# Chapter 4

**8. Write *a* program to (a) display a "?", (b) read two decimal digits
who.se sum "is less than 10, (c) display them and their sum on the
next line, with an appropriate message.**

**Sample execution:**
**?27**
**THE SUM OF *2* AND 7 IS 9**

```
.model small
.stack 100h
.data
 msg db 'THE SUM OF$'
 msg1 db '  $'
 msg2 db 'AND$'
 msg3 db 'IS$'

.code
 main proc

    mov dl,'?'
    mov ah,2
    int 21h


    mov ah,1
    int 21h

    mov bl,al

    mov ah,1
    int 21h

    mov cl,al



    mov ah,2
    mov dl,0dh        ; carriage return
    int 21h
```

```
mov dl,0ah        ;new line
int 21h

mov ax,@data  ;initialize data segmet
mov ds,ax
lea dx,msg
mov ah,9
int 21h



lea dx,msg1
mov ah,9
int 21h

mov ah,2
mov dl,bl
int 21h

lea dx,msg1
mov ah,9
int 21h

lea dx,msg2
mov ah,9
int 21h


lea dx,msg1
mov ah,9
int 21h

mov ah,2
mov dl,cl
int 21h


lea dx,msg1
mov ah,9
int 21h


lea dx,msg3
mov ah,9
int 21h

lea dx,msg1
mov ah,9
```

```
int 21h


add bl,cl   ;sum

sub bl,48d  ;convert to ascii number

mov dl,bl
mov ah,2
int 21h


mov ah,4ch
int 21h


main endp

end main
```

**Output:**


**9.Write a program to (a) prompt the user, (b) read first, middle, and last initials of a person's name, and (c) display them duwn the left margin.**

**Sample execution:**

**ENTER THRl::E INITIALS: JFK**
**J**
**F**
**K**

```
.model small
.stack 100h
.data
msg db 'ENTER THREE INITIALG: $'
.code
main proc

    mov ax,@data  ;initialize data segment
    mov ds,ax
    lea dx,msg
    mov ah,9
    int 21h

    mov ah,1
    int 21h
    mov bl,al


    mov ah,1
     int 21h
    mov cl,al


    mov ah,1
    int 21h
    mov bh,al

    mov ah,2
    mov dl,0dh  ;caariage return
    int 21h
    mov dl,0ah  ;new line
    int 21h



    mov ah,2
    mov dl,bl
    int 21h
```

```
    mov dl,0dh
    int 21h
    mov dl,0ah
    int 21h


    mov ah,2
    mov dl,cl
    int 21h

    mov dl,0dh
    int 21h
    mov dl,0ah
    int 21h


    mov ah,2
    mov dl,bh
    int 21h

    mov ah,4ch
    int 21h

  main endp
  end main
```

**Output:**

**10. Write· a program to read one of the hex digits *A-F,* and display it on the next line in decimal.**
**Sample execution:**

**ENTER A HEX DIGIT: C**
***IN* DECIMAL *IT* rs 12**

```
.model small
.stack 100h
.data
msg1 db 'Enter a hex digit: $'
msg2 db 'In decimal it is: $'
.code
main proc

    mov ax,@data
    mov ds,ax
    lea dx,msg1
    mov ah,9
    int 21h

    mov ah,1
    int 21h
    mov bl,al
    sub bl,17d  ; convert to corresponding hex value as C=67. So 67-17=50=’2’

    mov ah,2
    mov dl,0dh
    int 21h
    mov dl,0ah
    int 21h

   lea dx,msg2
   mov ah,9
    int 21h



    mov dl,49d  ;print 1 at first
    mov ah,2
    int 21h

    mov dl,bl
    mov ah,2 ; print next value of hex after 1
    int 21h
```

```
main endp
end main
```

