INTRODUCTION TO ICT

UNIT OUTCOME

Students will be able to:

- know the term data, information, technology and the sources of information;
- understand the differences between computers of one generation from the other;
- recognize the types of computers used today and their difference;
- understand the computer system.

1.1 OVERVIEW OF ICT

Information and Communication Technology (ICT) refers to technology that provides access to information through telecommunications (the transmission of signals over long distances). It focuses primarily on communication technologies. This includes the Internet, wireless networks, cell phones, and other communication media.

Information and Communication Technologies (ICTs) have become a major factor in social and economic development of the society. The advances in technology and reductions in costs have made ICTs suitable for less developed countries. ICTs are no longer luxury for the elite, but becoming absolute necessity for those in rural areas. Therefore, Ethiopia is not leaving ICTs as a sector for just commercial interests or free market and privatiation, but rather regards them as part of the general public welfare, participation, use and debate.

The ability to participate in ICTs requires participation, partnership, understanding of social implication of new technologies and management of changes at national level. The immediate potential benefits of ICTs in Ethiopia include:

Fig. 1.1: Use of ICT for the general public welfare

1 Efficient communications for manufacturing, service and tourism sector.
2 Fast response to natural disasters and effective rural health and family planning services.
3 Effective governance and administrative effectiveness.
4 Efficient education, research and communication of research results.
5. Access to global market and research information.

6. Employment opportunities for small and medium enterprises.

7. Effective and enhanced data and information gathering and distribution for better planning.

8. Enhanced national cohesion and integration of heterogeneous social composition or geographical dispersal.

Government, individuals and institutions should work hard in improving the use of ICTs in Ethiopia.

Basic Terms Related to ICT

Let us have an overview of the basic terms related to ICT:

● Data vs Information

The frequency of the use of the words data and information are very high in our daily lives. Depending on the context, the meanings and use of these words differ. Both data and information are types of knowledge or something used to attain knowledge. Though used interchangeably, there are many differences between the meanings of these two words.

Data is a collection of raw facts and figures or a raw input which when processed or arranged makes meaningful output. Data is the plural of the Latin word "*datum*". For example, students fill an admission form when they get admission in school/college. The form consists of raw facts about the students. These raw facts are student's name, father name, mother name, address, etc. The purpose of collection of this data is to maintain the records of the students during their study period in the school/college.

In computer terms, symbols, characters, images, or numbers are data. These are the inputs for the system to give a meaningful interpretation.

Users need data to create useful information.

Information is the data that is organized, meaningful and useful for making a decision. Computers process data to create information, such as the total marks for each student, which are used to decide who is the topper.

Data collected from census is used to generate different types of information. The Ethiopian government can use it to determine the literacy rate in the country. Government can use the information in making important decisions such as to improve literacy rate and implement ICTs etc.

Fig. 1.2: Census Information can be very useful for Implementing ICTs in Ethiopia

Data processing is the transformation of data into meaningful information.

The whole purpose of a computer (and communications) system is to produce (and transmit) usable information.

Figure 1.3 illustrates the processing of raw data into useful information, its recycling and its packaging in a new form so that it is easier to understand, more attractive, or more useful.
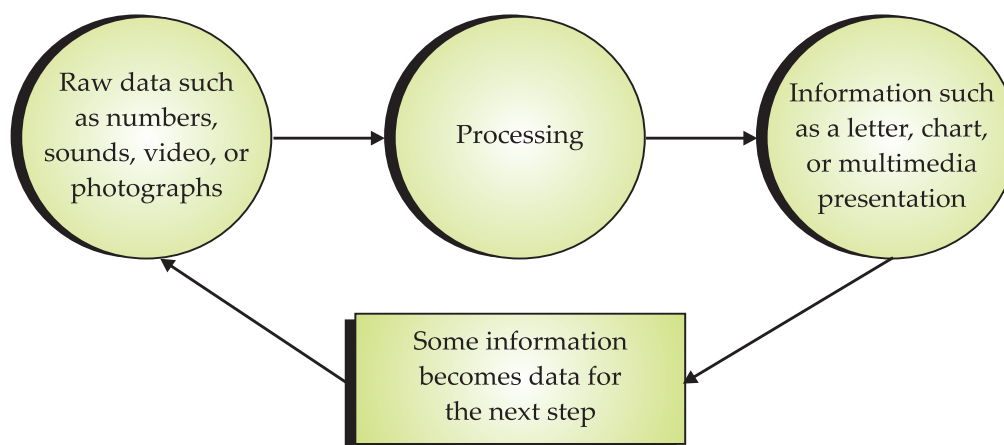
Fig. 1.3: Data versus Information

Data processing includes the following steps:

(*i*) Data Coding
(*ii*) Data Input,
(*iii*) Data Editing, and
(*iv*) Data Manipulation.

Table 1.1 gives the differences between data and information.

Table 1.1: Differences between Data and Information

Data	*Information*
It is a collection of facts and figures.	It is a collection of final results.
It is in an unorganied (raw) form.	It is in an organied form.
It is not in directly useful form.	It is in directly useful form.
It needs processing.	It does not need any processing.
It is also termed as input.	It is also termed as output.
It requires observations and recordings.	It requires analysis.

● Technology

Technology is the usage and knowledge of tools, crafts, techniques, or systems, or methods of organizations. Science is concerned with how and why things happen. Technology focuses on making things happen. Technology began to influence human beings as soon as people began using tools.

Now-a-days, technology is an integrated part of lives of human beings. For example, the technology in communications such as mobile phones help us to connect with the other people easily.

Technology has a simple but important role in our life now-a-days. Without it, we will not be having the connection with the other people.

● Information Technology

"Information Technology", or "IT", refers to anything related to computing technology, such as networking, hardware, software, the Internet, or the people that work with these technologies.

or

Information Technology is the study, design, development, implementation support and/or management of any computer based information systems. This relates particularly to software applications and computer hardware.

The history of IT goes back several years. In order to perform the functions associated with the field of technology, the modern field uses computers, servers, database management systems and cryptography.

Since we live in the "information age," information technology has become a part of our everyday lives. That means the term "IT," already highly overused, is here to stay.

Fig. 1.4: Information Technology has become a part of our daily lives (Courtesy: web.worldbank.org)

● Sources of Information

An information 'source' can be categorized by the type of information it contains. Sources are usually classified as primary, secondary and tertiary. Table 1.2 illustrates the various sources of information.

Table 1.2: Sources of Information

Primary Sources	Secondary Sources	Tertiary Sources
Original ideas and research	Analysis, discussion or interpretation of original ideas and research	Significant knowledge is combined, condensed and summarized
Examples:	Examples:	Examples:
Research articles, research reports, diaries, letters, performance recordings, standards, legislation.	Review articles, specialist texts, textbooks, newspaper articles.	Encyclopedias, handbooks, dictionaries, bibliographies.

The use of information sources is influenced by the following factors:

(i) subject of the study,
(ii) nature of the information sought,
(iii) the attitude of the user,
(iv) the intensity of the need one feels, and
(v) working conditions.

Fig. 1.5: Use of Information Sources is Influenced by the Working Conditions

Documentary Sources

As mentioned earlier the sources of information or evidence are often categorized as primary, secondary, or tertiary material. These classifications are based on the originality of the material and the proximity of the source or origin. This informs the reader as to whether the author is reporting information that is first hand or is conveying the experiences and opinions of others which is considered second hand. Determining if a source is primary, secondary, or tertiary can be tricky. Let us describe the three categories of information and give examples to help you make a determination.

Primary Documentary

Primary sources of information are *original materials* that often convey new ideas, discoveries, or information. These sources originate from the time period under study. Examples of primary sources include:

(*i*) original research studies (often in the form of journal articles in peer-reviewed publications), also called empirical studies (*e.g.*, psychology)

(*ii*) patents, technical reports

(*iii*) original documents such as diaries, letters, e-mails, manuscripts, lab data/notes

(*iv*) newspaper articles from the time period under study

(*v*) autobiographies, first-person accounts, case studies

(*vi*) artifacts and archival material such as official documents, minutes recorded by government agencies and organizations, photographs, coins, fossils, natural specimens

(*vii*) works of art such as literature, music, architecture, or paintings.

Secondary Documentary

Secondary sources of information are based on *primary sources*. They are generally written at a later date and provide some discussion, analysis, or interpretation of the original primary source. Examples of secondary sources include:

(*i*) review articles or analyses of research studies about the same topic (also often in peer-reviewed publications)

(*ii*) analyses of original documents or archival material

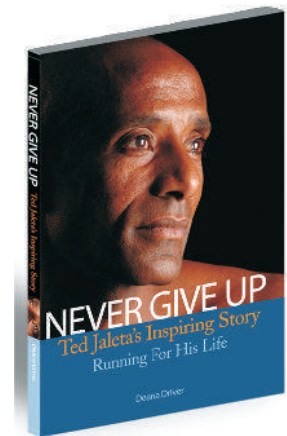(*iii*) biographies, reviews, or critiques of an author.

Fig. 1.6: A biography—One of the Secondary Documentary Sources of Information

Tertiary Documentary

Tertiary sources of information are *based on a collection of primary and secondary sources*. Examples of tertiary sources include:

(*i*) textbooks (sometimes considered as secondary sources)

(*ii*) dictionaries and encyclopedias

(*iii*) manuals, guidebooks, directories, almanacs

(*iv*) indexes and bibliographies.

How do you tell the difference?

It is not always easy to distinguish primary and secondary sources. The distinction between primary, secondary, and tertiary sources can differ between subjects and disciplines, particularly between the sciences and the humanities.

(*i*) In the sciences, research findings may be communicated informally through e-mail, then presented at meetings before being formally published as a primary source. Once published, they will be commented on by other scholars (secondary sources) and professionally indexed in a database or printed index (tertiary sources).

(*ii*) In the humanities, primary sources for the cultural history of the 90s might include the paintings, novels, and films of the period.

(*iii*) A newspaper article is a primary source if it is reporting the news or the views of the day, but may be a secondary source to the extent that it includes analysis and research based on other sources.

note

If a source does not fit the description of a primary source, it is most likely a secondary source.

Tip: *Work Backwards*

1 Start with tertiary sources (reference sources, databases, etc)

Find background information on your topic by consulting reference sources and web pages for introductions and summaries, and to find bibliographies or citations for secondary and primary sources.

2 Then go to secondary sources

Find articles, books, webpages, and other sources providing more extensive and in-depth analysis of a topic. Check to see what other scholars and experts have to say about your topic.

3 Then try primary sources

Once you have some background knowledge on your topic, you will be better able to understand, interpret, and analyze the primary source of information. See if you can find primary source evidence to support or refute what other scholars and experts have said about your topic, or try an interpretation of your own and look for more primary sources to confirm or refute your thesis. When you present your conclusions, you will have produced another secondary source to assist others in their research.

Non-documentary Sources

The non-documentary sources are also called Informal Information Sources. These include government departments, research organizations, learned professional societies, industries, universities, colleagues, corridor meetings at conferences and social gatherings.

Some examples of institutes which are excellent non-documentary sources in Ethiopia are given below along with their URLs (Uniform Resource Locators).

 (*i*) Addis Ababa University (URL: www.abyssiniacybergateway.net/ethiopia/)

 (*ii*) Alemaya University (URL: www.alemayau.edu.et/)

 (*iii*) Institute of Ethiopian Studies (URL: www.ies-ethiopia.org)

 (*iv*) International Community School of Addis Ababa (URL: www.icsaddis.edu.et/)

 (*v*) Jimma Institute of Health Sciences (Jimma, Ethiopia) (URL: www.ju.edu.et/)

Acquiring Information Through Non-documentary Sources

As far as non-documentary sources of information are concerned, private correspondence is still in wide use. Oral transmission of a particular topic is quite useful for acquiring information.

Agencies of non-documentary sources of information include:

 1 Communication among small groups, such as:

   (*i*) Suggestions from colleagues/friends,

   (*ii*) Contacts with peers,

   (*iii*) Off-prints from authors,

   (*iv*) Journal clubs,

   (*v*) Technological gatekeepers, and

   (*vi*) Corridor meetings at conferences.

 2 Communication among big groups, such as:

   (*i*) Seminars and conferences, and

   (*ii*) Invisible colleges (information exchange groups).

