2400  11111111  11111111  11111111  11111111  11111111  11111111  11111?11  11?11111
2500  11111111  11111111  11111111  11111111  11111111  11111111  ?1111?11  11?11000

2600  11111111  11111111  11111111  11111111  11111111  11111111  ?1111111  11?11111
2700  11111111  11111111  11111111  11111111  11111111  11111111  ?1111?11  11?11110

3000  11111111  11111111  11111111  11111111  11111111  11111111  11111?11  11?11111
3100  11111111  11111111  11111111  11111111  11111111  11111111  ?1111111  11?11111

3200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11?11111
3300  11111111  11111111  11111111  11111111  11111111  11111111  ?1111111  11?11111

3400  11111111  11111111  11111111  11111111  11111111  11111111  ?1111?11  1?111111
3500  11111111  11111111  11111111  11111111  11111111  11111111  ?1111?11  11?11111

3600  11111111  1111111?  11111111  11111111  11111111  11111111  ?1111?11  11?11111
3700  11111111  1111111?  11111?11  11111111  11111111  11111111  ?1111?11  11?11001
```

```
4000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
4100  11111111  11111111  11111111  11111111  11111111  11111111  11111111  10000011

4200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
4300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111110

4400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
4500  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111101

4600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
4700  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

5000  10000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000
5100  00000000  00000000  00000000  00000000  00000000  00000000  00000000  00000000