**Output:**

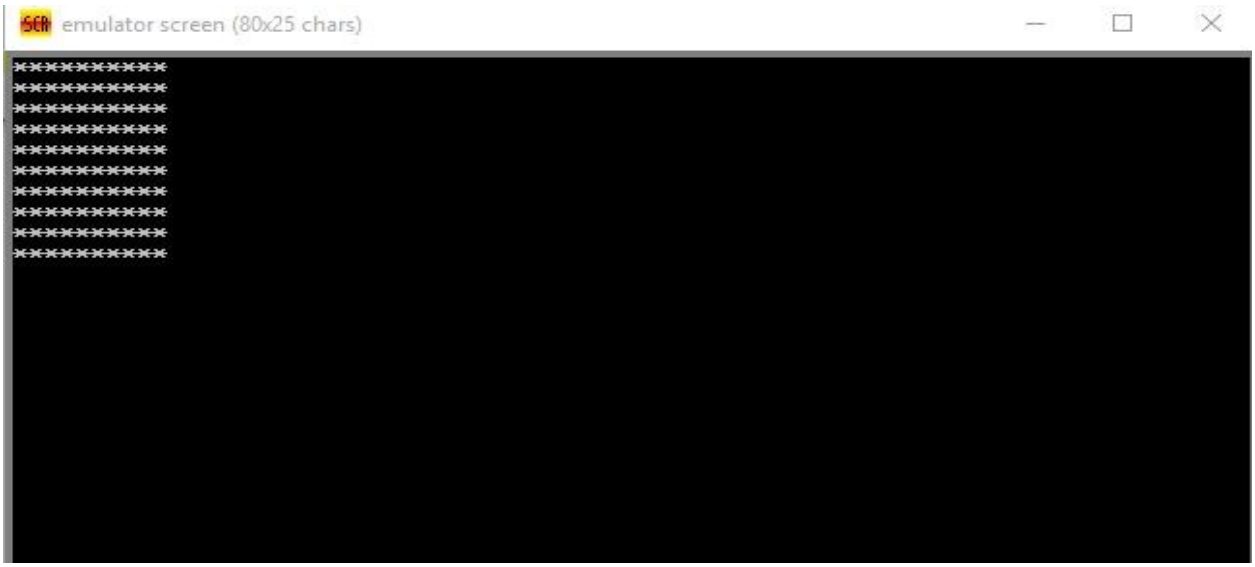

**11. Write *a* program to display *a* t 0 x 10 solid box of asterisks.**
***Hint:*** **declare *a* string in the data segment that specifies the box, and display it with INT 2lh, function 9h.**

```
.model small
.stack 100h
.data
msg1 db '**********$'

.code
main proc
    mov ax,@data
    mov ds,ax
    lea dx,msg1
    mov ah,9            ;print 10 times
    int 21h
    mov ah,2
    mov dl,0dh
    int 21h
```

```
mov dl,0ah
int 21h
lea dx,msg1
mov ah,9
int 21h
mov ah,2
mov dl,0dh
int 21h
mov dl,0ah
int 21h
lea dx,msg1
mov ah,9
int 21h

mov ah,2
mov dl,0dh
int 21h
mov dl,0ah
int 21h
lea dx,msg1
mov ah,9
int 21h

mov ah,2
mov dl,0dh
int 21h
mov dl,0ah
int 21h
lea dx,msg1
mov ah,9
int 21h

mov ah,2
mov dl,0dh
int 21h
mov dl,0ah
int 21h
lea dx,msg1
mov ah,9
int 21h

mov ah,2
mov dl,0dh
int 21h
mov dl,0ah
int 21h
lea dx,msg1
```

```
  mov ah,9
  int 21h

    mov ah,2
  mov dl,0dh
  int 21h
  mov dl,0ah
  int 21h
  lea dx,msg1
  mov ah,9
  int 21h

    mov ah,2
  mov dl,0dh
  int 21h
  mov dl,0ah
  int 21h
  lea dx,msg1
  mov ah,9
  int 21h

    mov ah,2
  mov dl,0dh
  int 21h
  mov dl,0ah
  int 21h
  lea dx,msg1
  mov ah,9
  int 21h

  mov ah,4ch
  int 21h

main endp
end main
```

**Output:**




**12. Write a program to (a) display"?", (b) read three initials,(<;) display**
**them in the middle of an 11 x 11 box of asterix, and (d)**
**beep the computer.**

```
.model small
.stack 100h
.data
msg1 db '**********$'
msg2 db '****$'


.code
main proc

    mov dl,'?'
    mov ah,2
    int 21h

    mov ah,1
    int 21h
    mov bl,al

    mov ah,1
    int 21h
    mov cl,al

    mov ah,1
    int 21h
```

```
mov bh,al

 mov ah,2
mov dl,0dh
int 21h
mov dl,0ah
int 21h

mov ax,@data
mov ds,ax
lea dx,msg1
mov ah,9
int 21h

mov ah,2
mov dl,0dh
int 21h
mov dl,0ah
int 21h
lea dx,msg1
mov ah,9
int 21h

mov ah,2
mov dl,0dh
int 21h
mov dl,0ah
int 21h
lea dx,msg1
mov ah,9
int 21h

mov ah,2
mov dl,0dh
int 21h
mov dl,0ah
int 21h
lea dx,msg1
mov ah,9
int 21h

mov ah,2
mov dl,0dh
int 21h
mov dl,0ah
int 21h
```

```
lea dx,msg1
mov ah,9
int 21h


mov ah,2
mov dl,0dh
int 21h
mov dl,0ah
int 21h

lea dx,msg2  ; printing less star to put the scanned value
mov ah,9
int 21h




mov dl,bl
mov ah,2    ;printing scanned value
int 21h

mov dl,cl
int 21h     ;printing scanned value


mov dl,bh  ;printing scanned value

int 21h

lea dx,msg2
mov ah,9
int 21h


mov ah,2
mov dl,0dh
int 21h
mov dl,0ah
int 21h
lea dx,msg1
mov ah,9
int 21h

mov ah,2
mov dl,0dh
int 21h
```

```
  mov dl,0ah
  int 21h
  lea dx,msg1
  mov ah,9
  int 21h

    mov ah,2
  mov dl,0dh
  int 21h
  mov dl,0ah
  int 21h
  lea dx,msg1
  mov ah,9
  int 21h

    mov ah,2
  mov dl,0dh
  int 21h
  mov dl,0ah
  int 21h
  lea dx,msg1
  mov ah,9
  int 21h

    mov ah,2
  mov dl,0dh
  int 21h
  mov dl,0ah
  int 21h
  lea dx,msg1
  mov ah,9
  int 21h



  mov ah,2
  mov dl,07h
  int 21h


  mov ah,4ch
  int 21h

main endp
end main
```

