

Microcontroller and Microprocessors
Experiment - 1
Basic Arithmetic Operations on 8bit and 16bit
numbers

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Aim :- To perform 8bit addition, subtraction, multiplication and division and 16bit addition, subtraction, multiplication in microcontroller 8051 using keil software.

Procedure :-

1. Click on START.
2. Open Keil μ vision5.
3. Open PROJECT. Create New μ vision project.
4. Open Legacy Device Database.
5. Click on + next to NXP in the application box that opens.
6. Select P89V51RD2 from the list under NXP.
7. Click OK.
8. Proceed further clicking Yes.
9. In the main screen, select blank page icon present under File.
10. A new Text Window opens, where we are to write the program to be executed.
11. Go to File in the menu bar and save the program with the extension .asm.
12. In project window, select target on clicking + and chose Add existing file to source group1 and chose the program to be executed.
13. On clicking + next to SOURCE GROUP, right click, build target.
14. Click on Debug icon.
15. Start debug session.
16. Click on OK when the window pops in.
17. Press RUN or F5.

8bit Addition

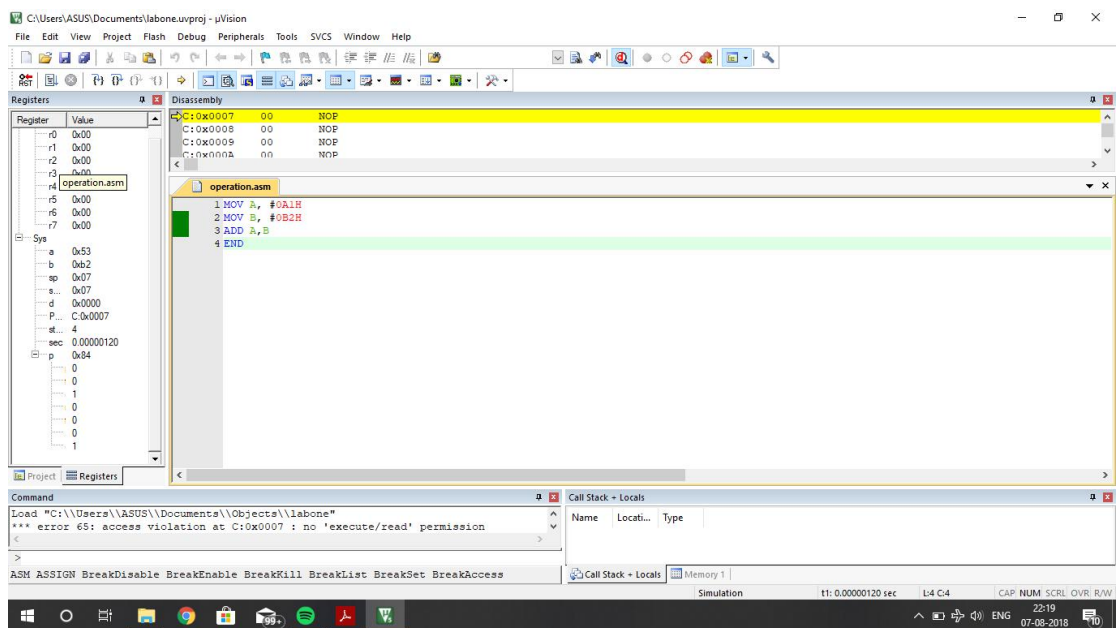
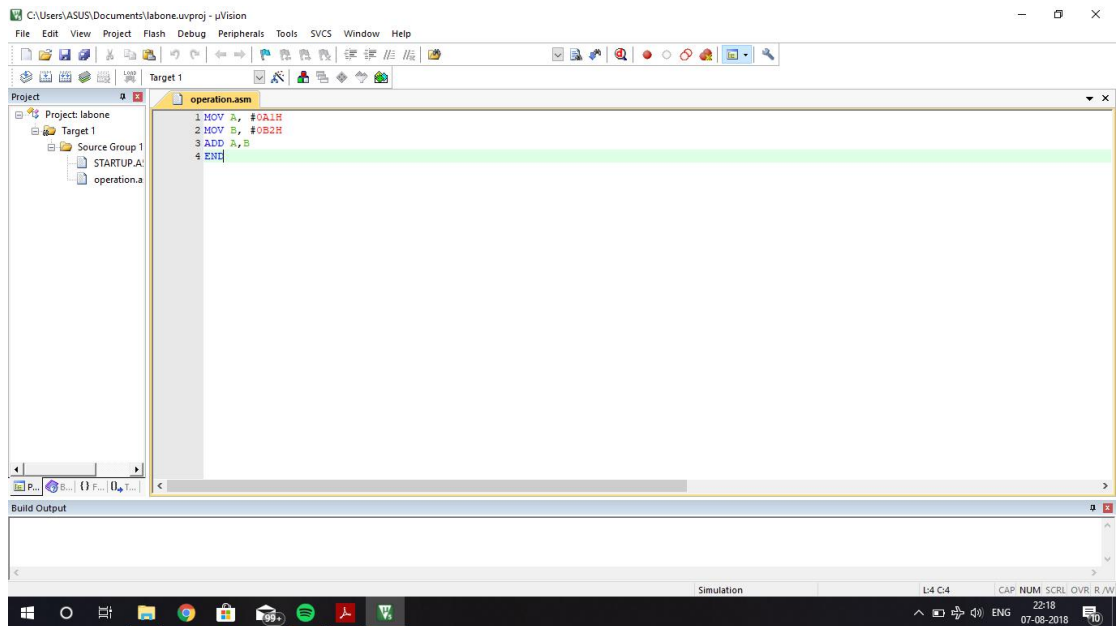
Algorithm :-

