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DECUS NO.	8-56
TITLE	FIXED POINT TRACE NO. 1
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SOURCE LANGUAGE	

FIXED POINT TRACE NO. 1

DECUS Program Library Write-up DECUS No. 8-56

General: Fixed Point Trace No. 1 is a minimum size monitor program which executes a user's program one instruction at a time and reports the contents of the program counter, the instruction carried out, the contents of the link and accumulator and of the effective address, by means of the ASR-33 teletype.

Since Fixed Point Trace No. 1 is of minimum size (2 pages of memory), virtually no decisions can be made by it and once the trace mode is initiated it will continue until the computer is stopped or a HLT instruction is encountered in the user's program.

The symbolic tape provided has a single origin setting instruction (6400). Any two consecutive pages of memory can be used, with the obvious exception of page zero, by changing this one instruction.

Usage:

Assuming the user's program to be in memory the trace program is loaded by means of the binary loader. The starting address (6400) is loaded into the program counter and the address at which the trace is to start is set in the switch register. When start is depressed the computer will halt with this address in the accumulator. The switch register is now set as described below to determine how subroutines will be traced, pressing continue will start the trace program.

Subroutine Tracings:

The symbolic tape provided has the instruction SNA CLA at location B6 + 5. As a consequence, if the switch register contains a zero, subroutines will be traced when they are encountered. If, however, the switch register is non-zero then subroutines will not be traced although they will be carried out when encountered.

The contents of B6 + 5 can be changed to SZA CLA if the opposite dependence on the switch register is advantageous.

Restrictions:

1. The program interrupt facility must not be used.

2. If the subroutine No Trace mode is used then it is required that the return from the subroutine be normal, i.e., to the following instruction or it must return to the following instruction +1.

i.e.,

```
JMS     ABLE  }
RETURN        }  legal

JMS     ABLE  }
0             }  legal
RETURN        }

JMS     ABLE  }  not
0             }  legal
0             }
RETURN        }
```

3. Any Input-Output Transfer by way of the ASR-33 will cause a local disturbance in the trace format, subroutines to print using the ASR-33 cannot be traced since the flags will not be properly set.

Output Format:

The following section indicates the output to be expected for each of the five general types of instruction.

Note: The second line is the outputted line.

Symbols:

PC	contents of the program counter
INST	octal instruction
L	contents of the link
ACC.	contents of the accumulator
ADDR	the effective address
C(ADDR)	contents of the effective address

I. AND, TAD, DCA, ISZ

```
PC      INST   L   ACC    ADDR   C(ADDR)
xxxx    xxxx   x   xxxx   xxxx   xxxx
```

Note that the instruction is carried out between the type out of INST and L. Therefore the link, accumulator and contents of the effective address are as they are after the completion of the instruction.

II. JMP

```
PC      INST          ADDR
xxxx    xxxx   JMP    xxxx
```

The address is the location to which the jump will transfer.

III. OPR

```
PC      INST          L    ACC
xxxx    xxxx   OPR    x    xxxx
```

Here again the link and accumulator are as they are after the operate instruction is carried out.

IV. JMS

```
PC      INST          ADDR   L   ACC
xxxx    xxxx   JMS    xxxx   x   xxxx
```

In the "subroutine trace mode" the output is as above but L and ACC are not written out. In the "non-trace mode" the subroutine is carried out after the address is printed and then the contents of the link and accumulator are printed. The link and accumulator indicate the situation after the subroutine is completed. Any input or output which might occur in the subroutine will be produced between the writing of the address and link.

