Instruction Set of 8086

- An instruction is a binary pattern designed inside a microprocessor to perform a specific function.
- The entire group of instructions that a microprocessor supports is called **Instruction Set**.
- 8086 has more than **20,000** instructions.

Classification of Instruction Set

- Data Transfer Instructions
- Arithmetic Instructions
- Logical Instructions
- Control Transfer Instructions
- String Manipulation Instructions
- Processor Control Instructions

Instruction Format

- The size of 8086 instruction is one to six bytes depending upon the addressing modes used for instructions.
- The general Instruction format that most of the **instructions of the 8086 microprocessor** follow is:

OpCode (6 bits)	D (1 bit)	W (1 bit)	MOD (2 bits)	REG (3 bits)	R/M (3 bits)	Lower order bits of displacement	Higher order bits of displacement

Format Contd…

- The Opcode stands for Operation Code.
- Every Instruction has a unique 6-bit opcode.
- For example, the opcode for **MOV** is 100010.
  - **D** stands for direction
    If **D=0**, then the direction is from the register
    If **D=1**, then the direction is to the register
  - **W** stands for word
    If **W=0**, then only a byte is being transferred, i.e. 8 bits
    If **W=1**, them a whole word is being transferred, i.e. 16 bits

- The 2 bit **mod** field defines the method of addressing the operand specified by the r/m field.

Code for mod field	Name of the mode
00	Memory mode with no displacement
01	Memory mode with 8-bit signed displacement
10	Memory mode with 16-bit signed displacement
11	Register mode

The 3 bit **reg** field is used to indicate the source or destination of the operand along with the **d** field

Code for reg field	Name of the register represented by the code when w=0 or 1	
	W=0	W=1
000	AL	AX
001	CL	CX
010	DL	DX
011	BL	BX
100	AH	SP
101	CH	BP
110	DH	SI
111	AH	DI

Code for r/m field	Effective address calculation when mod 00/01/10		
	Mod=00	Mod=01	Mod=10
000	[BX] + [SI]	[BX] + [SI] + d8	[BX] + [SI] + d16
001	[BX] + [DI]	[BX] + [DI] + d8	[BX] + [DI] + d16
010	[BP] + [SI]	[BP] + [SI] + d8	[BP] + [SI] + d16
100	[SI]	[SI] + d8	[SI] + d16
101	[DI]	[DI] + d8	[DI] + d16
110	d16 (direct)	[BP] + d8	[BP] + d16
111	[BX]	[BX] + d8	[BX] + d16

- The low order displacement and high order displacement are optional and the instruction format contains them only if there exists any displacement in the instruction.
- If the displacement is of 8 bits, then only the cell of low order displacement is filled and if the displacement is of 16 bits, then both the cells of low order and high order are filled, with the exact bits that the displacement number represents.

Types of Instruction formats

1. One byte instruction: Implied or register mode

MOV CL, DH

2. Two-byte instruction: Register to/from memory/register with no displacement

MOV AX, 35H

3. Three-byte instructions: register to/from memory with 8-bit displacement

LDA 2050H

4. Four-byte instructions: register to/from memory with 16-bit displacement

MOV AX, [BX+1324H]

5. Five-byte instructions: immediate 8-bit data to memory with 16-bit displacement

MOV [BX+08H], 12H

6. Six-byte instructions: immediate 16-bit data to memory with 16-bit displacement

MOV [BX+08H], 1234H