**SYSTEMS PROGRAMMING LAB REPORT**

**CLASS: UG-III SECTION: A1**

**GROUP NUMBER: C**

**GROUP MEMBERS**

Masud Rahaman Laskar (Roll: 18)

Soumyadeep Barman (Roll: 19)

Anuran Chakraborty (Roll: 20)

Arighna Saha (Roll: 21)

**ASSIGNMENT 1**

1. **Write and test a MASM program to Display your name and program title on the output screen.**

*; Write and test a MASM program to Display your name and program title on the output screen.*

.model small

.stack 100h

.data

name1 db"Name: Anuran$"

programTitle db"Program title: Ques1$"

.code

mov ax,@data

mov ds,ax

*;display the name*

lea dx,name1

mov ah,09h

int 21h

*;carriage return*

mov AH, 02h

mov DL, 0DH

int 21H

*;line feed*

mov DL, 0AH

int 21H

*;display program title*

lea dx,programTitle

mov ah,09h

int 21h

*;exit*

mov ah,4Ch

int 21h

end

1. **Write and test a MASM program to convert a letter from uppercase to lowercase.**

*; Write and test a MASM program to Convert a letter from uppercase to lowercase.*

.model small

.stack 100h

.data

msg1 db 10,13,"Enter a character: $"

msg2 db 10,13,"Lowercase character is: $"

.code

main proc

mov ax,@data

mov ds,ax

*;display input prompt*

lea dx,msg1

mov ah,09h

int 21h

*;accept a character*

mov ah,01h

int 21h

*;al has the character*

*;check if al is uppercase*

cmp al,'A'

jl display

cmp al,'Z'

jg display

add al,32

display:

*;display prompt*

lea dx,msg2

mov ah,09h

int 21h

*;display the character*

mov dl,al

mov ah,02h

int 21h

mov ah,4ch

int 21h

main endp

end main

1. **Write and test a MASM program to add two Hexadecimal Numbers.**

*;write and test a masm program to add two hexadecimal numbers.*

.model small

.stack 100h

.data

prompt1 db 13,10,"enter the 1st number: $"

prompt2 db 13,10,"enter the 2nd number: $"

prompt3 db 13,10,"the result of the addition is: $"

.code

main proc

mov ax,@data *;for moving data to data segment*

mov ds,ax

xor bx,bx *;initially bx value is equal to 0*

mov cl,4

lea dx, prompt1 *;show num1 prompt*

mov ah, 9

int 21h

mov ah,1 *;for taking input*

int 21h

input1:

cmp al,0dh *;compare whether the pressed key is 'enter' or not*

je line1 *;if it is equal to 'enter' then stop taking first value*

cmp al,39h *;compare the input whether it is letter or digit.39h is the ascii value of 9*

jg letter1

and al,0fh *;if it is digit then convert it's ascii value to real value by masking*

jmp shift1

letter1: *;if it is letter then subtract 37h from it to find it's real value*

sub al,37h

shift1:

shl bx, cl

or bl,al *;making 'or' will add the current value with previous value*

int 21h

jmp input1

line1:

lea dx, prompt2 *;show num2 prompt*

mov ah, 9

int 21h

xor dx,dx *;set dx value zero*

mov ah,1

int 21h

input2:

cmp al,0dh *;compare whether the pressed key is 'enter' or not*

je line2 *;if it is equal to 'enter' then stop taking first value*

cmp al,39h *;compare the input whether it is letter or digit.39h is the ascii value of 9*

jg letter2

and al,0fh *;if it is digit then convert it's ascii value to real value by masking*

jmp shift2

letter2: *;if it is letter then subtract 37h from it to find it's real value*

sub al,37h

shift2:

shl dx, cl

or dl,al *;making 'or' will add the current value with previous value*

int 21h

jmp input2

line2:

xor cx,cx

mov cx,dx

mov dh,16

sum:

add bx,cx *;add two number which are stored in bx and cs register*

jc pc1 *;if the register is overflowed then print an extra 1*

mov cl, 4

lea dx, prompt3 *;show answer prompt*

mov ah, 9

int 21h

output: *;level for printing their sum*

mov ch,bh

shr ch, cl

and ch,0fh

cmp ch,10 *;convert decimal to binary*

add ch,'0'

cmp ch,':'

jl tag

add ch,7

tag:mov dl,ch

mov ah,2

int 21h

mov ch,bh

and ch,0fh

cmp ch,10

add ch,'0'

cmp ch,':'

jl tag1

add ch,7

tag1:mov dl,ch

mov ah,2

int 21h

mov ch,bl

shr ch, cl

and ch,0fh

cmp ch,10

add ch,'0'

cmp ch,':'

jl tag2

add ch,7

tag2:mov dl,ch

mov ah,2

int 21h

mov ch,bl

and ch,0fh

cmp ch,10

add ch,'0'

cmp ch,':'

jl tag3

add ch,7

tag3:mov dl,ch

mov ah,2

int 21h

jmp exit

pc1: *;level for printing overflowed 1*

mov dl,'1'

mov ah,2

int 21h

jmp output

exit:

mov ah, 4ch *;return control to dos*

int 21h

main endp

end main

1. **Write and test a MASM program to find the second max and second min from an array.**

.model small

.stack 100h

.data

prompt\_0 db 'enter the number of array elements :',0dh,0ah,'$'

prompt\_1 db 'enter the array elements :',0dh,0ah,'$'

prompt\_2 db 'the 2nd maximum is : $'

prompt\_3 db 'the 2nd minimum is : $'

array dw 50 dup(0)

s dw ?

max dw ?

min dw ?

