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ASSEMBLY LANGUAGE CODE

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:

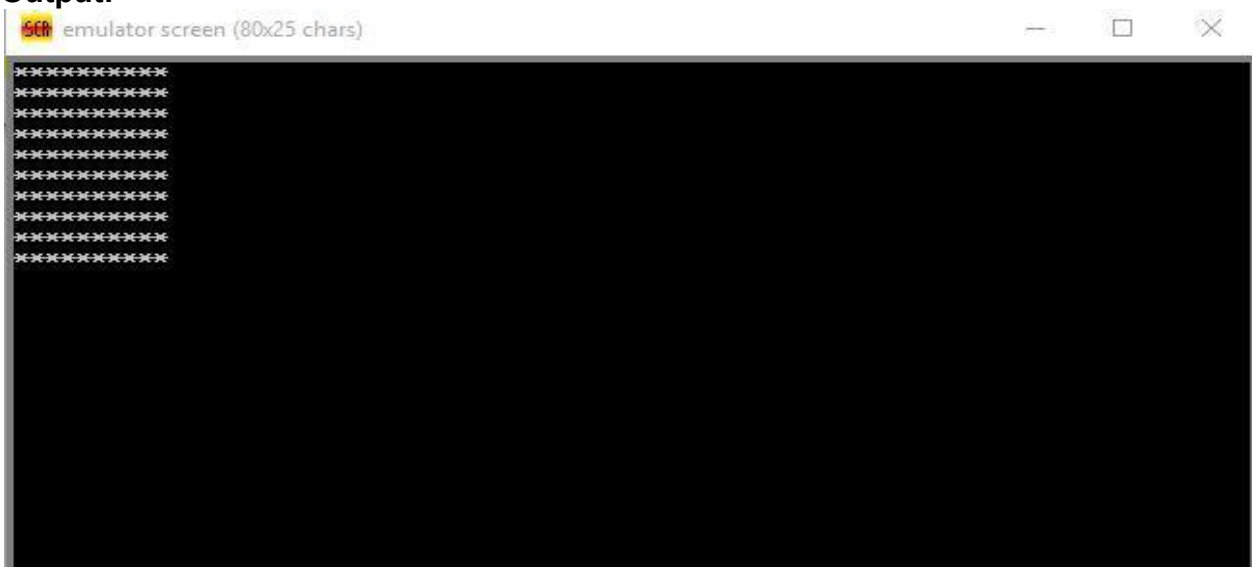
11. Write *a* program to display *a* t 0 x 10 solid box of asterisks.
Hint: **declare *a* string in the data segment that specifies the box, and display it with INT 2lh, function 9h.**

```
.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:

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:
```

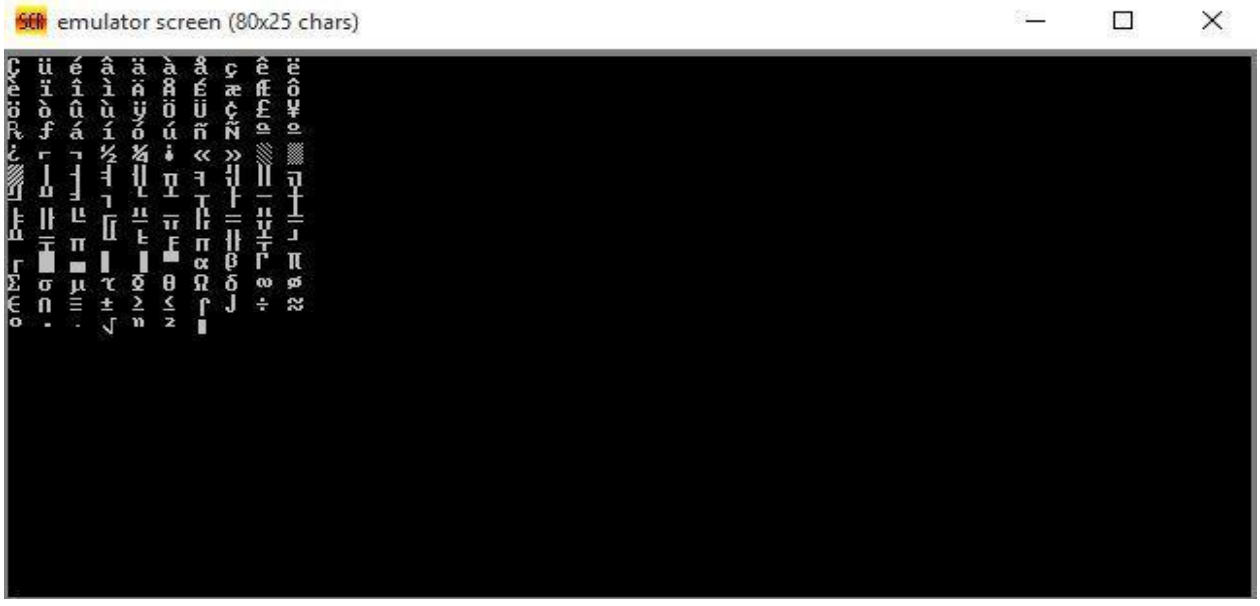
Output:

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



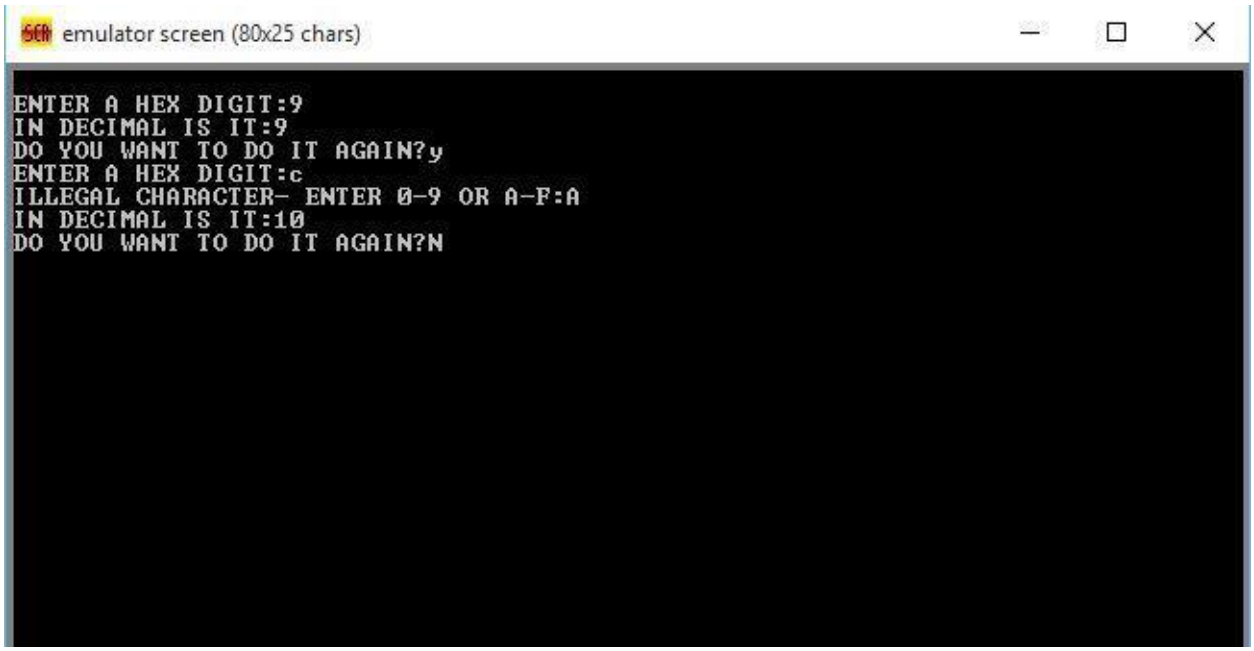
10. Write a program that will prompt the user to enter a hex digit character ("0"· ... "9" or "A" ... "F"), display it on the next line

