

# Part I - Personal Computer Hardware

*To err is Human, to forgive divine!  
Not to err is Computer, unless  
mistake thine!*  
- Praveen

## Week 1

### Fundamentals of Computer

**Task 1** Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

**Aim :** To identify the hardware components of a personal computer.

**Requirements :** A computer system with all the hardware components.

**Topics covered :** Fundamentals of a personal computer

- ◆ Computer System
- ◆ Functional Units of Computer
- ◆ Basic Components of a Computer
- ◆ Viva-voce questions



## Introduction

Do you remember your first “encounter” with a computer? People born after 1960’s have grown with this amazing machine, which surely has made a profound impact in everyone’s lives.

‘**Problem – solving**’ is a form of art and science in itself. The development of ‘**Computers**’ has provided a great impetus to this age old activity of problem solving. Computer today is redefining the lives of the people and transforming our world into knowledge based world. It has become the heart of modern day’s information technology. There is hardly any field of human interaction that a digital computer has left not touched.

A computer scientist, with his colleagues, in building a satellite may fix up a computer for controlling the critical tasks. A bank cashier uses a computer to handle the banking duties. In a super market a computer bills the commodities. Even to impart education computer has become a must. In one word computer has become a household name. It is not only the Engineers, not only the doctors, for that matter any professional who decide the future course of action but a computer also computes, suggests solution, makes decisions for the human beings to follow.

A basic understanding of the manner in which a computer works helps a person in today’s world to appreciate the utility and limitation of this powerful tool. One may use this knowledge to suggest more uses of computer in order to reduce human drudgery and improve the quality of service.

Computer science today rules the world by bringing together and understanding scientific and technological foundations of computing, hardware and software, information and communication technologies. This is the very reason, why we need to not only understand the computer but also to use it and control it for the betterment of the humankind.

## Definition :

Defining a computer is a Herculean task as one falls short of words owing to its multipurpose forms. Yet an apt definition which strikes in the present scenario would be – a computer is an electronic machine that enables arithmetic computations, data processing, information management and knowledge reasoning in an efficient manner. **COMPUTER** today stands for **Computation Oriented Machine for Processing, Utility, Trade, Education & Research**.

## Abilities of computer :

- Speed
- Accuracy
- Storage
- Processing of data

## Limitations of computer :

- Speed
- Storage
- Lack of reasoning
- What You Say Is What It Does (WYSIWID)

## Applications of computer:

- Business
  - Finance
  - Defense & Military
  - Medical
  - Engineering
  - Transportation
- Many more...

## Organization of a Computer System

A computer system is a collection of hardware and software components designed to perform computations very effectively, i.e. Computer System consists of four parts – hardware, software, people and data.

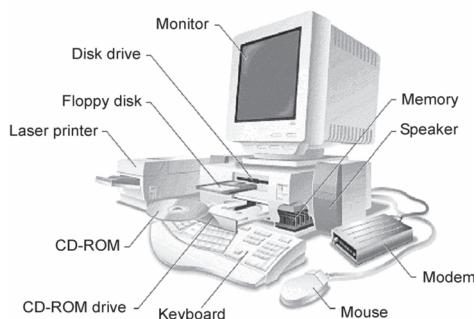
**Hardware:** Any device (or part) of the computer you can touch. Hardware consists of interconnected electronic devices that you can use to control the computer’s operation.

## 4 Part I: Personal Computer Hardware

**Software:** It is an asset of instructions consisting of complex codes (also known as programs) that make the computer perform tasks. Software tells the computer what to do.

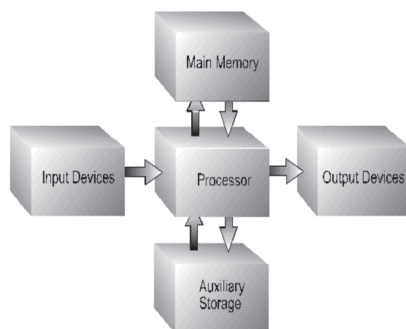
**Data:** It consists of raw facts, which the computer stores and reads in the form of numbers. Consequently, computerized data is digital.

**People (or User):** People are the computer operators.



### Functional Units of Computer

The block diagram of a computer is shown in the figure below:



Basically, every computer system is based on this architecture and it has also three major components, called as basic functional units. These are Central Processing Unit (CPU), Memory Unit & Input-Output Unit.

The basic function of the computer is execution of programs. In order to gain a greater understanding of this function and of the way in which the major components of the computer interact to execute a program we look into the following units.

