Unit

Computer basics

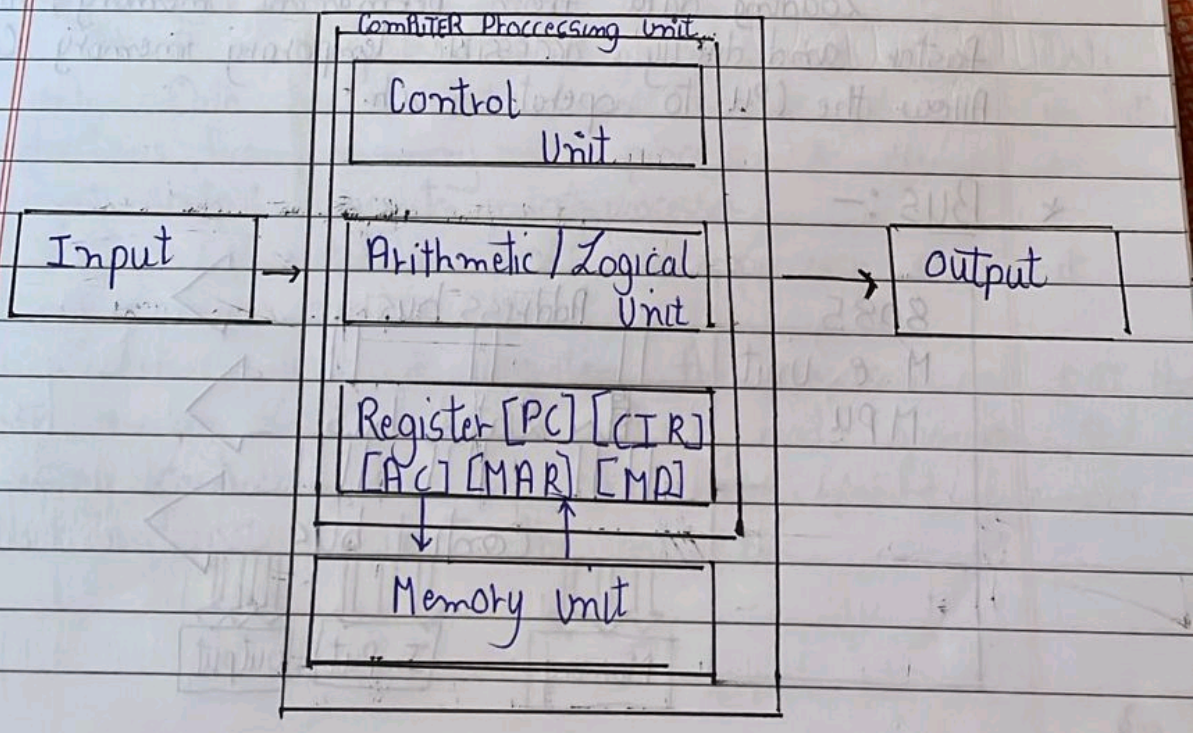
Topics:- Von Neuman model, CPU, Memory, I/O, Bus, Memory registers, program counter, Accumulator, Instruction register, Micro - operations, Register Transfer Language, Instruction Cycle, Instruction formats and addressing modes.

* **Von Neuman model:-**

Von - Neuman architecture was first publised by John Von Neuman in 1945.

His computer architecture design consist of a control unit, Arithemetic and logic unit (ALU) memory unit, Registers and input - output.

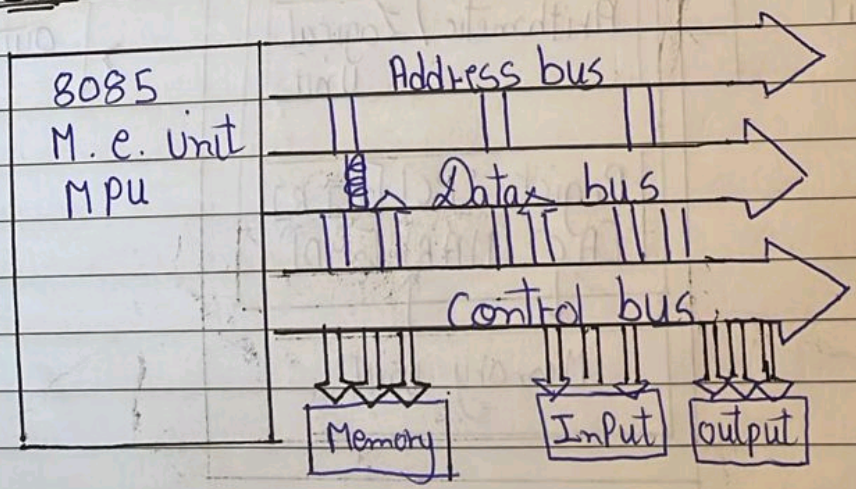
Von Neuman architecture is based on the stroked program computer concept, where instriction data and program data are ~~sto~~ stored in the same memory. This design is still used in most computer produced today.



