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ECE3003 MICROCONTROLLERS AND IT'S APPLICATIONS

EXPERIMENT – 2

THEORY

List of arithmetic instructions in 8051:

- ADD - ADDition
- ADDC - ADDition with Carry
- SUBB - SUBtraction with carry Borrow
- MUL - MULtiply
- DIV - DIVide
- INC - INCrement
- DEC - DECrement
- DA - Decimal Adjust
- CLR - CLeaR
- CMP - CoMPlement
- RL - Rotate Left
- RLC – Rotate Left with Carry
- RR – Rotate Right
- RRC – Rotate Right with Carry
- SWAP - SWAP

Program Status Word (PSW) Register:

CY – set when a Carry out on D7 bit
AC – set when a Carry form D3 to D4 bit
F0 – future use
OV – When A overflow (greater than FFh)
P – parity (set when A have odd number of one's)
RS0 & RS1 – to select Register bank

Register bank selection bits (RS1,RS0):

RS1	RS0	starting address		ending address
1	1	1Fh	Register Bank 3	18h
1	0	17h	Register Bank 2	10h
0	1	0Fh	Register Bank 1	08h
0	0	07h	Register Bank 0	00h

- **PROGRAM – 1**

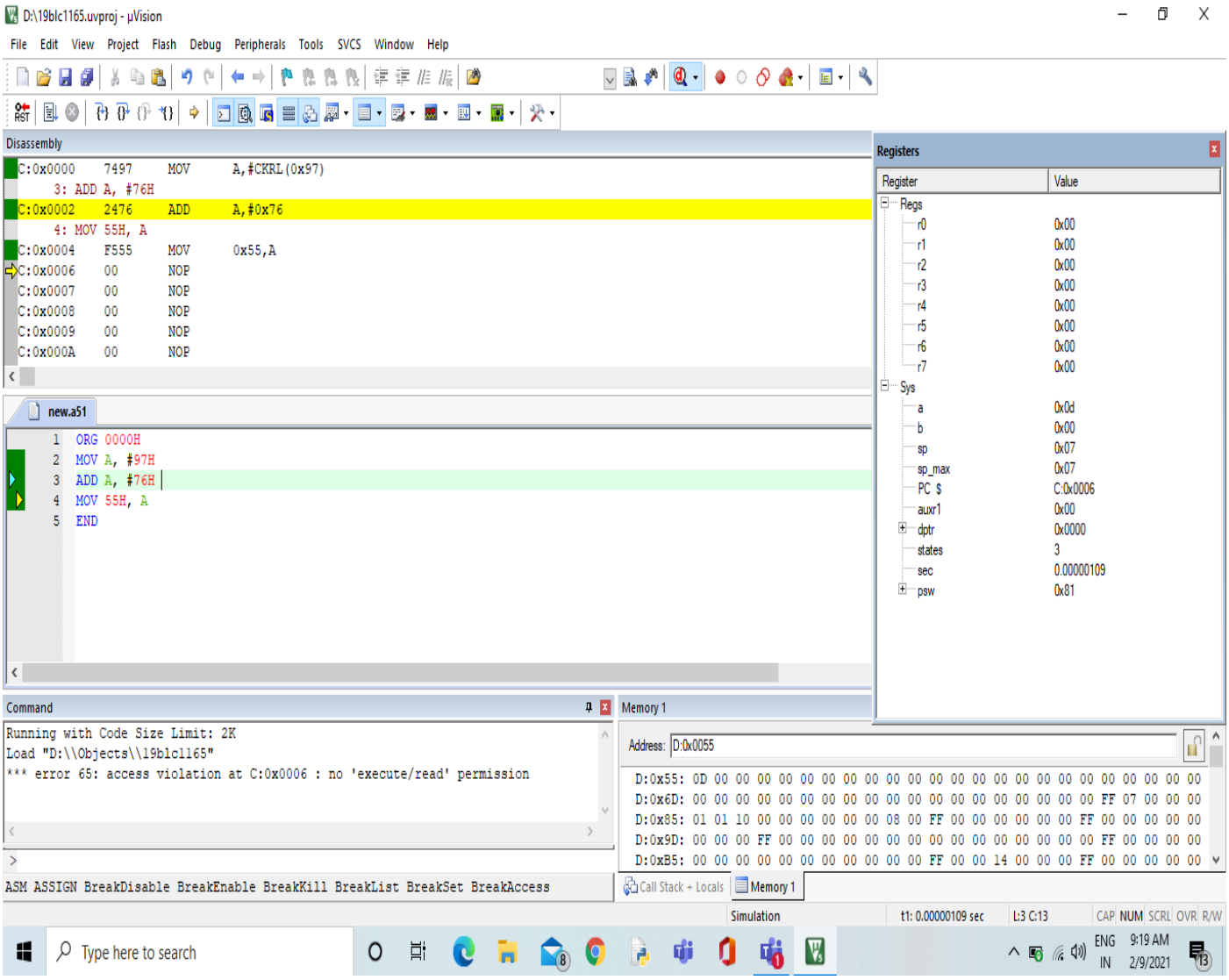
AIM - Write an 8051 ASM program to perform addition of two 8-bit numbers 97H and 76H and store the result at address location 55H.

MATERIAL REQUIRED – ARM KEIL software along with C51.