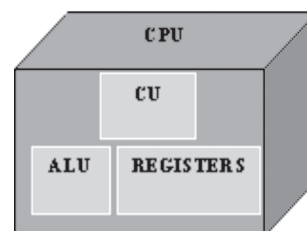
### Central Processing Unit (or Processor)

CPU is considered as the brain of computer. It is also called as '*processor*'. It is the place where all kinds of processing are done. This unit takes the input data from input devices and processes it according to the set of instructions called '*program*'. The outputs of processing of the data are directed to the output devices.

**Function:** The basic function of the CPU is to control the operations of the computer and performs its data processing functions, i.e. arithmetic and logical computations.

**Configuration:** Always computer performs operations at high speed that determines efficiency of the computer (Processor speed). The most common measurement unit for describing a processor is 'Hz'. When people talk about processor, the number of units is often so large i.e., it is useful to use terms such as KHz (Kilo Hz), MHz (Mega Hz), GHz (Giga Hz), THz (Tera Hz).

The CPU is composed of following three parts as shown in the figure below:



These are :

1. Arithmetic and Logical Unit (ALU)
2. Control Unit (CU)
3. Registers

### 1. Arithmetic and Logical Unit

This unit is responsible for carrying out

- Arithmetic operations on data by adding, subtracting, dividing and multiplying
- Logical operations, often known by using AND, OR, NOT and Exclusive-OR.
- Increment, decrement, shift and clearance operations on the set of data.

### 2. Control Unit

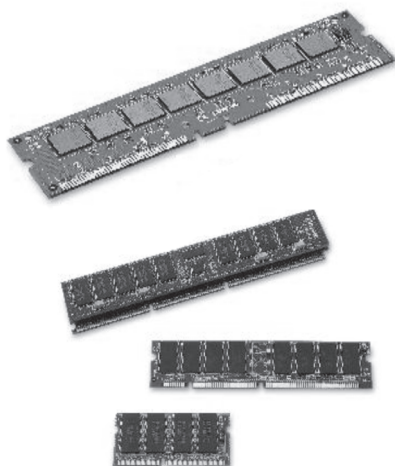
CU is another important unit of the CPU, which works in close association with other units. This unit is mainly used for generating the electronic control & timing signals for program execution. It controls all the operations of the computer.

### 3. Registers

CPU also possesses the memory to hold the data temporarily during the execution of an instruction. These are small memory locations in CPU. Registers provide a minimal storage to CPU. The total number of registers available in the CPU varies from processor to processor. The set of registers are classified into two categories:

- General-Purpose Registers
- Dedicated Registers

## Memory Unit



Memory unit is another important component of the computer. Memory is like an electronic scratch pad inside the computer. It is a storage unit to hold the data.

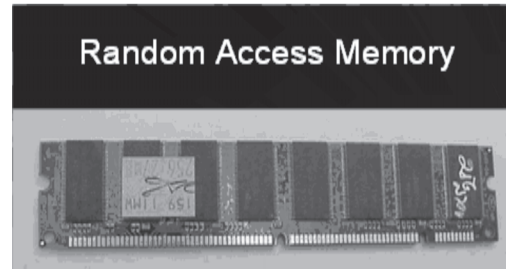
**Function:** When you launch a program, it is loaded into memory and then executed. Data used by the program is also loaded into memory for fast access. As you enter new data into the computer, it is also stored in memory.

The memory can broadly be classified into two categories, these are

1. Primary or Main Memory.
2. Secondary or Auxiliary Memory.

**Primary memory:** It is the fastest memory in a digital computer system. This memory is primarily used to store the data and program temporarily during the execution of a program. Primary Memory is further classified into two categories called

- Random Access Memory (RAM)
- Read Only Memory (ROM)



## Random Access Memory

The most common type of memory is called RAM; the term memory is commonly used to mean RAM. Data is both written to and read from this memory. The most important thing to remember about RAM is that it is volatile. When you turn off a computer, every thing in RAM disappears.

RAM may be classified into two categories as shown below:

- Static RAM
- Dynamic RAM

**Static RAM:** Static RAMs are fast, so that cache memory is made-up of these devices. Static RAM is made-up of Flip-Flops, an electronic device, which stores a bit as voltage.

**Dynamic Ram:** Is based on a technology called CMOS transistors. The data can be stored as charges on capacitors. These are used in main memory.

### Read Only Memory

It is a part of primary memory and it is also called non-volatile memory. The ROM can be used only for reading or fetching of data from it. When the power is switched –off, the data or program stored in ROM is not destroyed. Basic and important use of ROM is to store the Basic Input Output Software (BIOS). This program is very important as it is used by the operating system at the time of starting or booting the system.