5200
5300

5400
5500

5600
5700


6000
6100

6200
6300

6400
6500

6600
6700


7000
7100

7200
7300

7400
7500

7600
```


A	0104	CRLF	1753	FNRSLT	0637	LT	0657
ABLSR	2455	CURTST	0101	FORWD	0260	M40	0466
ABVAL	0760	DEHLT	1506	FRCTR	0141	MB	0111
AC	0107	DERPT	1513	GETRDY	0210	MBB	0125
ACB	0123	DERR	1450	GOOD	0646	MBD	1472
ACF	0127	DETMOQ	4721	HDD	1432	MBF	0131
ACR	0117	DFRP	1526	HDM	1233	MBM	1271
ACSB	0113	DIGIT	2142	HDSC0	2400	MBR	0121
ADAC	3000	DIVD	1462	HLT	7402	MBSB	0115
ADDA	0007	DIVERR	0355	HOMEDF	0160	MCTR	1675
ADDRZA	2134	DIVSM	2600	INCRTN	0232	MDEXR	4200
ADNAC	3012	DIVT	1400	INTAC	1016	MEHLT	1305
ADR1	4553	DLDZMB	1123	INTLD	4750	MERPT	1312
ADR2	4614	DLT	1437	INTSVC	1017	MERR	1251
ADR3	4647	DM11	2552	ION	6001	MFRP	1325
ADR4	4702	DSC1	2641	K0707	0154	MLDZMB	1076
ADSB	3025	DSLOOP	1563	K2	0147	MLT	1240
ADSFT	2443	DSMP	1550	K260	2144	MODE	0020
AMODE	7447	DSMSB	1135	K3	0150	MODEX	3771
AORB	4736	DSTR	1474	K4	0151	MOVE	1650
ARROW	2115	DVADR	1415	K6	0152	MOVEA	1663
ASCCN	4331	DVI	7407	K6060	0155	MQ	0110
ASCT	4371	DVOFLO	2627	K77	0465	MQBS	0133
ASR	7415	ENDTYP	0163	K7700	0156	MQ10M	0137
AVALUE	0762	FRPER	0675	KE8SP2	4372	MQA	7501
B	0105	ERPSB	2014	KSTART	0021	MQB	0124
BAD	0651	EX	4227	L	0106	MQF	0130
BDCNV	2077	EX1	4006	L0	0473	MQL	7421
BELCNT	0145	EX1ST	4000	L1	0476	MQR	0120
BELL	2175	EX2	4030	L10	0531	MQROT	2542
BELTYP	0170	EX2ST	4016	L11	0534	MQRTA	2563
BMODE	7431	EX3	4062	L12	0537	MQSB	0114
BVALUE	0767	EX3ST	4044	L13	0542	MSG1	2000
C1	1721	EX4	4124	L2	0501	MSG1A	1771
C100	0467	EX4ST	4102	L3	0504	MSG2	2064
C1A	1723	EXCMP	4237	L4	0507	MSLOOP	1356
C2	1722	EXEHLT	4324	L5	0512	MSMBR	1110
C240	0470	EXER	4245	L6	0515	MSMP	1347
C2A	1724	EXERP	1046	L7	0520	MSTR	1273
CAC	0661	EXERR	0710	LACRT	2760	MTADR	1215
CAM	7621	EXLOP	4321	LADR	2244	MULT	1263
CHAIN	0022	EXLT	4242	LATE	0523	MUY	7405
CHAINN	0234	FITEL	2256	LB	0122	MUYERR	0551
CHGTOB	0312	FADDR	1673	LCNT	0142	MUYSM	2464
CMB	0671	FBCTR	4167	LCTR	0143	MUYT	1200
CMPCTR	1725	FBRM	4150	LF	0126	MVR	2741
CMQ	0665	FBRT	4170	LINK	0157	NMI	7411
CNV	4354	FCTR	0140	LNINE	0526	NXTST	0103
CNVCTR	2143	FDOPR	3376	LOPSEL	4572	OFLO	0134
COMP	1676	FINDIT	0220	LR	0116	ONE	0547
COMPA	1706	FLAG	0464	LSB	0112	OPEN	0000
CRCTR	1770	FMFCT	3042	LSR	7417	OUT	1036

P1213	2423	SC4	0575	TST2	4461	WASC	4367
PFLAG	1015	SC5	0600	TST3	4466	WHATA	1150
PFR	2215	SC6	0603	TST4	4542	WHATB	1161
PL	2200	SC7	0606	TST5	4600	XTYPST	0026
PLB	2214	SCA	7441	TST6	4633	ZERO	0545
PLRGS	2230	SCAT	0654	TST7	4666	ZMB	0006
PRB	2173	SCATE	0611	TSTP	4323	ZMQ11	2567
PRB1	2714	SCCNT	0633	TYMOD	3756		
PRB2	2722	SCDVS	2753	TYPAT	0430		
PRB3	2732	SCL	7403	TYPSP	0434		
PRB4	2744	SCNINE	0614	TYPSTG	0400		
PRBX	4262	SCS	0132	UADAC	0062		
PRCTR	2174	SELECT	1360	UADNAC	0063		
PREG	2145	SELMOD	0303	UADSB	0064		
PRINT	0453	SETA	1366	UCOMP	0033		
PROB	7643	SETB	1371	UCRLF	0046		
PRT0	1726	SETCTR	0024	UDIVSM	0042		
PRT1	1732	SHALT	0274	UDIVT	0031		
PSPC	1736	SHL	7413	UERPSB	0054		
PUNCH	1000	SHLT	0023	UEXERP	0075		
PXCTR	2255	SHORT	0146	UF1TEL	0057		
R11Z	7136	SKIPMA	0471	UFBRM	0072		
RADR	2246	SKIPPA	0472	UHDSC0	0056		
RANCON	0357	SPCTR	1752	UMDEXR	0073		
RANDEX	0356	SR4MSK	1607	UMOVE	0032		
RANDNO	0027	SR4T	1600	UMQROT	0065		
RANGEN	0326	SR5MSK	1617	UMQRTA	0066		
RANSAV	0372	SR5T	1610	UMSG1	0047		
RANTAD	0343	SR6MSK	1627	UMSG1A	0050		
RANTBL	0360	SR6T	1620	UMSG2	0051		
RANTND	0371	SR7MSK	1637	UMUYSM	0041		
RDAD	4541	SR7T	1630	UMUYT	0030		
RDCTR	4540	SRSET	0200	UMVR	0067		
RDSTP	4475	SRST	0025	UNXINT	1044		
RDSTPA	4515	STCTR	1565	UP1213	0060		
RDSW1	4731	STF	2736	UPFR	0061		
RMAD	4460	SW1SET	0316	UPL	0052		
RMCTR	4457	SWITCH	0455	UPLRGS	0055		
RMSTP	4414	TAB	5000	UPREG	0053		
RMSTPA	4434	TABF	0135	UPRT0	0043		
RTNNO	0102	TADDR	1674	UPRT1	0044		
SASC	4370	TCTR	0144	UPSPC	0045		
SATEMK	1647	TEMP	0077	UPUNCH	0074		
SATET	1640	TEMP1	0100	USATET	0040		
SC0	0561	TEMQ	0462	USR4T	0034		
SC1	0564	TEMR	0463	USR5T	0035		
SC10	0617	TENPWR	2135	USR6T	0036		
SC11	0622	TEXR	0153	USR7T	0037		
SC12	0625	TSC1	0406	UTAB	0071		
SC13	0630	TSC2	0417	UTYMOD	0076		
SC2	0567	TST0	4400	UZMQ11	0070		
SC3	0572	TST1	4405	VALUE	2141		

ERRORS DETECTED: 0

LINKS GENERATED: 46

RUN-TIME: 27 SECONDS

3K CORE USED