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COMPUTER FUNDAMENTALS

We find computers everywhere around us at home, in schools, hospitals, railway stations, airports, banks, and shopping malls and so on. Before we proceed with our study of computers, let us first of all define a computer.

A computer is an electronic machine that takes an input, processes it to produce the desired output. Every computer is a combination of hardware and software. The physical components of a computer that can be seen and touched form the hardware. For example, CPU, monitor, keyboard, printer etc., are hardware or peripheral devices. The input to a computer is given in the form of instructions. These set of instructions that we give to the computer to perform a particular task constitutes a program. Many such programs together form a software for the computer. Operating system, Antivirus, MS Office, Computer games are all software applications.



OBJECTIVES

After reading this lesson, you will be able to:

- learn the basic components of a computer along with their functions;
- differentiate input, output and storage devices;
- describe various memory accessing modes;
- explain different ports used to connect various components of a computer;
- classify computers.

1.1 WORKING OF A COMPUTER

To function properly, the computer needs both hardware and software. Hardware consists of the mechanical and electronic devices, which we can see and touch. The software consists of programs, the operating system and the data that reside in the memory and storage devices.



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The working of a computer can be well understood by the block diagram shown in Fig. 1.1.

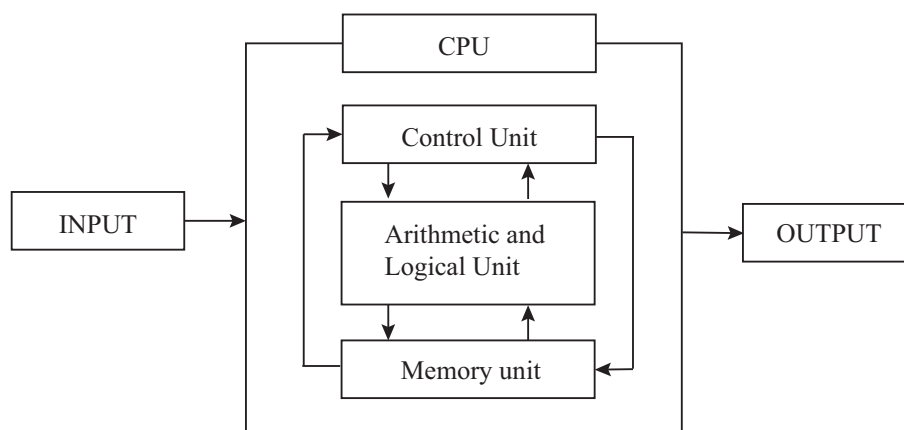


Fig. 1.1: Block diagram of a computer

The working of a computer can be broadly categorized into following four functions or steps.

- (i) Receive input – Accept data/information from user through various input devices like the keyboard, mouse, scanner, etc.
- (ii) Process information—Perform arithmetic or logical operations on data/information.
- (iii) Store information—Store the information in storage devices like hard disk, CD, pen drive etc.
- (iv) Produce output—Communicate information to the user through any of the available output devices like monitor, printer, etc.

The hardware components of the computer specialize in any one of these functions. Computer hardware falls into two categories: processing hardware and the peripheral devices. The processing hardware consists of the Central Processing Unit (CPU), and as its name implies, it is where the data processing is done. Peripheral devices allow people to interact with the CPU. Together, they make it possible to use the computer for a variety of tasks.

Now we shall discuss in detail about various components of a computer system.

1.2 COMPONENTS OF A COMPUTER

Computer has four main components

- Input Devices : These are the devices that are used to accept data and instructions from the user. Keyboard, mouse, scanner etc., are the examples of input devices.

- Central Processing Unit (CPU) : This is known as the ‘Brain of the Computer’ as it controls the complete working of the computer.
- Memory: The data and instructions are stored in this component of the computer. Hard disk, DVD, pen drive etc., are the examples of memory storage devices.
- Output Devices: These are the devices that are used to display the desired result or information. Monitor, printer etc., are the examples of output devices.

Let us now learn each of the components in detail.

1.3 INPUT DEVICES

An input device is used to get data or instructions from the user. This data is then passed on to CPU for processing so as to produce the desired result. Although keyboard and mouse are the two common input devices, other devices such as Optical Character Recognition (OCR), Magnetic Ink Character Recognition (MICR), and mark sense reader, etc., are also used as per our requirement.

Keyboard

The keyboard is very much like a standard typewriter with a few additional keys. Generally, we find a QWERTY keyboard with 104 keys on it. The additional keys may be included in modern multimedia keyboards.



Fig. 1.2: Keyboard

Mouse

The mouse is another very commonly used input device. It is basically a pointing device that controls the movement of the cursor or pointer on a display screen. It is a small object that you can roll along a hard and flat surface. As you move the mouse, the pointer on the display screen moves in the same direction. A mouse may contain one, two or three buttons which have different functions depending on what program is running.

Mouse is an electro-mechanical device. It is also called as pointing device.



Fig. 1.3: Mouse



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**Notes****Scanner**

Scanner is an input device that can read text or an illustration printed on paper and translates the information into a form that the computer can use. A scanner works by digitizing an image - dividing it into a grid of boxes and representing each box with either a zero or a one, depending on whether the box is filled in. The resulting matrix of bits, called a bit map, can then be stored in a file, displayed on a screen and manipulated by programs. Optical scanners do not distinguish text from illustrations; they represent all images as bit maps. Therefore, you cannot directly edit text that has been scanned. To edit text read by an optical scanner, you need an Optical Character Recognition (OCR) system to translate the image into ASCII characters.

