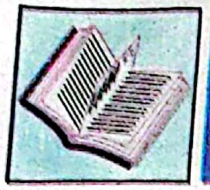


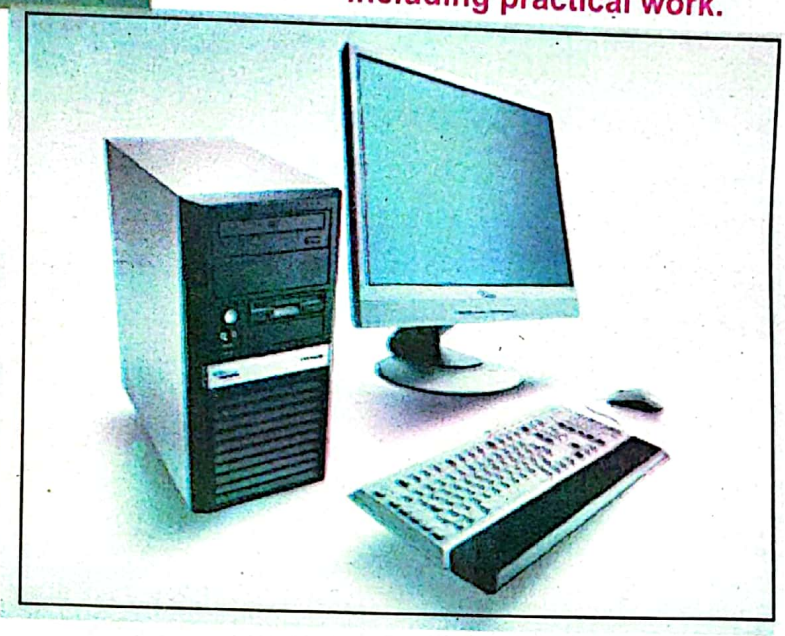
1

FUNDAMENTALS OF COMPUTER

After completing this lesson, you will be able to:

This is 10 periods Chapter including practical work.

- Know about the evolution of computer
- Describe brief history and generations of computer
- Define the types of computers (Analog, Digital and Hybrid)
- Differentiate between mainframe, mini and microcomputers
- Describe the use of computers in various fields
- Know the scope of the careers in the field of Information Technology
- Describe the components of computer (input/output devices, system unit and computer memory)



- Differentiate between port, expansion slot and expansion card
- Explain the input/output, processing and storage operations
- Define operating system, device drivers, utility programs and language processors
- Identify the use of productivity, business, entertainment and education software
- Elaborate open source software, shareware and freeware

UNIT INTRODUCTION

This Unit "Fundamentals of Computer" covers a foundational understanding of computer hardware and software along with how to get the most value and impact from computer technology. In this unit the history of computer is described so that students can understand how have computers evolved from very simple calculating devices to the modern electronic computing. It also provides material on application of computers in various fields to describe the role of computer in modern society and its impact on our daily life.

1.1 INTRODUCTION TO COMPUTER

Today's world is an information-rich world and it has become a necessity for everyone to know about computers. A computer is a general-purpose programmable machine. Computer is

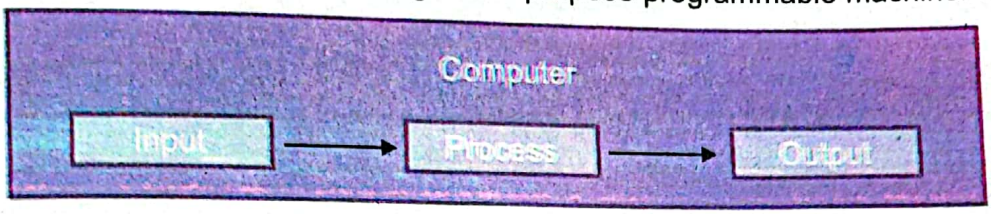


Fig.1-1 Computer processing system

an advanced electronic device that takes raw data as input from the user and processes it under the control of set of instructions (called program), gives the result (output), and saves it for future use. It has the ability to store, retrieve and process data. It processes data at very high speed according to the instructions given to it and produces accurate results. The instructions given to a computer to perform a particular task is known as computer program. Computer processing system is shown in Fig.1-1.

1.1.1 EVOLUTION OF COMPUTER

Evolution of computers means how the computers evolved from the first mechanical device, abacus, to electromechanical and then to the modern electronic digital computers.

Abacus

Abacus was the earliest calculating device most probably invented in China.

TITBITS

Abacus is still seen at some toy shops, made of plastic or wood for small children.

It consisted of a wooden frame having parallel rods as shown in Fig.1-2. These rods had a number of wooden beads which could slide freely along the length of rods. While performing calculations, beads were moved up and down with fingers. Abacus was used to perform addition, subtraction, multiplication and division. It has been used in China and some other Asian countries till the end of 20th century.

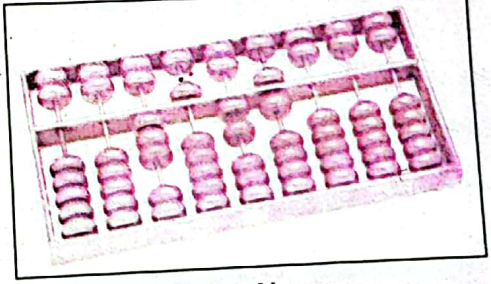


Fig.1-2 Abacus

Napier's Bone

John Napier, a Scottish mathematician invented a calculating device called Napier's Bone in 1614 which is shown in Fig.1-3. It consisted of a wooden box containing rotating cylinders each of which had the digits from 0 to 9. It could multiply, divide and find square roots of numbers by using simple addition and subtraction. His biggest achievement was the invention of logarithm.

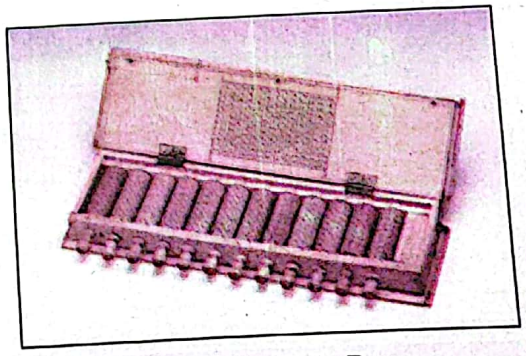


Fig.1-3 Napier's Bone

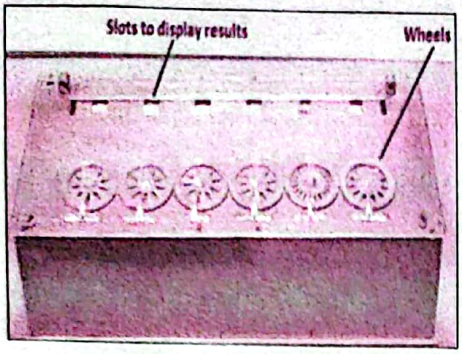


Fig.1-4 Pascaline

Pascaline

Blaise Pascal, a French mathematician invented a calculating machine called Pascaline in 1642 when he was only 19 years old. Pascaline used rotating wheels as shown in Fig.1-4. Each wheel had ten parts having digits from 0 to 9. Calculations were performed by the rotation of wheels. When one wheel completes a rotation, the next wheel moves by one digit. It had a number of small slots for displaying the result. It could perform addition and subtraction on whole numbers.

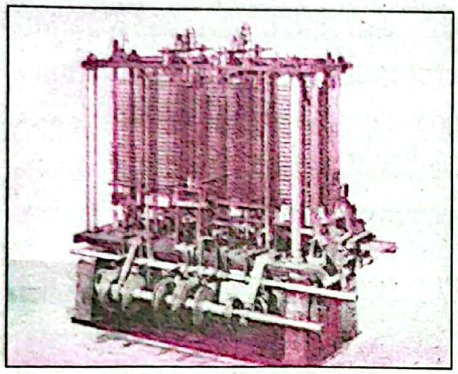


Fig.1-5 Analytical Engine

Difference Engine and Analytical Engine

In 1822, the English mathematician Charles Babbage started working on a big calculating machine about the size of a room. He called it Difference Engine.

Babbage worked for many years on this machine but he could not complete it. Later, he came up with idea of Analytical Engine which is shown in Fig.1-5. He could not complete it because the technology was not advanced enough but he laid the foundation stone of modern digital computers. Today's modern digital computers are based on the idea of analytical engine. Charles Babbage is known as the father of modern digital computers.

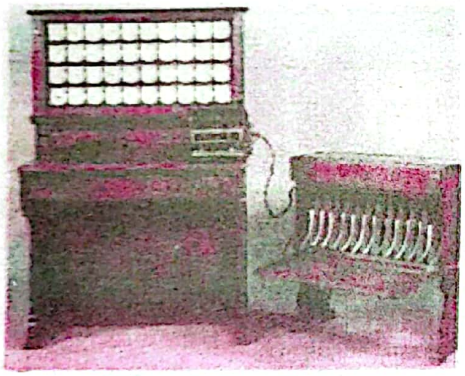


Fig.1-6 Hollerith Desk

Hollerith Desk

In 1890, Herman Hollerith built a tabulating machine called Hollerith Desk as shown in Fig.1-6. This machine was invented to help with the census of 1890 in America. Hollerith Desk consisted of a card reader which sensed the holes in the cards, a gear driven mechanism which could count and a large set of dial indicators to display the results. After building Hollerith Desk, Hollerith started a company by the name of Tabulating Machine Company. Eventually this company changed its name to International Business Machines (IBM).

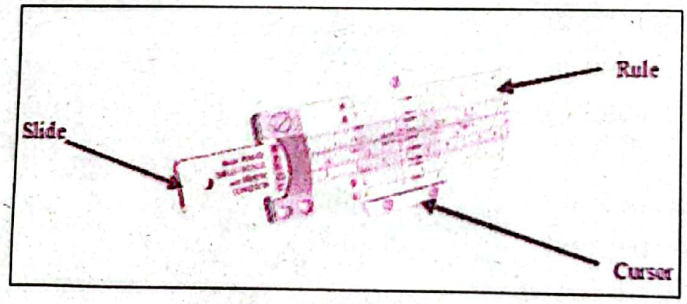


Fig.1-7 Slide Rule

Slide Rule

Based on the idea of logarithm, English mathematician, William Oughtred developed a device called Slid Rule in 1614. It was very useful for solving problems that involved

multiplications and divisions. It has three parts, slide, rule and a transparent sliding cursor as shown in Fig.1-7.

DO YOU KNOW?
Slide rule was replaced by electronic pocket calculator in the early 1970s.

Mark-I

The next successful computing machine invented was a digital computer known as Mark-I. It was invented by Howard Aiken in 1944. Mark-I could add three numbers having eight digits in one second. It could print out its results on punched cards or on an electric typewriter. Mark-I was 50 feet long, 8 feet high and weighed about 5 tons. It used 3,000 electric switches. Mark-I is shown in Fig.1-8.

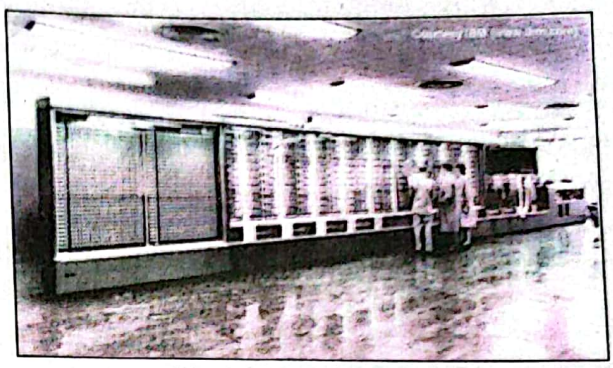


Fig.1-8 Mark-I Computer

More over Mark II, Mark III and Mark IV were also built under the supervision of Howard Aiken with extended capabilities.

Since computer evolution is a continuous process, it has not stopped in the modern era. New systems are being developed to provide voice recognition and understand natural languages. ***High performance computing (HPC)*** is being used in today's data centers for fast data processing. High-performance computing (HPC) is the use of parallel processing for running advanced application programs efficiently, reliably and fast.

The concept of "***Cloud Computing***" has been introduced. In the simplest terms, cloud computing means storing and accessing data and programs over the Internet instead of computer's hard drive. The current advancements in computer technology are likely to transform computer into intelligent machine having thinking power. The evolution of computers will probably continue till their processing capabilities have become equal to human intelligence or even beyond that.

1.1.2 GENERATIONS OF COMPUTER

History of computers is a chain that runs from the ancient abacus and the analytical engine of the nineteenth century, through the modern computers of present age. It is generally divided into five generations. Each generation of computers is characterized by major technological developments of that time.

First Generation Computers (1940 – 1956)

Vacuum tubes were used in the first generation computers. Vacuum tubes generated so much heat that they had to be cooled by air conditioner. Vacuum tubes burnt out very often and it was difficult to repair and maintain the computers of first generation. A vacuum tube is shown is Fig.1-9.

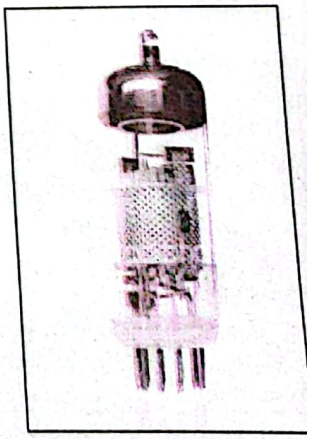


Fig.1-9 Vacuum Tube

The following are the characteristics of first generation computers.

- First generation computers used vacuum tubes.
- Speed was slow and memory was very small.
- They were huge in size taking up entire room.

- First generation computers were very expensive and unreliable.
- They consumed a lot of power and generated a lot of heat.
- Input was based on punched cards.
- Output was obtained on printouts through electric typewriter.
- Machine language was used in these computers.

Some examples of first generation Mini/Mainframe computers are ENIAC (Electronic Numerical Integrator and Computer), UNIVAC (Universal Automatic Computer), IBM 604, Mark-I and EDSAC. Electronic Delay Storage Automatic Calculator.

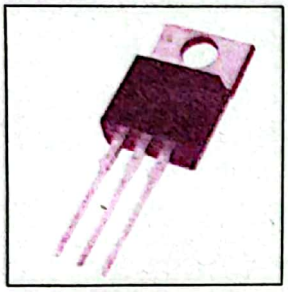


Fig.1-10 Transistor

Second Generation Computers (1956 – 1963)

In 1947, three scientists, William Shockley, John Bardeen and Walter Brattain invented transistor shown in Fig.1-10. Transistor functions like a vacuum tube. It replaced the vacuum tubes in the second generation computers. Transistor was faster, more reliable, smaller and much cheaper than vacuum tube.

The following are the characteristics of second generation computers.

- Transistors were used instead of vacuum tubes.
- Transistors reduced the size of computers and increased the speed and memory capacity.
- Computers became more reliable and cheaper.
- Second generation computers used punch card readers, magnetic tapes, magnetic disks and printers.
- Assembly language was used in these computers.
- High level programming languages, FORTRAN and COBOL were introduced in this generation of computers.

Examples of second generation computers are UNIVAC II, IBM 7030, 7780 and 7090, NCR 300 series, General Electric GE 635 and Control Data Corporation's CDC 1604 computers.

Third Generation Computers (1963 – 1971)

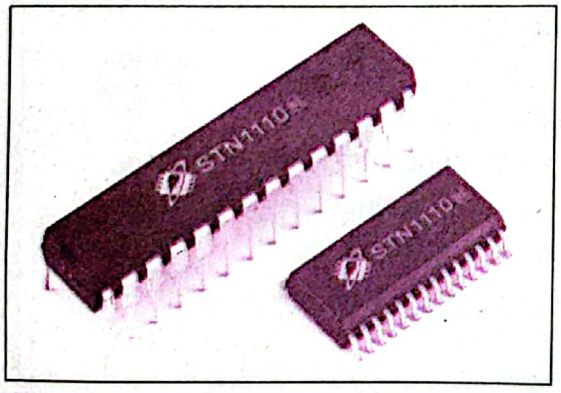


Fig.1-11 IC Chips

Integrated Circuits (ICs), also known as semiconductor chips were used in third generation of computers instead of transistors. IC chips were developed in early 1960s. A single IC chip contains a large number of transistors. IC chips increased the power and decreased the cost of computers. Invention of IC chips was a great breakthrough in advancing computer technology. IC chips are shown in Fig.1-11.

The following are the characteristics of third generation of computers.

- Third generation computers used IC chips.
- IC chips improved the speed and memory of computers.
- Computers consumed less electricity, became smaller, cheaper and more reliable than second generation computers.
- Keyboard and monitor were used with the computer.
- These computers could run different application programs at the same time.

DO YOU KNOW?
Intel invented the world's first microprocessor, the Intel 4004 in November, 1971.

Some examples of third generation computers are Burroughs 6700, IBM System/360, System 3 and Control Data Corporation's 3300 and 6600 computers.

Fourth Generation Computers (1971 – Present)

In this generation of computers LSI (Large Scale Integration) and VLSI (Very Large Scale Integration) chips having millions of transistors were developed. Microprocessor was also developed in fourth generation of computers. A microprocessor is a single chip that can handle all the processing of a computer. A microprocessor is shown in Fig.1-12.

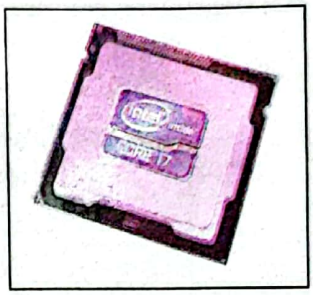


Fig.1-12 Microprocessor

The following are the characteristics of fourth generation of computers.

- Microprocessor was developed which resulted in the development of microcomputers.
- Fourth generation computers are very fast, have large storage capacity and use advanced input/output devices.
- Microcomputers are very small in size, very reliable, consume less power and are affordable.
- Large variety of software is available for use in microcomputers.
- Operating system having Graphical User Interface (GUI) was developed in this generation.
- These computers support multimedia software that combines text, image, sound and video.
- These computers support modern programming languages such as Visual Basic, C++, Java and Python for developing powerful software.
- Fourth generation computers support a large variety of portable and wireless input/output devices.

Some examples of microprocessors developed in fourth generation of computers are Intel Pentium series, Dual Core, Core2 Duo, Core i3, i5, i7 and AMD Athlon.

Some examples of fourth generation computers are IBM ThinkPad series, HP Pavilion series, Dell Inspiron series and Apple's MacBook Pro and MacBook Air series.

Fifth Generation Computers (Present and Beyond)

The goal of fifth generation of computers is to develop devices that can understand natural languages and have thinking power. This is a big challenge for computer developers and programmers to design such systems and software for them.

The following are the characteristics of fifth generation of computers.

For your Information
Artificial Intelligence is the branch of computer science concerned with making computer behave like humans.

- Fifth generation computes are based on Artificial Intelligence (AI).
- In the fifth generation of computers, AI will minimize the need to write programs.
- These computers will allow users to give commands in any natural language such as English.

Examples of fifth generation computers are robots and expert systems.

1.1.3 TYPES OF COMPUTERS

On the basis of data representation, processing, Input and Output, Computers can be classified into the following three types.

- Analog Computers
- Digital Computers
- Hybrid Computers

Fig.1-13 Analog computer

Analog Computers

Analog computers represent and process data by measuring quantities such as voltage and current to solve a problem. They work on supply of continuous signals as input and display output simultaneously. Analog computers are special purpose devices, designed to perform single specific task. Mostly these devices are used in engineering and scientific applications. The accuracy of analog computers is low but they are faster in speed as compared to digital computers. They mainly consist of electrical devices such as resisters, capacitors, transistors, etc. An analog computer with volt meter is shown in Fig.1-13.

Digital Computer

Digital computer works with digits. Everything in a digital computer is represented with binary digits 0s and 1s. It manipulates them at very fast speed. Data and instructions are fed into the digital computer through an input device in the form of 0s and 1s. The computer performs calculations on data according to the instructions given in a computer program. The results of calculations are displayed on monitor or printed on printer. A digital computer is shown in Fig.1-14.

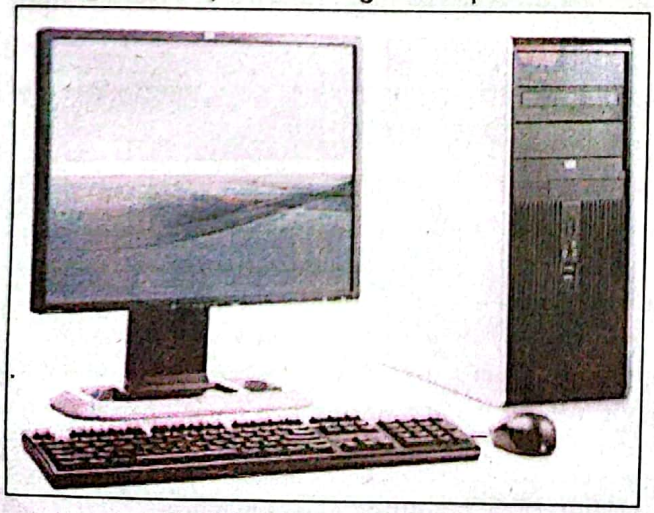


Fig.1-14 Digital Computer

Digital computers can store and process large amount of information at high speed. The results produced by digital computers are reliable and accurate. Digital computers are general-purpose computers, used in various fields.

Hybrid Computers

Hybrid computers are the combination of analog and digital computers. They combine the characteristics of both analog and digital computers. Hybrid computers are mainly used for scientific applications. These computers are used in spaceships, missile systems, scientific research, hospitals and for controlling industrial processes.

A hybrid computer known as Vital Sign Monitoring Unit is shown in Fig.1-15. It is used in hospitals to monitor patient's important data such as blood pressure, temperature, respiration and heartbeat.

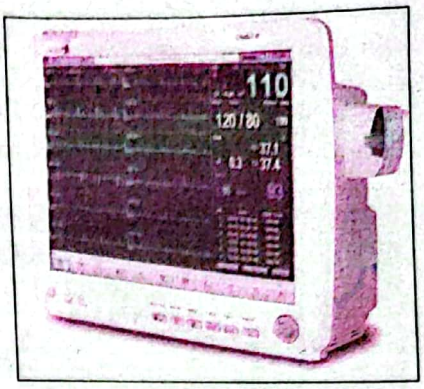


Fig.1-15 A Hybrid Computer (Vital Sign Monitoring Unit)

1.1.4 CLASSIFICATION OF DIGITAL COMPUTERS

Digital computers are classified into super, mainframe, minicomputer and microcomputer based on their size, speed, storage capacity and the number of users they can support.

Super Computer

Super computers are the largest and the most powerful computers. Super computers have been used for scientific and engineering applications that must handle very large databases and do a great amount of computation. These computers are very expensive. Their speed is measured in TIPS (Trillions of Instructions per Second). These computers are used in nuclear research and forecasting weather reports worldwide. Government organizations use these computers to meet their extra ordinary demand for processing data which require tremendous processing speed, memory and other services. Fig A-1-16 shows The Columbia Supercomputer located at the NASA Ames Research Center, USA.

Fig. A-1-16 Super computer

Mainframe Computer

Mainframe computers were developed in early 1940s. A mainframe computer is a very large, very powerful and expensive computer that can support hundreds and even thousands of users at the same time. Therefore, these computers are used in large organizations. The modern mainframe computers that use cutting edge technology are the foundation of today's business in banking, insurance, education, air travel, research, health care, government and many other public and private organization. These computers can execute more than trillion instructions per second (TIPS). Some examples of mainframe computers are IBM's z Enterprise EC12, EC 196, HP 16500 Series and HP Integrity Superdome. A mainframe is shown in Fig.B-1-16.

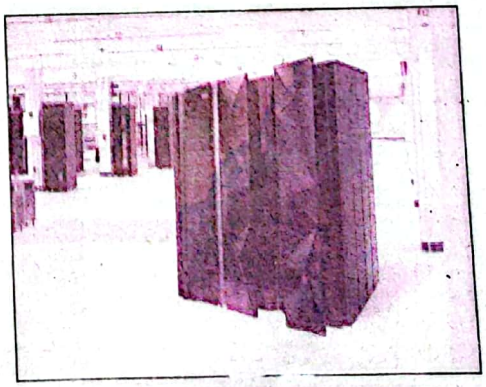


Fig. B-1-16 Mainframe computer

Minicomputer

Minicomputer was introduced in the 1960s when IC chips were introduced. A minicomputer is bigger than a microcomputer but smaller than a mainframe. These computers can execute billions of instructions per second (BIPS). Therefore, they can process more data than microcomputers. Today, minicomputers with cutting edge technology are playing an important role in business organizations for their data processing requirements. These are used in organizations that have hundreds of users such as PIA, NADRA, police departments, hospitals, etc. A minicomputer is shown in Fig.1-17. Examples of minicomputers are IBM System/36 and HP 3000.

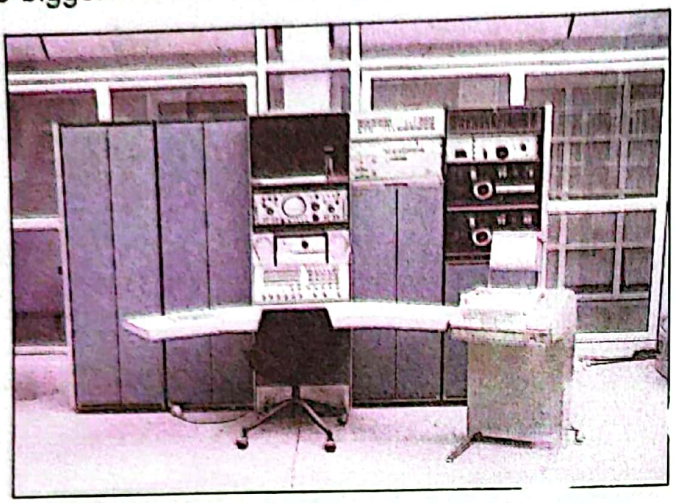


Fig.1-17 Minicomputer

Microcomputer

Microcomputers are the smallest and the low cost computers. These computers are most commonly used in homes and offices. Microcomputer was introduced in 1970s when microprocessor was developed. A microprocessor is a single chip that controls the operations of the entire computer system. Modern microcomputers have large storage capacity and they can execute millions of instructions per second (MIPS). A variety of software is available for use in these computers.

Microcomputers are available in various forms such as desktop, laptop and tablet as shown in Fig.1-18. Some popular companies that manufacture microcomputers are IBM, Dell, HP, Toshiba and Acer. A microcomputer is also known as Personal Computer or PC. IBM Lenovo series, Dell XPS series and HP Envy series are some popular microcomputers.

Do you know?

Today, microprocessor is not only used in microcomputers, they are also used in the devices including mobile phones, microwave ovens, cameras, washing machines,

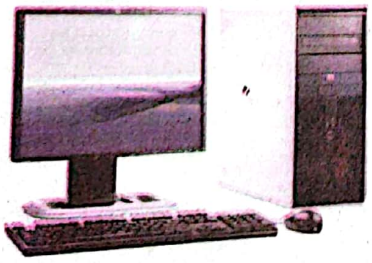


Fig.1-18 (a) Desktop

(b) Laptop

(c) Tablet Microcomputer

1.2 ROLE OF COMPUTER

Computer plays important role in modern society and it has changed it in many ways. It is the best invention ever made in the history of modern technology. It has brought advancement in various fields of life.

1.2.1 USE OF COMPUTERS IN VARIOUS FIELDS

Education

Role of computers in education has been given a lot of importance in the recent years. Computer technology eases the process of learning. Many programs are available for students to learn the subjects of Physics, Mathematics, Chemistry, Biology, etc. Multimedia software makes the process of learning interactive and interesting. It combines text, graphics, sound and video for effective learning. Internet has enormous information on a wide variety of subjects. Students can refer to Internet to find information on any topic. Nowadays computers with multimedia projectors are being used in classrooms for effective teaching. All the activities related to examinations are also being controlled using computers. Therefore, it plays an important role in education. Today, computer education is a part of curricula from elementary to university level. Use of computer in education is shown in Fig.1-19.

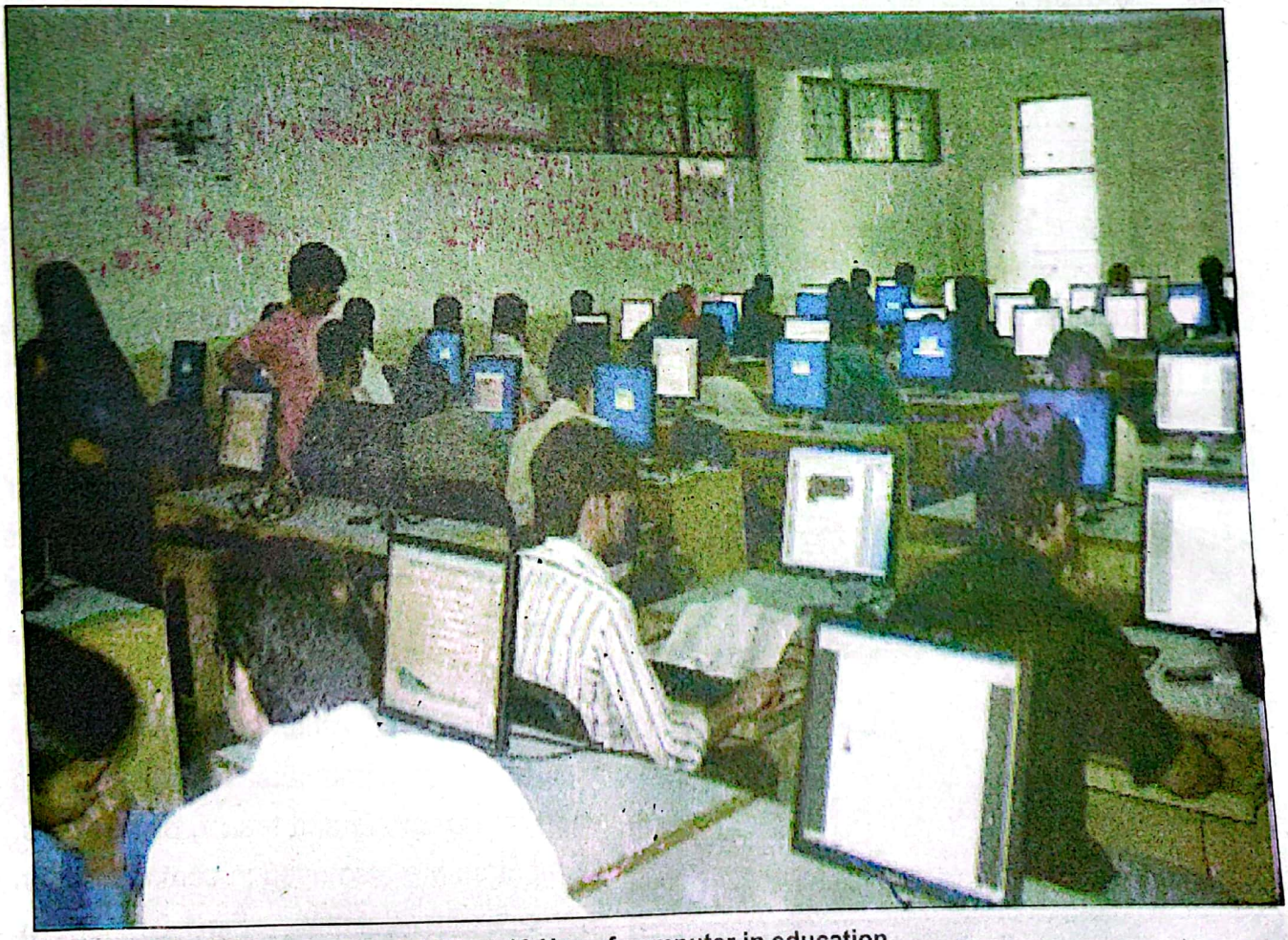


Fig.1-19 Use of computer in education

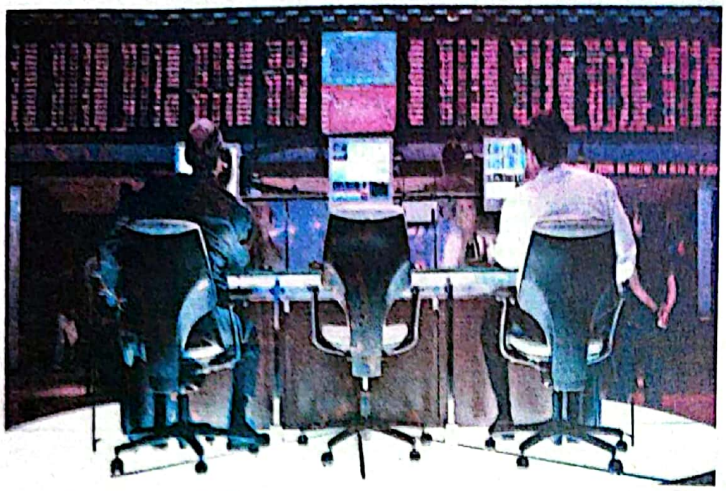


Fig.1-20 Use of computer is business

Business

Computers are used in all types of businesses as shown in Fig.1-20, to improve productivity. They help in running business activities efficiently. They are used to prepare business documents, reports, charts, presentations, invoices, etc. They help in staying in contact with employees and customers. The following are some important business areas where computers are used.

- Computer technology has revolutionized the banking business. Deposits and withdrawals are instantly logged into a customer's account. Accurate monthly bank statements are generated with the help of computer. Computer networks allow amount of bill to be transferred from customer's bank account to the store. People can obtain cash any time anywhere through Automated Teller Machine (ATM).
- Computers are used in retail stores. Bar code readers are linked to computer system that are used to read the bar code printed on each product sold to prepare the bill. With the use of computers at retail stores, the checkout process is faster and the bill produced is accurate.
- Electronic commerce, also known as e-commerce allows to sell products and services by means of computer networks such as Internet.
- Computers are very helpful in running many other types of businesses that include hotel, hospital, school, travel agency, real estate, stock exchange, etc.

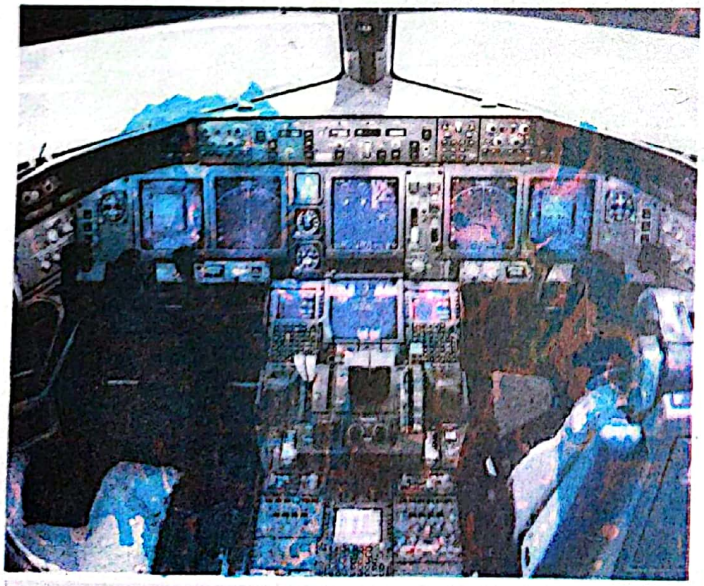


Fig.1-21 Use of computer in cockpit of fighter plane

Defense

There are various applications of computer technology in defense. Computers are used in tanks, planes and ships to target enemy forces. They help in tracking missiles and destroying them. Modern defense weapons and other equipment are controlled by computers. Computers are used for designing and testing of weapons. Computers are also used in communication systems in defense. Fig.1-21 shows application of computer in a fighter plane.

Media

Computers have lot of applications in print and electronic media. Print media refers to mass communication through printed material. Computer technology helps in preparation and production of newspapers, magazines, booklets and brochures, flyers, press releases and books. Electronic media refers to broadcast media that includes radio broadcast, cable and satellite television broadcast and the new-age media like Internet and mobile devices. Computer is used for television broadcasting as shown in Fig.1-22.

Fig.1-22 Use of computer in television broadcasting

Manufacturing

Now days, computer technology is widely used in manufacturing industry. It has improved the accuracy, quality and speed of manufacturing. Computers are used for product design and automation of manufacturing process in factories as shown in Fig.1-23. This is known as Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM). CAD involves the use of computer hardware and graphics software to create product designs. CAM involves the use of computer in planning and management of production operation. It helps in automatically producing finished products. CAD/CAM technology has been applied in many industries, including automobile, electronics, machine components, textiles, fashion, etc.

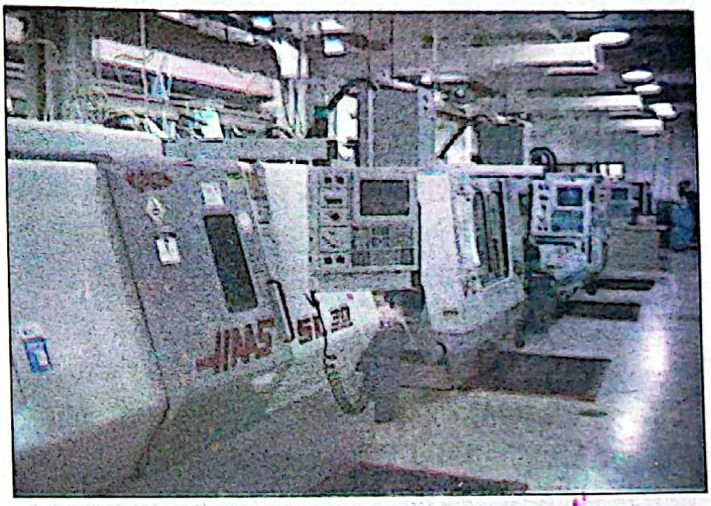


Fig.1-23 Computer controlled manufacturing machines

1.2.2 CAREERS IN INFORMATION TECHONOLOGY (IT)

Information Technology (IT) refers to anything related to computing technology, such as networking, hardware, software, the Internet, or the people that work with these technologies. Many companies now have IT departments for managing the computers, networks, and other technical areas of their businesses. Many jobs are offered in these departments. A few are discussed as below.

Software Engineer

Software engineer is a highly skilled person in the field of IT whose responsibilities involve the analysis, design, implementation and maintenance of computer software. Software engineer can be further classified into programmer and system analyst.

- **Programmer**

Computer programmers are IT professionals who have extensive knowledge and expertise in programming languages. Computer programmers write programs to solve problems related with business, education, engineering, government offices, hospitals, entertainment, etc.

- **System Analyst**

System analysts analyze the data processing requirements of organizations and develop information systems to implement them. They investigate problems, plan solutions, and recommend the type of hardware and software required for implementing the solution.

Hardware Engineer

Hardware engineers design and manufacture computer hardware. Their work also involves repair and maintenance of computer hardware. They have in-depth knowledge of internal working of computers, processors, circuit boards and other electronic equipment.

Network Administrator

Network administrators are responsible for installation, configuration and maintenance of computer networks in organizations. They are in charge of maintenance of computer hardware and software that make up a computer network.

Database Administrator

Database administrator is a person who is responsible for the design, implementation and maintenance of a database in an organization. He is also responsible for maintaining security and monitoring the performance of database.

Web Designer

Web designer is a person whose job is to plan and create websites. He designs web pages that include text, images, sound, video clips and make the website interactive. HTML (Hypertext Markup Language) is the most commonly used language for creating websites.

Multimedia Designer

Multimedia designers are people who organize and present information in an easy to understand and attractive manner. They combine text, graphics, animation, audio and video. Multimedia designers create digital images and arrange them in sequence for animation using computer software. They have the skills to edit and manipulate audio/video files. They usually work in film/TV industry, computer software companies and advertising companies.

Information Security Analyst

Information security analyst is a person whose job is to protect information and information systems from unauthorized access, use, modification, recording or destruction. He implements procedures and policies to ensure information security within the organization.

Computer Teacher

Computer teacher teaches the subject of computer science to students to make them computer literate. He conducts lessons on how to operate computers and the working principles and concepts of computer hardware. He also teaches how to develop computer programs using various programming languages.

1.3 COMPUTER HARDWARE

Computer hardware refers to the physical components that make up a computer system.

1.3.1 HARDWARE COMPONENTS OF COMPUTER

Hardware components of a computer system are classified into input devices, system unit, storage devices, output devices and memory.

INPUT DEVICES

All the devices used to feed data into the computer are known as input devices. Input devices allow us to communicate with the computer. Some commonly used input devices are keyboard, mouse, microphone, scanner, barcode reader, digital camera and touch screen.

POINT TO PONDER:
Why the keys on keyboard are not arranged in alphabetical order?

Keyboard: It is the main input device to communicate with the computer. It allows the computer user to enter letters, numbers and special symbols into the computer. A keyboard is shown is Fig.1-24.

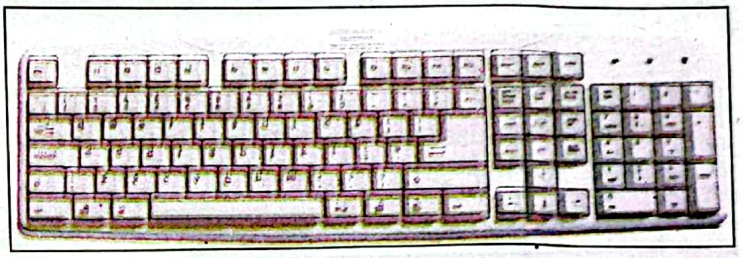


Fig.1-24 A standard keyboard

Mouse: It is a hand-held device used to control the movement of cursor or pointer on the screen. It has two or three buttons at the front that allows the computer user to make selection in menu, draw graphics or open files, folders and programs. A mouse is shown is Fig.1-25.

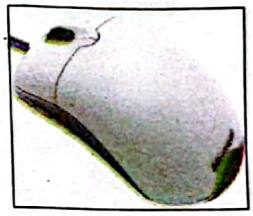


Fig.A-1-25 Mouse

Fig.B-1-25 Joystick

Joystick: A joystick is a pointing device with a vertical lever mounted on a base. The lever usually includes buttons called triggers, which activate certain events when pressed. Joysticks are mainly used for computer games.

Microphone: It is a device that allows computer user to input audio into the computer. It changes audio signals into electrical signals which are translated into digital form by the sound card for processing in the computer. A microphone is shown in Fig.1-26.

Fig.1-26 Microphone

Fig.1-27 Scanner

Scanner: It is a device that captures images from photographs, magazines, books etc. and stores them in computer in digital form. These images can be edited, displayed on the screen or inserted in documents. Many scanners also include optical character recognition (OCR) software, which can convert an image of text into a text file that can be edited. A scanner is shown in Fig.1-27.

Barcode Reader: It is a device that reads the barcode printed on products that represents product code, description and price. This information is used by the computer to print bill for the customer. A barcode reader is shown in Fig.1-28.

Fig.1-28 Barcode Reader

Fig.1-29 Digital Camera

Digital Camera: It is a device used to capture pictures and store them in digital form. These pictures can be downloaded to computer for editing, viewing or inserting in documents. A digital camera is shown in Fig.1-29.

Touch Screen: It is a pressure-sensitive display screen that is used to interact with the computer by touching pictures or words with finger. Touch screen is more commonly used with mobile phone and tablet. A touch screen is shown in Fig.A-1-30.

Touchpad: A touchpad is an input device on laptops and some keyboards to move a cursor with finger. As user moves finger on the surface, the mouse cursor moves in that same direction. A touchpad is shown in Fig. B-1-30.

Fig.A-1-30 Touch Screen

Fig. B-1-30 Touch Screen

SYSTEM UNIT

System unit is the main part of computer. It includes motherboard, power supply and drives (such as DVD and hard disk) inside the computer casing. All the input/output devices of a computer are connected to system unit through the ports.

- ***Motherboard***

Motherboard is the main circuit board inside the system unit. It contains microprocessor, main memory, expansion cards, many IC chips, connectors and other electronic components. It has many buses (electric pathways) printed on it. These are used to transmit information between various components of the computer. All the input/output devices are connected to the motherboard. A motherboard is shown in Fig.1-31.

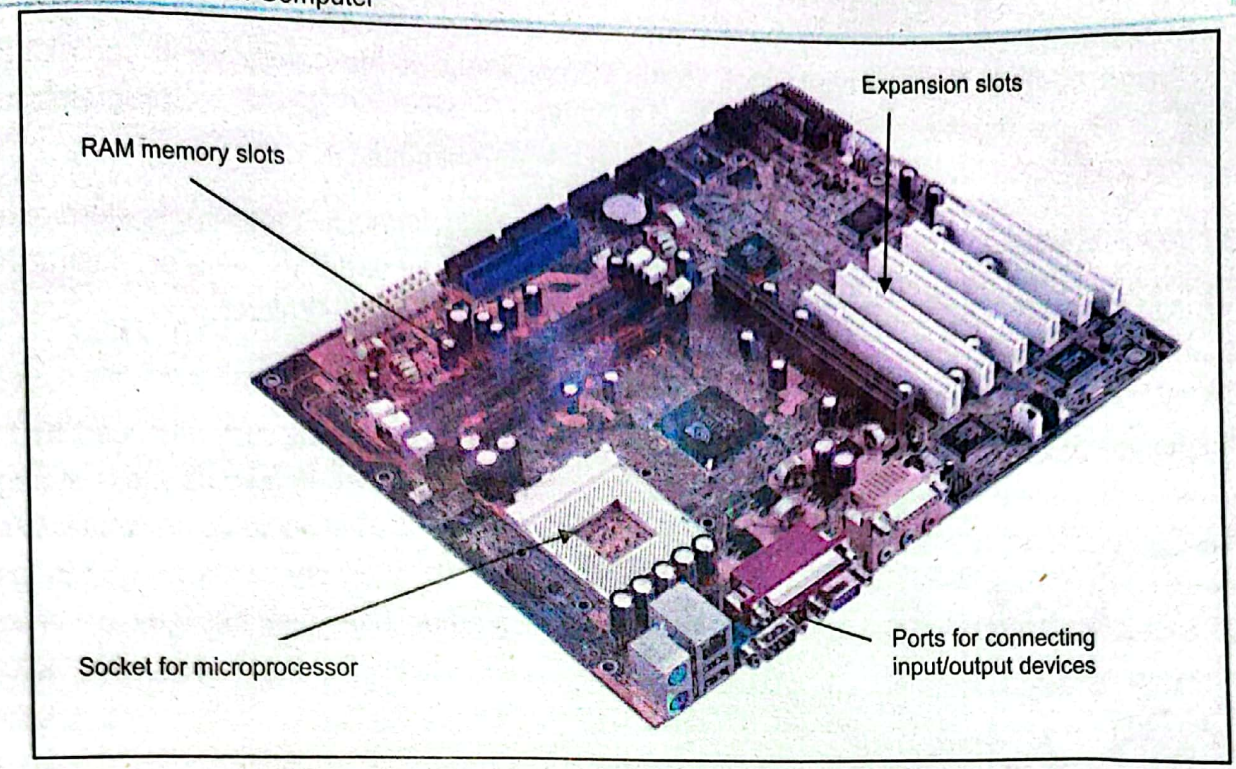


Fig.1-31 Motherboard

- **Microprocessor**

A microprocessor is the main chip on the motherboard that controls all the activities of the computer. It is also known as Central Processing Unit (CPU) or simply processor. It contains Control Unit (CU), Arithmetic Logic Unit (ALU) and registers. A microprocessor and the block diagram of CPU are shown in Fig.1-32.

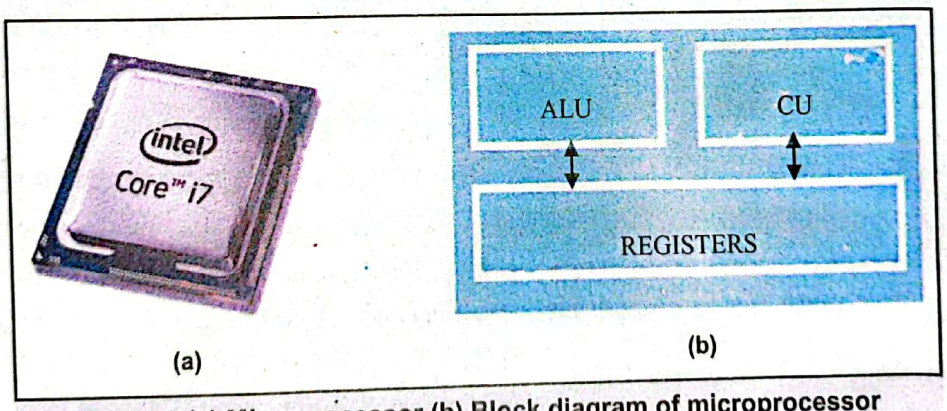


Fig.1-32 (a) Microprocessor (b) Block diagram of microprocessor

ALU is the part of the computer that performs all the calculations and comparisons. It consists of arithmetic unit and logic unit. Arithmetic unit performs all the arithmetic operations such as addition, subtraction, multiplication and division. Logic unit performs logical operations which include comparisons of numbers or alphabets.

Control unit controls the operations of all the components of the computer. It controls the working of all the input/output devices, storage devices and ALU. CU loads programs into memory and executes them. It consists of very complicated circuits.

Registers are small memory units inside the microprocessor used to temporarily store some information during the execution of a program. Some commonly used registers are Instruction Register, Accumulator Register, Data Register and Memory Address Register.

STORAGE DEVICES

Storage devices are used to store programs and data that are not currently used by the computer. They have huge storage capacity. Therefore, they are also known as mass storage devices or secondary memory. Hard disk is the most commonly used storage device that is fixed inside the system unit. Portable storage devices are CD, DVD, memory cards and USB flash drive. Portable storage devices have less storage capacity than hard disk but they are cheap and easy to carry.

Fig.1-33 Hard Disk

- **Hard Disk**

A hard disk is a magnetic storage device used to store computer data. It has storage capacity of hundreds of Gigabyte (GB). It is fixed inside the computer casing. Portable hard disk is also available that is attached to USB port.

- **CD**

CD stands for Compact Disk. It is a portable optical storage device with a storage capacity of 700 Megabytes (MB). A CD is 1.2 millimeter thick with a diameter if 120 millimeters. CD drive is used to read data from or write data to a CD.

Fig.1-34 CD/DVD

- **DVD**

DVD stands for Digital Versatile Disk. It has the same thickness and diameter as CD but has more storage capacity. Its storage capacity is in the range of 4 to 16 GB. A DVD writer is installed in the computer to read data from or write data to a DVD. A CD can also be used in a DVD writer.

Fig.1-35 Memory Card

- **Memory Card**

Memory card is a small storage device having storage capacity of few Gigabytes. It is available in different sizes and storage capacities. Memory cards are generally used in laptop computers and portable devices such as mobile phone and digital camera for storing pictures, audio and video. A memory card is shown in Fig.1-33.

- **USB Flash Drive**

USB flash drive is a small portable drive that is connected to computer through USB port. It is also known as USB memory. It is very fast in operation and its storage capacity is up to 128 GB till now. A USB flash drive is shown in Fig.1-34.

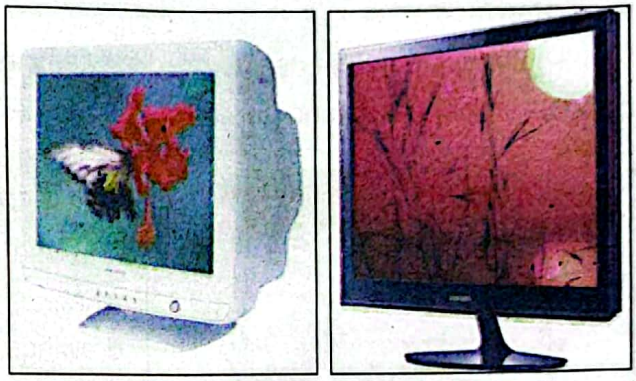
Fig.1-36 USB Flash Drive

OUTPUT DEVICES

Output devices are used to display text, graphics, and images on the monitor or to print information on paper. Information displayed on monitor is known as softcopy and anything printed on paper is known as hardcopy or printout. Commonly used output devices are monitor, printer, plotter and speaker.

- **Monitor**

It is an output device that has a screen on which information is displayed. It has two common types i.e. CRT (Cathode Ray Tube) monitor and LCD (Liquid Crystal Display) monitor. CRT monitor is very similar to old television. It is almost obsolete due to its big size and low display quality. LCD monitor is slim, uses less power and has better display quality than CRT monitor. CRT and LCD monitors are shown in Fig.1-35.



(a) (b)

Fig.1-37 (a) CRT Monitor (b) LCD Monitor

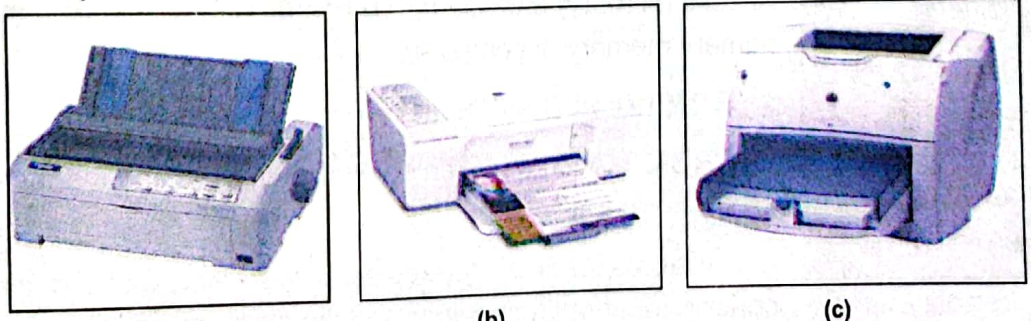
- **Printer**

Printer is an output device that prints text and graphics on paper which is known as hardcopy. There are two types of printers which are impact and non-impact printers.

FOR YOUR INFORMATION:
The first high-speed printer was developed in 1953 by Remington Rand (an early American business machines manufacturer) for use on UNIVAC computer.

Impact printer

Impact printer uses electro-mechanical mechanism which causes the character shape to strike against the paper and leave an image of the character on the paper. Dot matrix printer is the most commonly used impact printer. The printing speed varies from 50 to 500 cps (characters



(a) (b) (c)

Fig.1-38 (a) Dot Matrix Printer (b) Inkjet Printer (c) Laser Printer

per second). Their printing is very cheap but print quality is poor. They produce lot of noise while printing. These printers are still in use for printing invoices, bank statements, utility bills, etc. A Dot matrix printer is shown in Fig.1-36(a).

Non-Impact printer

Non-Impact printer prints without striking the paper. There are two types of non-Impact printers which are inkjet and laser printers. Inkjet printer stores ink in cartridge and sprays on paper through fine nozzles on the print-head. Laser printer uses technology similar to photocopying machine. Laser printer is more expensive, faster and has very high print quality compared to inkjet printer. Inkjet printers are used in all sectors such as homes and simple businesses. Laser printers are perfect for large scale businesses. Inkjet and laser printers are shown in Fig.1-36.(b,c).

- **Plotter**

Plotter is an output device used for printing engineering drawings, machine parts, building designs, maps, charts and panaflexes etc. on large size papers/sheets. Such large size printing is not possible on printers. It is more expensive than printer. There are two types of plotters, that is, ink plotter and pen plotter. Ink plotter is used for printing images whereas pen plotter is used for printing engineering drawings, machine parts, building designs, etc. Plotter is a slow output device but its printing quality is good. A plotter is shown in Fig.1-37.

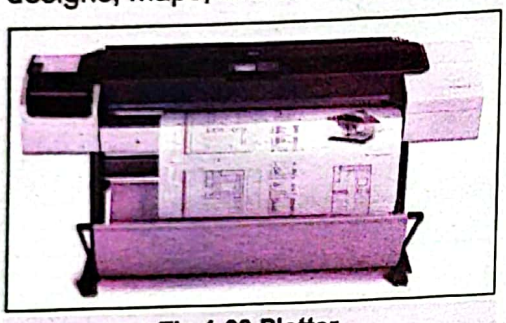


Fig.1-39 Plotter

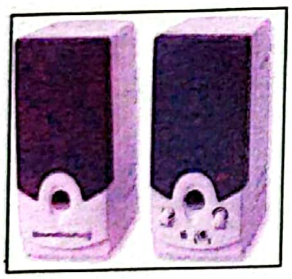


Fig.1-40 Speakers

- **Speaker**

Speaker is a device used to produce audio output. A pair of speakers is attached to the sound card on the motherboard. Speakers are commonly used with multimedia software and for playing music and videos on computer. A pair of speakers is shown in Fig.1-38.

MEMORY

Memory unit stores data and programs that are being executed by the computer. It also stores the results produced by the ALU after processing the data. There are three types of memories on the motherboard which are ROM (Read Only Memory), RAM (Random Access Memory) and Cache. These are known as main memory or primary memory of computer.

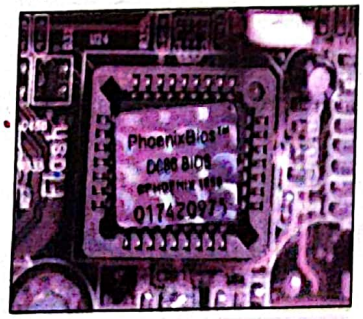


Fig.1-41 ROM chip

ROM (Read Only Memory)

ROM is a single IC chip which is installed on the motherboard as shown in Fig.1-39.

It stores the Basic Input/Output System (BIOS) of computer that controls input/output devices and the start-up or boot process. BIOS

programs test the computer's components when it is turned on and then load the operating system into the RAM to make the computer ready for operation.

BIOS programs are permanently stored in ROM when it is manufactured. It is non-volatile memory, that is, the programs stored in it are not lost when the computer is turned off. There are three common types of ROM which are PROM (Programmable ROM), EPROM (Erasable Programmable ROM) and EEPROM (Electrically Erasable Programmable ROM).

RAM (Random Access Memory)

RAM is high speed memory installed on the motherboard. It is READ/WRITE memory. Information can be read from or written into it. Programs are loaded into RAM from secondary storage devices such as hard disk or USB flash drive for execution by the microprocessor. It is volatile memory which means information stored in it, is lost when the computer is turned off.

RAM modules are installed in the memory slots on the motherboard. RAM modules are shown in Fig.1-40

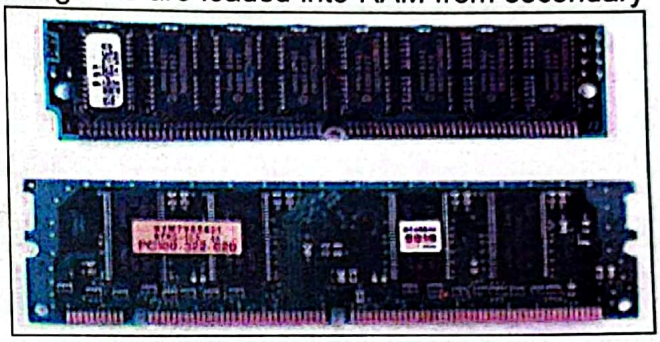


Fig.1-42 RAM modules

Cache Memory

Cache is a very small amount of extremely fast memory inside the microprocessor or on the motherboard. It is faster and more expensive than RAM. It stores information that is most frequently used by the computer. The purpose of using cache is to improve the processing speed of computer.

There are three types of cache memories which are Level 1 (L1), Level 2 (L2) and Level 3 (L3) as shown in Fig.1-41. L1 cache is built inside the microprocessor whereas L2 and L3 are on the motherboard. L1 cache is faster than L2 and L3 cache.

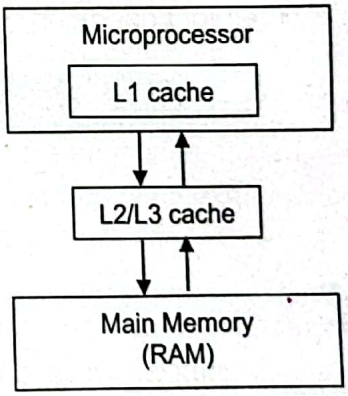


Fig.1-43 L1, L2 and L3 Cache Memories

1.3.2 PORTS, EXPANSION SLOTS AND EXPANSION CARDS

PORTS

Port is an interface for connecting various devices to the system unit. These are located on the motherboard and are usually seen at the back of the system unit. There are various types of ports for connecting keyboard, mouse, monitor, microphone, speakers and other input/output devices as shown in

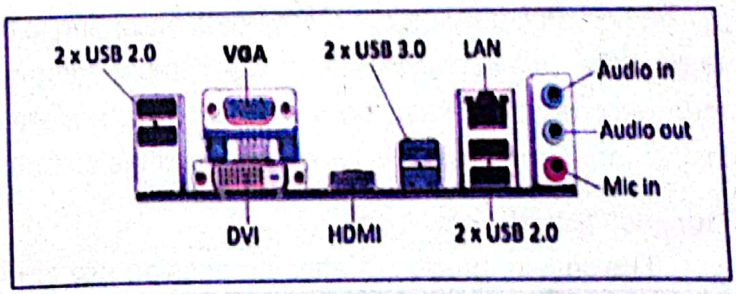


Fig.1-44 Ports on motherboard

Fig.1-42(a). In modern computers, USB (Universal Serial Bus), HDMI (High Definition Multimedia Interface), DVI (Digital Visual Interface), Audio and LAN (Local Area Network) ports are used for connecting various devices to the computer. These devices include digital camera, scanner, printer, external hard disk or DVD writer and USB memory, etc.

EXPANSION SLOTS AND EXPANSION CARDS

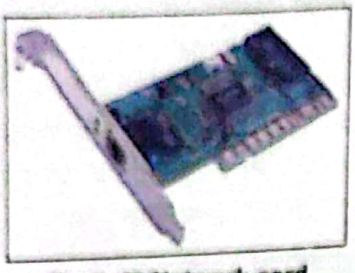


Fig.1-45 Network card

Expansion slots are long narrow sockets on the motherboard used for installing expansion cards. Expansion cards are small circuit boards. These cards add new capabilities to the computers. Commonly used expansion cards are sound card, graphics card, modem card and network card. In modern computers these cards are built-in on the motherboard. A network card is shown in Fig.1-43.

1.4 BASIC OPERATIONS OF A COMPUTER

The following four basic operations are performed by computers which are shown in Fig.1-44.

- Input operation
- Processing operation
- Storage operation
- Output operation

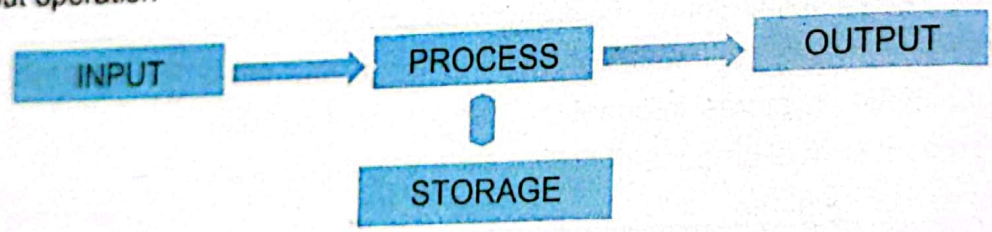


Fig.1-46 Basic operations of a computer

Input Operation

A computer is a data processing machine. Users enter data and instructions into the computer through keyboard or mouse. It can also be provided to the computer from a storage device such as hard disk, CD or USB memory. The input data/instructions are stored in memory for further processing.

Processing Operation

Microprocessor processes the data according to the instruction given to it. The microprocessor fetches the data/instructions from the memory and stores it in instruction register. The control unit then decodes the instruction to find out which operation is to be performed. After decoding the instruction, it sends signals to other parts of the computer to execute it.

Storage Operation

The results produced after processing are stored in memory before they are sent to the output device or permanent storage device like hard disk.

Output Operation

The results of data processing stored in memory must be output so that they can be seen by the user. The control unit displays the results on the monitor or prints it on the printer. Results can also be saved in a storage device such as hard disk for use in the future.

1.5 COMPUTER SOFTWARE

Computer programs are known as computer software. Computer program is a set of instructions that tells a computer what to do and how to do. It is classified into two categories, system software and application software.

1.5.1 SYSTEM SOFWARE

System software is a collection of programs which makes the use of computer easy and efficient. Highly experienced computer programmers develop system software. Following are the types of system software.

- Operating system
- Device drivers
- Utility programs
- Language processors

Operating System

An operating system is system software that is responsible for the management and coordination of all the activities performed by the computer. It provides the environment in which the user can interact with the computer hardware to operate the computer. The most popular operating system used in microcomputers is the Windows.

The following tasks are performed by the operating system.

i. It loads programs into memory and executes them.
ii. It controls the operation of input/output and storage devices.
iii. It manages files and folders.
iv. It allows to create password to protect computers from unauthorized use.
v. It detects hardware failures and displays messages to fix them.

Device Drivers

A device driver is system software that controls the operation of a computer device. When users attach a device such as printer or scanner to their computer, they should install its driver to make it operational. Device drivers are provided by device manufacturers.

Utility Programs

Utility programs perform specific tasks that are related to the management of the computer.

The following are some commonly used utility programs that perform specific tasks.

- Windows Explorer: It is used to manage files and folders.
- Backup utility: It is used to make backup of data.

- WinZip utility: It is used to compress files.
- Diagnostic utility: It is used to detect hardware and software problems.
- Antivirus software: It is used to detect and remove viruses.

Language Processors

A language processor is a system program used to translate computer programs into machine language. Machine language is directly understood by the computer. Therefore, all the programs must be translated into machine language before execution by the computer. Compiler and interpreter are language processors used to translate high level language programs into machine language. A program called assembler is used to translate assembly language programs into machine language.

1.5.2 APPLICATION SOFTWARE

Application software is developed for computer users to solve their problems such as preparing a letter, creating a presentation or managing a database. Commonly used application software includes productivity software, business software, entertainment software and education software.

Productivity Software

Productivity software includes word-processing, spreadsheet and database management software packages. These software packages are used by individuals to speed up their daily routine tasks by doing their work in an organized and efficient way.

Business Software

Any software that helps in running business in a more efficient way to improve productivity is known as business software. Some examples of commonly used business software are accounting, sales and marketing, inventory control, project management and payroll software.

Entertainment Software

Software developed to entertain people is known as entertainment software. Video games are one of the most popular forms of entertainment software. Many games are lot of fun to play but sometimes they can also help to improve skills such as typing or reading. The term edutainment merges games and education software into single software. Edutainment software is used mainly for entertainment but it educates as well.

Education Software

Software developed for educational purpose is known as education software. A large variety of education software has been developed. Education software includes typing tutor, spelling tutor, language learning, medical and healthcare, driving test and flight simulation software, etc.

1.5.3 OPEN SOURCE SOFTWARE, SHAREWARE AND FREEWARE

Open Source Software

It is computer software that is available in the form of source code that allows users to study, change and improve it. Open source software is free for use, modification and distribution. Some examples of open source software are Linux operating system, OpenOffice (office productivity software), Flight Gear (flight simulator) and Java programming language, etc.

Shareware

Shareware is distributed free of cost for a limited period, usually one or two months. It is trial version of software given to people to decide whether they would like to buy the full version of the software. Some shareware is installed on new computers when they are sold. Examples of shareware are antivirus software and computer games, etc.

Freeware

Freeware is given free of cost and it is full version of software for an unlimited period of time. It may have some restrictions such as allowed for personal or academic use only.

Examples of freeware are Google Chrome, Mozilla Firefox, VLC media player, etc.

Key Points

- Computer is a general-purpose programmable machine that has the ability to store, retrieve and process data that is represented in the form of 0s and 1s.
- First generation computers used vacuum tubes and their period was from 1940 to 1956.
- Second generation computers used transistors and their period was from 1956 to 1963.
- Third generation computers used IC chips that were developed in early 1960s and their period is from 1963 to 1971.
- Fourth generation computers use LSI and VLSI chips and their period is from 1971 to present.
- Fifth generation of computers is concerned with development of devices that can understand natural languages and have thinking power.
- Analog computer represents and processes data by measuring quantities such as voltage and current to solve a problem. It works on supply of continuous signals as input and displays output simultaneously.
- Digital computer works with binary digits 0 and 1. Data and instructions are fed into digital computer through an input device such as keyboard. The computer performs

calculations on data according to the instructions and displays results on monitor or prints on printer.

- Hybrid computer is a combination of analog and digital computers. It combines the characteristics of both analog and digital computers.
- Mainframe computer is a very large, very powerful and expensive computer that can support hundreds and even thousands of users at the same time.
- Minicomputer is bigger than microcomputer but smaller than mainframe. It is used in organizations that have hundreds of users.
- Microcomputer is the smallest and the low cost computer. It is the most commonly used computer in homes and offices.
- Software engineer is a highly skilled person in the field of IT whose responsibilities involve the analysis, design, implementation and maintenance of computer software.
- Computer programmer is an IT professional who has extensive knowledge and expertise in programming languages. He programs the computer by writing step-by-step instructions that tell the computer what to do.
- System analyst analyzes the data processing requirements of organizations and develops information systems to implement them.
- Hardware engineer is an IT professional who designs and manufactures computer hardware.
- Network engineer is a person who is responsible for installation, configuration and maintenance of computer networks in organizations.
- Database administrator is a person who is responsible for the design, implementation and maintenance of a database in an organization.
- Web designer is a person whose job is to plan, design and develop websites.
- Multimedia designer is a person who designs multimedia software by combining text, graphics, animation, audio and video.
- Information security analyst is a person whose job is to protect information and information systems from unauthorized access, use, modification, recording and destruction.
- Computer teacher is a person who teaches the subject of computer science to students.
- Computer hardware refers to the physical components that make up a computer system.
- Computer software is a set of instructions that tell a computer what to do and how to do.
- System software is a collection of programs which makes the use of computer easy and efficient.
- Operating system is system software that is responsible for the management and coordination of all the activities performed by the computer.

- Application software is developed to solve the problems of computer users such as writing letter, creating presentation or managing a database.
- Open source software is a program that is freely available in the form of source code that allows users to study, change and improve it.
- Shareware is trial version of software that is distributed free of cost for a limited period, usually one or two months.
- Freeware is software given free of cost for an unlimited period of time.

Exercise

Q1. Select the best answer for the following MCQs.

i. Who invented logarithm?

A. Blaise Pascal
B. John Napeir
C. Charles Babbage
D. Herman Hollerith

ii. Which generation of computer used transistor?

A. 1st Generation of Computers
B. 2nd Generation of Computers
C. 3rd Generation of Computers
D. 4th Generation of Computers

iii. In which generation of computer microprocessor was introduced?

A. 1st Generation of Computers
B. 2nd Generation of Computers
C. 3rd Generation of Computers
D. 4th Generation of Computers

iv. Which of the following computer supports thousands of users at the same time?

A. Microcomputer
B. Minicomputer
C. Mainframe computer
C. Laptop computer

v. Who is responsible for protecting information and information systems from unauthorized people in an organization?

A. System Analyst
B. Information Security Analyst
C. Network Administrator
D. Hardware Engineer

vi. Which of the following is the fastest memory?

A. USB flash drive
B. RAM
B. ROM
D. Cache

vii. What type of software a device driver is?

A. Application software
B. Business software
C. System software
D. Productivity software

viii. Which of the following is volatile memory?

A. RAM
B. ROM
C. USB flash drive
D. Hard disk

ix. Which software is distributed free of cost for a limited period as a trial version?

A. Open source software
B. Shareware
C. Freeware
D. Productivity software

x. When were IC chips developed?

A. Early 1960s
B. Early 1970s
C. 1980s
D. 1990s

Q2. Write short answers of the following questions.

i. Describe Napier's Bone and Slide Rule.
ii. Compare 1st and 3rd generation computers.
iii. Differentiate between analog and digital computers.
iv. Ahmed, a class IX student is asking his father to replace his home computer CRT monitor with LCD monitor. How will you justify his demand?
v. What will happen if storage devices are removed from a computer?
vi. Differentiate between systems software and application software.
vii. How a student can use computer to improve academic performance?
viii. Give any three uses of computers in a school library.
ix. Name few house hold appliances in which microprocessor is used.
x. What are the tasks performed by operating system?

Q3. Write long answers of the following questions.

i. Describe the five generations of computers.
ii. Write a note on mainframe, minicomputer and microcomputer.
iii. Explains the basic operations of a computer.
iv. Write short note on the following.

a. Hardware Engineer
b. Network Administrator
c. Database Administrator
d. Web Designer

e. **Multimedia Designer**

v. Describe the following types of application software.

a. Productivity software
b. Business software
c. Entertainment software
d. Education software

Lab Activities

Activity 1: Demonstrate how input/output devices are connected to the system unit of the computer.

Activity 2: Students should be shown components of computer such as RAM, ROM, microprocessor, ports, expansion slots and power supply attached to the computer system.

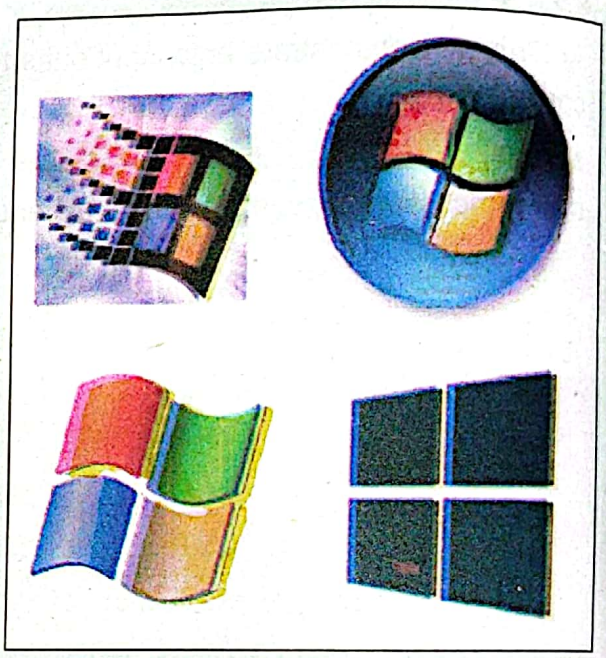
2

FUNDAMENTALS OF OPERATING SYSTEM

After completing this lesson, you will be able to:

This is 20 periods Chapter including practical work.

- Know the objectives of operating system
- Get familiar with functions of operating system
- Differentiate between common types of operating systems (Command Line Interface, Menu Driven Interface and Graphical User Interface)
- Define single user and multi-user operating systems
- Describe batch processing, time-sharing processing and real-time processing
- Identify the basic icons of operating system having graphical user interface
- Manage data (files/folders)
- Install operating system
- Install office automation software
- Install anti-virus software



UNIT INTRODUCTION

Computer user must know how to give commands to the computer to operate it properly. Therefore, this unit is dedicated to provide basic knowledge about operating system. It teaches the user how to use the operating system to run programs and manage files and folders. It describes the steps involved in installation of operating system, office automation software and antivirus software in computer. It presents material about the operating system used in modern computers and those used in the past. This will teach the user about the advantages of modern operating system over the old operating systems.

2.1 INTRODUCTION

Operating system is a collection of system software that controls the working of computer system. It acts as an interface between the computer user and computer. It facilitates program execution and helps in developing application programs.

2.1.1 OBJECTIVES OF OPERATING SYSTEM (O.S.)

The main objectives of the operating system are convenience and efficiency. It makes the computer more convenient to use. It allows computer resources such as CPU, memory, input/output devices and Internet to be used in an efficient manner. It can be viewed as a resource manager.

2.1.2 FUNCTIONS OF OPERATING SYSTEM

The following are the main functions of operating system.

- Process Management
- Memory Management
- Input/Output Management
- File Management
- Resource Management
- User Management

Process Management

Process management is an essential part of operating system (OS). A process is a program in execution. In computer system multiple processes are executing concurrently or waiting for their turn to be executed. A process in execution needs resources like processing resource, memory and I/O resources. The OS must allocate resources to processes, enable processes to share and exchange information, and protect the resources of each process from other processes.

Memory Management

Memory management is the process of allocating memory space for user programs in main memory. When programs are run by users, the operating system allocates portions of free memory to programs. When a program is closed, operating system will free the memory portion used by that program for reuse. The operating system automatically loads user programs in available memory space and executes them.

Input/Output Management

Input/output management is the process of controlling the operation of all the input/output devices attached to computer. User communicates with computer through various input/output devices such as keyboard, mouse, monitor printer, etc. Management of these devices is the responsibility of operating system. Operating system uses Input/Output controller to manage and coordinate the operation of all the input/output devices.

File Management

File management system is part of operating system that organizes stores and keeps track of computer files and folders. Computer files can be documents, programs, images, videos, etc. Operating system controls the common operations performed on files. These operations include creating, opening, editing, renaming, moving, copying, deleting and searching files.

Resource Management

Operating system automatically manages the resources of a computer when application programs are executed by computer user. The resources of a computer include microprocessor, memory and all the devices attached to the computer. Operating system allocates resources of a computer to the application program according to the user's requirement in an efficient way to improve the performance of the computer.

User Management

User management is an important feature of operating system for maintaining a secure computer system. The operating system gives full control over a computer system to a person known as administrator. Administrator installs various programs on the computer system for users. He also creates and manages user accounts. When a user account is created, the user is assigned a user name and a password. Administrator allows the users to run various application programs that are installed on the computer. A user can login to the computer system by entering the user name and password, run programs and save his files in his personal folder. Operating system does not allow the users to install programs or create new users.

2.1.3 OPERATING SYSTEMS INTERFACES

There are three types of operating systems based on ways of interaction with computer (interface). The three types of interfaces are:

- Command Line Interface
- Menu Driven Interface
- Graphical User Interface (GUI).

Command Line Interface (CLI)

In CLI, commands are given to computer with keyboard. It is based on textual input. The user types in a command and presses the Enter key to execute it. Two commonly used operating systems that use CLI are DOS (Disk Operating System) and UNIX. CLI is difficult to use because users have to remember the commands to perform any task.

- **Disk Operating System (DOS)**

DOS was the most popular CLI operating system. DOS displays the prompt (C:\>) to enter commands. User must know the syntax of the command. DOS commands are difficult to remember. Some DOS commands are still supported by the new Windows operating system. It is a single user and single task operating system.

The following are some examples of DOS commands with their description

DIR	Display the contents of current directory (folder)
FORMAT D:	Format the D drive
CD\PICS	CD stands for Change Directory, which makes PICS the current directory

DO YOU KNOW?
Microsoft introduced the MS DOS in 1981 and it was replaced by Windows 3.0 in 1990.

Some DOS commands are shown in Fig.2-1.

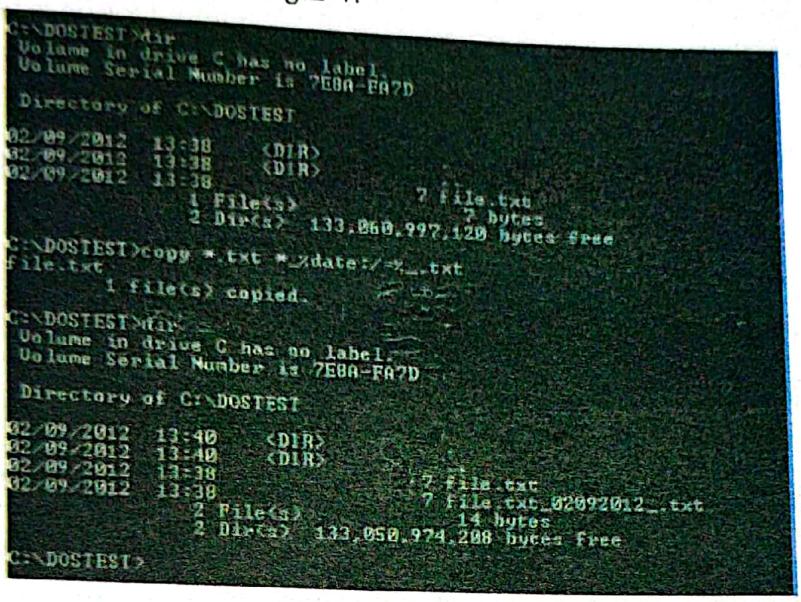


Fig.2-1 DOS Interface

- **UNIX**

UNIX is a multi-user CLI operating system introduced in 1969. It allows multiple users to run different programs at the same time. UNIX was developed for use on large computer system

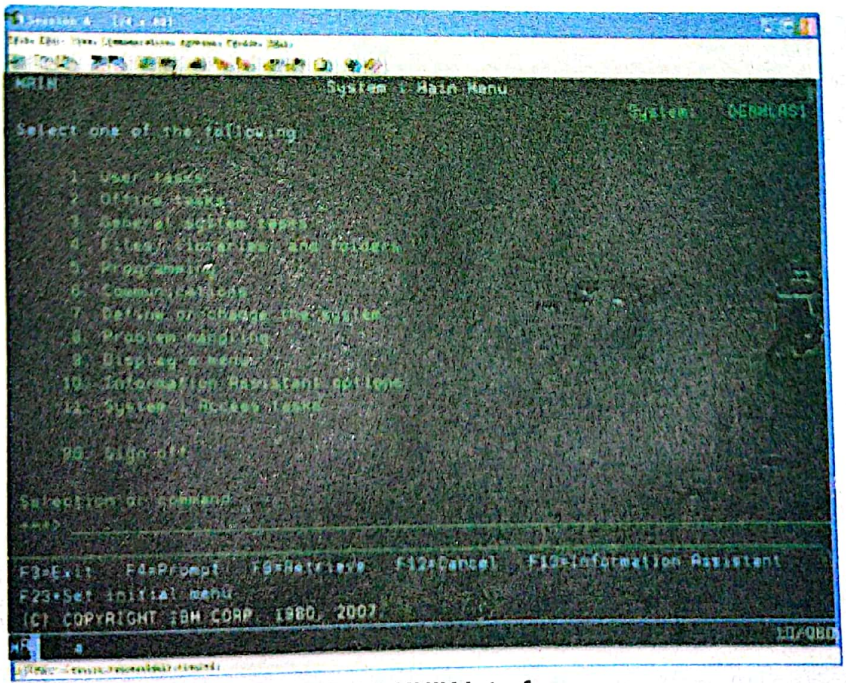


Fig.2-2 UNIX Interface

(Mainframe). It uses a command line interface but later Graphical User Interface was also introduced. UNIX commands are shown in Fig.2-2.

Menu Driven Interface

Menu driven interface presents a menu on the screen, user makes a choice and then the next menu appears. The user makes another choice and so on. Menu driven interface is easy to use as compared to CLI. The user reads the options and makes his choices. Menus contain the commands to use the operating system. Menu driven interface is also used in some application programs and other devices such as mobile phone and iPod.

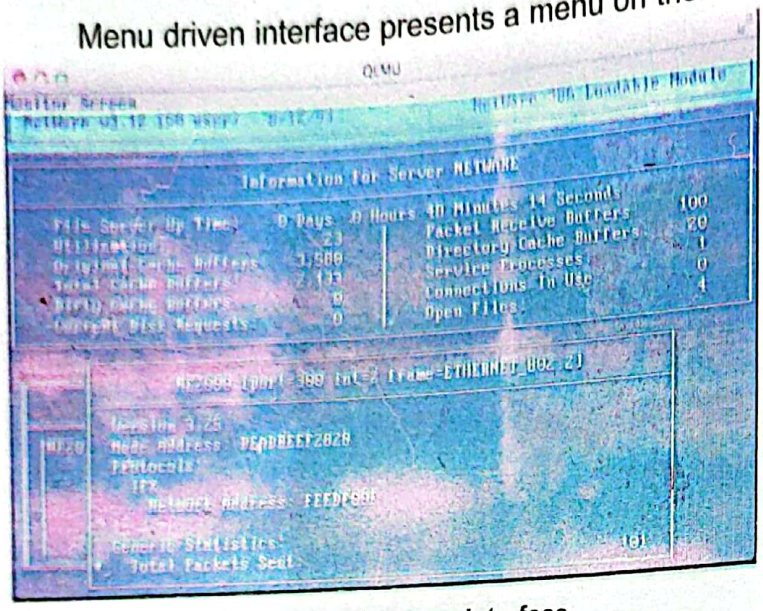


Fig.2-3 Novell Netware Interface

The following are two common menu driven operating systems

- **Novell's Netware**

Novell's Netware was a menu-driven operating system that was used in the past. Its first version was released in 1993. Novell's Netware interface is shown in Fig.2-3.

- **ProDOS**

ProDOS was another menu-driven operating system that was used on some Apple computers. ProDOS interface is shown in Fig.2-4.

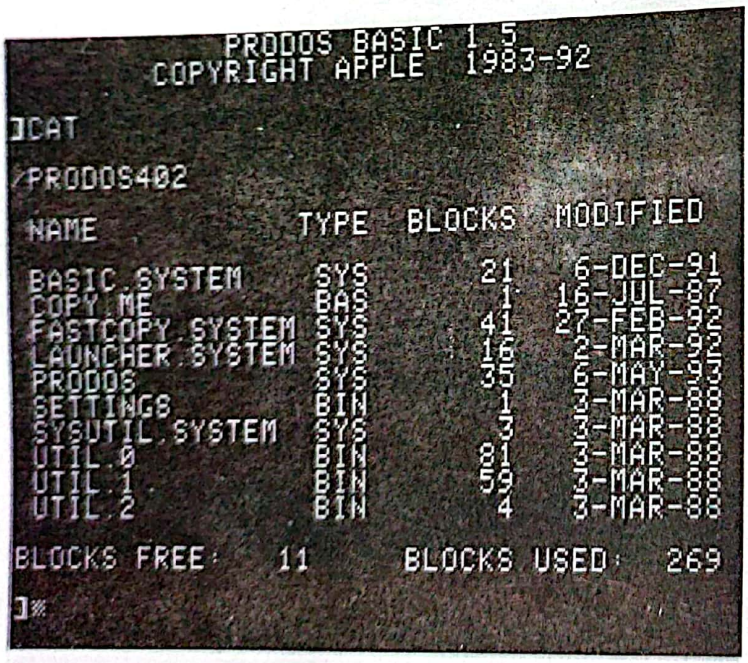


Fig.2-4 ProDOS Interface

Graphical User Interface (GUI)

GUI is a graphical interface for computer users to interact with computer. It uses windows, icons, menus and pointer. Window is a rectangular portion of monitor in which information is displayed. Icon is a graphical symbol that represents a file, folder, program, device, etc. To perform a task, the user has to select icons or make choices in menus using a pointing device such as mouse.