3 New social information exchange tools like Blogs (fun keeping journals on the Internet ac cessible to other users) and Twitter, such as:

(*i*) www.twitter.com   (*ii*) ethiopiatwitter.blogspot.com

(*iii*) www.ethiopianreview.com   (*iv*) www.african-safari-information.com

(*v*) twitter.com/ethiopiawire   (*vi*) green.blogs.nytimes.com

ACTIVITY 1.1

A REPORT ON SOURCES OF INFORMATION IN EDUCATION

Information can come from many sources — personal experiences, books, articles, expert opinions, encyclopaedias, the World Wide Web — and the type of information can change depending on the situation. In recent times, Ethiopia has shown encouraging signs in the expansion of utilizing ICT for multi-purposes. ICT plays a vital role in studying the sources of information in education sector all over the world.

Sources of Information

Look at the following sources of information. Notice the similarities between them. Keep in mind the following three questions:

1. Which sources can you find online?

2. Which sources guide you to other information on your topic?

3. Which sources would you use when writing a report?

Magazines

Newspapers

Books

Encyclopedias

World Wide Web

Library Catalogue

Fig. 1.7: Some Sources of Information

Searching Sources of Information in Education

The students can visit any school/college/institution in groups with their ICT teachers to know about the sources of information in education. There, students may find several sources of information which may be documentary (primary, secondary or tertiary sources) and non-documentary.

The students may find some sources of information in education like Periodicals, Laboratory Notebooks, Bibliographies, Reference Books, Yearbooks and Directories etc. in the school/college/institution. They may even look for some Blogs and Twitters on the World Wide Web.

Prepare a list of the sources of information in the form of a table as shown below.

Sources of Information

S.No.	Primary Sources	Secondary Sources	Tertiary Sources	Non-documentary
1.	....	....	....	....
2.	....	....	....	....
3.	....	....	....	....
4.	....	....	....	....
5.	....	....	....	....
...	....	....	....	....

Finally submit the report to your ICT teacher and get it evaluated.

KEY CONCEPTS

➤ Data is a collection of raw facts and figures or a raw input which when processed or arranged makes meaningful output.

➤ Information is the data that is organized, meaningful and useful.

➤ Technology is the usage and knowledge of tools, crafts, techniques, or systems, or methods of organizations.

➤ 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.

➤ An information 'source' can be categorized by the type of information it contains. The types are primary, secondary and tertiary.

ASSESSMENT 1.1

Fill in the Blanks

1. ICT stands for ....

2. .... consists of raw facts and figures that are processed into information.

3. .... is the usage and knowledge of tools, crafts, techniques, or systems, or methods of organizations.

4. The sources of information are usually classified as ...., ... and ....

State whether True or False

1. ICT is "the study of International Crime Technology."
2. When computer and communications are combined, the result is Information and Communications Technology.
3. Information is data that has been summarized or otherwise manipulated for use in decision-making.
4. The non-documentary sources are also called Informal Information Sources.

Answer the Following

1. Define data and information.
2. Give the differences between data and information.
3. Explain the term technology and information technology.
4. Write a short note on sources of information.

Suggested Activities

1. Explain and demonstrate the terms data, information and technology.
2. Explain and demonstrate the different sources of information.

Field Trips

1. Students should visit some big educational organization in their city. Interact with faculties there and prepare a report on "Basic concepts of ICT and sources of information".
2. Students should visit some places like shopping centre, hospitals and science laboratory in their city and report on "Impact of ICT on everyday life."

1.2 GENERATION OF COMPUTERS

A computer is an electronic device that accepts, processes, stores and outputs data under the control of sets of instructions.

Computers have come across a long way to acquire the current form and capability. It took around 60 years of continuous developments to bring the computer in its present form. The evolution of computers is mainly divided into five main generations. The computers of each of these generations have different properties.

Each new generation resulted in the following changes:

Increase in speed, storage capacity and reliability

Decrease in cost and size

● First Generation Computers (1940–1956)

The U.S. census Bureau developed the first business computer in the year 1951. This computer was called Universal Automatic Computer (UNIVAC). It used vacuum tube (see Fig. 13) circuits for processing. The

computers that used vacuum tube circuits were called the First Generation Computers. The vacuum tube circuits contained a filament that was heated to emit electrons.

The main features of the first generation computers were as follows:

1 They used vacuum tubes.
2 They had a very big size.
3 They consumed huge electricity.
4 They were prone to failures.
5 They generated a lot of heat.
6 They only supported machine language.

Fig. 1.8: Vacuum Tube

● **Second Generation Computers (1956–1964)**

Bell Labs of U.S.A. invented transistors (see Fig. 1.9) that were used instead of vacuum tubes. Transistors are electronic circuits that are small in size. They do not emit electrons and do not require any heating. The computers that used transistors were called the Second Generation Computers.

The main features of the second generation computers were as follows:

1 They used transistors instead of vacuum tubes.
2 They were smaller in size as compared to the first generation computers.
3 They generated lesser heat.
4 They were more reliable and faster than the first generation computers.
5 They used core memories, magnetic tapes and disks.
6 They used lesser electricity.
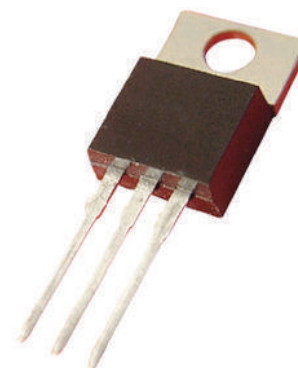7 They could be programmed by using machine as well as assembly language.

Fig. 1.9: Transistor

● **Third Generation Computers (1964–1971)**

The Third Generation Computers used Large Scale Integrated (LSI) circuits for processing. The LSI circuits were invented in mid 60s. LSI circuits integrate several circuit components into a single chip.

The main features of the third generation computers were as follows:

1 They used integrated circuits (see Fig. 1.10).
2 They had a small size as compared to the second generation computers.
3 They consumed less electricity.
4 They were faster and reliable than the second generation computers.
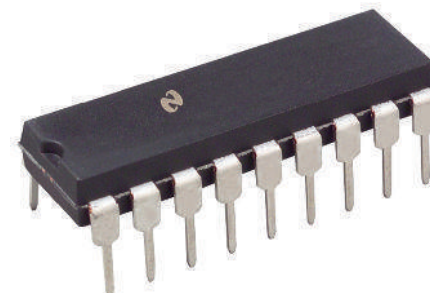5 They supported high level language.

Fig. 1.10: Integrated Circuit

● **Fourth Generation Computers (1971–Present)**

Very Large Scale Integrated (VLSI) chips were invented in the year 90. The computers that used VLSI chips were called the Fourth Generation Computers.

The main features of the fourth generation computers are:

1 They contain high-speed microprocessors.

2 They contain huge storage volumes in the form of magnetic and optical storage.

3 They contain main memories up to GBs (Gigabytes).

4 They are companied by great developments in the fields of networks.

## • Fifth Generation Computers (Future)

Fig. 1.11: VLSI chip

Recent research has focused on developing "thinking computers." These computers are called the Fifth Generation Computers.

Fifth generation computers will have the power to learn and apply knowledge to solve a problem. They would be able to work like humans do. You can watch a movie named "AI" by Steven Spielberg to have an idea of such computers.

Table 1.3 summarizes the key technologies and features of the various generations of computers.

Table 1.3: Comparison of Generations of Computers

Generation	Period	Circuitry	Input	Storage	Output	Language	Examples
1st	1940	Vacuum Tubes	Punched Cards	Magnetic tapes	Punch Cards	Machine Language	Univac, IBM 650, Burroughs 220
2nd	1956	Transistors	Punched Cards, Magnetic tapes	Magnetic tapes	Punch Cards	Machine, Assembly	IBM 1401, Honeywell 200
3rd	1964	Integrated Circuits (ICs)	Keyboards	Magnetic Disks	Monitor	Pascal, Fortran, Cobol, RPG	IBM System-360
4th	1971 present	Very Large Scale Integration (VLSI) of circuits	Mouse, Scanners, Sound, etc.	Magnetic Disks with higher capacity	Monitor, Printers	RDBMS, etc.	IBM System 360, HP 9000
5th	Future	With Artificial intelligence					
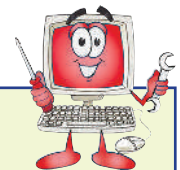
ACTIVITY 1.2

INTRODUCTION TO ARTIFICIAL INTELLIGENCE

In small groups students will discuss "Introduction to Artificial Intelligence" based on the following information. The group leader from each group will give a brief presentation to the class based on the discussions.

Artificial Intelligence

Artificial Intelligence (AI) is the ability of a computer or other machines to perform those activities that are normally thought to require intelligence.

or

Artificial Intelligence is the branch of computer science concerned with making computers behave like humans.

The term was coined in 1956 by John McCarthy at the Massachusetts Institute of Technology, located in Cambridge, Massachusetts (United States).

Artificial intelligence includes:

1. **Games playing:** Programming computers to play games such as chess and checkers.

Fig. 1.12: Games Playing

2. **Expert systems:** Programming computers to make decisions in real-life situations (for example, some expert systems help doctors diagnose diseases based on symptoms).
3. **Natural language:** Programming computers to understand natural human languages.
4. **Neural networks:** Systems that simulate intelligence by attempting to reproduce the types of physical connections that occur in animal brains.
5. **Robotics:** Programming computers to *see* and *hear* and *react* to other sensory stimuli.

Fig. 1.13: A Robot — An AI tool

Currently, no computers exhibit full artificial intelligence (that is, are able to simulate the human behaviour). The greatest advances have occurred in the field of games playing.

Today, the hottest area of artificial intelligence is neural networks, which are proving successful in a number of disciplines such as voice recognition and natural-language processing.

KEY CONCEPTS

➢ The computers that used vacuum tube circuits were called the First Generation Computers.

➢ The computers that used transistors were called the Second Generation Computers.

➢ The Third Generation Computers used Large Scale Integration (LSI) circuits for processing.

➢ The computers that used Very Large Scale Integrated (VLSI) chips were called the Fourth Generation Computers.

➢ Recent research has focused on developing "thinking computers". These computers are called the Fifth Generation Computers. They would be able to work like humans do.

ASSESSMENT 1.2

Fill in the Blanks

1   The evolution of computers is mainly divided into .... main generations.

2. Each new generation of computers resulted in decrease in .... and ....

3   The computers that used .... circuits were called the First Generation Computers.

4   .... generation computers will have the power to learn and apply knowledge to solve a problem.

State whether True or False

1   The computers of all the five generations have different properties.

2   The computers that used transistors were called the First Generation Computers.

3   The Third Generation Computers used integrated circuits.

4   The Fourth Generation Computers are companied by great developments in the fields of networks.

Answer the Following

1   List the generation of computers.

2   Compare the differences amongst each generation of computers.

Suggested Activity

Explain and demonstrate (pictorially or physically) each generation of computers.

Field Trip

Organize a field trip to various places such as government organizat ions and science laboratories to find out and report on:

Different generations of computers.

1.3   TYPES OF COMPUTERS

Computers can be classified into super computers, mainframe computers, minicomputers, and microcomputers (personal computers) on the basis of the following:

1   Size

2   Cost

3   Performance

   (i) Speed of processing data

  (ii) Storage capacity

 (iii) Ability to handle input and output devices

Let us classify the types of computers used today:

● Super Computers

(i) Super computers are the largest and fastest computers. They are also the costliest computers.

(*ii*) They are used in fields like science and defence. These computers are used for designing and launching missiles, weather forecasting, biomedical research, aircraft design and automobile design.

(*iii*) There are only a few super computers throughout the world. Some examples are IBM Blue Gene/L, IBM Roadrunner and Cray Jaguar.

Fig. 1.14: Super computer

• Mainframe Computers

(*i*) Mainframe computers are more powerful than minicomputers.

(*ii*) They have high processing speeds and can store large amounts of data. They are used in wide area networks and support hundreds of users. However, these computers consume more electricity.

(*iii*) Some examples are IBM 0 series and Univac 0

Fig. 1.15: Mainframe computer

• Minicomputers

(*i*) Minicomputers are small general-purpose computers, also called *mid-range servers*. These computers can perform more complex tasks and cost more than microcomputers.

(*ii*) They are larger in size and they have small to medium storage capacity.

(*iii*) They are used for processing data and analysing results of experiments. They are also used for controlling and monitoring production processes.

(*iv*) Some examples are PDP 1 2 and VAX 1 .

Fig. 1.16: Minicomputer

• Microcomputers

(*i*) Microcomputers are also called Personal Computers (PC s). These computers use microprocessors.

(*ii*) They are small in size. Also, they do not have large storage capacities.

(*iii*) They can perform difficult tasks. They are used mainly for desktop publishing, accounting, statistical analysis, graphics designing and project management.

(*iv*) Some examples are Apple II, IBM PC , PS /2 and Macintosh.

