1
Anatomy of a Digital Computer

1.1   Introduction

We should keep in mind that a computer is a programmable machine. The two main characteristics of a computer are: (i) it responds to a specific set of instructions in a well-defined manner. (ii) It can execute a pre-recorded list of instructions (a program). Modern computers are electronic and digital. The actual machinery - wires, transistors and circuits is called hardware; the instructions and data are called software. All general purpose computers require the following hardware components:

(i)   Central Processing Unit (CPU): The 'brain' of the computer, the component that actually executes instructions.

(ii)   Memory : It enables a computer to store, at least temporarily, data and programs.

(iii)   Input device : Usually a keyboard or mouse is used to read data and programs into the computer.

(iv)   Output device: A display screen, printer, etc. that lets you see what the computer has accomplished.

(v)   Mass storage device: It allows a computer to permanently store large amounts of data. Common mass storage devices include disk drive and tape drive.

In addition to these components, many others make it possible for the basic components of a computer to work together efficiently.

1.2 Objectives

After going through this lesson, you will be in a position to:

- identify the basic components of a computer and their working

- explain the importance of various units of a computer

- learn how these units work together to accomplish a given job

1.3 Functions and Components 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.

A computer does mainly the following four functions:

- Receive input —Accept data/information from outside through various input devices like the keyboard, mouse, scanner, etc.

- Process information—Perform arithmetic or logical operations on data/ information.

- Produce output—Communicate information to the outside world through output devices like monitor, printer, etc.

- Store information—Store the information in storage devices like hard disk, floppy disks, CD, etc.

These four basic functions are responsible for everything that computers do. 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, 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. Various parts of the computer have been shown in Fig. 1.1

Fig. 1.1 Various Parts of a Computer

Central Processing Unit (CPU)

This part of the computer that executes program instructions is known as the processor or Central Processing Unit (CPU). In a microcomputer, the CPU is based on a single electronic component, the microprocessor chip, within the system unit or system cabinet. The system unit also includes circuit boards, memory chips, ports and other components. A microcomputer's system cabinet will also house disk drives, hard disks, etc., but these are considered separate from the CPU.

The CPU has two parts —The Control Unit (CU) and the Arithmetic Logic Unit (ALU). In a microcomputer, both are on a single microprocessor chip.

Control Unit (CU)

The control unit tells the rest of the computer system how to carry out a program's instructions. It directs the movement of electronic signals between memory - which temporarily holds data, instructions and processes information - and the ALU. It also directs these control signals between the CPU and input/output devices.

Arithmetic - Logic Unit (ALU)

Arithmetic Logic Unit, usually called the ALU, performs two types of operations - arithmetical and logical. Arithmetical operations are the fundamental

mathematical operations consisting of addition, subtraction, multiplication and division. Logical operations consist of comparisons. That is two pieces of data are compared to see whether one is equal to, less than, or greater than the other.

Memory

Memory - also known as the primary storage or main memory - is a part of the microcomputer that holds data and instructions.

Part of the contents of the memory is 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.

Registers

Computers also have several additional storage locations called registers. These appear in the Control Unit and ALU and make processing more efficient. Registers are a sort of special hi-speed storage areas that hold data and instructions temporarily during processing. They are parts of the Control Unit and ALU rather than the memory. Their contents can, therefore be handled much faster than the contents of the memory.

Addresses

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.

How the CPU and Memory work

The working of the CPU and memory is shown in Fig. 1.2. Various steps involved for multiplying two numbers is shown in that figure and explained below.

1.   The control unit recognizes that the program has been loaded into the memory. It begins to execute the first step in the program.

2.   The program tells the user, "Enter 1st Number".

3.   The user types the number 100 on the keyboard. An electronic signal is sent to the CPU.

4.   The control unit recognizes this signal and routes the signal to an address in memory - say address 7.

5.   After completing the above instruction, the next instruction tells the user, "Enter 2nd Number."

6.   The user types the number 4 on the keyboard. An electronic signal is sent to the CPU.

7.   The control unit recognizes this signal and routes it to memory address 8.

8.   The next program instruction is executed - "Multiply 1st and 2nd Numbers."

9.   To execute this instruction, the control unit informs the ALU that two numbers are coming and the ALU is to multiply them. The control unit next sends to the ALU a copy of the contents of address 7 (100) and address 8(4).

