Assembly Level Program 1a – Binary Search

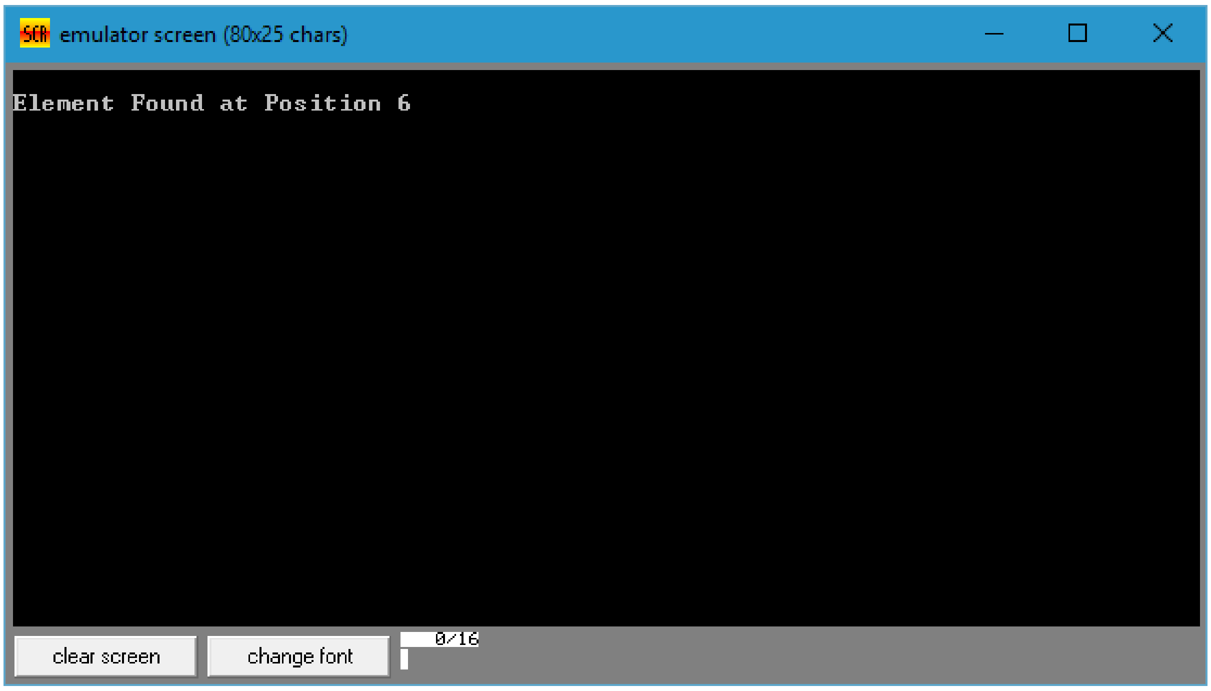
Write an Assembly Level Program to search a key element in a list of 'n' 16-bit numbers using the Binary Search Algorithm.

Program

```
.model SMALL

.data
        ARRAY       dW    1234h, 2345h, 3456h, 4567h, 5678h, 6789h
        LEN         dW    ($-ARRAY)/2
        KEY         dW    6789h

        STR1   dB     10, 13, 'Element Found at Position '
        POS    dB     ?, 10, 13, '$'
        STR2   dB     10, 13, 'Element Not Found!$'

.code
        MOV AX, @DATA
        MOV DS, AX

        MOV AX, 00h
        MOV CX, LEN
        MOV DX, KEY

Search:
        CMP CX, AX
        JB NotFound

        MOV BX, CX
        ADD BX, AX
        SHR BX, 01h ; Divides by 2
        MOV SI, BX
        SHL SI, 01h ; Multiplies with 2

        CMP ARRAY[SI], DX
        JB newLow
        JE Found

        CMP BX, 00h
        JE NotFound

        DEC BX
        MOV CX, BX
        JMP Search

newLow:
        INC BX
        MOV AX, BX
        JMP Search

Found:
        ADD BL, '1'
        MOV POS, BL
        LEA DX, STR1
        JMP Exit

NotFound:
        LEA DX, STR2
```

```
Exit:
        MOV AH, 09h
        INT 21h
        MOV AH, 4Ch
        INT 21h
END
```

Output



```
Element Found at Position 6
```

Assembly Level Program 2a – Reading & Printing String

Write 2 ALP modules stored in two different files; one module is to read a character from the keyboard and the other one is to display a character. Use the above two modules to read a string of characters from the keyboard terminated by the carriage return and print the string on the display in the next line.

PrintCharacter.inc

```
PRINTCH MACRO CHAR
        MOV DL, CHAR
        MOV AH, 02h
        INT 21h
ENDM
```

ReadCharacter.inc

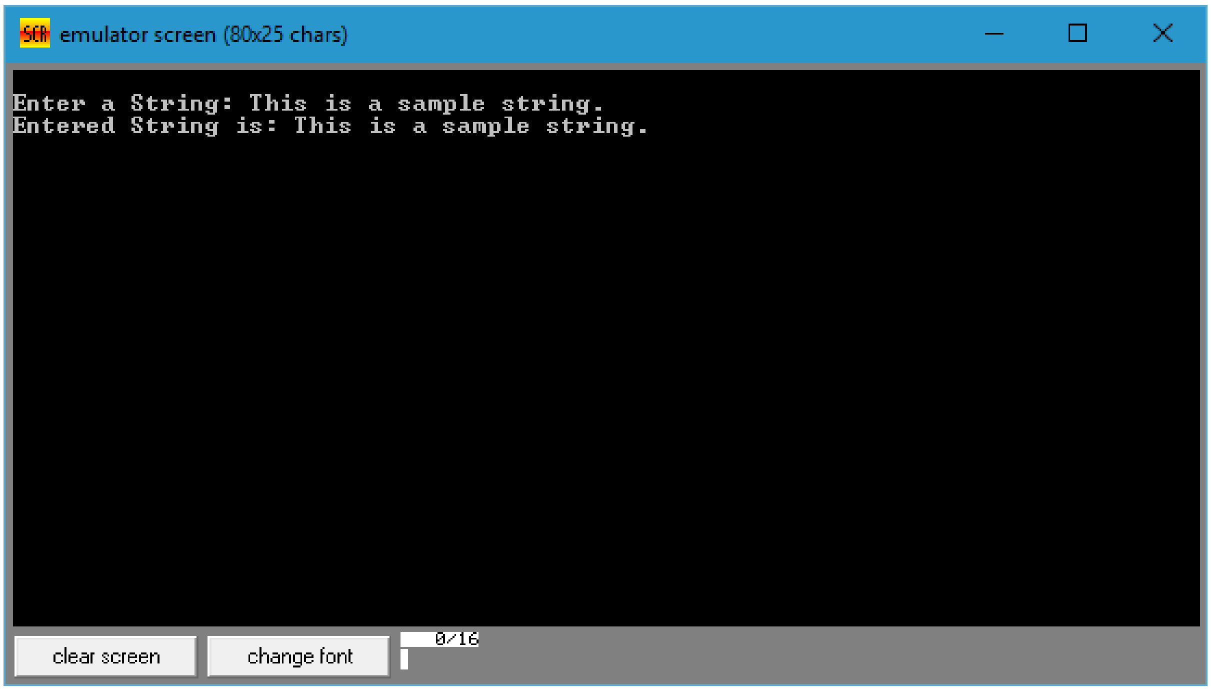
```
READCH MACRO
        MOV AH, 01h
        INT 21h
ENDM
```

