Lab 1

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Lab 1

Program (a)

Set ALPHA equal to the integer portion of BETA / GAMMA.

Code:

```
PROB1     START   1000
          LDA     BETA
          DIV     GAMMA
          STA     ALPHA
BETA      WORD    10
GAMMA     WORD    2
ALPHA     RESW    1
          END     PROB1
```

Sample Runs / Memory Contents:

```
         S t a t e   A f t e r   F e t c h   C y c l e
                   Contents of Registers
   A        x         L         B         S         T         PC        CC
FFFFFF    FFFFFF    FFFFFF    FFFFFF    FFFFFF    FFFFFF    001003      LT


                   I n s t r u c t i o n
    location         instruction        format        mnemonic
     001000            032006              3             lda


                   O p e r a n d
indxd        Calculation of Target Address        TA             mode
  no               adrs + (PC)                    0169           direct

             DATA =    0010

      Press any key to execute , Esc to continue
```

```
         S t a t e   A f t e r   F e t c h   C y c l e
                   Contents of Registers
   A        x         L         B         S         T         PC        CC
00000A    FFFFFF    FFFFFF    FFFFFF    FFFFFF    FFFFFF    001006      LT


                   I n s t r u c t i o n
    location         instruction        format        mnemonic
     001003            272006              3             div


                   O p e r a n d
indxd        Calculation of Target Address        TA             mode
  no               adrs + (PC)                    01612          direct

             DATA =    002

      Press any key to execute , Esc to continue
```

```
         S t a t e   A f t e r   F e t c h   C y c l e
                   Contents of Registers
   A        x         L         B         S         T         PC        CC
000005    FFFFFF    FFFFFF    FFFFFF    FFFFFF    FFFFFF    001009      LT


                   I n s t r u c t i o n
    location         instruction        format        mnemonic
     001006            0F2006              3             sta


                   O p e r a n d
indxd        Calculation of Target Address        TA             mode
  no               adrs + (PC)                    01615          direct


      Press any key to execute , Esc to continue
```

Program (B)

Set ALPHA equal to 4 * BETA + 3 * GAMMA

Code:

```
PROB1    START    1000
         LDA      BETA
         MUL      #4
         STA      ALPHA
         LDA      GAMMA
         MUL      #3
         ADD      ALPHA
         STA      ALPHA
BETA     WORD     2
GAMMA    WORD     3
ALPHA    RESW     1
         END      PROB1
```

Assumptions:

Beta = 2, Gamma = 3 and their sum is equal to 17 which is stored in register A as 11 in hexadecimal

