

Course Title: Microprocessors and Assembly Language Lab

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:

1. Write three appropriated assembly language code to accomplish the following tasks (use as many as possible arithmetic instructions with less number of registers):
 - $(30 + 15) * (575 - 225) + 210$
 - $0Bh * (200 - 225) + 127$
 - $FFFh * 10h + 1111b$
2. 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:

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 5/9 + 1$$