

COAL LAB 06 - 13 Mar 2025

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Task 1:

```
include irvine32.inc
```

```
.code
```

```
main PROC
```

```
    mov eax, 0
```

```
    mov ebx, 1
```

```
    mov ecx, 10
```

```
L1:
```

```
    call WriteDec
```

```
    call Crlf
```

```
    add eax, ebx
```

```
    xchg eax, ebx
```

```
    loop L1
```

```
    exit
```

```
main ENDP
```

```
END main
```

The screenshot shows the Microsoft Visual Studio IDE. The 'Source.asm' file is open, displaying the assembly code for Lab 6. The code includes the Irvine32 library, defines a main procedure, and implements a loop that prints the decimal value of the sum of two numbers (0 and 1) ten times. The output window shows the execution results, with the sum increasing from 0 to 34. The console window displays the path to the executable and instructions on how to close the window.

```
Source.asm 1 include irvine32.inc
           2 .code
           3 main PROC
           4     mov eax, 0
           5     mov ebx, 1
           6     mov ecx, 10
           7 L1:
           8     call WriteDec
           9     call Crlf
          10     add eax, ebx
          11     xchg eax, ebx
          12     loop L1
          13     exit
          14 main ENDP
          15 END main
```

Microsoft Visual Studio Debug Console

```
0
1
1
2
3
5
8
13
21
34

C:\Ibrahim\Personal\University Stuff\COAL\Labs\06\Lab 6\Debug\Lab 6.exe
To automatically close the console when debugging stops, enable Tools->C
le when debugging stops.
Press any key to close this window . . .
```

Task 2 - Part 1:

```
include irvine32.inc

.data
    num DWORD 1
    count DWORD 0

.code
    main PROC
        mov ecx,4
L1:
        mov count,ecx
        mov ecx,4
        sub ecx,count
        add ecx,1
L2:
        mov eax,num
        call WriteDec
        mov al,' '
        call WriteChar
        Loop L2
        call crlf
        mov ecx,count
        Loop L1
        exit
    main ENDP
END main
```

The screenshot shows the Microsoft Visual Studio IDE with the assembly code from the previous block loaded in the 'Source.asm' window. The code is as follows:

```
1 include irvine32.inc
2 .data
3     num DWORD 1
4     count DWORD 0
5 .code
6     main PROC
7         mov ecx,4
8 L1:
9         mov count,ecx
10        mov ecx,4
11        sub ecx,count
12        add ecx,1
13 L2:
14        mov eax,num
15        call WriteDec
16        mov al,' '
17        call WriteChar
18        Loop L2
19        call crlf
20        mov ecx,count
21        Loop L1
22        exit
23    main ENDP
24 END main
```

The 'Solution Explorer' on the right shows the project structure for 'Lab 6', including 'References', 'External Dependencies', 'Header Files', 'Resource Files', 'Source Files', and 'Source.asm'.

The 'Microsoft Visual Studio Debug' window at the bottom shows the output of the program:

```
1
1 1
1 1 1
1 1 1 1
```

Below the output, the debug console displays the following text:

```
C:\Ibrahim\Personal\University Stuff\COAL\Labs\06\Lab 6\Debug\Lab 6.exe
To automatically close the console when debugging stops, enable Tools->
Debug Console->Auto Close Console when debugging stops.
Press any key to close this window . . .
```

Task 2 - Part 2:

include irvine32.inc

.data

num DWORD 1

count DWORD 0

.code

main PROC

mov ecx,4

L1:

mov count,ecx

mov ecx,count

L2:

mov eax,num

call WriteDec

mov al,' '

call WriteChar

Loop L2

call crlf

mov ecx,count

Loop L1

exit

main ENDP

END main

The screenshot displays the Microsoft Visual Studio IDE. The 'Source.asm' window on the left shows the assembly code from the previous block, with line numbers 1 through 22. The 'Solution Explorer' on the right shows a project named 'Lab 6' with folders for 'References', 'External Dependencies', 'Header Files', and 'Resource Files'. The 'Microsoft Visual Studio Debug Console' window at the bottom right shows the output of the program: four lines of '1 1 1 1', followed by a blank line, and then the text 'C:\Ibrahim\Personal\University Stuff\COAL\Labs\06\Lab 6\Debug\Lab 6.e' and 'To automatically close the console when debugging stops, enable Tools'.

```
1 include irvine32.inc
2 .data
3     num DWORD 1
4     count DWORD 0
5 .code
6     main PROC
7     mov ecx,4
8 L1:
9     mov count,ecx
10    mov ecx,count
11 L2:
12    mov eax,num
13    call WriteDec
14    mov al,' '
15    call WriteChar
16    Loop L2
17    call crlf
18    mov ecx,count
19    Loop L1
20    exit
21 main ENDP
22 END main
```