1. Start the program by loading the first data into Accumulator.
2. Move the data to a register (B register).
3. Get the second data and load into Accumulator.
4. Add the two register contents.
5. Terminate the program.

Code :-

```
MOV A, #0AAH
MOV B, #0BBH
ADD A,B
END
```

Pictures :-



8bit Subtraction

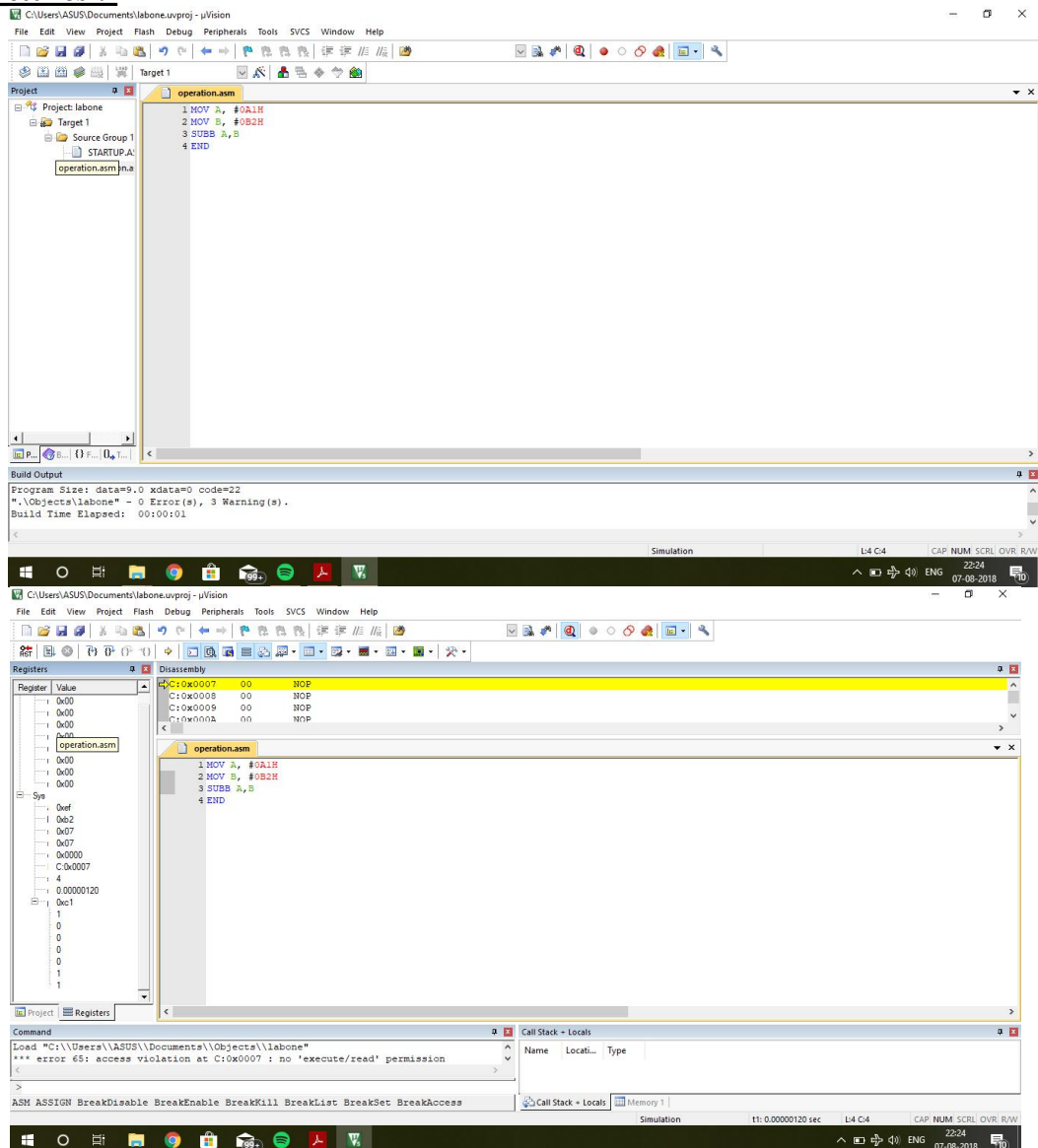
Algorithm :-

1. Start the program by loading the first data into Accumulator.
2. Move the data to a register (B register).
3. Get the second data and load into Accumulator.
4. Subtract the two register contents.
5. Terminate the program.