10.   ALU performs the multiplication : $100 \times 4 = 400$

11.   The control unit sends a copy of the multiplied result (400:) back to memory to store it in address 9.

12.   The next program instruction is executed : "Print the Result."

13.   To execute this instruction, the control unit sends the contents of the address 9 (400) to the monitor.

14.   Monitor displays the value 400.

15.   Final instruction is executed: "End". The program is complete.

Fig. 1.2 Working of the CPU and Memory

Fig. 1.2 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 the computer can interpret - electronic signals rather than the numbers and letters shown here.

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

1.4 Input devices

An input device presents data to the processing unit in a machine-readable form. Although the keyboard is a common input device for a small computer, a system may also support various other input devices such as Optical Character Recognition (OCR), Magnetic Ink Character Recognition (MICR), mark sense reader, etc.

1.4.1 Key board

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 for the trained typist to use the system. The additional keys are included to perform certain special functions such as loading a program, edition a text, etc. These are known as function keys that vary in number from system to system.

1.4.2 Optical Character Recognition

Often abbreviated as OCR, optical character recognition involves reading text from paper and translating the images into a form that the computer can manipulate. An OCR system enables you to take a book or a magazine article and feed it directly into an electronic computer file.

1.4.3 Magnetic Ink Character Recognition (MICR)

An MICR can identify characters printed with a special ink that contain particles of magnetic material. This device particularly finds applications in banking industry. Since the MICR system can recognise only certain character styles, the characters have to be accurately formed.

1.4.4 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 tests.

1.4.5 Bar Code Reader

These devices are generally available in super markets, bookshops, etc. Bar-code readers are photoelectric scanners that read the bar codes or vertical zebra striped marks, printed on product containers. Supermarkets use a bar code system called the Universal Product Code (UPC). The bar code identifies the product to the supermarket's computer which has a description and the latest price of the product. The computer automatically tells the Point of Sales (POS) terminal what the price is.

1.4.6 Digitiging Tablet

This is an input device that enables you to enter drawings and sketches into a computer. A digitiging 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. Digitiging tables are also called digitizers, graphics tables, touch tables or simply tables.

1.4.7 Scanner

Scanner is an input device that can read text or illustrations printed on paper and translate 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. Most optical scanners sold today come with OCR packages.

1.4.8 Mouse

Mouse is a device that controls the movement of the cursor or pointer on a display screen. It is a small object 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. Mouse contains at least one button and sometimes as many as three, which have different functions depending on what program is running.

1.4.9 Light Pen

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

1.4.10 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.

Intext Questions 1.1

1.   What are the four basic functions performed by the computer ?

2.   What is a scanner ? Explain briefly.

3.   Choose the correct answer :

   (a)   The task of performing arithmetic and logical operations is performed by.

   (i) ALU   (ii) Editor   (iii) storage   (iv) output

   (b)   The ALU and CU are jointly knows 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.

   (i) output   (ii) input   (iii) processing   (iv) storage

1.5 Memory Unit

There are two kinds of computer memory: primary and secondary. Primary memory is accessible directly by the processing unit. RAM is an example of primary memory. As soon as the computer is switched off, the contents of the primary memory is lost. You can store and retrieve data much faster with primary memory compared to secondary memory. Secondary memory such as floppy disk, magnetic disk, etc., is located outside the computer. Primary memory is more expensive than secondary memory.

Computer memory is used to store two things: i) instructions to execute a program and ii) data. When the computer is doing any job, 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 floppy disk.

As program or the set of instructions is kept in primary memory, the computer is able to follow instantly the set of instructions. For example, when you book ticket from railway reservation counter, the computer has to follow the same steps : take the request, check the availability of seats, calculate fare, wait for money to be paid, store the reservation and get the ticket printed out. The program containing these steps is kept in memory of the computer and is followed for each request.

