1.2 ADDRESSING MODES

The set of mechanisms by which an instruction can specify how to obtain its operands is known as Addressing modes. The Addressing modes of 8086 can be broken into two categories such as,

1. Data related Addressing modes
2. Branch Addressing modes

The CPU can access the operands (data) in a number of different modes The 8086 has 12Addressing modes can be classified into five groups.

- Addressing modes for accessing immediate and register data (register and immediatemodes).
- Addressing modes for accessing data in memory (memory modes)
- Addressing modes for accessing I/O ports (I/O modes)
- Relative Addressing mode
- Implied Addressing mode

IMMEDIATE ADDRESSING MODE:

In this mode, 8 or 16 bit data can be specified as part of the instruction - OP Code Immediate Operand

Example 1:

MOV CL, 03 H: Moves the 8 bit data 03 H into CL

Example 2:

MOV DX, 0525 H: Moves the 16 bit data 0525 H into DX

In the above two examples, the source operand is in immediate mode and thedestination operand is in register mode.

A constant such as “VALUE” can be defined by the assembler EQUATE directivesuch as VALUE EQU 35H

Example:

MOV BH, VALUE

Used to load 35 H into BH

REGISTER ADDRESSING MODE:

The operand to be accessed is specified as residing in an internal register of 8086. Anyone internal registers can be used as a source or destination operand, however only the data registers can be accessed as either a byte or word.

Example 1: MOV DX,CX

MOV DX (Destination Register) , CX (Source Register) Which moves 16 bit content ofCS into DX.

Example 2: MOV CL, DL

Moves 8 bit contents of DL into CL

Example 3: MOV BX, CH is an illegal instruction.

The register sizes must be the same.

DIRECT ADDRESSING MODE:

The instruction Opcode is followed by an affective address, this effective Address is directly used as the 16 bit offset of the storage location of the operand from the location specified by the current value in the selected segment register. The default segment is always DS. The 20 bit physical Address of the operand in memory is normally obtained as PA = DS:EA

The data resides in a memory location in the data segment, whose effective Address may becomputed using 5000H as the offset Address and content of DS as segment address. The effective address, here, is 10H*DS+5000H.

Example 1: MOV AX, [5000H]

If DS = 1010H, OFFSET=5000, AX = 1000H then EA=15100H.DS:BX

□1010H:5000H

10*HDS□ 10100

[BX] □ +5000

EA □ 12100H

Example 2:

MOV CH, START

If [DS] = 3050 and START = 0040

8 bit content of memory location 30540 is moved to CH.

REGISTER INDIRECT ADDRESSINGMODE:

The EA is specified in either pointer (BX) register or an index (SI or DI) register.

Example: MOV AX, [BX]

Here, data is present in a memory location in DS whose offset Address is in BX. The effective Address of the data is given as 10H*DS+ [BX].

MOV AX, [BX]

If DS = 1010H, BX = 2000H, AX = 1000H

then EA=12100H. DS:BX

□1010H:2000H

10*HDS□ 10100

[BX] □ +2000

EA □ 12100H

INDEXED ADDRESSING:

The offset of the operand is stored in one of the index registers. DS and ES are the defaultsegments for index registers SI and DI respectively.

Example: MOV AX, [SI]

Here, data is available at an offset Address stored in SI in DS. The effective address, in this case,is computed as 10H*DS+ [SI].

If DS = 1010H, SI = 3010H,

then EA=13110H. DS: SI

□1010H:

3010H 10*HDS□ 10100

[BX] □ +3010

EA □ 13110H

REGISTER RELATIVE ADDRESSING:

In this Addressing mode, the data is available at an effective Address formed by adding an 8-bit or 16-bit displacement with the content of any one of the registers BX, BP, SI and DI in the default (either DS or ES) segment. The example given before explains this mode.

Example: MOV AX, 5000H [BX]

Here, effective Address is given as 10H*DS+50H+ [BX].

If DS = 1010H, BX = 2000H, offset=5000

then EA=17100H.

DS:[5000+BX] □1010H:

5000+2000H

10*H □ 10100

DS

Offset □ 5000

[BX] □ +

2000

EA □ 17100H

BASED INDEXED:

The effective Address of data is formed, in this Addressing mode, by adding content of a base register (any one of BX or BP) to the content of an index register (any one of SI or DI). The default segment register may be ES or DS.

Example: MOV AX, [BX] [SI]

Here, BX is the base register and SI is the index register. The effective Address is computed as10H*DS+ [BX] + [SI]

If DS = 1010H, BX = 2000H, SI=3010

then EA=15110H.

DS:[SI+BX]

□1010H:[3010H: 2000H]

10*HDS □ 10100

[SI] □ 3010

[BX] □ +2000

EA □ 15110H

RELATIVE BASED INDEXED:

The effective Address is formed by adding an 8-bit or 16-bit displacement with the sum of contents of any one of the bases registers (BX or BP) and any one of the index registers, in a default segment.

Example: MOV AX, 5000H [BX] [SI]

Here, 50H is an immediate displacement, BX is a base register and SI is an index register. Theeffective address of data is computed as 160H*DS+ [BX] + [SI] + 50H.

If DS = 1010H, BX = 2000H, SI=3010 then

EA=1A110H.

DS:[5000+BX+SI] □1010H:

[5000+2000H+3010H]

10*H □ 10100

DS

[SI] □ 3010

[BX] □ 2000

Offset □ +5000

EA □ 1A110H

BRANCH RELATED ADDRESSING MODES:

These type of Addressing are related to whether the Addressing is within the same segment or to a different segment. Accordingly the Addressing modes in this category are knownas intrasegment and intersegment with direct or indirect

addressing. These are explained below:

INTRASEGMENT DIRECT ADDRESSING MODE:

The effective Address is the sum of the IP and 8 / 16 bit displacement. It leads to a short jump if displacement is 8 bit, and this Addressing may be used conditional or unconditional in a program.

INTRASEGMENT INDIRECT ADDRESSING:

In this Addressing mode the effective Address may be in a register or at a memory location as accessed by any data related addressingmode except the immediate and implied mode. This Addressing mode is called only unconditionally.

INTERSEGMENT DIRECT ADDRESSING MODE:

This Addressing mode when used replaces the content of the CS and IP with the offset and segment part of the instruction. Used to branch from one segment to another segment.

INTERSEGMENT INDIRECT ADDRESSING MODE:

The Addressing mode replaces the contentof the CS and IP with the Address given in a register or in memory using any of the data related Addressing modes.