80X86 Addressing Modes

The general format for an assembly language statement is

LABLE: INSTRUCTION ; COMMENT

An example of a complete assembly language statement is

Start: MOV AX,CX ; Copy CX into AX

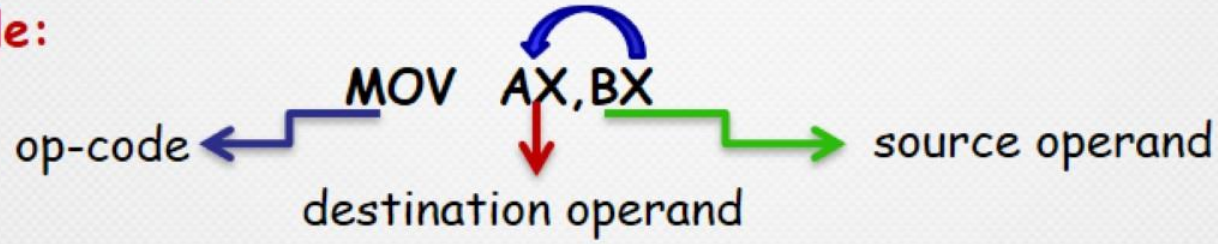
address identifier (label)	Instruction	Comment

Operation Codes and Operand

Instructions are made up of two parts:

1. Operation Code or Op-Code specifies the operation to be performed.
2. Operand identify source and destination of the data acted on by the op-code.

Example:



80X86 Addressing Modes

Addressing Mode: is the way in which MP can access operands.

80x86 provide a total of seven addressing modes:

1. Register
2. Immediate
3. Direct
4. Register Indirect
    a. Based.
    b. Index.
    c. Based Index.
    d. Base with Displacement.
    e. Index with Displacement.
    f. Base Index with Displacement.
5. Stack addressing mode.
6. String addressing mode.
7. Input output addressing mode.

1. Register addressing mode

- use of registers to hold the data to be manipulated
- Memory is not accessed when this addressing mode is executed
- therefore, it is relatively fast
- Example:

```
MOV   BX, DX    ;copy the contents of DX into BX
MOV   ES, AX    ;copy the contents of AX into ES
ADD   AL, BH    ;add the contents of BH to contents of AL
```

- Source and destination registers must have the same size

```
Example      DL=6F   , SI = 4000
   MOV     CL,DL
   MOV     BX,SI
```

CL= 6F
BX= 4000

2. Immediate addressing mode

- the source operand is a constant
- the operand comes immediately after the opcode
- For this reason, this addressing mode executes quickly
- Immediate addressing mode can be used to load information into any of the registers except the segment registers and flag registers.
- Ex:
  - MOV AX, 2550H ;move 2550H into AX
  - MOV CX, 625 ;load the decimal value 625 into CX
  - MOV BL, 40H ;load 40H into BL

Example 1

MOV AL,15

AL= 15

EX1:

```
MOV   SI,F902
MOV   BX,SI
MOV   AL,BL
MOV   DX,3F2
```

بعد التنفيذ الايعاز الاول
SI=F902
بعد تنفيذ الايعاز الثاني
BX=F902
بعد تنفيذ الايعاز الثالث
AL=02
بعد تنفيذ الايعاز الرابع
DX=03F2

2. Immediate addressing mode

☞ **Moving information to the segment registers**

- the data must first be moved to a general-purpose register and then to the segment register.
- Example:
- MOV AX, 2550H
- MOV DS, AX
- MOV DS, 0123H ;illegal instruction!

