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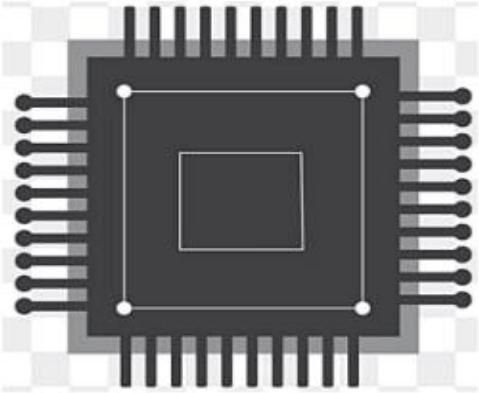


MICROPROCESSOR

PRATICAL FILE FOR PAPER CODE 32347504

Submitted By :

Harsh Jaiswal

Examination Roll no. 20058570011

BSc (Hons) Computer Science

Submitted To :

Dr. Vandana Gandotra

Department of Computer Science

Question1 Write a program for 32-bit binary Addition ,Subtraction, Division ,and Multiplication .

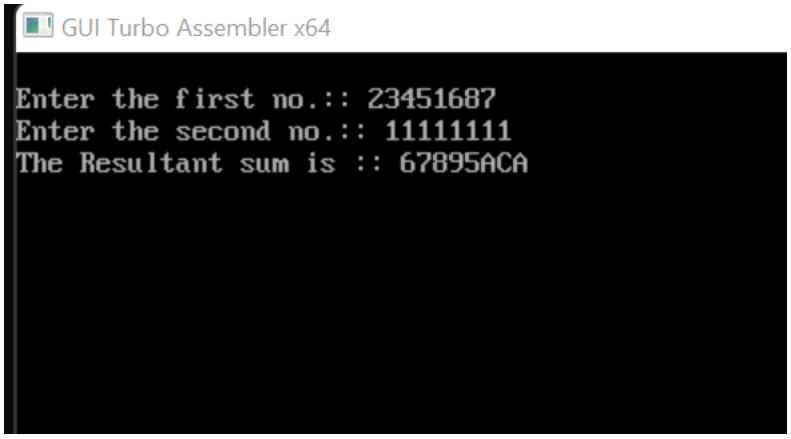
Solution:

32-Bit Binary Addition:

```
.model small
  .386
  .data

  DATA1 dd 00000000H
  msg db 10,13,"Enter the first no.:: $"
  msg1 db 10,13,"Enter the second no.:: $"
  msg2 db 10,13,"The Resultant sum is :: $"

  .code
  .startup
  MOV AH,09
  MOV DX,OFFSET msg
  INT 21H
  MOV EBX,0
  MOV CX,8

  AGAIN: MOV AH,01 ;1ST NO. ENTERED
  INT 21H
  CMP AL,'A'
  JGE L5
  SUB AL,30H
  JMP L6
  L5: SUB AL,37H
  L6: SHL EBX,4
  ADD BL,AL
```

```
LOOP AGAIN
MOV DATA1,EBX
MOV AH,09
MOV DX,OFFSET msg1
INT 21H
MOV EBX,0
MOV CX,8

AGAIN1:MOV AH,01 ;2nd NO. ENTERED
INT 21H
CMP AL,'A'
JGE L7
SUB AL,30H
JMP L8
L7: SUB AL,37H
L8: SHL EBX,4
ADD BL,AL

LOOP AGAIN1
ADD EBX,DATA1 ;ADDITION
MOV AH,09
MOV DX,OFFSET msg2
INT 21H
MOV CX,8

AGAIN2: ROL EBX,4
MOV DL,BL
AND DL,0FH
CMP DL,09
JG L1 ; to o/p given no.
```

```
ADD DL,30H
JMP PRINT
L1: ADD DL,37H
PRINT: MOV AH,02
INT 21H
LOOP AGAIN2

END
```