Code :-

```
MOV A, #0AAH
MOV B, #0BBH
SUBB A,B
END
```

Pictures :-



8bit Multiplication

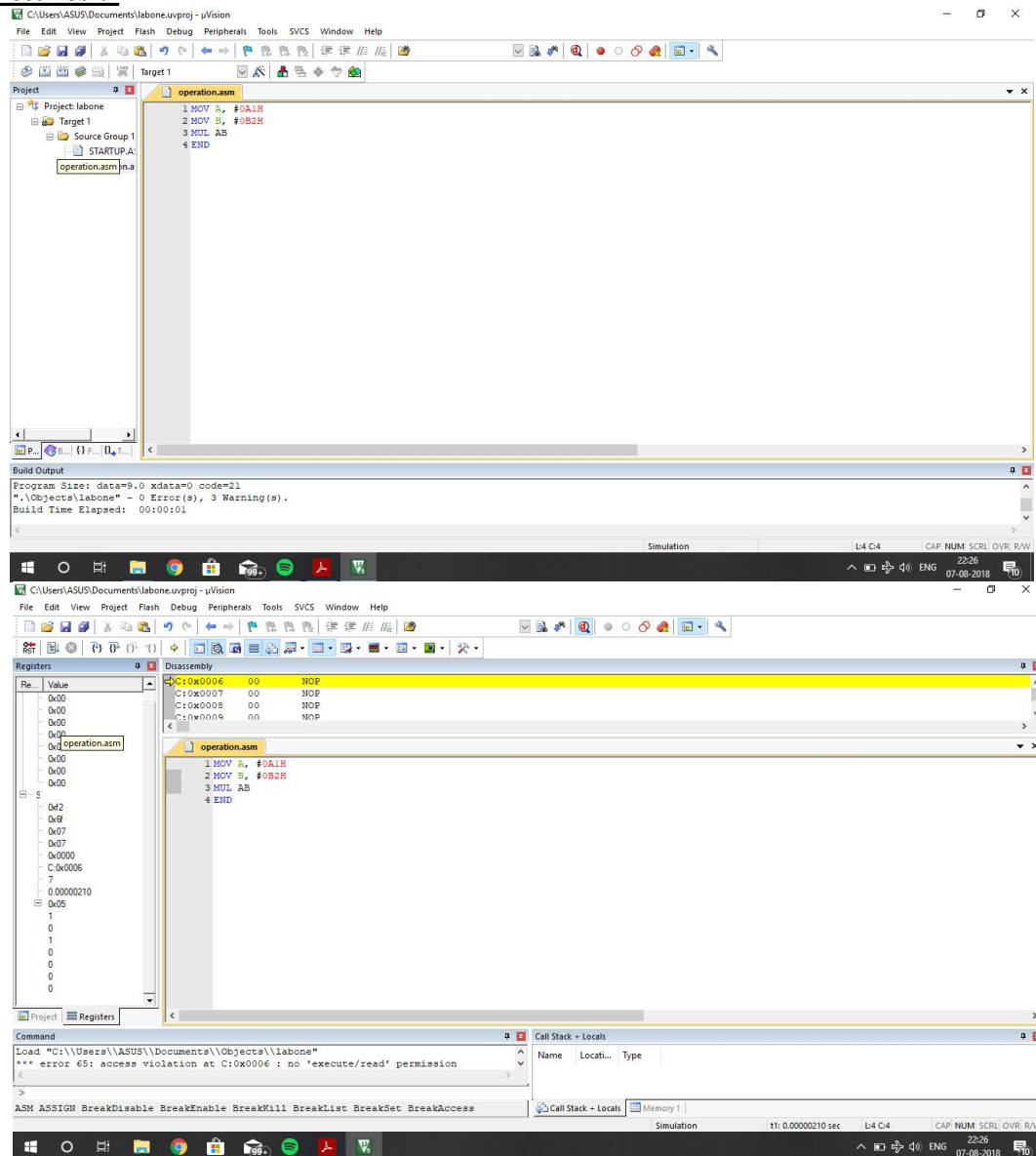
Algorithm :-

1. Start the program by loading the first data into Accumulator.
2. Move the data to a register (B register).
3. Get the second data and load into Accumulator.
4. Multiply the two register contents.
5. Terminate the program.

