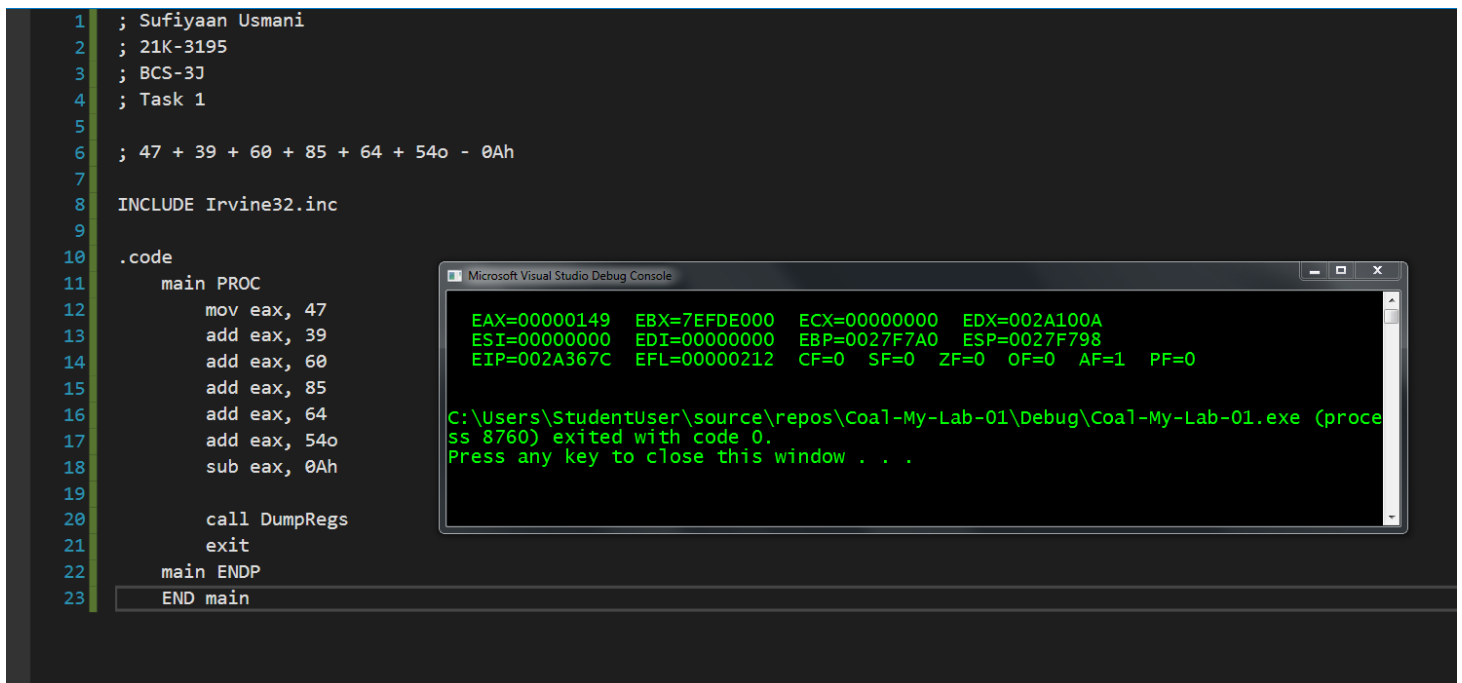


# COAL Lab 02

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## Question 1

Equation 1:  $47 + 39 + 60 + 85 + 64 + 540 - 0Ah$



The screenshot displays a Visual Studio IDE with an assembly file open. The code is as follows:

```
1 ; Sufiyaan Usmani
2 ; 21K-3195
3 ; BCS-3J
4 ; Task 1
5
6 ; 47 + 39 + 60 + 85 + 64 + 540 - 0Ah
7
8 INCLUDE Irvine32.inc
9
10 .code
11     main PROC
12         mov eax, 47
13         add eax, 39
14         add eax, 60
15         add eax, 85
16         add eax, 64
17         add eax, 540
18         sub eax, 0Ah
19
20         call DumpRegs
21         exit
22     main ENDP
23 END main
```