CODE –

```
ORG 0000H
MOV A, #97H ;  97H - 1001 0111
```

ADD A, #76H ; 76H - 0111 0110
MOV 55H, A ; 1 0DH - 1 0000 1101
END



- **PROGRAM – 2**

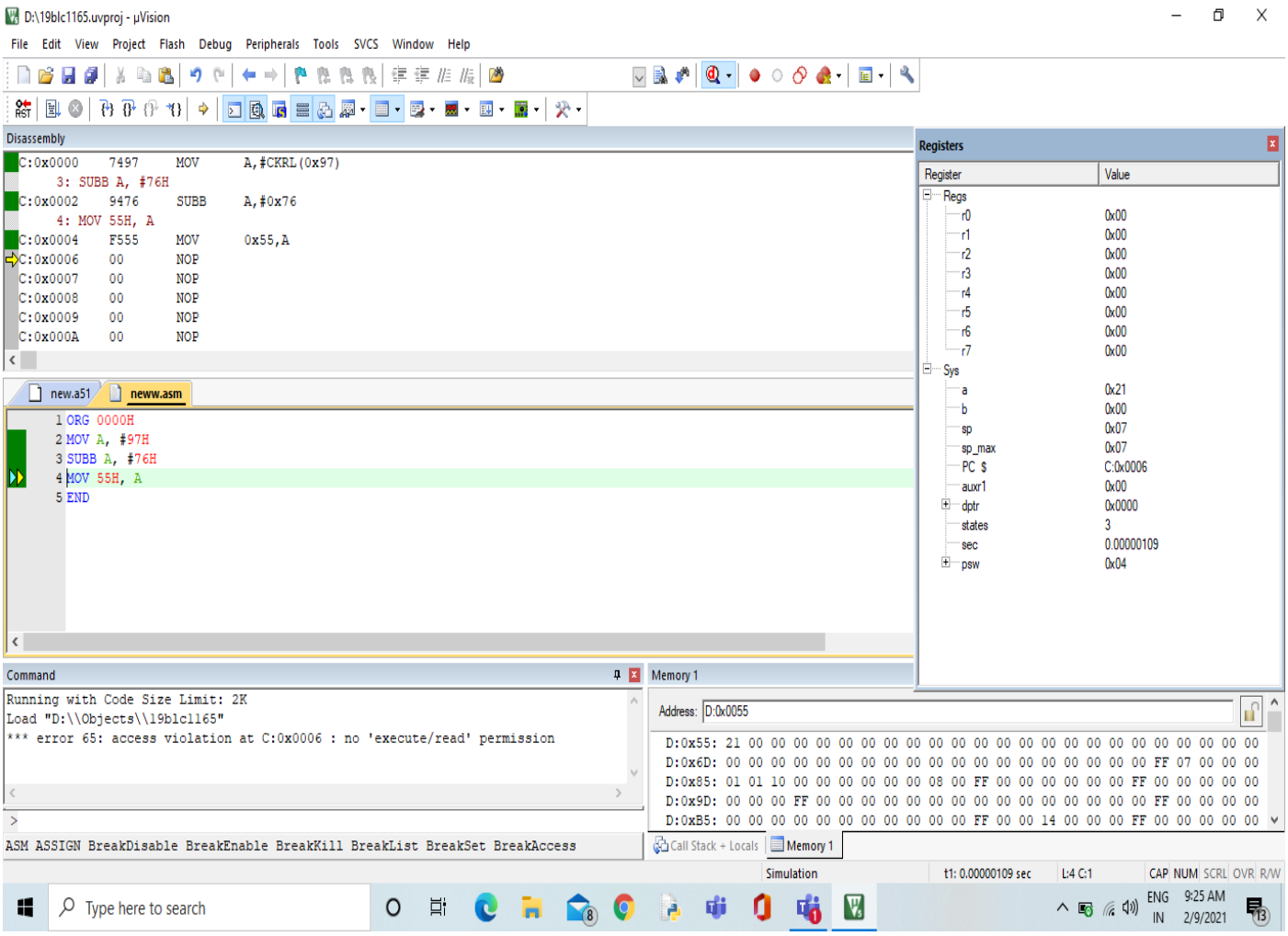
AIM - Write an 8051 ASM program to perform subtraction of two 8-bit numbers 76H and 97H and store the result at address location 55H.

MATERIAL REQUIRED – ARM KEIL software along with C51.

CODE –

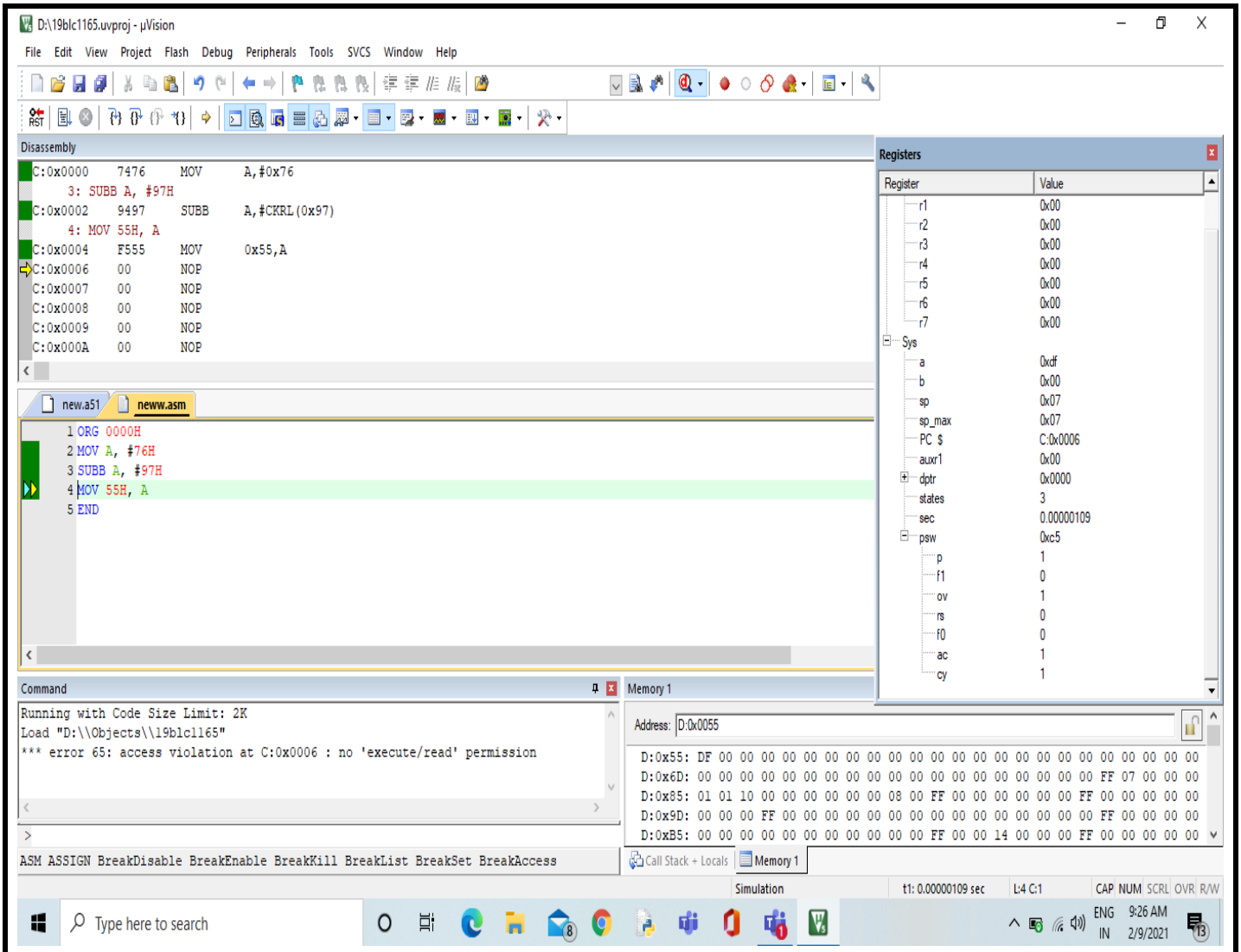
- ORG 0000H
  MOV A, #97H ; 97H - 1001 0111
  SUBB A, #76H ; 76H - 0111 0110
  MOV 55H, A ; 0 21H - 0 0010 0001
  END

