8-Bit Arithmetic Operations Using 8051

Aim:

To perform 8-bit arithmetic operations such as addition, subtraction, multiplication, and division using the 8051 microcontroller.

Apparatus Required:

Laptop with Keil uVision software

Algorithm:

1. Addition

1. Start the program.
2. Load the first 8-bit number from memory location **30H** into register **A**.
3. Load the second 8-bit number from memory location **31H** into register **B**.
4. Add the contents of **A** and **B**.
5. Store the result (sum) in memory location **40H**.
6. Check if a carry is generated.
7. If carry = 1, store carry in memory location **41H**, else store 00H.

2. Subtraction

1. Load the first number (minuend) from **30H** into register **A**.
2. Load the second number (subtrahend) from **31H** into register **B**.
3. Clear the carry flag.
4. Subtract **B** from **A** using `SUBB`.
5. Store the result in memory location **40H**.

3. Multiplication

1. Load the first number from **30H** into register **A**.
2. Load the second number from **31H** into register **B**.
3. Multiply **A × B** using the `MUL AB` instruction.

4. Store the **lower byte** (present in A) in memory location **40H**.
5. Store the **higher byte** (present in B) in memory location **41H**.

4. Division

1. Load the dividend from **30H** into register **A**.
2. Load the divisor from **31H** into register **B**.
3. Perform division using `DIV AB`.
   Store the **quotient** (present in A) in memory location **40H**.
4. Store the **remainder** (present in B) in memory location **41H**.

5. Stop

1. End the program execution by jumping to itself (infinite loop).

For Addition:

1. Load the first number from memory location 30H into register A.
2. Load the second number from memory location 31H into register B.
3. Add the contents of registers A and B.
4. Store the result in memory location 40H.
5. Store the carry (if any) in 41H.

For Subtraction:

1. Load the first number from memory location 30H into register A.
2. Load the second number from memory location 31H into register B.
3. Subtract B from A.
4. Store the result in memory location 40H.

For Multiplication:

1. Load the first number from memory location 30H into register A.
2. Load the second number from memory location 31H into register B.
3. Multiply A and B.
4. Store the lower byte of the result in memory location 40H.

5. Store the higher byte of the result in memory location 41H.

For Division:

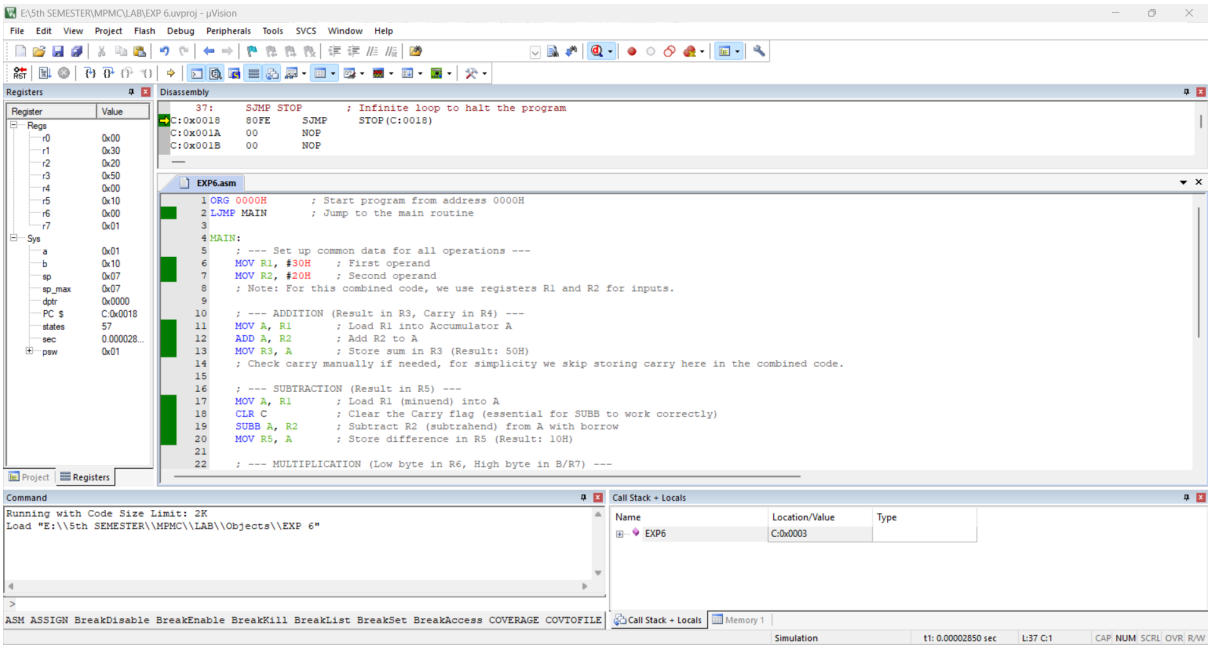
1. Load the dividend from memory location 30H into register A.
2. Load the divisor from memory location 31H into register B.
3. Divide A by B.
4. Store the quotient in memory location 40H.
5. Store the remainder in memory location 41H.

Programs:

```
ORG 0000H       ; Start program from address 0000H
LJMP MAIN       ; Jump to the main routine

MAIN:
   ; --- Set up common data for all operations ---
   MOV R1, #30H    ; First operand
   MOV R2, #20H    ; Second operand
   ; Note: For this combined code, we use registers R1 and R2 for inputs.

   ; --- ADDITION (Result in R3, Carry in R4) ---
   MOV A, R1       ; Load R1 into Accumulator A
   ADD A, R2       ; Add R2 to A
   MOV R3, A       ; Store sum in R3 (Result: 50H)
   ; Check carry manually if needed, for simplicity we skip storing carry here in the combined
code.

   ; --- SUBTRACTION (Result in R5) ---
   MOV A, R1       ; Load R1 (minuend) into A
   CLR C           ; Clear the Carry flag (essential for SUBB to work correctly)
   SUBB A, R2      ; Subtract R2 (subtrahend) from A with borrow
   MOV R5, A       ; Store difference in R5 (Result: 10H)

   ; --- MULTIPLICATION (Low byte in R6, High byte in B/R7) ---
   MOV A, R1       ; Load first operand into A
   MOV B, R2       ; Load second operand into B
   MUL AB          ; Multiply A and B (Product: A=Low byte, B=High byte)
   MOV R6, A       ; Store low byte in R6 (Result: 60H, as 30h * 20h = 600h)
   ; The high byte is already in B register, you could move B to R7 if desired: MOV R7, B

   ; --- DIVISION (Quotient in A, Remainder in B) ---
   MOV A, R1       ; Load dividend into A
   MOV B, R2       ; Load divisor into B
   DIV AB          ; Divide A by B (Quotient in A, Remainder in B)
```

```
    MOV R7, A       ; Store quotient in R7 (Result: 01H, integer division)
    ; The remainder is in B, you could store it in R0 if desired: MOV R0, B

STOP:
    SJMP STOP       ; Infinite loop to halt the program

END
```

Output:



The results of addition, subtraction, multiplication, and division operations will be stored in memory locations 40H and 41H as specified in the program.

Result:

The 8-bit arithmetic operations using the 8051 microcontroller have been successfully executed and verified using Keil software.