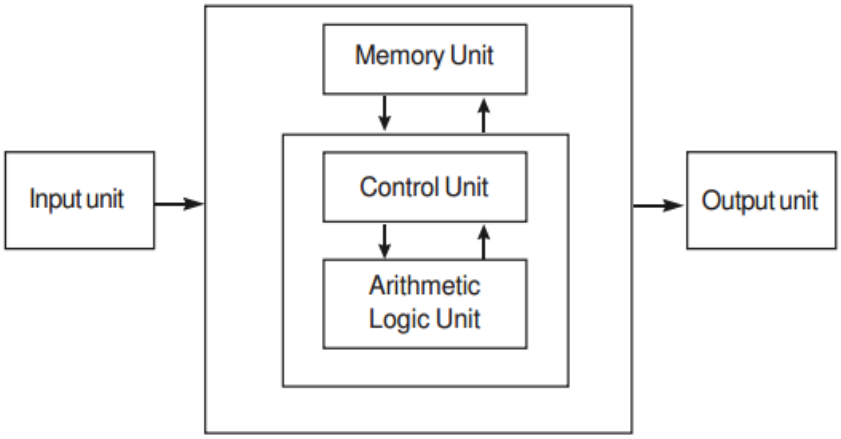
Unit 1

Fundamentals of Computer System

A **computer** is an electronic device which can store data and that manipulates information. It can **store**, **retrieve**, and **process** data. You can use a computer to type documents, send email, and browse the Web. You can also use it to handle spreadsheets, accounting, database management, presentations, games, and more.

Computer components:

CPU



Block diagram of a computer

Computer can be classified three main units. 1. Input unit 2. CPU (Central Processing Unit) 3. Output Unit

1. Input unit: An input device is any device that provides input to a computer. There are many input devices, but the two most common ones are a keyboard and mouse. Every key you press on the keyboard and every movement or click you make with the mouse sends a specific input signal to the computer.
   Eg. Key board, Mouse, Joystick, Stylus pen, Touch pad etc.

• **Keyboard**: The keyboard is very much like a standard typewriter keyboard with a few additional keys. The basic QWERTY layout of characters is maintained to make it easy to use the system. The additional keys are included to perform certain special functions. These are known as function keys that vary in number from keyboard to keyboard.

• **Mouse**: A device that controls the movement of the cursor or pointer on a display screen. A mouse is a small object you can roll along a hard and flat surface. Its name is derived from its shape, which looks a bit like a mouse. As you move the mouse, the pointer on the display screen moves in the same direction.

• **Trackball**: A trackball is an input device used to enter motion data into computers or other electronic devices. It serves the same purpose as a mouse, but is designed with a moveable ball on the top, which can be rolled in any direction.

• **Touchpad**: A touch pad is a device for pointing (controlling input positioning) on a computer display screen. It is an alternative to the mouse. Originally incorporated in laptop computers, touch pads are also being made for use with desktop computers. A touch pad works by sensing the user's finger movement and downward pressure.

• Touch Screen: It allows the user to operate/make selections by simply touching the display screen. A display screen that is sensitive to the touch of a finger or stylus. Widely used on ATM machines, retail point-of-sale terminals, car navigation systems, medical monitors and industrial control panels.

. Light Pen: Light pen is an input device that utilizes a light-sensitive detector to select objects on a display screen.

. Magnetic ink character recognition (MICR): MICR can identify character printed with a special ink that contains particles of magnetic material. This device particularly finds applications in banking industry.

• **Optical mark recognition (OMR)**: Optical mark recognition, also called mark sense reader is a technology where an OMR device senses the presence or absence of a mark, such as pencil mark. OMR is widely used in tests such as aptitude test.

• **Bar code reader**: Bar-code readers are photoelectric scanners that read the bar codes or vertical zebra strips marks, printed on product containers. These devices are generally used in super markets, bookshops etc.

Scanner: Scanner is an input device that can read text or illustration printed on paper and translates the information into a form that the computer can use. A scanner works by digitizing an image.

2. Central Processing Unit (CPU): CPU is a brain/heart of computer system. Further it

can be classified into three main units. 1. Memory unit 2. Control unit 3. Arthemetic & Logic Unit

1.1 Memory unit: Computer is used to store data and instructions.The data can be stored as permanently or temporarily. Computer's memory can be classified into two types; primary memory and secondary memory. The data can be represented in the systems as 0's and 1's. The memory can be classified into cells. The 0/1 called as 1 bit. Each cell capable of 1 bit of information. The set of 8 bits called as 1 byte.

