1

Basics of Computer

1.1 INTRODUCTION

In this lesson we present an overview of the basic design of a computer system: how the different parts of a computer system are organized and various operations performed to perform a specific task. You would have observed that instructions have to be fed into the computer in a systematic order to perform a specific task. Computer components are divided into two major categories, namely, hardware and software. In this lesson we will discuss about hardware, i.e., the machine itself and its connected devices such as monitor, keyboard, mouse etc., as well as software that makes use of hardware for performing various functions.

1.2 OBJECTIVES

After going through this lesson you would be able to:

● explain basic organization of computer system
● explain different types of input and output devices
● define Software and its classification
● distinguish between system software and application software
● describe computer language and its classification

1.3 WHAT IS A COMPUTER?

Computer is a device that transforms data into meaningful information. Data can be anything like marks obtained by you in various subjects. It can also be name, age, sex, weight, height, etc. of all the students in a class.

Computer can also be defined in terms of functions it can perform. A computer can i) accept data, ii) store data, iii) process data as desired, and iv) retrieve the stored data as and when required and v) print the result in desired format.

The major characteristics of a computer are high speed, accuracy, diligence, versatility and storage.

1.3.1 Computer Organisation

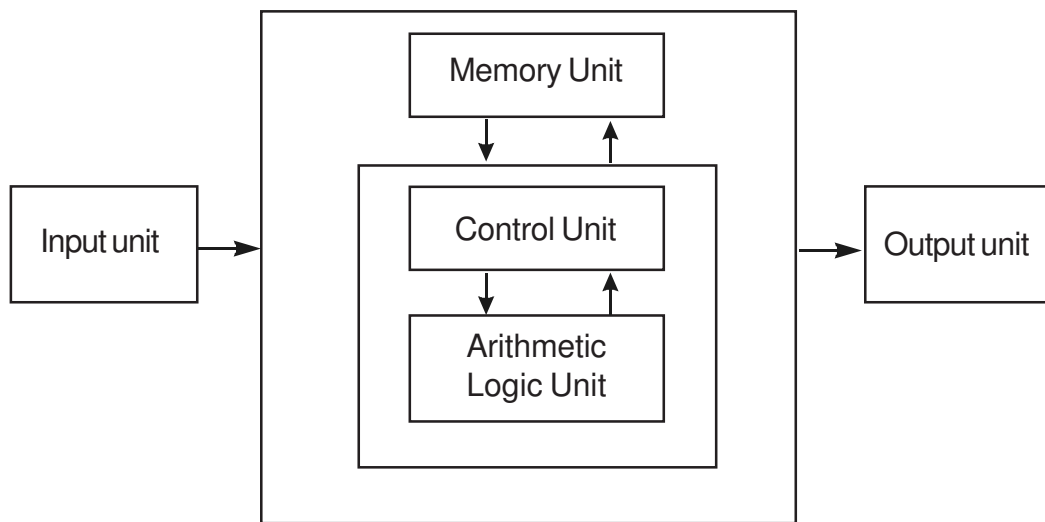The block diagram of computer is shown in Fig. 1.1.

Fig. 1.1 Block diagram of Computer Organisation

The computer performs basically five major operations of functions irrespective of their size and make. These are 1) it accepts data or instruction by way of input, 2) it stores data, 3) it can process data as required by the user, 4) it gives results in the form of output, and 5) it controls all operations inside a computer. We discuss below each of these operations.

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

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.

INTEXT QUESTIONS

1. What are the five basic operations performed by the computer?
2. Define ALU, CU and CPU.
3. Choose the correct answer.
    (a) The task of performing arithmetic and logical operations is called:
        (i) ALU   (ii) editing   (iii) storage (iv) Output
    (b) The ALU and CU jointly are known as
        (i) RAM   (ii) ROM   (iii) CPU   (iv) None of above
    (c) The process of producing results from the data for getting useful information is called:
        (i) output (ii) input   (iii) processing (iv) storage

1.4 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
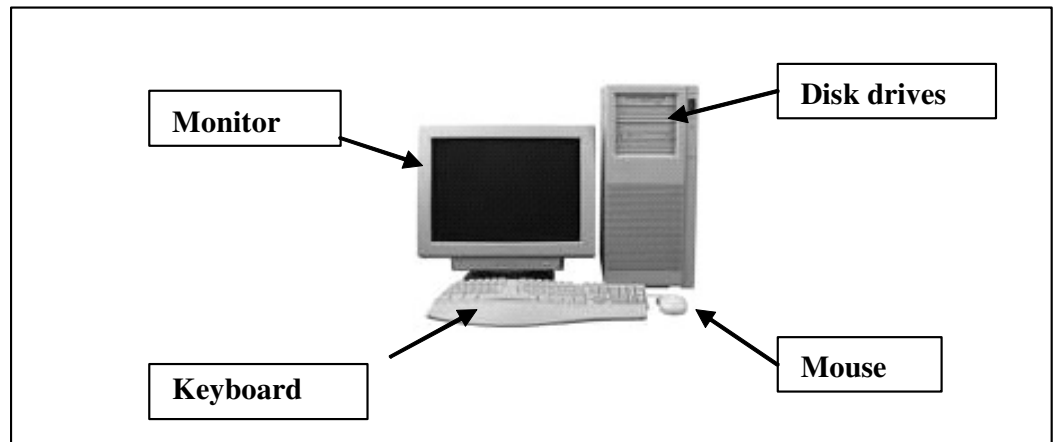2. Output Devices
3. Other Peripherals

Fig. 1.2 Different peripheral devices of Computer

1.5 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
5.   Touch Screen
6.   Microphone for voice as input
7.   Track Ball

1.5.1 Keyboard

A keyboard (as shown in figure 1.3) 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.