Program

```
.model SMALL


Include ReadCharacter.inc
Include PrintCharacter.inc


.data
        LOC          dB      100     DUP(0)
        STR1   dB      10, 13, 'Enter a String: $'
        STR2   dB      10, 13, 'Entered String is: $'
```

```
.code
        MOV AX, @DATA
        MOV DS, AX

        MOV CX, 00h

        LEA DX, STR1
        MOV AH, 09h
        INT 21h

        LEA SI, LOC

Read:
        READCH
        CMP AL, 0Dh
        JE Display

        MOV [SI], AL
        INC SI
        INC CL
        JMP Read

Display:
        LEA DX, STR2
        MOV AH, 09h
        INT 21h

        LEA SI, LOC

Print:
        PRINTCH [SI]
        INC SI
        Loop Print

        MOV AH, 4Ch
        INT 21h
END
```

Output



```
Enter a String: This is a sample string.
Entered String is: This is a sample string.
```

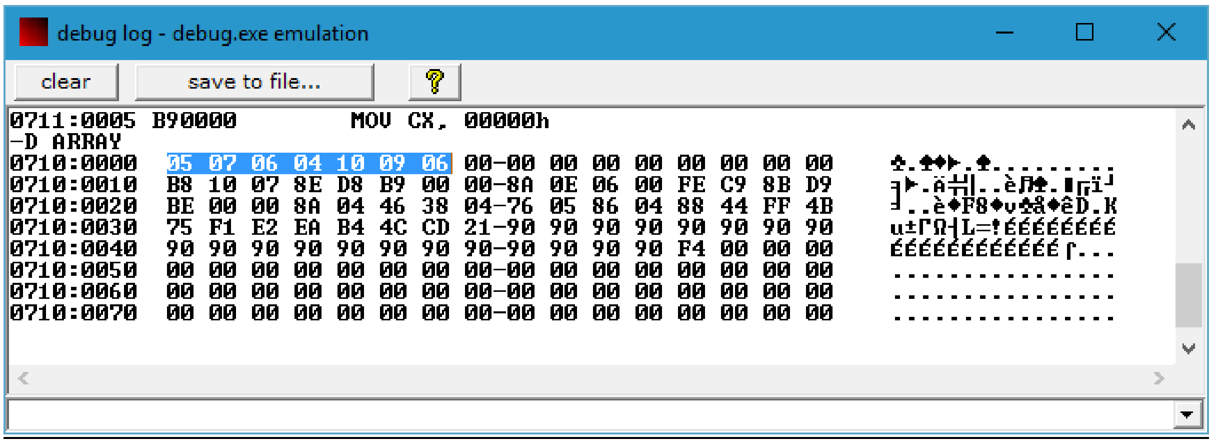
Assembly Level Program 3a – Bubble Sort

Write an Assembly Level Program to sort a given set of 'n' numbers in ascending and descending orders using the Bubble Sort algorithm.

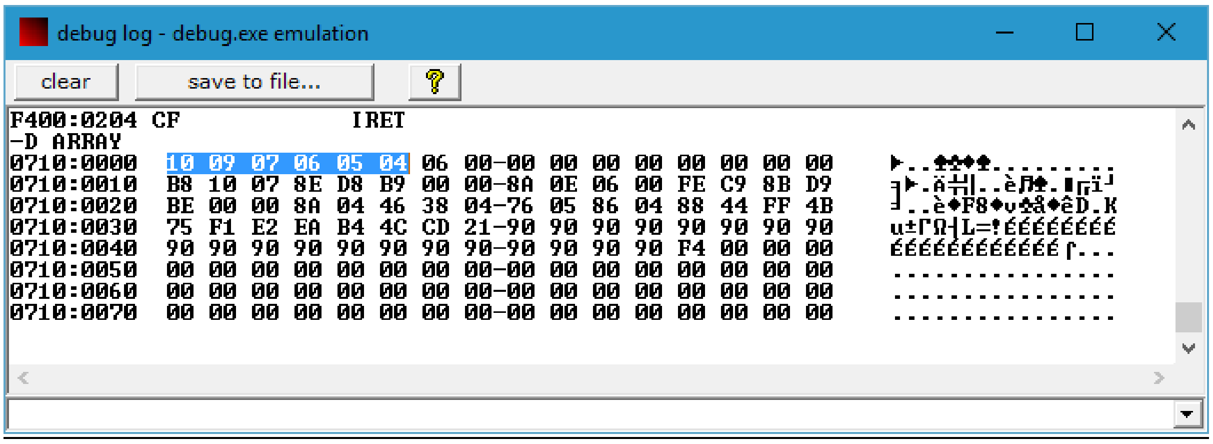
Program

```
.model SMALL


.data
        ARRAY       dB      05h, 07h, 06h, 04h, 10h, 09h
        LEN         dB      $-ARRAY


.code
        MOV AX, @DATA
        MOV DS, AX

        MOV CX, 00h
        MOV CL, LEN
        DEC CL

OuterLoop:
        MOV BX, CX
        LEA SI, ARRAY

InnerLoop:
        MOV AL, [SI]
        INC SI
        CMP [SI], AL
        JBE NoSwap

        XCHG [SI], AL
        MOV [SI-1], AL

NoSwap:
        DEC BX
        JNZ InnerLoop
        LOOP OuterLoop

Exit:
        MOV AH, 4Ch
        INT 21h
END
```

Output



```
0711:0005 B90000        MOV CX, 00000h
-D ARRAY
0710:0000  05 07 06 04 10 09 06 00-00 00 00 00 00 00 00 00   ♣.♠♦►.♠.........
0710:0010  B8 10 07 8E D8 B9 00 00-8A 0E 06 00 FE C9 8B D9   ╕►.Ä╪╣..è♫♠.■╔ï┘
0710:0020  BE 00 00 8A 04 46 38 04-76 05 86 04 88 44 FF 4B   ╛..è♦F8♦v♣å♦êD.K
0710:0030  75 F1 E2 EA B4 4C CD 21-90 90 90 90 90 90 90 90   u±ΓΩ┤L═!ÉÉÉÉÉÉÉÉ
0710:0040  90 90 90 90 90 90 90 90-90 90 90 90 F4 00 00 00   ÉÉÉÉÉÉÉÉÉÉÉÉ⌠...
0710:0050  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0710:0060  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0710:0070  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
```



```
F400:0204 CF            IRET
-D ARRAY
0710:0000  10 09 07 06 05 04 06 00-00 00 00 00 00 00 00 00   ►..♠♣♦♠.........
0710:0010  B8 10 07 8E D8 B9 00 00-8A 0E 06 00 FE C9 8B D9   ╕►.Ä╪╣..è♫♠.■╔ï┘
0710:0020  BE 00 00 8A 04 46 38 04-76 05 86 04 88 44 FF 4B   ╛..è♦F8♦v♣å♦êD.K
0710:0030  75 F1 E2 EA B4 4C CD 21-90 90 90 90 90 90 90 90   u±ΓΩ┤L═!ÉÉÉÉÉÉÉÉ
0710:0040  90 90 90 90 90 90 90 90-90 90 90 90 F4 00 00 00   ÉÉÉÉÉÉÉÉÉÉÉÉ⌠...
0710:0050  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0710:0060  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
0710:0070  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ................
```

