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Chapter Three

Programming the 8086 microprocessor

This lecture will be devoted to the basic concepts of programming the 8086 microprocessor.

Assembly and machine languages

It is essential to become familiar with these ideas before attempting to learn the functions of the instructions in the instruction set and their use in writing programs.

Assembly language instructions are provided to describe each of the basic operations that can be performed by a microprocessor .they are written using alphanumeric symbols instead of 0's and is of the microprocessor's machine code **.programs written in assembly language are called source code**

Each instruction in the source program can be divided into two separate parts its "opcode" and its "operand" .

The opcode part identity the operation that is to be performed (such as add, subtract ,move ..).in assembly language ,we assign a unique one ,two ,or three .letter combination for each operation. This letter combination is referred to as a mnemonic such as (ADD_ add , SUB_ subtract ,MOV_ move.etc.)

<u>The operands part</u> identify the data that are to be processed by the microprocessor as it carries out the operation specified by the opcode .

<u>For instance</u> to add the contents of two registers .

ADD AX , BX ; AX=AX+BX

Before a source program can be executed by the microprocessor .it must first be run through a process known as assembling with a program called an assembler .the result produced by this step is an equivalent program expressed in the machine code that is executed by the microprocessor. That is , it is equivalent of the source program but now written in 0's and 1's, it is known as object code.

Instruction set

the 8086 microprocessor provides a powerful instruction set containing (117) basic instructions for the purpose of discussion the instruction set will be divided in to a number of groups of functionally related instruction these are:-

1-Data transfer instructions .
2-arithmetic instructions .
3-logic instructions .
4-shift and rotate instructions .
5- program control instructions .
6-flag control instructions .
7-string instructions .
8-miscellaneous instructions
Each one of these types is a group of instructions . its operation details will be discussed in the next sections

1-data transfer instruction

A group of instructions that transfer data between two processor registers, or between a register and a memory location this group includes (MOV,XCHG,LEA,LDS,LES).

the MOV instruction

the MOV instruction is used to transfer a byte or a word of data from the source operand to the destination operand; these operands can take different forms as shown in figure (3,1) .

the large number of operands type results in many different MOV instruction

mnemonic	Meaning	format	operation	Affected flags
MOV	MOVE	MOV D,S	(S)→ (D)	NONE

Fig(3,1) the MOV instructions

(source/destination operands)

Reg ⟷ Reg

Reg ⟷ Memory

Reg ← Immediate

Memory← Immediate

Reg16 ⟷ Segment register

Mem16 ⟷ Segment register

Examples:- MOV AX,BX (AX)← (BX)

MOV DH,CL (DH)← (CL)

MOV CX,[SI] (CX) ← ((DS)0+(SI))

MOV [ABCD],BX ((DS)0+ABCD)← (BX)

MOV DI,A2F4H (DI) ← A2F4

MOV [BP],453AH ((SS)0+(BP))← 453A

MOV AX,DS (AX)← (DS)

NOTE

Cs and IP reg cannot to be used as a destination operands with MOV source they store address of the next instruction .

Ex:- if the DS reg contains 1234H ,what is the effect of executing the instruction give the following memory contents MOV CX,[0ABCDH]

SOL/

(12340+ABCD)CL

(12340+ABCD+1)CH

In other word the contents of memory location $1CF0D_{16}$

Is loaded into CL and the contents of $1CF0H_{16}$

Is loaded into CH

The XCHG instruction

In some application ,it is required to interchange the contents of tow register or between a register and a memory location contents the 8086 XCHG instruction perform this operation the forms of the XCHG instruction and its allowed operands are shown below:-

mnemonic	meaning	format	operation	Flag affected