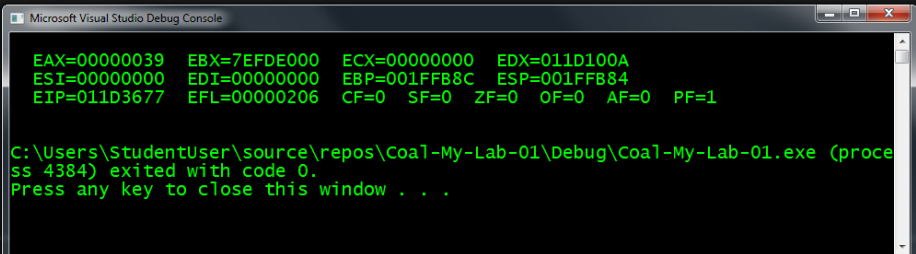
Overlaid on the bottom right is the 'Microsoft Visual Studio Debug Console' window. It shows the following register dump and status:

```
EAX=00000149  EBX=7EFDE000  ECX=00000000  EDX=002A100A
ESI=00000000  EDI=00000000  EBP=0027F7A0  ESP=0027F798
EIP=002A367C  EFL=00000212  CF=0  SF=0  ZF=0  OF=0  AF=1  PF=0
```

Below the register dump, it states: 'C:\Users\StudentUser\source\repos\Coal-My-Lab-01\Debug\Coal-My-Lab-01.exe (process 8760) exited with code 0. Press any key to close this window . . .'

## Equation 2: $30 - 9 + 150 - 186$

```
1 ; Sufiyaan Usmani
2 ; 21K-3195
3 ; BCS-3J
4 ; Task 2
5
6 ; 30 - 9 + 186 - 150
7
8 INCLUDE Irvine32.inc
9
10 .code
11     main PROC
12         mov eax, 30
13         sub eax, 9
14         add eax, 186
15         sub eax, 150
16
17         call DumpRegs
18         exit
19     main ENDP
20 END main
```



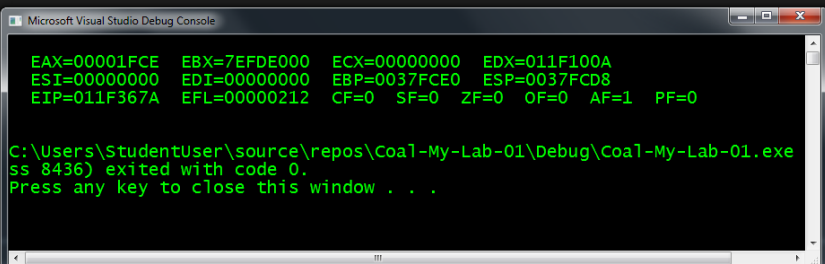
Microsoft Visual Studio Debug Console

```
EAX=00000039 EBX=7EFDE000 ECX=00000000 EDX=011D100A
ESI=00000000 EDI=00000000 EBP=001FFB8C ESP=001FFB84
EIP=011D3677 EFL=00000206 CF=0 SF=0 ZF=0 OF=0 AF=0 PF=1

C:\Users\StudentUser\source\repos\Coal-My-Lab-01\Debug\Coal-My-Lab-01.exe (process 4384) exited with code 0.
Press any key to close this window . . .
```

## Equation 3: $101110b + 50Ah + 6710d + 1010001b + F$

```
1 ; Sufiyaan Usmani
2 ; 21K-3195
3 ; BCS-3J
4 ; Task 3
5
6 ; 101110b + 50Ah + 6710d + 1010001b + F
7
8 INCLUDE Irvine32.inc
9
10 .code
11     main PROC
12         mov eax, 101110b
13         add eax, 50Ah
14         add eax, 6710d
15         add eax, 1010001b
16         add eax, 0Fh
17
18         call DumpRegs
19         exit
20     main ENDP
21 END main
```