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:
```

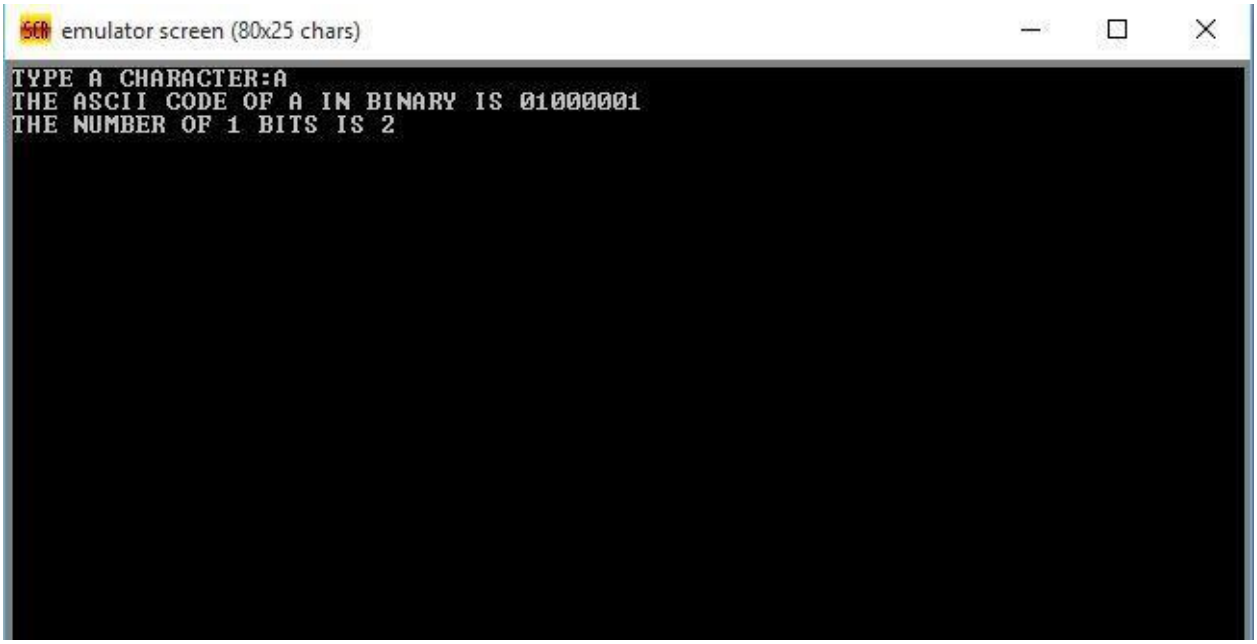
8. Write a program thC!t prompts the user to enter a character, and on subsequent lines prints its ASCII code in binary, and the number of 1 bits In Its ASCII code.

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:

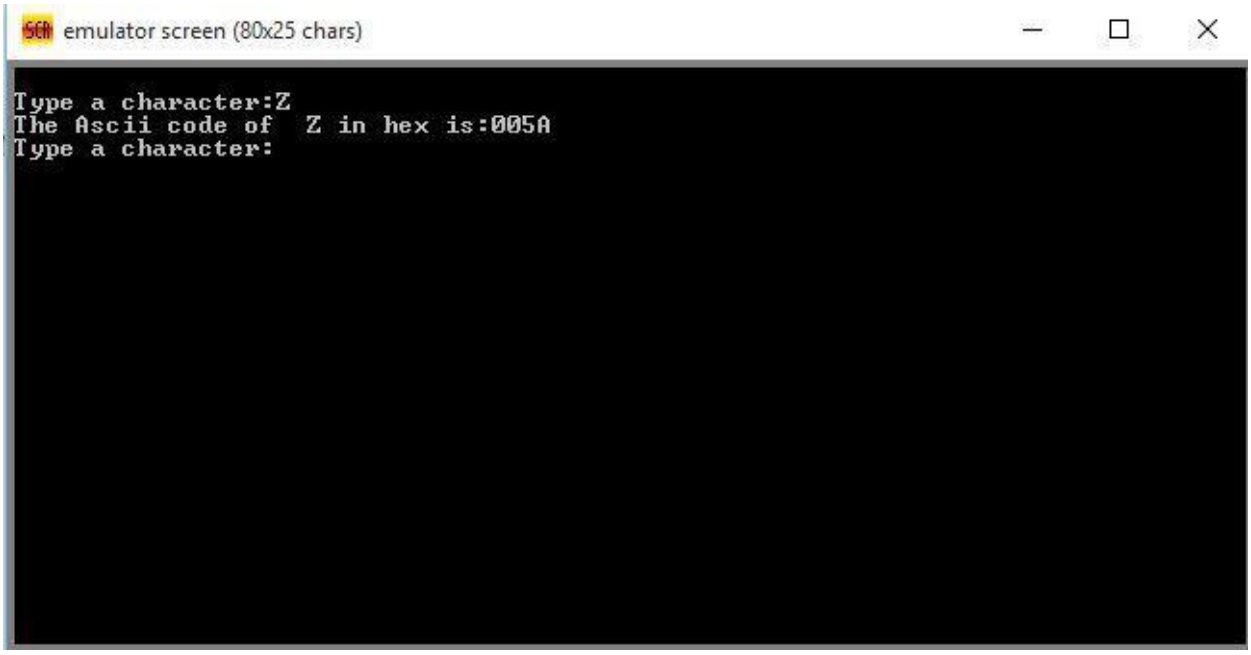
TYPE A CHARACTER: Z
THE ASCII CODE OF Z IN HEX IS 5A
TYPE A CHARACTER:

```
.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

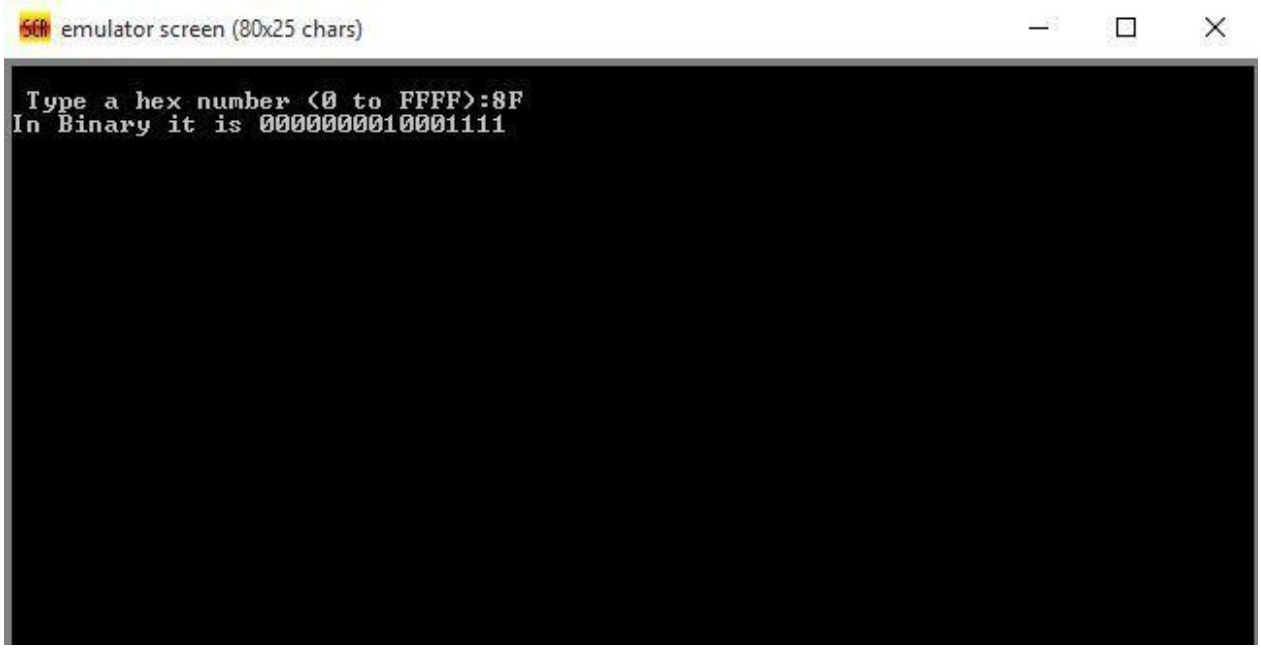
IN BINAPY IT IS 0001101010111100

```
.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.

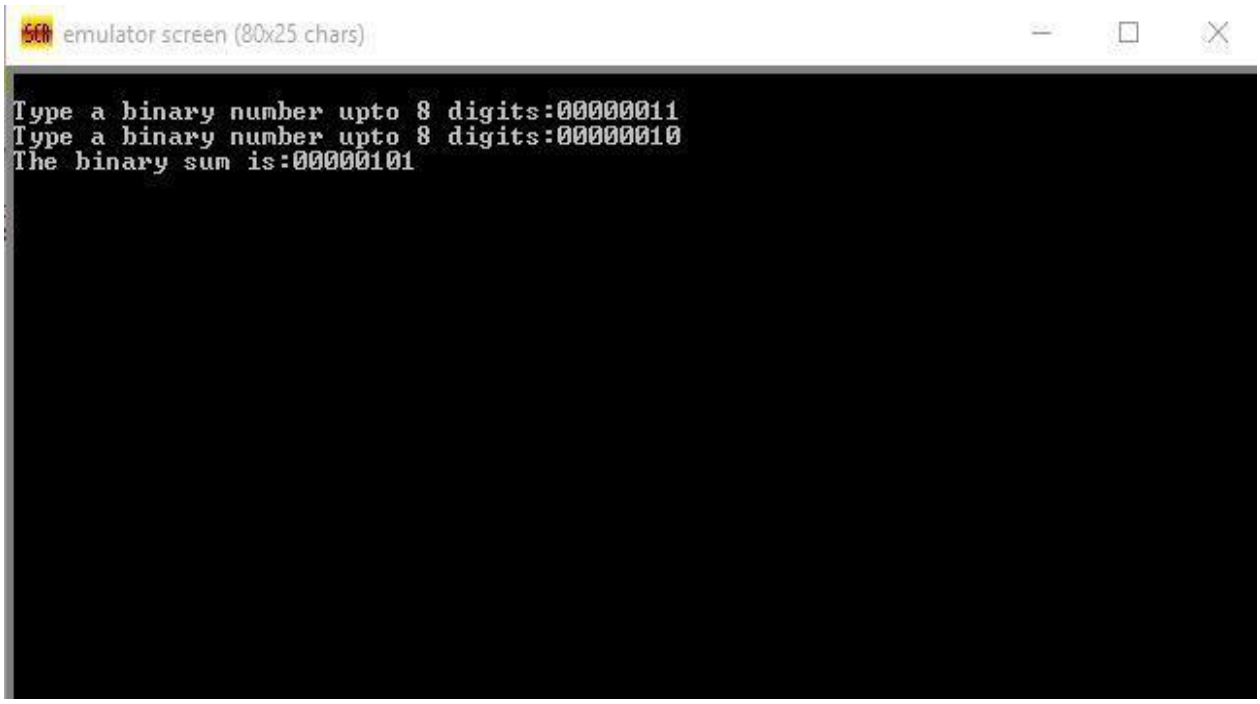
TYPE 'A BINARY NUMBER, UP TO 8 DIGITS: 11001010
TYPE 'A BINARY NUMBER, UP TO 8 DIGITS: 10011100
THE BINARY SUM IS 101100110

```
.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



8. Write a program that lets the user type s ome text, consisting of words separated by blanks, ending with a carriage return, and displays the text in the same word order as entered, but with the letters ·in each word reversed. For example, "this is a test" becomes "siht si a tset".

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

msg1 db 'Enter String:$'
msg2 db 'Reverse String:$'
count DW 0

main proc

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

    xor  cx,cx
    mov ah,1
    int 21h
```

```
input:

    cmp al,0dh
    je end_input
    push ax
    inc cx
    int 21h
    jmp input

end_input:
mov dx,0dh              ;carriage and new line
   mov ah,2
    int 21h

    mov dx,0ah
    mov ah,2
    int 21h
    mov bx,50h
    xchg bx,sp           ;swap  sp pointer
    push 0020h
    xchg bx,sp
```