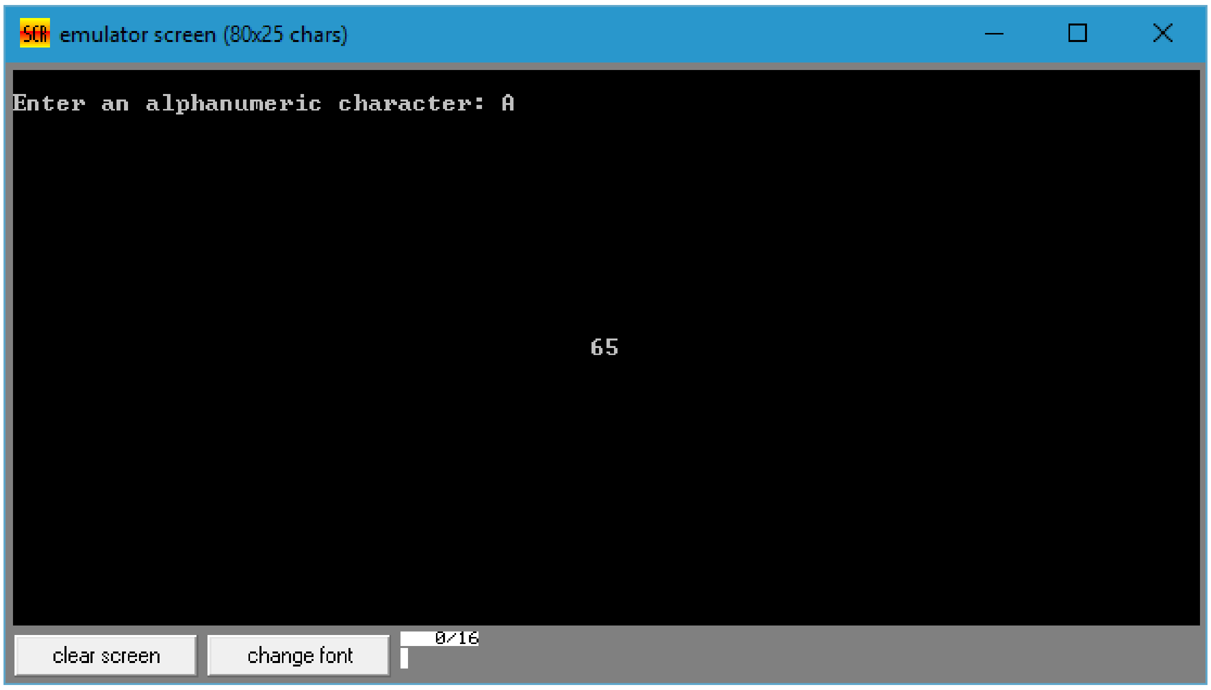
Assembly Level Program 4a – Bubble Sort

Write an Assembly Level Program to read an alphanumeric character and display its equivalent ASCII code at the center of the screen.

Program

```
.model SMALL

CLRSCR MACRO
        MOV AH, 00h
        MOV AL, 03h
        INT 10h
ENDM

SETCURSOR MACRO
        MOV AH, 02h
        MOV BH, 00h
        MOV DH, 12d
        MOV DL, 39d
        INT 10H
ENDM

.data
        MSG1 dB     10, 13, 'Enter an alphanumeric character: $'

.code
        MOV AX, @DATA
        MOV DS, AX
        CLRSCR

        ; Print Message in Data Segment
        LEA DX, MSG1
        MOV AH, 09h
        INT 21h

        ; Read Character from User
        MOV AH, 01h
        INT 21h

        MOV AH, 00h
        MOV BX, 10d
        PUSH BX

Conversion:
        MOV DX, 00h
        DIV BX
        PUSH DX

        CMP AX, 00h
        JNE Conversion

        SETCURSOR

Display:
        POP DX
        CMP DX, 10
        JE Exit



        ADD DL, 30h
        MOV AH, 02h
        INT 21h
        JMP Display

Exit:
        MOV AH, 4Ch
        INT 21h
END
```

Output



```
Enter an alphanumeric character: A

                                        65
```

Assembly Level Program 5a – Palindrome Checker

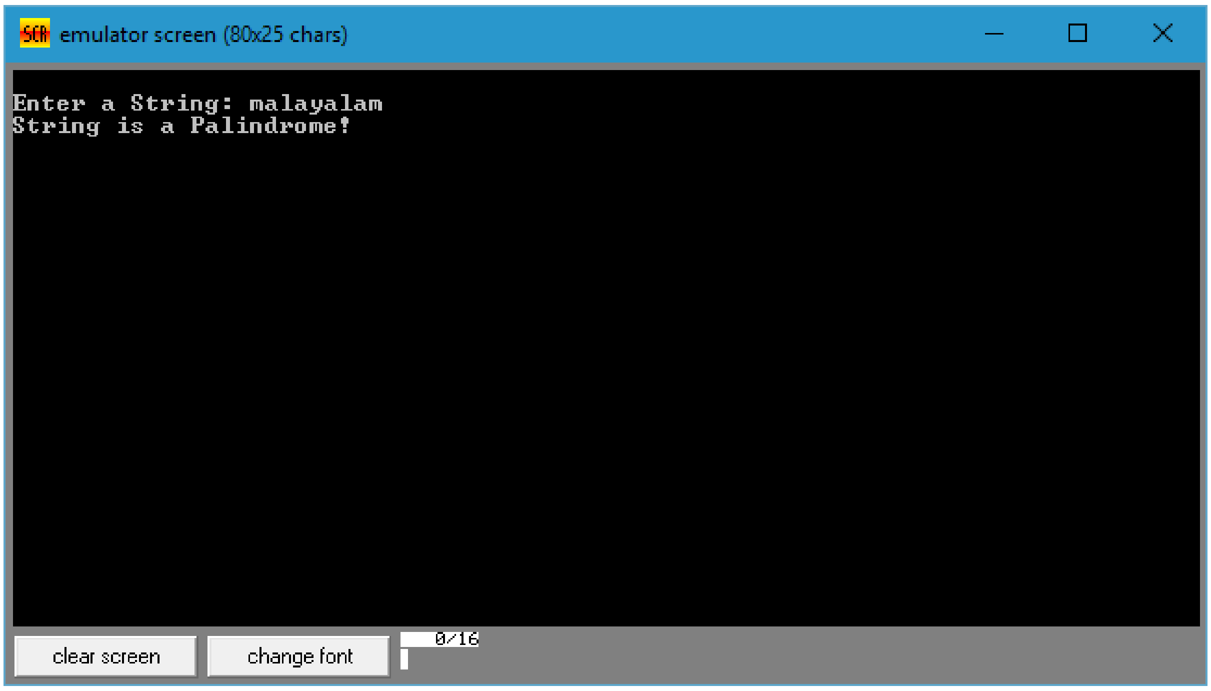
Write an ALP to reverse a given string and check whether it is a palindrome or not.

