IDENTIFICATION

PRODUCT CODE: MAINDEC-8E-D@GC-D

PRODUCT NAME: RANDOM DCA TEST

DATE CREATED: JUNE 11, 1971

MAINTAINER: DIAGNOSTIC GROUP

AUTHOR: BRUCE HANSEN

1. ABSTRACT

THIS PROGRAM TESTS THE DCA INSTRUCTION OF THE PDP-8/E. THE DCA INSTRUCTION ADDRESS, OPERAND ADDRESS, AND OPERANDS ARE TAKEN FROM A RANDOM NUMBER GENERATOR.

2. REQUIREMENTS

2.1 EQUIPMENT

PDP-8/E EQUIPPED WITH TELETYPE.

2.2 STORAGE

THE DIAGNOSTIC PROGRAM IS STORED IN LOCATIONS 0000 THROUGH 0407. THE PROGRAM USES 0410 THROUGH 7600 FOR A TEST AREA. THE BINARY LOADER MUST BE STORED IN THE LAST MEMORY PAGE.

2.3 PRELIMINARY PROGRAMS

MAINDEC-8E-D0A(N), AND MAINDEC-8E-D0B(N)

3. LOADING PROCEDURE

3.1 METHOD

THE STANDARD BINARY LOADER IS USED.

4. STARTING PROCEDURE

4.1 CONTROL SWITCH SETTINGS

SR0 (0) HALT AFTER ERROR PRINTOUT.
SR1 (1) BYPASS ERROR PRINTOUT
SR2 HOLD "FROM" CONSTANT (1). SELECT RANDOM "FROM" (0).
SR3 HOLD "OPERAND ADDRESS" CONSTANT (1). SELECT RANDOM "OPERAND ADDRESS" (0).
SR4 HOLD "OPERAND" CONSTANT (1). SELECT RANDOM "OPERAND" (0).

4.2 STARTING ADDRESS

0200

4.3 OPERATOR ACTION

1. SET SR TO 0200.
2. PRESS LOAD ADDRESS
3. SET SR TO 0000
4. PRESS CLEAR THEN CONTINUE

5. OPERATING PROCEDURE

SAME AS SECTION 4.

6. ERRORS

6.1 ERROR PRINTOUTS

F XXXX A YYYY O NNNN

L RRRR C MMMM

E

FROM,	F	XXXX WHERE XXXX = ADDRESS OF THE DCA INSTRUCTION
ADDRESS,	A	YYYY WHERE YYYY = ADDRESS WHERE DCA WILL DEPOSIT OPERAND
OPERAND	O	NNNN WHERE NNNN = THE OPERAND TO BE DEPOSITED.
LOCATION,	L	RRRR WHERE RRRR = A NONZERO LOCATION SOMEWHERE IN THE TEST FIELD.
CONTENTS,	C	MMMM WHERE MMMM = CONTENTS OF LOCATION RRRR.
END,	E	THIS LETTER IS TYPED TO INFORM THAT THE ENTIRE TEST AREA HAS BEEN SEARCHED FOR NONZERO OPERANDS.

6.2 EXAMPLES

A. THE FOLLOWING IS A TYPICAL ERROR PRINTOUT:

```
F  4572  A  0205  O  2525
L  0205  C  2527
E
```

LINE 1 IS SIMPLY A STATEMENT OF THE PROBLEM. IT SAYS THAT A DCA INSTRUCTION LOCATED AT 4572 TRIED TO DEPOSIT THE OPERAND 2525 INTO LOCATION 0205.

LINE 2 SAYS THAT INSTEAD OF FINDING A 2525 IN LOCATION 0205, THE PROGRAM FOUND A 2527. BIT 10 WAS "PICKED UP." THE E SIGNIFIES THAT A SEARCH OF THE TEST AREA SHOWED ONLY THE ABOVE PRINTED LOCATIONS DIFFERING FROM WHAT THEY SHOULD BE.

B. THE FOLLOWING IS A TYPICAL ERROR PRINTOUT:

```
F  4572  A  0205  O  2525
L  0215  C  2525
E
```

LINE 1 IS A STATEMENT OF THE PROBLEM AS IN THE PREVIOUS EXAMPLE. LINE 2 SAYS THAT LOCATION 0215 CONTAINS 2525, AND THE E ON LINE 3 SAYS THAT NO OTHER LOCATIONS WERE DISTURBED. IT IS APPARENT THEN THAT THE DCA INSTRUCTION DEPOSITED ITS OPERAND NOT INTO LOCATION 0205, BUT INTO LOCATION 0215. BIT 8 WAS "PICKED UP".

