

## COAL Assignment-02

*Rayyan Aamir | 24K-0687 | BCS-3F*

### Question 1:

Rayyan Aamir 24K-0687 BCS-3F																										
Computer Organization & Assembly Language		Date: _____																								
Assignment # 02		Page No. _____																								
<u>Question 01 :-</u>																										
<table border="1"><tr><td>mov eax, 3</td><td></td><td>eax = 7</td></tr><tr><td>mov ebx, 7</td><td></td><td>ebx = 10</td></tr><tr><td>push eax</td><td></td><td>eax = 3</td></tr><tr><td>push ebx</td><td>X 10</td><td></td></tr><tr><td>pop eax</td><td>X</td><td></td></tr><tr><td>push 10</td><td></td><td></td></tr><tr><td>pop ebx</td><td></td><td></td></tr><tr><td>pop eax</td><td></td><td></td></tr></table>			mov eax, 3		eax = 7	mov ebx, 7		ebx = 10	push eax		eax = 3	push ebx	X 10		pop eax	X		push 10			pop ebx			pop eax		
mov eax, 3		eax = 7																								
mov ebx, 7		ebx = 10																								
push eax		eax = 3																								
push ebx	X 10																									
pop eax	X																									
push 10																										
pop ebx																										
pop eax																										

## **Question 2:**

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; Assignment 02 | Question 02

INCLUDE Irvine32.inc

.data

```
num1 SDWORD ?
num2 SDWORD ?
num3 SDWORD ?
num4 SDWORD ?
colon BYTE ":",0
prompt BYTE "Enter the value of number ",0
result SDWORD ?
msg BYTE "Final Result: ",0
```

.code

main PROC

```
    mov ebx, 0
```

```
    inc ebx
```

```
    mov edx, OFFSET prompt
```

```
    call WriteString
```

```
    mov eax, ebx
```

```
    call WriteDec
```

```
    mov edx, OFFSET colon
```

```
    call WriteString
```

```
    call ReadInt
```

```
    mov num1, eax
```

```
inc ebx  
mov edx, OFFSET prompt  
call WriteString  
mov eax, ebx  
call WriteDec  
mov edx, OFFSET colon  
call WriteString  
call ReadInt  
mov num2, eax
```

```
inc ebx  
mov edx, OFFSET prompt  
call WriteString  
mov eax, ebx  
call WriteDec  
mov edx, OFFSET colon  
call WriteString  
call ReadInt  
mov num3, eax
```

```
inc ebx  
mov edx, OFFSET prompt  
call WriteString  
mov eax, ebx  
call WriteDec  
mov edx, OFFSET colon  
call WriteString  
call ReadInt
```

```
    mov num4, eax
```

L1:

```
    mov ebx, num2  
    cmp num1, ebx  
    jng L2
```

```
    mov ebx, num4  
    cmp num3, ebx  
    je L2
```

```
    mov eax, num1  
    add eax, num3  
    mov result, eax  
    jmp display_result
```

L2:

```
    mov ebx, num4  
    cmp num2, ebx  
    jne L3  
    mov eax, num2  
    sub eax, num1  
    mov result, eax  
    jmp display_result
```

L3:

```
    mov result, 0
```

display\_result:

```

call CRLF
call CRLF
mov edx, OFFSET msg
call WriteString
mov eax, result
call WriteInt

exit
main ENDP
END main

```

Q1.asm | Test.asm  
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Microsoft Visual Studio Debug + ⏮

Enter the value of number 1: 20  
Enter the value of number 2: 10  
Enter the value of number 3: 5  
Enter the value of number 4: 3

Final Result: +25  
C:\Users\Rayyan\source\repos\COAL\_Lab01\Debug\COAL\_Lab01.exe (process 5868) exited with code 0 (0x0).  
Press any key to close this window . . .

