PRODUCT CODE: MAINDEC-8E-D0MB-D

PRODUCT TEST: KE8-E (EAE) INSTRUCTION TEST 2
                     MULTIPLY AND DIVIDE

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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 TELE-
TYPE 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	SR9	SR10	SR11	
WITH	X	0	0	EXECUTE EACH ROUTINE IN "A" AND "B" MODES.
SR1=0	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	SR9	SR10	SR11	
WITH	0	0	0	SELECT ROUTINE 0, FIXED MULTIPLY TEST.
SR1=1	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, ADD-
ITONAL 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	0	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
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

C-

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"
A=	PROB	0	000000000111	000111000111	000000001000	
	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), CJO), 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   007111110011

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 Ø THROUGH 7.

TEST ROUTINE Ø, 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.

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                        /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  2002              2
0003  7003              3
0004  0000              OPEN
0005  2000              OPEN
              0006      .6
0006  0000      ZMB,    OPEN
0007  2000      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
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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
```

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          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   R112,   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,  0707
          0155  6060   K6060,  6060
          0156  7700   K7700,  7700
          0157  0000   LINK,   OPEN

          0160  0000   HOMEDF, OPEN
          0161  0020          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
```

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          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
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2

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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
```

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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"
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3

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0436  7041          CIA
0437  7450          SNA
0440  5230          JMP TYPAT                /01 TYPE "@"
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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4

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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
2576  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              0031

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  0100              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
```

5

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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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6

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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 8I,
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
```

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1222  1147          TAD K2
1223  3225          DCA ,+2
1224  4432          JMS I UMOVE    /GET AND STORE
1225  2000          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    /LOCK 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            /60 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  2000  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  1132          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
1361  7012          RTR
1362  7420          SNL            /SR 10 SET?
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       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   3106              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
```

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       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
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9

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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  4336              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,     CPEN
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
```

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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,
                   /
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10

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        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
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                      /
        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  3643            PROB
        2024  4445            JMS I UPSPC     /SPACE 6
        2025  7772            -6
        2026  4455            JMS I UPLRGS    /PRINT 3 REGISTER
        2027  3106            L
        2030  7775            -3
        2031  4446            JMS I UCRLF     /CRLF
        2032  7777            -1              /ONCE,
        2033  4426            JMS I XTYPST    /PRINT GOOD
        2034  0646            GOOD
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11

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        2035  4445          JMS I UPSPC     /SPACE 6
        2036  7772          -6
        2037  4455          JMS I UPLRGS    /PRINT 3 REGISTERS
        2040  2112          LSB
        2041  7775          -3
        2042  4426          JMS I XTYPST    /PRINT BAD
        2043  2651          BAD
        2044  4445          JMS I UPSPC     /SPACE 7
        2045  7771          -7
        2046  4455          JMS I UPLRGS    /PRINT 3 REGISTERS
        2047  2116          LR
        2050  7775          -3
        2051  4446          JMS I UCRLF     /CRLF
        2052  7777          -1              /ONCE,
        2053  4426          JMS I XTYPST    /PRINT SCA
        2054  2654          SCAT
        2055  4445          JMS I UPSPC     /SPACE 8
        2056  7770          -10
        2057  4453          JMS I UPREG     /PRINT 1 REGISTER
        2060  2132          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  2140          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
```

```
        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 07
        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
```