.code

main proc

mov ax, @data *; initialize ds*

mov ds, ax

lea dx, prompt\_0 *; load and display the string prompt\_0*

mov ah, 9

int 21h

mov ah,1 *;for taking input*

int 21h

input1:

cmp al,0dh *;compare whether the pressed key is 'enter' or not*

je line1 *;if it is equal to 'enter' then stop taking first value*

and al,0fh *;convert it's ascii value to real value by masking*

shl bx, 1

shl bx, 1

shl bx, 1

shl bx, 1

or bl,al *;making 'or' will add the current value with previous value*

int 21h

jmp input1

line1:

lea dx, prompt\_1 *; load and display the string prompt\_1*

mov ah, 9

int 21h

lea si, array *; set si=offset address of array*

mov s,bx

mov cx, bx *; set cx=bx*

@read\_array: *; loop label*

mov ah,1 *;for taking input*

int 21h

xor dx,dx

input2:

cmp al,0dh *;compare whether the pressed key is 'enter' or not*

je line2 *;if it is equal to 'enter' then stop taking first value*

and al,0fh *;convert it's ascii value to real value by masking*

shl dx,1

shl dx,1

shl dx,1

shl dx,1

or dl,al *;making 'or' will add the current value with previous value*

int 21h

jmp input2

line2:

mov [si], dx *; set [si]=ax*

add si, 2 *; set si=si+2*

mov dl, 0ah *; line feed*

mov ah, 2 *; set output function*

int 21h *; print a character*

loop @read\_array *; jump to label @read\_array while cx!=0*

*; array input done*

lea si,array

mov ax,bx

dec ax

xor bx,bx

xor cx,cx

mov bx,word ptr[si] *;store the maximum*

mov cx,word ptr[si] *;store the 2nd*

add si, 2

*; loop to find max and 2nd max*

arrayloop2:

cmp word ptr[si],bx

jl max2

mov cx,bx

mov bx,word ptr[si]

max2:

cmp word ptr[si],cx

jl incre

cmp word ptr[si],bx

je incre

mov cx,word ptr[si]

incre:

add si, 2

dec ax

jnz arrayloop2

*; now bx has max cx has 2nd max*

mov max,bx

*; displaying the prompt*

lea dx,prompt\_2

mov ah,09h

int 21h

*; display contents of cx*

mov bx,cx

mov dh,bh

shr dh, 1

shr dh, 1

shr dh, 1

shr dh, 1

and dh,0fh

add dh,'0'

mov dl,dh

mov ah,2

int 21h

mov dh,bh

and dh,0fh

add dh,'0'

mov dl,dh

mov ah,2

int 21h

mov dh,bl

shr dh, 1

shr dh, 1

shr dh, 1

shr dh, 1

and dh,0fh

add dh,'0'

mov dl,dh

mov ah,2

int 21h

mov dh,bl

and dh,0fh

cmp dh,10

add dh,'0'

mov dl,dh

mov ah,2

int 21h

mov dl, 0ah *; line feed*

mov ah, 2 *; set output function*

int 21h *; print a character*

*;=================================================================================*

lea si,array

mov ax,s

dec ax

mov bx,max

*; loop to find min and 2nd min*

arrayloop3:

cmp word ptr[si],bx

jg min2

mov cx,bx

mov bx,word ptr[si]

min2:

cmp word ptr[si],cx

jg incre2

cmp word ptr[si],bx

je incre2

mov cx,word ptr[si]

incre2:

add si, 2

dec ax

jnz arrayloop3

*; now bx has min cx has 2nd min*

*; displaying the prompt*

lea dx,prompt\_3

mov ah,09h

int 21h

*; display contents of cx*

mov bx,cx

mov dh,bh

shr dh, 1

shr dh, 1

shr dh, 1

shr dh, 1

and dh,0fh

add dh,'0'

mov dl,dh

mov ah,2

int 21h

mov dh,bh

and dh,0fh

add dh,'0'

mov dl,dh

mov ah,2

int 21h

mov dh,bl

shr dh, 1

shr dh, 1

shr dh, 1

shr dh, 1

and dh,0fh

add dh,'0'

mov dl,dh

mov ah,2

int 21h

mov dh,bl

and dh,0fh

cmp dh,10

add dh,'0'

mov dl,dh

mov ah,2

int 21h

exit:

mov ah, 4ch *;return control to dos*

int 21h

main endp

end main

1. **Write and test a MASM program to display a terminating message.**

*; Write and test a MASM program to display a terminating message.*

.model small

.stack 100h

.data

prompt1 db 13,10,"enter the 1st number: $"

prompt2 db 13,10,"enter the 2nd number: $"

promptyes db 13,10,"the second number is less than the first$"

promptno db 13,10,"the second number is not less than the first$"

promptter db 13,10,"Terminating!!!$"