A desktop microcomputer   A tower microcomputer
Fig. 1.17: Two Microcomputers

Personal computer or PCs are the popular form of computers. Individuals as well as organizations use these computers. The classification of PCs is as:

1. *Desktops:* These PCs are those in which the case or main housing sits on a desk, with keyboard in front and screen (monitor) often on top.

2. *Portables:* These PCs are so small that they can be placed on your lap.

The difference between portables and desktops is that portables can be carried while travelling unlike desktops. The portables are classified as:

(*i*) *Laptops:* These are small-sized machines that have the same power of a desktop. The weight of a laptop is around 7 to 12 kg. The drawback of a laptop is that it is too bulky. *Examples*: Toshiba 200CD and SLT/86.

(*ii*) *Notebooks:* These are smaller than a laptop and are designed to overcome the drawbacks of a laptop. They have the size of a notebook but are as powerful as a desktop. They weigh 3 to 4 kg. *Examples*: Contura 3/20 and Acer AnyWare.

(*iii*) *Palmtops* or *Personal Digital Assistants (PDAs):* These are handheld computers which have the size of a pocket calculator. They are not as powerful as a desktop. PDAs combine personal organization tools — schedule planners, address books, to-do lists — with the ability in some cases to send e-mail and faxes. *Example*: HP 95LX.

A Laptop   A Notebook   A Personal Digital Assistant (PDA)

Fig. 1.18: A laptop, a notebook and a Personal Digital Assistant (PDA)

● Characteristics of a Computer

Computers are capable of performing highly complex tasks, which human beings cannot perform efficiently. The following are the main characteristics of computers, which make them so powerful:

1. Speed

Computers work at an amazing speed without any mistakes. The work, which a normal person would complete in a few hours can be done within fractions of a second by a computer. Speed of computers is measured in terms of milliseconds (10^{-3} seconds), microseconds (10^{-6} seconds) or nanoseconds (10^{-9} seconds).

2. Accuracy

A computer performs its task with great accuracy. It never commits mistakes in processing the data. It produces errors when we enter inaccurate input, *i.e.*, Garbage In Garbage Out (GIGO).

3. Reliability

Computers are more reliable than human beings as they do not get bored of the repetitive tasks and never get tired.

4. Storage Capacity

A computer can store large amount of data. It can store various documents, articles, pictures, etc., in its memory which can be used whenever required. On the other hand, a human being can keep only a limited information in his/her mind and rest of the things, he/she forgets.

5. Versatility

A computer can perform various types of jobs. On a computer system, we can listen to songs while typing text or play games while working on any other package, do calculations, make drawings, surf the net, send e-mail, etc.

6. Reduction in Manpower

Earlier, the work in industries/factories was done by a number of persons. But with computers, it can be completed by a few persons and that too more accurately and efficiently. The advent of computer has reduced the need of manpower.

7. Paper Work can be Reduced

The use of computer reduces the burden of paper work in any organiat ion. *For example*, record of each student of a school can be kept in the computer itself rather than keeping manual files for each student. Also, information regarding any student can be obtained easily and quickly with the help of a computer.

● Limitations of a Computer

Despite having various advantages, computers do have the following limitations that are the strengths of human beings. These are:

1. No Decision-making Ability

Computers cannot take any decisions. Human beings assist the computer to take the decisions. *For example*, suppose a street hawker is selling flowers. If such kind of flowers are already in our house, we will decide not to purchase them. Taking decision in this way, without the assistance of human beings, is not possible by a computer.

2. No Intelligence

Computers do not have intelligence of their own, they work according to the instructions given by humans.

3. No Emotions and Feelings

Computers are far away from emotions and certainly being machines, they cannot have feelings and instincts.

These limitations of computers are characteristics of human beings. Thus, computers and human beings work in collaboration to make a perfect pair.

ACTIVITY 1.3

USES OF COMPUTERS

In small groups students will discuss "Some uses of computers" based on the following information. The group leader from each group will give a brief presentation to the class based on the discussions.

Computers are everywhere. Some of the modern uses of computers are:

1. Traffic Control System

Computers are used to control the movement of people, goods, and vehicles in order to ensure their safe, orderly, and expeditious (done with speed and efficiency) flow throughout the transportation system. Each of the five areas of transportation—roadways, airports and airways, railways, coastal and inland waterways, and pipelines—have unique systems of control.

The traffic control system has improved worldwide so much that being mobile (whether walking or riding) has become a lot safer.

Fig. 1.19: An air traffic control system

2. Ticket Machines

The ticket machines are computerized vending machines that generate tickets. Whatever the size, the process is the same. The person chooses the ticket type and quantity from the display. After choosing the payment method, the ticket is generated.

3. Cash Machines in Banks

A cash machine or an ATM (Automated Teller Machine) is an unattended machine (outside some banks) that dispenses money when a personal coded card is used.

Fig. 1.20: A ticket machine

The central bank of Addis Ababa is known as the **National Bank of Ethiopia (NBE)**. Besides the central bank, there are many other banks in Addis Ababa. The ATM counters in Addis Ababa can be located at:

(*i*) Hilton Hotel, Ground Floor

(*ii*) Sheraton Hotel, Lounge

(*iii*) Wabe Shebelle Hotel, Ground Floor
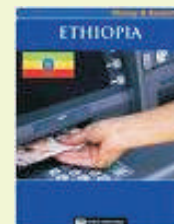
(*iv*) Dembel Shopping Mall, Ground Floor

Fig. 1.21: A cash Machine or an ATM

🔑 KEY CONCEPTS

➤ Super computers are the most powerful computers among digital computers.

➤ Mainframe computers are designed to handle huge volumes of data and information.

➤ Minicomputers are small general purpose computers, also called *mid-range servers*.

> ➢ Microcomputers are also called Personal Computers (PCs). These are classified into desktops and portables.
>
> ➢ The main characteristics of a computer are: speed, accuracy, reliability, storage capacity, versatility, reduction in manpower and reduction in paper work.

Assessment 1.3

Fill in the Blanks

1 .... can be classified into super computers, mainframe computers, minicomputers and microcomputers.

2 .... are the largest and fastest computers.

3 .... are those computers in which the case or main housing sits on a desk, with keyboard in front and screen (monitor) often on top.

4 Personal Digital Assistants (PDAs) have the size of a ....

State whether True or False

1 We cannot classify the computers on the basis of size.

2 Mainframe computers are more powerful than minicomputers.

3 Minicomputers cannot be called mid-range servers.

4 Laptops are small sized machines that have the same power of a desktop.

Answer the Following

1 Classify the types of computers used today.

2 List the characteristics of each type of computer.

Suggested Activity

Categorize the computers in terms of size, processing speed and capacity only.

Field Trips

1 Determine what types of computers are being used in your school. In which departments are the different types of computer used? What are they used for? How are they connected to other computers?

2 Organize a field trip to various places such as science laboratories and government organizations to find out and report on:

Types of computers and their uses.

1.4 INTRODUCTION TO DATA REPRESENTATION

A digital computer works with binary number system. The binary number system has only two digits 0 and 1. Inside the computer, binary number is represented by an electrical pulse. 1 means a pulse of electricity and 0 means no pulse.

Data is divided into three types – alphabetic data, numeric data and alphanumeric data. Alphabetic data is used to represent the alphabets. It consists of capital letters A–Z , small letters a–z and blank space etc. Alphabetic data is also called non-numeric data. Numeric data consists of ten digits

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, two signs + and – and decimal point. Alphanumeric data is used to represent alphabetic data, numeric data, special characters and symbols.

One digit in binary number system is called a *bit* and combination of eight bits is called a *byte*. A byte is the basic unit that is used to represent the alphabetic, numeric and alphanumeric data.

All the data that is entered into a computer is first converted into the binary form and after processing, it is again converted to human readable form as shown in Fig. 1.22.
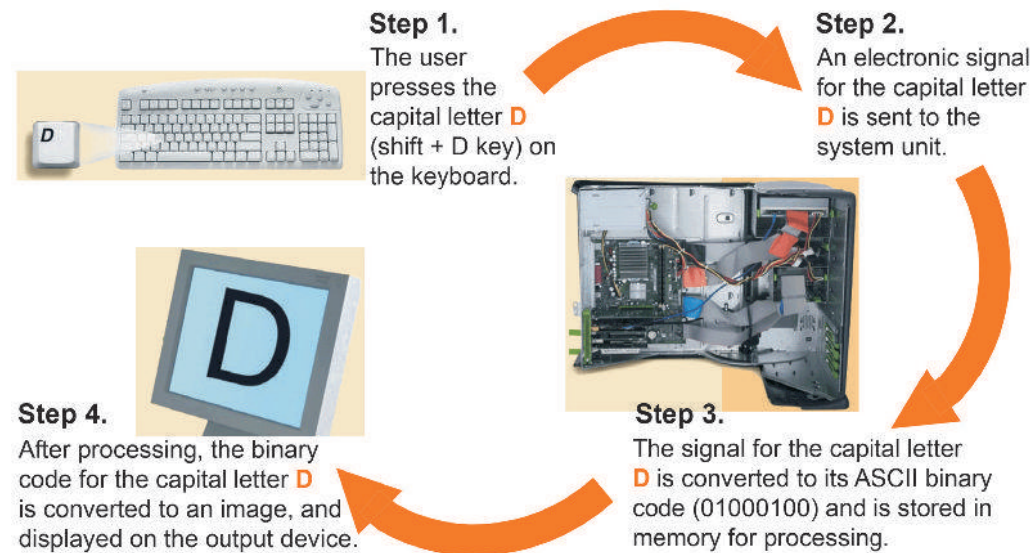

Step 1. The user presses the capital letter **D** (shift + D key) on the keyboard.

Step 2. An electronic signal for the capital letter **D** is sent to the system unit.

Step 3. The signal for the capital letter **D** is converted to its ASCII binary code (01000100) and is stored in memory for processing.

Step 4. After processing, the binary code for the capital letter **D** is converted to an image, and displayed on the output device.

Fig. 1.22: Conversion of a letter to Binary form and back

We will learn about computer coding system later in this unit.

● Number Systems

There are different types of number systems that are used to represent data. You are already familiar with the decimal number system. The other useful number systems are binary, octal and hexadecimal. You may regard each digit as a box that can hold a number.

Let us discuss the various number systems:

Binary Number System

In the binary number system, there can only be two choices for representing data—either a "0" or a "1".

The base or radix of the binary number system is 2

Octal Number System

In the octal number system, there can be eight possibilities:

"0", "1", "2", "3", "4", "5", "6", "7".

The base or radix of the octal number system is 8

Hexadecimal Number System

In the hexadecimal number system, we have 16 symbols:

"0", "1", "2", "3", "4", "5", "6", "7", "8", "9", "A", "B", "C", "D", "E", and "F".

The base or radix of the hexadecimal number system is 16

As shown in Table 1.4, there is a direct correspondence between the binary system and the octal system, with three binary digits corresponding to one octal digit. Likewise, four binary digits translate directly into one hexadecimal digit. In computer usage, hexadecimal notation is especially common because it easily replaces the binary notation, which is too long and human mistakes in using the binary numbers are too easily made.

Table 1.4: Base Conversion Table

Decimal	Binary Equivalent	Octal Equivalent	Hexadecimal Equivalent
0	0	0	0
1	1	1	1
2	10	2	2
3	11	3	3
4	100	4	4
5	101	5	5
6	110	6	6
7	111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F

● Conversion of Numbers from One Number System to the Other

We can convert a number in one system to the other system by following rules specified by the number systems. Following conversions are generally performed in calculations.

Decimal to Binary Conversion

To convert a decimal number to its equivalent binary number, follow these steps:

1. Divide the number by 2 and store the remainder.
2. Divide the quotient by 2 and store the remainder.
3. Repeat these steps until quotient becomes 0
4. Write the remainders from bottom to top order.

This arrangement of remainder digits will be the binary equivalent of the number. Let us describe this conversion process with decimal number 23.

2	23	Remainder	
2	11	1	= 10111
2	5	1	
2	2	1	
2	1	0	
	0	1	

Converting Decimal to Octal

To convert a decimal number to its equivalent octal number, follow these steps:

1 Divide the number by 8 and store the remainder.

2 Divide the quotient by 8 and store the remainder.

3 Repeat these steps until quotient becomes 0

4 Write the remainders from bottom to top order.

The steps are same as in decimal to binary conversion with only one difference that the number is divided by 8 because, 8 is the base in octal number system. For example, 833 in decimal will be equal to 1501 in octal.