### Secondary Memory or Auxiliary Memory

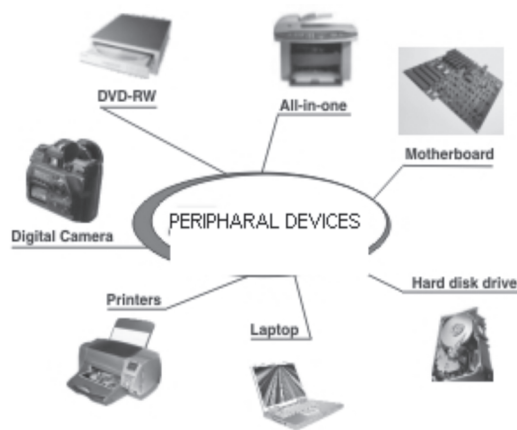
The auxiliary storage device or secondary memory is used to hold the output, data or program for future use. These memory devices are for long-term storage. The auxiliary devices are much larger in capacity than main memory but they are generally slower than main memory. Auxiliary storage data is first transferred to main memory and then CPU fetches the data from main memory. Magnetic tape, Magnetic Disk, CD-ROM, Floppy Disk are examples of auxiliary storage devices.



### Input-Output (or Peripheral Devices)

The processor takes the data from the real world, processes it according to a program and sends the result to the out-side environment (user).

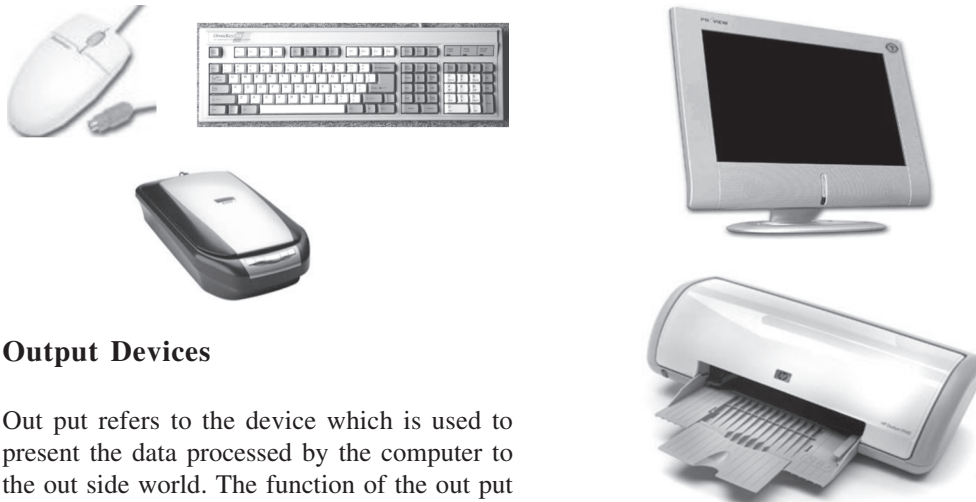
**Definition:** The communication between the processor and the outside world (user) is established through I/O devices only. These devices are also known as ‘Peripheral devices’.



### Input Devices

Input devices are used to enter the command, program, images as well as the devices, which are used to control various operations related to games and graphics etc. The component “Input Unit” refers to the devices, which convert the data or signals from outside / real world into the form of data, which is understood by the computer system. These are devices by which a programmer or computer operator interacts with the computer system. These devices allow the user to feed the data and program the computer to do specific task.

**Ex:** Mouse, Keyboard, Scanner, etc.



### Output Devices

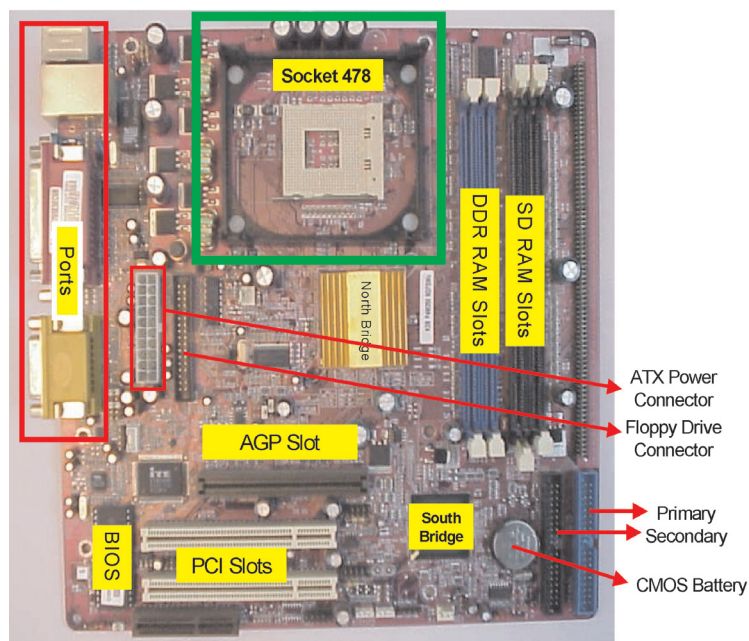
Output refers to the device which is used to present the data processed by the computer to the outside world. The function of the output unit is to store the processed information and use it as and when required by the user.