**Output:**


# Chapter 6

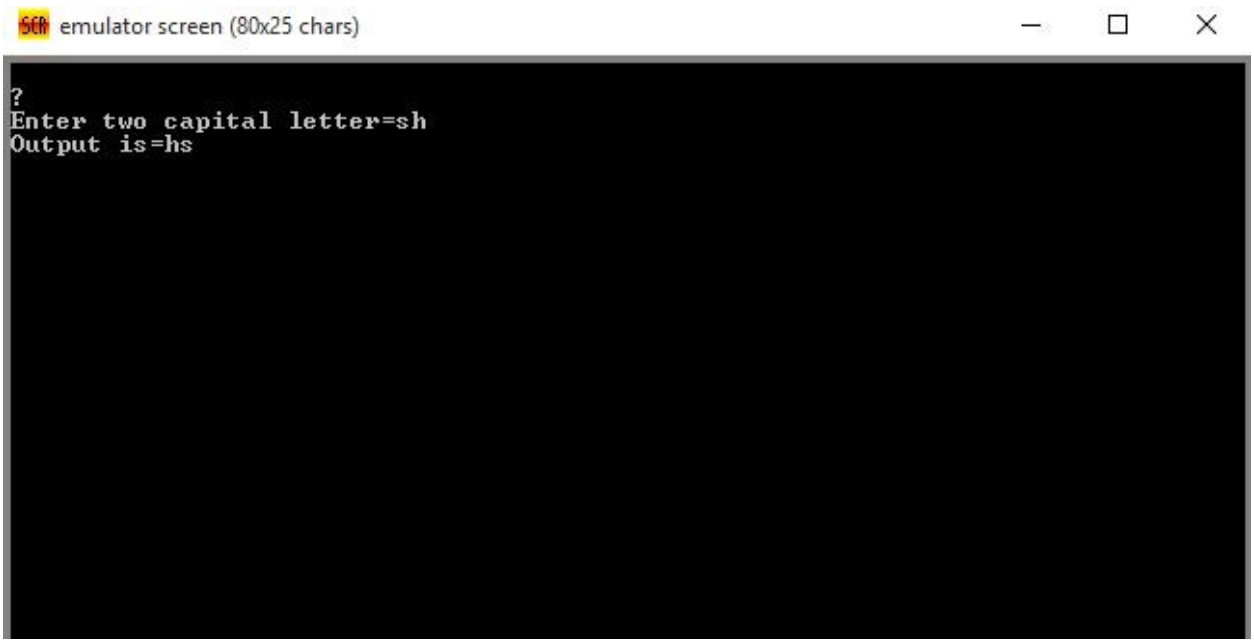
**8. Write a program to display a "?", read two capital letters, and display them on the next line In alphabetical order.**

```
.model small
.stack 100h
.data

msg db 10,13,'?$'
msg1 db 10,13,'Enter two capital letter=$'
msg2 db 10,13,'Output is=$'

.code

    mov ax,@data
    mov ds,ax
```

```
    lea dx,msg

    mov ah,9
    int 21h

    lea dx,msg1
    mov ah,9
    int 21h

    mov ah,1
    int 21h
    mov bl,al



    mov ah,1
    int 21h
    mov cl,al

   lea dx,msg2
   mov ah,9
   int 21h


    cmp bl,cl
    ja go           ; if bl>cl

   mov dl,bl
   mov ah,2
   int 21h

   mov dl,cl
   int 21h

   jmp exit:


go:


   mov dl,cl
   mov ah,2
   int 21h

   mov dl,bl
   int 21h
```

```
    jmp exit:

exit:
```

**Output:**

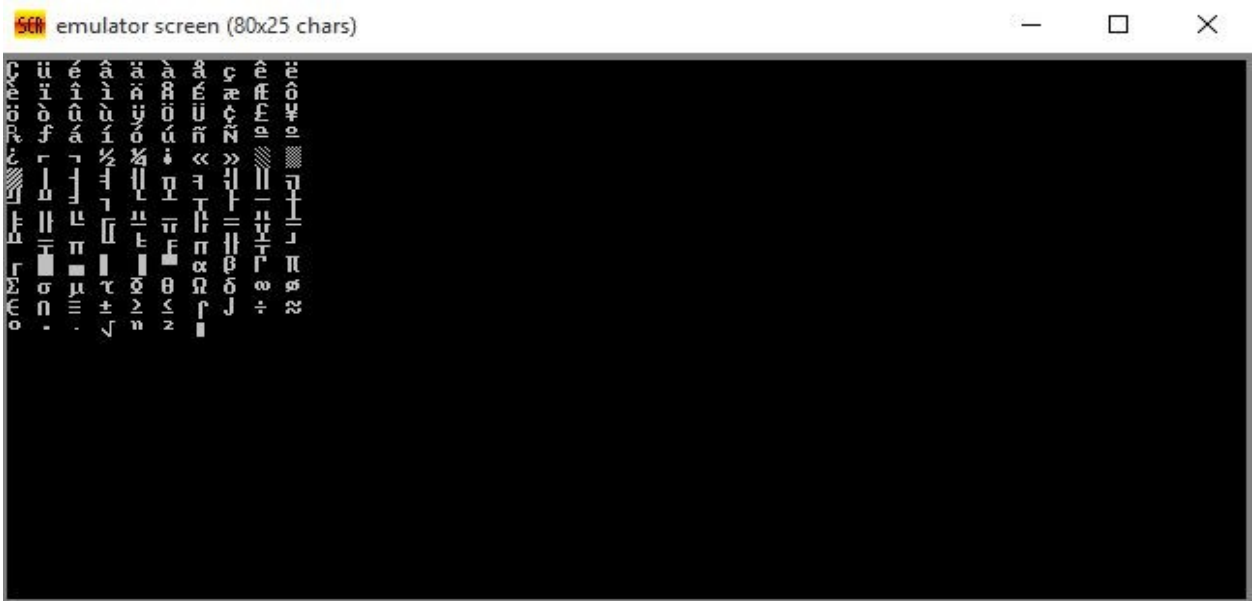



**9. Write *a* program to display the extended ASCII characters (ASCJI codes 80h to FF_h). Display 10 characters per line, separated by blanks. Stop after the extended characters have been displayed once.**

```
.model small
.stack 100h
.data

.code

    main proc

     mov cx,127   ;initialize number of character
     mov bl,0


 print:

     mov ah,2
     inc cx
```

```
    cmp cx,255
    ja exit
    mov dx,cx
    int 21h
    mov dx,32d    ; giving space
    int 21h
    jmp go


go:

  inc bl
  cmp bl,10   ; 10 char per line
  je nl
  jmp print


nl:

    mov ah,2
    mov dl,0dh
    int 21h
    mov dl,0ah
    int 21h
    mov bl,0
    jmp print

exit:
```