Program

```
.model SMALL


PRINTSTR MACRO MSG
        LEA DX, MSG
        MOV AH, 09h
        INT 21h
ENDM


READSTR     MACRO BUF
        LEA DX, BUF
        MOV AH, 0Ah
        INT 21h
ENDM


.data
        BUF1  dB     20d
        LEN1  dB     ?
        STR1  dB     20d     DUP(0)

        RSTR  dB     20d     DUP(0)

        MSG1  dB     10, 13, 'Enter a String: $'
        MSG2  dB     10, 13, 'String is a Palindrome!$'
        MSG3  dB     10, 13, 'String is not a Palindrome!$'

.code
```

```
        MOV AX, @DATA
        MOV DS, AX
        MOV ES, AX

        PRINTSTR MSG1
        READSTR BUF1

        LEA SI, STR1
        DEC SI

        MOV CX, 00h
        MOV CL, LEN1

        ADD SI, CX
        MOV DI, SI

        LEA SI, RSTR

CopyString:
        MOV AL, [DI]
        MOV [SI], AL
        INC SI
        DEC DI
        LOOP CopyString

        LEA SI, STR1
        LEA DI, RSTR

        MOV CX, 00h
        MOV CL, LEN1
        CLD ; Clear Direction Flag

        REPE CMPSB
        JE Palindrome

        PRINTSTR MSG3
        JMP Exit

Palindrome:
        PRINTSTR MSG2

Exit:
        MOV AH, 4Ch
        INT 21h
END
```

Output



```
Enter a String: malayalam
String is a Palindrome!
```

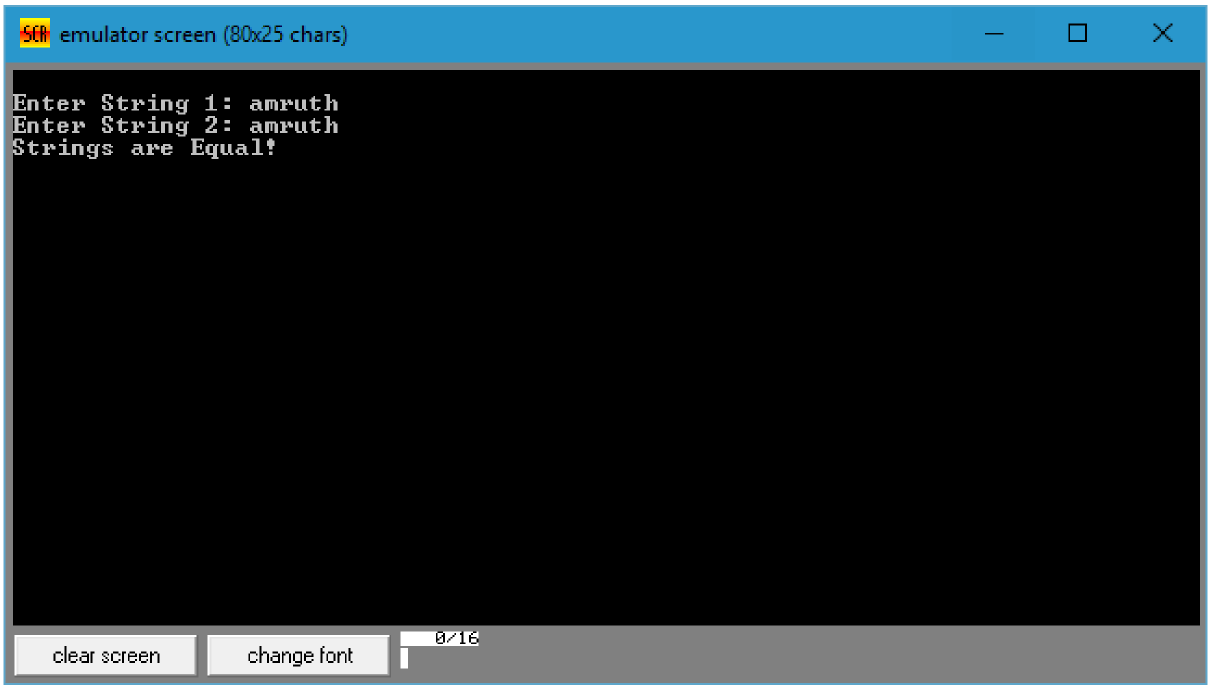
Assembly Level Program 6a – String Equality

Write an ALP to read two strings, store them in locations STR1 and STR2. Check whether they are equal or not and display appropriated messages. Also display the length of the stored strings.

Program

```
.model SMALL

PRINTSTR MACRO MSG
        LEA DX, MSG
        MOV AH, 09h
        INT 21h
ENDM

READSTR MACRO BUF
        LEA DX, BUF
        MOV AH, 0Ah
        INT 21h
ENDM

.data
        BUF1  dB     20d
        LEN1  dB     ?
        STR1  dB     20d DUP(0)

        BUF2  dB     20d
        LEN2  dB     ?
        STR2  dB     20d DUP(0)


        MSG1  dB     10, 13, 'Enter String 1: $'
        MSG2 dB      10, 13, 'Enter String 2: $'

        MSG3 dB      10, 13, 'Length of String 1: $'
        MSG4 dB      10, 13, 'Length of String 2: $'

        MSG5 dB      10, 13, 'Strings are Equal!$'
        MSG6 dB      10, 13, 'Strings are Not Equal!$'

.code
        MOV AX, @DATA
        MOV DS, AX
        MOV ES, AX

        PRINTSTR MSG1
        READSTR BUF1

        PRINTSTR MSG2
        READSTR BUF2

        MOV CL, LEN1
        CMP CL, LEN2
        JNE NotEqual

        LEA SI, STR1
        LEA DI, STR2

        MOV CH, 00h
        MOV CL, LEN1

        CLD ; Clear Direction Flag
        REPE CMPSB ; Compare String Byte-by-Byte
        JE Equal

NotEqual:
        PRINTSTR MSG6
        JMP Exit

Equal:
        PRINTSTR MSG5

Exit:
        MOV AH, 4Ch
        INT 21h
END
```

Output



```
Enter String 1: amruth
Enter String 2: amruth
Strings are Equal!
```

Assembly Level Program 7a – What Is Your Name?

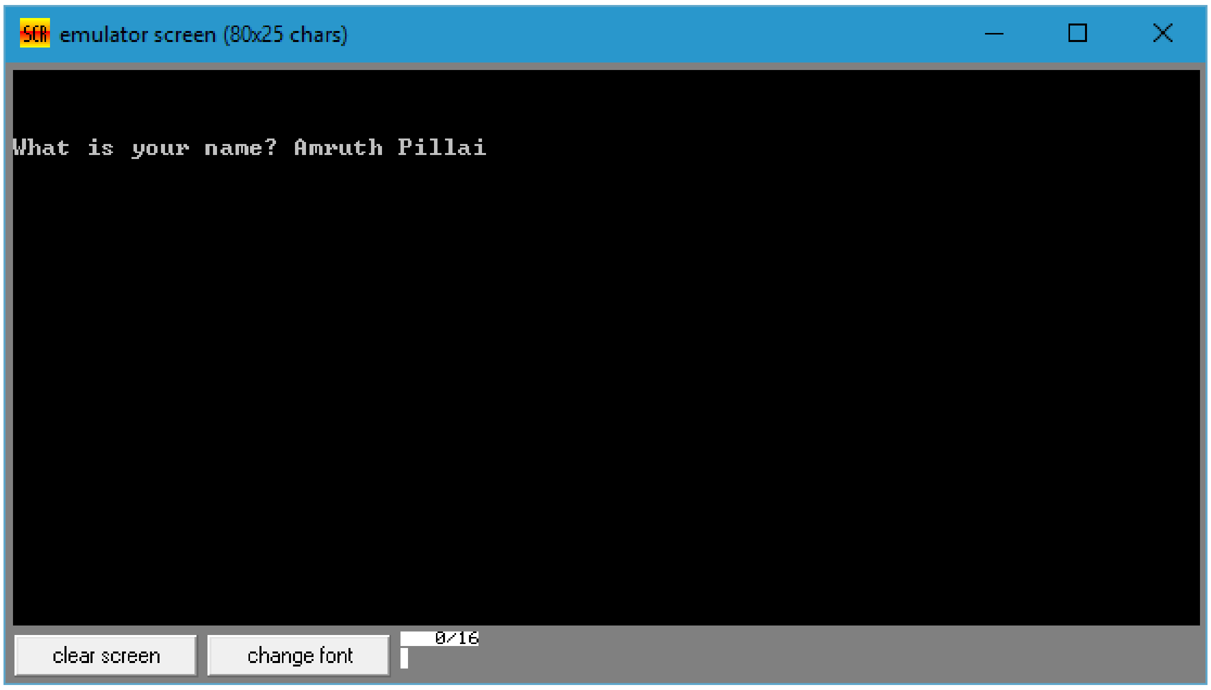
Write an Assembly Level Program to read your name from the keyboard and display it at a specified location on the screen in front of the message What is your name? You must clear the entire screen before display.