**Fig. 1.4: Scanner****Optical Character Recognition (OCR)**

An Optical Character Recognition (OCR) is a device that is used for reading text from paper and translating the images into a form that the computer can understand. An OCR is used to convert books, magazines and other such printed information into digital form.

Magnetic Ink Character Recognition (MICR)

An MICR can identify characters printed with a special magnetic ink. This device particularly finds applications in banking industry. The cheques used for transactions have a unique MICR code that can be scanned by an MICR device.

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 for assessing the objective examinations involving multiple choice questions.

Bar Code Reader

A bar code reader is an input device that is generally seen in super markets, bookshops, libraries etc., A bar-code reader is a photoelectric scanner that reads the bar codes (vertical striped black and white marks), printed on product containers. The bar code reader scans the bar code of the product and checks the description and the latest price of the product.

Digitizing Tablet

This is an input device that enables you to enter drawings and sketches into a computer. A digitizing tablet consists of an electronic tablet and a cursor or pen. A cursor (also called a puck) is similar to a mouse, except that it has a window with cross hairs for pinpoint placement, and it can have as many as 16 buttons. A pen (also called a stylus) looks like a simple ballpoint pen but uses an electronic head instead of ink. The tablet contains electronic field that enables it to detect movement of the cursor or pen and translate the movements into digital signals that it sends to the computer. Digitizing tablets are also called digitizers, graphic tablets, touch tablets or simply tablets. Now-a-days most tablets allow you to simply use your finger to choose items or open or select apps by simply tapping them.

Light Pen

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

Speech input devices

Speech or voice input devices convert a person's speech into digital form. These input devices, when combined with appropriate software, form voice recognition systems. These systems enable users to operate microcomputers using voice commands.

1.4 CENTRAL PROCESSING UNIT (CPU)

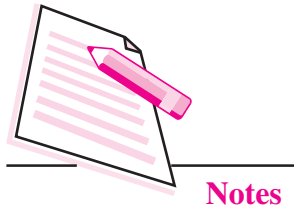
As mentioned earlier, CPU is the 'Brain of your computer'. This is because it processes or executes the instructions given to the computer. Any type of instruction given to the computer using any of the input devices has to be sent to the CPU for execution. In a microcomputer, the CPU is based on a single chip called the microprocessor.

A typical CPU has the following components:

- Control Unit (CU)
- Arithmetic Logic Unit (ALU)
- Memory Registers



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1.4.1 Control Unit (CU)

The Control unit manages the instructions given to the computer. It coordinates the activities of all the other units in the system by instructing rest of the components of the computer about how to carry out a program's instructions. It reads and interprets instructions from memory and transforms them in to series of signals to be executed or stored. It also directs the movement of these electronic signals between memory and ALU or between CPU and input/output devices. Hence it controls the transfer of data and information between various units. The user's program provides the basic control instructions. Conceptually, the control unit fetches instructions from the memory, decodes them and directs the various units to perform the specified functions.

1.4.2 Arithmetic Logic Unit (ALU)

Arithmetic Logic Unit or ALU performs two types of operations - arithmetic and logical. Arithmetic operations are the fundamental mathematical operations consisting of addition, subtraction, multiplication and shifting operations. Logical operations consist of boolean comparisons such as AND, OR and NOT.

1.4.3 Memory Registers

The CPU processes data and instruction with high speed. There is also movement of data between various units of the computer. It is necessary to transfer the processed data with high speed. So the computer uses a number of special memory units called registers. A memory register is a sort of special storage area that holds the data and instructions temporarily during processing. Since this is internally located in the CPU, the processing time is very less. They often hold data for less than a millisecond. This high speed storage area make processing more efficient.

To locate the characters of data or instructions in the main memory, the computer stores them in locations known as addresses. A unique number designates each address. Addresses can be compared to post office mailboxes. Their numbers remain the same, but contents continuously change.

The contents of the memory are held only temporarily, that is, it is stored only as long as the microcomputer is turned on. When you turn the machine off, the contents are lost. The capacity of the memory to hold data and program instructions varies in different computers. The original IBM PC could hold approximately several thousand characters of data or instructions only. But modern microcomputers can hold millions or even billions of characters in their memory.

How the CPU and Memory work together?

The working of the CPU and memory is shown in Fig. 1.5.