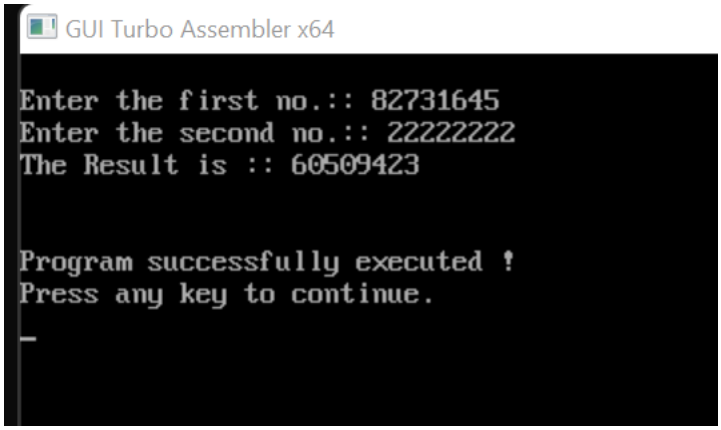


32-Bit Binary Subtration:-

```
.model small
.386
.data
DATA1 dd 00000000H
msg db 10,13,"Enter the first no.:: $"
msg1 db 10,13,"Enter the second no.:: $"
msg2 db 10,13,"The Result is :: $"
.code
.startup
MOV AH,09
MOV DX,OFFSET msg
```

```
 INT 21H
MOV EBX,0
 MOV CX,8
 AGAIN: MOV AH,01 ;1ST NO. ENTERED
 INT 21H
 CMP AL,'A'
 JGE L5
 SUB AL,30H
 JMP L6
 L5: SUB AL,37H
 L6: SHL EBX,4
 ADD BL,AL
 LOOP AGAIN
 MOV DATA1,EBX
 MOV AH,09
 MOV DX,OFFSET msg1
 INT 21H
 MOV EBX,0
 MOV CX,8
 AGAIN1:MOV AH,01 ;2nd NO. ENTERED
 INT 21H
 CMP AL,'A'
 JGE L7
 SUB AL,30H
JMP L8
 L7: SUB AL,37H
 L8: SHL EBX,4
 ADD BL,AL
 LOOP AGAIN1
 SUB EBX,DATA1 ;ADDITION
 MOV AH,09
```

```
MOV DX,OFFSET msg2
INT 21H
MOV CX,8
AGAIN2: ROL EBX,4
MOV DL,BL
AND DL,0FH
CMP DL,09
JG L1 ; to o/p given no.
ADD DL,30H
JMP PRINT
L1: ADD DL,37H
PRINT: MOV AH,02
INT 21H
LOOP AGAIN2
END
```



32-bit Multiplication:-

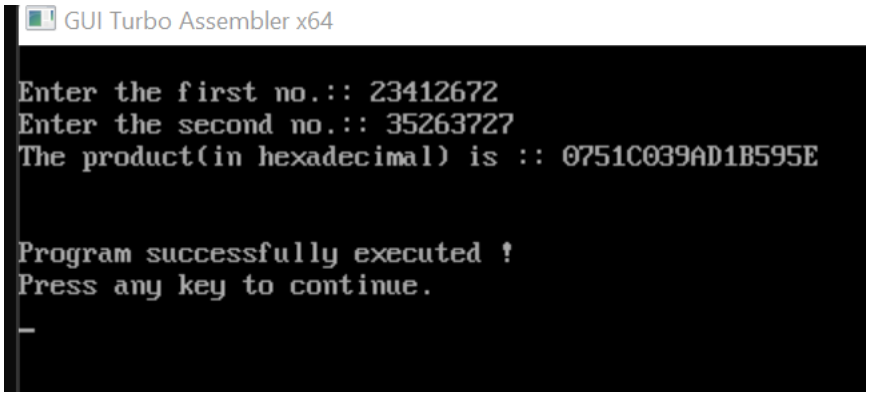
```
.model small
  .386
  .data

  DATA1 dd 00000000H
```

```
DATA2 dd 00000000H
PROD1 dd ?
PROD2 dd ?

msg db 10,13,"Enter the first no.:: $"
msg1 db 10,13,"Enter the second no.:: $"
msg2 db 10,13,"The product(in hexadecimal) is :: $"

.code
.startup
MOV AH,09
MOV DX,OFFSET msg
INT 21H
MOV EBX,0
MOV CX,8

AGAIN: MOV AH,01 ;1ST NO. ENTERED
INT 21H
CMP AL,'A'
JGE L5
SUB AL,30H
JMP L6
L5: SUB AL,37H
L6: SHL EBX,4

ADD BL,AL
LOOP AGAIN
MOV DATA1,EBX
MOV AH,09
MOV DX,OFFSET msg1
INT 21H
```

```
MOV EBX,0
MOV CX,8

AGAIN1:MOV AH,01 ;2nd NO. ENTERED
INT 21H
CMP AL,'A'
JGE L7
SUB AL,30H
JMP L8
L7: SUB AL,37H
L8: SHL EBX,4
ADD BL,AL
LOOP AGAIN1

MOV DATA2,EBX
MOV EBX,0
MOV EDX,0
MOV EAX,0
MOV EAX,DATA1
MOV EBX,DATA2

MUL EBX
MOV PROD1,EDX
MOV PROD2,EAX
MOV AH,09
MOV DX,OFFSET msg2
INT 21H
MOV EBX,PROD1
MOV CX,8

AGAIN2: ROL EBX,4
```

```
MOV DL,BL
AND DL,0FH ; to o/p the result
CMP DL,9
JBE L1
ADD DL,37H
MOV AH,02
INT 21H
JMP L2

L1: ADD DL,30H
MOV AH,02
INT 21H

L2: LOOP AGAIN2
MOV EBX,PROD2
MOV CX,8
AGAIN3: ROL EBX,4
MOV DL,BL
AND DL,0FH ; to o/p the result
CMP DL,9
JBE L3
ADD DL,37H
MOV AH,02
INT 21H
JMP L4

L3: ADD DL,30H
MOV AH,02
INT 21H
L4: LOOP AGAIN3
```

```
MOV AH,4CH
INT 21H
END
```