Program

```
.model SMALL

READCH MACRO LOC
        MOV AH, 01h
        INT 21h
        MOV LOC, AL
ENDM

CLRSCR MACRO
        MOV AH, 00h
        MOV AL, 03h
        INT 10h
ENDM

SETCURSOR MACRO
        MOV AH, 02h
        MOV BH, 00h
        MOV DH, 2
        MOV DL, 20
        INT 10h
ENDM



.data
        MSG1 dB     10, 13, 'Enter your name: $'
        MSG2 dB     10, 13, 'What is your name? $'

        ARRAY       dB     40h     DUP(?)

.code
        MOV AX, @DATA
        MOV DS, AX

        MOV SI, 00h

        LEA DX, MSG1
        MOV AH, 09h
        INT 21h

ReadName:
        READCH ARRAY[SI]
        INC SI
        CMP AL, 13
        JNZ ReadName

        MOV ARRAY[SI], '$'

        CLRSCR
        SETCURSOR

        LEA DX, MSG2
        MOV AH, 09h
        INT 21h

        MOV SI, 00h
```

```
DisplayName:
        LEA DX, ARRAY[SI]
        MOV AH, 09h
        INT 21h

        MOV AH, 4Ch
        INT 21h
END
```

<u>Output</u>



```
What is your name? Amruth Pillai
```

Assembly Level Program 8a – Calculate NCR

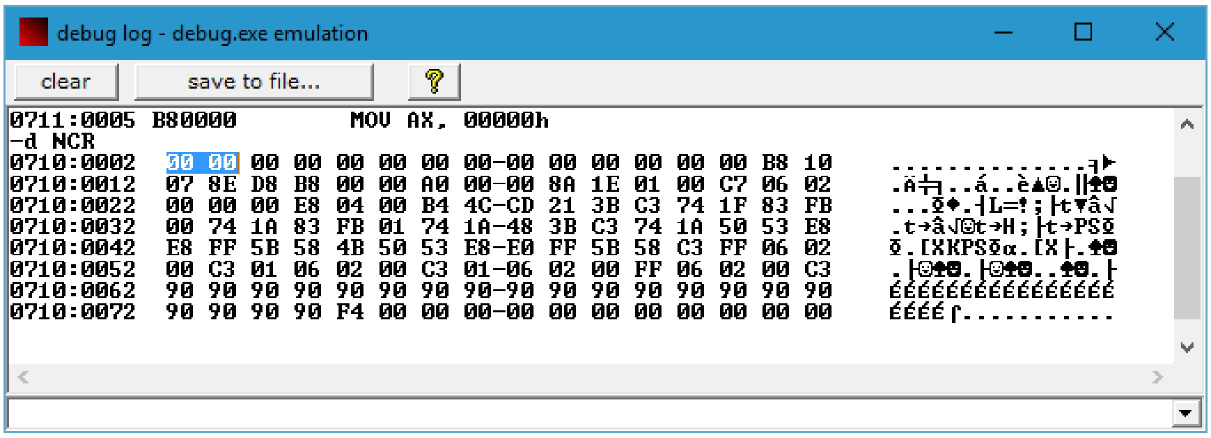
Write an Assembly Level Program to compute nCr using recursive procedure. Assume that 'n' and 'r' are non-negative integers.

Program

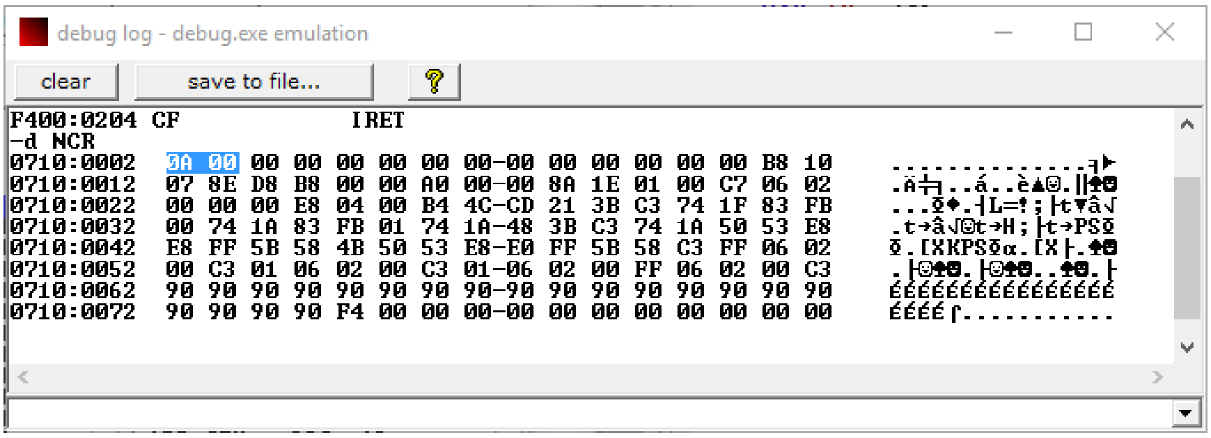
```
.model SMALL

.data
        N           dB      05d
        R           dB      02d
        NCR         dW      ?

.code
        MOV AX, @DATA
        MOV DS, AX

        MOV AX, 00h
        MOV AL, N
        MOV BL, R
        MOV NCR, 00h
        CALL NCRProcedure

        MOV AH, 4Ch
        INT 21h

        NCRProcedure PROC
                CMP AX, BX
                JE IncrementBy1

                CMP BX, 00h
        JE IncrementBy1

        CMP BX, 01h
        JE IncrementByN

        DEC AX
        CMP AX, BX
        JE IncrementBoth

        PUSH AX
        PUSH BX
        CALL NCRProcedure

        POP BX
        POP AX
        DEC BX
        PUSH AX
        PUSH BX
        CALL NCRProcedure

        POP BX
        POP AX
        RET

IncrementBy1:
        INC NCR
        RET

IncrementByN:
        ADD NCR, AX
```

```
                RET


        IncrementBoth:

                ADD NCR, AX

                INC NCR

                RET

        NCRProcedure ENDP

END
```

