

## Unit 1

## Introduction to Computers

### Structure:

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  - Objectives
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- 1.3 The evolution of computers
- 1.4 Characteristics of computers
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### 1.1 Introduction

Today computers have become part of our life. Usage of computers in different fields has become a necessity in the present competitive world. Lot of work and evolutions has transpired from the initial computer systems to the present day computer systems. Computers are made up of Electrical, Electronic and Mechanical components. Computers are just the machines and you must specify the work that is to be carried out by the computer. Thus to carry out a specific task series of instructions must be given to the Computer in a particular order.

In this unit, we are going to study the computer structure, evolution of computers, characteristics of computer & organization of the computer.

### Objectives:

After studying this unit, you should be able to:

- define Computer
- explain the evolution of the Computers
- explain the Characteristics of computers
- explain Organization of a Computer and its units

## 1.2 Computer – Definitions

A computer is a device that receives information (in the form of digitalized data) and manipulates it for some result based on a program or sequence of instructions on how the data is to be processed. Complex computers also include the means for storing data (including the program, which is also a form of data) for some necessary duration. A program may be invariable and built into the computer (and called logic circuitry as it is on microprocessors) or different programs may be provided to the computer (loaded into its storage and then started by an administrator or user).



**Fig. 1.1: Graphical Presentation of Computer**

Ultimate histories of the modern computer begin with the Analytical Engine envisioned by Charles Babbage following the mathematical ideas of George Boole, the mathematician who first stated the principles of logic inherent in today's digital computer. Babbage's assistant and collaborator, Ada Lovelace, is said to have introduced the ideas of program loops and subroutines and is sometimes considered the first programmer. Apart from mechanical calculators, the first really useable computers began with the vacuum tube, accelerated with the invention of the transistor, which then became embedded in large numbers in integrated circuits, ultimately making possible the relatively low-cost personal computer.

Modern computers inherently follow the ideas of the stored program laid out by John von Neumann in 1945. Essentially, the program is read by the computer one instruction at a time, an operation is performed, and the

computer then reads in the next instruction, and so on. Recently, computers and programs have been devised that allow multiple programs (and computers) to work on the same problem at the same time in parallel. With the advent of the Internet and higher bandwidth data transmission, programs and data that are part of the same overall project can be distributed over a network and embody the Sun Microsystems slogan: "The network is the computer."

Technically, a computer is a programmable machine. This means it can execute a programmed list of instructions and respond to new instructions that it is given. Today, however, the term is most often used to refer to the desktop and laptop computers that most people use. When referring to a desktop model, the term "computer" technically only refers to the computer itself - not the monitor, keyboard, and mouse. Still, it is acceptable to refer to everything together as the computer. If you want to be really technical, the box that holds the computer is called the "system unit."

Some of the major parts of a personal computer (or PC) include the motherboard, CPU, memory (or RAM), hard drive, and video card. While personal computers are by far the most common type of computers today, there are several other types of computers. For example, a "minicomputer" is a powerful computer that can support many users at once. A "mainframe" is a large, high-powered computer that can perform billions of calculations from multiple sources at one time. Finally, a "supercomputer" is a machine that can process billions of instructions a second and is used to calculate extremely complex calculations.

### **Self Assessment Questions**

1. \_\_\_\_\_ is a device that accepts information (in the form of digitalized data) and manipulates it for some result based on a program or sequence of instructions on how the data is to be processed.
2. Technically, a computer is a \_\_\_\_\_ machine.

### **1.3 The evolution of computers**

Since civilizations began, many of the advances made by science and technology have depended upon the ability to process large amounts of data and perform complex mathematical calculations. For thousands of years, mathematicians, scientists and businessmen have searched for

computing machines that could perform calculations and analyze data quickly and efficiently. One such device was the abacus.

The abacus was an important counting machine in ancient Babylon, China, and throughout Europe where it was used until the late middle ages. It was followed by a series of improvements in mechanical counting machines that led up to the development of accurate mechanical adding machines in the 1930's. These machines used a complicated assortment of gears and levers to perform the calculations but they were far too slow to be of much use to scientists. Also, a machine capable of making simple decisions such as which number is larger was needed. A machine capable of making decisions is called a computer.