6.3 ERROR RECOVERY

TO ENTER A SCOPE MODE LOOP, SET SR0 TO A 0. WHEN A HALT OCCURS FOLLOWING AN ERROR, SET SWITCHES 1, 2, 3, AND 4 AND PUSH CONTINUE. A SCOPE MODE LOOP IS ENTERED USING THE CONDITIONS DESCRIBED BY THE LAST ERROR PRINTOUT.

IF IT IS DESIRED TO ENTER A SCOPE MODE LOOP USING A SPECIFIC SET OF CONDITIONS, STOP THE PROGRAM AND MAKE THE FOLLOWING ENTRIES:

A. ENTER DESIRED FROM ADDRESS INTO MEMORY LOCATION 0167.

B. ENTER DESIRED OPERAND ADDRESS INTO MEMORY LOCATION 0166.

C. ENTER DESIRED OPERAND INTO MEMORY LOCATION 0170.

RESTART THE PROGRAM USING A CONTROL SWITCH SETTING OF 3600.

7. RESTRICTIONS (NONE)

8. MISCELLANEOUS

8.1 EXECUTION TIME

3904 RANDOM TESTS/PASS
7 PASSES/BELL
27,328 RANDOM TESTS/PASS

9. PROGRAM DESCRIPTION

MEMORY LOCATIONS 0410 THROUGH 7600 ARE DESIGNATED AS TEST LOCATIONS, AND ZEROES ARE DEPOSITED INTO EACH AT THE BEGINNING OF THE PROGRAM. THE PROGRAM NOW SELECTS A LOCATION FOR THE DCA INSTRUCTION. THIS SELECTED LOCATION MAY BE SPECIFIED OR RANDOM, DEPENDING UPON THE SWITCH REGISTER SETTING. THE OPERAND AND OPERAND ADDRESS ARE SELECTED IN A SIMILAR MANNER. THE PROGRAM NOW JUMPS TO THE TEST DCA, PERFORMS THE INSTRUCTION, THEN JUMPS BACK TO A CHECKING ROUTINE. THE CHECKING ROUTINE VERIFIES THAT THE OPERAND WAS DEPOSITED CORRECTLY. IF AN ERROR IS DETECTED, THE ERROR ROUTINE SEARCHES THE TEST AREA AND PRINTS THE CONTENTS OF ANY NONZERO LOCATION EXCEPT FOR THE TEST DCA INSTRUCTION. UPON COMPLETION OF THIS SCAN THROUGH THE TEST AREA, AN E IS PRINTED AND A NEW TEST IS BEGUN.