Output



```
0711:0005  B80000          MOV  AX, 00000h
-d NCR
0710:0002   00 00 00 00 00 00 00 00-00 00 00 00 00 00 B8 10    ..............╕►
0710:0012   07 8E D8 B8 00 00 A0 00-00 8A 1E 01 00 C7 06 02    •Ä╪╕..á..è▲☺.╟♠☻
0710:0022   00 00 00 E8 04 00 B4 4C-CD 21 3B C3 74 1F 83 FB    ...Φ♦.┤L═!;├t▼â√
0710:0032   00 74 1A 83 FB 01 74 1A-48 3B C3 74 1A 50 53 E8    .t→â√☺t→H;├t→PSΦ
0710:0042   E8 FF 5B 58 4B 50 53 E8-E0 FF 5B 58 C3 FF 06 02    Φ.[XKPSΦα.[X├.♠☻
0710:0052   00 C3 01 06 02 00 C3 01-06 02 00 FF 06 02 00 C3    .├☺♠☻.├☺♠☻..♠☻.├
0710:0062   90 90 90 90 90 90 90 90-90 90 90 90 90 90 90 90    ÉÉÉÉÉÉÉÉÉÉÉÉÉÉÉÉ
0710:0072   90 90 90 90 F4 00 00 00-00 00 00 00 00 00 00 00    ÉÉÉÉ⌠...........
```



```
F400:0204  CF              IRET
-d NCR
0710:0002   0A 00 00 00 00 00 00 00-00 00 00 00 00 00 B8 10    ..............╕►
0710:0012   07 8E D8 B8 00 00 A0 00-00 8A 1E 01 00 C7 06 02    •Ä╪╕..á..è▲☺.╟♠☻
0710:0022   00 00 00 E8 04 00 B4 4C-CD 21 3B C3 74 1F 83 FB    ...Φ♦.┤L═!;├t▼â√
0710:0032   00 74 1A 83 FB 01 74 1A-48 3B C3 74 1A 50 53 E8    .t→â√☺t→H;├t→PSΦ
0710:0042   E8 FF 5B 58 4B 50 53 E8-E0 FF 5B 58 C3 FF 06 02    Φ.[XKPSΦα.[X├.♠☻
0710:0052   00 C3 01 06 02 00 C3 01-06 02 00 FF 06 02 00 C3    .├☺♠☻.├☺♠☻..♠☻.├
0710:0062   90 90 90 90 90 90 90 90-90 90 90 90 90 90 90 90    ÉÉÉÉÉÉÉÉÉÉÉÉÉÉÉÉ
0710:0072   90 90 90 90 F4 00 00 00-00 00 00 00 00 00 00 00    ÉÉÉÉ⌠...........
```

Assembly Level Program 9a – System Time

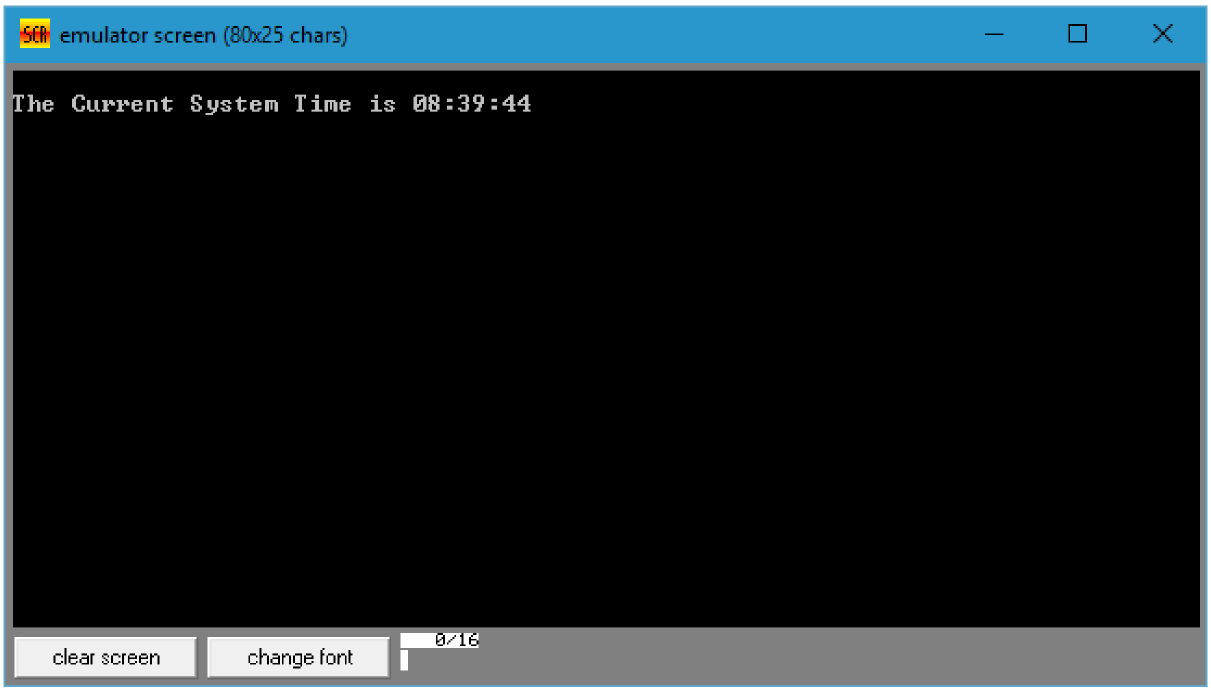
Write an Assembly Level Program to read the current time from the system and display it in the standard format on the screen.

Program

```
.model SMALL

DISPLAY MACRO
        AAM ; BCD Adjustment After Multiplication
        MOV BX, AX

        MOV DL, BH
        ADD DL, 30h
        MOV AH, 02h
        INT 21h

        MOV DL, BL
        ADD DL, 30h
        MOV AH, 02h
        INT 21h
ENDM

COLON MACRO
        MOV DL, ':'
        MOV AH, 02h
        INT 21h
ENDM


.data
```

```
        MSG1  dB      10, 13, 'The Current System Time is $'

.code
        MOV AX, @DATA
        MOV DS, AX

        LEA DX, MSG1
        MOV AH, 09h
        INT 21h

        ; Interrupt to Fetch System Time
        ; CH - Hours | CL - Minutes | DH - Seconds | DL - Miliseconds
        MOV AH, 2Ch
        INT 21h

        MOV AL, CH
        DISPLAY
        COLON

        MOV AL, CL
        DISPLAY
        COLON

        MOV AL, DH
        DISPLAY

        MOV AH, 4Ch
        INT 21h
END
```