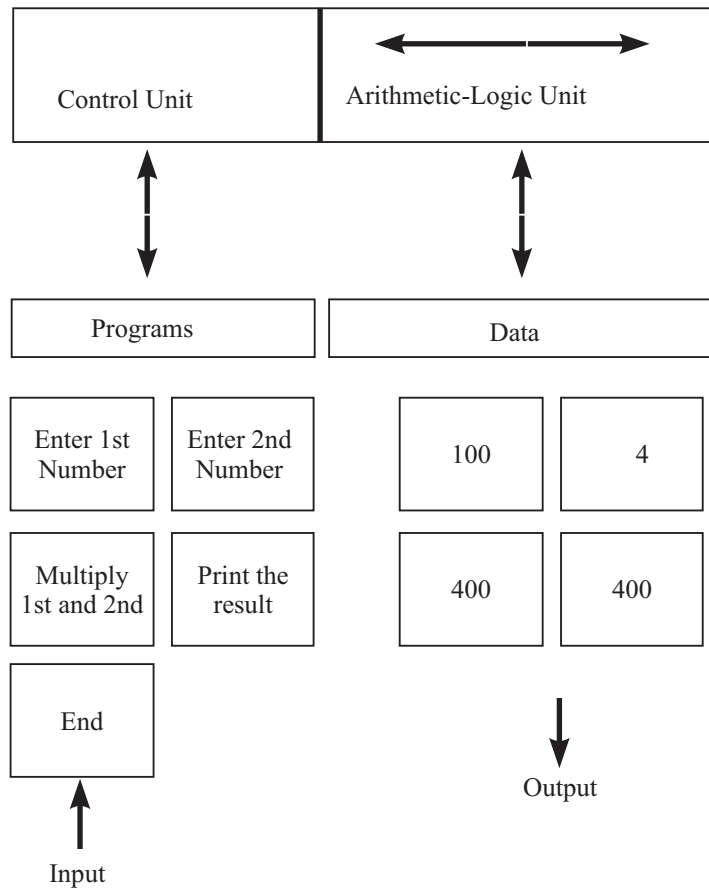


Fig. 1.5: Working of the CPU and Memory

Various steps involved for multiplying two numbers is shown in Fig. 1.5. Let us take an example and understand how CPU and memory work together to execute a given instruction. The control unit recognizes that the program has been loaded into the memory. It begins to execute the first step in the program.

1. The program tells the user, “Enter 1st Number”.
2. The user types the number 100 on the keyboard. An electronic signal is sent to the CPU.
3. The control unit recognizes this signal and routes the signal to an address in memory - say address 7.
4. After completing the above instruction, the next instruction tells the user, “Enter 2nd Number.”
5. The user types the number 4 on the keyboard. An electronic signal is sent to the CPU.



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6. The control unit recognizes this signal and routes it to memory address 8.
7. The next program instruction is executed - “Multiply 1st and 2nd Numbers”.
8. To execute this instruction, the control unit informs the ALU that two numbers are coming and the ALU has to multiply them. The control unit next sends to the ALU a copy of the contents of address 7 (100) and address 8(4).
9. ALU performs the multiplication: $100 \times 4 = 400$
10. The control unit sends a copy of the multiplied result (400:) back to memory to store it in address 9.
11. The next program instruction is executed: “Print the Result.”
12. To execute this instruction, the control unit sends the contents of the address 9 (400) to the monitor.
13. Monitor displays the value 400.
14. Final instruction is executed: “End”. The program is end.

Please note that Fig. 1.5 is a simplified version of the actual processing activity. The actual working of the CPU and memory is much more complicated. For example, there are actually many more memory addresses - thousands to millions that cannot be shown here. Moreover, the addresses are in a form that the computer can interpret. The data and instructions are stored in the computer in the form of 0s and 1s only.

1.5 OUTPUT DEVICES

Output devices receive information from the CPU and present it to the user in the desired form. Some of the output devices are monitor, printers, plotters, etc. Let us now learn each of them in detail.

1.5.1 Monitor

The monitor is just like a television screen and it is used to display data and information. When some data or instruction is being keyed in, the monitor displays the characters being typed. The monitors are available in various sizes. They may also differ for different types of computers. The standard size is 24 lines by 80 characters. The output displayed on the monitor is called soft copy.

Monitor is also called as Visual Display Unit

There are two types of monitors – CRT and TFT-LCD monitors.

CRT Monitor : CRT (Cathode Ray Tube) monitor is a relatively older type of monitor. It is rarely being used today. These were bigger and bulkier monitors and hence took lot of desk space. They also consumed lot of electricity.

TFT-LCD monitors: TFT stands for Thin Film Transistor and LCD stands for Liquid Crystal Display. These monitors are lighter and occupy less space. They are also commonly referred to as flat screen displays and consume much less electricity than CRT monitors. Now-a-days even LED (Light Emitting Diode) monitors are being used.



Fig. 1.6: monitor

1.5.2 Printer

You must have used printer for taking printouts. Printer is a device that produces the output on paper. Such an output is also known as hard copy and it may be in the form of text or graphics. There are many different types of printers. These printers vary in terms of size, speed and quality of output. Some of them are discussed below:

- (i) **Dot Matrix Printer :** It is a type of printer that uses a print head to print characters on paper. The print head moves in back and forth or up and down motion on the page. The print head strikes on an ink soaked cloth ribbon that is laid against a paper. The characters formed from dots are thus printed on the paper.
- (ii) **Ink-jet Printer:** Ink-jet printers work by spraying ionized ink on a sheet of paper. Magnetized plates in the ink's path direct the ink onto the paper in the desired shapes. Ink-jet printers are capable of producing a better print than the dot matrix printers. A typical ink-jet printer provides a resolution of 300 dots per inch, although some newer models offer higher resolutions. These are also known as **Line printers** as the output is produced line by line.

