(Question 1)

Develop and ALP to input keystrokes from the keyboard and display characters on the monitors. Pressing F1 - F10 should interrupt (using BIOS commands) and exit to DOS (using DOS commands).

(Aim)

To accept ascii keys as input and repeat till non-ascii key encountered using BIOS and DOS Interrupts.

(Algorithm/Pseudocode for BIOS Interrupt)

START

Load Service number 00H to read keyboard character
Call keyboard service interrupt 16H to execute
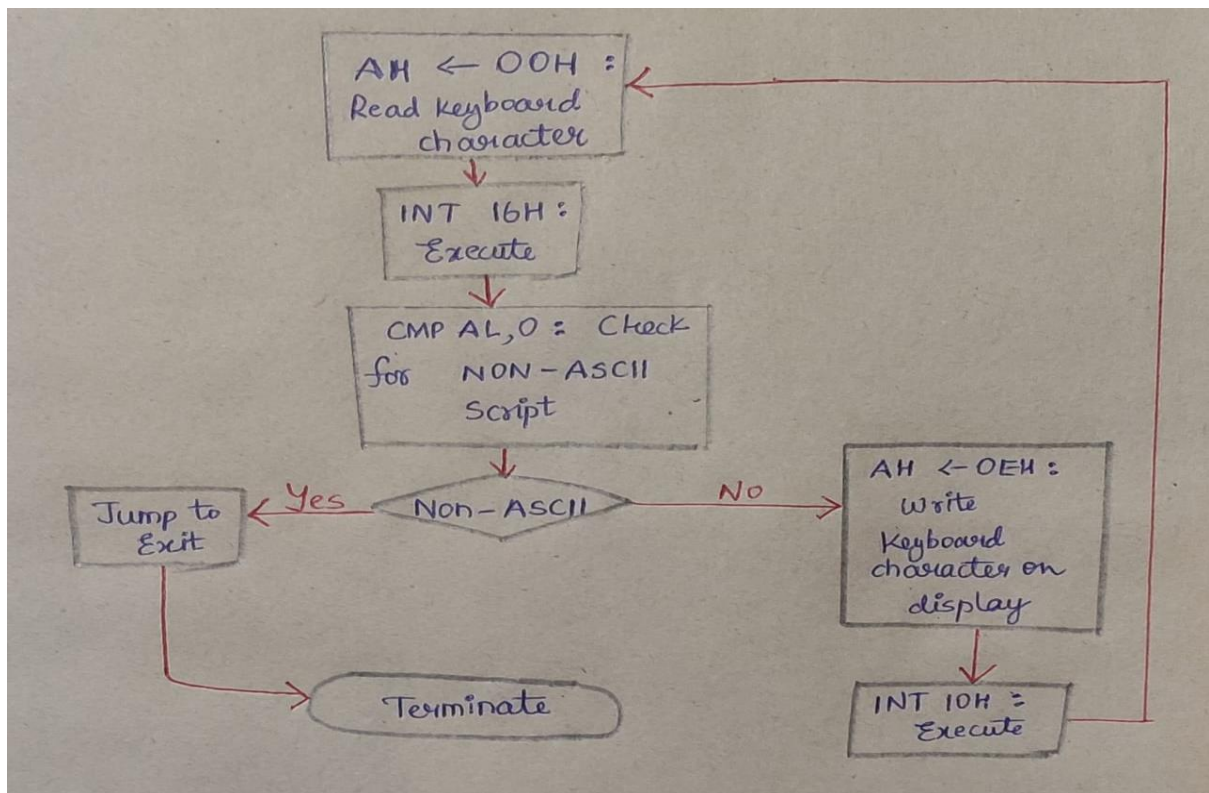Check for Non-ASCII Script
If Non-ASCII key pressed, then exit
Load Service number 0EH to write character in display
Call keyboard service interrupt 10H to execute
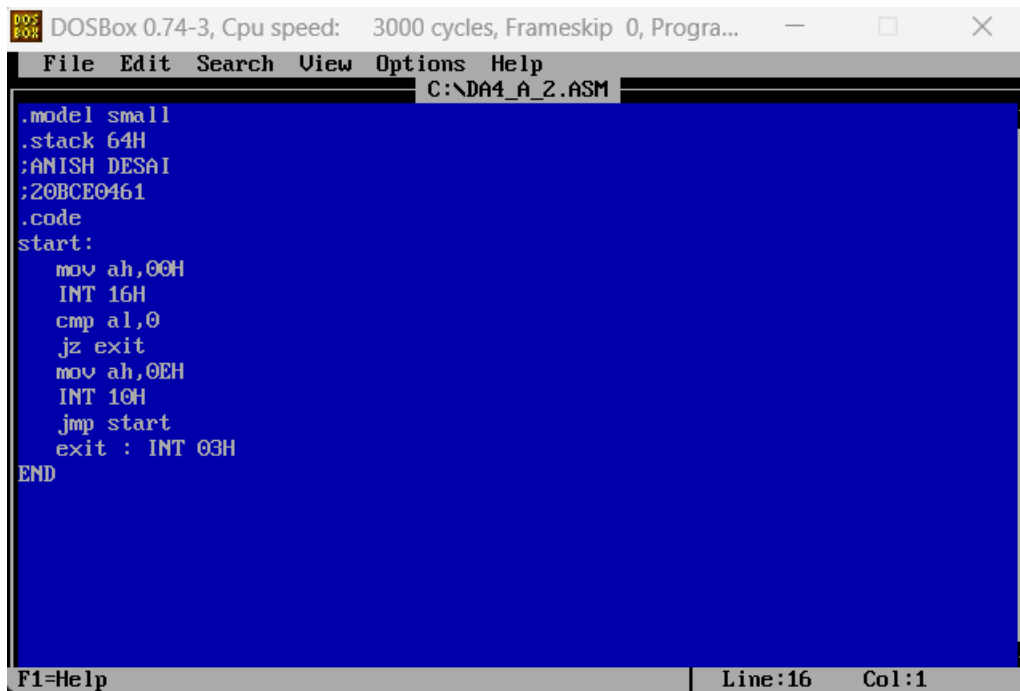Repeat until Non-ASCII key pressed
END

