Chapter Four Instructions Set

Instructions set

Instructions set 8086 has 117 instructions, these instructions divided into 6 groups:

1. Data transfer instructions
2. Arithmetic instructions
3. Logic instructions
4. Shift instructions
5. Rotate instructions
6. Advance instructions

Data Transfer Instructions

Data Transfer Instructions The microprocessor has a group of data transfer instructions that are provided to move data either between its internal registers or between an internal register and a storage location in memory. Some of these instructions are:

- **MOV:** use to transfer a byte or a word of data from a source operand to a destination operand. These operands can be internal registers and storage locations in memory. Notice that the MOV instruction cannot transfer data directly between a source and a destination that both reside in external memory. For instance, flag bits within the microprocessors are not modified by execution of a MOV instruction.

EXAMPLES

1. MOV DX, CS where DX = 0100H

   DX = CS = 0100H

2. MOV SUM, AX DS = 0200H SUM = 1212H

   PA = 02000H +1212H = 03212H

   AL Memory location 03212H

   AH Memory location 03213H

3. If DS contain 1234H what is the effect of executing the instruction MOV CX,[0ABCDH]

   CL loaded with the content of Memory location

   1234H + ABCDH =1CF0DH And CH is loaded with the content of Memory location 1234H + ABCDH +1 = 1CF0EH

- **XCHG:** in MOV instruction the original contents of the source location are preserved and the original contents of the destination are destroyed. But **XCHG** instruction can be used to swap data between two general purpose register or between a general purpose register and storage location in memory.

EXAMPLES:

1. XCHG AX, DX (AX) (DX)

2. XCHG SUM, BX

   (DS (0) + SUM) BX

   DS = 02000 H + 1234 H = 03234 H

(3234) (BL)

(3235) (BH)

2.Arithmetic Instructions

Arithmetic instructions includes instructions for the addition, subtractions can be performed on numbers expressed in a variety of numeric data formats. The status that results from the execution of an arithmetic instruction is recoded in the flags of the microprocessor. The flags that are affected by arithmetic instructions are CF, AF, SF, ZF, and PF.

- **Addition:** ADD, ADC, and INC

  ADD AX,BX

  AX= AX+BX

EXAMPLE:

AX= 1100H, BX=0ABCH ADD AX, BX

1100H+ 0ABCH = 1BBCH = AX

- **ADC AX, BX AX**

  = AX+BX+CF

- **INC AH AH**

  = AH +1

EXAMPLE:

The original contents of AX, BL, memory location SUM, and CF are AX=1234H, BL= ABH, Sum=00CDH and CF=0 respectively, describe the result of execution the following sequence of instruction:

ADD AX, SUM A

DC BL, 05H

INC SUM

1. AX= 1234H + 00CDH = 4301H CF=0

2. BL= ABH +05H +0=B0H CF=0

3. SUM=00CDH + 1=00CEH CF=0

Instructions	AX	BL	SUM	CF
Initial state	1234H	ABH	00CDH	0
ADD AX,	4301H	ABH	00CDH	0
SUM ADC BL,	4301H	B0H	00CDH	0
05H INC SUM	4301H	B0H	00CEH	0

- **Subtraction:** SUB, SBB, DEC, and NEG

- SUB AX, BX

AX = AX – BX

- SBB AX, BX

AX = AX - BX – CF

EXAMPLE:

BX = 1234H, CX = 0123H, CF = 0

SBB BX, CX

BX = 1234H - 0123H - 0 = 1111H

- DEC subtract 1 from its operand

- NEG BX (2's complement)

  00H – BX 0000 + 2's complement of BX

EXAMPLE:

BX = 3A H NEG BX 0011 1010

0000 H +FFC6H 1100 0101 +

1

1100 0110

C 6

- **Multiplication and Division MUL, DIV**

- **MUL CL**

  (AX)= AL* CL

- **MUL CX**

  (DX, AX) = AX * CX

- **DIV CL**

  (AH), (AL) = AX/CL 51

And AL the quotient

Where AH is the reminder