1 1 1 1
1 1 1
1 1
1
C:\Ibrahim\Personal\University Stuff\COAL\Labs\06\Lab 6\Debug\Lab 6.e
To automatically close the console when debugging stops, enable Tools
Press any key to close this window . . .

Task 2 - Part 3:

```
include irvine32.inc
```

```
.data
```

```
    num DWORD ?
```

```
    count DWORD 0
```

```
.code
```

```
main PROC
```

```
    mov ecx,4
```

```
L1:
```

```
    mov count,ecx
```

```
    mov ecx,count
```

```
    mov num,4
```

```
L2:
```

```
    mov eax,num
```

```
    call WriteDec
```

```
    mov al,' '
```

```
    dec num
```

```
    call WriteChar
```

```
    Loop L2
```

```
    call crlf
```

```
    mov ecx,count
```

```
    Loop L1
```

```
    exit
```

```
main ENDP
```

```
END main
```

The screenshot shows the Microsoft Visual Studio IDE. The 'Source.asm' file is open, displaying the assembly code from the previous block. The code is as follows:

```
1  include irvine32.inc
2  .data
3      num DWORD ?
4      count DWORD 0
5  .code
6  main PROC
7      mov ecx,4
8  L1:
9      mov count,ecx
10     mov ecx,count
11     mov num,4
12  L2:
13     mov eax,num
14     call WriteDec
15     mov al,' '
16     dec num
17     call WriteChar
18     Loop L2
19     call crlf
20     mov ecx,count
21     Loop L1
22     exit
23 main ENDP
24 END main
```

The 'Solution Explorer' on the right shows the project structure for 'Lab 6'. The 'Microsoft Visual Studio Debug Console' is open, showing the output of the program:

```
4 3 2 1
4 3 2
4 3
4

C:\Ibrahim\Personal\University Stuff\COAL\Labs\06\Lab 6\Debug\Lab 6.exe
To automatically close the console when debugging stops, enable Tools
> Options> Debugging> Automatically close console when debugging stops.
Press any key to close this window . . .
```

Task 2 - Part 4:

include irvine32.inc

.data

num DWORD ?

count DWORD 0

.code

main PROC

mov ecx,4

L1:

mov count,ecx

mov ecx,count

mov num,1

L2:

mov eax,num

call WriteDec

mov al,' '

inc num

call WriteChar

Loop L2

call crlf

mov ecx,count

Loop L1

exit

main ENDP

END main

The screenshot displays the Microsoft Visual Studio IDE. On the left, the 'Source.asm' file is open, showing assembly code. The code includes 'irvine32.inc', defines a data section with 'num' and 'count', and a code section with a 'main' procedure. The 'main' procedure uses nested loops (L1 and L2) to print numbers 1 through 4, each followed by a space, and then a newline. On the right, the 'Solution Explorer' shows a project named 'Lab 6'. Below the code editor, the 'Microsoft Visual Studio Debug Console' is open, displaying the output of the program: '1 2 3 4', '1 2 3', '1 2', and '1' on separate lines. At the bottom of the debug console, a message states: 'C:\Ibrahim\Personal\University Stuff\COAL\Labs\06\Lab 6\Debug\Lab 6.e... To automatically close the console when debugging stops, enable Tools... le when debugging stops. Press any key to close this window . . .'

```
1 include irvine32.inc
2 .data
3     num DWORD ?
4     count DWORD 0
5 .code
6     main PROC
7     mov ecx,4
8 L1:
9     mov count,ecx
10    mov ecx,count
11    mov num,1
12 L2:
13    mov eax,num
14    call WriteDec
15    mov al,' '
16    inc num
17    call WriteChar
18    Loop L2
19    call crlf
20    mov ecx,count
21    Loop L1
22    exit
23 main ENDP
24 END main
```

1 2 3 4
1 2 3
1 2
1

C:\Ibrahim\Personal\University Stuff\COAL\Labs\06\Lab 6\Debug\Lab 6.e...
To automatically close the console when debugging stops, enable Tools...
le when debugging stops.
Press any key to close this window . . .