(Flowchart for BIOS Interrupt)

(ALP Code for BIOS Interrupt)

```
.model small
.stack 64H
;ANISH DESAI
;20BCE0461
.code
start:
    mov ah,00H
    INT 16H
    cmp al,0
    jz exit
    mov ah,0EH
    INT 10H
    jmp start
    exit : INT 03H
END
```

(MASM Output for BIOS Interrupt)

```
C:\>masm da4_a_2.asm
Microsoft (R) Macro Assembler Version 5.00
Copyright (C) Microsoft Corp 1981-1985, 1987.  All rights reserved.

Object filename [da4_a_2.OBJ]:
Source listing  [NUL.LST]:
Cross-reference [NUL.CRF]:

  51738 + 464806 Bytes symbol space free

      0 Warning Errors
      0 Severe  Errors

C:\>link da4_a_2.obj

Microsoft (R) Overlay Linker  Version 3.60
Copyright (C) Microsoft Corp 1983-1987.  All rights reserved.

Run File [DA4_A_2.EXE]:
List File [NUL.MAP]:
Libraries [.LIB]:
```

```
C:\>da4_a_2.exe
23_
```

```
C:\>da4_a_2.exe
23
```

Displays the ascii keys pressed.

Stops execution on the pressing of non-ascii key.

(Algorithm/Pseudocode for DOS Interrupt)

START

Load Service number 07H to read character from standard input
Call DOS Interrupt 21H to execute
Check for Non-ASCII script
If Non-ASCII key presses, then exit
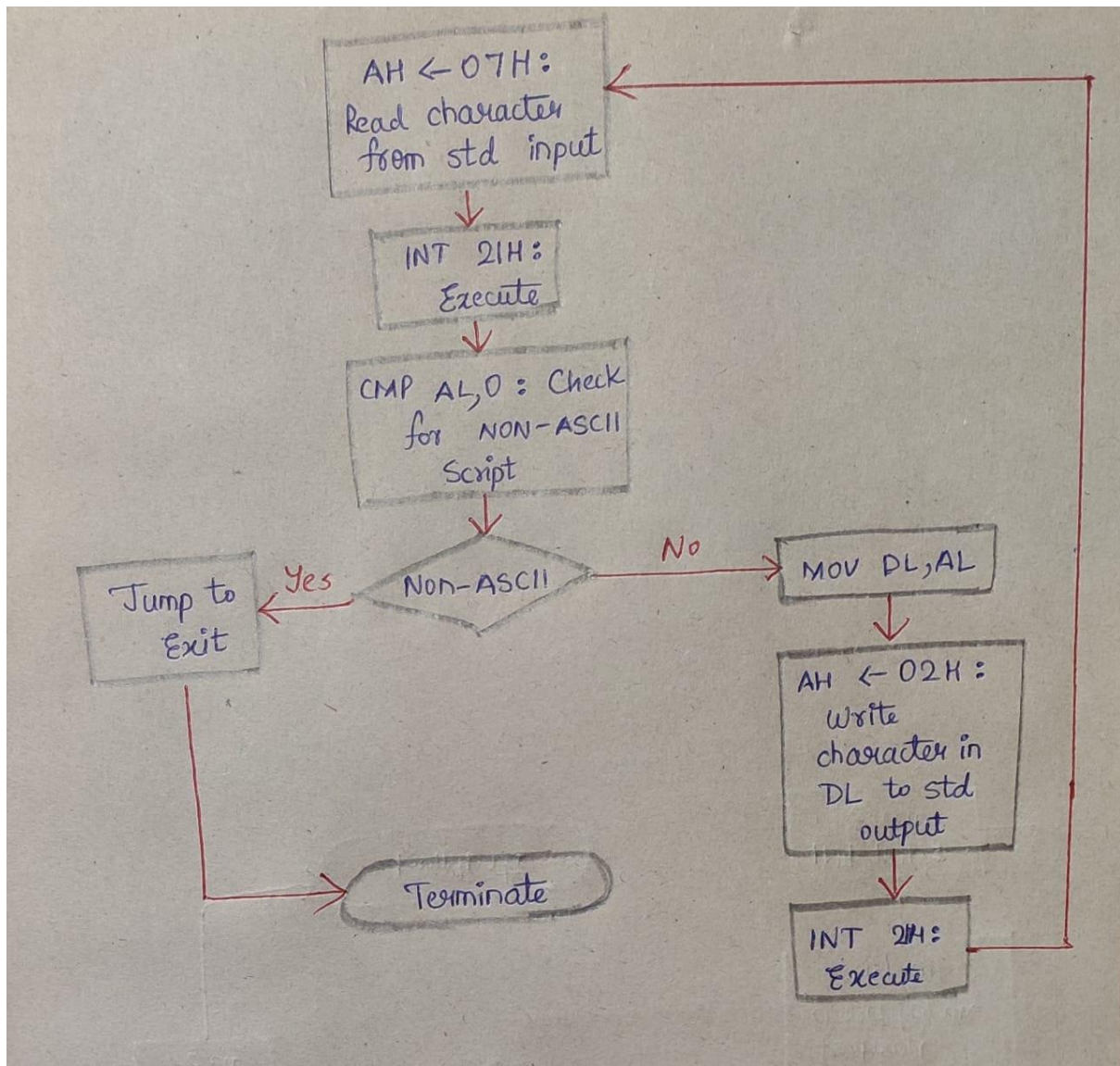Copy character from AL to DL
Load Service number 02H to write character present in DL to standard output
Repeat until Non-ASCII key given as input
EXIT to DOS

