



Department of Computer Science
Faculty of Computing
UNIVERSITI TEKNOLOGI MALAYSIA

SUBJECT NAME: COMPUTER ORGANISATION AND ARCHITECTURE

SUBJECT CODE: SECR2033

SEMESTER: 2-2020/2021

LAB TITLE: PROGRAMMING 1: ASSEMBLY LANGUAGE FUNDAMENTALS

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SECTION: 01

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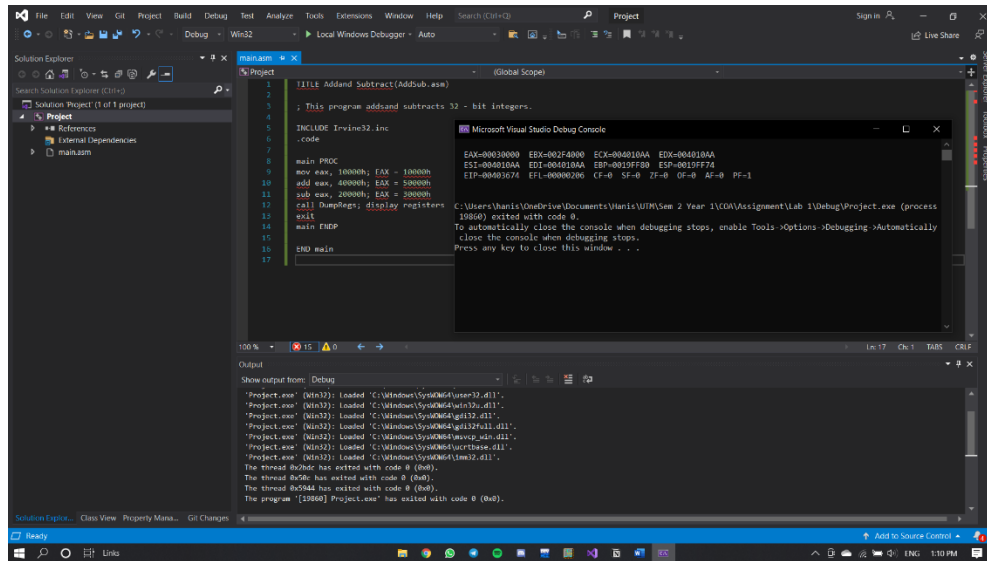
SUBMITTED DATE: 11 APRIL 2021

COMMENTS:

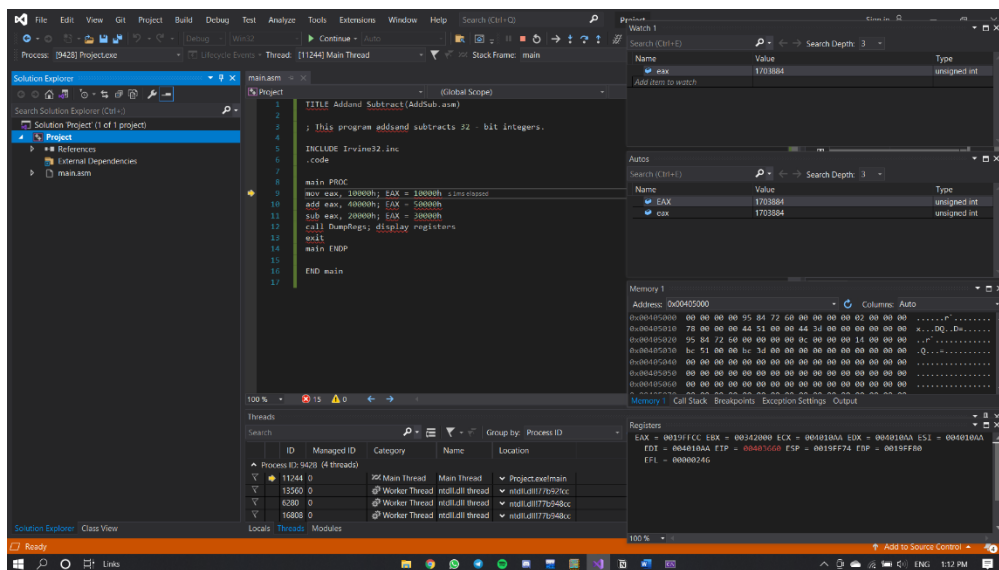
Lab 1 Submission

Part A

1. The output from dos prompt



2. The 4 windows



Visual Studio 2019 - Debugging Project.exe

Process: [9428] Project.exe Thread: [11244] Main Thread Stack Frame: main

Solution Explorer: Project (1 of 1 project) | References | External Dependencies | main.asm

main.asm (Global Scope):

```
1  TITLE Addand Subtract(AddSub.asm)
2
3  ; This program addand subtracts 32 - bit integers.
4
5  INCLUDE Irvine32.inc
6  .code
7
8  main PROC
9      mov eax, 10000h; EAX = 10000h
10     add eax, 40000h; EAX = 50000h
11     sub eax, 20000h; EAX = 30000h
12     call DumpRegs; display registers
13     exit
14 main ENDP
15
16 END main
```

Threads:

ID	Managed ID	Category	Name	Location
11244	0	XX Main Thread	Main Thread	Project.exe!main
13560	0	Worker Thread	ntdll.dll thread	ntdll.dll!77b92fc
6280	0	Worker Thread	ntdll.dll thread	ntdll.dll!77b948c
16808	0	Worker Thread	ntdll.dll thread	ntdll.dll!77b948c

Registers:

EAX = 00010000 EDI = 00342000 ECX = 004010AA EDX = 004010AA ESI = 004010AA
EBP = 004010AA EIP = 00403665 ESP = 0019FF74 EBP = 0019FF80
EFL = 00000240

Visual Studio 2019 - Debugging Project.exe

Process: [9428] Project.exe Thread: [11244] Main Thread Stack Frame: main

Solution Explorer: Project (1 of 1 project) | References | External Dependencies | main.asm

main.asm (Global Scope):

```
1  TITLE Addand Subtract(AddSub.asm)
2
3  ; This program addand subtracts 32 - bit integers.
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13     exit
14 main ENDP
15
16 END main
```

Threads:

ID	Managed ID	Category	Name	Location
11244	0	XX Main Thread	Main Thread	Project.exe!main
13560	0	Worker Thread	ntdll.dll thread	ntdll.dll!77b92fc
6280	0	Worker Thread	ntdll.dll thread	ntdll.dll!77b948c
16808	0	Worker Thread	ntdll.dll thread	ntdll.dll!77b948c

Registers:

EAX = 00050000 EDI = 00342000 ECX = 004010AA EDX = 004010AA ESI = 004010AA
EBP = 004010AA EIP = 0040366A ESP = 0019FF74 EBP = 0019FF80
EFL = 00000200

Visual Studio 2019 - Debugging Project.exe

Process: [9428] Project.exe Thread: [11244] Main Thread Stack Frame: main

Solution Explorer: Project (1 of 1 project) | References | External Dependencies | main.asm

main.asm (Global Scope):