Sample Runs:

```
          S t a t e   A f t e r   F e t c h   C y c l e

                 Contents of Registers
     A        x        L        B        S        T        PC       CC
   FFFFFF   FFFFFF   FFFFFF   FFFFFF   FFFFFF   FFFFFF   001003     LT


                  I n s t r u c t i o n
        location         instruction       format        mnemonic
         001000            032012            3             lda


                       O p e r a n d
   indxd       Calculation of Target Address        TA           mode
    no               adrs + (PC)                   01621        direct


               DATA =   002

        Press any key to execute , Esc to continue
```

```
          S t a t e   A f t e r   F e t c h   C y c l e

                 Contents of Registers
     A        x        L        B        S        T        PC       CC
   000002   FFFFFF   FFFFFF   FFFFFF   FFFFFF   FFFFFF   001006     LT


                  I n s t r u c t i o n
        location         instruction       format        mnemonic
         001003            210004            3             mul


                       O p e r a n d
   indxd       Calculation of Target Address        TA           mode
    no                  adrs                        004        immediate


               DATA =   004

        Press any key to execute , Esc to continue
```

```
                 S t a t e   A f t e r   F e t c h   C y c l e

                       Contents of Registers
     A         x         L         B         S         T         PC        CC
   000008    FFFFFF    FFFFFF    FFFFFF    FFFFFF    FFFFFF    001009      LT


                           I n s t r u c t i o n
        location           instruction        format        mnemonic
          001006              0F2012            3              sta


                            O p e r a n d
    indxd        Calculation of Target Address          TA             mode
      no              adrs + (PC)                      01627          direct



        Press any key to execute , Esc to continue




                 S t a t e   A f t e r   F e t c h   C y c l e

                       Contents of Registers
     A         x         L         B         S         T         PC        CC
   000008    FFFFFF    FFFFFF    FFFFFF    FFFFFF    FFFFFF    00100C      LT


                           I n s t r u c t i o n
        location           instruction        format        mnemonic
          001009              03200C            3              lda


                            O p e r a n d
    indxd        Calculation of Target Address          TA             mode
      no              adrs + (PC)                      01624          direct

                    DATA =    003

        Press any key to execute , Esc to continue
```

```
        S t a t e   A f t e r   F e t c h   C y c l e

                  Contents of Registers
    A         x         L         B         S         T         PC         CC
 000003    FFFFFF    FFFFFF    FFFFFF    FFFFFF    FFFFFF    00100F       LT


                  I n s t r u c t i o n
     location          instruction      format          mnemonic
      00100C             210003           3               mul


                  O p e r a n d
   indxd       Calculation of Target Address        TA              mode
    no                  adrs                        003           immediate

              DATA =    003

       Press any key to execute , Esc to continue
```

```
        S t a t e   A f t e r   F e t c h   C y c l e

                  Contents of Registers
    A         x         L         B         S         T         PC         CC
 000009    FFFFFF    FFFFFF    FFFFFF    FFFFFF    FFFFFF    001012       LT


                  I n s t r u c t i o n
     location          instruction      format          mnemonic
      00100F             1B2009           3                add


                  O p e r a n d
   indxd       Calculation of Target Address        TA              mode
    no              adrs + (PC)                     01627          direct

              DATA =    008

       Press any key to execute , Esc to continue
```

```
          S t a t e   A f t e r   F e t c h   C y c l e

                    Contents of Registers
     A         x         L         B         S         T          PC          CC
  000011    FFFFFF    FFFFFF    FFFFFF    FFFFFF    FFFFFF     001015       LT


                         I n s t r u c t i o n
     location             instruction          format            mnemonic
      001012                 0F2006               3                 sta


                         O p e r a n d
  indxd        Calculation of Target Address            TA              mode
    no              adrs + (PC)                        01627           direct


         Press any key to execute , Esc to continue
```

Program (C)..Clear a 100-byte string to all blanks

Code

```
.234567890123456789
PROB1     START    1000
          LDX      #0
LOOP      LDCH     BLANK
          LDB      STR,X
          STCH     STR,X
          LDB      STR,X
          RMO      X,A
          ADD      #1
          RMO      A,X
          COMP     TEST
          JLT      LOOP
TEST      WORD     100
STR       RESB     100
BLANK     BYTE     C' '
          END      PROB1
|
```

Assumptions:
The blank assumed here in this problem is a space character which is equal to '20' in hexadecimal