**Ex:** Monitor, Printer, etc.

Hardware components) can be installed. It manages all transactions of data between CPU and the peripherals. It houses the CPU and its second level cache, the chipset, the BIOS, main memory, I/O chips, ports for keyboard, serial I/O, parallel I/O, disks and plug-in cards. The top view of mother board is shown in the figure below.

### Mother Board

The major part of the PC Hardware is mother board, on which, the system components (i.e.

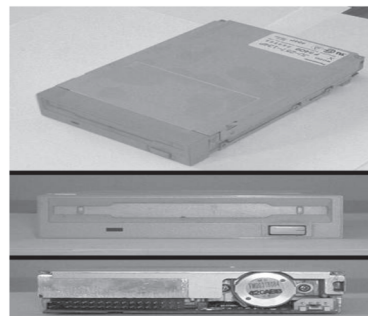




**Basic Components of a Computer****CD-ROM Drive**

CD-ROM (Compact Disc, read-only-memory) is an adaptation of the CD that is designed to store computer data in the form of text and graphics, as well as hi-fi stereo sound. The original data format standard was defined by Philips and Sony in the 1983 Yellow Book. Other standards are used in conjunction with it to define directory and file structures, including ISO 9660, HFS (Hierarchical File System, for Macintosh computers), and Hybrid HFS-ISO. Format of the CD-ROM is the same as for audio CDs: a standard CD is 120 mm (4.75 inches) in diameter and 1.2 mm (0.05 inches) thick and is composed of a polycarbonate plastic substrate (under layer - this is the main body of the disc), one or more thin reflective metal (usually aluminum) layers, and a lacquer coating. Today, CD-ROMs are standardized and will work in any standard CD-ROM drive. CD-ROM drives can also read audio compact discs for music, although CD players cannot read CD-ROM discs. CD-ROM Data Storage although the disc media and the drives of the CD and CD-ROM are, in principle, the same, there is a difference in the way data storage is organized. Two new sectors were defined, Mode 1 for storing computer data and Mode 2 for compressed audio or video/graphic data. Data encoding and Reading the CD-ROM, like other

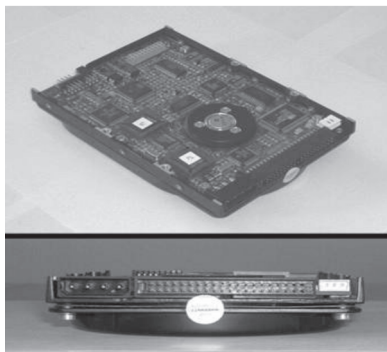
CD adaptations, has data encoded in a spiral track beginning at the center and ending at the outermost edge of the disc. The spiral track holds approximately 650 MB of data. That's about 5.5 billion bits. The distance between two rows of pits, measured from the center of one track to the center of the next track is referred to as track pitch. The track pitch can range from 1.5 to 1.7 microns, but in most cases is 1.6 microns. Constant Linear Velocity (CLV) is the principle by which data is read from a CD-ROM. This principal states that the read head must interact with the data track at a constant rate, whether it is accessing data from the inner or outermost portions of the disc. This is affected by varying the rotation speed of the disc, from 500 rpm at the center, to 200 rpm at the outside. In a music CD, data is read sequentially, so rotation speed is not an issue. The CD-ROM, on the other hand, must read in random patterns, which necessitates constantly shifting rotation speeds. Pauses in the read function are audible, and some of the faster drives can be quite noisy because of it.

**Floppy Disk Drive**



The Floppy Disk Drive (FDD) was invented at IBM by Alan Shugart in 1967. The first floppy drives used an 8-inch disk (later called a “diskette” as it got smaller), which evolved into the 5.25-inch disk that was used on the first IBM Personal Computer in August 1981. The 5.25-inch disk held 360 kilobytes compared to the 1.44 megabyte capacity of today’s 3.5-inch diskette. The 5.25-inch disks were dubbed “floppy” because the diskette packaging was a elastic plastic envelope unlike the rigid case used to hold today’s 3.5-inch diskettes. By the mid-1980s, the improved designs of the read/write heads, along with improvements in the magnetic recording media, led to the less-elastic, 3.5-inch, 1.44-megabyte (MB) capacity FDD in use today. For a few years, computers had both FDDs (3.5-inch and 5.25-inch). But by the mid-1990s, the 5.25-inch version had fallen out of popularity, partly because the diskette’s recording surface could easily become contaminated by fingerprints through the open access area.

