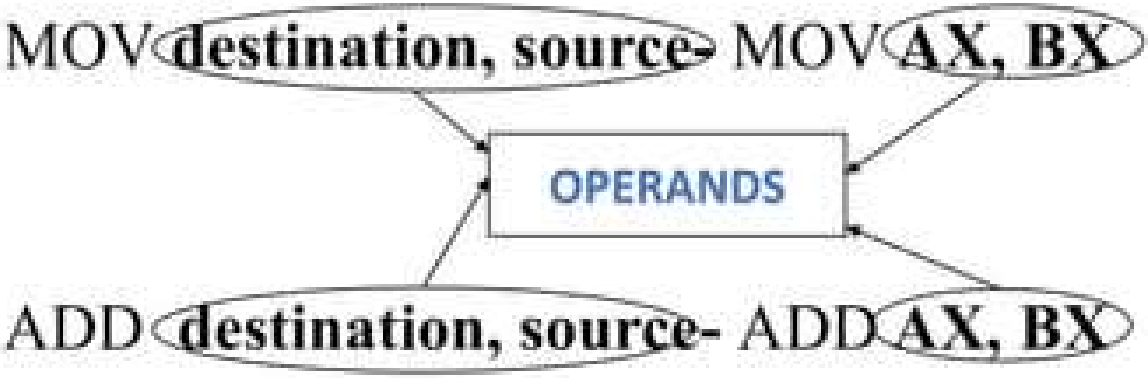
Definition:-

The way in which the operands are specified in an instruction is called addressing modes.

Operands?

Any instruction has two parts one is source and the other one is destination.

Example: MOV **destination, source**- MOV **AX, BX**



CLASSIFICATION OF ADDRESSING MODES

- Immediate Addressing Mode
- Direct Addressing Mode
- Register Addressing Mode
- Register-Indirect Addressing Mode
- Indexed Addressing Mode
- Register Relative Addressing Mode
- Based Indexed Addressing Mode
- Relative-Based Indexed Addressing Mode
- Intersegment direct and indirect addressing mode
- Intrasegment direct and indirect addressing mode

IMMEDIATE ADDRESSING MODE

- The data will be specified directly in the source operand.
- Either 16 bit hex data (4 digits) or 8 bit hex data (2 digits) can be specified in the instruction.

Example:

➢ MOV AX, 0004H- The 16 bit data 0004H will be moved to accumulator register.

Before Execution	After Execution
The value of AX---->A00C	The value of AX---->0004

➢ MOV AL, 04H- The 8 bit data 04 is moved to lower byte of accumulator register.

Before Execution			After Execution		
	AH	AL		AH	AL
The value of AX---->	A0	0C	The value of AX---->	A0	04

Note: If 16 bit data is to be specified, use AX, BX,CX, DX..

If 8 bit data is to be specified, use AL, AH, BL, BH, CH, CL, DL,DH..

DIRECT ADDRESSING MODE

- In this mode, the **16 bit offset address** or the input-output (**IO**) address (8 bit) is directly specified in the instruction.

Example:

- MOV AX, [6000H]- The data which resides in memory location 6000H and 6001H is moved to AX register.
- Assume the data in 6000H----> 04 and 6001H---->01.

Before Execution	After Execution
The value of AX---->A00C	The value of AX---->0104

Note: Every memory location can store only 8 bit data. So, to do any operation with 16 bit data, 2 memory locations are needed. The value of 1st memory location is stored in lower byte and the value of 2nd memory location is stored in higher byte.

- IN AL, 80H- This instruction reads the data from the address 80H and stores it in AL register.
- Assume the data in 80H---> 05

Before Execution	After Execution
The value of AX---->A00C	The value of AX---->0105

REGISTER ADDRESSING MODE

- In this mode, **both source and destination operands** are registers.

Example:

➢ MOV AX, BX- The data which resides in BX register is moved/copied to AX register.

Before Execution	After Execution
The value of AX---->A00C The value of BX--->0902	The value of AX---->0902 The value of BX--->0902

➢ ADD AL, BL- The data in BL register and AL register are summed up and the result is stored in AL register.

Before Execution				After Execution			
AX register		BX register		AX register		BX register	
AH	AL	BH	BL	AH	AL	BH	BL
03	03	01	02	03	05	01	02

REGISTER INDIRECT ADDRESSING MODE

- The **address of the memory location** which contains the data (will be enclosed in square brackets) is specified by offset registers.
- Offset register-BX register

Example:

➢ MOV AX, [BX]- Assume the BX register has the value 4000H. Now, this 4000H is considered as offset address/ memory location. Then, the data in 4000H and 4001H are moved to AX register.

Before Execution	After Execution
The value of AX---->A00C The value of BX---> 4000 BX---> 4000 04 4001 06	The value of AX---->0604 The value of BX--->4000

Note: If no square brackets are enclosed, it becomes register addressing mode.