V. IOT

```
PC      INST          L    ACC
xxxx    xxxx    IOT   x    xxxx
```

Here again the actual IOT instruction is carried out after printing IOT and before the link is printed. If, for example, there was an output of a carriage return then the link and accumulator contents would overwrite the contents of the program counter and Inst.

```
/FIXED POINT TRACE #1
/STARTING ADDRESS 6400. CAN BE PUT ON ANY TWO
/CONSECUTIVE PAGES BY CHANGING THE ONE ORIGIN
/SETTING INSTRUCTION WHICH FOLLOWS
/
/
/
            *6400
/
/
/
```

```
6400  7606  START,    LAS  HLT
6401  3347            DCA       PROCNT
6402  3350            DCA       LINK
6403  3351            DCA       ACCUM
6404  4777  RACK,     JMS  I    TYPCPP
6405  1747            TAD  I    PROCNT
6406  3352            DCA       INST
6407  1347            TAD       PROCNT
6410  4776            JMS  I    OUT4P
6411  1352            TAD       INST
6412  4776            JMS  I    OUT4P
6413  1352            TAD       INST
6414  0365            AND       NOPE
6415  3353            DCA       OPCODE
6416  1354            TAD       SKIP
6417  3270            DCA       B7
6420  1352            TAD       INST
6421  0355            AND       PAGENO
6422  7650            SNA  CLA
6423  5775            JMP  I    B2PP
6424  1356            TAD       MASK5
6425  0347            AND       PROCNT
6426  3357            DCA       ADDR
6427  1360            TAD       MASK7
6430  0352            AND       INST
6431  1357            TAD       ADDR
6432  3357            DCA       ADDR
6433  1361            TAD       INDRCT
6434  0747            AND  I    PROCNT
6435  7650            SNA  CLA
6436  5241            JMP       .+3
6437  1757            TAD  I    ADDR
6440  3357            DCA       ADDR
6441  1353            TAD       OPCODE
6442  1362            TAD       P4000
6443  7650            SNA  CLA
6444  5326            JMP       B6
6445  7430            SZL
6446  5277            JMP       B5
6447  1353  B4,       TAD       OPCODE
```

```
6450  1363          TAD         BASIC
6451  3255          DCA         I2
6452  1350  B1,     TAD         LINK
6453  7010          RAR
6454  1351          TAD         ACCUM
6455  0000  I2,      0
6456  7410          SKP
6457  2347          ISZ         PROCNT
6460  2347          ISZ         PROCNT
6461  3351          DCA         ACCUM
6462  7004          RAL
6463  3350          DCA         LINK
6464  1350          TAD         LINK
6465  4774          JMS I       OUT1P
6466  1351          TAD         ACCUM
6467  4776          JMS I       OUT4P
6470  0000  B7,     0
6471  5204          JMP         BACK
6472  1357          TAD         ADDR
6473  4776          JMS I       OUT4P
6474  1757          TAD I       ADDR
6475  4776          JMS I       OUT4P
6476  5204          JMP         BACK
6477  1353  B5,     TAD         OPCODE
6500  1364          TAD         P2000
6501  7650          SNA CLA
6502  5314          JMP         B3
6503  7420          SNL
6504  5323          JMP         B9
6505  1357          TAD         ADDR
6506  3347          DCA         PROCNT
6507  1773          TAD I       JMPP
6510  4772          JMS I       OUTPP
6511  1357          TAD         ADDR
6512  4776          JMS I       OUT4P
6513  5204          JMP         BACK
6514  1771  B8,     TAD I       IOTP
6515  4772          JMS I       OUTPP
6516  1352          TAD         INST
6517  3255          DCA         I2
6520  1365          TAD         NOPE
6521  3270          DCA         B7
6522  5252          JMP         B1
6523  1770  B9,     TAD I       OPRP
6524  4772          JMS I       OUTPP
6525  5316          JMP         .-7
6526  1767  B6,     TAD I       JMSP
6527  4772          JMS I       OUTPP
6530  1357          TAD         ADDR
6531  4776          JMS I       OUT4P
6532  7604          LAS
6533  7650          SNA CLA     / CAN BE CHANGED TO SZA CLA
6534  5340          JMP         .+4
6535  1365          TAD         NOPE
6536  3270          DCA         B7
6537  5247          JMP         B4
```

```
6540  2347              ISZ         PROCNT
6541  1347              TAD         PROCNT
6542  3757              DCA I       ADDR
6543  1357              TAD         ADDR
6544  7001              IAC
6545  3347              DCA         PROCNT
6546  5204              JMP         BACK
6547  0000  PROCNT,0
6550  0000  LINK,0
6551  0000  ACCUM,0
6552  0000  INST,0
6553  0000  OPCODE,0
6554  7410  SKIP,       SKP
6555  0200  PAGENO,     0200
6556  7600  MASK5,      7600
6557  0000  ADDR,0
6560  0177  MASK7,      0177
6561  0400  INDRCT,     0400
6562  4000  P4000,      4000
6563  0757  BASIC,      AND I       ADDR
6564  2000  P2000,      2000
6565  7000  NOPE,       NOP
6566  7000               NOP
6567  6725  JMSP,       JMSTBL-1
6570  6720  OPRP,       OPRTBL-1
6571  6713  IOTP,       IOTTBL-1
6572  6612  OUTPP,      OUT
6573  6706  JMPP,       JMPTBL-1
6574  6636  OUT1P,      OUT1B
6575  6736  B2PP,       B2
6576  6645  OUT4P,      OUT4
6577  6675  TYPCPP,     TYPCR
6600  0000  PRINT1,     0
6601  7000              NOP
6602  6046              TLS
6603  6041              TSF
6604  5203              JMP         .-1
6605  5600              JMP I       PRINT1