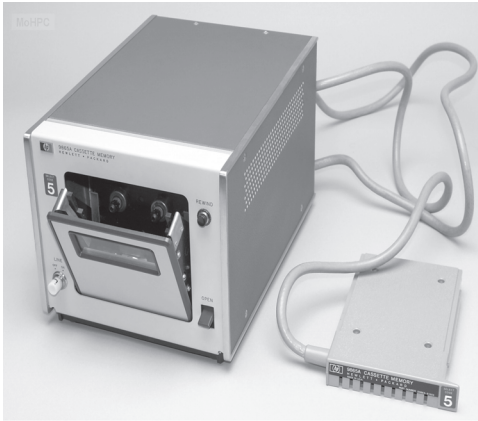
## Hard Disk Drive



A Hard Disk is often called a “disk drive,” “hard drive,” or “hard disk drive,” that store and provides relatively quick access to large amounts of data on an electromagnetically charged surface or set of surfaces. A hard disk is really a set of stacked “disks,” each of which, like phonograph records, has data recorded electromagnetically in concentric circles or “tracks” on the disk. A “head” (something like a phonograph arm but in a relatively fixed position) records (writes) or reads the information on the tracks. Two heads, one on each side of a disk, read or write the data as the disk spins. Each read or write operation requires that data be located, which is an operation called a “seek.” (Data already in a disk cache, however, will be located more quickly.) A hard disk/drive unit comes with a set rotation speed varying from 4500 to 7200 rpm. Disk access time is measured in milliseconds. Although the physical location can be identified with cylinder, track, and sector locations, these are actually mapped to a logical block address (LBA) that works with the larger address range on today’s hard disks. What is a Drive Letters? The hard drive is the primary device that a computer uses to store information. Most computers have one hard drive, located inside the computer case. If a computer has one hard drive, it is called drive C. If a computer has additional hard drives, they are called drives D, E, F, and so on.

## Tape Drive





Tape is for backup, pure and simple. It provides an inexpensive place to put your data just in case—some light-fingered freelancer decides to separate your PC from your desktop, in case the fire department hoses to death everything in your office that the fire and smoke failed to destroy, in case you think DEL \*.\* means “display all file names,” in case that nagging head cold turns out to be a virus that infects your PC and formats your hard disk, in case your next-door neighbor bewitches your PC and turns it into a golden chariot pulled by a silver charger that once was your mouse, in case an errant asteroid ambles through your roof. Having an extra copy of your important data helps you recover from such disasters and those that are even less likely. Computer tape drives work on the same principles as the cassette recorder in your stereo. Some are, in fact, cassette drives. All such drives use tape as an inexpensive medium for storing data. All modern tape systems put their tape into cartridges that you can lock safely away or send across the continent. And all are slower than you’d like and less reliable than you’d suspect. Nevertheless, tape remains the backup medium of choice for most people who choose to make backups.

## Bus



**Electronic Pathway :** The bus is the electronic pathway in a computer that carries information between devices.

**Bus Width :** The bus width is similar to the number of lanes on a highway. The greater the width, the more data can flow along the bus at a time. Bus width is measured in bits. Eight bits equals one character.

**Bus Speed :** The bus speed is similar to the speed limit on a highway. The higher the speed, the faster data travels along the bus. Bus speed is measured in megahertz (MHz), or millions of cycles per second.

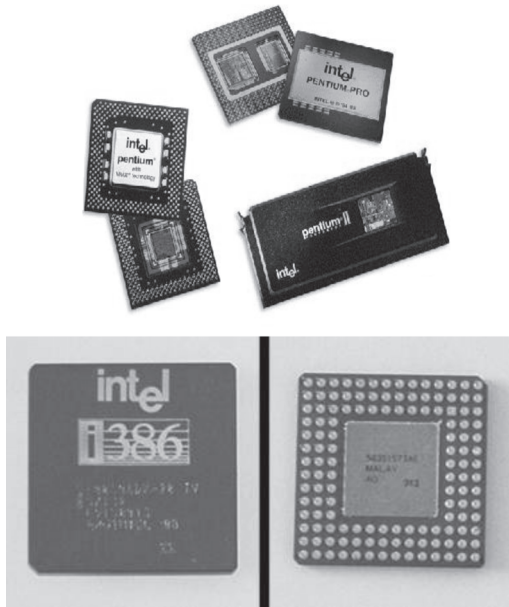
**Bus Type : ISA Bus :** The Industry Standard Architecture (ISA) bus is the slowest and oldest type of bus. This bus is often used for transferring information to and from a slow device, such as a modem. The ISA bus has a width of 16 bits and a speed of 8 MHz. The ISA bus is found in Pentium and Pentium II computers.