The following are the advantages of GUI.

i. Much easier to learn and use
ii. No need to memorize the commands
iii. Allows users to run more than one program at the same time
iv. Most of the GUIs provide good help facilities
v. Many application programs also use a similar interface so it is easy to use a new program

The following are the disadvantages of GUI.

i. Takes up lot of memory.
ii. Needs faster computer as compared to other interfaces.

Examples of operating systems that use GUI are Macintosh, Linux and Windows.

- **Macintosh Operating System**

Mac OS is a series of operating systems developed by Apple Incorporation for their Macintosh computers. It was introduced in 1984 with the original Macintosh computer and has GUI. The latest version is Mac OS X. It is a UNIX based user-friendly operating system. There are some specialized versions of Mac OS X used on devices such as iPhone, iPod, iPad and new Apple TV. Mac OS X interface is shown in Fig.2-5.

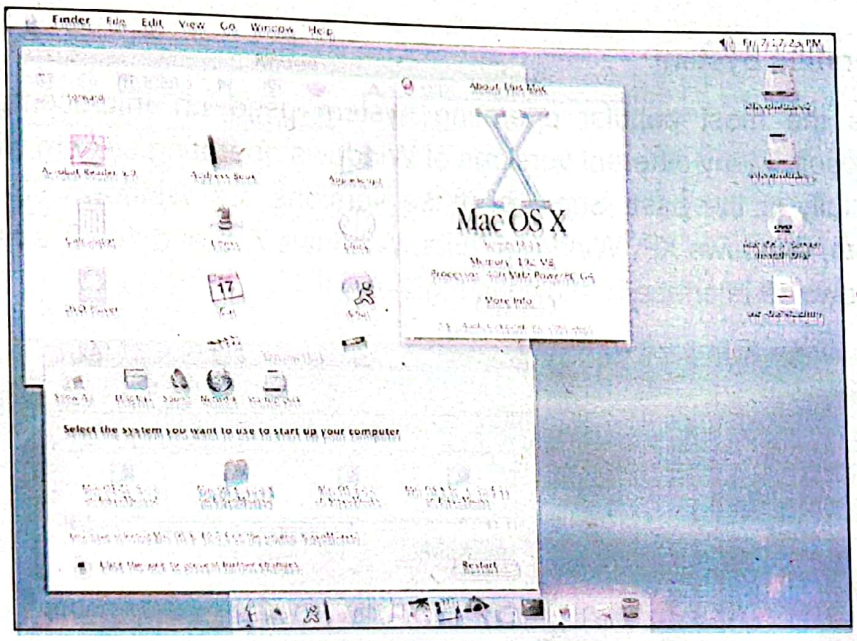


Fig.2-5 Mac OS X Interface

- **Linux Operating System**

Linux is free open-source operating system introduced by Linus Torvalds in 1991. It is faster but difficult to use as compared to Macintosh and Windows operating systems. It is not a popular operating system. Linus Torvalds started the development of Linux operating system and laid its foundation. Millions of programmers around the world work on Linux to improve it

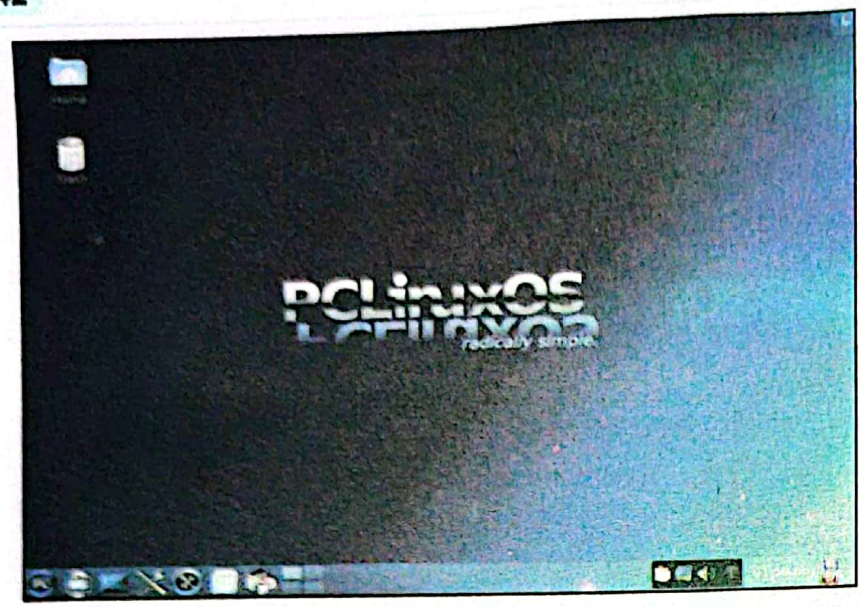


Fig.2-6 Linux Interface

Its source code is freely available on Internet. Programmers can view, edit and publish an improved version.

Linux OS can be installed on PCs, laptops, netbooks, mobile and tablet devices, video game consoles, servers, supercomputers and more. The Linux OS is frequently packaged as a Linux distribution for both desktop and server use, and includes the Linux kernel (the core of the operating system) as well as supporting tools and libraries. Popular Linux OS distributions include Debian, Ubuntu, Fedora, Red Hat and openSUSE. Linux operating system interface is shown in Fig.2-6.

- **Windows Operating System**

Windows is the most popular operating system used on microcomputers. It was developed by Microsoft. Many different versions of Windows operating system were developed and used successfully in the past. Some of these versions are Windows 95, Windows 98, Windows Millennium, Windows XP, Windows Vista, Windows 7, 8 and 10. The latest version is Windows 10. Windows 10 interface is shown in Fig.2-7.

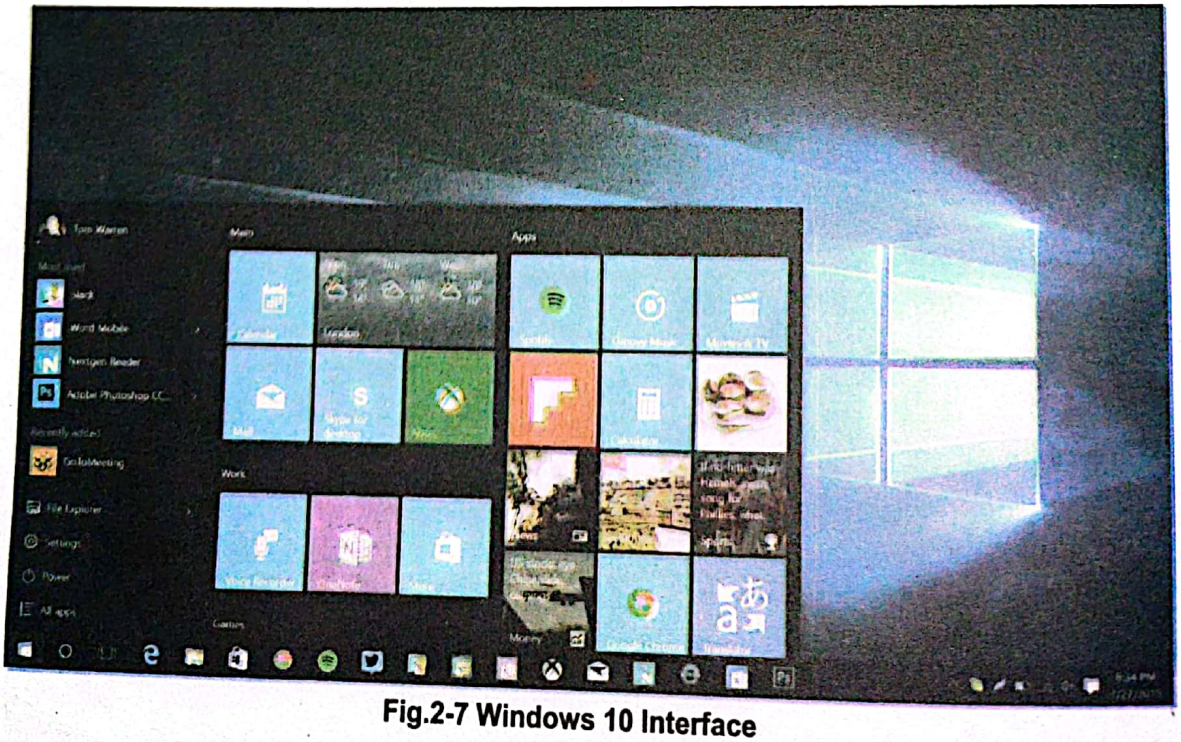


Fig.2-7 Windows 10 Interface

2.2 OPERATING SYSTEM

2.2.1 CLASSIFICATION OF OPERATING SYSTEM

Operating systems can be classified into two major categories, single-user and multi-user operating systems.

Single-user Operating System

Operating system that is used by a single user at a time is known as single-user operating system.

- It allows a single user to login and use the computer at a time. It is easy to use.
- Resources of the computer, such as CPU, memory and input/output devices are not shared with other computers.
- It is used on microcomputers.
- User can open many programs at the same time and switch among them as required.
- It requires less memory and costs less.
- Some examples of single-user operating systems are DOS, Windows 95, Windows XP, Windows 7, etc.

Multi-user Operating System

Operating system that allows many users to use a computer at the same time is known is multi-user operating system.

- It allows many users to login to a single big computer and run different programs at the same time.
- It shares the resources of the computer with other users over the network.
- It is used on minicomputers and mainframes.
- Users can communicate with each other and share files.
- A person known as administrator is responsible for assigning and managing user names and passwords.
- It requires a powerful CPU, large memory and large hard drives.
- It supports multiprogramming and time-sharing.
- Windows NT, UNIX and Linux are popular multi-user operating systems.

2.2.2 TYPES OF OPERATING SYSTEMS

There are three types of operating systems. These are batch processing, Time-sharing and real-time operating systems.

Batch Processing System

SLO 2.2.3

In a batch processing system, jobs are grouped in batches and the computer executes them one.by.one. When the current job terminates, the computer automatically loads the next job and starts executing it. Batch processing operating systems greatly improved the use of computer system.

Batch processing systems are suitable for tasks where large amount of data has to be collected and processed on a regular basis. For example, in credit card billing systems, all the data of credit card holders is collected and held until processed as a batch at the end of billing cycle. As another example, in examination report card system, all the data of students' examinations is collected and processed as a batch for printing report cards.

Timesharing System

Timesharing system is a feature of operating system in which multiple users can run different programs on a large-scale computer. It allows many users to have access to a computer at the same time and share the computer's time. In a timesharing system, the central processing unit is switched rapidly between the programs so that all the user programs are executed simultaneously. The operating systems used in minicomputers and mainframe computers support timesharing. Timesharing operating systems are used in organizations such as airline, bank, hotel, university, etc. where many users need access to the central computer at the same time.

For example, hundreds of students access the university's mainframe computer at the same time and they run different programs in a timesharing system in interactive mode.

Real time Systems

Real time operating systems must process information and produce a response within a specified time. These operating systems are developed for special applications.

These are used to control industrial processes such as oil refining. Real time operating systems are used to supply immediate response within limited time. For example, a measurement from an oil refinery indicating that temperatures are getting too high might demand quick response to avert an explosion. Example oil refinery indicates temperature regulation

There are a number of real-time operating systems used in military and space research programs. For example, real-time operating system is used to monitor the position of rocket in the space. Many cities are installing real-time traffic control systems to facilitate smooth flow of traffic at busy intersections.

2.3 GETTING STARTED WITH GUI OPERATING SYSTEM

A GUI Operating System provides a user-friendly interface. This makes it easier for people with little computer skills to operate the computer. A GUI combines four elements which are Window, Icon, Menu and Pointer. All the information displayed on the screen is presented inside a window. Small graphical symbols known as icons are used to represent files, folders, drives, programs and commands. Menus present various commands from which the user makes a selection with a pointing device. Mouse or touchpad is used as pointing device for performing different tasks such as selecting an option or opening a file, folder or program.

2.3.1 BASIC ICONS OF GUI OPERATING SYSTEM

An icon is a small graphical symbol that represents a file, folder, application or device. There are some special system icons such as Recycle Bin and Computer that are kept on the desktop. Icon has a label at the bottom describing its name.

The basic icons of Windows 7 are shown in Fig.2-8 and are described below:

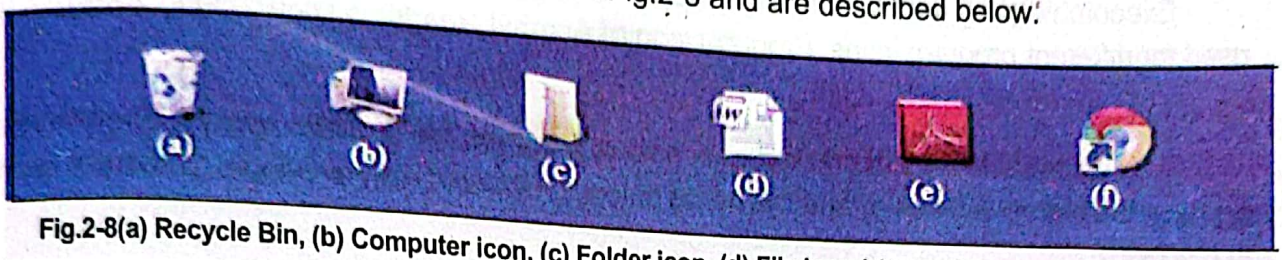


Fig.2-8(a) Recycle Bin, (b) Computer icon, (c) Folder icon, (d) File icon (e) Program icon (f) Shortcut icons

Recycle Bin

It is a temporary place (folder) for items that the user deletes from the hard disk. When a file or folder is deleted from a hard disk it goes to the Recycle Bin. The user can restore it to its original location. User can also delete a file or folder permanently from the Recycle Bin.

Tip: You can delete a file from your hard disk without sending it to **Recycle Bin** by clicking the file and then pressing Shift + Delete keys.

Computer Icon

Computer icon allows the user to access the contents of computer drives and manage files and folders. When user double-clicks on Computer icon, it will open a window similar to the one shown in Fig.2-9 that displays the drives present in the computer. It is used to navigate and manage the computer resources.

Folder Icon

Folder icon resembles a physical file folder. It is used to store files. A folder can have another folder inside it which is known as subfolder. Folders are used to keep files in an organized manner on a storage device such as hard disk so that they can be accessed easily.

Tip: Right click a shortcut icon, select **Properties** and click **Open File Location** to know the location of program, file or folder to which a shortcut belongs.

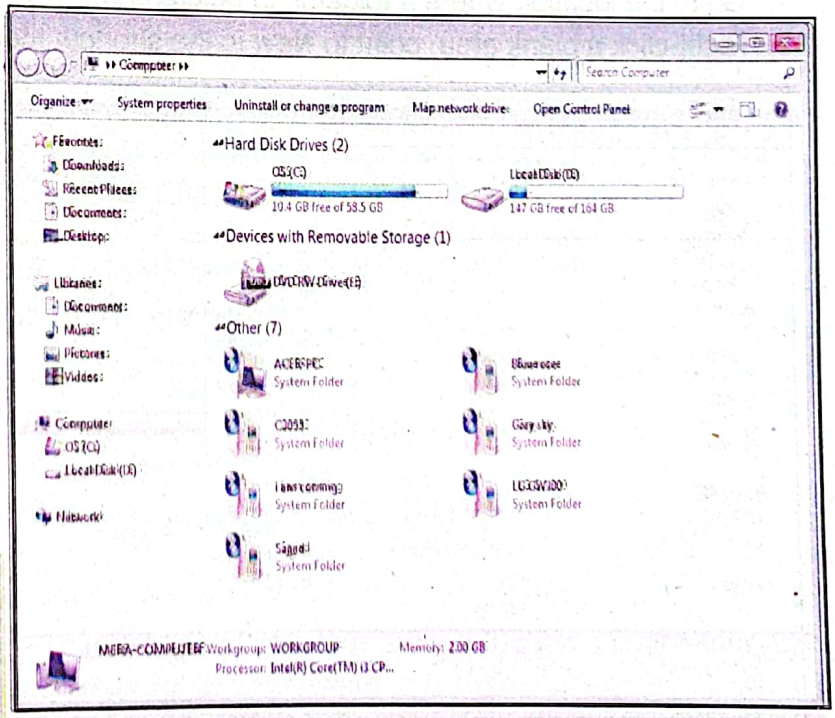


Fig.2-9 Computer-Icon window

File Icon

In a GUI, files are also represented by icons. A file may contain text, image, music or video. Users recognize a file by its icon. Icon of a Microsoft Word file is shown in Fig.2-8(d).

Program Icon

Executable program files are also represented by icons. Different graphical symbols are used for different program icons. Program icon of Acrobat Reader is shown in Fig.2-8(e).

Shortcut Icon

Shortcut icons are created to access a program, file or folder quickly. They have an arrow at the bottom left corner and the name below it. Shortcut icon of Google Chrome is shown in Fig.2-8(f).

2.3.2 MANAGING DATA (FILES/FOLDERS)

Managing data means storing files in secondary storage devices such as hard disk or USB flash drive, in an organized way. This helps in finding files easily and quickly. Files are stored in folders. The Document folder in Windows is the default folder where the user saves files.

Tip: You can create a new folder in Windows Explorer by simply pressing the Ctrl+Shift+N keys and then rename it.

File management tools of GUI operating system provide facilities to quickly and easily create folders and copy or move files into them. It also allows the user to delete files and folders that are not needed any more.

The following are the steps to create a new folder.

1. Go to the location where a folder is to be created.
2. Right-click a blank area, point to **New** in the shortcut menu and then click **Folder** as shown in Fig.2-10.

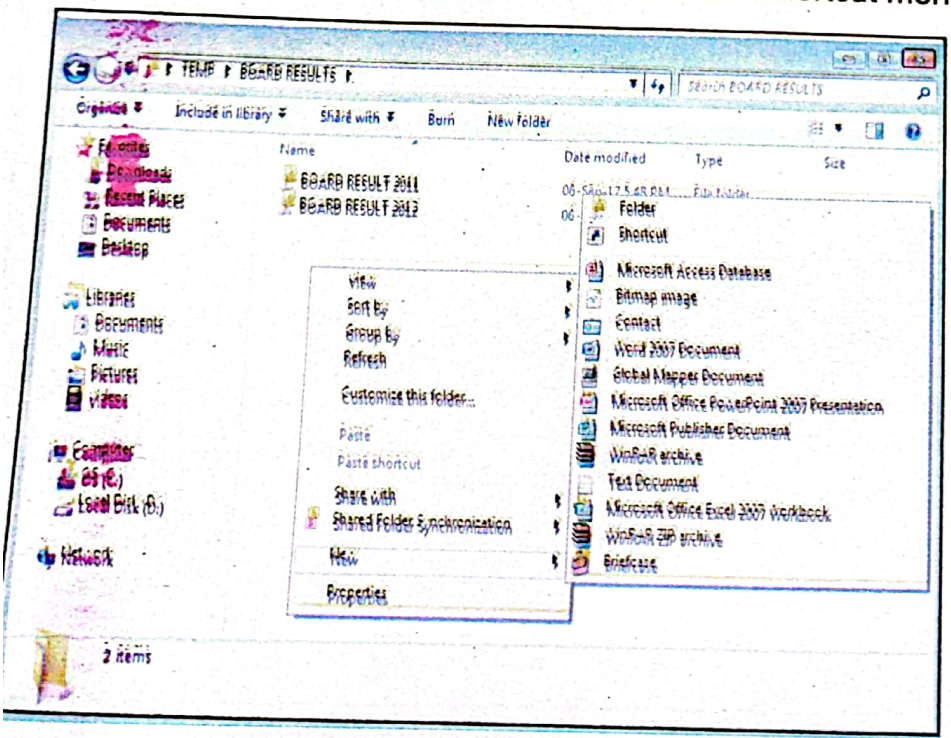


Fig.2-10 Shortcut menu to create a folder

3. Type a name for the new folder and then press **Enter** key.

The following are the steps to copy or move files.

1. Go to the location from where files are to be copied or moved.
2. Select the files to copy or move.

To select consecutive group of multiple files or folders, create a selection around the outside of all the items by dragging the mouse pointer.

To select non-consecutive group of files or folders, press and hold down the **Ctrl** key and then click each item one by one.

To select all the items in a window, click **Organize** on the toolbar and then click **Select all.**

3. Right-click on any selected file icon and then select copy or move from the shortcut menu as shown in Fig.2-11.

DO YOU KNOW?

There are six different versions of Windows 7. These are Starter, Home Basic, Home Premium, Professional, Enterprise and Ultimate.

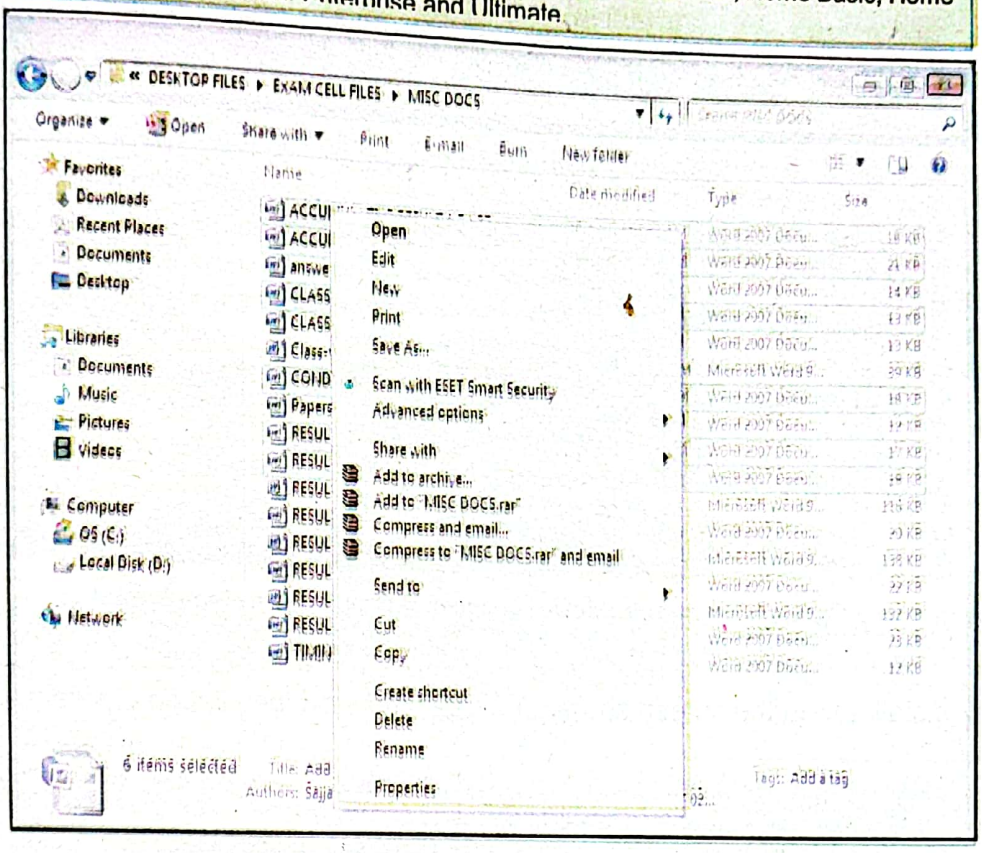


Fig.2-11 Shortcut menu for copying or moving files

4. Go to the location where the files are to be copied or moved.
5. Right-click a blank area and click **Paste**.

The following are the steps to delete files or folders.

1. Go to the location from where files or folders are to be deleted.
2. Select the items to delete as describe earlier.
3. Right-click any selected item and then click **Delete** in the shortcut menu.

2.4 SYSTEM INSTALLATION

A computer system consists of hardware and software. Before the use of computer, user must install the operating system and other required software.

2.4.1 INSTALLATION OF WINDOWS 10 OPERATING SYSTEM

The following are the steps for installation of Windows 10 operating system.

1. Turn on the computer and insert the Windows 10 DVD and boot the computer. Make sure DVD is set as the first boot device.
2. When the screen shown in Fig.2-12 appears, select the Language, Time and currency format, Keyboard or input method and click Next.

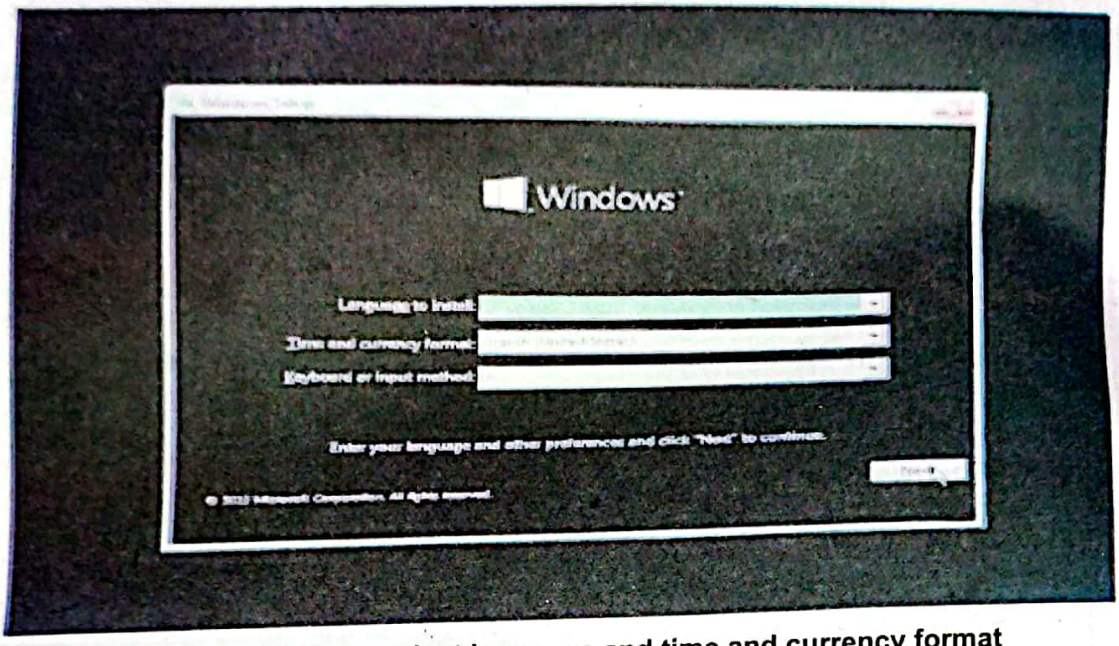


Fig.2-12 Screen to select language and time and currency format

3. Click Install now in the screen shown in Fig.2-13 to start installation of Windows 10.

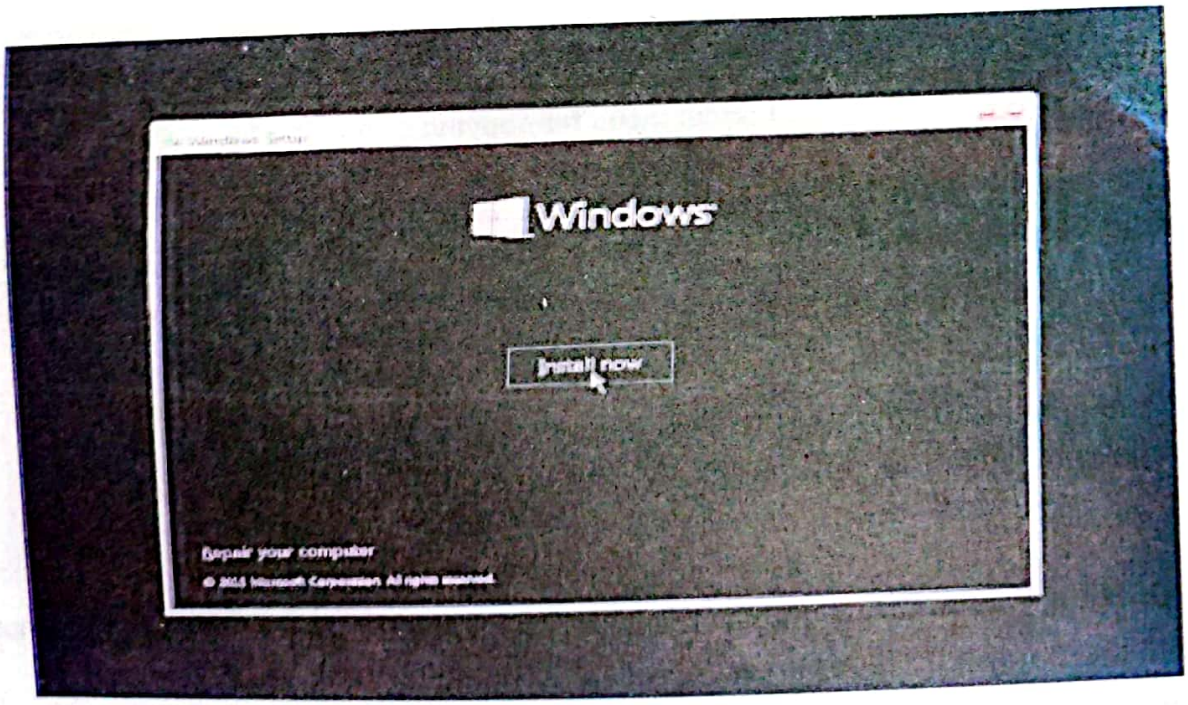


Fig.2-13 Screen to Install now

4. Wait for a few seconds for the setup to start (Fig. 2-14).

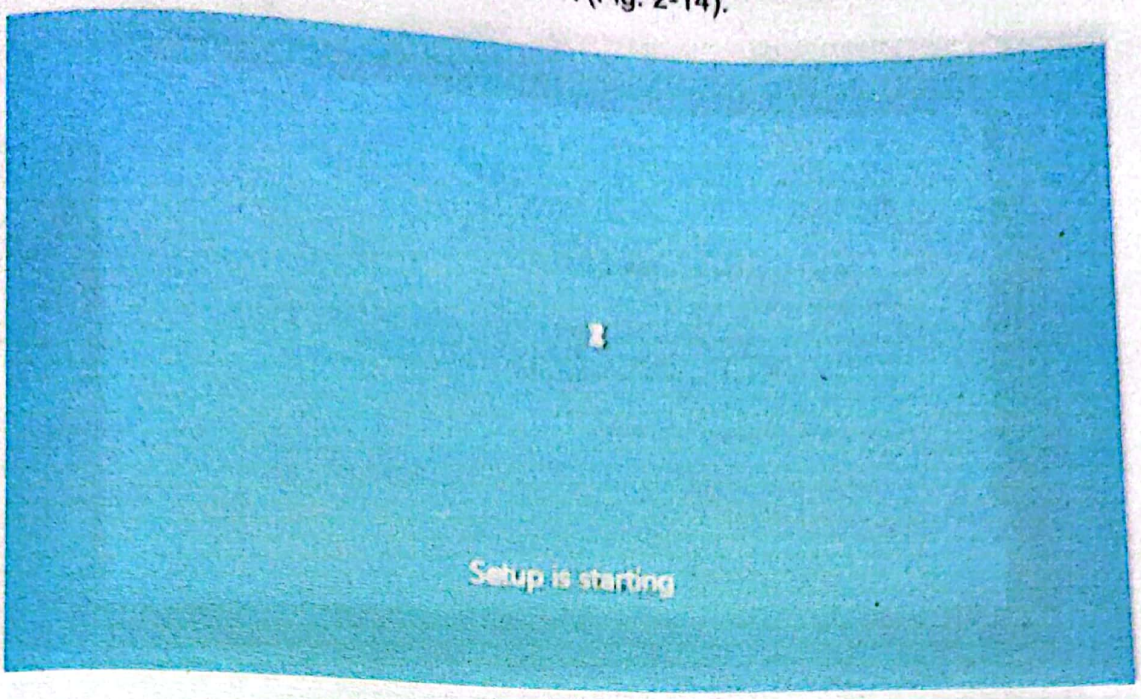


Figure 2-14

5. If you have a product key, enter it, otherwise click on Skip (Fig. 2-15).

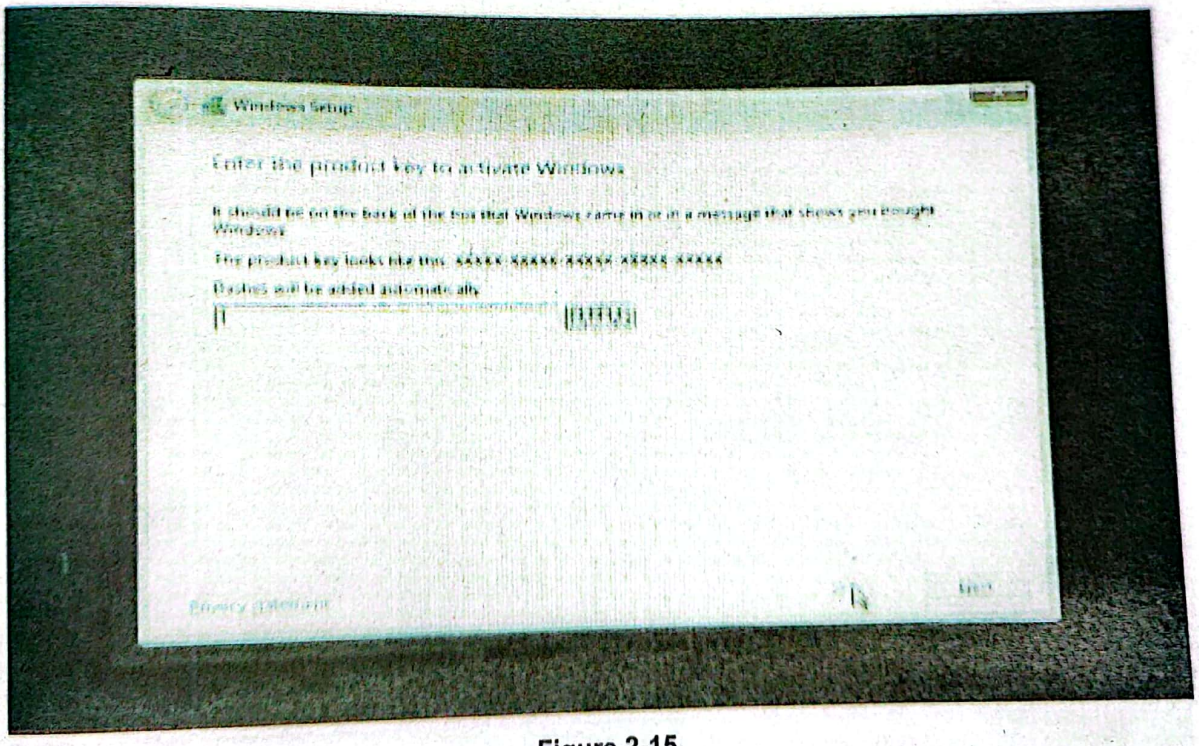


Figure 2-15

6. Accept the license terms and click on Next (Fig. 2-16).

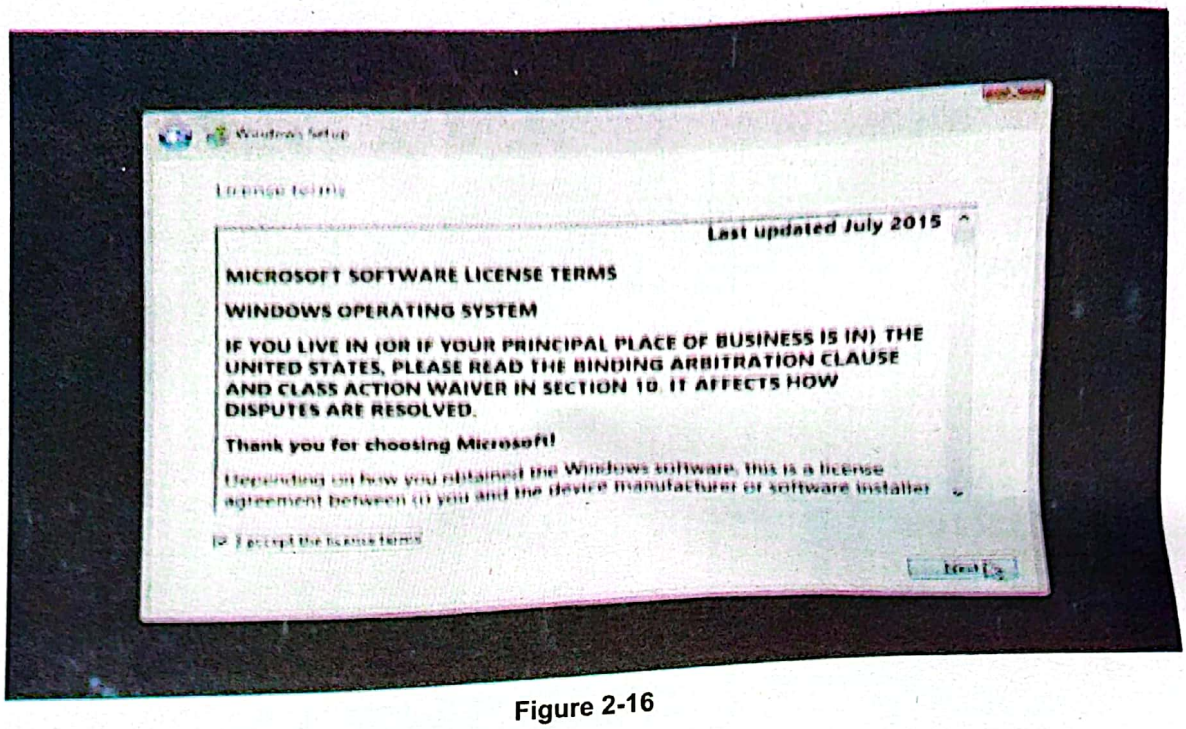


Figure 2-16

7. Select "Custom: install Windows only (Advanced)" (Fig. 2-17)

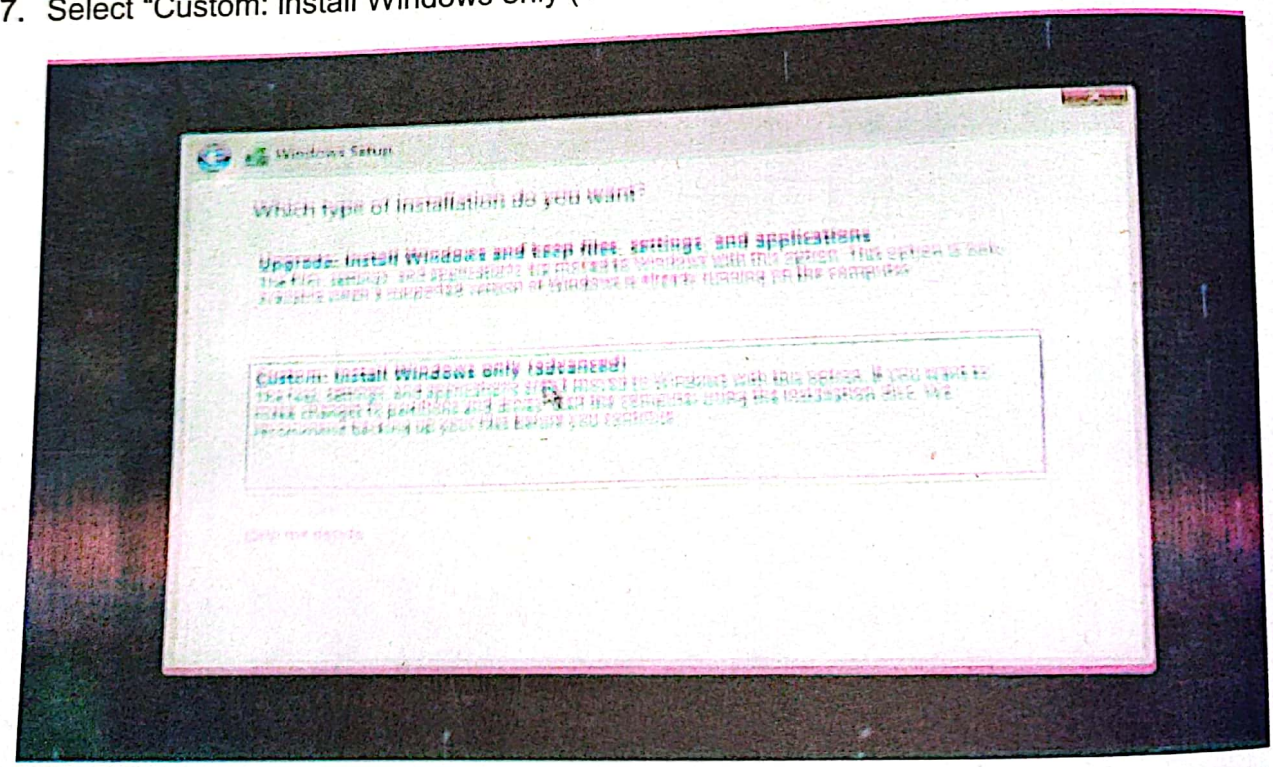


Figure 2-17

8. Select the drive where you want to install Windows 10 (Fig. 2-18).
Note: Make sure the drive is formatted, if not you can format by selecting the format option provided.

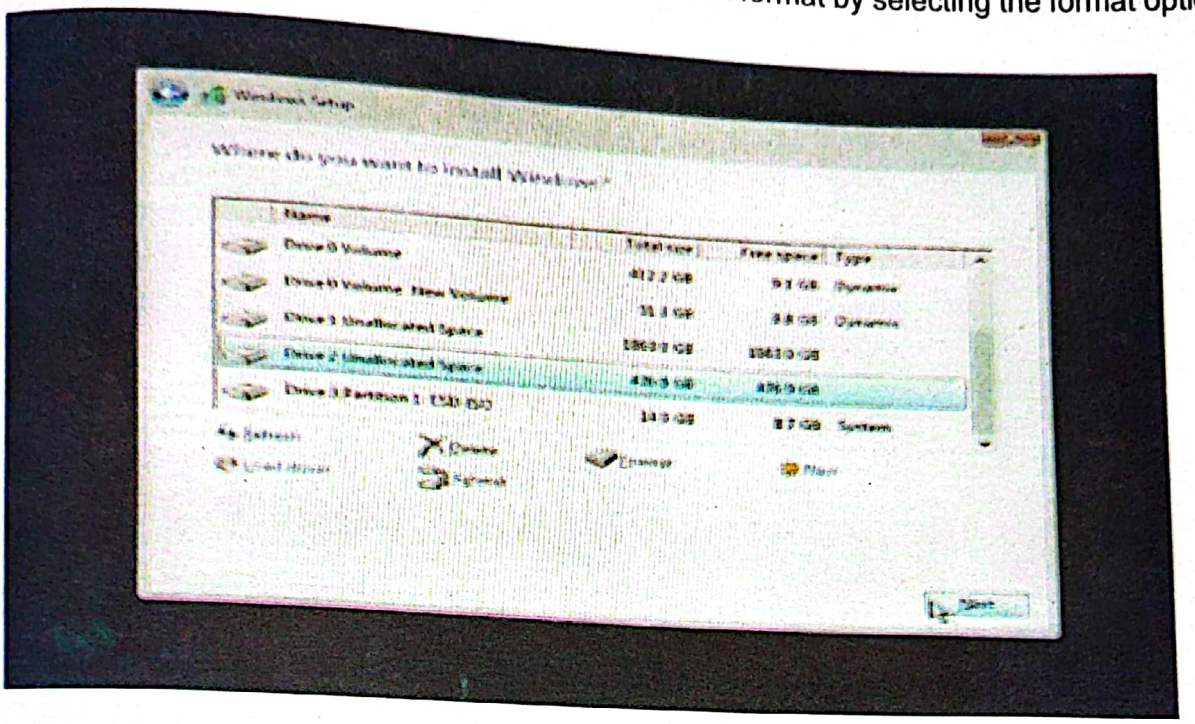


Figure 2-18

9. Wait for a sometime until Windows is being installed. This may take from a few minutes to an hour depending on the hardware of your personal computer. Once this process is complete, your PC will restart (Fig. 2-19).

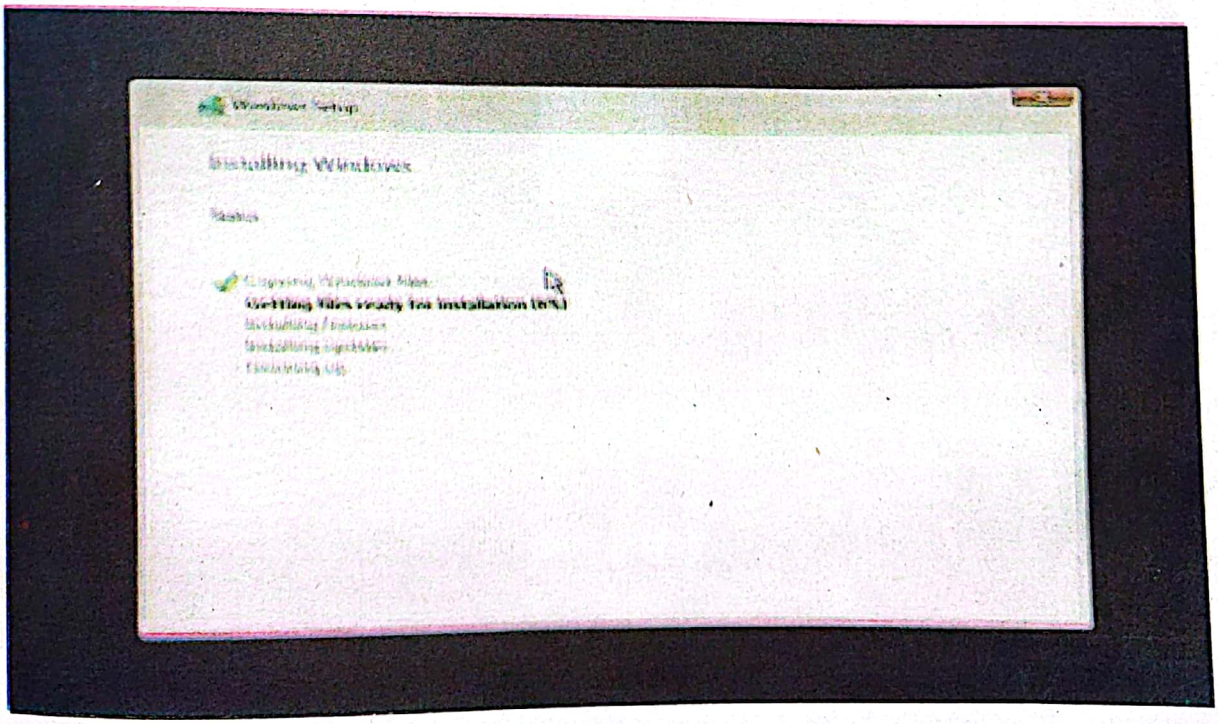


Figure 2-19

10. Choose Windows 10 (Fig. 2-20).

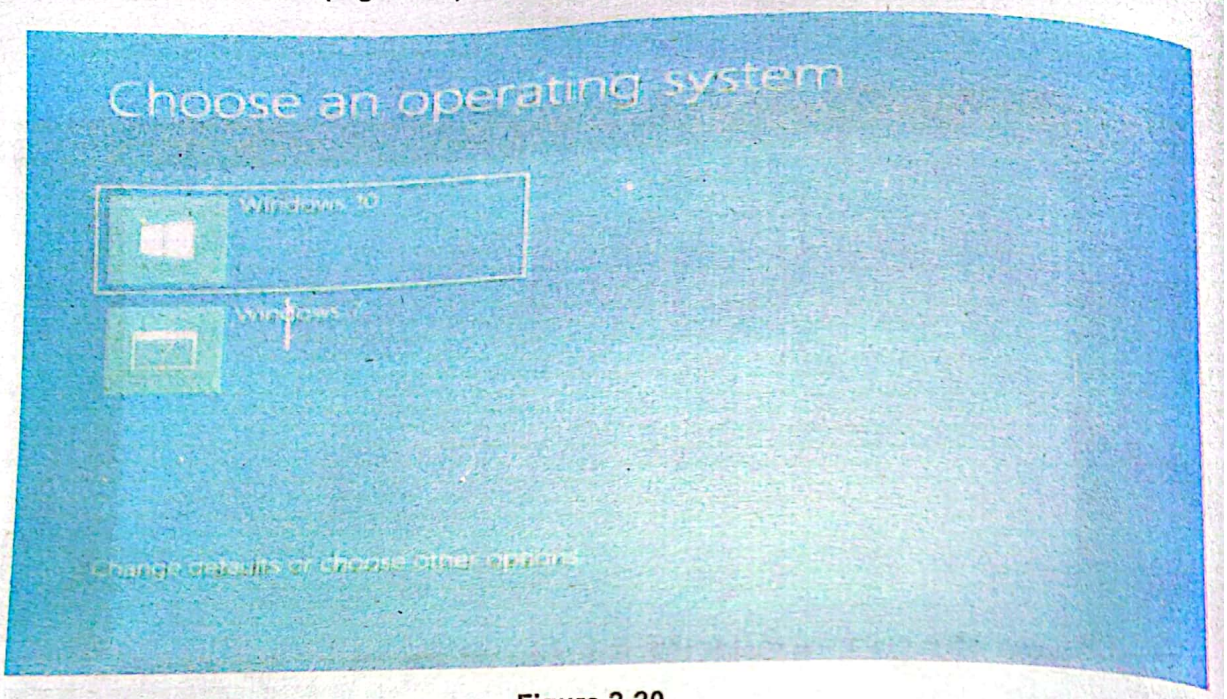


Figure 2-20

11. Wait for some more time (Fig. 2-21).

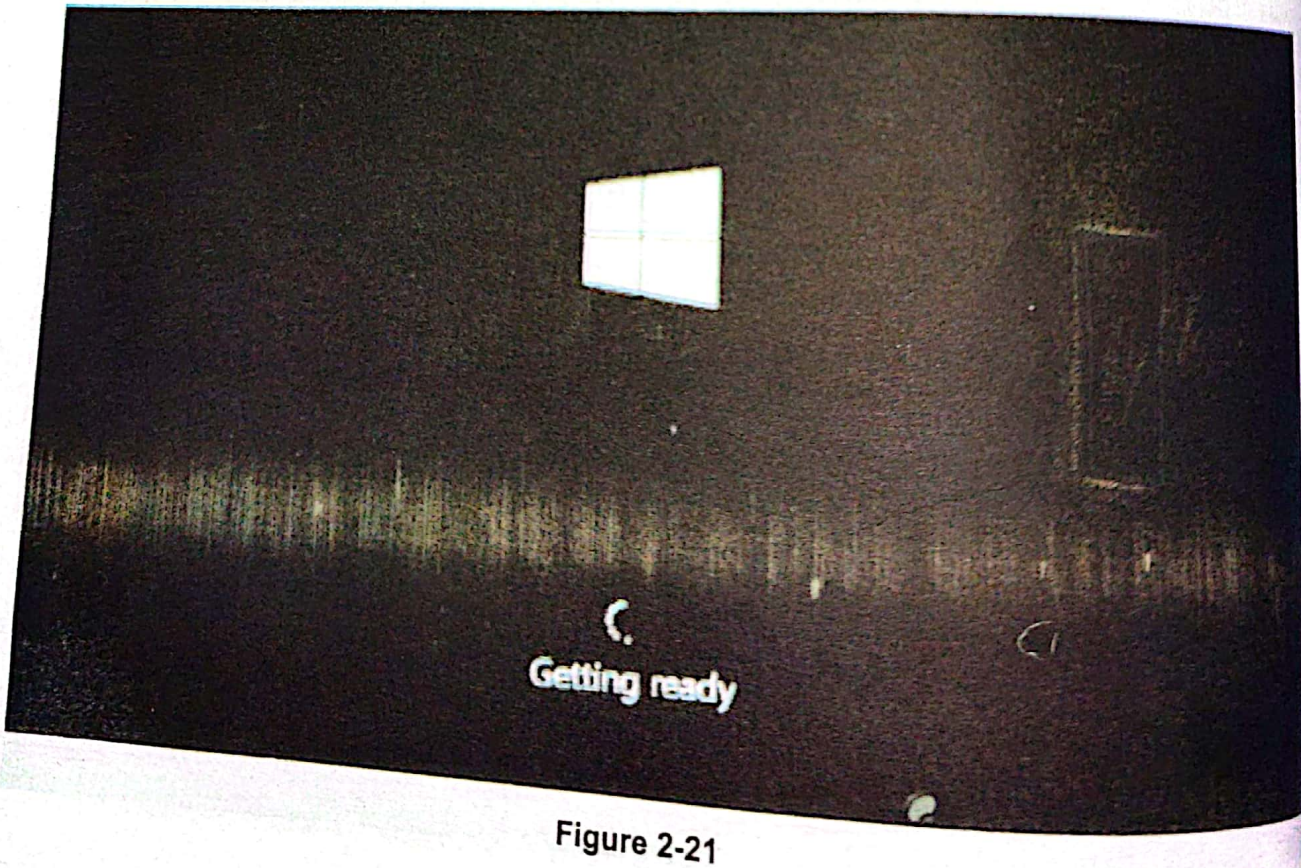


Figure 2-21

12. Enter a serial key, otherwise click on Do this later to skip this option (Fig. 2-22).

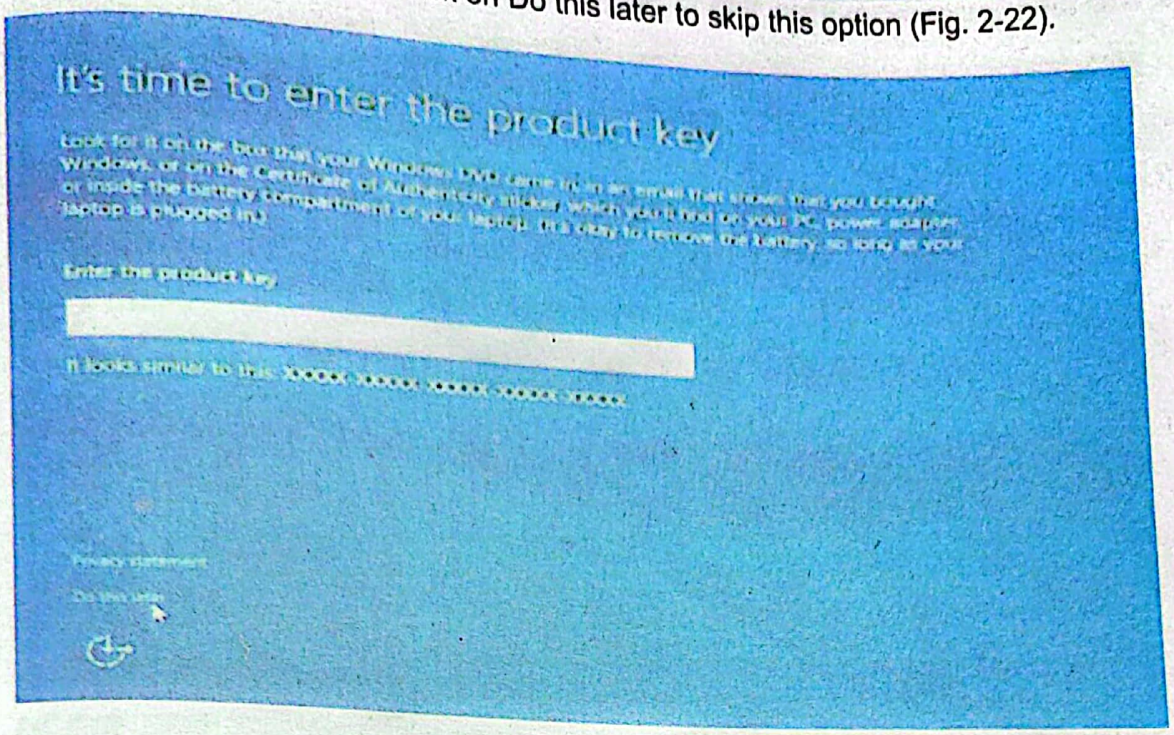


Figure 2-22

13. Click on Use express settings to use the recommended settings. Alternatively you can even click on Customize settings to customize the settings (Fig. 2-23).

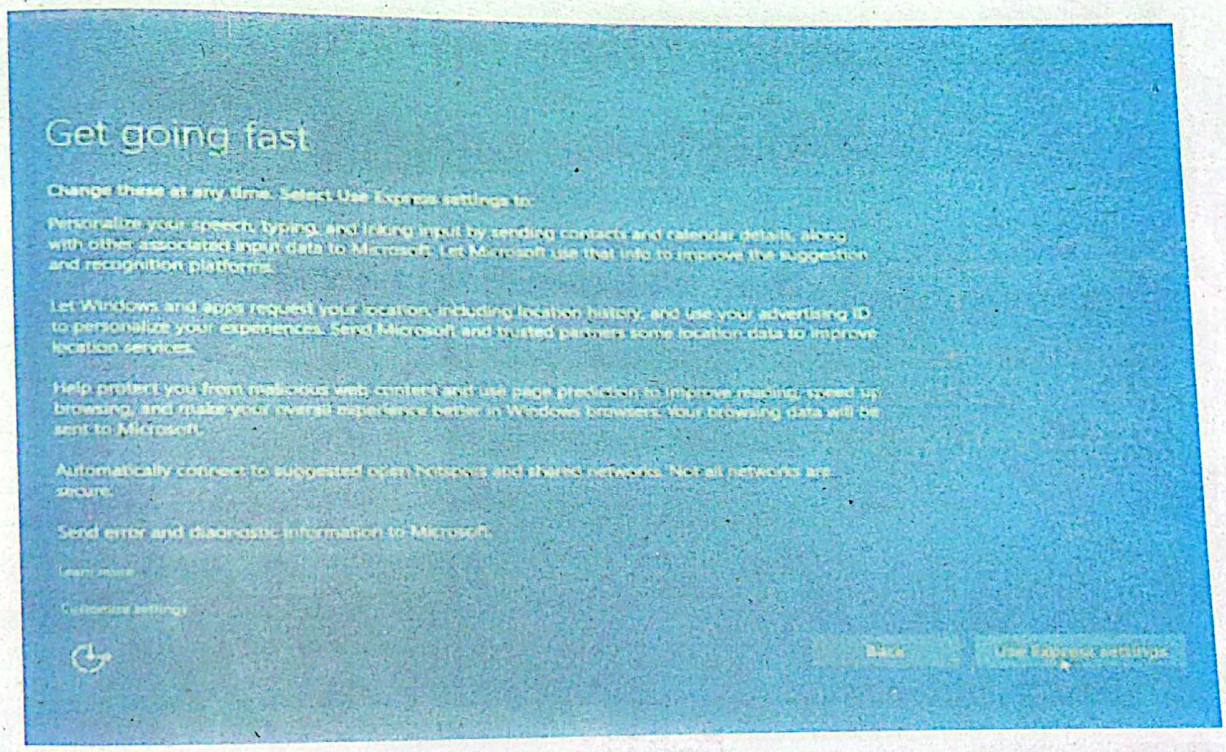


Figure 2-23

14. Wait for a few seconds more (Fig. 2-24).

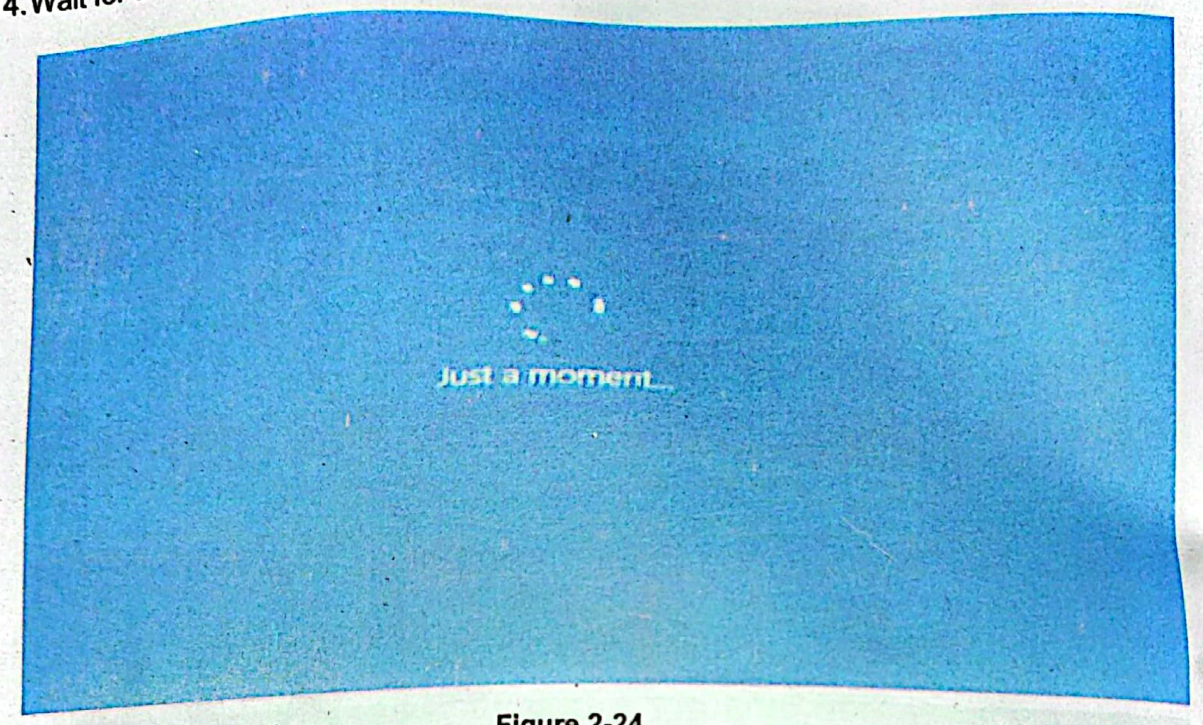


Figure 2-24

15. Enter a name and password to create your account (Fig. 2-25).

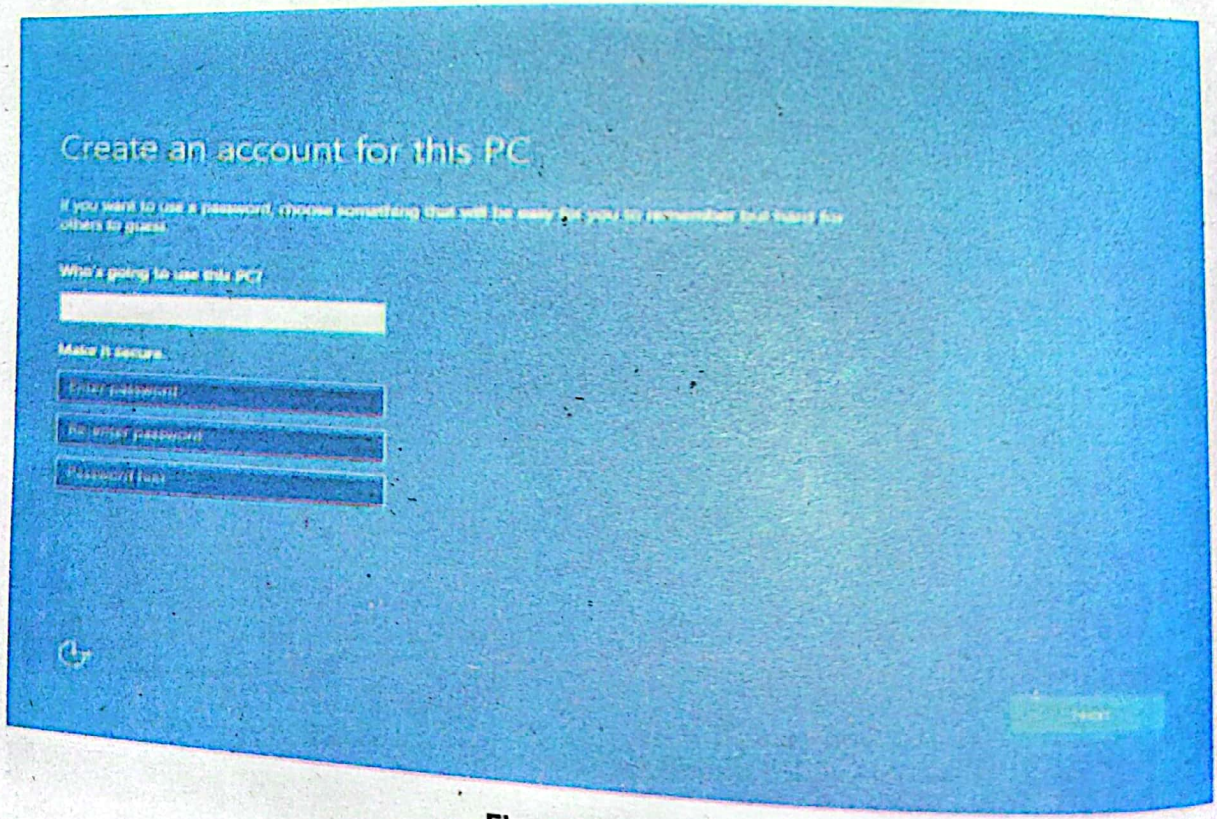


Figure 2-25

16. Wait for a few seconds more (Fig. 2-26).

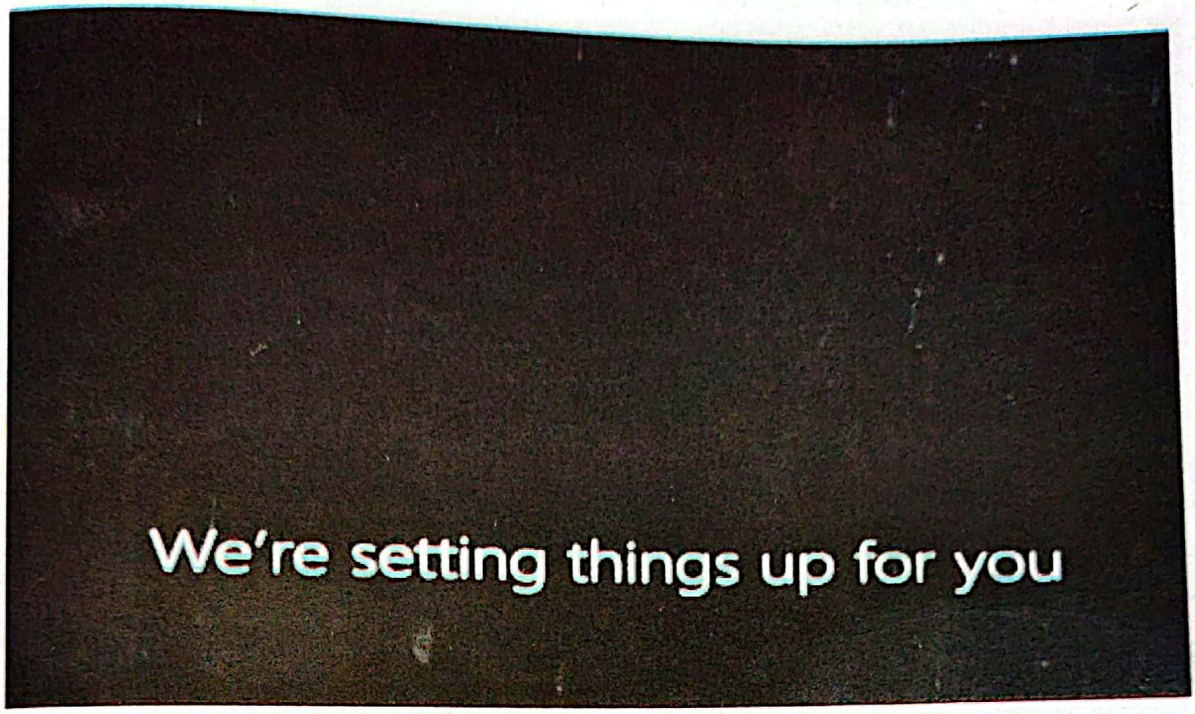


Figure 2-26 a

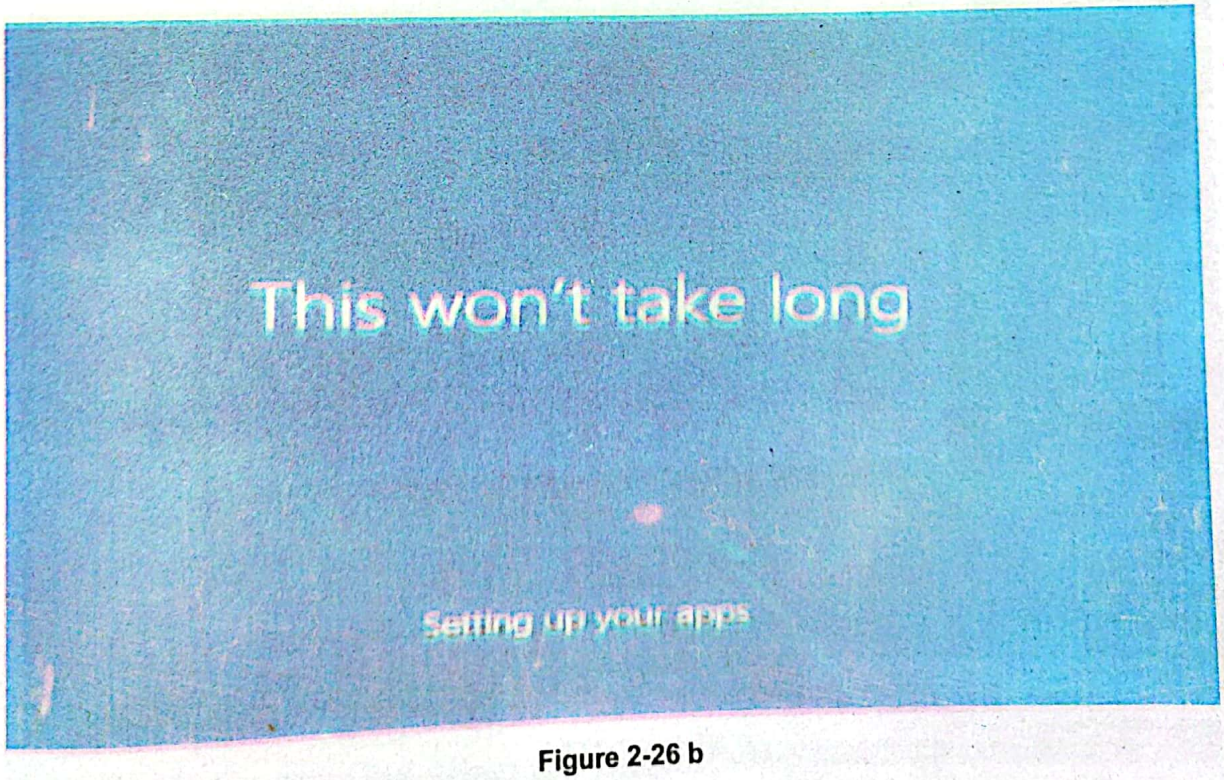


Figure 2-26 b

17. There you go, you are finally on Windows 10 (Fig. 2-27).

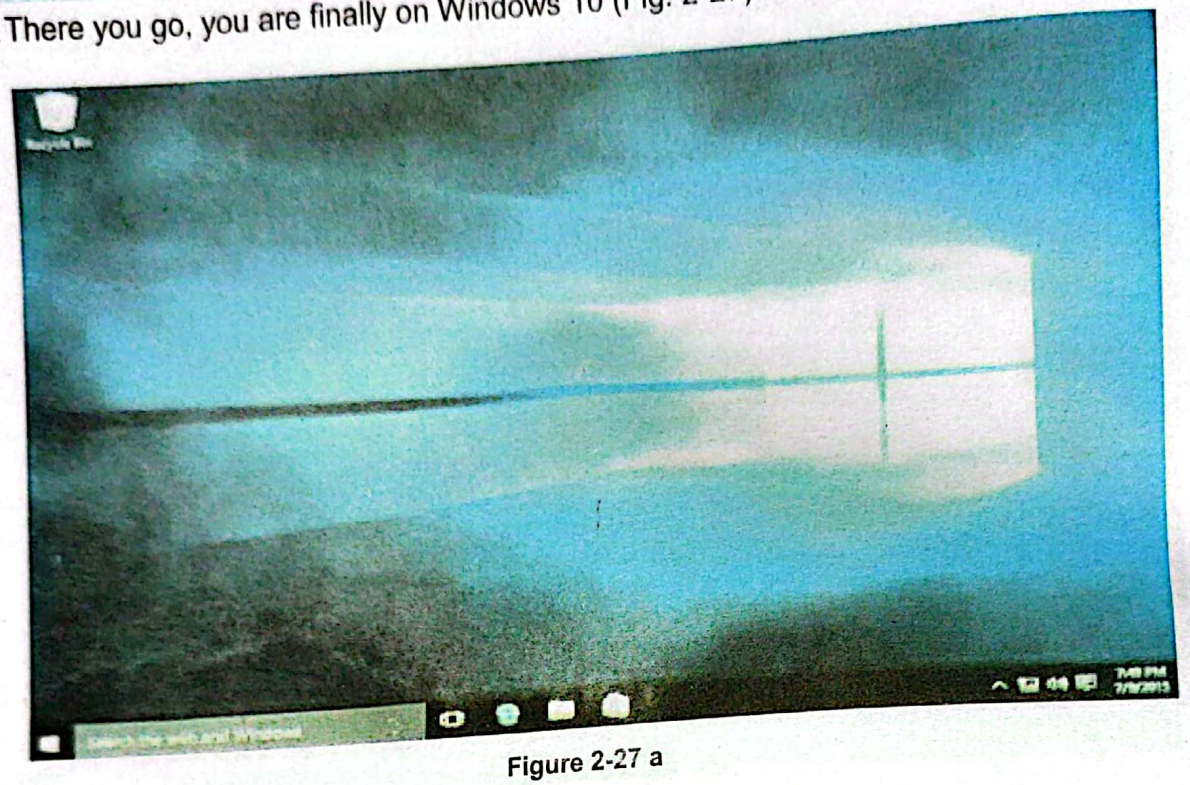


Figure 2-27 a

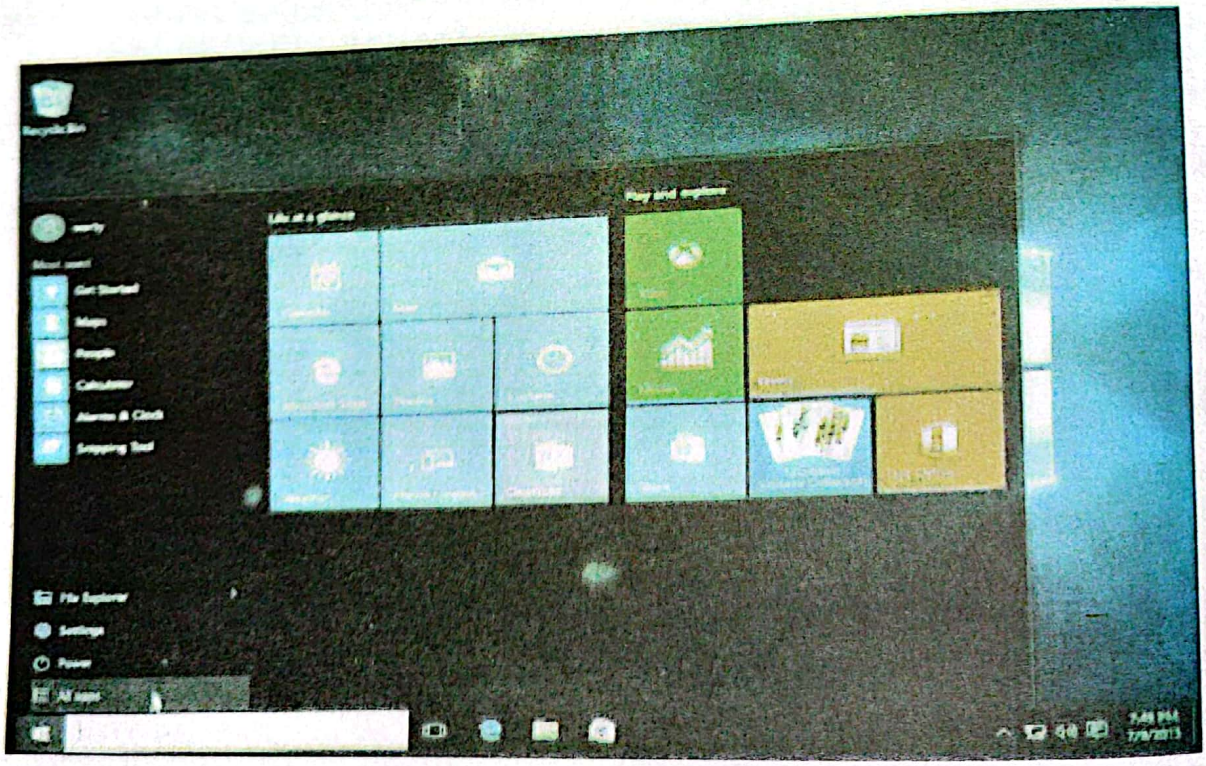


Figure 2-27 b

2.4.2 INSTALLATION OF ANITVIRUS SOFTWARE

The following are the steps for installation of AVG Antivirus software.

Fig.2-28 Icon of AVG Antivirus program

1. Download the AVG Antivirus Free Edition from Internet that runs on Microsoft Windows.
2. Double-click on the installation program shown in Fig.2-28.
3. Welcome screen will appear as shown in Fig.2-29. Click the Next button to proceed with the installation.

DO YOU KNOW?
The first antivirus software was developed by Bernd Fix in early 1987 to remove Vienna virus.

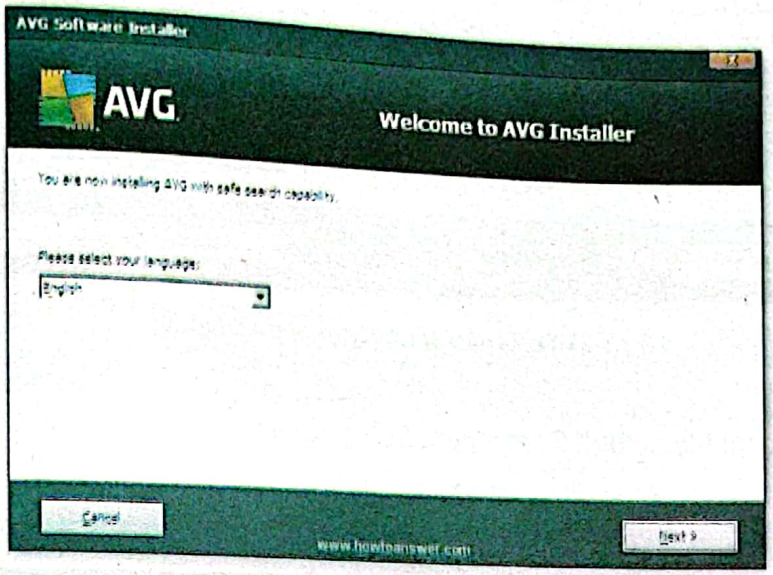


Fig.2-29 Welcome screen of AVG Antivirus

4. License Agreement screen will be displayed as shown in Fig.2-30. Click Accept to continue with the installation.

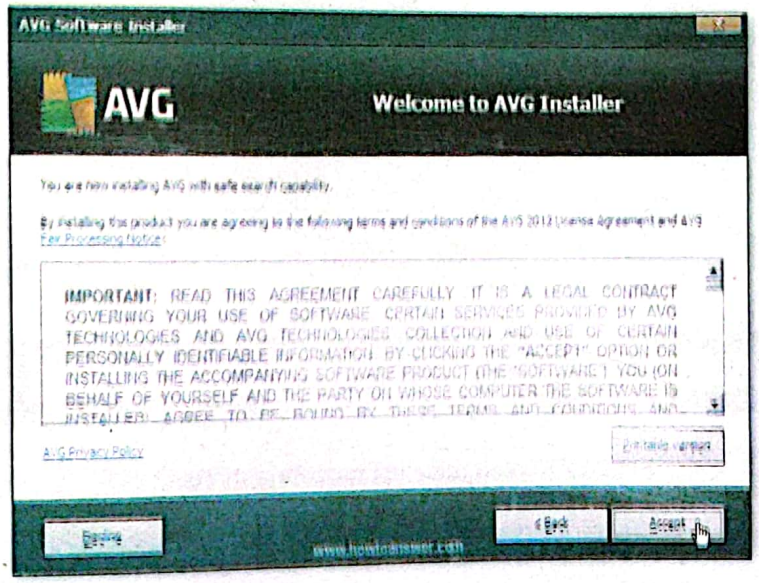


Fig.2-30 License Agreement screen

5. Select Express Install in the screen shown in Fig.2-31 and click Next.

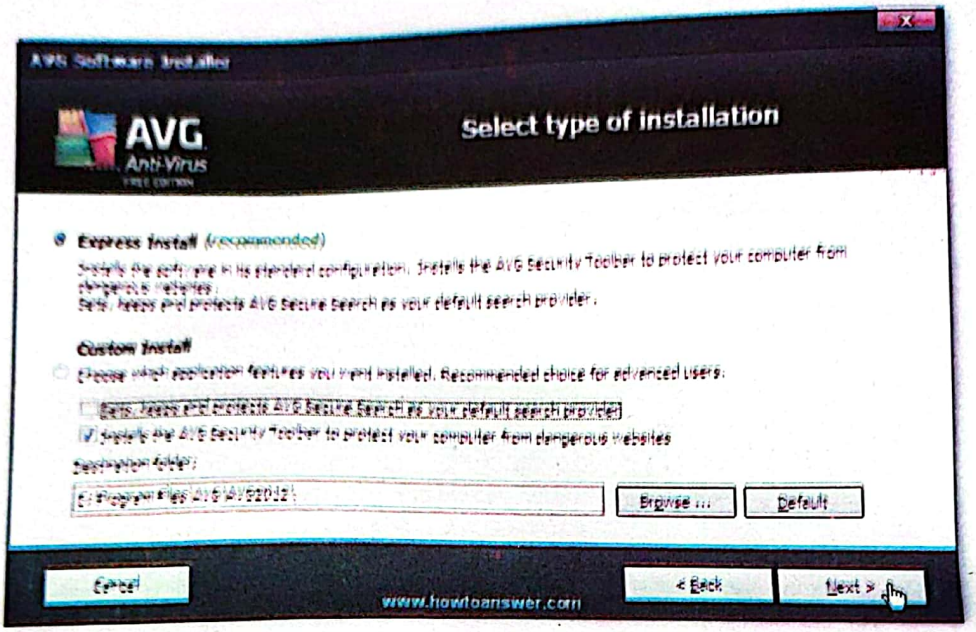


Fig.2-31 Screen to select type of installation

6. Click Next to accept the default Component Selection shown in the screen of Fig.2-32.

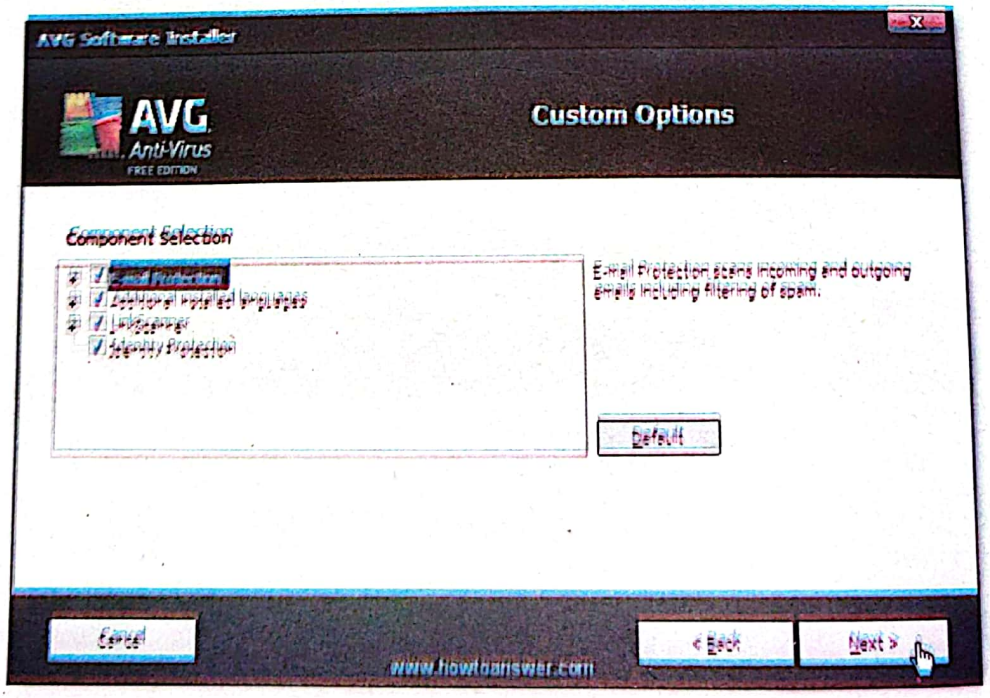


Fig.2-32 Screen to select custom options

7. Tick (✔) the option in the screen of Fig.2-33 if required and click Finish to complete the installation.

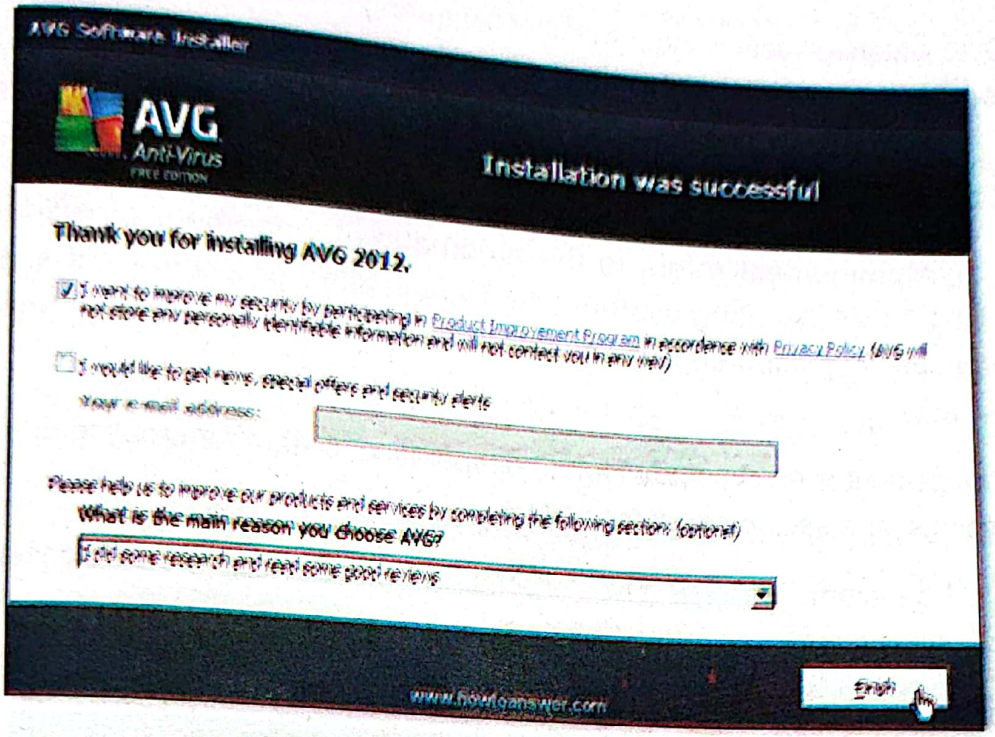


Fig.2-33 Screen to finish the installation

2.4.3 WINDOWS DEFENDER

Windows 10 comes with Windows Defender which is anti-virus software. Now, computer users do not have to buy anti-virus software. When Windows 10 is installed on a computer, Windows Defender is also installed as built-in anti-virus software. It runs in the background and checks for viruses. It automatically scans programs and files that user opens or downloads. If any type of malware is detected, it will display warning message and recommend what to do next to keep the computer safe.