### Question 3:

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; Assignment 02 | Question 03

INCLUDE Irvine32.inc

```
.data
arr SDWORD 5,-10,15,-20,25,0
sum SDWORD 0
countArr DWORD ?
```

```
msg BYTE "Sum: ",0
```

```
.code
```

```
main PROC
```

```
    mov eax, LENGTHOF arr
```

```
    mov countArr, eax
```

```
    mov ebx, 0
```

```
    mov esi, 0
```

```
calculate_sum:
```

```
    cmp ebx, countArr
```

```
    jge exit_program
```

```
    cmp arr[esi], 0
```

```
    jg add_sum
```

```
    dec sum
```

```
    jmp next
```

```
add_sum:
```

```
    mov eax, sum
```

```
    add eax, arr[esi]
```

```
    mov sum, eax
```

```
next:
```

```
    add esi, TYPE arr
```

```
    inc ebx
```

```
    jmp calculate_sum
```

```
exit_program:
```

```
    mov edx, OFFSET msg
```

```
    call WriteString
```

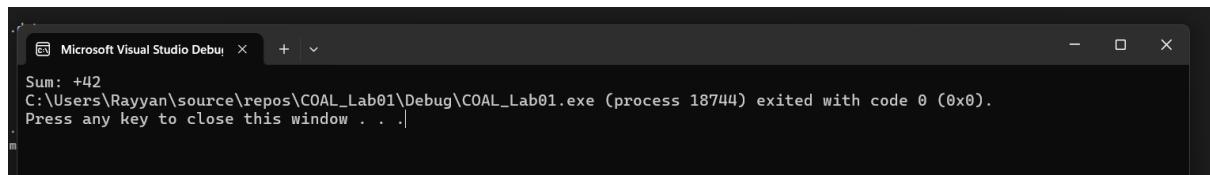
```
    mov eax, sum
```

```
    call WriteInt
```

```
exit
```

```
main ENDP
```

```
END main
```



#### Question 4:

Question 04:-

The loop decrements ECX by 1 every time and runs while ECX is greater than zero. This means AX is decremented by 1 each of the 10 times the loop runs as the initial value of ECX is 0Ah

$ECX = A h \Rightarrow AX = FFFF h$	$ECX = 5 h \Rightarrow AX = FFFA h$
$ECX = 9 h \Rightarrow AX = FFFE h$	$ECX = 4 h \Rightarrow AX = FFF9 h$
$ECX = 8 h \Rightarrow AX = FFFD h$	$ECX = 3 h \Rightarrow AX = FFF8 h$
$ECX = 7 h \Rightarrow AX = FFFC h$	$ECX = 2 h \Rightarrow AX = FFF7 h$
$ECX = 6 h \Rightarrow AX = FFB h$	$ECX = 1 h \Rightarrow AX = FFG6 h$

$\therefore \text{Final value of } AX = FFG6 h$

### Question 5:

Question 05 :-

```
mov AL, 0D4H ; AL = 1101 0100 b
shl AL, 3      ; AL = 1010 0000 b = A0h
mov AL, 0D4H ; AL = 1101 0100 b
sal AL, 3      ; AL = 1010 0000 b = A0h
stc            ; CF = 1
mov AL, 0D4H ; AL = 1101 0100 b
rol AL, 1      ; AL = 1010 1001 b = A9 h
stc            ; CF = 1
```

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Date: \_\_\_\_\_

```
mov AL, 0D4H ; AL = 1101 0100 b
rcr AL, 3      ; AL = 0011 1010 b = 3Ah
```

↓  
dry Run:-

i	CF in	AL before	AL after	CF out
1	1	1101 0100	1110 1010	0
2	0	1110 1010	0111 0101	0
3	0	0111 0101	0011 1010	1

Final Values :-

A0h, A0h, A9h, 3Ah

## **Question 6:**

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; Assignment 02 | Question 06

INCLUDE Irvine32.inc

.data

op1 DWORD 5

op2 DWORD 8

x DWORD 3

y DWORD 6

z DWORD 0

msg BYTE "Final value of z: ",0

.code

main PROC

while\_loop:

    mov eax, op2

    cmp op1, eax

    jg exit\_loop

    mov eax, x

    cmp op1, eax

    jl else\_condition

    mov eax, y

    cmp op1, eax

    jg else\_condition

```
add z, 10
```

```
jmp next
```

```
else_condition:
```

```
sub z, 10
```

```
next:
```

```
dec op1
```

```
jmp while_loop
```

```
exit_loop:
```

```
mov eax, z
```

```
mov edx, OFFSET msg
```