12

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           2204   2270          ISZ PL
           2205   1614          TAD I PLB                /GET CONTENTS OF REG,
           2206   7640          SZA CLA          /0?
           2207   5212          JMP .+3          /NO,
           2210   4443          JMS I UPRT0      /YES, PRINT 0
           2211   5630          JMP I PL                 /EXIT
           2212   4444          JMS I UPRT1      /PRINT 1
           2213   5630          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
```

13

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2354  2526           LNINE
2355  7776           -2
2356  4426           JMS I XTYPST    /PRINT SC10
2357  7617           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  7622           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  7633           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  7561           SC0
2415  4445           JMS I UPSPC     /SPACE 7
2416  7771           -7
2417  4455           JMS I UPLRGS    /PRINT SC0 RESULTS
2420  7473           L0
2421  7776           -2
2422  5600           JMP I HDSC0     /EXIT
2423  0000     P1213,  0
2424  4426           JMS I XTYPST    /PRINT SC12
2425  7625           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  7630           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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14

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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               /MQBS,
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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15

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          2700  4353          JMS SCDVS              /SC2-11 SEQUENCE
          2701  4341          JMS MVR           /REGS TO L11
          2702  0534          L11
          2703  4353          JMS SCDVS              /SC2-11 SEQUENCE
          2704  4341          JMS MVR           /REGS TO L12
          2705  0537          L12
          2706  4464          JMS I UADSB       /ADD/SUBTRACT?
          2707  4466          JMS I UMQRTA      /ROTATE MQ
          2710  4341          JMS MVR           /REGS TO L13
          2711  0542          L13
          2712  7300          CLA CLL
          2713  1124          TAD MQB
          2714  7012          RTR
          2715  7430          SZL
          2716  5323          JMP .+5
          2717  7710          SPA CLA           /MQ10(0),MQ11(0)=MEM ADD
          2720  5336          JMP STF           /TO AC
          2721  4462          JMS I UADAC
          2722  5336          JMP STF           /MQ10(0),MQ11(1)= AC TO AC
          2723  7710          SPA CLA
          2724  5327          JMP .+3                   /MQ10(1),MQ11(0)=MEM ADD
          2725  4463          JMS I UADNAC          /TO NOT AC
          2726  5336          JMP STF
          2727  1122          TAD LB            /MQ10(1),MQ11(1)= NOT AC TO AC
          2730  7104          RAL CLL
          2731  1123          TAD ACB
          2732  7060          CMA CML
          2733  3123          DCA ACB           /STORE AC
          2734  7004          RAL
          2735  3122          DCA LB            /STORE LINK
          2736  4341    STF,  JMS MVR           /REGS TO LF
          2737  0126          LF
          2740  5600          JMP I DIVSM       /EXIT,

          2741  0000    MVR,  0
          2742  7200          CLA
          2743  1741          TAD I MVR                 /MOVE LB, ACR, AND
          2744  3347          DCA .+3           /MQB TO LOC SPECIFIED
          2745  4432          JMS I UMOVE       /AT CALL(+1)
          2746  0122          LB
          2747  0000          0
          2750  7775          -3
          2751  2341          ISZ MVR
          2752  5741          JMP I MVR                     /EXIT
                      /
          2753  0000    SCDVS, 0
          2754  4464          JMS I UADSB       /SUBROUTINE CALL
          2755  4466          JMS I UMQRTA      /SEQUENCE FOR
          2756  4360          JMS LACRT                 /DSC2-11
          2757  5753          JMP I SCDVS       /EXIT
                      /
          2760  0000    LACRT, 0
          2761  7200          CLA               /ROTATE LEFT LB AND ACB,
          2762  1124          TAD MQB           /IF MQB10=0, MQ0S GOES
          2763  7012          RTR               /TO ACB11, IF MQB10=1,
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          2764  7630          SZL CLA           /NOT MQ0S GOES TO ACB11
          2765  7040          CMA
          2766  1133          TAD MQ0S
          2767  7004          RAL
          2770  7200          CLA
          2771  1123          TAD ACB
          2772  7004          RAL
          2773  3123          DCA ACB
          2774  7010          RAR
          2775  3122          DCA LB
          2776  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
```

16

```
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
```

17

```
3216  2007      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
```