8	833	Remainder
8	104	1
8	13	0	= 1501
8	1	5
	0	1

Converting Decimal to Hexadecimal

To convert a decimal number to its equivalent hexadecimal number, follow these steps:

1 Divide the number by 16 and store the remainder.

2 Divide the quotient by 16 and store the remainder.

3 Repeat these steps until quotient becomes 0

4 Write the remainders from bottom to top order.

The steps are same as in decimal to binary conversion with only one difference that the number is divided by 16 because, 16 is the base in hexadecimal number system. For example, 1715 in decimal will be equal to 6B3 in hexadecimal.

16	1715	Remainder	Hexadecimal equivalent	
16	107	3	3	
16	6	11	B	= 6B3
	0	6	6	

Converting Binary to Decimal

You can convert a binary number back to decimal number by multiplying each digit from right side with increasing power of 2 and adding the result. This means, the first digit from right will be multiplied by 2^0, the second digit with 2^1 and so on. For example,

$$(10111)_2 = ?_{10}$$
$$= 1 \times 2^0 + 1 \times 2^1 + 1 \times 2^2 + 0 \times 2^3 + 1 \times 2^4$$
$$= 1 + 2 + 4 + 0 + 16$$
$$= 23$$

Converting Octal to Decimal

We can also convert an octal number to decimal number by multiplying each digit from right side with increasing power of 8 and adding the result. This means, the first digit from right will be multiplied by 8^0, the second digit with 8^1 and so on. For example,

$$(5105)_8 = ?_{10}$$
$$= 5 \times 8^0 + 0 \times 8^1 + 5 \times 8^2 + 1 \times 8^3$$
$$= 5 + 0 + 320 + 512$$
$$= 837$$

Converting Hexadecimal to Decimal

We can also convert an hexadecimal number to decimal number by multiplying each digit from right side with increasing power of 16 and adding the result. This means, the first digit from right will be multiplied by 16^0, the second digit with 16^1 and so on. For example,

$$(6B3)_{16} = ?_{10}$$
$$(6B3)_{16} = 3 \times 16^0 + 11 \times 16^1 + 6 \times 16^2 \qquad \text{(Here, B = 11)}$$
$$= 3 + 176 + 1536$$
$$= 1715$$

Converting Binary to Octal

To convert a binary number to its equivalent octal number, follow these steps:

1 Divide the binary number into groups of three bits each beginning from right side.
2 Add 0 to the left, if last group is incomplete.
3 Convert each group into decimals.

For example, consider the following:

$$(101011)_2 = ?_8$$
$$= 101 \qquad 011$$
$$= 5 \qquad\qquad 3$$

As $\qquad\qquad 101 = 1 \times 2^0 + 0 \times 2^1 + 1 \times 2^2$
$$= 1 + 0 + 4 = 5$$

and $\qquad\qquad 011 = 1 \times 2^0 + 1 \times 2^1 + 0 \times 2^2$
$$= 1 + 2 + 0$$
$$= 3$$

Therefore, $\qquad (101011)_2 = (53)_8$

Converting Octal to Binary

To convert an octal number to its equivalent binary number, follow these steps:

1. Convert each digit octal number to its equivalent three digit binary number.
2. Combine all the binary groups into a single group.

For example, consider

$$(53)_8 = ?_2$$
$$(53)_8 = 5 \qquad 3$$
$$= 101 \qquad 011$$

as $\qquad 101 = 5$ and $011 = 3$ in decimal (refer to Table 1.4)

Therefore, $\qquad (53)_8 = (101011)_2$

Converting Binary to Hexadecimal

To convert a binary number to its equivalent hexadecimal number, follow these steps:

1. Divide the binary number into groups of four bits each beginning from right side.
2. Add 0 to the left, if last group is incomplete.
3. Convert each group into decimals.

For example, consider the following

$$(110101)_2 = ?_{16}$$
$$= 0011 \qquad 0101$$
$$= 3 \qquad 5$$

as 0011 is 3 in decimal and 0101 is 5 in decimal (refer to Table 1.4).

Therefore, $\qquad (110101)_2 = (35)_{16}$

Converting Hexadecimal to Binary

To convert a hexadecimal number to its equivalent binary number, follow these steps:

1. Convert every digit *i.e.*, A to F of hexadecimal number (if any) to decimal equivalent.
2. Convert every decimal number to its equivalent four digit binary number.
3. Combine all the binary groups to form a single binary number.

For example,

$$35_{16} = ?_2$$
$$3 = (0011)_2 \qquad \text{(refer to Table 1.4)}$$
$$5 = (0101)_2$$

Therefore, $\qquad (35)_{16} = (00110101)_2$

> **note**
>
> It must be remembered that whatever number system one may use, the information stored in the computer memory is always in terms of binary digits. It is only for our convenience that we use octal or hexadecimal numbers.

● Computer Coding System

We are already familiar about different types of number systems. The computers convert the information, numeric or non-numeric, into binary form. Therefore, one must know how the data/information is stored in computer memory.

A computer handles non-numeric data in addition to numerical data, that is, alphabets, punctuation marks and other special characters. Some predefined codes are used to represent the numeric and non-numeric characters. These codes are known as **alphanumeric codes**. Any data or information is represented internally using the bits 0 and 1

> A computer system's data/information storage capacity is represented by bytes, kilobytes, megabytes, gigabytes and terabytes.
>
> 1 Byte = 8 bits
>
> 1 Kilobyte (KB) = 2^{10} bytes = 1024 bytes
>
> 1 Megabyte (MB) = 1024 KB = $2^{10} \times 2^{10}$ bytes = 2^{20} bytes
>
> 1 Gigabyte (GB) = 1024 MB = $2^{10} \times 2^{20}$ bytes = 2^{30} bytes
>
> 1 Terabyte (TB) = 1024 GB = $2^{10} \times 2^{30}$ bytes = 2^{40} bytes

Let us discuss some useful codes for data representation:

BCD (Binary Coded Decimal)

Binary Coded Decimal (BCD) code is one of the early computer codes. The idea of this coding scheme is to convert each digit of a decimal number into its binary equivalent instead of converting the entire decimal value into a binary number. This makes the conversion process easier.

Table 1.5 shows BCD equivalent of each decimal digit. Since 8 and 9 require 4 bits, all decimal digits are represented in BCD by 4 bits.

Table 1.5: BCD equivalent of decimal digits

Decimal Digits	BCD Equivalent
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

Note that each decimal digit is independently converted to a 4 bits binary number, and hence, the conversion process is very easy. Also note that when four bits are used, altogether (16 = 2^4) combinations are possible (refer to hexadecimal number system). However, from Table 1.5 you can see that only the first 10 of these combinations are used to represent decimal digits. The remaining six arrangements (1010, 1011, 1100, 1101, 1110 and 1111) have decimal values from 10 to 15. These arrangements are not used in BCD coding. That is, 1010 does not represent 10_{10} in BCD. Instead,

$$10_{10} = \begin{array}{c|c} 1 & 0 \\ \hline 1 & 0 \end{array} \quad \text{or} \quad 00010000 \text{ in BCD}$$

Similarly,

$$15_{10} = \begin{array}{c|c} 1 & 0 \\ \hline 1 & 5 \end{array} \quad \text{or} \quad 00010101 \text{ in BCD}$$

In the discussion above, we have used a group of four bits to represent a digit (character) in BCD. 4 bits BCD coding system can be used to represent only decimal numbers because four bits are insufficient to represent the various characters used by a computer. Hence, instead of using four bits with only 16 possible characters, computer designers commonly use six bits to represent characters in BCD code. In 6 bit BCD code, the four BCD numeric place positions are retained but two additional zone positions are added. With six bits, it is possible to represent 64 (2^6) different characters. This is sufficient to code the decimal digits (10), alphabetic letters (26 in number), and other special characters (28 in number). Table 1.6 illustrates coding of alphabetic and numeric characters in BCD.

Table 1.6: Alphabetic and numeric characters in BCD along with their Octal equivalent

Character	Zone	Digit	Octal Equivalent	Character	Zone	Digit	Octal Equivalent
A	11	0001	61	S	01	0010	22
B	11	0010	62	T	01	0011	23
C	11	0011	63	U	01	0100	24
D	11	0100	64	V	01	0101	25
E	11	0101	65	W	01	0110	26
F	11	0110	66	X	01	0111	27
G	11	0111	67	Y	01	1000	30
H	11	1000	70	Z	01	1001	31
I	11	1001	71				
				0	00	0000	00
J	10	0001	41	1	00	0001	01
K	10	0010	42	2	00	0010	02
L	10	0011	43	3	00	0011	03
M	10	0100	44	4	00	0100	04
N	10	0101	45	5	00	0101	05
O	10	0110	46	6	00	0110	06
P	10	0111	47	7	00	0111	07
Q	10	1000	50	8	00	1000	10
R	10	1001	51	9	00	1001	11

Example 1.1 *Write the binary digits used to record the word BASE in BCD.*

Solution.   In BCD notation:

$$B = 110010 \quad A = 110001 \quad S = 010010 \quad E = 0$$

Hence, the binary digits

0	0	0 0	0
B	A	S	E

will record the word BASE in BCD.

Example 1.2 *Using Octal notation, write the BCD coding for the word DIGIT.*

Solution.   In BCD notation:

$$D = 64 \quad I = 71 \quad G = 67 \quad I = 71 \quad T = 23$$

Hence, the BCD coding for the word DIGIT in octal notation will be

64	71	67	71	23
D	I	G	I	T

ASCII

Pronounced "a sk-ee," ASCII (**A**merican **S**tandard **C**ode for **I**nformation **I**nterchange) is the binary code most widely used with microcomputers. It has replaced many of the special codes that were previously used by computer manufacturers.

ASCII 7 bit code can represent up to 2 characters. A letter, digit or special symbol is called a character. It includes upper-case and lower-case alphabets, numbers, punctuation marks, special characters and control characters.

ASCII 8 bit code can represent up to 2 characters. Table 1.7 shows ASCII 8 bit coding scheme for alphabets and digits.

Table 1.7: ASCII 8-bit Coding Scheme

Character	Decimal	ASCII–8	Character	Decimal	ASCII–8
A	6	0 0 0	a	97	0 0
B	6	0 0 0	b	98	0 0
⋮	⋮	⋮	⋮	⋮	⋮
O	9	0 0 1	o	1	0 1
P	8	0 0 0	p	2	0 0
Q	8	0 0 0	q	3	0 0
⋮	⋮	⋮	⋮	⋮	⋮
Y	9	0 0 0	y	2	0 0
Z	90	0 0 0	z	2	0 0
0	8	0 1 0	5	3	0 0
1	9	0 1 0	6	4	0 0
2	0	0 1 0	7	5	0 0
3	5	0 1 0	8	6	0 0
4	2	0 1 0	9	7	0 0

UNICODE

Unicode uses two bytes (16 bits) for each character. It can handle 65536 character combinations. Thus, it allows almost all the written languages of the world to be represented using a single character set. Formally,

Unicode provides a unique number for every character,

no matter what the platform,

no matter what the program,

no matter what the language.

Unicode standard covers the principal written languages of the America, Europe, the Middle East, Africa, India and Asia.

KEY CONCEPTS

➢ A digital computer works with binary number system.

➢ All the data that is entered into a computer is first converted into the binary form and after processing, it is again converted to human readable form.

➢ There are different types of number systems (binary, octal, hexadecimal) that are used to represent data.

➢ We can convert a number in one system to the other system by following rules specified by the number system.

➢ Some useful computer coding systems are BCD, ASCII and UNICODE.

ASSESSMENT 1.4

Fill in the Blanks

1 A digital computer works with .... number system.

2 A .... is the basic unit that is used to represent the alphabetic, numeric and alphanumeric data.

3 1 Kilobyte (KB) = ... bytes.

4 The full form of ASCII is ....

State Whether True or False

1 The binary number system has only one digit 1

2 We can convert a number in one system to the other system by following rules specified by the number system.

3 BCD code is one of the early computer codes.

4 UNICODE uses one byte (8 bits) for each character.

Answer the Following

1 Explain how data is represented in the computer.

2 Discuss in brief the number systems – binary, octal and hexadecimal.

3 Perform the following inter-number system conversions:

    (i) $(10)_2 = (\ )_{10}$ (ii) $(52)_{10} = (\ )_2$

    (iii) $(59)_{10} = (\ )_8$ (iv) $(6)_8 = (\ )_2$

    (v) $(9F)_{16} = (\ )_2$ (vi) $(9D)_{16} = (\ )_{10}$

    (vii) $(10)_2 = (\ )_8$ (viii) $(7)_8 = (\ )_{10}$

    (ix) $(9)_{10} = (\ )_{16}$

4 Write short notes on the following computer coding systems:

    (i) BCD   (ii) ASCII   (iii) UNICODE

Suggested Activity

Introduce an idea of the complexity of data representation in computer.