END
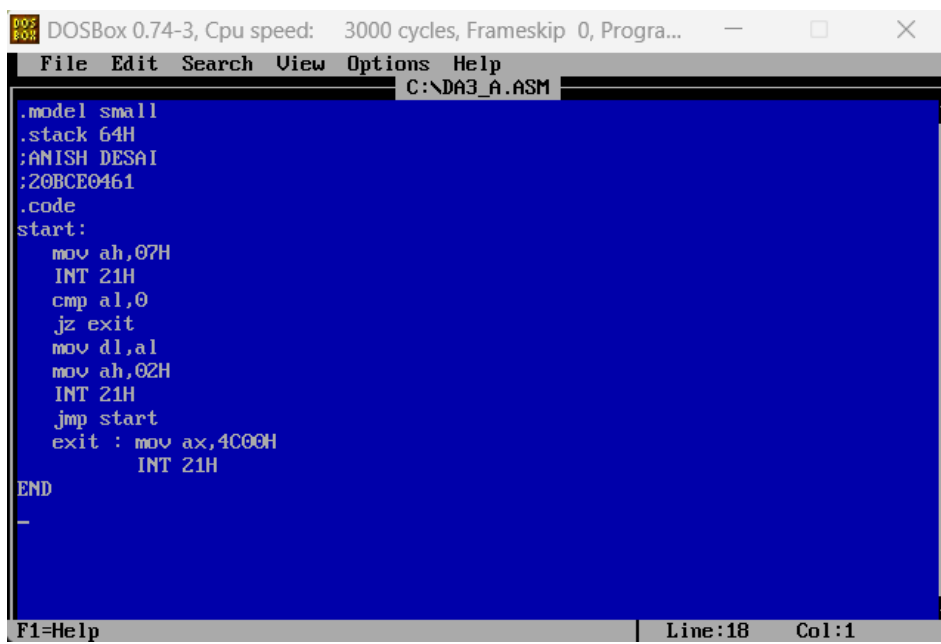
(Flowchart for DOS Interrupt)

(ALP Code for DOS Interrupt)

```
.model small
.stack 64H
;ANISH DESAI
;20BCE0461
.code
start:
    mov ah,07H
    INT 21H
    cmp al,0
```

```
    jz exit
    mov dl,al
    mov ah,02H
    INT 21H
    jmp start
    exit : mov ax,4C00H
        INT 21H
END
```


(MASM Output for DOS Interrupt)

```
C:\>da3_a.exe
2_
```

```
C:\>da3_a.exe
2
```

```
C:\>da3_a.exe
78_
```

```
C:\>da3_a.exe
78
```
Displays the ascii keys pressed.

```
C:\>da3_a.exe
78
C:\>;
```

Stops execution when Non-ascii key (F1) pressed.

(Result)

As we can see from MASM output screens above, DOS and BIOS interrupts have successfully accepted the input of ASCII keys and stops execution upon encountering any Non-ASCII key (F1-F10).

(Question 2)

Implement the following

     i. Develop an ALP to display your Roll number in the centre of page 2 of text display (Text colour = Magenta)

     ii. Develop an ALP to display an equilateral triangle in the centre of page 3 of a graphics display (Graphics colour = Cyan)

(Aim)

To display required graphics using interrupts.

(Algorithm/Pseudocode for Roll No.)

START

Select Display Type : AX ← 0002H
Call Interrupt 10H to execute

Set cursor position : AH ← 02H
Set row and column numbers (DH and DL respectively)
Set Page number (BH)
Call Interrupt 10H to execute

Activate current page
Set Fg and Bg colour, Page number and Number of times to be printed
Pass the character to be printed to AL
Call Interrupt 10H to execute

Repeat for other characters

END

(Flowchart for Roll No.)

No branch instructions, thus flowchart not required.