In general, the price of ink-jet printers is lower than that of laser printers. However, they are also considerably slower. Another drawback of ink-jet printers is that they require a special type of ink that is apt to smudge on inexpensive



Fig. 1.7: Ink-jet printer



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copier paper. Since ink-jet printers require smaller mechanical parts than laser printers, they are especially popular as portable printers. In addition, colour ink-jet printers provide an inexpensive way to print full-colour documents.

- (iii) **Laser Printer:** It works on the principle of a photocopier. It utilizes a laser beam to produce an image on a drum. The light of the laser alters the electrical charge on the drum wherever it hits. The drum is then rolled through a reservoir of toner, which is picked up by the charged portions of the drum. Finally, the toner is transferred to the paper through a combination of heat and pressure.

Since the entire page is transmitted to a drum before the toner is applied, laser printers are sometimes called page printers. In addition to text, laser printers are very adept at printing graphics. However, you need significant amounts of memory in the printer to print high-resolution graphics.

The speed of laser printers ranges from about 4 to 20 pages of text per minute (ppm). A typical rate of 6 ppm is equivalent to about 40 characters per second (cps).

- (iv) **Thermal printer:** Thermal printers are printers that produce images by pushing electrically heated pins against special heat-sensitive paper. Thermal printers are inexpensive and are used in most calculators and many fax machines. They produce low-quality print, and the paper tends to curl and fade after a few weeks or months.

1.5.3 Plotter

A Plotter is a device that is used to draw charts, graphs, maps etc., with two or more automated pens. Multi-colour plotters use different-coloured pens to produce a multi-coloured output.



Fig. 1.8: Plotter

Different types of plotters are available in the market. A drum plotter has a paper wrapped around a moving drum and the pens move on the paper to print the output. A flatbed plotter has a flat surface on which the paper is placed and the pens move to draw the output. An electrostatic plotter has a negatively charged paper on which the drawing is made using a positively charged toner.

Plotters are considerably more expensive than printers. These were the first of the devices that could print full sized engineering drawings with colour. They are frequently used for Computer Aided Engineering (CAE) applications such as Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM).



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1.5.4 Speakers

The speakers are used to produce audio output. The computers have sound cards that enable the computer to produce audio output through the speakers.



Fig. 1.9: Sound Card and Speakers

Now-a-days, 3D audio is a technique for giving more depth to traditional stereo sound. Typically 3D sound or 3D audio is produced by placing a device in a room with stereo speakers. The device dynamically analyses the sound coming from the speakers and sends feedback to the sound system so that it can read just the sound to give the impression that the speakers are further apart. 3D audio devices are particularly popular for improving computer audio where the speakers tend to be small and close together. There are a number of 3D audio devices that can be attached to a computer's sound card.



INTEXT QUESTIONS 1.1

Fill in the blanks:

- The four basic functions performed by the computer are,,,
- A bar code reader is a / an device.

**Notes**

3. Choose the correct answer:
- (a) Arithmetic and logical operations is performed by unit.
(i) ALU (ii) Editor (iii) storage (iv) output
- (b) The ALU and CU are jointly known as
(i) RAM (ii) ROM (iii) CPU (iv) none of the above
- (c) The process of producing results from the data for getting useful information is called as
(i) output (ii) input (iii) processing (iv) storage

1.6 MEMORY UNIT

There are two kinds of computer memory: primary and secondary. Primary memory is accessible directly by the Central Processing Unit. RAM is an example of primary memory. You will know more about RAM later in this lesson. As soon as the computer is switched off, the primary memory loses its contents. But data can be stored and retrieved at much faster rate with primary memory as compared to secondary memory. Examples of secondary memory storage devices are floppy disk, magnetic disk, hard disk, CD, pen drive etc. The secondary memory devices may be inside or located outside the computer. Primary memory is more expensive than secondary memory.

When the computer is doing any task, the data that have to be processed are stored in the primary memory. This data may come from an input device like keyboard or from a secondary storage device like a hard disk. As program or the set of instructions is kept in primary memory, the computer is able to follow them instantly. For example, when you book ticket from railway reservation counter, the computer has to follow some steps, viz., take the request, check the availability of seats, calculate fare, wait for money to be paid, save the reservation and print the ticket. The program containing these steps is kept in primary memory of the computer.

But inside the computer, the steps followed are quite different from what we see on the monitor or screen. In computer's memory both programs and data are stored in the binary form. You have already been introduced with decimal number system that is the numbers 0 to 9. The binary system has only two digits, 0 and 1. These are called bits. A bit is an acronym for binary digit, which stands for one binary piece of information. As human beings we all understand decimal system but the computer can only understand binary system. Consider that a computer consists of numerous switches. If a switch is ON then it is considered as 1 otherwise it is considered as 0. A number of switches in different states will give you a message like this: 110101.....10. So the computer takes input in the form of 0 and 1 and gives output in the same form, i.e., 0 and 1 only. But we do not receive

output in the form of 0's & 1's only. This is because every number stored in binary form can be converted to decimal system and vice versa. For example, 1010 in binary is equivalent to 10 in decimal. Therefore, it is the computer that takes information or data in decimal form from you, converts it into binary form, processes it, produces output in binary form and finally again converts the output to decimal form.