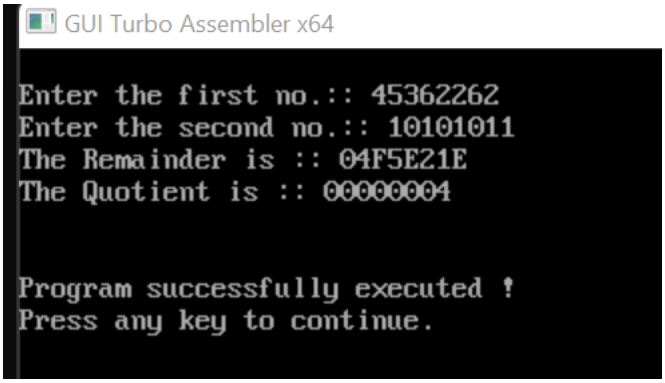
32-bit division

```
model small
.386
.data

DATA1 dd 00000000H
DATA2 dd 00000000H
REM dd ?
QUO dd ?

msg db 10,13,"Enter the first no.:: $"
msg1 db 10,13,"Enter the second no.:: $"
msg2 db 10,13,"The Remainder is :: $"
msg3 db 10,13,"The Quotient is :: $"

.code
.startup
MOV AH,09
```

```
MOV DX,OFFSET msg
INT 21H
MOV EBX,0
MOV CX,8

AGAIN: MOV AH,01 ;1ST NO. ENTERED
INT 21H
CMP AL,'A'
JGE L5
JMP L6

L5: SUB AL,37H
L6: SUB AL,30H
SHL EBX,4
ADD BL,AL
LOOP AGAIN
MOV DATA1,EBX
MOV AH,09
MOV DX,OFFSET msg1
INT 21H
MOV EBX,0
MOV CX,8

AGAIN1:MOV AH,01 ;2nd NO. ENTERED
INT 21H
CMP AL,'A'
JGE L7
SUB AL,30H
JMP L8

L7: SUB AL,37H
```

```
L8: SHL EBX,4
ADD BL,AL
LOOP AGAIN1
MOV DATA2,EBX
MOV EBX,0
MOV EDX,0
MOV EAX,0
MOV EAX,DATA1
MOV EBX,DATA2
DIV EBX
MOV REM,EDX ;REM=REMAINDER
MOV QUO,EAX ;QUO=QUOTIENT
MOV AH,09
MOV DX,OFFSET msg2
INT 21H
MOV EBX,REM
MOV CX,8
AGAIN2: ROL EBX,4
MOV DL,BL
AND DL,0FH ; to o/p the result in rem
CMP DL,9
JBE L1
ADD DL,37H
MOV AH,02
INT 21H
JMP L2

L1: ADD DL,30H
MOV AH,02
INT 21H
L2: LOOP AGAIN2
```

```
MOV AH,09
MOV DX,OFFSET msg3
INT 21H
MOV EBX,QUO
MOV CX,8
AGAIN3: ROL EBX,4
MOV DL,BL
AND DL,0FH ; to o/p the result in quo
CMP DL,9
JBE L3
ADD DL,37H
MOV AH,02
INT 21H
JMP L4
L3: ADD DL,30H
MOV AH,02
INT 21H
L4: LOOP AGAIN3
MOV AH,4CH
INT 21H
END
```



Question 2 :-Write a program for 32-Bit BCD Addtion and Subtraction.

Solution:-

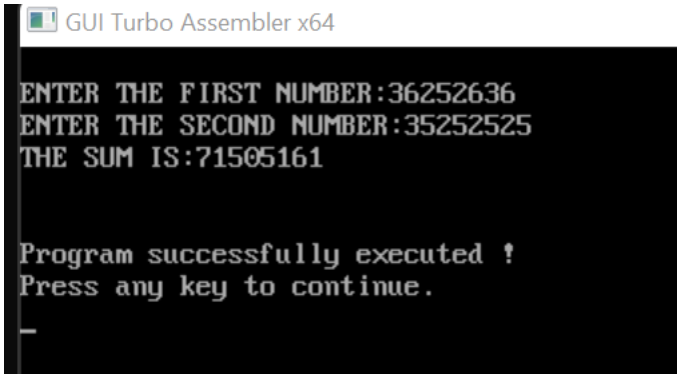
32-Bit BCD Addition

```
.MODEL SMALL
  .386
  .DATA

  MESS0 DB 10,13,"ENTER THE FIRST NUMBER:$"
  MESS1 DB 10,13,"ENTER THE SECOND NUMBER:$"
  MESS2 DB 10,13,"THE SUM IS:$"

  A DD ?
  B DD ?
  C DD ?
  COUNT DB 04h

  .CODE
  .STARTUP
  LEA DX,MESS0
  MOV AH,09
  INT 21H

  MOV EBX,0
  MOV CX,8
  AGAIN:
  MOV AH,01
  INT 21H
  CMP AL,'A'
  JGE L5
  SUB AL,30H
```

```
JMP L6

L5: SUB AL,37H
L6: SHL EBX,4
ADD BL,AL
LOOP AGAIN
MOV A,EBX

LEA DX,MESS1
MOV AH,09
INT 21H

MOV EBX,0
MOV CX,8
AGAINS:
MOV AH,01
INT 21H
CMP AL,'A'
JGE L51
SUB AL,30H
JMP L61

L51: SUB AL,37H
L61: SHL EBX,4
ADD BL,AL
LOOP AGAINS
MOV B,EBX

MOV AX,WORD PTR A
MOV BX,WORD PTR B
```

```
ADD AL,BL
DAA
MOV BL,AL

ADC AH,BH
MOV AL,AH
DAA
MOV BH,AL

MOV WORD PTR C,BX

MOV AX,WORD PTR A+2
MOV BX,WORD PTR B+2
ADC AL,BL
DAA
MOV BL,AL
ADC AH,BH
MOV AL,AH
DAA
MOV BH,AL
MOV WORD PTR C+2,BX

LEA DX,MESS2
MOV AH,09
INT 21H

MOV BX,WORD PTR C+2
MOV DH,2

L1: MOV CH,04H
MOV CL,04H
```

```
L2: ROL BX,CL
MOV DL,BL
AND DL,0FH
CMP DL,09
JBE L4
ADD DL,07

L4: ADD DL,30H
MOV AH,02
INT 21H
DEC CH
JNZ L2
DEC DH
CMP DH,0
MOV BX,WORD PTR C
JNZ L1

MOV AH,4CH
INT 21H
END
```