Code :-

```
MOV A, #0AAH
MOV B, #0BBH
MUL AB
END
```

Pictures :-



8bit Division

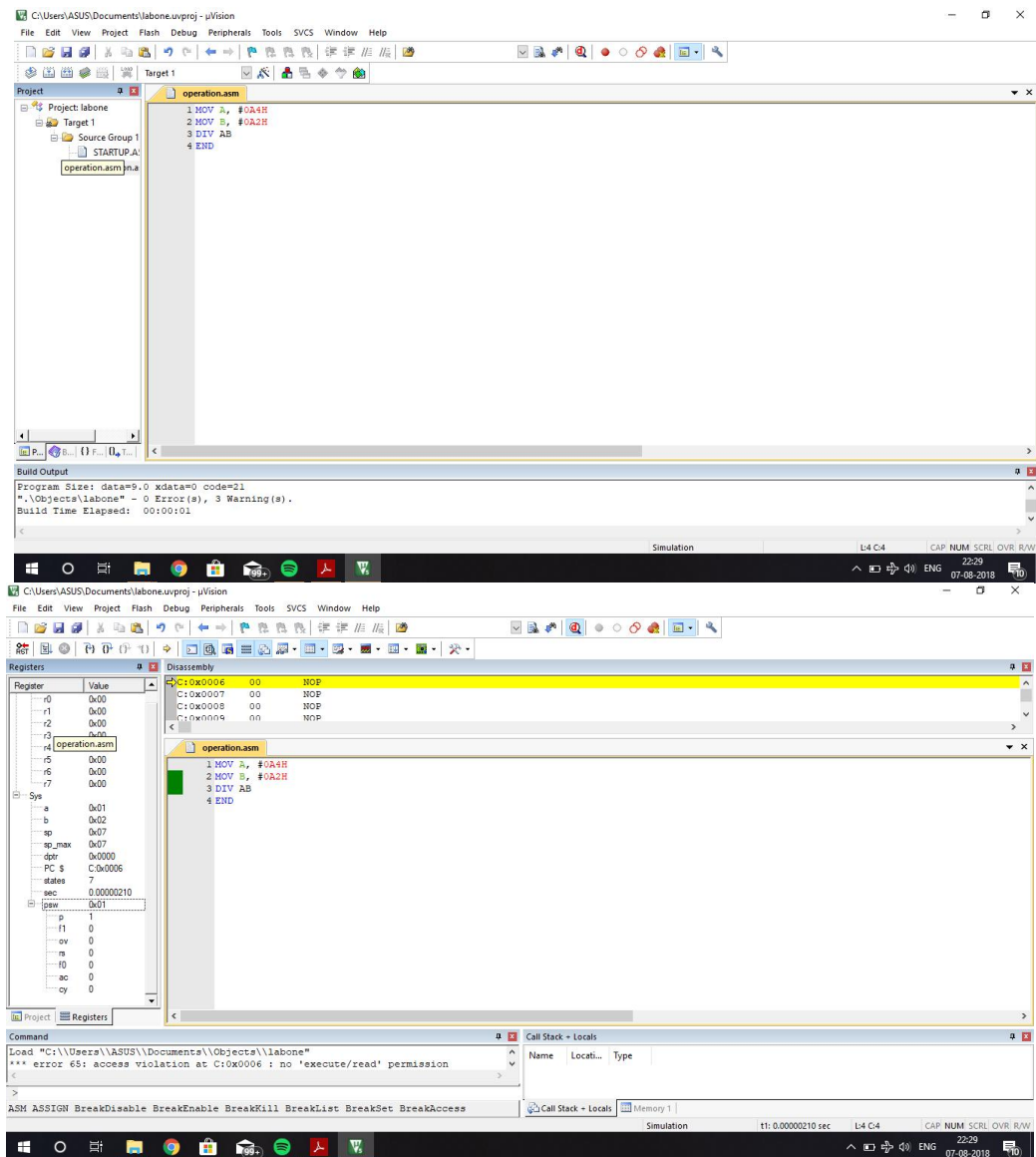
Algorithm :-

1. Start the program by loading the first data into Accumulator.
2. Move the data to a register (B register).
3. Get the second data and load into Accumulator.
4. Multiply the two register contents.
5. Terminate the program.