Output



```
The Current System Time is 08:39:44
```

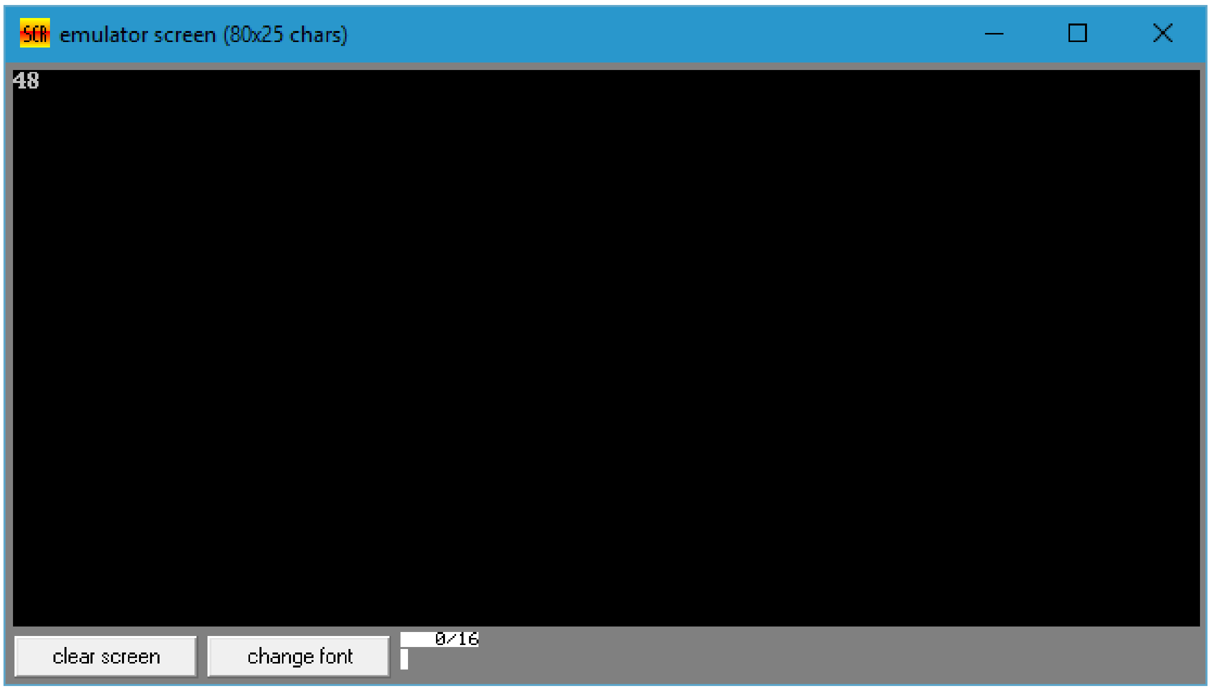
Assembly Level Program 10a – Decimal Up Counter

Write an Assembly Level Program to simulate a Decimal Up Counter to display 00 to 99.

Program

```
.model SMALL


.code
        MOV AL, 30h
FirstLoop:
        MOV DL, AL
        MOV AH, 02h
        INT 21h
        PUSH AX


        MOV BL, 30h
SecondLoop:
        MOV DL, BL
        MOV AH, 02h
        INT 21h


        INC BL


        ; Set Cursor to 2nd Column
        MOV AH, 02h
        MOV DL, 01h
        INT 10h


        CMP BL, 039h
        JLE SecondLoop
        ; Set Cursor to 1st Column
        MOV AH, 02h
        MOV DL, 00h
        INT 10h

        POP AX
        INC AL

        CMP AL, 039h
        JLE FirstLoop

        MOV AH, 4Ch
        INT 21h
END
```

Output



```
48
```

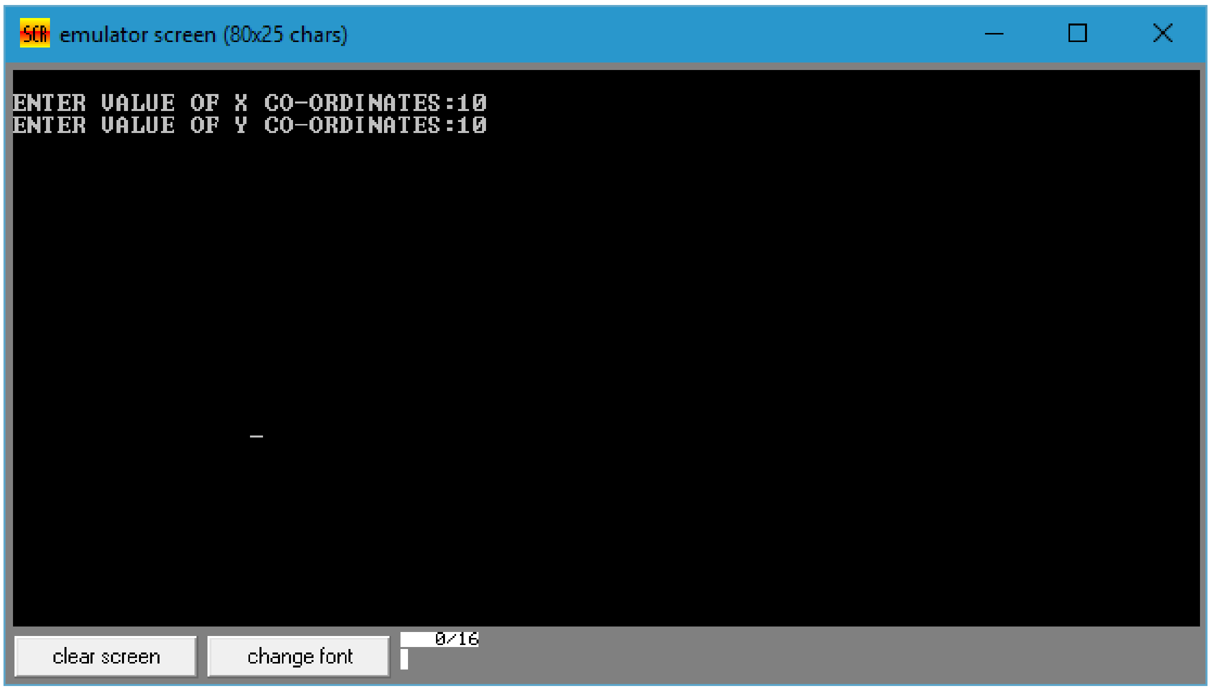
Assembly Level Program 11a – Cursor Movement

Write an Assembly Level Program to read a pair of input co-ordinates in BCD and move the cursor to the specified location on the screen.

Program

```
.MODEL SMALL

.DATA
        XMSG DB 13,10,'ENTER VALUE OF X CO-ORDINATES:','$'
        X DB ?
        YMSG DB 13,10,'ENTER VALUE OF Y CO-ORDINATES:','$'
        Y DB ?

.CODE
        MOV AX,@DATA
        MOV DS,AX

        MOV DX,OFFSET XMSG ;TO READ BCD CO=ORDINATES
        CALL READ_BCD
        MOV X,BH
        MOV DX,OFFSET YMSG
        CALL READ_BCD
        MOV Y,BH

        MOV AH,02H ;TO SET CURSOR POSITION
        MOV DH,X
        MOV DL,Y
        MOV BH,0
        INT 10H
        MOV DL,'-'
        MOV AH,06H
        INT 21H

        MOV AH,4CH
        INT 21H

        READ_BCD PROC
                MOV AH,09H
                INT 21H

                MOV AH,01H ;FIRST DIGIT
                INT 21H

                MOV BH,AL
                MOV AH,01H ;SECOND DIGIT
                INT 21H

                MOV BL,AL
                MOV CL,4H
                SUB BH,30H ;TO CONVERT FROM ASCII TO BCD
                SUB BL,30H
                SHL BH,CL
                OR BH,BL
        RET
        READ_BCD ENDP
END
```