32-Bit BCD SUBTRATION:-

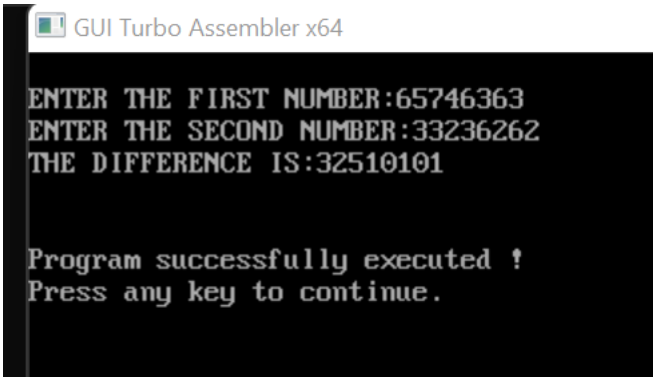
```
.MODEL SMALL
```

```
.386
.DATA

MESS0 DB 10,13,"ENTER THE FIRST NUMBER:$"
MESS1 DB 10,13,"ENTER THE SECOND NUMBER:$"
MESS2 DB 10,13,"THE DIFFERENCE IS:$"

A DD ?
B DD ?
C DD ?
COUNT DB 04h

.CODE
.STARTUP
LEA DX,MESS0
MOV AH,09
INT 21H

MOV EBX,0
MOV CX,8
AGAIN:
MOV AH,01
INT 21H
CMP AL,'A'
JGE L5
SUB AL,30H
JMP L6

L5: SUB AL,37H
L6: SHL EBX,4
ADD BL,AL
```

```
LOOP AGAIN
MOV A,EBX

LEA DX,MESS1
MOV AH,09
INT 21H

MOV EBX,0
MOV CX,8
AGAINS:
MOV AH,01
INT 21H
CMP AL,'A'
JGE L51
SUB AL,30H
JMP L61

L51: SUB AL,37H
L61: SHL EBX,4
ADD BL,AL
LOOP AGAINS
MOV B,EBX

MOV AX,WORD PTR A
MOV BX,WORD PTR B

SUB AL,BL
DAS
MOV BL,AL

SBB AH,BH
```

```
MOV AL,AH
DAS
MOV BH,AL

MOV WORD PTR C,BX

MOV AX,WORD PTR A+2
MOV BX,WORD PTR B+2
SBB AL,BL
DAS
MOV BL,AL
SBB AH,BH
MOV AL,AH
DAS
MOV BH,AL
MOV WORD PTR C+2,BX

LEA DX,MESS2
MOV AH,09
INT 21H

MOV BX,WORD PTR C+2
MOV DH,2

L1: MOV CH,04H
MOV CL,04H

L2: ROL BX,CL
MOV DL,BL
AND DL,0FH
CMP DL,09
```

```
JBE L4
ADD DL,07

L4: ADD DL,30H
MOV AH,02
INT 21H
DEC CH
JNZ L2
DEC DH
CMP DH,0
MOV BX,WORD PTR C
JNZ L1

MOV AH,4CH
INT 21H
END
```



Question3:- Write a program for Sorting.