P - 0, OV – 0, AC - 0 , C - 0



- ORG 0000H
  MOV A, #76H ; 76H - 0111 0110
  SUBB A, #97H ; 97H - 1001 0111
  MOV 55H, A ; 1 DFH - 1 1101 1111
  END

P - 1, OV - 1, AC - 1 , C - 1



- **PROGRAM – 3**

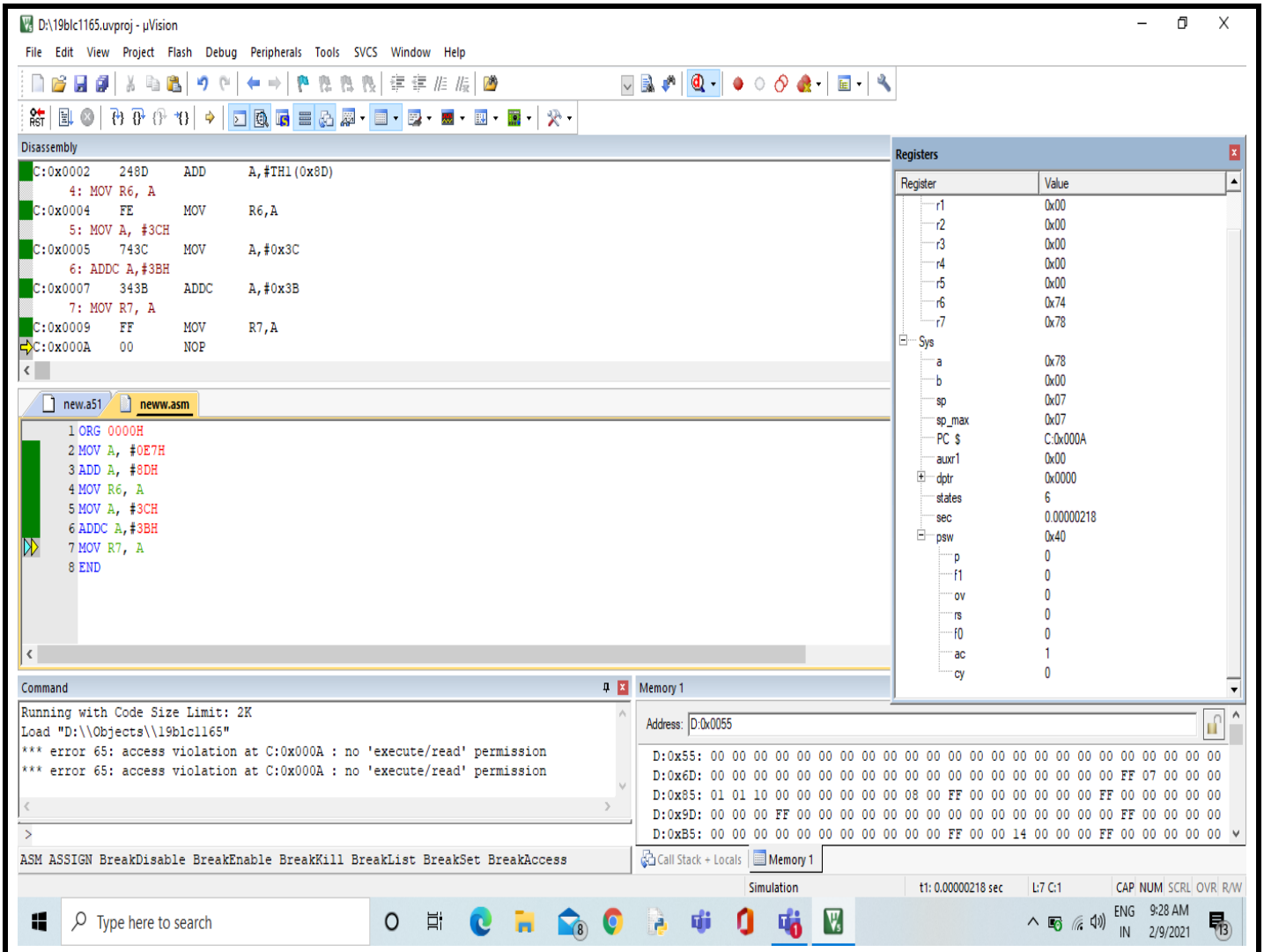
AIM - Write an 8051 ASM program to perform addition of two 16-bit numbers. The numbers are 3CE7H and 3B8DH. Place the sum in R7 and R6; R6 should have the lower byte.

MATERIAL REQUIRED – ARM KEIL software along with C51.