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 1 to 9 and 0. The binary system has only two values 0 and 1. These are called bits. As human beings we all understand decimal system but the computer can only understand binary system. It is because a large number of integrated circuits inside the computer can be considered as switches, which can be made ON, or OFF. If a switch is ON it is considered 1 and if it is OFF it is 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. Is it not absurd if the computer gives outputs as 0's & 1's only? But you do not have to worry about. Every number in binary system can be converted to decimal system and vice versa; for example, 1010 meaning decimal 10. Therefore, it is the computer that takes information or data in decimal form from you, converts it into binary form, processes it

producing output in binary form and finally again converts the output to decimal form.

The primary memory as you know in the computer is in the form of IC's (Integrated Circuits). These circuits are called Random Access Memory (RAM). Each of RAM's location stores one byte of information. (One byte is equal to 8 bits). A bit is an acronym for binary digit, which stands for one binary piece of information. This can be either 0 or 1. You will know more about RAM later. 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. The address starts at 0 and goes up to (N-1). You should know that the memory is like a large cabinet containing as many drawers as there are addresses son memory. Each drawer contains a word and the address is written on outside of the drawer.

1.5.1 Capacity of Primary Memory

You know that each cell of memory contains one character or 1 byte of data. So the capacity is defined in terms of byte or words. Thus 64 kilobyte (KB) memory is capable of storing 64 x 1024 = 32,768 bytes. (1 kilobyte is equal to 1024 bytes). A memory size ranges from few kilobytes in small systems to several thousands kilobytes in large mainframe and super computer. In your personal computer you will find memory capacity in the range of 8 MB, 16 MB and even 128 MB (MB = Million bytes). The following terms related to memory of computer are discussed below:

(a)   **Random Access Memory (RAM)** : The primary storage is referred to as Random Access Memory (RAM) because it is possible to randomly select and use any location of the memory directly to store and retrieve data. It takes same time to any address of the memory as the first address. It is also called read/write memory. The storage of data and instructions inside the primary storage is temporary. It disappears from RAM as soon as the power to the computer is switched off. The memories, which loose their content on failure of power supply, are known as volatile memories. So now we can say that RAM is volatile memory.

(b) **Read Only Memory (ROM)** : There is another memory in computer, which is called Read Only Memory (ROM). Again it is the ICs inside the PC that form the ROM. The storage of program and data in the ROM is permanent. The ROM stores some standard processing programs supplied by the manufacturers to operate the personal computer. The ROM can only be read by the CPU but it cannot be changed. The basic input/output program is stored in the ROM that examines and initializes various equipment attached to the PC when the switch is turned ON. The memories, which do not loose their content on failure of power supply, are known as non-volatile memories. ROM is non-volatile memory.

(c) **PROM** : There is another type of primary memory in computer, which is called 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 and remain intact even if power is switched off. Therefore, programs or instructions written in PROM or ROM cannot be erased or changed.

(d) **EPROM** : This stands for Erasable Programmable Read Only Memory, which overcome 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.

(e) **EAPROM** : This stands for Electrically Alterable Programmable Read Only Memory. This concept is same as that of EPROM. The only difference is that the memory can be altered using electrical signals. The whole of the memory need not be erased.

(f) **Cache Memory** : The speed of CPU is extremely high compared to the access time of main memory. Therefore, the performance of CPU decreases due to the slow speed of main memory. The decreases the mismatch in operating speed, a small memory chip is attached between CPU and Main memory whose access time is very close to the processing speed of CPU. It is called CACHE memory. CACHE memories are

accessed much faster than conventional RAM. It is used to store programs or data currently being executed or temporary data frequently used by the CPU. It is also very expensive to have bigger size of cache memory. Its size is therefore, normally kept small.

(g)   **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. They are not par of the main memory but they store data or information temporarily and pass it on as directed by the control unit.

Intext Questions 1.2

1.   Distinguish between bit and byte.

2.   Define volatile and non-volatile memory.

3.   Write True or False:

   (a)   There are two kinds of computer memory: primary and secondary.

   (b)   The computer can understand decimal system also.