**PCI Bus :** The Peripheral Component Interconnect (PCI) bus is a sophisticated type of bus found in most new computers. This bus can handle many high-speed devices. The PCI bus can have a width of 32 or 64 bits and speeds of up to 100 MHz. The PCI bus supports Plug and Play, which lets you add new devices to a

computer without complex installation procedures. The PCI bus is found in Pentium III and Pentium 4 computers.

**AGP Bus :** An Accelerated Graphics Port (AGP) bus is specifically designed to carry complex graphics data between an AGP video card and your computer's main memory. The AGP bus has a width of 32 bits and a speed of 66 MHz. The AGP bus is found in Pentium III and Pentium 4 computers.

### CPU



The Central Processing Unit (CPU)/ Microprocessor is a computer processor on a microchip. It's sometimes called a logic chip. It is the “engine” that goes into motion when you turn your computer on. A microprocessor is designed to perform arithmetic and logic operations that make use of small number-holding areas called registers. When the computer is turned on, the microprocessor is designed to get

the first instruction from the Basic Input/Output System (BIOS) that comes with the computer as part of its memory. After that, either the BIOS, or the operating system that BIOS loads into computer memory, or an application program is “driving” the microprocessor, giving it instructions to perform.

### Cache memory



**Increase Speed :** Memory cache speeds up the computer by storing data the computer has recently used.

**Internal L1 Cache :** When the computer needs data, the computer first looks in the L1 cache. L1 cache is on the CPU chip and provides the fastest way for the computer to get data frequently used. L1 cache is also called as primary cache.

**Internal L2 Cache :** If the computer cannot find the data it needs in the L1 cache, the computer looks in the L2 cache. It is also called the secondary cache.

**RAM Memory :** If the computer cannot find the data it needs in the L1 or L2 cache, the computer

## 12 Part I: Personal Computer Hardware

---

must get the data from the slower main memory, called RAM. Each time the computer requests data from RAM, the computer places a copy of the data in the memory cache. This process constantly updates the memory cache so it always contains the most recently used data.

**Using Memory Cache :** Using memory cache is similar to working with documents in your office. For e.g. when you need information, you look for information in a specific order. Each step along the way takes up more of your valuable time.

- 1 Look through documents on your desk (L1 cache).
- 2 Look through documents in your desk drawer (L2 cache).
- 3 Look through documents in your filing cabinet (RAM).

### Digital Camera



A Digital Camera records and stores photographic images in digital form that can be fed to a computer as the impressions are recorded or stored in the camera for later loading into a computer. Programs, most digital cameras come with a program called an image editor. Image editors allow you to view and edit photos on your computer. The resolution of a digital camera determines the quality of photos the camera can produce. The higher the resolution, the clearer

and more detailed the photos. A digital camera with a resolution of 640 x 480 can produce photos suitable for viewing on a monitor. Digital cameras with a resolution of 1,152 x 864 or higher, called mega pixel cameras are best if you want to print good quality photos. Memory, store photos in memory until you transfer the photos to your computer. Most digital cameras have either built-in or removable memory.

### Joystick



A joystick helps you control the movement of objects in many computer games. Joysticks are used for arcade-type computer games because they let you move quickly and accurately in any direction.

### Keyboard





On most computers, a keyboard is the primary text input device. The most common keyboards are 101-key Enhanced keyboard, 104-key Windows keyboard, 82-key Apple standard keyboard and 108-key Apple Extended keyboard. A typical keyboard has four basic types of keys: Typing keys, Numeric keypad, Function keys and Control keys. The typing keys are the section of the keyboard that contains the letter keys, generally laid out in the same style that was common for typewriters, and this layout, known as QWERTY. The numeric keypad has keys laid in the same configuration as the most adding machines and calculators. In 1986, IBM extended the basic keyboard with the addition of function and control keys. The function keys, arranged in a line across the top of the keyboard, could be assigned specific commands by the current application or the operating system. Control keys provided cursor and screen control. Four keys arranged in an inverted T formation between the typing keys and numeric keypad allows the user to move the cursor on the display in small increments. The control keys allow the user to make large jumps in most applications. The Windows keyboard adds some extra control keys: two Windows or Start keys, and an Application key.