```
inc count

loop1:

    pop dx                  ;swap bx and sp
    xchg bx,sp
    push dx                 ; push to new stack
    xchg bx,sp
    inc count

  loop loop1
    lea dx, msg2
    mov ah,9
    int 21h

     mov cx,count
     mov count,0
     push 0020h             ; push 0020H onto the STACK
     inc count

     reverse:

      xchg bx, sp           ; swap bx and sp
      pop dx                ; pop a value from stack into dx
      xchg bx, sp           ; swap bx and sp
      cmp dl, 20h
       jne skip

       mov ah, 2

       loop2:
         pop dx             ; pop and show output
         int 21h

         dec count
         jnz loop2

         mov dx, 0020h

       skip:

       push dx
       inc count
```

```
    loop reverse

    mov ah, 4ch
    int 21h
  main endp
end main
```

10. The following method can be used to generate random numbers in the range 1 to 32767.

Start with any number in this range.
Shift left once.
Replace bit 0 by the XOR of bits 14 and 15.
Clear bit 15.

Write the following procedures:
a. A procedure READ that l<:ts the user enter a binary number and stores it in AX. You may use the code for binary input given in section 7.4.
b. A procedure RANDOM that receives a number in AX and returns a random number in AX.
***c.* A procedure WRITE that displays AX in binary. You may use the algorithm given in section 7.4.**
Write a program that displays a '?', calls READ to read a binary numl>cr, and calls RANDOM and WRITE to compute and display 100 random numbers. The numbers should be displayed four per line, with four blanks scparatlng the numbers.

```
.model small
```

```
.stack 100h

.data

msg1 db 'Enter a binary number:$'
msg2 db 10,13,'Random numbers are:$'
msg3 db 10,13,'illegal entry: try again:$'

va dw ?
vb dw ?
vc dw ?
.code

main proc

mov ax,@data
mov ds,ax

mov vb,1      ; mov 1 to word vb
call rproc    ; callling new procedure

mov ah,9
lea dx,msg2
int 21h

star:

mov vc,1
cmp vb,25
jg las
inc vb

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

start:

call random      ; calling random proc
call write
mov ah,2
mov dl,' '
int 21h
inc vc
```

```
cmp vc,4
jle start
jmp star

las:
mov ah,1
int 21h
mov ah,4ch
int 21h
main endp

rproc proc

mov ah,9
lea dx,msg1
int 21h
soo:
mov cl,16
xor bx,bx

top:
mov ah,1
int 21h

cmp al,0dh
je last
cmp al,'0'
jne as
jmp asd

as:
cmp al,'1'
jne error

asd:
and al,0fh
shl bx,1
or bl,al
loop top
jmp last

error:
mov ah,9
lea dx,msg3
```

```
int 21h

jmp soo

last:
ret

rproc endp

random proc

shl bx,1

xor dx,dx
mov a,bx
mov dx,bx
shl va,1
xor dx,a
rol dx,1
jc setbx

and bx,0fffeh
jmp go

setbx:

or bx,0001h

go:
ret

random endp

write proc

mov cl,16

top1:

rol bx,1
jc one

mov ah,2
mov dl,'0'
```

```
int 21h
jmp en
one:

mov  ah,2
mov dl,'1'
int 21h

en:
loop top1

ret                ; returning to procedure

write  endp

end main
```

Output:


emulator screen (80x25 chars)
0000000101000
000 0000001010000000 0000010100000000 0000101000000000
0001010000000000 00101000
00000000 0101000000000001 1010000000000011
0100000000000111 1000000000001111 000
0000000011110 0000000000111100
0000000001111000 0000000011110000 0000000111100000
0 0000001111000000
0000011111000000 0000111110000000 0001111000000000 0011110000000000
0111100000000001 1111000000000010 1110000000000100 1100000000001000
1000000000010001 0000000000100010 0000000001000100 0000000010001000
0000000100010000 0000001000100000 0000010001000000 0000100010000000
0001000100000000 0010001000000000 0100010000000001 1000100000000011
0001000000000110 0010000000001100 0100000000011001 1000000000110011
0000000001100110 0000000011001100 0000000110011000 0000001100110000
0000011001100000 0000110011000000 0001100110000000 0011001100000000
0110011000000001 1100110000000010 1001100000000101 0011000000001010
0110000000010101 1100000000101010 1000000001010101 0000000010101010
0000000101010100 0000001010101000 0000010101010000 0000101010100000
0001010101000000 0010101010000000 0101010100000001 1010101000000011
0101010000000111 1010100000001111 0101000000011111 1010000000111111
0100000001111111 1000000011111111 0000000111111110 0000001111111100
0000011111111000 0000111111110000 0001111111100000 0011111111000000
0111111110000001 1111111100000010 1111111000000100 1111110000001000
```
```

8. Modify procedure INDEC so that it will check for overflow.

Modified Decimal Input Code (INDEC) For Overflow :