(ALP Code for Roll No.)

```
.model small
.stack 100H
;ANISH DESAI
;20BCE0461
```

```
.data
.code
  mov ax,0002H
  INT 10H

  mov ah,02H
  mov dh,12
  mov dl,36
  mov bh,02H
  INT 10H

  mov ax,0502H
  INT 10H

  mov ah,09H
  mov bl,05H
  mov bh,02H
  mov cx,0001H
  mov al,'2'
  INT 10H

  mov ah,02H
  mov dl,37
  INT 10H
  mov ah,09H
  mov al,'0'
  INT 10H

  mov ah,02H
  mov dl,38
  INT 10H
  mov ah,09H
  mov al,'B'
  INT 10H

  mov ah,02H
  mov dl,39
  INT 10H
```

```
mov ah,09H
mov al,'C'
INT 10H

mov ah,02H
mov dl,40
INT 10H
mov ah,09H
mov al,'E'
INT 10H

mov ah,02H
mov dl,41
INT 10H
mov ah,09H
mov al,'0'
INT 10H

mov ah,02H
mov dl,42
INT 10H
mov ah,09H
mov al,'4'
INT 10H

mov ah,02H
mov dl,43
INT 10H
mov ah,09H
mov al,'6'
INT 10H

mov ah,02H
mov dl,44
INT 10H
mov ah,09H
mov al,'1'
INT 10H
```
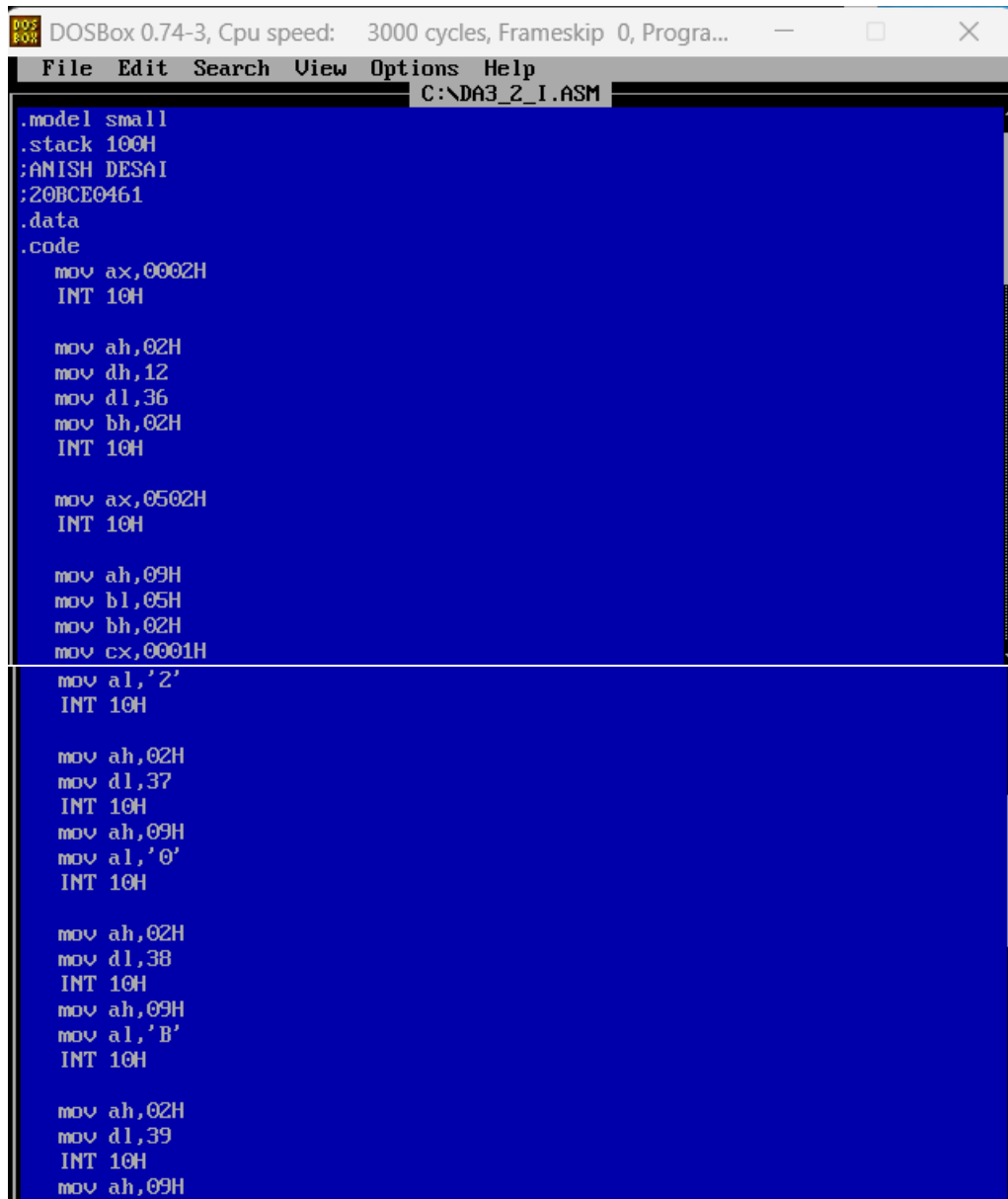
mov ax,4C00H
INT 21H
END

```
 File  Edit  Search  View  Options  Help
                         C:\DA3_2_I.ASM
.model small
.stack 100H
;ANISH DESAI
;20BCE0461
.data
.code
   mov ax,0002H
   INT 10H

   mov ah,02H
   mov dh,12
   mov dl,36
   mov bh,02H
   INT 10H

   mov ax,0502H
   INT 10H

   mov ah,09H
   mov bl,05H
   mov bh,02H
   mov cx,0001H
   mov al,'2'
   INT 10H

   mov ah,02H
   mov dl,37
   INT 10H
   mov ah,09H
   mov al,'0'
   INT 10H

   mov ah,02H
   mov dl,38
   INT 10H
   mov ah,09H
   mov al,'B'
   INT 10H

   mov ah,02H
   mov dl,39
   INT 10H
   mov ah,09H
```

```
    mov al,'C'
    INT 10H

    mov ah,02H
    mov dl,40
    INT 10H
    mov ah,09H
    mov al,'E'
    INT 10H

    mov ah,02H
    mov dl,41
    INT 10H
    mov ah,09H
    mov al,'0'
    INT 10H

    mov ah,02H
    mov dl,42
    INT 10H
    mov ah,09H
    mov al,'4'
    INT 10H

    mov ah,02H
    mov dl,43
    INT 10H
    mov ah,09H
    mov al,'6'
    INT 10H

    mov ah,02H
    mov dl,44
    INT 10H
    mov ah,09H
    mov al,'1'
    INT 10H

mov ax,4C00H
INT 21H
END
```

F1=Help   Line:85   Col:1

(MASM Output for Roll No.)