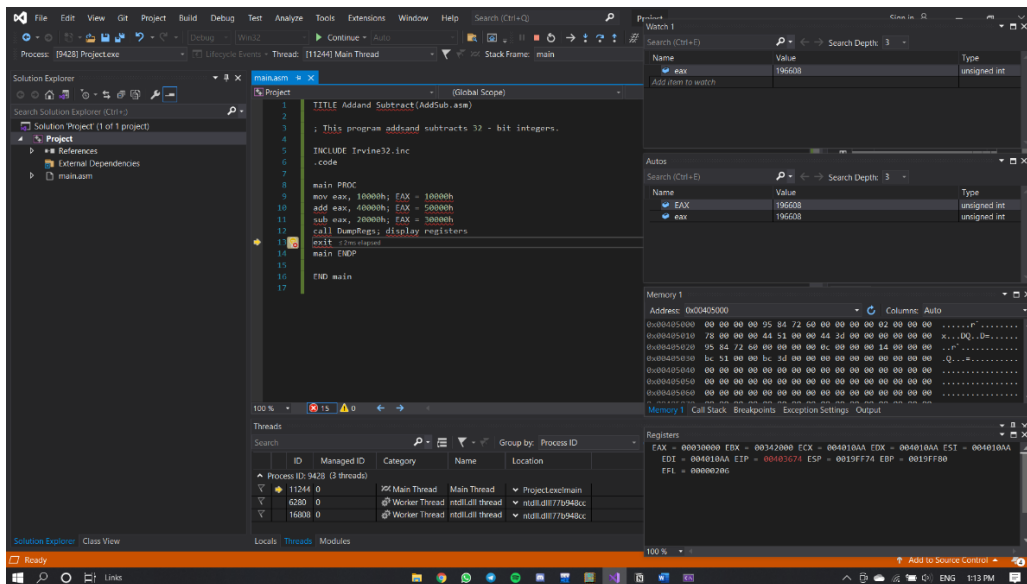
```
1  TITLE Addand Subtract(AddSub.asm)
2
3  ; This program addand subtracts 32 - bit integers.
4
5  INCLUDE Irvine32.inc
6  .code
7
8  main PROC
9      mov eax, 10000h; EAX = 10000h
10     add eax, 40000h; EAX = 50000h
11     sub eax, 20000h; EAX = 30000h
12     call DumpRegs; display registers
13     exit
14 main ENDP
15
16 END main
```

Threads:

ID	Managed ID	Category	Name	Location
11244	0	XX Main Thread	Main Thread	Project.exe!main
13560	0	Worker Thread	ntdll.dll thread	ntdll.dll!77b92fc
6280	0	Worker Thread	ntdll.dll thread	ntdll.dll!77b948c
16808	0	Worker Thread	ntdll.dll thread	ntdll.dll!77b948c

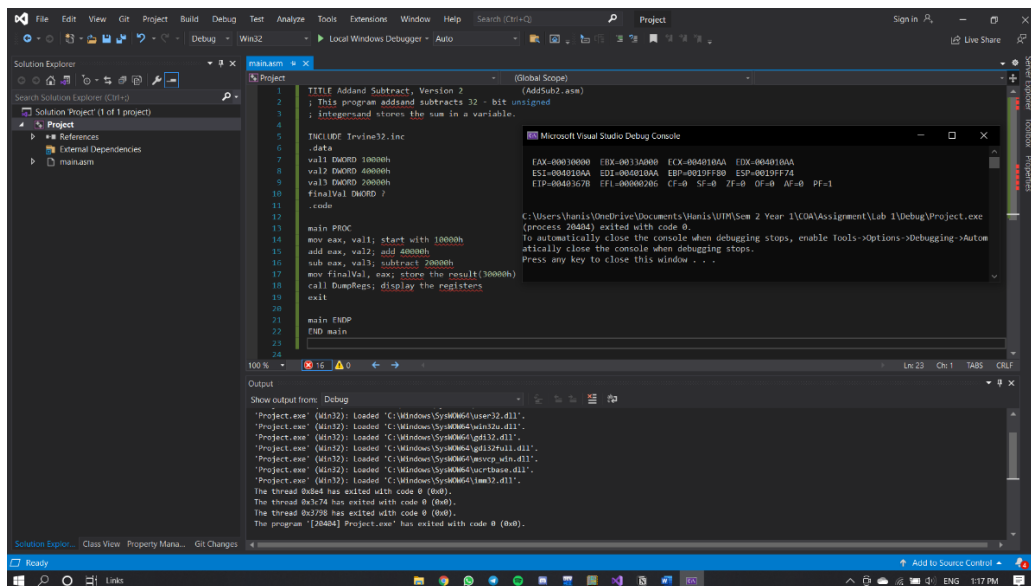
Registers:

EAX = 00030000 EDI = 00342000 ECX = 004010AA EDX = 004010AA ESI = 004010AA
EBP = 004010AA EIP = 0040366F ESP = 0019FF74 EBP = 0019FF80
EFL = 00000200



Part B

1. The output from dos prompt



2. The 4 windows

Visual Studio IDE showing the assembly code for a project named "main.asm". The code is titled "TITLE AddSub2, Version 2" and includes a comment: "This program addsub subtracts 32-bit unsigned integers and stores the sum in a variable." The code includes Irvine32.inc and defines data (val1, val2, finalVal) and a main PROC. The main PROC moves val1 to eax, adds val2, subtracts 20000h, and stores the result in finalVal. It then calls DumpRegs and exits.

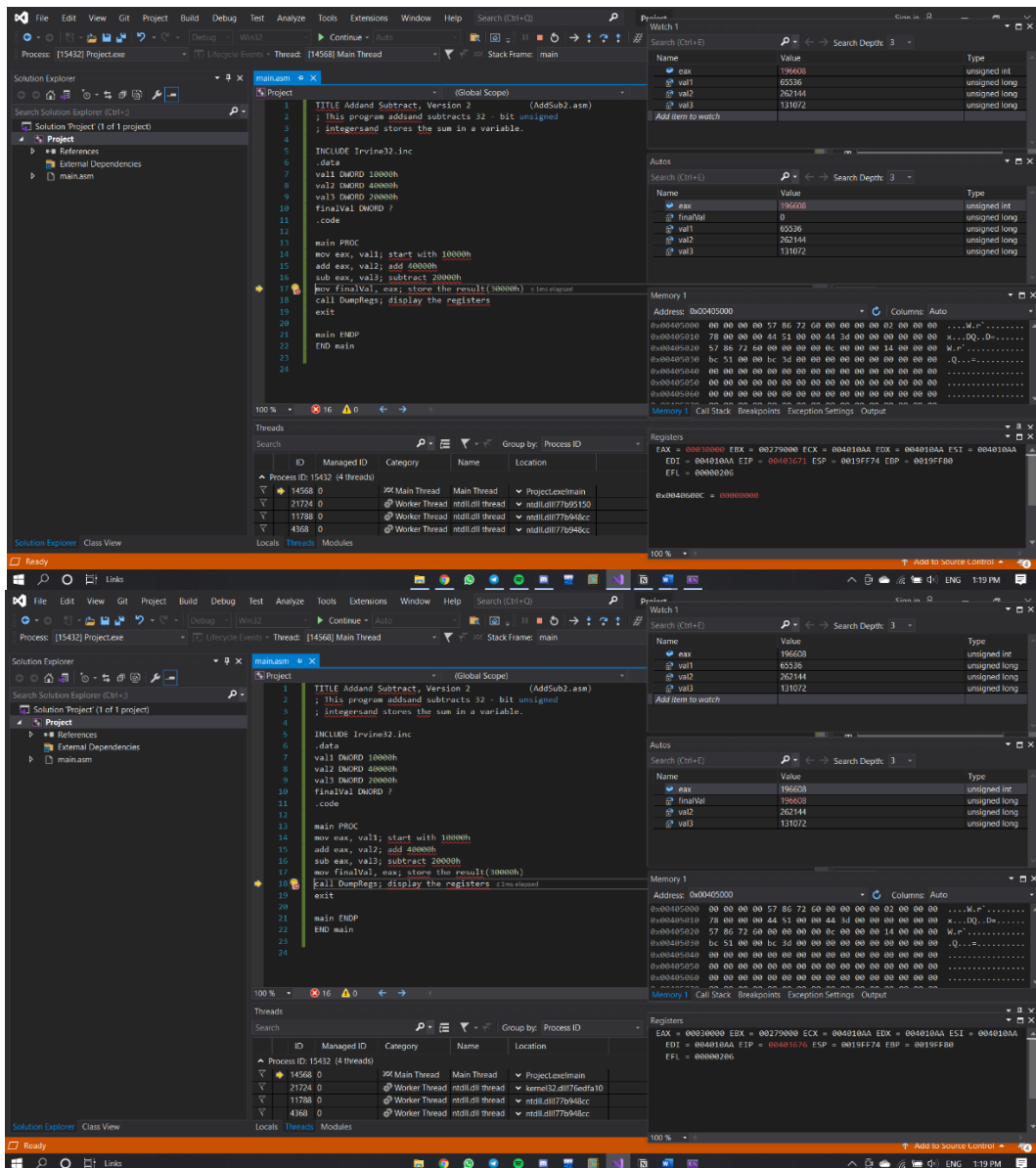
The Solution Explorer shows the project structure with references to Irvine32.inc and main.asm. The Threads window shows the main thread (Process ID: 15432) and several worker threads. The Registers window shows the current state of the registers: EAX = 0019FCC, ECX = 00279000, EDI = 004010AA, ESI = 004010AA, EIP = 004010AA, ESP = 0019FF74, EBP = 0019FF80, EFL = 00000246.