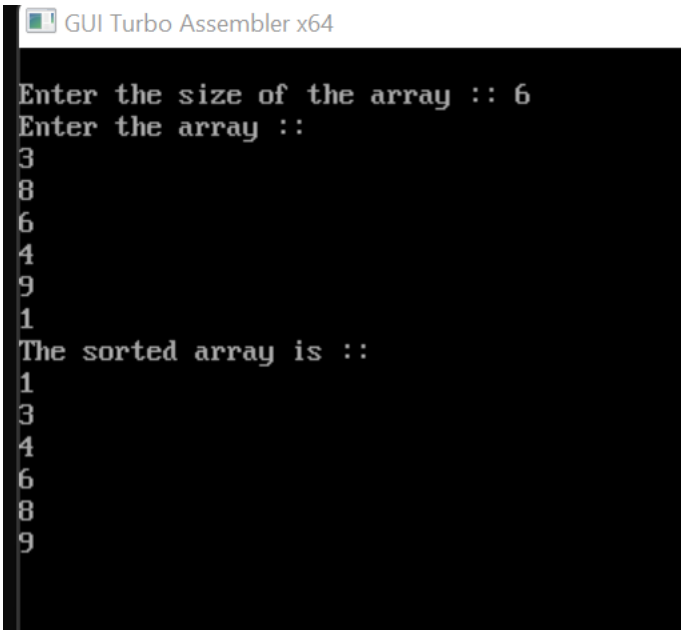
Solution:-

```
.model small
.386
.data
ARRAY DW 20 DUP (?)
```

```
DATA1 dw 0000H

msg db 10,13,"Enter the size of the array :: $"
msg2 db 10,13,"Enter the array :: $"
msg3 db 10,13,"The sorted array is :: $"

.code
.startup
MOV AH,09
MOV DX,OFFSET msg
INT 21H
MOV AH,01
INT 21H
SUB AL,30H
MOV AH,0
MOV CX,AX
MOV DATA1,AX
MOV AH,09
MOV DX,OFFSET msg2
INT 21H
MOV AH,0
MOV SI, 0
MOV BX, OFFSET ARRAY

L1: MOV DL, 0AH ; jump onto next line
MOV AH, 02H
INT 21H
MOV DX, SI ; input element of the array
MOV AH, 01H
INT 21H
SUB AL,30H
```

```
MOV SI, DX
MOV [BX + SI], AX
INC SI
LOOP L1
MOV CX, DATA1
MOV BX, OFFSET ARRAY
MOV DI,CX
L2: MOV CX, DATA1
MOV SI, 0

L3: MOV AL, [BX + SI]
CMP AL, [BX + SI + 1]
JL L4
XCHG AL,[BX + SI + 1]
MOV [BX + SI],AL

L4: INC SI
LOOP L3
DEC DI
JNZ L2
MOV CX, DATA1
MOV SI, 1
MOV BX, OFFSET ARRAY
MOV AH,09
MOV DX,OFFSET msg3
INT 21H

L5: MOV DL, 0AH ; jump onto next line
MOV AH, 02H
INT 21H
MOV DX, [BX + SI]
```

```
INC SI

ADD DL, 30H

MOV AH, 02

INT 21H

LOOP L5


END
```



Question4:- Write a program for Linear search and Binary Search.

Solution:-

Linear – Search:-

```
.MODEL SMALL

.STACK

.386

.DATA


ARRAY DB 9 DUP(?)

MESS01 DB 13,10,"MAX. NO. OF ELEMENTS IN ARRAY IS 9 $"

MESS02 DB 13,10,"  $"

MESS1 DB 13,10,"ENTER THE NUMBER OF ELEMENTS: $"
```

Harsh 20058570011

```
MESS0 DB 13,10,"ENTER THE NUMBER: $"
MESS2 DB 13,10,"ENTER THE ELEMENT TO BE SEARCHED: $"
MESS3 DB 13,10,"VALUE FOUND AT LOCATION - $"
MESS4 DB 13,10,"VALUE NOT FOUND!!!$"
ErrMess DB 13,10,"ERROR IN INPUT DIGIT$"

DAT DB ?
number dw ?
POS DW ?

.CODE
.STARTUP

   MOV DX, OFFSET MESS01
   MOV AH, 09
   INT 21H

   MOV DX, OFFSET MESS02
   MOV AH, 09
   INT 21H

   MOV DX,OFFSET MESS1
   MOV AH, 09
   INT 21H

   MOV AH, 01
   INT 21H
   CMP al,39h
   JBE abc

   MOV DX, OFFSET ErrMess
```