The first computer like machine was the Mark I developed by a team from IBM and Harvard University. It used mechanical telephone relays to store information and it processed data entered on punch cards. This machine was not a true computer since it could not make decisions.

In June 1943, work began on the world's first electronic computer. It was built at the University of Pennsylvania as a secret military project during World War II and was to be used to calculate the trajectory of artillery shells. It covered 1500 square feet and weighed 30 tons. The project was not completed until 1946 but the effort was not wasted. In one of its first demonstrations, the computer solved a problem in 20 seconds that took a team of mathematicians three days. This machine was a vast improvement over the mechanical calculating machines of the past because it used vacuum tubes instead of relay switches. It contained over 17,000 of these tubes, which were the same type tubes used in radios at that time.

The invention of the transistor made smaller and less expensive computers possible. Although computers shrank in size, they were still huge by today's standards. Another innovation to computers in the 60's was storing data on tape instead of punch cards. This gave computers the ability to store and retrieve data quickly and reliably. This series covers many of the major milestones in computer history with a concentration on the history of personal home computers. See table 1.1, which shows the evolution of Computers.

**Table 1.1: Evolution of Computers**

<b>Computer History Year/Enter</b>	<b>Computer History Inventors/Inventions</b>	<b>Computer History Description of Event</b>
1936	Konrad Zuse - Z1 Computer	First freely programmable computer.
1942	John Atanasoff & Clifford Berry ABC Computer	Who was first in the computing biz is not always as easy as ABC.
1944	Howard Aiken & Grace Hopper Harvard Mark I Computer	The Harvard Mark 1 computer.
1946	John Presper Eckert & John W. Mauchly ENIAC 1 Computer	20,000 vacuum tubes later...
1948	Frederic Williams & Tom Kilburn Manchester Baby Computer & The Williams Tube	Baby and the Williams Tube turn on the memories.
1947/48	John Bardeen, Walter Brattain & William Shockley The Transistor	No, a transistor is not a computer, but this invention greatly affected the history of computers.
1951	John Presper Eckert & John W. Mauchly UNIVAC Computer	First commercial computer & able to pick presidential winners.
1953	International Business Machines IBM 701 EDPM Computer	IBM enters into 'The History of Computers'.
1954	John Backus & IBM FORTRAN Computer Programming Language	The first successful high level programming language.
1955 (In Use 1959)	Stanford Research Institute, Bank of America, and General Electric ERMA and MICR	The first bank industry computer - also MICR (magnetic ink character recognition) for reading checks.
1958	Jack Kilby & Robert Noyce The Integrated Circuit	Otherwise known as 'The Chip'
1962	Steve Russell & MIT Spacewar Computer Game	The first computer game invented.

1964	Douglas Engelbart Computer Mouse & Windows	Nicknamed the mouse because the tail came out the end.
1969	ARPAnet	The original Internet.
1970	Intel 1103 Computer Memory	The world's first available dynamic RAM chip.
1971	Faggin, Hoff & Mazor Intel 4004 Computer Microprocessor	The first microprocessor.
1971	Alan Shugart & IBM The "Floppy" Disk	Nicknamed the "Floppy" for its flexibility.
1973	Robert Metcalfe & Xerox The Ethernet Computer Networking	Networking.
1974/75	Scelbi & Mark-8 Altair & IBM 5100 Computers	The first consumer computers.
1976/77	Apple I, II & TRS-80 & Commodore Pet Computers	More first consumer computers.
1978	Dan Bricklin & Bob Frankston VisiCalc Spreadsheet Software	Any product that pays for itself in two weeks is a surefire winner.
1979	Seymour Rubenstein & Rob Barnaby WordStar Software	Word Processors.
1981	IBM The IBM PC - Home Computer	From an "Acorn" grows a personal computer revolution
1981	Microsoft MS-DOS Computer Operating System	From "Quick And Dirty" comes the operating system of the century.
1983	Apple Lisa Computer	The first home computer with a GUI, graphical user interface.
1984	Apple Macintosh Computer	The more affordable home computer with a GUI.
1985	Microsoft Windows	Microsoft begins the friendly war with Apple.

**Self Assessment Questions**

3. Invention of the \_\_\_\_\_ made smaller and less expensive computers possible.
4. \_\_\_\_\_ was an important counting machine in ancient Babylon, China.