Task 3:

include irvine32.inc

.data

```
employees DWORD 5
lds DWORD 5 DUP(?)
names BYTE 5 DUP(20 Dup(?))
birthyear DWORD 5 DUP(?)
annualSalary DWORD 5 DUP(?)
msg1 db 'enter employee id ',0
msg2 db 'enter employee name ',0
msg3 db 'enter employee date of birth ',0
msg4 db 'enter employee annual salary ',0
msg5 db 'annual salary for all employees ',0
```

.code

```
main PROC
mov ecx,employees
mov esi,0
mov edi,0
```

L1:

```
mov edx,offset msg1
call WriteString
call ReadDec
mov lds[esi],eax

mov edx,offset msg2
call WriteString
mov ebx,ecx
mov edx,offset names
add edx,edi
mov ecx,20
call ReadString
mov ecx,ebx
add edi, 20

mov edx,offset msg3
Call WriteString
call ReadDec
mov birthyear[esi],eax
```

```

mov edx,offset msg4
Call WriteString
call ReadDec
mov annualSalary[esi],eax

```

```

add esi,4
call crlf
Loop L1
mov ecx,employees
mov esi,offset annualSalary
mov eax,0

```

L2:

```

add eax,[esi]
add esi,TYPE annualSalary
Loop L2
mov edx, OFFSET msg5
Call WriteString
call WriteInt
exit

```

main ENDP

END main

The screenshot displays the Microsoft Visual Studio IDE. On the left, the 'Source.asm' file is open, showing assembly code with line numbers 30 through 60. The code includes instructions for reading strings, calculating offsets, writing strings, and looping through an array of employees to calculate their annual salaries. On the right, the 'Microsoft Visual Studio Debug' window shows the execution output, which prompts the user to enter employee details (id, name, date of birth, and annual salary) for six employees. The final output shows the total annual salary for all employees as +22400.

```

Source.asm
30  call ReadString
31  mov ecx,ebx
32  add edi, 20
33
34  mov edx,offset msg3
35  Call WriteString
36  call ReadDec
37  mov birthyear[esi],eax
38
39  mov edx,offset msg4
40  Call WriteString
41  call ReadDec
42  mov annualSalary[esi],eax
43
44  add esi,4
45  call crlf
46  Loop L1
47  mov ecx,employees
48  mov esi,offset annualSalary
49  mov eax,0
50
51  L2:
52  add eax,[esi]
53  add esi,TYPE annualSalary
54  Loop L2
55  mov edx, OFFSET msg5
56  Call WriteString
57  call WriteInt
58  exit
59  main ENDP
60  END main

```

```

Microsoft Visual Studio Debug
enter employee id 15
enter employee name Ibrahim
enter employee date of birth 2002
enter employee annual salary 2500

enter employee id 29
enter employee name Johar
enter employee date of birth 1985
enter employee annual salary 5500

enter employee id 53
enter employee name John
enter employee date of birth 2001
enter employee annual salary 1200

enter employee id 32
enter employee name Jake
enter employee date of birth 1998
enter employee annual salary 8700

enter employee id 24
enter employee name Michael
enter employee date of birth 1996
enter employee annual salary 4500

annual salary for all employees +22400

```

Task 4:

```
include irvine32.inc
```

```
.data
```

```
    source BYTE "Ibrahim Johar - Task 4",0
```

```
    target BYTE SIZEOF source DUP(?)
```

```
.code
```

```
main PROC
```

```
    mov esi,0
```

```
L1:
```

```
    mov al,source[esi]
```

```
    mov target[esi],al
```

```
    inc esi
```

```
    cmp al,0
```

```
    jne L1
```

```
    mov edx,offset target
```

```
    call WriteString
```

```
    exit
```

```
main ENDP
```

```
END main
```