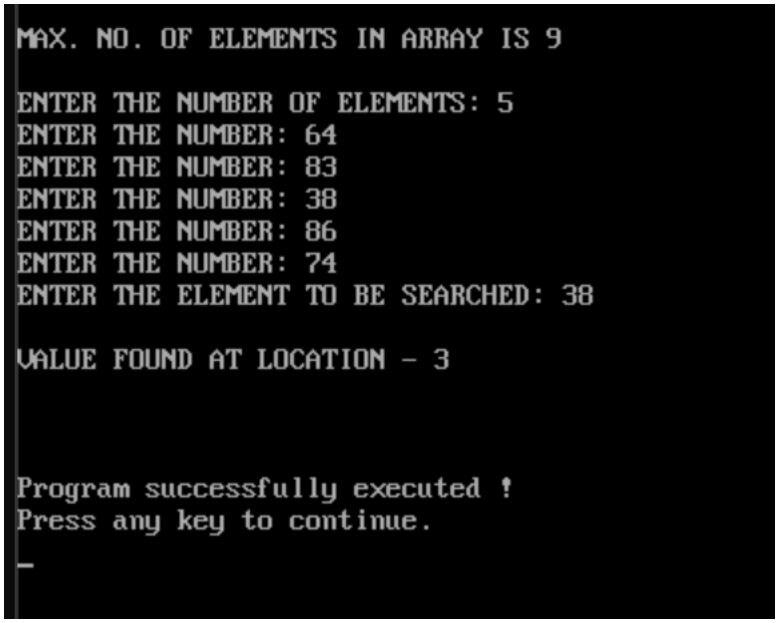
```
    MOV AH, 09
    INT 21H

    JMP myexit

    abc: AND AL, 0FH

    MOV AH, 0
    MOV number, AX
    MOV CX, AX  ; SET COUNTER AL TIMES
    MOV DI, 0

; INPUT ELEMENTS IN ARRAY

    MYLOOP:
    MOV DX, OFFSET MESS0
    MOV AH, 09
    INT 21H

    ; Tens digit

    MOV AH, 01
    INT 21H
    CMP AL, 39H
    JBE abc2

    MOV DX, OFFSET ErrMess
    MOV AH,09
    INT 21H
    JMP myexit
```

```
abc2: AND al,0fh
SHL AL, 4
MOV BL, AL

; Units digit

MOV AH,01
INT 21H
cmp al,39h
jbe abcx

MOV DX,OFFSET ErrMess
MOV AH,09
INT 21H
jmp myexit

abcx:
AND al,0fh
ADD al, bl
MOV ARRAY[DI], AL
INC DI
LOOP MYLOOP

;INPUT ELEMENT TO BE SEARCHED

MOV DX,OFFSET MESS2
MOV AH,09
INT 21H

; Tens digit
```

```
MOV AH,01
INT 21H
cmp al,39h
jbe abcl

MOV DX,OFFSET ErrMess
MOV AH,09
INT 21H
jmp myexit

abcl:
and al,0fh
shl al,4
mov bl,al

; Units digit

MOV AH,01
INT 21H
cmp al,39h
jbe abcm

MOV DX,OFFSET ErrMess
MOV AH,09
INT 21H
jmp myexit

abcm:
and al,0fh
add al,bl
mov DAT,AL
```

```
; SEARCH PROCESS

    MOV AX, DS
    MOV ES, AX

    MOV AL, DAT
    CLD ; Auto-Increment Mode
    MOV CX, number
    MOV DI, OFFSET ARRAY
    REPNE SCASB

    CMP CX, 0
    JE NOTFOUND

    MOV DX, OFFSET MESS02
    MOV AH, 09
    INT 21H

    MOV DX, OFFSET MESS3
    MOV AH,09
    INT 21H

    SUB NUMBER, CX
    ADD NUMBER,30H

    MOV DX, NUMBER
    MOV AH, 02
    INT 21H
    JMP myexit
```

```
    NOTFOUND:
    MOV DX,OFFSET MESS4
    MOV AH,09
    INT 21H

    myexit:
    MOV DX, OFFSET MESS02
    MOV AH, 09
    INT 21H
.EXIT
END
```