**1.4 Characteristics of computers**

Computers of all sizes have common characteristics - speed, arithmetical and logical operations, accuracy, reliability, storage, retrieving data and programs, automation, versatility, communications, diligence, feelings, consistency and precision. Computers are the foundation of business, travel, and leisure life today. Computers provide the processing speed required by all facets of society. The quick service we expect at the bank, at the grocery store, on the stock exchange, and on the Internet are dependent on the speed of computers. Can you imagine our world without computers?

Computers are extremely reliable as well. Most errors are caused by humans, not computers. Computers are capable of storing enormous amounts of data that must be located and retrieved very quickly. The capability to store and retrieve volumes of data is at the core of the Information Age. Now-a-days computer is playing a main role in everyday life it has become the need of people just like television, telephone or other electronic devices at home. It solves the human problems very quickly as well as accurately. The important characteristics of a computer are described below:

**1. Speed**

The computer is a very high speed electronic device. The operations on the data inside the computer are performed through electronic circuits according to the given instructions. The data and instructions flow along these circuits with high speed that is close to the speed of light. Computer can perform millions of billions of operations on the data in one second. The computer generates signals during the operation process therefore the speed of computer is usually measure in megahertz (MHz) or Giga hertz (GHz). It means million cycles units of frequency is hertz per second. Different computers have different speed.

**2. Arithmetical and Logical Operations**

A computer can perform arithmetical and logical operations. In arithmetic operations, it performs the addition, subtraction, multiplication and division on the numeric data. In logical operation it compares the numerical data as well as alphabetical data.

**3. Accuracy**

In addition to being very fast, computer is also very accurate device. It gives accurate output result provided that the correct input data and set of instructions are given to the computer. It means that output is totally depended on the given instructions and input data. If input data is in-correct then the resulting output will be in-correct. In computer terminology it is known as garbage-in garbage-out.

**4. Reliability**

The electronic components in modern computer have very low failure rate. The modern computer can perform very complicated calculations without creating any problem and produces consistent (reliable) results. In general, computers are very reliable. Many personal computers have never needed a service call. Communications are also very reliable and generally available whenever needed.

**5. Storage**

A computer has internal storage (memory) as well as external or secondary storage. In secondary storage, a large amount of data and programs (set of instructions) can be stored for future use. The stored data and programs are available any time for processing. Similarly information downloaded from the internet can be saved on the storage media.

**6. Retrieving data and programs**

The data and program stored on the storage media can be retrieved very quickly for further processing. It is also very important feature of a computer.

**7. Automation**

A computer can automatically perform operations without interfering the user during the operations. It controls automatically different devices attached with the computer. It executes automatically the program instructions one by one.



**8. Versatility**

Versatile means flexible. Modern computer can perform different kind of tasks one by one or simultaneously. It is the most important feature of computer. At one moment you are playing game on computer, the next moment you are composing and sending emails etc. In colleges and universities computers are used to deliver lectures to the students. The talent of computer is dependent on the software.

**9. Communications**

Today computer is mostly used to exchange messages or data through computer networks all over the world. For example the information can be received or send through the internet with the help of computer. It is most important feature of the modern information technology.

**10. Diligence**

A computer can continually work for hours without creating any error. It does not get tired while working after hours of work it performs the operations with the same accuracy as well as speed as the first one.

**11. Feelings**

Computer is an electronic machine. It has no feelings. It detects objects on the basis of instructions given to it. Based on our feelings, taste, knowledge and experience: we can make certain decisions and judgments in our daily life. On the other hand, computer cannot make such judgments on their own. Their judgments are totally based on instructions given to them.

**12. Consistency**

People often have difficulty to repeat their instructions again and again. For example, a lecturer feels difficulty to repeat a same lecture in a class room again and again. Computer can repeat actions consistently (again and again) without losing its concentration:

- To run a spell checker (built into a word processor) for checking spellings in a document.
- To play multimedia animations for training purposes.
- To deliver a lecture through computer in a class room etc.
- A computer will carry out the activity with the same way every time.
- You can listen a lecture or perform any action again and again.