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Progra...   —   □   ×

20BCE0461

C:\>

(Algorithm/Pseudocode for Equilateral Triangle)

START

Select Display type : AX ← 000DH
Call Interrupt 10H to execute

Activate Page No. 3 : AX ← 0503H
Call Interrupt 10H to execute

Call Service 0CH to write a pixel : AH ← 0CH
Set Fg and Bg colours, row and column numbers and page number
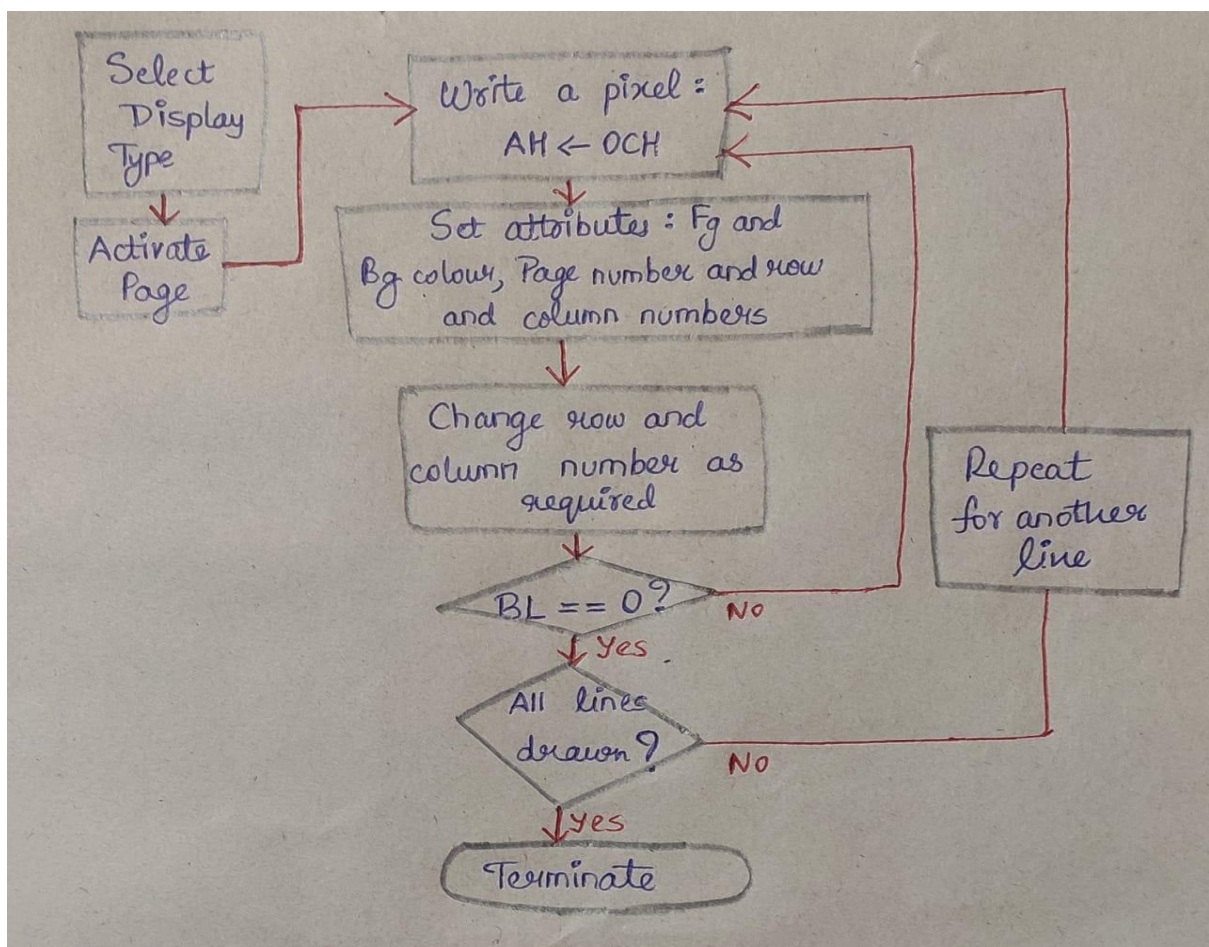Set length of the line to be drawn
Loop to draw a line by joining pixels
Call Interrupt 10H to execute

Repeat for other lines

END

(Flowchart for Equilateral Triangle)