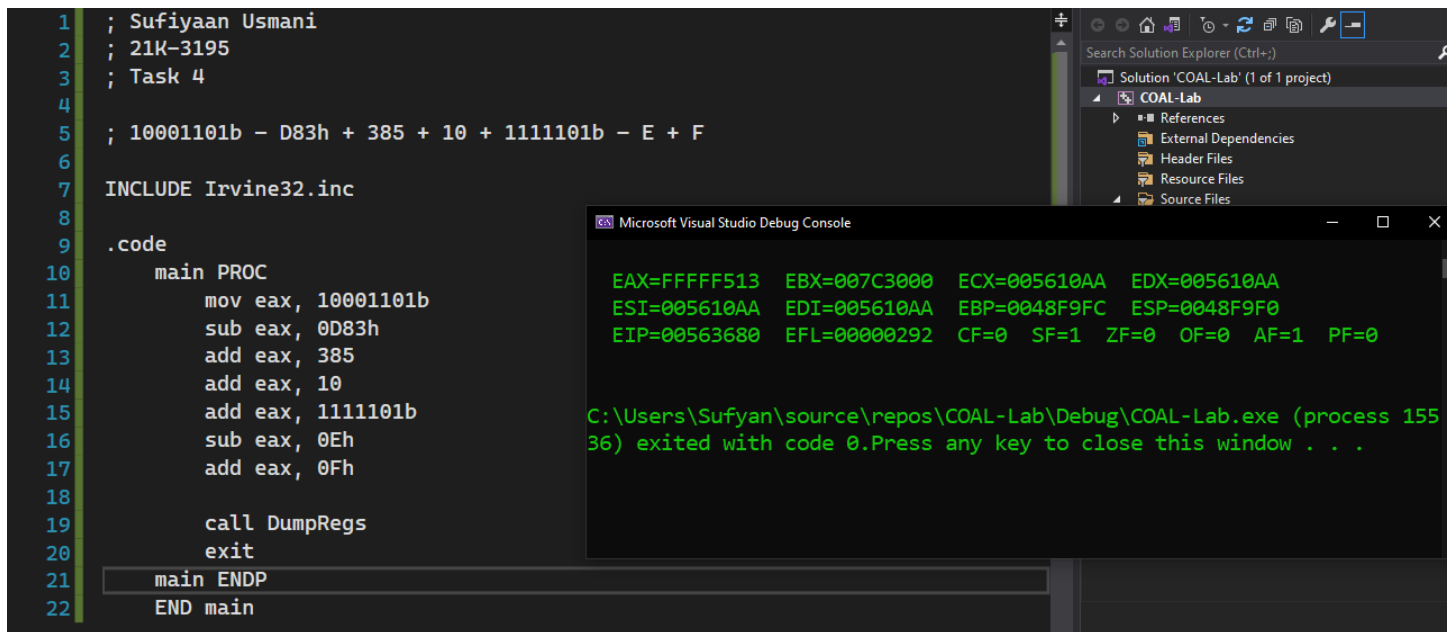


Microsoft Visual Studio Debug Console

```
EAX=00001FCE EBX=7EFDE000 ECX=00000000 EDX=011F100A
ESI=00000000 EDI=00000000 EBP=0037FCE0 ESP=0037FCD8
EIP=011F367A EFL=00000212 CF=0 SF=0 ZF=0 OF=0 AF=1 PF=0

C:\Users\StudentUser\source\repos\Coal-My-Lab-01\Debug\Coal-My-Lab-01.exe (process 8436) exited with code 0.
Press any key to close this window . . .
```

## Equation 4: $10001101b - D83h + 385 + 10 + 1111101b - E + F$



The screenshot shows the Visual Studio IDE with a solution named 'COAL-Lab'. The assembly code in the main editor is as follows:

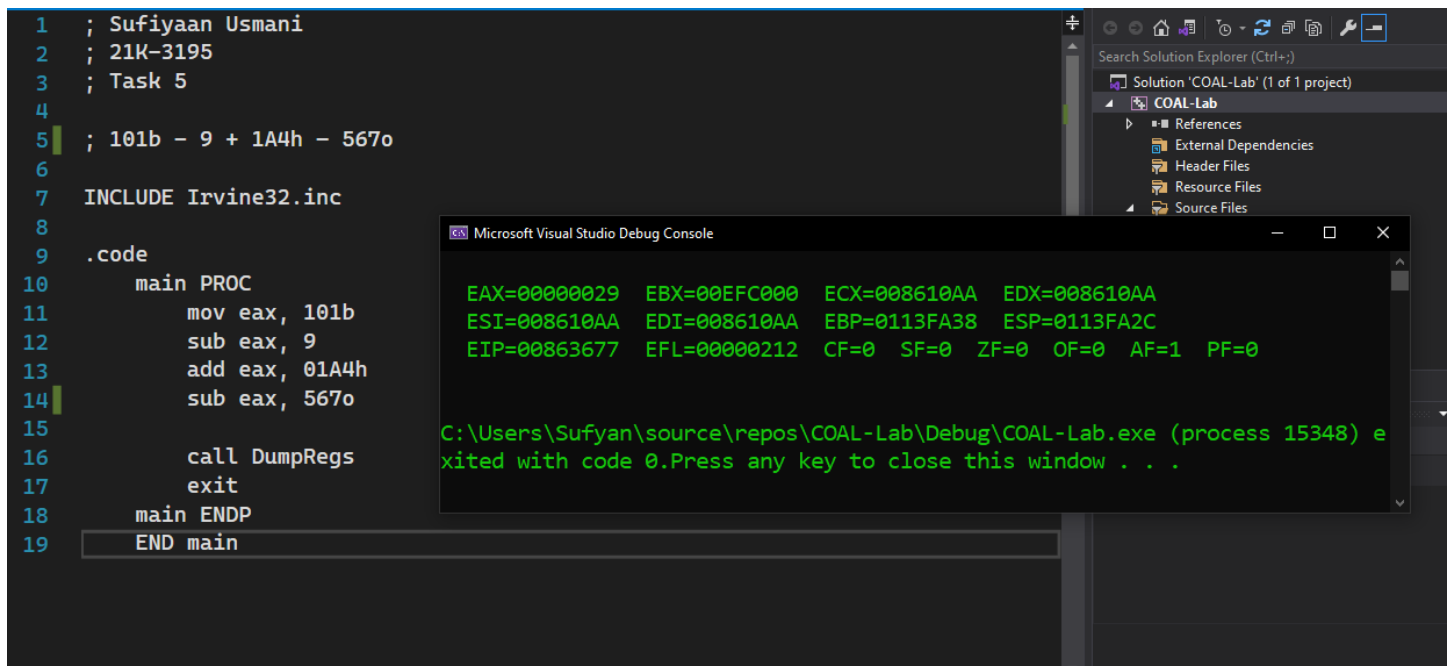
```
1 ; Sufiyaan Usmani
2 ; 21K-3195
3 ; Task 4
4
5 ; 10001101b - D83h + 385 + 10 + 1111101b - E + F
6
7 INCLUDE Irvine32.inc
8
9 .code
10 main PROC
11     mov eax, 10001101b
12     sub eax, 0D83h
13     add eax, 385
14     add eax, 10
15     add eax, 1111101b
16     sub eax, 0Eh
17     add eax, 0Fh
18
19     call DumpRegs
20     exit
21 main ENDP
22 END main
```

The Microsoft Visual Studio Debug Console shows the following register values and status flags after execution:

```
EAX=FFFFFF513  EBX=007C3000  ECX=005610AA  EDX=005610AA
ESI=005610AA  EDI=005610AA  EBP=0048F9FC  ESP=0048F9F0
EIP=00563680  EFL=00000292  CF=0  SF=1  ZF=0  OF=0  AF=1  PF=0
```

The console also displays the message: "C:\Users\Sufyan\source\repos\COAL-Lab\Debug\COAL-Lab.exe (process 15536) exited with code 0. Press any key to close this window . . ."

## Equation 5: $101b - 9 + 1A4h - 567o$



The screenshot shows the Visual Studio IDE with a solution named 'COAL-Lab'. The assembly code in the main editor is as follows:

```
1 ; Sufiyaan Usmani
2 ; 21K-3195
3 ; Task 5
4
5 ; 101b - 9 + 1A4h - 567o
6
7 INCLUDE Irvine32.inc
8
9 .code
10 main PROC
11     mov eax, 101b
12     sub eax, 9
13     add eax, 01A4h
14     sub eax, 567o
15
16     call DumpRegs
17     exit
18 main ENDP
19 END main
```