**Self Assessment Questions**

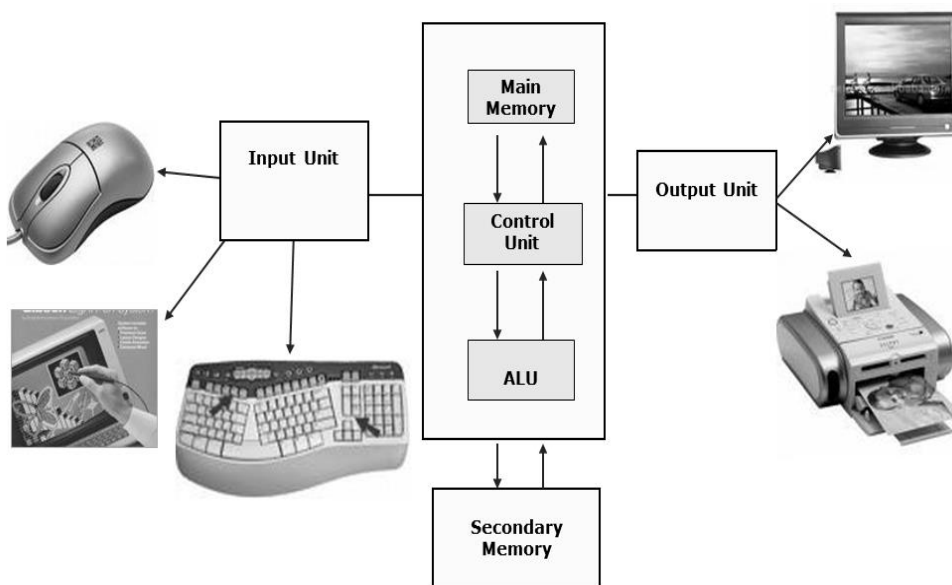
5. The speed of computer is usually measure in \_\_\_\_\_
6. Different arithmetic operations are \_\_\_\_\_

**13. Precision**

Computers are not only fast and consistent but they also perform operations very accurately and precisely. For example, in manual calculations and rounding fractional values (That is value with decimal point can change the actual result). In computer however, you can keep the accuracy and precision upto the level, you desire. The length calculations remain always accurate.

**1.5 Organization of a Computer**

A computer is a fast and accurate device, which can accept data, store data, process them and give, desired results as output. The computer is organized into four units such as, Input unit, CPU, Secondary memory and Output unit as shown in the following diagram.



**Fig. 1.2: Block Diagram of Computer**

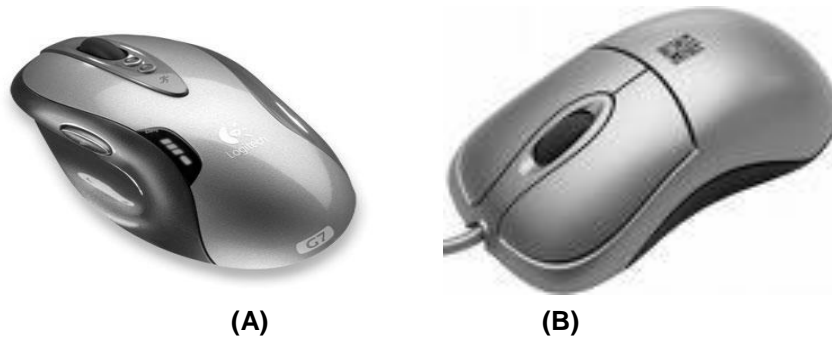
A hardware device that accepts inputted information and also has the capability of outputting that information.

### 1.5.1 Input Unit

Any device designed to assist in the entry of data into a computer is known as Input device. Input devices convert data from any convenient external format into binary codes that a computer can store and manipulate internally. Some of the most common, most popularly used devices are discussed below.

#### 1. Mouse:

This Input device is categorized as a pointing device because it is used to point and select an option on the monitor. It is small boxlike object that is connected to the computer by a cable and can be rolled around on the table. A pointer on the screen follows the movements of the mouse; rolling the mouse left moves the pointer left by an equipment amount, rolling the mouse in the right direction moves the pointer in the right direction, rolling the mouse in the up direction moves the pointer in the up direction, rolling the mouse in the down direction moves the pointer in the down direction and you can roll the mouse in a angular direction also. In order to select an option on the computer screen, the user should move the pointer at the desired position and press the button on the mouse. The mouse can be used to open menus, select texts for editing, move objects on the screen, draw images or diagrams etc.