INDEXED ADDRESSING MODE

- The **address of the memory location** which contains the data (will be enclosed in square brackets) is specified by index registers.
- Index registers-SI (Source Index), DI (Destination Index)

Example:

➢ MOV AX, [SI]- Assume the SI is pointed to the content 4000H. Then, the data in 4000H and 4001H are moved to AX register.

Before Execution	After Execution
The value of AX---->A00C The value of SI---> 4000 SI---> 4000 04 4001 06	The value of AX---->0604 The value of SI---> 4000

➢ MOV [DI], AX- Assume the DI is pointed to the content 6002H . Then, the data in AX register is moved to 6002H and 6003H.

Before Execution	After Execution
The value of AX---->A00C DI---> 6002 09 6003 0E	The value of AX---->A00C DI---> 6002 0C 6003 A0

REGISTER RELATIVE ADDRESSING MODE

- In this mode, the offset address will be formed by adding **8 bit displacement value** or **16 bit displacement value** to the content of any one registers such as **BX, BP, SI, DI.**

Example:

- MOV AX, 50H [BX] - Assume the BX register has the value 4000H. Now, this 4000H is added with the value 50H to form the offset address. Then, the data in the resultant location(4050 H) is moved to AX register.
- Physical Significance: MOV AX, [50H+BX]
- Assume the value in 4050H location is 04H and in 4051H, it is 06H.

Before Execution	After Execution
The value of AX---->A00C The value of BX---> 4000 4050 04 4051 06	The value of AX---->0604 The value of BX--->4000

Note: The word relative indicates the displacement value.

BASED INDEXED ADDRESSING MODE

- In this mode, the offset address will be formed by adding **the content of base register (BX) to the content of index registers (DI, SI)**

Example:

- MOV AX, [SI] [BX] - Assume the BX register has the value 4000H. Also, assume the value of SI to be 2002H. Now the offset address is equal to [4000+2002]=[6002H]. The content/data in 6002H and 6003H are moved to AX register.
- Physical Significance: MOV AX, [SI+BX]
- Assume the value in 6002H location is 04H and in 6003H, it is 06H.

Before Execution	After Execution
The value of AX---->A00C The value of BX---> 4000 The value of SI--->2002 6002 04 6003 06	The value of AX---->0604 The value of BX---> 4000 The value of SI--->2002

RELATIVE BASED INDEXED ADDRESSING MODE

- In this mode, the offset address will be formed by adding **the content of base register (BX), the content of index registers (DI, SI) and the 8 bit or 16 bit displacement value.**

Example:

- MOV AX, 50H [SI] [BX] - Assume the BX register has the value 4000H. Also, assume the value of SI to be 2002H. Now the offset address is equal to [4000+2002+50]=[6052H]. The content/data in 6052H and 6053H are moved to AX register.
- Physical Significance: MOV AX, [SI+BX+50]
- Assume the value in 6052H location is 04H and in 6053H, it is 06H.

Before Execution	After Execution
The value of AX---->A00C The value of BX---> 4000 The value of SI--->2002 6052 | 04 6053 | 06	The value of AX---->0604 The value of BX---> 4000 The value of SI--->2002

INTERSEGMENT & INTRASEGMENT ADDRESSING

- In general, the memory location in 8086 (called Physical/Effective Address) is formed by two addresses: Segment address and Offset/Base address.

- The offset address will be specified in the instruction. However, the segment address will be calculated by the processor based on the nature of the instruction.

- For any instruction, If the source location and destination location lies in the same segment, it is intrasegment addressing.

- If the source location and destination location lies in the different segment, it is intersegment addressing.

- Both Addressing modes are further classified into Direct and Indirect Addressing mode.

INTRASEGMENT ADDRESSING MODE

Intrasegment Direct Addressing:

- If address to which the control is to be transferred appears directly in the instruction as a displacement value, it is intra segment direct mode.

Example: JMP SHORT LABEL

Here SHORT LABEL refers to 8 bit signed displacement.

Intrasegment Indirect Addressing:

- If address to which the control is to be transferred is specified through any content of the registers, it is intra segment indirect mode.

Example: JMP [BX]

Jump to the effective address specified by BX register.

INTERSEGMENT ADDRESSING MODE

Intersegment Direct Addressing:

- If the segment address to which the control is to be transferred and location in the segment appears directly in the instruction, it is inter segment direct mode.

Example: JMP 2000H:3000H

Jump from the segment address 2000H to the segment address 3000H

Intersegment Indirect Addressing:

- If the segment address to which the control is to be transferred and location in the segment appears indirectly in the instruction, it is inter segment indirect mode.

Example: JMP [2000H]

Jump from the current segment to another segment whose effective address is specified as 2000H.