**Output**

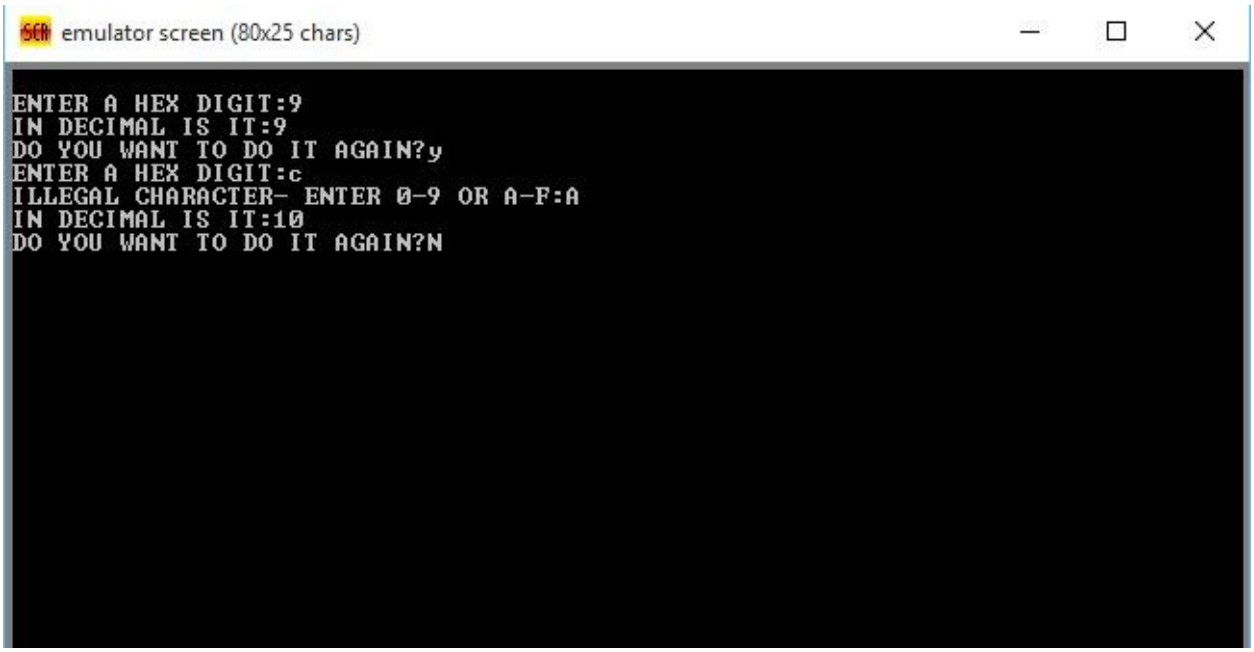


**10. Write a program that will prompt the user to enter a hex digit character ("0"· ... "9" or "A" ... "F"), display it on the next line in decimal, and ask the user i.i he or she wants to do it again. If the user types "y" or "Y", the ·program repeats; If the user types anything else, the program terminates. If the user enters an illegal character, prompt the user to try again.**

```
.model small
.stack 100h
.data
msg1 db 10,13,'ENTER A HEX DIGIT:$'
msg2 db 10,13,'IN DECIMAL IS IT:$'
msg3 db 10,13,'DO YOU WANT TO DO IT AGAIN?$'
msg4 db 10,13,'ILLEGAL CHARACTER- ENTER 0-9 OR A-F:$'


.code


again:

   mov ax,@data
   mov ds,ax
   lea dx,msg1
   mov ah,9
   int 21h

   mov ah,1
   int 21h

   mov bl,al


   jmp go
```

```
go:


   cmp bl,'9'
   ja hex     ;if bl>9  go t hex label
   jb num
   je num




 hex:

    cmp bl,'F'
    ja illegal   ;if bl>F illegal


   lea dx,msg2
   mov ah,9
   int 21h

    mov dl,49d
    mov ah,2
    int 21h

    sub bl,17d  ; convert to letter
    mov dl,bl
    mov ah,2
    int 21h

    jmp inp



 inp:

    lea dx,msg3
    mov ah,9
    int 21h

    mov ah,1
    int 21h

    mov cl,al
```

```
    cmp cl,'y'
    je again
    cmp cl,'Y'
    je again
    jmp exit


 num:

   cmp bl,'0'
   jb illegal

   lea dx,msg2
   mov ah,9
   int 21h


   mov dl,bl
   mov ah,2
   int 21h

   jmp inp



 illegal:

       lea dx,msg4
       mov ah,9
       int 21h

       mov ah,1
       int 21h

       mov bl,al

       jmp go


exit:
```