**Fig. 1.3: Graphical representation of A. Wireless mouse. B. Optical Mouse**

A mouse can be classified on the basis of the number of buttons it has, the technology it uses, and the kind of interface it shares with the computer. A mouse may have one, two or three buttons. The program that uses the mouse determines the function of each button. A mouse may be classified as a Mechanical mouse and an Optical mouse, on the basis of the technology it uses. In a Mechanical mouse, the rubber-coated ball that

projects through the bottom surface rotates as the mouse is moved along a flat surface and sends electrical signals to the system unit by means of switches inside the mouse. This causes the cursor, or pointer, to move in a corresponding fashion. An Optical mouse uses diodes to emit light beam instead of a rotating ball to detect movement across a specially patterned metal pad.

## 2. Light Pen:



**Fig. 1.4: Graphical representation of light pen**

This is also categorized into a pointing device, which can be used only with video displays. It can be used to select an option by simply pointing at it, or drawing figures directly on the screen. An electron beam that repeatedly scans the display screen from left to right and from top to bottom produce a video display. Because of this scanning action, each point on the display is illuminated at a slightly different time.

The light pen, which is a pen like device, has a photo detector at its tip. The detector can detect changes in the brightness of the screen. The light pen is connected to the computer by a cable. When the pen is pointed at a particular spot on the screen, the point is scanned and the photo detector records changes in the brightness and sends electrical pulses to the computer. The computer can find out the exact spot with this information. Light pens are useful for menu-based applications. It is also useful for drawing graphics in Computer Aided Design software.

### 3. Touch Screen:



**Fig. 1.5: Touchscreen**

A type of display screen that has a touch-sensitive transparent panel covering the screen. Instead of using a pointing device such as a mouse or light pen, you can use your finger to point directly to objects on the screen.

Although touch screens provide a natural interface for computer novices, they are unsatisfactory for most applications because the finger is such a relatively large object. It is impossible to point accurately to small areas of the screen.

### 4. Joy Stick:



**Fig. 1.6: Joy Stick**

A lever that moves in all directions and controls the movement of a pointer or some other display symbol. A joystick is similar to a mouse, except that

with a mouse the cursor stops moving as soon as you stop moving the mouse. With a joystick, the pointer continues moving in the direction the joystick is pointing. To stop the pointer, you must return the joystick to its upright position. Most joysticks include two buttons called triggers. Joysticks are used mostly for computer games, but they are also used occasionally for CAD/CAM systems and other applications.

### 5. Keyboard:



**Fig. 1.7: Keyboard**

Keyboards are the most widely used input devices. The most popular keyboards are those that look, feel, and possibly sound like an ordinary typewriter keyboard. Alternatives are Membrane keyboards, whose keys are merely printed on a plastic membrane. A pressure sensitive two-dimensional keyboard covered with a dust proofed and dirt proofed plastic sheet are useful in dirty environments. Keyboards are of different varieties. Generally a keyboard has 105 keys. It features 12 function keys arranged at the top of the keyboard, and larger Backspace key, a numeric keypad, a cursor movement keypad, toggle lights, Shift keys, Alt keys, Ctrl keys, Caps Lock key, Num Lock key, Spacebar key, Enter key, Alphabetical keys etc.

### 6. Scanners:

These are the eyes of your computer. They can see images or printed text and translate them into binary code. Most scanners collect data from a page by recording, which areas are light and which areas are dark. They contain a camera, which is made up of thousands of tiny cells, called charge coupled devices (CCD). Each CCD detects whether a small part of the image is either light or dark. It transmits this data to the CPU, which then creates the image. Some scanners are sensitive enough to tell the difference between colors.



**Fig. 1.8: Scanner**

Many scanners available nowadays are capable of not only scanning texts and graphics, but also integrated text and graphic files. Scanners are used to reproduce photographs on the computer screen. Businesses use scanners for storing documents on the computer.

### **7. Optical Character Readers (OCR):**

These are another kind of input devices that are used to read any printed text. They can interpret handmade marks, handwritten characters, machine printed characters and special symbols and codes. Optical character readers scan text character-by-character converts them into machine-readable codes and store it in the memory. Since they read characters at the rate of around 2600 characters per second this reduces the organizations the data inputting time.