(ALP Code for Equilateral Triangle)

```
.model small
.stack 100H
;ANISH DESAI
;20BCE0461
.code

mov ax,000DH
INT 10H

mov ax,0503H
INT 10H

mov ah,0CH
mov al,03H
mov bh,03H
mov cx,160
mov dx,75
mov bl,50
LINE1 : INT 10H
     DEC CX
     INC DX
     DEC BL
     JNZ LINE1

mov ah,0CH
mov al,03H
mov bh,03H
mov cx,160
mov dx,75
mov bl,50
LINE2 : INT 10H
     INC CX
     INC DX
     DEC BL
     JNZ LINE2
```

```
mov ah,0CH
mov al,03H
mov bh,03H
mov cx,110
mov dx,125
mov bl,100
LINE3 : INT 10H
      INC CX
      DEC BL
      JNZ LINE3

mov ax,4C00H
INT 21H
END
```



```
.model small
.stack 100H
;ANISH DESAI
;20BCE0461
.code

mov ax,000DH
INT 10H

mov ax,0503H
INT 10H

mov ah,0CH
mov al,03H
mov bh,03H
mov cx,160
mov dx,75
mov bl,50
LINE1 : INT 10H
        DEC CX
        INC DX
        DEC BL
```
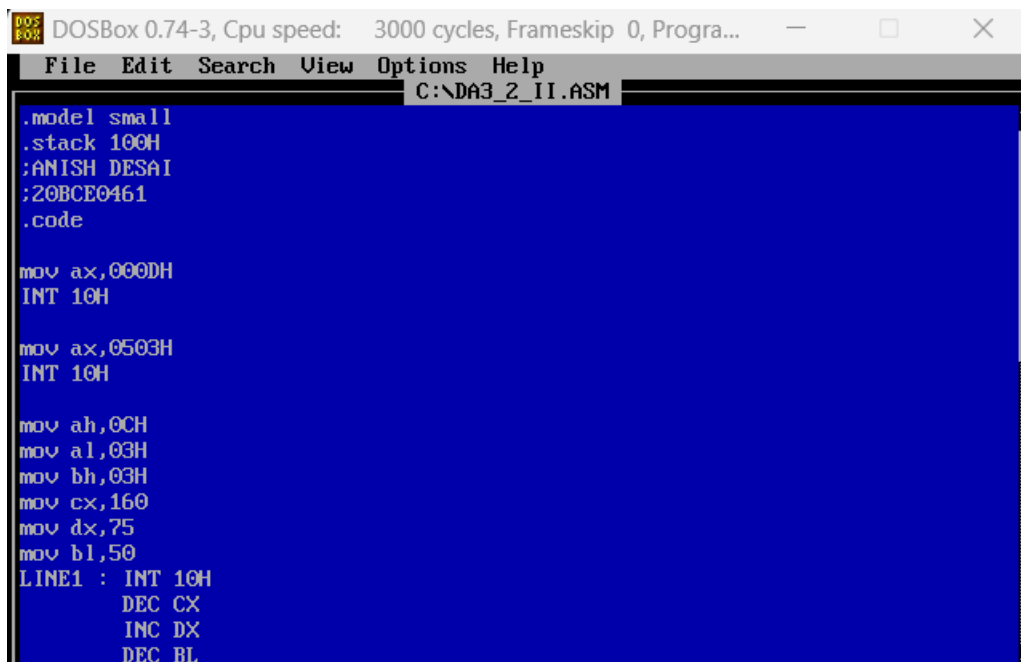
```
        JNZ LINE1

mov ah,0CH
mov al,03H
mov bh,03H
mov cx,160
mov dx,75
mov bl,50
LINE2 : INT 10H
        INC CX
        INC DX
        DEC BL
        JNZ LINE2

mov ah,0CH
mov al,03H
mov bh,03H
mov cx,110
mov dx,125
mov bl,100
LINE3 : INT 10H
        INC CX
        DEC BL
        JNZ LINE3

mov ax,4C00H
INT 21H
END
F1=Help                          Line:51    Col:1
```
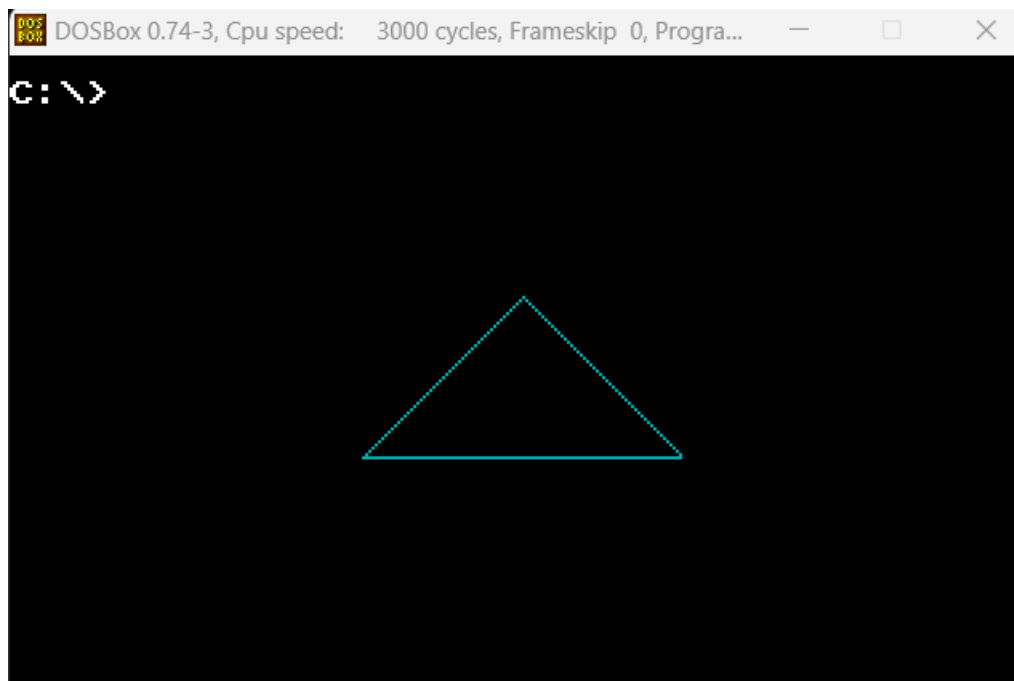
(MASM Output for Equilateral Triangle)

(Result)

As we can see from MASM screens above, graphics using interrupts have been successfully executed to print Roll No. and draw an Equilateral Triangle with required specifications.