### Monitor



Monitor is a computer display and related parts packaged in a physical unit that is separate from other parts of the computer. In practice, the terms monitor and display are used interchangeably. A display is a computer output surface and projecting mechanism that shows text and often graphic images to the computer user, using a cathode ray tube (CRT), liquid crystal display (LCD), light-emitting diode, gas plasma, or other image projection technology. The display is usually considered to include the screen or projection surface and the device that produces the information on the screen. Most computer displays use analog signals as input to the display image creation mechanism. This requirement and the need to continually refresh the display image mean that the computer also needs a display or video adapter. The video adapter takes the digital data sent by application programs, stores it in video random access memory (video RAM), and converts it to analog data for the display scanning mechanism using a digital-to-analog converter (DAC).

### Mouse



A Mouse is a small device that a computer user pushes across a desk surface in order to point to a place on a display screen and to select one or more actions to take from that position. The mouse first became a widely-used computer tool when Apple Computer made it a standard part of the Apple Macintosh. Today, the mouse is an integral part of the Graphical User Interface (GUI) of any personal computer. The Computer is made more accessible, is by the mouse developed by Douglas C.Engelbart during his tenure at the Stanford Research Institute between 1957 and 1977. The user points at the menu selection by physically moving the pointing device, which causes a corresponding onscreen movement on the cursor. One or more buttons atop the device enables the user to indicate that he wants to select a menu item.

## **Printer**



Printer is a device that accepts text and graphic output from a computer and transfers the information to paper, usually to standard size sheets of paper. Printers are sometimes sold with computers, but more frequently are purchased separately. Printers vary in size, speed, sophistication, and cost. In general, more expensive printers are used for higher-resolution

color printing. PC printers can be distinguished as impact or non-impact printers. Early impact printers worked something like an automatic typewriter, with a key striking an inked impression on paper for each printed character. The dot-matrix printer was a popular low-cost personal computer printer. It's an impact printer that strikes the paper a line at a time. The best-known non-impact printers are the inkjet printer, of which several makes of low-cost color printers are an example, and the laser printer. The inkjet sprays ink from an ink cartridge at very close range to the paper as it rolls by. The laser printer uses a laser beam reflected from a mirror to attract ink (called toner) to selected paper areas as a sheet rolls over a drum. Printers are used to produce letters, invoices, newsletters, transparencies, labels, packing slips and much more

## **Ink-Jet Printer**



An ink-jet printer produces high-quality documents at a relatively low price. This type of printer is ideal for routine business and personal documents. An ink-jet printer has a print head that sprays ink through small holes onto a page.

**Speed :** Most ink-jet printers produce images at a speed of 0.5 to 4 pages per minute (ppm).

**Resolution :** The resolution, or quality, of the images produced by an ink-jet printer ranges from 180 to 720 dots per inch (dpi)

**Ink :** Ink-jet printers use ink stored in cartridges. When the ink runs out, you replace the cartridge.

**Paper :** Ink-jet printers accept 8 by 11-inch paper. Some ink-jet printers accept larger paper sizes. Ink-jet printers also accept envelopes, labels and transparencies.

**Color :** Color ink-jet printers are very popular because they are less expensive than color laser printers and still produce high-quality color images.

### **Laser Printer**



A laser printer is a high-speed printer that is ideal for business and personal documents and for proofing professional graphics work. A laser printer works like a photocopier to produce high-quality images on a page.

**Speed :** Most laser printers produce images at a speed of 4 to 20 pages per minute (ppm).

**Resolution :** The resolution of the images produced by a laser printer ranges from 300 to 1200 dots per inch (dpi).

**Paper :** All laser printers can print on 8 by 11-inch paper, envelopes, labels and transparencies.

**Ink :** Like photocopiers, laser printers use a fine powdered ink, called toner, which comes in a cartridge. When the toner runs out, you buy a new cartridge.

**Color :** You can buy laser printers that produce color images. A color laser printer is more expensive than a color ink jet printer, but it produces superior output.

**Memory :** Laser printers store pages in built-in memory before printing. A typical laser printer comes with 4 MB to 8 MB of memory.

**Printer Language :** A printer language is software that tells a printer how to print a document. There are two main types of laser printer languages- PCL and PostScript.

### **Scanner**



A Scanner is a device that reads graphics and text into a computer.

**Scan Graphics :** You can scan graphics such as photographs, drawings and logos into a computer. You can then use the graphics in documents, such as reports or newsletters. Most



scanners come with image editing software, which lets you change the appearance of a scanned graphic.

**Scan Text :** You can scan text to quickly enter documents into a computer. This lets you scan interesting paper documents and e-mail them to friends or colleagues. You can also scan office documents to store them on your computer for quick access. Most scanners come with Optical Character Recognition (OCR) software. This software places scanned text into a document that can be edited in a word processor. Scanners usually attach to your personal computer with a Small Computer System Interface (SCSI). An application such as PhotoShop uses the TWAIN program to read in the image. Some major manufacturers of scanners include: Epson, Hewlett-Packard, Microtek, and Relisys.