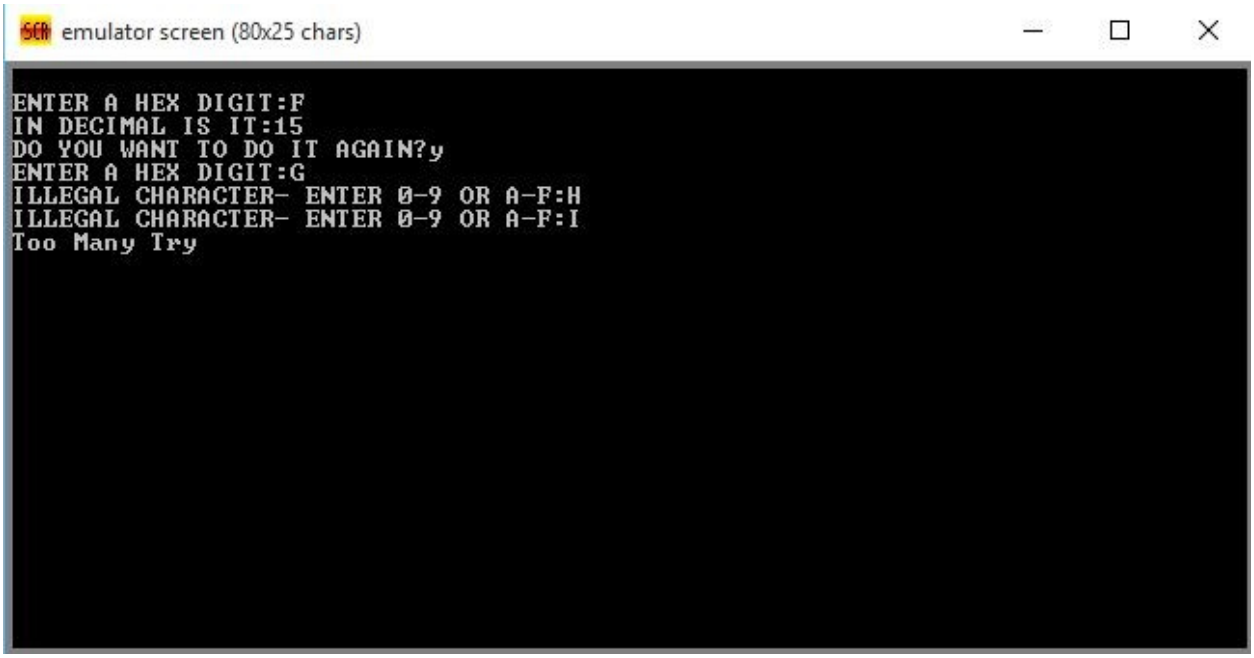

**11. Do programming exercise 10, except that if the user fails to enter a hex-digit character In three tries, display a message and terminate the program.**

```
.model small
.stack 100h
.data
msg1 db 10,13,'ENTER A HEX DIGIT:$'
msg2 db 10,13,'IN DECIMAL IS IT:$'
msg3 db 10,13,'DO YOU WANT TO DO IT AGAIN?$'
msg4 db 10,13,'ILLEGAL CHARACTER- ENTER 0-9 OR A-F:$'
msg5 db 10,13,'Too Many Try$'


.code



again:


  mov cx,0
  mov ax,@data
  mov ds,ax
  lea dx,msg1
  mov ah,9
```

```
   int 21h

   mov ah,1
   int 21h

   mov bl,al

   jmp go


go:

   cmp bl,'9'
   ja hex
   jb num
   je num




 hex:

    cmp bl,'F'
    ja illegal


   lea dx,msg2
   mov ah,9
   int 21h

    mov dl,49d
    mov ah,2
    int 21h

    sub bl,17d
    mov dl,bl
    mov ah,2
    int 21h

    jmp inp



 inp:

    lea dx,msg3
```

```
    mov ah,9
    int 21h

    mov ah,1
    int 21h

    mov cl,al
    cmp cl,'y'
    je again
    cmp cl,'Y'
    je again
    jmp exit


num:

   cmp bl,'0'
   jb illegal

   lea dx,msg2
   mov ah,9
   int 21h


   mov dl,bl
   mov ah,2
   int 21h

   jmp inp



illegal:

        inc cx
        cmp cx,3
        je i2

        lea dx,msg4
        mov ah,9
        int 21h

        mov ah,1
        int 21h

        mov bl,al
```

```
    jmp go


i2:
    lea dx,msg5
    mov ah,9
    int 21h
    jmp exit

exit:
```



