**LAB MANUAL # 03**

**Implementation of Flag Registers**

**FLAG REGISTER**

8086 has 16 flag registers among which 9 are active. The purpose of the FLAG register is to indicate the status of the processor. It does this by setting the individual bits called flags. There are two kinds of FLAGS;

Status FLAGS and Control FLAGS. Status FLAGS reflect the result of an operation executed by the processor. The control FLAGS enable or disable certain operations of the processor.

1.Carry Flag(CF): holds the carry out after addition or borrow after subtraction. Also indicates error condition.

2.Parity Flag (PF): this flag is set to 1 when there is even number of one bits in result, and to 0 when there is odd number of one bits.

3.Auxiliary Flag(AF): The auxiliary carry holds the carry (half-carry) after addition or the borrow after subtraction between bit positions 3 and 4 of the result.

4.Zero Flag (ZF): set to 1 when result is zero. For non-zero result this flag is set to 0.

5.Sign Flag (SF): set to 1 when result is negative. When result is positive it is set to0. (This flag takes the value of the most significant bit.)

6.Trap Flag (TF): Used for on-chip debugging.

7.Interrupt enable Flag (IF): when this flag is set to 1 CPU reacts to interrupts from external devices.

8.Direction Flag (DF): this flag is used by some instructions to process data chains, when this flag is set to 0 - the processing is done forward, when this flag is set to 1the processing is done backward.

9.Overflow Flag (OF): An overflow indicates that the result has exceeded the capacity of the machine.

**Example 1:-**

MOV DX, 126FH

ADD DX, 3465H

MOV BX, 0FFFFH

ADD BX, 1

Use Single Step and observe changes in flags after executing every single statement. Also, convert the numbers to binary and prove the results(manually) as observed using emulator.

**Example 2:-**

MOV BL,+8

MOV DH,+4

ADD BL,DH

**Example 3:-**

MOV AL, +66

MOV CL, +69

ADD CL,AL

**Example 4:-**

MOV AL, -12

MOV BL, +18

ADD BL,AL

**Example 5:-**

MOV AH, -30

MOV DL, +14

ADD DL, AH

**Describe briefly:**

1. What is Emulator and how it helps a hardware/embedded system designer?

2. What is the difference between machine code and assembly language?

3.Define Purpose of IP register?

4.Write down the purpose of AX,BX, CX and DX Registers?

5.How flags in a microprocessor help a hardware designer?

**Lab Tasks**

**Execute the following tasks CLO [1]**

**Task 1**

What effect on Conditional Flags will happens after the addition of 10110001 and 10101011? (write state of each of the flag as observed, note values of flags after execution of every single instruction in the program)

**Task 2**

Add two numbers in BIN, save the result in AX register and observe the value of flags.

1000 0000 0000 0000

1100 1000 0000 0000

(write state of each of the flag as observed, note values of flags after execution of every single

instruction in the program

**Task 3**

Check out the status of flags for the following examples?