

1. Introduction to Computer Fundamentals

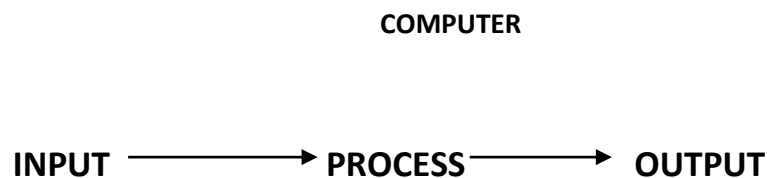
1.1 Introduction to Computer

Computer is an advanced electronic device that takes raw data as input from the user and processes it under the control of set of instructions (called program), gives the result (output), and saves it for the future use. This Computer Fundamentals tutorial covers a foundational understanding of computer hardware, software, operating systems, peripherals etc. These notes provide a general introduction to computers systems. A computer system is made up of both hardware and software. Software is another term for computer program. Software controls the computer and makes it do useful work. Without software a computer is useless. Hardware refers to the physical components that make up a computer system. These include the computer's processor, memory, monitor, keyboard, mouse, disk drive, printer and so on. In these notes we take a brief look at the functions of the different hardware components. In addition we describe the some of the essential software required for the operation of a computer system.

1.1.1 Functionalities of a computer

Any digital computer carries out five functions in gross terms:

- Takes data as input.
- Stores the data/instructions in its memory and use them when required.
- Processes the data and converts it into useful information.
- Generates the output • Controls all the above four steps.



Definition

Computer is an electronic data processing device which

- accepts and stores data input,
- processes the data input, and

- generates the output in a required format.

1.1.3 Advantages

Following list demonstrates the advantages of computers in today's arena.

1) High Speed

- Computer is a very fast device.
- It is capable of performing calculation of very large amount of data.
- The computer has units of speed in microsecond, nanosecond, and even the picosecond.
- It can perform millions of calculations in a few seconds as compared to man who will spend many months for doing the same task.

2) Accuracy

- In addition to being very fast, computers are very accurate.
- The calculations are 100% error free.
- Computers perform all jobs with 100% accuracy provided that correct input has been given.

3) Storage Capability

- Memory is a very important characteristic of computers.
- A computer has much more storage capacity than human beings.
- It can store large amount of data.
- It can store any type of data such as images, videos, text, audio and many others.

4) Diligence

- Unlike human beings, a computer is free from monotony, tiredness and lack of concentration.
- It can work continuously without any error and boredom.
- It can do repeated work with same speed and accuracy.

5) Versatility

- A computer is a very versatile machine.
- A computer is very flexible in performing the jobs to be done.

- This machine can be used to solve the problems related to various fields.
- At one instance, it may be solving a complex scientific problem and the very next moment it may be playing a card game.

6)Reliability

- A computer is a reliable machine.
- Modern electronic components have long lives.
- Computers are designed to make maintenance easy.

7)Automation

- Computer is an automatic machine
- Automation means ability to perform the given task automatically
- Once a program is given to computer i.e., stored in computer memory, the program and instruction can control the program execution without human interaction.

8)Reduction in Paper Work

- The use of computers for data processing in an organization leads to reduction in paper work and results in speeding up a process.
- As data in electronic files can be retrieved as and when required, the problem of maintenance of large number of paper files gets reduced.

9)Reduction in Cost

- Though the initial investment for installing a computer is high but it substantially reduces the cost of each of its transaction.

1.1.4Disadvantages

Following list demonstrates the disadvantages of computers in today's arena

1)No I.Q

- A computer is a machine that has no intelligence to perform any task.
- Each instruction has to be given to computer.

- A computer cannot take any decision on its own.

2)Dependency

- It functions as per a user's instruction, so it is fully dependent on human being

3)Environment

- The operating environment of computer should be dust free and suitable.

4)No Feeling

- Computers have no feelings or emotions.
- It cannot make judgement based on feeling, taste, experience, and knowledge unlike a human being.

1.1.5 Components of computer

All types of computers follow a same basic logical structure and perform the following five basic operations for converting raw input data into information useful to their users.