   (c)   The storage of program and data in the RAM is permanent.

   (d)   PROM is secondary memory.

   (e)   The memories which do not loose their content on failure of power supply are known as non-volatile memories.

1.6   Secondary Storage

You are now clear that the operating speed of primary memory or main memory should be as fast as possible 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 magnetic tapes, magnetic disks and floppy disks.

1.6.1 Magnetic Tape

Magnetic tapes are used for large computers like mainframe computers where large volume of data is stored for a longer time. In PCs also you can use tapes in the form of cassettes. 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 cassette tape recorder.
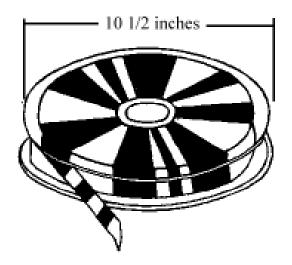

Fig.1.3 Magnetic Tape

Advantages of Magnetic Tape

- **Compact** : A 10-inch diameter reel of tape is 2400 feet long and is able to hold 800, 1600 or 6250 characters in each inch of its length. The maximum capacity of such type is 180 million characters. Thus data are stored much more compact on tape

- **Economical** : The cost of storing characters on tape is very less as compared to other storage devices.

- **Fast** : Copying of data is easier and fast.

- **Long term Storage and Re-usability** : Magnetic tapes can be used for long term storage and a tape can be used repeatedly with out loss of data.

1.6.2 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 made on the same principle. It rotates with very high speed inside the disk drive. Data are stored on both the surface 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 sports. The presence of a magnetic sport 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.

1.6.3 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.

Fig. 1.4 Floppy Diskette

1.6.4 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.

(i) **Compact Disk/Read Only Memory (CD-ROM)**: CD-ROM disks are made of reflective metals. 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 1/2 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.

(ii) **Write Once Read Many (WORM)**: The inconvenience that we can not write any thing in to a CD-ROM is avoided in WORM. A WORM allows the user to write data permanently on the disk. Once the data is written it can never be erased without physically damaging the disk. Here data can be recorded from keyboard, video scanner, OCR equipment and other devices. The advantage of WORM is that it can store vast amount of data amounting to gigabytes. Any document in a WORM can be accessed very fast.

(iii) **Erasable Optical Disk** : These are optical disks where data can be written, erased and re-written. This also applies a laser beam to write and re-write the data. These disks may be used as alternatives to traditional disks. Erasable optical disks are based on a technology known as magnetic optical (MO). To write a data bit on the erasable optical disk the MO drive's laser beam heats a tiny, precisely defined point on the disk's surface and magnetises it.

1.7   Arithmetic Logic Unit (ALU)

This unit is used to perform all the arithmetic and logic operations, such as addition, multiplication, comparison, etc. For example, consider the addition of two numbers A and B. The control unit will select the number A from its location in the memory and load it into the arithmetic logic unit. The result will

then be stored in the memory or retained in the arithmetic unit for further calculations.

1.8   Control Unit (CU)

This unit coordinates the activities of all the other units in the system. Its main functions are:

(i)   To control the transfer of data and information between various units;

(ii)   To initiate appropriate functions by the arithmetic logic unit.

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.

1.9   Output Devices

Output devices receive information from the CPU and present it to the user in the desired form. Output devices include display screen, loudspeakers, printers, plotters, etc.

1.9.1 Display Screen

When a program is keyed in, the screen (which is similar to a television screen) displays the characters. The user can read the program line by line and make corrections before it is stored or printed on a printer. It is also possible to bring to the screen a portion of the program stored in the external storage for editing.

Screen sizes differ from system to system. The standard size is 24 lines by 80 characters. Most systems have provision for scrolling. This facilitates the user to move the text vertically or horizontally on the screens thus bringing to the screen the hidden text. Thus the user can scan through the entire file either to review or to select a particular portion. The cursor on the screen is controlled by the cursor keys on the keyboard,

1.9.2 Printer

Printer is a device that prints text or illustrations on paper and in may cases on

transparencies and other media. There are many different types of printers. In terms of the technology utilised, printer fall into the following categories.

