

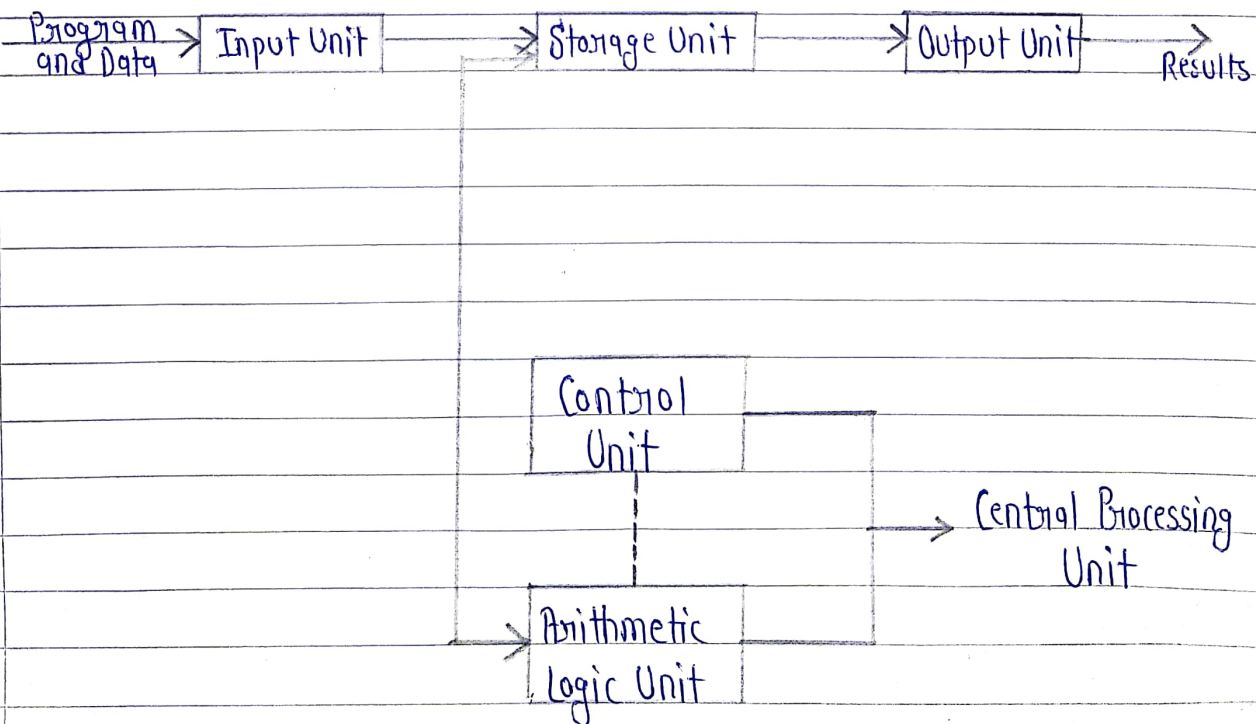
# Computer Organization & Architecture (CER361)

## Tutorial - 1

Q. 1. What are the basic functional units of computer system?  
What are the role's of units.

Ans Basic Functional Units of Computer System

- Functional units of a computer system are parts of the CPU that performs the operations and calculations called for by the computer program.
- A computer consist of five main components namely Input unit, Central Processing Unit, Memory Unit, Arithmetic & Logical unit, Control Unit, Output Unit.



## \* Input Unit

- Input units are used by the computer to read the data. The most commonly used input devices are keyboards, mouse, joysticks, trackballs, microphones etc.
- However the most well-known input device is a keyboard. Whenever a key is pressed the corresponding letter or digit is automatically translated into its corresponding binary code and transmitted over a cable to either the memory or the processor.

## \* Central Processing Unit

- Central processing unit commonly known as CPU can be referred as an electronic circuitry within a computer that carries out the instructions given by a computer program by performing the arithmetic, logical, control and input/output (I/O) operations specified by the instructions.

## \* Memory Unit

- The memory unit can be referred to as the storage area in which programs are kept which are running, and that contains data needed by the running programs.
- The Memory unit can be categorized in two ways namely, primary memory and secondary memory.
- It enables a processor to access running execution applications and services that are temporarily stored in a specific memory location.
- Primary Storage is the fastest memory that operates at



electronic speed. Primary memory contains a large number of semiconductor storage cells, capable of storing a bit of information. The word length of a computer is between 16-64 bits.

- It is also known as the volatile form of memory, means when the computer is shut down, anything contained in RAM is lost.

- Cache memory is also a kind of memory which is used to fetch the data very soon. They are highly coupled with the processor.

- The most common example of primary memory are RAM and ROM.

- Secondary Memory is used when a large amount of data and programs have to be stored for a long-term basis.

- It is also known as the Non-volatile memory form of memory, means the data is stored permanently irrespective of shut down.

- The most common examples of secondary memory are magnetic disks, magnetic tapes, and optical disks.

## \* Arithmetic & Logical Unit

- Most of all the arithmetic and logical operations of a computer are executed in the ALU (Arithmetic and Logical Unit) of the processor. It performs arithmetic operations like addition, subtraction, multiplication, division and also the logical operations like AND, OR, NOT operations.