Sr.No.	Operation	Description
1	Take Input	The process of entering data and instructions into the computer
2	Store Data	Saving data and instructions so that they are available for processing as and when required.
3	Processing Data	Performing arithmetic, and logical operations on data in order to convert them into useful information.
4	Output Information	The process of producing useful information or results for the user as a printed report or visual display.
5	Control the workflow	Directs the manner and sequence in which all of the above operations are performed.

1. Input: this is the process of entering data and programs into the computer system.

Input unit

Output unit

Memory Unit

Control Unit

Arithmetic Logic

Unit 2. Control Unit (CU):

The process of input, output, processing and storage is performed under the supervision of a unit called 'Control Unit'. It decides when to start receiving data, when to stop it, where to store data, etc. It takes care of step -by-step processing of all operations in side the computer.

3. Memory Unit:

Computer is used to store data and instructions.

4. Arithmetic Logic Unit (ALU):

The major operations performed by the ALU are addition, subtraction, multiplication, division, logic and comparison.

5. Output:

This is the process of producing results from the data for getting useful information. The ALU and the CU of a computer system are jointly known as the central processing unit (CPU). You may call CPU as the brain of any computer system.

PERIPHERAL DEVICES

Peripheral devices are connected to the computer externally. These devices are used for performing some specific functions. Peripheral devices are as follows:

1. Input Devices
2. Output Devices
3. Other Peripherals
4. Data Entry Operations

INPUT DEVICES

Input devices accept data and instructions from the user. Following are the examples of various input devices, which are connected to the computer for this purpose.

1. Keyboard
2. Mouse
3. Light Pen

4. Optical/magnetic Scanner
- r 5. Touch Screen
6. Microphone for voice as input
7. Track Ball

Keyboard

A keyboard is the most common input device. Several kinds of keyboards are available, but they resemble each other with minor variations. The keyboard in most common use is the QWERTY board. Generally standard keyboard has 104 keys. In these keyboards, the cursor control keys are duplicated to allow easier use of the numeric pad. Keyboards vary greatly in the number and arrangement of keys. Most keyboards include the following:

- a. **Alphanumeric keys** - The letters of the alphabet, numerals, and punctuation symbols (numeric keypads may be separate on portable computers)
- .b. **Dedicated formatting keys** - Keys for text formatting operations such as a Space bar, a Tab key, and a Return or Enter key.
- c. **Modifier keys** - Keys that modify or qualify the effects of other keys for as long as they are held down, for example, Shift, Ctrl, and Alt.
- d. **Navigation keys** - Keys that move a cursor, for example, Arrow keys, Home, End, Page Up, and Page Down.
- e. **Fixed-function key** - Keys provided for extra or general functions, typically labeled F1, F2, and so on.
- f. **Special purpose keys** - Keys that have a special function, such as Help, Delete, and Backspace. When to use.

If applicable, keyboards shall be provided for the entry of alphabetic, numeric, and other special characters into the system. , Include a numeric keypad for entering numeric data. If an application requires substantial and repetitive input of numeric data, the keyboard shall include a numeric keypad. Keyboards intended solely for the entry of numbers shall have the numerals "1" through "9" arranged in a three by three array, with "0" centered below the bottom row. Numeric keyboards for communication. If the keyboard will be used primarily for communications, it shall use the "telephone" arrangement, that is, with the numerals 1, 2, and 3 in the top row. Numeric keyboards for number manipulation. If the keyboard will be used primarily for manipulating numbers, it shall use the "calculator" arrangement, that is, with the numerals 1, 2, and 3 in the bottom row. Alphanumeric keyboards. Keyboards intended for the entry of both alphabetic and numeric information shall conform to the standard "QWERTY" arrangement. Key size. The minimum horizontal surface width for a key on a typing keyboard should be 12 mm Horizontal spacing of keys. Horizontal centerline distances should be between