CODE –

```
ORG 0000H
MOV A, #0E7H
ADD A, #8DH
MOV R6, A
MOV A, #3CH
ADDC A,#3BH
MOV R7, A
END
```

P - 0, OV - 0, AC - 1 , C - 0



- **PROGRAM – 4**

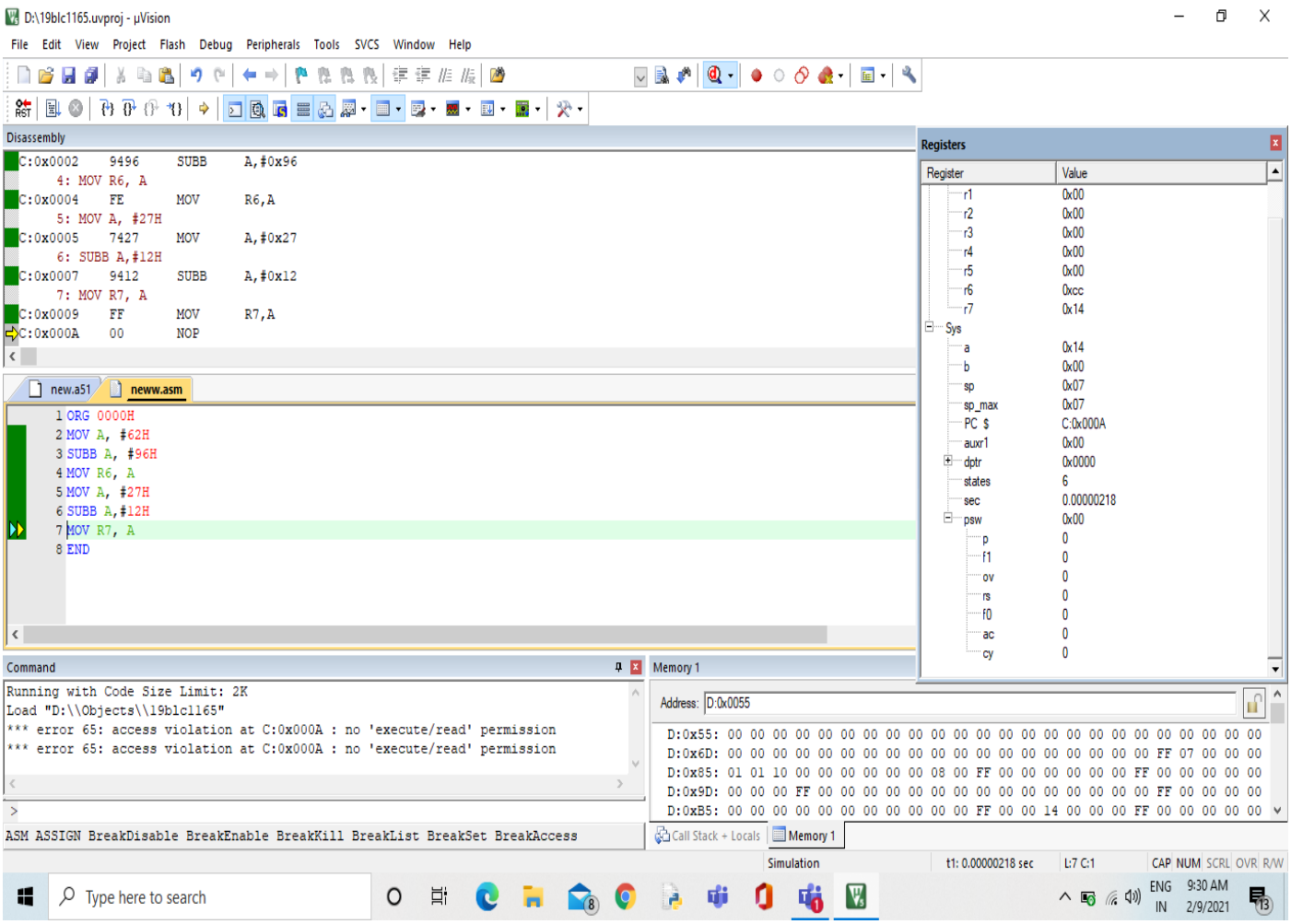
AIM - Write an 8051 ASM program to perform subtraction of two 16-bit numbers. The numbers are 2762H and 1296H. Place the sum in R7 and R6; R6 should have the lower byte.

MATERIAL REQUIRED – ARM KEIL software along with C51.

CODE –

```
ORG 0000H
MOV A, #62H
SUBB A, #96H
MOV R6, A
MOV A, #27H
SUBB A,#12H
MOV R7, A
END
```

P - 0, OV - 0, AC - 0 , C - 0



- **PROGRAM – 5**

AIM - Write an 8051 ASM program to perform multiplication of two 8-bit numbers present in data memory address location 33H & 34H and store the result in 35H (higher byte) & 36H (Lower byte).