```
indec proc
   push  bx
   push   cx
   push dx

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

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

   xor bx,bx   ; bx is for total=0
   xor cx,cx   ; cx is for detecting sign
   mov ah,1
   int 21h
    cmp al,'-'  ; if minus sign set it
   je min
   cmp al,'+'  ; if plus sign set it
   je pl
   jmp convert  ; else convert to decimal
   min:
  mov cx,1     ; negative is true

  pl:
  int 21h
   convert:
   cmp al,'0'
```

```
 jl  illegal
 cmp  al,'9'
 jg illegal

 and ax,000Fh  ; convert ascii char to decimal
 push ax       ; save on stack

 mov ax,10     ; set value 10 for multiply
 imul bx       ; multiply by 10, ax=total*10

 jo of1        ; jump if overflow

 pop bx        ; bx= converted decimal digit
 add bx,ax     ; total=total*10+ decimal digit
 jo of2        ; jump if overflow
 mov ah,1
 int 21h
 cmp al,0dh
 je cr
  jmp convert
   cr:

   mov ax,bx  ; move decimal number to ax
   or cx,cx    ; negative sign
    je exit     ; if not negative
   neg ax
exit:
   pop dx
   pop cx     ;restore registers
   pop bx
 ret
 of1:
   pop bx
  mov ah,9
  lea dx,msg1
  int 21h
  jmp start
```

```
 of2:
    mov ah,9
    lea dx,msg1
    int 21h
    jmp start
 illegal:
     mov ah,2
   mov dl,0ah
   int  21h
   jmp start
indec endp
```

Decimal Output Code (OutDEC):

```
outdec proc

   push ax
   push bx
   push  cx
   push dx

   or ax,ax
   jge valid   ; if ax>=0

   push ax
   mov dl,'-'
   mov ah,2
   int 21h

   pop ax
   neg ax

 valid:

    xor cx,cx
    mov bx,10d   ; bx is divisor
```

```
divide:

    xor dx,dx    ; dx is remainder

    div bx       ; divide ax by bx, ax =quotient, dx=remainder

    push dx      ; push remainder

    inc cx
    or ax,ax     ; untill ax is not zero
    jne divide
  mov ah,2
   print:
      pop dx
     or dl,30h   ;print digits
     int 21h

  loop print
    pop dx
    pop cx
    pop bx
    pop ax
    ret
    outdec endp
```

Input And Output Decimal:

```
.model small
.stack 100h
.data
msg1 db 10,13,'Invalid!! Overflow',0AH,'$'
.code
  main proc
    mov ax,@data
    mov ds,ax
    call indec
    push ax
    mov ah,2
    mov dl,0dh
    int 21h
```

