

# COAL LAB 4 - 24K0546

## Task 1

INCLUDE Irvine32.inc

.data

num1 BYTE 25 ; equivalent to 19h

num2 WORD 01200h

num3 DWORD ?

.code

main PROC

MOV AL, num1 ; AL becomes 19h

call DumpRegs

MOV AX, num2 ; AX becomes 1200h

call DumpRegs

MOVZX EAX, AX ; EAX becomes 1200h with zero-extends

MOV num3, EAX ; MOV EAX to num3

call DumpRegs

exit

main ENDP

END main

```
task.asm
1  INCLUDE Irvine32.inc
2
3  .data
4      num1 BYTE 25 ; equivalent to 19h
5      num2 WORD 01200h
6      num3 DWORD ?
7
8  .code
9      main PROC
10
11         MOV AL, num1 ; AL becomes 19h
12         call DumpRegs
13
14         MOV AX, num2 ; AX becomes 1200h
15         call DumpRegs
16
17         MOVZX EAX, AX ; EAX becomes 1200h with zero-extends
18         MOV num3, EAX ; MOV EAX to num3
19         call DumpRegs
20
21     exit
22 main ENDP
23 END main
```

Microsoft Visual Studio Debug Console

EAX=004FFA19	EBX=00277000	ECX=00A810AA	EDX=00A810AA
ESI=00A810AA	EDI=00A810AA	EBP=004FFA38	ESP=004FFA2C
EIP=00A8366A	EFL=00000246	CF=0	SF=0 ZF=1 OF=0 AF=0 PF=1

EAX=004F1200	EBX=00277000	ECX=00A810AA	EDX=00A810AA
ESI=00A810AA	EDI=00A810AA	EBP=004FFA38	ESP=004FFA2C
EIP=00A83675	EFL=00000246	CF=0	SF=0 ZF=1 OF=0 AF=0 PF=1

EAX=00001200	EBX=00277000	ECX=00A810AA	EDX=00A810AA
ESI=00A810AA	EDI=00A810AA	EBP=004FFA38	ESP=004FFA2C
EIP=00A83682	EFL=00000246	CF=0	SF=0 ZF=1 OF=0 AF=0 PF=1

C:\Users\Admin\source\repos\Lab03\Debug\Lab03.exe (process 16616) ex  
To automatically close the console when debugging stops, enable Tool  
le when debugging stops.  
Press any key to close this window . . .

## Task 2

```
INCLUDE Irvine32.inc
```

```
.data
```

```
var1 SBYTE -50 ; CE in SBYTE hexadecimal representation - FFFF FFCE in DWORD
```

```
var2 BYTE 200 ; C8 in BYTE hexadecimal representation
```

```
.code
```

```
main PROC
```

```
    MOVZX EAX, var1 ; MOV var1 with sign-extend
```

```
    call DumpRegs
```

```
    MOVZX EAX, var2 ; MOV var2 with zero-extend
```

```
    call DumpRegs
```

```
exit
```

```
main ENDP
```

```
END main
```

```
task.asm
1  INCLUDE Irvine32.inc
2  .data
3      var1 SBYTE -50 ; CE in SBYTE hexadecimal representation - FFFF FFCE in DWORD
4      var2 BYTE 200 ; C8 in BYTE hexadecimal representation
5  .code
6  main PROC
7
8      MOVZX EAX, var1 ; MOV var1 with sign-extend
9      call DumpRegs
10
11     MOVZX EAX, var2 ; MOV var2 with zero-extend
12     call DumpRegs
13
14     exit
15 main ENDP
16 END main
```

Microsoft Visual Studio Debug Console

EAX=FFFFFFFCE	EBX=007E7000	ECX=00CA10AA	EDX=00CA10AA
ESI=00CA10AA	EDI=00CA10AA	EBP=008FFE34	ESP=008FFE28
EIP=00CA366C	EFL=00000246	CF=0	SF=0 ZF=1 OF=0 AF=0 PF=1

C:\Users\Admin\source\repos\Lab03\Debug\Lab03.exe (process 17372) exited  
To automatically close the console when debugging stops, enable Tools->Options->Environment->Debugger->Close console when debugging stops.  
Press any key to close this window . . .

