

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

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Lab # 01

Program Structure and Arithmetic Operations using Assembly Language Program in EMU8086.

Objective:

Getting familiar with Program Structure and Arithmetic operations using Assembly Language Program in 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, BX, CX, DX etc.

Theory:

• **Data Transfer Instructions:**

Format: *MOV Destination, Source*

Registers (Direct): Move contents of one register to another register

MOV AL, BL
MOV AX, BX

Immediate: Load a register with an immediate value or equivalent binary/hexa-decimal

MOV CL, 240
MOV CL, 11110000B
MOV CL, 00F0H

MOV CX, 256
MOV CX, 0000000100000000B
MOV CX, 0100H

Direct: Move contents of the variable named COUNT to a register

MOV DL, COUNT ; here COUNT is a 8-bit variable
MOV DX, COUNT ; here COUNT is a 16-bit variable

• **Arithmetic / Logic Instructions:**

Arithmetic and logic instructions can be performed on 8-bit (byte) and 16-bit values.

Increment the contents of a register by a value (decimal/binary/hexa-decimal)

ADD AX, 4

Add the contents of a register with the contents of another register

ADD AX, BX

Subtract a value (decimal/binary/hexa-decimal) from the contents of a register
SUB DL, 4

Subtract the contents of a register from the contents of another register
SUB DX, CX

Multiply AX by BX, the result will be in AX
MUL BX

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

Clear the contents of AX register
XOR AX, AX

Negation and NOT of a register value
NEG AL; 2's Complement
NOT AL; 1's Complement

Example for Assembly Language Program Structure:

```
ORG 0100h ; Offset of the program in memory

.DATA ; Data Segment Starts
A DB 11 ; Variable A got a BYTE value 11
B DW 500 ; Variable B got a WORD value 500
SUM DW ? ; Variable SUM is defined as a WORD variable without any value
DIFFERENCE DB ? ; Variable DIFFERENCE is defined as a WORD variable without any value
MULTIPLICATION DW ?
DIVISION DB ?

.CODE ; Code Segment Starts

MAIN PROC ; Initialize Data Segment Register
    MOV AL, 30 ; Move decimal 30 to AL register
    ADD AL, 15 ; Add decimal 15 to the content of AL and store the result in AL

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

Tasks to do:

1. Write appropriate assembly language codes to accomplish the following tasks (use as many as possible arithmetic instructions with less number of registers):
 - $(30 + 15) * (575 - 225) + 210$
 - $0Bh * (200 - 225) + 127$
 - $0FFFh * 10h + 1111b$
 - Convert 260° C (Celsius) to F (Fahrenheit) using the following expression and store in a variable F:
$$^{\circ}F = ^{\circ}C \times 10/5 + 32 - 1$$