Measuring Memory

The primary or internal storage unit is made up of several small storage locations called cells. Each of these cells can store a fixed number of bits called word length. Each cell has a unique number assigned to it called the address of the cell and it is used to identify the cells. Hence we can say that memory is like a large cabinet containing as many drawers as there are addresses on memory. Each drawer contains a word and the address is written on outside of the drawer.

You know that data in computer is stored in the form of 0s and 1s. Each of these digits is known as a bit. A collection of 8 bits constitutes a byte. Each cell of memory contains one character or 1 byte of data. So the capacity is defined in terms of bytes or words. However higher units of memory are Kilobytes, Megabytes, Gigabytes etc. 1 Kilobyte is equal to 1024 bytes. Thus 64 Kilobyte (KB) memory is capable of storing $64 \times 1024 = 32,768$ bytes. Other units of memory are listed in the table below:

(KB) Kilobyte	$2^{10} = 1024$ bytes
(MB) Megabyte	$2^{20} = 1024$ KB
(GB) Gigabyte	$2^{30} = 1024$ MB
(TB) Terabyte	$2^{40} = 1024$ GB

1.6.1 Primary Memory

Primary memory is the memory that is accessed by the processor directly. It is also known as main memory or internal memory. It helps in executing applications that are temporarily stored in a specific memory location. Primary memory is of two types – RAM and ROM.

Random Access Memory (RAM)

Random Access Memory (RAM) is the type of memory in which it is possible to randomly select and use any location of the memory directly to store and retrieve data. It is also called as read/write memory. Since it is volatile, the data from RAM is lost as soon as the power to the computer is switched off.



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Read Only Memory (ROM)

This is another type of primary memory from which data can only be read. We cannot write or modify data once written on to the ROM. Also this type of primary memory is not volatile. The storage of program and data in the ROM is permanent. The ROM stores some standard processing programs supplied by the manufacturers to operate our computer. The Basic Input Output System (BIOS) is stored in the ROM. It examines and initializes the start up process of the computer and also checks various peripheral devices attached to the PC when the computer is turned ON. The various types of ROMs are discussed below:

- **Programmable Read Only Memory (PROM):** You know that it is not possible to modify or erase programs stored in ROM, but it is possible for you to store your program in PROM chip. Once the programs are written it cannot be changed. Also the program is not lost even if power is switched off.
- **Erasable Programmable Read Only Memory (EPROM) :** This type of ROM overcomes the problem of PROM and ROM. EPROM chip can be programmed time and again by erasing the information stored earlier in it. Information stored in EPROM can be erased by exposing it to ultraviolet light. This memory can be reprogrammed using a special programming facility. When the EPROM is in use, information can only be read.
- **Electrically Erasable Programmable Read Only Memory (EEPROM):** This type of ROM is somewhat similar to EPROM. The only difference is that unlike EPROM, electrical signals are used to erase the contents of EEPROM. Also, this type of ROM need not be completely erased. Partial modification of ROM is possible.

1.6.2 Cache Memory

The speed of CPU is extremely high as compared to the access time of main memory. Therefore, the performance of CPU decreases due to the slow speed of main memory. To increase the performance of CPU, a small memory chip is attached between CPU and main memory whose access time is very close to the processing speed of CPU. This memory is called as Cache memory. Cache memories are accessed much faster than conventional RAM. It is used to store programs or data currently being executed or data that is being frequently used by the CPU. Fast access of these data and instructions increases the overall execution speed of the software. It is very expensive memory and so has to be used in a limited amount.

Cache memory is also known as CPU memory. It is either integrated directly with the CPU chip or is placed separately on the motherboard. As the microprocessor processes data, it first looks in the cache memory. If the required data or instructions are found there, it does not have to spend more time in reading data

from other storage devices that have slower access time. Hence the processing speed increases.

1.6.3 Secondary Memory

You are now clear that the operating speed of primary memory or main memory should be as fast as possible so as to cope up with the CPU speed. These high-speed storage devices are very expensive and hence the cost per bit of storage is also very high. Again, the storage capacity of the main memory is also very limited. Often it is necessary to store hundreds of millions of bytes of data for the CPU to process. Therefore, additional memory is required in all the computer systems. This memory is called auxiliary memory or secondary storage.

In this type of memory the cost per bit of storage is low. However, the operating speed is slower than that of the primary memory. Huge volume of data are stored here on permanent basis and transferred to the primary storage as and when required. Most widely used secondary storage devices are hard disks, CDs, DVDs and pen drives. But before learning about these modern storage devices let us also have a look at some primitive storage devices like magnetic tapes, magnetic drums and floppy disks.

Magnetic Tape

Magnetic tapes are used for large computers like mainframe computers where large volume of data is stored for a longer time. Earlier these were used with PCs also. The cost of storing data in tapes is inexpensive. Tapes consist of magnetic materials that store data permanently. It can be 12.5 mm to 25 mm wide plastic film-type and 500 meter to 1200 meter long which is coated with magnetic material. The deck is connected to the central processor and information is fed into or read from the tape through the processor. It is similar to a cassette tape recorder.