Visual Studio IDE showing the assembly code for a project named "main.asm". The code is titled "TITLE AddSub2, Version 2" and includes a comment: "This program addsub subtracts 32-bit unsigned integers and stores the sum in a variable." The code includes Irvine32.inc and defines data (val1, val2, finalVal) and a main PROC. The main PROC moves val1 to eax, adds val2, subtracts 20000h, and stores the result in finalVal. It then calls DumpRegs and exits.

The Solution Explorer shows the project structure with references to Irvine32.inc and main.asm. The Threads window shows the main thread (Process ID: 15432) and several worker threads. The Registers window shows the current state of the registers: EAX = 00010000, ECX = 00279000, EDI = 004010AA, ESI = 004010AA, EIP = 004010AA, ESP = 0019FF74, EBP = 0019FF80, EFL = 00000246.

Visual Studio IDE showing the assembly code for a project named "main.asm". The code is titled "TITLE AddSub2, Version 2" and includes a comment: "This program addsub subtracts 32-bit unsigned integers and stores the sum in a variable." The code includes Irvine32.inc and defines data (val1, val2, finalVal) and a main PROC. The main PROC moves val1 to eax, adds val2, subtracts 20000h, and stores the result in finalVal. It then calls DumpRegs and exits.

The Solution Explorer shows the project structure with references to Irvine32.inc and main.asm. The Threads window shows the main thread (Process ID: 15432) and several worker threads. The Registers window shows the current state of the registers: EAX = 00000000, ECX = 00279000, EDI = 004010AA, ESI = 004010AA, EIP = 004010AA, ESP = 0019FF74, EBP = 0019FF80, EFL = 00000246.



Part C

Screen shot for each part

3. The output from dos prompt

Microsoft Visual Studio Debug Console

```
EAX=00193000 EBX=003C1000 ECX=004010AA EDX=004010AA
ESI=004010AA EDI=004010AA EBP=0019FF80 ESP=0019FF74
EIP=0040367F EFL=00000206 CF=0 SF=0 ZF=0 OF=0 AF=0 PF=1

EAX=00030000 EBX=003C1000 ECX=004010AA EDX=004010AA
ESI=004010AA EDI=004010AA EBP=0019FF80 ESP=0019FF74
EIP=0040369C EFL=00000206 CF=0 SF=0 ZF=0 OF=0 AF=0 PF=1

D:\uni dina\1Y SEM 2\COA\LAB1 PART C\Debug\Project.exe (process 21980) exited with code 0.
Press any key to close this window . . .
```

4. The 4 windows

Visual Studio interface showing the initial state of the debugger. The main window displays assembly code for 'main.asm'. The 'Watch' window shows variables 'valv3', 'finalValv', 'ah', and 'valb1'. The 'Autos' window shows 'ah' and 'ax'. The 'Memory' window shows address 0x00405000. The 'Registers' window shows EAX, EBX, ECK, EDI, ESI, EIP, ESP, EBP, and EFL. The 'Modules' window shows a list of loaded modules including Project.exe, ntdll.dll, kernel32.dll, and KernelBase.dll.