Fig. 1.3 Keyboard

1.5.2 Mouse

A mouse is an electro-mechanical, hand-held device (as shown in figure 1. 4). It is used as a pointer. It can perform functions like selecting menu commands, moving icons, resizing windows, starting programs, and choosing options.

Fig. 1.4 Mouse

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.

1.5.3 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 (as shown in figure 1.5), 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.

Fig. 1.5 Light Pen

1.5.4 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.

Fig. 1.6 Scanner

1.5.5 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.

Fig. 1.7 Touch Screen Monitor

1.5.6 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 (as shown in figure 1.8):

1.   Desktop Microphone

2.   Hand held Microphone

Fig. 1.8 Desktop microphone and Hand-held Microphone

1.5.7 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.

Fig. 1.9 Track Ball

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.

1.6 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

1.6.1 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,

Fig. 1.10 CRT and LCD Monitor

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.

1.6.2 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

Fig. 1.11 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.

Fig. 1.12 Ink-Jet Printer

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.

Fig. 1.13 Dot Matrix Printer

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.

Fig. 1.14 Line Printer

1.6.3 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.

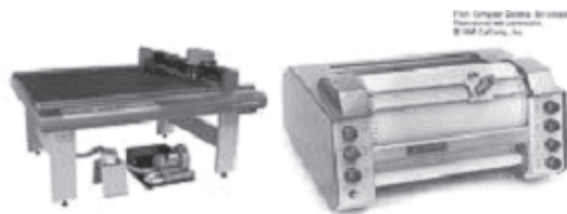2. Drum: These plotters are of big size using rolls of paper of unlimited length.

Fig. 1.15 Flat bed and Drum Plotter

1.6.4 Speaker

Speakers (as shown in figure 1.16) are another type of output device, which allow you to listen to voice like music, and conversation with people.

Fig. 1.16 Speaker

INTEXT QUESTION

4.   Write True or False for the following:

   (a)   Mouse is an output device.

   (b)   OCR stands for Optical Content Reader.

   (c)   LCD Monitor is used in notebook computer.

   (d)   Speed of DOT Matrix Printer is measured in Characters Per Second.

   (e)   Plotters are used to produce high quality drawings and images, such as construction plans for buildings or blueprints for mechanical objects.

1.7 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 shown in Figure 1.17.
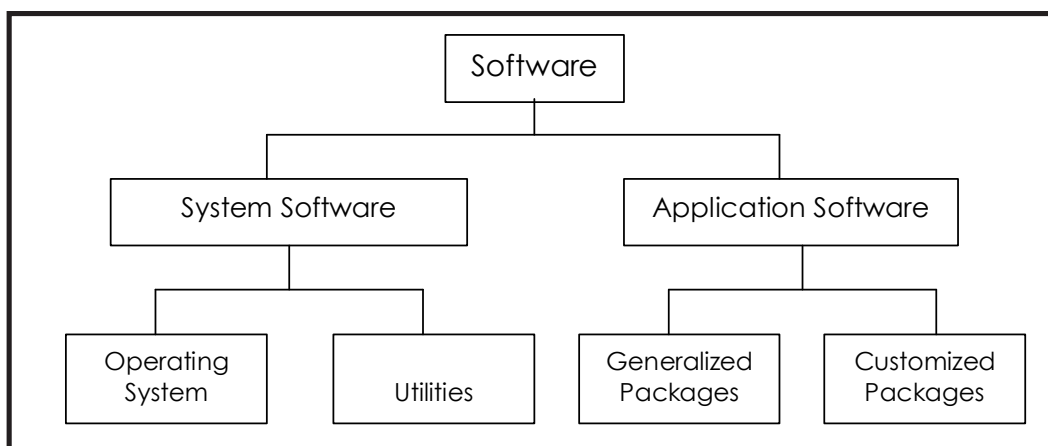

Fig. 1.17 Classification of Software

1.7.1 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.

1.7.2 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

These are the applications that are customized (or developed) to meet the specific requirements of an organization/institution. For Example: Student information details, Payroll packages, inventory control etc.

These packages are developed using high-level computer language.

1.8 COMPUTER LANGUAGES

Languages are a means of communication. Normally people interact with each other through a language. On the same pattern, communication with computers is carried out through a language. This language is understood both by user and the machine. Just as every language like English, Hindi has its grammatical rules; every computer language is bound by rules known as SYNTAX of that language. The user is bound by that syntax while communicating with the computer system.