**Fig. 1.9: Optical Character Reader**

**8. Magnetic Ink Character Reader (MICR):**

A magnetic character reader system for reading and identifying magnetized characters printed on a document such as a check, in which analog waveforms derived from scanning the characters are analyzed by rectifying and integrating the waveform to generate a value representing the gain of a programmable gain amplifier for use in amplifying the waveform to compensate for variations in ink intensity.

Means are provided for generating a value representing the center of gravity of the area under each peak of the amplified waveform for use in retiming the peak sampling windows for compensating for variations in the speed of the document past the magnetic read head. Digital values representing the area under each peak curve in the waveform are compared with corresponding values of a plurality of reference characters to identify the unknown character.

**9. Bar Code Reader:**

This is used to read different kind of vertical lines known as bars which signify some information.

**10. Touch Pad**

Most laptop computers today have a touch pad pointing device. You move the on-screen cursor by sliding your finger along the surface of the touch pad. The buttons are located below the pad, but most touch pads allow you to perform “mouse clicks” by tapping on the pad itself.



**Fig. 1.10: Touch Pad**



Touch pads have the advantage over mouse that they take up much less room to use. They have the advantage over trackballs (which were used on early laptops) that there are no moving parts to get dirty and result in jumpy cursor control.

### 11. Track Point



**Fig. 1.11: Track Point**

Some sub-notebook computers (such as the IBM ThinkPad), which lack room for even a touch pad, incorporate a trackpoint, a small rubber projection embedded between the keys of the keyboard. The trackpoint acts like a little joystick that can be used to control the position of the on-screen cursor.

### Graphics Tablet:



**Fig. 1.12: Graphics Tablet**

A graphics tablet consists of an electronic writing area and a special “pen” that works with it. Graphics tablets allow artists to create graphical images

with motions and actions similar to using more traditional drawing tools. The pen of the graphics tablet is pressure sensitive, so pressing harder or softer can result in brush strokes of different width (in an appropriate graphics program).

**Microphone:**

**Fig. 1.13: Microphone**

A microphone can be attached to a computer to record sound (usually through a sound card input or circuitry built into the motherboard). The sound is digitized – turned into numbers that represent the original analog sound waves – and stored in the computer to later processing and playback.

**1.5.2 Central Processing Unit:**

The central processing unit (CPU) is the electronic brain of the computer. The CPU in a personal computer is usually a single chip. It organizes and carries out instructions that come from either the user or from the software. The processor is made up of many components, but two of them are worth mentioning at this point. These are the arithmetic and logic unit and the control unit. The control unit controls the electronic flow of information around the computer. The arithmetic logic unit, ALU, is responsible for mathematical calculations and logical comparisons.

The processor is plugged into the computer's motherboard. The motherboard is a rigid rectangular card containing the circuitry that connects the processor and all the other components that make up your personal computer. In most personal computers, some of the components are attached directly to the motherboard and some are housed on their own small circuit boards that plug into the expansion slots built into the motherboard.

The processing capacity of a computer is measured in terms the amount of data processed by the CPU in one operation. The CPU has three important sub units.

- 1) Arithmetic-Logic unit
- 2) Control Unit
- 3) Memory Unit

**Arithmetic-Logic Unit (ALU):** The ALU is an electronic circuit used to carry out the arithmetic operations like addition, subtraction, multiplication and division. This unit carries out logical operations like greater than, less than, equal to etc. It performs the operation on the data provided by the input devices. A comparison operation allows a program to make decisions based on its data input and results of the previous calculations. Logical operations can be used to determine whether particular statement is TRUE or FALSE.

The ALU operates on the data available in the main memory and sends them back after processing again to main memory.

**Control Unit:** The control unit coordinates the activities of all the other units in the system. Its main functions are to control the transfer of data and information between various units and to initiate appropriate actions by the arithmetic-logic unit. Conceptually, the control unit fetches instructions from the memory, decodes them, and directs them to various units to perform the specified tasks.

**Memory Unit:** The main memory is also called primary memory, is used to store data temporarily. Although, the CPU is the brain behind all the operations in the computer, it needs to be supplied with the data to be processed and the instructions to tell it what to do. Once the CPU has carried out an instruction, it needs the result to be stored. This storage space is provided by the computer's memory. Data provided by the input device, and the result of that processed data is also stored in the memory nit. This main memory is like a scratch pad. The storage capacity of the memory is generally measured in megabytes.