18-19 mm. Vertical spacing of keys. Vertical centerline distances should be between 18-21 mm. Force to depress keys. The maximum force needed to depress keys shall measure between 0.25N and 1.5N with a preferred range between 0.5N and 0.6N. Keyboard slope. The slope of the keyboard for typing should be between 0 and 25 degrees, preferably less than 15 degrees. Standard keyboards. If feasible, standard keyboards should be used. Nonstandard keyboards should contain only those keys that are used by the keyboard user. The presence of non-relevant keys, such as those that might be used by programmers, adds to keyboard complexity and may induce errors. If a keyboard will be used for text processing, it shall provide for movement of the cursor in two dimensions, for example by including a set of cursor control keys. Cursor control key layout. If cursor control keys are included, they should be arranged in a two-dimensional array. Cursor movement keys. Cursor movement keys shall be arranged in a spatial configuration reflecting the direction of actual cursor movement.

Mouse

A mouse is an electro-mechanical, hand-held device .It is used as a pointer. It can perform functions like selecting menu commands, moving icons, resizing windows, starting programs, and choosing options. The most common mouse uses an internal, magnetically coated ball, to detect the movement of the mouse across a flat surface, usually a desktop. Now a days Optical or laser mouse is used to detect the movement. All windows based applications today are designed to work with a mouse. A mouse is used to replace hard -to-remember key combinations with easier "Point and Click" actions. However, it cannot substitute all keyboard operations. It can be alternative for commands based operations.

Light pen

An input device that utilizes a light-sensitive detector to select objects on a display screen. A light pen is similar to a mouse except that with a light pen you can move the pointer and select objects on the display screen by directly pointing to the objects with the pen.

Optical Scanner

These devices are used for automatic data collection. The devices of this category completely eliminate manual input of data. For example, the bar-code reader is actually just a special type of image scanner. An image scanner translates printed images into an electronic format that can be stored in a computer's memory, and with the right kind of software, one can alter a stored image. Another example of scanner is optical character recognition (OCR) device, used by banks to convert the scanned image of a typed or printed page into text that can be edited on the computer.

Touch Screen

Touch panel displays and pads are now being offered as alternatives to keyboard. Here the input can be given through the computer screen, that accepts the input through monitor; users touch electronic buttons displayed on the screen or they may use light pen.

Microphone

Microphone is an input device, which takes voice as input. The voice communication is more error-prone than information through keyboard. There are two types of microphones available

1. Desktop Microphone
2. Hand held Microphone

Track Ball

Trackball, a pointing device, is a mouse lying on its back (as shown in figure 1. 9). To move the pointer, you rotate the ball with your thumb, your fingers, or the palm of your hand. There are usually one to three buttons next to the ball, which you use just like mouse buttons. The advantage of trackballs over mouse is that the trackball is stationary so it does not require much space to use it. In addition, you can place a trackball on any type of surface, including your lap. For both these reasons, trackballs are popular pointing devices for portable computers.

OUTPUT DEVICES

Output devices return processed data that is information, back to the user. Some of the commonly used output devices are:

1. Monitor (Visual Display Unit)
2. Printers
3. Plotter
4. Speakers

Monitor

Out of all the output devices, monitor (as shown in figure 1.10) is perhaps the most important output device because people interact with this device most intensively than others. Computer information is displayed, visually with a video adapter card and monitor. Information processed within the CPU, that needs to be visually displayed, is sent to video adapter. The video adapter converts information from the format used, in the same manner as a television displays information sent to it by a cable service. Two basic types of monitors are used with microcomputers, which are as follows:

1. CRT

2. LCD Cathode Ray Tube (CRT):

CRT or Cathode Ray Tube Monitor is the typical monitor that you see on a desktop computer. It looks a lot like a television screen, and works the same way. This type uses a large vacuum tube, called cathode ray tube (CRT). Liquid Crystal Displays (LCD): This type of monitors are also known as flat panel monitor. Most of these employ liquid crystal displays (LCDs) to render images. These days LCD monitor are very popular. When people talk about the capabilities of various monitors, one critical statistic is the resolution of the monitor. Most monitors have a resolution of at least 800 x 600 pixels. High-end monitors can have resolutions of 1024 x 768 pixels or even 1280 x 1024 pixels. Thus monitors are available either in low resolution or in high resolution.