Key Points

- Operating System is a collection of system software that controls the working of computer system and acts as an interface between the computer user and computer.
- The main objectives of operating system are convenience and efficiency. It makes the computer more convenient to use.

- Memory Management is the process of allocating memory space for user programs in main memory and managing it.
- Input/Output Management is the process of controlling the operation of all the input/output devices attached to computer.
- File Management System is the part of operating system that organizes, stores and keeps track of computer files and folders.
- Resource Management refers to the automatic management of resources of a computer by the operating system when application programs are executed by computer user. Resources of a computer are CPU, memory, input/output devices, etc.
- User Management is an important feature of operating system for creating and managing user accounts for a secure computer system.
- Command Line Interface (CLI) is a type of computer interface that is based on textual input. In CLI, commands are given with a keyboard.
- Menu Driven Interface presents a menu on the screen and the user makes a choice and then the next menu appears. The user makes another choice and so on to operate the computer.
- GUI is a graphical interface for computer users to interact with computer. It uses windows, icons, menus and pointer. To perform a task, the user has to select icons or make choices in menus using a mouse.
- The operating system that is used by a single user at a time is known as Single.user Operating System. It is used in microcomputers.
- Multi-user Operating System allows many users to use a computer at the same time. These are used on large computers such as minicomputers and mainframes. They manage a large number of users.
- Batch Processing System groups jobs in batches and the computer executes them one.by.one.
- Time-sharing System is a feature of operating system in which multiple users can run different programs on a large-scale computer. It allows many users to have access to a computer at the same time and share the computer's time.
- Real-time System must process information and produce a response within a specified time. It is developed for special applications.

- Recycle Bin is a temporary place (folder) for items that the user deletes form the hard disk. Deleted items can be restored if required.
- Computer icon allows the user to access the contents of computer drives and manage files and folders.
- Folder icon resembles a physical file folder and it is used to store files.
- In a GUI files are represented by file icons. A file can be easily recognized by looking at its icon. It opens by double-clicking on it.
- Program icons represent executable program files. They open when the user Double-clicks on them.
- Shortcut icons are created to access a program, file or folder quickly. They have an arrow at bottom left corner and the name below it.
- Managing Data means storing files in secondary storage devices such as hard disk or USB flash drive, in an organized way in folders so that they can be accessed easily and quickly when needed.

Exercise

Q1. Select the best answer for the following MCQs.

i. Which interface is based on textual input?

A. GUI
B. CLI
C. Menu-driven interface
D. Windows

ii. Which of the following interface uses window, icon, menu and pointer to interact with computer?

A. GUI
B. CLI
C. Menu-driven interface
D. DOS

iii. Which of the following operating system was introduced in 1969?

A. Macintosh
B Linux
C. Unix
D. Windows

iv. Which of the following operating system must process information and produce a response within a specified time?

A. Batch Processing System
B. Time-sharing System
C. Multiprogramming System
D. Real-time System

v. Which of the following is open source operating system?

A. UNIX
B. Linux
C. DOS
D. Novell's Netware

vi. Which of the following user interface is the easiest one to learn and use?

A. CLI
B. GUI
C. Menu driven interface
D. DOS

vii. Which of the following operating system allows many users to use a computer at the same time?

A. Single-user operating system
B. Batch processing system
C. Real-time processing system
D. Multi-user operating system

viii. In which of the following operating system, CPU is switched rapidly between all the programs to simultaneously execute all of them?

A. Batch Processing System
B. Time-sharing System
B. Real-time System
D. DOS

ix. Which of the following Windows icon allows user to access a program, file or folder quickly?

A. Program icon
B. Computer icon
C. Shortcut icon
D. Recycle Bin icon

x. Which of the following Windows icon allows user to access the contents of computer drives and manage files and folders?

A. Program icon
B. Computer icon
B. Shortcut icon
D. Recycle Bin icon

Q2. Write short answers of the following questions.

i. Why operating system is important software for a computer? Give any five reasons.

ii. Give any three objectives of operating system?

iii. Mention few disadvantages of using DOS.

iv. Name two operating systems which are used in modern mobile phones.

v. What difficulties a student may face if he/she is not familiar with the operating system of a computer?

vi. Define UNIX and Windows operating system.

vii. Differentiate between single-user and multi-user operating systems.

viii. What is meant by managing data and why is it important?

ix. What is meant by resources of computer?

x. What types of problems may a student face if no antivirus is installed in his/her computer system.

Q3. Write long answers of the following questions.

i. Explain the main functions of operating system.

ii. Describe the following computer interfaces.
   a) Command Line Interface
   b) Graphical User Interface
   c) Menu-driven Interface

iii. Describe the following types of operating systems.
   a) Batch Processing System
   b) Time-sharing System
   c) Real-time System

iv. Write notes on Macintosh and Linux operating systems.

v. Describe the basic icons of Windows operating system.

Lab Activities

Activity 1: The commonly used commands for using Windows operating system should be demonstrated. Students should be shown how to open and close a program. The commands for setting date and time, adjusting resolution, changing desktop background, color scheme, screen saver, etc. should be demonstrated.

Activity 2: The file management commands such as create folder, copy, move, delete, rename files and folders are to be demonstrated. Use of Recycle Bin should be demonstrated.

Activity 3: Installation and un-installation of a program and antivirus software should be demonstrated to students.

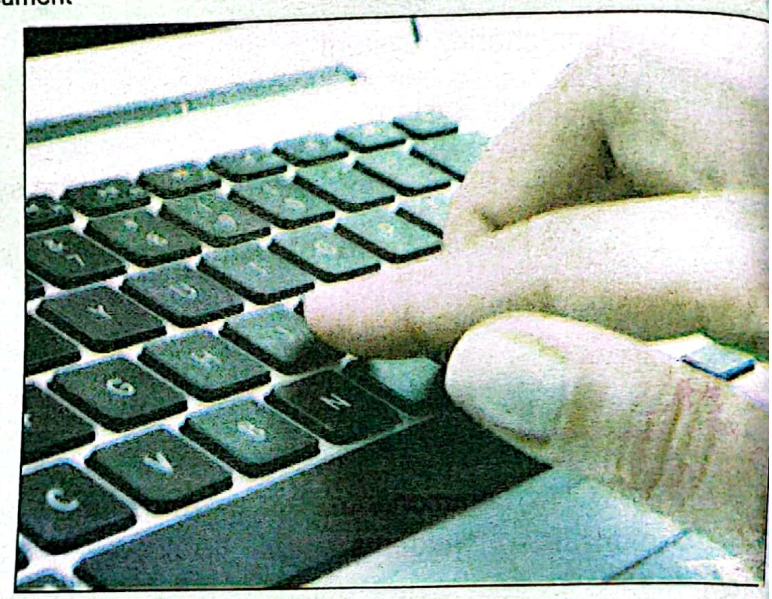
3

OFFICE AUTOMATION

This is 28 periods Chapter including practical work.

After completing this lesson, you will be able to:

- Recognize and define word processor
- Manage a document (Create, Open, Save, Save as, Print)
- Edit text, show/hide Ribbon, insert symbols and use Equation Editor
- Format text, paragraph and page
- Insert page break, section break, header, footer and page number
- Insert and position pictures within a document
- Insert Word Art
- Create table with formatting
- Change the margins of document
- Use Hyperlink
- Know the basics of spreadsheet
- Work with functions and formulas in a spreadsheet
- Represent spreadsheet data graphically
- Manipulate and format spreadsheet data
- Use Urdu editor



UNIT INTRODUCTION

Computer users have to prepare documents in whichever profession they are. It i essential for all the users to learn how to create documents such as letters, reports, proposals resumes, etc. Spreadsheets are also commonly required in business and office. These are used to store and process numeric data. Hence, all the users should have basic knowledge to create documents and spreadsheets. This unit describes how to prepare professional-looking documents and spreadsheets using a word processing and a spreadsheet program respectively. The last section of the unit describes how to prepare documents in Urdu with an Urdu editor.

3.1 OFFICE AUTOMATION

Office Automation refers to modern technology used to create, store, process and communicate information for accomplishing basic tasks performed in offices. The system that facilitates office automation is known as Office Automation System (OAS). Office Automation System consists of computer hardware, software and network. The software used for office automation consists of word-processing, spreadsheet, database management, presentation, graphics, electronic mail and video conferencing software. Office automation software allows users to create letters, reports, spreadsheets, graphs, manipulate images and send email to or receive email from users on the network. Office automation software helps in improving productivity and saving money and human efforts.

The most commonly used office automation software is Microsoft Office. It is an office suite of applications. It consists of MS Word, MS Excel, MS Access, MS PowerPoint and MS Outlook. It was first announced by Bill Gates on 1 August 1988. Its latest version is Microsoft Office 2016 released on 22 September, 2015.

Some other examples of office automation software are Apache OpenOffice, LibreOffice and NeoOffice. All of these are based on OpenOffice office suite. These can be freely downloaded and installed on Windows, Linux and MacOS operating systems.

3.1.1 INSTALLATION OF OFFICE AUTOMATION SOFTWARE

The common office automation software is Microsoft Office. It is productivity software for Windows operating system. It includes word processing, spreadsheet, presentation, database and e-mail communication programs. These programs provide facilities that are commonly required to run an office or business.

The following are the steps to install Microsoft Office 2010 software.

1. Run the installation program.
2. Enter the Product Key and click Continue button as shown in Fig.3-1.
3. Read the Microsoft Software License Terms shown in

DO YOU KNOW?
Microsoft Office 2010 cannot be installed on a computer on which Windows XP operating system is installed.

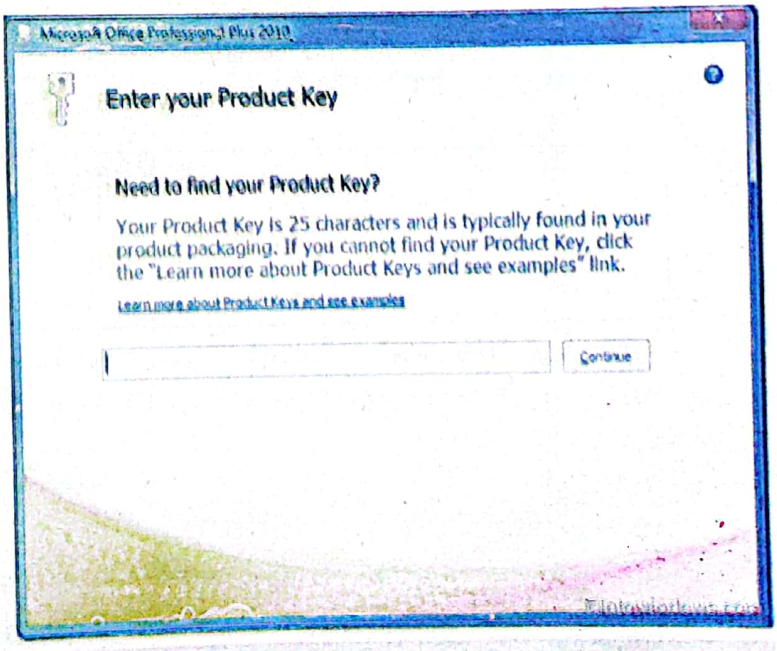


Fig.3-1 Screen for entering Product Key

Fig.3-2, check the box to accept the terms of agreement and click Continue.

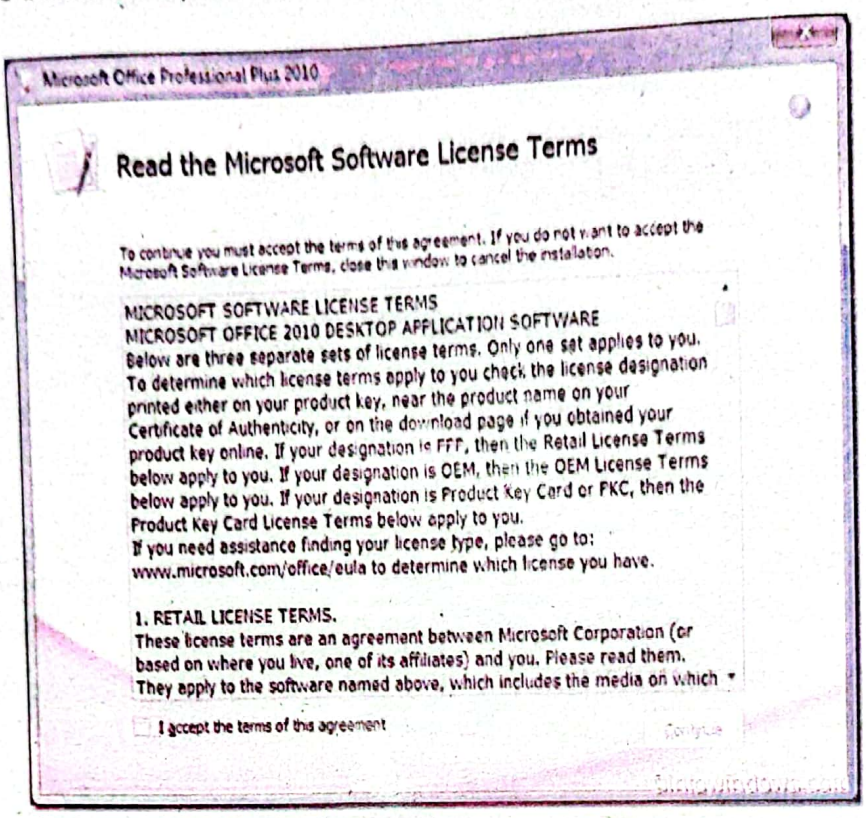


Fig.3-2 Microsoft Software License Terms

4. Click Install Now button shown in Fig.3-3 to start the installation.

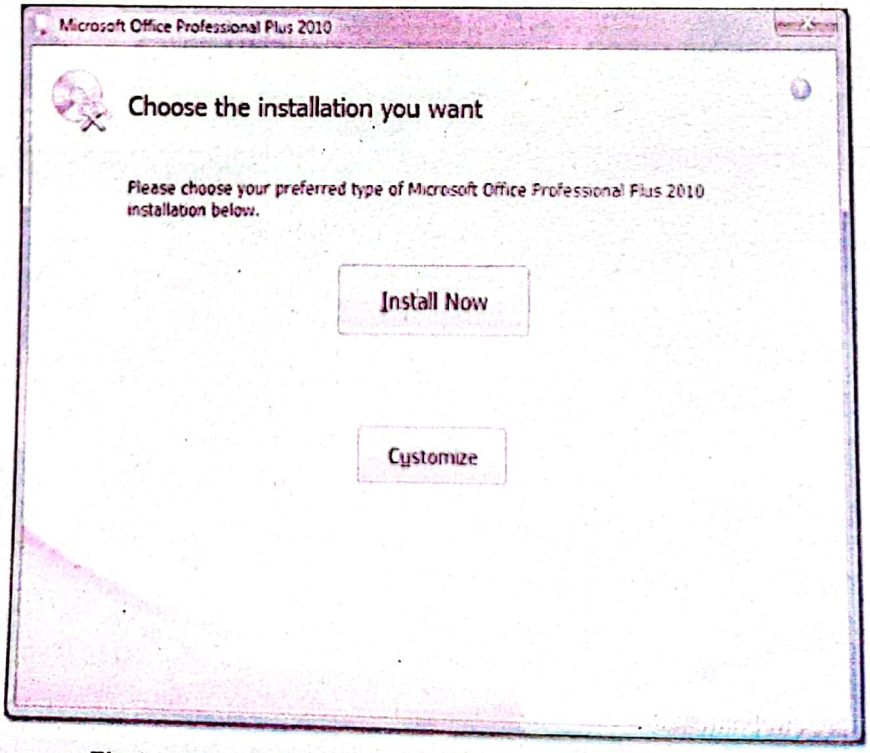


Fig.3-3 Screen to choose preferred type of installation

5. Progress bar indicating how much installation has progressed will appear as shown in Fig.3-4. This may take several minutes to complete.

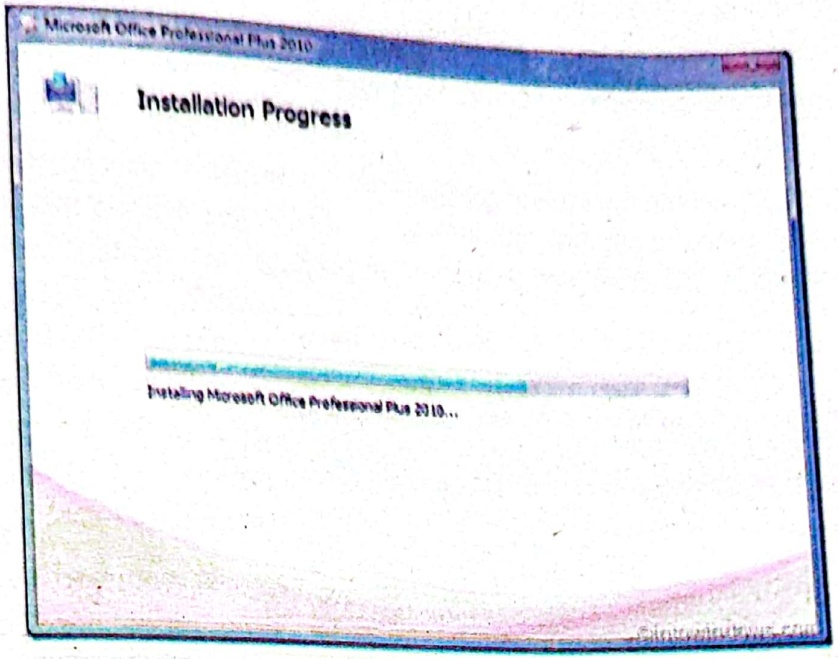


Fig.3-4 Progress bar indicating installation progress

6. Click the Close button shown in Fig.3-5 to exit the installation program.

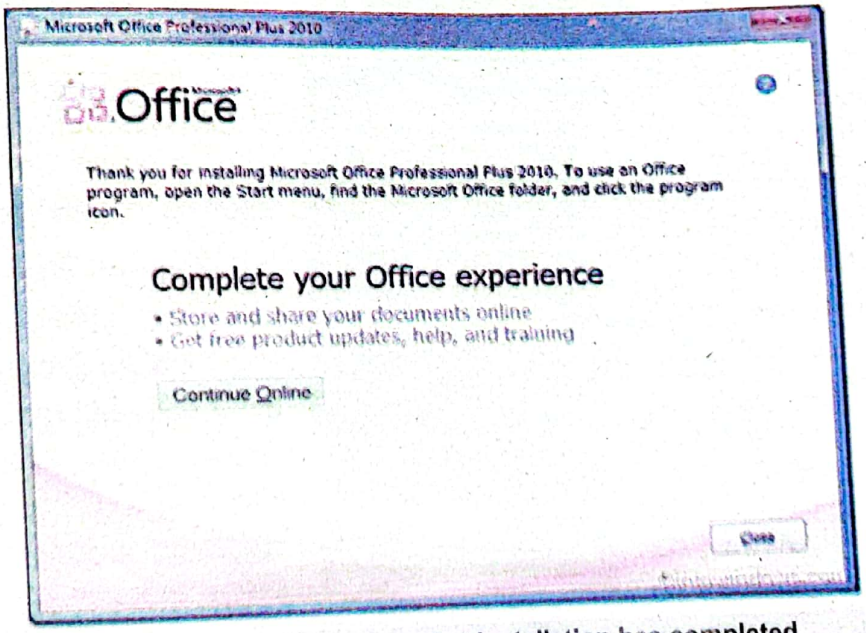


Fig. 3-5 Screen indicating that installation has completed

DO YOU KNOW?

The first version of Microsoft Word was released in 1983 for DOS and first Windows version was released in 1989.

3.1.2 WORD PROCESSING

Word processing refers to the use of computer to create, edit, format and print documents.

Word processor is computer application software that is used for the creation of different types of documents on computer.

Word processor is a commonly used application of computer. Word processor allows user to delete, modify and rearrange document without retyping any of the existing text. Word processing system has the advantage of reducing time required to prepare documents. It provides features to create appealing professional documents. With word processing programs, user can create many types of documents such as letters, reports, resumes, newsletters, memos, flyers, etc.

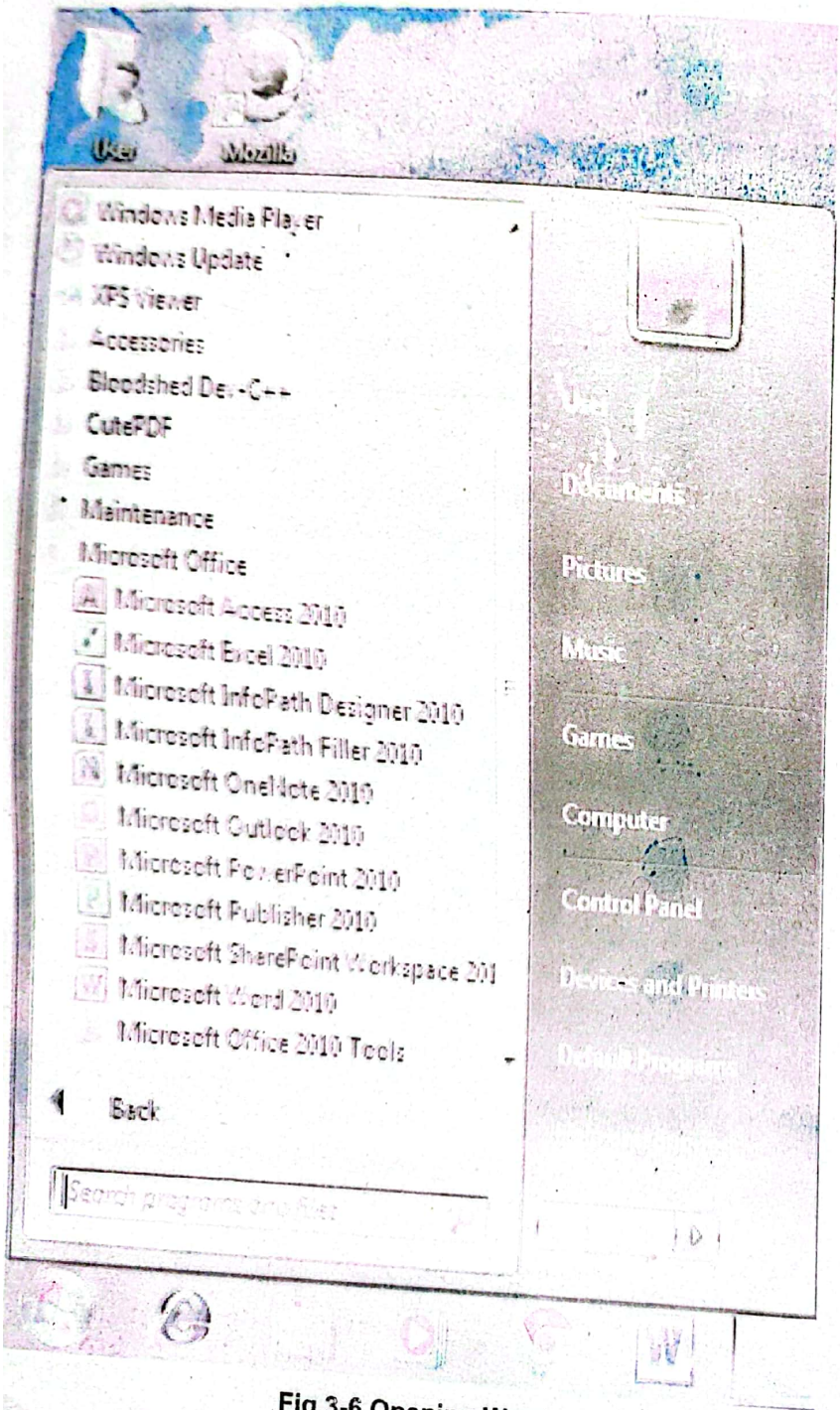


Fig.3-6 Opening Word

A common word processing program used is Microsoft Word. It is a part of Microsoft Office software. Microsoft Office contains word processing, record-keeping, spreadsheet and presentation software.

Opening the MS Word Program

The following are the steps for opening the MS Word program.

1. Turn on the computer and click **Start** button.
2. Click **All Programs**.
3. Click **Microsoft Office** to display the submenu. The submenu contains all the programs included in **Microsoft Office** software.
4. Click **Microsoft Word 2010** to open the Word program shown in Fig.3-6.

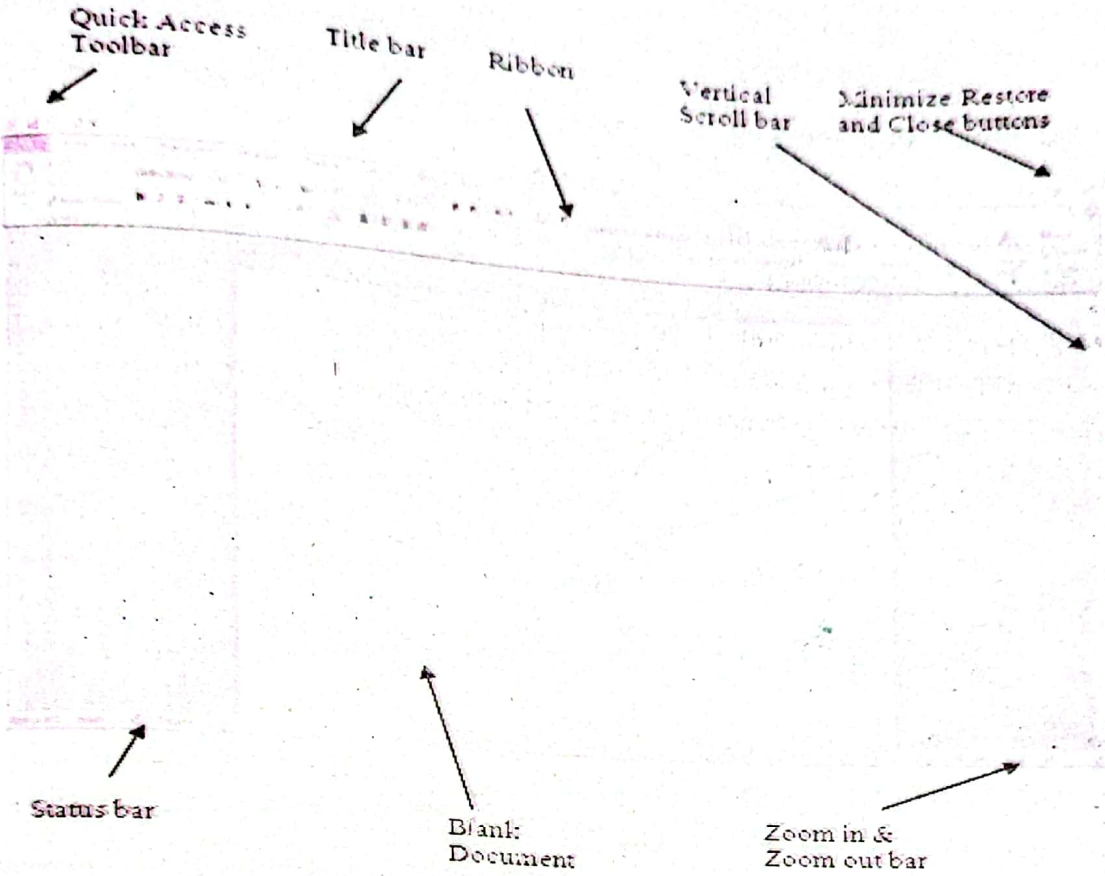


Fig.3-7 Word Window

Word Window

The main components of Word window consist of Quick Access Toolbar, Ribbon, Horizontal / Vertical Scroll bars and Status bar as shown in Fig.3-7.

Quick Access Toolbar

Quick Access Toolbar is located at the top left corner of Word window. It provides easy access to commonly used **Save**, **Undo** and **Redo** commands. If the user clicks the down arrow at the right side, Word will display a list of commands that can be quickly added to or removed from the Quick Access Toolbar.

Ribbon

Ribbon is located below the title bar of the Word window. Ribbon consists of tabs, groups and commands as shown in Fig.3-8. It provides access to the commands that are performed while working on a document.

There are nine types of tabs in the ribbon which are File, Home, Insert, Page Layout, References, Mailings, Review, View and Add-Ins. Home tab is the most commonly used tab. To display any of these tabs just click on it.

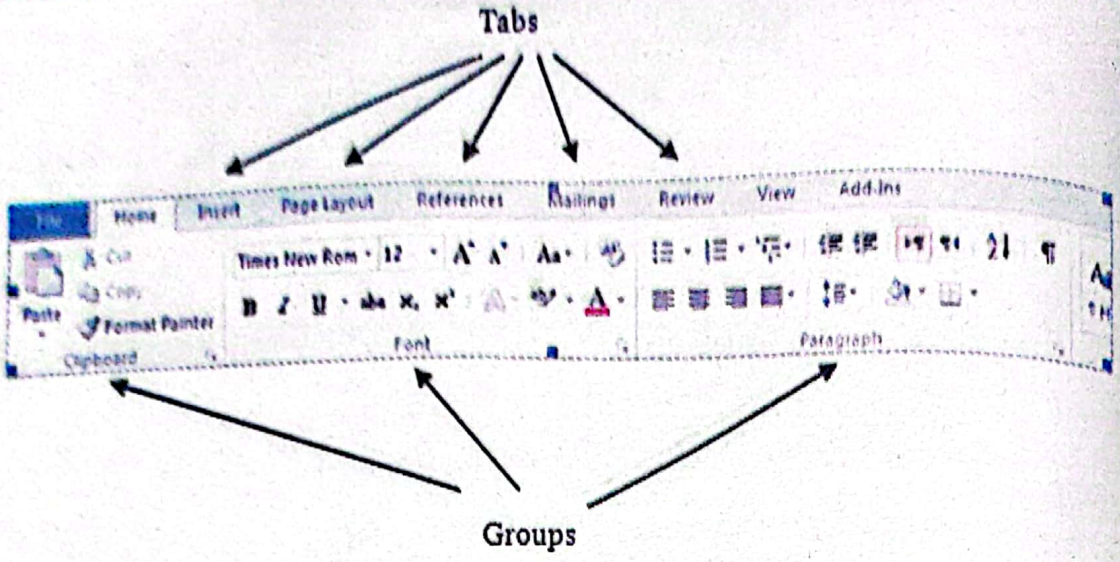


Fig.3-8 Ribbon

Horizontal and Vertical Scroll Bars

Vertical scroll bar is located at the right edge of the document window. It is used to scroll down or up the document that is too large to fit in the document window. Horizontal scroll bar appears automatically at the bottom of the document window if a document is too wide to fit in the document window.

Status Bar

Status bar is located at the bottom of the document window above the Windows task bar, It presents information about the document such as current page, total number of pages in the document, number of words in the document, etc. It also provides controls for viewing the document in different layouts. The right edge of status bar presents zoom in and zoom out bar. Zoom in is used to get close-up view of document and zoom out is used to view more of the page at a reduced size.

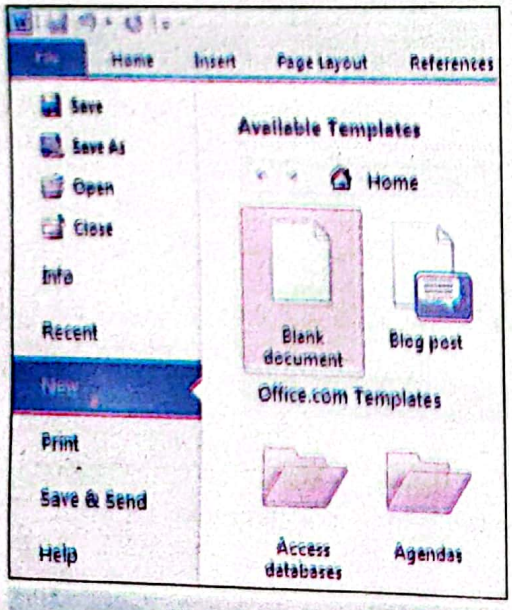


Fig.3-9 File tab

3.1.3 MANAGING A DOCUMENT

Creating a New Document

The following are the steps to create a new document.

1. Click the **File** tab.
2. Click **New** in the pull-down menu as shown in Fig.3-9.
3. Select **Blank document** which is below **Available Templates**. User can also start a new document by selecting a template.
4. Click **Create**. A new blank document will appear

Another way to start a new blank document is press Ctrl+N on the keyboard. Ctrl+N means keep pressing the Ctrl key while pressing the N key.

Opening a Document

1. Click the **File** tab

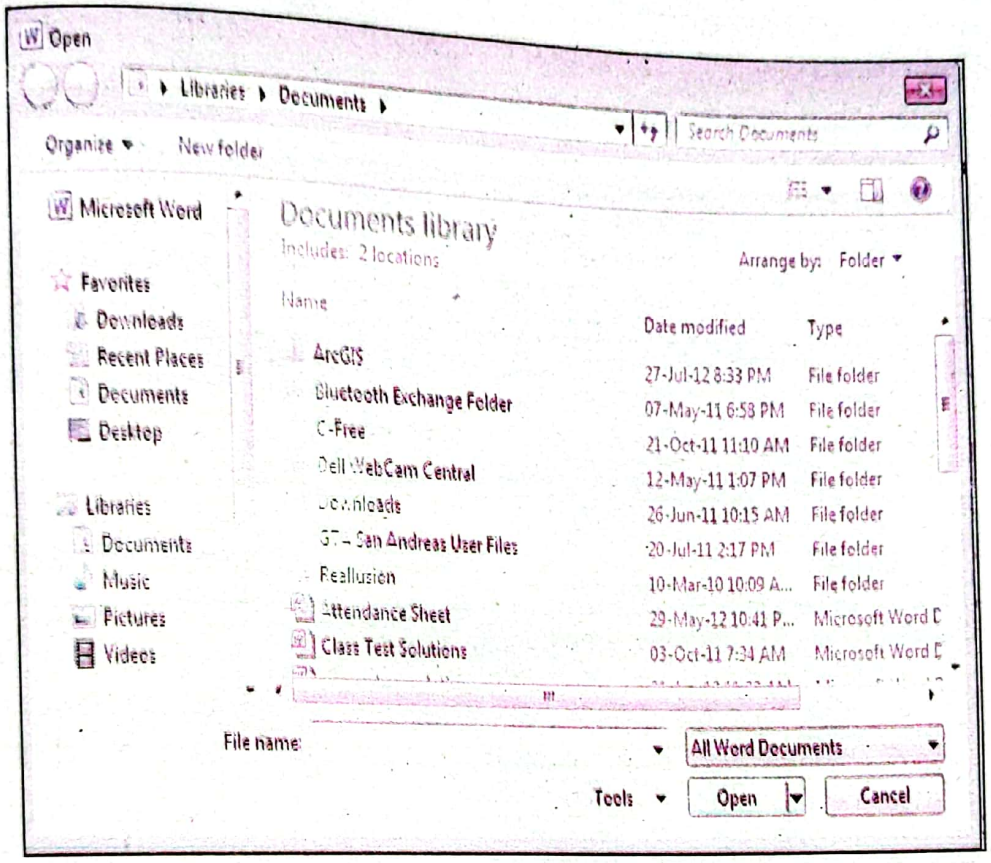


Fig.3-10 Open dialog box

2. Click **Open**. The Open dialog box as shown in Fig.3-10 will appear.
3. Select the document and click **Open**.

If the user has recently opened the document that he wants to open then he can follow the steps given below.

1. Click **File** tab.
2. Click **Recent**.
3. Select the document from the **Recent Document list**.

Saving a Document

1. Click **File** tab.
2. Click **Save** or **Save As**.
3. Select the folder where the document is to be saved as shown in Fig.3-11.
4. Give a file name to your document.

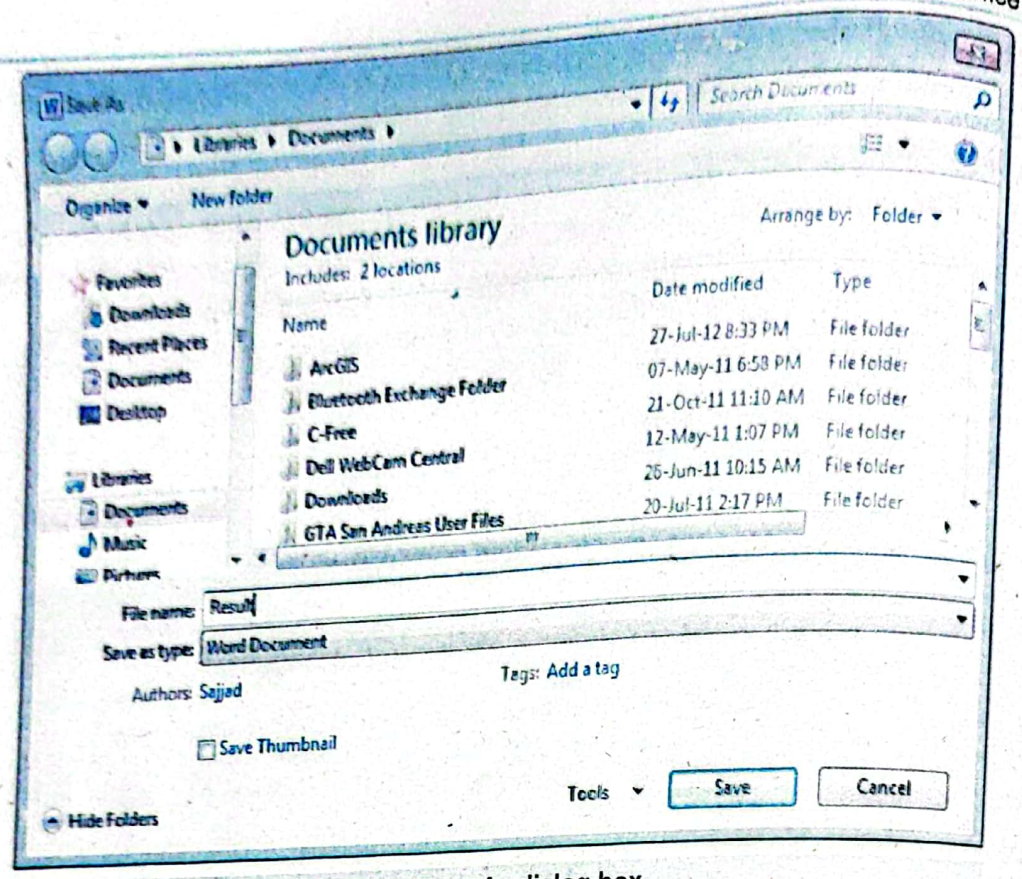
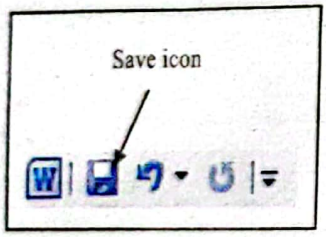


Fig.3-11 Save As dialog box

5. Click **Save**.



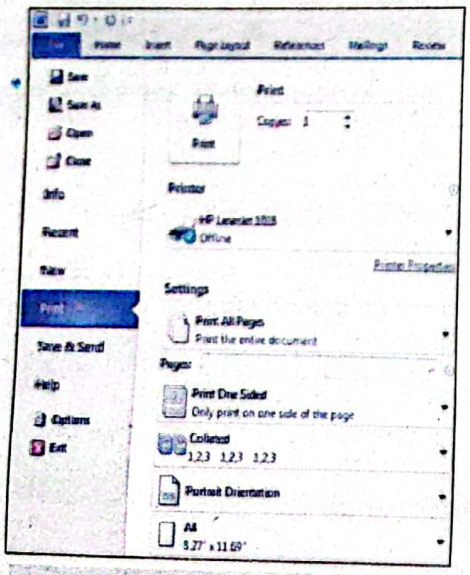


Fig.3-12 printing a document

Save As option is used when changes have been made in an existing file and the user wants to save the new version of the document with a different file name.

Another way to save a document is, click the **Save** icon on the Quick Access Toolbar and give the new document a file name.

Printing a Document

The following are the steps to print a document.

1. Click the **File** tab.
2. Select **Print**.
3. Change the print settings shown in Fig.3-12 if required and click **Print**.

3.1.4 INSERTING AND EDITING TEXT

To insert text in a document, type it using the keyboard. The text will appear at the insertion point. When typing a paragraph, there is no need to press the Enter key at the end of the line. When the user reaches the right margin, Word will automatically position the insertion point at the beginning of the next line. The user should only press the Enter key when he wants to end a line of text, start a new paragraph or insert a blank line. Shortcut keys for cursor movement are shown in Table 3-13.

Cursor Movement	Shortcut Key
Beginning of the line	Home
End of line	End
Top of the document	Ctrl + Home
End of document	Ctrl + End

Table 3-13 Shortcut keys for cursor movement

Selecting Text

To move or copy words, sentences or paragraphs to another location in the document, first select the text and then use cut-and-paste or copy-and-paste technique. Commands shown in Table 3-14 are used for selecting various items in a document with mouse.

Tip: To search text in a document, press Ctrl+F, type the search text in the box and press Enter.

Item to Select	Mouse Command
Characters	Drag through characters
Single word	Double-click the word
Words	Drag through words
Sentence	Press and hold down Ctrl key and click anywhere in the sentence
Line	Move the mouse pointer to the left of the line until it changes to a right-pointing arrow and then single click
Paragraph	Move the mouse pointer to the left of the paragraph until it changes to a right-pointing arrow and then Double-click
Entire document	Move the mouse pointer to the left of the document until it changes to a right-pointing arrow and then triple-click
Block of text	Click at the beginning of the text to be selected. Move the mouse pointer to the end of the selection and hold down Shift key and then click or drag through the text.
Graphic	Click the graphic

Table 3-14 Mouse commands for selecting items

Copying and Moving Text

The following are the steps to copy or move the first two sentences of the paragraph shown in Fig.3-15.

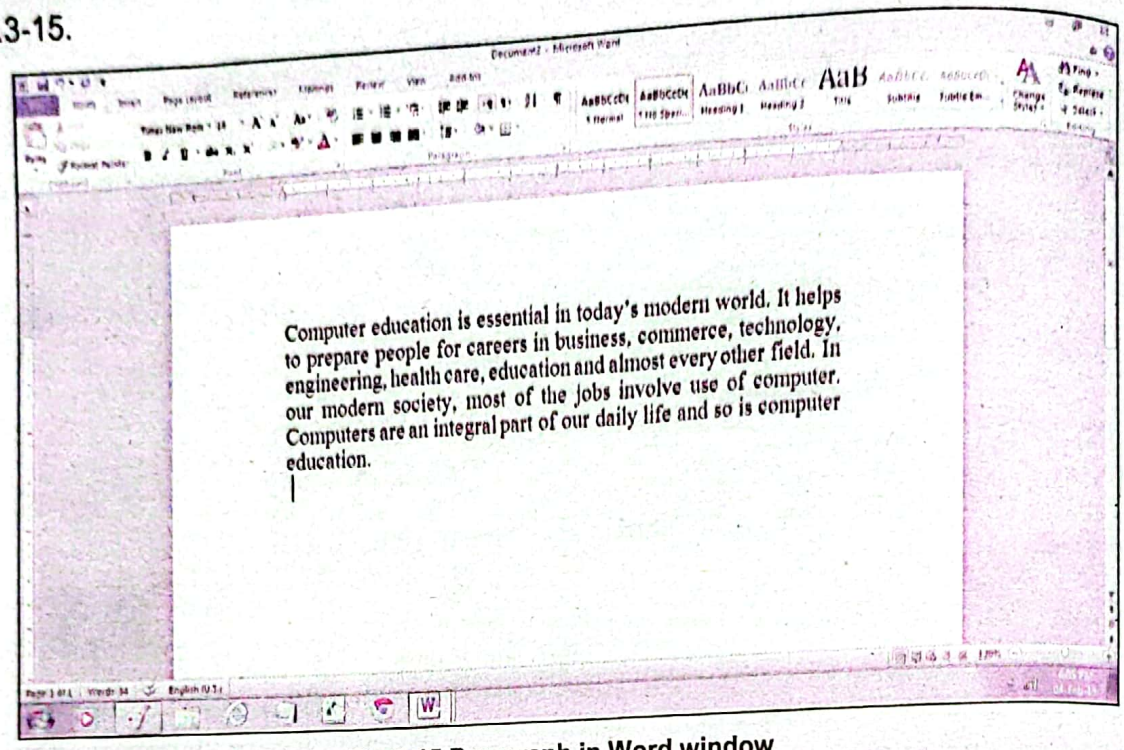


Fig.3-15 Paragraph in Word window

1. Select the text that is to be copied or moved as shown in Fig.3-16

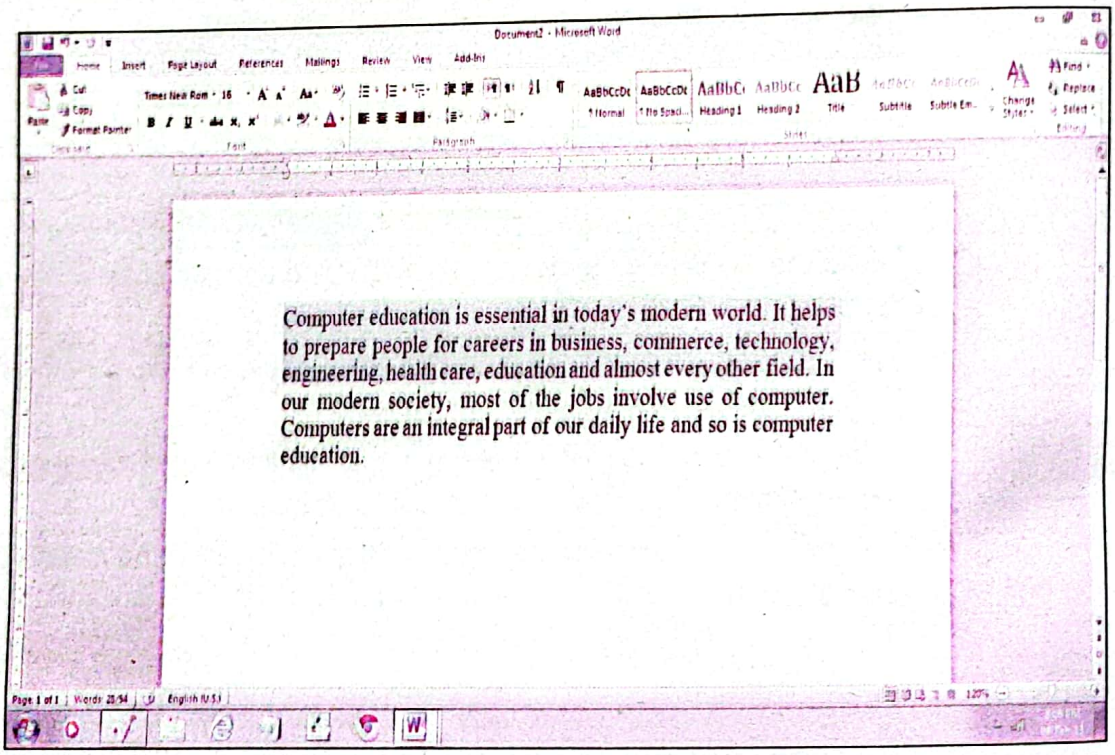
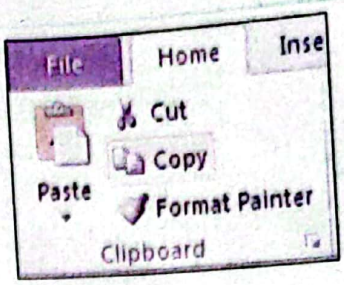


Fig.3-16 Text selected for copying

2. Click **Copy** or **Cut** in the **Clipboard** group of **Home** tab as shown above.



3. Position the mouse pointer at the location where you want to copy or move the text.
4. Click **Paste** in the **Clipboard** group. Copied text is shown in Fig.3-17.

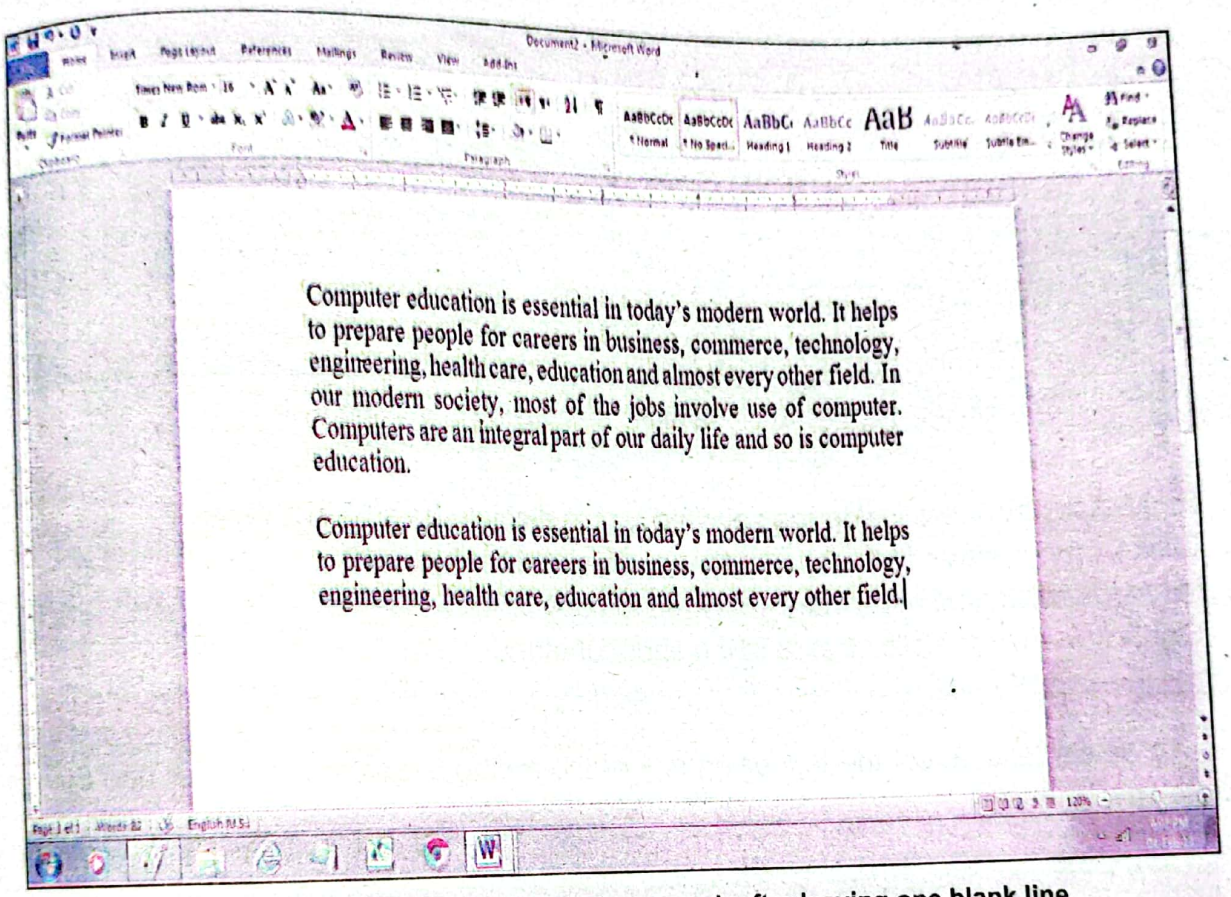


Fig.3-17 Text copied at the end of paragraph after leaving one blank line

There is another method for copying and moving text using shortcut keys. The steps for this are given below.

1. Select the text.
2. Press **Ctrl+C** for copying or **Ctrl+X** for moving text.
3. Position the mouse pointer to the location where you want to copy or move the text.
4. Press **Ctrl+V** for pasting the text.

There is also a third method for copying and moving text. The following are the steps for this method.

1. Select the text as shown in Fig.3-18.

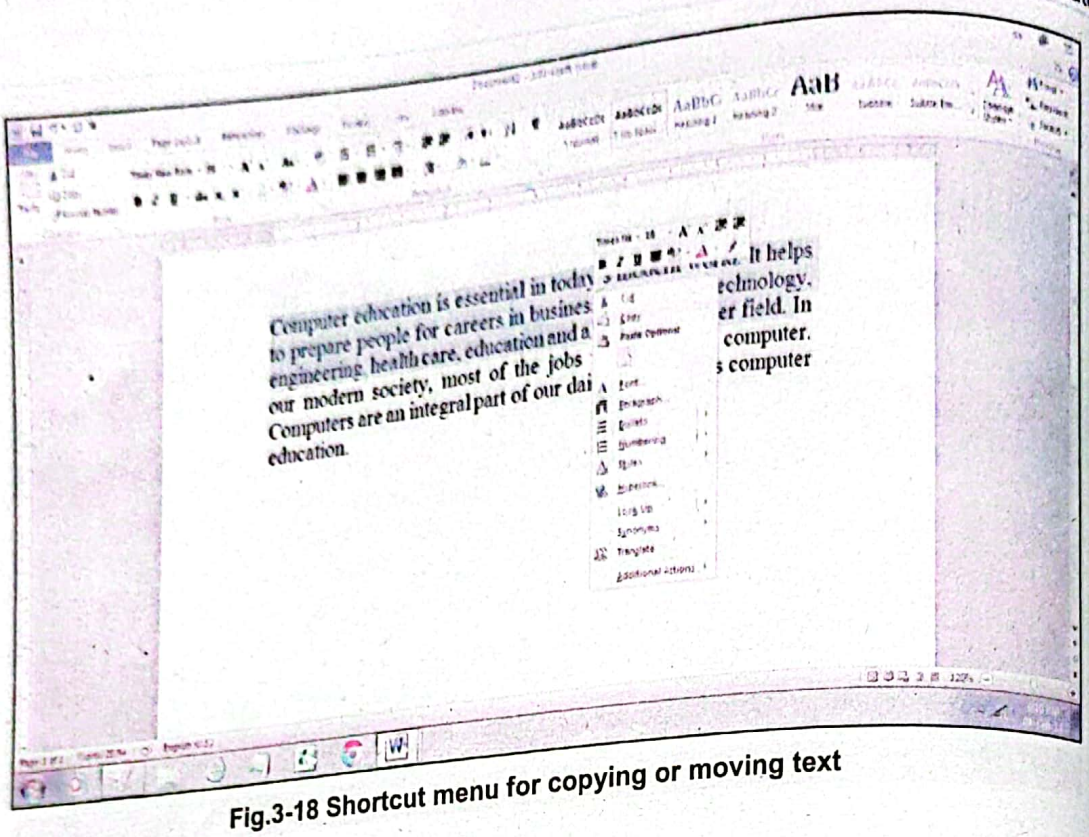


Fig.3-18 Shortcut menu for copying or moving text

2. Right click anywhere inside the selected text to display the shortcut menu.
3. Click **Copy** or **Move** in the shortcut menu as shown in Fig.3-19
4. Move the mouse pointer where you want to copy or move the text.
5. Right click and then click **Paste** in the shortcut menu.

Deleting Text

To delete text, select the text using any of the methods described earlier and then press **Delete** key.

3.1.5 MINIMIZE/MAXIMIZE RIBBON

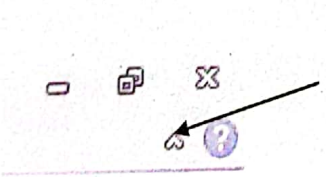


Fig.3-19 Minimizing or maximizing Ribbon

To minimize the Ribbon for more screen space, click the arrow in the upper-right corner of the Ribbon as shown in Fig.3-19. When Ribbon is minimized, click on a tab to display it. The Ribbon will disappear again when it is not in use. To maximize the Ribbon, click the arrow again.

3.1.6 INSERTING SYMBOLS

The following are the steps to insert symbols or special characters in documents.

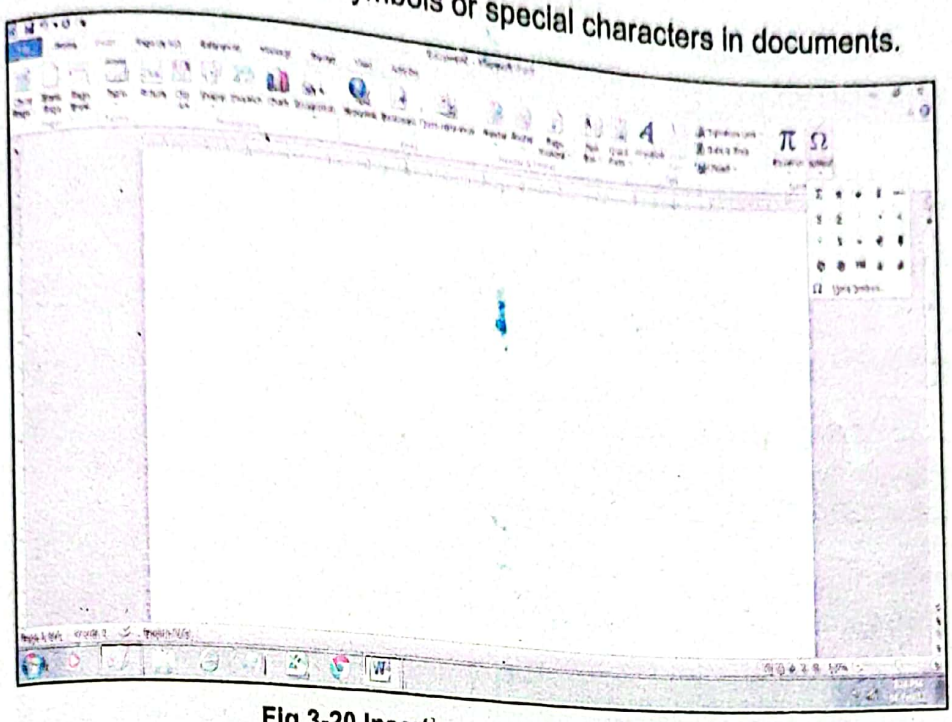


Fig.3-20 Inserting symbols in document

1. Click **Insert** tab.
2. Click **Symbol** which is at the right end of ribbon. A group of symbols will be displayed as shown in Fig.3-20.
3. Click the symbol that is to be inserted in document. The symbols will be inserted in the document as shown in Fig.3-21.

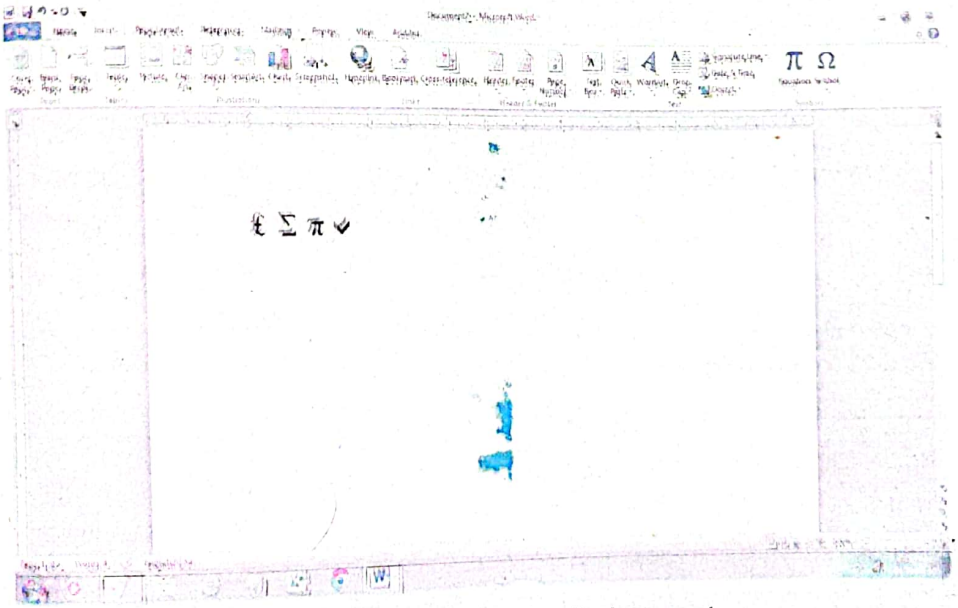


Fig.3-21 Symbols inserted in document

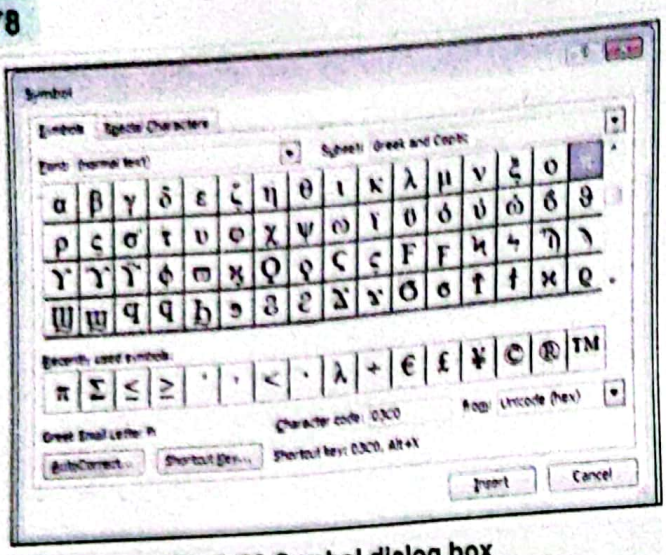


Fig.3-22 Symbol dialog box

To display more symbols, click **More Symbols** in the **Symbol** menu. A new dialog box will open with two tabs, **Symbols** and **Special Characters** as shown in Fig.3-22. Now, select the symbol and click the **Insert** button.

3.1.7 INSERTING EQUATION

Word allows user to insert common mathematical equations or build up his own equations using a library of symbols.

The following are the steps to insert built. In equation.

1. Click **Insert** tab.
2. Click **Equation** button on the Symbols group.
3. Select the type of equation you want to insert as shown in Fig.3-23.

To following steps allow the user to insert his/her own equation.

1. Click **Insert** tab.
2. Click **π** button on the **Symbols** group. This will open the **Design** tab shown in Fig.3-24 that allows inserting common mathematical equations or build equation using a library of math symbols.

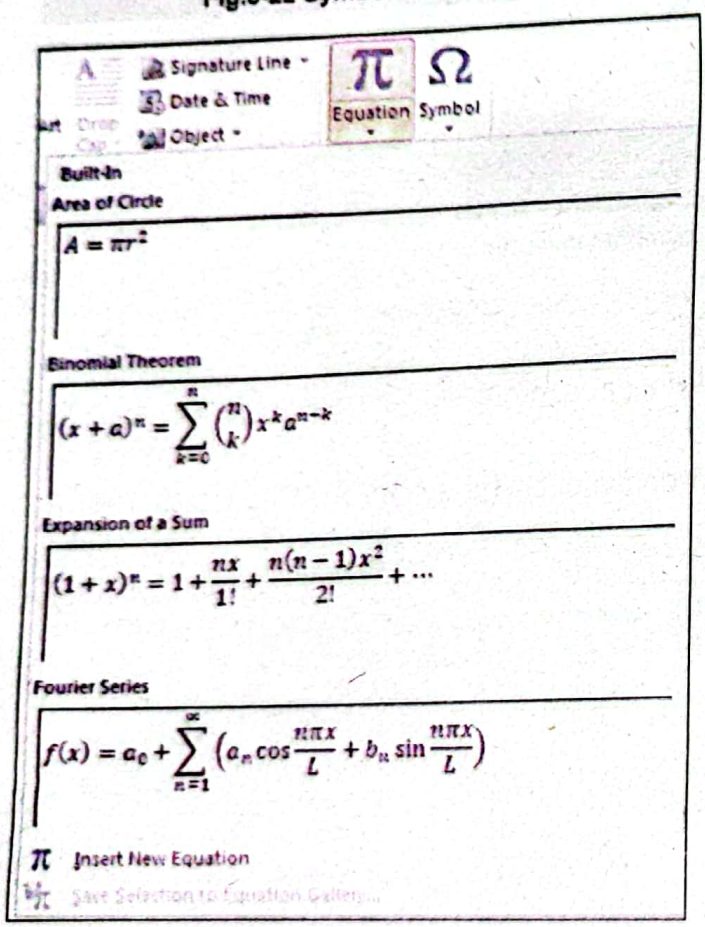


Fig.3-23 Inserting equation

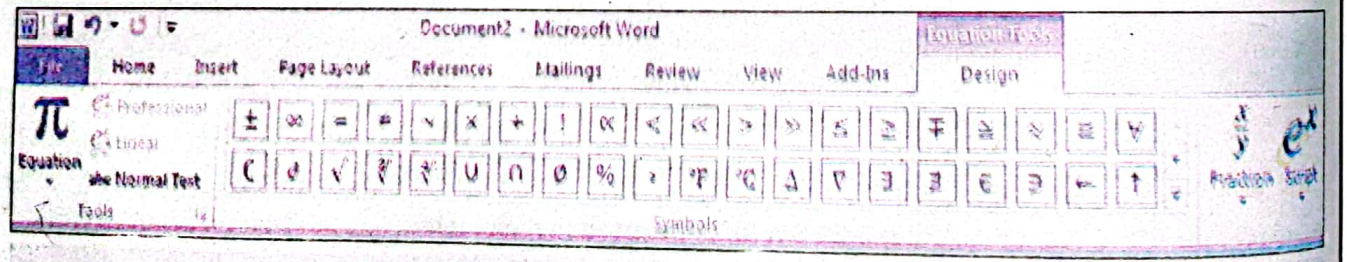


Fig.3-24 Design tab for inserting equation

3.1.8 FORMATTING TEXT, PARAGRAPH AND PAGE

Formatting Text

Formatting text means changing the font type, size, style, color and effects of text.

Changing the Font Type and Size of Text

Open the **Home** tab and click the arrow on the right side of the currently selected font type as shown in Fig.3-25 and choose another font type. To change the font size, click the arrow on the right side of the font size and select a font size from the drop-down list or type a new font size. To change the font type or size of existing text, select the text and then make the changes.

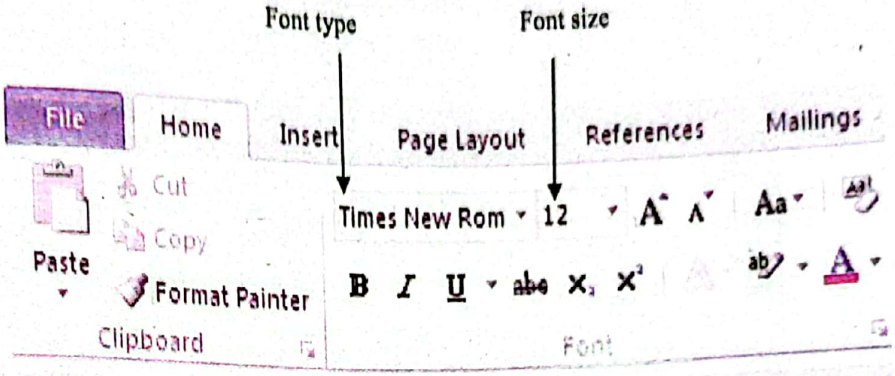


Fig.3-25 Changing font type and font size

Changing Font Styles and Effects

The following are the steps for changing font styles and effects.

1. Click the **Home** tab.
2. Click the dialog box launcher on the lower-right corner of the **Font** group. This will open the **Font** dialog box shown in Fig.3-21. Now, the user can change font styles and effects of text.

Some changes that are available in the **Font** dialog box can be made directly from the **Font** group in **Home** tab.

The following are the steps to clear the text formatting.

1. Select the text you want to clear the formatting.
2. Click the **Home** tab.
3. Open the **Styles** dialog box and select **Clear all** as shown in Fig.3-26.

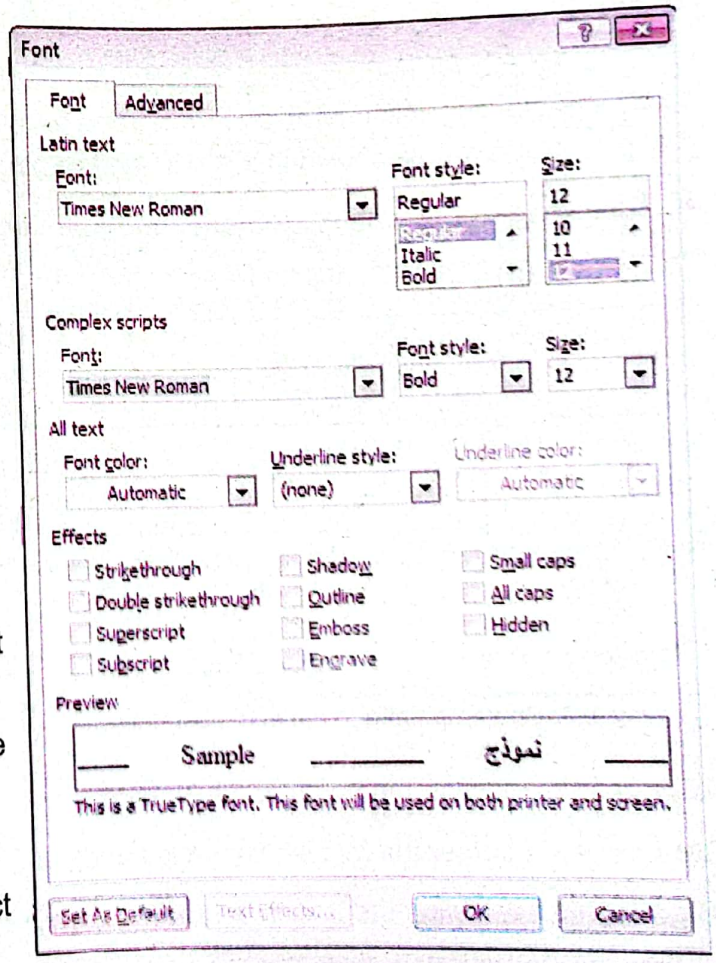


Fig.3-26 Font dialog box

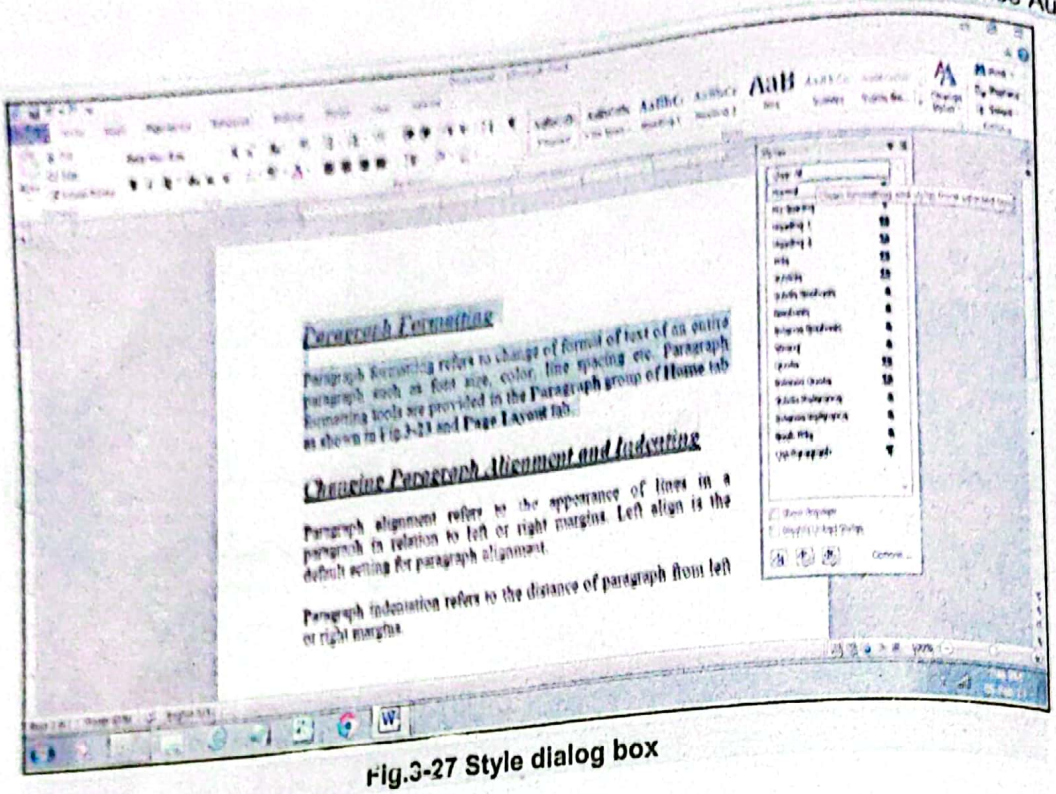


Fig.3-27 Style dialog box

Paragraph Formatting

Paragraph formatting refers to change of format of text of paragraph such as font size, color, line spacing, alignment etc. Paragraph formatting tools are provided in the **Paragraph** group of **Home** tab as shown in Fig.3-27 and **Page Layout** tab.

- **Changing Paragraph Alignment and Indenting**

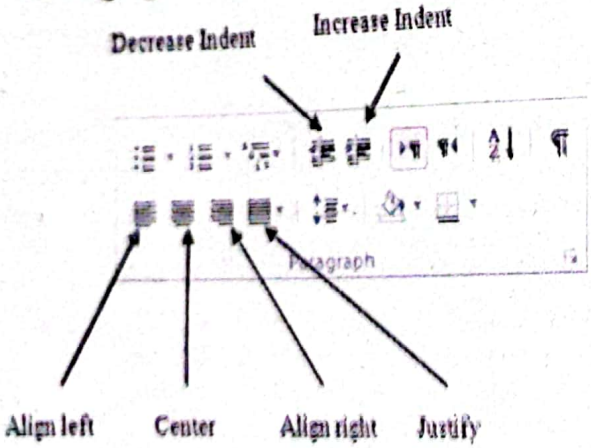


Fig.3-28 Paragraph alignment and indenting

Paragraph alignment refers to the appearance of lines in a paragraph in relation to left or right margins. Left align is the default setting for paragraph alignment.

Paragraph indentation refers to the distance of paragraph from left margin.

Select the paragraph to change the alignment and then select an alignment from the **Paragraph** group on **Home** tab as shown in Fig.3-28.

Align left: It will align the text to the left margin.

Center: It will center the text within the left and right margins.

Align right: It will align the text to the right margin.

Justify: It will align the text both to the right and left margins.

To increase paragraph indent, click the **Increase Indent** button shown in Fig.3-23, in the **Paragraph** group on **Home** tab. To decrease the paragraph indent, click the **Decrease Indent** button. Increasing indentation will move the paragraph to the right side by one tab position. Decreasing indentation will move the paragraph to the left side by one tab position.

- **Changing Spacing between Paragraphs and Lines**

The following are the steps for changing spacing between paragraphs and lines.

1. Select the paragraph or paragraphs.
2. Click **Home** tab.
3. Open the **Paragraph** dialog box shown in Fig.3-29 by clicking the small arrow at the bottom right corner of the **Paragraph** group.
4. Make the required changes.
5. Click **OK** to apply the changes.

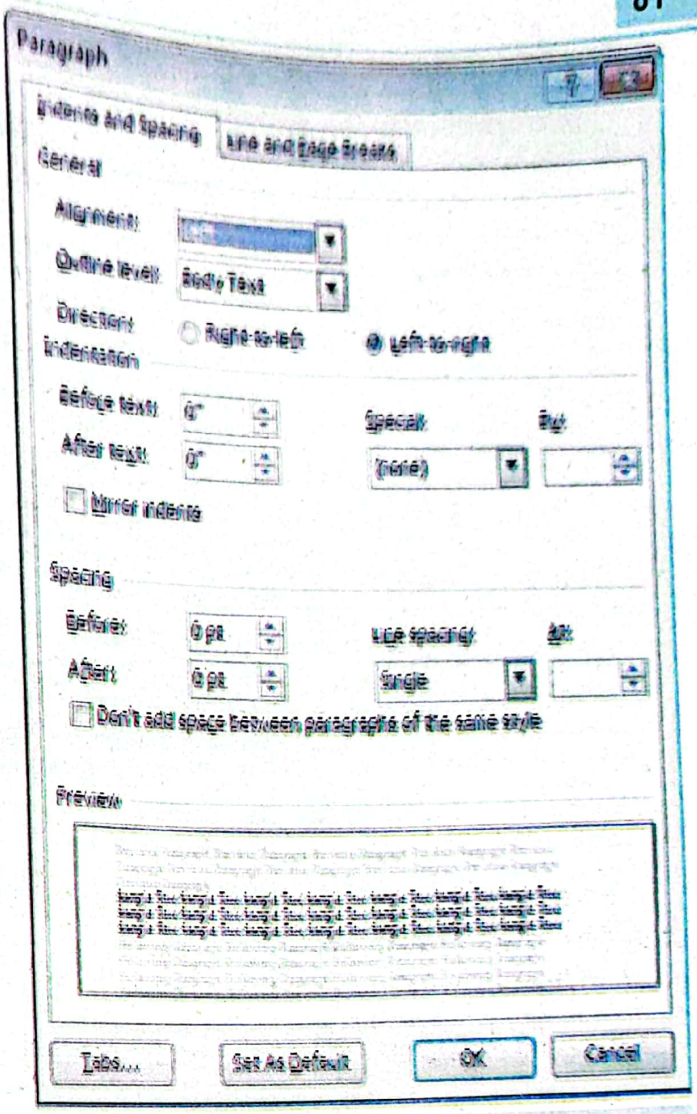


Fig.3-29 Paragraph dialog box

Page Formatting

Page formatting refers to formatting that affects the entire page such as changing page orientation, margins, page numbering, header and footer, etc. Page formatting commands are included in the **Page Layout** tab on the **Ribbon**. These are in the **Themes**, **Page Setup** and **Page Background** groups as shown in Fig.3-30.

Commonly used page formatting commands include changing theme, margins, orientation, page size and background.

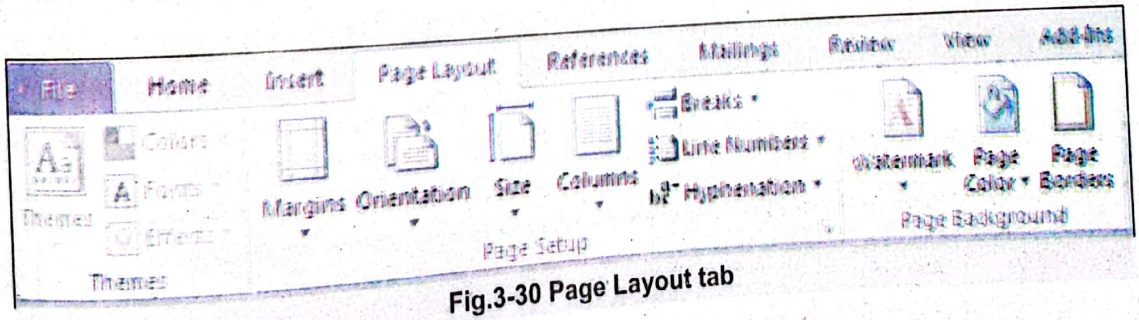


Fig.3-30 Page Layout tab

- **Document Theme**

Themes change the overall appearance of the entire document, including colors, fonts and effects.

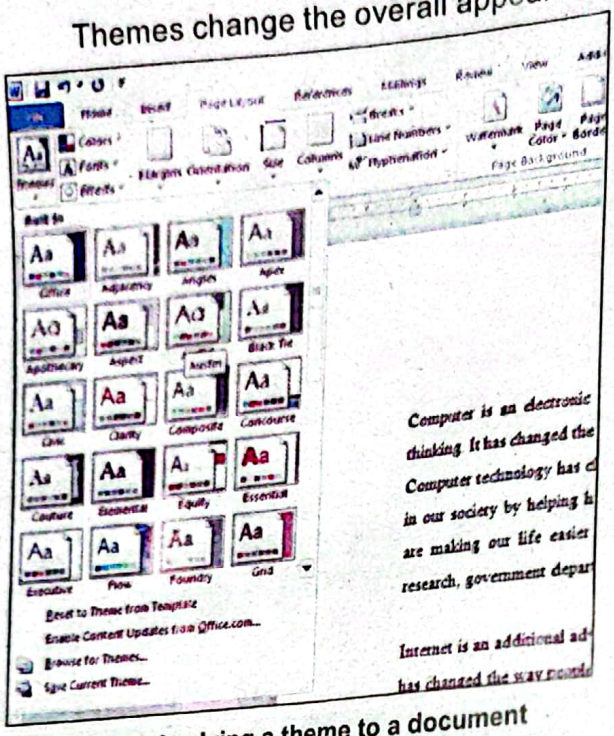


Fig.3-31 Applying a theme to a document

The following are the steps to apply a theme.

1. Click the **Page Layout** tab.
2. Click the **Themes** button in the **Themes** group.
3. Select a theme to apply from the menu shown in Fig.3-31. If the user does not like the selected theme, he can select another one. To remove a theme from the document select Office theme.

- **Page Margins**

Page Margins refer to the amount of blank space that appears at the top, bottom, left and right edges of a document.

The following are the steps to set margins.

1. Click the **Page Layout** tab.
2. Click **Margins** button.
3. Select margins from the menu that appears as shown in Fig.3-32.

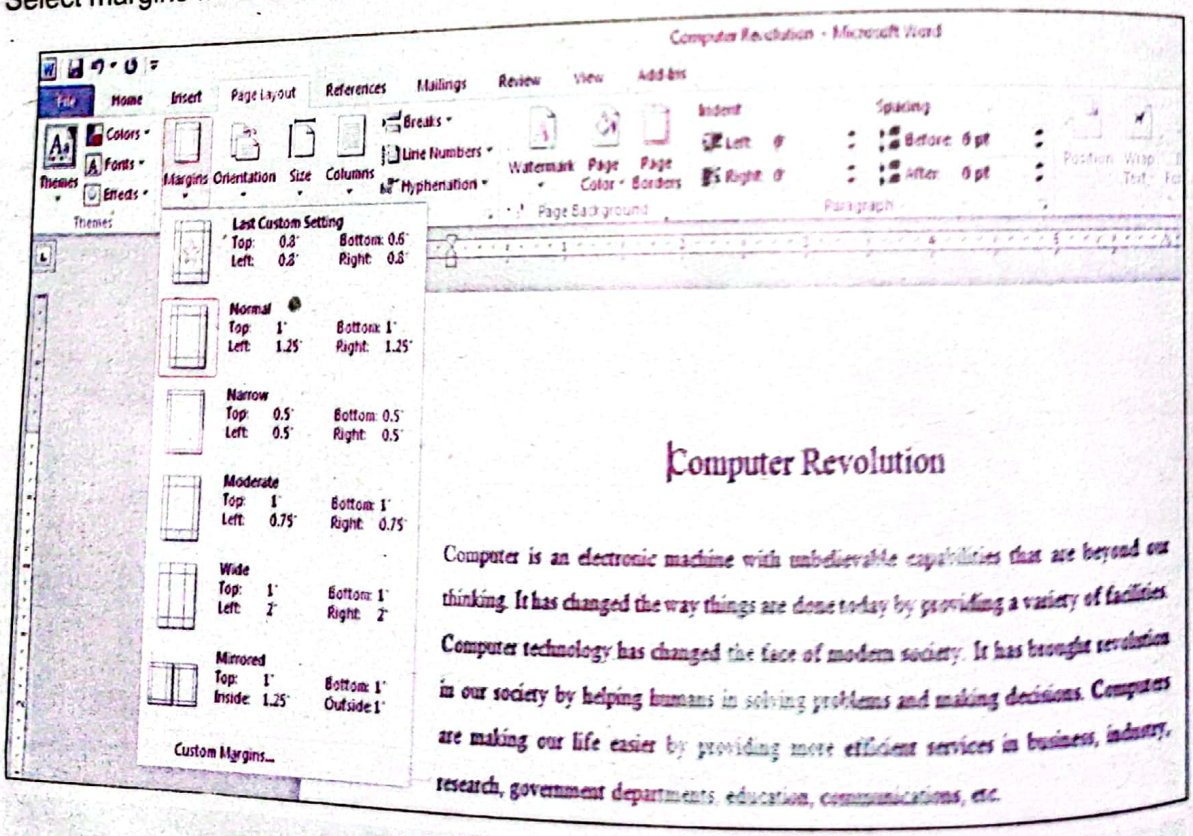


Fig.3-32 Setting page margins

- **Page Orientation**

Page orientation refers to the way rectangular page is oriented for viewing. There are two types of page orientations which are portrait and landscape. In portrait orientation, the height of display is greater than width. In landscape orientation, the width of display is greater than height.

The following are the steps to apply a page orientation.