Sample runs / Memory contents:

```
C:\sic\Simulator\SICSIM.exe                                                      —    □    ×

 A=FFFFFF   X=000064   L=FFFFFF   B=2020FF   S=FFFFFF   T=FFFFFF   P=001085   CC=EQ


          0  1  2  3    4  5  6  7    8  9  A  B    C  D  E  F

   0FE0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   0FF0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   1000    05 00 00 53   20 7D 6B A0   16 57 A0 13   6B A0 10 AC
   1010    10 19 00 01   AC 01 2B 20   03 3B 2F E7   00 00 64 20
   1020    20 20 20 20   20 20 20 20   20 20 20 20   20 20 20 20
   1030    20 20 20 20   20 20 20 20   20 20 20 20   20 20 20 20
   1040    20 20 20 20   20 20 20 20   20 20 20 20   20 20 20 20
   1050    20 20 20 20   20 20 20 20   20 20 20 20   20 20 20 20
   1060    20 20 20 20   20 20 20 20   20 20 20 20   20 20 20 20
   1070    20 20 20 20   20 20 20 20   20 20 20 20   20 20 20 20
   1080    20 20 20 20   FF FF FF FF   FF FF FF FF   FF FF FF FF
   1090    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   10A0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   10B0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   10C0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   10D0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
       Press Esc to Quit,   Up or Dn arrows Scrolling
```
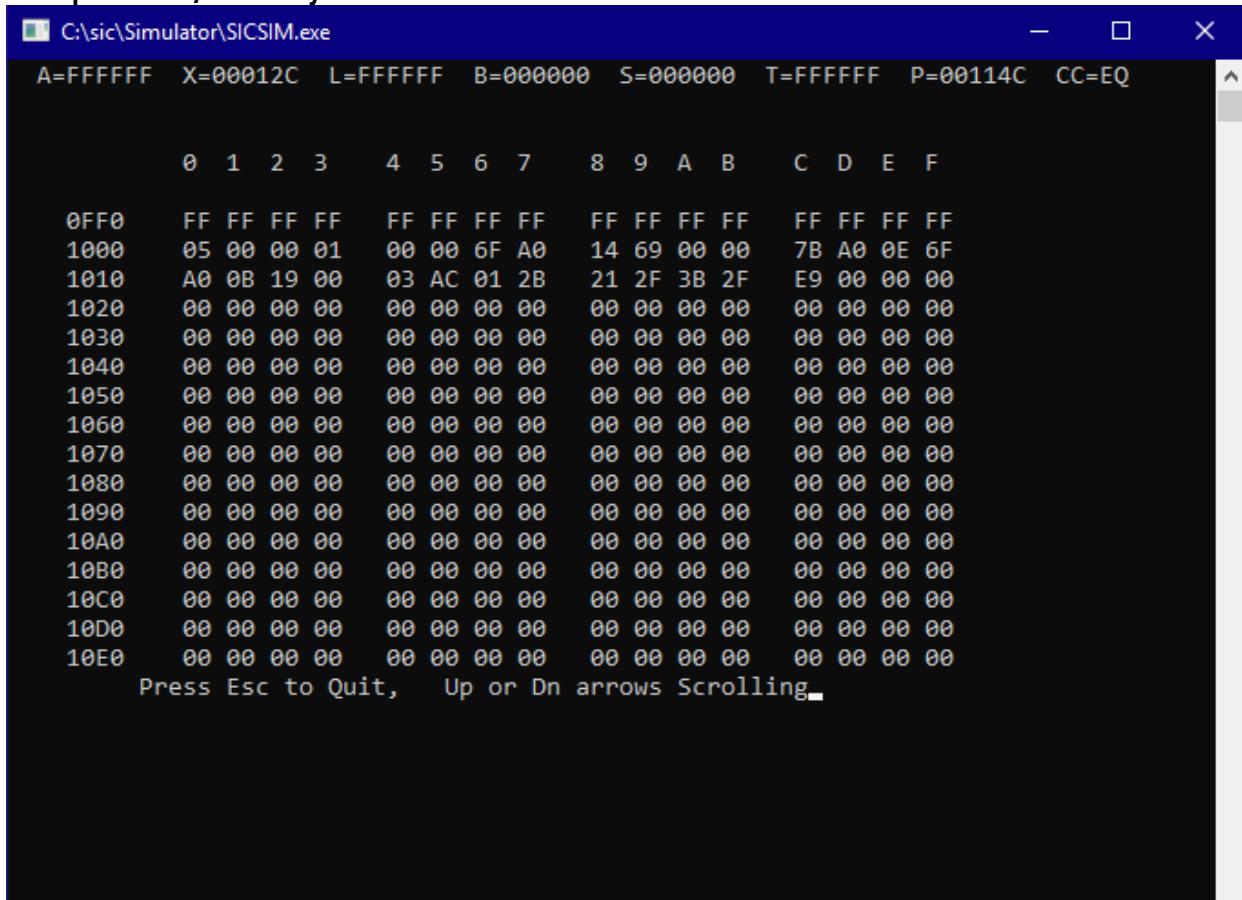
Program (D) SET elements of a 100-word array to 0