.code

main proc

mov ax,@data *;for moving data to data segment*

mov ds,ax

xor bx,bx *;initially bx value is equal to 0*

mov cl,4

lea dx, prompt1 *;show num1 prompt*

mov ah, 9

int 21h

mov ah,1 *;for taking input*

int 21h

input1:

cmp al,0dh *;compare whether the pressed key is 'enter' or not*

je line1 *;if it is equal to 'enter' then stop taking first value*

cmp al,39h *;compare the input whether it is letter or digit.39h is the ascii value of 9*

jg letter1

and al,0fh *;if it is digit then convert it's ascii value to real value by masking*

jmp shift1

letter1: *;if it is letter then subtract 37h from it to find it's real value*

sub al,37h

shift1:

shl bx, cl

or bl,al *;making 'or' will add the current value with previous value*

int 21h

jmp input1

line1:

lea dx, prompt2 *;show num2 prompt*

mov ah, 9

int 21h

xor dx,dx *;set dx value zero*

mov ah,1

int 21h

input2:

cmp al,0dh *;compare whether the pressed key is 'enter' or not*

je line2 *;if it is equal to 'enter' then stop taking first value*

cmp al,39h *;compare the input whether it is letter or digit.39h is the ascii value of 9*

jg letter2

and al,0fh *;if it is digit then convert it's ascii value to real value by masking*

jmp shift2

letter2: *;if it is letter then subtract 37h from it to find it's real value*

sub al,37h

shift2:

shl dx, cl

or dl,al *;making 'or' will add the current value with previous value*

int 21h

jmp input2

line2:

xor cx,cx

mov cx,dx

mov dh,16

compare\_nums:

cmp bx,cx *;add two number which are stored in bx and cs register*

jg pc1

lea dx, promptno *;show answer prompt*

mov ah, 9

int 21h

jmp exit *;if the register is overflowed then print an extra 1*

pc1:

lea dx, promptyes *;show answer prompt*

mov ah, 9

int 21h

exit:

lea dx, promptter *;show terminating prompt*

mov ah, 9

int 21h

mov ah, 4ch *;return control to dos*

int 21h

main endp

end main

1. **Write and test a MASM program to Take a character from keyboard and print it.**

*; Write and test a MASM program to Take a character from keyboard and print it.*

.model small

.stack 100h

.data

msg1 db 10,13,"Enter a character: $"

msg2 db 10,13,"The character is: $"

.code

main proc

mov ax,@data

mov ds,ax

*;display input prompt*

lea dx,msg1

mov ah,09h

int 21h

*;accept a character*

mov ah,01h

int 21h

*;al has the character*

*;display prompt*

lea dx,msg2

mov ah,09h

int 21h

*;display the character*

mov dl,al

mov ah,02h

int 21h

mov ah,4ch

int 21h

main endp

end main

1. **Write and test a MASM program to validate second numbers is less than the first.**

*; Write and test a MASM program to validate second numbers is less than the first.*

.model small

.stack 100h

.data

prompt1 db 13,10,"enter the 1st number: $"

prompt2 db 13,10,"enter the 2nd number: $"

promptyes db 13,10,"the second number is less than the first$"

promptno db 13,10,"the second number is not less than the first$"

.code

main proc

mov ax,@data *;for moving data to data segment*

mov ds,ax

xor bx,bx *;initially bx value is equal to 0*

mov cl,4

lea dx, prompt1 *;show num1 prompt*

mov ah, 9

int 21h

mov ah,1 *;for taking input*

int 21h

input1:

cmp al,0dh *;compare whether the pressed key is 'enter' or not*

je line1 *;if it is equal to 'enter' then stop taking first value*

cmp al,39h *;compare the input whether it is letter or digit.39h is the ascii value of 9*

jg letter1

and al,0fh *;if it is digit then convert it's ascii value to real value by masking*

jmp shift1

letter1: *;if it is letter then subtract 37h from it to find it's real value*

sub al,37h

shift1:

shl bx, cl

or bl,al *;making 'or' will add the current value with previous value*

int 21h

jmp input1

line1:

lea dx, prompt2 *;show num2 prompt*

mov ah, 9

int 21h

xor dx,dx *;set dx value zero*

mov ah,1

int 21h

input2:

cmp al,0dh *;compare whether the pressed key is 'enter' or not*

je line2 *;if it is equal to 'enter' then stop taking first value*

cmp al,39h *;compare the input whether it is letter or digit.39h is the ascii value of 9*

jg letter2

and al,0fh *;if it is digit then convert it's ascii value to real value by masking*

jmp shift2

letter2: *;if it is letter then subtract 37h from it to find it's real value*

sub al,37h

shift2:

shl dx, cl

or dl,al *;making 'or' will add the current value with previous value*

int 21h

jmp input2

line2:

xor cx,cx

mov cx,dx

mov dh,16

compare\_nums:

cmp bx,cx *;add two number which are stored in bx and cs register*

jg pc1

lea dx, promptno *;show answer prompt*

mov ah, 9

int 21h

jmp exit *;if the register is overflowed then print an extra 1*

pc1:

lea dx, promptyes *;show answer prompt*

mov ah, 9

int 21h

exit:

mov ah, 4ch *;return control to dos*

int 21h

main endp

end main

1. **Write and test a MASM program to find maximum and minimum from an array.**

.model small

.stack 100h

.data

prompt\_0 db 'enter the number of array elements :',0dh,0ah,'$'

prompt\_1 db 'enter the array elements :',0dh,0ah,'$'

prompt\_2 db 'the maximum is : $'

prompt\_3 db 'the minimum is : $'

array dw 50 dup(0)

s dw ?