1. Click **Page Layout** tab.
2. Click **Orientation** button in the **Page Setup** group.
3. Select **Portrait** or **Landscape** orientation as shown in Fig.3-33

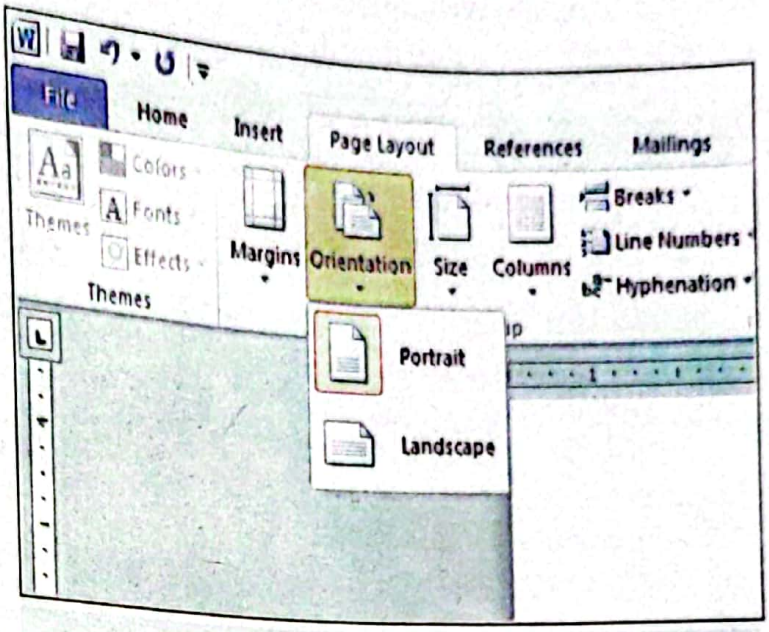


Fig.3-33 Applying page orientation

- **Page Size**

Page size refers to the height and width of page.

The following are the steps to set page size.

1. Click **Page Layout** tab.
2. Click **Size** button in the **Page Setup** group.
3. Select a page size from the menu shown in Fig.3-34.

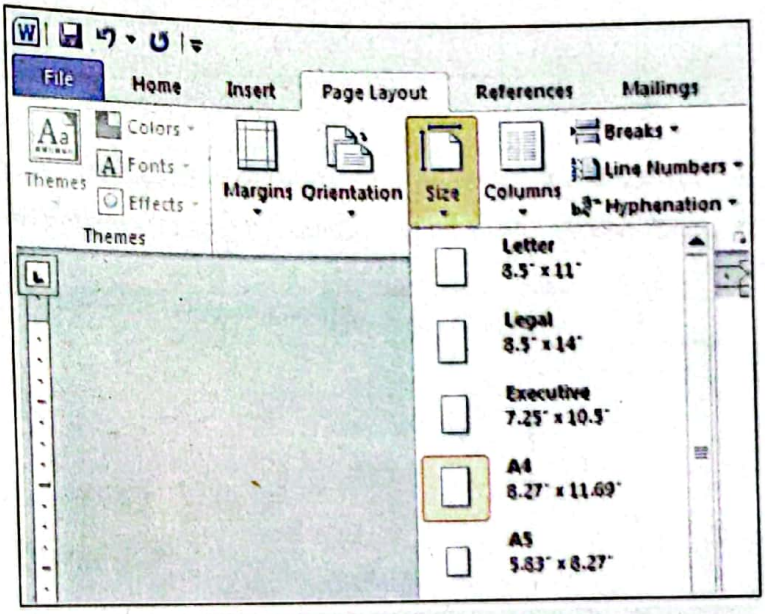


Fig.3-34 Selecting a page size

- **Page Background**

The **Background** group has three items to set for the document which include **Watermark**, **Page Color** and **Page Borders**. **Watermark** inserts dim text behind the content of the page. **Page Color** sets the page background color and **Page Borders** option inserts or changes the border around the page.

The following are the steps to set watermark

1. Click **Page Layout** tab.
2. Click **Watermark** command in the **Page Background** group.

3. Click **Custom Watermark** from the menu shown in Fig.3-35. User can also select a watermark that is displayed in the menu if it fulfills the requirement.

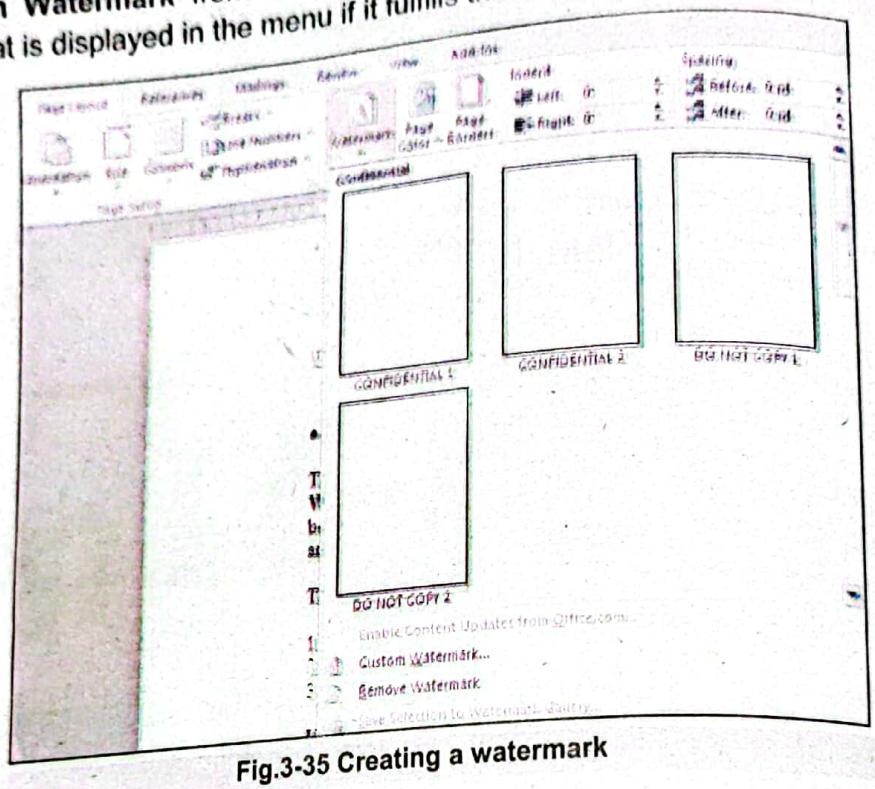


Fig.3-35 Creating a watermark

4. Type the text for watermark as shown in Fig.3-36
5. Click **Apply** and then click **Close** to close the dialog box.

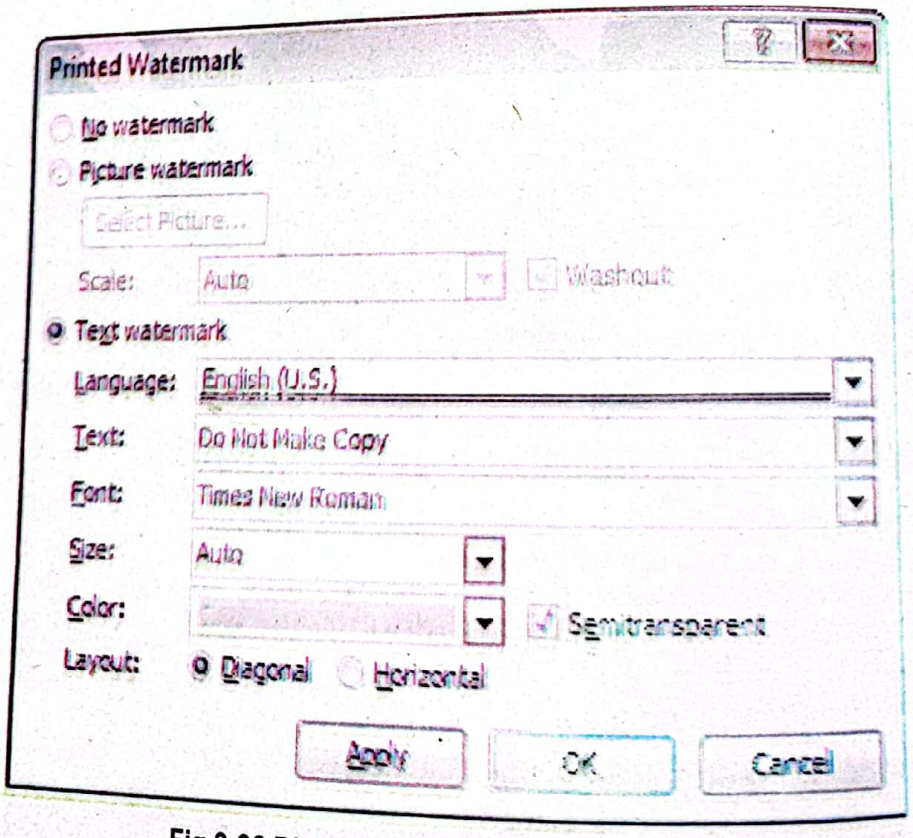


Fig.3-36 Dialog box to create watermark

The following are the steps to set page color.

1. Click **Page Layout** tab.
2. Click the **Page Color** command.
3. Select a page color from the menu shown in Fig.3-37

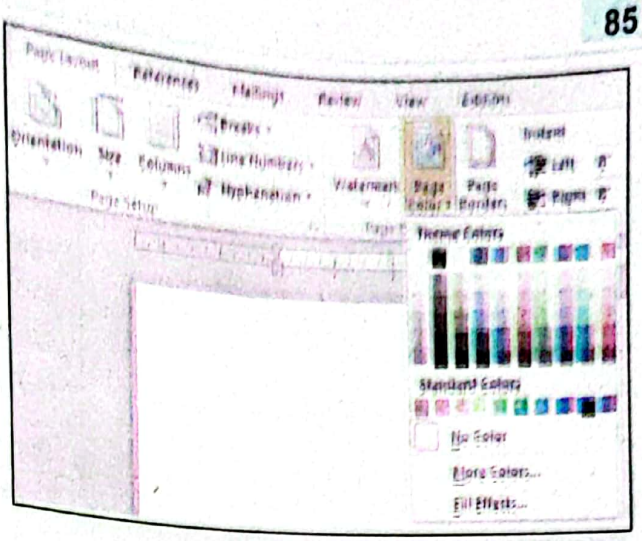


Fig.3-37 Setting a page color

The following are the steps to set page border.

1. Click **Page Layout** tab.
2. Click the **Page Borders** command in **Page Background** group.
3. Select a page border style from the **Borders and Shading** dialog box shown in Fig.3-38

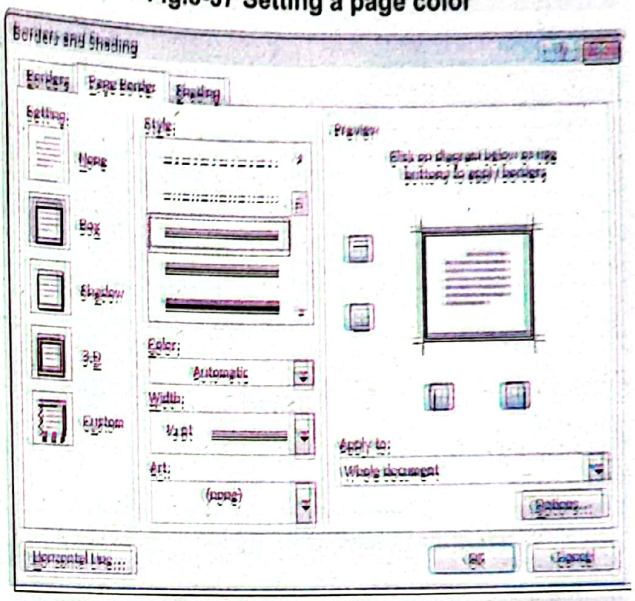


Fig.3-38 Selecting a page border style

3.1.9 INSERTING PAGE BREAKS AND SECTION BREAKS

A page break is a marker that tells Word program that the contents which follow are to appear on a new page. Word automatically inserts a page break when the user reaches the end of a page. Page break is inserted in document when user wants to add a new page to the document.

A section break also inserts a new page but it allows the user to change the page format without having any effect on the formatting of the previous pages. For example, section break can be used to break a document into sections having different header and footer for each chapter of a book.

The following are the steps for inserting page break and section break.

1. Click the **Page Layout** tab.
2. Click the **Breaks** icon to open the drop-down menu shown in Fig.3-39.
3. To insert a page break click the first option under the **Page Breaks** heading and to insert a section break click the first option under the **Section Breaks** heading.

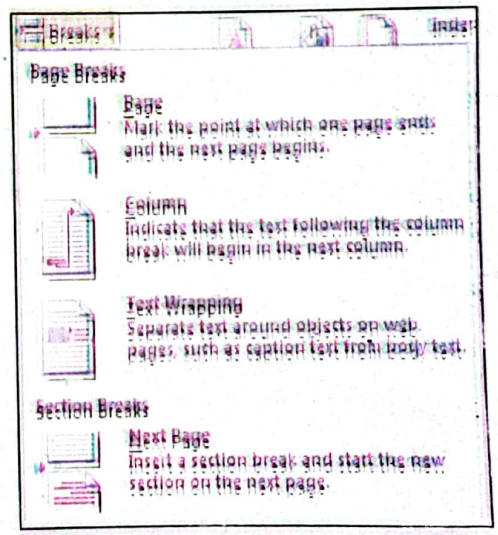
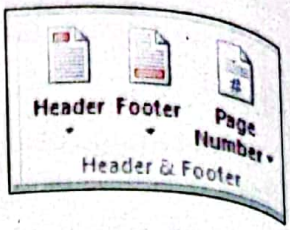


Fig.3-39 Breaks drop-down menu

3.1.10 INSERTING HEADER, FOOTER AND PAGE NUMBER



Header refers to information that appears at the top of a page and footer refers to information that appears at the bottom of a page. The type of information that may appear in the header or footer includes book title, document title, chapter number and title, page number, company name, etc.

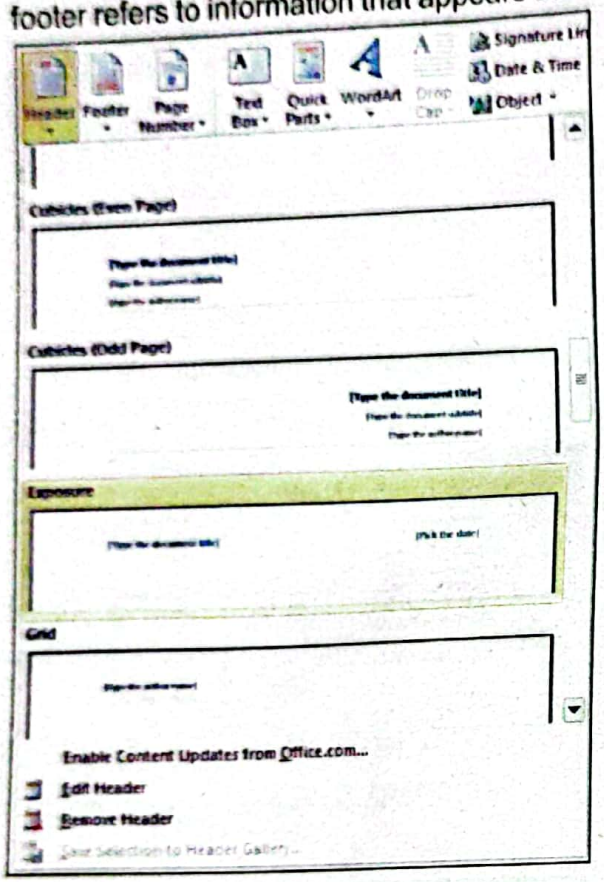


Fig.3-40 Inserting a header

The following are the steps for inserting header or footer.

1. Click the **Insert** tab.
2. Click the **Header** or **Footer** in the **Header & Footer** group shown above to open the drop-down menu.
3. Select a predesigned header or footer from the drop-down menu shown in Fig.3-40. Header or footer will appear in the document and the **Design** tab will appear in the **Ribbon** as shown in Fig.3-41.
4. Type the information in the header or footer.
5. After entering the information, click **Close Header and Footer** in the **Design** tab.

To edit the information in the header or footer Double-click anywhere on the header or footer and make the changes.

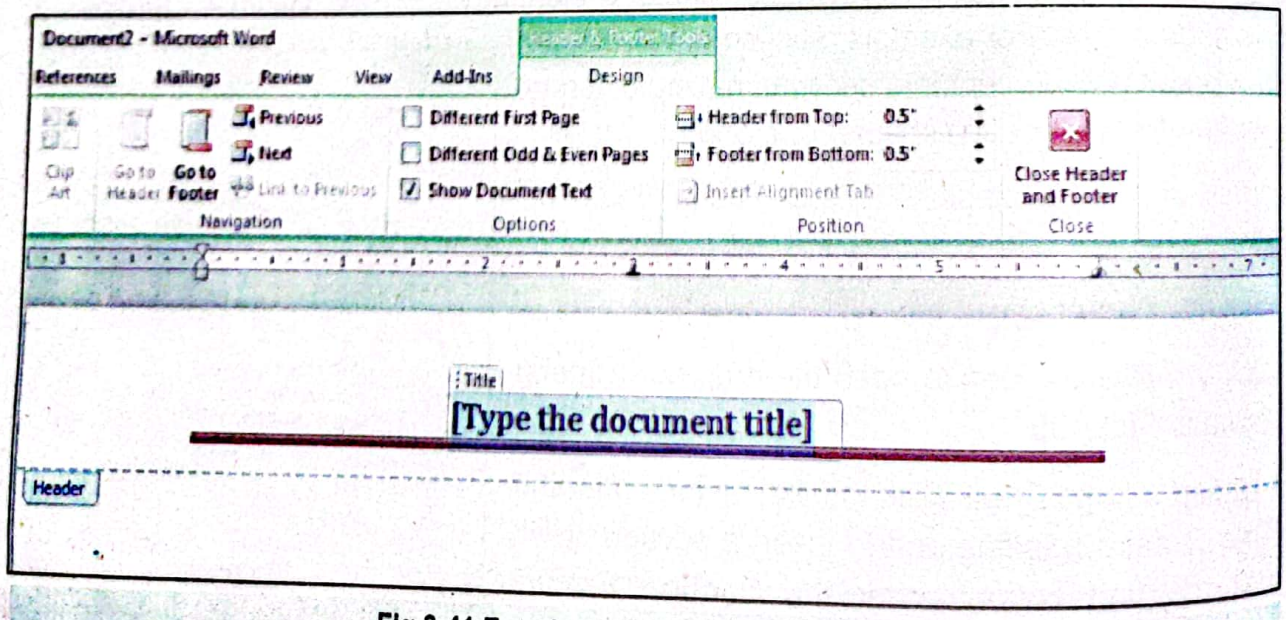


Fig.3-41 Entering Information in header

Inserting Page Numbers

The following are the steps for inserting page numbers in documents.

1. Click the **Insert** tab.
2. Click **Page Number** in the **Header & Footer** group. A drop-down menu will appear.
3. Move the mouse pointer on **Top of Page** or **Bottom of Page** command. This will open a submenu as shown in Fig.3-42.
4. Select an option from the submenu. Page number will be inserted in the document and **Design** tab will appear on the **Ribbon**.
5. Set the value for Header from Top or Footer from Bottom in the **Position** group of **Design** tab if required.
6. Click the **Close Header and Footer** button on the **Design** tab.

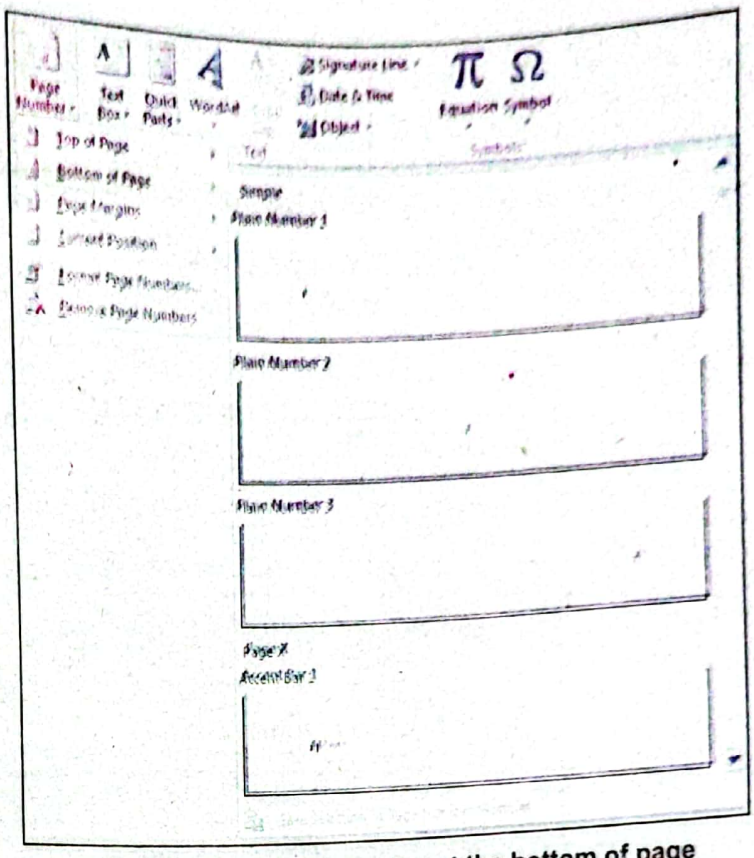


Fig.3-42 Inserting page number at the bottom of page

3.1.11 INSERTING AND POSITIONING PICTURE

The following are the steps for inserting a picture in a document.

1. Place the cursor where to insert the picture.
2. Click **Insert** tab.
3. Click **Picture** command in **Illustrations** group. The **Insert Picture** dialog box will appear as shown in Fig.3-43.
4. Browse and select the picture file to insert and click **Insert** button.

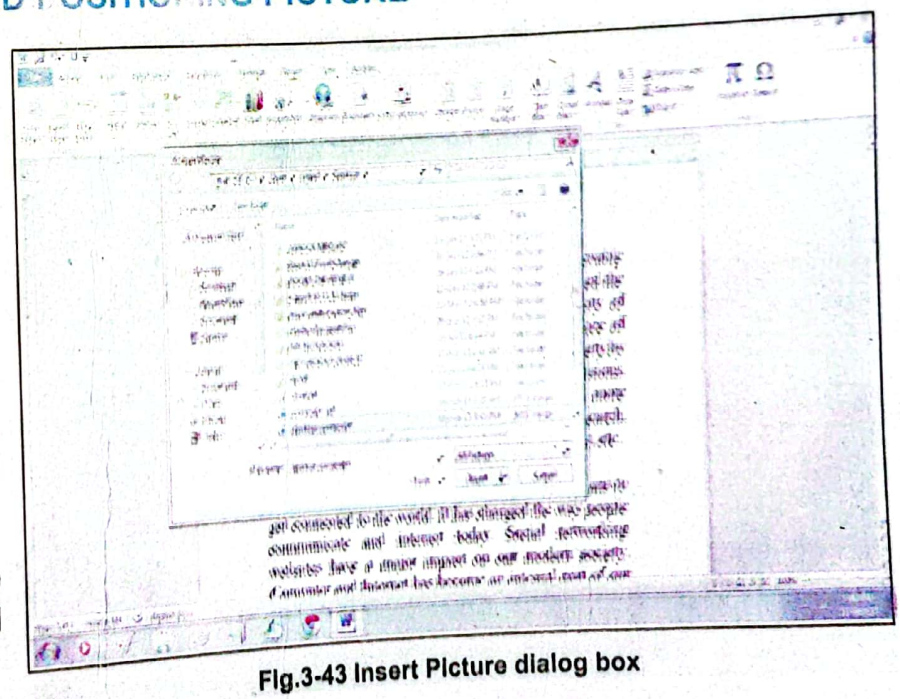


Fig.3-43 Insert Picture dialog box

Positioning Picture within a Page

Tip: If you want to change the page number format, click **Insert** tab then click **Page Number** and select **Format Page Numbers**.

The following are the steps for positioning picture on page.

1. Click the picture that is to be positioned. **Format** tab will appear on the screen.
2. Click **Position** command on the **Arrange** group.
3. Select a position from the menu. Top right corner is selected for positioning the picture in Fig.3-44.

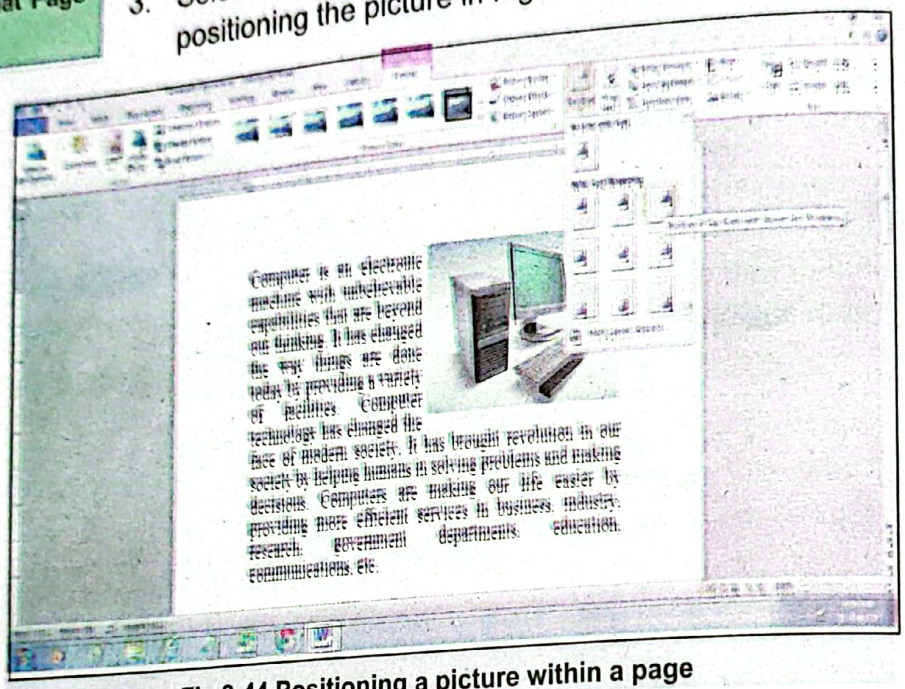


Fig.3-44 Positioning a picture within a page

4. Picture positioned at top right corner of page is shown in Fig.3-45.

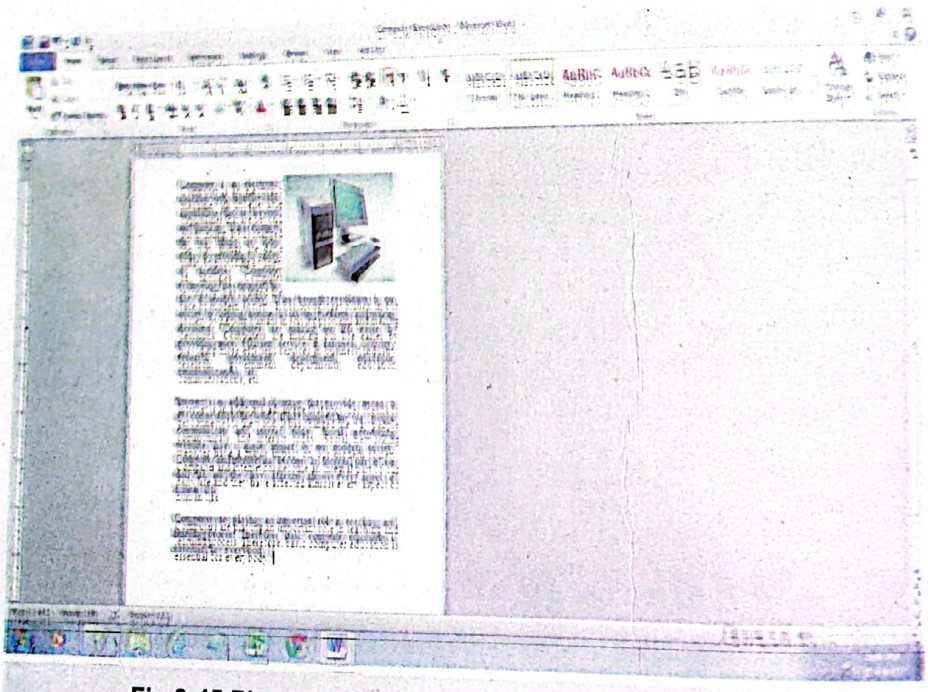


Fig.3-45 Picture positioned at top right corner of page

3.1.12 INSERTING WORDART

WordArt is a text modifying feature in Word to create decorative effects such as shadow, colors, outlines, 3D effects, changing shape of text, etc. as shown in Fig.3-46. It is also possible to convert existing text into WordArt.

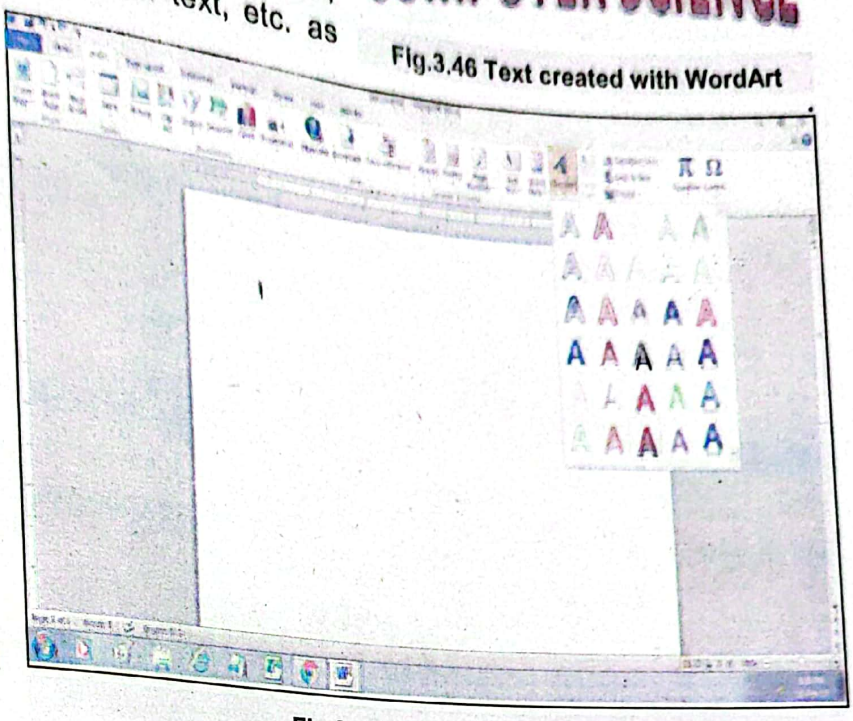


Fig.3.46 Text created with WordArt

The following are the steps to insert WordArt in a document.

1. Click the **Insert** tab.
2. Click **WordArt** in the **Text** group.
3. Select character style from the drop-down menu shown in Fig.3-47. **Format** tab will appear on the Ribbon.
4. Type the text in the text box shown in Fig.3-48.

Fig.3-47 Inserting WordArt

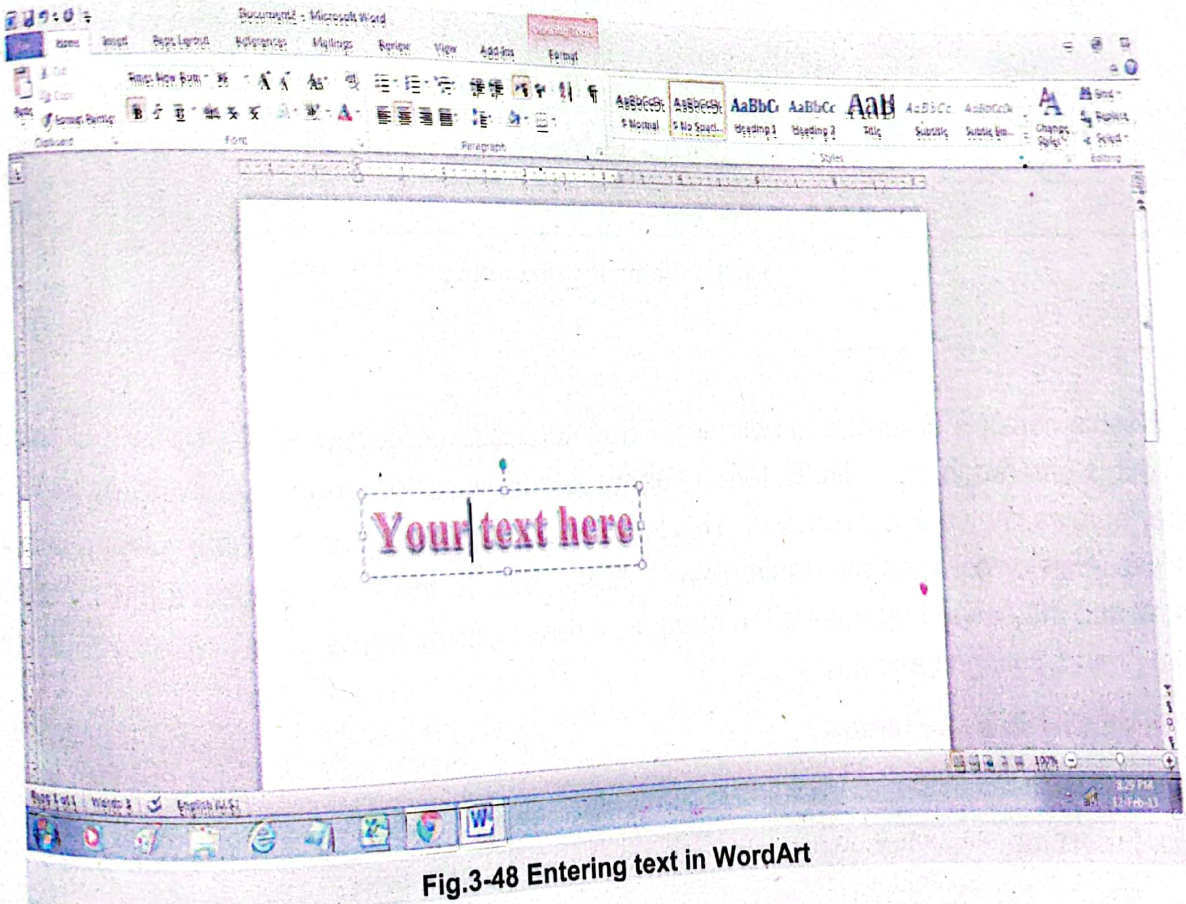


Fig.3-48 Entering text in WordArt

5. Click **Text Effects** command in the **WordArt Styles** group.
6. Move the mouse pointer over **Transform** and select a text effect from the submenu as shown in Fig.3-49.

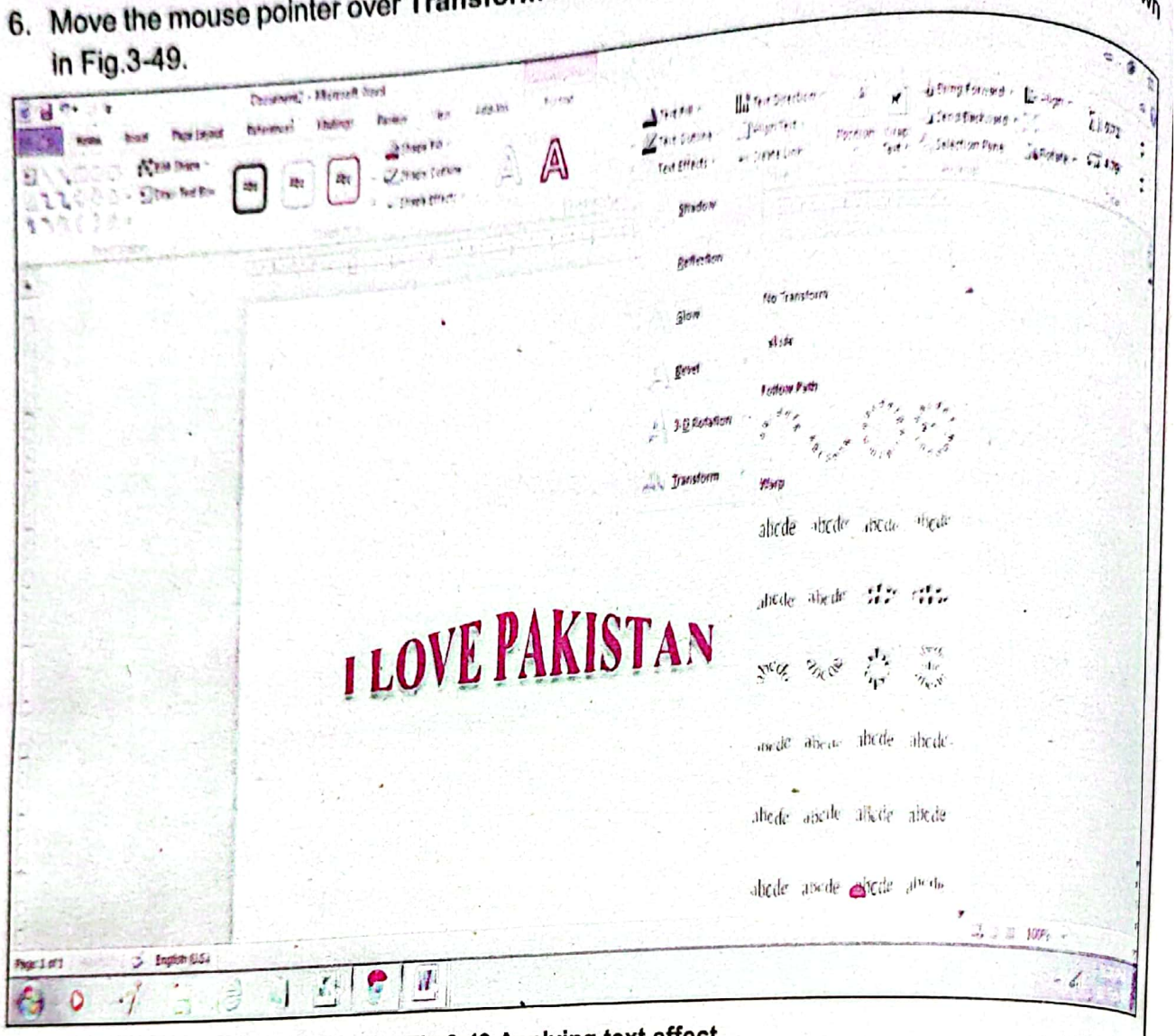


Fig.3-49 Applying text effect

3.1.13 CREATING AND FORMATTING TABLE

A table consists of rows and columns. The intersection of a row and a column is called a cell. Text is entered in the cells. Before inserting a table in a document, user should know the number of rows and columns required. This is called the dimension of the table. User can easily add more rows or columns as required. In table dimension, the first number is the number of columns and the second number is the number of rows. For example, a 5x4 (five by four) table means it has 5 columns and 4 rows.

Inserting Table in a Document

The following are the steps for inserting a 5x4 table.

1. Click **Insert** tab.

Tip: Another way to insert table is, click **Insert** tab, click Table and then select **Insert Table**. Specify the number of rows and columns in the dialog box and click OK.

2. Click **Table** command in the **Tables** group as shown in Fig.3-50.

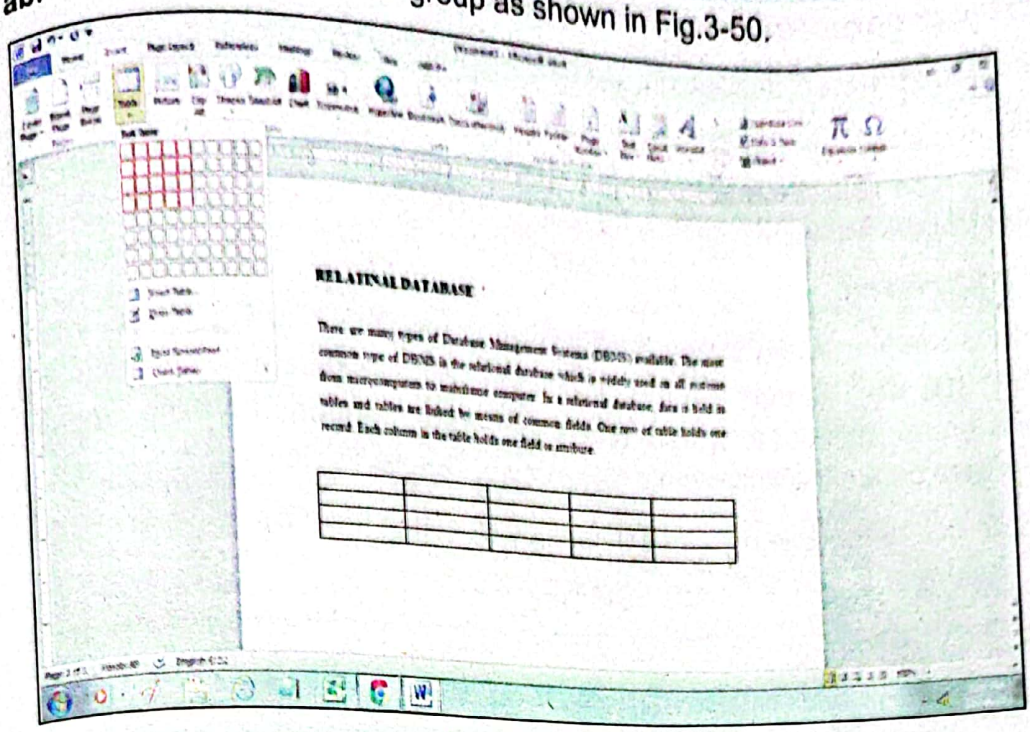


Fig.3-50 Inserting a 5x4 table in a document

3. Position the mouse pointer on the cell in the fourth row and fifth column and click. A blank table consisting of 4 rows and 5 columns will be inserted in the document.

4. Now, user can enter data in the cells.

A 5x4 table with data is shown in Fig.3-51.

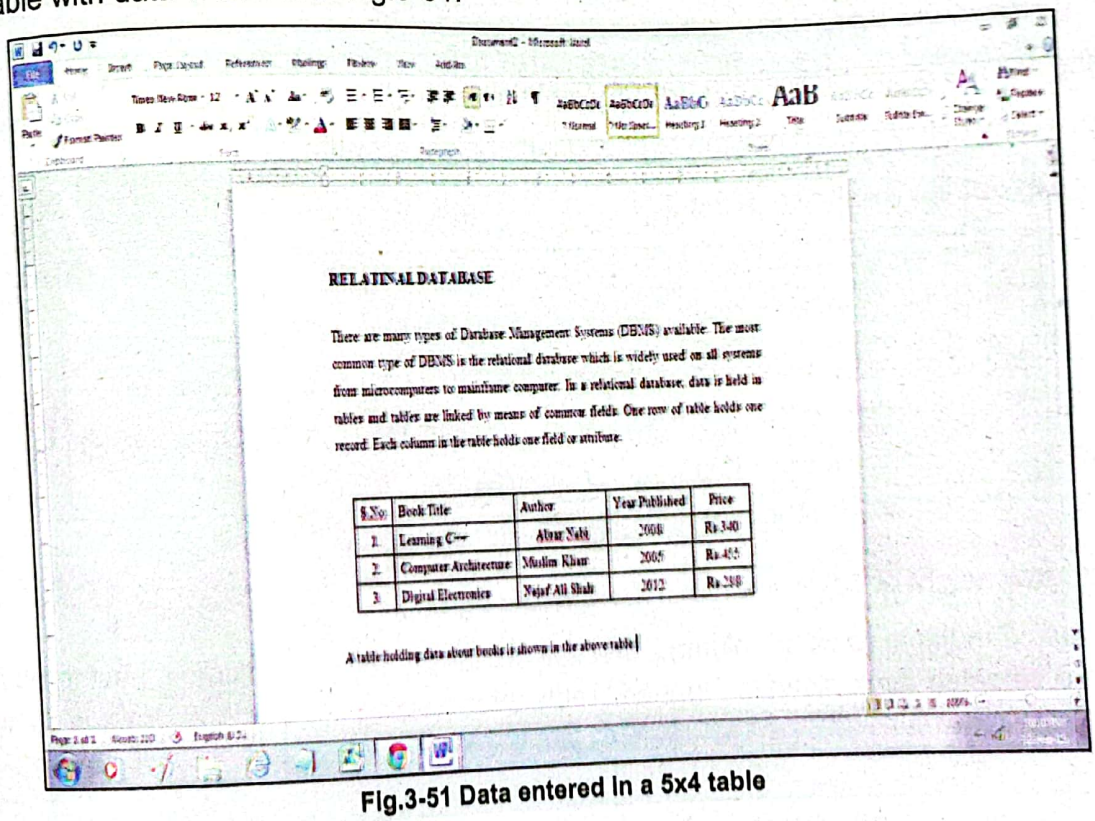


Fig.3-51 Data entered in a 5x4 table

Adding and Deleting Rows or Columns

The following are the steps for adding and deleting rows or columns.

1. To insert a row, click in the cell below or above which a blank row is to be inserted. To insert a column, click in the cell to the right or left of which a blank column is to be inserted. **Design** and **Layout** tabs will appear on the Ribbon.
2. Click the **Layout** tab.
3. Click the command in the **Rows & Columns** group shown in Fig.3-52 to insert a row or column. If you want to delete a row or column click the **Delete** command in the **Rows & Columns** group. Select the **Delete Rows** or **Delete Columns** from the drop-down menu. User can also delete the entire table by selecting **Delete Table**.

User can delete multiple rows or columns by selecting them by dragging and then clicking the **Delete** command.

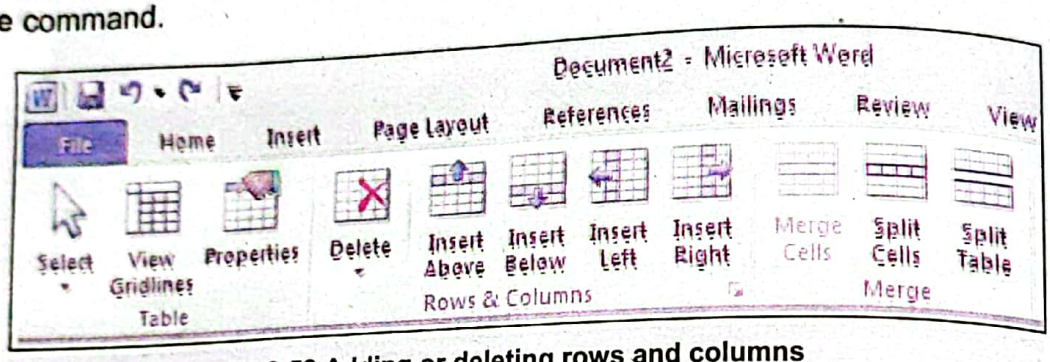


Fig.3-52 Adding or deleting rows and columns

Resizing Rows and Columns

Following are the steps for resizing row or columns.

1. Click in any cell of row or column to change the height or width.
2. Click **Layout** tab as shown in Fig.3-53.

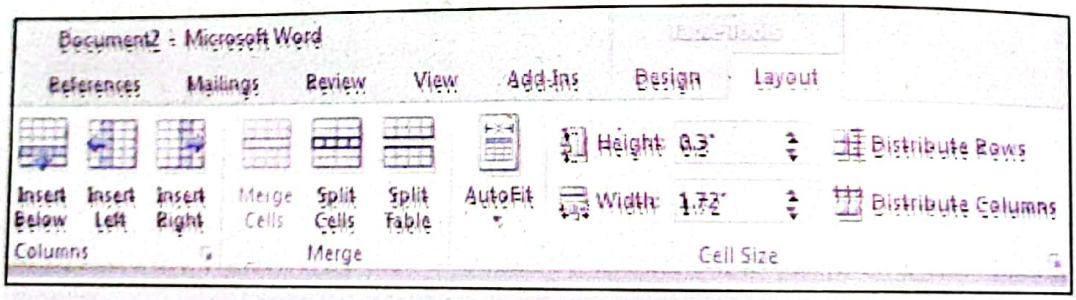


Fig.3-53 Resizing row and column size

3. Resize row height or column width in the **Cell Size** group.

To resize multiple rows or columns, first select multiple rows or columns. Last three rows of table are selected for resizing in Fig.3-54. Table after resizing the last three rows is shown in Fig.3-55.

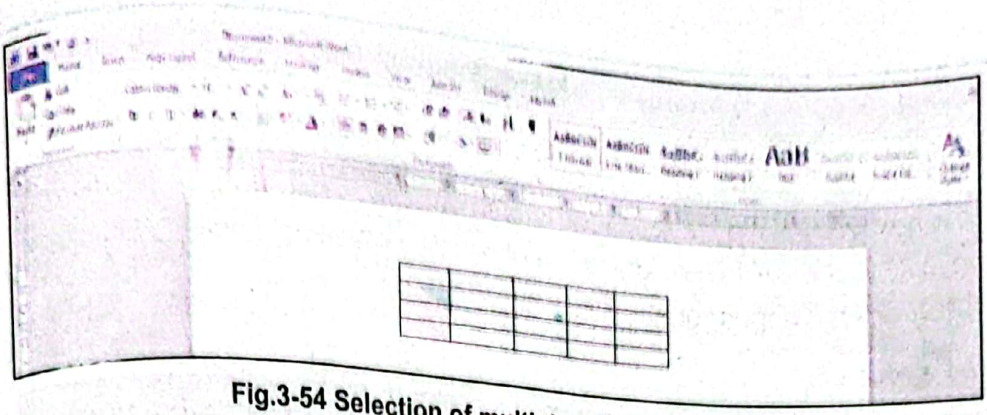


Fig.3-54 Selection of multiple rows for resizing

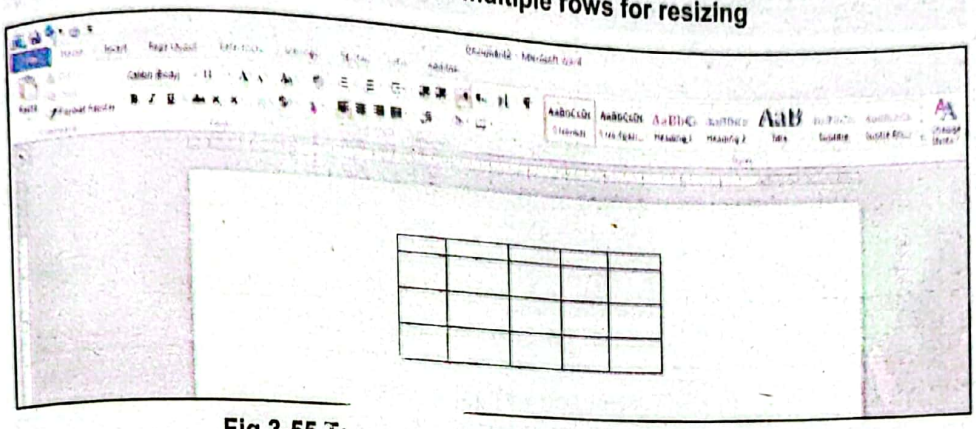


Fig.3-55 Ta sizing the last three rows

Adding or Changing Border

The following are the steps for adding or changing border lines and shading.

1. Select the cells
2. Click the **Design** tab.
3. Open the **Border** drop-down menu in the **Table Styles** group and select a border as shown in Fig.3-56.

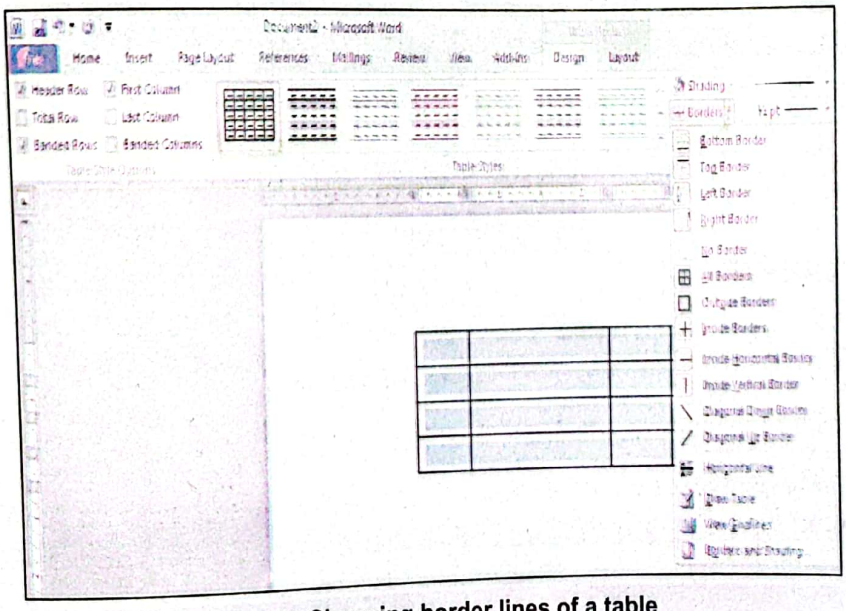


Fig.3-56 Changing border lines of a table

4. For shading, open the **Shading** drop-down menu in the **Table Styles** group and select a shading color as shown in Fig.3-57.

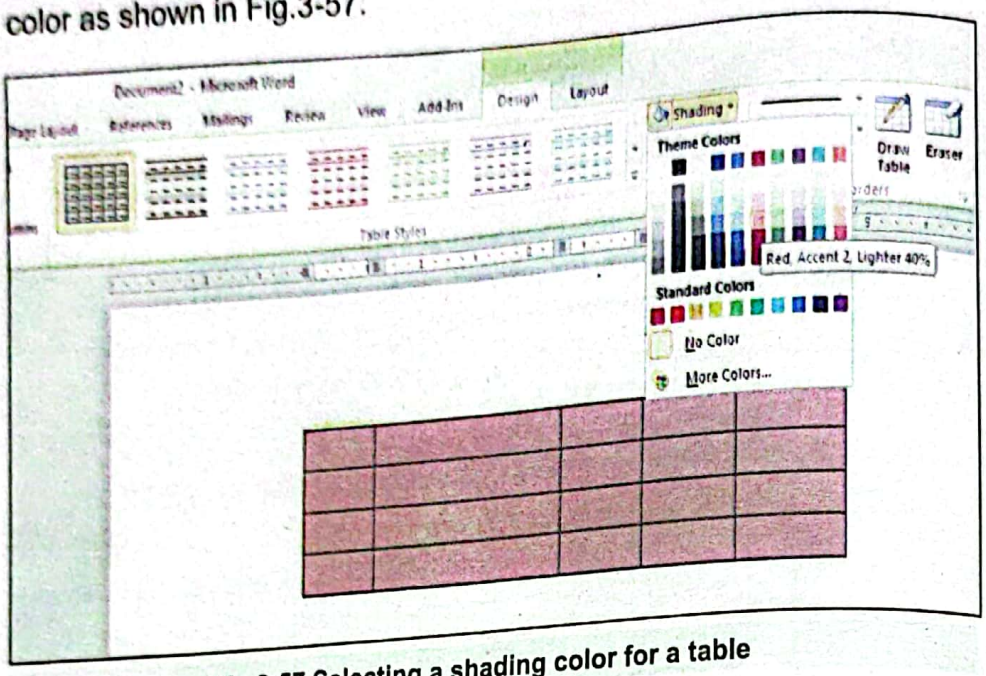


Fig.3-57 Selecting a shading color for a table

Merging and Splitting Cells

1. Select the cells for merging or splitting.
2. Click the **Layout** tab.
3. Click **Merge Cells** command in the **Merge** group as shown in Fig.3-58. Table after merging the selected cells is shown in Fig.3-59. For splitting cells, click the **Split Cells** command in the same group and enter required values in the **Split Cells** dialog box and click **OK**.

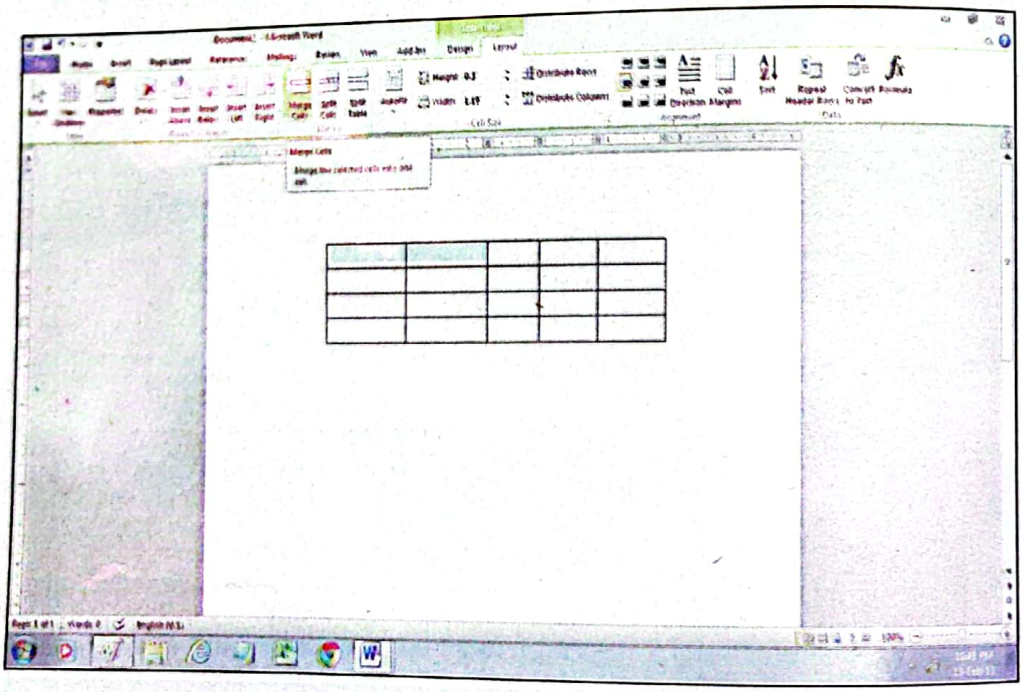


Fig.3-58 Selecting cells for merging

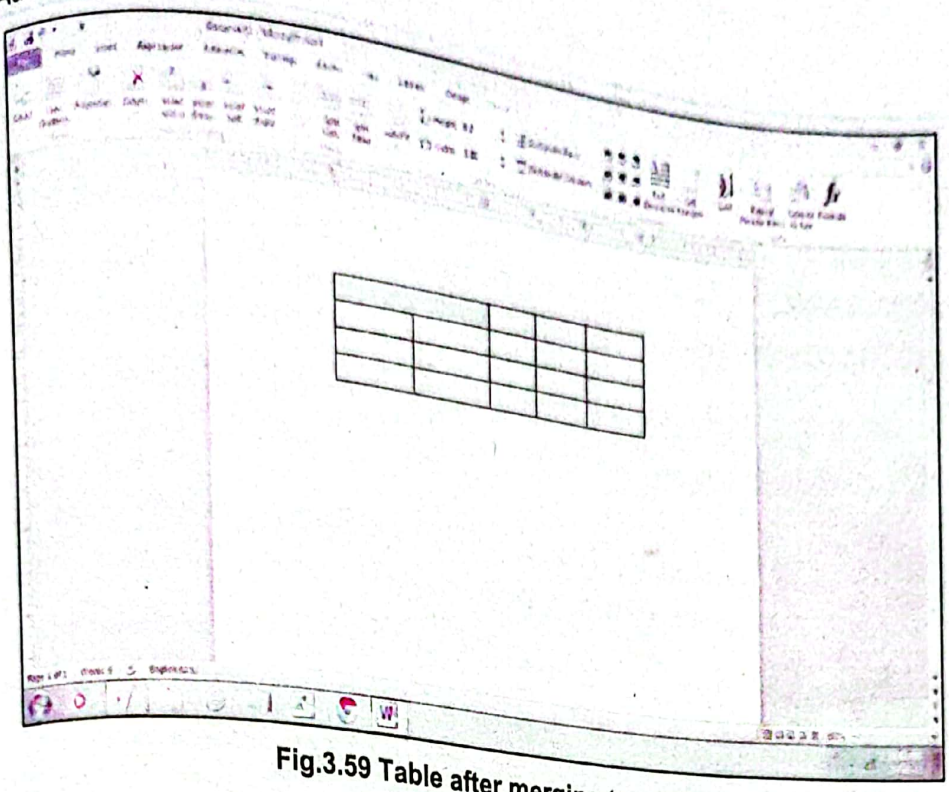


Fig.3.59 Table after merging two cells

3.1.14 CHANGING MARGINS

The following are the steps for changing margins.

1. Click **Page Layout** tab.
2. Click **Margins** in the **Page Setup** group.
3. Select margins from the drop-down menu as shown in Fig.3-60 or click **Custom Margins** and set the required margins in the **Margins** tab of **Page Setup** dialog box.
4. Click **OK**.

A page with **Normal** margins and **Narrow** margins is shown in Fig.3-61.

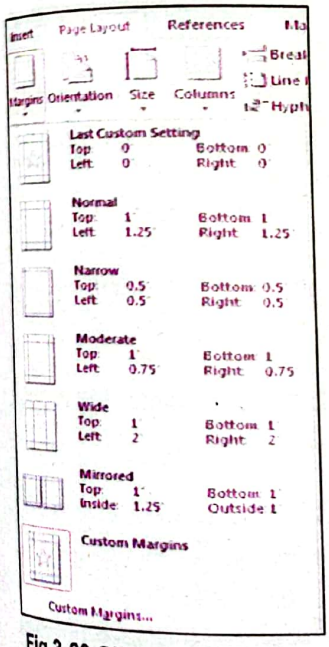


Fig.3-60 Changing margins

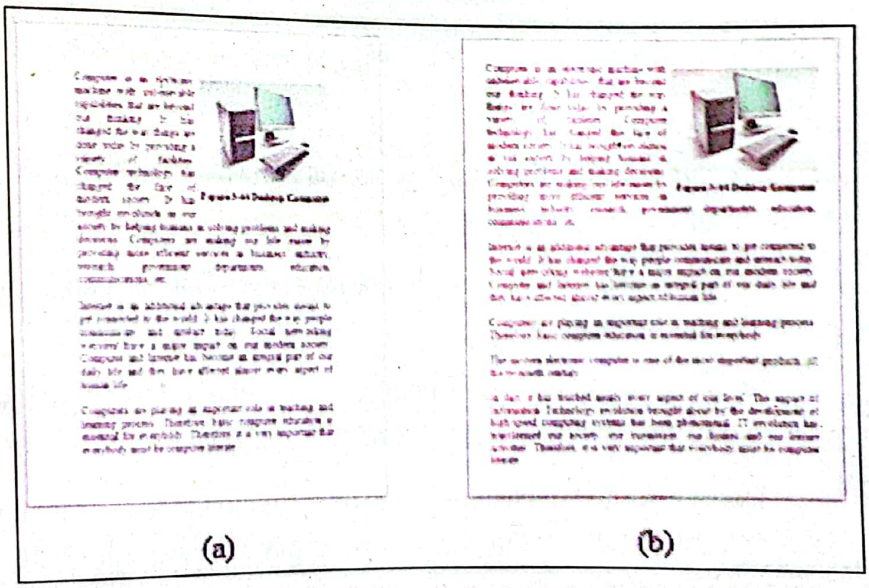


Fig.3-61 (a) Page with Normal margins (b) Page with Narrow Margins

3.1.15 USING HYPERLINK

Hyperlink is text in a Web page or document that links to another Web page or another place in the same document when the user clicks on it.

The following are the steps to create a Hyperlink.

1. Select the text that is to be displayed as Hyperlink as shown in Fig.3-62.

DO YOU KNOW?

A Webpage is a document which can be displayed in a web browser such as Google Chrome, Internet Explorer or Edge. These are also often called just "pages." A collection of webpages are grouped together to from a Website.

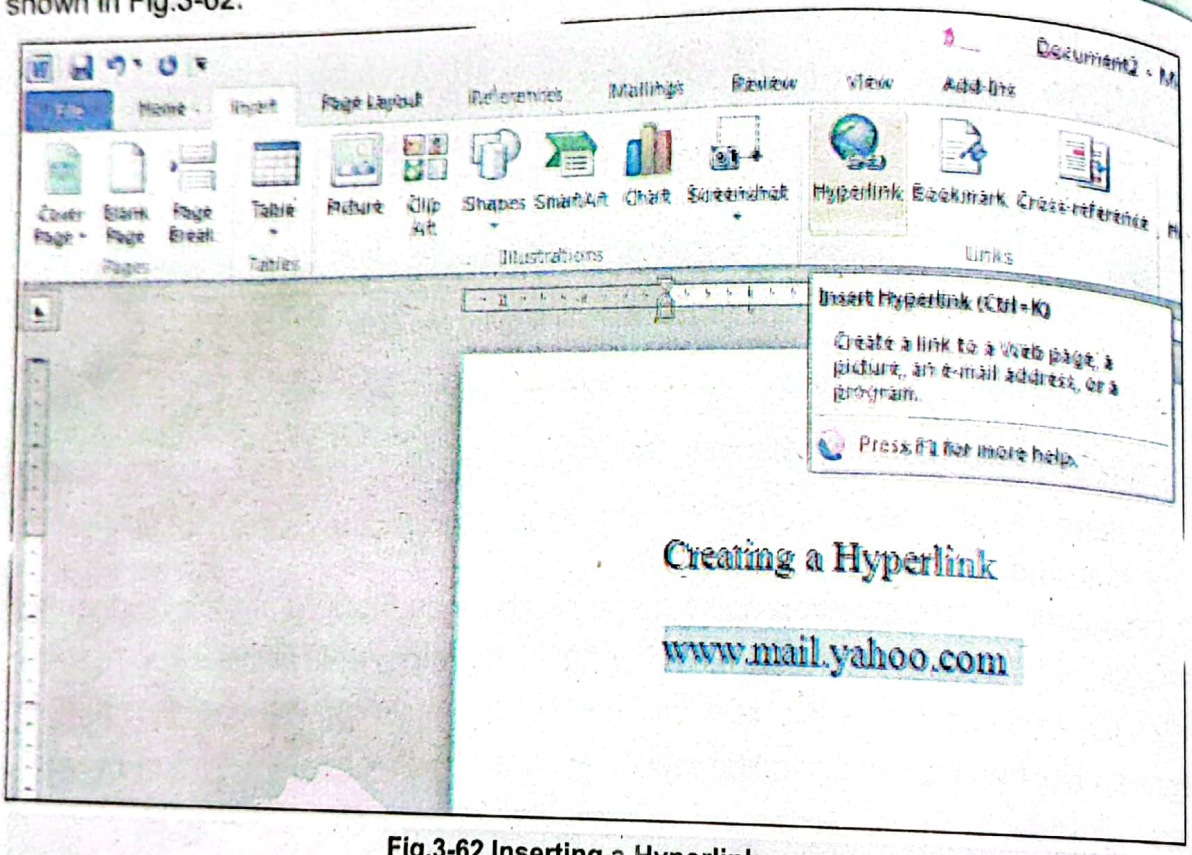


Fig.3-62 Inserting a Hyperlink

2. Click the **Insert** tab.
3. Click **Hyperlink** in the **Links** group as shown in Fig.3-63.
4. Click **OK**.

There is also an easy way to create a Hyperlink to Web page. Type the Hyperlink text and press Spacebar or Enter key.

Hyperlink appears in blue color and underlined. To open the Web page, position the mouse pointer over the Hyperlink and press the Ctrl key while clicking the mouse button.

The text format of Hyperlink can be formatted to regular text, that is, it should not be in blue color or underlined. To remove the text format of Hyperlink, Right-click the Hyperlink and select **Remove Hyperlink** from the shortcut menu.

3.2 SPREADSHEET

Spreadsheet is used to store, organize, calculate and present numerical data in an easily understandable format.

3.2.1 INTRODUCTION TO SPREADSHEET

A spreadsheet is a grid of rows and columns in which user enters numbers and text. Spreadsheet programs are powerful multipurpose calculators, capable of everything from adding two plus two to solving problems that involve complicated calculations. Spreadsheet programs allow user to organize data, perform calculations, draw graphs of numeric data and develop professional looking reports.

A common spreadsheet program is Microsoft Excel. It is a part of Microsoft Office 2010 software. Therefore, use of Microsoft Excel 2010 will be explained.

Opening the Microsoft Excel Program

The following are the steps to open the Excel program.

> **DO YOU KNOW?**
> Microsoft was founded by Bill Gates and Paul Allen in April, 1975.

1. Turn on the computer and click **Start** button.
2. Click **All Programs**.
3. Click **Microsoft Office** to display the submenu.
4. Click **Microsoft Excel 2010** to open the Excel program. The opening screen of Excel will appear as shown in Fig.3-63.

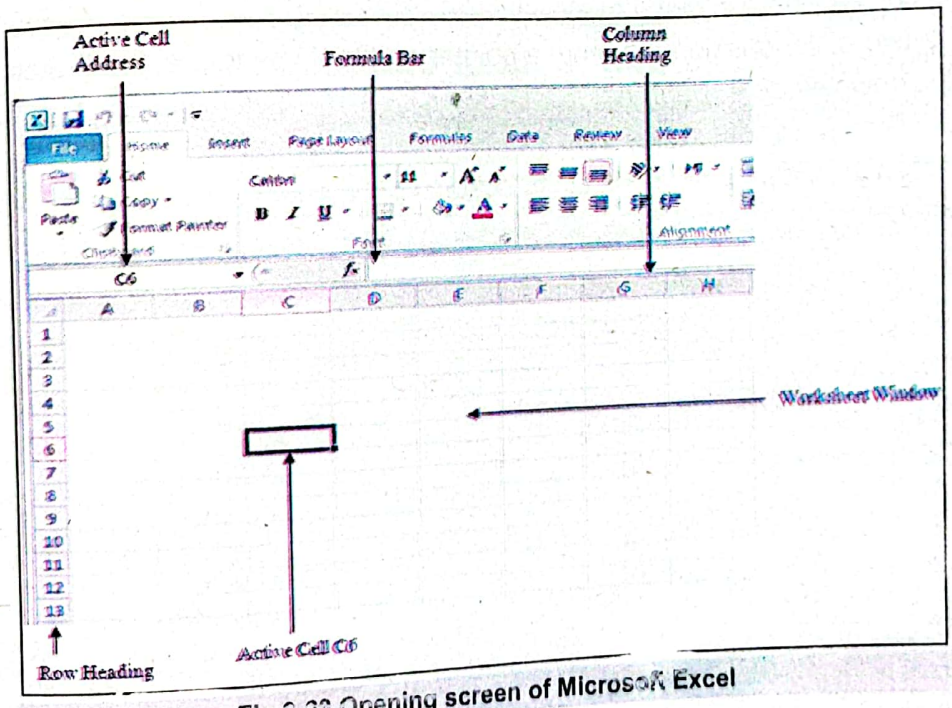


Fig 3-63 Opening screen of Microsoft Excel

Identifying Cells

The boxes formed by the intersection of individual rows and columns are known as cells. Cells are identified by the combination of their column letter and row number. For example, the sixth cell in the third column is known as cell C6. This is known as cell's address.

Active Cell

At any moment user is positioned in a single cell known as active cell or current cell. Active cell has dark border as shown in Fig.3.63. When the user enters data, it goes in this cell.

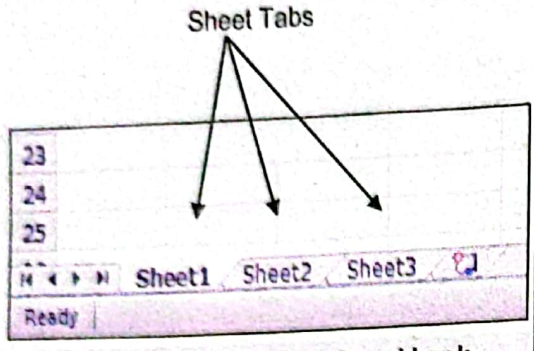


Fig.3-64 Sheets of Excel workbook

Excel Workbook

When user starts Excel, it creates a new blank workbook, called Book1. A workbook contains sheets, each of which is called a worksheet. Excel opens a workbook with three worksheets as shown in Fig.3-64.

DO YOU KNOW?

Tip: You can rename a worksheet. For this, right click the sheet tab of the worksheet that you want to rename, select Rename in the shortcut menu, type a name and press Enter.

Size of Spreadsheet

Each worksheet in a workbook has 16,384 columns and 1,048,576 rows. Work area is like a movable window. The user can move the window sideways to view additional columns as well as up and down to view additional rows.

Filling Columns and Rows

The following are the steps to fill a series of numbers from 1 to 7.

1. Enter 1 in cell A1 and 2 in cell A2 below it.
2. Select the two cells, position the mouse pointer on the fill handle at the bottom right corner and drag it downwards through A7.
3. The cells will be filled with series from 1 to 7.
4. You can open the drop-down menu at the bottom right corner as shown in Fig.3-65 and select another option.

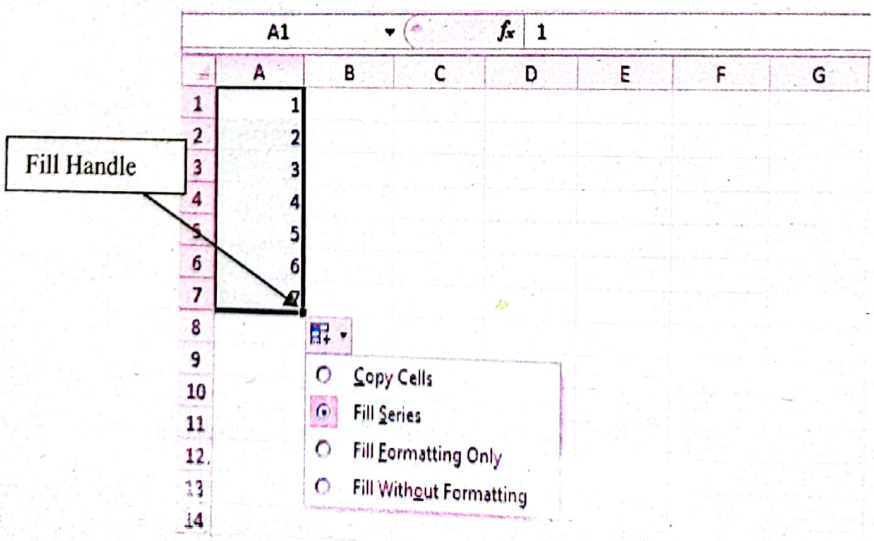


Fig.3-65 Filling a series in cells in rows

Cells are filled with odd numbers in Fig.3-66 by entering 15 in cell A3 and 17 in cell B3 and then dragging the fill handle to cell F3.

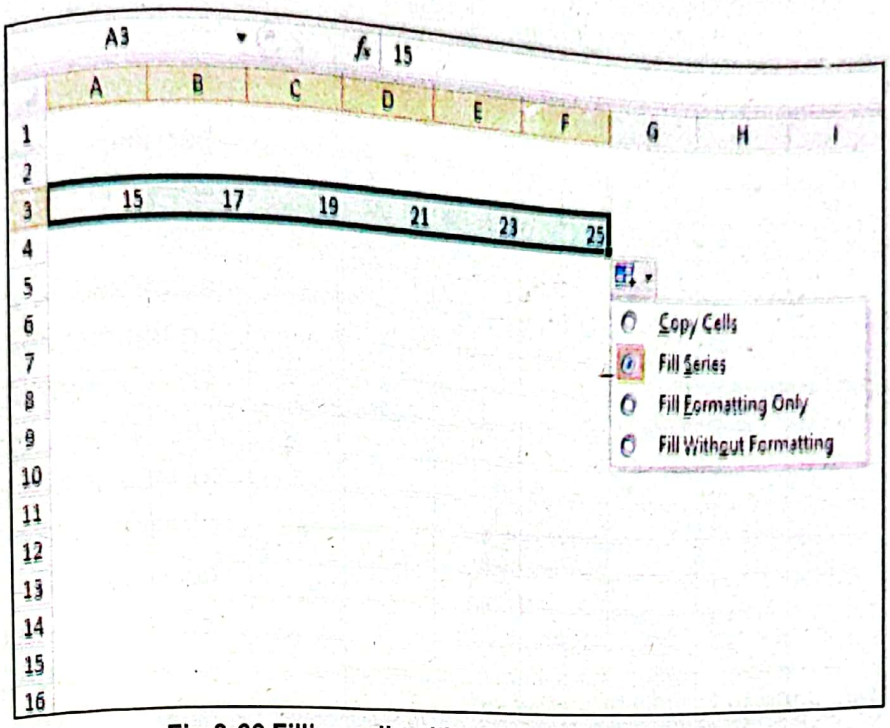


Fig.3-66 Filling cells with odd numbers in columns

Relative Cell Addressing

In Excel, cell addresses included in a formula or function are relative cell addresses. Relative cell address means when a formula is copied to other cells, the cell references in the formula change to reflect the formula's new location.

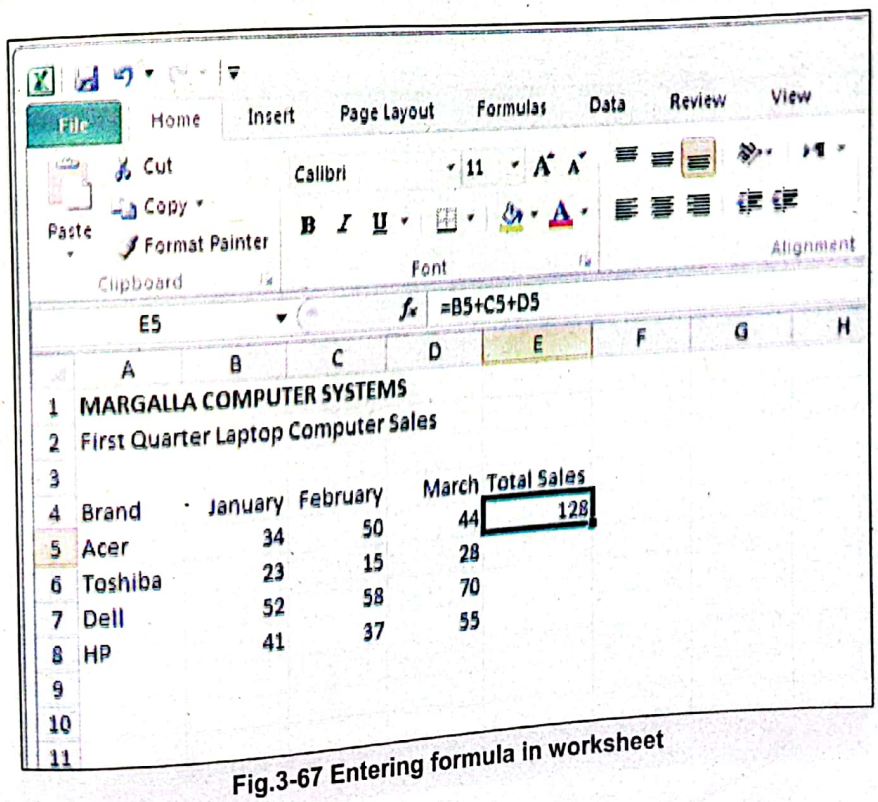


Fig.3-67 Entering formula in worksheet

To understand relative addressing, consider the worksheet shown in Fig.3-67.

- Enter the formula =B5+C5+D5 in cell E5 to calculate the total number of Acer laptop computers sold in the first quarter.
- Copy the formula in cell E6.
- The formula in cell E6 becomes =B6+C6+D6 as shown in Fig.3-68.
- The cell references have automatically changed based on the relative position of row and columns because relative cell addressing is used in formula in cell E5.
- Similarly, the formula will become =B7+C7+D7 in cell E7 and in cell E8 it will become =B8+C8+D8. This is what is required in this worksheet.

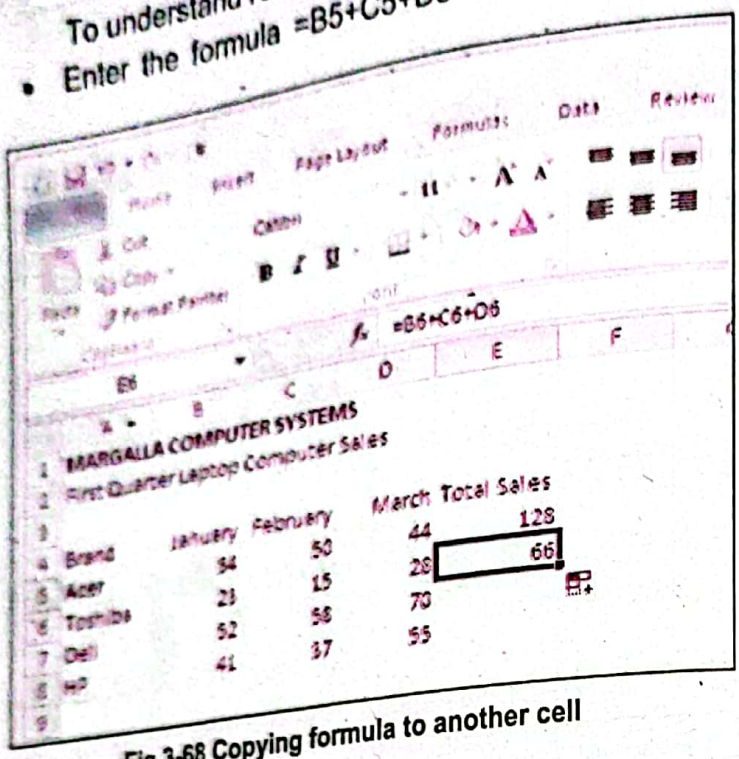


Fig.3-68 Copying formula to another cell

Absolute Cell Addressing

User can address a particular cell location no matter where the formula appears by using absolute cell address. Absolute cell addressing keeps a cell reference constant when copying a formula or function. Absolute cell addresses begin with a dollar sign in the formula, such as =C5 + D5.

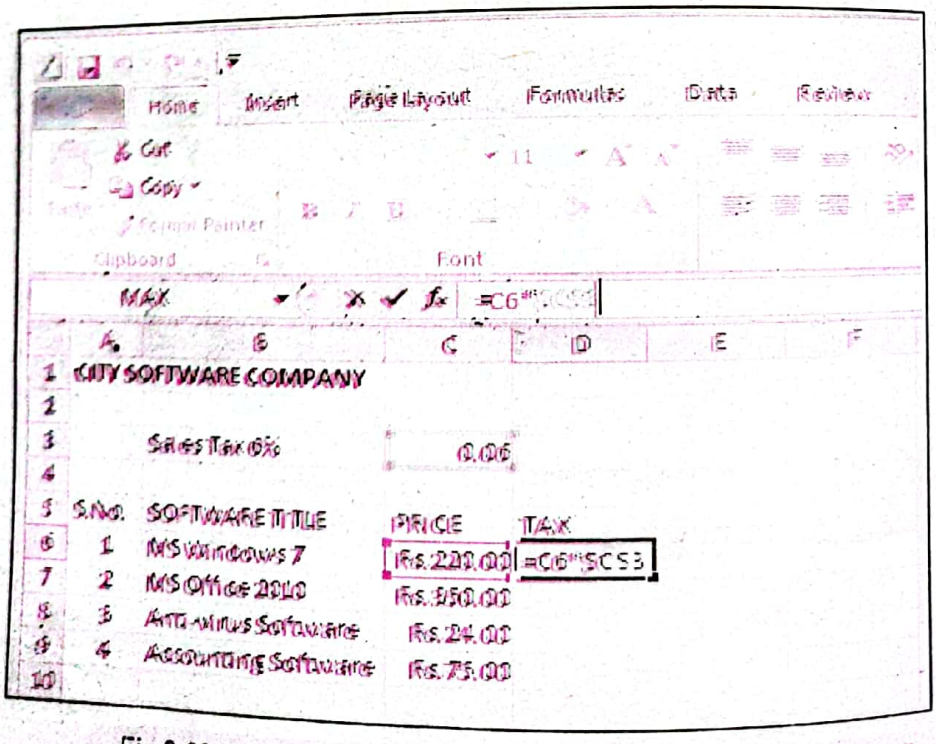


Fig.3-69 Using absolute cell addressing in formula

In the worksheet of Fig.3-69, sales tax is calculated as 6% for software items. Absolute cell addressing is used for the cell C3 in the formula =C6*C3 in cell D6 for calculating sales tax because it should not change when the formula will be copied to cells D7, D8 and D9 as shown in Fig.3-70 .

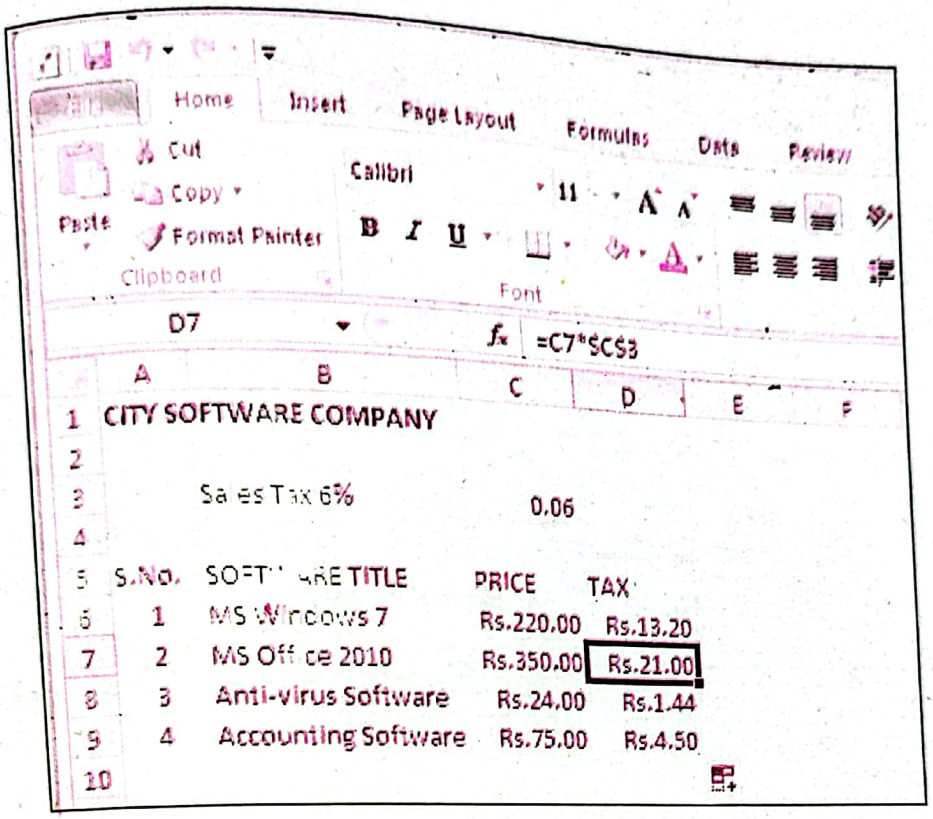


Fig.3-70 Copying formula that has absolute addressing

Paste Special

Excel copies all the information in the selected range of cells when you paste data. Excel's Paste Special command allows many other options while pasting cells such as paste only formats of selected cells without contents or paste contents without formulas.

The following steps describe the use of Paste Special command.

