MICROPROCESSOR

- Bit - A digit of binary number or code is called bit.
- Nibble - The 4bit (4 digit) Binary number or code is called nibble.
- Byte - The 8bit (8 digit) BN or code is called byte.
- Word - The 16 bit (16-digit) Binary number or code is called word.
- Double word - 32bit
- Multiple word - 32bit.

Data - The quantity (BN/code) operated by an Instⁿ of a Program is called data. The size of data is Specified as bit, byte, word etc.

Address - Address is an Identification number in binary for ML. The 8086 processor uses 20 bit address for memory.

Microprocessor - The MP is a Program controlled Semiconductor device (IC), which fetches (from memory), decodes and Executes instructions. It is used as CPU (Central Processing Units) in Computers.

The Basic function blocks of MP are ALU, an Array of registers and a control unit. The MP is identified with the size of data, and the ALU of the Processor it can work with at a time. The 8085 processor has 8-bit ALU. Hence it is called 8bit processor. The 8086 processor has 16 bit ALU, hence it is called 16 bit processor.

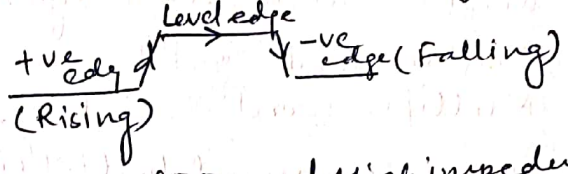
BUS :- A bus is a group of conducting lines that carries Data, addresses and control signals. Bus can be classified into Data bus, Address bus and control bus.

- The group of conducting lines that carries Data is called DB
- The group of conducting lines that carries address is called AB
- The group of conducting lines that carries control signals is called control bus.

CPU Bus - The group of conducting line that are directly connected to MP is called CPU bus. In a CPU bus the signals are Multiplexed i.e more than one signal are passed through the same line but at different timings.

System bus - The group of conducting lines that carries data, address and control signals in a MP system is called System bus. Multiplexing is not allowed in system bus.

Clock - The time taken for the MP and the system to execute an Instr or program are measured only in terms of the time period of its clock.



Tristate logic - In device with tristate logic. They are high state, low state and High impedance state.

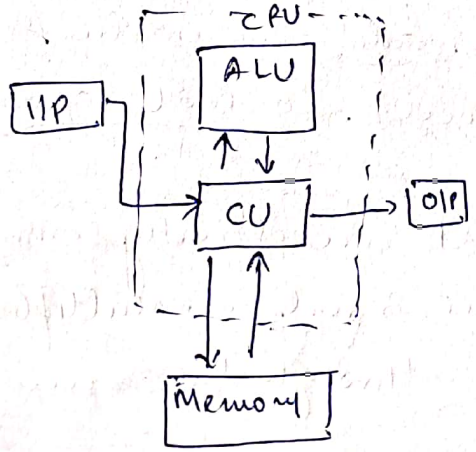
*High + low states are normal logic level for Data, address or control signals.

*High Impedance state is provided to keep the device electrically isolated from the system - HI state is electricaley open ckt condition.
- In this HI state, they cannot receive or send any signals or Information.

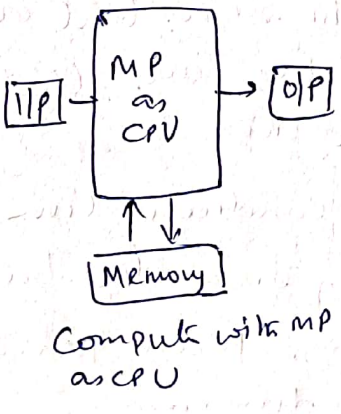
→ Each MP has a fixed set of Instructions in the Binary Pattern called a M/c language.

→ The binary instructions are given abbreviated names, called Mnemonics, which form the assembly language for a given MP.

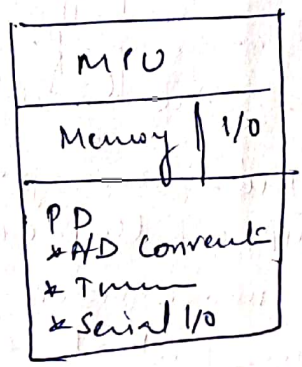
A MP is a multipurpose, programable, clock driven, Register based electronic device that reads Binary instructions from a storage device called memory, accepts binary data as I/P and processes data according to those instructions, and provides results as O/P.