Printer

After a document is created on the computer, it can be sent to a printer for a hard copy (printout). Some printers offer special features such as colored and large page formats. Some of the most commonly used printers are:

1. Laser Printer
2. Ink Jet Printer
3. Dot Matrix Printer
4. Line Printer

Laser Printer:

A laser printer produces high quality print that one normally finds in publishing. It is extremely fast and quiet. Moreover, the operation of a laser printer is easy with automatic paper loading and no smudging or messing up of ink ribbons. The fastest laser printer can print up to 200 pages per minute in monochrome (black and white) and up to 100 pages per minute in colour.

Ink-Jet Printer:

An ink-jet printer creates an image directly on paper by spraying ink through as many as 64 tiny nozzles. Although the image it produces is not generally quite as sharp as the output of a laser printer, the quality of ink-jet images is still high. In general, ink-jet printer offers an excellent middle ground between dot matrix and laser printer. Like laser printer, an ink-jet printer is quiet and convenient, but not particularly fast. Typically, an ink-jet printer is more expensive than a dot-matrix printer, but costs only half as much as a laser printer.

Dot Matrix Printer:

The dot matrix printer was very popular at one point of time. It is a very versatile and inexpensive output device. In dot matrix printer the print head physically "hits" the paper

through the ribbon and produces text (or images) by combinations of dots; hence the name dot matrix printer. Its speed is measured in characters per second (CPS). Although it is less expensive, it is louder, slower and produces lower print quality.

Line Printer:

A line printer is generally used with large computer systems to produce text based data processing reports. Line printers are high-speed printers with speeds ranging anywhere from 100 to about 3800 lines per minute. In the past, print quality on line printers was not high. Developments in technology are improving the print quality on line printers. These are in the cost range of lacs of Rupees.

Plotter

A plotter is a special kind of output device that, like a printer, produces images on paper, but does so in a different way. Plotters are designed to produce large drawings or images, such as construction plans for buildings or blueprints for mechanical objects. A plotter can be connected to the port normally used by a printer. An array of different colored pens in a clip rack and a robotic arm is part of plotter. The instructions that a plotter receives from a computer consist of a color, and beginning and ending coordinates for a line. With that information, the plotter picks up the appropriate pen through its arm, positions it at the beginning coordinates drops the pen down to the surface of the paper and draws to the ending coordinates. Plotters draw curves by creating a sequence of very short straight lines.

Plotters usually come in two designs:

1. Flat Bed: Plotters of small size to be kept on table with restriction of paper size.
2. Drum: These plotters are of big size using rolls of paper of unlimited length.

SOFTWARE

As you are aware, computer cannot do anything on its own. It is the user who instructs computer; what to do, how to do and when to do. In order to perform any task, you have to give a set of instructions in a particular sequence to the computer. These sets of instructions are called Programs. Software refers to a set of programs that makes the hardware perform a particular set of tasks in particular order. Software can be classified mainly into following categories and sub-categories are Software

System Software

Application Softwar

e Generalized Packages

Customized Packages

Utilities

Operating System

System Software

When you switch on the computer the programs stored in ROM are executed which activates different units of your computer and makes it ready for you to work on it. This set of programs can be called system software. System softwares are sets of programs, responsible for running the computer, controlling various operations of computer systems and management of computer resources. Operating System (OS) falls under this category. An operating system is a system software that provides an interface for a user to communicate with the computer, manages hardware devices (disk drives, keyboard, monitor, etc), manages and maintains disk file systems and supports application programs. Some popular Operating systems are UNIX, Windows and Linux. Although operating system provides all the features users need to use and maintain their systems, inevitably, they still do not meet everyone's expectations. This has led to another type of system software called "Utilities". These are programs that bridge the gap between the functionality of an OS and the needs of users. Utility programs are a broad category of software such as compress (zip)/uncompress (unzip) files software, anti virus software, split and join files software, etc.