1. Select the cell range to paste.
2. Open the **Paste** drop-down menu in **Clipboard** group of **Home** tab and select **Paste Special** as shown in Fig.3-71. **Paste Special** dialog box will open.

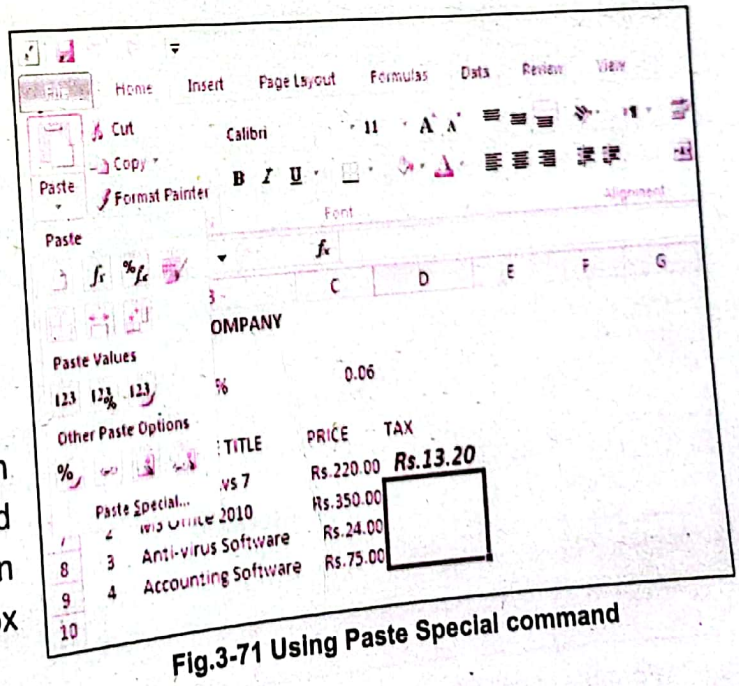


Fig.3-71 Using Paste Special command

3. Select an option from the **Paste Special** dialog box shown in Fig.3-72 and click **OK**.

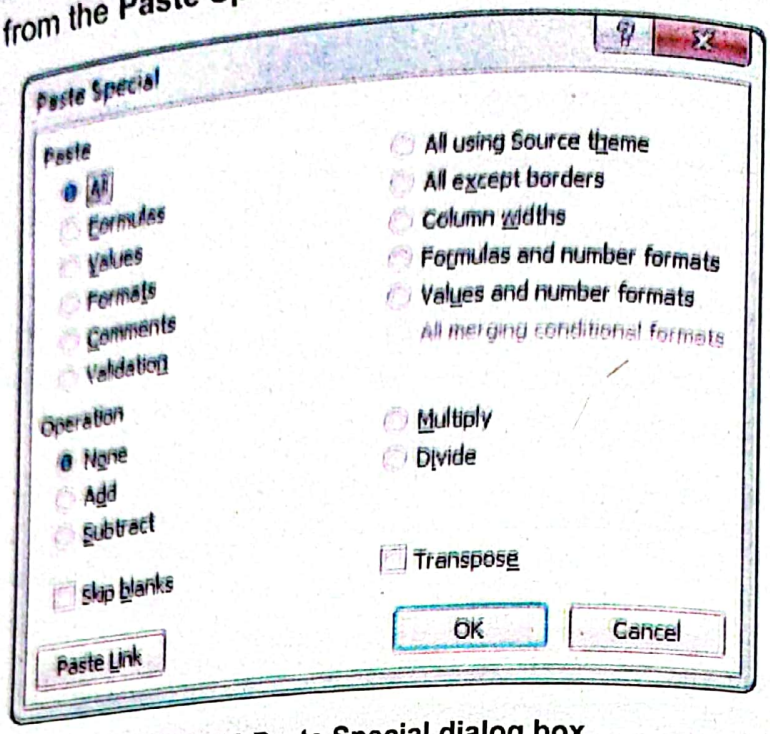


Fig.3-72 Paste Special dialog box

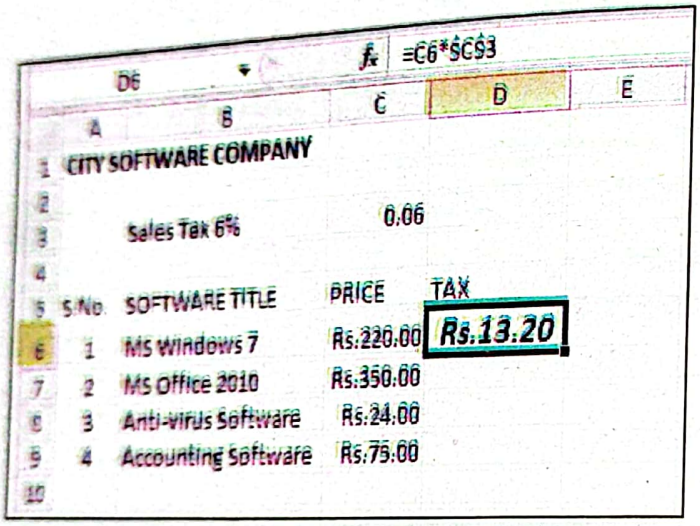


Fig.3-73 Formula in cell D6 is formatted

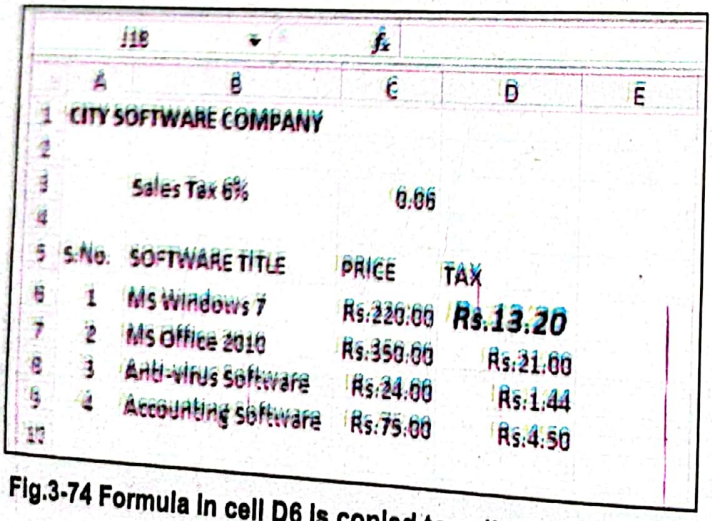


Fig.3-74 Formula in cell D6 is copied to cell D7, D8 and D9

Commonly used options of Paste Special dialog box are explained below.

All: Used to paste all the information in the selected cell range. This is same as normal paste command.

Formulas: Used to paste text, numbers and formulas without formatting.

The formula in cell D6 in the worksheet shown in Fig.3-73 is formatted. When this formula is copied to cells, D7, D8 and D9 using paste special, the format of cell D6 is not copied as shown in Fig.3-74.

Values: Used to convert formulas in the selected cell range to their calculated values and then apply the paste command.

Formats: Used to paste only the formatting of selected cell range without cell contents.

All except borders: Used to paste all the information in the selected range without copying any borders if used.

3.2.2 WORKING WITH FUNCTIONS AND FORMULAS

Working with Functions

Functions are built-In formulas in Excel that allow user to easily perform common calculations on data. Functions can be entered in a worksheet using keyboard, **Insert Function** command or **AutoSum** drop-down menu.

- **Using Keyboard to Find Average**

The following are the steps to calculate average sale for Acer laptop computer during the first quarter using the AVERAGE function.

1. Select cell E5 where the result will appear.
2. Type **=av** to display the Formula AutoComplete list as shown in Fig.3-75.

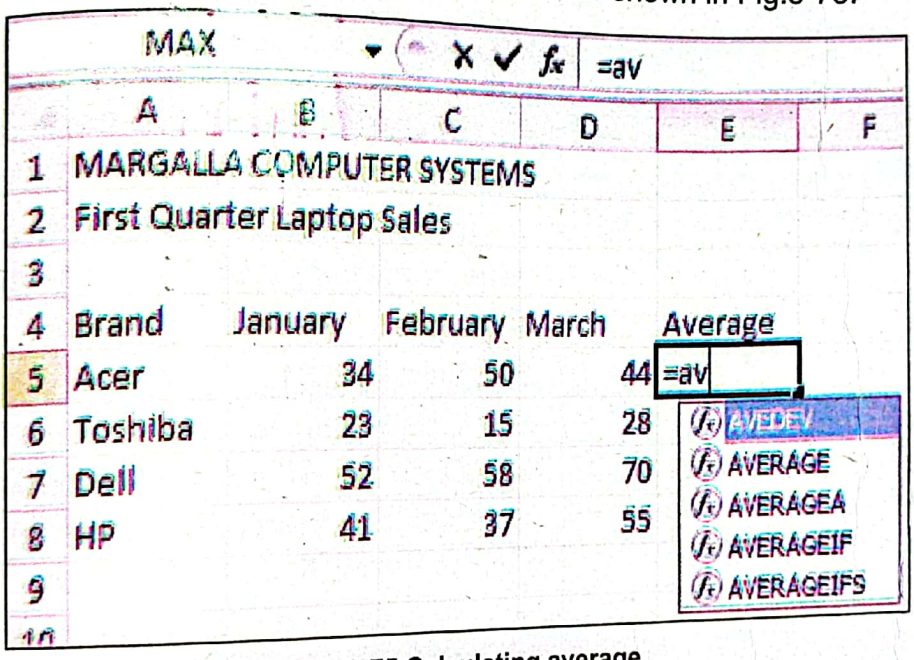


Fig.3-75 Calculating average

3. Point to **AVERAGE** function and Double-click.
4. Select the range B5:D5 to insert it as argument to the **AVERAGE** function.
5. Press **Enter** key.

- **Using Insert Function command to Find the Highest Value**

The following are the steps to find the highest value.

1. Select cell B11 where the answer will appear.
2. Click **Insert Function** command shown in Fig.3-76. **Insert Function** dialog box will be displayed.
3. Select **MAX** in the function list and click **OK**.

4. Type B5:B8 in the **Number 1** text box of **Function Arguments** dialog box and click **OK**.

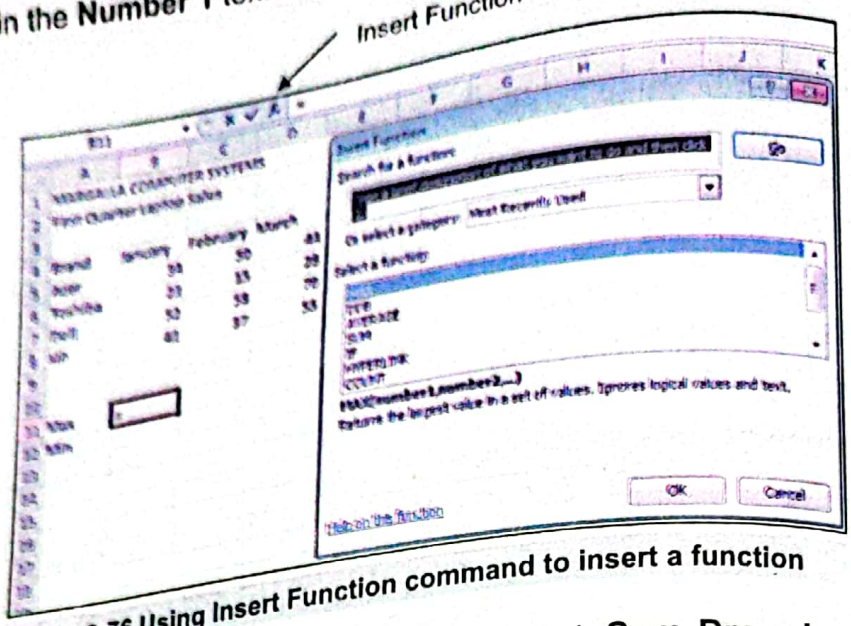


Fig.3-76 Using Insert Function command to insert a function

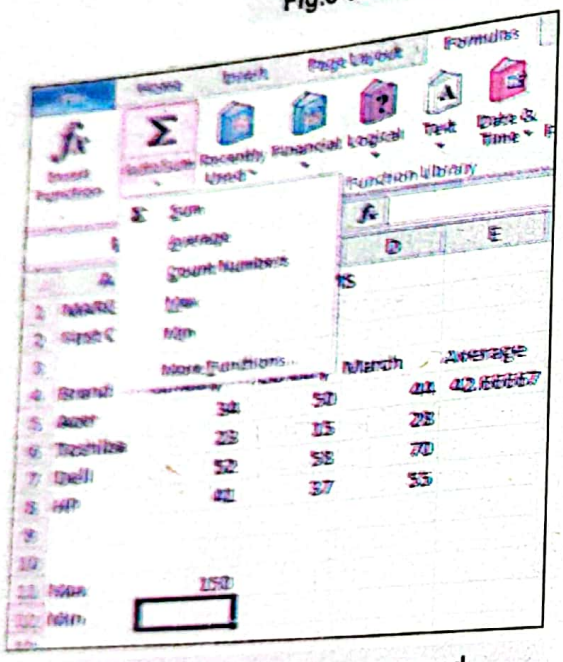


Fig.3-77 Using AutoSum command

- **Using AutoSum Drop-down Menu to Find the Lowest Value**

The following are the steps to find the lowest value in the range B5:B8 using **AutoSum** drop-down menu.

1. Select cell B12 where the answer will appear.
2. Click **Formulas** tab.
3. Open the **AutoSum** drop-down menu in the **Function Library** group as shown in Fig.3-77 and select **Min**.
4. Type the range B5:B8 and press **Enter**.

Working with Formulas

A formula is an expression that performs calculations. It consists of operators, constants and cell addresses. The standard operators used in Excel formulas are given in Table 3-78.

Arithmetic Operation	Excel Operator
Addition	+
Subtraction	-
Multiplication	*
Division	/
Exponent	^

Table 3-78 Arithmetic operators used in Excel

All the Excel formulas begin with equal sign (=) just like functions. For example, to multiply two numbers 4 and 7, the formula will be =4*7. User can also use cell addresses in formulas such as =(A4+B4)/5. This formula will first add the contents of cell A4 and B4 and then divide the sum by 5.

Following are the steps to calculate the total number of laptop computer sale for the months of January, February and March in the worksheet shown in Fig.3-79.

	A	B	C	D	E
1	MARGALLA COMPUTER SYSTEMS				
2	First Quarter Laptop Sales				
3					
4	Brand	January	February	March	
5	Acer	34	50	44	
6	Toshiba	23	15	28	
7	Dell	52	58	70	
8	HP	41	37	55	
9		=B5+B6+B7+B8			
10					

Fig.3-79 Using formula to find sum

1. Click cell B9 where the answer will appear.
2. Type the formula =B5+B6+B7+B8 as shown in Fig.3-73 and press Enter.
3. To calculate the total number of laptop computers sold in the months of February and March copy the formula from cell B9 to C9 and D9.
4. Click the cell B9, point to the fill handle and drag it through cell D9.

The user can also calculate the total number of laptop computers sold in January by performing the following steps.

1. Click cell B9.
2. Click **Formulas** tab.
3. Double-click the **AutoSum** command in the **Function Library** group.

Excel Automatically Recalculates Formula Results

Whenever the user changes the value in a cell, the result of the formula in which that value is used will be automatically updated. This feature known as automatic recalculation is one of the main advantages that spreadsheets have over calculators.

3.2.3 GRAPHICAL REPRESENTATION OF DATA

A chart is used to represent data graphically. Charts are very helpful in explanation and representation of data. A commonly used chart is the column chart. Therefore, creation of this chart will be described for the worksheet shown in Fig.3-80.

	A	B	C	D	E	F	G
1	MARGALLA COMPUTER SYSTEMS						
2	Half Yearly Sale of Laptop Computers						
3							
4	Brand	Jan	Feb	Mar	Apr	May	Jun
5	Acer	14	22	27	23	9	20
6	Toshiba	23	28	25	31	26	40
7	Dell	52	58	70	58	65	69
8	HP	41	37	55	45	38	51

Fig.3-80 Half yearly sale of laptop computers

Creating a Column Chart

The following are the steps for creating a column chart.

	A	B	C	D	E	F	G
1	MARGALLA COMPUTER SYSTEMS						
2	Half Yearly Sale of Laptop Computers						
3							
4	Brand	Jan	Feb	Mar	Apr	May	Jun
5	Acer	14	22	27	23	9	20
6	Toshiba	23	28	25	31	26	40
7	Dell	52	58	70	58	65	69
8	HP	41	37	55	45	38	51
9							

Fig.3-81 Selected cell range for column chart

1. Select the cell range (source data) as shown in Fig.3-81 that you want to represent in the column chart.
2. Click **Insert** tab.
3. In the **Charts** group, open the drop-down menu of **Column** command.
4. Select a chart from the menu. For example, the chart on the top left corner of menu.

The chart shown in Fig.3-82 will appear on the screen.

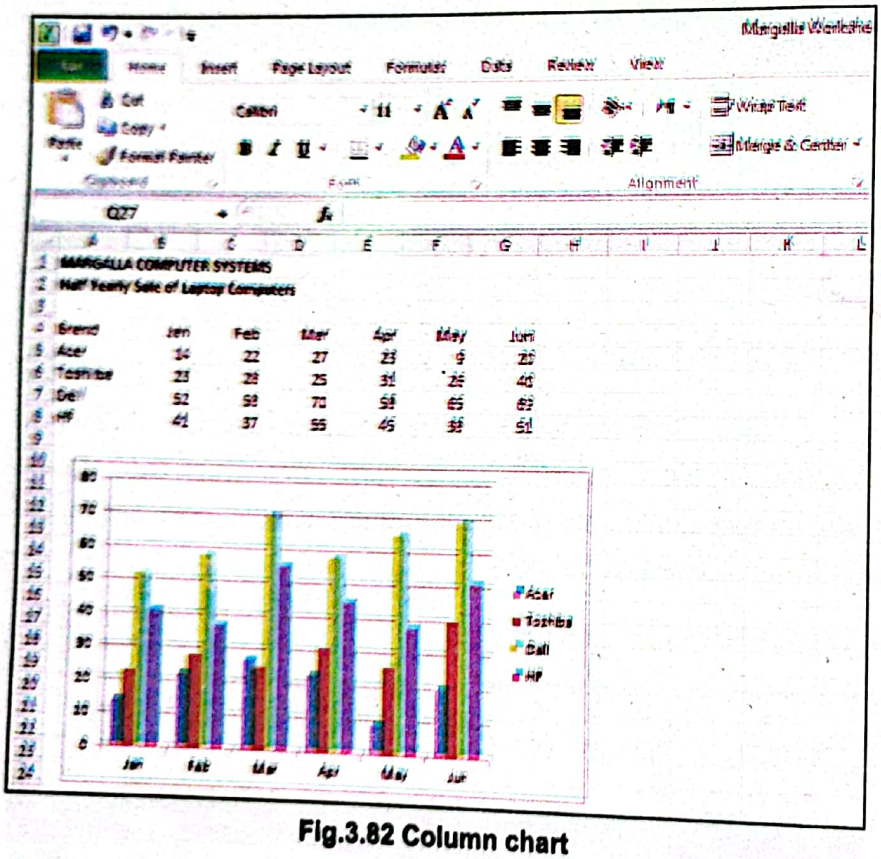


Fig.3.82 Column chart

Tip: To select a predefined chart style, click the chart that you want to format. This will display **Chart Tools**. On the **Design** tab, in the Chart Style group, select the chart style.

Following are the steps to give titles to the chart and horizontal and vertical axis to make it more meaningful.

1. Click anywhere in the chart to make the **Chart Tool** tabs appear in the **Ribbon**.
2. Click **Layout** tab as shown in Fig.3-83.

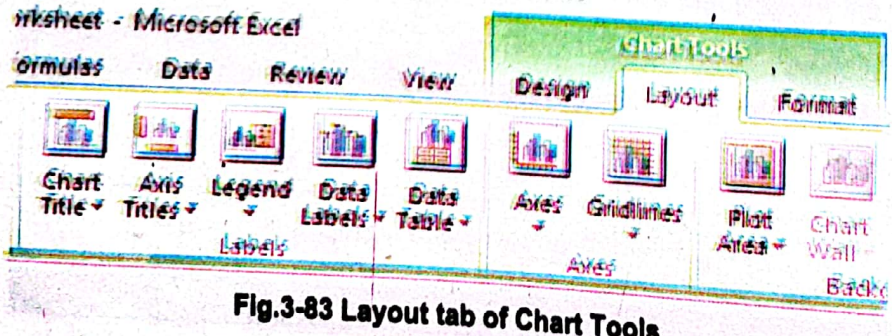


Fig.3-83 Layout tab of Chart Tools

Tip: To only print the chart in a worksheet, click anywhere in the chart and give the print command.

4. Click **Chart Title** in **Labels** group and select **Above Chart**.
5. Type the chart title in the text box.
6. Click the **Axis Titles** command, select **Primary Horizontal Axis Title** and select **Title Below Axis**.
7. Type the horizontal axis title in the text box. In the same way give a title to the vertical axis. The resulting chart is shown in Fig.3-84

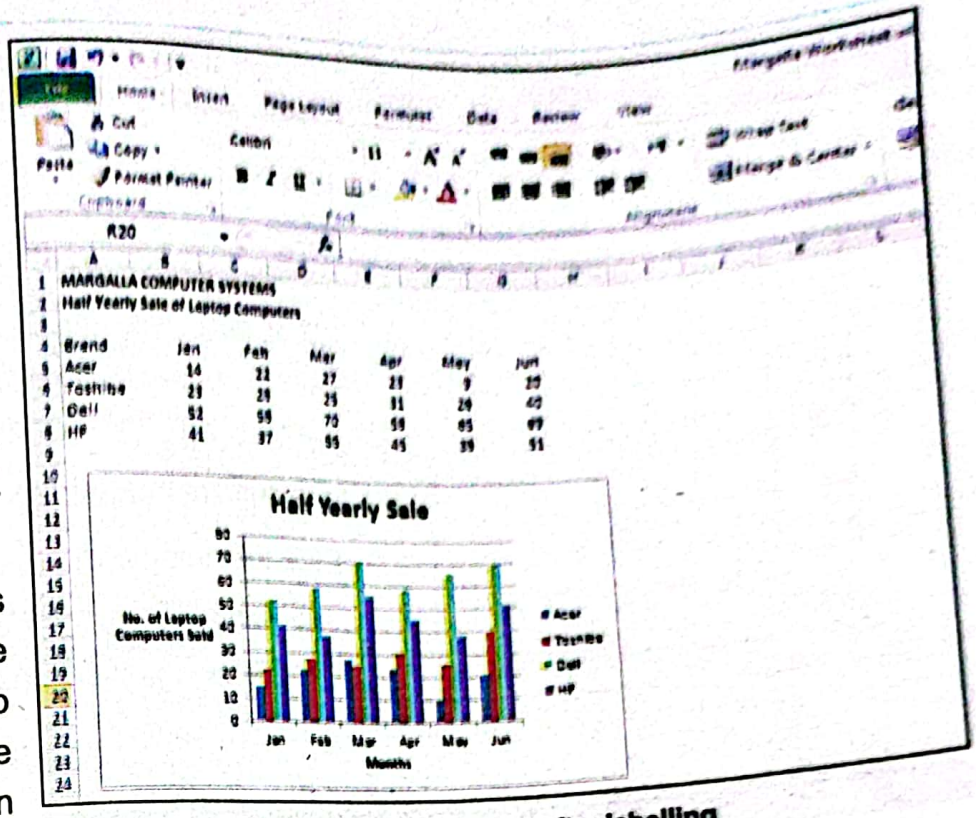


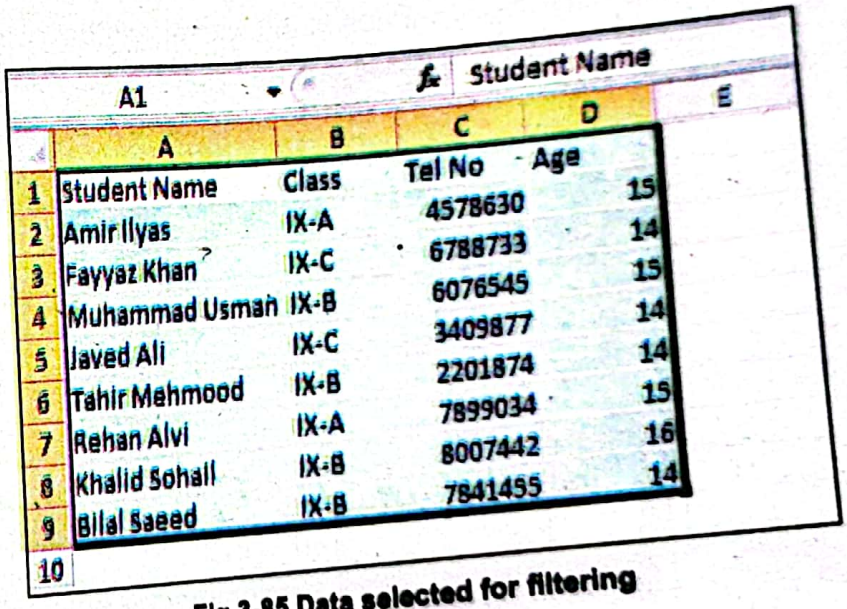
Fig.3-84 Column chart after labelling

3.2.4 MANIPULATING AND FORMATTING DATA

Filtering Data

Filtering data means displaying only the information that the user needs based on a condition. For example, user could filter a list of students for viewing who belong to a particular class. User could also filter a list of people whose ages are above 30.

The following are the steps to filter a list of students who belong to class IX.B.



	A	B	C	D
1	Student Name	Class	Tel No	Age
2	Amir Ilyas	IX-A	4578630	15
3	Fayyaz Khan	IX-C	6788733	14
4	Muhammad Usman	IX-B	6076545	15
5	Javed Ali	IX-C	3409877	14
6	Tahir Mehmood	IX-B	2201874	14
7	Rehan Alvi	IX-A	7899034	15
8	Khalid Sohail	IX-B	8007442	16
9	Bilal Saeed	IX-B	7841455	14
10				

Fig.3-85 Data selected for filtering

1. Select the rows you want to filter including the header row as shown in Fig.3-85.
2. Select the **Data** tab on the **Ribbon**.
3. Click the **Filter** command in the **Sort and Filter** group.
4. Drop-down arrows will appear in the header of each column.

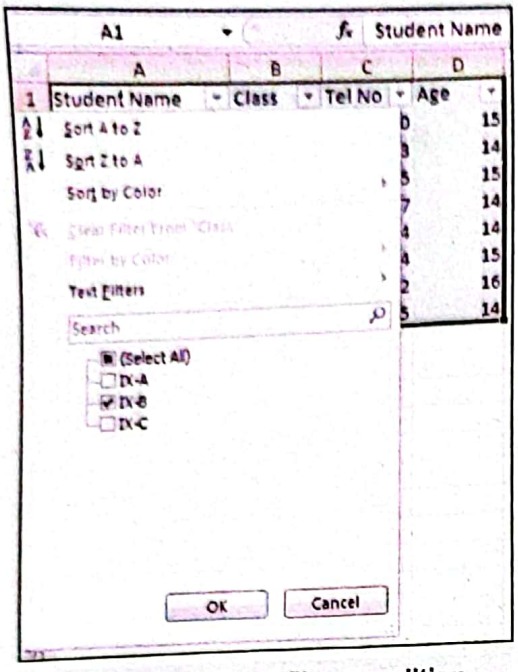


Fig.3-86 Selecting filter condition

5. Click the drop-down arrow for class column. The filter menu will appear as shown in Fig.3-86.
6. Uncheck the boxes next to (Select All), IX.A and IX.C.
7. Check the box next to IX.B.
8. Click **OK**. Only the information of students who belong to class IX.B will be displayed. The other data will be temporarily hidden.

The following are the steps to clear the filter.

1. Click the drop-down arrow in the Class column.
2. Click **Clear Filter From** "Class".
3. Click **Filter** Command in the **Ribbon**.

Data Validation

Data validation is used to control the values or the type of data that user enters into a cell.

The following steps will define criteria for entries in class column of student worksheet to IX.A, IX.B and IX.C. If the user enters any other data, an error message will appear.

1. Create a list of valid entries in the worksheet that contains the data IX.A, IX.B and IX.C.
2. Select all the cells in Class columns without the column header.
3. Click the **Data** tab on the **Ribbon** as shown in Fig.3-87.

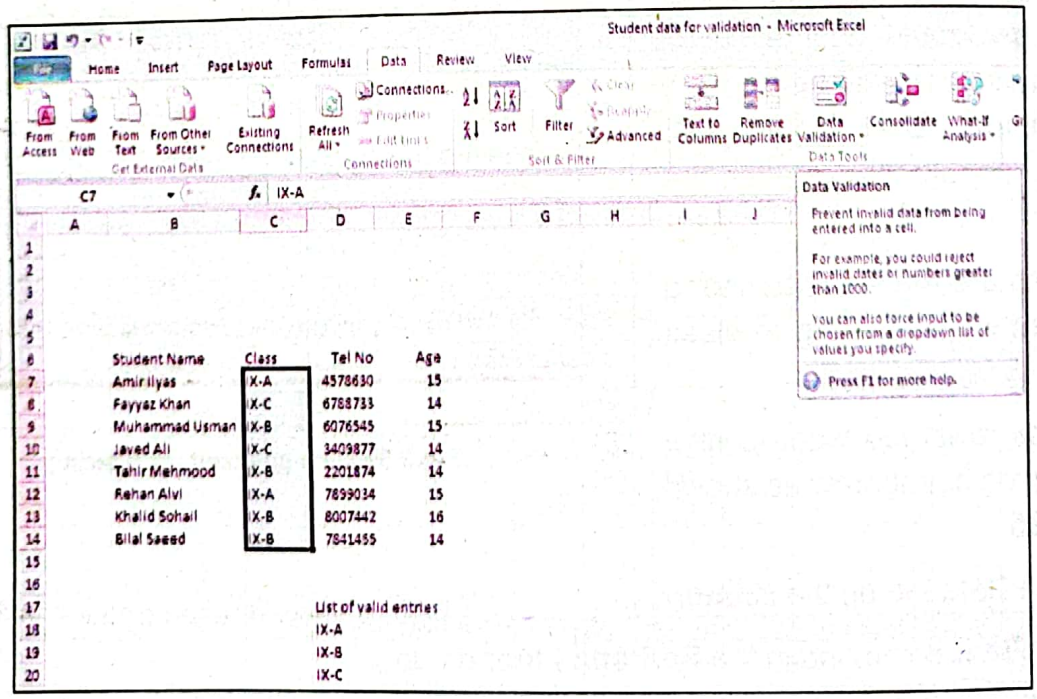


Fig.3-87 Using Data Validation command

4. Click **Data Validation** command in the **Data Tools** group. **Data Validation** dialog box shown in Fig.3-88 will appear.
5. Click the drop-down arrow below **Allow** heading and select List.
6. Click the button on the right side below **Source**.
7. Select the cell range that contains the list of valid entries and click **Close**.
8. Click **OK** to apply validation.

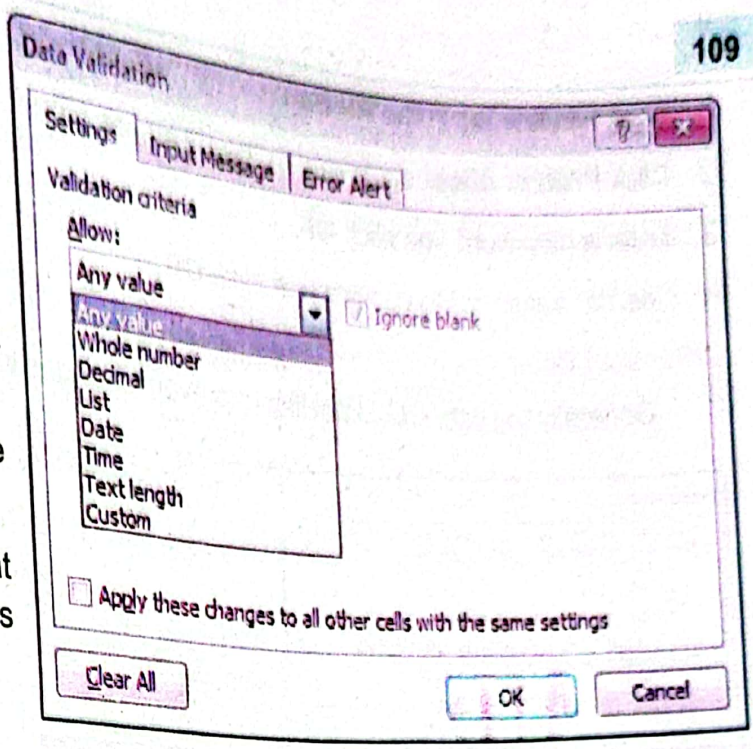


Fig.3-88 Data Validation dialog box

As another example, restrict data entries in the Age column to ages between 13 to 17.

1. Select all the cells in Age column without the column header.
2. Click **Data** tab on the Ribbon.
3. Click **Data Validation** command in the **Data Tools** group. **Data Validation** dialog box will appear.
4. Click the drop-down arrow below **Allow**.
5. Select **Whole number** from the menu as shown in Fig.3-89.

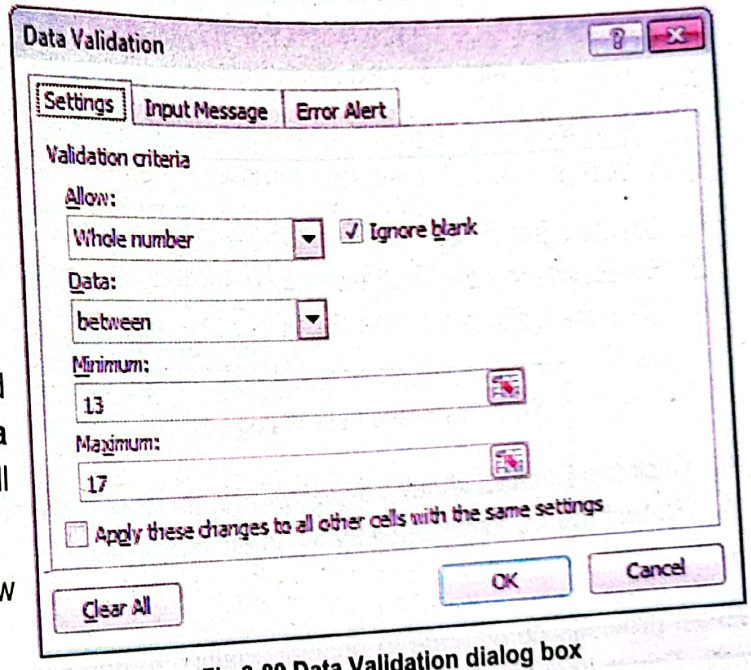


Fig.3-89 Data Validation dialog box

6. Enter 13 for the minimum value and 17 for the maximum value
7. Click **OK** to apply validation.

Protecting a Worksheet

When a worksheet is protected, other users can only view the information in it but changes cannot be made.

The following are the steps to protect a worksheet.

1. Click **Review** tab in the **Ribbon**.
2. Click **Protect Sheet** command in the **Changes** group.
3. Enter a password and click **OK**.
4. Reenter password to confirm and click **OK**

Unlocking Cells

Generally the user would not like to prevent changes to the entire worksheet. The user may want to allow other users to make changes in worksheet data but prevent changes to titles and formulas. For this, unlock the cells in which data editing is to be allowed.

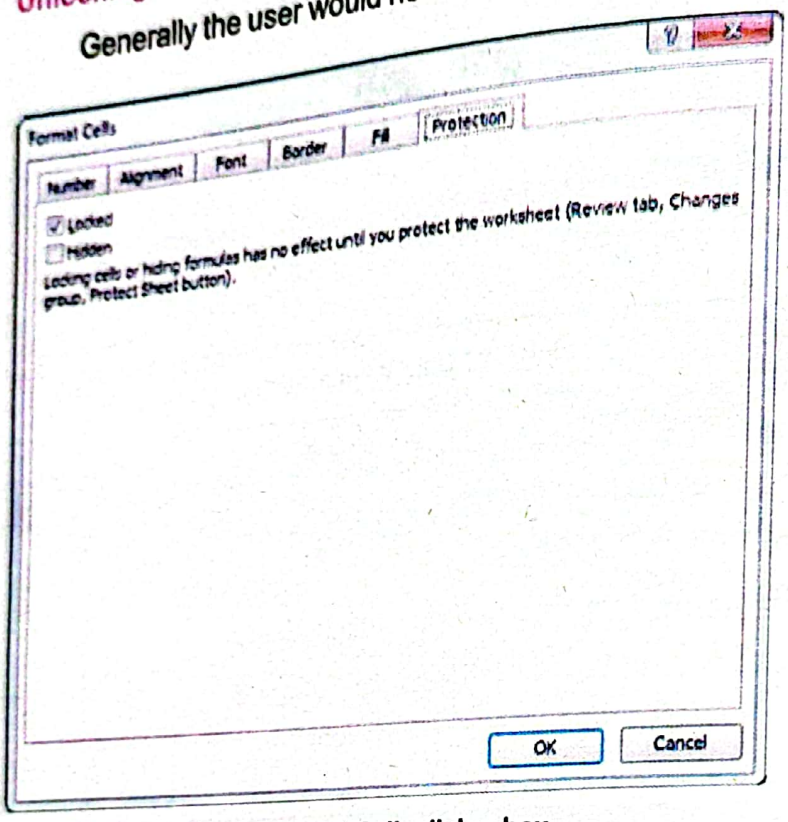


Fig.3-90 Format Cells dialog box

The following are the steps to unlock cells.

1. If your worksheet is protected, click the **Unprotect Sheet** command in the **Changes** group on the **Review** tab.
2. Select the cells you want to unlock.
3. Press Ctrl+1 to open the **Format Cells** dialog box and click the **Protection** tab as shown in Fig.3-90.
4. Click the **Locked** check box to remove its check mark and click **OK**.
5. Protect the worksheet as explained earlier.

Conditional Formatting

Excel provides commands to apply formatting to one or more cells based on the value of the cell. This is known as conditional formatting. User can apply one or more rules to cells such as if the value in the cell is less than 33 then color the cell red. The advantage of applying such rules is that the user can easily view which cells have value less than 33.

	A	B	C	D	E	F	G	H
1	Student Name	Maths	Comp	Phy	Chem	Eng	Urdu	Isl
2	Afzal Ahmed	42	55	50	48	67	60	47
3	Javed Khan	47	26	38	20	39	48	35
4	Ali Haider	22	30	43	36	51	44	33
5	Waseem Abbas	46	43	36	55	52	63	58
6	Nouman Ali	31	34	12	15	42	45	39

Fig.3-91 Result sheet of students

The following steps will color the text red with light red background in cells that have value less than 33 in the worksheet shown in Fig.3-91

3. Select the cells to which you want to apply conditional formatting.
4. Click **Home** tab on the **Ribbon**.
5. Click **Conditional Formatting** command in Styles group to open the drop-down menu and select **Highlight Cells Rules** as shown in Fig.3-92.

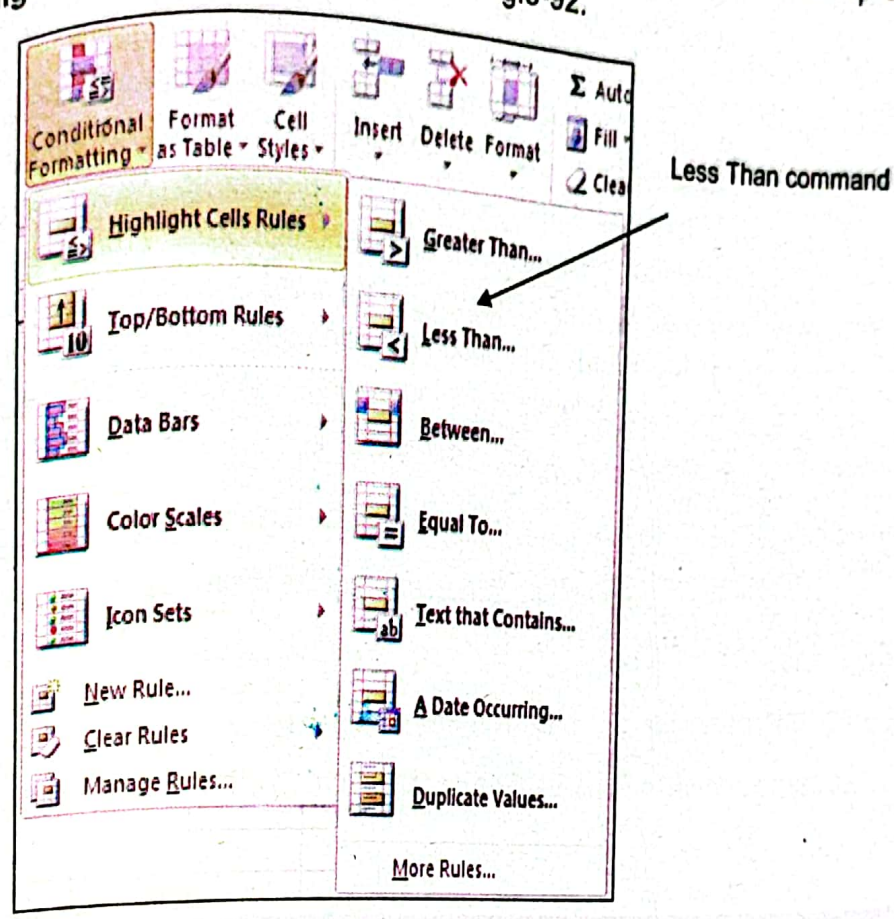


Fig.3-92 Conditional Formatting

4. Select **Less Than** in the submenu.
5. Enter 33 and select **Light Red Fill with Dark Red Text** in **Less Than** dialog box to view the failing marks in red color with light red background as shown in Fig.3-93.
6. Click **OK** to apply the formatting.

	A	B	C	D	E	F	G	H
1	Student Name	Maths	Comp	Phy	Chem	Eng	Urdu	Isl
2	Afzal Ahmed	42	55	50	48	67	60	47
3	Javed Khan	47	26	38	20	39	48	35
4	Ali Haider	22	30	43	36	51	44	33
5	Waseem Abbas	46	43	36	55	52	63	58
6	Nouman Ali	31	34	12	15	42	45	39

Fig.3-93 Worksheet after conditional formatting

3.3 URDU EDITOR

3.3.1 INTRODUCTION TO INPAGE URDU EDITOR

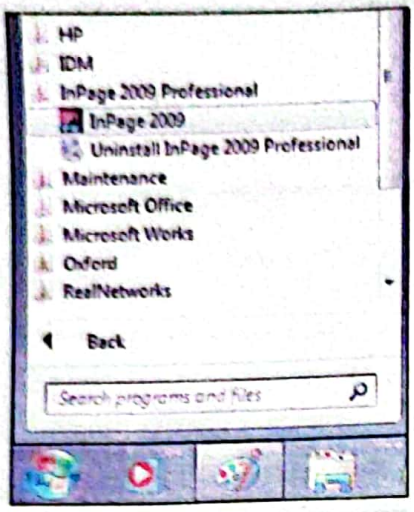


Fig.3-94 Opening Inpage Program

Inpage is widely used Urdu language editor introduced in 1994. It runs on Windows operating system and it is used for creating documents in Urdu/Arabic languages, etc. It provides all the standard formatting and editing tools available in word processors used for creating documents in English. It is easy to learn and use. Inpage allows user to create wide variety of documents such as letters, reports, books, magazines, newspapers and brochures in Urdu. Urdu word processing is now available in MS Word. That option may be used. Next year you may learn MS Word Urdu using the language bar in windows 7 onward.

Opening the Inpage Program

The following are the steps for opening the Inpage program.

1. Turn on the computer and click **Start** button.
2. Click **All Programs**.
3. Click **Inpage 2009 Professional** to display the submenu.
4. Click **Inpage 2009** as shown in Fig.3-94. The opening screen of Inpage will appear as shown in Fig.3-95.

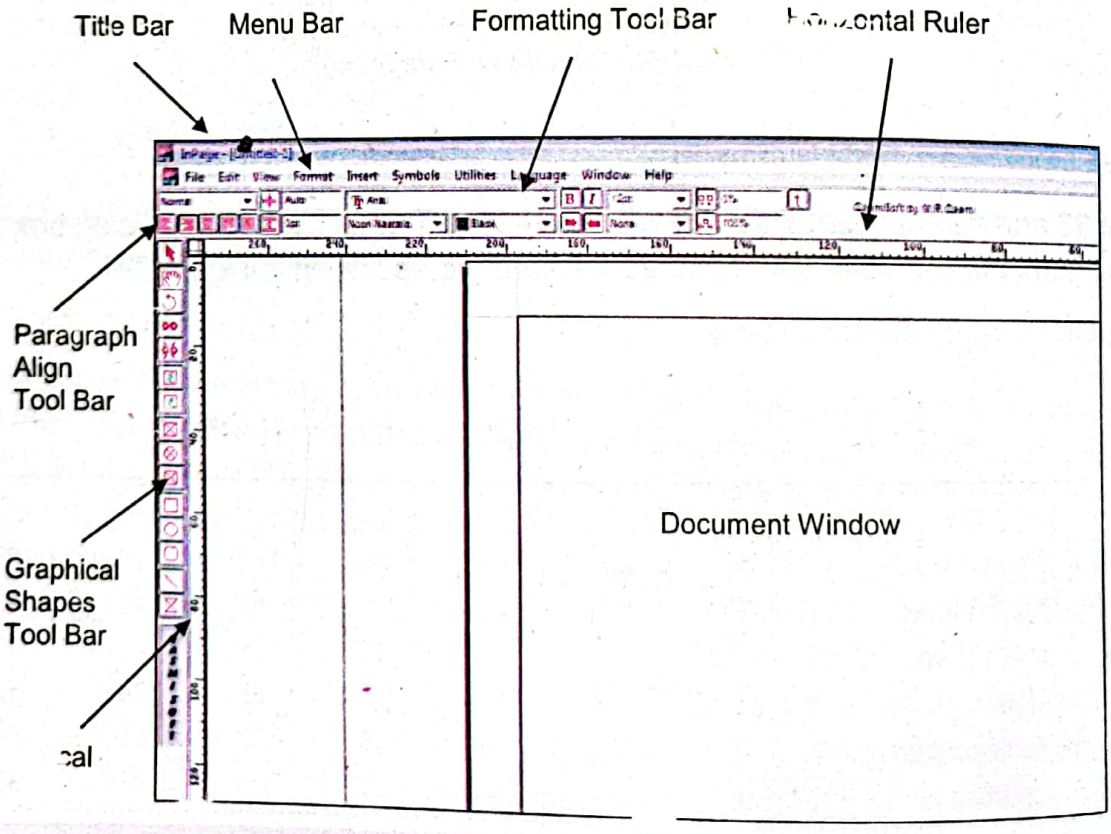


Fig.3-95 Opening Screen of Inpage Urdu Editor

3.3.2 MANAGING A DOCUMENT IN INPAGE

Creating a New Document

1. Click the **File** tab.
2. Click **New** in the pull-down menu as shown in Fig.3-96.
3. **New Document** window will appear as shown in Fig.3-97.
4. Set the **Page**, **Margins** and **Columns** setting and click **OK**.
5. Now, type the text in Urdu.

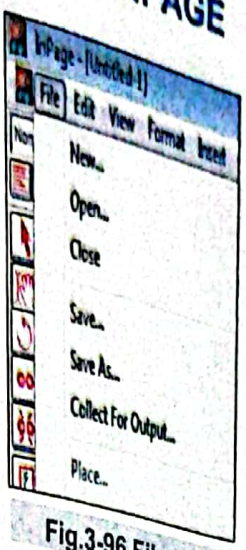


Fig.3-96 File tab

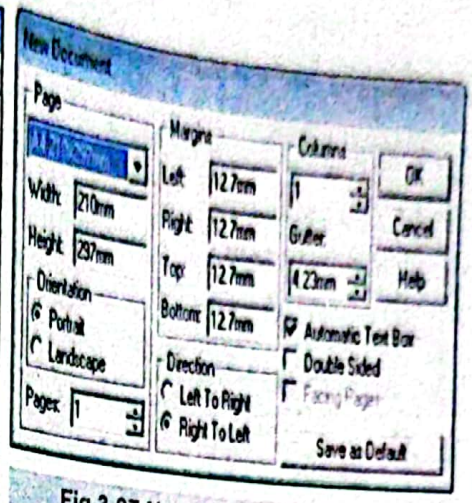


Fig.3-97 New Document window

Selecting a Keyboard Layout

1. Click **Edit** to open the **Edit** pull-down menu.
2. aClick **Preferences** to open the submenu and select **Keyboard Preferences** as shown in Fig.3-98.
3. Select a keyboard from the **Keyboard Preferences** window shown in Fig.3-99 and click

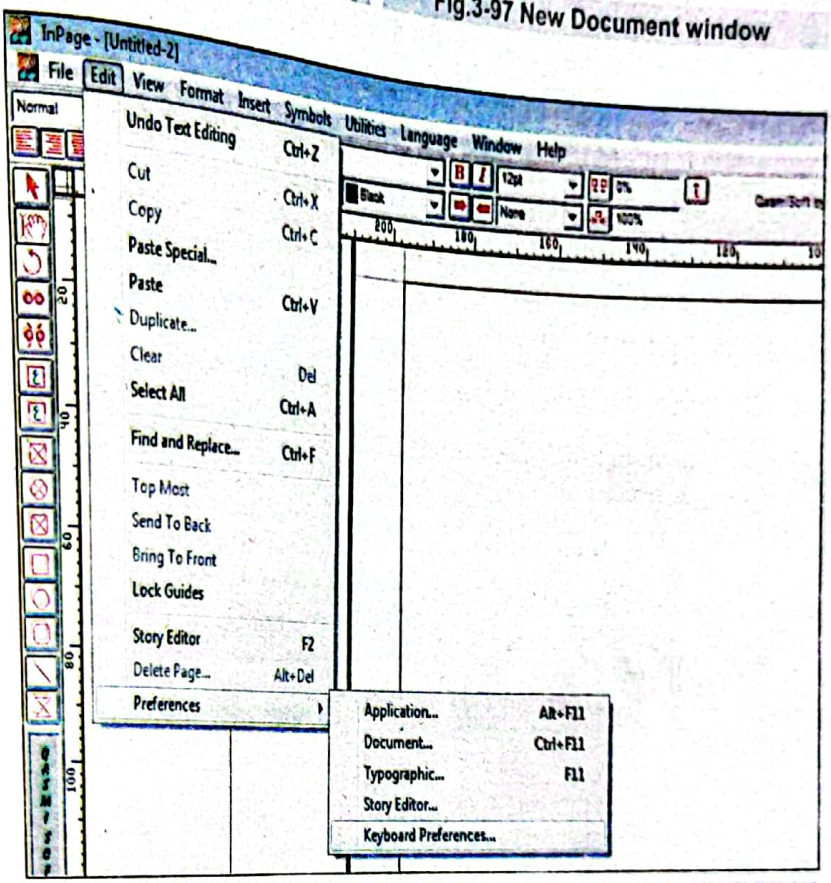


Fig.3-98 Selecting a keyboard layout

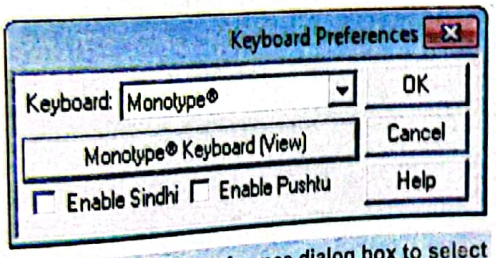
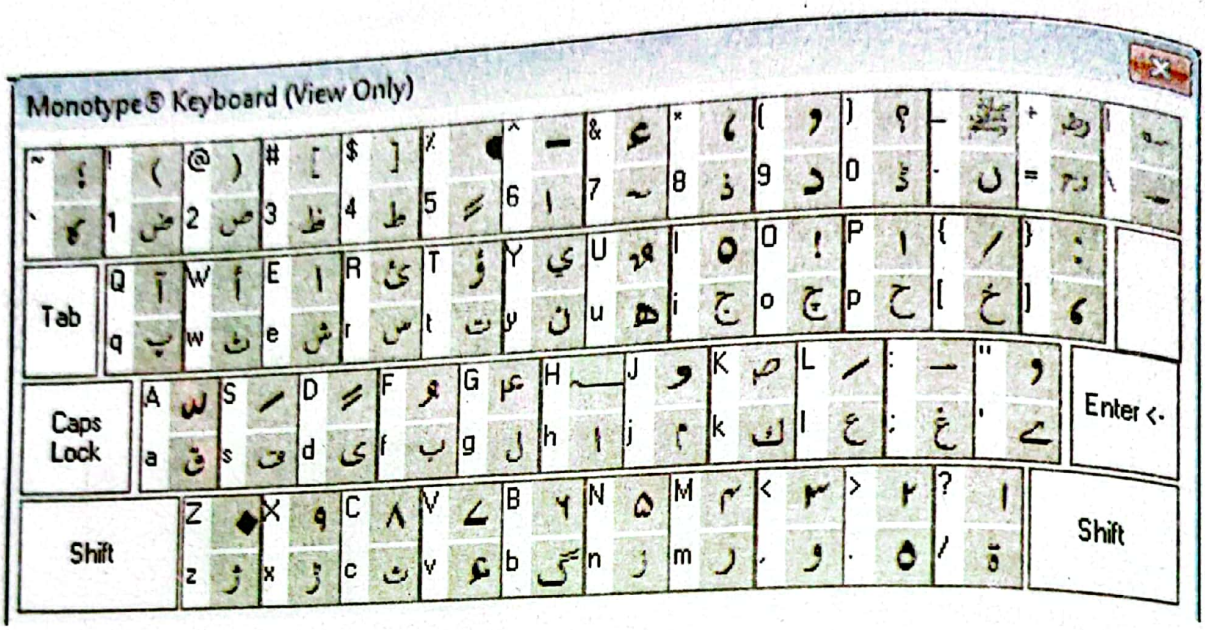
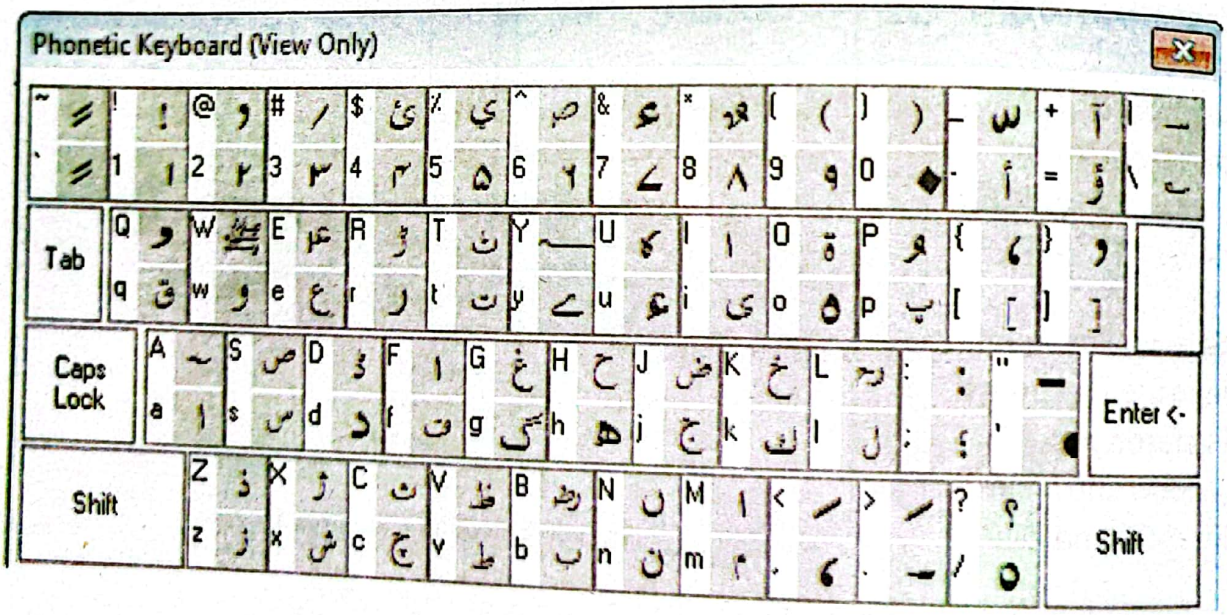


Fig.3-99 Keyboard Preference dialog box to select a keyboard

OK. User can also view the keyboard layout as shown in Fig.3-100 by clicking the view option.



(a)



(b)

Fig.3-100 Keyboard layout of (a) Monotype and (b) Phonetic Keyboard

Opening a Document

1. Click the **File** tab.
2. Click **Open**. The **Open Document** dialog box shown in Fig.3-101 will appear.
3. Select the document
4. Click **Open**.

An Urdu document prepared in Inpage program is shown in Fig.3-102.

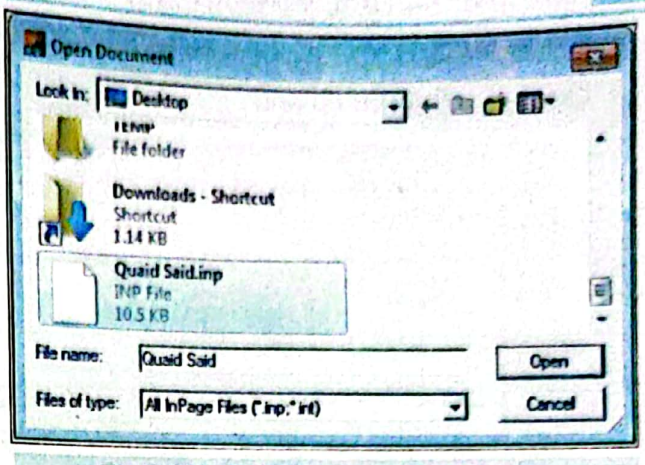


Fig.3-101 Open Document dialog box.

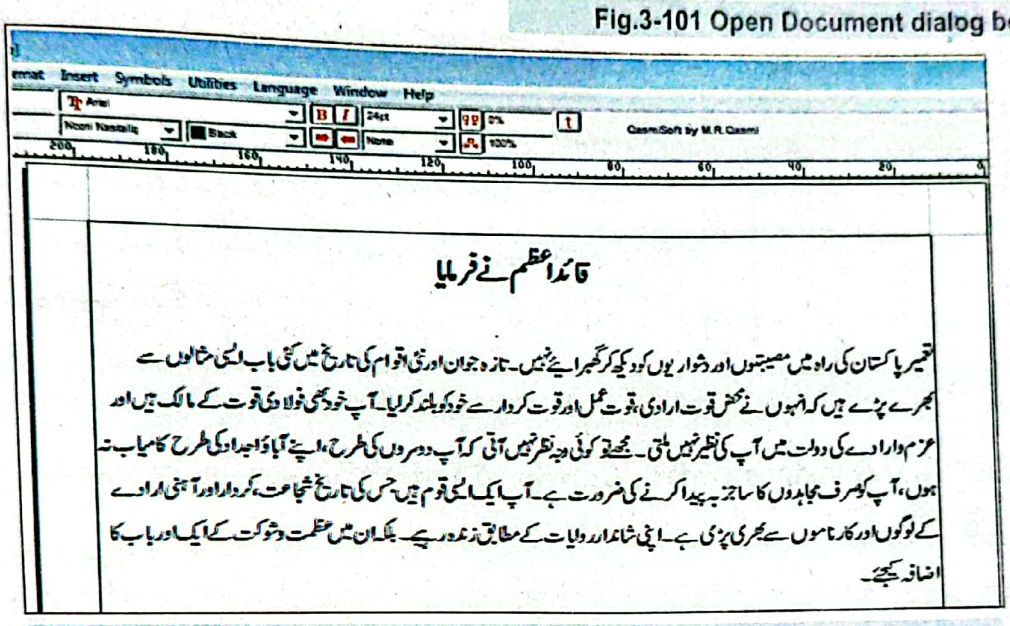


Fig.3-102 Urdu document

Saving a Document

1. Click **File** tab.
2. Select **Save** or **Save as**. **Save Document As** dialog box shown in Fig.3-103 will appear.
3. Select the folder where document is to be saved.
4. Give a file name to the document.
5. Click **Save**.

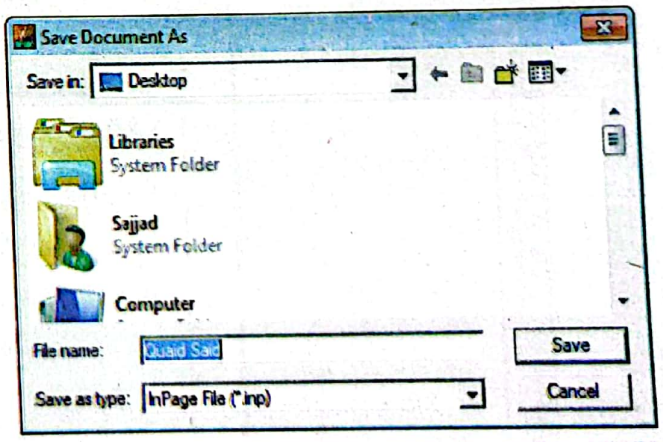


Fig.3-103 Save Document As dialog box

3.3.3 FORMATTING DOCUMENT

Copying or Moving Text

1. Select the text to copy or move by dragging the mouse pointer. The selected text will be highlighted.
2. Click **Edit** to open the **Edit** pull-down menu as shown in Fig.3-104.
3. Select **Copy** or **Cut**.

4. Position the mouse pointer at the location where the text is to be copied or moved.
5. Open the **Edit** menu and click **Paste**.

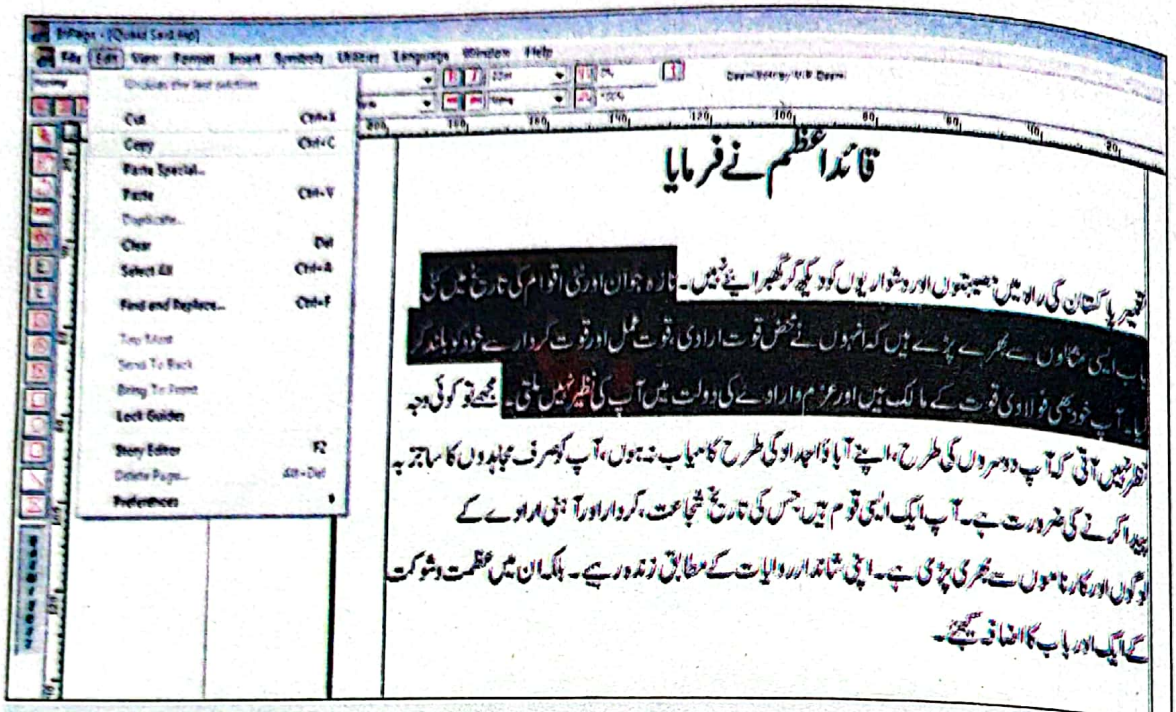


Fig.3-104 Text selected for copying

The shortcut commands **Ctrl+C**, **Ctrl+X** and **Ctrl+V** can also be used for Copy, Cut and Paste respectively.

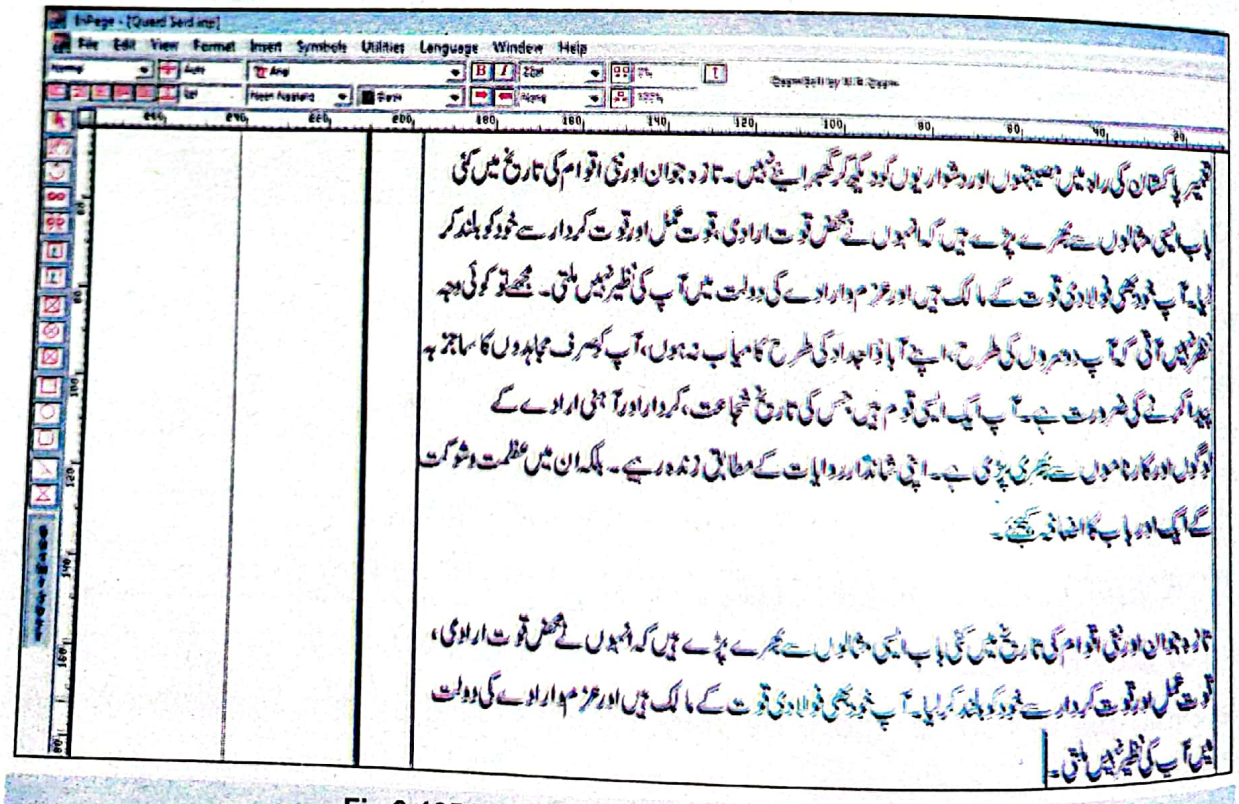


Fig.3-105 Document after copying the text

Deleting Text

To delete text, select the text as shown in Fig.3-106 by dragging the mouse pointer and then press the **Delete** key.

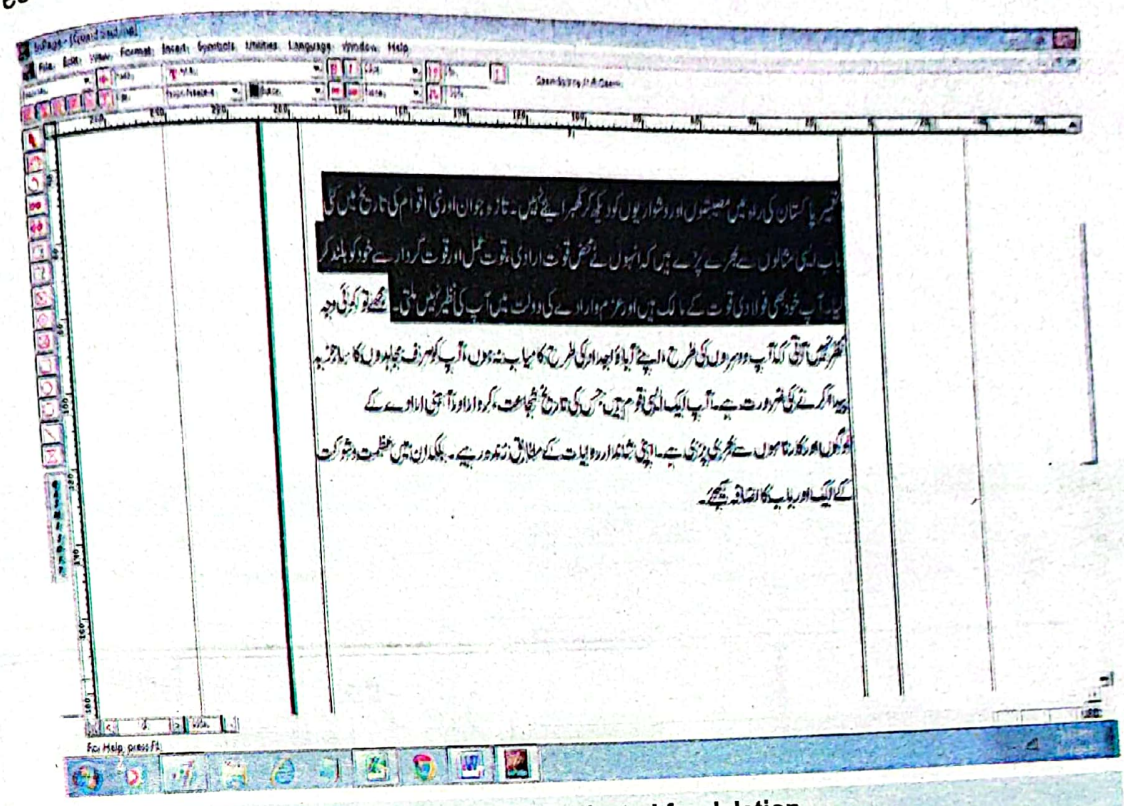


Fig.3-106 Text selected for deletion

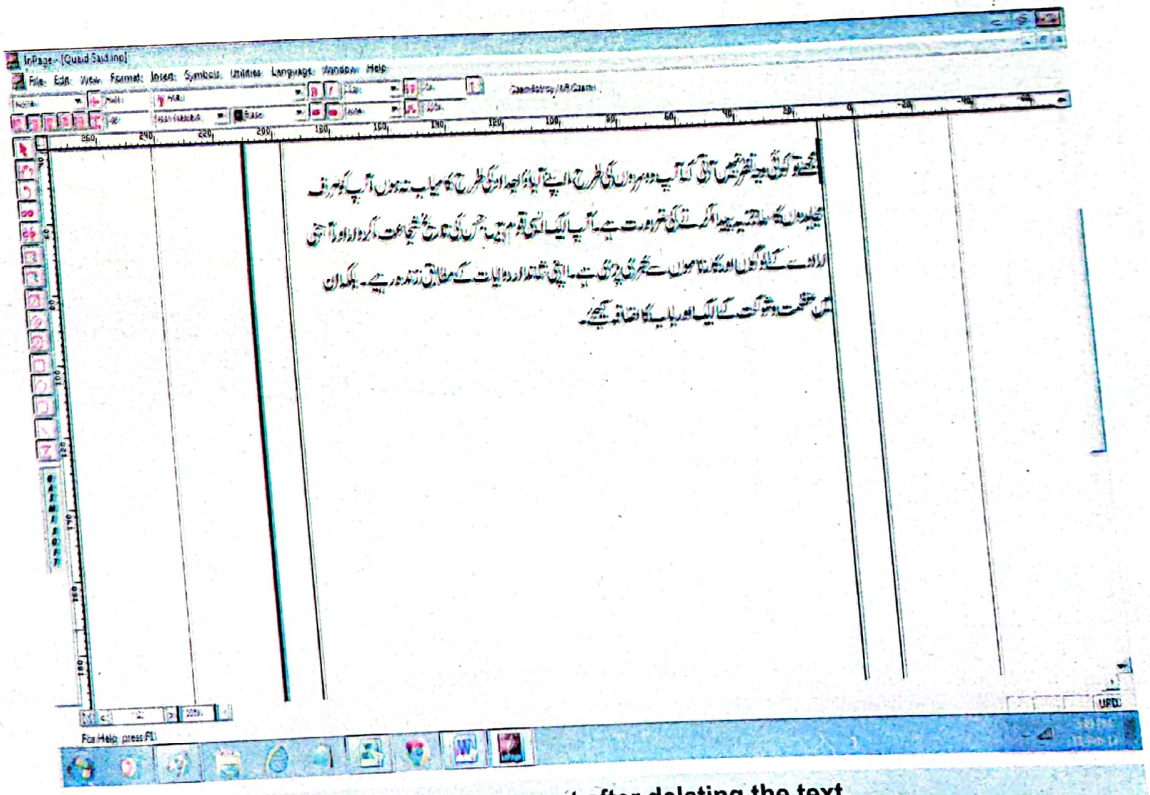


Fig.3-107 Document after deleting the text

Changing Language

The following are the steps for changing to English language.

1. Click **Language** in **Menu Bar** as shown in Fig.3-108.
2. Click **Toggle Language**.
3. Perform the same steps to return back to Urdu typing.

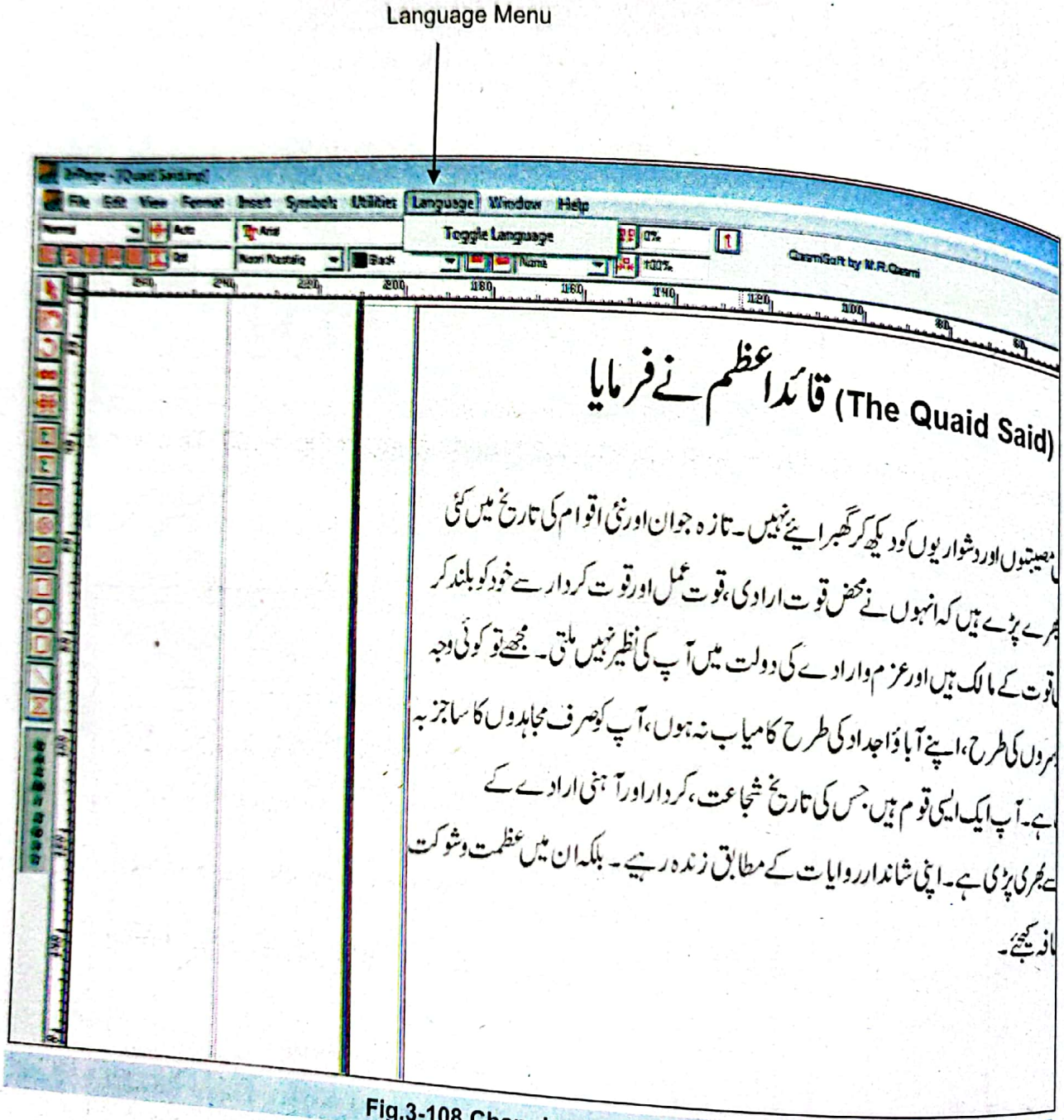


Fig.3-108 Changing language

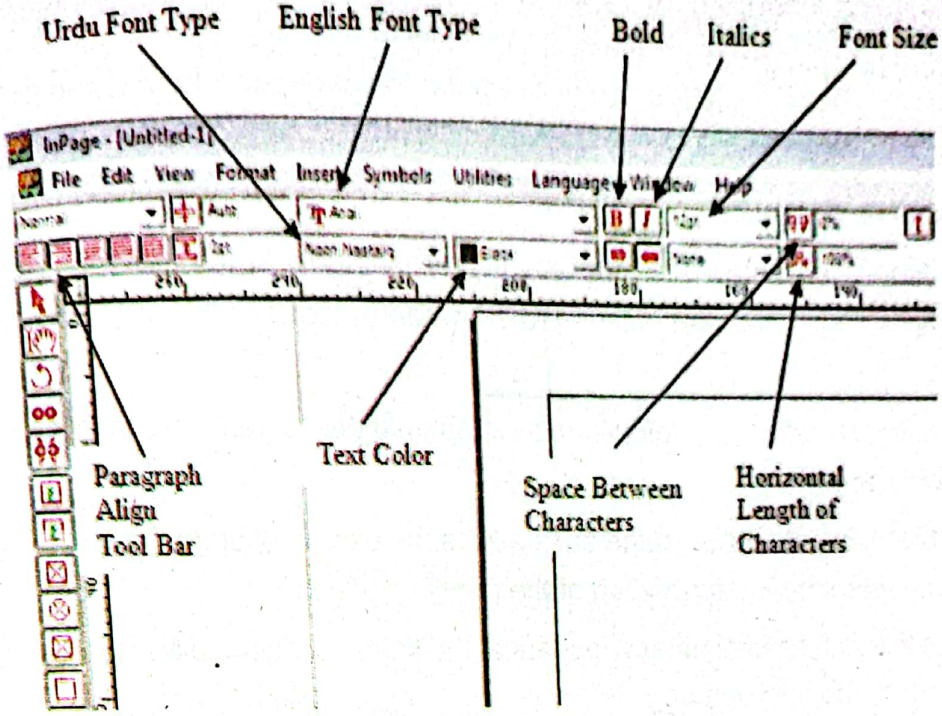


Fig.3-109 Text Formatting Tools

Select the text and apply the appropriate commands given in Fig.3-109. Text with different formatting is shown in Fig.3-110.

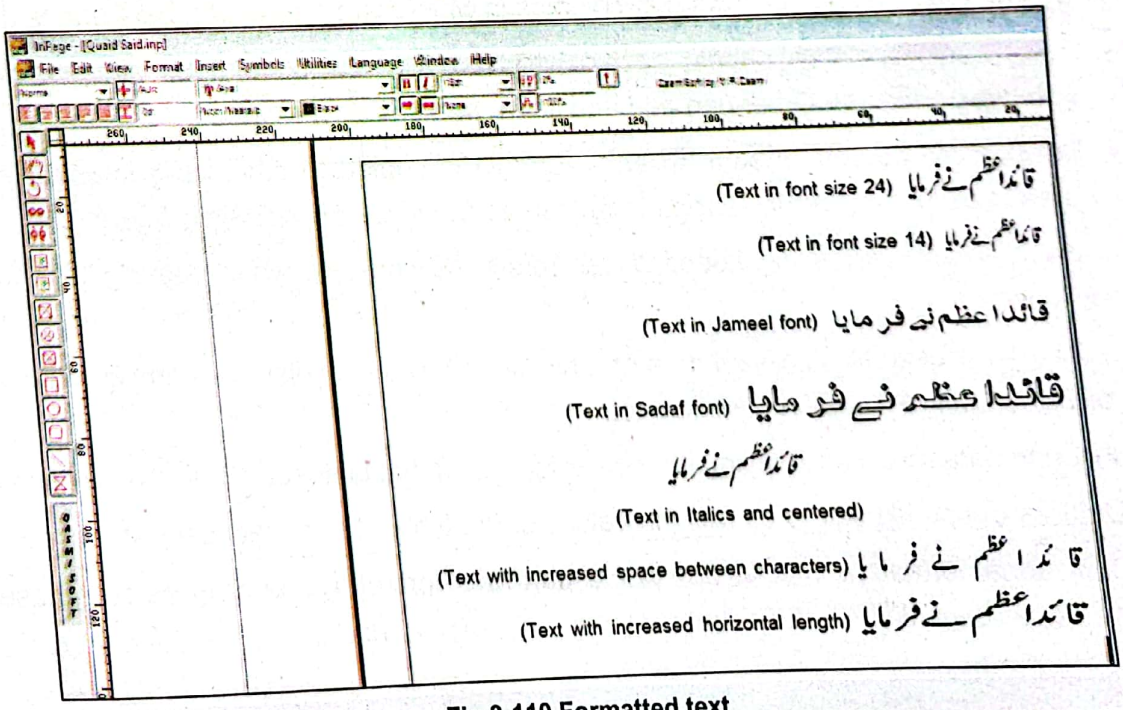


Fig.3-110 Formatted text

Key Points

- Word processing refers to the use of computer to create, edit, format and print documents.
- A word processor is computer application software that is used for the creation of documents on computer.
- Ribbon is located below the title bar of Word window and it consists of tabs, groups and commands. It provides access to commands that are needed while working on a document.
- Page break is a marker that tells Word program that the contents which follow are to appear on a new page.
- Section break inserts a new page but it allows the user to change the page format without having any effect on the formatting of the previous pages.
- Header refers to information that appears at the top of a page and footer to information that appears at the bottom of a page.
- WordArt is a text modifying feature in Word to create decorative effects such as shadow, colors, 3D effects, changing shape of text, etc.
- Hyperlink is text in a Web page or document that links to another Web page or another place in the same document when user clicks on it.
- Spreadsheet is a grid of rows and columns in which user enters numbers and text.
- A workbook consists of sheets, each of which is called a worksheet. Excel opens workbook with three sheets but user can add additional worksheets if required.
- Relative cell address means when a formula is copied to other cells in Excel, the cell references in the formula change to reflect the formula's new location.
- Absolute cell addressing keeps a cell reference constant when copying a formula or function.
- A chart is a used to represent data graphically. It helps in explanation and communication of the meaning of data in a worksheet.
- Filtering data means displaying only the information that is needed based on a condition.
- Data validation is used to control the values or the type of data that user enters into a cell.
- Conditional formatting means applying a particular format to one or more cells based on the value of the cell.

Exercise

Q1. Select the best answer for the following MCQs.

i. Which of the following software is used for creating professional documents?
A. Spreadsheet Software B. Word processor
C. Typing Tutor D. Both A and B

ii. Which of the following tab of Word Ribbon contains Clipboard group?
A. Page Layout B. Insert
C. File D. Home

iii. By default how many tabs are there in Word Ribbon?
A. 7 B. 8
C. 9 D. 10

iv. What is used for creating decorative effects in Word?
A. Paragraph formatting B. Text formatting
C. Page formatting D. WordArt

v. Which of the following tab contains the commands for creating charts in Excel?
A. Home B. Formulas
C. Insert D. Data

vi. Which of the following command in Excel allows the user to view only certain data in a worksheet based on a condition?
A. Data validation B. Data filtering
C. Conditional formatting D. Data manipulation

vii. Which of the following command in Excel restricts user from entering wrong data in cells of a worksheet?
A. Data validation B. Data Filtering
C. Conditional formatting D. Data manipulation

viii. Which of the following command is used to apply formatting to one or more cells based on the value of the cell?
A. Data validation B. Data filtering
C. Conditional formatting D. Data manipulation

ix. Which of the following shortcut keys are used for pasting selected text?
A. Ctrl+C B. Ctrl+X
C. Ctrl+V D. Ctrl+P

x. When the mouse pointer is at extreme left and changes to a right-pointing arrow, which of the following command is used in Word to select the entire document?
A. Double-click B. Triple-click
C. Ctrl+Single-click D. Shift+Single-click

Q2. Write short answers of the following questions.

i. What is a word processor? Write some advantages of it over a typewriter.
ii. Name any three types of documents which can be prepares in Word.
iii. Differentiate between page break and section break.
iv. Why header and footer are important in a Word document?
v. What is the purpose of control buttons in Word window?
vi. Why hyperlinks are created in Word document?
vii. Name any three areas of application of Excel.
viii. Differentiate between relative and absolute cell addressing in Excel.
ix. What are the advantages of protecting an Excel worksheet?
x. How graphical representation of spreadsheet data can be helpful in business.

Q3. Write long answers of the following questions.

i. Which shortcut keys are used in Word to move cursor to the beginning of line, end of line, top of the document and end of the document?
ii. Write the mouse commands used for selecting various items is a Word document such as single word, sentence, paragraph, etc.
iii. Explain text and paragraph formatting in Word.
iv. Describe the Paste Special command used in Excel.
v. Describe how functions are used in Excel with examples.
vi. Describe how formulas are used in Excel with examples.