Traditional Block diagram of Computer



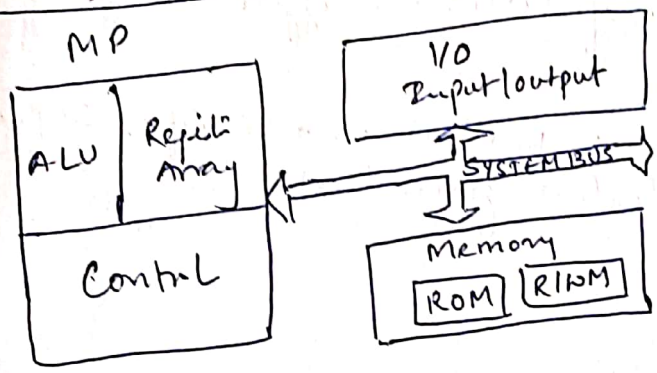
Computer with MP as CPU



Microcontroller.

1971 1976
4004 → 8008 → 8080 → 8085 → 8086 → 8088 → 80286 - 80386 - 80486
Pentium → Pen Pro → PII → PIII → Pentium-4. (2000)

Microprocessor-Based system with Bus Architecture :-



- It includes three components ; MP, I/O and M (RIW and ROM)
- These components are organized around a common comm path called a Bus.
- The Entire group of Component is also refered to as system or Microcomputer System and the Component refered to as a Subsystem.

MP.

ALU - The area of the MP where various computing function are performed on data. ALU unit perform such as Arithmetic op^n as addition and substraction. and such logic op^n AND, OR and Ex-OR.

Regist Array. Various Regist identified by letter such as B, C, D & E, H, and L. These regist are primarily used to store data temporarily during the Execution of a program and are accible to the user through instruction.

Control unit - Control unit provide the necessary timing and Control Signals to all the op^n in the Microcomputer. It control data flow of data both MP, Memory and peripheral.

MICROCONTROLLERS :-

These micro computers are designed on single chip, which typically include a MP, 256byte of RIW Memory, from 1K or 8K byte of ROM, several signal lines & Connecti I/Os. These are used microcomputer on a chip; they are also known as Microcontroller.

Traffic lights. Example of MC include Singh chips as zilog Z8, Intel MCS 51 series, Motorola 68HC11 and the Micro chip Technology PIC family.

Instruction – A cmd in binary that is recognized and exe by the Compute to accomplish a task. Some instruction are designed with One word and some require Multiple words.

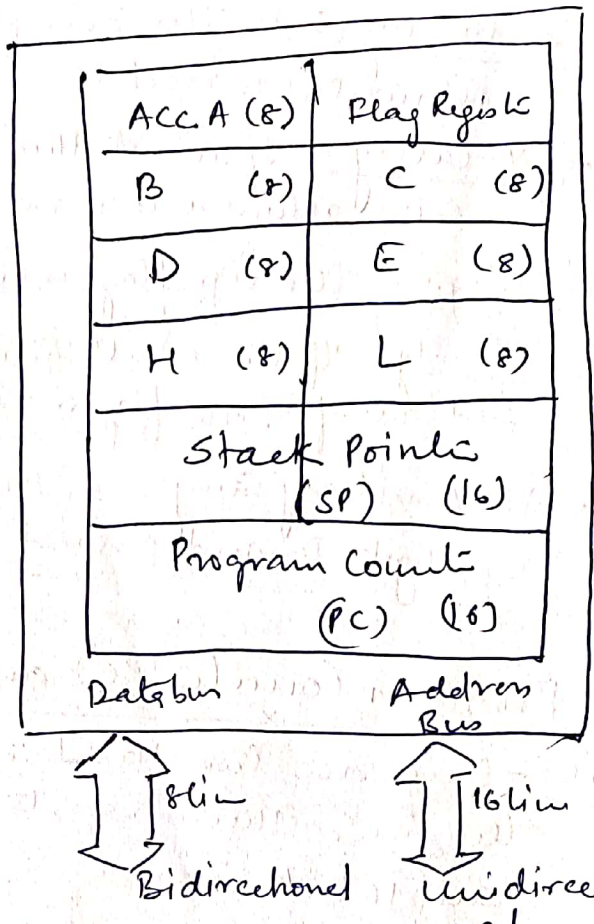
Mnemonics – A combination of letters to suggest the op^n of an Instruction.

Program – A set of instructions written in a specific sequence for the Compute to accomplish a given task.

8085 Programming Model

D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
S	Z		AC		P		CY

Flag Register.



Programming Model

8085 PModel

PM consist of some segments of ALU and the register. The model includes six register. One Accumulator and One flag Register. It has two 16 bit Register: the stack pointer and Program Counter.

Register - 8085 has six General purpose register to store
* 8bit data: these are identified as B, C, D, E, H and L
* They are combined as Register pairs - BC, DE and HL - to perform some 16 bit opⁿ.
* Programmer can use these register to store or copy data into the register by using data copy Fnᴹ.