- 1024 bytes ------- 1 Kilo byte
- 1024 Kilo bytes ------- 1 Mega Byte
- 1024 Mega bytes ------- 1 Giga Byte
- 1024 Giga byte ------- 1 Tera Byte

Primary Memory: It can be further classified as **RAM and ROM**.

• RAM or Random Access Memory is the unit in a computer system. RAM is volatile memory having a limited storage capacity. It is the place in a computer where the operating system, application programs and the data in current use are kept temporarily so that they can be accessed by the computer's processor. It is said to be 'volatile' since its contents are accessible only as long as the computer is on. The contents of RAM are no more available once the computer is turned off.

ROM or Read Only Memory is a special type of memory which can only be read and contents of which are not lost even when the computer is switched off. It typically contains manufacturer's instructions. Among other things, ROM also stores an initial program called the 'bootstrap loader' whose function is to start the operation of computer system once the power is turned on.

Secondary Memory:

RAM is volatile memory having a limited storage capacity. Secondary/auxiliary memory is storage other than the RAM. These include devices that are peripheral and are connected and controlled by the computer to enable permanent storage of programs and data.

- **CD ROM**

Secondary storage devices are of two types; magnetic and optical. Magnetic devices include hard disks and optical storage devices are CDs, DVDs, Pen drive, Zip drive etc.

• Hard Disk

Hard disks are made up of rigid material and are usually a stack of metal disks sealed in a box. The hard disk and the hard disk drive exist together as a unit and is a permanent part of the computer where data and programs are saved. These disks have storage capacities ranging from 1GB to 1TB and more. Hard disks are rewritable.

• Compact Disk

Compact Disk (CD) is portable disk having data storage capacity between 650-700 MB. It can hold large amount of information such as music, full-motion videos, and text etc. CDs can be either read only or read write type.

• Digital Video Disk

Digital Video Disk (DVD) is similar to a CD but has larger storage capacity and enormous clarity. Depending upon the disk type it can store several Gigabytes of data. DVDs are primarily used to store music or movies and can be played back on your television or the computer too. These are not rewritable.

1.2 Control Unit (CU): This unit will control all the other units in the system. 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 inside the computer.

1.3 Arithmetic Logic Unit (ALU): It can performs all the athematic and logical operations. The major operations performed by the ALU are addition, subtraction, multiplication, division, logic and comparison.

3. Output unit: Output device receives information from the CPU and presents it to the user in the desired from. The processed data, stored in the memory of the computer is sent to the output unit, which then converts it into a form that can be understood by the user. The output is usually produced in one of the two ways – on the display device, or on paper (hard copy).
   Eg: Monitor, Printer, Plotter, Speaker etc.

•**Monitor**: is often used synonymously with “computer screen” or “display.” Monitor is an output device that resembles the television screen. It may use a Cathode Ray Tube (CRT) to display information. The monitor is associated with a keyboard for manual input of characters

and displays the information as it is keyed in. It also displays the program or application output. Like the television, monitors are also available in different sizes.

• **Printer**: Printers are used to produce paper (commonly known as hard copy) output. Based on the technology used, they can be classified as Impact or Non-impact printers.

Impact printers use the typewriting printing mechanism wherein a hammer strikes the paper through a ribbon in order to produce output. Dot-matrix and Character printers fall under this category.

Non-impact printers do not touch the paper while printing. They use chemical, heat or electrical signals to etch the symbols on paper. Inkjet, Deskjet, Laser, Thermal printers fall under this category of printers.

Plotter: Plotters are used to print graphical output on paper. It interprets computer commands and makes line drawings on paper using multi colored automated pens. It is capable of producing graphs, drawings, charts, maps etc.

• **Facsimile (FAX)**: Facsimile machine, a device that can send or receive pictures and text over a telephone line. Fax machines work by digitizing an image.

• **Sound cards and Speaker(s)**: An expansion board that enables a computer to manipulate and output sounds. Sound cards are necessary for nearly all CD-ROMs and have become commonplace on modern personal computers. Sound cards enable the computer to output sound through speakers connected to the board, to record sound input from a microphone connected to the computer, and manipulate sound stored on a disk.

Further, computer system can be classified into four parts

1. Hardware
2. Software
3. Data
4. People

1. Hardware: Computer hardware is the collection of physical elements that constitutes computer system. Computer hardware refers to the physical parts or components of a computer such as the monitor, mouse, keyboard, computer data storage, hard drive disk (HDD), system unit (graphic cards, sound cards, memory, motherboard and chips), etc. all of which are physical objects that can be touched. Software is instructions that can be stored and run by hardware.