THE TELETYPE BELL RINGS AFTER 7 PASSES OF 3904 TEST/PASS.

```
                    /RANDOM DCA TEST
                    /SR0(0)=HALT ON ERROR
                    /SR1(1)=NO PRINTOUTS
                    /SR2(1)=CONSTANT FROM
                    /SR3(1)=CONSTANT OPERAND ADDRESS
                    /SR4(1)=CONSTANT OPERAND
     0000           *0
0000 0000                   0
0001 5001                   JMP 1
0002 0002                   2
0003 0003                   3
0004 0000                   0
0005 0000                   0
0006 7771           CNT2,   7771
0007 0400           PSUB,   SUB
0010 0000           WORK,   0
0011 0000           CNT,    0
0012 0300           M7500,  -7500
0013 0207           BEL,    207
0014 0003           THREE,  3

                    /CLEAR MEMORY
     0020           *20
0020 1175           START,  TAD LIMLO
0021 3010                   DCA WORK
0022 3410                   DCA I WORK
0023 1010                   TAD WORK
0024 7041                   CIA
0025 1174                   TAD LIMHI
0026 7640                   SZA CLA
0027 5022                   JMP START+2

                    /CHECK FOR CONSTANT FROM
0030 7604           CK1,    LAS
0031 7006                   RTL
0032 7510                   SPA
0033 5052                   JMP CK2

                    /GET FROM ADDRESS
0034 4154                   JMS GENRAN
0035 3167                   DCA FROM

0036 1167                   TAD FROM
0037 7510                   SPA
0040 5046                   JMP .+6
0041 7041                   CIA
0042 1175                   TAD LIMLO
0043 7710                   SPA CLA
0044 5052                   JMP CK2
0045 5034                   JMP CK1+4
0046 7041                   CIA
0047 1174                   TAD LIMHI
0050 7710                   SPA CLA
0051 5034                   JMP CK1+4
```

```
                        /CHECK FOR CONSTANT OPERAND ADDRESS
0052  7604    CK2,      LAS
0053  7006              RTL
0054  7004              RAL
0055  7510              SPA
0056  5075              JMP CK3

                        /GET OPERAND ADDRESS
0057  4154              JMS GENRAN
0060  3166              DCA OPAD

0061  1166              TAD OPAD
0062  7510              SPA
0063  5071              JMP .+6
0064  7041              CIA
0065  1175              TAD LIMLO
0066  7710              SPA CLA
0067  5075              JMP CK3
0070  5057              JMP CK2+5
0071  7041              CIA
0072  1174              TAD LIMHI
0073  7710              SPA CLA
0074  5057              JMP CK2+5
                        /CHECK FOR CONSTANT OPERAND
0075  7604    CK3,      LAS
0076  7006              RTL
0077  7006              RTL
0100  7710              SPA CLA
0101  5104              JMP CK4

                        /GET OPERAND
0102  4154              JMS GENRAN
0103  3170              DCA OPER


                        /CHECK FOR FROM+1=OPERAND ADDRESS
                        /CHECK FOR FROM=OPERAND ADDRESS
0104  1167    CK4,      TAD FROM
0105  7041              CIA
0106  1166              TAD OPAD
0107  7450              SNA
0110  5030              JMP CK1
0111  7041              CIA
0112  7040              CMA
0113  7650              SNA CLA
0114  5030              JMP CK1

                        /PLACE THE INSTRUCTIONS
0115  1171              TAD DCA1
0116  3567              DCA I FROM
0117  1167              TAD FROM
0120  7001              IAC
0121  3173              DCA FROMP1
0122  1172              TAD JMP1
```

```
0123  3573            DCA I FROMP1
0124  1170            TAD OPER
0125  7000            NOP
0126  5567            JMP I FROM              /GO OUT TO TEST
0127  7402            HLT                     /JMP FAILURE

                  /RETURN FROM TEST
0130  1566  BACK,    TAD I OPAD
0131  7041            CIA
0132  1170            TAD OPER
0133  7640            SZA CLA
0134  4577            JMS I AERR
0135  3566            DCA I OPAD
0136  3567            DCA I FROM
0137  3573            DCA I FROMP1

                  /RING BELL AFTER 7 PASSES OF 3904 TEST PER PASS
0140  1011            TAD CNT
0141  7001            IAC
0142  3011            DCA CNT
0143  1011            TAD CNT
0144  1012            TAD M7500
0145  7640            SZA CLA
0146  5030            JMP CK1
0147  3011            DCA CNT
0150  2006            ISZ CNT2
0151  5030            JMP CK1
0152  4407            JMS I PSUB
0153  5030            JMP CK1

                  /RANDOM NUMBER GENERATOR
0154  0000  GENRAN,  0
0155  7200            CLA
0156  1165            TAD RANUM
0157  7104            RAL CLL
0160  7430            SZL
0161  1014            TAD THREE
0162  3165            DCA RANUM
0163  1165            TAD RANUM
0164  5554            JMP I GENRAN