Lab Activities

1. Type the following text and apply the commands given at the end.

COMPUTER ETHICS

Computer ethics is concerned with the moral guidelines for the ethical use of computer technology. It emerged with the invention of computer. It specifies what is right and what is wrong when using computer technology. The following are some important points of computer ethics.

Computer should not be used to harm other people
Computer should not be used to commit any type of crime
Computer users should not create computer virus

a. Center the title and make it bold
b. Apply font size 16 to the title
c. Justify the paragraph

d. Underline and bold the words "Computer ethics" in the paragraph
e. Apply italics and bold to the words "computer technology"
f. Apply bullets to the last three lines

2. **Create weekly timetable of your class in Word and give title to it using WordArt.**

3. **Create the following worksheet in Excel and calculate sum and average using formulas.**

Expenses of 1st Quarter						
S.No.	Expense	Jan	Feb	Mar	Total	Average
1.	Salary	87000	102400	113800		
2.	Rent	2500	2500	2500		
3.	Utilities	3250	3500	3080		
4.	Transport	7830	6885	8940		
5.	Miscellaneous	4500	6708	7740		

4. **Create a column chart for expenses in the months of January, February and March for the above worksheet.**

5. **Create the following worksheet in Excel and enter marks in the subject columns in the range 0 to 75. Restrict data entries in the subject columns to the specified range using data validation command.**

S.No.	Student Name	Mathematics	Physics	Computer	Chemistry
1.	Abrar Nabi				
2.	Mumtaz Akbar				
3.	Muhammad Bilal				
4.	Javed Akhtar				
5.	Afzal				
6.	Muslim Khan				

6. **Write a leave application in Urdu using the Inpage Urdu editor.**

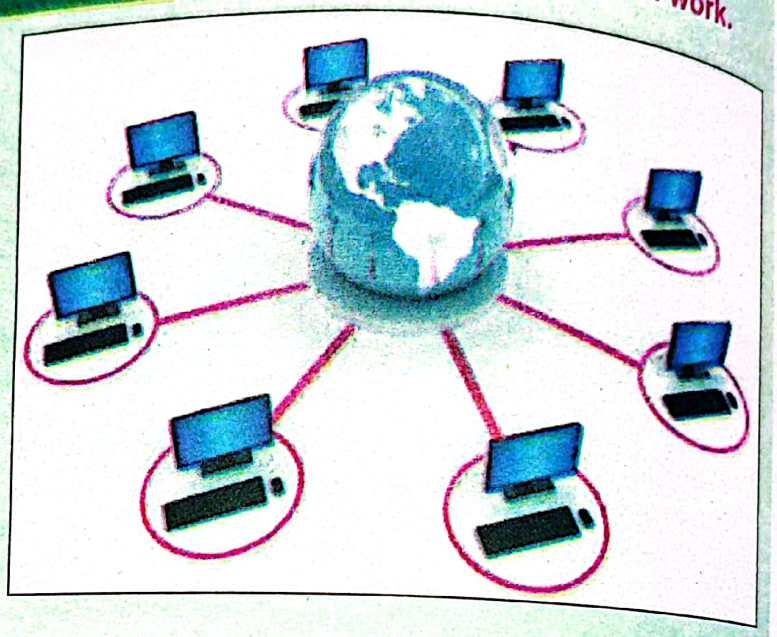
4

DATA COMMUNICATION

This is 22 periods Chapter including practical work.

After completing this lesson, you will be able to:

- Define data, data transmission, analog signals and digital signals
- Explain the components of communication system (Sender, Receiver, Message, Protocol and Transmission Medium)
- Explain message delivery, accuracy and timeliness of a good communication system
- Describe synchronous and asynchronous transmission
- Differentiate between guided and unguided media
- Describe guided media (twisted pair, coaxial and fiber optic cables)
- Describe unguided media (radio waves, microwave, infra.red and satellite)
- Explain transmission impairments in communication media (attenuation, amplification, distortion and cross talk)
- Describe the use of communication devices (dialup modem, network interface card, router and switch/access point)
- Understand communication terminologies (data rate, baud rate, bandwidth and signal to noise ratio)
- Use appropriate formulae to determine the characteristics of a communication channel



UNIT INTRODUCTION

Today, we are living in information age that is dominated by computer and data communication through computer networks. Therefore, it is important for students to learn how a data communication system is established. This unit describes the functions of commonly used communication devices and transmission media that allow data communication to take place.

4.1 DATA COMMUNICATION

Data communication is the transmission of data between two points. A data communication system is a collection of hardware and software arranged to communicate information from one location to another.

4.1.1 BASIC TERMS OF DATA COMMUNICATION

The following terms are associated with data communication.

- Data
- Data transmission
- Analog signal
- Digital signal

Data

Data means any types of raw facts and figures which can be provided as input to the computer for processing. Data can be in the form of text, sound, graphics, image or video.

Data transmission

Data transmission means sending information from one place to other using computer networks and data communication systems. In computer technology, it means sending streams of bits or bytes from one place to another using copper wire, Fibre optics, satellite communication, etc.

Analog and Digital Signals

A signal is a variation of physical quantity with time. The physical quantity can be temperature, pressure, rate of heart beat, etc. An electrical signal is a change in voltage or current with time. Electrical signals can be divided into two main types, analog and digital signals

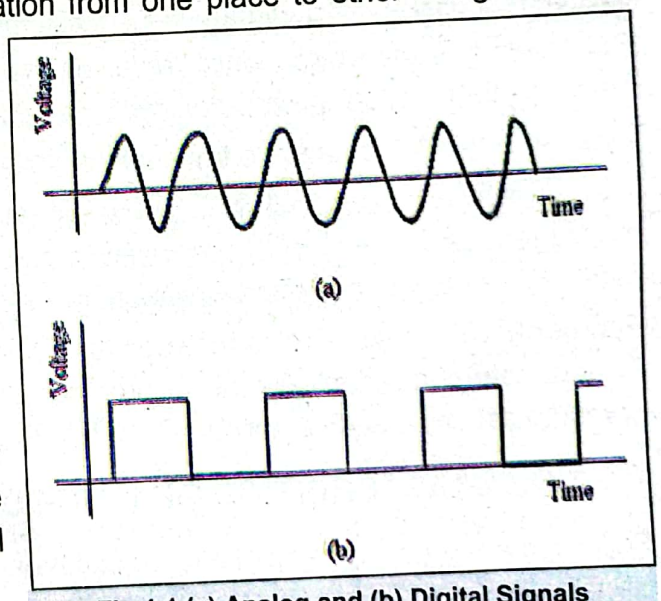


Fig.4-1 (a) Analog and (b) Digital Signals

Analog signal is in continuous form. It varies continuously within a range as shown in Fig.4-1(a). For example, sound is an analog signal. Analog transmission uses signals that are exactly the same as sound waves.

Digital signals are not continuous. They switch between two discrete, low and high voltage levels as shown in Fig.4-1(b). In digital computers, low voltage level represents binary 0 and high voltage level represents binary 1. Information represented in digital form can be easily transmitted by series of "ON" and "OFF" signals by pulses of electricity. A pulse "ON" can represent 1 and the absence of pulse "OFF" can represent 0.

4.1.2 COMPONENTS/ELEMENTS OF A COMMUNICATIO SYSTEM

Communication system consists of the following five basic components as shown in Fig.4-2.

- Sender
- Receiver
- Message
- Transmission Medium
- Protocol

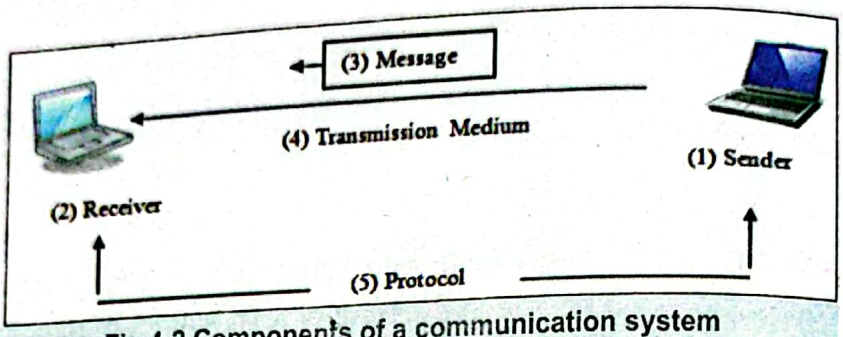


Fig.4-2 Components of a communication system

Sender: It is the device which sends the message. In other words, it is the source of message that can be a computer, telephone handset, etc.

Receiver: It is the device which receives the message. In other words it is the destination of message that can be a computer, radio, telephone handset, etc.

Message: It is the data to be transmitted. It can be text, graphics, image, sound or video.

Transmission Medium: It is the physical pathway (also known as channel) over which the message is sent from sender to receiver. Some examples of transmission media are coaxial cable, Fibre optic cable, microwaves, etc.

Protocol: It is the set of rules between the two communicating devices that governs the process of data communication. Without a protocol, two devices may be connected but they cannot communicate with each other.

4.1.3 CHARACTERISTICS OF A GOOD COMMUNICATION SYSTEM

Following are the properties of a good communication system.

Delivery

Data communication system must deliver the message to the correct destination. Message must be received by only the device or user to whom it is sent.

For example, when e-mail is sent to a person, it is received only by the person to whom it is addressed. This is managed by the protocol used in the data communication system.

Accuracy

System must deliver the message accurately without any change. If incorrect data is transmitted by the system, it may not be usable by the receiver.

For example, when data is transmitted over a long distance, it may get corrupted due to transmission errors. The data that is not correctly received at the destination is retransmitted from the source. This is ensured by the protocol used in the data communication system.

Timeliness

The system must deliver the data without significant delay in a timely manner. It is very important in real time transmission such as video conferencing that video and audio are delivered as soon as they are produced. Data delivered late may be useless.

Some real time systems require immediate transmission of data within limited time. For example, a computerized real time system is used to monitor the temperature in an oil refinery. If the temperature is getting too high, it must be transmitted immediately otherwise there can be an explosion.

4.1.4 ASYNCHRONOUS AND SYNCHRONOUS TRANSMISSION MODES

Asynchronous and synchronous transmissions are the methods by which characters are transferred between components within the computer or between the computer and an external network.

Asynchronous Transmission

The transmission mode in which time interval between each character is not the same is known as asynchronous transmission. This is shown in Fig.4-3.

- In asynchronous transmission, each character is transmitted with additional control information. Control information consists of additional start and stop bits. Start bit indicates that transmission is about to start and stop bit indicates that it is about to stop.
- Start bit is generally 0 and stop bit is 1.
- Between the start and stop bits, the bits representing a character are transmitted at uniform time intervals.
- Asynchronous transmission is slow because of the additional bits transmitted with each character. It is suitable for low speed connection between system unit and keyboard or mouse.

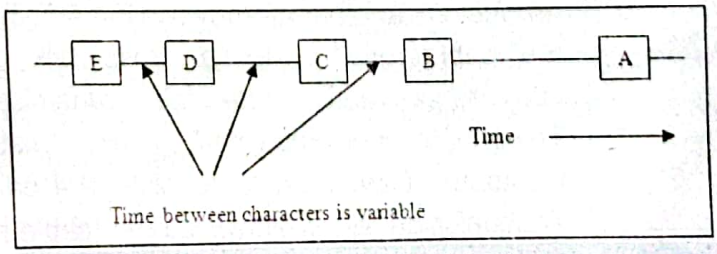


Fig.4-3 Asynchronous transmission

Synchronous Transmission

The transmission mode in which time interval between the characters is always the same, is known as synchronous transmission. This is shown in Fig.4-4.

- In synchronous transmission, there is no control information added with the characters.
- Data consisting of 0s and 1s is transmitted as one long stream of bits. The receiver counts the bits as they arrive and recognizes the characters.
- Synchronous transmission is faster than asynchronous transmission because it does not require extra start and stop bits. Therefore, it is used for fast data communication between computers in computer networks.

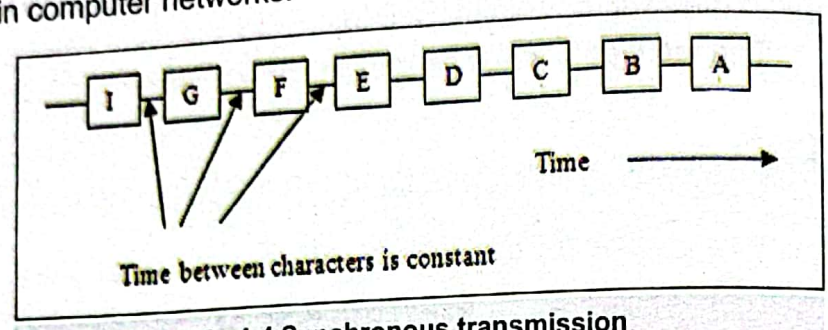


Fig.4-4 Synchronous transmission

4.2 TRANSMISSION MEDIA

Transmission media provide the means by which data travels from source to destination. In other words, it is the pathway for transmitting data.

4.2.1 TYPES OF TRANMISSION MEDIA

There are two types of transmission media, Guided Media and Unguided Media.

4.2.2 GUIDED MEDIA

Guided media uses cabling system that guides the data signals along a specific path. Different types of guided media are twisted pair, coaxial cable and Fibre optic cable.

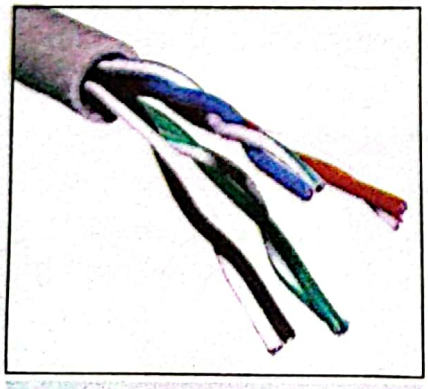


Fig.4-5 Twisted pair cable

Twisted pair cable

Twisted pair cable is the most commonly used cable for data communication. It consists of pairs of copper wires twisted around one another as shown in Fig.4-5. The purpose of twisting the cables is to reduce cross talk and electromagnetic interference and make the transmission more reliable. Telephone cable consists of two twisted insulated wires. Computer network cable consists of 4 pairs of twisted cables. Transmission speed of twisted pair cable ranges from 2 million bits per second to 10 billion bits per second.

Coaxial Cable

Coaxial cable is used for local area networks and cable television systems. It consists of copper wire surrounded by insulating layer. The insulating layer itself is surrounded by conductive layer as shown in Fig.4-6. Insulation reduces interference and distortion. Transmission speed ranges from 200 million bits per second to more than 500 million bits per second.

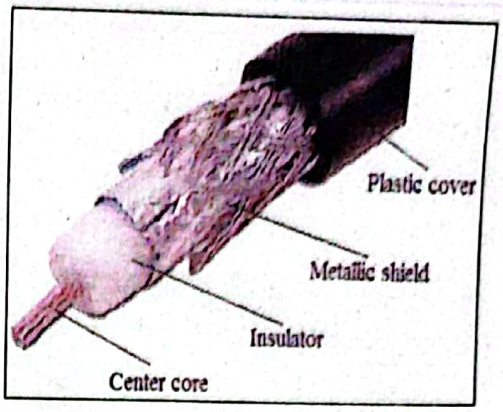


Fig.4-6 Coaxial cable

Fibre Optic Cable

Fibre optic cable consists of smooth hair-thin strands of transparent material. In Fibre optic communication, the transmitter has a converter that converts electrical signals into light waves. These light waves are transmitted over the Fibre optic cable. Another converter is placed at the receiving end that converts the light waves back to electrical signals.

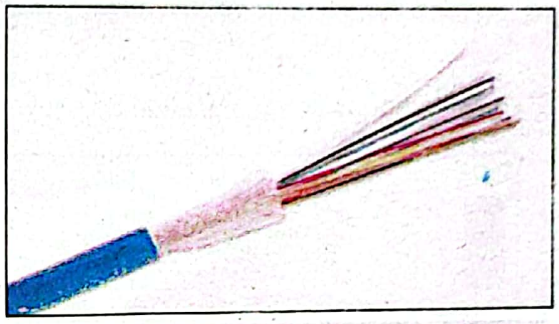


Fig.4-7 Fibre optic cable

A single Fibre optic cable can carry up to 50,000 communication lines. It provides high quality transmission at extremely fast speed. It can transmit trillions of bits per second. It is not affected by electromagnetic fields and can transmit both analog and digital signals.

Fiber optic cable is more expensive than twisted pair and coaxial cables. It is used for data transmission over long distance. Fibre optic cable is shown in Fig.4-7.

4.2.3 UNGUIDED MEDIA

Unguided media signals travel through open space and nothing guides them along any specific path. They do not use cables for data transmission. Unguided media can be classified into radio waves, microwave, infra-red and satellite communication.

Radio Waves

Radio waves are electromagnetic waves that are propagated by antennas. Radio transmission consists of a transmitter and a receiver. A transmitter transmits a radio signal to a receiver which receives it. Radio waves are used to transmit music, conversation, pictures and data. Data can be transmitted over long distance using radio waves. These waves are invisible and undetectable to human beings.

The following are some applications of radio waves.

- Radio and television broadcast as shown in Fig.4-8.

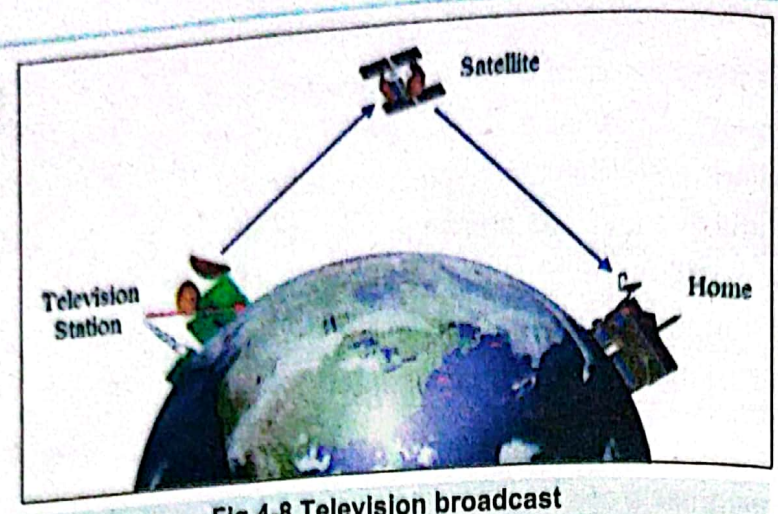


Fig.4-8 Television broadcast

- Cell phones communication as shown in Fig.4-9

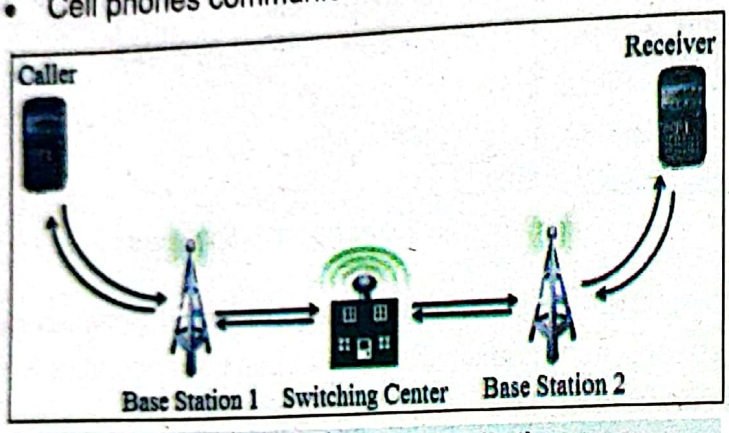


Fig.4.9 Cell phone communication

Fig.4-10 Radio controlled car

- Radio-controlled toys as shown in Fig.4-10
- Satellite communication
- Wireless networks and wireless Internet

Microwave

Microwave signals travel through open space like radio waves. Microwaves provide much faster transmission rate than telephone lines or coaxial cables. Microwave antennas are installed on high buildings or high towers as shown in Fig.4-11. The transmitting and the receiving sites must be within sight of one another. Microwaves are used for satellite communication and other long distance wireless communications.

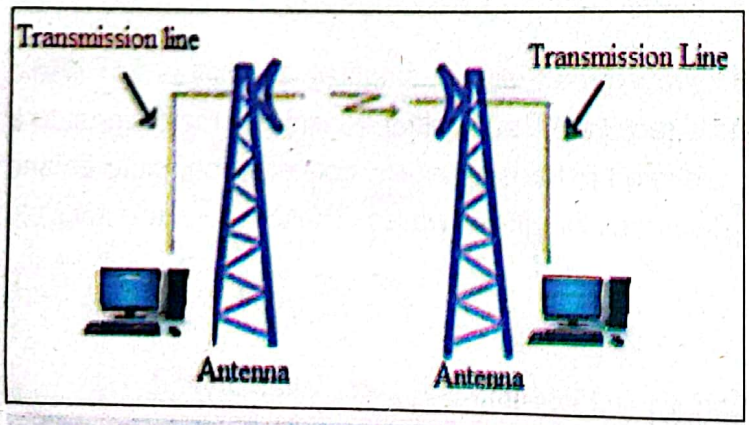


Fig.4-11 Microwave Transmission

Infra-red

Infra-red waves are light energy that we cannot see. It travels through space at the speed of light. It is used for short distance communication. Infra-red waves are usually used in remote controls for television, DVD players and other similar devices. Infra-red wireless signals are disrupted by persons or objects in between the transmitter and receiver but it does not get interference of other radio signals. It is also used in industrial, scientific and medical appliances and night-vision devices. Infra-red communication between television and remote control is shown in Fig.4-12.

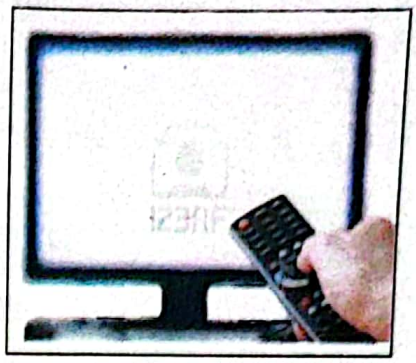


Fig.4-12 Infra-red communication

Bluetooth

Bluetooth is a wireless communication technology that uses radio waves to connect portable electronic devices over short distance. It eliminates the need for cable connection and provides fast and reliable transmission. It supports networking of wide range of portable devices that work on low battery. These devices include mobile phone, mouse, keyboard, wireless speaker, wireless headset, tablet, laptop computer and personal computer. Laptop computer has built-in Bluetooth but personal computer can use Bluetooth adapter to communicate with Bluetooth devices. The most common use of Bluetooth is connecting a mobile phone to a wireless headset or to a laptop computer to transfer voice data. Bluetooth technology can transmit text, image, voice and video.

Satellite

A satellite is an object that is placed in an orbit around the earth and revolves around it with speed that is slightly faster than Earth's average orbital speed for communication. It is a wireless Receiver and Transmitter used for transmitting data over long distance at high speed. Ground stations beam signals through antennas to satellites. Satellites amplify and retransmit the signals

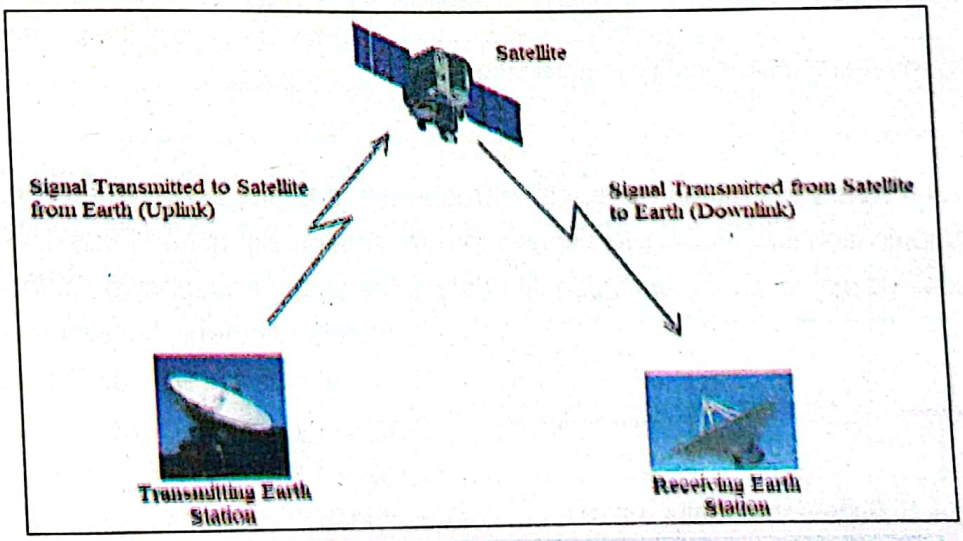


Fig.4-13 Satellite Communication

to another ground station which can be located many thousands of miles away as shown in Fig.4-13. The main drawback of satellite communication is the high cost of placing the satellite into its orbit. Satellites are launched by rockets or space shuttles and precisely positioned in the space with an orbit speed that exactly matches with the rotation speed of the earth.

4.2.4 TRANSMISSION IMPAIRMENTS

POINT TO PONDER
Why do satellites stay in orbit and never fall on the earth?

The errors that occur during data communication from one point to another are called transmission impairments. When a signal is transmitted over a communication medium, it may have different types of impairments. Impairments occur due to imperfect characteristics of communication medium. As a consequence, the received and the transmitted signals are not always the same.

The types of impairments in communication media are attenuation, amplification, distortion and cross talk.

Attenuation

Attenuation is the fall of signal strength with the distance as signal travels through the communication media which is shown in Fig.4-14. If the attenuation is too much, the receiver may not be able to detect the signal at all.

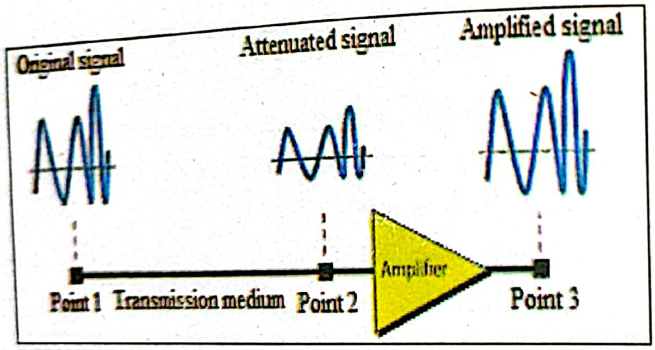


Fig.4-14 Attenuation in data communication

Amplification

Amplification refers to strengthening of signal to solve the problem of attenuation in data transmission. An amplifier is a device used in data communication that receives weak signals, amplifies it and then retransmits.

Distortion

Distortion refers to change in shape or frequency of digital signal when it is transmitted over a communication line. Fig.4-15(a) shows the transmitted signal and Fig.4-15(b) shows the distorted received signal. Communication line delays the signal frequency by different amounts because different frequency components travel at different speed. Therefore, various frequency components of a signal are received at different delays. This causes distortion in digital signals.

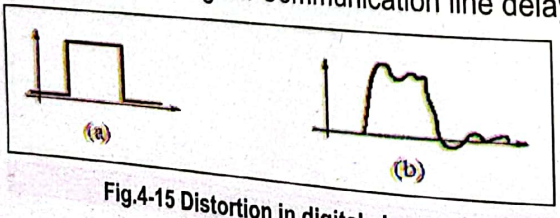


Fig.4-15 Distortion in digital signal

Cross Talk

Cross talk occurs in guided media. As signal is transmitted through a wire, undesired signals enter the path of the transmitted signal due to electromagnetic radiation. It is caused because of putting several wires together in a single cable. Sometimes, user can hear another conversation in the background when talking on the phone. This happens by the coupling between two wires that are close to each other.

4.3 COMMUNICATION DEVICES

A communication device is hardware that is used for transmission of information from one place to another between computers and other devices.

The following communication devices are commonly used in computer networks in data communication systems.

- Dial-up Modem
- Network Interface Card
- Router
- Switch/Access Point

FOR YOUR INFORMATION
The first dial-up modem was built in 1962. It had a speed of 300 bits per second.

Dial-up Modem

Dial-up modem provides Internet connection through telephone line. Maximum speed of Dial-up modem is 56 Kilobits per second which is very slow. It is being replaced by faster DSL connection for Internet. A Dial-up modem is shown in Fig.4-16.

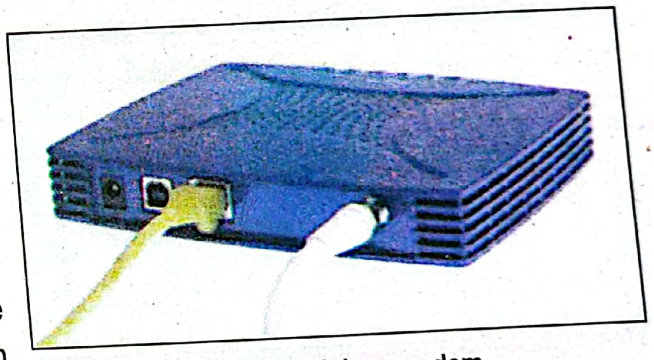


Fig.4-16 Dial-up modem

A telephone line is used for voice transmission which is analog signal. A modem converts digital computer signal to analog form for transmission over telephone line as shown in Fig.4-17. This process is called modulation. Another modem at the receiving end, converts the analog signal back to digital form which is called demodulation. Modem is abbreviation of Modulator-Demodulator.

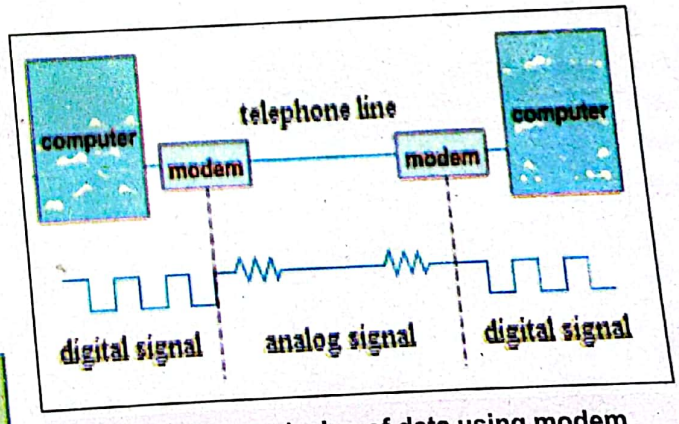


Fig.4-17 Transmission of data using modem

DO YOU KNOW?
Wireless network card provides an easy way to create a wireless network but it is slow and less reliable than wired network card.

Network Interface Card

A Network Interface Card (NIC) or simply network card is used to connect computers together to create computer network. It makes communication between computers possible. It is a card that is installed on the motherboard. In modern computers, it is integrated on the motherboard. There are two types of network cards, wired network card and wireless network card. Wired and wireless network cards are shown in Fig.4-18.

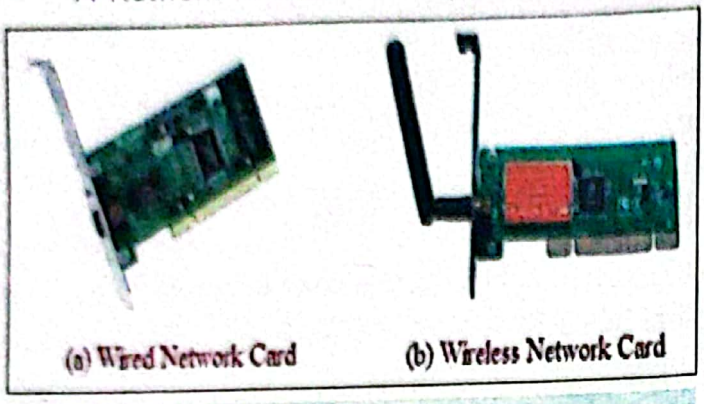


Fig.4-18 Network cards

Router

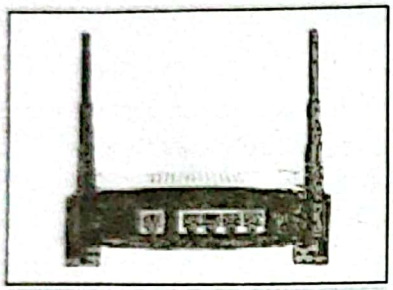


Fig.4-19 Wireless router

Router is a communication device that is used when two networks have to be connected for communication. They send information from one network to another by selecting the best pathway available. There are two types of routers i.e. wired and wireless. A wireless router is shown in Fig.4-19. This router is used to connect wireless devices such as laptop computer and mobile phone to Internet.

DO YOU KNOW?
A local area network (LAN) is a computer network within a small geographical area such as a home, school, computer laboratory, office building or group of buildings.

Switch and Access Point

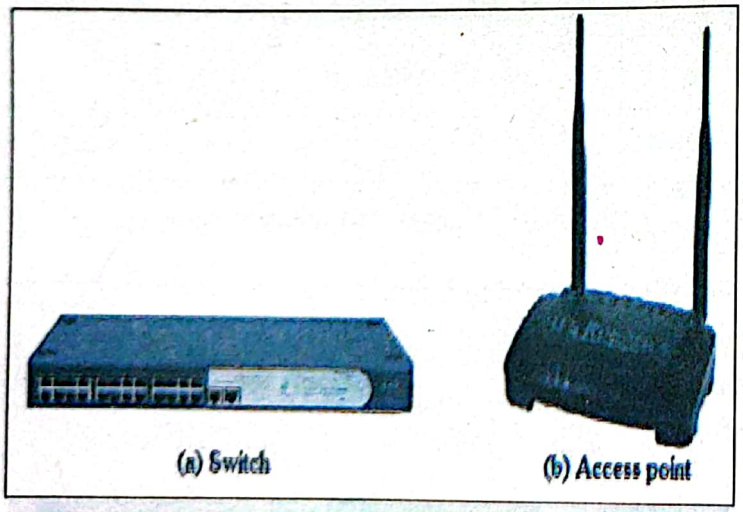


Fig.4-20 Switch and access point

A switch and access point devices are used for connecting computers together in local area network (LAN). Switch is used in wired networks whereas Access point device is used in wireless networks. A Switch or Access point device receives information from a computer in the network, inspects it and then transmits it appropriately to the destination computer. A Switch and an Access point devices are shown in Fig.4-20.

4.4 COMMUNICATION TERMINOLOGIES

Communication Terminologies refers to terms or words that are related with data transmission or characteristics of communication channel.

4.4.1 DATA TRANSMISSION TERMINOLOGIES

The following terms are used to determine the data transmission capabilities of a transmission media such as telephone line, coaxial cable, etc.

- Data rate
- Baud rate
- Bandwidth
- Signal to Noise Ratio

Data Rate

Data rate is the speed with which data can be transmitted from one device to another. It is generally measured in Kilobits (thousand bits) or Megabits (million bits) per second. The abbreviation kbps, is used for kilobits per second and mbps for million bits per second.

Baud Rate

Baud is the rate of change of electrical signals per second during data communications. An electrical signal can have two or more than two states to represent binary digits 0 and 1.

If an electrical signal has two states to represent binary digits then one state represents binary 0 and the other binary 1. In this case the baud rate and the number of bits transferred per second (data rate) are the same.

If an electrical signal has four states then each state can represent two binary digits. For example, the analog signals generated by modem can have four voltage levels such as 1, 2, 3 and 4 Volts. There are four states of analog signal one for each voltage level. These four voltage levels can be used to represent 00, 01, 10 and 11. These will double the bit transfer rate.

Bandwidth

Bandwidth describes the overall data transmission capacity of a medium or channel. It represents the amount of data that passes through a network connection per unit of time. Bandwidth is also measured in bits per second like data rate.

Signal-to-Noise Ratio

Signal-to-noise ratio is the ratio of signal power to the noise power that causes errors in data transmission. In other words, it means the ratio of useful data transmission to errors caused by noise over a transmission medium. The measurement of Signal-to-noise ratio defines the data transmission quality of a communication medium. If a transmission line has Signal-to-noise ratio higher than 1:1 that means more signal transmission than noise

4.4.2 CHARACTERISTICS OF COMMUNICATION CHANNEL

The maximum number of bits that can be transmitted over a communication line is a characteristic of transmission media. If more bits per second are transmitted than the line is capable of, some information will be lost due to transmission errors.

The baud rate can be calculated as:

Baud rate = Number of signal changes per second

The baud rate and data transmission rate measured as bits per seconds are not always the same.

For example, the Baud rate of a transmission line that uses modem is 28 kbps. If the electrical signal has two states to represent binary digits 0 and 1, then the Baud rate and data rate are the same. If the electrical signal has four states to represent 00, 01, 10 and 11 as mentioned earlier, then Baud rate and data rate will not be the same. Data rate will be calculated as:

Data rate = 2 x Baud rate = 2 x 28 = 56 kbps

Key Points

- Data communication refers to transmission of information from one location to another using copper wires, Fibre optics, satellites, etc.
- A data communication system is a collection of hardware and software arranged to communicate information from one location to another.
- Analog signals are continuous. They vary continuously within a range. Analog transmission uses signals that are exactly the same as sound waves.
- Digital signals consist of binary digit 0 and 1 to represent information. These signals are transmitted by a series of "ON" and "OFF" signals by pulses of electricity or light. The "ON" signal represents binary 1 and "OFF" signal binary 0.
- Transmission medium is the physical pathway over which message is transmitted from sender to receiver.
- Protocol is a set of rules between two communication devices that govern the process of data communication.
- In asynchronous transmission, time interval between each character is not the same. Each character is transmitted with additional start and stop bits.
- In synchronous transmission, time interval between each character is always the same. It does not require start or stop bits.
- Guided media uses cabling system that guides the data signals along a specific path.
- Unguided media signals travel through open space and nothing guides them along any specific path.

- Radio waves are electromagnetic waves that are propagated by antennas.
- Satellite is an object that is placed in an orbit around the earth and revolves around it with speed that is same as the rotational speed of earth for communication.
- Attenuation is signal fall off with distance in guided or unguided media.
- Distortion refers to signal change in shape or form as it travels through communication lines.
- Cross talk refers to undesired signals that enter the path of the transmitted signal due to electromagnetic radiation.
- A Network Interface Card (NIC) is used to connect computers together to create computer network and make communication between computers possible.
- A router is a communication device used to connect computers together in different networks.
- A switch is used for connecting computers together in wired local area network whereas access point connects computers in wireless local area network.

Exercise

Q1. Select the best answer for the following MCQs.

i. In which type of data transmission start/stop bits are used?

A. Synchronous transmission
B. Asynchronous transmission
C. Satellite transmission
D. Microwave transmission

ii. In which of the following transmission, the time interval between the characters is always the same?

A. Synchronous transmission
B. Asynchronous transmission
C. Satellite transmission
D. Microwave transmission

iii. Which of the following transmission media uses light waves for transmitting information?

A. Coaxial cable
B. Twisted pair cable
C. Telephone line
D. Fibre optic cable

iv. Which of the following is used for short distance communication?

A. Radio signals
B. Microwave

C. Infra-red
D. Satellite communication

v. In which of the following impairment, the strength of signal falls off with distance?
A. Distortion
B. Attenuation
C. Cross talk
D. Noise

vi. Which of the following impairment refers to undesired signals that enter the path of the transmitted signal due to electromagnetic radiation?
A. Distortion
B. Attenuation
C. Cross talk
D. Noise

vii. Which of the following device is used for connecting computers together in wireless local area network?
A. Dial-up modem
B. Router
C. Switch
D. Access point

viii. Which of the following device is used for connecting computers together in wired local area network?
A. Dial-up modem
B. Router
C. Switch
D. Access point

ix. Which of the following device forwards information from one network to another by selecting the best pathway available?
A. Dial-up modem
B. Router
C. Switch
D. Access point

x. What represents the overall data transmission capacity of a computer network?
A. Data rate
B. Bandwidth
C. Signal strength
D. Baud rate

Q2. Write short answers of the following questions.

i. Differentiate between analog and digital signals.
ii. Why digital signals are used in computer systems?
iii. Name the properties of a good communication system.
iv. Give any three reasons why guided communication medium is more reliable than unguided medium.
v. What is meant by transmission impairment?
vi. Differentiate between attenuation and distortion.
vii. What is cross talk?

viii. What is Dial-up modem? Why is it used?

ix. Define data rate and baud rate.

x. Define bandwidth.

Q3. Write long answers of the following questions.

i. Describe the components of communication system with the help of diagram.

ii. Explain asynchronous and synchronous transmission modes with examples.

iii. Describe the following guided media.

a) Twisted pair cable

b) Coaxial cable

c) Fiber optic cable

iv. Describe any three types of unguided media.

v. Describe the functions of the following communication devices.

a) Router

b) Network Interface Card (NIC)

c) Switch/Access point

Lab Activities

Activity 1: Students should be shown twisted pair, coaxial and fibre optic cables and their usage in data communication.

Activity 2: Students should be shown communication devices such as network card, router, switch, etc.

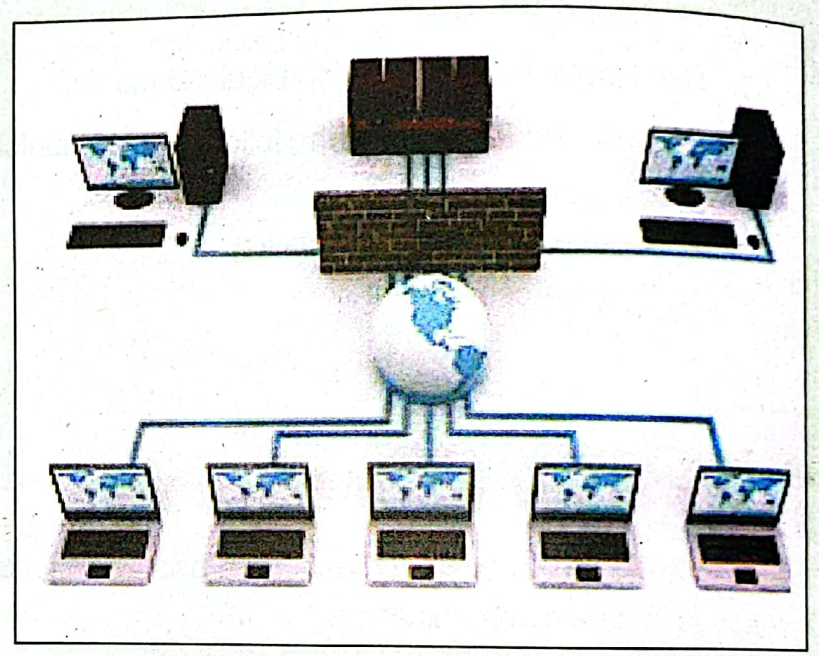
5

COMPUTER NETWORKS

After completing this lesson, you will be able to:

This is 24 periods Chapter including practical work.

- Define computer network
- Describe the uses of networks
- Define data transmission modes
- Define network architecture
- Differentiate between Client/Server, Peer-to-Peer and Point-to-Point networks
- Describe the types of networks (Local Area Network, Metropolitan Area Network and Wide Area Network)
- Define network topology
- Describe bus, ring, star and mesh topologies
- Describe the types of lines which use the telephone network for data communication
- Describe dial-up, DSL and ISDN modems
- Compare data communication lines on the basis of transfer rate, cost per month, advantages and disadvantages



UNIT INTRODUCTION

Computer networks are installed in almost all the organizations to exchange information among users and share resources such as printer, Internet, etc. Therefore, students must have basic knowledge about operation of computer network. This unit provides fundamentals of computer network, types of networks and how information is transmitted from one computer to another. It also presents material about types of Internet connections and their characteristics.

5.1 INTRODUCTION TO NETWORKS

Computer network is interconnection between computers and devices to provide facilities among users to exchange information and share resources. The resources that can be shared over a computer network include programs, documents, printers, plotters and Internet. Without a computer network, computer users can only access the resources of their own computers.

5.1.1 COMPUTER NETWORK

A computer network can be defined as an interconnection of two or more computers to share data and other resources such as documents, printers and Internet connection. A small computer network is shown in Fig.5-1.

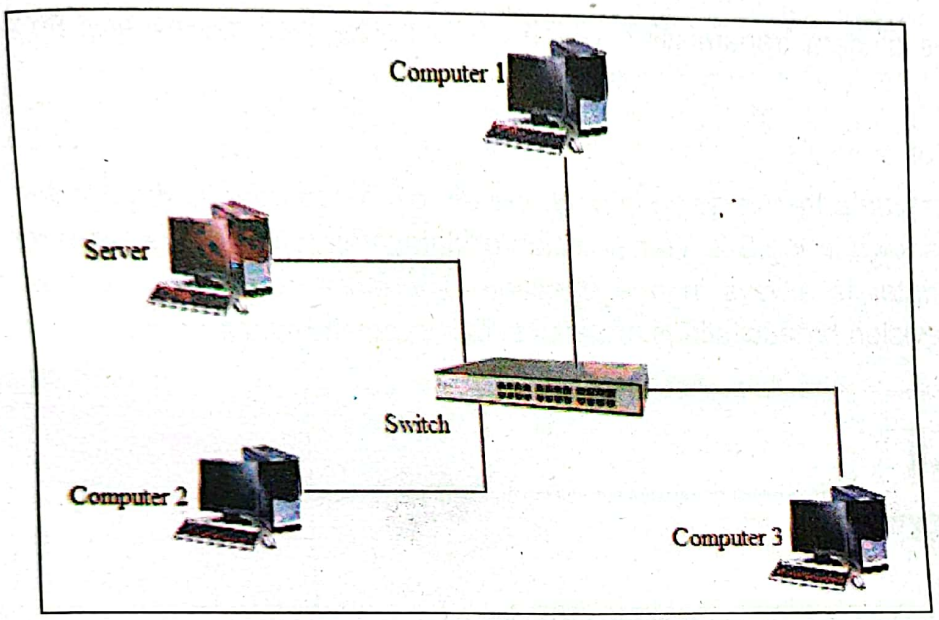


Fig.5-1 A Small Computer Network

For Your Information
Internet is a world-wide network that interconnects millions of computers and provides information and communication facilities.

DO YOU KNOW?
A Server is a main computer in computer network that manages all network resources.

5.1.2 USES OF NETWORKS

The following are some common uses of networks.

Hardware Sharing

Network allows sharing of computer hardware such as hard disk and printer. A hard disk can be attached to a server to share it with other network users. A single hard disk can provide storage space to many users. A printer can also be connected to a computer to share it with all the other computer users across the network. Every user on network can use it for printing documents and there is no need to buy a printer for every user.

Software Sharing

Application software can be installed on a server and shared over the network. There is no need to install it on all the computers in network.

File Sharing

A user of a network can easily share files with other users over the network. A user can place a file in a shared location on one computer and make it available to other users. Users can access, view and modify information stored on another computer in the network.

Internet Sharing

A single high speed Internet connection can be shared with all the users over a network. There is no need to provide a separate Internet connection to every user on the network.

5.1.3 DATA TRANSMISSION MODES

Data transmission is the process of sending data from one device to another. It consists of sender, receiver and the medium which carries the information.

There are three modes of data transmission which are simplex, Half-duplex and Full-duplex.

Simplex Transmission Mode

A simplex mode provides data transmission in only one direction. One end is the sender and the other is receiver as shown in Fig.5-2. Transmission of data/information from keyboard to CPU or from CPU to printer is always in one direction. Therefore, these are simplex transmissions. Radio and television broadcastings are also simplex transmissions.

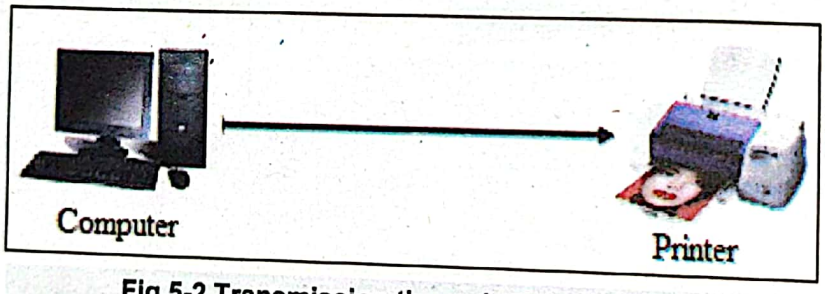


Fig.5-2 Transmission through simplex mode

Half-duplex Transmission Mode

A Half-duplex mode can send and receive data/information in both directions but not simultaneously. During data transmission, one end is the sender and the other is receiver. Half-duplex transmission is used in ATM machines for withdrawal of cash, money transfer and paying bills, etc. Half-duplex transmission is shown in Fig.5-3.

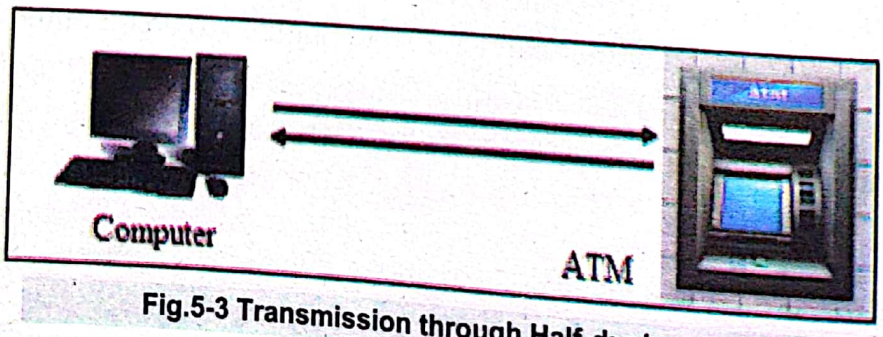


Fig.5-3 Transmission through Half-duplex mode

Full-duplex Transmission Mode

A Full-duplex mode is used to transmit data/information in both directions simultaneously as shown in Fig.5-4. A Full-duplex mode can transmit more data/information at higher rate.

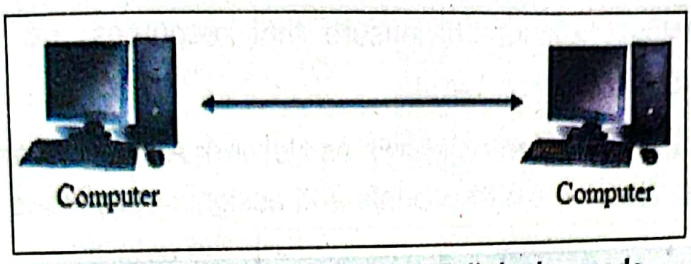


Fig.5-4 Transmission through Full-duplex mode

Examples of Full-duplex mode are communication between computers in a network and communication over telephone line.

5.1.4 NETWORK ARCHITECTURE

Network architecture refers to layout of network that consists of computers, communication devices, software, wired or wireless transmission of data and connectivity between components.

A computer network can be as small as two computers linked together by a single cable whereas large networks connect thousands of computers and other devices.

5.1.5 TYPES OF NETWORK ARCHITECTURES

Three types of network architectures are commonly used which are:

- Client and Server network
- Peer-to-peer network
- Point-to-point network

Client/Server Network

A Server is a main computer in a network which is used to manage network resources and facilitates other computers. Clients are computers in a network that access services made available by a server.

In a Client and Server network, each computer on the network acts as either a server or a client. Servers are not used as client computers and client computers are not used as servers. In a Client and Server network, server shares its resources such as hard disk, printers and Internet connection with client computers. A Client and Server network is illustrated in Fig.5-5.

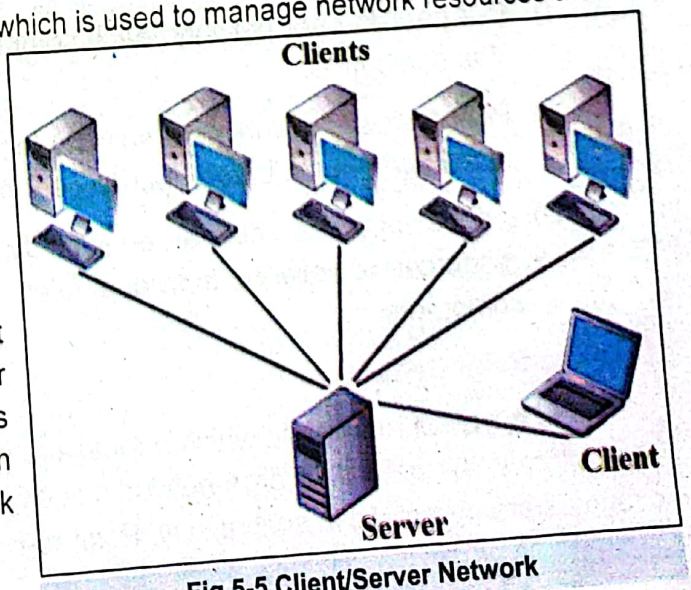


Fig.5-5 Client/Server Network

Characteristics of Client/Server Networks

i) Client/server network can be as small as two computers and it can have hundreds and even thousands of computers as well.

ii) It provides centralized security to ensure that resources are not accessed by unauthorized users.

iii) In a client/server network, a person known as Network Administrator is responsible for sharing resources, creating user accounts and assigning privileges to all the users of the network.

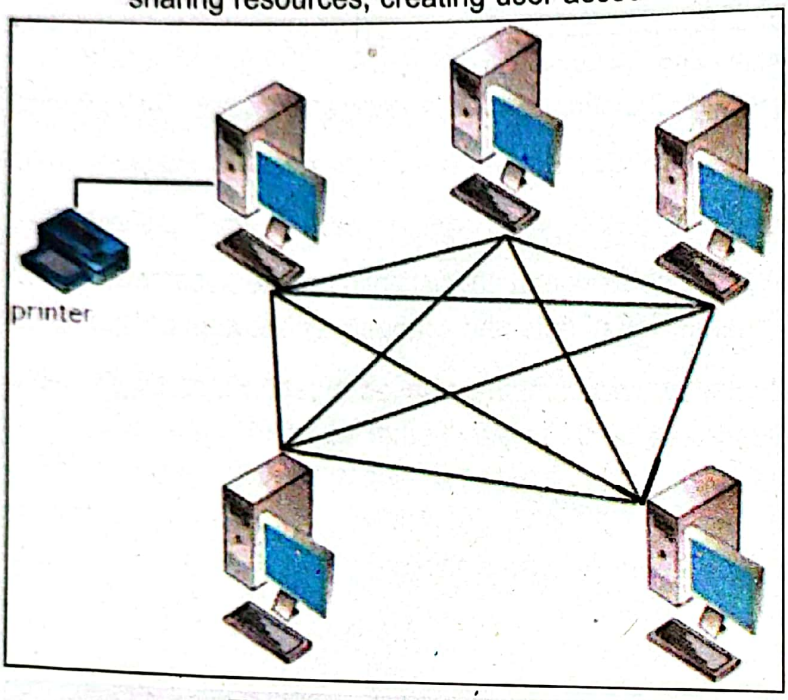


Fig.5-6 Pee-.t-.Peer Network

Peer-to-Peer Network

In Peer-to-Peer network all computers have the same status. Every computer is capable of playing the role of client, server or both at the same time. Each computer on the network is known as peer. A peer on the network can share as well as access available resources on the network. Peer-to-peer network is illustrated in Fig.5-6.

Characteristics of Peer-to-Peer Networks

i) In a peer-to-peer network, each computer can play the role of server, client or both at the same time.

ii) Peer-to-peer networks are suitable for a small number of users, ranging between two to ten computers. Large peer-to-peer networks become difficult to manage.

iii) It does not provide centralized security. No single person is assigned to administer the resources of network. Individual users have complete control over resources of their computers.

Point-to-Point Networks

It is a type of network in which a message is sent from one computer to another via other computers in the network. Large networks such as wide area networks that connect cities and countries are organized in such a way. Point-to-Point network is shown in Fig.5-7.

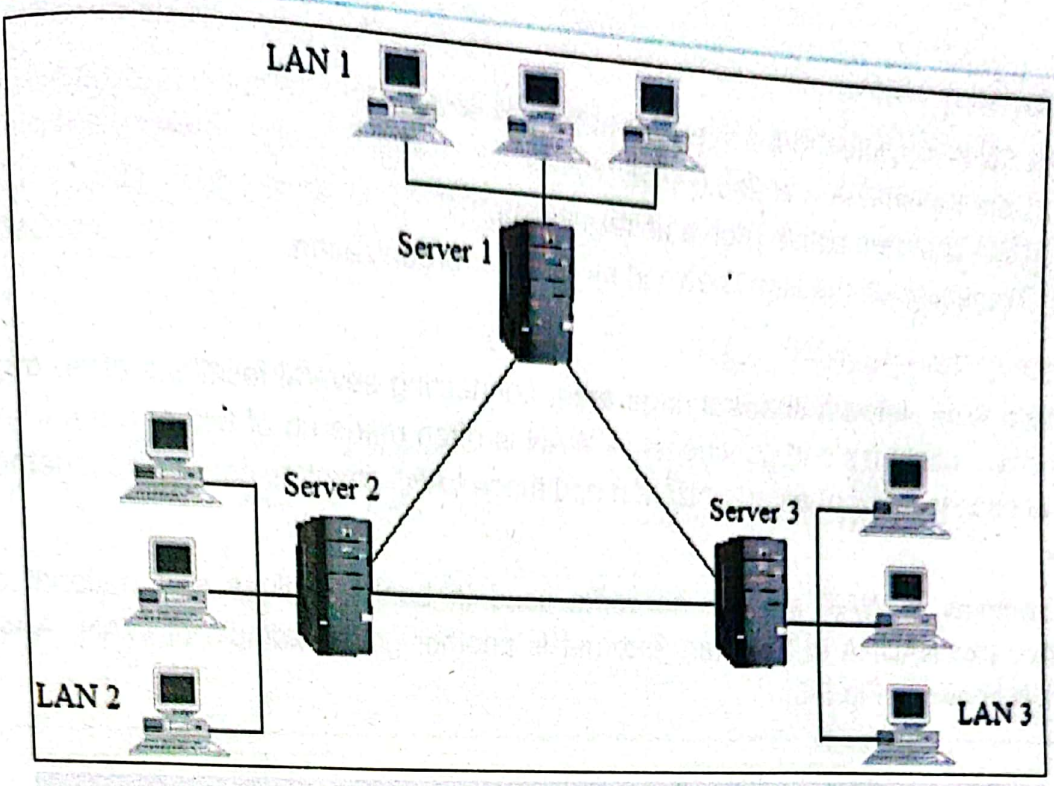


Fig.5-7 A Point-to-Point Network

Characteristics of Point-to-Point Networks

i) Point-to-Point networks are generally used for long distance communication.

ii) There may be different paths for transmission of information.

5.2 TYPES OF NETWORKS

A variety of computer networks exist based on the geographical distance covered and the type of topology used.

5.2.1 TYPES OF NETWORKS BASED ON GEOGRAPHICAL AREA

Based on the geographical distance covered, computer networks are classified into Local Area Network, Wide Area Network and Metropolitan Area Network.

Local Area Network (LAN)

Local area network is commonly used network. It is a network that covers a limited area, usually ranging from a small office to a campus of nearby buildings.

Examples of LAN include networks within a school, college, business and organization. A local area network is shown in Fig.5-8.

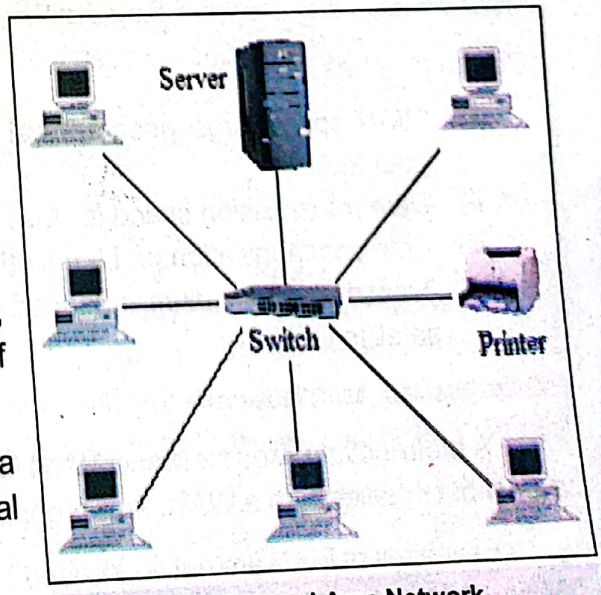


Fig.5-8 Local Area Network

Characteristics of LAN

i) LAN is restricted to a limited geographical area.
ii) Data transmission speed is fast.
iii) Data communication problems rarely occur.
iv) Transmission medium is owned by the user organization.

Wide Area Network (WAN)

Wide Area Network spans a large area, connecting several locations of an organization across cities, countries and continents. A WAN is often made up of two or more LANs and/or MANs at each location of an organization and these LANs might be connected together to form a WAN.

Examples of WAN are the networks used in banks, airlines and national database authorities like NADRA in Pakistan. Internet is another good example of WAN. A wide area network is shown in Fig.5-9.

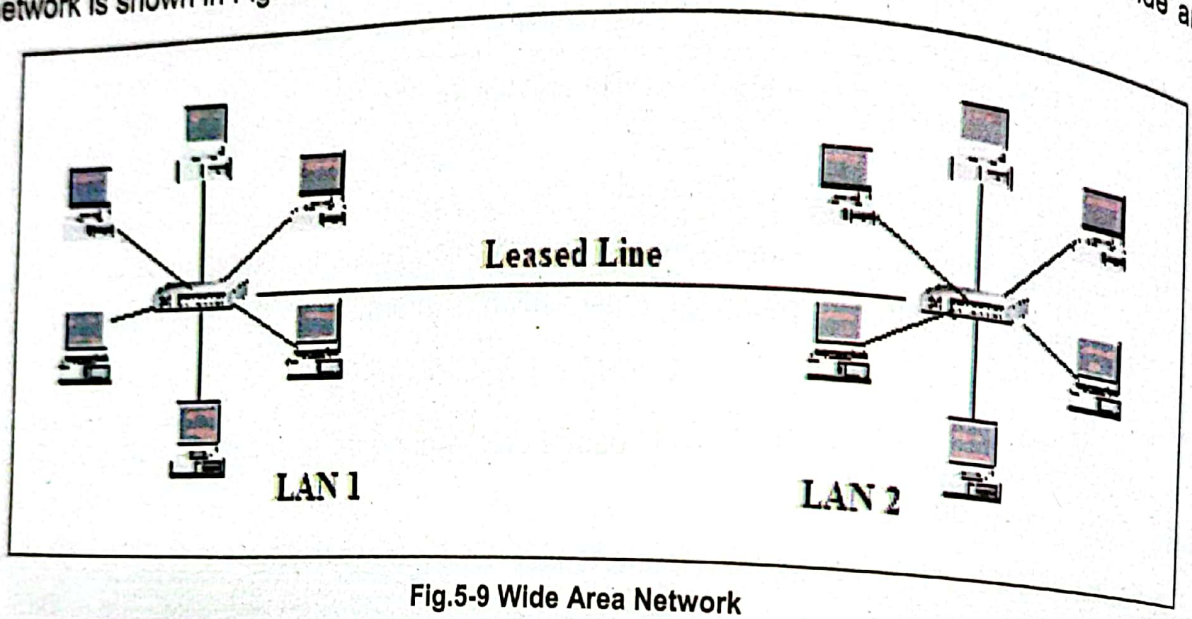


Fig.5-9 Wide Area Network

Characteristics of WAN

i) WAN spans large geographical area. It can connect computers between cities and countries.
ii) Data transmission speed is slow.
iii) Data communication problems often occur.
iv) Transmission medium is leased lines or public systems such as telephone lines or satellite links.

Metropolitan Area Network (MAN)

A Metropolitan Area Network (MAN) falls between LAN and WAN. It spans area larger than a LAN but smaller than a WAN. A metropolitan area network is shown in Fig.5-10.

Examples of MAN are networks used by telecommunication companies for providing Cable TV and Internet services.

Characteristics of MAN

i) MAN can connect computers within several blocks of buildings to entire city.
ii) Data transmission speed is slower than LAN but faster than WAN.
iii) Fibre optic cable or wireless microwave transmission is used as communication medium.

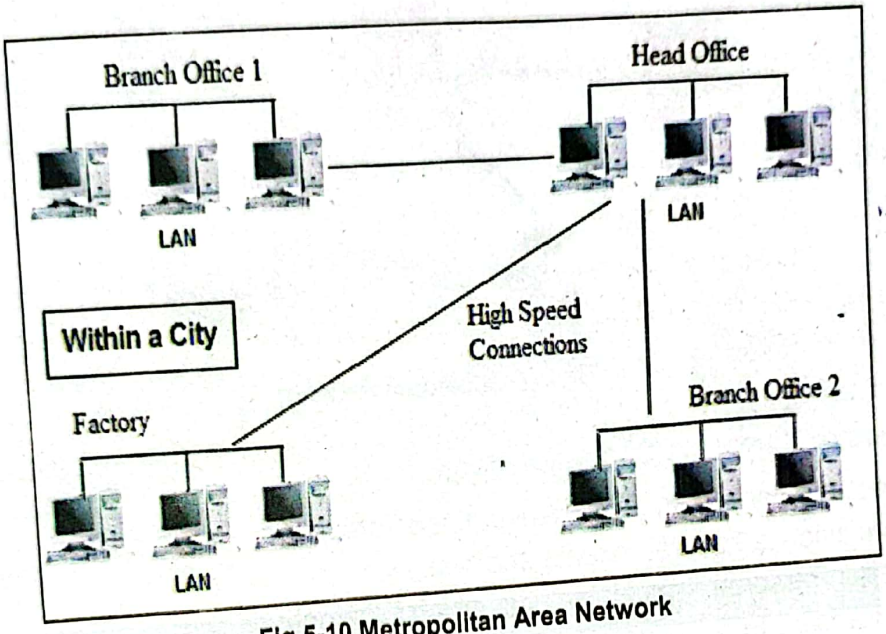


Fig.5-10 Metropolitan Area Network

Personal Area Network (PAN)

A personal area network (PAN) is a computer network organized around an individual person. Personal area networks typically involve a mobile computer, a cell phone and/or a handheld computing device such as a PDA. Users can use these networks to transfer files including emails, calendar appointments, photos and audio/video files.

Personal area networks can be wired or wireless. USB and FireWire technologies often link together a wired PAN, while wireless PANs typically use Bluetooth or sometimes infrared connections.

The following is the example of wireless PAN using Bluetooth technology.

Bluetooth Network

The process of setting up a Bluetooth network is referred to as "**Pairing**". Pairing is done through interaction between two users. The user interaction is required to confirm the identity of the devices. When pairing process completes, a network forms between the two devices and now the devices can communicate with each other. It is possible to pair one device to multiple other devices. Bluetooth creates a secure network. A Bluetooth network connecting various Bluetooth devices is shown in Fig. 5-11.

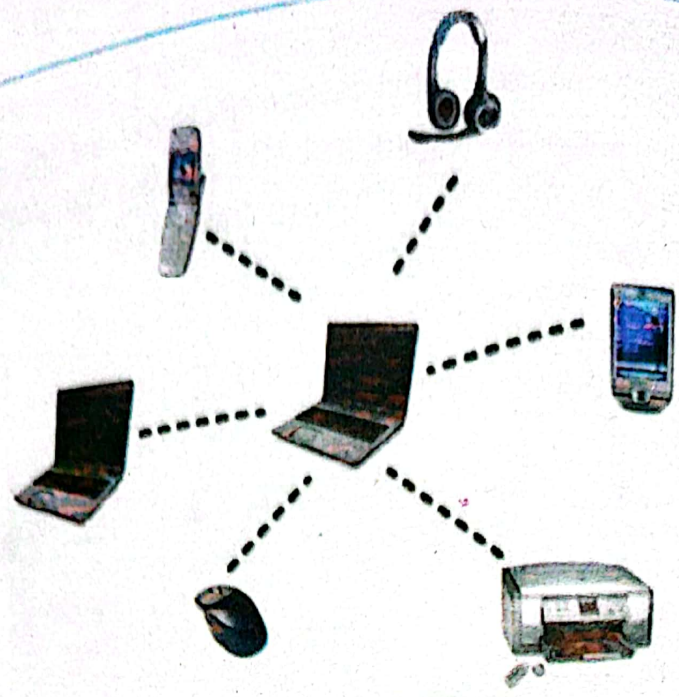


Fig.5-11 Bluetooth Network

Characteristics of Bluetooth Communication

i) Bluetooth transmission eliminates the need of cable to form a network.
ii) Transmission is secure, reliable and fast.
iii) It creates Personal Area Network in which Bluetooth devices are close to each other.
iv) It can transmit text, images, audio files and video files.

Internet (International Network)

Internet is the largest computer network that connects millions of computers all over the world. Computers on the Internet are connected together using telephone lines, fiber optics or wireless signals. Each computer on the Internet has an IP address. IP stands for Internet Protocol. It identifies each computer on the Internet with its location.

Internet has brought a huge revolution in our daily life. It allows people to send e-mail, chat with friends around the world and obtain information on any topic. Computer users pay bills, do shopping, find jobs, work at home and do reservation for trains, flights, and hotels through Internet. Social networking websites such as Facebook and Twitter allow millions of people all over the world to communicate with each other and share their views and ideas.

World Wide Web (www) or Web in short, is the most popular and widely used system to access the Internet. It is a collection of websites available on the Internet. A website contains related webpages that can be accessed using a browser such as Google Chrome or Internet Explorer. To access a website, computer users enter a string of characters called Uniform Resource Locator (URL) into a browser. For example to access the website of Federal board, the user will enter the URL ***www.fbise.gov.pk*** into a browser.

5.2.2 NETWORK TOPOLOGY

The physical arrangement of network nodes is called network topology. A node represents a computer or a network device.

5.2.3 TYPES OF NETWORK TOPOLOGIES

Four types of network topologies are commonly used which are bus, ring, star and mesh.

Bus Topology

It is the simplest network topology. It consists of a single central cable known as bus. All the devices are connected to the bus along its length to communicate with each other as shown in Fig.5-12. A computer sends a message on the bus. The computer to whom the message is sent receives it while others ignore it. At each end of bus a device called terminator is attached so that the signals do not bounce back on the bus causing errors.

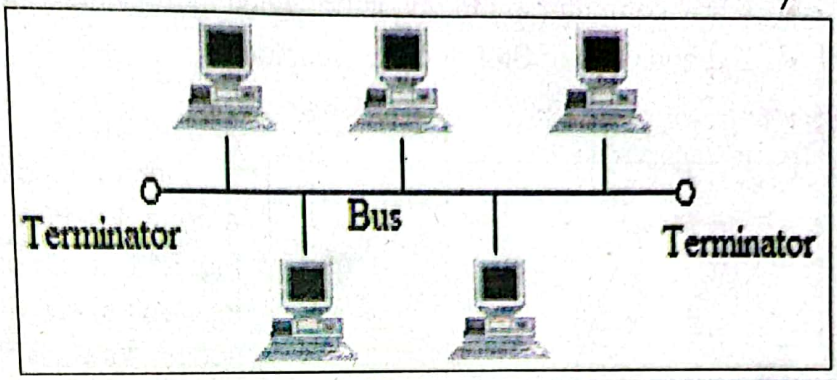


Fig.5-12 Bus topology

Advantages of Bus Topology

- Lowest cost topology to implement due to short cable length.
- Easy to add new computers.
- Easy to setup as compared to Star or Mesh topology.
- Suitable for small networks.

Limitations of Bus Topology

- If bus is damaged at any point, the entire network stops working.
- Difficult to detect and fix faults.

Ring Topology

The ring network topology is shaped just like a ring as shown in Fig.5-13. It is like a bus with both ends connected together. All the messages travel in the same direction. Message from one node is sent to the next node. It is received by it if it is addressed to it otherwise it is ignored and passed on to the next until the destination is reached.

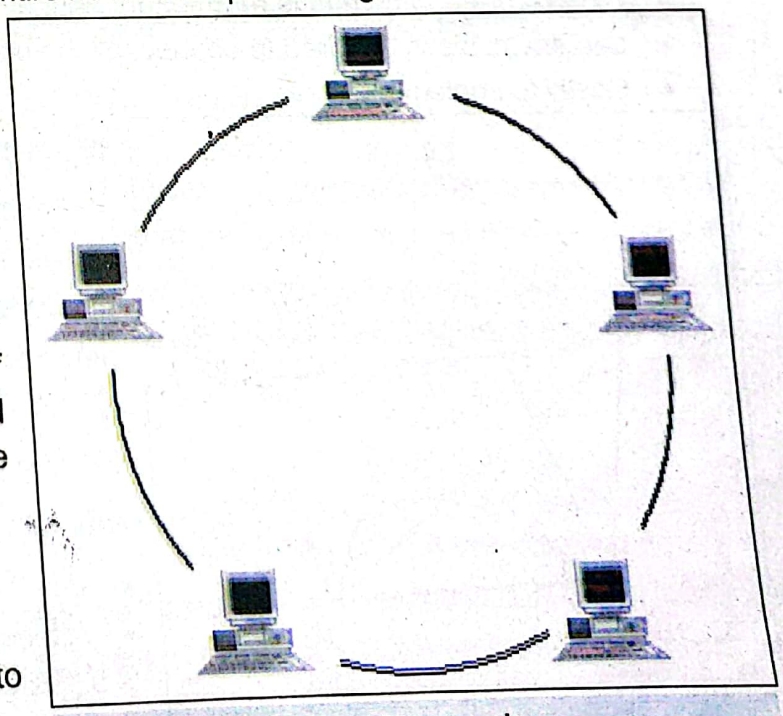


Fig.5-13 Ring topology

Advantages of Ring Topology

- High network performance.
- Server or switch is not required to manage the network.

- All the computers have equal opportunity to transmit data.

Limitations of Ring Topology

- If ring is broken at any point, the entire network stops functioning.
- Detection of fault is difficult.
- If any computer in the ring is not working the whole network is affected.
- Expansive than Star and Bus topologies.

Star Topology

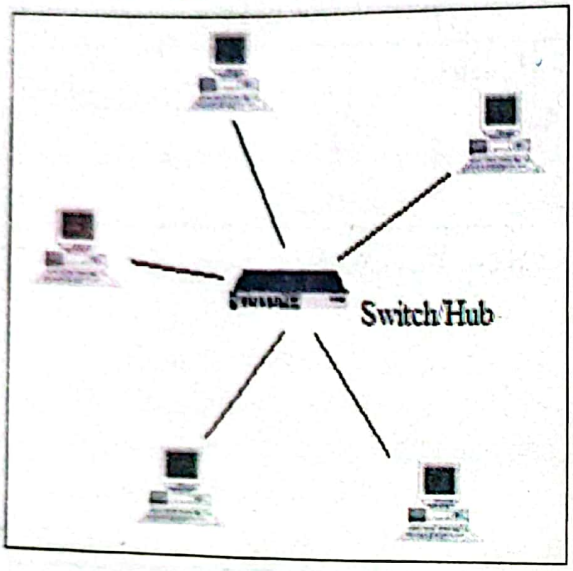


Fig.5-14 Star topology

In star topology all the nodes are connected to a central device called switch or hub as shown in Fig.5-14. It is a one of the commonly used network topologies. A switch can connect 4, 8, 16, 24 or 32 nodes. A switch can be connected to another switch to expand the network.

Advantages of Star Topology

- Provides fast communication between computers.
- Easy to connect new devices to the network.
- Easy to detect and fix faults.
- Failure of one computer does not stop functioning of the entire network.

Limitations of Star Topology

- At least one switch/hub is required for connecting two computers.
- Lengthy cable is required to connect all the computers to the switch.
- Costly to implement.

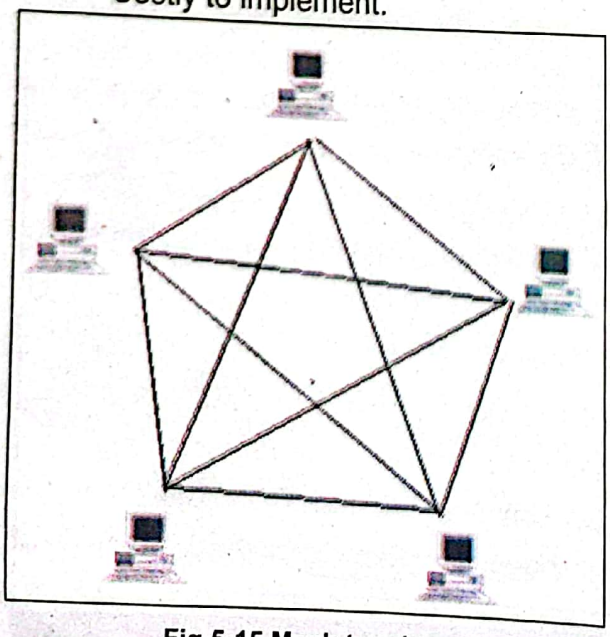


Fig.5-15 Mesh topology

Mesh Topology

In mesh network topology, all the network nodes are connected to all the other nodes as shown in Fig. 5-15. Message sent on a mesh network, can take any possible path from source to destination. It is not commonly used since it is costly and difficult to implement.

Advantages of Mesh Topology

- It is the most reliable network topology
- Alternative paths are available in case a path is broken from source to destination

Limitations of Mesh Topology

- Most expensive topology to implement since it requires more cable then Bus, Ring or Star topologies.
- Difficult to implement as compared to other topologies.
- Difficult to add new computer.

5.3 COMMUNICATION OVER NETWORKS

Communication over network refers to transmission of data/information from one computer to another through a communication medium.

5.3.1 COMMUNICATION VIA TELEPHONE NETWORKS

Telephone network is now commonly used for data communications. The main reason for using telephone network is that it exists all over the world.

Following four types of communication lines are provided via telephone networks.

- Dial-up line
- Digital Subscriber Line (DSL)
- Integrated Services Digital Network (ISDN) lines
- Code Division Multiple Access (CDMA)

Dial-up Line

Dial-up line uses standard telephone lines for Internet connection. It requires a Dial-up modem that provides a maximum Internet connection speed of 56Kbps. The main advantage of using Dial-up line is that it uses complex network of telephone lines that allows data to be transmitted to almost any location in the world. It is becoming outdated due to very slow Internet connection.

DSL

DSL (Digital Subscriber Line) provides a very high speed broadband Internet connection. It is called broadband because it has broad range of frequencies for transmitting digital data. Any type of Internet speed that is 256Kbps or above is known as broadband. A DSL modem is required for setting up the DSL Internet connection. Internet Service Providers (ISPs) have several DSL speeds available with different monthly rates.

ISDN

ISDN stands for Integrated Services Digital Network. It provides a maximum speed of 128Kbps which is more than Dial-up connection but less than DSL. It can transmit both voice and data at the same time over a single cable. It requires that the user has ISDN digital telephone service from telephone company and uses a faster modem than Dial-up modem. ISDN service is being replaced by faster DSL service.

CDMA Technology

CDMA stands for Code Division Multiple Access. It is a wireless cellular communication technology. CDMA services include short messaging, voice, data and.video transmission. It can provide speed of several Mbps for video transmission.

5.3.2 TYPES OF MODEMS

There are three types of modem which are commonly used. These are Dial-up modem, DSL modem and ISDN modem.

Dial-up Modem

A Dial-up modem is required for Dial-up Internet connection. It is the short form of **MODulator/DEModulator**. Modem accepts digital data from the computer in the form of two-level signals and converts them into analog signals for transmission over the telephone line. This process is called modulation. A second modem at the receiving end is used to convert the analog signals back to digital form which is called demodulation. Dial-up modems are shown in Fig.5-16.

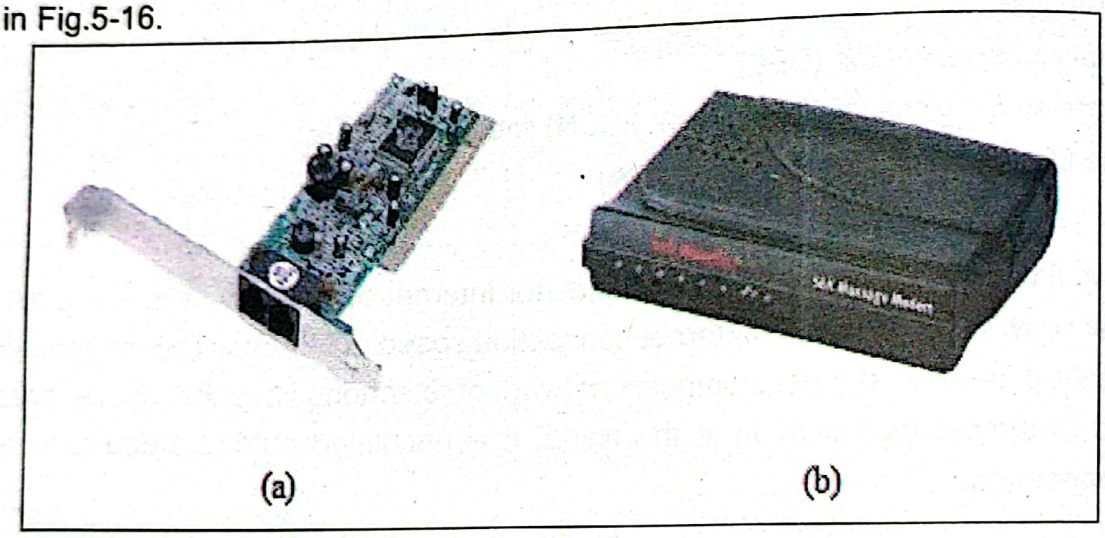


Fig.5-16 (a) Internal Dial-up modem (b) External Dial-up modem

DSL Modem

A DSL modem is used to connect microcomputers to high-speed DSL connections. It is designed to provide high-speed Internet access.

A DSL modem is an external device that connects to a computer via USB or Ethernet port. These ports are usually available at the back of system unit. Wireless DSL modems are also available for connecting laptop and other wireless devices such as mobile phones to Internet. DSL modem converts the digital signals into analog high frequency signals that are carried by the telephone lines and vice versa. DSL modems are shown in Fig.5-17.

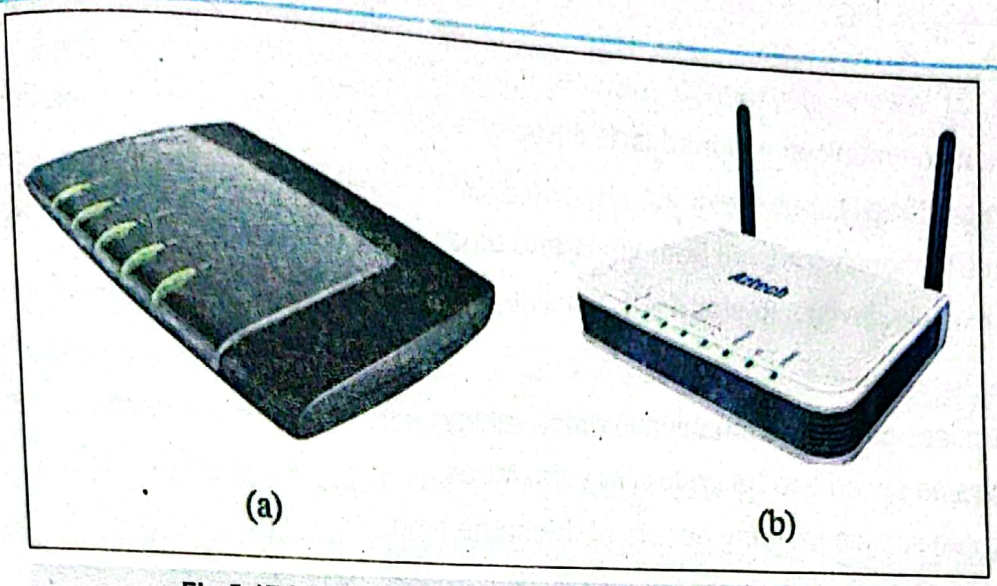


Fig.5-17 (a) Wired DSL Modem (b) Wireless DSL Modem

ISDN Modem

ISDN modem is a device that converts digital signals used in computers to the signals that can be transmitted over the ISDN lines. It provides both voice and data transmission on a single line at the same time. ISDN modem is shown in Fig.5-18.

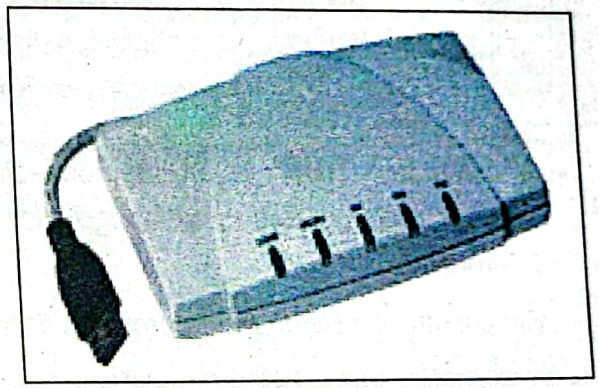


Fig.5-18 ISDN Modem

5.3.3 COMPARISON BETWEEN DATA COMMUNICATION LINES

Dial-up Line

- Maximum speed is 56 Kbps.
- Easily available anywhere, no extra lines required.
- Cheaper than other Internet services.
- Internet connection is not permanently available.
- Voice communication is not possible while using Internet.

DSL

- Typical speed is 256Kbps or above.
- DSL connection is always available.
- Telephonic conversation and Internet access are available simultaneously.
- Costly than other types of Internet services.
- Various monthly rates are charged depending on the speed.
- Connection is available as soon as computer and DSL modem are turned on.

ISDN

- Maximum communication speed is 128 Kbps.
- Costs more than Dial-up service.
- Can simultaneously transmit both voice and data.
- Allows multiple devices to share a single line.

CDMA

- It is a wireless cellular communication technology.
- Transmission speed can be up to a several Mbps.
- Can provide service to many people at the same time.
- Provides improved voice quality.

Key Points

- A computer network is an interconnection between computers and devices to provide facilities among users to exchange information and resources such as printer, hard disk, Internet, etc.
- Simplex transmission mode provides data transmission in only one direction.
- Half-duplex transmission mode can send and receive data in both directions but not simultaneously.
- Full-duplex transmission mode provides data transmission in both directions at the same time.
- A computer that shares resources for others to use on a network is known as a server.
- A computer that accesses the resources shared by other computers on a network is known as a client.
- In a client/server network, each computer in the network acts as either a server or a client. Server cannot be used as client computer and client computer cannot act as server.
- In peer-to-peer network, all the computers have the same status. Every computer is capable of playing the role of client, server or both as the same time.
- Point-to-Point network is a type of network in which when a message is sent from one computer to another, it usually has to be sent via other computers in the network.
- Local Area Network (LAN) covers a limited area, usually ranging from a small office to a campus of nearby buildings.