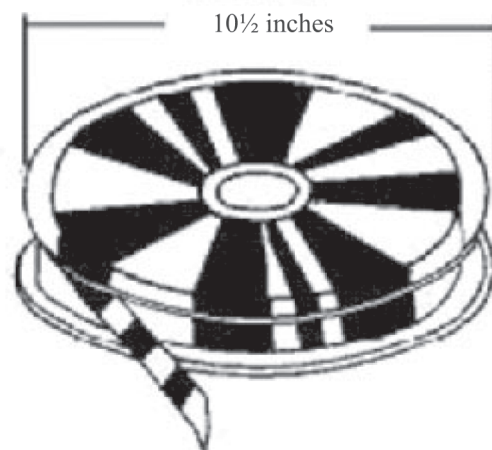
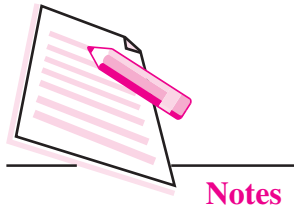


Fig. 1.10: Magnetic Tape



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Magnetic Disk

You might have seen the gramophone record, which is circular like a disk and coated with magnetic material. Magnetic disks used in computer are also made on the same principle. It rotates with very high speed inside the disk drive. Data are stored on both the surfaces of the disk. Magnetic disks are most popular for direct access storage. Each disk consists of a number of invisible concentric circles called tracks. Information is recorded on tracks of a disk surface in the form of tiny magnetic spots. The presence of a magnetic spot represents one bit (1) and its absence represents zero bit (0). The information stored in a disk can be read many times without affecting the stored data. So the reading operation is non-destructive. But if you want to write a new data, then the existing data is erased from the disk and new data is recorded.

Floppy Disk

It is similar to magnetic disk discussed above. It is 3.5 inch in diameter. The capacity of a 3.5 inch floppy is 1.44 mega bytes. It is cheaper than any other storage devices and is portable. The floppy is a low cost device particularly suitable for personal computer system.

Floppy disks have been made obsolete because the storage space was very small in floppy disks in comparison to other storage devices.



Fig. 1.11: Floppy Diskette

Hard Disk

A hard disk is the most commonly used secondary storage device. Although generally it is fixed inside the CPU cabinet but still external hard disks are also available. It can store huge amount of data and also provides relatively quick access to data stored on it.

A hard disk is a set of numerous disks stacked one above the other with a cylindrical spindle in-between (Fig. 1.12). The data is recorded electromagnetically in the form of concentric circles called tracks. The tracks are further divided into blocks as shown in the figure. In the hard disk drive, there is a Read/Write head mounted on the arm placed next to the stacked disks. This head moves horizontally and vertically to read or write data on the disks.

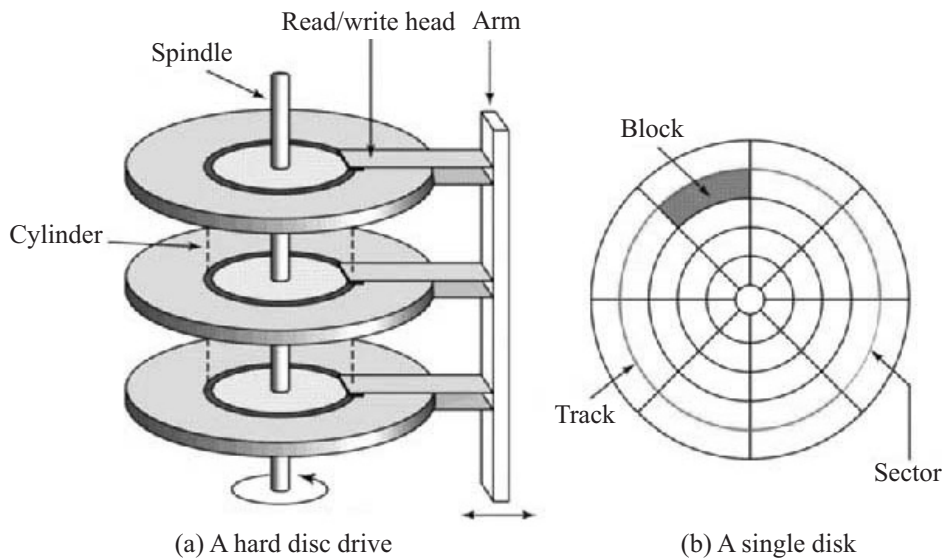


Fig. 1.12: Hard disk

Optical Disk

With every application and software there is greater demand for memory capacity. It is the necessity to store large volume of data that has led to the development of optical disk storage medium. Optical disks can be divided into the following categories.

- **Compact Disk - Read Only Memory (CD-ROM):** CD-ROMs are made of reflective metals. A CD-ROM is written during the process of manufacturing by high power laser beam. Here the storage density is very high, storage cost is very low and access time is relatively fast. Each disk is approximately 4 ½ inches in diameter and can hold over 600 MB of data. As the CD-ROM can be read only we cannot write or make changes into the data contained in it.
- **Compact Disk - Recordable (CD-R) :** These CDs can be used to write data on to them provided your computer has a CD writer. The CD writer uses a special laser light to write data on to a blank CD. Once the CD-R has been burnt, i.e. data has been written on it, it cannot be modified. The information can be added to it but the parts that have been burnt cannot be edited.
- **Compact Disk – Read/Write (CD- R/W):** This type of CD can be used for both reading and writing. Also these can be written and erased again and again.
- **Digital Versatile Disk (DVD) :** A DVD is an optical storage disk with much larger storage capacity than that of CDs. A single sided DVD can store upto 4.7 GB of data. Due to its high storage capacity, DVDs are generally used to store movies and other audio video files.