### **Touch Pad**



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. How the Touch Pad Works? The touch pad contains several layers of material. The top layer is the pad that you touch. Beneath it are layers (separated by very thin insulation) containing horizontal and vertical rows of electrodes that form a grid. Beneath these layers is a circuit board to which the electrode layers are connected. The layers with electrodes are charged with a constant alternating current (AC). As the finger approaches the electrode grid, the current is interrupted and the interruption is detected by the circuit board. The initial location where the finger touches the pad is registered so that subsequent finger movement will be related to that initial point. Some touch pads contain two special places where applied pressure corresponds to clicking a left or right mouse button. Other touch pads sense single or double taps of the finger at any point on the touch pad.

### **Trackball**



A Trackball is an upside-down mouse that remains stationary on your desk. You roll the ball with your fingers or palm to move the pointer on the screen. The user rolls the ball to direct the cursor to the desired place on the screen and can click one of two buttons (identical to mouse buttons) near the trackball to select desktop objects or position the cursor for text entry. A trackball is a great alternative to a mouse when you have limited desk space.

### Computer related terms:

In order to communicate with a computer to solve a problem needs a common code i.e., common language. A “language” which is used to instruct the computer is called “**machine language**”, which is understood by the processor. This machine language also called “**binary language**” is a sequence of zeros and ones, which is cumbersome to produce and understand.

Format of giving the instructions using the binary language is as follows:

Operation code	Operands
----------------	----------

Operation code (Op code) represents the operation to be performed on the operands in the second box in the above figure. Remembering the op codes (0's & 1's) is very difficult and hence, a language which is understood by us and later translated to the computer's language is the remedy for this. Also the fact that each processor has its own set of instructions further causes the problem of compatibility. The instruction written on one machine would not work on another machine. Only advantage which binary language possesses is that the CPU needs no translator.

A ‘**program**’ is a set of instructions which are stored in the memory as per German Mathematician von Neumann’s “**stored program**” concept and then used for execution. A program is written in a programming language

which adheres to a particular syntax. Programming languages are broadly categorized into three :

- Low level language  
§ Eg : Assembly language
- Middle level language  
§ Eg : C
- High level languageB  
§ Eg : BASIC, FORTRAN, PASCAL, COBOL

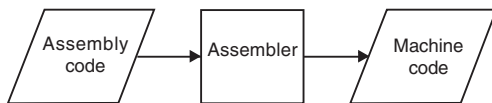
The **low level language** category is very near to machine language. Machine language can also be treated as low level. **Assembly language** uses short codes for op codes which are called the “mnemonics”. Eg: ADD, SUB, MPY, DIV, LOAD, STOR, etc. When the CPU encounters an assembly language code it would not be able to interpret the mnemonics. Hence, a translator used to translate the assembly language to machine language which is termed as an “**assembler**”.

**Middle level language** has the ability to bring together features of low level and high level languages. ‘C’ language with its flexibility to communicate with the hardware using the bit operators and exhibit the high level features is an apt example.

**High level language** uses an ordinary English like approach to represent the instructions and the instructions are translated into machine language either by a compiler or interpreter.

**Compiler** is a translating program that converts the entire high level instructions (source program) into machine usable code (object code). All the syntactical errors are reported after the compiler goes through the whole source code. Compiler is faster in executing the source code to produce the object code when compared to interpreter which is discussed next. C compiler is an example which executes the whole program and gives the object code.

**Interpreter** converts the source code into machine code by executing the instructions one by one (i.e., line by line of a program). Interpreter is best suited when a user wishes for debugging after every line. BASIC and LISP are the best examples which demonstrate the interpreter method of translation.



### Viva-voce questions

1. Define a computer?
2. Define hardware?
3. Define software?
4. What are the functional units of a computer?
5. What are the logical operations in a computer?
6. What are the arithmetical operations used in a computers?
7. What is the function of a register?
8. What are the different types of registers available in a computer?
9. Define memory?
10. RAM stands for?
11. ROM stands for?
12. What are the differences between volatile and non-volatile memory?
13. BIOS stands for?
14. Define peripheral device?
15. List some of the peripheral devices?
16. What is the use of a motherboard?
17. Define storage?
18. CLV stands for?
19. Define the bus?
20. What are the various types of buses used in a computer?
21. What is the function of cache memory?
22. Define binary language?
23. 1Byte is equal to how many bits?
24. Define bit?
25. Define Program?
26. What are the differences between compiler and interpreter?
27. Opcode stands for ?
28. What are the various types of programming languages?

\* \* \*