## Task 3

```
INCLUDE Irvine32.inc
```

```
.data
```

```
num1 WORD 01234h
```

```
num2 WORD 05678h
```

```
.code
```

```
main PROC
```

```
    MOVZX EAX, num1 ; Initial num1
```

```
    call DumpRegs
```

```

MOV AX, num2 ; Initial num2
call DumpRegs
MOV AX, num1
XCHG AX, num2
MOV num1, AX
MOV AX, num1 ; num1 swapped value
call DumpRegs
MOV AX, num2 ; num2 swapped value
call DumpRegs
MOV AX, num1
XCHG AX, num2
MOV num1, AX
MOV AX, num1 ; num1 reswapped value
call DumpRegs
MOV AX, num2 ; num2 reswapped value
call DumpRegs
exit
main ENDP
END main

```

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

```

7      MOVZX EAX, num1 ; Initial num1
8      call DumpRegs
9
10     MOV AX, num2 ; Initial num2
11     call DumpRegs
12
13
14     MOV AX, num1
15     XCHG AX, num2
16     MOV num1, AX
17
18     MOV AX, num1 ; num1 swapped value
19     call DumpRegs
20
21     MOV AX, num2 ; num2 swapped value
22     call DumpRegs
23
24     MOV AX, num1
25     XCHG AX, num2
26     MOV num1, AX
27
28     MOV AX, num1 ; num1 reswapped value
29     call DumpRegs
30
31     MOV AX, num2 ; num2 reswapped value
32     call DumpRegs

```

The 'Microsoft Visual Studio Debug Console' shows the following register states at various points:

- Initial state (EIP=001410AA): EAX=00005678, EBX=0093F000, ECX=001410AA, EDX=001410AA, ESI=001410AA, EDI=001410AA, EBP=00B3F9F4, ESP=00B3F9E8, EIP=001410AA, EFL=00000246, CF=0, SF=0, ZF=1, OF=0, AF=0, PF=1.
- After first swap (EIP=001413695): EAX=00005678, EBX=0093F000, ECX=001410AA, EDX=001410AA, ESI=001410AA, EDI=001410AA, EBP=00B3F9F4, ESP=00B3F9E8, EIP=001413695, EFL=00000246, CF=0, SF=0, ZF=1, OF=0, AF=0, PF=1.
- After second swap (EIP=0014136A0): EAX=00001234, EBX=0093F000, ECX=001410AA, EDX=001410AA, ESI=001410AA, EDI=001410AA, EBP=00B3F9F4, ESP=00B3F9E8, EIP=0014136A0, EFL=00000246, CF=0, SF=0, ZF=1, OF=0, AF=0, PF=1.
- After third swap (EIP=0014136BE): EAX=00001234, EBX=0093F000, ECX=001410AA, EDX=001410AA, ESI=001410AA, EDI=001410AA, EBP=00B3F9F4, ESP=00B3F9E8, EIP=0014136BE, EFL=00000246, CF=0, SF=0, ZF=1, OF=0, AF=0, PF=1.
- After fourth swap (EIP=0014136C9): EAX=00005678, EBX=0093F000, ECX=001410AA, EDX=001410AA, ESI=001410AA, EDI=001410AA, EBP=00B3F9F4, ESP=00B3F9E8, EIP=0014136C9, EFL=00000246, CF=0, SF=0, ZF=1, OF=0, AF=0, PF=1.

The process eventually exits with the message: 'C:\Users\Admin\source\repos\Lab03\Debug\Lab03.exe (process 11200) exited. To automatically close the console when debugging stops, enable Tools->Options->When debugging stops, enable Tools->Close console when debugging stops. Press any key to close this window...'.