* Central processing unit (CPU):-
The central processing unit is the electronic circuit responsible for executing the instruction of a computer program.
It is sometime refferred to as the microprocesser or processor.
The CPU contain ALU, CU and a vairty of register.

* Memory unit (MU):-
The memory unit consists of RAM sometimes ~~reff. reff.~~ refferred to as primary or main memory. Unlike a hard drive this memory is fast and also directly assessible by this CPU.
RAM is split into partitions. Each partition consists of an adress and its content.
The address will uniquely identify every location in the memory.
Loading data from permanent memory, into the faster and directly accessible temporary memory (RAM) Allow the CPU to operate much.

* Bus:-



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1. Address bus :-

It is a group of conducting wires which carries address is unidirectional because data flow in one direction from micropocessor to memory or from microprocessor to input · output device.

Length of address bus of 8085 micro processor is 16 Bit ranging from 0000H to ffffH . The microprocessor 8085 on transfer maximum 16 bit address which means it can address 65,536 different memory location.

The length of the address bus determine the amount of memory a system can address, such as a system with a 32-bit address bus can address 2^32 memory locations · If each memory location hold one byter, the addressable memory space is 4 GB, However, the actual amount of memory that can be accessed is usually much less than this theoritical limit due to chip-set and mother-board limitations

2. Data bus :-

It is a group of conducting wires which carries Data only. Data bus is bidirectional because data flow in both directions, from ~~memory~~ micro-processor to memory or input-output device to micro-processor.

Length of data bus 8085 microprocessor in 8 bit ranging from 00H to ffH.

when it is write operation, the processor will put the data on the data bus, when it is read operation, the memory controller will the data from specific memory block and put it into the data bus.

The width of the data bus is directly related to the largest number that the bus can carry. Such as on 8 bit bus can represent 2 to the power of 8 unique value this equates to the number 0 to 256. A 16 bit bus can carry 0 to 65535.

3. Control bus
It is a group of conducting wires, which is used to generate timing and control signals to control all the associated pepherals, microprocessor uses control bus to process data, that is what to do with selected memory location. Some control signal are :-

- Memory read
- Memory write
- I/O read
- I/O write
- opcode fetch

If one line of control bus may be the read/write line. If the wire is low then the memory is read, if the wire is high then the memory is written.

* Register Memory :-
Register memory is the smallest and fastes memory in the computer. It is not a part of main memory and is located in the CPU in form of register, which are the smallest data hold elements. A register temporary holds instructions that are currently processed by the CPU. All data is required to pass through register before it

be processed so, they are used by CPU to process the data entered by the users.

* **Program Counter :-**
A program counter is a register in a computer processor that contain the address of the instruction being executed at the current time. As each instruction gets ~~fen~~ fetched, the program counter increases its stored value by 1. After each instruction is fetched, the program counter point to the next instruction in the sequence. When the computer restarts or is reset, the program conter normal reverts to 0.

* **Accumulator :-**
An accumulator is a register for short term, intermediate storage of Arithematic and logic data in computer C. The term "Accumulator" is rarely used in reference to contempory CPU's having been replaced around the turn of the millenium by the term "register". In a mordern computer any register can function as an accumlators. It is mostly used for adding sequence ~~to contemporary CPU's~~ to of numbers. The numerical value in the accumulator, ~~it~~ is increases as each number is added, exacatly as it happens in a simple desktop calculator (but much faster of couse). Once the sum has been determined, it is written to main memory or to another register.

* Instruction Register (IR) :-
In a typical CPU, in addition to an accumator there are register such as address register. The CPU perform fetch, decode and executes operations on memory units according to its use of the registers. All of this serves the purpose of the memory processing that is the heart of the CPU's raison d'etre, which is why some experts call registers "the most important part of the CPU." In a sense, the intruction register is particularly important in that it holds the "active" memory value that it holds the "active being worked on at a given times.