Visual Studio interface showing the debugger state after stepping through the code. The main window displays assembly code for 'main.asm'. The 'Watch' window shows variables 'finalValv', 'ah', 'valb1', 'valb2', 'valb3', and 'finalValb'. The 'Autos' window shows 'ah', 'valb1', and 'valb2'. The 'Memory' window shows address 0x00405000. The 'Registers' window shows EAX, EBX, ECK, EDI, ESI, EIP, ESP, EBP, and EFL. The 'Modules' window shows a list of loaded modules including Project.exe, ntdll.dll, kernel32.dll, and KernelBase.dll.

Visual Studio IDE showing the assembly code for `main.asm` and the Watch window.

Assembly Code:

```
10 finalValw WORD ?
11
12 valb1 BYTE 10h
13 valb2 BYTE 40h
14 valb3 BYTE 20h
15 finalValb BYTE ?
16
17 .code
18
19 main PROC
20 mov ax, valw1; start with 10000h
21 add ax, valw2; add 40000h
22 sub ax, valw3; subtract 20000h
23 mov finalValw, ax; store the result(30000h)
24 call DumpRegs; display the registers
25
26 mov ah, valb1; start with 10000h
27 add ah, valb2; add 40000h
28 sub ah, valb3; subtract 20000h
29 mov finalValb, ah; store the result(30000h)
30 call DumpRegs; display the registers
31
32 exit
33 main ENDP
34 END main
35
```

Watch Window:

Name	Value	Type
finalValw	12288	unsigned short
ah	0'h	unsigned char
valb1	16 '\x10'	unsigned char
valb2	64 '@'	unsigned char
valb3	32 ''	unsigned char
finalValb	0 '\0'	unsigned char

Autos Window:

Name	Value	Type
ah	0'h	unsigned char
valb1	16 '\x10'	unsigned char
valb2	64 '@'	unsigned char

Memory Window:

Address: 0x00405000

Address	Value	Comment
0x00405000	00 00 00 00 82 7f 71 60 00 00 00 00 02 00 00 00	q.....
0x00405010	4f 00 00 00 44 51 00 00 44 3d 00 00 00 00 00 00	0...DQ...D.....
0x00405020	82 7f 71 60 00 00 00 00 0c 00 00 00 14 00 00 00	q.....
0x00405030	94 51 00 00 94 3d 00 00 00 00 00 00 00 00 00 00	Q.....

Registers Window:

EAX = 00195000 EBX = 00239000 ECX = 004010AA EDX = 004010AA ESI = 004010AA
EDI = 004010AA EIP = 00403688 ESP = 0019FF74 EBP = 0019FF80
EFL = 00000206

Modules Window:

Name	Path	Optimized	User Code	Symbol Status	Symbol
Project.exe	D:\uni\dina\1Y SEM 2\COALAB1 P...	N/A	Yes	Symbols loaded.	D:\uni...
ntdll.dll	C:\Windows\SysWOW64\ntdll.dll	N/A	No	Cannot find or open the P...	
kernel32.dll	C:\Windows\SysWOW64\kernel32...	N/A	No	Cannot find or open the P...	
KernelBase.dll	C:\Windows\SysWOW64\KernelBa...	N/A	No	Cannot find or open the P...	
user32.dll	C:\Windows\SysWOW64\user32.dll	N/A	No	Cannot find or open the P...	

Call Stack Window:

Project.exe!main() Line 28
[External Code]
ntdll.dll[Frames below may be incorrect and/or missing, no symbols loaded for ntdll.dll]

Visual Studio IDE showing the assembly code for `main.asm` and the Watch window.