0165  2525  RANUM,    2525


                  /CONSTANTS AND VARIABLES

0166  3000  OPAD,     3000
0167  3001  FROM,     3001
0170  2525  OPER,     2525
0171  3566  DCA1,     DCA I OPAD
0172  5130  JMP1,     JMP BACK
0173  3002  FROMP1,   3002
0174  7600  LIMHI,    7600
0175  0410  LIMLO,    410
0176  0000  WORK1,    0
0177  0201  AERR,     ERR
```

```
                0200    *200
                        /DCA ERROR, CHECK ALL MEMORY
0200  5020             JMP START
0201  0000     ERR,    0
0202  7604             LAS
0203  7004             RAL
0204  7710             SPA CLA
0205  5601             JMP I ERR
0206  4265             JMS PHD
0207  1175             TAD LIMLO
0210  3010             DCA WORK
0211  1410             TAD I WORK
0212  7640             SZA CLA
0213  4233             JMS ER1
0214  1010             TAD WORK
0215  7041             CIA
0216  1174             TAD LIMHI
0217  7640             SZA CLA
0220  5211             JMP .-7
0221  1374             TAD E
0222  4351             JMS PRINT
0223  1375             TAD CR
0224  4351             JMS PRINT
0225  1376             TAD LF
0226  4351             JMS PRINT
0227  7604             LAS
0230  7700             SMA CLA
0231  7402             HLT                 /HALT ON ERROR
0232  5601             JMP I ERR

                        /MEMORY LOCATION WRONG (MAYBE)
0233  0000     ER1,    0
0234  1010             TAD WORK
0235  7041             CIA
0236  1167             TAD FROM
0237  7650             SNA CLA
0240  5633             JMP I ER1               /FORGET IT. THIS IS LOC FROM
0241  1010             TAD WORK
0242  7041             CIA
0243  1173             TAD FROMP1
0244  7650             SNA CLA
0245  5633             JMP I ER1               /FORGET IT. THIS IS LOC FROM+1
0246  1372             TAD L
0247  4351             JMS PRINT
0250  1010             TAD WORK
0251  4310             JMS TYPAC
0252  1010             TAD WORK
0253  3176             DCA WORK1
0254  1373             TAD C
0255  4351             JMS PRINT
0256  1576             TAD I WORK1
0257  4310             JMS TYPAC
```

```
0260  1375          TAD CR
0261  4351          JMS PRINT
0262  1376          TAD LF
0263  4351          JMS PRINT
0264  5633          JMP I ER1

              /PRINT FIRST LINE OF ERROR

0265  0000  PHD,    0
0266  7200          CLA
0267  1367          TAD F
0270  4351          JMS PRINT
0271  1167          TAD FROM
0272  4310          JMS TYPAC
0273  1371          TAD A
0274  4351          JMS PRINT
0275  1166          TAD OPAD
0276  4310          JMS TYPAC
0277  1377          TAD O
0300  4351          JMS PRINT
0301  1170          TAD OPER
0302  4310          JMS TYPAC
0303  1375          TAD CR
0304  4351          JMS PRINT
0305  1376          TAD LF
0306  4351          JMS PRINT
0307  5665          JMP I PHD

              /TYPE AC CONTENTS IN OCTAL

0310  5310  TYPAC,  JMP .
0311  3366          DCA SAVE+3
0312  1366          TAD SAVE+3
0313  7012          RTR
0314  7010          RAR
0315  3365          DCA SAVE+2
0316  1365          TAD SAVE+2
0317  7012          RTR
0320  7010          RAR
0321  3364          DCA SAVE+1
0322  1364          TAD SAVE+1
0323  7012          RTR
0324  7010          RAR
0325  3363          DCA SAVE
0326  1370          TAD SPACE
0327  4351          JMS PRINT
0330  1357          TAD FOUR
0331  3360          DCA CTR


0332  1363  LUP,    TAD SAVE
0333  0361          AND MSK7
0334  1362          TAD TW6
```

```
0335  4351            JMS PRINT
0336  1364            TAD SAVE+1
0337  3363            DCA SAVE
0340  1365            TAD SAVE+2
0341  3364            DCA SAVE+1
0342  1366            TAD SAVE+3
0343  3365            DCA SAVE+2
0344  2360            ISE CTR
0345  5332            JMP LUP
0346  1370            TAD SPACE
0347  4351            JMS PRINT
0350  5710            JMP I TYPAC
0351  0000  PRINT,    0
0352  6046            TLS
0353  6041            TSF
0354  5353            JMP .-1
0355  7200            CLA
0356  5751            JMP I PRINT

                      /CONSTANTS

0357  7774  FOUR,     -4
0360  0000  CTR,      0
0361  0007  MSK7,     7
0362  0260  TW6,      0260
0363  0000  SAVE,     0
0364  0000            0
0365  0000            0
0366  0000            0
0367  0306  F,        306
0370  0240  SPACE,    240
0371  0301  A,        301
0372  0314  L,        314
0373  0303  C,        303
0374  0305  E,        305
0375  0215  CR,       215
0376  0212  LF,       212
0377  0317  O,        317

      0400  *400
0400  0000  SUB,      0
0401  1207            TAD PASS
0402  3006            DCA CNT2
0403  1013            TAD BEL
0404  6046            TLS
0405  7200            CLA
0406  5600            JMP I SUB
0407  7771  PASS,     7771
      $
```