The screenshot displays the Microsoft Visual Studio IDE. The main window shows the assembly file 'Source.asm' with the following code:

```
1 include irvine32.inc
2 .data
3     source BYTE "Ibrahim Johar - Task 4",0
4     target BYTE SIZEOF source DUP(?)
5 .code
6     main PROC
7         mov esi,0
8     L1:
9         mov al,source[esi]
10        mov target[esi],al
11        inc esi
12        cmp al,0
13        jne L1
14        mov edx,offset target
15        call WriteString
16        exit
17    main ENDP
18    END main
```

The Solution Explorer on the right shows the project structure for 'Lab 6', including 'Source Files' and 'Source.asm'. The Microsoft Visual Studio Debug Console at the bottom shows the output of the program:

```
Ibrahim Johar - Task 4
C:\Ibrahim\Personal\University Stuff\COAL\Labs\06\Lab 6\Debug\Lab 6.e
To automatically close the console when debugging stops, enable Tools
le when debugging stops.
Press any key to close this window . . .
```


Task 5:

include irvine32.inc

.data

arr BYTE 1,2,3,4,5

.code

main PROC

mov ecx,(LENGTHOF arr)/2

mov esi,0

mov edi,4

L1:

mov al,arr[esi]

mov bl,arr[edi]

mov arr[esi],bl

mov arr[edi],al

inc esi

dec edi

Loop L1

mov ecx,LENGTHOF arr

mov eax,0

mov esi,offset arr

L2:

mov al,[esi]

call WriteInt

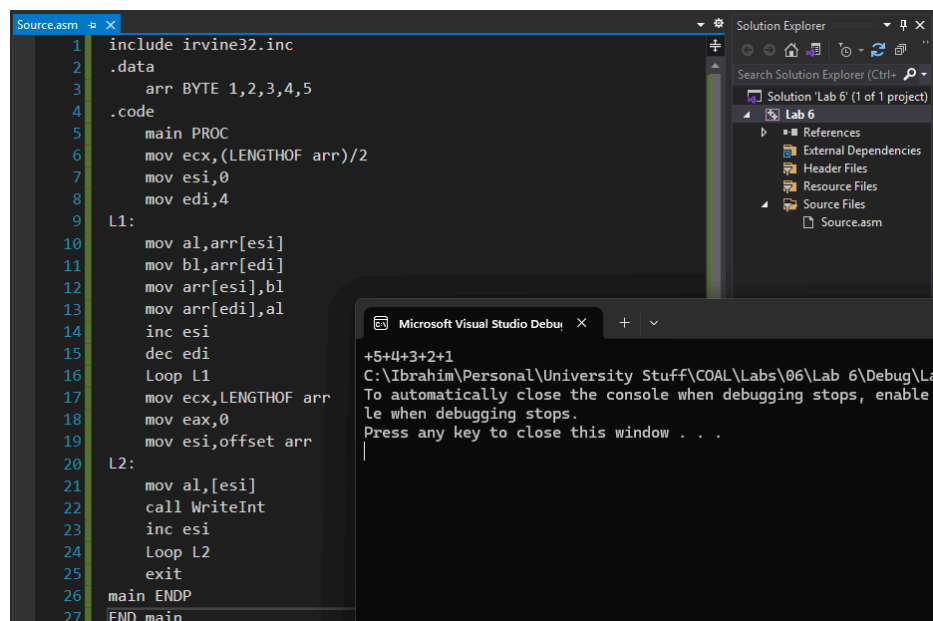
inc esi

Loop L2

exit

main ENDP

END main



Task 6:

```
include irvine32.inc
```

```
.data
```

```
arr DWORD 8,5,1,2,6
```

```
count DWORD ?
```

```
.code
```

```
main PROC
```

```
mov ecx,LENGTHOF arr
```

```
L1:
```

```
mov count,ecx
```

```
mov ecx,LENGTHOF arr
```

```
dec ecx
```

```
mov esi,0
```

```
L2:
```

```
mov eax,arr[esi]
```

```
mov edi,esi
```

```
add edi,TYPE arr
```

```
mov ebx,arr[edi]
```

```
CMP eax,ebx
```

```
JG SWAPPING
```

```
L3:
```

```
add esi,TYPE arr
```

```
Loop L2
```

```
mov ecx,count
```

```
Loop L1
```

```
JMP DISPLAY
```

```
SWAPPING:
```

```
mov arr[edi],eax
```

```
mov arr[esi],ebx
```

```
JMP L3
```

```
DISPLAY:
```

```
mov ecx,LENGTHOF arr
```

```
mov esi,0
```

```
L4:
```