1.5 COMPUTER SYSTEM

A computer is an electronic device that can accept data and instructions, store and process it to produce the required result.

> The acronym for **COMPUTER** is "**C**ommon **O**riented **M**achine **P**articularly **U**sed for **T**rade, **E**ducation and **R**esearch".

The computer mainly consists of hardware and software components. Both of these work together to process data. Figure 1.23 illustrates these two components.

```
                Computer
                   |
        ---------------------
        |                   |
    Hardware            Software
```
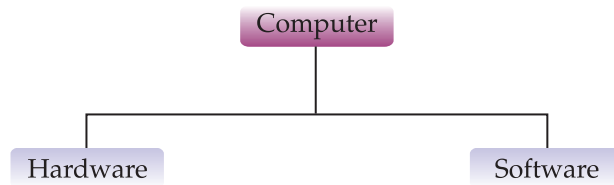
Fig. 1.23: Hardware and software

Hardware

The physical components of the computer that can be seen and touched are called as hardware. The term hardware is used to refer to all the components inside or outside the computer. In addition to this, components used to interconnect two or more components, for example, wires are also regarded as hardware. We have several hardware devices that are used at various phases of data processing cycle. The hardware that are used to supply input to computer are called as *input devices*. The hardware that are used to process the data, are called as *processing devices* and the devices that are used to present output of computer are called as *output devices*. Each of these categories has a broad variety of devices of various brands and qualities.

Software

The sets of instructions that instruct the computer to do different tasks are called as software. For example, word processing, games, painting, e-mail, spreadsheets etc.

Software is the driving force behind the working of computer. Without the presence of software, the computer is as good as a piece of plastic and metal. Hardware can be considered as organs and the software is life that moves inside these organs. Both of them cannot perform their function without the presence of each other.

● Hardware Components

Hardware consists of all the machinery and equipment in a computer system. The hardware includes, the keyboard, the monitor, the printer, and the "box" — the computer or processing device itself. Figure 124 illustrates hardware of a computer.

Fig. 1.24: Hardware of a computer

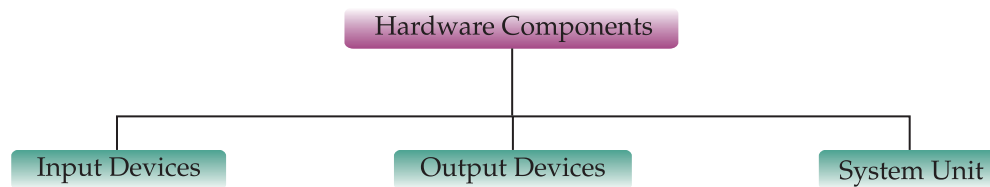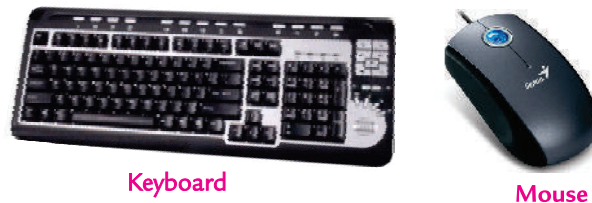The hardware components are given in Fig. 125

Fig. 1.25: Hardware components

Input Devices

Input devices allow people to put data into the computer in a form that the computer can use, for example, keyboard and mouse.

Keyboard   Mouse

Fig. 1.26: Input devices

Output Devices

Output devices translate information processed by the computer into a form that humans can understand— print, sound, graphics, or video. For example, monitor, printer and sound speakers.

Monitor   Printer   Sound Speakers

Fig. 1.27: Output devices

System Unit

The system unit is also known as case. It is the box that houses the processor chip (CPU) *i.e.*, the 'brain' of computer, the memory chips, and the motherboard with power supply, as well as some secondary storage devices—floppy-disk drive, hard-disk drive, and CD or DVD drive. The case comes in desktop or tower models. It includes a power supply unit and a fan to keep the circuitry from overheating.

Fig. 1.28: Case or system cabinet

Secondary Storage Devices

Within the motherboard in the system cabinet, the secondary storage devices are connected to it. Secondary storage or permanent storage stores your data as long as you want.

Let us discuss the commonly used secondary storage devices—Compact Disk (CD) and Digital Versatile Disk (DVD):

Compact Disk (CD)

The compact disk or CD is an optical storage medium. It is relatively cheap and has a storage capacity of up to 700 Megabytes of data. There are three main types of CDs:

 (*i*) *CD-ROM* (*Compact Disk—Read Only Memory*): It is an optical-disk format that is used to hold pre-recorded text, graphics and sound, for example, encyclopedias, software, games, e-books etc. It is a read-only disk. Read-only means that the disk's content is recorded at the time of manufacture and cannot be written on or erased by the user.

 (*ii*) *CD-R* (*Compact Disk-Recordable*): It is an optical-disk format on which data can be recorded only once but can be read many times. It allows users to make their own CD disks, though it is a slow process. Once recorded the contents cannot be erased. CD-R is often used by companies for archiving, that is, to store vast amounts of information.

 (*iii*) *CD-RW* (*Compact Disk-Rewritable*): It is an erasable disk that allows users to record and erase data, so the disk can be used over and over again. CD-RW disks are used for archiving and backing up large amounts of data or work in multimedia production or desktop publishing, however, they are relatively slow.

Digital Versatile Disk (DVD)

The digital versatile disk or digital video disk or DVD is an optical storage medium. It is a CD-style disk but is able to hold about 15 times as much information and transfer it to the computer about 20 times as fast as a CD-ROM. There are three main types of DVDs:

 (*i*) *DVD-ROM* (*Digital Versatile Disk—Read Only Memory*): It is a high capacity optical disk capable of storing 4.7 Gigabytes to 17 Gigabytes. It is a powerful and versatile secondary storage medium which was originally developed for the movie industry.

 (*ii*) *DVD-R* (*DVD-Recordable*): It is similar to CD-R that allows users to write on the disk only once but read it many times. Recordable DVDs offer the user yet another option for storing large amount of data.

 (*iii*) *DVD-RW* (*DVD-Rewritable*): Most writable DVD drives are DVD-RW. The DVD-RW disks can be recorded on and erased more than once.

DVD technology is bringing down prices these days.
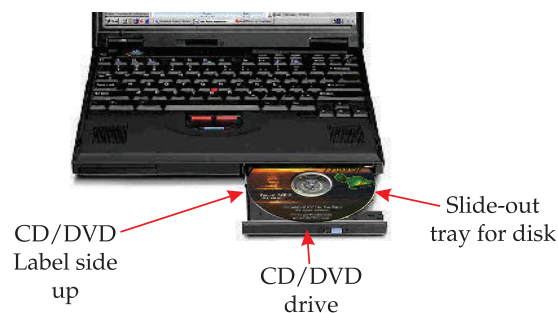
Figure 1.29 shows how to use a CD/DVD.

CD/DVD Label side up

CD/DVD drive

Slide-out tray for disk

Fig. 1.29: How to use a CD/DVD

Some secondary storage devices are also called input and output devices. For example, CD, DVD and Pen Drive etc.

● Types of Software

Software is generally divided into two main categories: *System Software* and *Application Software*. The system software are generally concerned with the various operations of a computer system and the application software are concerned with providing various services to the users. Figure 30 shows the two types of software.
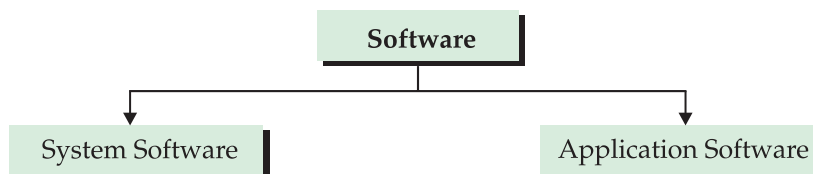
```
                    ┌──────────────┐
                    │   Software   │
                    └──────────────┘
                ┌──────────┴──────────┐
    ┌───────────────────┐   ┌────────────────────────┐
    │  System Software  │   │  Application Software  │
    └───────────────────┘   └────────────────────────┘
```

Fig. 1.30: Types of software

System Software

System software is a set of master programs that keep the computer system working.

The basic components of system software are given below:

Operating System Software

Operating system is a bridge between the computer hardware and the user. Various types of operating systems are Windows, Mac OS, Unix, Linux etc.

Operating systems perform basic tasks, such as:

1. Recognizing input from the keyboard
2. Sending output to the display screen
3. Keeping track of files and directories on the disk
4. Controlling peripheral devices such as disk devices and printers.

Language Software

A language acceptable to a computer system is called *computer language* or *programming language*. All computer languages can be classified broadly into the following three categories:

1. Machine Language
2. Assembly Language
3. High-level Language.

Low Level Language

Machine Language

Every computer understands only one language without using a translation program which is called *machine language* of the computer.

Assembly Language

A language that allows instructions and storage locations to be represented by letters and symbols instead of numbers is called *assembly language* or *symbolic language*.

Machine and assembly languages are often referred to as *low-level programming languages*.

High Level Languages

High-level programming languages overcome the limitations of low-level programming languages. The main feature of high-level languages is *machine independence*, *i.e.*, *portable* (can be used on different computers with or without minor changes).

Today many different high-level languages are in use because each one was designed for a different purpose. For example, LOGO, FORTRAN, COBOL, BASIC, Pascal, C, C++, C#, Java, RPG, LISP and SNOBOL.

Source Program and Object Program

Let us define source and object program:

Source Program: A computer program written in high level language by a programmer that can be converted (or translated) into machine language.

Object Program: A computer program translated from an equivalent source program into machine language by a compiler or assembler.

Compilers and Interpreters

Computers work in machine language. These need translators for converting different computer languages into machine language. Compilers and interpreters are translators which are also known as language processors.

Compiler

Compiler software translates a source program that is usually written in a high level language by a programmer into machine language. The compiler is capable of replacing single source program statement with a series of machine language instructions. For each language the machine requires a separate compiler. Figure 1.31 shows the working of a compiler.
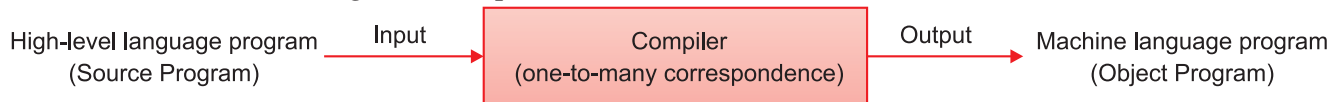
| High-level language program (Source Program) | → Input → | Compiler (one-to-many correspondence) | → Output → | Machine language program (Object Program) |

Fig. 1.31: Working of a compiler

Interpreter

Interpreter software translates each source program statement into a sequence of machine instructions and then executes these machine instructions before translating the next source language statement. Interpreter is also unique for each high level language like compiler. Figure 1.32 shows the working of an interpreter.
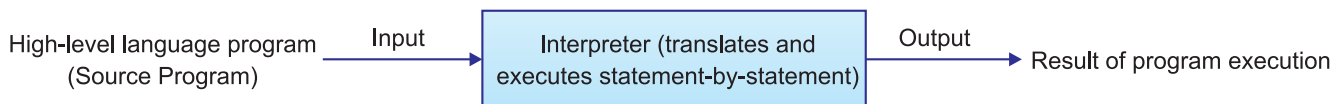
| High-level language program (Source Program) | → Input → | Interpreter (translates and executes statement-by-statement) | → Output → | Result of program execution |

Fig. 1.32: Working of an interpreter

Others

Program Utilities

Utilities are the programs that carry out general tasks such as formatting disks, storing files, virus checking. Some examples of utilities are *text editors*, *backup utility*, *compression utility*, *disk defragmenter* and *antivirus software*.

You can buy the utility programs at computer stores. Some utility programs are also available free of cost on the Internet.

Device Drivers

Device drivers are programs which allow hardware devices such as the keyboard, printers to interface with the computer.

Modern operating systems have inbuilt support for a variety of input and output devices. For example, Windows XP contains drivers of hundreds of printers, scanners and other devices.

● Application Software

Application software allows the user to perform specific tasks. An application software, designed to satisfy one purpose may not be able to solve other purpose of the same user. For example, software for financial management cannot be used for designing two-dimensional graphics. Similarly, we have word processors for letter writing and presentation software for presentations. We cannot interchange the use of two application software with each other.

There are two main categories of application software: *Pre-Written* and *Customised* Application Software.

Pre-Written Application Software These are designed for common needs of various businesses. For example, Word Processing Software, Electronic Spreadsheets, Presentation Software, Database Management Systems, Communication Software, Desktop Publishing Software.