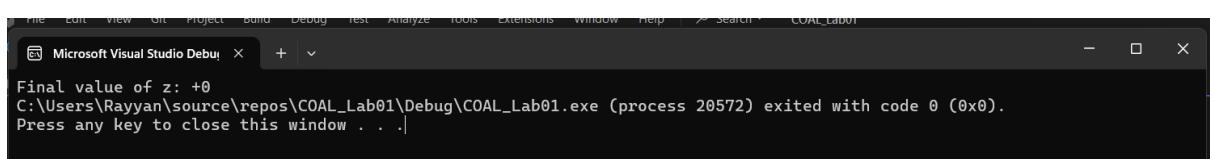
```
call WriteString
```

```
call WriteInt
```

```
exit
```

```
main ENDP
```

```
END main
```



## **Question 7:**

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; Assignment 02 | Question 07

INCLUDE Irvine32.inc

.data

```
prompt BYTE "Enter a number: ",0
msgZero BYTE "The number entered is zero.",0
msgPos BYTE "The number entered is positive.",0
msgNeg BYTE "The number entered is negative.",0
num SBYTE ?
```

.code

main PROC

```
    mov edx, OFFSET prompt
```

```
    call WriteString
```

```
    call ReadInt
```

```
    mov num, al
```

```
    cmp num, 0
```

```
    je ZERO
```

```
    jg POSITIVE
```

```
    call CRLF
```

```
    call CRLF
```

```
    mov edx, OFFSET msgNeg
```

```
    call WriteString
```

```
    jmp end_program
```

ZERO:

```
call CRLF
call CRLF
mov edx, OFFSET msgZero
call WriteString
jmp end_program
```

POSITIVE:

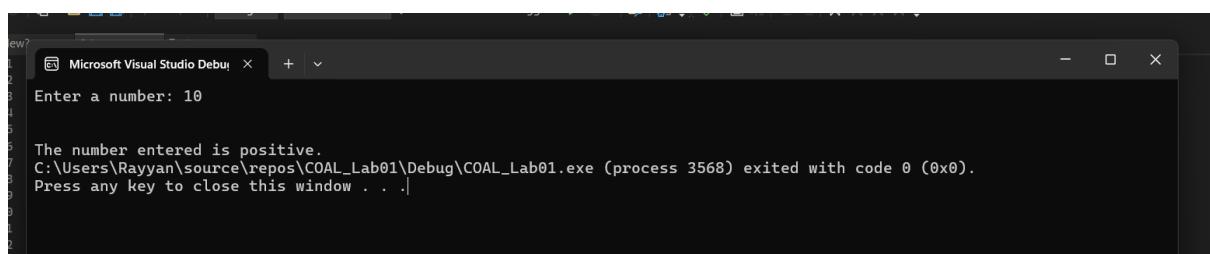
```
call CRLF
call CRLF
mov edx, OFFSET msgPos
call WriteString
```

end\_program:

```
exit
```

```
main ENDP
```

```
END main
```



## **Question 8:**

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; Assignment 02 | Question 08

INCLUDE Irvine32.inc

.data

num1 SWORD ?

num2 SWORD ?

result SDWORD ?