2. Software: Software, also known as computer programs, is the non-tangible component of computers. Computer software contrasts with computer hardware, which is the physical component of computers. Computer hardware and software require each other and neither can be realistically used without the other.
3. Data: Data is collection of raw facts. It simply exists and has no significance beyond its existence (in and of itself). It can exist in any form, usable or not. It does not have meaning of itself. In computer parlance, a spreadsheet generally starts out by holding data. The processed data called information. Information is data that has been given meaning by way of relational connection. This "meaning" can be useful, but does not have to be. In computer parlance, a relational database makes information from the data stored within it.
4. People/Users: People are the computer operators People design, build, program & repair computer systems.

Other Memory Types:

Cache memory: Cache memory is random access memory (RAM) that a computer microprocessor can access more quickly than it can access regular RAM. As the microprocessor processes data, it looks first in the cache memory and if it finds the data there (from a previous reading of data), it does not have to do the more time-consuming reading of data from larger memory. The data available in the cache is called cache hit. The data not available in the cache is called as cache miss.

- Cache memory is very fast memory that the processor can access much more quickly than main memory or RAM.
- Cache memory, is much like other memory, except it can operate much faster, and much more expensive.
- Cache memory attempts to bridge the gap between fast, expensive memory that can be made in limited quantities, and the large amounts of RAM needed for modern applications.
- By giving the processor a small amount of fast memory to used, and then having that memory read in and write to main memory in "spare" time, the processor can operate at full speed much of the time.

Virtual Memory: If your computer lacks the random access memory (RAM) needed to run a program or operation, Windows uses virtual memory to compensate. Virtual memory combines your computer's RAM with temporary space on your hard disk. When RAM runs low, virtual memory moves data from RAM to a space called a paging file. Moving data to and from the paging file frees up RAM so your computer can complete its work. The more RAM your computer has, the faster your programs will generally run. If a lack of RAM is slowing your computer, you might be tempted to increase virtual memory to compensate. However, your computer can read data from RAM much more quickly than from a hard disk, so adding RAM is a better solution.

- **Virtual memory** or **virtual memory addressing** is a memory management technique, used by multitasking computer operating systems wherein non-contiguous memory is presented to a software as contiguous memory.
- This contiguous memory is referred to as the virtual address space.

Software types & usage:

Software can be classified into two types. System Software and Application Software.

System Software: Any computer software that is an essential part of the computer system. System software is a set of programs that handle the running of your computer's hardware. It is used by the system to manage its own resources. The two main categories are: operating system and Utility programs.

An **Operating System** (commonly abbreviated to either *OS* or *O/S*) is an interface between hardware and user; an OS is responsible for the management and coordination of activities and the sharing of the resources of the computer.

The operating system acts as a host for computing applications that are run on the machine. As a host, one of the purposes of an operating system is to handle the details of the operation of the hardware. This relieves application programs from having to manage these details and makes it easier to write applications.

Types of Operating System:

Multi-user and Single-user Operating Systems: The operating systems of this type allow a multiple users to access a computer system concurrently. Time-sharing system can be classified as multi-user systems as they enable a multiple user access to a computer through

the sharing of time. Single-user operating systems, as opposed to a multi-user operating system, are usable by a single user at a time.

Multi-tasking and Single-tasking Operating Systems: When a single program is allowed to run at a time, the system is grouped under a single-tasking system, while in case the operating system allows the execution of multiple tasks at one time, it is classified as a multi-tasking operating system.

Distributed Operating System: An operating system that manages a group of independent computers and makes them appear to be a single computer is known as a distributed operating system.

Embedded System: The operating systems designed for being used in embedded computer systems are known as embedded operating systems. They are designed to operate on small machines like PDAs(Personal Digital Assistant) with less autonomy. They are able to operate with a limited number of resources. They are very compact and extremely efficient by design. Windows CE, FreeBSD and Minix 3 are some examples of embedded operating systems.

Application Software: Application software is a set of one or more programs designed to carry out operations for a specific application. Application software cannot run on itself but it is dependent on system software to execute. For example: MS Word, MS Excel, Tally software, Library management system, billing system, etc. Application software can be classified into languages and packages.

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:

1. BASIC (Beginners All Purpose Symbolic Instruction Code): It is widely used, easy to learn general purpose language. Mainly used in microcomputers in earlier days.
2. COBOL (Common Business Oriented language): A standardized language used for commercial applications.
3. FORTRAN (Formula Translation): Developed for solving mathematical and scientific problems. One of the most popular languages among scientific community.
4. C: Structured Programming Language used for all purpose such as scientific application, commercial application,developing games etc.
5. C++: Popular object oriented programming language, used for general purpose.

COMPILER, INTERPRETER AND ASSEMBLER

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, Interpreter 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 compiler translate High level program into machine level program at once. All the errors will be displayed at once. 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.

Interpreter also converts high level language program into machine level language by line by line.

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.