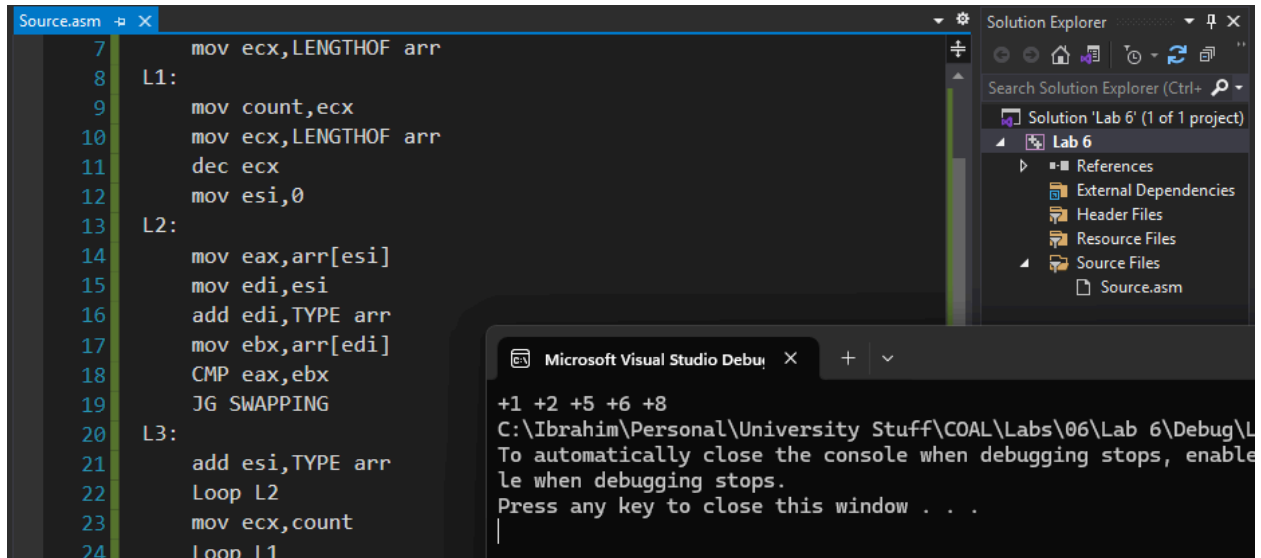
```
mov eax,arr[esi]
```

```
call WriteInt
```

```
mov al,' '
```

```
call WriteChar
```

```
        add esi,TYPE arr
    Loop L4
    exit
main ENDP
END main
```



The screenshot shows the Visual Studio IDE with the 'Source.asm' file open. The assembly code is as follows:

```
7      mov ecx,LENGTHOF arr
8  L1:
9      mov count,ecx
10     mov ecx,LENGTHOF arr
11     dec ecx
12     mov esi,0
13  L2:
14     mov eax,arr[esi]
15     mov edi,esi
16     add edi,TYPE arr
17     mov ebx,arr[edi]
18     CMP eax,ebx
19     JG SWAPPING
20  L3:
21     add esi,TYPE arr
22     Loop L2
23     mov ecx,count
24     Loop L1
```

The Solution Explorer on the right shows the project structure for 'Lab 6', including 'References', 'External Dependencies', 'Header Files', 'Resource Files', and 'Source Files' (containing 'Source.asm').

The Microsoft Visual Studio Debug Console at the bottom displays the following text:

```
+1 +2 +5 +6 +8
C:\Ibrahim\Personal\University Stuff\COAL\Labs\06\Lab 6\Debug\Lab 6.exe
To automatically close the console when debugging stops, enable
the 'Close console when debugging stops' option in Tools > Options >
Debugging.
Press any key to close this window . . .
```