Code:

```
.234567890123456789
PROB1    START   1000
         LDX     #0
         LDA     #0
LOOP     LDS      ARRAY,X
         LDB     #0
         STB      ARRAY,X
         LDS      ARRAY,X
         ADD     #3
         RMO      A,X
         COMP    TEST
         JLT     LOOP
ARRAY    RESW    100
TEST     WORD    300
         END     PROB1
```

Sample Runs/Memory Contents:

```
C:\sic\Simulator\SICSIM.exe                                        —    □    ×

 A=FFFFFF   X=00012C   L=FFFFFF   B=000000   S=000000   T=FFFFFF   P=00114C   CC=EQ


            0  1  2  3    4  5  6  7    8  9  A  B    C  D  E  F

    0FF0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
    1000    05 00 00 01   00 00 6F A0   14 69 00 00   7B A0 0E 6F
    1010    A0 0B 19 00   03 AC 01 2B   21 2F 3B 2F   E9 00 00 00
    1020    00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1030    00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1040    00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1050    00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1060    00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1070    00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1080    00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1090    00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    10A0    00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    10B0    00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    10C0    00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    10D0    00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    10E0    00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
        Press Esc to Quit,   Up or Dn arrows Scrolling▮
```

```
A=FFFFFF   X=00012C   L=FFFFFF   B=000000   S=000000   T=FFFFFF   P=00114C   CC=EQ


              0  1  2  3    4  5  6  7    8  9  A  B    C  D  E  F

    1060     00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1070     00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1080     00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1090     00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    10A0     00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    10B0     00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    10C0     00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    10D0     00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    10E0     00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    10F0     00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1100     00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1110     00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1120     00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1130     00 00 00 00   00 00 00 00   00 00 00 00   00 00 00 00
    1140     00 00 00 00   00 00 00 00   00 00 01 2C   FF FF FF FF
    1150     FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
         Press Esc to Quit,    Up or Dn arrows Scrolling_
```

Program (e)

Read a string from device F3, calculate its length and store it in register A.
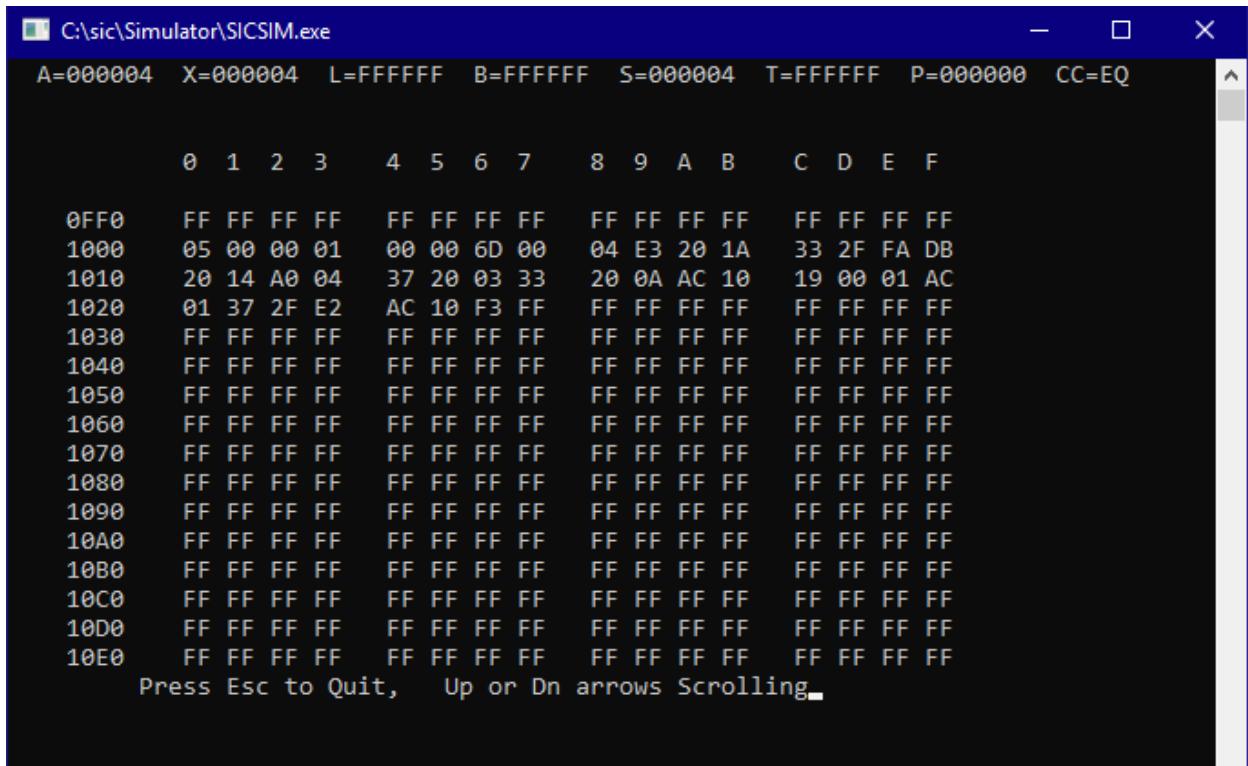
Code:

```
.234567890123456789
PROB1     START   1000
          LDX     #0
          LDA     #0
LOOP      LDS     #4
AGAIN     TD       INDEV
          JEQ      AGAIN
          RD       INDEV
          COMPR    A,S
          JGT      ZWD
          JEQ      KHAL
ZWD       RMO      X,A
          ADD     #1
          RMO      A,X
          JGT      LOOP
KHAL      RMO      X,A
INDEV     BYTE     X'F3'
          END      PROB1
```