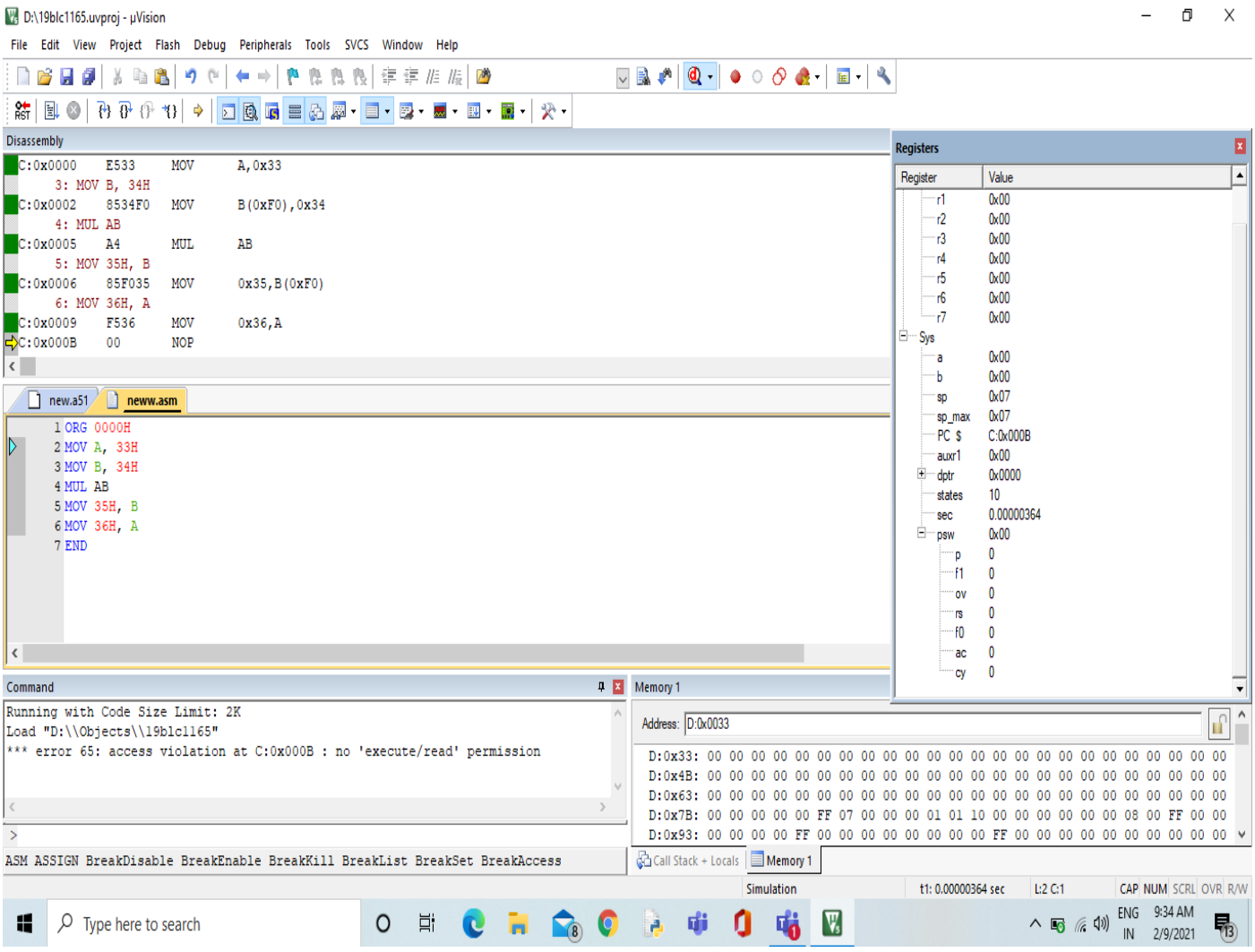
```
MUL AB      ;A x B, place 16-bit result in B and A
```

Multiplication	Operand 1	Operand 2	Result
byte × byte	A	B	A = low byte, B = high byte

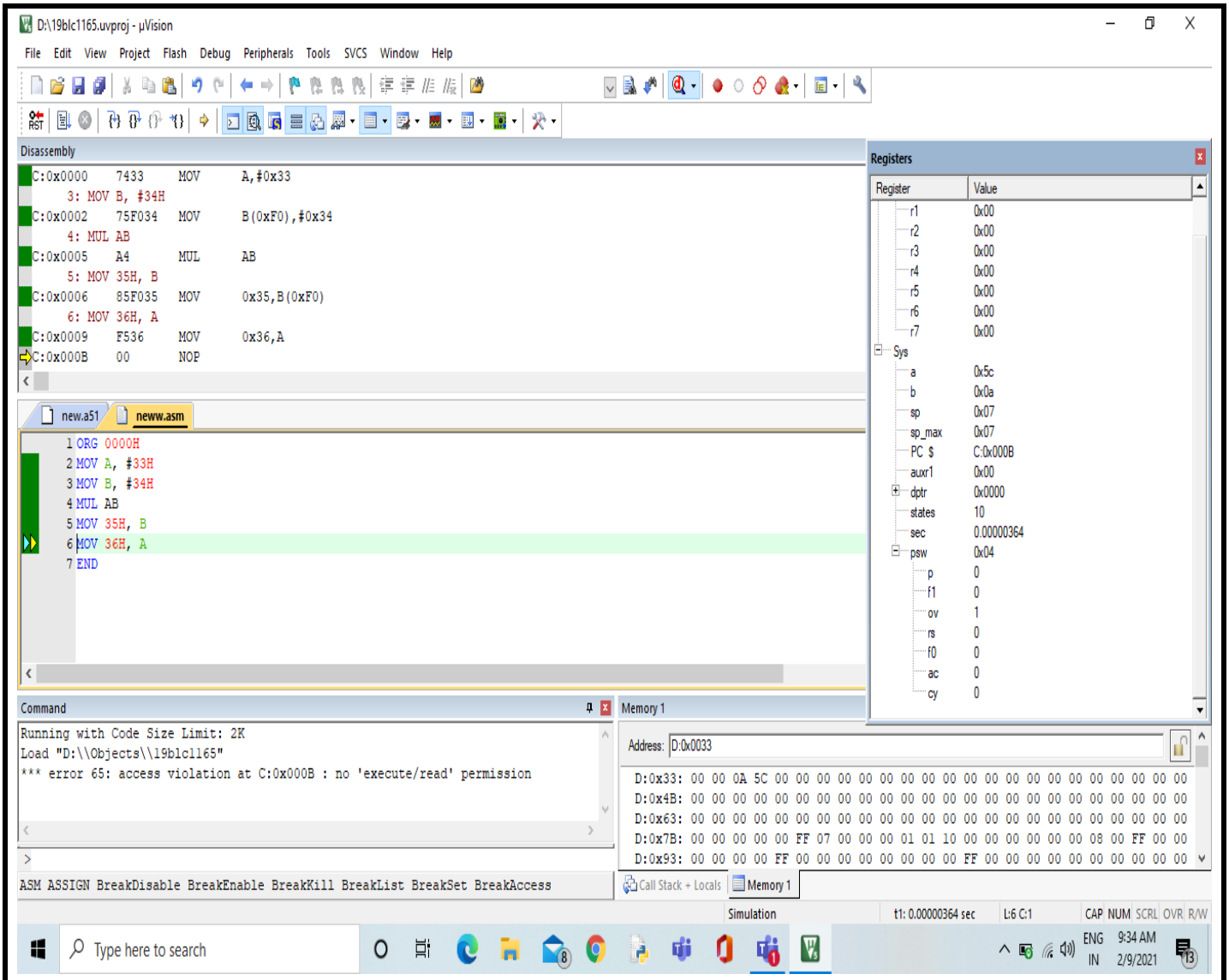
MATERIAL REQUIRED – ARM KEIL software along with C51.