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Flash Memories

Flash memory is a memory chip that is used for storage and also for transferring of data between a computer and digital device. A flash memory is one that retains data in spite of the electricity supply being switched off. Hence it is a non-volatile memory. It evolved from EPROM and EEPROM but more often it is said to be a distinct type of EEPROM which is programmed and erased in blocks. That means devices using flash memories erase data at the block level. A block of flash memory chip must be erased before data is written on it.

Flash memory is widely used for storage in consumer devices like mobile phones, USB flash drives, tablet computers, digital cameras and other solid state drives. It is the least expensive form of semiconductor memory. It is non-volatile and consumes very less power. That is why its use is increasing day by day, especially for in-memory devices to help speed up performance and at the same time increase the scalability of the devices. The data in flash memory can be erased, modified and rewritten many times. It does not require batteries for solid state storage. It has very fast access time and also has higher resistance to kinetic shock as compared to hard disk drive. It is extremely durable and can withstand extreme pressure and temperature.

The **memory card** that you find in your digital cameras and mobile phones is also a type of flash memory. A variety of such cards are available in the market. Some of the varieties are Secure Digital Card (SD Card), Memory stick, Multimedia Card (MMC) etc. The price of these cards depends on their size and their storage capacities.

Another form of flash memory or solid state memory is a **pen drive**. A pen drive is a small portable secondary storage device (somewhat shaped like a pen) that connects to a computer through a USB port. It functions as a portable hard drive and is small enough to be carried easily. These are also known as thumb drives.



INTEXT QUESTIONS 1.2

1. Fill in the blanks.
 - (a) 1 KB = bytes.
 - (b) Primary memory is of two types : and
 - (c) To increase the performance of CPU, a small memory chip is attached between CPU and main memory whose access time is very close to the processing speed of CPU. This memory is called memory.
 - (d) A hard disk is the most commonly used storage device.

2. State whether the following statements are true or false:
- There are two kinds of computer memory: primary and secondary.
 - The computer can understand decimal system also.
 - The storage of program and data in the RAM is permanent.
 - PROM is secondary memory.
 - The memories which do not lose their content on failure of power supply are known as non-volatile memories.



Notes

1.7 MEMORY ACCESSING MODES

An addressing mode refers to the manner in which a given memory location is accessed. Some of the memory accessing modes are discussed below:

1.7.1 Direct Access or Random Access

It is the type of accessing mode in which the value to be stored in a particular memory location is obtained directly. Since the data can be accessed in any order that is why this type of memory access is also known as random access of memory. This type of memory access is generally fast and more flexible. The type to be stored in memory is obtained directly by retrieving it from another memory location. This type of memory access is based on the principle that any piece of data can be returned in a constant time, regardless of its physical location and previous access. The web uses direct memory access mode.

1.7.2 Sequential Access memory

It is the type of memory in which the stored data is read in sequence. That means if you want to display the fourth record, the reading will start from the first record and then move to second, third and then fourth record. This type of memory access can be time consuming and hence slow, especially when the data to be read is towards the end. Sequential access devices are generally a form of magnetic storage. Hard disks, CD-ROMs and magnetic tapes use sequential access of memory.

The Fig 1.13 illustrates the concept of random and sequential memory access.

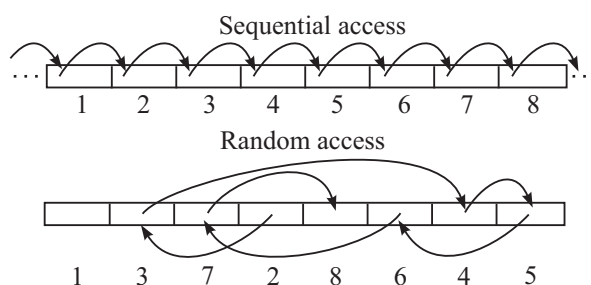


Fig. 1.13: Sequential and Random Memory Access

**Notes**

1.8 SYSTEM SECURITY AND DATA SECURITY

Securing your computer and also the data stored on your computer is the worldwide concern today. Securing stored data involves preventing unauthorized people from accessing it. It also includes preventing accidental or even intentional destruction or modification of data. Hence data security involves digital privacy measures that are applied to prevent any sort of unauthorized access to computers, databases or even websites.

There are various data security measures that are prevalent nowadays. These include software/hardware disk encryption, backups, data masking, scrambling etc.

1.9 PORTS

Ports are the connecting points on the CPU. Monitor, keyboard, printer and other peripheral devices are connected to the computer through ports. Some of the ports are discussed below:

Serial Ports

A serial port transfers data one bit at a time. It is a single wire that transmits 8 bits of data. Also a start byte has to be transmitted before each byte of data and a stop bit has to be sent after the byte. Serial ports are also known as COM ports or RS232C ports and come in the form of 9 pin or 25 pin male connector. A mouse is connected to the CPU through a serial port.

Parallel Port

A parallel port sends or receives 8 bits (1 byte) at a time. These 8 bits are transmitted in parallel to each other. These ports come in the form of 25-pin female connector and are generally used to connect devices like printer, scanner, external hard disk drive etc.