Code :-

```
MOV A, #0AAH  
MOV B, #0BBH  
DIV AB  
END
```

Pictures :-



16bit Addition

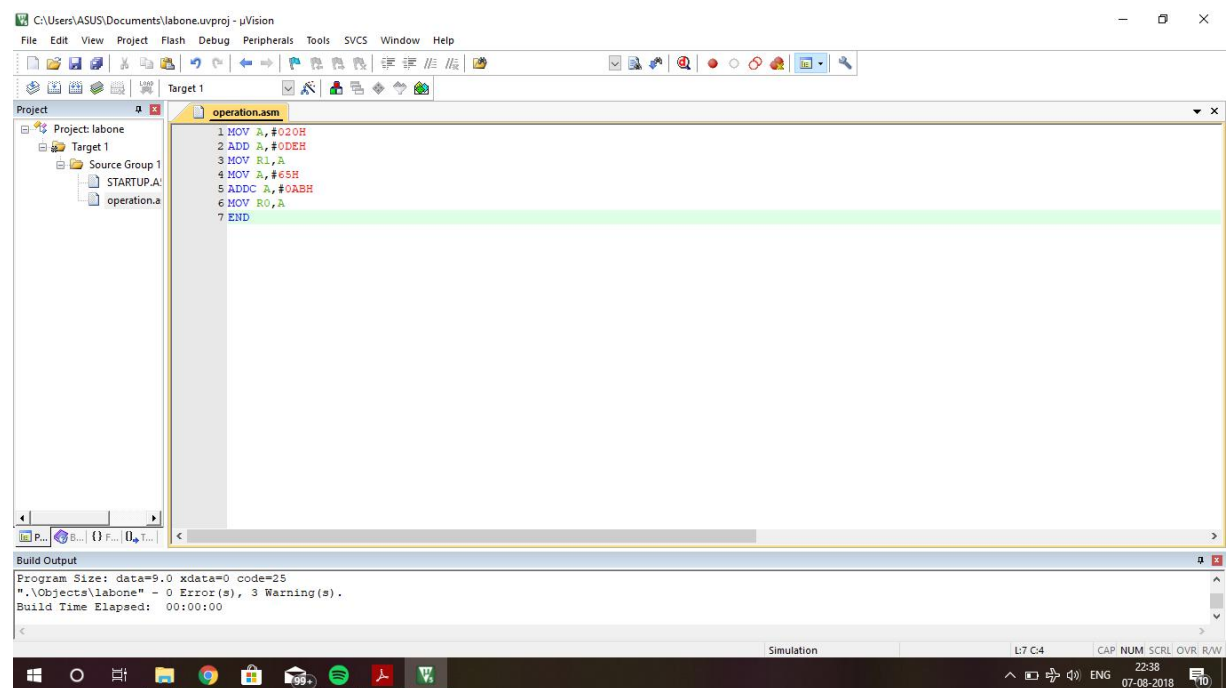
Algorithm :-

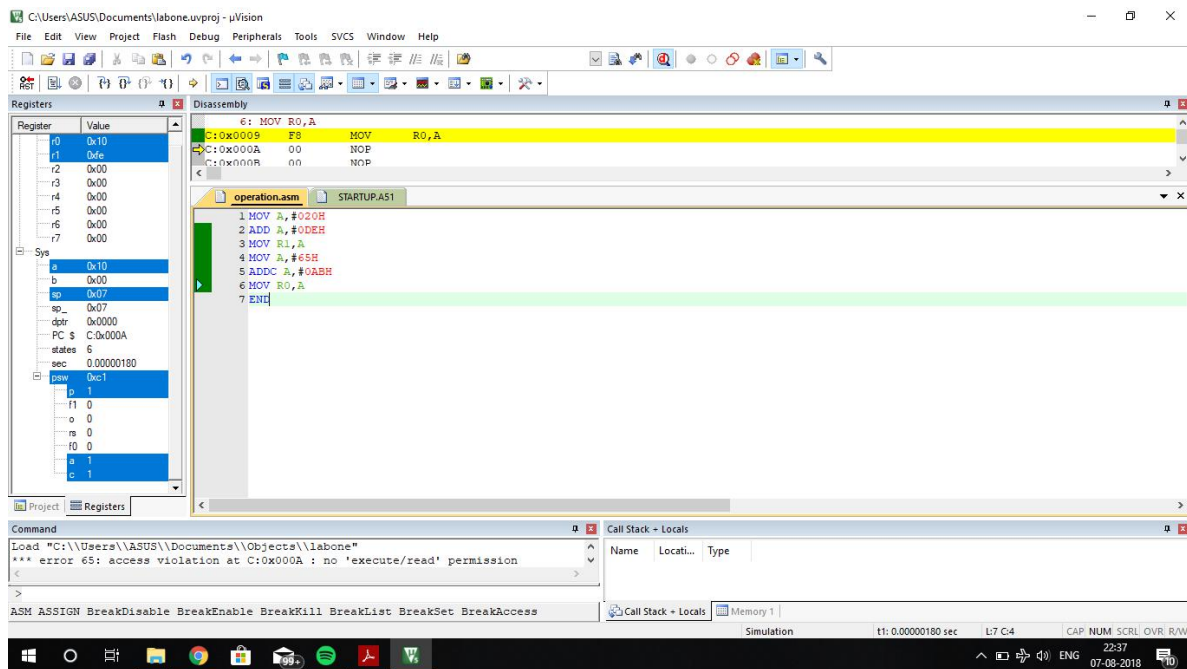
- Step 1 : Start the microprocessor
- Step 2 : Get the 1st 8 bit in 'C' register (LSB) and 2nd 8 bit in 'H' register (MSB) of 16 bit number. Step 3 : Save the 1st 16 bit in 'DE' register pair
- Step 4 : Similarly get the 2nd 16 bit number and store it in 'HL' register pair.
- Step 5 : Get the lower byte of 1st number into 'L' register
- Step 6 : Add it with lower byte of 2nd number
- Step 7 : Store the result in 'L' register
- Step 8 : Get the higher byte of 1st number into accumulator
- Step 9 : Add it with higher byte of 2nd number and carry of the lower bit addition.
- Step 10 : Store the result in 'H' register
- Step 11 : Store 16 bit addition value in 'HL' register pair
- Step 12 : Stop program execution

Code :-

```
MOV A,#020H
ADD A,#0DEH
MOV R1,A
MOV A,#65H
ADDC A,#0ABH
MOV R0,A
END
```

Pictures :-





16bit Subtraction

Algorithm :-

- Step 1 : Start the microprocessor
- Step 2 : Get the 1st 16 bit in 'HL' register pair
- Step 3 : Save the 1st 16 bit in 'DE' register pair
- Step 4 : Get the 2nd 16 bit number in 'HL' register pair
- Step 5 : Get the lower byte of 1st number
- Step 6 : Get the subtracted value of 2nd number of lower byte by subtracting it with lower byte of 1st number
- Step 7 : Store the result in 'L' register
- Step 8 : Get the higher byte of 2nd number
- Step 9 : Subtract the higher byte of 1st number from 2nd number with borrow
- Step 10 : Store the result in 'HL' register
- Step 11 : Stop the program execution