6606  0000  PRINT0,     0
6607  4200              JMS         PRINT1
6610  7200              CLA
6611  5606              JMP I       PRINT0
6612  0000  OUT,        0
6613  3235              DCA         INDEXC
6614  1635              TAD I       INDEXC
6615  7450              SNA
6616  5222              JMP         OUT+10
6617  4206              JMS         PRINT0
6620  2235              ISZ         INDEXC
6621  5214              JMP         OUT+2
6622  7300              CLA CLL
6623  1233              TAD         INST1A
6624  3216              DCA         OUT+4
6625  1332              TAD         SPCTBL-1
6626  5213              JMP         OUT+1
6627  1234              TAD         INST2A
```

```
6630  3216            DCA         OUT+4
6631  7100            CLL
6632  5612            JMP I       OUT
6633  5227  INST1A,   JMP         OUT+15
6634  5222  INST2A,    JMP         OUT+10
6635  0000  INDEXC,    0
6636  0000  OUT1B,     0
6637  1244            TAD         CONST5
6640  4206            JMS         PRINT0
6641  1332            TAD         SPCTBL-1
6642  4212            JMS        OUT
6643  5636            JMP I       OUT1B
6644  0260  CONST5,    0260
6645  0000  OUT4,      0
6646  3272            DCA         PTEM
6647  1273            TAD         CONST4
6650  3271            DCA         DCN
6651  1272            TAD         PTEM
6652  7104            CLL RAL
6653  7004  PNU2,     RAL
6654  7006            RTL
6655  3272            DCA         PTEM
6656  1272            TAD         PTEM
6657  0274            AND         PCON
6660  1244            TAD         CONST5
6661  4206            JMS         PRINT0
6662  1272            TAD         PTEM
6663  2271            ISZ         DCN
6664  5253            JMP         PNU2
6665  7200            CLA
6666  1332            TAD         SPCTBL-1
6667  4212            JMS         OUT
6670  5645            JMP I       OUT4
6671  0000  DCN,      0
6672  0000  PTEM,     0
6673  7774  CONST4,   7774
6674  0007  PCON,     0007
6675  0000  TYPCR,    0
6676  1304            TAD         CARRTN
6677  4206            JMS         PRINT0
6700  1305            TAD         LINFED
6701  4206            JMS         PRINT0
6702  7100             CLL
6703  5675            JMP I       TYPCR
6704  0215  CARRTN,   0215
6705  0212  LINFED,   0212
6706  6707            .+1
6707  0312  JMPTBL,   0312
6710  0315            0315
6711  0320            0320
6712  0000            0000
6713  6714            .+1
6714  0311  IOTTBL,   0311
6715  0317            0317
6716  0324            0324
6717  0000            0000
```

```
6720  6721                .+1
6721  0317  OPRTBL,       0317
6722  0320                0320
6723  0322                0322
6724  0000                0000
6725  6726                .+1
6726  0312  JMSTBL,       0312
6727  0315                0315
6730  0323                0323
6731  0000                0000
6732  6733                .+1
6733  0240  SPCTBL,       0240
6734  0240                0240
6735  0000                0000
6736  1776  B2,           TAD I       INSTP
6737  0365                AND         MSK416
6740  7640                SZA CLA
6741  5775                JMP I       B22P
6742  1776                TAD I       INSTP
6743  0366                AND         MSK10
6744  7650                SNA CLA
6745  5775                JMP I       B22P
6746  1776                TAD I       INSTP
6747  3774                DCA I       I2P
6750  1776                TAD I       INSTP
6751  0367                AND         MSK17P
6752  3371                DCA         TRCTMP
6753  1776                TAD I       INSTP
6754  0370                AND         MSK400
6755  7640                SZA CLA
6756  5362                JMP         .+4
6757  1371                TAD         TRCTMP
6760  3773                DCA I       ADDRP
6761  5775                JMP I       B22P
6762  1771                TAD I       TRCTMP
6763  2771                ISZ I       TRCTMP
6764  5360                JMP         .-4
6765  4160  MSK416,4160
6766  0010  MSK10,0010
6767  0017  MSK17P,0017
6770  0400  MSK400,0400
6771  0000  TRCTMP,0
6772  6452  B1P,          B1
6773  6557  ADDRP,        ADDR
6774  6455  I2P,          I2
6775  6426  B22P,         BACK+22
6776  6552  INSTP,        INST
6777  7000  NOP
ACCUM   6551
ADDR    6557
ADDRP   6773
BACK    6404
BASIC   6563
B1      6452
B1P     6772
B2      6736
B2PP    6575
B22P    6775
B4      6447
B5      6477
B6      6526
B7      6470
B8      6514
B9      6523
```

```
CARRTN  6704
CONST4  6673
CONST5  6644
DCN     6671
INDEXC  6635
INDRCT  6561
INST    6552
INSTP   6776
INST1A  6633
INST2A  6634
IOTP    6571
IOTTBL  6714
I2      6455
I2P     6774
JMPP    6573
JMPTBL  6707
JMSP    6567
JMSTBL  6726
LINFED  6705
LINK    6550
MASK5   6556
MASK7   6560
MSK10   6766
MSK17P  6767
MSK400  6770
MSK416  6765
NOPE    6565
OPCODE  6553
OPRP    6570
OPRTBL  6721
OUT     6612
OUTPP   6572
OUT1B   6636
OUT1P   6574
OUT4    6645
OUT4P   6576
PAGENO  6555
PCON    6674
PNU2    6653
PRINT0  6606
PRINT1  6600
PROCNT  6547
PTEM    6672
P2000   6564
P4000   6562
SKIP    6554
SPCTBL  6733
START   6400
TRCTMP  6771
TYPCPP  6577
TYPCR   6675
```