#### Task 4

```
INCLUDE Irvine32.inc
```

```
.data
```

```
    Xval DWORD 25
```

```
    Yval DWORD 15
```

```
    Zval DWORD 40
```

```
    Rval DWORD ?
```

```
.code
```

```
main PROC
```

```
    MOV EAX, Xval
```

```
    ADD EAX, Yval
```

```
    SUB EAX, Zval
```

```
    NEG EAX
```

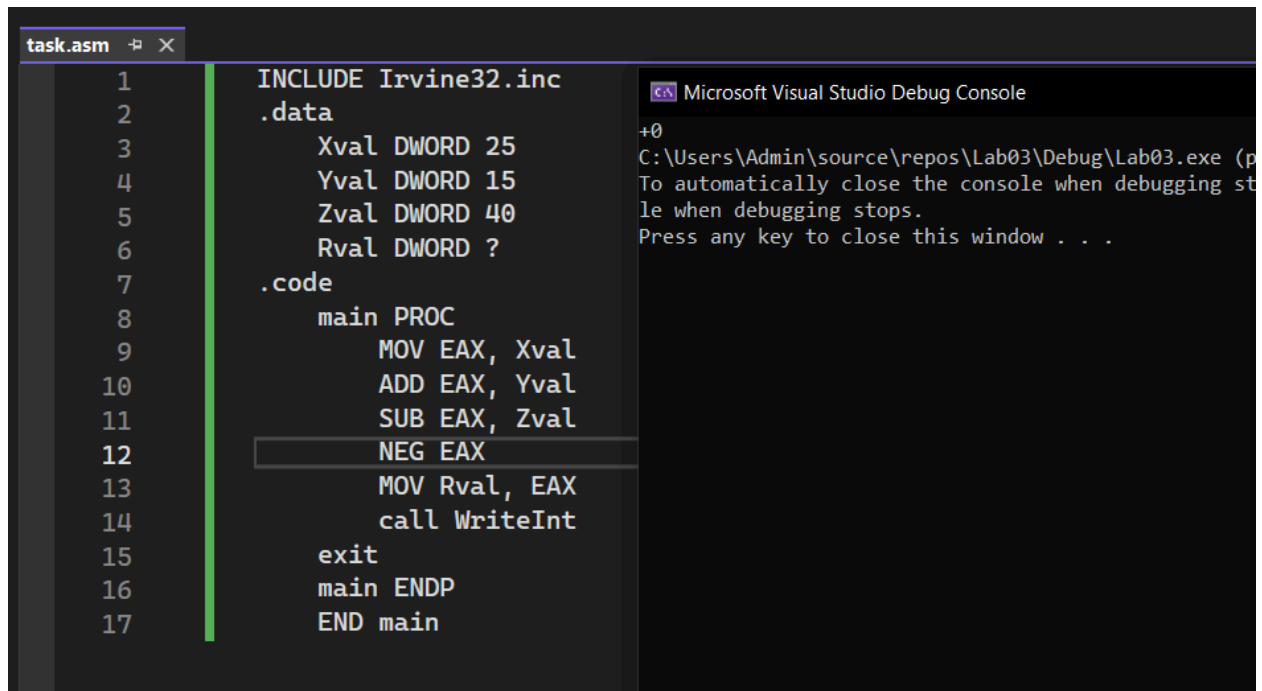
```
    MOV Rval, EAX
```

```
    call WriteInt
```

```
exit
```

```
main ENDP
```

```
END main
```



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

```
1  INCLUDE Irvine32.inc
2  .data
3      Xval DWORD 25
4      Yval DWORD 15
5      Zval DWORD 40
6      Rval DWORD ?
7  .code
8      main PROC
9          MOV EAX, Xval
10         ADD EAX, Yval
11         SUB EAX, Zval
12         NEG EAX
13         MOV Rval, EAX
14         call WriteInt
15     exit
16     main ENDP
17 END main
```

On the right, the `Microsoft Visual Studio Debug Console` is open, displaying the following text:

```
+0
C:\Users\Admin\source\repos\Lab03\Debug\Lab03.exe (p
To automatically close the console when debugging st
le when debugging stops.
Press any key to close this window . . .
```

## Task 5

INCLUDE Irvine32.inc

MAX = 100 ; declare MAX with = directive (reassignable)

MIN EQU 10 ; declare MIN with EQU directive (not reassignable)

.data

var1 BYTE ?

var2 BYTE ?

sum BYTE ?