```
  mov dl,0ah
  int 21h
  pop ax
  call outdec
  mov ah,4ch
  int 21h
  main endp
  include outdec.asm
 include indec.asm
 end main
```

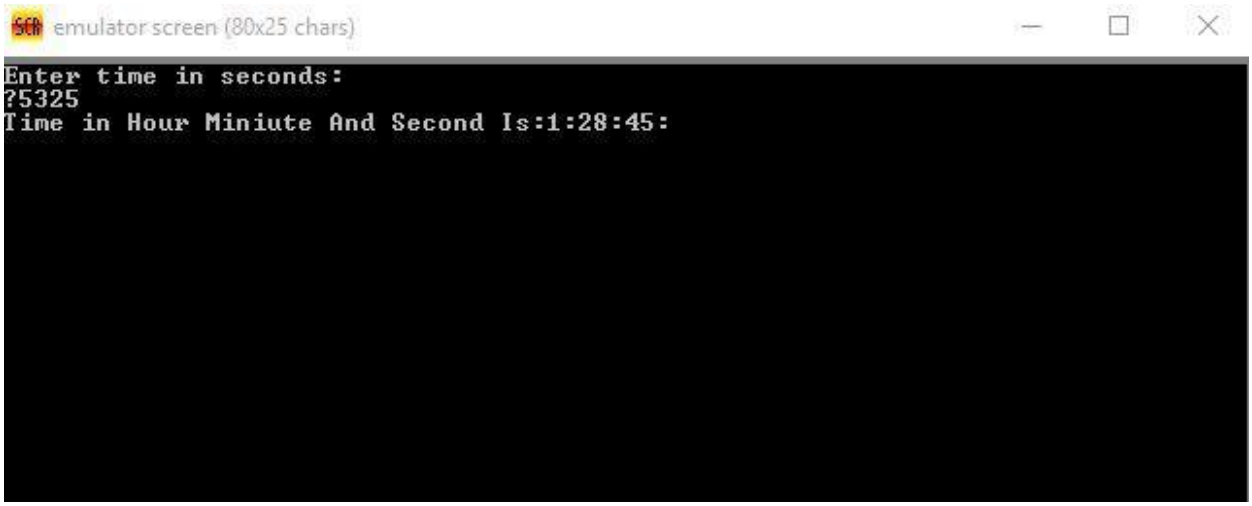
Output:

9. Write a program that lets the user enter time in seconds, up to 65535, and outputs the time as hours, minutes, and seconds. Use INDEC and OUIDEC to do the 1/0.

```
.model small
.stack 100h
.data
msg1 db 'Enter time in seconds:$'
msg2 db 10,13,'Time in Hour Miniute And Second Is:$'

.code
  main proc
    mov ax,@data
    mov ds,ax
    lea dx,msg1
    mov ah,9
    int 21h

    call indec
      push ax
```

```
  xor cx,cx
  mov  cl,3
  pop ax

l1:

  xor dx,dx     ; dx is remainder
  mov bx,60d    ; bx is divisor
  div bx        ; ax =quotient
  push dx       ; push remainder
loop l1

mov ah,9
lea dx,msg2
int 21h

mov cl,3

time:
   pop ax        ; get remainder
   call outdec
   mov ah,2
   mov dl,':'
   int 21h
loop time

mov ah,4ch
int 21h
main endp

   include outdec.asm
   include indec.asm
end main
```

Output:



12. Write a program to find the greatest common divisor (GCD) of two integers *M* and *N*, according to the following algorithm:
1. Divide *M* by *N*, getting quotient *O* and remainder *R*.
2. If *R* = 0,. stop. *N* is the GCD of *M* and *N*.
3. If *R* <> O, · replace *M* by *N*, *N* by *R*, and repeat step 1.

Use INDEC to enter M and N and OUTDEC to print the GCD.

```
.model small
.stack 100h
.data
msg1 db 'Enter M=$'
msg2 db 10,13,'Enter N=$'
msg3 db 10,13,'GCD is=$'

a dw ?
b dw ?

.code
   main proc
      mov ax,@data
      mov ds,ax
      lea dx,msg1
      mov ah,9
      int 21h
```

```
    call indec      ;input
    push ax
    lea dx,msg2
    mov ah,9
    int 21h

    call indec      ;input
     push ax
     xor bx,bx
     pop bx
     pop ax

   cmp ax,bx        ; if ax is small then swap
   jl swap
   jmp gcd

swap:
    mov a,ax        ;swap ax and bx
    mov ax,bx
    mov bx,a

gcd:
   xor dx,dx        ;remainder dx
   mov b,bx
   div b

   cmp dx,0         ; if remainder is zero print gcd
   je go
   mov ax,bx        ; replace divident by divisor
   mov bx,dx        ; replace divisor by remainder
jmp gcd

go:
  lea dx,msg3       ;print gcd
  mov ah,9
  int 21h
  mov ax,b
  call outdec

  mov ah,4ch
  int 21h


  main endp
```

```
include outdec.asm
include indec.asm

end main
```

Output:

THE END

BEST OF LUCK