**8 Bits = 1 Byte**

**1024 Bytes = 1 Kilobyte (KB)**

**1024 Kilobytes = 1 Megabyte (MB)**

**1024 Megabytes = 1 Gigabyte (GB)**

Different kinds of primary memory are Random Access Memory (RAM) and Read Only Memory (ROM). You can read and write data in RAM but the data is volatile or temporary that is whenever the power is switched off the contents of RAM is lost so it is required to store the data in the secondary memory if the data is required for the future use. But you can only read the data from ROM and you cannot write anything into it and the data is permanent. The manufacturer himself has written the data in it initially.

### 1.5.3 Secondary Memory

This is the permanent memory. The data stored in it is permanent. But you can delete the data if you want. There are different kinds of secondary storage devices available. Few of them are Floppy disks, Fixed (hard) disks, and Optical disks etc.

Examples:

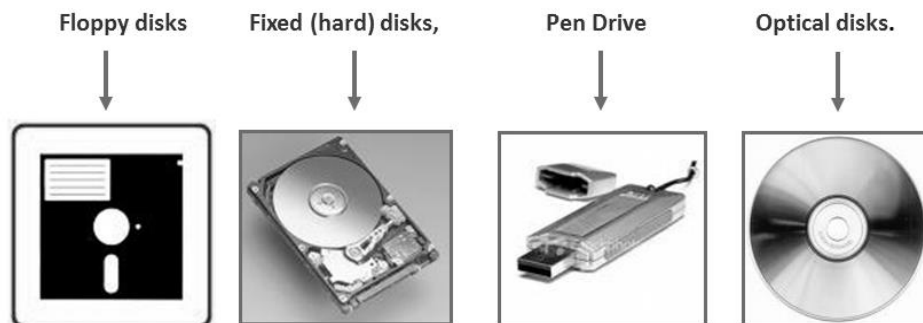


Fig. 1.14: Secondary Memory Devices

### 1.5.4 Computer Output Units

Any peripheral device that converts the stored binary coded data into convenient external forms as text and pictures are known as Output devices. Some of the most popularly used Output devices are discussed below.

#### CRT Monitor

The traditional output device of a person computer has been the CRT (Cathode Ray Tube) monitor. Just like a television set (an older one, anyway) the CRT monitor contains a large cathode ray tube that uses an electron beam of varying strength to “paint” a picture onto the color phosphorescent dots on the inside of the screen. CRT monitors are heavy and use more electrical power than flat panel displays, but they are

preferred by some graphic artists for their accurate color rendition, and preferred by some gamers for faster response to rapidly changing graphics.



**Fig. 1.14: CRT Monitor**

Monitor screen size is measured diagonally across the screen, in inches. Not all of the screen area may be usable for image display, so the viewable area is also specified. The resolution of the monitor is the maximum number of pixels it can display horizontally and vertically (such as 800 x 600, or 1024 x 768, or 1600 x 1200). Most monitors can display several resolutions below its maximum setting. Pixels (short for picture elements) are the small dots that make of the image displayed on the screen. The spacing of the screen's tiny phosphor dots is called the dot pitch (dp), typically .28 or .26 (measured in millimeters). A screen with a smaller dot pitch produces sharper images.

Your computer must produce a video signal that a monitor can display. This may be handled by circuitry on the motherboard, but is usually handled by a video card in one of the computer's expansion slots; often the slot is a special one dedicated to video use, such as an AGP slot (Accelerated Graphics Port). Video cards are also called video display adapters, and graphics cards. Many video cards contain separate processors and dedicated video memory for generating complex graphics quickly without burdening the CPU. These accelerated graphics cards are loved by gamers.

### **Flat Panel Monitor**

A flat panel display usually uses an LCD (Liquid Crystal Display) screen to display output from the computer. The LCD consists of several thin layers

that polarize the light passing through them. The polarization of one layer, containing long thin molecules called liquid crystals, can be controlled electronically at each pixel, blocking varying amounts of the light to make a pixel lighter or darker. Other types of flat panel technology exist (such as plasma displays) but LCDs are most commonly used in computers, especially laptops.