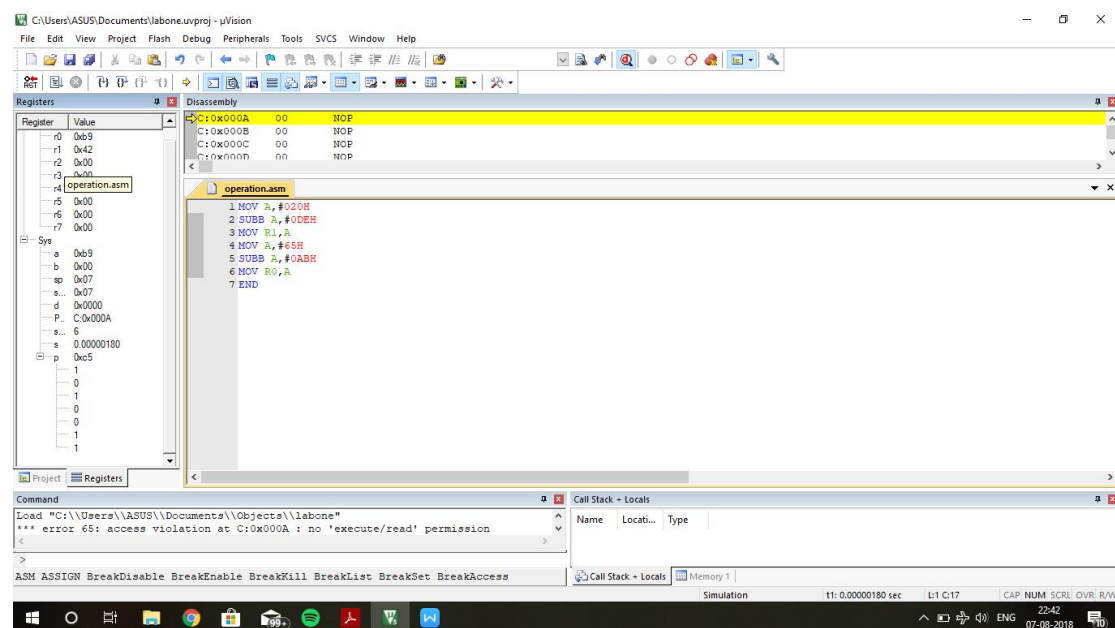
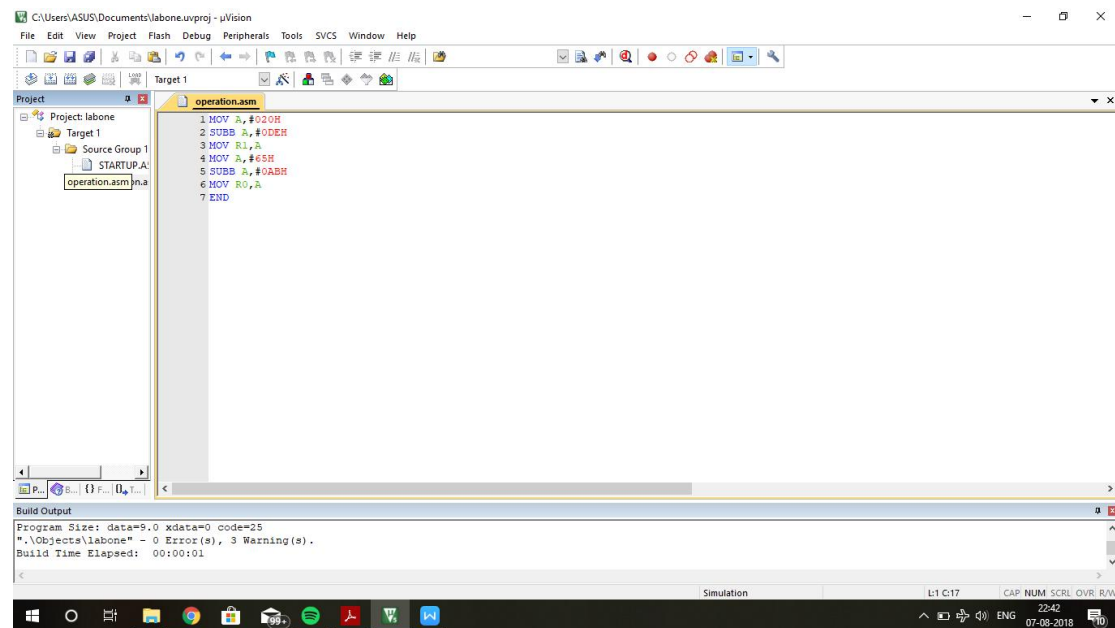
Code :-

```

MOV A,#020H
SUBB A,#0DEH
MOV R1,A
MOV A,#65H
SUBB A,#0ABH
MOV R0,A
END