- Wide Area Network (WAN) spans a large area, connecting several locations of an organization across cities, countries and continents.
- Metropolitan Area Network (MAN) falls between LAN and WAN. It spans area larger than a LAN but smaller than a WAN, such as a city.
- The physical arrangement of network nodes is known as network topology.
- Bus topology consists of a single central cable known as bus. All the devices are connected to the bus along its length to communicate with each other.
- Ring topology is shaped just like a ring. It is like a bus with both ends connected together.
- In star topology, all the nodes are connected to a central device called switch or hub.
- In mesh topology, all the network nodes are connected to all the other nodes.
- Dial-up modem is a communication device that converts digital signals to analog signals for transmission over telephone line. The analog signals are converted back to digital signals by the modem attached to computer at the receiving end.
- DSL modem is a communication device that provides high-speed connection to Internet.
- ISDN modem is a device that converts digital signals used in computers to the signals that can be transmitted over the ISDN lines.

Exercise

Q1. Select the best answer for the following MCQs.

i. In which of the following transmission mode, information is transmitted in both directions but not simultaneously?

A. Simplex mode
B. Half-duplex mode
C. Full-duplex mode
D. High speed mode

ii. In which of the following network, every computer can act as client, server or both at the same time?

A. Client and server network
B. Peer-to-peer network
C. Point-to-Point network
D. Local area network

iii. Which of the following network provides centralized security?

A. Client and server network
B. Peer-to-peer
C. Point-to-Point network
D. Local area network

iv. Which of the following computer shares resources on a network for others to use?
A. Desktop computer
B. Client
C. Server
D. Microcomputer

v. Which of the following topology is most expensive to implement?
A. Star
B. Bus
C. Ring
D. Mesh

vi. In which of the following network topology, switch is required?
A. Star
B. Bus
C. Ring
D. Mesh

vii. Which of the following network is used to provide Cable TV and Internet services?
A. Local area network
B. Wide area network
C. Metropolitan area network
D. Point-to-Point network

viii. Which of the following provides high speed Internet connection?
A. Dial-up connection
B. DSL connection
C. ISDN connection
D. CDMA connection

ix. Which of the following network connects computers across cities, countries and continents?
A. Local area network
B. Wide area network
C. Metropolitan area network
D. Client/Server network

x. Which of the following network topology uses a device called terminator?
A. Ring topology
B. Mesh topology
C. Bus topology
D. Star topology

Q2. Write short answers of the following questions.

i. Describe any three difficulties a company may face in running a business without having computer network.
ii. What is meant by data transmission?
iii. Differentiate between Half-duplex and Full-duplex transmission modes.
iv. Define network architecture?
v. Differentiate between a server and a client computer.
vi. Compare LAN and WAN.
vii. Why star topology is more reliable than bus or ring topologies?
viii. Mention any three problems which may occur if peer-to-peer network is used for a large number of users in an organization.

ix. What is ISDN?

x. What is CDMA technology?

Q3. Write long answers of the following questions.

i. What are the advantages of using networks?

ii. Describe Client/Server and Peer-to-Peer networks.

iii. Describe the types of networks based on area covered.

iv. Explain the types of network topologies.

v. Write a note on Dial-up and DSL Internet connections.

Lab Activity

The students should be shown/explained a switch and network card and its use to create a local area network in school computer lab. The cables and connectors used for creating a local area network (LAN) should also be physically shown to students.

7

WORLD WIDE WEB AND HTML

After completing this lesson, you will be able to:

- Define terms related with website (WWW, Webpage, Website, Web browser, Web Server, URL, Search Engine, Home Page, Web Hosting)
- Describe various types of websites
- Define Hypertext Mark-up Language (HTML)
- Create and save an HTML file
- Display a Web page
- Identify the tags used to mark-up HTML elements
- Identify HTML, Head section and Body section of HTML file
- Describe the steps involved to specify a page title, create a paragraph, insert line breaks, insert spaces and add heading/sub-heading
- Identify the text formatting tags used to format text
- Know the use of various text formatting tags
- Differentiate among unordered, ordered, definition and nested lists
- Add an image and border to the image
- Specify width and height of an image
- Apply background color to a Web page
- Assign a background image to a Web page
- Define and create hyperlink
- Define and create anchor
- Create a graphical hyperlink
- Create table and apply various table attributes
- Define a frame and differentiate between a frame and a frameset
- Create a frameset

Reading

UNIT INTRODUCTION

World Wide Web (WWW) enables users to find documents on the Internet in a variety of formats that includes text, graphics, images, audio and video. It allows documents on the Internet to be linked to other documents and enables the users to search for information by moving from one document to another. Documents on the Internet are created in Hypertext Mark-up Language (HTML). HTML is the main language of Internet's WWW. Therefore, students need basic knowledge about WWW, types of websites and how to create Web pages using HTML.

7.1 INTRODUCTION TO WORLDWIDE WEB

Internet is a worldwide network of computers and World Wide Web is the main application Internet for accessing and sharing information. It allows people all over the world to share owledge and ideas.

.1.1 TERMS RELATED WITH WORLD WIDE WEB

Web Page

A Web page is a document on e Internet that can be accessed rough a Web browser. Web owser displays Web pages on onitor or mobile devices. Web ages may have hyperlinks that ovide navigation to other Web ages. Web pages contain text, aphics, images, sound and video ips all in one place. A Web page in own in Fig.7-1.

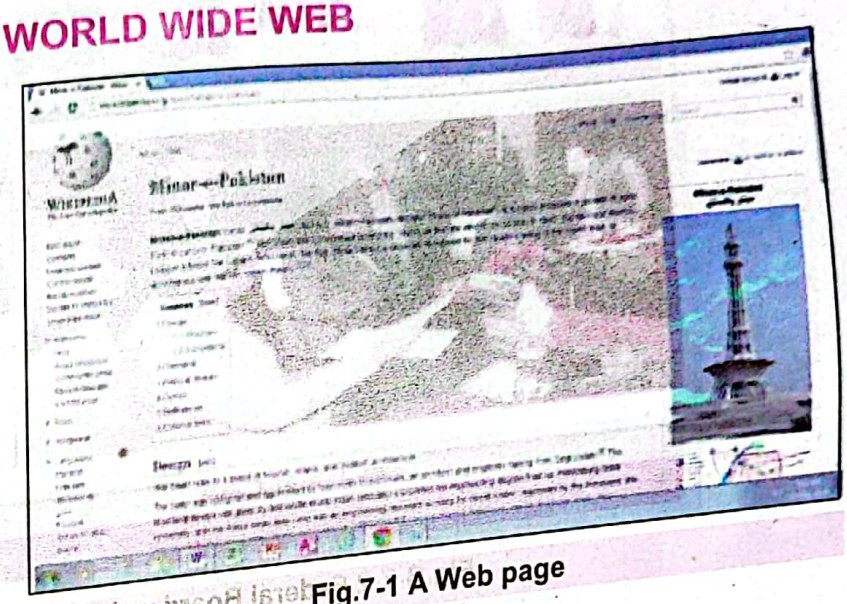


Fig.7-1 A Web page

Website

A website is a collection of related Web pages hosted on a Web server. It is accessible rough an Internet address known as Uniform Resource Locator (URL). A URL is what the ser types in Web browser such as Internet Explorer to display a particular website. A website r air ticket reservation is shown in Fig.A-7-2. Federal board (FBISE) Urdu website is shown in ig.B-7-2.

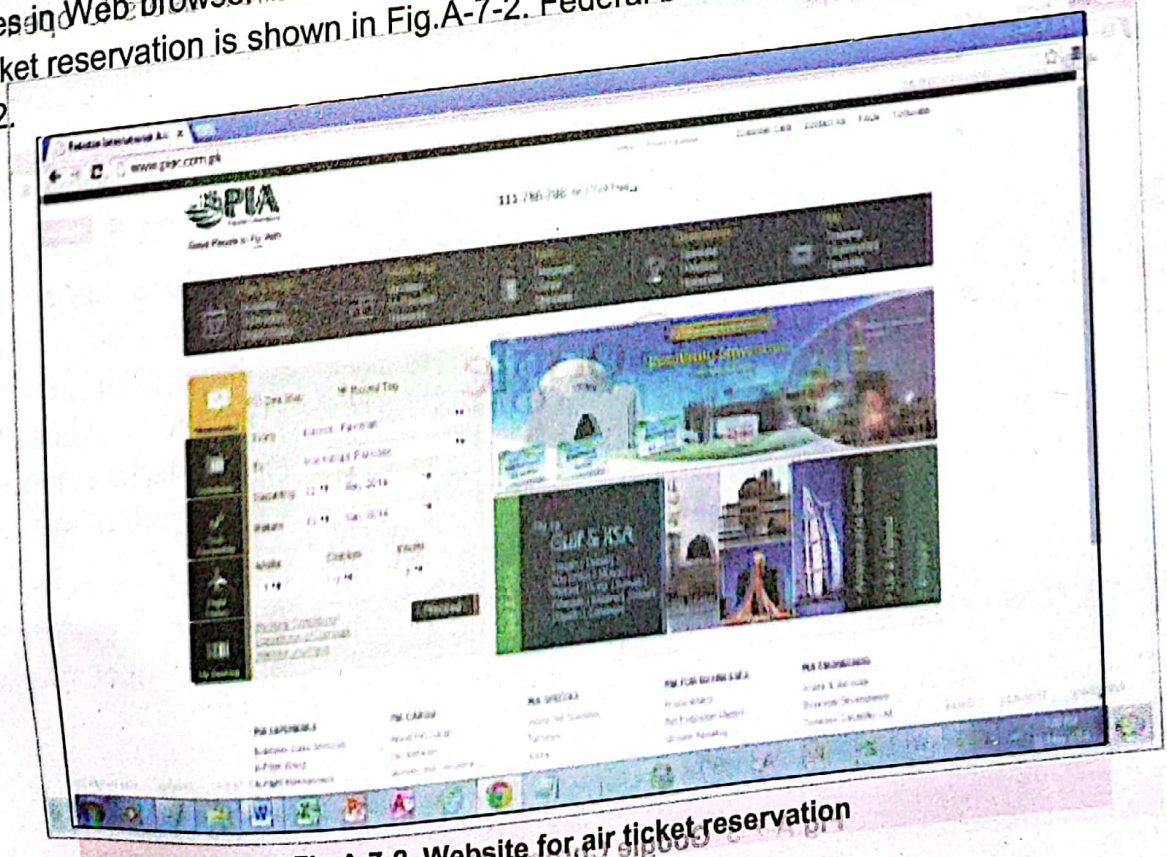


Fig.A-7-2 Website for air ticket reservation

Fig B-7-2 Federal Board website in Urdu language

Web Browser

A Web browser is a software that enables users to retrieve information on the Web. Information on the Web is accessed by the URLs. Web browsers allow users to open multiple

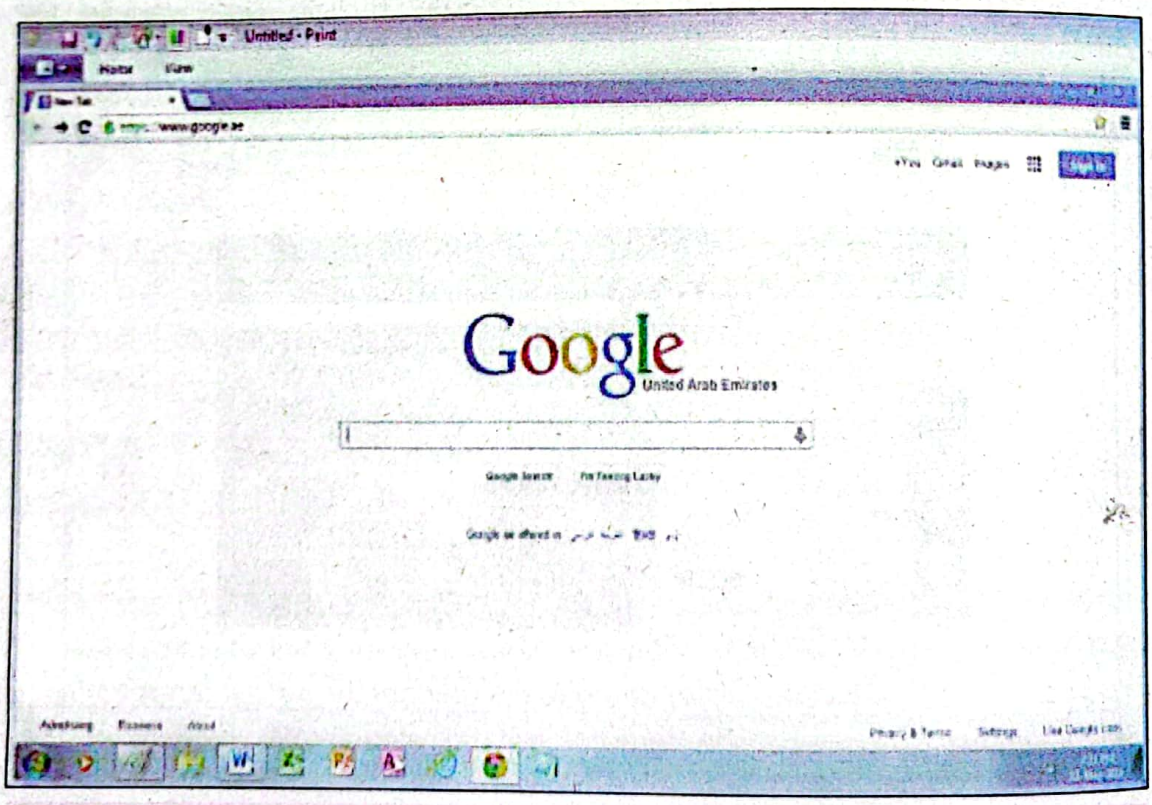


Fig A-7-3 Google Chrome Web browser

websites at the same time, either in different browser windows or in different tabs of the same window. All the browsers have graphical interface which is very easy to learn and use. Two very popular Web browsers are Internet Explorer from Microsoft and Google Chrome from Google which is shown in Fig.7-3. It can also be opened in other languages, e.g. Urdu as shown in Fig.B-7-3.

Fig.B-7-3 Google Urdu Web browser

Web Server

A Web server is a computer that makes Web pages available through the Internet as shown in Fig.7-4. Web servers are used to host websites, data storage and also for running applications. Web servers deliver HTML documents when an Internet user types a URL of a website in the browser.

Any computer can be turned into a Web server by installing server software and connecting the computer to the Internet.

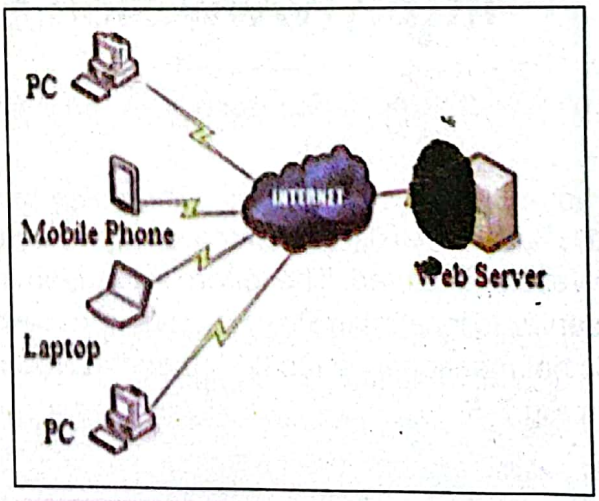


Fig.7-4 Web Server on the Internet

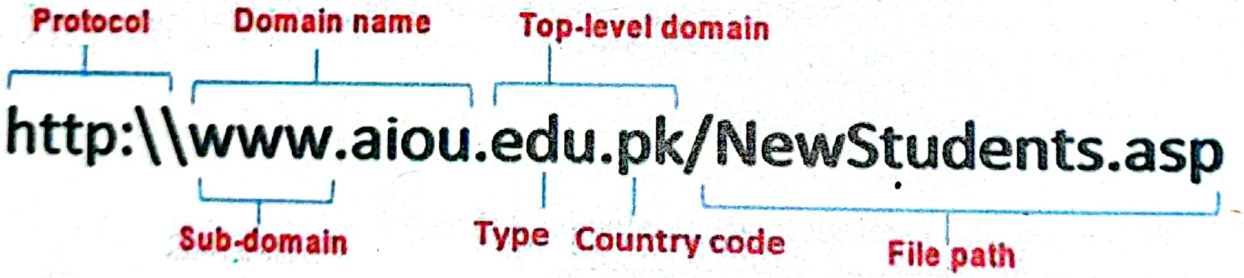
Uniform Resource Locator

Uniform Resource Locator (URL) is the address of a file or resource on the Web. When the user types the URL of a website in the browser it retrieves the Web pages of that site.

It consists of three parts.

- **Protocol:** The first part, **http://** is known as protocol. It tells the server what type of file is being requested.
- **Resource name:** It is the address of a specific computer where the website is located. It consists of three parts, separated with dots (.) between them.
    - **Domain name** – This is the name of the website. This is the name that the browser uses to check with the web server whether this site exists or not.
    - **Top-level domain** – The **.com** is referred to as the Top level domain (TLD). This is the name the browser will use to resolve the location of the requested site. Most common TLDs are .com, .org, .net etc. Some sites have another part next to the top level domain for example .pk (for Pakistan), .uk, .us etc. This is called country-code top-level domain (ccTLD). They are specific to each country.
- **File path:** It links to a specific page or resource in the website.

Different parts of a URL are explained with the following URL.



In this URL, **www.aiou.edu.pk** is the Resource name of the Web server on which the Website is stored. The letters **edu** mean it is an educational website and **pk** means the Web server is located in Pakistan. **NewStudents.asp** is file name given to file path. If a file name is not mentioned in the URL then the **Home** page of the website will open. This URL is shown in Fig.7-5.

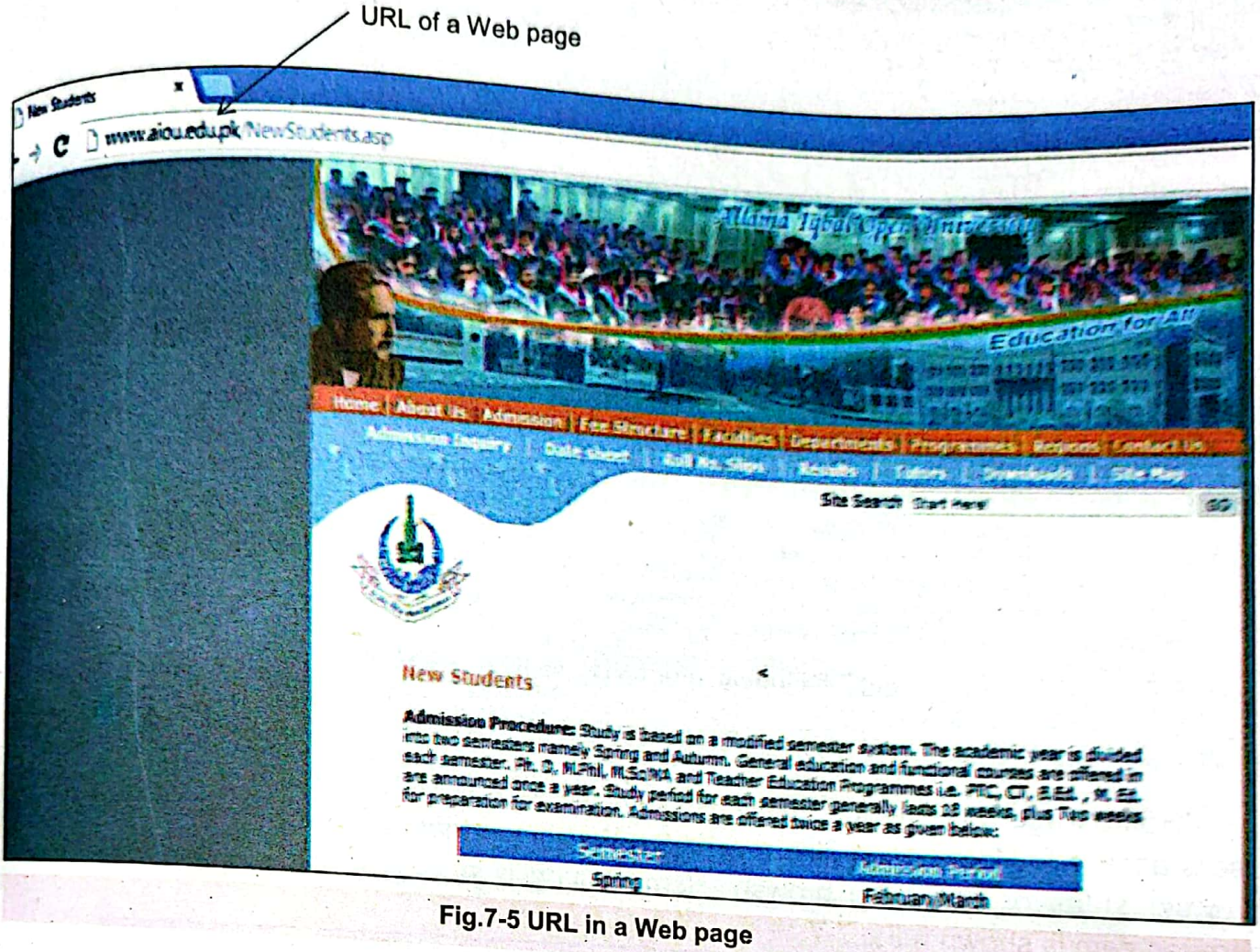


Fig.7-5 URL in a Web page

Search Engine

A search engine is a website or software that allows people to find information on the World Wide Web.

Finding exactly what the user is looking for is not easy with billions of Web pages on the Web. Therefore, search engines have been designed to help users find specific information on the Web.

Users type in one or more keywords in a search engine. The search engine will look for matching websites from all over the Web. User will see the total number of matches found and then the first ten sites that most closely match the keywords. The information shown for each website includes a title and a brief description. To display the next ten sites, the user clicks a button labeled Next Results, Next Page or a similar button at the bottom of the page. If the user wants to open any site, he just clicks on the hyperlink.

Most popular search engines are Yahoo! and Google. Finding information using a search engine is shown in Fig.7-6.

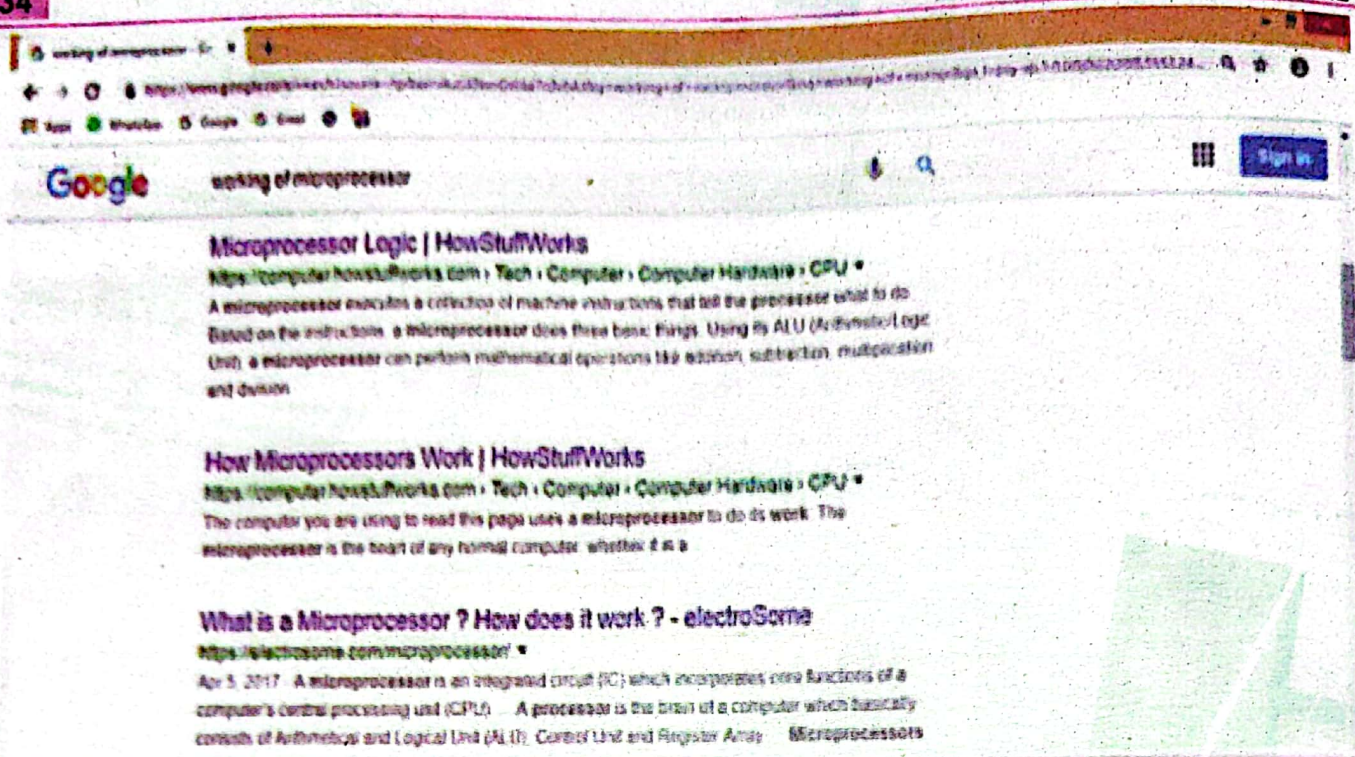


Fig.7-6 Finding information using a search engine

Home Page

Home Page refers to the main/first Web page of a website that opens in a browser when users access it. Home page also means the Web page that automatically loads when a Web browser starts or when the browser Home button is pressed. Home page of the website zameen.com is shown n Fig.7-7.

Fig.7-7 Home page of a website

Web Hosting

Web hosting is a service that uploads a website on a Web server and makes it available for computer users. It makes the website running on a computer all the time that is connected to Internet. To host a website a Web server and a permanent connection to the Internet is required. It also requires website administration such as managing and configuring a Web server and virus protection.

Computer users' first design Web pages on their computer and test it to ensure they work properly. When Web pages are ready they are uploaded on a Web server to make them available for others.

There are companies that provide Web hosting service. These companies provide 24 hour support and online control for managing the website.

7.1.2 TYPES OF WEBSITES

There are a large variety of websites on the Web, each providing a particular type of service. Most popular types of Web sites are discussed here.

Web Portals

Web portal is a website that offers a large variety of services. These include online shopping malls, news, stock prices, e-mail, search engines, etc. Web portals function as a point of access to information on the Web. For example, a school Web portal delivers information about the school's historical background, admission requirement, school curriculum, tuition fees structure, school news, student results, etc., in a unified way. Web portal of National University of Sciences & Technology (NUST) is shown in Fig.7-8

Fig.7-8 Web portal of National University of Sciences and Technology

News Websites

News websites provide information about current events and opinions. These sites publish news stories and let their visitors' voice be heard. These sites provide their visitors a way to get their thoughts and views published. Very often at the end of news stories, visitors are asked to share their experience or knowledge about the topic. Therefore, a link for the readers comment is provided for feedback.

Some examples of news websites are **www.paktribune.com**, **www.dailytimes.com**, **www.thenews.com.pk**, **www.pakobserver.net** and **www.nation.com.pk**. The News website is shown in Fig.7-9.

Fig.7-9 The News website

Informational Websites

Informational websites provide information on any topic in the form of text, graphics, sound and videos. For example, **www.wikipedia.org** is an informational website that provides information on thousands of articles. It allows users to contribute and edit articles as well. As another example, **www.ask.com** is another informational website that provides information on a large variety of topics including arts and humanities, automotive, animals, business, computer and literature, beauty and personal care, health, real estate, education, etc. This website is shown in Fig.7-10.

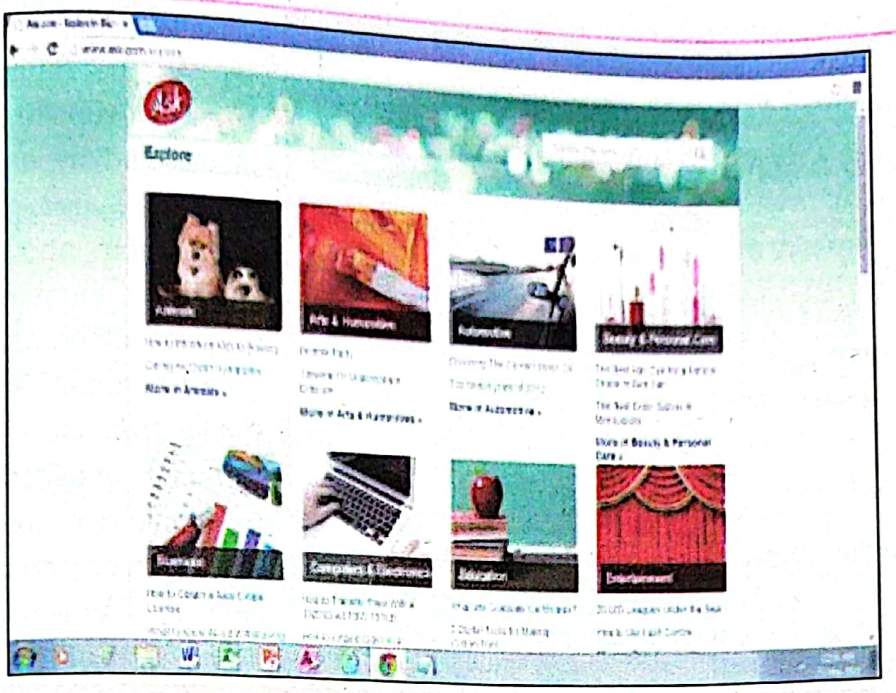


Fig.7-10 The www.ask.com informational website

Educational Websites

Educational websites are created for educational purpose. These sites contain animation, slide presentations and tutorials to educate people on various topics. Information is presented in a very well organized way. The purpose of any educational website is to impart knowledge to people who are looking for better understanding of a topic and pursue knowledge.

Some examples of Pakistani educational websites are **www.ilmkidunya.com**, **www.pknotes.com, www.knowledgepk.com**, and **www.sabaq.pk**.

The home page of educational website **www.knowledgepk.com** is shown in Fig.7-11.

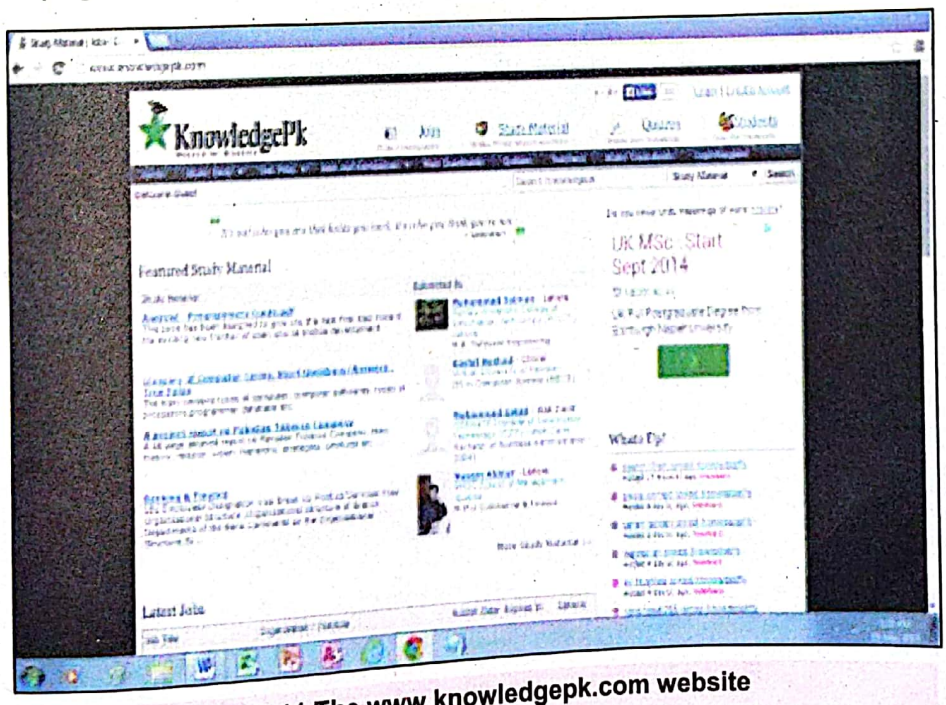


Fig.7-11 The www.knowledgepk.com website

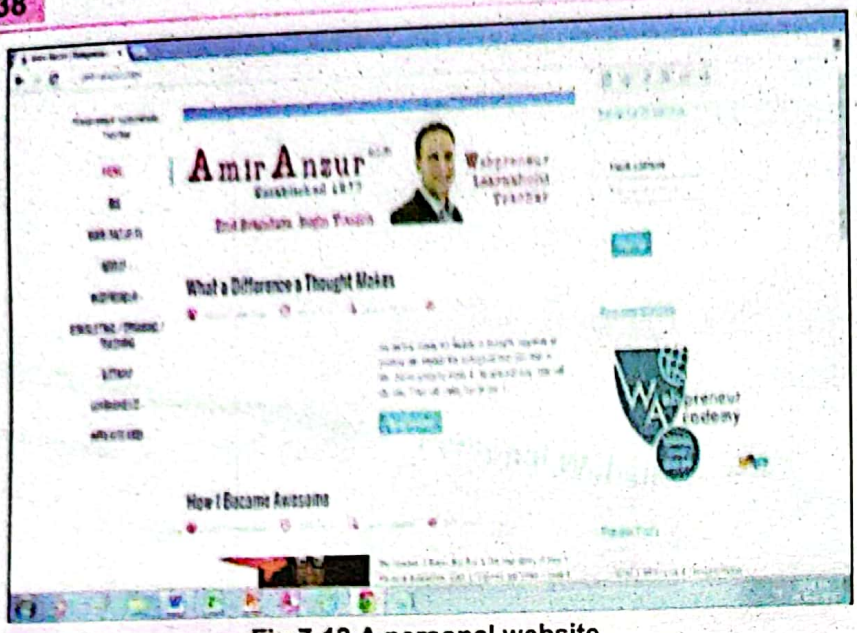


Fig.7-12 A personal website

Personal Websites

As the name suggests, a personal website is created and maintained by an individual for personal use. It contains information about a person's interests, hobbies, etc. The purpose of personal sites is to share personal information with family members and friends. Personal websites are also open for public and anybody can visit and leave comments. A personal website is shown in Fig.7-12.

Business Websites

Business websites provide facilities to maintain business relationships and selling information, services and commodities via Internet. These sites facilitate exchange of business documents, such as orders or invoices between suppliers and customers. Services provided by business sites include sale of goods, provision of services, such as banking, ticket reservations and stock market transactions and even remote education. A business website for ticket reservation is shown in Fig.7-13.

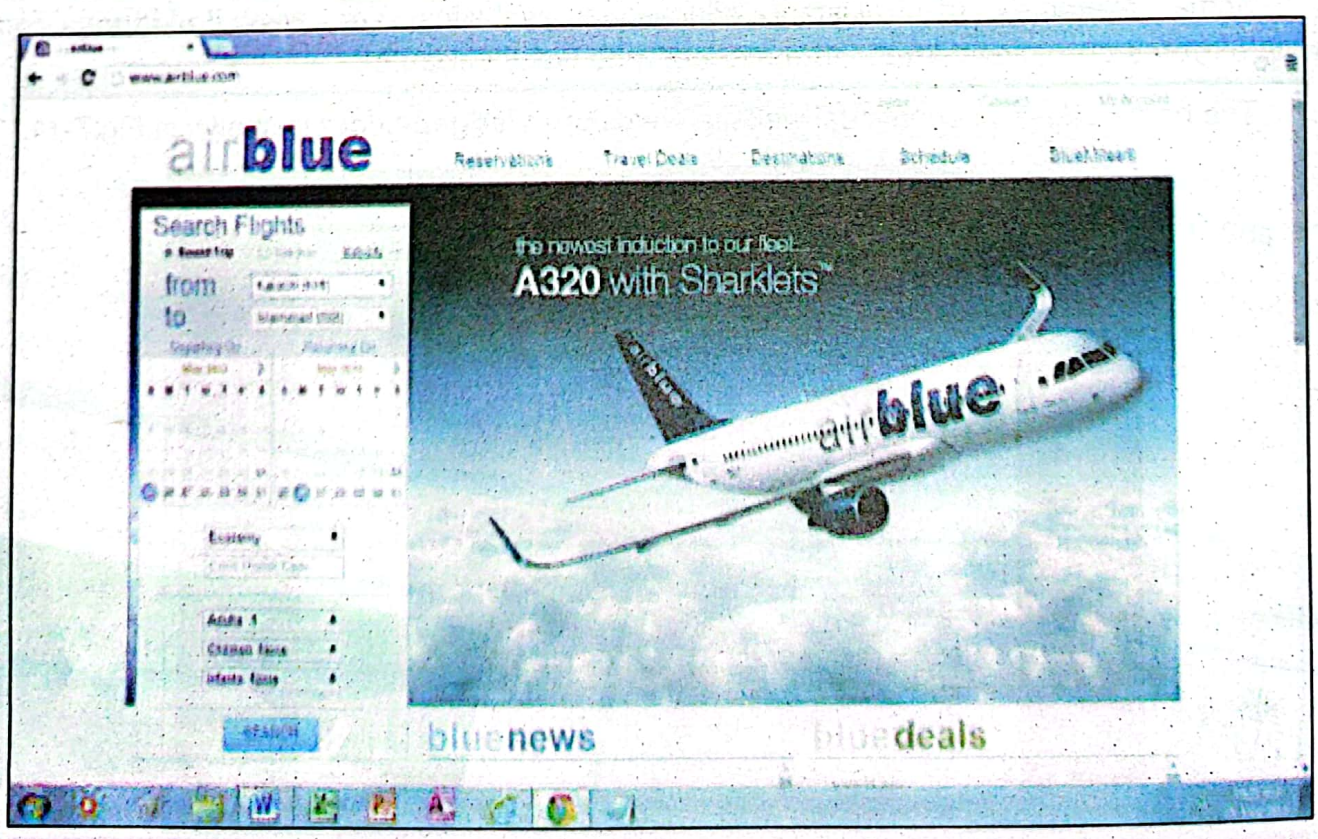


Fig.7-13 Business website for ticket reservation

Entertainment Websites

A website that provides some form of entertainment to computer users is known as entertainment website. Entertainment websites include sports, music, movies, radio, television, computer game, comedy, fashion and theater websites. These websites are created by those people who find enjoyment in providing information about people to visitors that they never knew before and to reach people who have common interests.

Some examples of entertainment websites are **www.youtube.com**, **www.fashioncentral.pk**, **www.hamariweb.com**, **sports.ptv.com.pk**, **www.reviewit.pk**, **www.zemtv.com** and **www.radio.net.pk**.

The sports website **sports.ptv.com.pk** is shown in Fig.7-14.

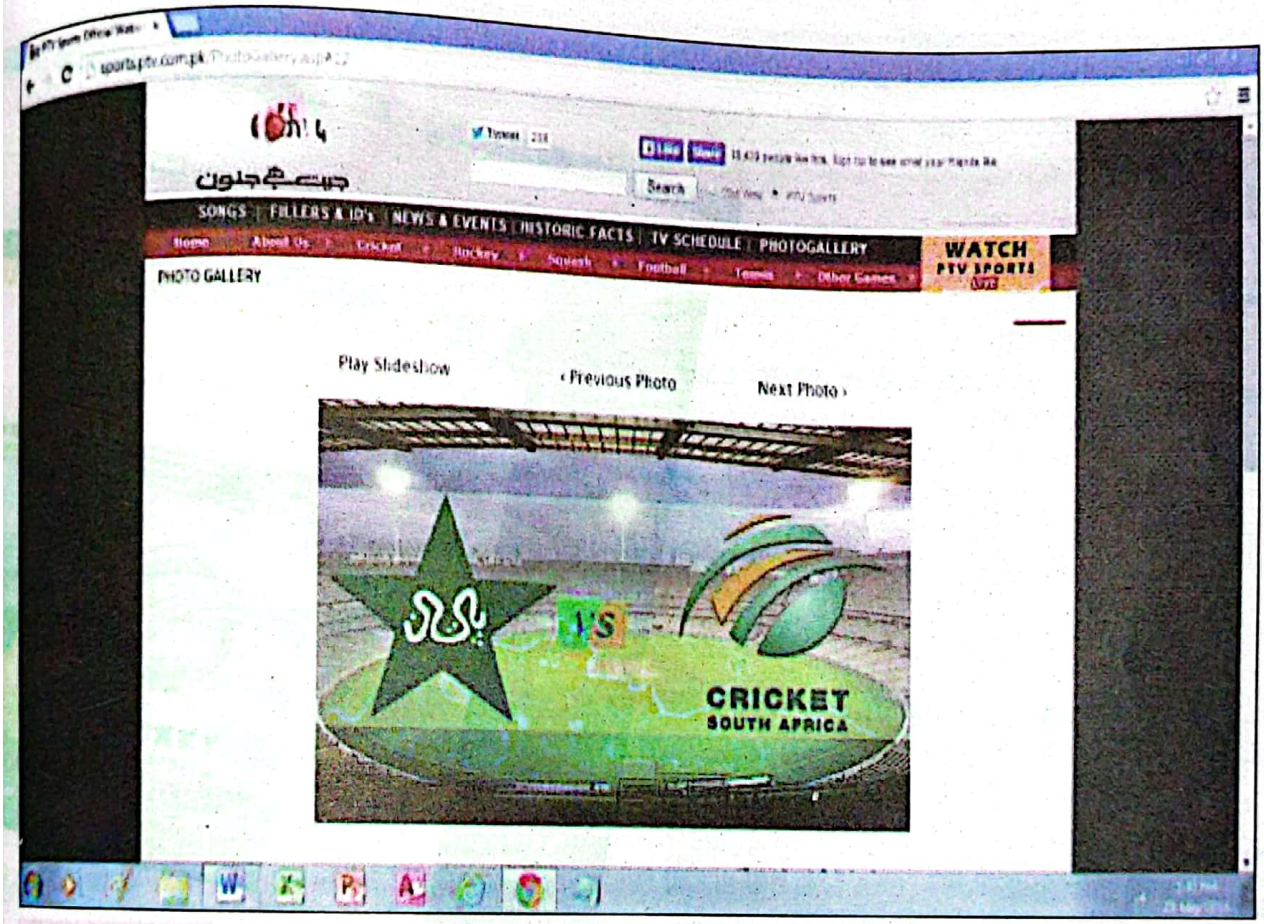


Fig.7-14 A sports website

7.2 INTRODUCTION TO HTML

HTML is a mark-up language used to create Web pages. A browser such as Internet Explorer or Google Chrome is used to read HTML document and display it on the screen as Web pages.

7.2.1 HYPERTEXT MARK-UP LANGUAGE

HTML stands for Hypertext Mark-up Language. It is called mark-up language because it uses mark-up tags that tell the Web browser how to display the Web page. It is the language of Internet's World Wide Web. Websites and Web pages are written in HTML. It is used to create hypertext documents that bring together text, pictures, sounds, video clips and links all in one place. HTML files are plain text files, so they can be created using a simple editor such as Notepad or Wordpad.

7.2.2 CREATING AND DISPLAYING HTML DOCUMENT

Creating the First HTML Document

Open the **Notepad** program and type the text shown in Fig.7-15.

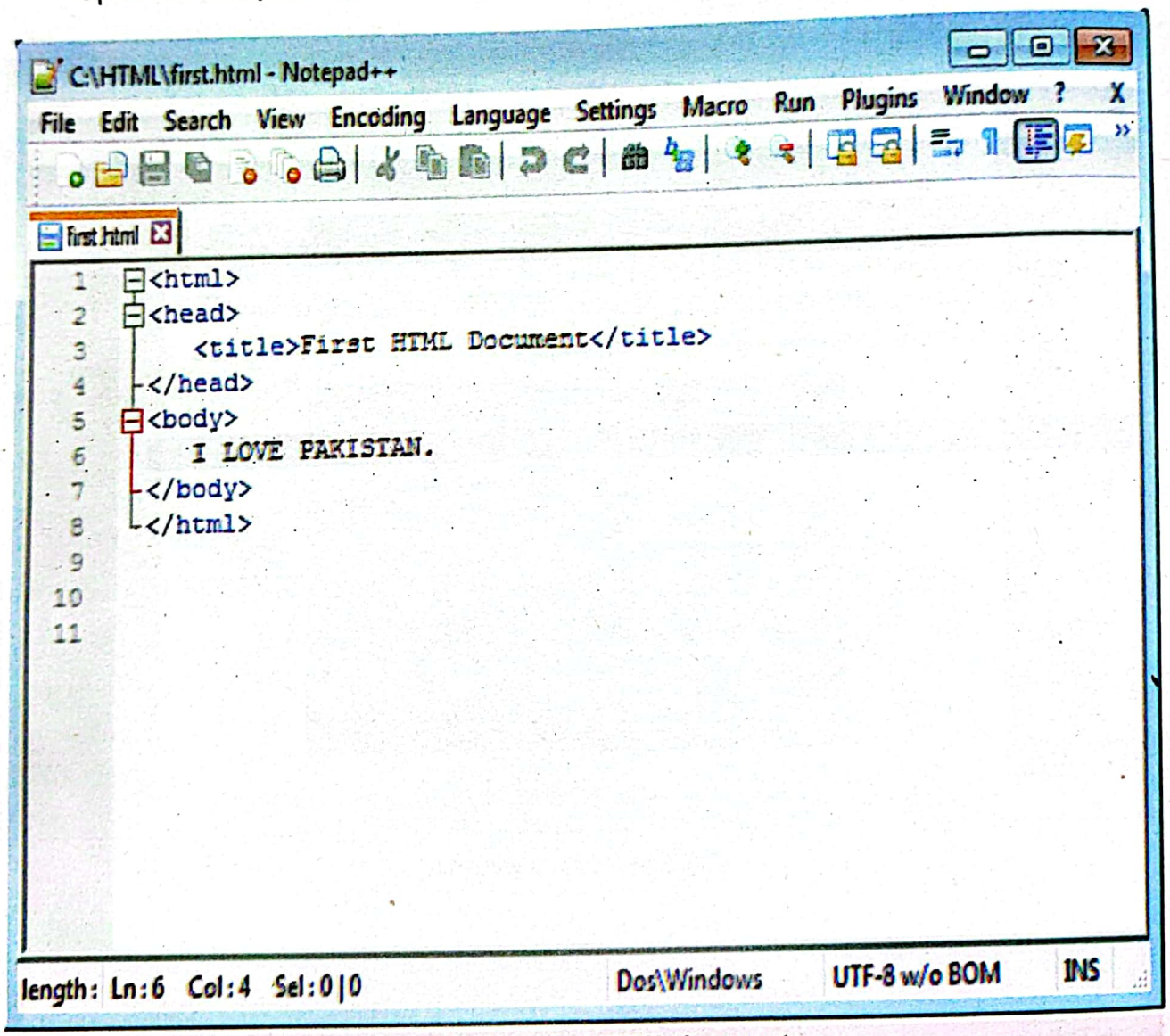


Fig.7-15 Creating a HTML document

Now to save your first HTML document, open the File menu and select **Save As...** and give it the name first.html.

Displaying the HTML document (Web page)

To open the first.html document in the browser window, go to the location where you saved it. Double click on it to open. The browser window will display it as shown in Fig.7-16.

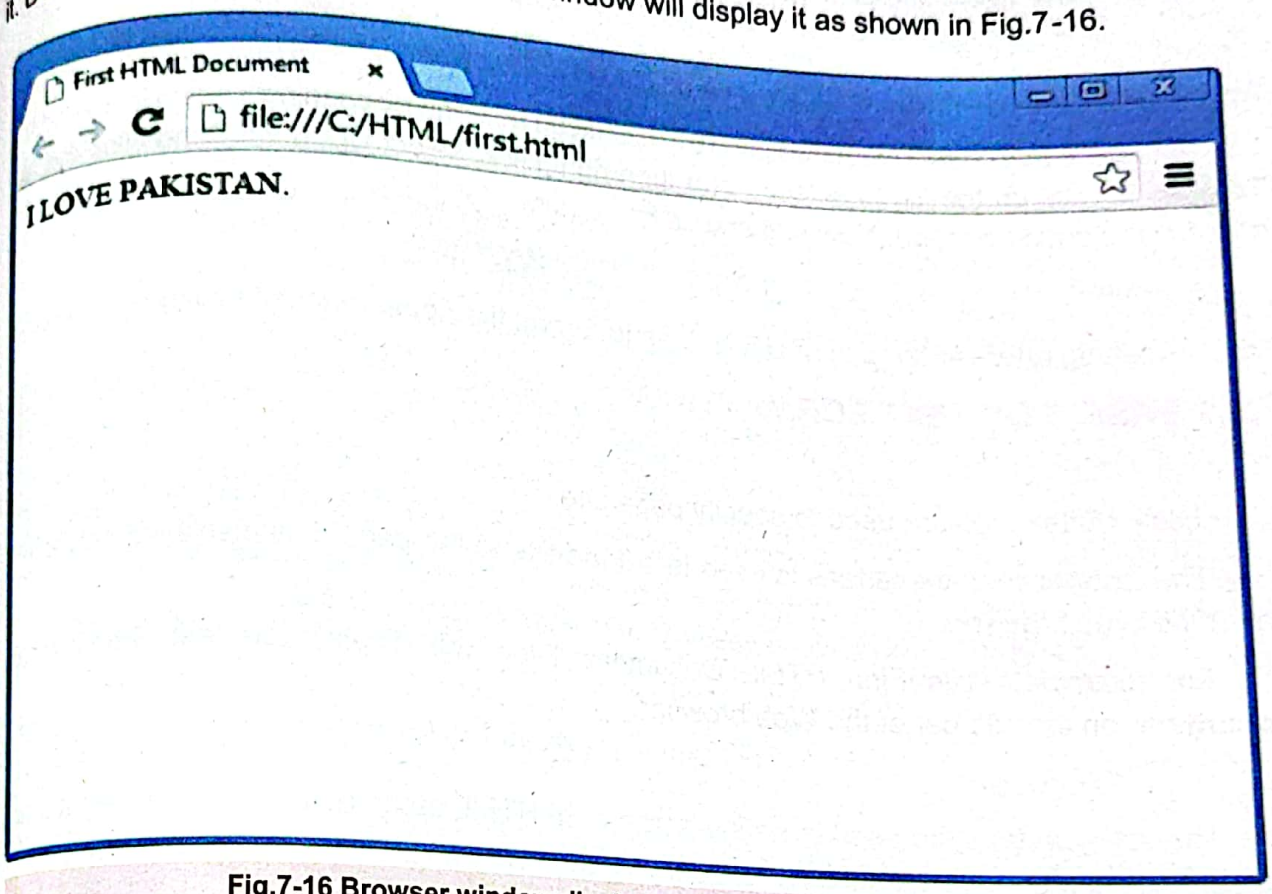


Fig.7-16 Browser window displaying the first.html document

7.2.3 TAGS USED TO MARK-UP HTML ELEMENTS

An HTML tag is a command or code that specifies how a Web page is formatted. HTML documents consist of text files that contain HTML elements. HTML elements are defined using HTML tags. HTML tags are surrounded by the two characters < and > and generally they come in pairs, such as <head> and </head>. The text between these two tags is known as element content. The first tag is the start tag and the second tag is the end tag. HTML tags are not case sensitive, so the user can write them in upper-case or lower-case letters. Lower-case letters will be used throughout this unit.

7.2.4 THE HTML, HEAD AND BODY TAGS

The following tags are used to mark-up the HTML elements in the first.html document.

<html> </html> Tags

The first tag in the html document is <html> that indicates the start of the HTML document. The last tag is </html> that tells the browser that this is the end of the HTML document.

<head> </head> Tags

It is used to give title to the Web page.

<body> </body> Tags

Anything typed inside the body tags will be displayed in the browser window as shown in Fig.7-16.

If there is any change required in HTML file, it can be done by opening it again in text editor. To open it, click on the file to select it and then right click, select **Open with** and click the text editor in the shortcut menu. Now edit and save it again.

7.3 TEXT FORMATTING

Text formatting refers to the use of HTML tags to format the appearance of text in a Web page.

7.3.1 BASICS OF TEXT FORMATTING

Specifying a Page Title

The <title> </title> tags are used to specify page title.

The text between these tags is used to set the title to the page. It is displayed on the title bar of the Web browser.

For example, <title>First HTML Document</title> will display the text, **First HTML Document,** on the title bar of the Web browser.

Creating a Paragraph

The tags are used to define paragraph. HTML automatically adds an extra blank line before and after a paragraph.

Inserting Line Breaks

The <br> tag is line break tag. It is used to end a line wherever it is placed and it does not have a closing tag.

Inserting Spaces

Very often, spaces are needed in HTML documents. If the user inserts more than one space anywhere in a document, the browser will show only one space, rest of the spaces will be truncated. If the user wants to have many spaces in a HTML document then the   character entity must be used. Some characters have special meaning in HTML, like   (non-breaking space) and <, these are known as character entities.

Adding Headings/Sub-headings

There are six heading tags, <h1></h1> to <h6></h6>. The <h1></h1> tags are used to specify the largest heading and <h6></h6> tags specify the smallest.

The HTML document in Fig.7-17 demonstrates how to use the above mentioned tags in a Web page.

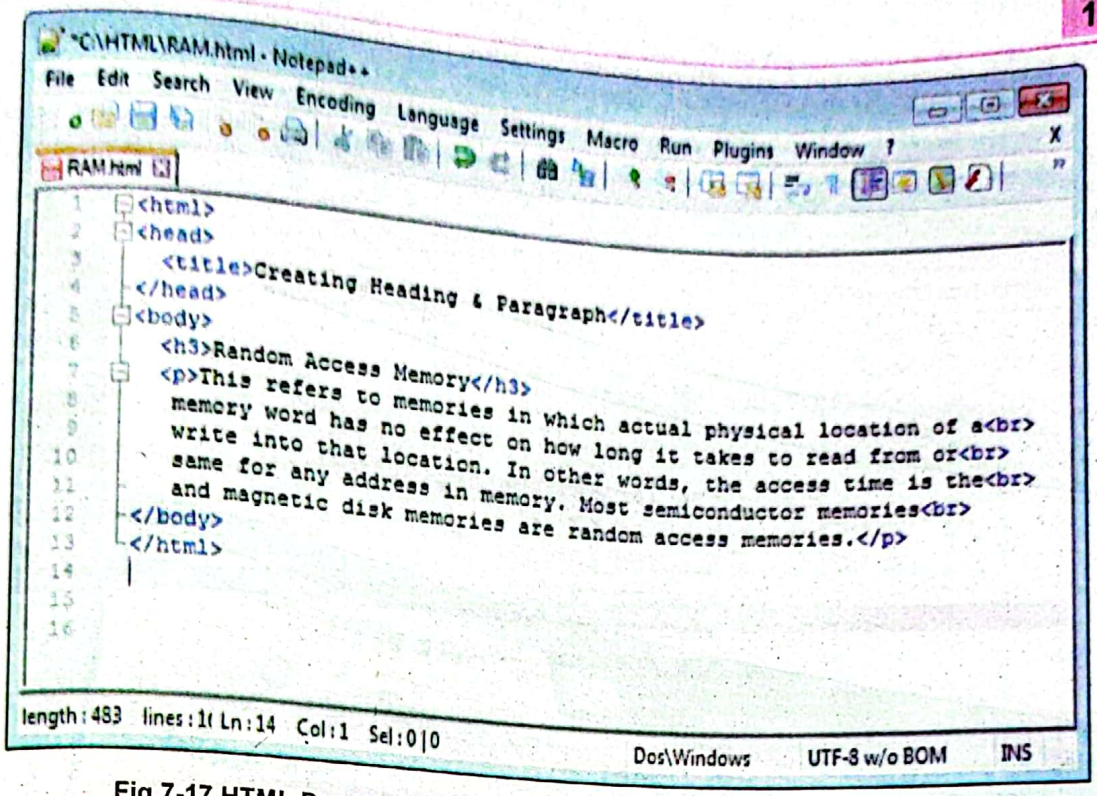


Fig.7-17 HTML Document to demonstrate the use of basic tags

The browser window will display it as shown in Fig.7-18.

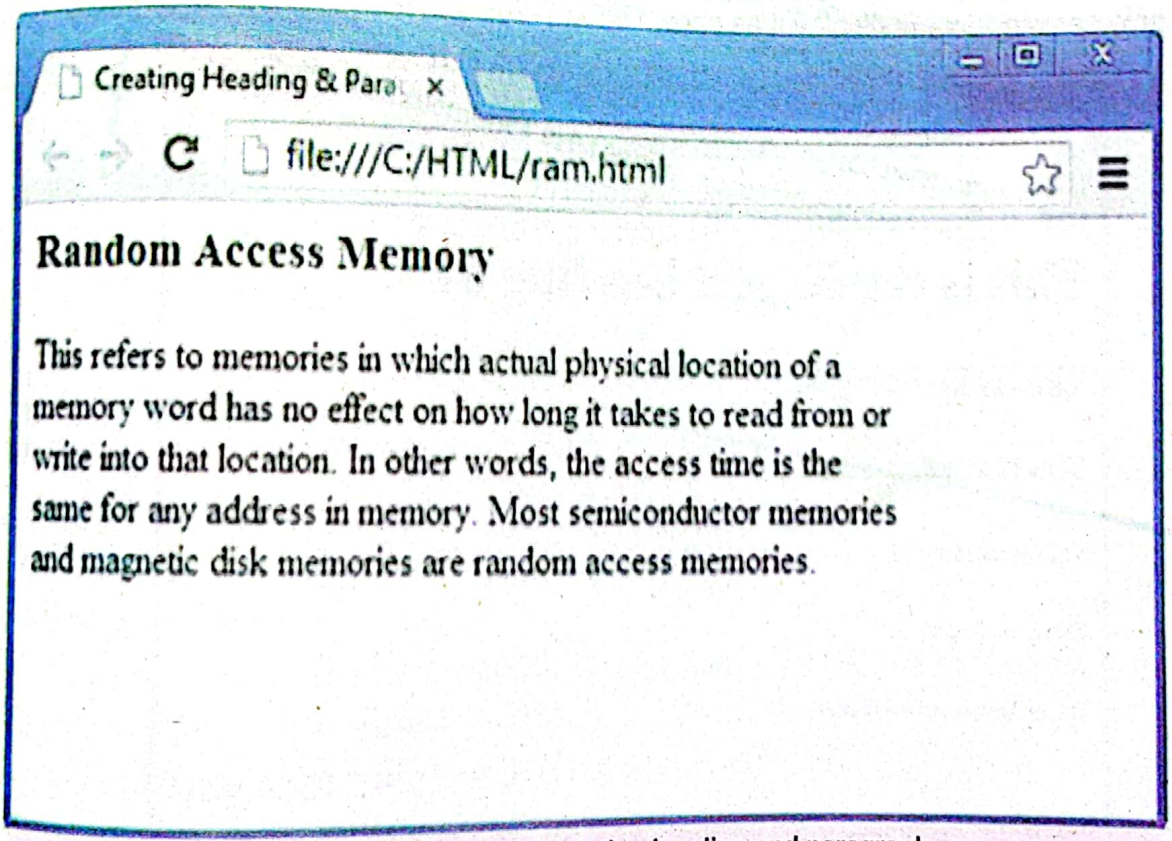


Fig.7-18 Browser window showing heading and paragraph

The HTML document in Fig.7-19 demonstrates the use of all the heading tags.

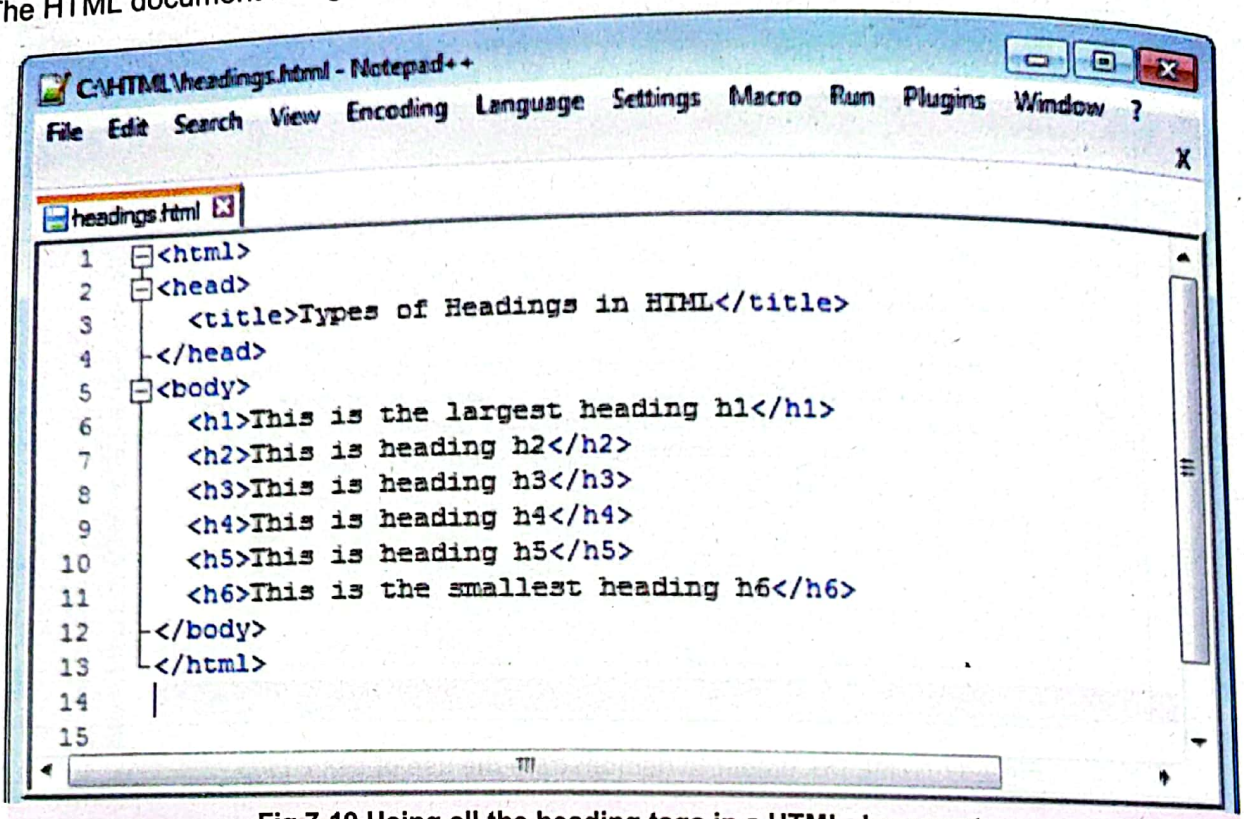


Fig.7-19 Using all the heading tags in a HTML document

The browser window will display it as shown if Fig.7-20.

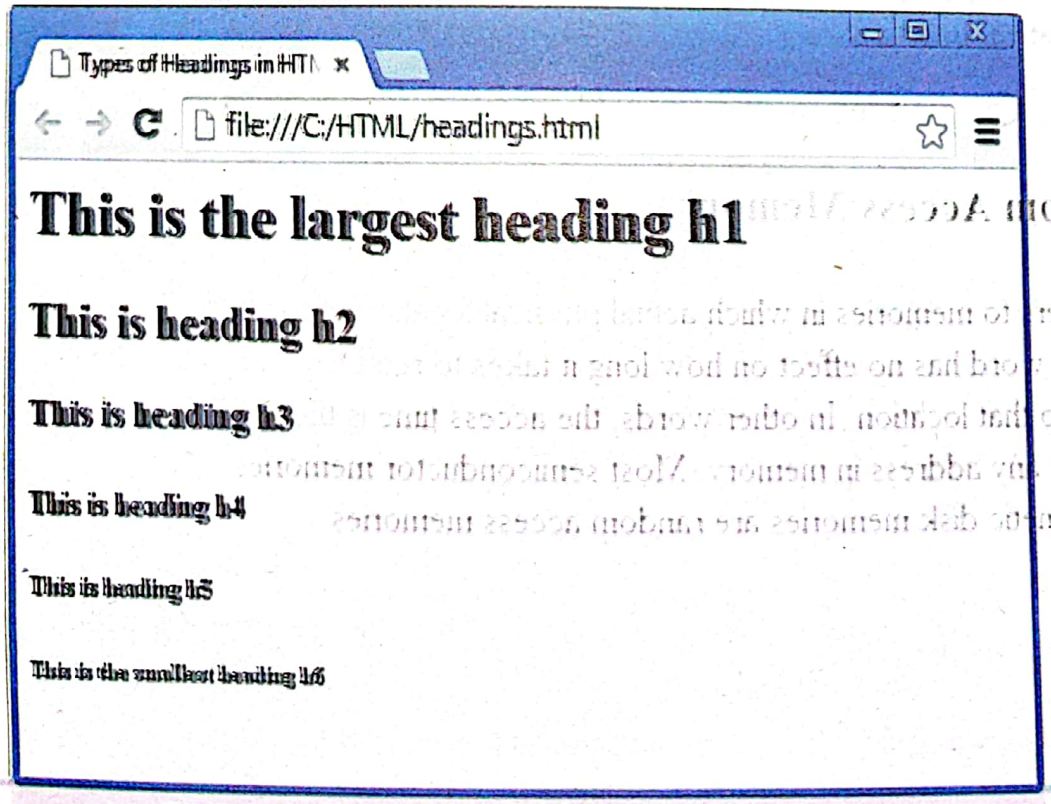


Fig.7-20 Browser window displaying various headings

7.3.2 TEXT FORMATTING TAGS

Text formatting tags are used to format the text in HTML document. Some commonly used text formatting tags are described below.

- **Bold **

  These tags will make the text bold that is within the tags.

  For example: Chapter 5 Output Devices

  Result: **Chapter 5 Output Devices**

- **Underline <u></u>**

  These tags will underline the text that is within the tags.

  For example: <u>Please Note:</u>

  Result: Please Note:

- **Italic **

  These tags are used to make the text italic that is within the tags.

  For Example: I Love Pakistan

  Result: *I Love Pakistan*

- **Strike-out <strike></strike>**

  These tags will put a line right through the center of the text that is within the tags. This is known as strike-out.

  For Example: <strike>Obsolete Computer Devices</strike>
  Result: ~~Obsolete Computer Devices~~

- **Superscript **

  These tags are used to convert the text to superscript that is within the tags.

  For example: X_Y
  Result: X^{Y}

- **Subscript **

  These tags are used to convert the text to subscript that is within the tags.

  For example: X₅
  Result: X_5

- **Center **

  These tags will make the text centered that is within the tags, the text will appear in the middle of the left and right margins.

  For example: UNIT 2 PROGRAMMING IN C
  Result:

- **Font Size **

  These tags are used to change the font size. Replace the ? symbol with a number in the range 1 to 7. One is the smallest and seven is the largest font size.

  For example: Types of Computers

  Result: Types of Computers

- **Font Color **

  These tags are used to change the color of text that is within the tags. Replace the ? symbol with color such as black, blue, brown, gray, green, maroon, orange, pink, red, white, yellow, etc.

  For example: Laptop Computer

  Result: Laptop Computer

- **Font Face **

  These tags are used to change the font face of text that is within the tags. Replace the ? symbol with font face such as arial, courier, calibri, new times roman, etc.

  For example: FORMATTING TAGS

  Result: FORMATTING TAGS

7.3.3 USING TEXT FORMATTING TAGS

The following HTML document demonstrates the use of various text formatting tags.

- **Using Bold, Underline and Italic Tags**

  Any combination of these tags can be applied to text at the same time. For example, tex can be made bold and underline or bold and italic at the same time. The HTML documer in Fig.7-21 demonstrates the use of these tags.

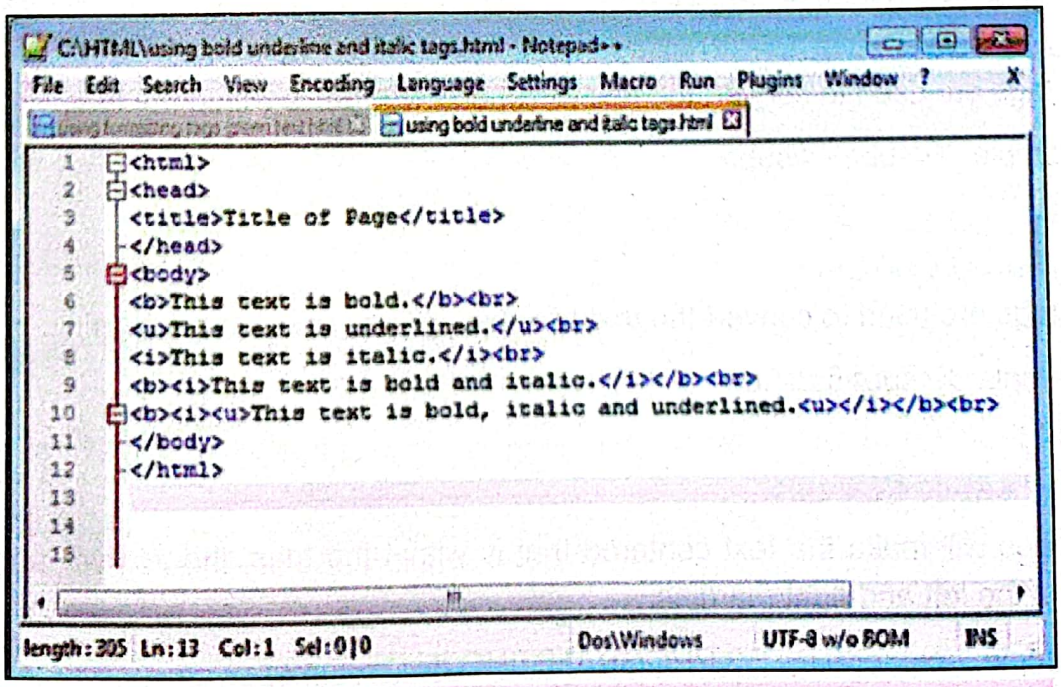


Fig.7-21 Using bold, underline and italic in HTML document

The browser window will display it as shown in Fig.7-22.

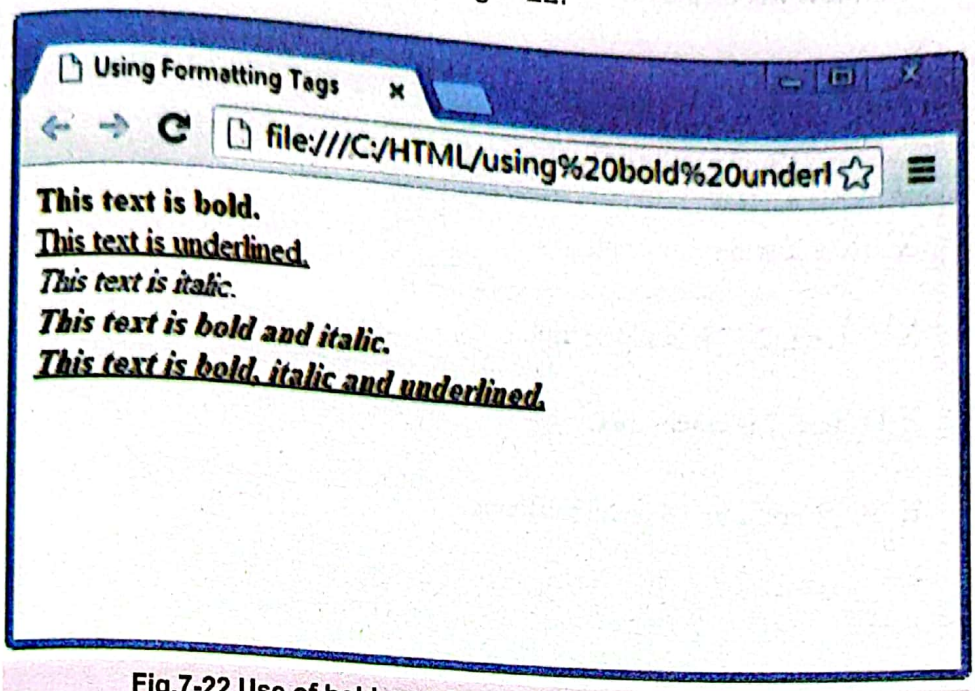


Fig.7-22 Use of bold, underline and italic tags in Web page

Using Superscript and Subscript Tags

The HTML document in Fig.7-23 demonstrates the use of superscript and subscript tags.

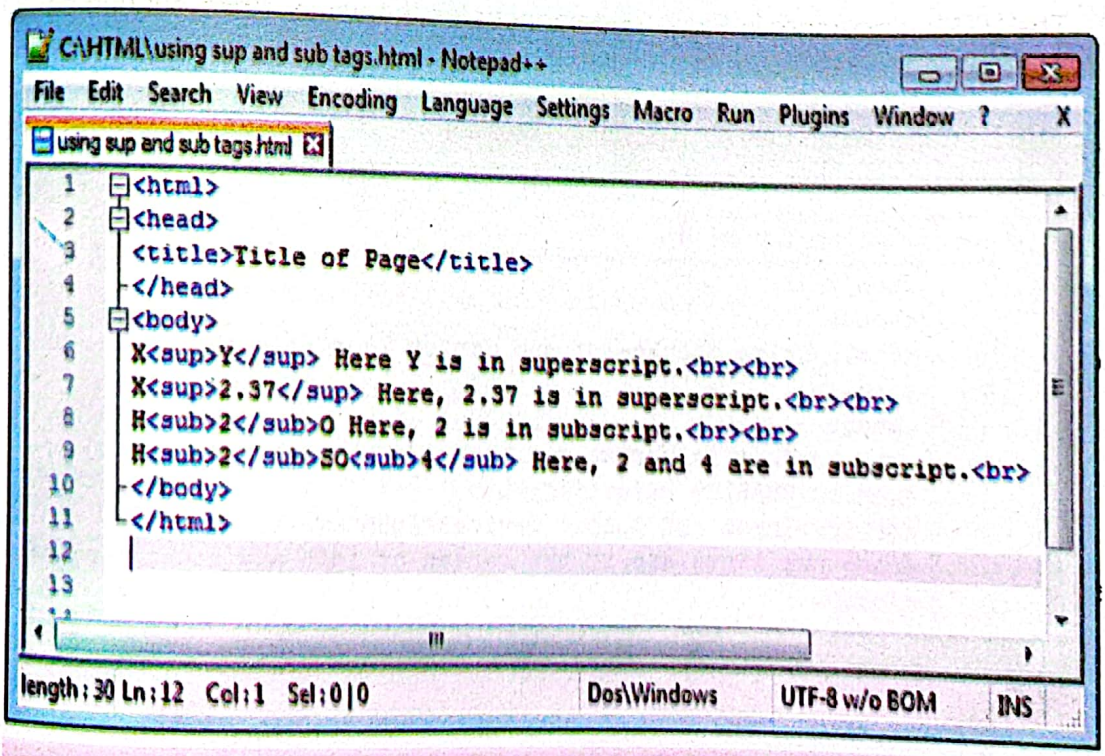


Fig.7-23 Using superscript and subscript in HTML document

The browser window will display it as shown in Fig.7-24

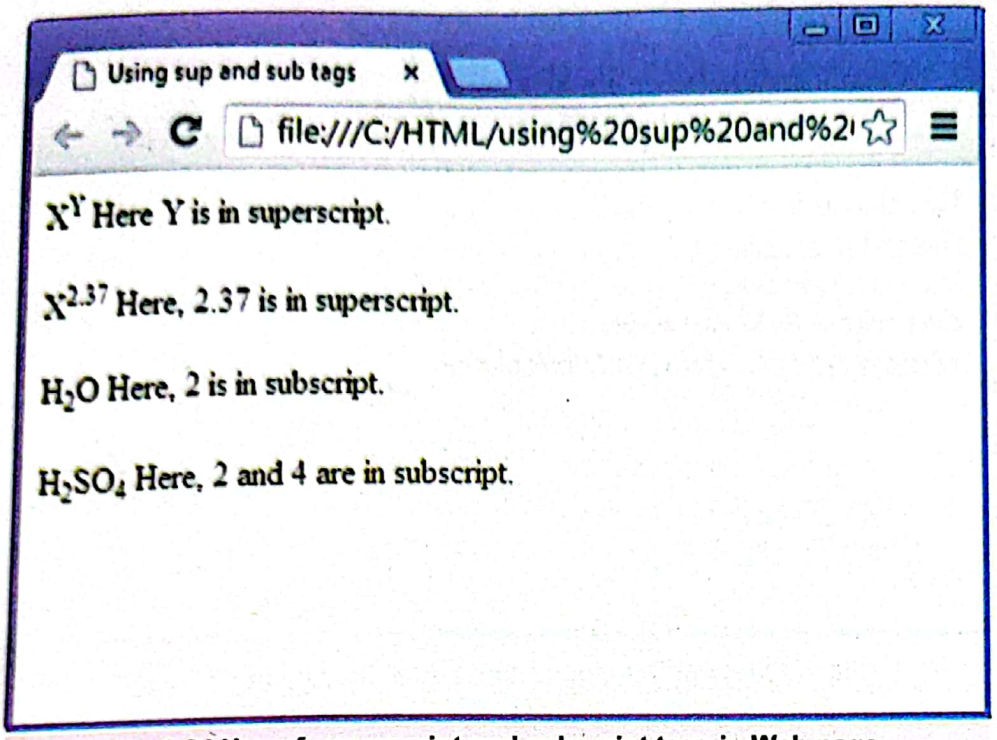


Fig.7-24 Use of superscript and subscript tags in Web page

- ## Using Strike-out and Center Tags

The HTML document in Fig.7-25 demonstrates the use of strike-out and center tags.

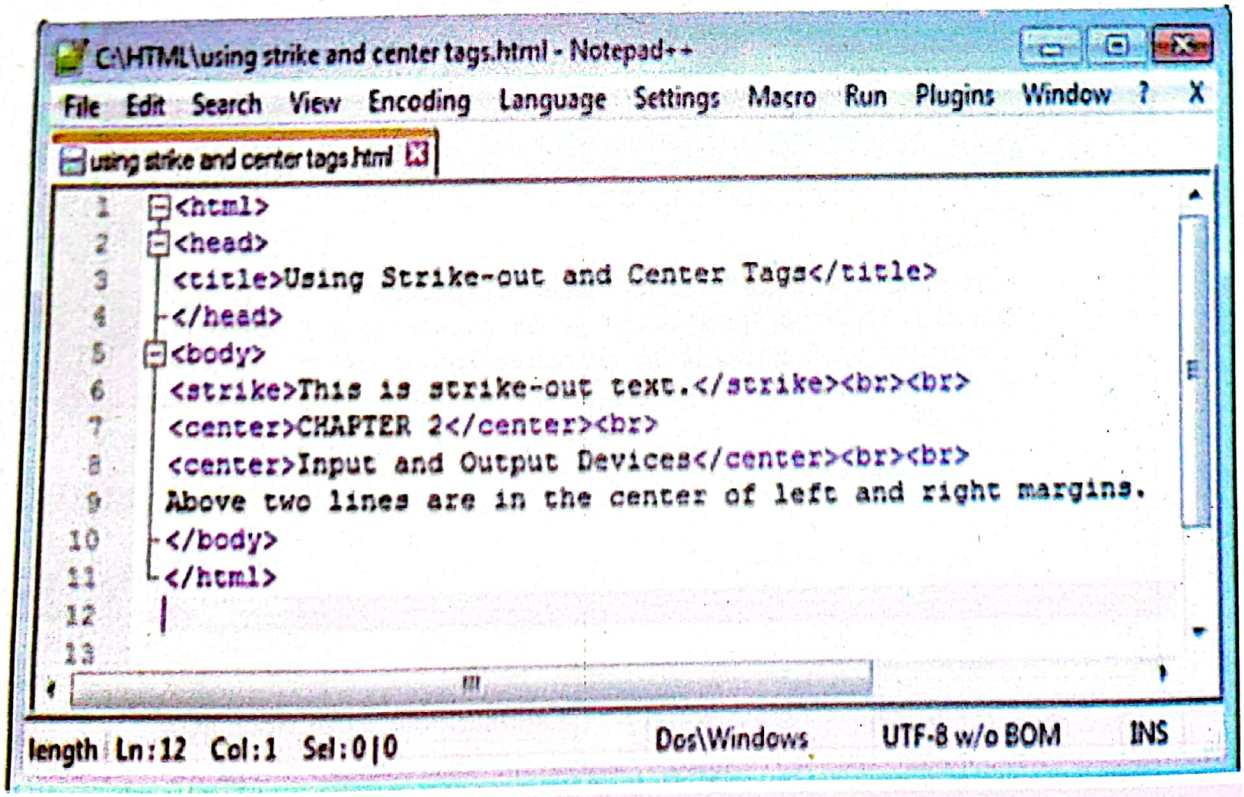


Fig.7-25 Using strike-out and center tags in HTML document

The browser window will display it as shown in Fig.7-26.

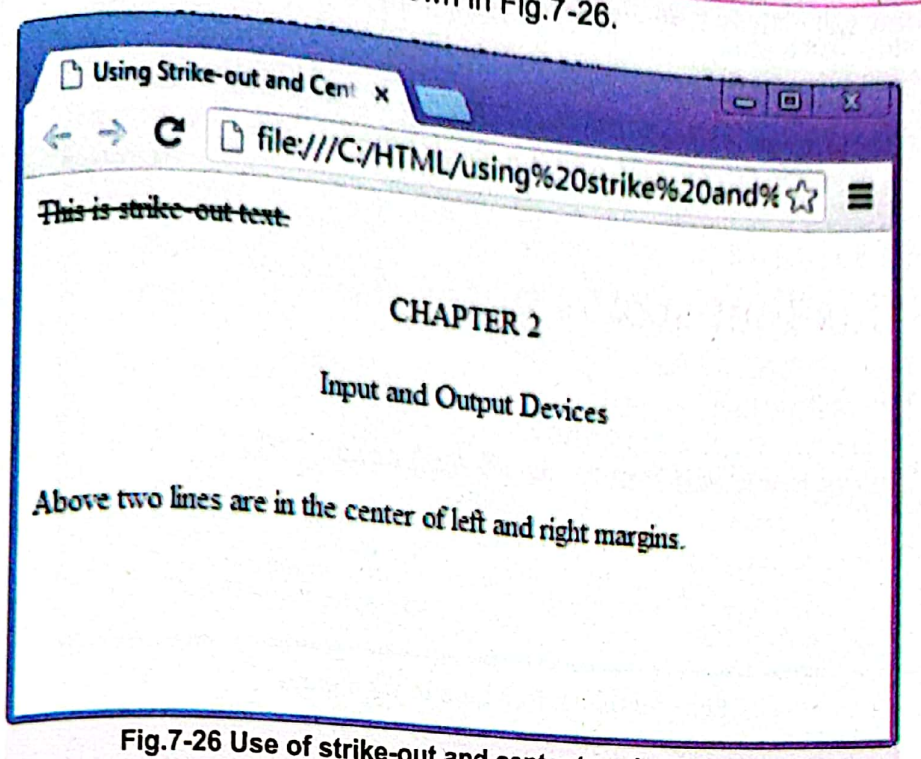


Fig.7-26 Use of strike-out and center tags in Web page

Using Font Tags

The HTML document in Fig.7-27 demonstrates the use of font tags.

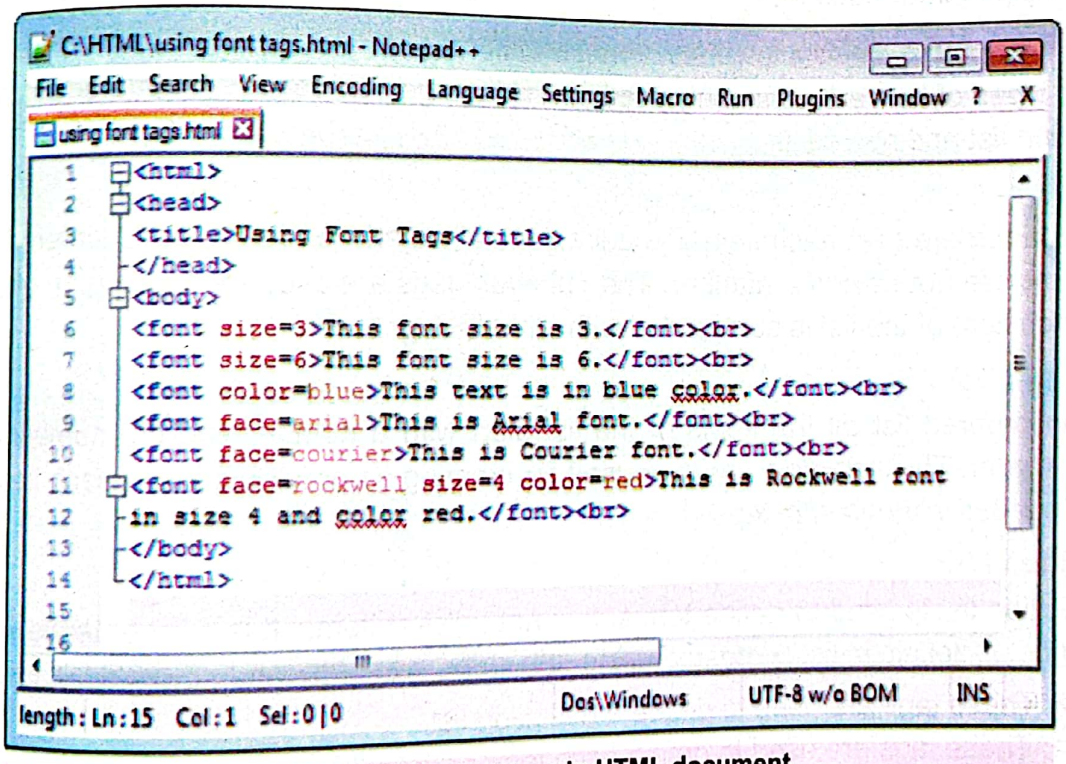


Fig.7-27 Using font tags in HTML document

The browser window will display it as shown in Fig.7-28.