Assumptions:

The end of the file is marked by EOT char is equal to '04' in hexadecimal, so at each byte, its hexadecimal value is compared to EOT character.

Sample Runs/Memory Contents:
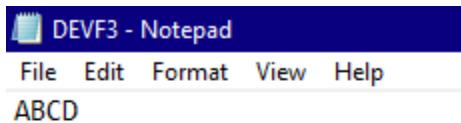
```
C:\sic\Simulator\SICSIM.exe                                    —   □   ×

A=000004   X=000004   L=FFFFFF   B=FFFFFF   S=000004   T=FFFFFF   P=000000   CC=EQ

           0  1  2  3    4  5  6  7    8  9  A  B    C  D  E  F

   0FF0    FF FF FF FF  FF FF FF FF   FF FF FF FF   FF FF FF FF
   1000    05 00 00 01  00 00 6D 00   04 E3 20 1A   33 2F FA DB
   1010    20 14 A0 04  37 20 03 33   20 0A AC 10   19 00 01 AC
   1020    01 37 2F E2  AC 10 F3 FF   FF FF FF FF   FF FF FF FF
   1030    FF FF FF FF  FF FF FF FF   FF FF FF FF   FF FF FF FF
   1040    FF FF FF FF  FF FF FF FF   FF FF FF FF   FF FF FF FF
   1050    FF FF FF FF  FF FF FF FF   FF FF FF FF   FF FF FF FF
   1060    FF FF FF FF  FF FF FF FF   FF FF FF FF   FF FF FF FF
   1070    FF FF FF FF  FF FF FF FF   FF FF FF FF   FF FF FF FF
   1080    FF FF FF FF  FF FF FF FF   FF FF FF FF   FF FF FF FF
   1090    FF FF FF FF  FF FF FF FF   FF FF FF FF   FF FF FF FF
   10A0    FF FF FF FF  FF FF FF FF   FF FF FF FF   FF FF FF FF
   10B0    FF FF FF FF  FF FF FF FF   FF FF FF FF   FF FF FF FF
   10C0    FF FF FF FF  FF FF FF FF   FF FF FF FF   FF FF FF FF
   10D0    FF FF FF FF  FF FF FF FF   FF FF FF FF   FF FF FF FF
   10E0    FF FF FF FF  FF FF FF FF   FF FF FF FF   FF FF FF FF
       Press Esc to Quit,   Up or Dn arrows Scrolling_
```
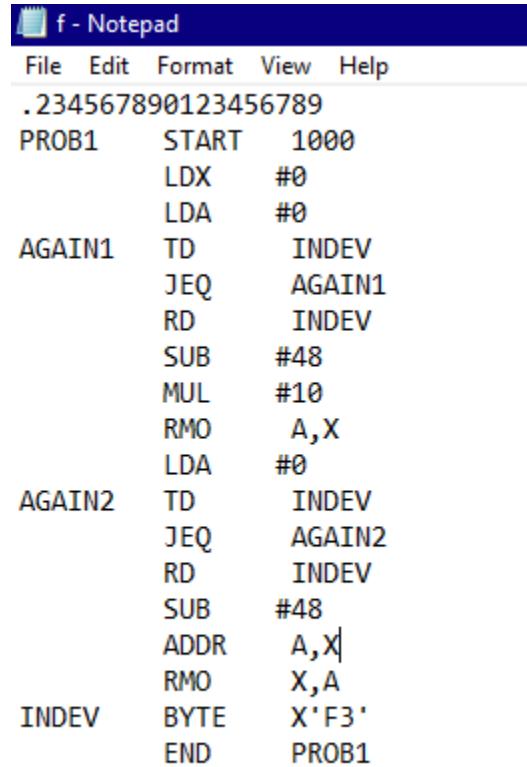
The contents of F3 in this sample run

```
DEVF3 - Notepad
File  Edit  Format  View  Help
ABCD
```