Accumulator -

The Accumulator is a 8bit register that is part of the ALU. The register is used to store 8bit data and perform arithmetic and logical opⁿ. The Result of an operation is stored in The Accumulator. The ACC is also identified as Register A.

Flags - ALU includes five FF, which are set or reset after Opⁿ. They are called Zero(Z), Carry(CY), Sign(S), Parity(P) and Auxillary Carry (AC) flags. The most Common used flags are Zero, carry ad sign flags.

* Zero Flag (Z) - The Zero flag is set to 1 when the result is zero. Otherwise it is reset.
* CY - Carry - If an Arithmetic op^n results in a Carry, the CY Flag is set: otherwise it is reset.
* S - Sign - The Sign flag is set if Bit D_7 of result = 1; otherwise it is reset.
* P - Parity - If the result has an even no. of 1s, the flag is set: for an odd no. of 1s, the flag is reset.
* AC - Auxilliary Carry - In Arithmetic op^n, when a carry is generated by digit D_3 and passed to digit D_4, the AC flag is set.

Program Counter (PC) and Stack Pointer (SP) :-

PC - There are two 16 bit registers used to hold Memory addresses. The size of these registers is 16 bits because the Memory addresses are 16 bits.

The MP uses the PC Register to sequence the Execution of the Instructions. The function of PC is to point to the Memory address from which the next byte is to be fetched. When byte is being fetched, the PC is incremented by one to point to the Next ML.

SP - SP is also 16 bit register used as a Memory pointer. It points to a ML in R/W Memory called the stack.

INSTRUCTION CLASSIFICATION :-

An Instruction is a binary pattern designed inside a MP to perform a specific function. The Entire group of Instruction called the Instruction Set.

8085 Instruction Set :- 8085 Instructions are classified into 5 (five) categories - Data transfer (copy), AO, LO, Bo and M/C operations.

1) Data transfer (copy) Operations
This group of instructions copies data from a location called a Source to another location called, a distination, without modifying the content of the source. Various types of Data transfer (copy) can take place with Examples -

Types
1) Between Registers
2) Specific Data byte to Reg or ML
3) Bet^n a ML and a R
4) Bet^n I/O device and the Accumulator

Examples
1) Copy the content of Reg B into Reg D.
2) Load Reg B with data byte 32H
3) From ML 2000H to Reg B.
4) From an I/P keyboard to the Acc.

2) Arithmetic op^n - AO such as Addition, Subtraction, Increment and Decrement.

3) Logical operation - These instructions perform various logical op^n with the content of the Acc.

* AND, OR, Ex-OR - Store No, or the Content of Reg or of ML can be logically ANDed, ORed or Exclusive-ORed with the content of Accu. The result are stored in the Accumulator
* Rotate - Each bit in Acc can shifted either Left or Right to Next position
* Compare - Any 8bit no, or the content of Reg or ML can be Compared for equality, greater than or less than, with the Content of Accumulator.
* Complement - the Content of Accumulator can be complimented all 0's are replaced by 1's and all 1's are replaced by 0's.

Branching op^n - These group of Instn alter the sequence of Program execution either conditionally or unconditionally.

* **Jump** - Conditional jumps are important aspect of decision making process in Prog.

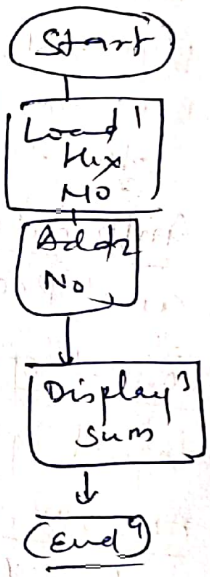
* **Call, Return and Restart :-** Instn change the sequence of a Program either by calling a subroutine or returning from a subroutine

M/C Control op^n :-
These Instn are m/c control functions such as Halt, Interrupt or do nothing.

How to write, Assemble and execute a simple program

Problem - Write Instn to load the two Hexadecimal no 32H and 48H in Register A and B. Add the numbers and display the sum at the LED O/P port PORT 1.

Algo - 1) Load the Numbers in the Register
2) Add the No.
3) Display the sum at the O/P port PORT 1.



Block 1 - MVI A, 32H
Block 2 - MVI B, 48H
Block 3 - ADD B
Block 4 - STA 2050H
HALT

From AL to Hex code

MVI A, 32H	3EH	— 2 byte
	32H	
MVI B, 48H	06H	— 2 byte
	48H	
ADD B	80H	— 1 byte
STA 2050H	32H	— 3 byte
	50H	
	20H	
HLT	76H	— 1 byte