Application Software

Application software is a set of programs, which are written to perform specific tasks, for example: An application package for managing library known as library information system is used to manage information of library such as: keeping book details, account holder details, book issue details, book return details etc. Another application package for managing student details is called student's information system, manages student's roll no, name, parents name, address, class, section, processing of examination results etc. Application software can be broadly classified into two types:

(a) Generalized packages

(b) Customized packages

Generalized Packages

These are user friendly softwares written to cater to user's very general needs such as preparing documents, drawing pictures, database to manage data/information, preparing presentations, play games etc. It is a group of programs that provide general purpose tools to solve specific problems. Some of the generalized packages are listed below:

Word Processing Software(for preparing documents): Word Perfect, MS-Word, OpenOffice.org Writer

Spreadsheets (Data Analysis): Lotus Smart suites, MS- Excel, OpenOffice.org Calc, Apple Numbers

Presentations : Presentation Graphics, MS-PowerPoint, OpenOffice.org Impress

Database Management System: MS-Access, OpenOffice.org Base, MS-SQL Server, ORACLE

Graphics Tools: Paint shop pro, Adobe Photoshop

Customized Packages

Classification of Computers

Computers differ based on their data processing abilities. They are classified according to purpose, data handling and functionality. According to purpose, computers are either general purpose or specific purpose. General purpose computers are designed to perform a range of tasks. They have the ability to store numerous programs, but lack in speed and efficiency. Specific purpose computers are designed to handle a specific problem or to perform a specific task. A set of instructions is built into the machine. According to data handling, computers are analog, digital or hybrid. Analog computers work on the principle of measuring, in which the measurements obtained are translated into data. Modern analog computers usually employ electrical parameters, such as voltages, resistances or currents, to represent the quantities being manipulated. Such computers do not deal directly with the numbers. They measure continuous physical magnitudes. Digital computers are those that operate with information, numerical or otherwise, represented in a digital form. Such computers process data into a digital value (in 0s and 1s). They give the results with more accuracy and at a faster rate. Hybrid computers incorporate the measuring feature of an analog computer and counting feature of a digital computer. For computational purposes, these computers use analog components and for storage, digital memories are used.

According to functionality, computers are classified as :

Analog Computer

An analog computer (spelt analogue in British English) is a form of computer that uses continuous physical phenomena such as electrical, mechanical, or hydraulic quantities to model the problem being solved.

Digital Computer

A computer that performs calculations and logical operations with quantities represented as digits, usually in the binary number system.

Hybrid Computer (Analog + Digital)

A combination of computers those are capable of inputting and outputting in both digital and analog signals. A hybrid computer system setup offers a cost effective method of performing complex simulation

On the basis of Size

Super Computer

The fastest and most powerful type of computer Supercomputers are very expensive and are employed for specialized applications that require immense amounts of mathematical calculations. For example, weather forecasting requires a supercomputer. Other uses of supercomputers include animated graphics, fluid dynamic calculations, nuclear energy research, and petroleum exploration. The chief difference between a supercomputer and a mainframe is that a supercomputer channels all its power into executing a few programs as fast as possible, whereas a mainframe uses its power to execute many programs concurrently.

Mainframe Computer

A very large and expensive computer capable of supporting hundreds, or even thousands, of users simultaneously. In the hierarchy that starts with a simple microprocessor (in watches, for example) at the bottom and moves to supercomputers at the top, mainframes are just below supercomputers. In some ways, mainframes are more powerful than supercomputers because they support more simultaneous programs. But supercomputers can execute a single program faster than a mainframe.

Mini Computer

A midsized computer. In size and power, minicomputers lie between workstations and mainframes. In the past decade, the distinction between large minicomputers and small mainframes has blurred, however, as has the distinction between small minicomputers and workstations. But in general, a minicomputer is a multiprocessing system capable of supporting from 4 to about 200 users simultaneously.

Micro Computer or Personal Computer

Desktop Computer: a personal or micro-mini computer sufficient to fit on a desk.

- Laptop Computer: a portable computer complete with an integrated screen and keyboard. It is generally smaller in size than a desktop computer and larger than a notebook computer.
- Palmtop Computer/Digital Diary /Notebook /PDAs: a hand-sized computer. Palmtops have no keyboard but the screen serves both as an input and output device.