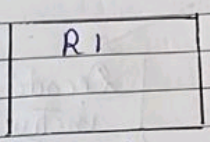
* Micro - operation :-
If CPU wants to perform any operation, suppose executions of only one instructions or even break it down one particular execution phase (like fetch instruction, write back, decode, operand fetch etc) CPU cannot perform one operation in one single step it performs these operations in multiple small-small steps of operations are micro-oprations.

* Register Transfer :-
The information transformed from one register to another register is represented in symbolic form by replacement operator is called register tranfer.

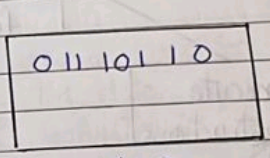
Replacement operator :-
In the statement, $R_2 \leftarrow R_1 \leftarrow$ acts as replacement operator. This statement defines the transfer of content of register R_1 into register R_2.

There are various method of RTL :-

1. General ways of representing a register is by the name of the register inclosed in a rectangle box as shown in (a).
2. Register is numbered in a sequence of 0 to (n-1) as shown.
3. The numbering of bits in a register can be marked on the top box as shown in (e).
4. A bit register PC is divided into 2 part. Bit (8 to 15) are assigned with higher bytes of 16-bit address as shown in (d).



(a)



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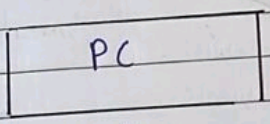

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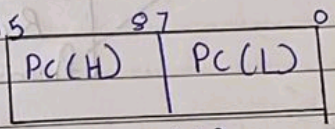


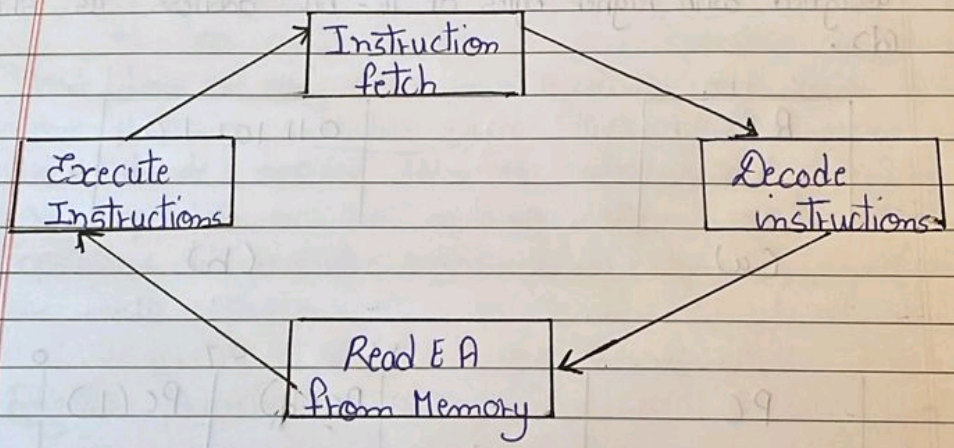
(d)

* basic symbol of RTL :-

( )	Denoted a Register	MAR , R_1 , R_2
←	show a transfer of info	$R \leftarrow R$

* Instruction Cylile
Instruction cycle a program that exists inside computer memory unit consists of a series instruction.
The proccessor executes these instructions through a cycle for each instruction.
In a basic computer, each instruction cycle consist of the following phase.

- Instraction fetch : fetch instruction from memory.
- Decode the instruction
- Read the effective address from memory.
- Executes the instruction.



* Execute instruction Cycle :-
The initial three cycle are predictable and quick. Each require simple, small and fixed micro-operation sequence. The some micro-operation is repeated every time around each event. Executes instruction cycle is different from them. like there is N different N-opcodes.

Step-1 :- The address partion of IR is loaded into MAR.

Step-2 :- The address field of the IR is updated from the MBR, so. the reference memory location is read.

Step-3 :- Now, the contents of R and MBR are added by the ALU.

* Addressing Modes :-
The term mode refers to the way in which the operand of an instruction is specified a rule for interpreting or modifing the address field of the instruction before the operand is actually executed.

Implied mode :-
The implied addressing the operand specified in the instruction itself. In this mode the data is 8 bits or 16 bits long and data is the part of instruction.