## \* Control Unit

- The control unit is a component of a computer's central processing unit that coordinates the operation of the processor. It tells the computer's memory, arithmetic/logic unit and input and output devices how to respond to a program's instructions.

- The control unit is also known as the ~~nerve~~ center of a computer.
- Let's us consider an example of addition of two operands by the instruction given as Add LOCA, R0. This instruction adds the memory location LOCA to the operand in the register R0 and places the sum in the register R0. This instruction internally performs several steps.

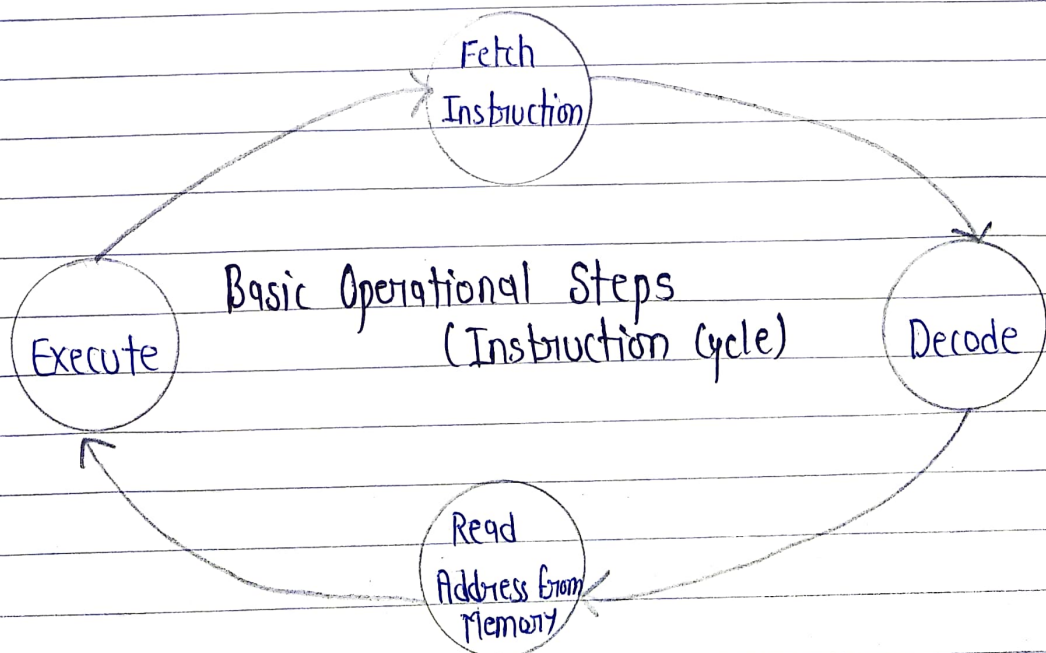
## \* Output Unit

- The primary function of the output unit is to send the processed results to the user. Output devices display information in a way that the user can understand.
- Output devices are pieces of equipment that are used to generate information or any other response processed by the computer. These devices display information that has been held or generated within a computer.
- The most common example of an output device is a monitor.



Q. 2. What are the basic operational steps required to complete execution of a program.

- Ans. • A program residing in the memory unit of the computer consists of a sequence of instructions. The program is executed in the computer by going through a cycle for each instruction.
- Each instruction cycle in turn is subdivided into a sequence of subcycles or phase. In the basic computer each instruction cycle consists of the following phases:
1. Fetch an instruction from memory
  2. Decode the instruction
  3. Read the effective address from memory if the instruction has an indirect address.
  4. Execute the instruction.
- After step 4, the control goes back to step 1 to fetch, decode and execute the next instruction. This process continues unless a HALT instruction is encountered.



Q.3. Full Form of :-

(i) ENIAC

Ans Electronic Numerical Integrator and Computer

(ii) MAR

Ans Memory Address Register

(iii) MDR

Ans Memory Data Register

(iv) IR

Ans Instruction Register

(v) PC

Ans Program Counter

(vi) MISC

Ans Multiple Instruction, Single Data

Q.4. How we can calculate the 'elapsed time or total execution time to complete a program or write performance equation?

Ans Performance equation analyzes execution time as a product of 3 relatively independent factors :-

(i) Instruction Count (IC) :- This is the total number of instructions involved in a program.

(ii) Clock Per Instruction (CPI) :- This is the average of all instruction execution in program.  
CPI is calculated on different categories of instruction.

(iii) Clock Time (CT) :- This is the period of clock that synchronizes circuits of processor.

$$CT = \frac{1}{CF} \quad (CF \text{ is clock frequency})$$

$$\begin{aligned} \text{Hence, execution time} &= IC * CPI * CT \\ &= IC * CPI * \frac{1}{CF} \end{aligned}$$

Here, it can also be represented as,

T = Execution Time

N = Instruction Count

S = Clocks Per Instruction

R = Clock Frequency

$$T = \frac{N \times S}{R}$$

$$\text{Performance} = \frac{1}{\text{Execution Time}}$$