Binary-Search :-

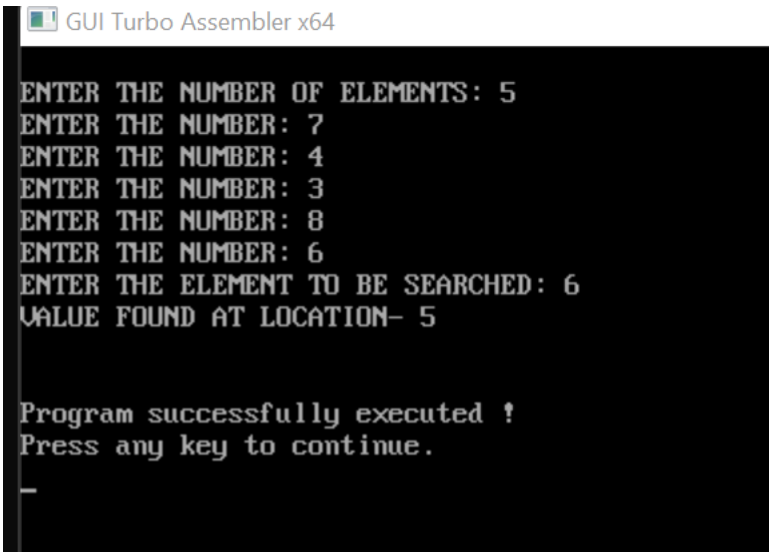
```
.model small
    .stack
    .386
    .data
    ARRAY DB 10 DUP(?)

    MESS0 DB 13,10,"ENTER THE NUMBER: $"
```

```
MESS1 DB 13,10,"ENTER THE NUMBER OF ELEMENTS: $"
MESS2 DB 13,10,"ENTER THE ELEMENT TO BE SEARCHED: $"
MESS3 DB 13,10,"VALUE FOUND AT LOCATION- $"
MESS4 DB 13,10,"VALUE NOT FOUND!!!$"

ErrMess DB 13,10,"ERROR IN INPUT DIGIT$"
DAT DB ?
number dw ?

.code
.startup

MOV DX,OFFSET MESS1
MOV AH,09
INT 21H

MOV AH,01
INT 21H
cmp al,39h
jbe abc

MOV DX,OFFSET ErrMess
MOV AH,09
INT 21H
jmp myexit
abc:
and al,0fh
mov ah,0
mov number,ax
MOV CX,AX
MOV DI,0
```

```
MYLOOP:
MOV DX,OFFSET MESS0
MOV AH,09
INT 21H
MOV AH,01
INT 21H
cmp al,39h
jbe abc2
MOV DX,OFFSET ErrMess
MOV AH,09
INT 21H
jmp myexit

abc2:
and al,0fh
MOV ARRAY[DI],AL
INC DI
LOOP MYLOOP

MOV DX,OFFSET MESS2
MOV AH,09
INT 21H
MOV AH,01
INT 21H
cmp al,39h
jbe abc3
MOV DX,OFFSET ErrMess
MOV AH,09
INT 21H
jmp myexit
```

```
abc3:
and al,0fh
MOV DAT,AL

mov ax,ds
mov es,ax
mov al,dat
CLD
mov cx,number
INC CX
mov DI, offset ARRAY
repne SCASB

CMP CX,0
JE NTFOUND
MOV DX,OFFSET MESS3
MOV AH,09
INT 21H
SUB NUMBER,CX ;FIND ELEMENT LOCATION
ADD NUMBER,30H
MOV DX,NUMBER
INC DX
MOV AH,02
INT 21H
JMP myexit

NTFOUND:
MOV DX,OFFSET MESS4
MOV AH,09
INT 21H
```

```
myexit:
MOV AH,4CH
INT 21H

END
```



Question5:- Write a program to add and subtract two array.

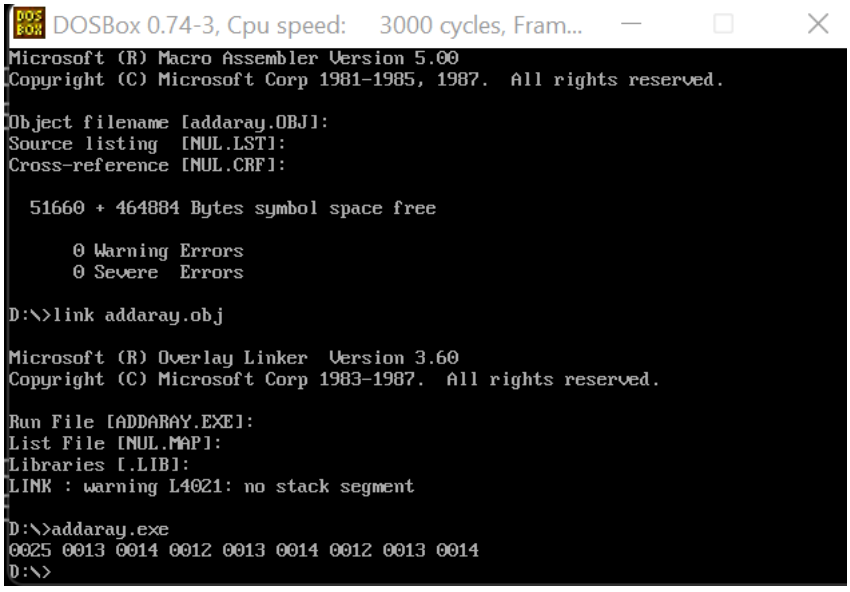
Solution:-

Addition of Two Array:

```
.model small
  .data
  mat1 db 12h, 11h, 12h, 10h, 11h, 12h, 10h, 11h, 12h
  mat2 db 13h, 02h, 02h, 02h, 02h, 02h, 02h, 02h, 02h
  res3 dw 9 dup(?)
  .code

  mov ax, @data
  mov ds, ax
  mov cx, 09h
  mov di, offset mat1
```

```
mov bx, offset mat2
mov si, offset res3

back : mov ah, 0
mov al, [di]
add al, [bx]
adc ah, 00
mov [si], ax
inc di
inc bx
inc si
inc si
loop back
mov si, offset res3
mov dh, 9

l10:  mov ch, 04h
mov cl, 04h
mov bx, [si]

l2:  rol bx, cl
mov dl, bl
and dl, 0fh
cmp dl, 09
jbe l4
add dl, 07

l4:  add dl, 30h
mov ah, 02
int 21h
dec ch
```

```
jnz l2
mov dl, ' '  ;This is a whitespace
int 21h
inc si
inc si
dec dh
jnz l10
mov ah, 4ch
int 21h

end
```

