What are Digital Computers?

The **digital computer** is a digital system that performs various computational tasks. The word **digital** implies that the information in the computer is represented by variables that take a limited number of discrete values. These values are processed internally by components that can maintain a limited number of discrete states.

The decimal digits 0, 1, 2, ..., 9, for example, provide 10 discrete values. The first electronic digital computer, developed in the late 1940s, was used primarily for numerical computations and the discrete elements were the digits. From this application the term **digital** computer emerged.

In practice, digital computers function more reliably if only two states are used. Because of the physical restriction of components, and because human logic tends to be binary (i.e. true or false, yes or no statements), digital components that are constrained to take discrete values are further constrained to take only two values and are said to be **binary**.

Digital computers use the binary number system, which has two digits: `0` and `1`. A binary digit is called a **bit**. Information is represented in digital computers in groups of bits. By using various coding techniques, groups of bits can be made to represent not only binary numbers but also other discrete symbols, such as decimal digits or letters of the alphabet.

Digital Computers: Computer Organization

Computer Organization is concerned with the way the hardware components operate and the way they are connected together to form the computer system.

The various components are assumed to be in place and the task is to investigate the organizational structure to verify that the computer parts operate as intended.

Digital Computers: Computer Design

Computer Design is concerned with the hardware design of the computer. Once the computer specifications are formulated, it is the task of the designer to develop hardware for the system.

Computer design is concerned with the determination of what hardware should be used and how the parts should be connected. This aspect of computer hardware is sometimes referred to as **computer implementation**.

Digital Computers: Computer Architecture

Computer Architecture is concerned with the structure and behaviour of the computer as seen by the user.

It includes the information, formats, the instruction set, and techniques for addressing memory. The architectural design of a computer system is concerned with the specifications of the various functional modules, such as processors and memories, and structuring them together into a computer system.

Two basic types of computer architecture are:

1. **von Neumann architecture**

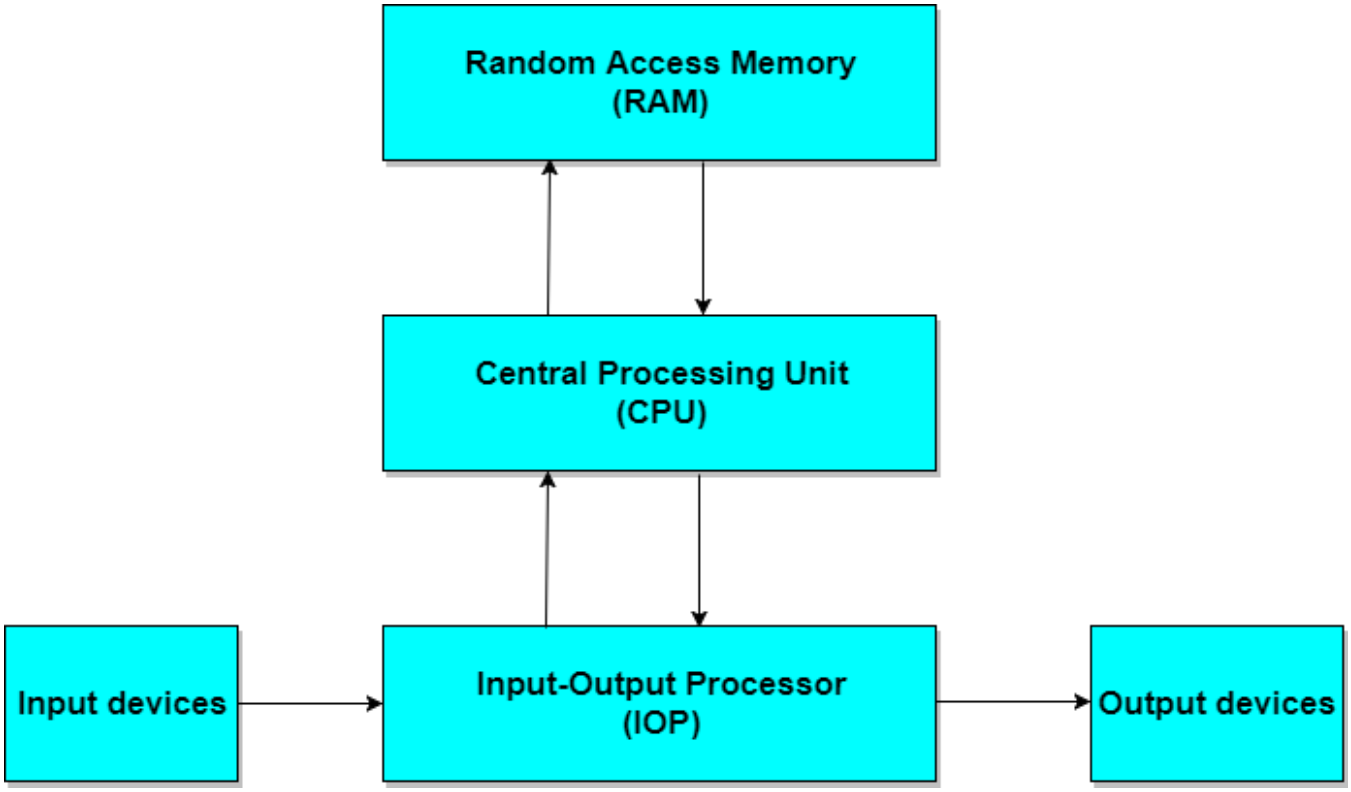
2. **Harvard architecture**

1. von Neumann architecture

The **von Neumann architecture** describes a general framework, or structure, that a computer's hardware, programming, and data should follow. Although other structures for computing have been devised and implemented, the vast majority of computers in use today operate according to the von Neumann architecture.

von Neumann envisioned the structure of a computer system as being composed of the following components:

1. **ALU:** The **Arithmetic-Logic unit** that performs the computer's computational and logical functions.
2. **RAM:** Memory; more specifically, the computer's main, or fast, memory, also known as **Random Access Memory(RAM)**.
3. **Control Unit**: This is a component that directs other components of the computer to perform certain actions, such as directing the fetching of data or instructions from memory to be processed by the ALU; and
4. **Man-machine interfaces;** i.e. input and output devices, such as keyboard for input and display monitor for output.



Components of a Computer System

Saying that computers have revolutionized our lives would be an understatement. These machines have completely changed the way we perform all daily tasks. In order to further maximize their potential, we must understand the core components of a computer system in detail – input unit, output unit, CPU.

Meaning of Computers

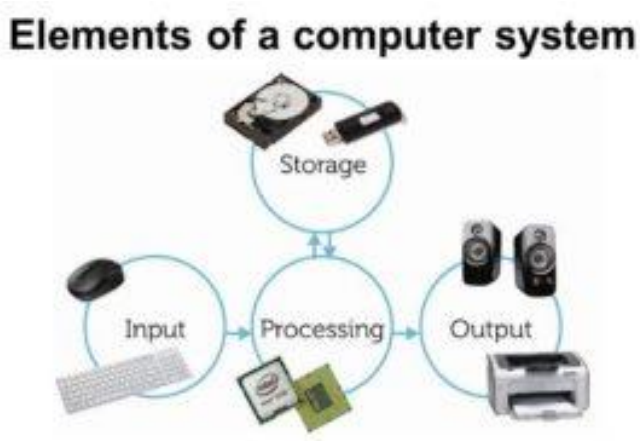
Computers, in simple words, are machines that perform a set of functions according to their users' directions. Going by this definition, several electronicdevices, from laptops to calculators, are computers.

A computer comprises of some basic elements. These include hardware, software, programmes, data and connectivity. No computer can function in the absence of these elements. Apart from these elements, a computer system comprises of three basic components. These components are responsible for making computers actually function. Let's take a look at them in detail.

Components of a Computer System

Every computer system has the following three basic components:

1. Input unit
2. Central processing unit
3. Output unit



While there are other components as well, these three are primarily responsible for making a computer function. They must work in complete synergy because that will ensure smooth overall functioning. Hence, we can even call them building blocks of a computer system.

Input Unit

These components help users enter data and commands into a computer system. Data can be in the form of numbers, words, actions, commands, etc. The main function of input devices is to direct commands and data into computers. Computers then use their CPU to process this data and produce output.

For example, a laptop's keyboard is an input unit that enters numbers and characters. Similarly, even a mouse can be an input unit for entering directions and commands. Other examples include barcode readers, Magnetic Ink Character Readers (MICR), Optical Character Readers (OCR), etc.

Another example of input devices is touch-screens. Users can simply touch these screens without using any other device to enter commands. From smartphones toATM machines, these input devices are becoming very popular these days.

Central Processing Unit (CPU)

After receiving data and commands from users, a computer system now has to process it according to the instructions provided. Here, it has to rely on a component called the central processing unit. The CPU further uses these three elements:

a) Memory Unit

Once a user enters data using input devices, the computer system stores this data in its memory unit. This data will now remain here until other components of CPU process it.

The memory unit uses a set of pre-programmed instructions to further transmit this data to other parts of the CPU.

b) Arithmetic and Logic Unit

This part of the CPU performs arithmetic operations. It does basic mathematical calculations like addition, subtraction, division, multiplication, etc. Further, it can even perform logical functions like the comparison of data.

c) Control Unit

This unit is the backbone of computers. It is responsible for coordinating tasks between all components of a computer system. The control unit collects data from input units and sends it to processing units depending on its nature. Finally, it also further transmits processed data to output units for users.

Output Unit

The third and final component of a computer system is the output unit. After processing of data, it is converted into a format which humans can understand. After conversion, the output units displays this data to users. Examples of output devices include monitors, screens, printers and speakers. Thus, output units basically reproduce the data formatted by the computer for users' benefit.