Program (F)

Read a two-digit number from device F3, convert this string to a number and store the number in register A

Code:
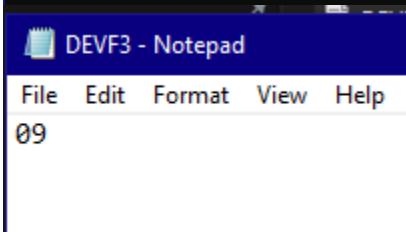
```
 f - Notepad
File  Edit  Format  View  Help
.234567890123456789
PROB1     START    1000
          LDX      #0
          LDA      #0
AGAIN1    TD        INDEV
          JEQ       AGAIN1
          RD        INDEV
          SUB      #48
          MUL      #10
          RMO       A,X
          LDA      #0
AGAIN2    TD        INDEV
          JEQ       AGAIN2
          RD        INDEV
          SUB      #48
          ADDR      A,X
          RMO       X,A
INDEV     BYTE      X'F3'
          END       PROB1
```

Sample Runs/Memory Contents:
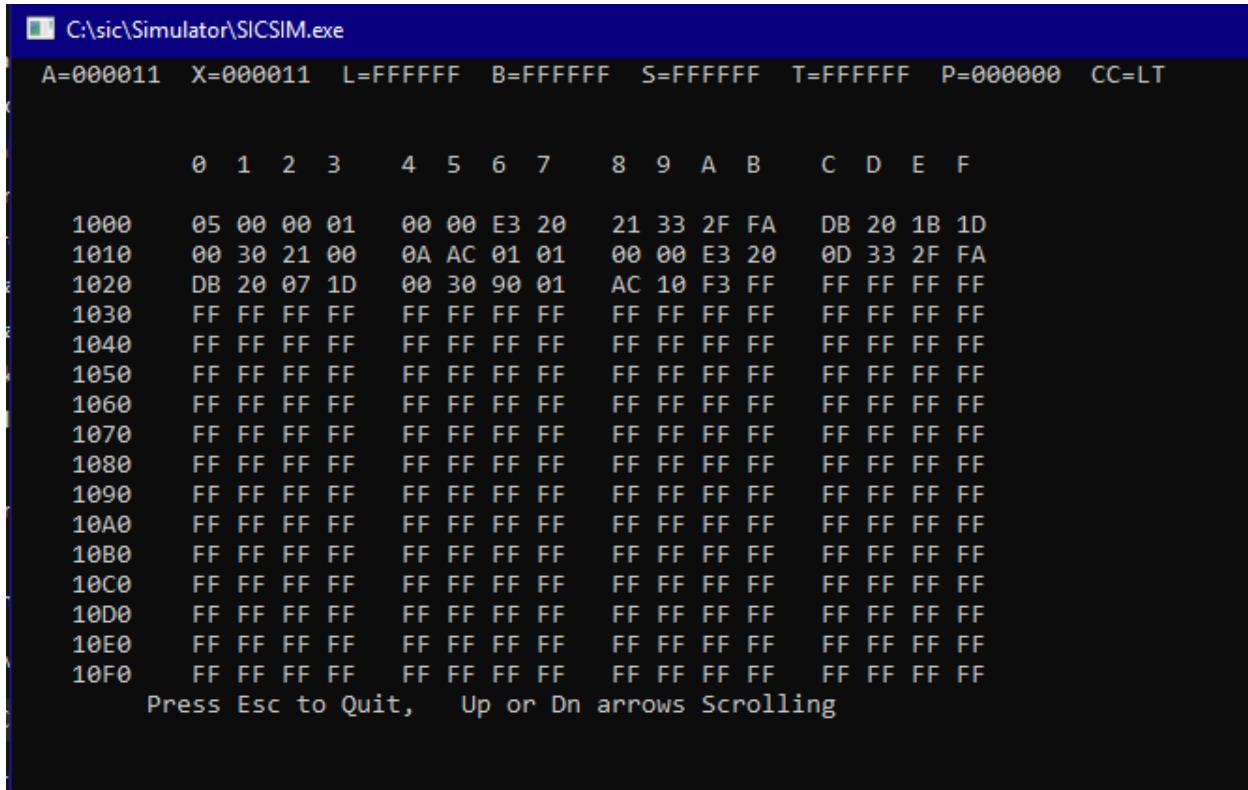
```
C:\sic\Simulator\SICSIM.exe                                       —   □   ✕

 A=000009   X=000009   L=FFFFFF   B=FFFFFF   S=FFFFFF   T=FFFFFF   P=000000   CC=LT


           0  1  2  3    4  5  6  7    8  9  A  B    C  D  E  F

   1000    05 00 00 01   00 00 E3 20   21 33 2F FA   DB 20 1B 1D
   1010    00 30 21 00   0A AC 01 01   00 00 E3 20   0D 33 2F FA
   1020    DB 20 07 1D   00 30 90 01   AC 10 F3 FF   FF FF FF FF
   1030    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   1040    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   1050    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   1060    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   1070    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   1080    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   1090    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   10A0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   10B0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   10C0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   10D0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   10E0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