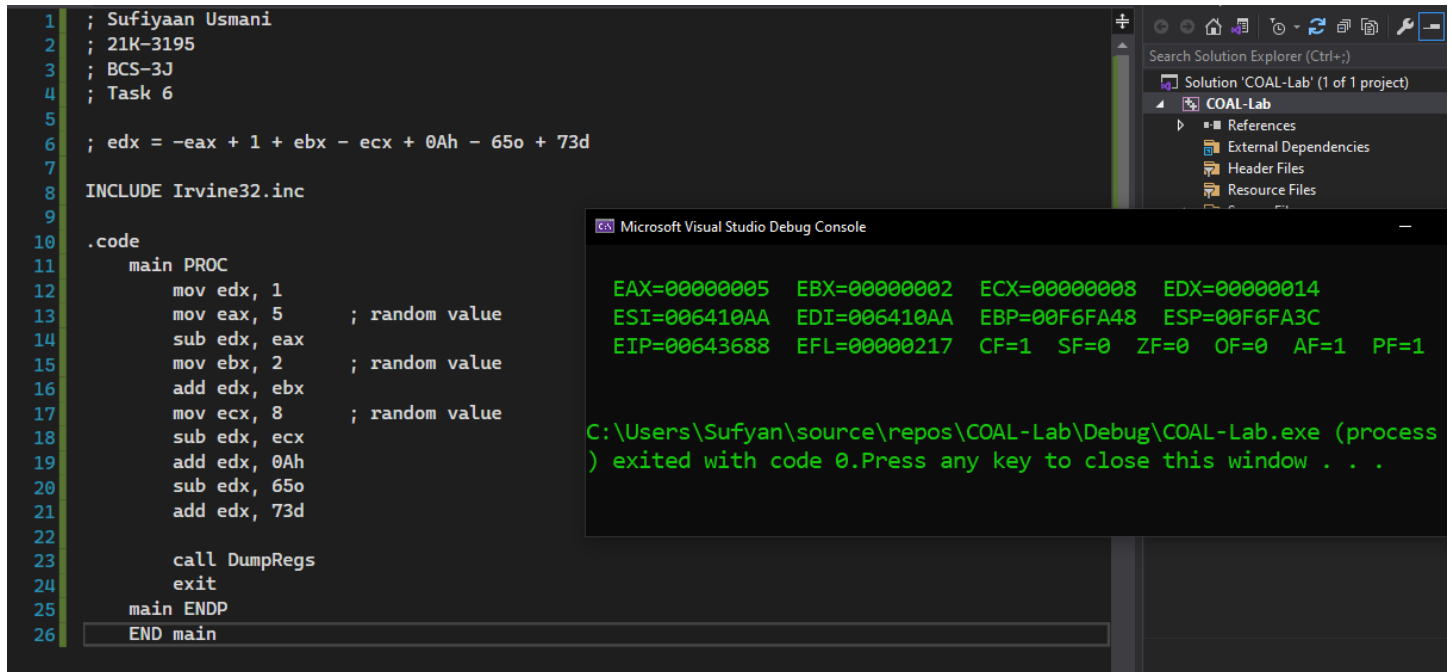
The Microsoft Visual Studio Debug Console shows the following register values and status flags after execution:

```
EAX=00000029  EBX=00EFC000  ECX=008610AA  EDX=008610AA
ESI=008610AA  EDI=008610AA  EBP=0113FA38  ESP=0113FA2C
EIP=00863677  EFL=00000212  CF=0  SF=0  ZF=0  OF=0  AF=1  PF=0
```

The console also displays the message: "C:\Users\Sufyan\source\repos\COAL-Lab\Debug\COAL-Lab.exe (process 15348) exited with code 0. Press any key to close this window . . ."

## Question 2

Equation 1:  $edx = -eax + 1 + ebx - ecx + 0Ah - 65o + 73d$



The screenshot shows the Visual Studio IDE with an assembly file open. The code implements Equation 1:  $edx = -eax + 1 + ebx - ecx + 0Ah - 65o + 73d$ . The assembly code is as follows:

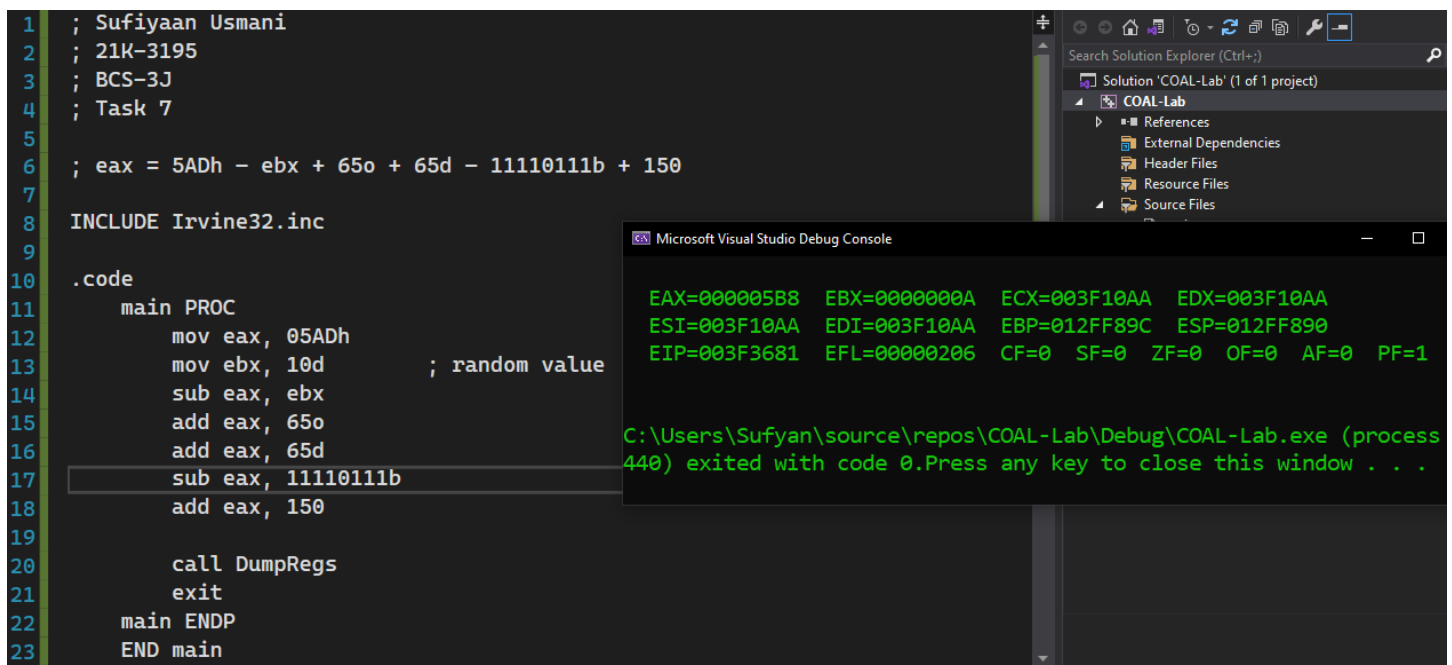
```
1 ; Sufiyaan Usmani
2 ; 21K-3195
3 ; BCS-3J
4 ; Task 6
5
6 ; edx = -eax + 1 + ebx - ecx + 0Ah - 65o + 73d
7
8 INCLUDE Irvine32.inc
9
10 .code
11     main PROC
12         mov edx, 1
13         mov eax, 5      ; random value
14         sub edx, eax
15         mov ebx, 2      ; random value
16         add edx, ebx
17         mov ecx, 8      ; random value
18         sub edx, ecx
19         add edx, 0Ah
20         sub edx, 65o
21         add edx, 73d
22
23         call DumpRegs
24         exit
25     main ENDP
26     END main
```

The Microsoft Visual Studio Debug Console shows the following register values:

```
EAX=00000005 EBX=00000002 ECX=00000008 EDX=00000014
ESI=006410AA EDI=006410AA EBP=00F6FA48 ESP=00F6FA3C
EIP=00643688 EFL=00000217 CF=1 SF=0 ZF=0 OF=0 AF=1 PF=1
```

The console also displays the message: "C:\Users\Sufyan\source\repos\COAL-Lab\Debug\COAL-Lab.exe (process) exited with code 0. Press any key to close this window . . ."

Equation 2:  $eax = 5ADh - ebx + 65o + 65d - 11110111b + 150$



The screenshot shows the Visual Studio IDE with an assembly file open. The code implements Equation 2:  $eax = 5ADh - ebx + 65o + 65d - 11110111b + 150$ . The assembly code is as follows:

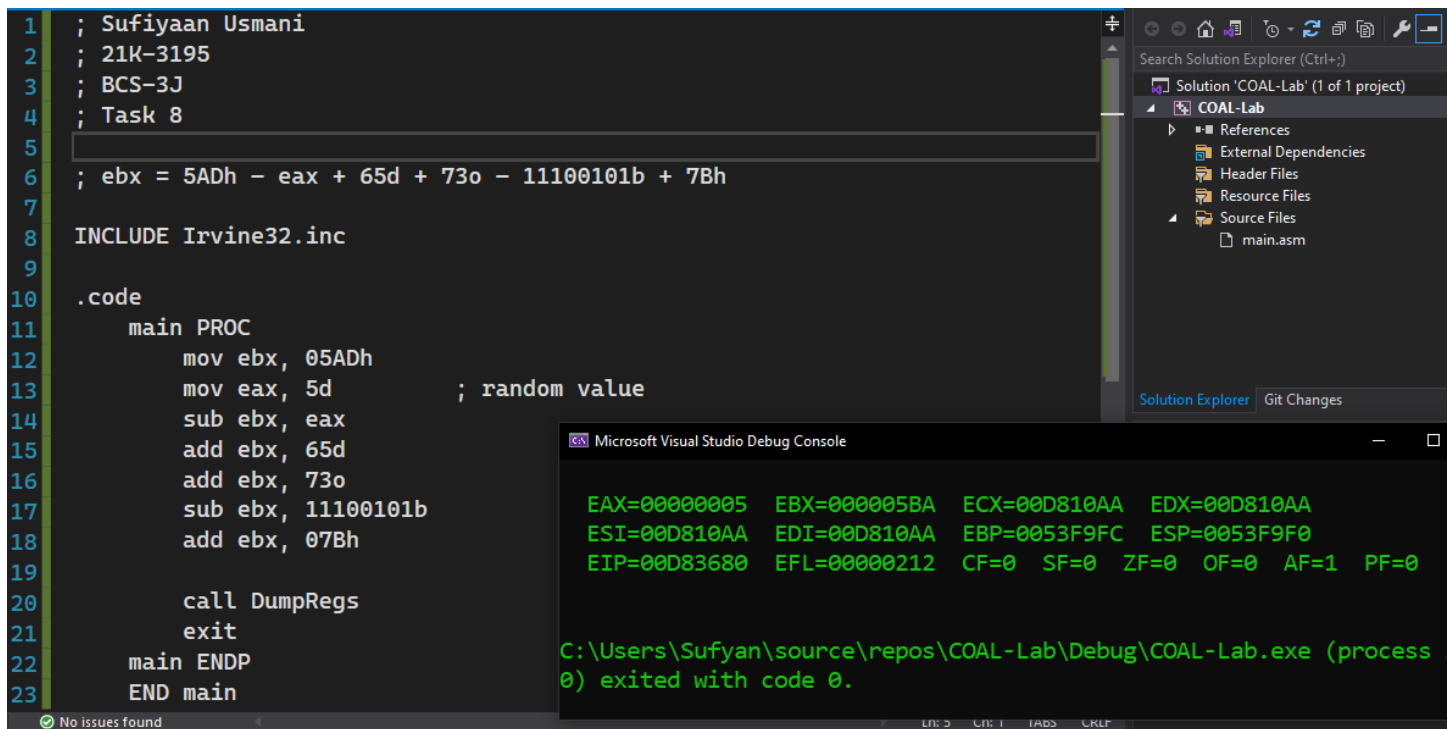
```
1 ; Sufiyaan Usmani
2 ; 21K-3195
3 ; BCS-3J
4 ; Task 7
5
6 ; eax = 5ADh - ebx + 65o + 65d - 11110111b + 150
7
8 INCLUDE Irvine32.inc
9
10 .code
11     main PROC
12         mov eax, 05ADh
13         mov ebx, 10d    ; random value
14         sub eax, ebx
15         add eax, 65o
16         add eax, 65d
17         sub eax, 11110111b
18         add eax, 150
19
20         call DumpRegs
21         exit
22     main ENDP
23     END main
```

The Microsoft Visual Studio Debug Console shows the following register values:

```
EAX=000005B8 EBX=0000000A ECX=003F10AA EDX=003F10AA
ESI=003F10AA EDI=003F10AA EBP=012FF89C ESP=012FF890
EIP=003F3681 EFL=00000206 CF=0 SF=0 ZF=0 OF=0 AF=0 PF=1
```

The console also displays the message: "C:\Users\Sufyan\source\repos\COAL-Lab\Debug\COAL-Lab.exe (process 440) exited with code 0. Press any key to close this window . . ."

Equation 3:  $ebx = 5ADh - eax + 65d + 73o - 11100101 + 7Bh$



The screenshot shows the Visual Studio IDE with an assembly file named `main.asm`. The code implements Equation 3. The debug console displays the state of registers and flags after execution.