Customised Application Software These are created for a specific application of a specific environment. For example, software required by a publishing house. This type of software may not be useful for a computer assembling house who deals in the items having warranty period. Software engineers are hired to create such software. Different computer languages are used to create these software.

Types, Examples and Uses of Application Software

Application software can be classified in many ways—for productivity, speciality education/reference, entertainment, and personal uses. Figure 1.33 illustrates the types of application software.
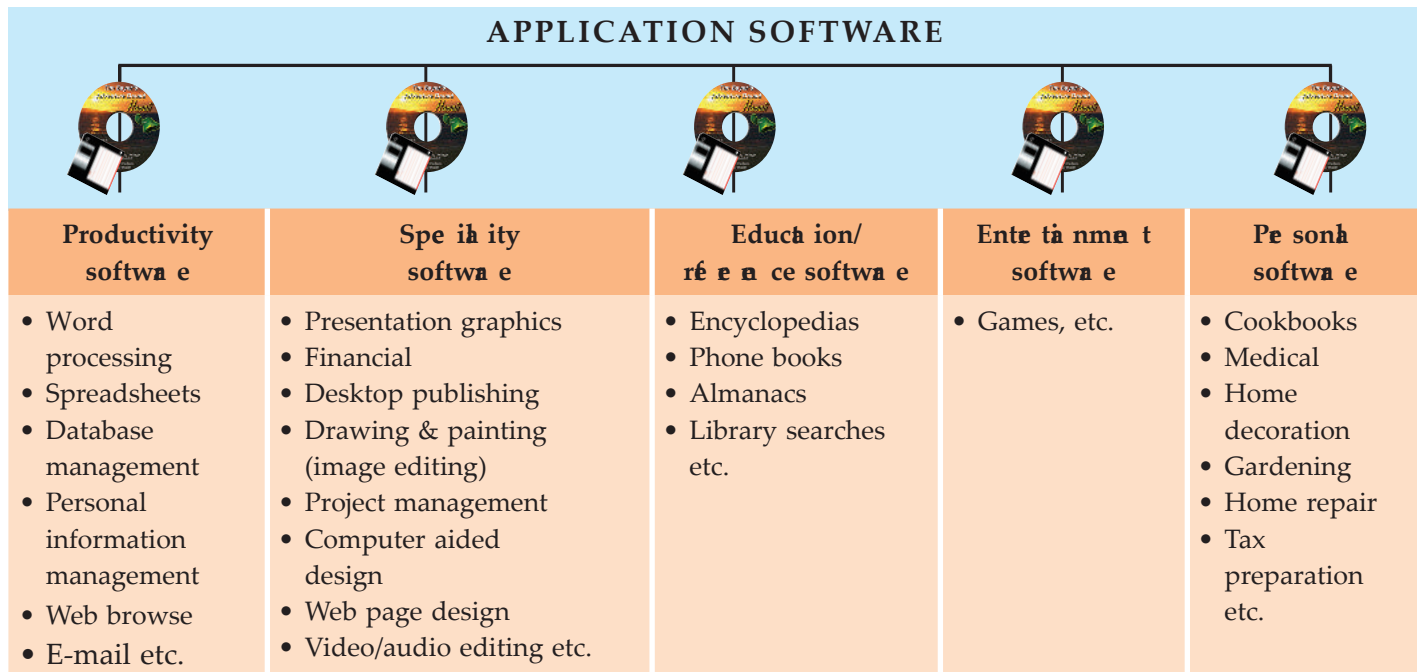
APPLICATION SOFTWARE				
Productivity software	Speciality software	Education/ reference software	Entertainment software	Personal software
• Word processing • Spreadsheets • Database management • Personal information management • Web browse • E-mail etc.	• Presentation graphics • Financial • Desktop publishing • Drawing & painting (image editing) • Project management • Computer aided design • Web page design • Video/audio editing etc.	• Encyclopedias • Phone books • Almanacs • Library searches etc.	• Games, etc.	• Cookbooks • Medical • Home decoration • Gardening • Home repair • Tax preparation etc.

Fig. 1.33: Types of application software

Let us discuss some of the application software in brief:

(a) *General purpose software*: These software are useful in controlling the general activities of organizations. For example, MS-WORD, MS-EXCEL and DTP software.

(b) *Speciality software*: These software are used for a special purpose. For example, Peachtree.

(c) *Entertainment software*: These software allow a computer to be used as an entertainment tool. For example, Solitaire and Pinball.

(d) *Educational software*: These software allow a computer to be used as a teaching and learning tool. For example, Microsoft Encarta, Mavis Beacon and TypingMaster Pro.

● Features of Operating System

Operating System (OS) is a bridge between the computer hardware and the user. For example, Windows, Linux, Mac OS, Solaris, UNIX etc.

Windows provides a Graphical User Interface (GUI). A graphical user interface is simple to use because any action that is performed is in the form of button clicks or selection of commands.

Some of the features of an OS are given below:

1 Manipulates the files and folders on a computer.
2 Transfers files from one folder to another.
3 Finds a file or folders using a 'search' facility.
4 Customizes the computer desktop.

Let us discuss these features using Windows XP operating system.

Creating Folders or Directories

Folder is like a container, which can store programs, files and also other folders.

(i) **To Create a Folder at the Desktop**

1 Right-click in an empty area of the desktop.
2 From the pop-up menu so displayed, select *New* (see Fig. 1.34).
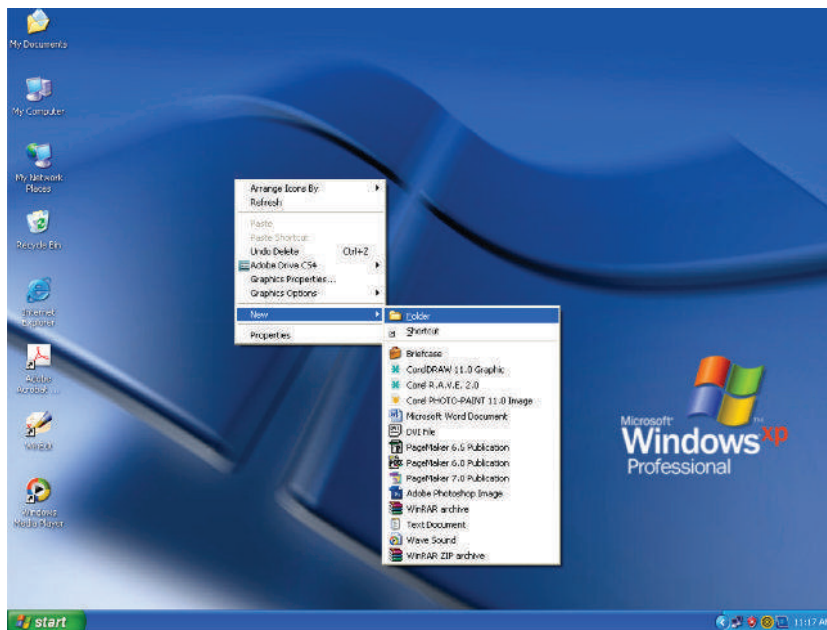
Fig. 1.34: Creating a folder at the desktop

3 From the cascading menu, select the option *Folder* (see Fig. 34). A folder icon appears with the name 'New Folder' highlighted.

4 Type a name for the newly created folder and press *Enter* key.

(*ii*) **To Create a Folder in a Drive/ Folder**

1 In 'My Computer' navigate to the item (drive/folder) in which you wish to create a new folder.

2 Double click on this item, so that a window exhibiting its contents is opened.

3 Right-click on an empty area in the window.

4 Select *New* from the pop-up menu displayed, and *Folder* from the cascading menu (see Fig. 35). A folder icon appears with the name 'New Folder' highlighted.
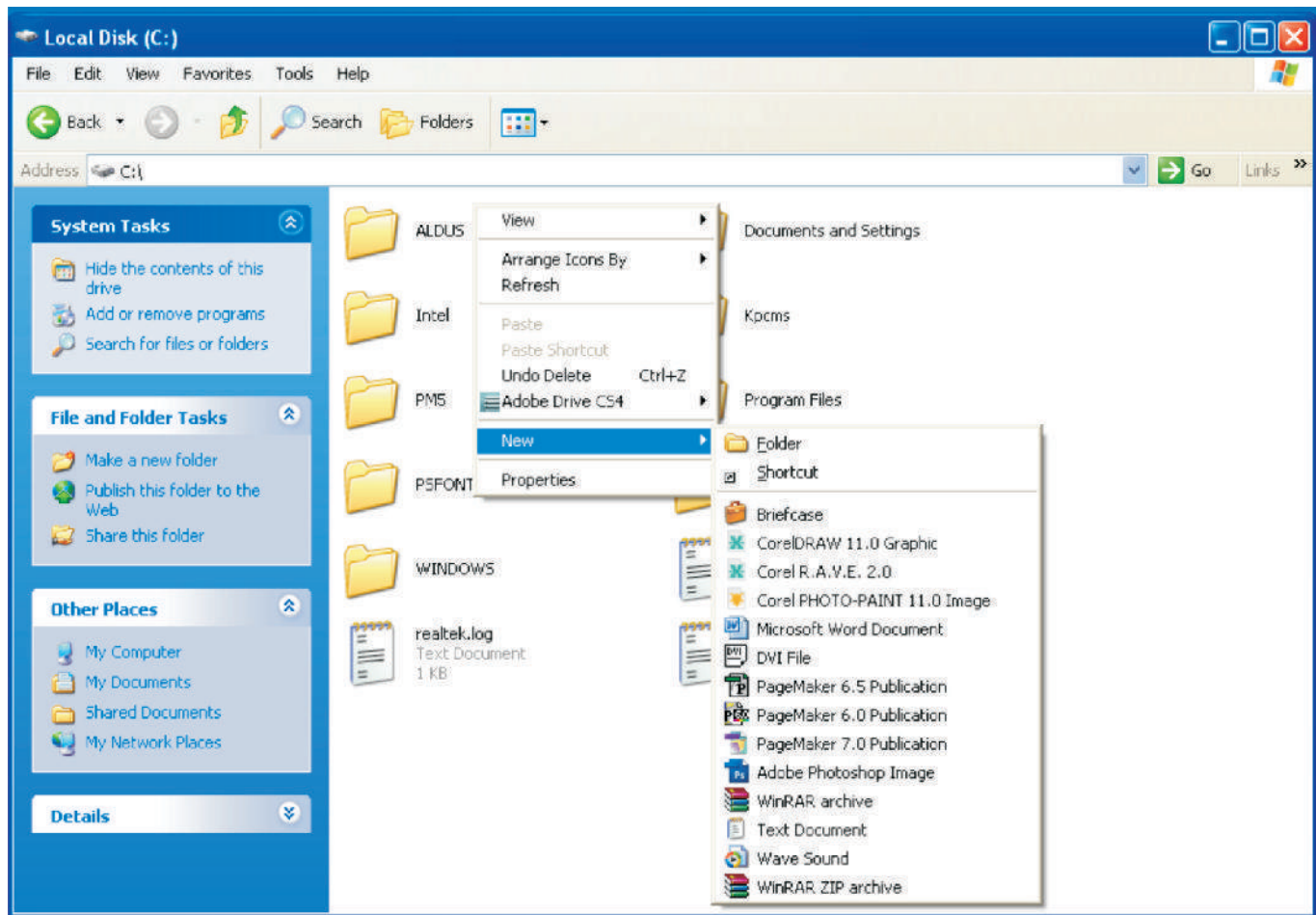
Fig. 1.35: Creating a folder in a drive/folder

5 Type a name for the newly created folder and press *Enter* key.

Say, you create a new folder called Software in the ICT folder. In this case, the ICT folder is called the parent folder and the Software folder is called the subfolder.