(Question 3)

Develop an ALP to display your name with an underline in the centre of page 3 of a graphics display. (Name in magenta, underline in cyan).

(Aim)

To display name with an underline using appropriate graphic interrupts

(Algorithm/Pseudocode)

START

Select Display Type : AH ← 000DH
Call Interrupt 10H to execute

Activate Page No. 3 : AX ← 0503H
Call Interrupt 10H to execute

Call Service 0CH to write a pixel : AH ← 0CH
Set Fg and Bg colours, row and column numbers and page number
Set length of the line to be drawn
Loop to draw a line by joining pixels
Call Interrupt 10H to execute

Set cursor position : AH ← 02H
Set row and column numbers
Call Interrupt 10H to execute

Call Service 0EH to write a character in teletype mode : AH ← 0EH
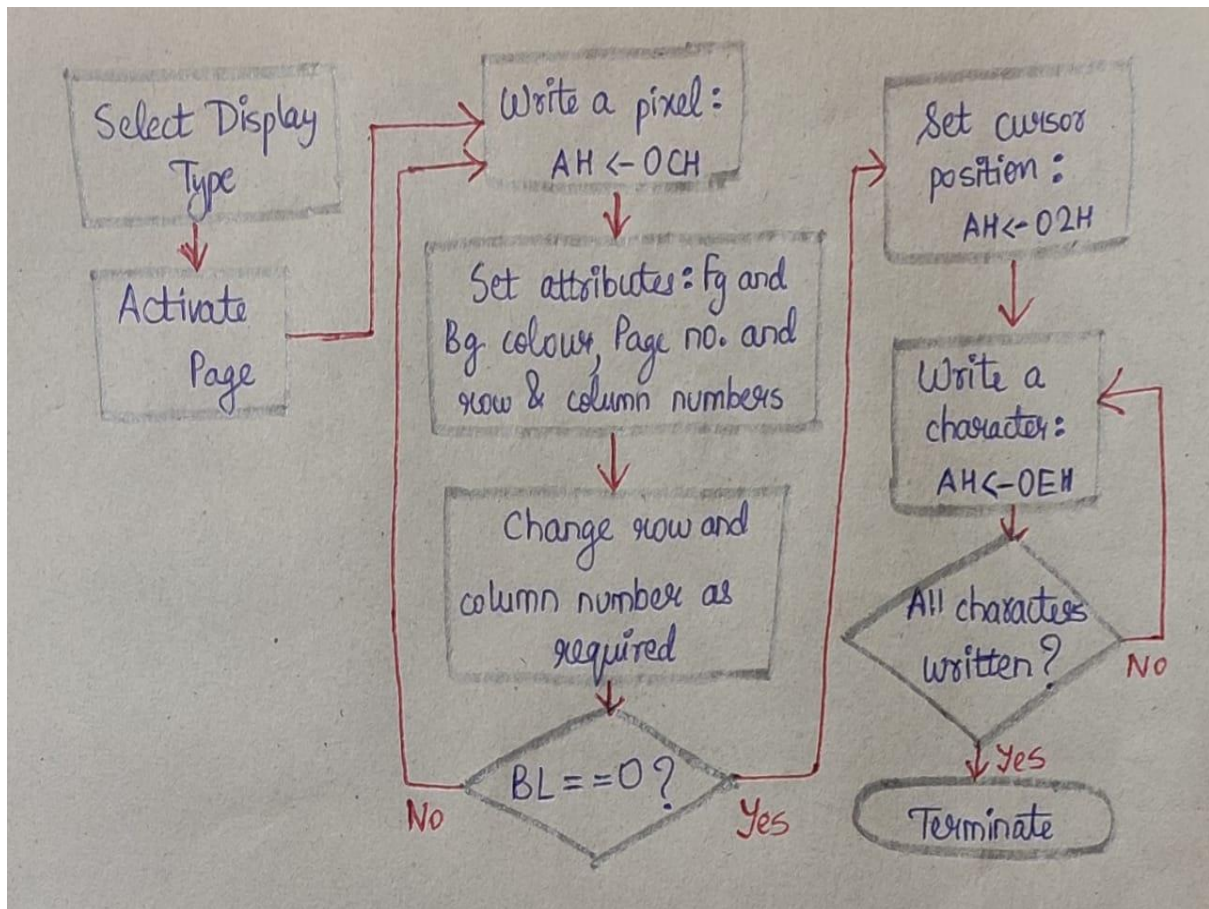Set Fg colour and character to be written
Call Interrupt 10H to execute
Increment Column number : DL

Repeat for other characters

END

(Flowchart)