18

```
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
```

19

```
3536  2000     0           /0000 0007/7777=0 0007 0000
3537  2007     7
3540  7777     7777
3541  2000     0
3542  2007     7
3543  2000     0
3544  2000     0           /0000 0017/7777=0 0017 0000
3545  0017     17
3546  7777     7777
3547  2000     0
3550  0017     17
3551  2000     0
3552  2000     0           /0000 0037/7777=0 0037 0000
3553  0037     37
3554  7777     7777
3555  2000     0
3556  0037     37
3557  2000     0
3560  2000     0           /0000 0077/7777=0 0077 0000
3561  2077     77
3562  7777     7777
3563  0000     0
3564  0077     77
3565  2000     0
3566  0000     0           /0000 0377/7777=0 0377 0000
3567  0377     377
3570  7777     7777
3571  0000     0
3572  0377     377
3573  2000     0
3574  0000     0           /0000 0777/7777=0 0777 0000
3575  0777     777
3576  7777     7777
3577  2000     0
3600  0777     777
3601  0000     0
3602  2000     0           /0000 1777/7777=0 1777 0000
3603  1777     1777
3604  7777     7777
3605  2000     0
3606  1777     1777
3607  0000     0

3610  2000     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  2000     0
3620  7777     7777
3621  2000     0
3622  0001     1
```

```
3623  0001     1
3624  0003     3           /0003 0000/7777=0 0003 0003
3625  0000     0
3626  7777     7777
3627  2000     0
3630  0003     3
3631  0003     3
3632  0007     7           /0007 0000/7777=0 0007 0007
3633  2000     0
3634  7777     7777
3635  2000     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  2000     0
3652  0037     37
3653  0037     37
3654  0077     77          /0077 0000/7777=0 0077 0077
3655  2000     0
3656  7777     7777
3657  2000     0
3660  0077     77
3661  0077     77
3662  0177     177         /0177 0000/7777=0 0177 0177
3663  2000     0
3664  7777     7777
3665  2000     0

3666  0177     177
3667  0177     177

3670  0377     377         /0377 0000/7777=0 0377 0377
3671  2000     0
3672  7777     7777
3673  2000     0
3674  0377     377
3675  0377     377
3676  0777     777         /0777 0000/7777=0 0777 0777
3677  0000     0
3700  7777     7777
3701  2000     0
3702  0777     777
3703  0777     777
3704  1777     1777        /1777 0000/7777=0 1777 1777
3705  2000     0
3706  7777     7777
3707  0000     0
```

20

```
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                       /EXERCISE1
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                       /EXERCISE1
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
```

21

```
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       /NO, 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
```

22

```
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  2141              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 .-5         /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
```

23

```
        4374  7040            7040        /8ISPACE
        4375  6200            6200        /2IEND
        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  3106            DCA L           /YES CLEAR REGISTERS,
        4422  4432            JMS I UMOVE
        4423  0106            L
        4424  0107            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  3106            DCA L           /YES, CLEAR REGISTERS
        4503  4432            JMS I UMOVE
        4504  0106            L
        4505  0107            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  0020    RDSTPA, 0               /MOVE DIVIDE OPERANDS TO
        4516  0107            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
```

24

```
        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
```

25

```
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 1,
4723  7430          SZL           /SR 10=1? 0L=NO; 1L=YES,
4724  5336          JMP AORB      /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  AORB,   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 CCDF
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
```

26

```
                5000    *, 177+1
                        /
        5000    0000    TAB,    0
                7570    *, +2567
                        S
        0173    6201
        0174    6000
        0175    0007
        0176    0205
        0177    0203
```

```
0000  11111111  00000000  11111111  11111111  11111111  11111111  11111111  11111111
0100  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

0200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

0400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0500  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

0600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
0700  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11110000

1000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1100  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

1200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11110111

1400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1500  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

1600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
1700  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111110

2000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
2100  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111110

2200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
2300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111000

2400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
2500  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111000

2600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
2700  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111110

3000  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
3100  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

3200  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
3300  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

3400  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
3500  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111

3600  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111111
3700  11111111  11111111  11111111  11111111  11111111  11111111  11111111  11111001
```

27

```
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	DETMOD	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	0555	HOMEOF	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	0194	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	MQ0S	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	F1TEL	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

28

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	2453	SETA	1366	UCOMP	0033		
PROB	2643	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	7357	SPCTR	1752	UMDEXR	0073		
RANDEX	7356	SR4MSK	1607	UMOVE	0032		
RANDNO	7027	SR4T	1600	UMQROT	0065		
RANGEN	7326	SR5MSK	1617	UMQRTA	0066		
RANSAV	2372	SR5T	1610	UMSG1	0047		
RANTAD	7343	SR6MSK	1627	UMSG1A	0050		
RANTBL	7360	SR6T	1620	UMSG2	0051		
RANTND	7371	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	7102	TADDR	1674	UPRT1	0044		
SASC	4370	TCTR	0144	UPSPC	0045		
SATEMK	1647	TEMP	0077	UPUNCH	0074		
SATET	1640	TEMP1	0100	USATET	0040		
SC0	7561	TEMQ	0462	USR4T	0034		
SC1	7564	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	7567	TST0	4400	U2MQ11	0070		
SC3	0572	TST1	4405	VALUE	2141		

ERRORS DETECTED: 0

LINKS GENERATED: 46

RUN-TIME: 27 SECONDS

3K CORE USED