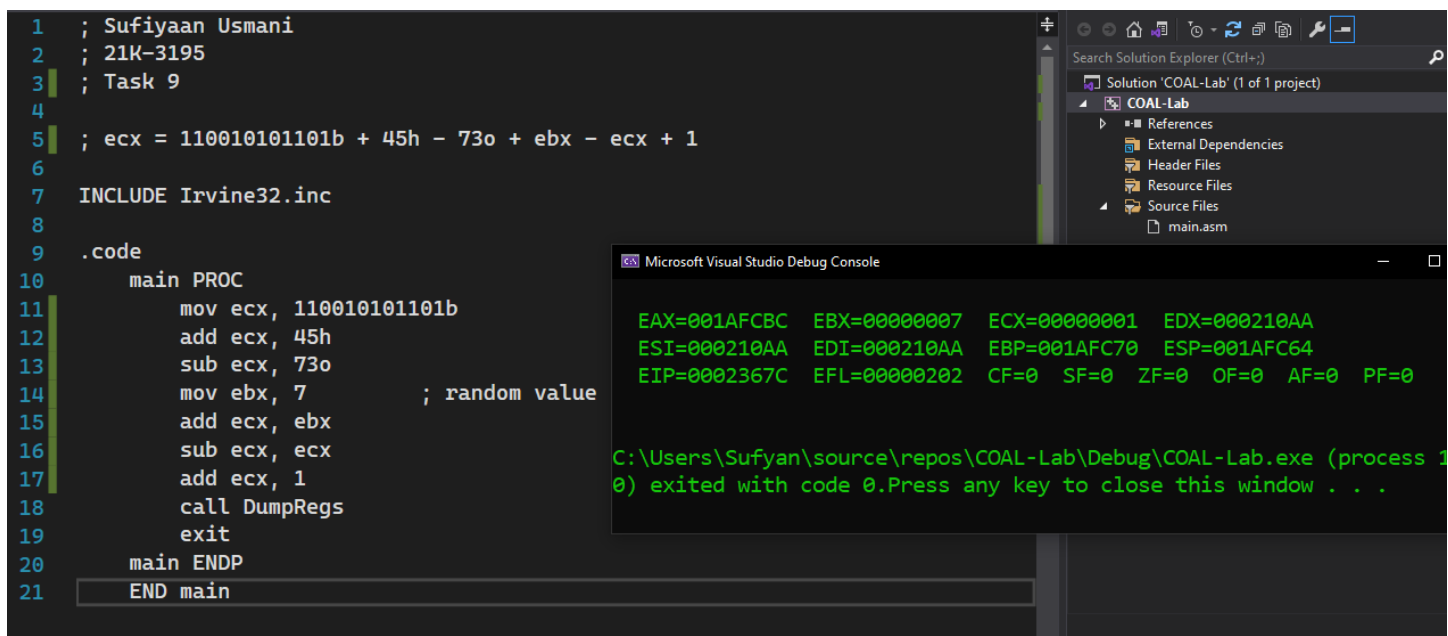
```
1 ; Sufiyaan Usmani
2 ; 21K-3195
3 ; BCS-3J
4 ; Task 8
5
6 ; ebx = 5ADh - eax + 65d + 73o - 11100101b + 7Bh
7
8 INCLUDE Irvine32.inc
9
10 .code
11     main PROC
12         mov ebx, 05ADh
13         mov eax, 5d          ; random value
14         sub ebx, eax
15         add ebx, 65d
16         add ebx, 73o
17         sub ebx, 11100101b
18         add ebx, 07Bh
19
20         call DumpRegs
21         exit
22     main ENDP
23 END main
```

Microsoft Visual Studio Debug Console output:

```
EAX=00000005 EBX=000005BA ECX=00D810AA EDX=00D810AA
ESI=00D810AA EDI=00D810AA EBP=0053F9FC ESP=0053F9F0
EIP=00D83680 EFL=00000212 CF=0 SF=0 ZF=0 OF=0 AF=1 PF=0

C:\Users\Sufyan\source\repos\COAL-Lab\Debug\COAL-Lab.exe (process 0) exited with code 0.
```

Equation 4:  $ecx = 110010101101b + 45h - 73o + ebx - ecx + 1$



The screenshot shows the Visual Studio IDE with an assembly file named `main.asm`. The code implements Equation 4. The debug console displays the state of registers and flags after execution.

```
1 ; Sufiyaan Usmani
2 ; 21K-3195
3 ; Task 9
4
5 ; ecx = 110010101101b + 45h - 73o + ebx - ecx + 1
6
7 INCLUDE Irvine32.inc
8
9 .code
10     main PROC
11         mov ecx, 110010101101b
12         add ecx, 45h
13         sub ecx, 73o
14         mov ebx, 7          ; random value
15         add ecx, ebx
16         sub ecx, ecx
17         add ecx, 1
18         call DumpRegs
19         exit
20     main ENDP
21 END main
```

Microsoft Visual Studio Debug Console output:

```
EAX=001AFCBC EBX=00000007 ECX=00000001 EDX=000210AA
ESI=000210AA EDI=000210AA EBP=001AFC70 ESP=001AFC64
EIP=0002367C EFL=00000202 CF=0 SF=0 ZF=0 OF=0 AF=0 PF=0

C:\Users\Sufyan\source\repos\COAL-Lab\Debug\COAL-Lab.exe (process 1) exited with code 0. Press any key to close this window . . .
```