Copying Files and Folders

To copy a file or a folder to another folder, perform the following steps:

1 Select the file or folder.
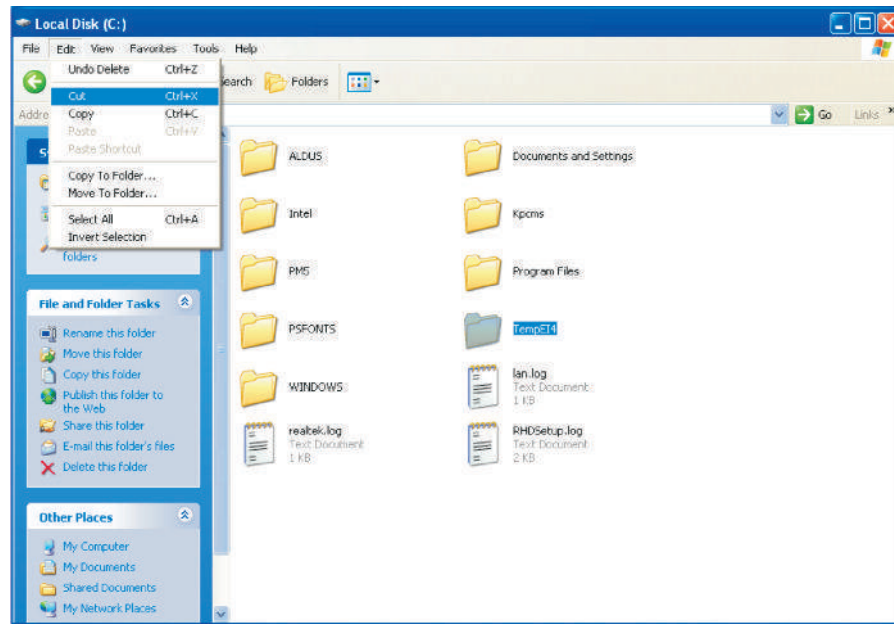
2 Click the Edit menu.

3 Click the *Copy* option.

Alternatively, you can right-click the file or folder, click the *Copy* option from the shortcut menu or press the Ctrl and C keys simultaneously (see Fig. 1.36).
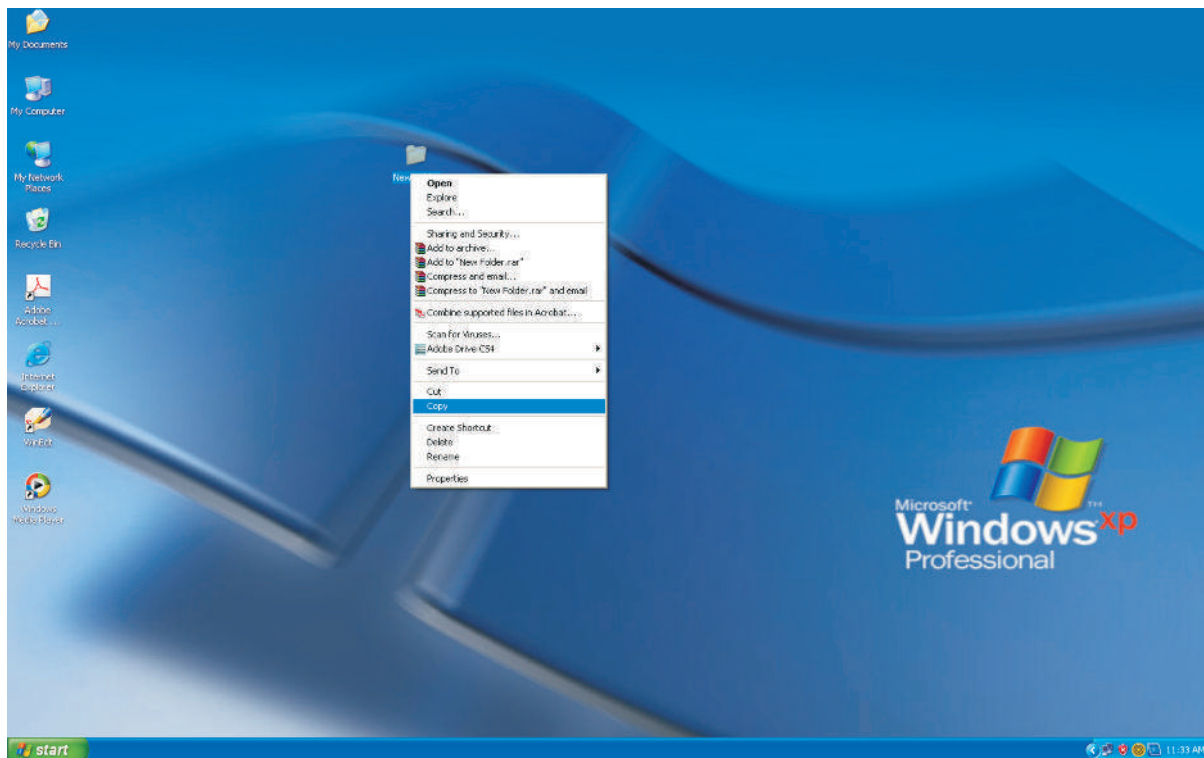
Fig. 1.36: Copying files and folders

4 Select the folder where you have to paste the file or folder.

5 Click the Edit menu.

6 Click the *Paste* option.

Alternatively, you can right-click the folder, click the Paste option from the shortcut menu or press the Ctrl and V keys simultaneously.

A quick way to move and copy files or folders is to use right mouse button to invoke the shortcut menu (a menu which gets displayed by right click of mouse).

Moving Files and Folders

To move a file or a folder completely from one folder to another, perform the following steps:

1 Select the file or folder.

2 Click the Edit menu.

3 Click the *Cut* option (see Fig. 1.37).

Fig. 1.37: Selecting the Cut option

Alternatively, you can right-click the file or folder, select the *Cut* option from the shortcut menu or press the Ctrl and X keys simultaneously.

4 Select the folder where you have to paste the file or folder.

5 Click the Edit menu.
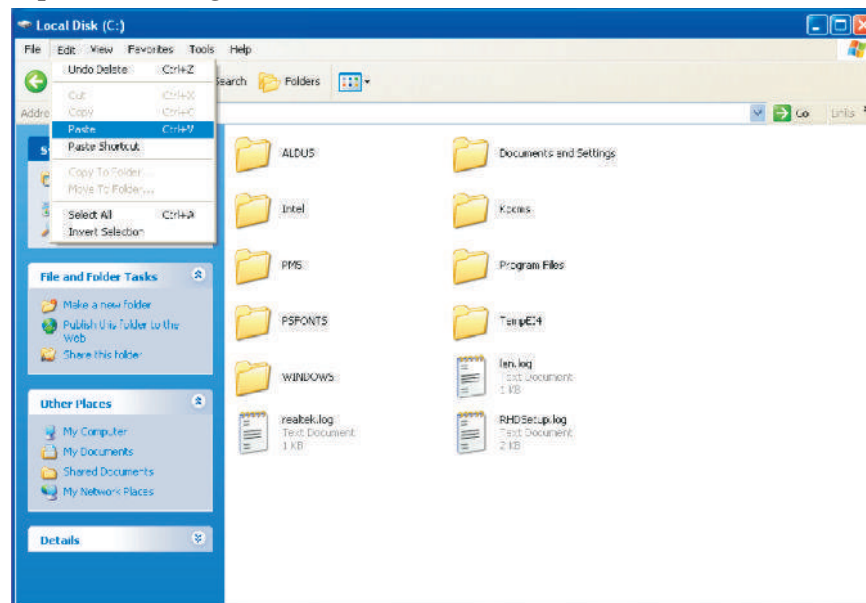
6 Click the *Paste* option (see Fig. 1.38).

Fig. 1.38: Selecting the Paste option

If a number of files have to be copied or moved, it can be done using the Shift key or the Ctrl key. When you want to select consecutive files and folders, click the first item, hold down the *<Shift>* key and click the last item. When you want to select files that are not consecutive, hold down the *<Ctrl>* key and click each item. To select all files and folders in the window, choose *Edit*, *Select All*.

Copying an item places an exact replica of the copied item at the new location also retaining the item as the location where it is copied from. But, moving an item from a location to another erases its existence at the original location.

Renaming Files and Folders

A file or folder can be renamed immediately after it is created or later.

To rename a file,

1 Select the file or folder.

2 Click the Rename option in the File menu.

3 Type a new name and press the <Enter> key.

Alternatively,

1 Right-click the file or folder.

2 Click the *Rename* option in the pop-up menu (see Fig. 1.39).

3 Type a new name and press the *Enter* key.
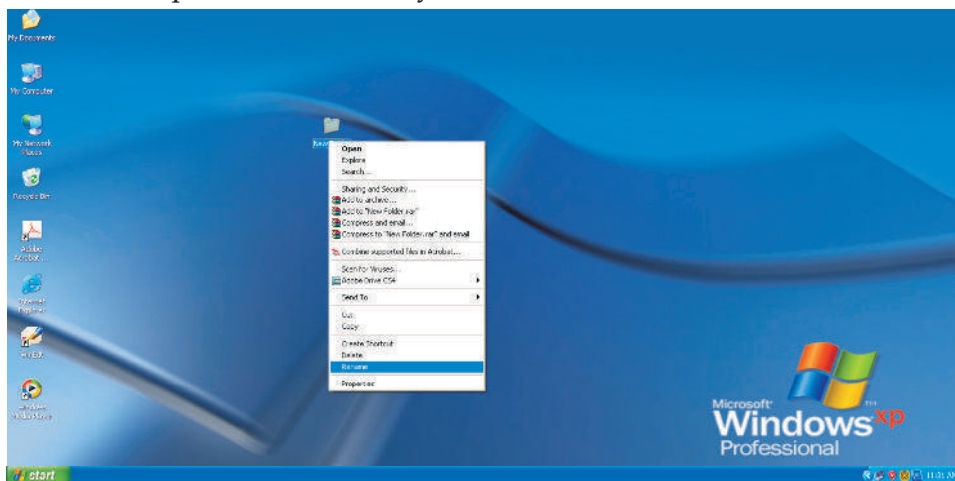
Fig. 1.39: Renaming files and folders

You can also select the file and press the F2 key to change the name.

The name of the file or folder is highlighted. Type the new name and press the *Enter* key.

Deleting a File or Folder

To delete a file or folder, perform the following steps:

1 Select the file or folder.

2 Press the *Delete* key.

Windows asks for confirmation before deleting a file or folder as shown in Fig. 1.40. Click *Yes* to delete the file or folder. Click *No* to cancel the operation.

Alternatively, you can right-click the file or folder and select the Delete option in the pop-up menu.

Deleted files and folders are stored in the Recycle Bin. If you delete any file by mistake, it can be restored by clicking the Restore option in the File menu of the
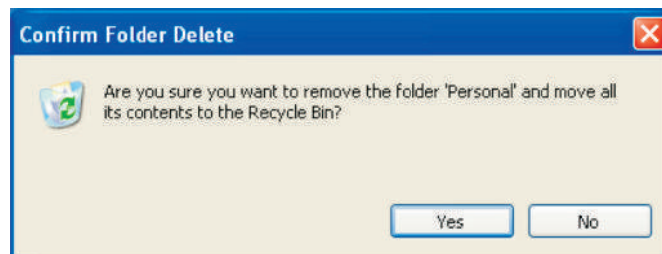

Fig. 1.40: Deleting a File or a Folder

Recycle Bin window. If any file or folder has to be deleted permanently from the machine, then right click on the *Recycle Bin* and select the *Empty Recycle Bin* option.

On clicking *Empty Recycle Bin* option the following message will be displayed (see Fig. 1.41).
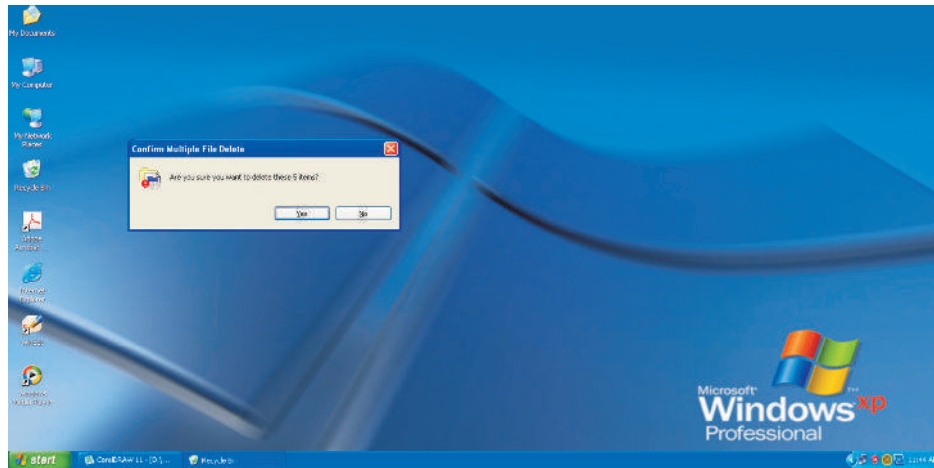

Fig. 1.41: Confirm Multiple File Delete dialog box

Click *Yes* to permanently delete the files and folders from Recycle Bin.