(i)   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 high quality print approaching to that produced by laser printers. A typical ink-jet printer provides a resolution of 300 dots per inch, although some newer models offer higher resolutions.

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 copier paper.

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

Fig. 1.5 Ink-jet Printer

(ii)   Laser Printer

Laser Printer 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. This is also the way copy machines work.

Because an entire page is transmitted to a drum before the toner is applied, laser printers are sometimes called page printers. There are two other types of page printers that fall under the category of laser printers even though they do not use lasers at all. One uses an array of LEDs to expose the drum, and the other uses LCDs. Once the drum is charged, however, they both operate like a real laser printer.

One of the chief characteristics of laser printers is their resolution - how many dots per inch (dpi) they lay down. The available resolutions range from 300 dpi at the low end to 1,200 dpi at the high end. By comparison, offset printing usually prints at 1,200 or 2,400 dpi. Some laser printers achieve higher resolutions with special techniques known generally as resolution enhancement.

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. To print a full-page graphic at 300 dpi, for example, you need at least 1 MB (megabyte) of printer RAM. For a 600-dpi graphic, you need at least 4 MB RAM.

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).

(iii) Line Printer

Line printers are high-speed printers capable of printing an entire line at one time. A fast line printer can print as many as 3,000 lines per minute. The disadvantages of line printers are that they can print only one font, they cannot print graphics, the print quality is low, and they are very noisy.

(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.

1.9.3 Plotter

Plotter is a device that draws pictures on paper based on commands from a computer. Plotters differ from printers in that they draw lines using a pen. As a result, they can produce continuous lines, whereas printers can only simulate lines by printing a closely spaced series of dots. Multicolour plotters use different-coloured pens to draw different colours.

Fig. 1.6 Plotter

In general, plotters are considerably more expensive than printers. They are used in engineering applications where precision is mandatory.

1.9.4 Sound Cards & Speakers

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.

Nearly all sound cards support MIDI, a standard for representing music electronically. In addition, most sound cards are Sound Blaster-compatible, which means that they can process commands written for a Sound Blaster card, the de facto standard for PC sound.

Fig. 1.7 Sound Card and Speakers

1.9.5 3D-Audio

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 readjust 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 1.3

1.   Define the following terms briefly:

   (a)   ALU

   (b)   Ink-jet Printer

   (c)   Plotter

2.   Fill in the blanks:

   (a)   .... unit coordinates the activities of all the other units in the system.

   (b)   The standard size of display screen is .... lines by .... characters.

   (c)   .... printer utilizes a laser beam to produce an image on a drum.

(d)   .... audio is a technique for giving more depth to traditional stereo sound.

1.10 What you have Learnt

In this lesson you learnt in detail about various components of a computer. You also learnt how various units of computer interact with each other to accomplish a given job.

1.11 Terminal Questions

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.

1.12 Feedback to In-Text Questions

In-Text Questions 1.1

1.   Four basic functions are:

(a)   Receive input

(b)   Process information

(c)   Produce output

(d)   Store information for future use

2.   Scanner is an input device that can read text or illustration printed on paper

and translate the information into a form that the computer can use

3.   (a)   ALU   (b)   CPU   (c)   processing

In-Text Question 1.2

1.   A bit is an acronym for binary digit, which stands for one binary piece of information. This can be either 0 or 1. Byte consists of 8 bits. Each of RAM's location stores one byte of information.

2.   The memories, which loose their content on failure of power supply, are known as volatile memories. RAM is a volatile memory. On the other hand ROM is a non-volatile memory because it does not loose its contents on failure of power supply.

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

In-Text Questions 1.3

1.   (a)   ALU is used to perform all the arithmetic and logic operations such as addition, subtruction multiplication, comparison, etc.

      (b)   Ink-jet printers work by spraying ionized ink at a sheet of paper. These printers are capable of producing high quality print nearer to that produced by laser printers.

      (c)   Plotter is a device that draws pictures on paper based on commands from a computer.

2.   (a)   Control   (b)   24, 80 (c)   Laser (d)   3D