Ex1: Define data segment at address 9000

الحل :

```
MOV  DX,9000
MOV  DS,DX
```

3. Direct addressing mode

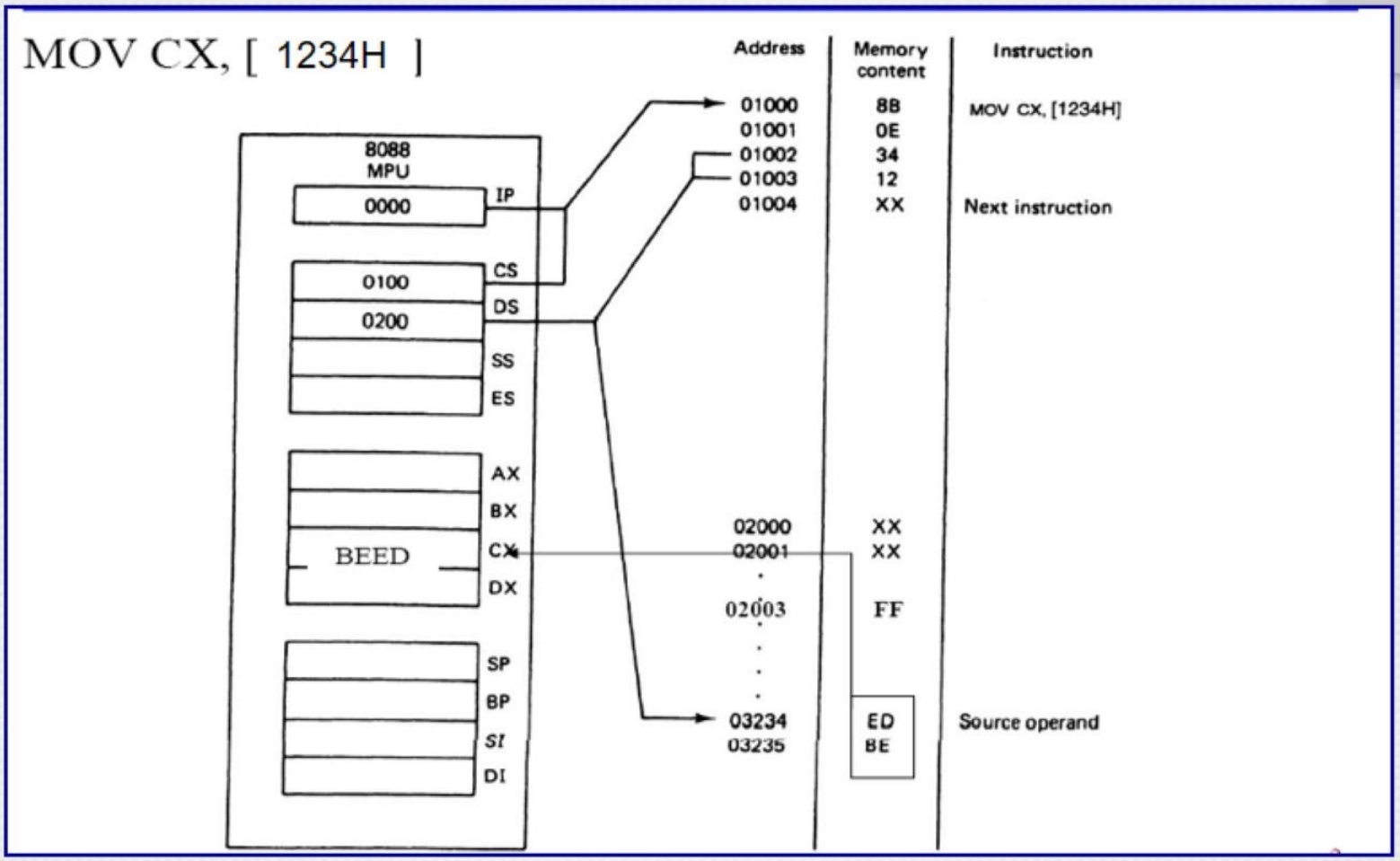
- the data is in some memory location(s) and the address of the data in memory comes immediately after the instruction
- This address is the offset address
- Example
  - MOV DL, [2400] ;move contents of DS:2400H into DL
- the physical address is calculated by combining the contents of offset location 2400 with DS

Note the brackets

PA= segment Base : Direct offset address

$$\text{PA} = \begin{Bmatrix} CS \\ DS \\ SS \\ ES \end{Bmatrix} : \{Direct\ offset\ address\}$$

Example


MOV CX, [1234H]
8088
MPU
IP
0000
CS
0100
DS
0200
SS
ES
AX
BX
BEED
CX
DX
SP
BP
SI
DI
Address
Memory content
Instruction
01000
01001
01002
01003
01004
8B
0E
34
12
XX
MOV CX, [1234H]
Next instruction
02000
02001
02003
XX
XX
FF
03234
03235
ED
BE
Source operand

Examples

Example1:

Find the physical address of the memory location and its contents after the execution of the following, assuming that DS = 1512H.

```
MOV   AL, 99H
MOV   [3518], AL
```

MOV AL, 99H → Immediate addressing mode

MOV [3518], AL → Direct addressing mode

الحل :

AL= 99 بعد تنفيذ الايعاز الاول

الايعاز الثاني

PA= SEG.* 10 + OFFSET

= 1512*10 + 3518= 15120+3518=18638

	:
18638	99
	:

Examples

Example2: ASSUME THAT DS= F900

```
MOV   DX, F205   ⟶  Immediate addressing mode
MOV   [2000],DX  ⟶  Direct addressing mode
MOV   BH,[2000]  ⟶  Direct addressing mode
```

الحل :

تنفيذ الايعاز الثاني :

Ph= DS*10 + OFFSET

PH= F9000+ 2000=FB000

الايعاز الثالث التنفيذ

(DS:2000) ⟶ BH

BH= 05