

**Course Title:** Microprocessors and Assembly Language Lab (CSE-4504)

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**Lab # 01**

*Introduction to Assembly Language Programming using EMU8086 Assembler and Generate the Corresponding Hex (Machine Code) with Required Memory Locations.*

**Objective:**

Getting familiar with Program Structure of Assembly Language Program and its assembler software EMU8086.

**Installation of EMU8086 and Run for the First Time:**

- Step 1:** Run the setup.exe file to install the program.  
**Step 2:** Launch the EMU8086 emulator. Choose “New” and specify “empty workspace” template.  
**Step 3:** Using the assembler editor, get familiar with the example codes.  
**Step 4:** Start emulation by clicking the “emulate” button on the toolbar. A new emulator window will appear.  
**Step 5:** Debug the program codes by pressing the “single step” button on the toolbar of the emulator window.  
**Step 6:** Each time after pressing the “single step” button, check and record down the contents of registers like AX (al & ah), BX (bl & bh), CX (cl & ch), DX (dl & dh) etc.

**Example for Assembly Language Program:**

```
MOV AX, 30          ; Move decimal 30 to AX register
ADD AX, 15          ; Add decimal 15 to the content of AX and store the result in AX
```

**Tasks to do:**

- Write three appropriated assembly language code to accomplish the following tasks (use as many as possible arithmetic instructions with less number of registers):
  - $(30 + 15) * (575 - 225) + 210$
  - $0Bh * (200 - 225) + 127$
  - $FFFh * 10h + 1111b$
- Find the Machine Code of the corresponding Assembly Language Program using MASM (i.e., use \*.lst file).

- **Arithmetic / Logic Instructions:**

**Increment** the contents of BX register by 4

ADD BX, 4

**Add** the contents of AX register with the contents of CX register

ADD AX, CX

**Subtract** 1 from the contents of AL register

SUB AL, 1

**Subtract** the contents of CX register from the contents of DX register

SUB DX, CX

**Multiply** AL by BL, the result will be in AX

MUL BL

**Divide** the contents of AX register with the value of CL and store the result in AX

DIV CL

**Increase** or **Decrease** the contents of BX register by 1

INC BX ; Increase

DEC BX ; Decrease

**Compare** (subtract and set flags of flag register but without storing result)

CMP AX, 0054H

**Clear** the contents of AX register

XOR AX, AX

**Negation** of a register value

NEG AX

**Assembly Language Program Skeleton:**

ORG 0100h

.DATA ; Data Segment Starts

A DB 11

B DB 4

SUM DB ?

DIFFERENCE DB ?

MULTIPLICATION DB ?

DIVISION DB ?

.CODE ; Code Segment Starts

MAIN PROC ; Initialize Data Segment

MOV AX, @DATA

MOV DS, AX

...

***; Write Your Code Here***

...

```
MAIN ENDP      ; End Procedure
END MAIN      ; End MAIN
RET           ; Return to DOS
```

**Tasks to do:**

3. Write an appropriate assembly language code to accomplish the following tasks (use as many as possible arithmetic instructions with less number of registers):
  - a. Convert 260° C (Celsius) to F (Fahrenheit) using the following expression and store in a variable F:
$$^{\circ}\text{F} = ^{\circ}\text{C} \times 9/5 + 32 - 1$$
  - b. Convert 999 °F (Fahrenheit) to °C (Celsius) using the following expression and store in a variable C:
$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 5/9 + 1$$
4. After getting the result, derive the negative value of F and C.
5. Find the Machine Code of the corresponding Assembly Language Program using MASM (i.e., use \*.lst file).