Assembly Code:

```
10 finalValw WORD ?
11
12 valb1 BYTE 10h
13 valb2 BYTE 40h
14 valb3 BYTE 20h
15 finalValb BYTE ?
16
17 .code
18
19 main PROC
20 mov ax, valw1; start with 10000h
21 add ax, valw2; add 40000h
22 sub ax, valw3; subtract 20000h
23 mov finalValw, ax; store the result(30000h)
24 call DumpRegs; display the registers
25
26 mov ah, valb1; start with 10000h
27 add ah, valb2; add 40000h
28 sub ah, valb3; subtract 20000h
29 mov finalValb, ah; store the result(30000h)
30 call DumpRegs; display the registers
31
32 exit
33 main ENDP
34 END main
35
```

Watch Window:

Name	Value	Type
finalValw	12288	unsigned short
ah	48 '0'	unsigned char
valb1	16 '\x10'	unsigned char
valb2	64 '@'	unsigned char
valb3	32 ''	unsigned char
finalValb	0 '\0'	unsigned char

Autos Window:

Name	Value	Type
ah	48 '0'	unsigned char
finalValb	0 '\0'	unsigned char
valb1	16 '\x10'	unsigned char

Memory Window:

Address: 0x00405000

Address	Value	Comment
0x00405000	00 00 00 00 82 7f 71 60 00 00 00 00 02 00 00 00	q.....
0x00405010	4f 00 00 00 44 51 00 00 44 3d 00 00 00 00 00 00	0...DQ...D.....
0x00405020	82 7f 71 60 00 00 00 00 0c 00 00 00 14 00 00 00	q.....
0x00405030	94 51 00 00 94 3d 00 00 00 00 00 00 00 00 00 00	Q.....

Registers Window:

EAX = 00193000 EBX = 00239000 ECX = 004010AA EDX = 004010AA ESI = 004010AA
EDI = 004010AA EIP = 00403691 ESP = 0019FF74 EBP = 0019FF80
EFL = 00000206

Modules Window:

Name	Path	Optimized	User Code	Symbol Status	Symbol
Project.exe	D:\uni\dina\1Y SEM 2\COALAB1 P...	N/A	Yes	Symbols loaded.	D:\uni...
ntdll.dll	C:\Windows\SysWOW64\ntdll.dll	N/A	No	Cannot find or open the P...	
kernel32.dll	C:\Windows\SysWOW64\kernel32...	N/A	No	Cannot find or open the P...	
KernelBase.dll	C:\Windows\SysWOW64\KernelBa...	N/A	No	Cannot find or open the P...	
user32.dll	C:\Windows\SysWOW64\user32.dll	N/A	No	Cannot find or open the P...	

Call Stack Window:

Project.exe!main() Line 29
[External Code]
ntdll.dll[Frames below may be incorrect and/or missing, no symbols loaded for ntdll.dll]

Visual Studio IDE showing the assembly view of a program. The assembly code is as follows:

```

10 finalValw WORD ?
11
12 valb1 BYTE 10h
13 valb2 BYTE 40h
14 valb3 BYTE 20h
15 finalValb BYTE ?
16
17 .code
18
19 main PROC
20 mov ax, valw1; start with 10000h
21 add ax, valw2; add 40000h
22 sub ax, valw3; subtract 20000h
23 mov finalValw, ax; store the result(30000h)
24 call DumpRegs; display the registers
25
26 mov ah, valb1; start with 10000h
27 add ah, valb2; add 40000h
28 sub ah, valb3; subtract 20000h
29 mov finalValb, ah; store the result(30000h)
30 call DumpRegs; display the registers
31
32 exit
33 main ENDP
34 END main
35

```

The Watch window shows the following variables:

Name	Value	Type
finalValw	12288	unsigned short
ah	48 0'	unsigned char
valb1	16 '\x10'	unsigned char
valb2	64 '@'	unsigned char
valb3	32 ''	unsigned char
finalValb	48 0'	unsigned char

The Autos window shows the following variables:

Name	Value	Type
ah	48 0'	unsigned char
finalValb	48 0'	unsigned char
valb2	64 '@'	unsigned char
valb3	32 ''	unsigned char

The Memory window shows the following memory dump:

Address	0x00405000	0x00405010	0x00405020	0x00405030
Value	00 00 00 00 82 7f 71 60 00 00 00 02 00 00 00 00	4f 00 00 00 44 51 00 00 44 3d 00 00 00 00 00 00	82 7f 71 60 00 00 00 0c 00 00 00 14 00 00 00 00	94 51 00 00 94 3d 00 00 00 00 00 00 00 00 00 00

The Registers window shows the following register values:

Register	Value
EAX	00193000
EBX	00239000
ECX	004010AA
EDX	004010AA
ESI	004010AA
EDI	004010AA
EIP	00403697
ESP	0019FF74
EBP	0019FFB0
EFL	00000206

The Modules window shows the following modules:

Name	Path	Optimized	User Code	Symbol Status	Symbol
Project.exe	D:\uni\dina\1Y SEM 2\COALAB1 P...	N/A	Yes	Symbols loaded.	D:\uni...
ntdll.dll	C:\Windows\SysWOW64\ntdll.dll	N/A	No	Cannot find or open the P...	
kernel32.dll	C:\Windows\SysWOW64\kernel32...	N/A	No	Cannot find or open the P...	
KernelBase.dll	C:\Windows\SysWOW64\KernelBa...	N/A	No	Cannot find or open the P...	
user32.dll	C:\Windows\SysWOW64\user32.dll	N/A	No	Cannot find or open the P...	

Visual Studio IDE showing the assembly view of a program. The assembly code is as follows:

```

10 finalValw WORD ?
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12 valb1 BYTE 10h
13 valb2 BYTE 40h
14 valb3 BYTE 20h
15 finalValb BYTE ?
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20 mov ax, valw1; start with 10000h
21 add ax, valw2; add 40000h
22 sub ax, valw3; subtract 20000h
23 mov finalValw, ax; store the result(30000h)
24 call DumpRegs; display the registers
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26 mov ah, valb1; start with 10000h
27 add ah, valb2; add 40000h
28 sub ah, valb3; subtract 20000h
29 mov finalValb, ah; store the result(30000h)
30 call DumpRegs; display the registers
31
32 exit
33 main ENDP
34 END main
35

```

The Watch window shows the following variables:

Name	Value	Type
valw3	8192	unsigned short
finalValw	12288	unsigned short
ah	48 0'	unsigned char
valb1	16 '\x10'	unsigned char
valb2	64 '@'	unsigned char
valb3	32 ''	unsigned char
finalValb	48 0'	unsigned char

The Autos window shows the following variables:

Name	Value	Type
ah	48 0'	unsigned char
finalValb	48 0'	unsigned char

The Memory window shows the following memory dump:

Address	0x00405000	0x00405010	0x00405020	0x00405030
Value	00 00 00 00 82 7f 71 60 00 00 00 02 00 00 00 00	4f 00 00 00 44 51 00 00 44 3d 00 00 00 00 00 00	82 7f 71 60 00 00 00 0c 00 00 00 14 00 00 00 00	94 51 00 00 94 3d 00 00 00 00 00 00 00 00 00 00

The Registers window shows the following register values:

Register	Value
EAX	00193000
EBX	00239000
ECX	004010AA
EDX	004010AA
ESI	004010AA
EDI	004010AA
EIP	0040369C
ESP	0019FF74
EBP	0019FFB0
EFL	00000206

The Modules window shows the following modules:

Name	Path	Optimized	User Code	Symbol Status	Symbol
Project.exe	D:\uni\dina\1Y SEM 2\COALAB1 P...	N/A	Yes	Symbols loaded.	D:\uni...
ntdll.dll	C:\Windows\SysWOW64\ntdll.dll	N/A	No	Cannot find or open the P...	
kernel32.dll	C:\Windows\SysWOW64\kernel32...	N/A	No	Cannot find or open the P...	
KernelBase.dll	C:\Windows\SysWOW64\KernelBa...	N/A	No	Cannot find or open the P...	
user32.dll	C:\Windows\SysWOW64\user32.dll	N/A	No	Cannot find or open the P...	