prompt BYTE "Enter a number: ",0

msg BYTE "Result: ",0

.code

main PROC

mov edx, OFFSET prompt

call WriteString

call ReadInt

mov num1, ax

mov edx, OFFSET prompt

call WriteString

call ReadInt

mov num2, ax

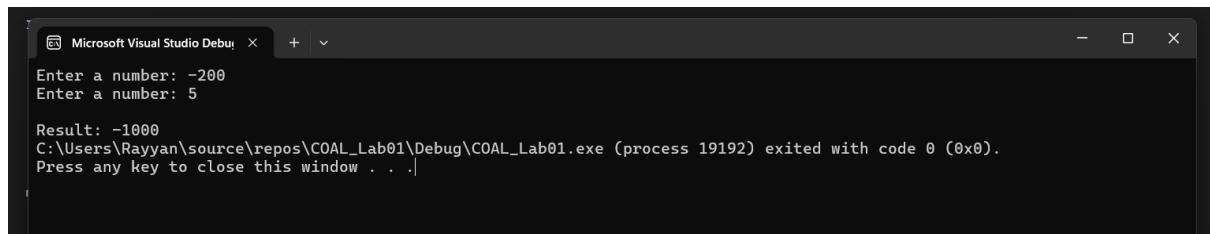
movsx eax, num1

movsx ebx, num2

imul eax, ebx

```
    mov result, eax
    call CRLF
    mov edx, OFFSET msg
    call WriteString
    mov eax, result
    call WriteInt

exit
main ENDP
END main
```



### Question 9:

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; Assignment 02 | Question 09

INCLUDE Irvine32.inc

```
.data
arr WORD 5,10,51,68,25,50
sample WORD 50
arrSize WORD LENGTHOF arr
index WORD 0
sum WORD 0
msg BYTE "Sum: ",0
```

```
.code
main PROC
while_loop:
    mov ax, index
    cmp ax, arrSize
    jge exit_loop

    movzx esi, index
    mov cx, arr[esi * TYPE arr]

    cmp cx, sample
    jg greater_than_sample

    mov ax, sum
    add ax, cx
    mov sum, ax

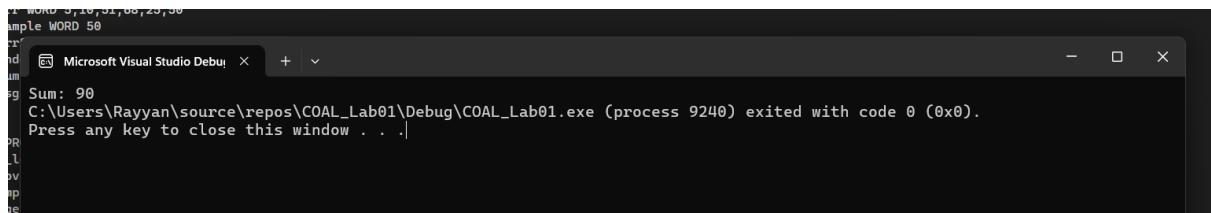
greater_than_sample:
    inc index
    jmp while_loop

exit_loop:
    mov edx, OFFSET msg
    call WriteString
    movzx eax, sum
    call WriteDec

exit
```

```
main ENDP
```

```
END main
```



```
1 WORD 3,10,51,68,23,50
ample WORD 50
r
d Microsoft Visual Studio Debug X + v
um
sg Sum: 90
C:\Users\Rayyan\source\repos\COAL_Lab01\Debug\COAL_Lab01.exe (process 9240) exited with code 0 (0x0).
Press any key to close this window . . .|
```

### **Question 10 (a) & (b):**

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; Assignment 02 | Question 10

INCLUDE Irvine32.inc

COMMENT !

Intuition:

$$26 = 16 + 8 + 2$$

$$26 = 2^4 + 2^3 + 2^1$$

$2^4$  = shift left 4 times

$2^3$  = shift left 3 times

$2^1$  = shift left 1 time

$$\text{EAX} * 26 = (\text{EAX} * 2^4) + (\text{EAX} * 2^3) + (\text{EAX} * 2^1)$$

!

.data

initialVal DWORD 2

result DWORD 0

```
msg BYTE "2 * 26 = ",0
```

```
.code
```

```
main PROC
```

```
    mov eax, initialVal
```

```
    shl eax, 4
```

```
    mov result, eax
```

```
    mov eax, initialVal
```

```
    shl eax, 3
```

```
    add result, eax
```

```
    mov eax, initialVal
```

```
    shl eax, 1
```

```
    add result, eax
```

```
    mov eax, result
```

```
    mov edx, OFFSET msg
```

```
    call WriteString
```

```
    call WriteInt
```

```
exit
```

```
main ENDP
```

```
END main
```