CODE –

- ORG 0000H
  MOV A, 33H
  MOV B, 34H
  MUL AB
  MOV 35H, B
  MOV 36H, A
  END



- ORG 0000H
  MOV A, #33H
  MOV B, #34H
  MUL AB
  MOV 35H, B
  MOV 36H, A
  END



- **PROGRAM – 6**

AIM - Write an 8051 ASM program to perform division on 8-bit numbers present in data memory address location 33H & 34H and store the result in 35H (Reminder) & 36H (Quotient).

```
DIV AB      ;divide A by B
```

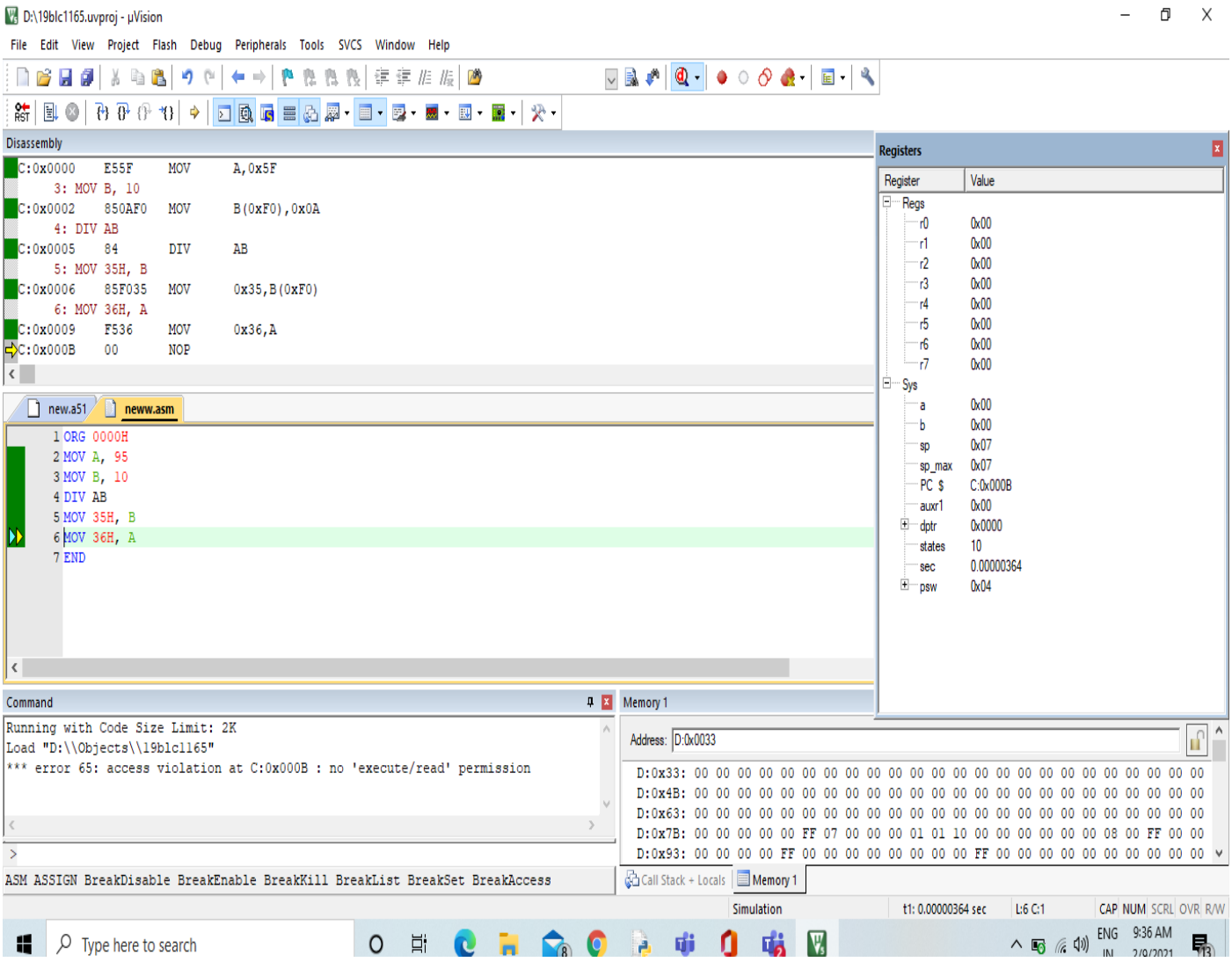
Division	Numerator	Denominator	Quotient	Remainder
byte / byte	A	B	A	B

(If B = 0, then OV = 1 indicating an error)