.code

main proc

mov ax, @data *; initialize ds*

mov ds, ax

lea dx, prompt\_0 *; load and display the string prompt\_0*

mov ah, 9

int 21h

mov ah,1 *;for taking input*

int 21h

input1:

cmp al,0dh *;compare whether the pressed key is 'enter' or not*

je line1 *;if it is equal to 'enter' then stop taking first value*

and al,0fh *;convert it's ascii value to real value by masking*

shl bx, 1

shl bx, 1

shl bx, 1

shl bx, 1

or bl,al *;making 'or' will add the current value with previous value*

int 21h

jmp input1

line1:

lea dx, prompt\_1 *; load and display the string prompt\_1*

mov ah, 9

int 21h

lea si, array *; set si=offset address of array*

mov cx, bx *; set cx=bx*

@read\_array: *; loop label*

mov ah,1 *;for taking input*

int 21h

xor dx,dx

input2:

cmp al,0dh *;compare whether the pressed key is 'enter' or not*

je line2 *;if it is equal to 'enter' then stop taking first value*

and al,0fh *;convert it's ascii value to real value by masking*

shl dx,1

shl dx,1

shl dx,1

shl dx,1

or dl,al *;making 'or' will add the current value with previous value*

int 21h

jmp input2

line2:

mov [si], dx *; set [si]=ax*

add si, 2 *; set si=si+2*

mov dl, 0ah *; line feed*

mov ah, 2 *; set output function*

int 21h *; print a character*

loop @read\_array *; jump to label @read\_array while cx!=0*

*; array input done*

lea si,array

mov ax,bx

dec ax

xor bx,bx

xor cx,cx

mov bx,word ptr[si] *;store the maximum*

mov cx,word ptr[si] *;store the minimum*

add si, 2

*; loop to find max and min*

arrayloop2:

cmp word ptr[si],bx

jg maximum

cmp word ptr[si],cx

jl minimum

jmp incre

maximum:

mov bx,word ptr[si]

jmp incre

minimum:

mov cx,word ptr[si]

incre:

add si, 2

dec ax

jnz arrayloop2

*; displaying the prompt*

lea dx,prompt\_2

mov ah,09h

int 21h

*; display contents of bx*

output: *;level for printing their sum*

mov dh,bh

shr dh, 1

shr dh, 1

shr dh, 1

shr dh, 1

and dh,0fh

add dh,'0'

mov dl,dh

mov ah,2

int 21h

mov dh,bh

and dh,0fh

add dh,'0'

mov dl,dh

mov ah,2

int 21h

mov dh,bl

shr dh, 1

shr dh, 1

shr dh, 1

shr dh, 1

and dh,0fh

add dh,'0'

mov dl,dh

mov ah,2

int 21h

mov dh,bl

and dh,0fh

cmp dh,10

add dh,'0'

mov dl,dh

mov ah,2

int 21h

mov dl, 0ah *; line feed*

mov ah, 2 *; set output function*

int 21h *; print a character*

*; displaying the prompt*

lea dx,prompt\_3

mov ah,09h

int 21h

*; display contents of cx*

mov bx,cx

mov dh,bh

shr dh, 1

shr dh, 1

shr dh, 1

shr dh, 1

and dh,0fh

add dh,'0'

mov dl,dh

mov ah,2

int 21h

mov dh,bh

and dh,0fh

add dh,'0'

mov dl,dh

mov ah,2

int 21h

mov dh,bl

shr dh, 1

shr dh, 1

shr dh, 1

shr dh, 1

and dh,0fh

add dh,'0'

mov dl,dh

mov ah,2

int 21h

mov dh,bl

and dh,0fh

cmp dh,10

add dh,'0'

mov dl,dh

mov ah,2

int 21h

exit:

mov ah, 4ch *;return control to dos*

int 21h

main endp

end main

1. **Write and test a MASM program to loop until the user decides to quit.**

*;Write and test a MASM program to loop until the user decides to quit*

.model small

.stack 100h

.data

msg db 10,13,"Enter q to quit any other key to continue looping: $"

looping db 10,13,"loop$"

.code

main proc

mov ax,@data

mov ds,ax

label1:

*;display loop message*

lea dx,looping

mov ah,09h

int 21h

*;display input prompt*

lea dx,msg

mov ah,09h

int 21h

*;accept a character*

mov ah,01h

int 21h

*; check if character is q*

cmp al,'q'

jne label1

*;exit*

mov ah,4Ch

int 21h

main endp

end main

1. **Write and test a MASM program to print all the characters from A-Z.**

*; Write and test a MASM program to Print all the characters from A-Z.*

.model small

.stack 100h

.data

space db ' '

.code

main proc

mov ax,@data

mov ds,ax

mov bx,65

mov cx,0

label1:

*;print the character*

mov ah,02h

mov dl,bl

int 21h

*;print the character*

mov ah,02h

mov dl,space

int 21h

*;increment*

inc bx

inc cx

cmp cx,26

jne label1

mov ah,4ch

int 21h

main endp

end main

**ASSIGNMENT 2**

**N.B.: For the following assignments a macro table mtab.asm has been created and used.**

**mtab.asm**

*;macro to print new line*

new\_line macro

mov ah,02h

mov dl,0dh

int 21h

mov dl,0ah

int 21h

endm

*;macro to print space*

space macro

mov ah,02h

mov dl,' '

int 21h

endm

*;macro to print a message*

printm macro mess

lea dx,mess

mov ah,09h

int 21h

endm

*;macro to exit*

exitp macro

mov ah,4ch

int 21h

endm

*; macro for decimal input*

dec\_input macro

local input,skip

*; output: bx*

xor bx,bx

mov ah,01h

int 21h

*;if \r*

cmp al,0dh

je skip

input:

and ax,000fh

push ax

*; bx=bx\*10+ax*

mov ax,10

mul bx

mov bx,ax

pop ax

add bx,ax

*; take input*

mov ah,01h

int 21h

cmp al,0dh

jne input

skip:

endm

*; macro for decimal output*

dec\_output macro

local start,repeat,display

*; input : bx*

*; output : none*

*; cmp bx, 0 ; compare bx with 0*

*; jge start ; jump to label start if bx>=0*

*; mov ah, 2 ; set output function*

*; mov dl, "-" ; set dl='-'*

*; int 21h ; print the character*

*; neg bx ; take 2's complement of bx*

start: *; jump label*

mov ax, bx *; set ax=bx*

xor cx, cx *; clear cx*

mov bx, 10 *; set bx=10*

repeat: *; loop label*

xor dx, dx *; clear dx*

div bx *; divide ax by bx*

push dx *; push dx onto the stack*

inc cx *; increment cx*

or ax, ax *; take or of ax with ax*

jne repeat *; jump to label repeat if zf=0*

mov ah, 2 *; set output function*

display: *; loop label*

pop dx *; pop a value from stack to dx*

or dl, 30h *; convert decimal to ascii code*

int 21h *; print a character*

loop display

endm

*; macro to take binary input*

bin\_input macro

local skip,input

*; output: bx*

xor bx,bx

mov ah,01h

int 21h

cmp al,0dh

je skip

input:

xor ah,ah

sub ax,'0'

shl bx,1

or bx,ax

*; take input*

mov ah,01h

int 21h

cmp al,0dh

jne input

skip:

endm

*; macro to take binary output*

bin\_output macro

local output,display\_loop

*; input: bx*

mov ah,02h

mov cx,0

output:

mov dx,bx

and dx,01h

add dx,'0'

push dx

inc cx

shr bx,1

jnz output

mov cx,cx

display\_loop:

pop dx

int 21h

loop display\_loop

endm

*;macro for hex input*

hex\_input macro

local skip,input,letter,shift

*; output: bx*

xor bx,bx

mov ah,01h

int 21h

cmp al,0dh

je skip

input:

xor ah,ah

cmp ax,'A'

jge letter

sub ax,'0'

jmp shift

letter:

sub ax,55

shift:

shl bx,1

shl bx,1

shl bx,1

shl bx,1

or bx,ax

*; take input*

mov ah,01h

int 21h

cmp al,0dh

jne input

skip:

endm

*;macro for hex\_output*

hex\_output macro

local output,display\_loop,letter,line

*; input: bx*

mov ah,02h

mov cx,0

output:

mov dx,bx

and dx,0fh

cmp dx,10

jge letter

add dx,'0'

jmp line

letter:

add dx,55

line:

push dx

inc cx

shr bx,1

shr bx,1

shr bx,1

shr bx,1

jnz output

mov cx,cx

display\_loop:

pop dx

int 21h

loop display\_loop

endm

dec\_input\_with\_neg macro

local @read,@error,@minus,@plus,@inpit,@end,@exit

jmp @read *; jump to label @read*

@error: *; jump label*

lea dx, illegal *; load and display the string illegal*

mov ah, 9

int 21h

@read: *; jump label*

xor bx, bx *; clear bx*

xor cx, cx *; clear cx*

mov ah, 1 *; set input function*

int 21h *; read a character*

cmp al, "-" *; compare al with "-"*

je @minus *; jump to label @minus if al="-"*

cmp al, "+" *; compare al with "+"*

je @plus *; jump to label @plus if al="+"*

jmp @input *; jump to label @input*

@minus: *; jump label*

mov cx, 1 *; set cx=1*

@plus: *; jump label*

int 21h *; read a character*

cmp al, 0dh *; compare al with cr*

je @end *; jump to label @end if al=cr*

@input: *; jump label*

cmp al, 30h *; compare al with 0*

jl @error *; jump to label @error if al<0*

cmp al, 39h *; compare al with 9*

jg @error *; jump to label @error if al>9*

and ax, 000fh *; convert ascii to decimal code*

push ax *; push ax onto the stack*

mov ax, 10 *; set ax=10*

mul bx *; set ax=ax\*bx*

mov bx, ax *; set bx=ax*

pop ax *; pop a value from stack into ax*

add bx, ax *; set bx=ax+bx*

mov ah, 1 *; set input function*

int 21h *; read a character*

cmp al, 0dh *; compare al with cr*

jne @input *; jump to label if al!=cr*

@end: *; jump label*

or cx, cx *; check cx is 0 or not*

je @exit *; jump to label @exit if cx=0*

neg bx

@exit:

endm

dec\_output\_with\_neg macro

cmp bx, 0 *; compare bx with 0*

jge @start *; jump to label @start if bx>=0*

mov ah, 2 *; set output function*

mov dl, "-" *; set dl='-'*

int 21h *; print the character*

neg bx *; take 2's complement of bx*

@start: *; jump label*

mov ax, bx *; set ax=bx*

xor cx, cx *; clear cx*

mov bx, 10 *; set bx=10*

@repeat: *; loop label*

xor dx, dx *; clear dx*

div bx *; divide ax by bx*

push dx *; push dx onto the stack*

inc cx *; increment cx*

or ax, ax *; take or of ax with ax*

jne @repeat *; jump to label @repeat if zf=0*

mov ah, 2 *; set output function*

@display: *; loop label*

pop dx *; pop a value from stack to dx*

or dl, 30h *; convert decimal to ascii code*

int 21h *; print a character*

loop @display *; jump to label @display if cx!=0*

endm

pushall macro

push ax

push bx

push cx

push dx

endm

popall macro

pop dx

pop cx

pop bx

pop ax

endm

1. **Write and test a MASM program to add two 16 bit numbers.**

*;Write and test a program to Convert a Binary digit to Decimal and vice versa*

include mtab.asm

.model small

.stack 100h

.data

iprompt1 db "Enter two numbers: $"

oprompt1 db "Their sum is: $"

oprompt2 db "Their difference is: $"

num1 dw ?

num2 dw ?

.code

main proc

mov ax,@data

mov ds,ax

*;input prompt*

printm iprompt1

hex\_input

mov num1,bx

hex\_input

mov num2,bx

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* SUM \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

printm oprompt1

mov cx,num1

add bx,cx

jnc display

carry\_disp:

*;display carry*

mov ah,02h

mov dl,'1'

int 21h

display:

hex\_output

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* SUM \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* DIFF \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

new\_line

printm oprompt2

mov bx,num1

mov cx,num2

sub bx,cx

hex\_output

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* DIFF \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

exitp

main endp

end main

1. **Write and test a MASM program to Convert Binary digit to Decimal.**

*;Write and test a program to Convert a Binary digit to Decimal and vice versa*

include mtab.asm

.model small

.stack 100h

.data

iprompt1 db "Enter binary number: $"

iprompt2 db "Enter decimal number: $"

oprompt1 db "Equivalent decimal number: $"

oprompt2 db "Equivalent binary number: $"

.code

main proc

mov ax,@data

mov ds,ax

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* BINARY TO DECIMAL \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

*;input*

printm iprompt1

bin\_input *; binary number in bx*

*;output*

new\_line

printm oprompt1

dec\_output

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* DECIMAL TO BINARY \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

*;input*

new\_line

printm iprompt2

dec\_input *; binary number in bx*

*;output*

new\_line

printm oprompt2

bin\_output

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

exitp

main endp

end main

1. **Write and test a MASM program to perform subtraction of two 16 bit numbers.**

*;Write and test a program to print pairs of even numbers where the summation of the numbers in each pair is 100.*

include mtab.asm

.model small

.stack 100h

.data

tempb dw ?

tempc dw ?

.code

main proc

mov ax,@data

mov ds,ax

mov bx,0

mov cx,100

@print\_loop:

mov tempb,bx

mov tempc,cx

dec\_output

space

mov bx,tempc

dec\_output

new\_line

mov bx,tempb

mov cx,tempc

inc bx

inc bx

dec cx

dec cx

cmp bx,52

jle @print\_loop

exitp

main endp

end main

1. **Write and test a MASM program to multiply two 8 bit numbers.**

*;Write and test a program to Convert a Binary digit to Decimal and vice versa*

include mtab.asm

.model small

.stack 100h

.data

iprompt1 db "Enter two numbers: $"

oprompt1 db "Their product is: $"

num1 db ?

num2 db ?

.code

main proc

mov ax,@data

mov ds,ax

xor bh,bh

*;input prompt*

printm iprompt1

dec\_input

mov num1,bl

xor bh,bh

dec\_input

mov num2,bl

xor bh,bh

xor ah,ah

mov al,num1

mul bx

mov bx,ax

new\_line

printm oprompt1

dec\_output

exitp

main endp

end main

1. **Write and test a MASM program to Convert Binary digit to Hex digit.**

*;Write and test a program to Convert a Binary digit to Decimal and vice versa*

include mtab.asm

.model small

.stack 100h

.data

iprompt1 db "Enter binary number: $"

iprompt2 db "Enter hexadecimal number: $"

oprompt1 db "Equivalent hexadecimal number: $"

oprompt2 db "Equivalent binary number: $"

.code

main proc

mov ax,@data

mov ds,ax

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* BINARY TO HEXADECIMAL \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

*;input*

printm iprompt1

bin\_input *; binary number in bx*

*;output*

new\_line

printm oprompt1

hex\_output

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* HEXADECIMAL TO BINARY \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

*;input*

new\_line

printm iprompt2

hex\_input *; binary number in bx*

*;output*

new\_line

printm oprompt2

bin\_output

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

exitp

main endp

end main

1. **Write and test a MASM program to divide a 16 bit number by a 8 bit number.**

*;Write and test a program to divide a 16 bit number by a 8 bit number.*

include mtab.asm

.model small

.stack 100h

.data

iprompt1 db 10,13,"Enter 16 bit number: $"

iprompt2 db 10,13,"Enter 8 bit number: $"

oprompt1 db 10,13,"Quotient is: $"

oprompt2 db 10,13,"Remainder is: $"

num1 dw ?