**Fig. 1.15: Flat Panel Monitor**

Older LCDs had slow response times and low contrast, but active matrix LCD screens have a transparent thin film transistor (TFT) controlling each pixel, so response, contrast, and viewing angle are much improved.

Flat panel displays are much lighter and less bulky than CRT monitors, and they consume much less power. They have been more expensive than CRTs in the past, but the price gap is narrowing. You will see many more flat panels in the future. As with CRTs, the display size of a flat panel is expressed in inches, and the resolution is the number of pixels horizontally and vertically on the display.

### **Ink Jet Printer**

For hardcopy (printed) output, you need some kind of printer attached to your computer (or available over a network). The most common type of printer for home systems is the color ink jet printer. These printers form the image on the page by spraying tiny droplets of ink from the print head. The printer needs several colors of ink (cyan, yellow, magenta, and black) to make color images. Some photo-quality ink jet printers have more colors of ink. Ink jet printers are inexpensive, but the cost of consumables (ink

cartridges and special paper) make them costly to operate in the long run for many purposes.

**Laser Printer**

A laser printer produces good quality images by the same technology that photocopiers use. A drum coated with photosensitive material is charged, then an image is written onto it by a laser (or LEDs) which makes those areas lose the charge. The drum then rolls through toner (tiny plastic particles of pigment) that are attracted to the charged areas of the drum. The toner is then deposited onto the paper, and then fused into the paper with heat.

Most laser printers are monochrome (one color only, usually black), but more expensive laser printers with multiple color toner cartridges can produce color output. Laser printers are faster than ink jet printers. Their speed is rated in pages per minute (ppm). Laser printers are more expensive than ink jets, but they are cheaper to run in the long term if you just need good quality black & white pages.

**Sound Output**

Computers also produce sound output, ranging from simple beeps alerting the user, to impressive game sound effects, to concert quality music. The circuitry to produce sound may be included on the motherboard, but high quality audio output from a PC usually requires a sound card in one of the expansion slots, connected to a set of good quality external speakers or headphones. Multimedia is a term describing computer output that includes sound, text, graphics, movies, and animation. A sound card is an example of a multimedia output device (as is a monitor that can display graphics).

**Self Assessment Questions**

7. Device is designed to assist in the entry of data into a computer is known as \_\_\_\_\_.
8. \_\_\_\_\_ device is categorized as a pointing device because it is used to point and select an option on the monitor.
9. CCD stands for \_\_\_\_\_.
10. \_\_\_\_\_ is the electronic brain of the computer.
11. \_\_\_\_\_ unit coordinates the activities of all the other units in the system.

**1.6 Summary**

- A computer is a device that accepts information (in the form of digitalized data) and manipulates it for some result based on a program or sequence of instructions on how the data is to be processed.
- Technically, a computer is a programmable machine. This means it can execute a programmed list of instructions and respond to new instructions that it is given.
- The abacus was an early aid for mathematical computations.
- A statistician Dr. Herman Hollerith, developed a punched card that would contain data coded in the form of punched holes.
- Computers of all sizes have common characteristics – speed, arithmetical and logical operations, accuracy, reliability, storage, retrieving data and programs, automation, versatility, communications, diligence, feelings, consistency and precision.

**1.7 Terminal Questions**

1. What is Computer?
2. Explain the characteristics of computers.
3. Briefly explain the organization structure of the Computer.
4. Explain functional aspects of input and output units.

**1.8 Answers****Self Assessment Questions**

1. Computer
2. Programmable
3. Transistor
4. Abacus
5. Megahertz or Giga hertz
6. Addition, Subtraction, Multiplication and Division
7. Input device
8. Mouse
9. Charge coupled devices
10. Central processing unit
11. Control



**Terminal Questions**

1. A computer is a device that accepts information (in the form of digitalized data) and manipulates it for some result based on a program or sequence of instructions on how the data is to be processed. Refer section 1.2.
2. Computers of all sizes have common characteristics – speed, arithmetical and logical operations, accuracy, reliability, storage, retrieving data and programs, automation, versatility, communications, diligence, feelings, consistency and precision. Refer section 1.4.
3. A computer is a fast and accurate device, which can accept data, store data, process them and give, desired results as output. Refer section 1.5.
4. A hardware device that accepts inputted information and also has the capability of outputting that information. Refer section 1.5.1 & 1.5.4.