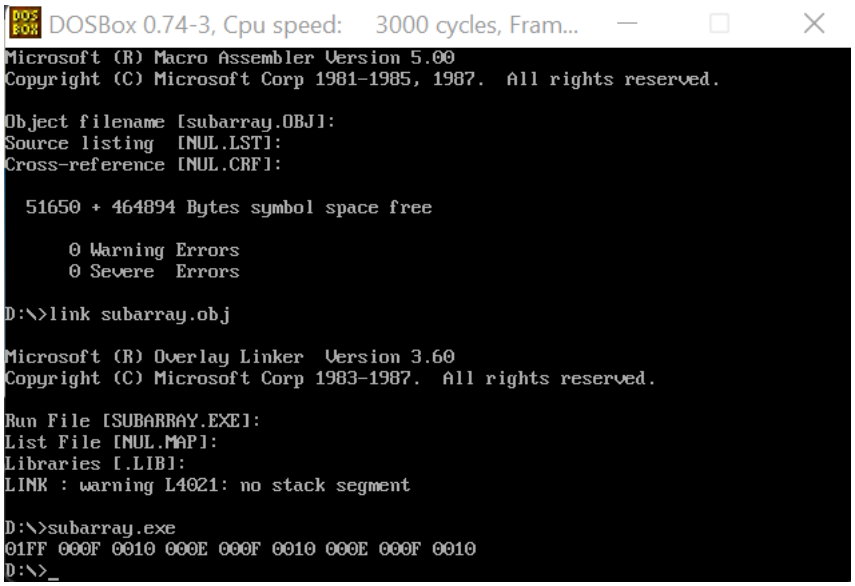


Subtraction of two array:-

```
.model small
    .data
    mat1 db 12h, 11h, 12h, 10h, 11h, 12h, 10h, 11h, 12h
    mat2 db 13h, 02h, 02h, 02h, 02h, 02h, 02h, 02h, 02h
    res3 dw 9 dup(?)
    .code
```

```
mov ax, @data
mov ds, ax
mov cx, 09h
mov di, offset mat1
mov bx, offset mat2
mov si, offset res3
back : mov ah, 0
mov al, [di]
sub al, [bx]
adc ah, 00
mov [si], ax
inc di
inc bx
inc si
inc si
loop back
mov si, offset res3
mov dh, 9

l10:  mov ch, 04h
mov cl, 04h
mov bx, [si]

l2:  rol bx, cl
mov dl, bl
and dl, 0fh
cmp dl, 09
jbe l4
add dl, 07
```

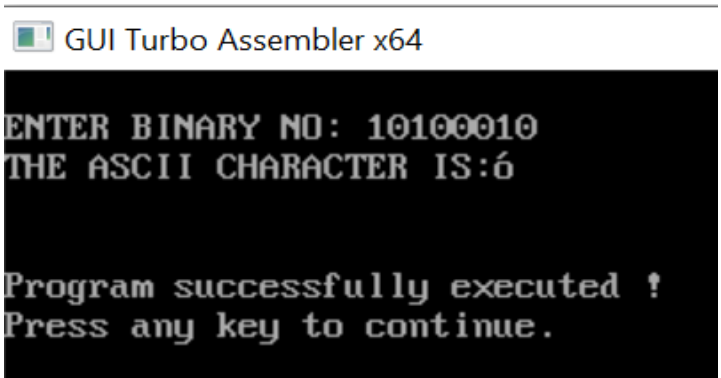
```
l4:  add dl, 30h
mov ah, 02
int 21h
dec ch
jnz l2
mov dl, ' '  ;This is a whitespace
int 21h
inc si
inc si
dec dh
jnz l10
mov ah, 4ch
int 21h

end
```



Question6:-write a program for binary to ascii conversion.

```
.MODEL SMALL
  .DATA
  INPUT DB 10,13 , 'ENTER BINARY NO: $'
```

```
  DB 10,13, 'THE ASCII CHARACTER IS:$'
ARR DB ?

.CODE
.STARTUP
MOV AH,09H
MOV DX,OFFSET INPUT
INT 21H

MOV BL, 00H
MOV CL,08H
INPUT1: MOV AH,01H
INT 21H
SUB AL,30H
SHL BL,1
ADD BL,AL
LOOP INPUT1

MOV AH,09H
LEA DX,
INT 21H
MOV AH,02H
MOV DL,BL
INT 21H

MOV AH,4CH
INT 21H
END
```



Question 7:-Write a program for ascii to binary conversion.

```
.model small
.stack 100h

.data
    input db "Enter an ASCII character :$"
     db 10,13,"Binary Equiv: $"

.code
    MOV AX ,@DATA
    MOV DS ,AX
    MOV DX ,OFFSET input
    MOV AH, 09H
    INT 21H


    MOV AH,01H
    INT 21H


    MOV BL,AL

    MOV DX,OFFSET
    MOV AH,09H
    INT 21H

    MOV CX,8

    BIN_EQUIV:
```

```
    SHL BL,1
    JC PRINTONE
    PRINTZERO:
      MOV DL,30H
      JMP PRINT
    PRINTONE:
        MOV DL,31H
    PRINT:
        MOV AH,02H
        INT 21H
    LOOP BIN_EQUIV

  MOV AH,4CH
  INT 21H
  END
```