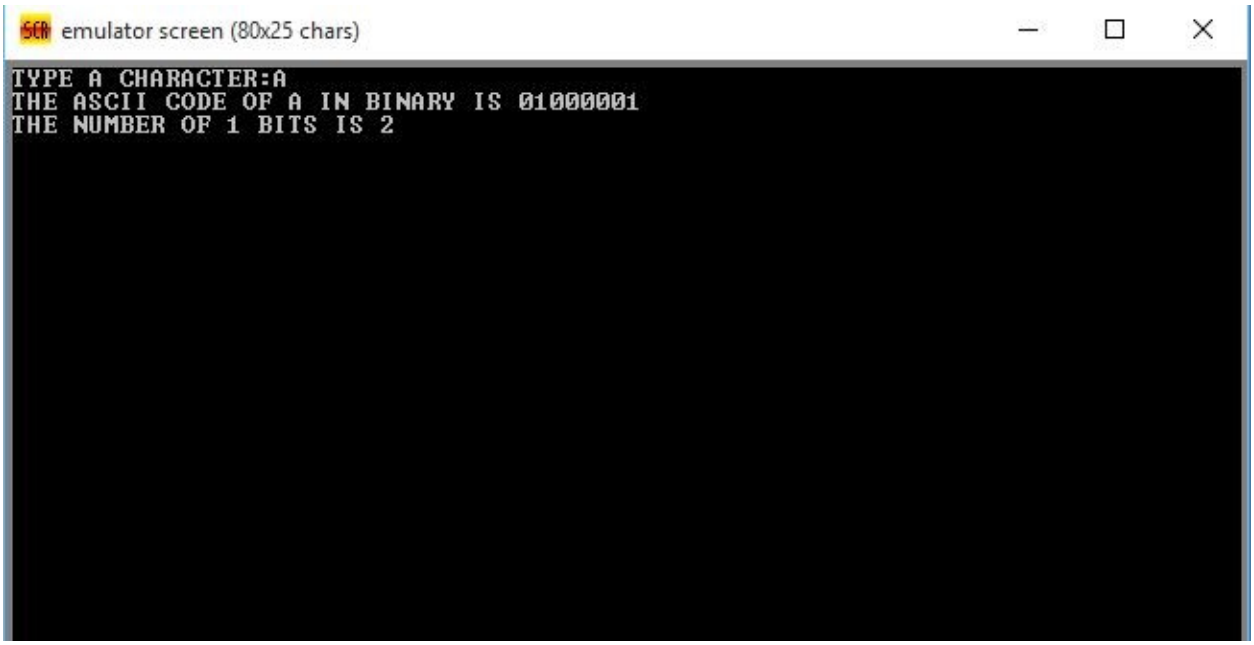

# Chapter 7

**8. Write a program thC!t prompts the user to enter a character, and on subsequent lines prints its ASCII code in binary, and the number**

**of 1 bits In Its ASCII code.**
***Sample execution:***
**TYPE A CHARACTER: A**
**THE ASCII CODE OF A IN BINARY IS 01000001**
**THE NUMBER OF l BITS IS 2**

```
.model small

.stack 100h

.data

 msg1 DB 'TYPE A CHARACTER:$'
 msg2 DB 0DH,0AH,'THE ASCII CODE OF $'
 msg3 DB ' IN BINARY IS $'
 msg4 DB 0DH,0AH,'THE NUMBER OF 1 BITS IS $'

.code

  main proc


  mov ax,@data
  mov ds,ax
  lea dx,msg1
  mov ah,9
  int 21h

  mov ah,1
  int 21h

  xor bx,bx
  mov bl,al

  lea dx,msg2
  mov ah,9
  int 21h

  mov dl,bl
  mov ah,2
  int 21h

  lea dx,msg3
  mov ah,9
  int 21h
```

```
mov cx,8 ; limit for loop i<=8 for 8 bit
mov bh,0


binary:

  shl bl,1
  jnc zero;  CF=0
  inc bh
  mov dl,31h
  jmp display


zero:

  mov dl,30h


display:

  mov ah,2
  int 21h


loop binary     ;loop will be terminated while cx>8


ADD bh,30h

lea dx,msg4
mov ah,9
int 21h

mov dl,bh
mov ah,2
int 21h
```




**9. Write a program that prompts the user to enter a character and prints the ASCII code of the character in hex on the next line. Repeat this process until the user types a carriage return.**

***Sample execution:***

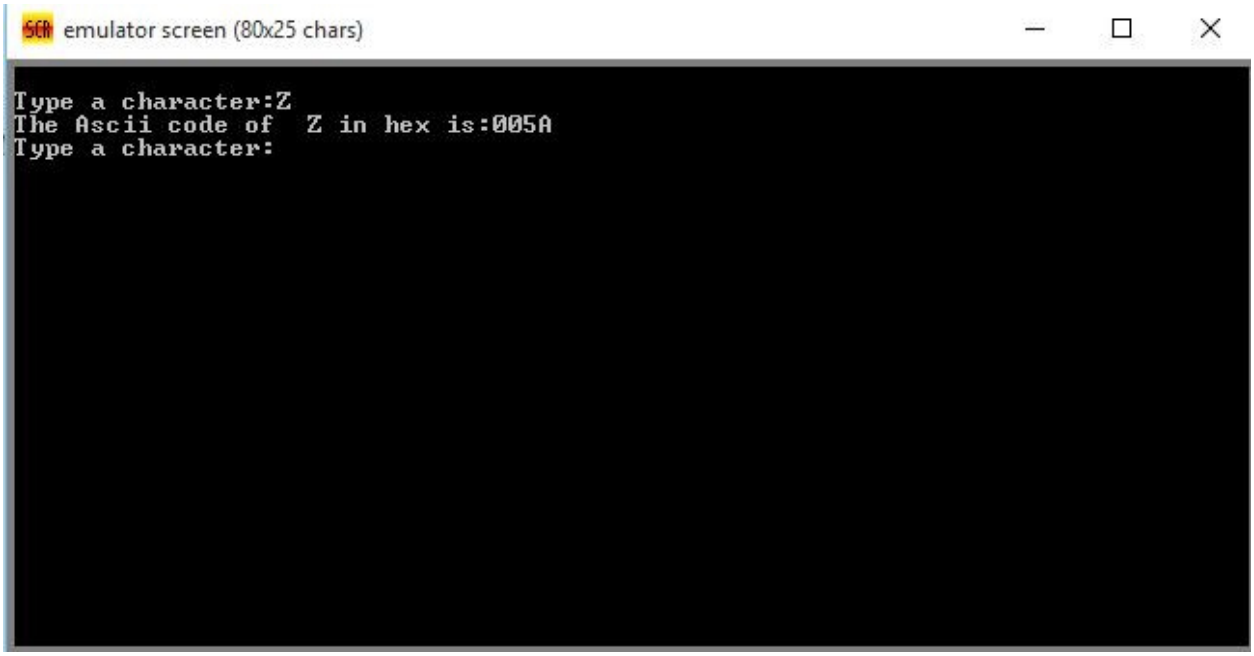
**TYPE A CHARACTER: Z**
**THE ASCII CODE OF Z IN HEX IS 5A**
**TYPE A CHARACTER:**

```
.model small

 .stack 100h

 .data

 msg1 db 10,13,'Type a character:$'
 msg2 db 10,13,'The Ascii code of  $'
 msg3 db ' in hex is:$'


 .code

  main proc


    mov ax,@data
    mov ds,ax
```

```
input:

    lea dx,msg1
    mov ah,9
    int 21h

    mov ah,1
    int 21h

    mov bl,al

    cmp bl,0dh
    je end

    lea dx,msg2
    mov ah,9
    int 21h

    mov dl,bl
    mov ah,2
    int 21h

    lea dx,msg3
    mov ah,9
    int 21h

    mov cx,4

 convert:

      mov dl,bh
      shr dl,1       ;shift left 4 times
      shr dl,1
      shr dl,1
      shr dl,1

      cmp dl,9
      jbe num

      add dl,55d
      jmp display

 num:

    add dl,30h
```

```
display:

   mov ah,2
   int 21h

   rcl bx,1    ;rotate carry left 4 times
   rcl bx,1
   rcl bx,1
   rcl bx,1

loop convert


jmp input


end:
     MOV AH,4CH
     INT 21H

  MAIN ENDP
END MAIN
```