   10F0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
       Press Esc to Quit,   Up or Dn arrows Scrolling
```

```
DEVF3 - Notepad

File   Edit   Format   View   Help

09
```

Another Sample Run

```
C:\sic\Simulator\SICSIM.exe
 A=000011   X=000011   L=FFFFFF   B=FFFFFF   S=FFFFFF   T=FFFFFF   P=000000   CC=LT


          0  1  2  3    4  5  6  7    8  9  A  B    C  D  E  F

  1000    05 00 00 01   00 00 E3 20   21 33 2F FA   DB 20 1B 1D
  1010    00 30 21 00   0A AC 01 01   00 00 E3 20   0D 33 2F FA
  1020    DB 20 07 1D   00 30 90 01   AC 10 F3 FF   FF FF FF FF
  1030    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
  1040    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
  1050    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
  1060    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
  1070    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
  1080    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
  1090    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
  10A0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
  10B0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
  10C0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
  10D0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
  10E0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
  10F0    FF FF FF FF   FF FF FF FF   FF FF FF FF   FF FF FF FF
       Press Esc to Quit,    Up or Dn arrows Scrolling
```

```
DEVF3 - Notepad
File  Edit  Format  View  Help
1763
```

–17 is equal to 11 in the hexadecimal

-The program reads only first two digits as required .