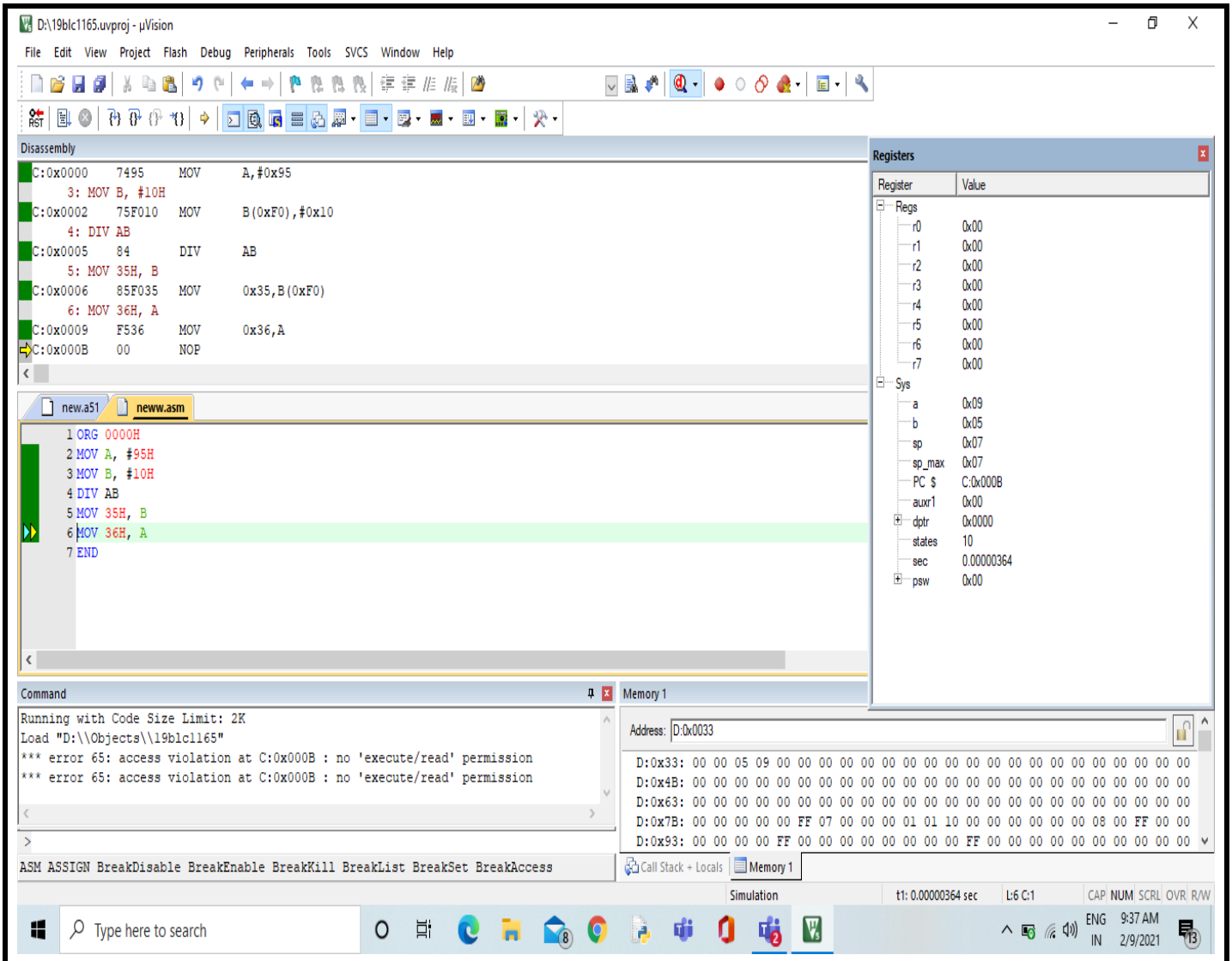
MATERIAL REQUIRED – ARM KEIL software along with C51.

CODE –

- ORG 0000H
  MOV A, 95
  MOV B, 10
  DIV AB
  MOV 35H, B
  MOV 36H, A
  END



- ORG 0000H
  MOV A, #95
  MOV B, #10
  DIV AB
  MOV 35H, B
  MOV 36H, A
  END



CHALLENGING TASKS

- **TASK 1**

AIM - Write an 8051 ASM program to solve the following mathematical equation:

W=(Y+3Z-6X)/6D

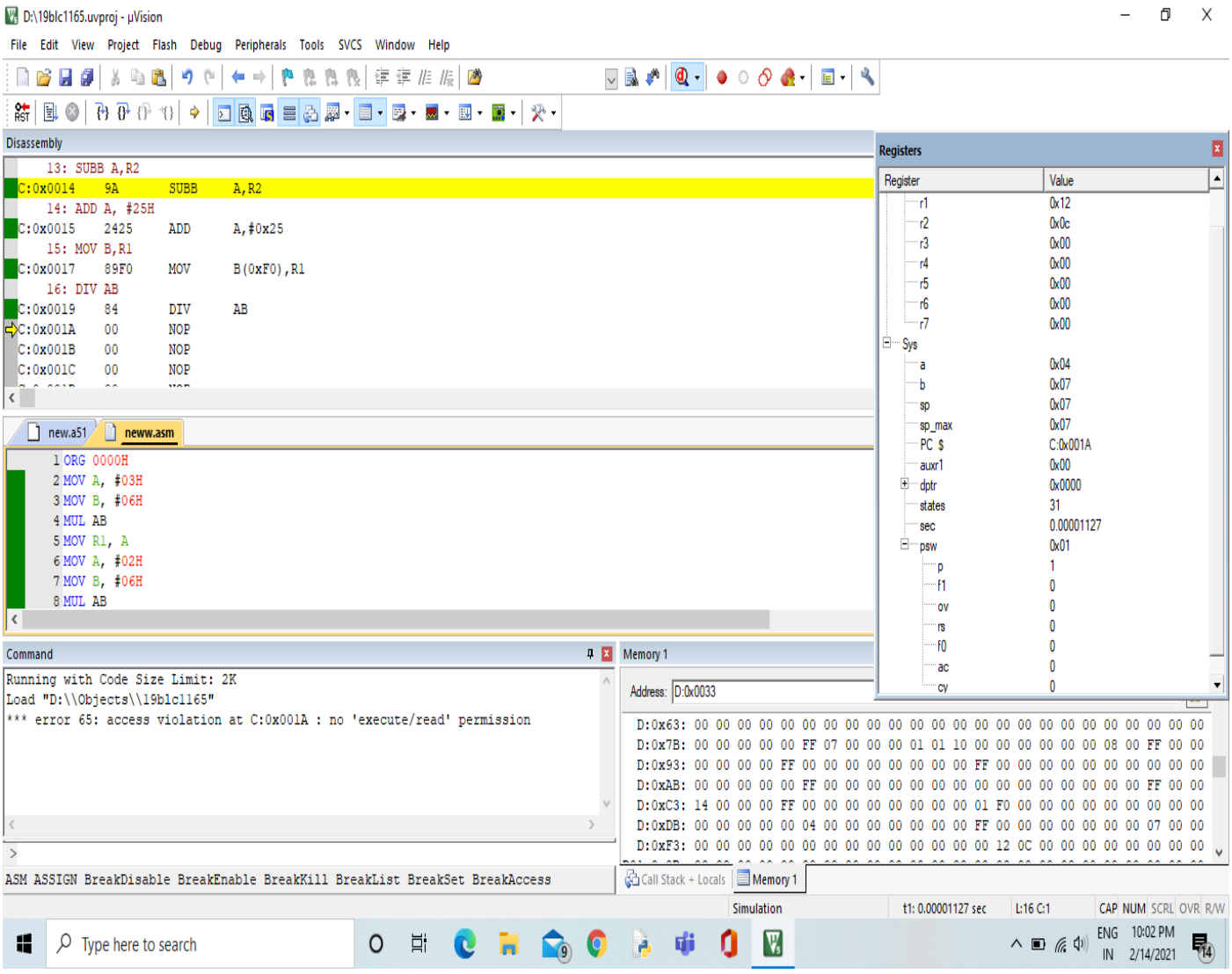
Where D=03H, X=02H, Y=25H and Z=12H

MATERIAL REQUIRED – ARM KEIL software along with C51.

CODE –

```
ORG 0000H
MOV A,#03H
MOV B,#06H
MUL AB
MOV R1,A
MOV A,#02H
```

```
MOV B,#06H
MUL AB
MOV R2,A
MOV A,#12H
MOV B,#03H
MUL AB
SUBB A,R2
ADD A,#25H
MOV B,R1
DIV AB
END
```



- **TASK 2**

AIM - Write an 8051 ASM program to solve the following mathematical equation:

$$(a-b)^2 = a^2 + b^2 - 2ab$$

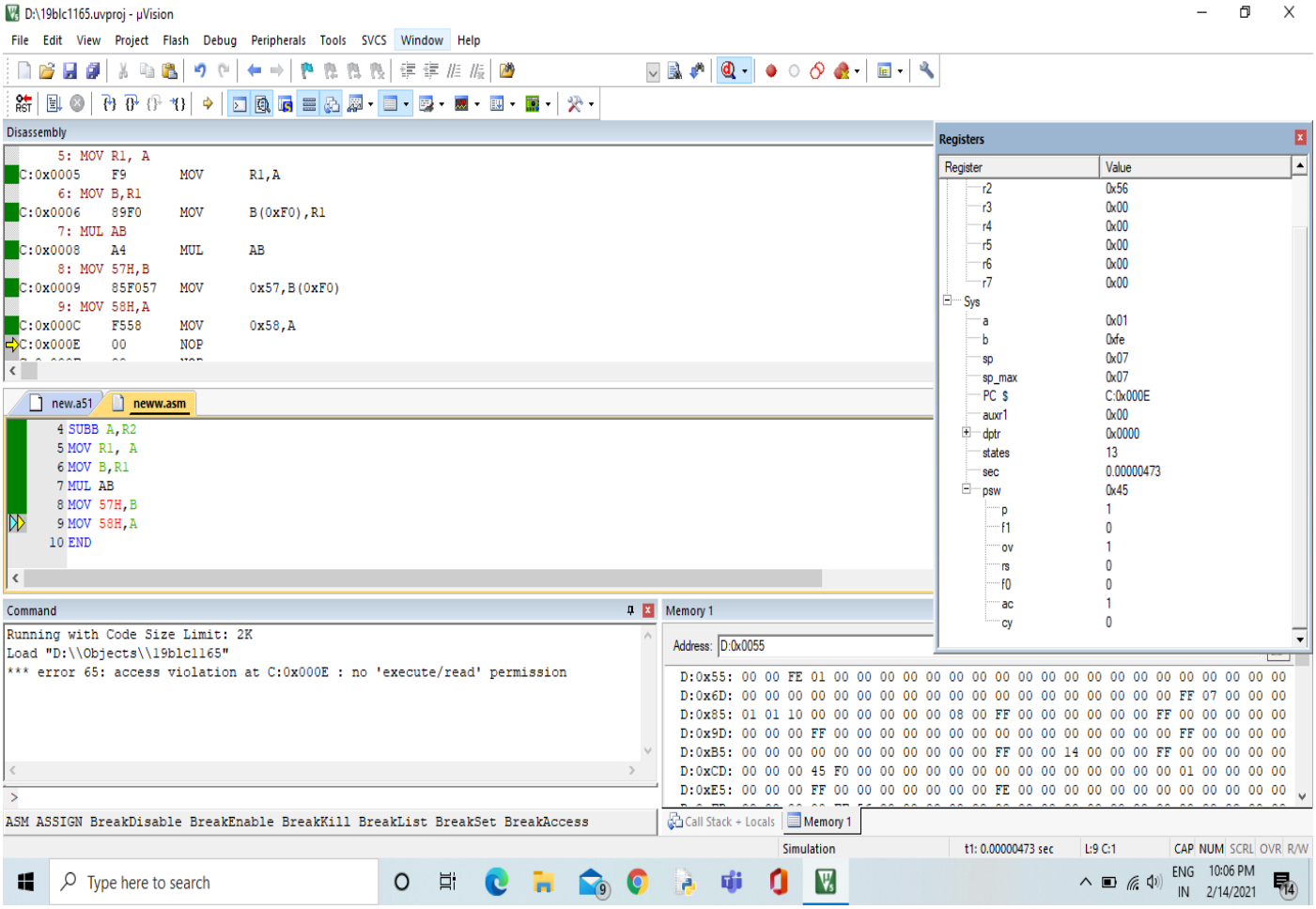
Where "a" & "b" are values at memory location 55H & 56H and store the result in 57H (High byte) & 58H (Low Byte).

MATERIAL REQUIRED – ARM KEIL software along with C51.

CODE –

```
ORG 0000H
MOV A,55H

MOV R2,56H
SUBB A,R2
MOV R1,A
MOV B,R1
MUL AB
MOV 57H,B
MOV 58H,A
END
```



RESULT –

This is the simulation result of the experiment on ARM KEIL simulation software.