Computer languages are broadly classified as:

1. Low Level Language:

The term low level means closeness to the way in which machine understand. The low level languages are:

a. Machine Language:

This is the language (in the form of 0's and 1's, called binary numbers) understood directly by the computer. It is machine dependent. It is difficult to learn and even more difficult to write programs.

b. Assembly Language:

This is the language where the machine codes comprising of 0's and 1's are substituted by symbolic codes (called **mnemonics**) to improve their understanding. It is the first step to improve programming structure.

Assembly language programming is simpler and less time consuming than machine level programming, it is easier to locate and correct errors in assembly language than in machine language programs. It is also machine dependent. Programmers must have knowledge of the machine on which the program will run.

2. High Level Language

You know that low level language requires extensive knowledge of the hardware since it is machine dependent. To overcome the limitation, high level language has been evolved which uses normal English like, easy to understand statements to solve any problem. Higher level languages are computer independent and programming becomes quite easy and simple.

Various high level languages are given below:

●   **BASIC** (Beginners All Purpose Symbolic Instruction Code): It is widely used, easy to learn general purpose language. Mainly used in microcomputers in earlier days.

- **COBOL** (Common Business Oriented language): A standardized language used for commercial applications.

- **FORTRAN** (Formula Translation): Developed for solving mathematical and scientific problems. One of the most popular languages among scientific community.

- **C**: Structured Programming Language used for all purpose such as scientific application, commercial application, developing games etc.

- **C++**: Popular object oriented programming language, used for general purpose.

1.9 COMPILER AND ASSEMBLER

As you know that High Level language is machine independent and assembly language though it is machine dependent yet **mnemonics** that are being used to represent instructions are not directly understandable by machine. Hence to make the machine understand the instructions provided by both the languages, Compiler and Assembler are required to convert these instructions into machine language.

The software (set of programs) that reads a program written in high level language and translates it into an equivalent program in machine language is called as **Compiler**.

The program written by the programmer in high level language is called **source program** and the program generated by the compiler after translation is called as **object program.**
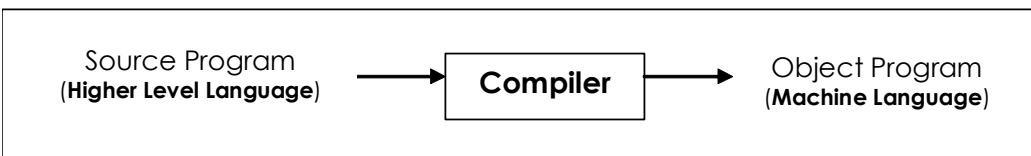

Source Program
(**Higher Level Language**) → **Compiler** → Object Program
(**Machine Language**)

Fig. 1.18 Compiler

The software (set of programs) that reads a program written in assembly language and translates it into an equivalent program in machine language is called as **Assembler**.
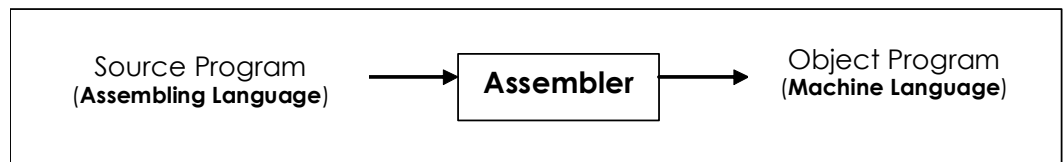
Fig. 1.19 Assembler

INTEXT QUESTION

5.   Write True or False for the following:

(a)   Operating System (OS) is an Application Software.

(b)   High level languages are easy to program than low level language.

(c)   Computer language FORTRAN is used to solve Scientific and Mathematical problems.

(d)   C is an object oriented programming language.

(e)   Compiler converts high level languages into machine language.

1.10 WHAT YOU HAVE LEARNT

A computer is useful only when it interacts with the external devices such as keyboard, mouse, monitor, speaker, which are called as peripheral devices. In this lesson we have discussed in details about major peripheral devices of a computer system. You have learnt that only hardware does not do anything of its own without the help of software. Hence we have explained in details about software, its types and the computer languages used to prepare the software.

1.11 TERMINAL QUESTIONS

1.   What is a computer? Draw a block diagram to illustrate the basic organisation of a computer system and explain the functions of various units.

2.   What is an input device? Briefly describe varioius important input devices.

3.   Discuss two basic types of monitors CRT and LCD.

4. What is a software? Discuss its various categories with the help of diagram.

5. Distinguish between system and application software.

6. Write short notes on:

    (a) Laser Printer

    (b) High level language

    (c) Compiler

    (d) Plotter

7. Write a note on Computer language and its classification.

1.12 FEEDBACK TO INTEXT QUESTIONS

1. The five basic operations that a computer performs are input, storage, processing, output and control.

2. ALU : Arithmetic Logic Unit

   CU : Control Unit

   CPU : Central Processing Unit

3. (a) i   (b) iii   (c) i

4. (a) False   (b) False   (c) True   (d) True   (e) True

5. (a) False   (b) True   (c) True   (d) False   (e) True