**Output:**



**10. Write a program that prompts the user to type a hex number of four hex digits or less, and outputs it In binary on the next line. If the user enters an illegal character, he or she should be · prompted to begin again. Accept only uppercase letters.**
***Sample exenitio11:***
**TYPE A HEX NUMBER (0 TO FFFF): la**
**ILLEGAL HEX DIGIT, TRY AGAIN: lABC**
**IN BINAPY IT IS 0001101010111100**

```
.model small

.stack 100h

.data

 msg1 db 10,13,' Type a hex number (0 to FFFF):$'
 msg2 db 10,13,'Illegal hex digit,try again:$'
 msg3 db 10,13,'In Binary it is $'


.code

  mov ax,@data
  mov ds,ax
  jmp input

invalid:

    lea dx, msg2
    mov ah,9
    int 21h


input:

  lea dx,msg1
  mov ah,9
  int 21h

  xor bx,bx
  mov cl,4

  mov ah,1
  int 21h
```

```
convert:

  cmp al,0dh
  je end_input

  cmp al,'0'
  jb invalid

  cmp al,'F'
  ja invalid

  cmp al,39h
  ja letter

  and al,0fh
  jmp left


letter:

   sub al,55d  ;convert char to binary

left:

    shl bx,cl
    or bl,al

    mov ah,1
    int 21h
    jmp convert


end_input:

     lea dx,msg3
     mov ah,9
     int 21h

     xor dx,dx
     mov cx,16


print_binary:
```

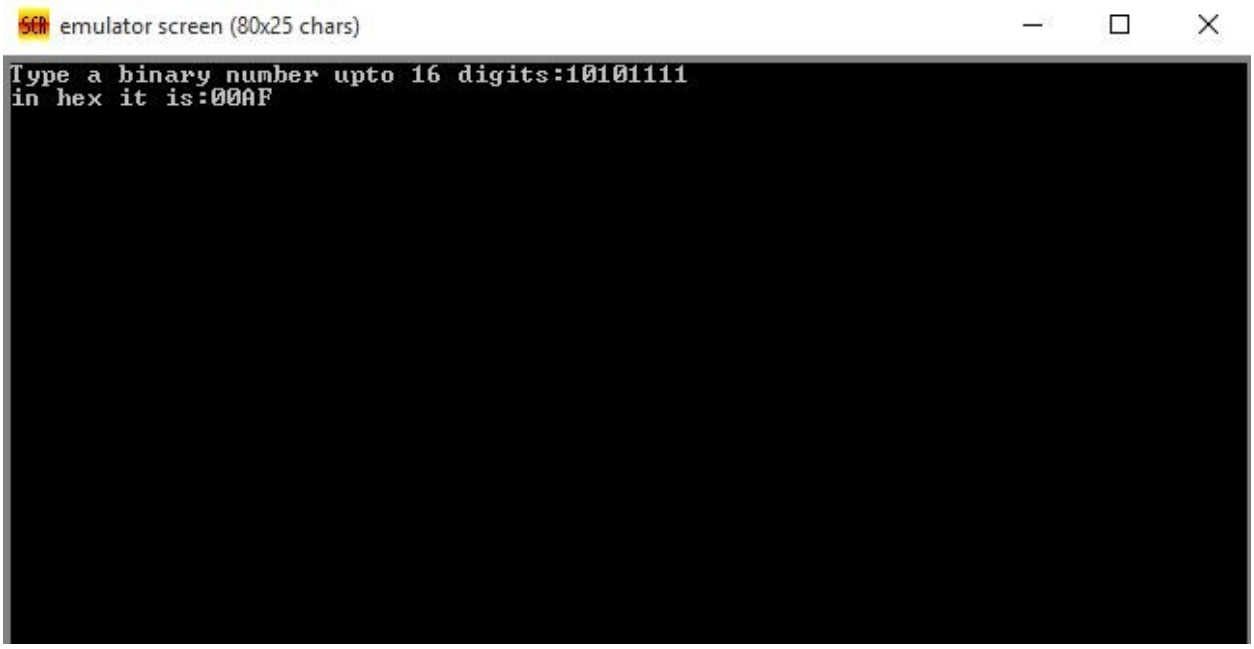
```
    shl bx,1 ;catch bx bit

    jc one ;cf=1

    mov dl,30h
    jmp display


one:
   mov dl,31h

display:

    mov ah,2
    int 21h

loop print_binary

main endp
end main
```


**11. Write a program that.prompts the user to type a binary number of 16 digits or less, and outputs It In hex on the next line. If the user enters an illegal character, he or she should be prompted to begin again .**