(ALP Code)

```
.model small
.stack 100H
;ANISH DESAI
;20BCE0461
.code

mov ax,000DH
INT 10H

mov ax,0503H
INT 10H

mov ah,0CH
mov bh,03H
mov al,03H
mov cx,135
```

```
    mov dx,100
    mov bl,100
LINE : INT 10H
      INC CX
      DEC BL
      JNZ LINE

    mov ah,02H
    mov dl,20
    mov dh,11
    INT 10H

    mov ah,0EH
    mov bl,05H
    mov al,'A'
    INT 10H
    INC dl

    mov ah,0EH
    mov bl,05H
    mov al,'N'
    INT 10H
    INC dl

    mov ah,0EH
    mov bl,05H
    mov al,'I'
    INT 10H
    INC dl

    mov ah,0EH
    mov bl,05H
    mov al,'S'
    INT 10H
    INC dl

    mov ah,0EH
    mov bl,05H
```

```
mov al,'H'
INT 10H

mov ax,4C00H
INT 21H
END
```

```
File  Edit  Search  View  Options  Help
                    C:\DA3_3.ASM
.model small
.stack 100H
;ANISH DESAI
;20BCE0461
.code

mov ax,000DH
INT 10H

mov ax,0503H
INT 10H

mov ah,0CH
mov bh,03H
mov al,03H
mov cx,135
mov dx,100
mov bl,100
LINE : INT 10H
       INC CX
       DEC BL
       JNZ LINE

mov ah,02H
mov dl,20
mov dh,11
INT 10H

mov ah,0EH
mov bl,05H
mov al,'A'
INT 10H
INC dl

mov ah,0EH
mov bl,05H
mov al,'N'
INT 10H
INC dl

mov ah,0EH
mov bl,05H
mov al,'I'
INT 10H
INC dl
```

```
mov ah,0EH
mov bl,05H
mov al,'S'
INT 10H
INC dl

mov ah,0EH
mov bl,05H
mov al,'H'
INT 10H

mov ax,4C00H
INT 21H
END
```
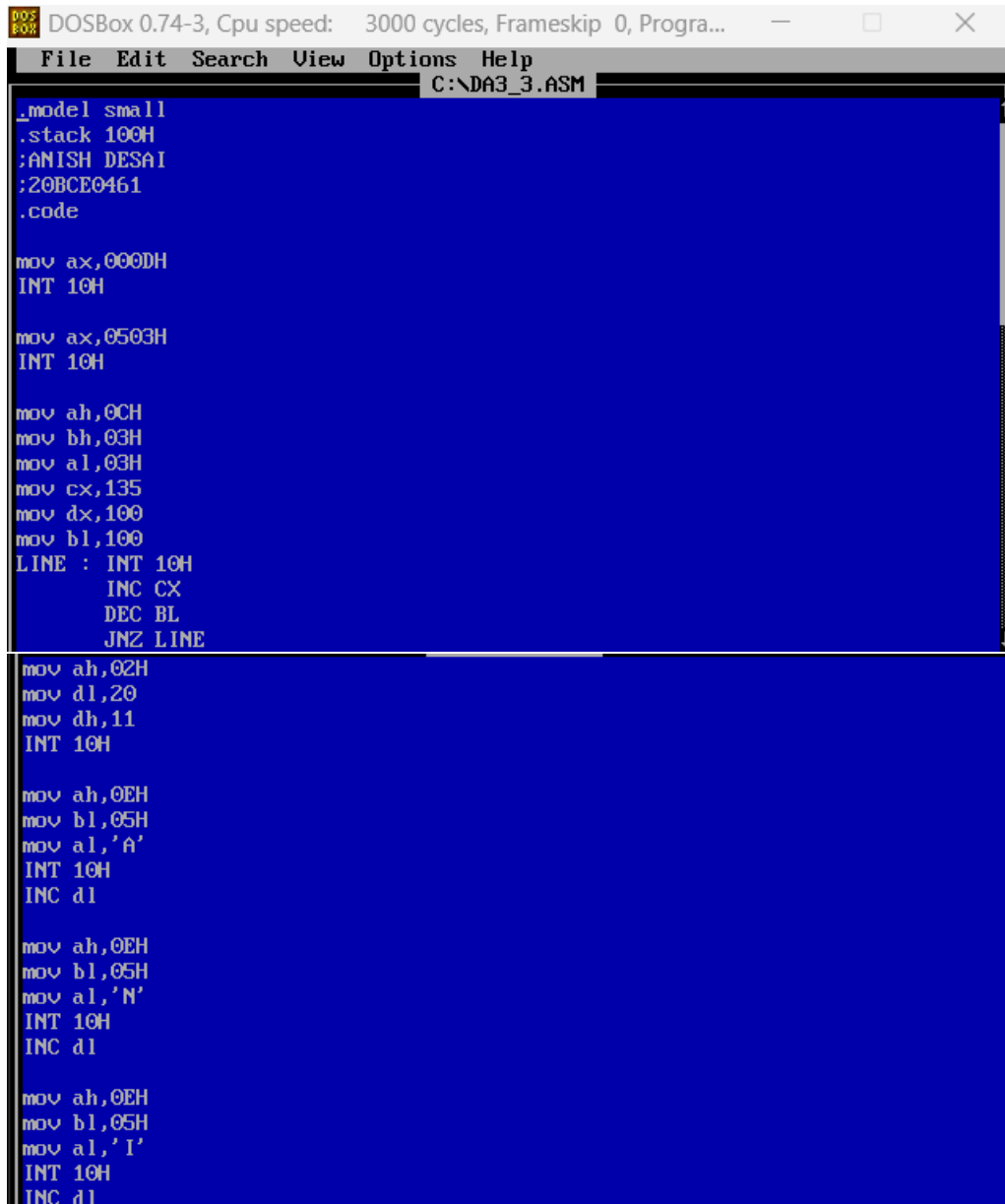F1=Help   Line:61   Col:1

(MASM Output)

DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Progra...

C:\>   ANISH

(Result)

As we can see from the above MASM screen output, interrupts have been
successfully executed to get required graphics.