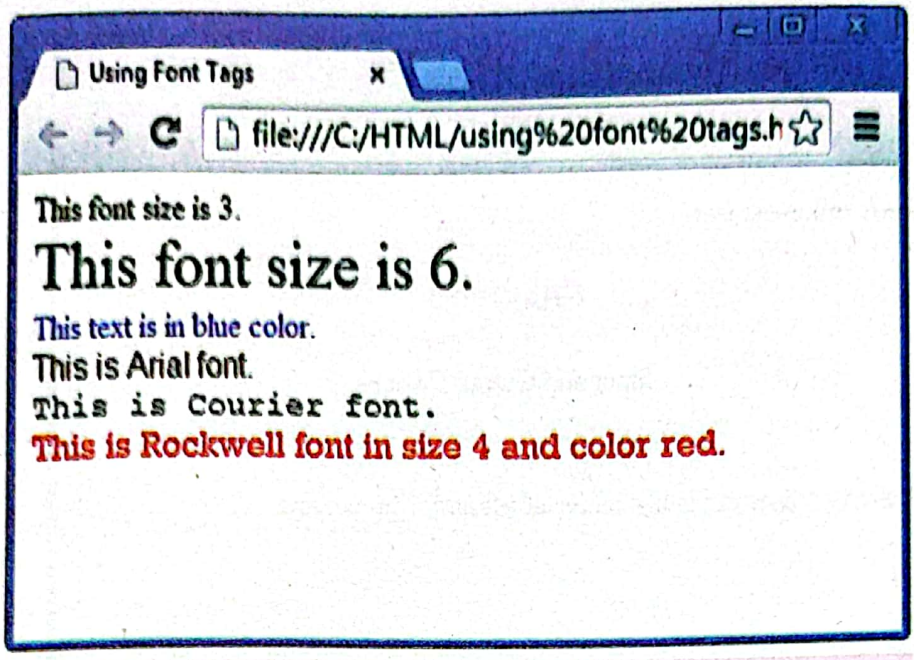


Fig.7-28 Use of font tags in Web page

7.4 CREATING LISTS IN HTML

Lists are very commonly required in Web pages. HTML provides various methods for specifying lists of information.

7.4.1 TYPES OF LISTS

Four types of lists are commonly used in HTML pages. These are unordered list, ordered list, definition list and nested list.

- **Unordered List**

In an unordered list each item of the list generally starts with a bullet. Unordered means the list items are not having a number. The tags are used for creating an unordered list and each item of the list is surrounded with tags.

- **Ordered List**

In an ordered list all the items of the list start with a number and the numbers are in ascending order. The tags are used for creating an ordered list and each item of the list is surrounded with tags.

- **Definition List**

Definition list is used to define terms. It is not a list of items. It is a list of terms with their explanations. A definition list is created using <dl></dl>, <dt></dt> and <dd></dd> tags.

<dl></dl>: These tags are used to define a definition list.
<dt></dt>: These tags are used to define each term of definition list.
<dd></dd>: These tags are used to explain each term of definition list.

Nested List

Nested list means a list within another list. We can create a nested unordered list within another unordered list. Any combination of ordered or unordered lists can be used for creating nested lists.

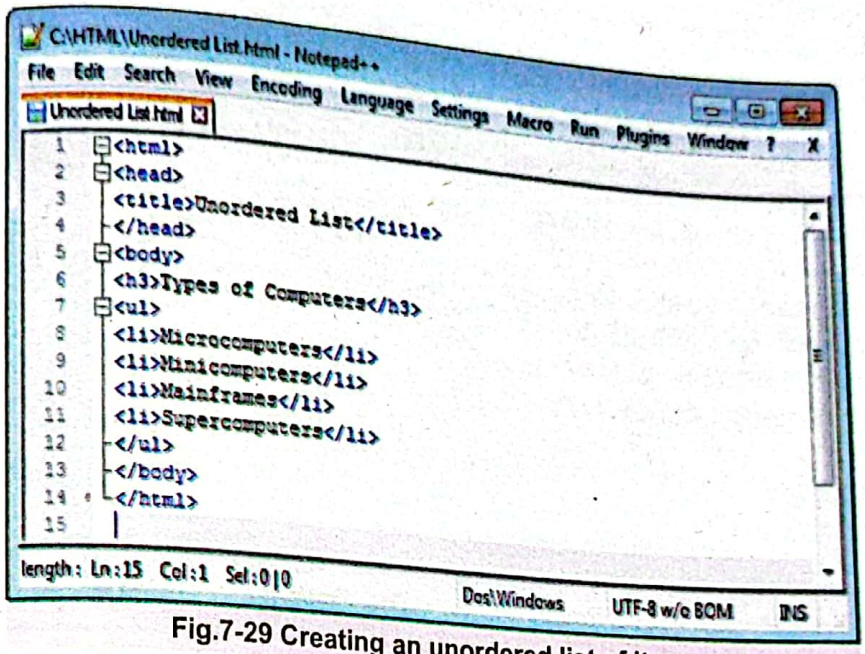


Fig.7-29 Creating an unordered list of items

7.4.2 CREATING LISTS

Creating an Unordered List

The HTML document in Fig.7-29 demonstrates the creation of an unordered list. The browser window will display it as shown in Fig.7-30.

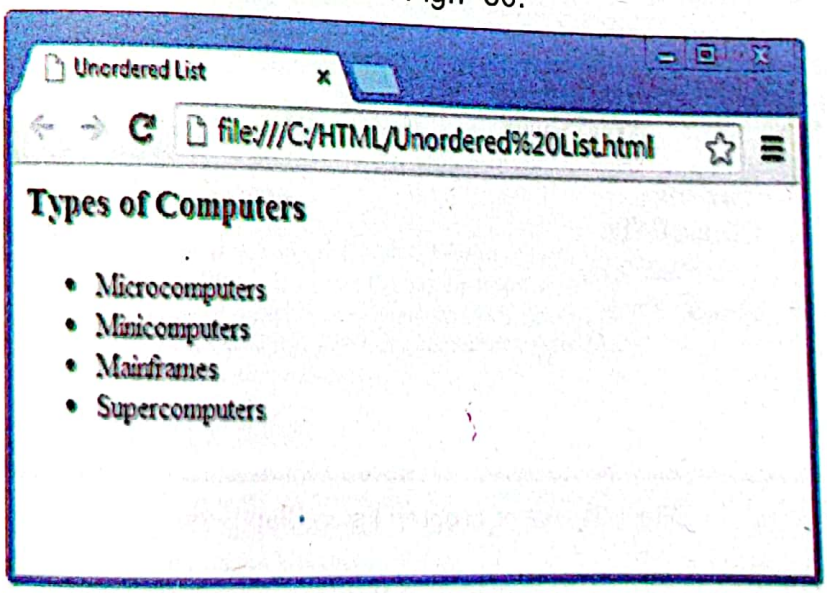


Fig.7-30 Use of unordered list in Web page

Creating an Ordered List

The HTML document in Fig.7-31 demonstrates the creation of an ordered list.

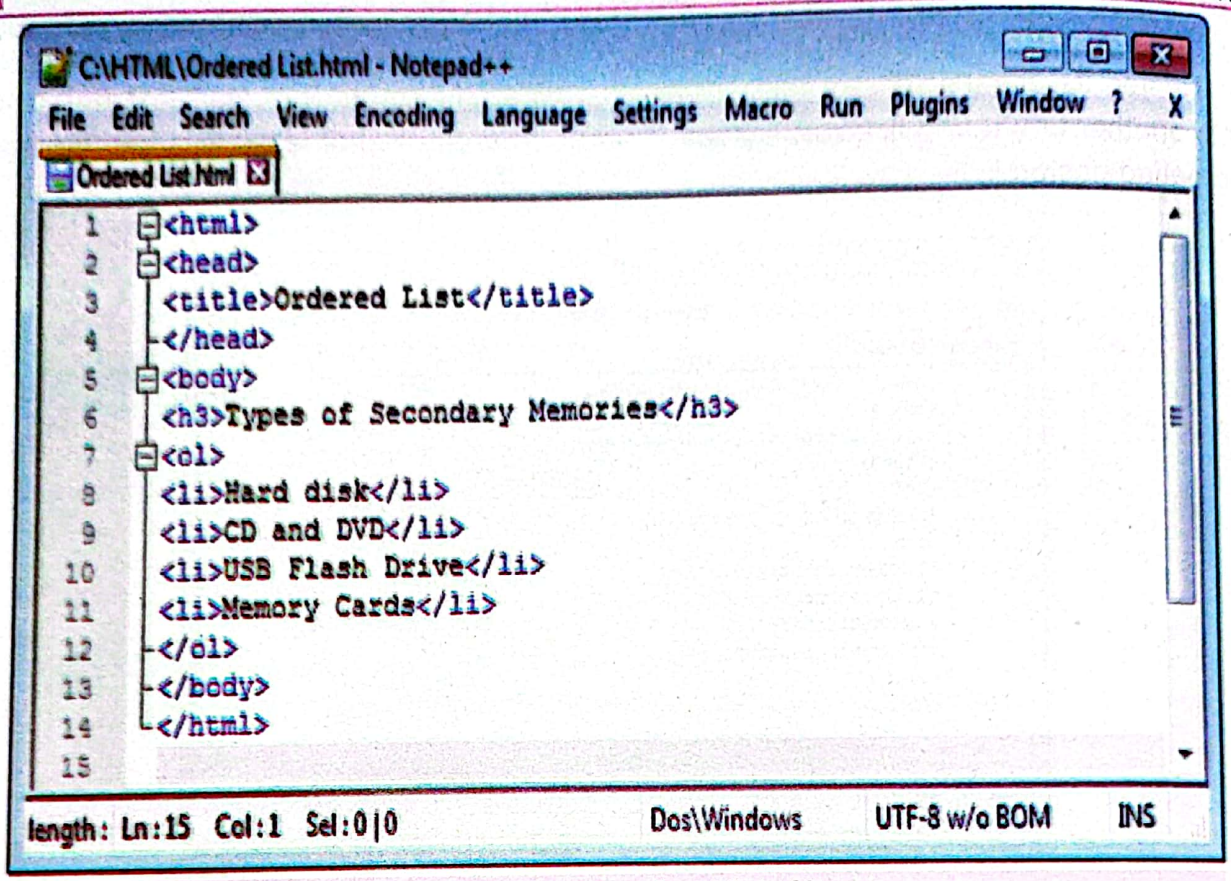


Fig.7-31 Creating an ordered list of items

The browser window will display it as shown if Fig.7-32.

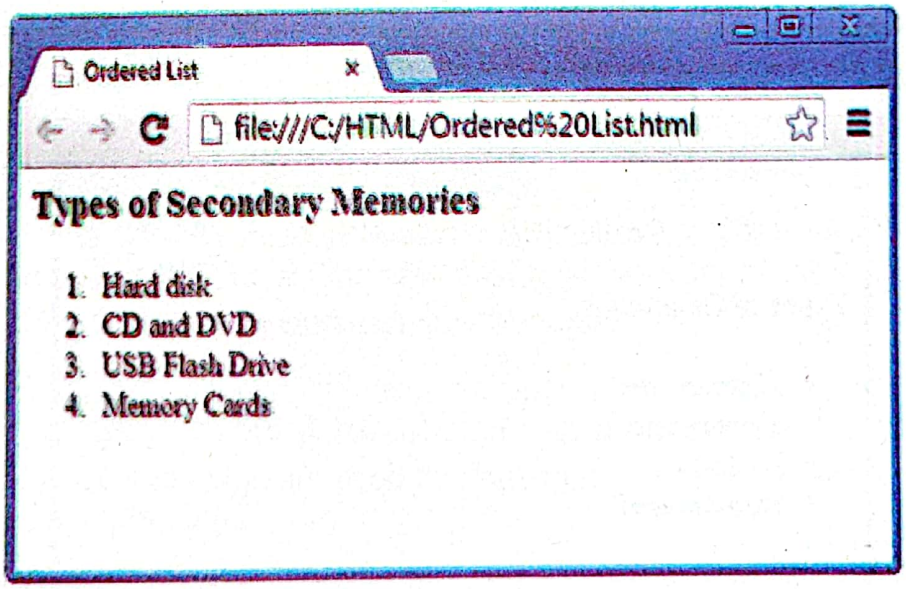


Fig.7-32 Use of ordered list in Web page

- **Creating a Definition List**

The HTML document in Fig.7-33 creates a definition list that defines local area and wide area networks.

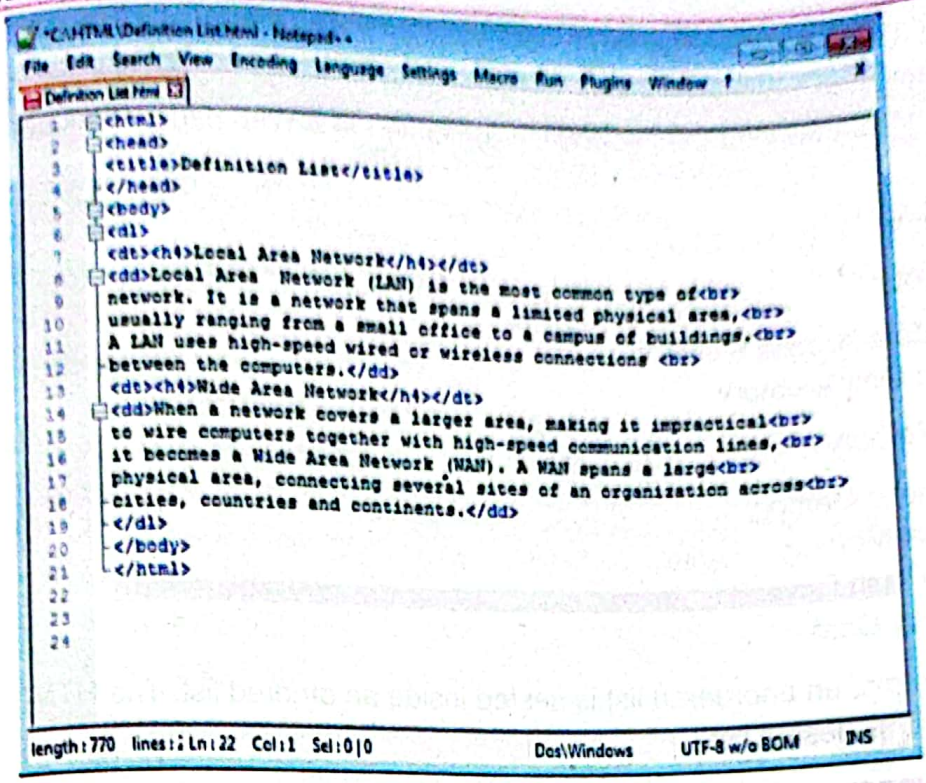


Fig.7-33 Creating a definition list of terms

In this HTML document, the entire definition list is within the <dl></dl> tags.

The two terms **Local Area Network** and **Wide Area Network** are enclosed within the <dt></dt> tags.

The explanation of the terms is written within the <dd></dd> tags in paragraphs.

The browser window will display it as shown if Fig.7-34.

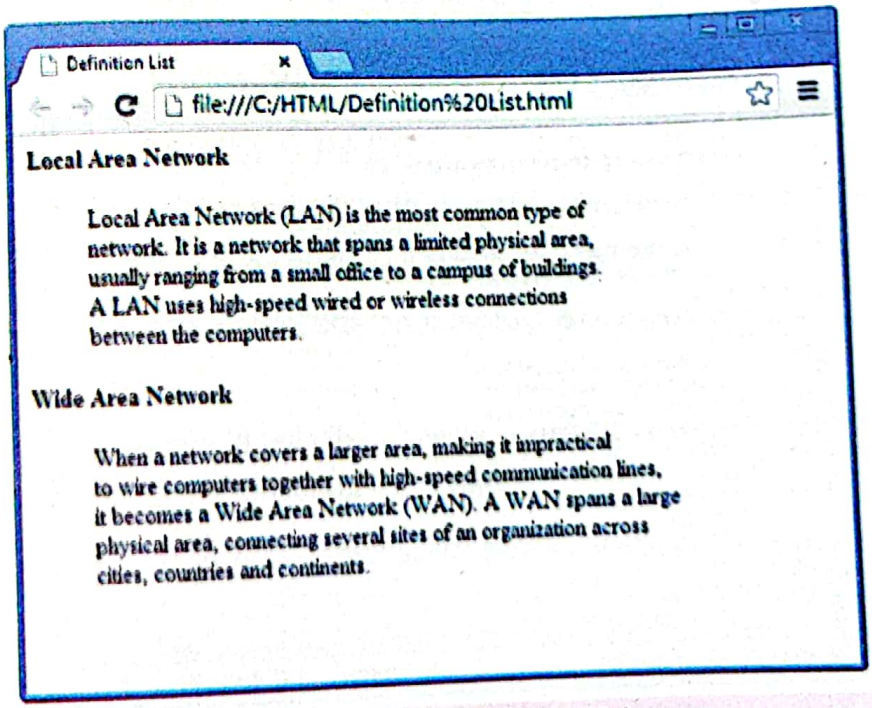


Fig.7-34 Use of definition list in Web page

Creating a Nested List

Sometimes, it is required in a Web page to nest a list inside another list. This makes it easy for the reader to understand the information presented in a Web page. Consider the following example:

Type of Memories

1. Primary Memory
   - Random Access Memory
   - Read Only Memory
2. Secondary Memory
   - Magnetic Memory
   - Optical Memory
   - USB Flash Drive
   - Memory Card

In this example, an unordered list is nested inside an ordered list. The HTML document in Fig.7-35 creates this nested list.

Here, heading tags <h3></h3> are used for the title, **Types of Computer Memories.**

The ordered list has two items having the subtitles, **Primary Memory** and **Secondary Memory.** The first subtitle has a list of two unordered items and the second subtitle has a list of four unordered items.

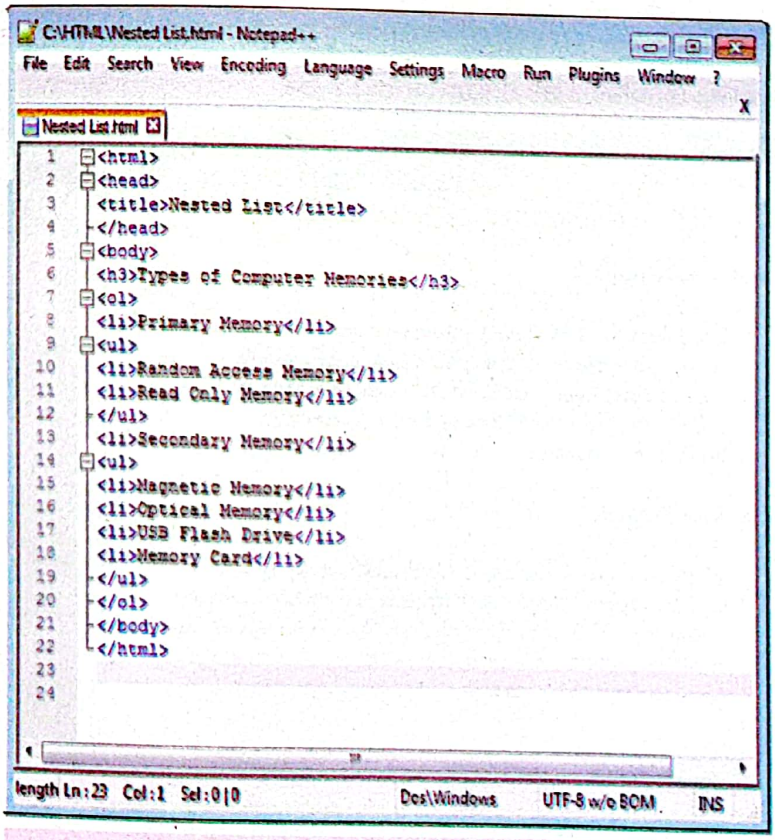


Fig.7-35 Creating a nested list

The browser window will display it as shown if Fig.7-36.

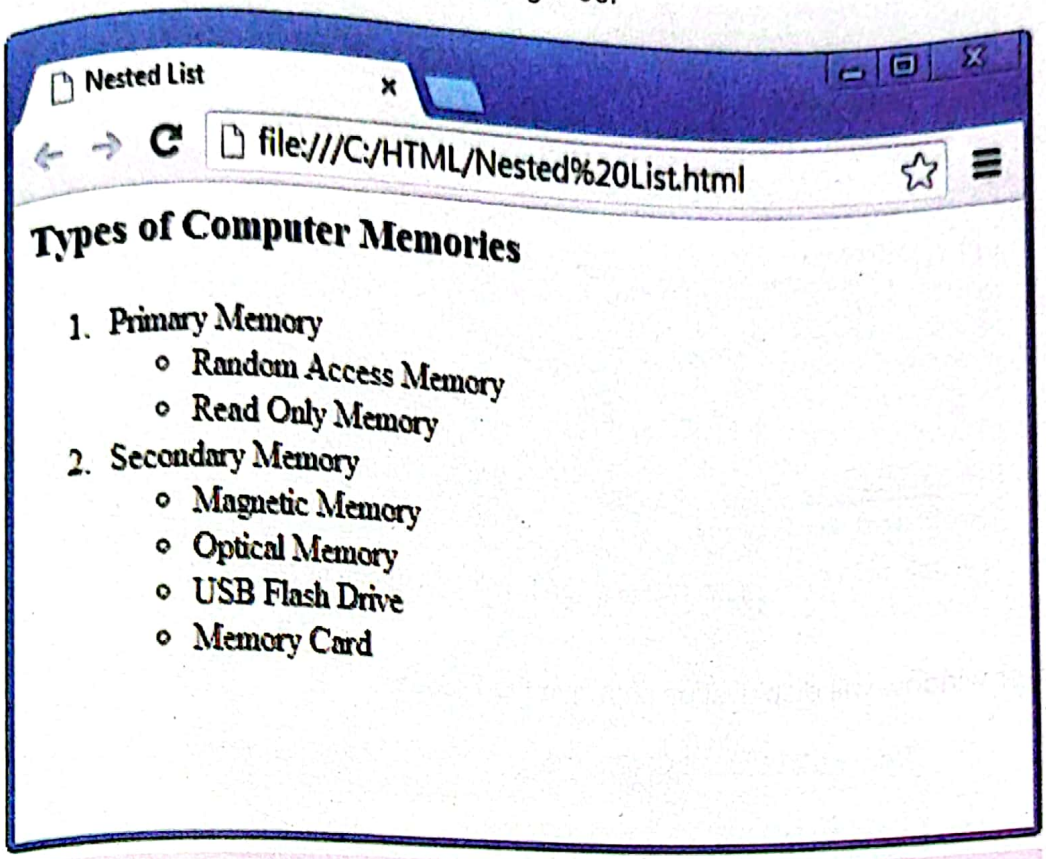


Fig.7-36 Browser window displaying a nested list in a Web page

7.5 IMAGES AND BACKGROUNDS

Instead of reading a lot of text which takes time and effort, people prefer Web pages with relevant images. Images can be of great value in a Web page. Images attract attention and provide an easy way to improve the visitor's experience of a Web page.

7.5.1 ADDING IMAGE IN A WEB PAGE

The image tag, <img> with its **src** attribute is used for displaying an image in a Web page. Image is not part of HTML file, it is a separate file stored in computer's memory.

<img> tag: It is the HTML tag that inserts an image in a Web page. It has attributes but no closing tag.

src attribute: It stand for source. It tells the browser where the image file is located. <img> tag has many attributes but src is the most important one.

The HTML document in Fig.7-37 demonstrate how to display an image in a page. Assume that the image file, mosque.jpg and HTML document are in the same folder.

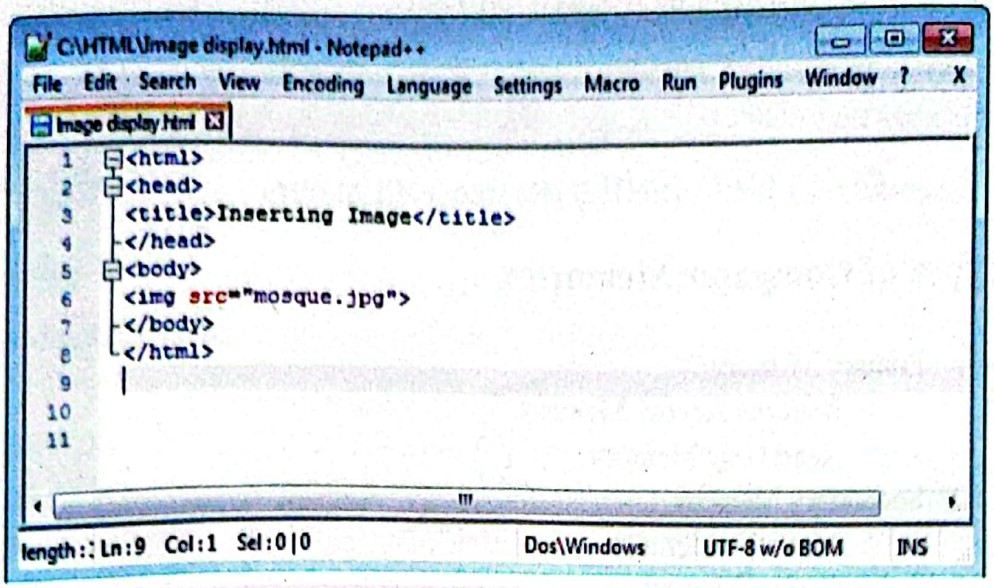


Fig.7-37 Using image is HTML document

The browser window will display it as shown in Fig.7-38.

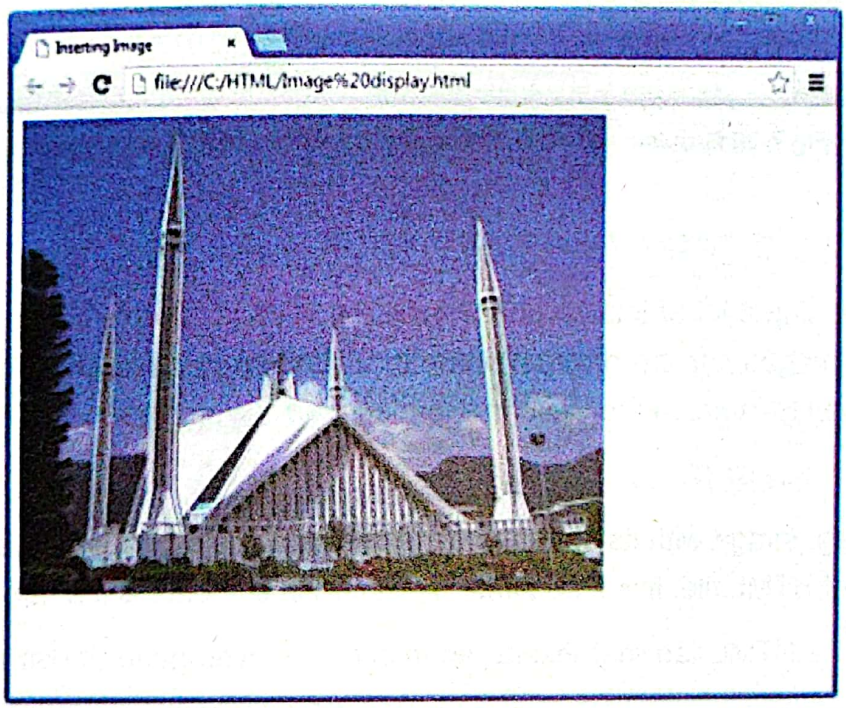


Fig.7-38 Image displayed in browser window

Adding Border to an Image

Border is a box of lines that is around the boundary of an image. A border can be set around an image using the border attribute in the <img> tag as given below.

<img src="image.jpg" border=5>

Here, the number 5 specifies the width of the border in pixels. The browser window will display the image with border as shown in Fig.7-39.

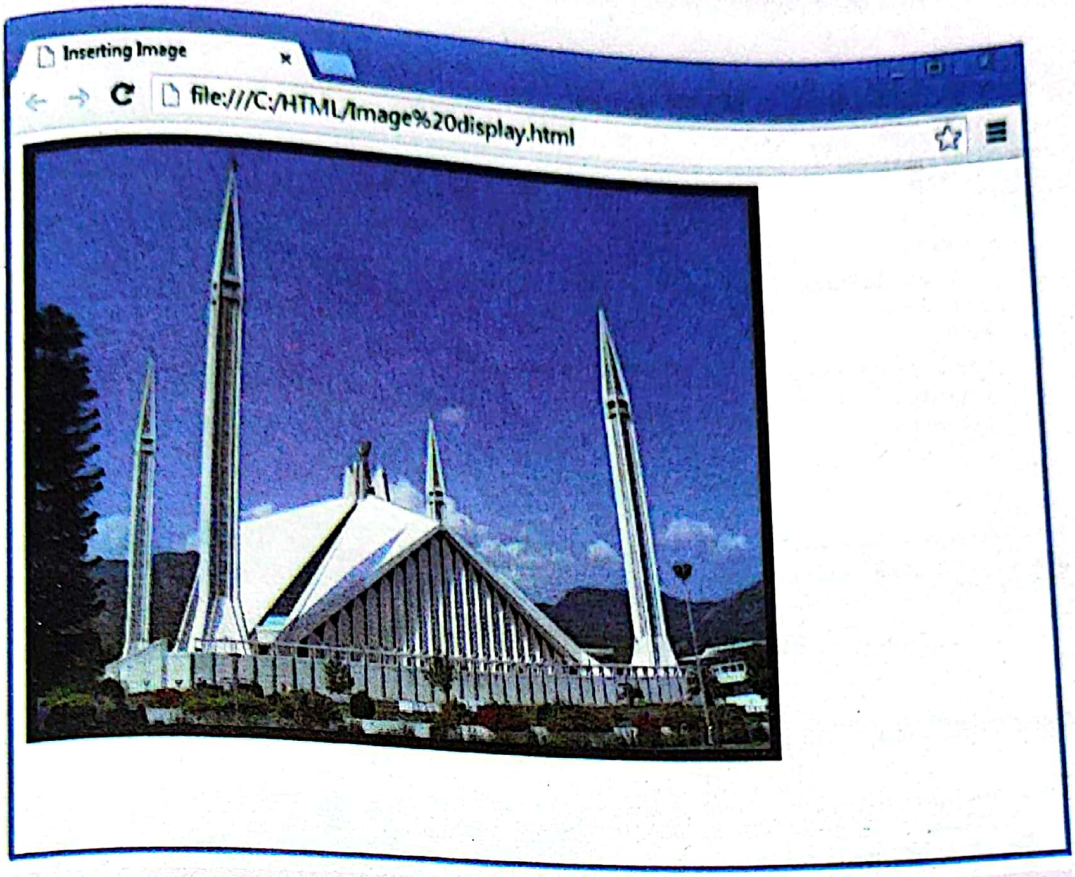


Fig.7-39 Image with border displayed in browser window

7.5.2 SPECIFYING IMAGE SIZE IN A WEB PAGE

User can use the height, width and alt attributes in the <img> tag to resize the image in Web page.

height attribute: This attribute is inserted in the <img> tag to specify the height of the image in pixels. This can be different than the real height of the image. The browser resizes the image as specified in the <img> tag.

width attribute: This attribute is inserted in the <img> tag to specify the width of the image in pixels. This can be different than the real width of the image. The browser resizes the image as specified in the <img> tag.

alt attribute: If for some reason the browser cannot display an image, the user can insert the alt attribute in the <img> tag to tell the reader what image is missing in the page. The value of the **alt** attribute provides alternative text in place of image in the Web page.

The HTML document in Fig.7-40, demonstrates the use of height, width and alt attributes in <img> tag to resize an image in Web page.

C:\HTML\Resizing Image.txt - Notepad++

File Edit Search View Encoding Language Settings Macro Run Plugins Window ?

Resizing Image.txt

```
1  <html>
2  <head>
3  <title>Specifying Image Size</title>
4  </head>
5  <body>
6  <img src="image.jpg" width=200 height=150 alt="Image of Faisal Mosque">
7  </body>
8  </html>
9
```

length : 162 lin Ln : 9 Col : 1 Sel : 0 | 0 Dos\Windows UTF-8 w/o BOM INS

Fig.7-40 Resizing an image in HTML document

The browser window will display it as shown in Fig.7-41.

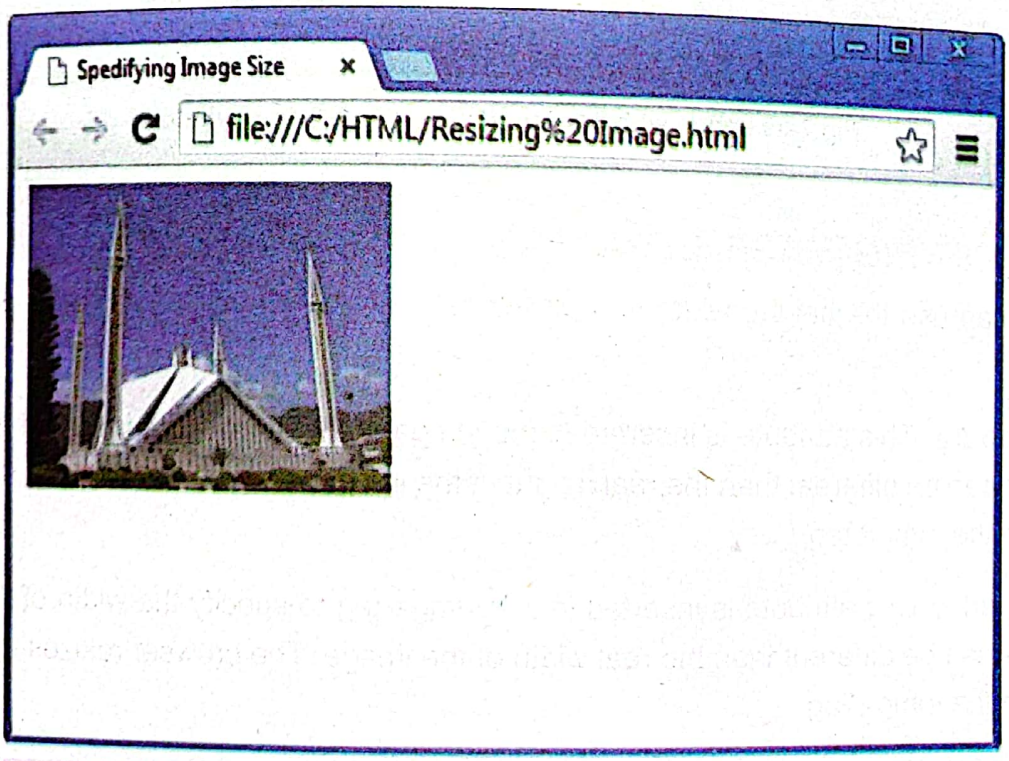


Fig.7-41 Resized image in Web page

If the browser cannot display the image for some reason, the Web page will be displayed as shown in Fig.7-42.

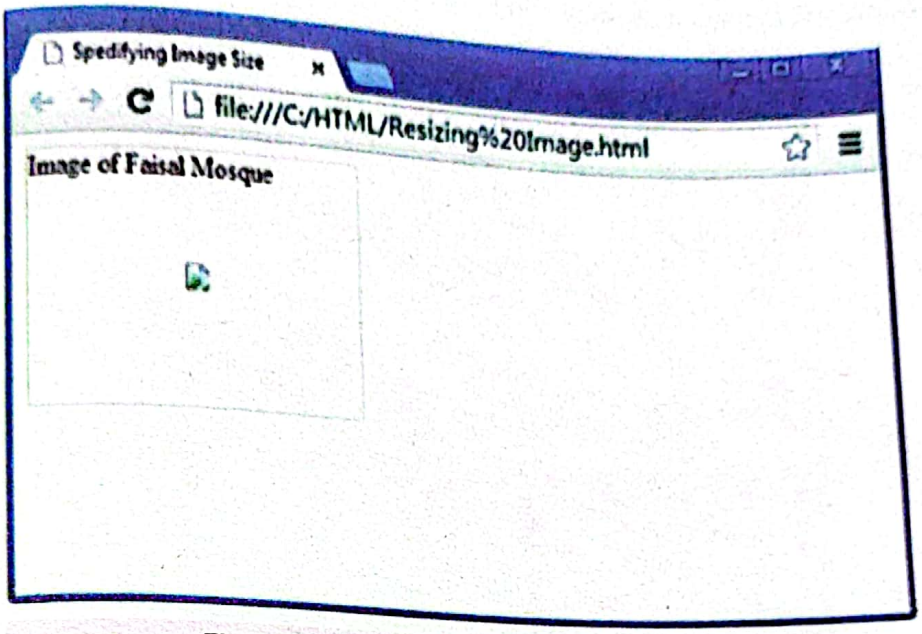


Fig.7-42 Web page if image is not displayed.

7.5.3 APPLYING BACKGROUND AND FOREGROUND COLORS

To apply a background color in a page, insert the bgcolor attribute and for foreground color, insert text attribute in the <body> tag as shown in Fig.7-43.

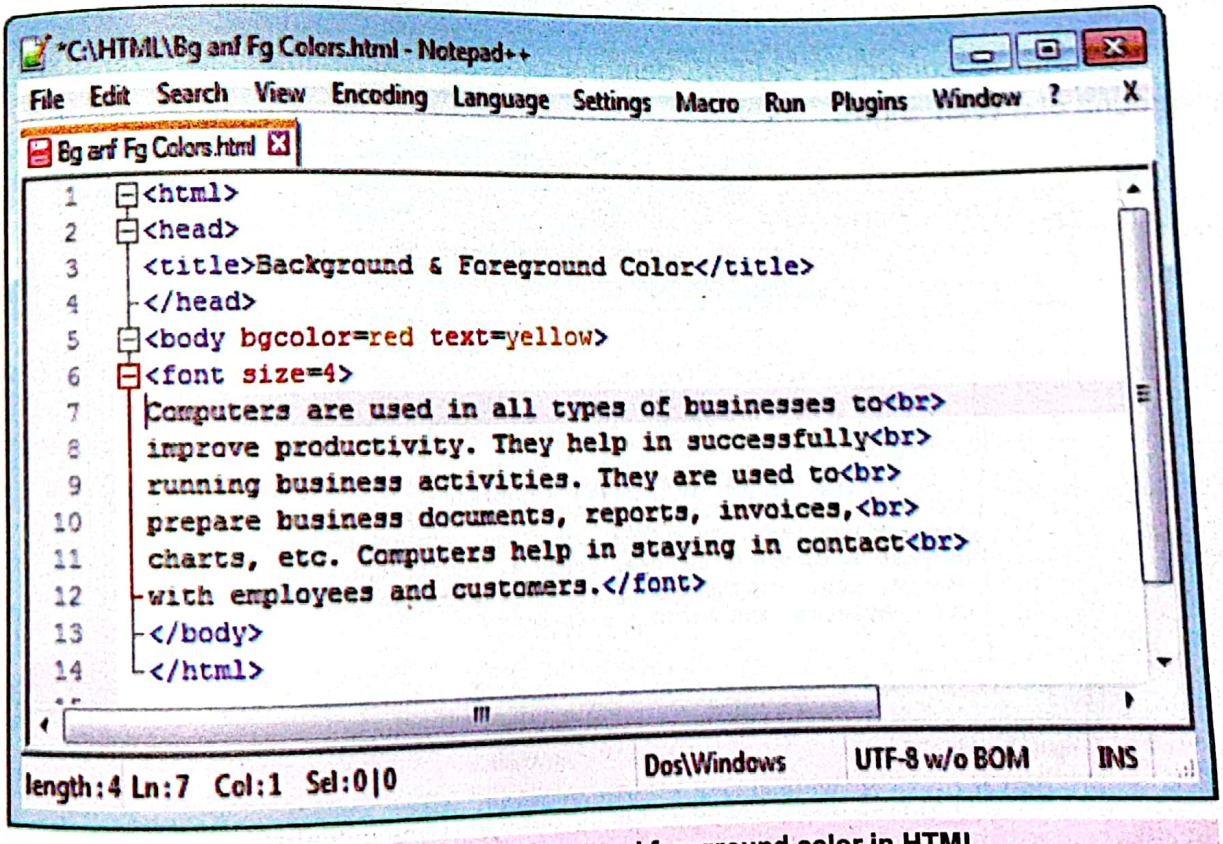


Fig.7-43 Using background and foreground color in HTML

In this HTML document, the background color is red and foreground color is yellow. The browser window will display it as shown in Fig.7-44

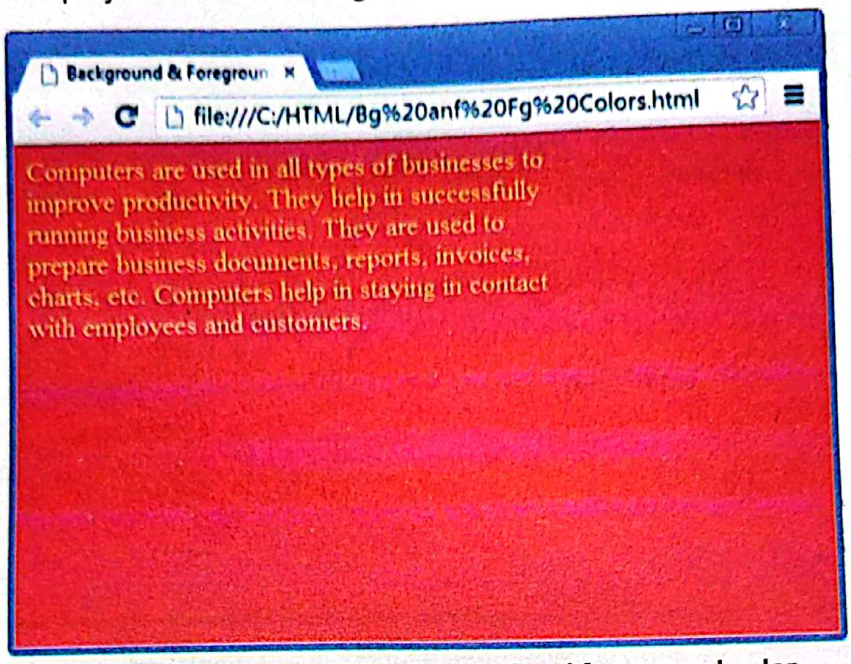


Fig.7-44 Web page with background and foreground color

7.5.4 APPLYING BACKGROUND IMAGE

An image can be set as background of a page using the background attribute in the <body> tag.

<body background="image.jpg">

If the image is smaller than the browser window then it will repeat itself till the entire window is filled.

The HTML document in Fig.7-45 demonstrates the use of image file **computer.jpg** as background of a Web page.

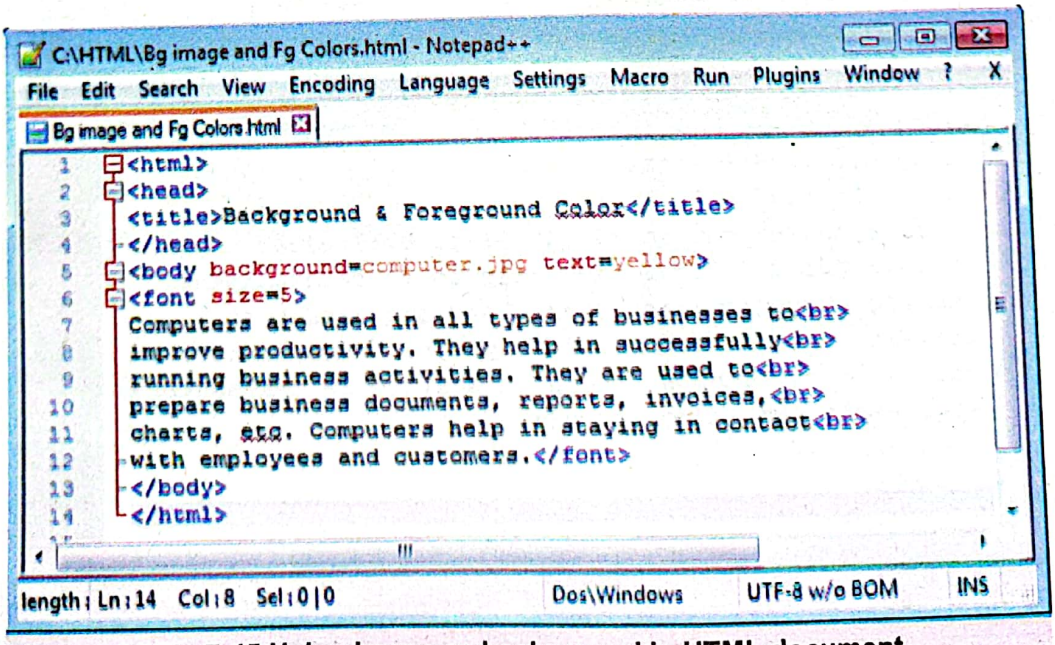


Fig.7-45 Using image as background in HTML document

The browser will display it as shown in Fig.7-46

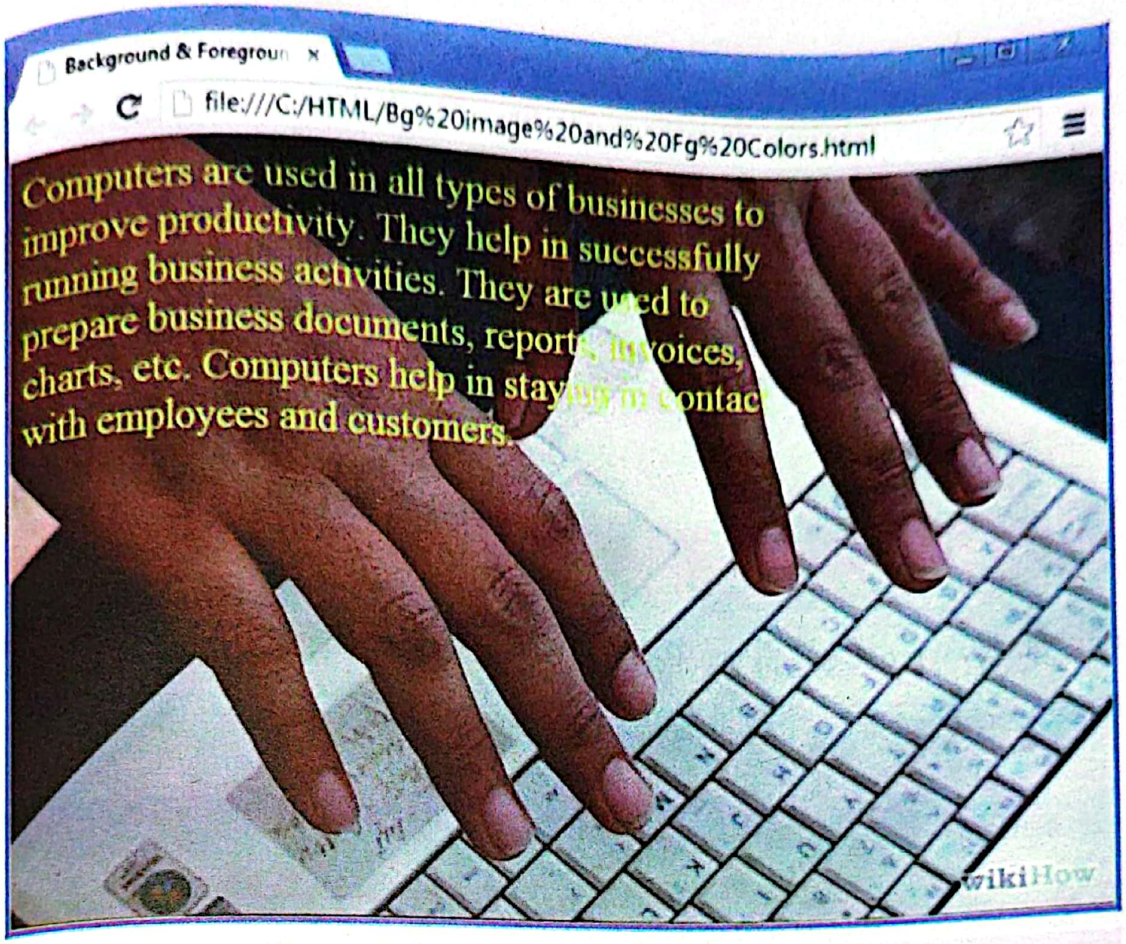


Fig 7-46 Using image as background of Web page

7.6 HYPERLINKS

The entire World Wide Web is connected by hyperlinks. Web pages contain many hyperlinks, each sends the user to a related Web page or picture/file.

7.6.1 HYPERLINK

A hyperlink is text or image in a Web page that links it to another Web page or another section of the same page when user clicks on it. Hyperlinks are usually blue and underlined. When the reader moves the pointer over a hyperlink, the pointer changes to a small hand. Clicking on it allows the reader to jump from page to page.

7.6.2 ANCHOR TAGS

The <a> tag is known as anchor. It is used to create a hyperlink which may be text or image, with the **href** attribute.

7.6.3 CREATING A HYPERLINK TO A WEB PAGE

The syntax of creating a hyperlink to another web page is:

text to be displayed

For example:

Visit Federal Board

It will be displayed as Visit Federal Board in the browser window and when the reader clicks on it, it will open the Federal Board website that has the URL www.fbise.edu.pk.

Few more examples of creating hyperlinks are given below.

Ilmki Dunya

The Nation

Quaid-i-Azam University, Islamabad

The HTML document in Fig.7-47 demonstrates the use of hyperlinks in a Web page.

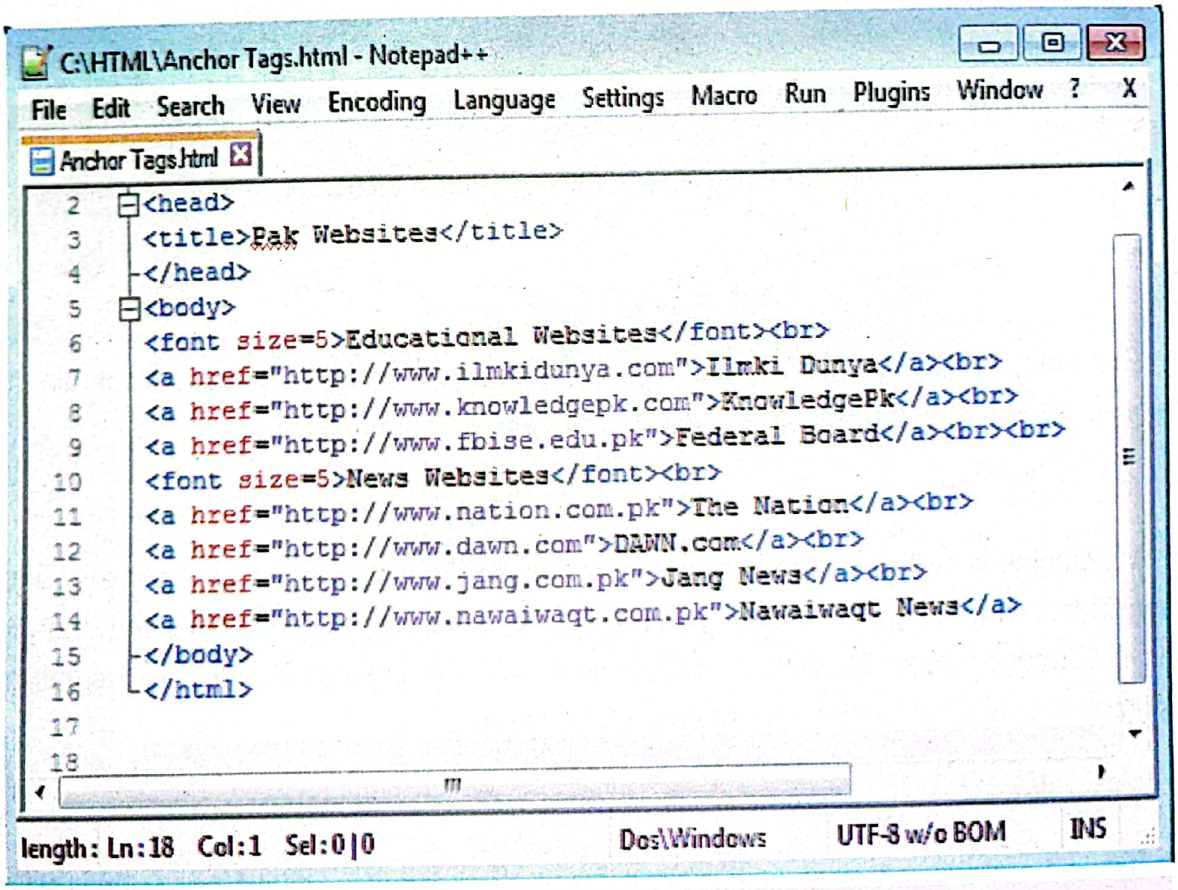


Fig.7-47 Creating hyperlinks in HTML document

The browser window will display it as shown in Fig.7-48.

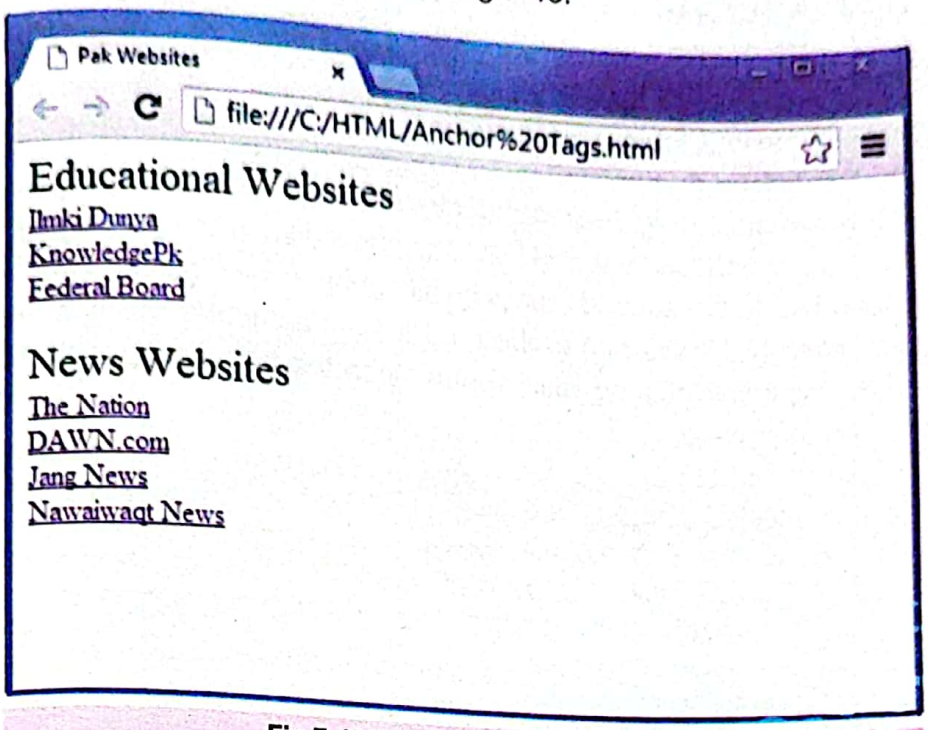


Fig.7-48 Hyperlinks in Web page

7.6.4 CREATING A HYPERLINK WITHIN A WEB PAGE

Anchor with a **name** attribute is used to create a hyperlink within a Web page. It involves two steps, creating the anchor itself and then creating a hyperlink to the anchor.

Creating the Anchor

Create the label in the anchor tag at the location in the page where you want to hyperlink. The syntax for creating the label is:

```
<a name="label"></a>
```

Creating a Hyperlink to the Anchor

The user can make a hyperlink to the anchor using the normal <a> tag with the **href** attribute. The syntax for this is:

```
<a href="#label">text to be displayed</a>
```

The **#** symbol must be put before the label.

For example, create the following anchor before Chapter 5 and this is the location where you want to hyperlink.

```
<a name="chapter5"></a>
```

Now, create the hyperlink to the anchor at any location as given below.

```
Click <a href="#chapter5">here</a> to go to Chapter 5.
```

The browser window will display it as:

Click here to go to Chapter 5.

When the reader clicks on the word **here**, it will take him to the location where Chapter 5 starts within the Web page.

The HTML document in Fig.7-49 demonstrates how to create hyperlinks within a Web page. There are three hyperlinks in this HTML document. When the user clicks on the second hyperlink, it will take him to the second topic which is about minicomputer. When the user clicks on the third hyperlinks, it will take him to the third type of computer which is mainframe. If the user clicks the first hyperlink nothing will happen since the first topic about microcomputer is already displayed on the screen.

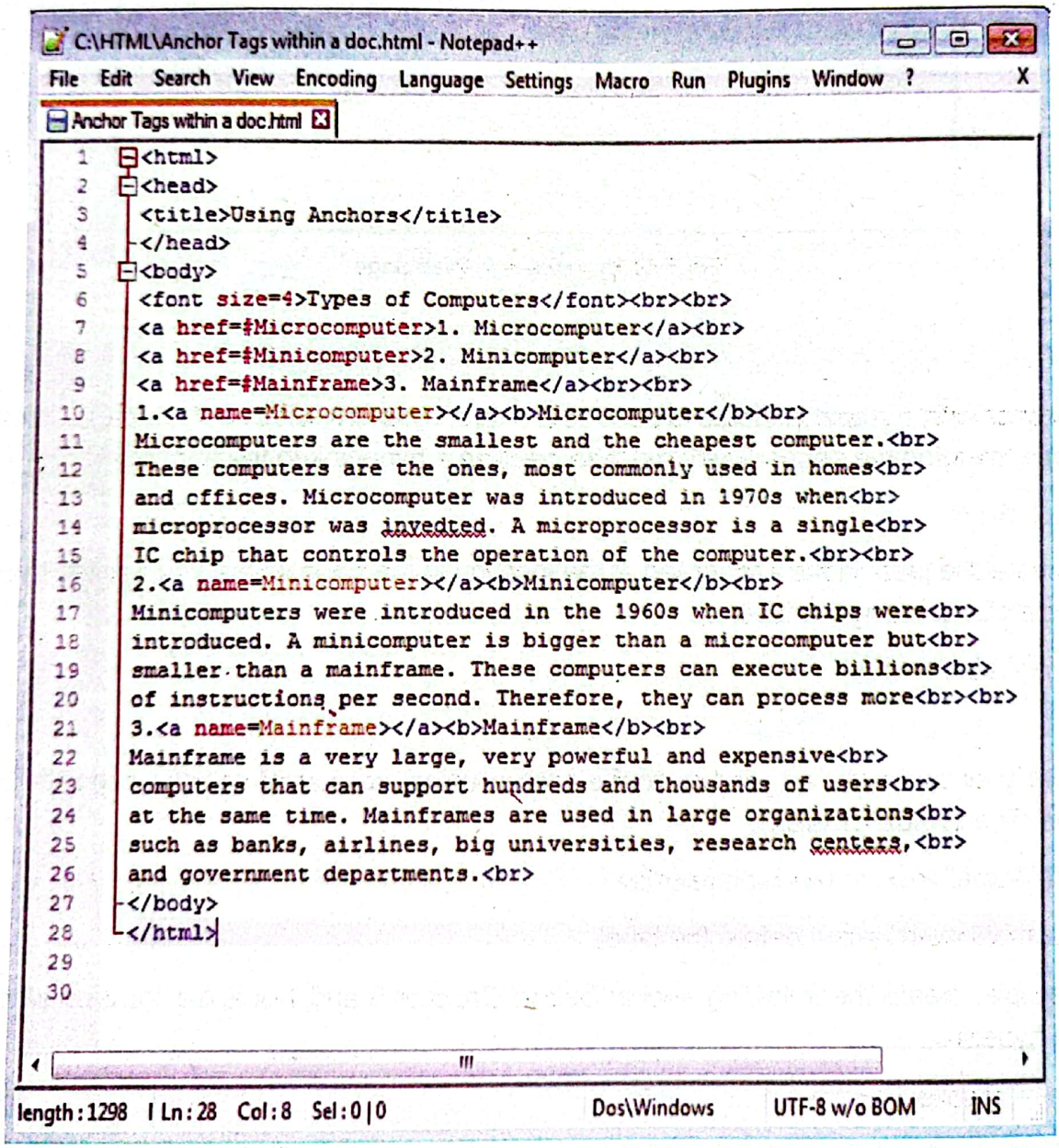


Fig.7-49 Using hyperlinks within a Web page in HTML document

The browser windows will display the Web page as shown in Fig.7-50.

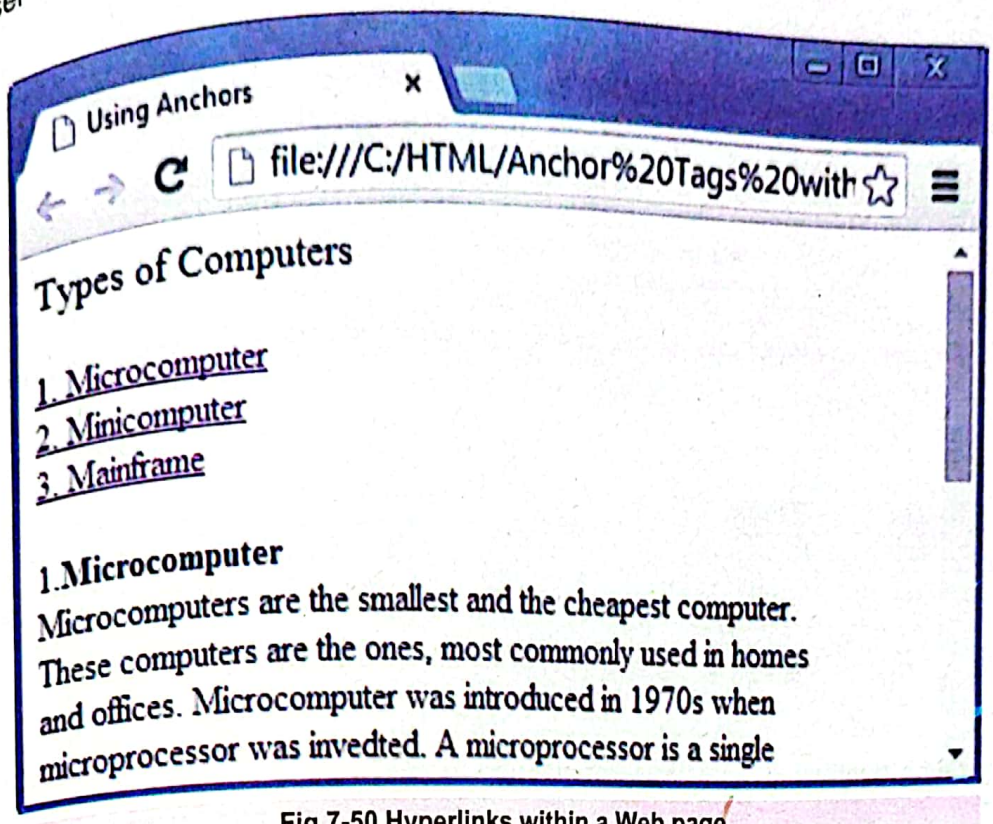


Fig.7-50 Hyperlinks within a Web page

7.6.5 CREATING A GRAPHICAL HYPERLINK

The syntax for creating a graphical hyperlink to another Web page is:

<img scr="name of image file>

For example:

<img src="image.jpg">

It will display the image.jpg image file in the browser window. When the reader moves the mouse pointer over the image, it will change to a small hand and clicking on the image will open the Federal Board website that has the URL www.fbise.edu.pk.

The HTML document in Fig.7-51 demonstrates how to create a graphical hyperlink.

C:\HTML\image anchor.html - Notepad++

File Edit Search View Encoding Language Settings Macro Run Plugins Window ? X

image anchor.html

```
1  <html>
2  <head>
3   <title>Inserting Image Anchor</title>
4   </head>
5  <body>
6   <a href="http://www.fbise.edu.pk"><img src="image.jpg"></a>
7   <br><br>
8   <font size=3>Click on the image to visit Federal Board Web site</font>
9   </body>
10  </html>
11
12
13
```

length : 237 lines Ln : 8 Col : 53 Sel : 0 | 0 Dos\Windows UTF-8 w/o BOM INS

Fig.7-51 Using graphical hyperlink in HTML document

The browser windows will display it as shown in Fig.7-52.

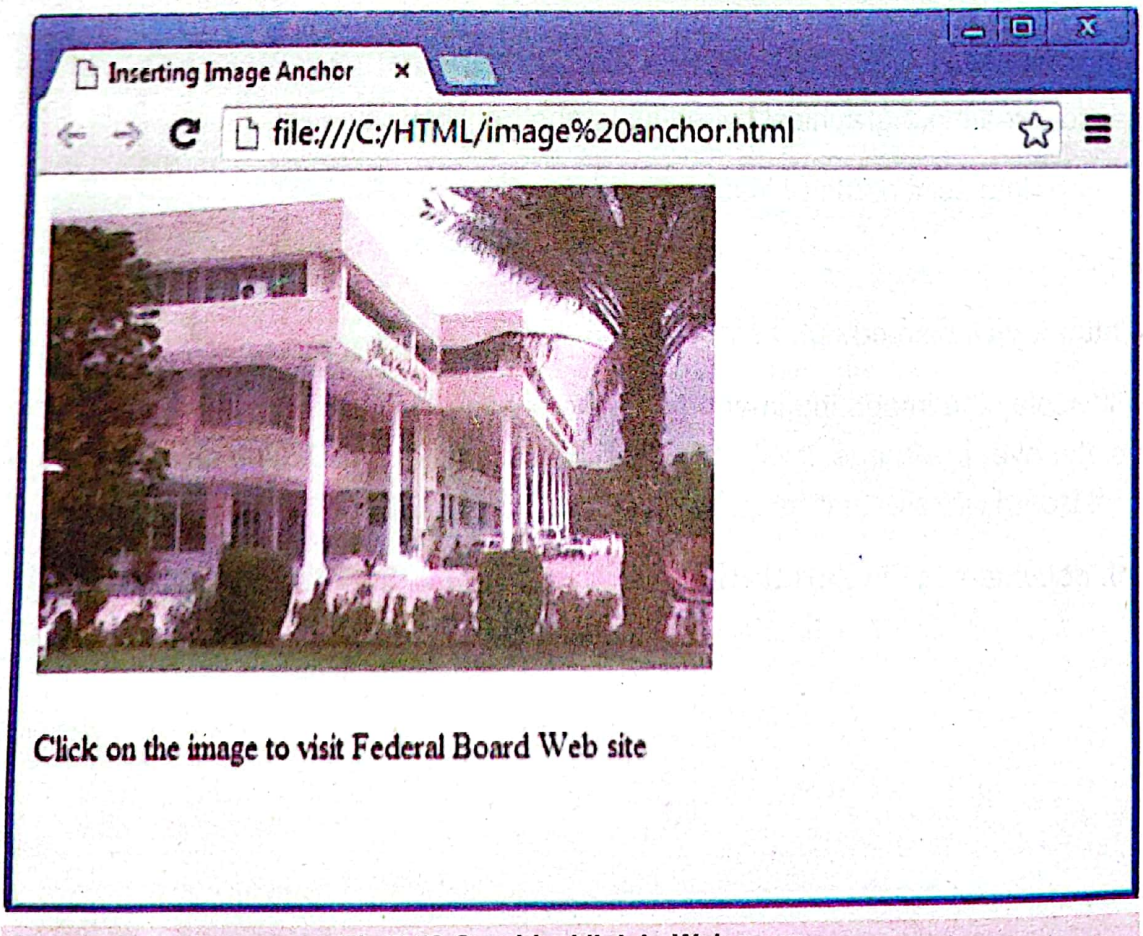


Fig.7-52 Graphical link in Web page

Key Points

- **Internet** is a worldwide network of computers and World Wide Web is the main application of Internet for accessing and sharing information.
- **Web Page** is a document on the Internet that can be accessed through a Web browser.
- **Website** is a collection of related Web pages hosted on a Web server and accessible through an Internet address known as Uniform Resource Locator.
- **Web browser** is a software that enables users to retrieve information on the Web.
- **Web server** is a computer that makes Web pages available through the Internet.
- **Uniform Resource Locator** (URL) is an Internet address that identifies a website.
- **Search engine** is a website or software that allows people to find information on the World Wide Web.
- **Home page** refers to the main Web page of a website that opens in a browser when users access it. It also means the Web page that automatically loads when a Web browser is opened.
- **Web hosting** is a service that uploads a website on a Web server and makes it available for computer users.
- **Web portal** is a website that offers a large variety of services such as online shopping mall, news, stock prices, e-mail, search engine, etc.
- **HTML** is the language of Internet's World Wide Web. Web pages are written in HTML.
- **Hyperlink** is text or image in a Web page that links it to another Web page or another section of the same page when the user clicks on it.

Exercise

Q1. Select the best answer for the following MCQs.

i. What is an Internet address called that identifies a website?
   A. Web page
   B. Website
   C. Web server
   D. URL

ii. What is a collection of Web pages hosted on a Web server called?
   A. Web address
   B. Website
   C. Home page
   D. Web browser

iii. Which language is used for creating Web pages?
   A. HTML
   B. C language
   C. URL
   D. Web browser

iv. What is text or image in a Web page called that links it to another Web page when user clicks on it?
   A. web link
   B. browser link
   C. hyperlink
   D. search link

v. Which of the following refers to uploading of Web pages to Web server so that others can access it?
   A. Configuring Web pages
   B. Web surfing
   C. Installing website
   D. Web hosting

vi. How many types of lists are commonly used in HTML pages?
   A. 2
   B. 3
   C. 4
   D. 5

vii. Anything typed inside which tags is displayed in the browser window?
   A. <body> </body>
   B. <html> </html>
   C. <head> </head>
   D. <title> </title>

viii. Which of the following tags does not have a closing tag?
   A. <tr>
   B.
   C.
   D.

Short Questions

Q2. Give short answers to the following questions.

i. Differentiate between website and Web server.
ii. Describe how a search engine is used for searching information on the Internet.
iii. Define URL and Web hosting.
iv. Describe HTML.
v. What is hyperlink?

Extensive Questions

Q3. Describe any four types of websites.

Q4. Write the HTML tags for the following?

i) Paragraph
ii) Heading
iii) Bold
iv) Underline
v) Italic
vi) Center text
vii) Strike out
viii) Superscript
ix) Subscript
x) Font size, color and typeface

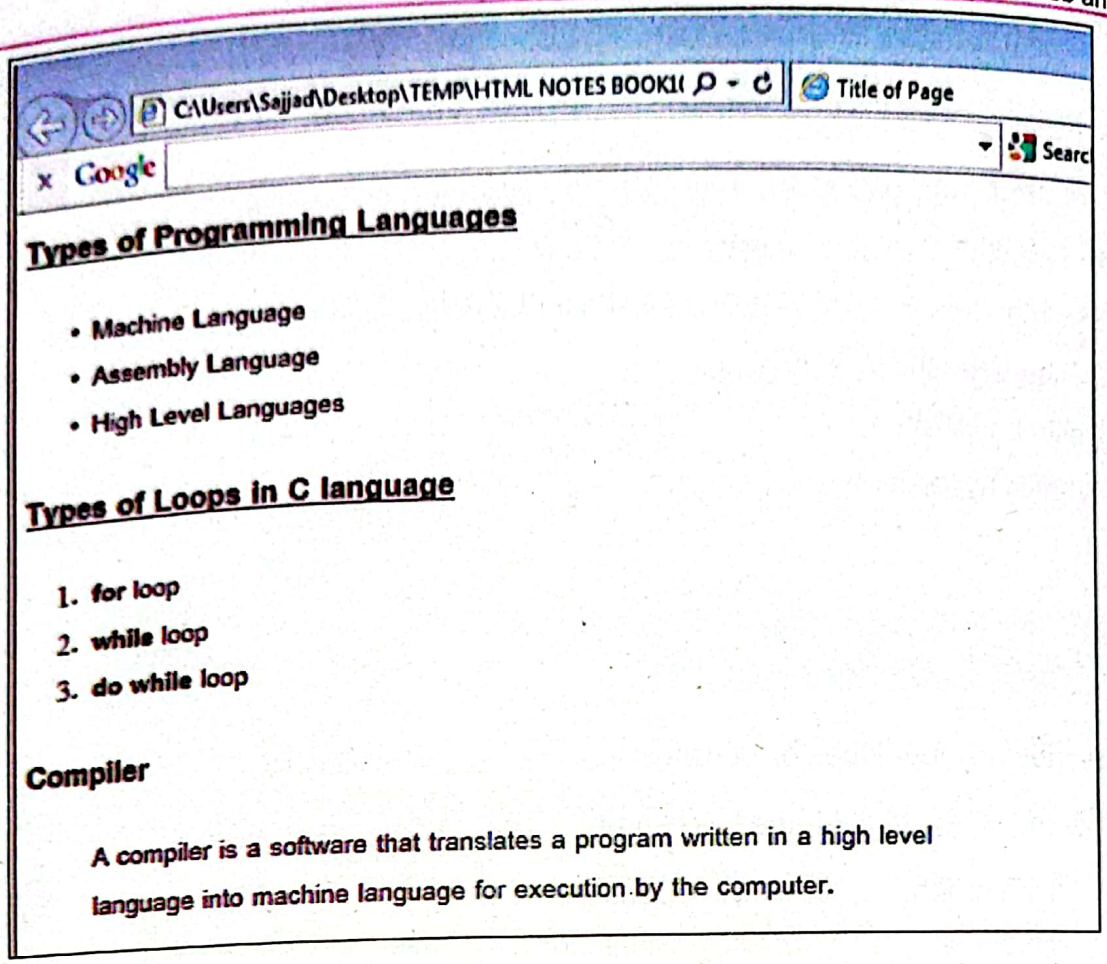
Q5. Create a Web page in HTML that displays image of a computer. The width of image should be 350 pixels and height 220 pixels.

Q6. Describe how background color and image are applied to Web page.

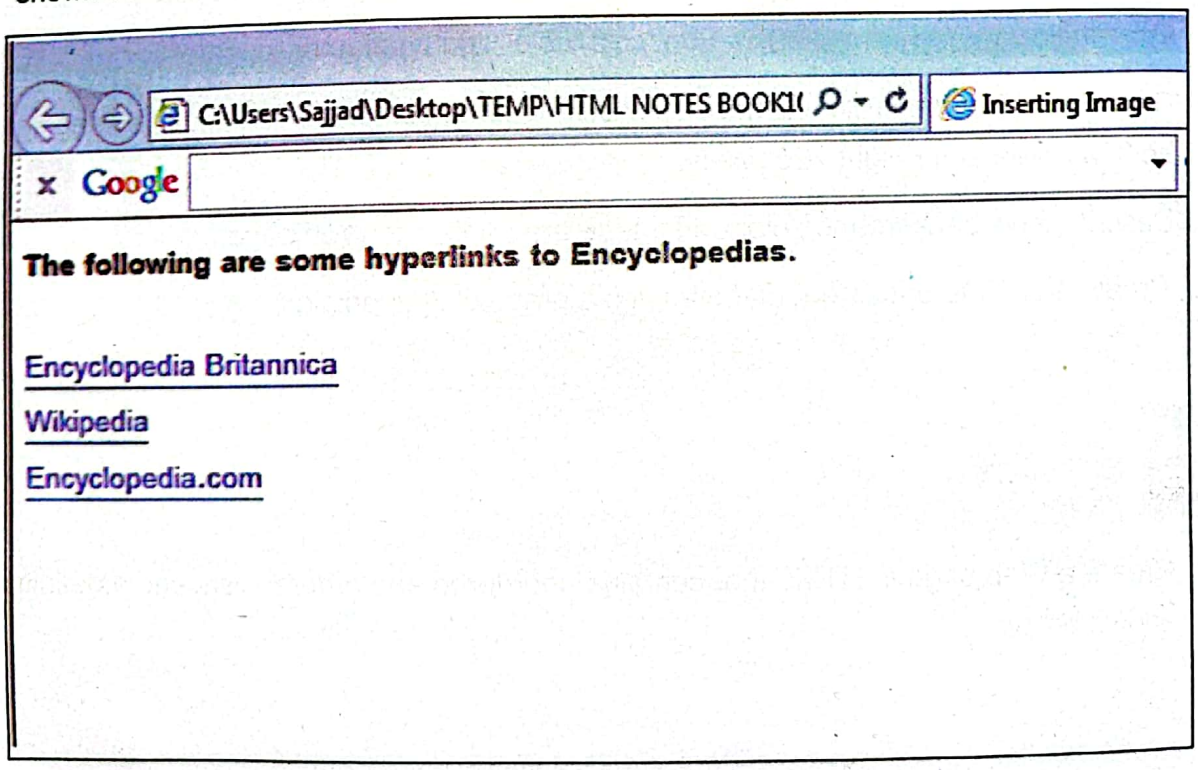
Q7. Create an HTML document that contains a graphical hyperlink.

Lab Activities

1. Create a Web page in HTML that contains unordered and ordered lists and a definition as shown below.



2. Create an HTML document that contains hyperlinks to three websites of encyclopedias as shown below.



URL of Website	Name of Website
www.britannica.com	Encyclopedia Britannica
www.wikipedia.org	Wikipedia
www.encyclopedia.com	Encyclopedia.com

3. Create the following table in HTML.

RESULT SHEET			
S.No.	Student Name	Class	Total Marks
1.	Javed Akhtar	IX-A	445
2.	Afzal Khokhar	IX-A	480
3.	Muslim Khan	IX-B	462
4.	Syed Najaf Ali Shah	IX-B	470
5.	Sajjad Heder	IX-C	452

Answers to MCQs of Exercises

UNIT 1

Q1. Select the best answer for the following MCQs.

i. C	ii. B	iii. C	iv. B
v. A	vi. D	vii. C	viii. A

UNIT 2

Q1. Select the best answer for the following MCQs.

i. C	ii. A	iii. B	iv. C	v. B
vi. A	vii. C	viii. C	ix. A	x. D

UNIT 3

Q1. Select the best answer for the following MCQs.

i. B	ii. D	iii. B	iv. C	v. B
vi. A	vii. C	viii. A	ix. C	x. D

UNIT 4

Q1. Select the best answer for the following MCQs.

i. B	ii. C	iii. C	iv. B
v. D	vi. C	vii. D	viii. B

UNIT 5

Q1. Select the best answer for the following MCQs.

i. D	ii. C	iii. B	iv. A	v. B
vi. C	vii. B	viii. A	ix. B	x. D

UNIT 6

Q1. Select the best answer for the following MCQs.

i. B	ii. A	iii. D	iv. C
v. B	vi. A	vii. C	viii. C

UNIT 7

Q1. Select the best answer for the following MCQs.

i. D	ii. B	iii. A	iv. C
v. D	vi. C	vii. A	viii. B

Answers to MCQs of Exercises

UNIT 1

Q1. Select the best answer for the following MCQs.

i. B	ii. B	iii. D	iv. C	v. B
vi. D	vii. C	viii. A	ix. B	x. A

UNIT 2

Q1. Select the best answer for the following MCQs.

i. B	ii. A	iii. C	iv. D	v. B
vi. B	vii. D	viii. B	ix. C	x. B

UNIT 3

Q1. Select the best answer for the following MCQs.

i. B	ii. D	iii. C	iv. D	v. C
vi. B	vii. A	viii. C	ix. C	x. B

UNIT 4

Q1. Select the best answer for the following MCQs.

i. B	ii. A	iii. D	iv. C	v. B
vi. C	vii. D	viii. C	ix. B	x. B

UNIT 5

Q1. Select the best answer for the following MCQs.

i. B	ii. B	iii. A	iv. C	v. D
vi. A	vii. C	viii. B	ix. B	x. C

UNIT 6

Q1. Select the best answer for the following MCQs.

i. C	ii. D	iii. B	iv. C	v. C
vi. D	vii. D	viii. C	ix. D	x. B

Glossary

Adware	A type of malware that attaches itself to free software on the Internet and infects other computers when it is downloaded.
Analog Computer	A computer that represents and processes data by measuring quantities such as voltage and current to solve a problem.
Application Software	Software developed for computer users to solve their problems.
Asynchronous Transmission	A method of data transmission in which time interval between characters is not the same.
Attenuation	Strength of signal fall off with distance in guided or unguided media.
Bandwidth	Overall data transmission capacity of a medium or channel.
Bluetooth	Bluetooth is a wireless communication technology that uses radio waves to connect portable electronic devices over short distance.
Bus Topology	A topology that consists of a single central cable known as bus, to which all the devices are connected along its length to communicate with each other.
Cache	Very small amount of extremely fast memory inside the microprocessor or on the motherboard.
Client Computer	A computer that accesses the resources that are shared by other computers in a network.
Client/Server Network	A network in which each computer acts as either a server or a client.
Command Line Interface (CLI)	User interface in which commands are given to computer with keyboard.
Computer Ethics	Moral guidelines concerned with the ethical use of computer technology.
Computer Network	Interconnection between computers and devices to provide facilities among users to exchange information and share resources such as printer, hard disk, Internet, etc.
Computer Software	A set of instructions that tells a computer what to do and how to do.

Computer Virus	A type of malware that spreads by inserting a copy of itself into another program or file.
Cross Talk	Interference that occurs in guided media when undesired signals enter the path of transmitted signals.
Cybercrime	Any crime committed by means of computer and Internet technology.
Data Validation	Allowing only certain values or the type of data that is defined by the user to be entered into cells in Excel.
Database Administrator	A person who is responsible for the design, implementation and maintenance of a database in an organization.
Digital Computer	A general-purpose programmable machine that works with binary digits and has the ability to store, retrieve and process data at high speed.
Distortion	Change in form of digital signal when it reaches the receiver during data transmission.
Expansion Slots	Long narrow sockets on the motherboard used for installing expansion cards.
Filtering Data	Displaying only the information that the user needs based on a condition in Excel.
Full-duplex Mode	A type of data transmission mode used to transmit data/information in both directions simultaneously.
Graphical User Interface (GUI)	A type of user interface that is based on windows, icons, menus and pointer.
Guided Media	Transmission media that uses cabling system that guides data signals along a specific path.
Hacker	A person who illegally breaks into computer systems to destroy, modify or steal information.
Half-duplex Mode	A type of data transmission mode used to transmit data/information in both direction but not simultaneously.
Hybrid Computer	A type of computer that is a combination of analog and digital computers.
IC Chip	A silicon chip that contains a large number of transistors.
Language Processor	System software used to translate computer programs into machine language.

Glossary

Local Area Network (LAN)	A network that covers a limited area such as a small office or a campus of nearby buildings.
Mesh Topology	A topology in which all the network nodes are connected to all the other nodes.
Metropolitan Area Network (MAN)	A network that spans area larger than LAN but smaller than WAN such as a city.
Motherboard	Main circuit board inside the system unit that contains microprocessor, main memory, expansion cards, many IC chips, connectors and other electronic components.
Network Administrator	A person responsible for installation, configuration and maintenance of computer networks in organizations.
Network Interface Card (NIC)	Expansion card used to connect computers together to create computer network.
Network Topology	Physical arrangement of network nodes. A node represents a computer or a network device.
Operating System	A collection of system software that controls the working of computer system.
Output Devices	Devices used to display text, graphics and images on monitor or print on paper.
Peer-to-Peer Network	A network in which all the computers have the same status and there is no distinction at all between servers and clients.
Personal Identification Number (PIN)	A confidential numeric password used to authenticate a user to get access to a computer system.
Ports	Interface used for connecting various devices to the system unit.
Protocol	Set of rules between two communicating devices that govern the process of data communication.
Registers	Small memory units inside the microprocessor used to temporarily store some information during the execution of a program.
Ring Topology	A topology shaped just like a ring to which nodes are connected.
Router	Communication device that is used when two networks have to be connected for communication.
Server Computer	A computer that shares resources for others to use on a network.
Simplex Mode	A type of transmission mode that provides data/information transmission in only one direction.

Software Piracy	Making illegal copies of software for use or sale for financial benefit.
Spreadsheet	A grid of rows and columns in which numbers and text are entered.
Spyware	A type of malware developed to spy on computer users by gathering information about their activities.
Star Topology	A topology in which all the nodes are connected to a central device called switch.
Switch/Access Point	Communication device used for connecting computers together in a local area network.
Synchronous Transmission	A method of data transmission in which time interval between characters is always the same.
System Software	A collection of programs which makes the use of computer easy and efficient.
System Unit	Main part of computer that consists of motherboard, power supply and drives inside the computer casing.
Transmission Medium	Physical pathway over which data is sent from sender to receiver.
Unguided Media	Transmission of data signals through open space, that is, without using cables.
Wide Area Network	A network that spans a large area, connecting several locations of an organization across cities, countries and continents.
Word Processing	Use of computer to create, edit, format and print documents.
Word Processor	Computer application software used for the creation of documents on computers.
Worm	A type of malware that transmits itself over a network to infect other computers.

Abbreviations

Abbreviation	Description
AI	Artificial Intelligence
ALU	Arithmetic Logic Unit
ATM	Automated Teller Machine
CAD	Computer Aided Design
CAM	Computer Aided Manufacturer
CDMA	Code Division Multiple Access
CLI	Command Line Interface
CPU	Central Processing Unit
CRT	Cathode Ray Tube
CU	Control Unit
DOS	Disk Operating System
DSL	Digital Subscriber Line
DVI	Digital Visual Interface
EDVAC	Electronic Discrete Variable Automatic Computer
ENIAC	Electronic Numerical Integrator and Computer
GUI	Graphical User Interface
HDMI	High Definition Multimedia Interface
HTML	Hypertext Mark-up Language
IBM	International Business Machines
IC	Integrated Circuit
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
IT	Information Technology
LAN	Local Area Network
LCD	Liquid Crystal Display

LSI	Large Scale Integration
MAN	Metropolitan Area Network
MSI	Medium Scale Integration
NIC	Network Interface Card
OS	Operating System
PAN	Personal Area Network
PDA	Personal Digital Assistant
PIN	Personal Identification Number
RAM	Random Access Memory
ROM	Read Only Memory
SSI	Small Scale Integration
UNIVAC	Universal Automatic Computer
USB	Universal Serial Bus
VLSI	Very Large Scale Integration
WAN	Wide Area Network