Searching Files and Folders

To search files and folders, perform the following steps:

1 Click the *Search* option in the *Start* menu. The *Search Results* window appears.

2 Click the 'All Files and Folders' option.

3 Specify the name of the file or the folder that has to be searched.

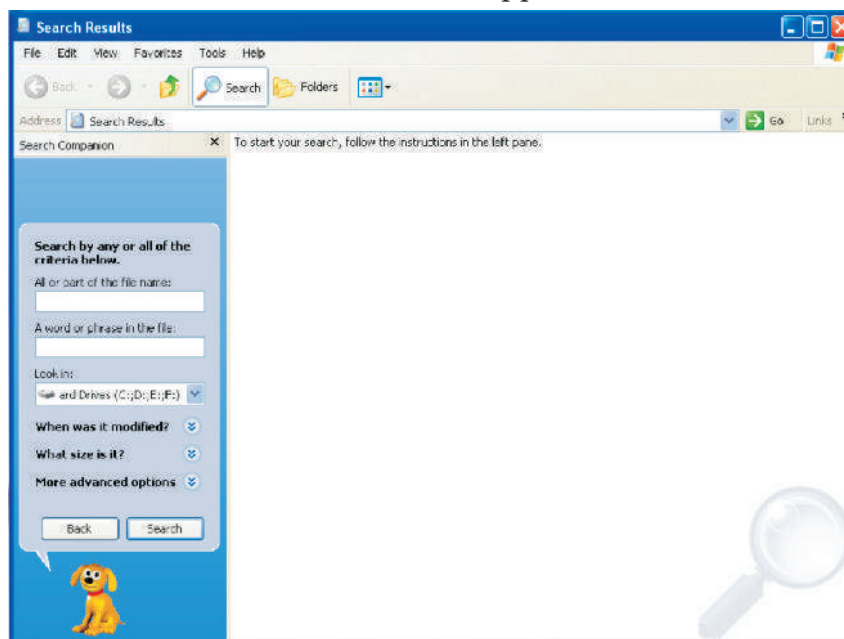4 Specify the folder in which the search has to be happened.

Fig. 1.42: The Search option

The results are displayed in the right pane. You can also access the Search option by pressing the Ctrl and E keys simultaneously.

Customizing Computer Desktop

Arranging Icons on the Desktop

Icons can be arranged on the desktop. These can be dragged and placed anywhere on the screen. To automatically arrange these, perform the following steps:

1 Right-click on the empty space on the desktop.

   A pop-up menu appears. A menu that appears when you click the right mouse button is called a context-sensitive menu.

2 Choose the *Arrange Icons By* option from the pop-up menu.
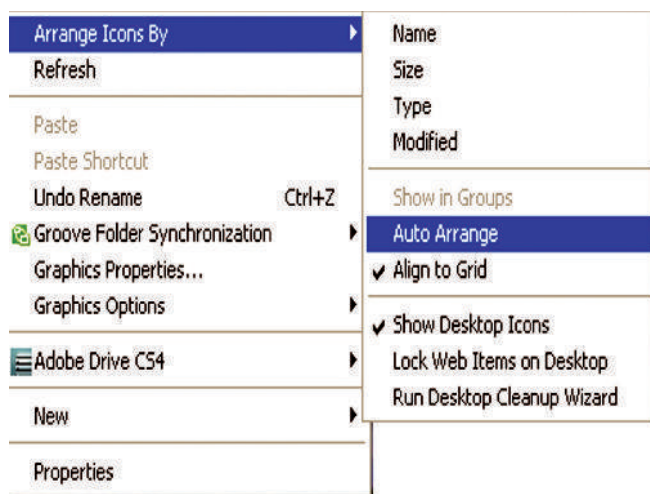
3 Click the *Auto Arrange* option (see Fig. 1.43).

Fig. 1.43: Auto Arrange Icon option

You can also arrange the icons by Name, Size, Type, etc.

Changing the Desktop Background

The background of a desktop can be changed. To change the background of the desktop, perform the following steps:

1 Right-click on the empty space on the desktop.
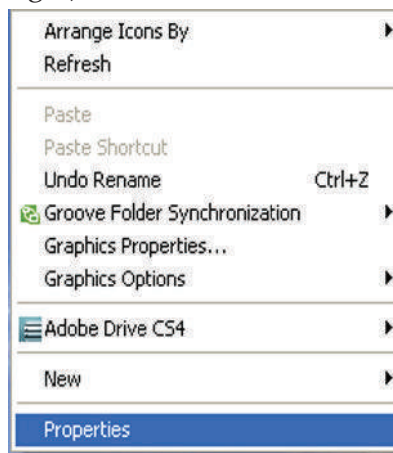
2 Click the *Properties* option (see Fig. 1.44).

Fig. 1.44: Properties option

3 The *Display Properties* dialog box appears. Click the *Desktop* tab (see Fig. 1.45).

4 Select any option from the *Background* list box. For example, select Windows XP as the background and click the *Apply* button (see Fig. 1.45).

5 Click the *OK* button to close the dialog box.

Fig. 1.45: Changing background.

The background is also known as the wallpaper.

Changing the Screen Saver

Screen saver is a moving picture or pattern that appears on the screen when the mouse or the keyboard is not used for a specified period of time. You can set the time using the Wait spin box. To select the screen saver, perform the following steps:

1 Right-click on the empty space of the desktop.

2 Click the *Properties* option.

3 Click the *Screen Saver* tab (see Fig. 1.46).

4 Select any Screen saver from the list.

5 Click the *Apply* button.
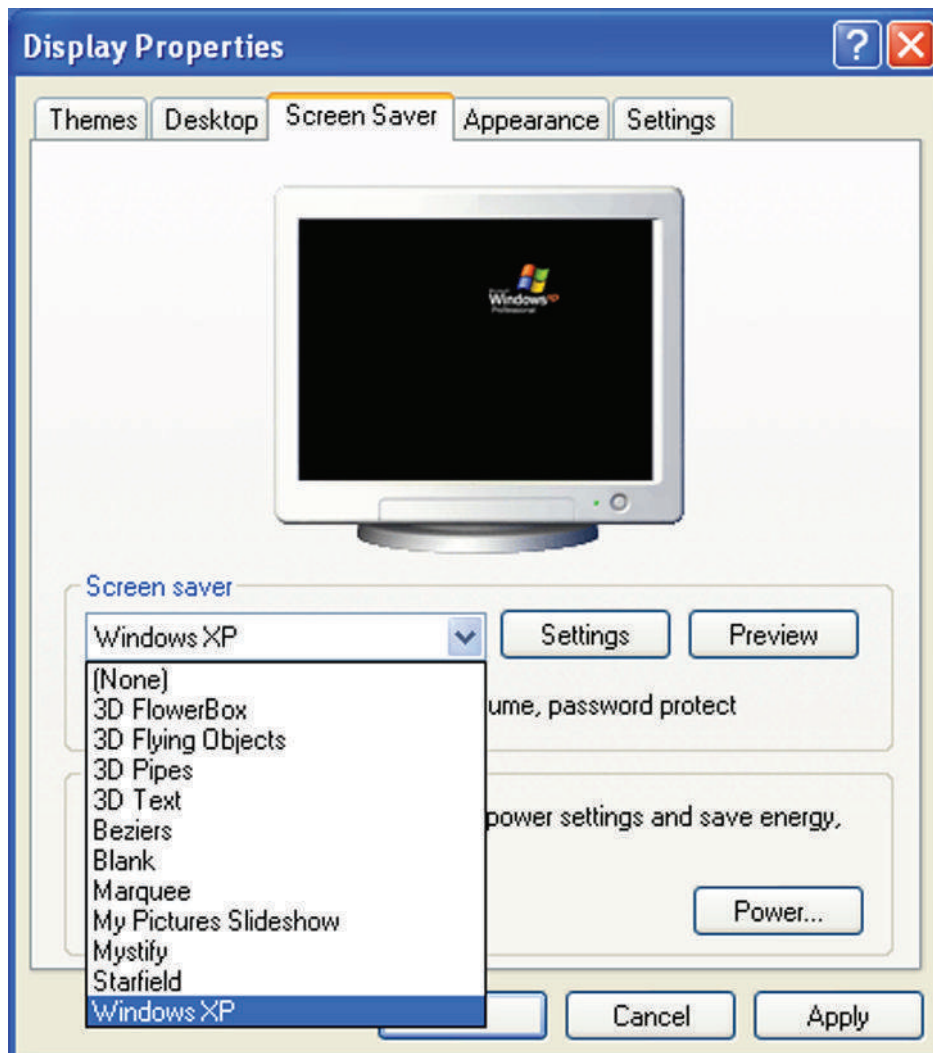
6 Click the *OK* button to close the dialog box.

Fig. 1.46: Changing Screen Saver

Changing the Appearance

The appearance of the desktop can be changed. To change the appearance of the desktop, perform the following steps:

1 Right-click on the empty space of the desktop.

2 Click the *Properties* option.

3 Click the *Appearance* tab (see Fig. 1.47).

4 Select any option from the list box. For example, select Windows XP style from Windows and buttons.

5 Click the *Apply* button.
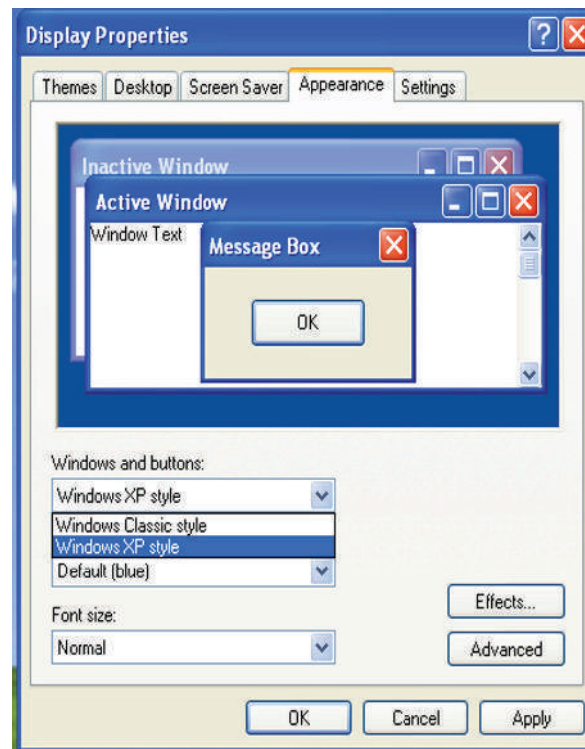
6 Click the *OK* button to close the dialog box.

Fig. 1.47: Changing the Appearance

You can change Color scheme and Font size depending on your choice.

KEY CONCEPTS

➤ A computer system consists of hardware components and software components.

➤ Hardware are the physical parts of the computer that can be seen and touched.

➤ Software are the sets of instructions that instruct the computer to do different tasks for example: word processing, games, painting, email, spreadsheets.

➤ Software can be classified as systems and application software.

➤ Operating system is a bridge between the computer hardware and the user.

REVIEW QUESTIONS

Fill in the Blanks

1 A .... consists of hardware and software components.

2 Commonly used secondary storage devices are .... and ....

3 .... software keep the computer system working.

4 .... are programs which allow hardware devices to interface with the computer.

State Whether True or False

1 Hardware are the sets of instructions that instruct the computer to do different tasks.

2 System unit contains the motherboard, power supply and hard disk.

3 Program Utilities carry out general tasks such as formatting disks, storing files, virus checking etc.

4 An operating system cannot customize computer desktop.

Multiple Choice Questions

1   ICT focuses primarily on .... technologies.

(a) Water   (b) Communication (c) Research   (d) Transportation

2 Computers can be classified on the basis of the following.

(a) Size   (b) Cost   (c) Performance   (d) All of these

3 Which of the following coding scheme uses two bytes (16 bits) for each character?

(a) EBCDIC   (b) UNICODE   (c) ASCII   (d) BCD

4 A program written in high level language is known as ....

(a) Main Program   (b) Image Program   (c) Object Program   (d) Source program

Match the Following

Column A		Column B	
1	Social information exchange tool	(a)	1024 KB
2	Characteristics of a computer	(b)	Transistor
3	Megabyte	(c)	Integrated Circuit
4	Entertainment Software	(d)	Blog
5	First generation	(e)	1024 KB
6	Second generation	(f)	Versatility
7	Third generation	(g)	Very Large Scale Integration
8	Fourth generation	(h)	Vacuum Tube
		(i)	Solitaire

Answer the Following

1 Describe the computer system.

2 List major hardware components of a computer system.

3 Define system software and application software. Give their uses also.

4 Give the features of an operating system.

Suggested Activities

1 Demonstrate and explain in brief a computer system.

2 Define and explain the difference between system software and application software.

Field Trip

Students should visit some big educational organization in their city. Interact with faculties there and prepare a report on the latest computer system in use.