USB Port

USB stands for Universal Serial Bus. It is becoming popular day by day and is used to connect variety of devices like printers, scanners, mouse, keyboard, speakers etc. It is a simple and an easy to use port.

InfraRed Port

This port sends and receives a ray of light of infrared frequency from one device to another. These types of ports are used for wireless data transmission. This is the same technology that is used for TV remotes and in case of computers, it is used in devices like wireless keyboard and wireless mouse.

Bluetooth

A Bluetooth is a telecommunication industry specification that is used to connect mobile phones, computers and other such devices to connect to each other using short range wireless connection. The maximum range of Bluetooth communication is 10 meters.

1.10 CLASSIFICATION OF COMPUTERS

The computers can be classified according to their shapes and sizes and also according to the technology being used. Do you know the different types of computers available in the market today?

Broadly, computers can be of three types:

- **Analog Computers:** These computers work with continuous and physical quantities like temperature, voltage, current, weight etc. These are not as accurate as digital computers. They are used in engineering and scientific applications. For example, a blood pressure monitoring machine is a type of analog computer.
- **Digital Computers:** These computers work with discrete quantities. The data is converted into binary form i.e., 0s and 1s. These are much faster than the analog computers and are also far more accurate. We use digital computers for scientific and business applications. Digitally programmed watches are good examples of digital computers.
- **Hybrid Computers:** These types of computers use both analog and digital technology. Some calculations may take place in analog manner while others may be in digital form. These are used in weather forecasting.

1.10.1 Types of Digital Computers

Digital computers can be further classified as follows:

(i) MicroComputers

A microcomputer is a computer that contains a microprocessor chip inside it. These are mainly used in offices, homes, schools, shops etc. These microcomputers can be further categorized as :

- a. *Mobile Computers:* These computers can be held in hand and used for variety of purposes. Although they have limited capabilities as compared to other micro-computers, yet they are being used extensively, these days because of excellent features contained in them. An excellent example of this type of microcomputer is a smartphone. In addition to communicating with people, a smartphone has an internet connection



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so that we use various web services like email, chat, video chat, GPS, online games etc. Smartphones generally have a touch screen interface.

- b. *Portable Personal Computers*: This category of microcomputers includes laptops, notebooks, tablets etc. These are larger in size than mobile computers but can be easily carried from one place to another.
- c. *Desktop PCs*: These computers are installed on a table or desk. These are large and heavy computers. So they are not portable. These are generally used in places where the user has to work sitting at one place only like offices, shops, hospitals, ticket booking counters etc.

(ii) Minicomputers

Minicomputers provide faster operating speeds and larger storage capacity than microcomputers. These serve as servers in multiuser environments. These computer can support large number of high speed input/output devices and also many users can simultaneously work on these systems. Small business organizations having about 50-100 users use minicomputers as their servers.

(iii) Mainframe Computers

Mainframe computers or simply mainframes are the second largest in terms of the capacity and size of computers. Mainframes are huge and very expensive computers but can support hundreds of users at a time. These multi-processor systems have very large storage capacity and so can handle huge volumes of data and information. These are used in large organizations like railways where centralized data for the entire railway reservation system is maintained.

(iv) Supercomputers

Supercomputers are the most powerful computers in the world. In a supercomputer many processors work simultaneously, so they have very high processing speed. They can process huge volume data and information with ultrafast calculations. Supercomputers are used in specialized applications like weather forecast, space research, molecular modeling etc.



INTEXT QUESTIONS 1.3

Fill in the blanks:

1. USB stands for
2. The maximum range of bluetooth communication is meters.
3. Digital computers can be classified as,, and



WHAT YOU HAVE LEARNT

- Computer is an electronic machine that takes an input, processes it to produce the desired output.
- Hardware consists of the mechanical and electronic devices, which we can see and touch.
- The software consists of programs, the operating system and the data that reside in the memory and storage devices.
- Computer has four main components namely input devices, output devices, memory, CPU.
- An input device is used to get data or instructions from the user.
- Central Processing Unit is the brain of computer.
- Output devices receive information from the CPU and present it to the user in the desired form.
- There are two kinds of computer memory: primary and secondary.
- Direct access memory is the type of accessing mode in which the value to be stored in a particular memory location is obtained directly.
- Sequential access memory is the type of memory in which the stored data is read in sequence.



TERMINAL EXERCISE

1. What are the major components of a computer?
2. What is CPU and how does it work? Explain briefly.
3. What is a plotter and how does it work?
4. Describe the various types of printers briefly.
5. Differentiate between the following:
 - (a) RAM and ROM
 - (b) Volatile and non-volatile memory.
 - (c) Sequential access and Random access
6. Explain different types of ports.



Notes



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ANSWERS TO INTEXT QUESTIONS

1.1

1. receive input
process information
produce output
store information for future use
2. input
3. (a) ALU (b) CPU (c) processing

1.2

1. (a) 1024
(b) RAM, ROM
(c) cache
(d) secondary
2. (a) True (b) False (c) False
(d) False (e) True

1.3

1. Universal Serial Bus
2. 10
3. Microcomputers, minicomputers, mainframe computers, supercomputers.