Output



```
ENTER VALUE OF X CO-ORDINATES:10
ENTER VALUE OF Y CO-ORDINATES:10
```

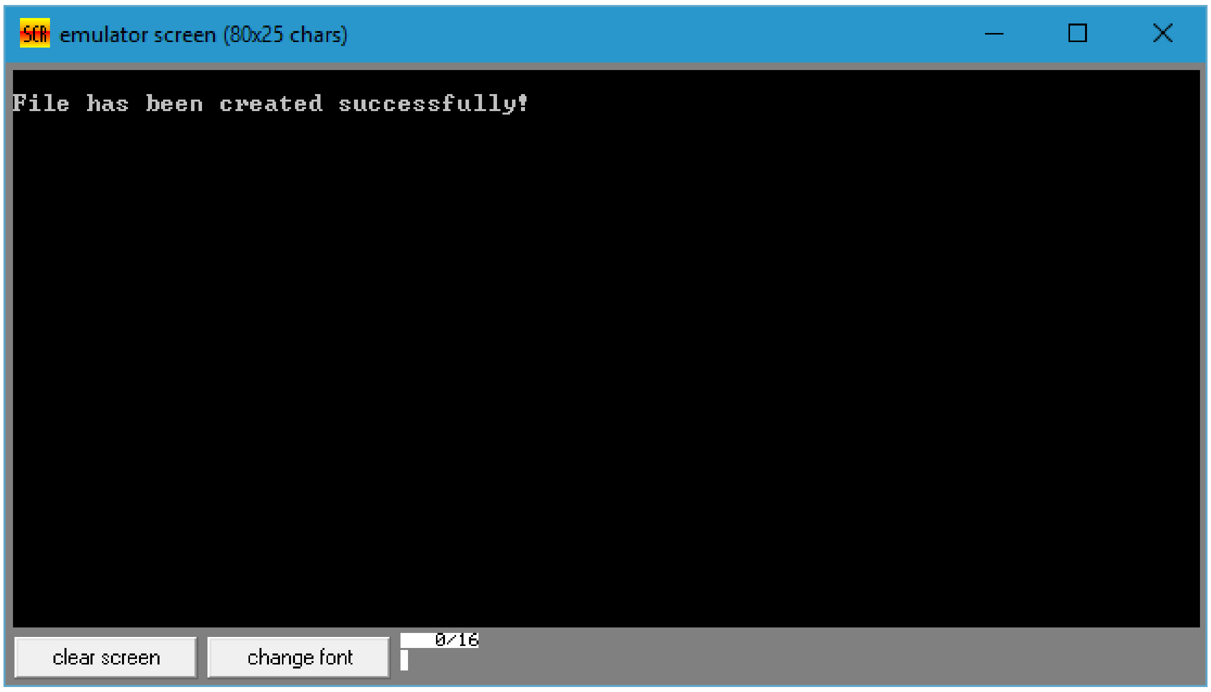
Assembly Level Program 12a – File Handling

Write an Assembly Level Program to create a file (input file) and to delete an existing file.

CreateFile.asm

```
.model SMALL


.data
        FNAME       dB      'SampleFile.txt', 00h
        SUCCESS     dB      10, 13, 'File has been created successfully!$'
        FAILURE     dB      10, 13, 'An Error Occurred during File Creation!$'


.code
        MOV AX, @DATA
        MOV DS, AX


        MOV CX, 20h


        ; Interrupt to Create a File
        LEA DX, FNAME
        MOV AH, 3Ch
        INT 21h
        JC ErrorOccurred


        LEA DX, SUCCESS
        MOV AH, 09h
        INT 21h
        JMP Exit



ErrorOccurred:
        LEA DX, FAILURE
        MOV AH, 09h
        INT 21h

Exit:
        MOV AH, 4Ch
        INT 21h
END
```

Output



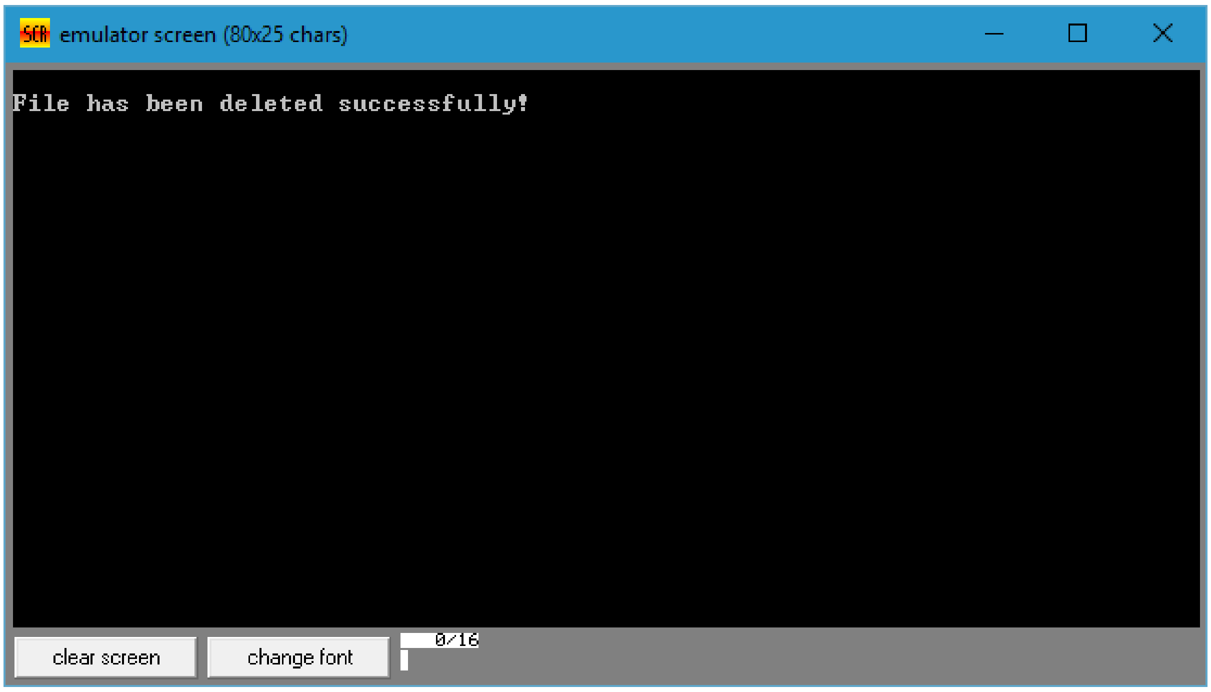
```
File has been created successfully!
```

DeleteFile.am

```
.model SMALL

.data
        FNAME       dB      'SampleFile.txt', 00h
        SUCCESS     dB      10, 13, 'File has been deleted successfully!$'
        FAILURE     dB      10, 13, 'An Error Occurred during File Deletion!$'

.code
        MOV AX, @DATA
        MOV DS, AX

        MOV CX, 20h

        ; Interrupt to Delete a File
        LEA DX, FNAME
        MOV AH, 41h
        INT 21h
        JC ErrorOccurred

        LEA DX, SUCCESS
        MOV AH, 09h
        INT 21h
        JMP Exit

ErrorOccurred:
        LEA DX, FAILURE
        MOV AH, 09h
        INT 21h
```

```
Exit:
        MOV AH, 4Ch
        INT 21h
END
```

Output



```
File has been deleted successfully!
```