**... . .. .- -.-**
**TYPE A BINARY NUMBER, UP TO 16 DIGITS: 11100001**
**IN HEX IT IS El**

```
.model small

.stack 100h

.data

  msg1 db 'Type a binary number upto 16 digits:$'
  msg2 db 10,13,'in hex it is:$'


.code

 main proc


    mov ax,@data
    mov ds,ax
    lea dx,msg1
    mov ah,9
    int 21h

    xor bx,bx
    mov ah,1
    int 21h


input:

    cmp al,0dh
    je exit

    and al,0fh
    shl bx,1
    or  bl,al

    int 21h

    jmp input


exit:

   lea dx,msg2
```

```
   mov ah,9
   int 21h

   mov cx,4


convert:

    mov dl,bh
    shr dl,1
    shr dl,1
    shr dl,1
    shr dl,1

    cmp dl,9
    jbe num
    add dl,55d
    jmp display


num:

   add dl,30h



display:


     mov ah,2
     int 21h

     rcl bx,1
     rcl bx,1
     rcl bx,1
     rcl bx,1


loop convert

main endp
end main
```




**12. Write a program that prompts the user to enter two.binary numbers of up to 8 digits each, and prints their sum on the next line in binary. If the user enters an illegal character, he or she should be prompted to begin again. Each input ends with a carriage return.**

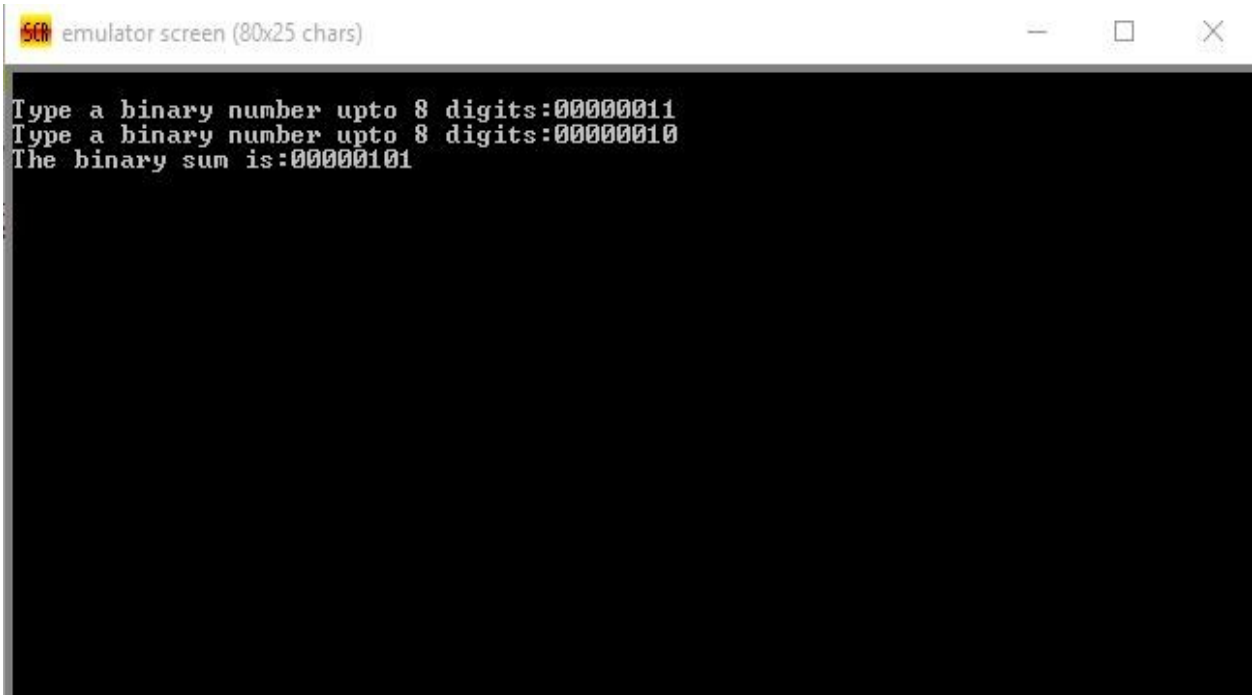
**TYPE 'A BINARY NUMBER, UP TO 8 DIGITS: 11001010**
**TYPE 'A BINARY NUMBER, UP TO 8 DIGITS: 10011100**
**THE BINARY SUM IS 101100110**

```
.model small

.stack 100h

.data

  msg1 db 10,13,'Type a binary number upto 8 digits:$'
  msg2 db 10,13,'The binary sum is:$'


.code

  main proc
```

```
  mov ax,@data
  mov ds,ax
  lea dx,msg1
  mov ah,9
  int 21h

  mov ah,1
  int 21h

  xor bx,bx
  mov cx,8

input1:

  mov ah,1
  int 21h

  cmp al,0dh
  je break

  and al,0fh ;convert to binary
  shl bl,1 ;make room for new value

  or bl,al ;insert value

loop input1


break:

  lea dx,msg1
  mov ah,9
  int 21h

  mov cx,8


input2:


      mov ah,1
      int 21h

      cmp al,0dh
      je break2

      and al,0fh      ;convert to binary
      shl bh,1        ;make room for new value
```

```
      or bh,al        ;insert value

   loop input2



break2:

   lea dx,msg2
   mov ah,9
   int 21h


sum:

  add bl,bh    ;sum binary 00000011+00000010, bl=000000101
  jnc zero     ;if sum has no carry then no need to print zero
  mov dl,31h
  mov ah,2
  int 21h    ;if sum has  carry 1 then  need to print 1


zero:

      mov dl,30h

mov cx,8

print:

  shl bl,1     ;sending one by onee bit to print 000000101
  jnc z
  mov dl,31h
  jmp display

z:
      mov dl,30h

display:
    mov ah,2
    int 21h

loop print

main endp
end main
```

**Output**


emulator screen (80x25 chars)
Type a binary number upto 8 digits:00000011
Type a binary number upto 8 digits:00000010
The binary sum is:00000101