.code

main proc

mov ax,@data

mov ds,ax

*;input*

printm iprompt1

hex\_input

mov num1,bx

printm iprompt2

hex\_input

mov ax,num1

xor dx,dx

div bx

*;output*

mov bx,ax

mov num1,dx

printm oprompt1

pushall

hex\_output

popall

mov bx,num1

printm oprompt2

pushall

hex\_output

popall

exitp

main endp

end main

1. **Write and test a MASM program to Print Fibonacci series.**

*;Write and test a program to Print Fibonacci series up to 10 terms*

include mtab.asm

.model small

.stack 100h

.data

prompt db "The fibonacci series upto 10 terms is: $"

f1 dw 1

f2 dw 1

f3 dw ?

.code

main proc

mov ax,@data

mov ds,ax

mov bx,1

mov dx,1

printm prompt

new\_line

pushall

dec\_output

space

popall

pushall

dec\_output

space

popall

mov bx,1

mov dx,1

mov cx,8

@loop\_fibo:

mov f1,bx

mov f2,dx

add bx,dx

mov f3,bx *;f3=f1+f2*

pushall

dec\_output

space

popall

mov bx,f2 *;f1=f2*

mov dx,f3 *;f2=f3*

loop @loop\_fibo

exitp

main endp

end main

1. **Write and test a MASM program for sub string deletion.**

.model medium

.stack 100h

.data

prompt\_1 db 10,13,'enter the string : $'

prompt\_2 db 10,13,'enter the substring to be deleted : $'

prompt\_3 db 10,13,'the new string is : $'

newline db 10,13,'$'

*;input string*

buffersize\_1 db 51 *; 50 char + return*

inputlength\_1 db 0 *; number of read characters*

string db 51 dup(0) *; actual buffer*

end\_1 db '$'

index1 db 0 *;index for looping*

*;input substring*

buffersize\_2 db 21 *; 20 char + return*

inputlength\_2 db 0 *; number of read characters*

substring db 21 dup(0) *; actual buffer*

index2 db 0 *;index for looping*

*;modified output string*

index3 db 0 *;index for looping*

newstring db 50 dup('$')

*;macro to display prompt and print string*

display macro msg

mov ah,9

lea dx,msg

int 21h

endm

*;macro for string input*

get\_string macro buffer\_

mov dx, offset buffer\_ *; load our pointer to the beginning of the structure*

mov ah, 0ah *; getline function*

int 21h

mov si, offset buffer\_ + 1 *;move pointer to the input string size*

mov cl, [ si ] *;move input string size to cl*

mov ch, 0 *;clear ch to use cx*

inc cx

add si, cx *;move pointer to the next byte of the last input*

mov al, '$'

mov [ si ], al *;add '$' after the input string*

endm

*;macro for copynig character from input string to output string*

string\_copy macro

mov di,offset newstring *; load our pointer to the beginning of the structure*

mov al,index3

xor ah,ah *;load the index in ax register*

add di,ax *;go to the next location where the character is to be copied*

mov dl,[ si ]

mov [ di ],dl *;copy from input string to output string*

inc al

mov index3,al *;increment the index*

endm

*;macro to check whether two character of the input string and substring are same or not*

compare macro

mov dl,[ si ] *; load the character of input string in dl*

mov di,offset substring

mov al,index2

mov ah,ah

add di,ax

mov dh,[ di ] *; load the character of input substring in dh*

cmp dl,dh *; compare dl and dh*

endm

.code

main proc

mov ax,@data

mov ds,ax

display prompt\_1

get\_string buffersize\_1 *; input the string*

display prompt\_2

get\_string buffersize\_2 *; input the substring*

mov si,offset string *; load our pointer to the beginning of the structure*

mov cl,inputlength\_1 *; move length of the string in cl*

@loop1:

mov di,offset substring *; load our pointer to the beginning of the structure*

mov index2,0

string\_copy

compare

jne @label1

mov bl,inputlength\_2

xor bh,bh

dec bx

@loop2:

inc si

dec cl

inc index2

string\_copy

compare

jne @label1

dec bl

jne @loop2

*;if the substring is present*

mov bl,inputlength\_2 *;move substring length to bl*

mov al,index3 *; move new string index to al*

sub al,bl *; subtract bl from al*

mov index3,al *; save al in new string index*

@label1:

inc si

loop @loop1

@print:

string\_copy *; add '$' after the output string*

display prompt\_3

display newstring *; display the output string*

mov ah,4ch

int 21h

main endp

end main

1. **Write and test a MASM program to create and delete a file.**

.model small

.stack 100h

.data

msg1 db 10,13,'enter file name to be created $'

msg2 db 10,13,'file is created$'

msg3 db 10,13,'enter file name to be deleted $'

msg4 db 10,13,'file is deleted$'

msg5 db 10,13,'deletion error$'

fnc db 50 dup(?)

fnd db 50 dup(?)