.code

main PROC

MOV AL, MAX

MOV var1, AL ; Store MAX in var1

MOV AL, MIN

MOV var2, AL ; Store MIN in var2

MOV AL, var1

ADD AL, var2 ; Add var1 & var2

MOV sum, AL ; store in result

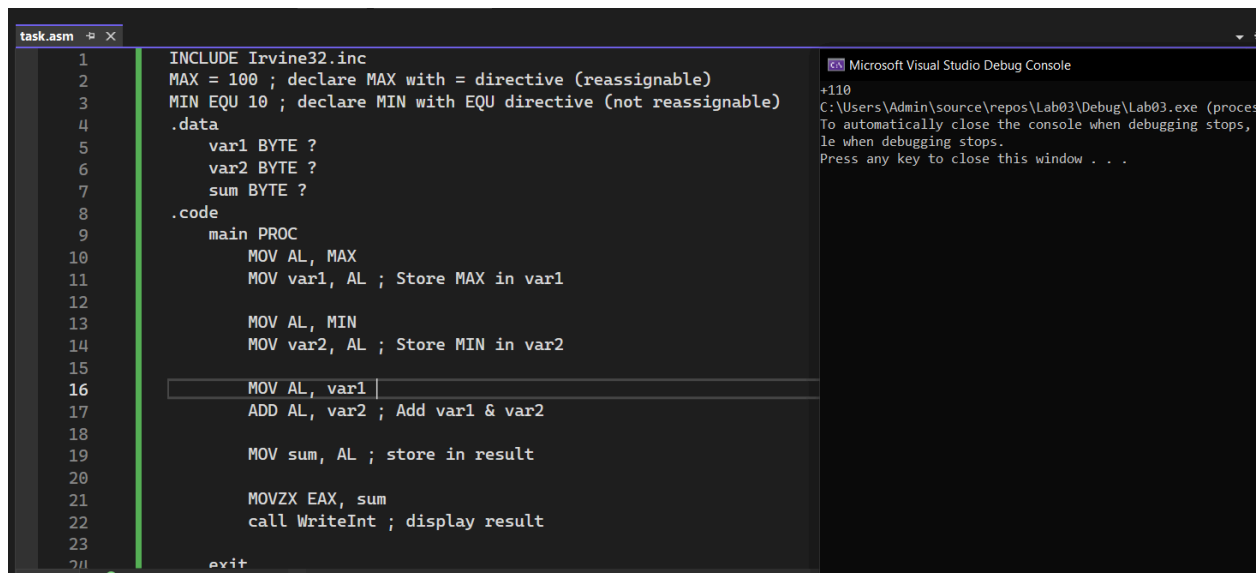
MOVZX EAX, sum

call WriteInt ; display result

exit

main ENDP

END main



The screenshot shows a Visual Studio IDE with a dark theme. On the left, a file explorer shows 'task.asm'. The main editor displays the assembly code from the previous blocks, with line numbers 1 through 23. A green vertical line indicates the current position is at line 16. To the right, the 'Microsoft Visual Studio Debug Console' is open, showing the output of the program: '+110' followed by a path 'C:\Users\Admin\source\repos\Lab03\Debug\Lab03.exe (proces...' and a message 'To automatically close the console when debugging stops, le when debugging stops. Press any key to close this window . . .'. At the bottom left, a status bar shows '121 %' and 'No errors found'.

```
task.asm
1  INCLUDE Irvine32.inc
2  MAX = 100 ; declare MAX with = directive (reassignable)
3  MIN EQU 10 ; declare MIN with EQU directive (not reassignable)
4  .data
5      var1 BYTE ?
6      var2 BYTE ?
7      sum BYTE ?
8  .code
9      main PROC
10         MOV AL, MAX
11         MOV var1, AL ; Store MAX in var1
12
13         MOV AL, MIN
14         MOV var2, AL ; Store MIN in var2
15
16         MOV AL, var1
17         ADD AL, var2 ; Add var1 & var2
18
19         MOV sum, AL ; store in result
20
21         MOVZX EAX, sum
22         call WriteInt ; display result
23
24     exit
25 main ENDP
26 END main
```

Microsoft Visual Studio Debug Console

+110  
C:\Users\Admin\source\repos\Lab03\Debug\Lab03.exe (proces...  
To automatically close the console when debugging stops, le when debugging stops.  
Press any key to close this window . . .

121 % No errors found