```

Pictures :-



16bit Multiplication

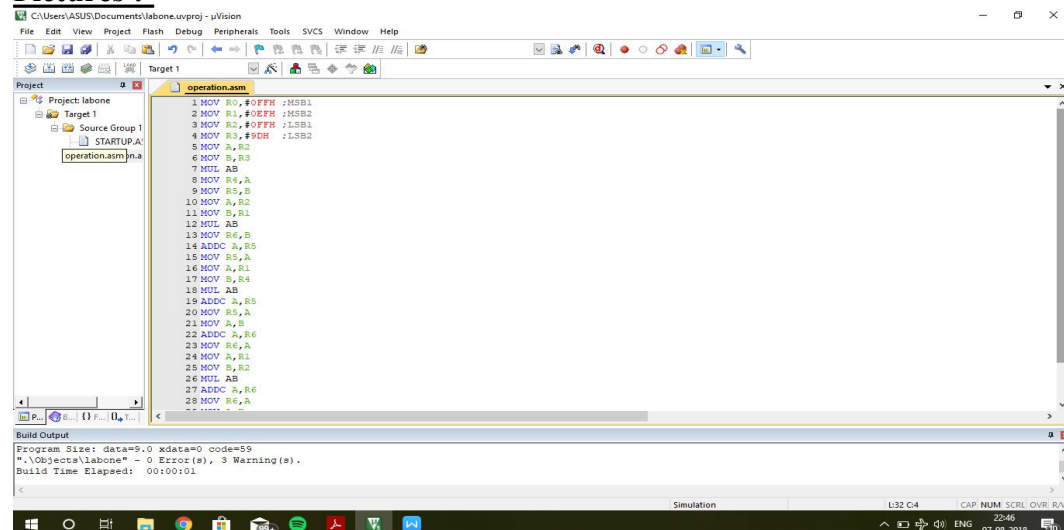
Algorithm :-

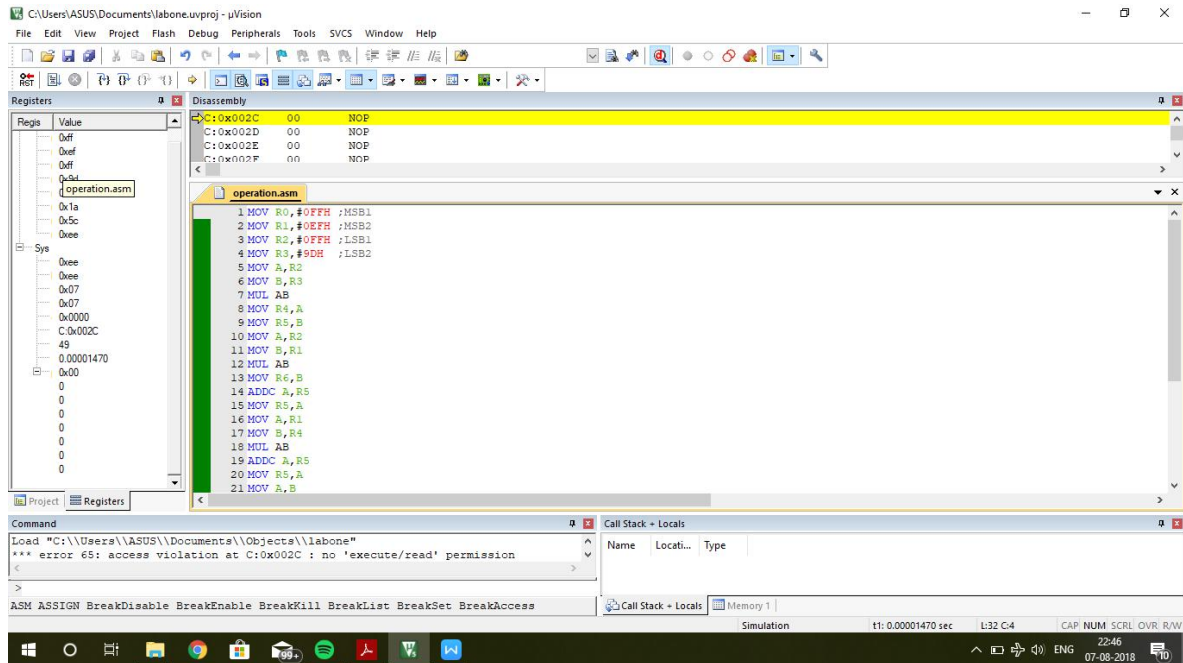
- Step 1: Start.
- Step 2: Load the MSB's of Data in two different registers.
- Step 3: Load the LSB's of Data in other two different registers.
- Step 4: Successive multiplication is carried out.
- Step 5: The product obtained in the registers.
- Step 6: The output is stored in the registers.
- Step 7: End.

Code :-

```
MOV R0,#0FFH ;MSB1
MOV R1,#0EFH ;MSB2
MOV R2,#0FFH ;LSB1
MOV R3,#9DH ;LSB2
MOV A,R2
MOV B,R3
MUL AB
MOV R4,A
MOV R5,B
MOV A,R2
MOV B,R1
MUL AB
MOV R6,B
ADDC A,R5
MOV R5,A
MOV A,R1
MOV B,R4
MUL AB
ADDC A,R5
MOV R5,A
MOV A,B
ADDC A,R6
MOV R6,A
MOV A,R1
MOV B,R2
MUL AB
ADDC A,R6
MOV R6,A
MOV A,B
ADDC A,#00H
MOV R7,A
END
```

Pictures :-





Conclusion :- The 8bit addition, subtraction, multiplication, division and 16bit addition, subtraction, multiplication was done successfully using the keil software and results were verified using calculator. This proves that microcontroller 8051 is able to do basic operations.