.code

pushall macro

push ax

push bx

push cx

push dx

endm

popall macro

pop dx

pop cx

pop bx

pop ax

endm

print macro arg

mov dx,offset arg

mov ah,09h

int 21h

endm

readstr macro arg

local readlp,exit

mov di,offset arg

readlp:

mov ah,01h

int 21h

cmp al,13

je exit

mov [di],al

inc di

jmp readlp

exit:

endm

main proc

mov ax,@data

mov ds,ax

print msg1

pushall

readstr fnc

popall

crte:

mov cx,0

mov dx,offset fnc

mov ah,3ch

int 21h

print msg2

print msg3

pushall

readstr fnd

popall

dlte:

lea dx,fnd

mov ah,41h

int 21h

jc nfound

print msg4

jmp exit

nfound:

print msg5

exit:

mov ah,4ch

int 21h

main endp

end main

1. **Write and test a MASM program to Implement Linear search.**

*;Write and test a program to Implement Linear search.*

include mtab.asm

.model small

.stack 100h

.data

prompts db 10,13,"Enter size of array: $"

prompte db 10,13,"Enter elements of array: $"

promptsr db 10,13,"Enter element to search: $"

promptfound db 10,13,"element found at: $"

promptnotfound db 10,13,"element not found $"

arr dw 50 dup(?)

s dw ?

.code

main proc

mov ax,@data

mov ds,ax

*; display prompt for size*

printm prompts

*;accept size*

dec\_input

*; bx has the size*

printm prompte

mov s,bx

lea si,arr

mov cx,bx

@array\_input:

pushall

dec\_input

mov word ptr[si],bx

popall

inc si

inc si

loop @array\_input

*; enter element to search*

printm promptsr

dec\_input

*;bx has the element to be searched*

lea si,arr

mov cx,s

@linear\_search:

cmp bx,word ptr[si]

je @found

inc si

inc si

loop @linear\_search

*; not found case*

printm promptnotfound

jmp @exit

@found:

printm promptfound

mov bx,s

sub bx,cx

inc bx

dec\_output

new\_line

@exit:

exitp

main endp

end main

**ASSIGNMENT 3**

1. **Write and test a MASM program to Implement Binary search. Show the steps. Each step will be succeeded by “*Enter*” key.**
2. **Write and test a MASM program to Implement Selection Sort. Show the steps. Each step will be succeeded by “*Enter*” key. The Program will terminate when the “*Esc*” key is pressed.**

*;Write and test a MASM program to Implement Selection Sort. Show the steps.*

*;Each step will be succeeded by “Enter” key. The Program will terminate when the “Esc” key is pressed.*

include mtab.asm

array\_output macro arr

local @array\_print

*;printing the array*

lea si,arr

mov cx,s

@array\_print:

mov bx,word ptr[si]

mov temp,cx

dec\_output

space

inc si

inc si

mov cx,temp

loop @array\_print

endm

.model small

.stack 100h

.data

prompts db 10,13,"Enter size of array: $"

prompte db 10,13,"Enter elements of array: $"

promptsr db 10,13,"The sorted array is: $"

wrong\_key db 10,13,"Invalid key entered: $"

arr dw 50 dup(?)

s dw ?

temp dw ?

min\_idx dw ?

.code

main proc

mov ax,@data

mov ds,ax

*; display prompt for size*

printm prompts

*;accept size*

dec\_input

*; bx has the size*

printm prompte

mov s,bx

lea si,arr

mov cx,bx

*;\*\*\*\*\*\*\*\*\*\* array input \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

@array\_input:

mov temp,cx

dec\_input

mov word ptr[si],bx

mov cx,temp

inc si

inc si

loop @array\_input

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\* sorting \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

lea si,arr

mov cx,s

dec cx

@outer\_loop:

mov dx,cx *; dx is the inner loop counter*

mov di,si

inc di

inc di

mov min\_idx,si

push si

@inner\_loop:

mov si,min\_idx

mov bx,word ptr[si]

cmp word ptr[di],bx

jge @incr

*; else set min\_idx the elements*

mov min\_idx,di

@incr:

inc di

inc di

dec dx

jnz @inner\_loop

*;swap*

pop si

mov di,min\_idx

mov bx,word ptr[di]

xchg word ptr[si],bx

mov word ptr[di],bx

inc si

inc si

push si

push cx

array\_output arr

*; here keyboard input inserted*

*;\*\*\*\*\*\*\*\*\*\* pressing enter will show next step esc will exit \*\*\*\*\*\*\*\*\*\*\*\**

@error\_enter:

mov ah,01h

int 21h

cmp al,1bh *;check if esc is pressed*

je @exit

cmp al,0dh

je @next\_iter

printm wrong\_key

jmp @error\_enter

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

@next\_iter:

pop cx

pop si

loop @outer\_loop

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

*;\*\*\*\*\*\*\* array output \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

printm promptsr

array\_output arr

*;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\**

@exit:

exitp

main endp

end main

1. **Write and test a MASM program to wait for left mouse clicks and display a text string at the exact clicked spot in the client area.**