



U P RAJARSHI
TANDON OPEN UNIVERSITY

1

BCA-1.1 Computer Fundamentals and PC Software

Block

1

COMPUTER FUNDAMENTALS: HARDWARE AND SOFTWARE

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COURSE INTRODUCTION

This course presents an overview of the technology relating to the computer systems and exposes you to operating systems and application packages. The course covers aspects on computer hardware, computer software, data communication, computer security, graphical user interface, word processor and presentation software.

The first block discusses about hardware and software of computer system. It includes discussions on data presentation, memory system of computers, Input/Output devices, parallel organisation, pipelining and reduced instruction set computers. It also covers aspects relating to the computer software such as the components of programming languages and operating system concepts.

The second block presents an introduction to data communication, networking and related technology. The field of data communication has progressed tremendously during the past decade. Therefore, the concepts relating to it are of utmost importance for a computer user.

This block also discusses about the computer security and virus. The importance of computer security is of the utmost importance when we are discussing concepts like paperless offices, computerised defense systems where every bit information will be available through the computers. Computer virus is major threat to computer security. We will also discuss about how to deal with it in this block.

The third block is a mix of theoretical and practical components. On the theoretical side we have discussed about the concepts relating to graphical user interface whereas on the practical side, it provides details of a graphical user interface "Windows 95".

Fourth block mainly emphasises Word processing Application and Presentation software.

You can do Practicals on "Windows 95", "MS-Word" and "MS-PowerPoint" along with the last two blocks.

UNIT 1 COMPUTER AND MEMORY SYSTEM

Structure

- 1.0 Introduction
- 1.1 Objectives
- 1.2 What is a Computer?
 - 1.2.1 The Computer and Integrated Circuit Technology
 - 1.2.2 Classification of Computers
- 1.3 Memory System
- 1.4 Characteristics Terms for Various Memory Devices
- 1.5 Main Memory or Primary Storage
- 1.6 External/Auxiliary Memory
 - 1.6.1 Magnetic Disk
 - 1.6.2 Winchester Disk
 - 1.6.3 Magnetic Tape
 - 1.6.4 Optical Memories
- 1.7 High Speed Memories
- 1.8 Summary
- 1.9 Model Answers
- 1.10 Further Readings

1.0 INTRODUCTION

The use of Information Technology is well recognised. It has become must for the survival of business houses with the growing information needs. Computer is one of the major components of an Information Technology network. Today, computer technology has permeated every sphere of existence of modern man. From railway reservations to medical diagnosis, from TV programmes to satellite launching, from matchmaking to criminal catching- everywhere, we witness the elegance, sophistication and efficiency possible only with help of computers.

In this block, we will introduce you to the computer hardware technology, how does it work and what is it? In addition we will also discuss some of the terminology closely linked with information Technology and computers. More details on these terms can be obtained from further readings. In this unit, we shall discuss about basic computer structure, the memory system and characteristics of various memories etc. We will also define the terms such as the main memory, cache memory, secondary storage and optical memories.

1.1 OBJECTIVES

This unit being the first unit of the block introduces you to the world of computers. At the end of the unit, you will be able to:

- define the term computer
- define Von Neumann architecture
- describe key characteristics of memory system.
- distinguish various types of memories
- differentiate various external memories
- define the importance of cache memory.

1.2 WHAT IS A COMPUTER?

Let us first define the term "computer". In Oxford Dictionary, Computer is defined as "An automatic electronic apparatus for making calculations or controlling operations that are expressible in numerical or logical terms".

The basic function performed by a computer is the execution of a program. A program is a sequence of instructions, which operate on data to perform certain tasks. In modern digital computers data is represented in binary form by using two symbols 0 and 1 which are called binary digits or bits. Computers use eight bits to represent a character internally. This allows up to $2^8=256$ different items to be represented uniquely. This collection of eight bits is called a byte. Thus, one byte is used to represent one character internally. One of the most common codes to represent characters in computers is ASCII (American Standard Code for Information Interchange). Most computers use two bytes or four bytes to represent numbers (positive and negative) internally. Another term that is commonly used in computer is a Word. A word may be defined as a unit of information that a computer can process or transfer at a time. A word must be equal to the number of bits transferred between the central processing unit and the main memory in a single step or it may be defined as the basic unit of storage of integer data in a computer. Normally, a word may be equal to 8, 16, 32, or 64 bits. The terms like 32 bit computer, 64 bit computers etc. basically point to the word size of the computer.

One of the key aspects in program execution is the execution of an instruction. The key questions that can be asked in this respect are (a) how are instructions supplied to the computer? And (b) how are they interpreted and executed? We will answer these questions along with the discussion on the basic structure of the computer system.

Most of today's computer designs are based on concepts developed by John Von Neumann referred to as the "Von Neumann architecture". Von Neumann proposed that there should be a unit performing arithmetic and logical operations on the data. This unit is termed as Arithmetic Logic Unit (ALU). A control unit directs the ALU to perform specific arithmetic and logical functions on the data. Therefore, in such a system, by changing the control signal, the desired operation can be performed on data.

But, how can these control signals be supplied? Let us try to answer this from the definition of a program. A program consists of a sequence of steps. Each of these steps, require certain arithmetic or logical or input/output operations to be performed on data. Therefore, each step may require a set of control signals. Is it possible for us to provide a unique code for each set of control signals? Well, the answer is Yes. But what do we do with these codes? What about adding a hardware segment that accepts the code and generates control signals? The unit that interprets a code to generate respective control signal is termed as Control Unit (CU). Thus, a program now consists of a sequence of codes. This machine is quite flexible, as we only need to provide a new sequence of codes for a new program. Each code is, in effect, an instruction, for the computer. The hardware interprets each of these instructions and generates respective control signals.

The Arithmetic Logic Unit (ALU) and the Control Unit (CU) together are termed as the Central Processing Unit (CPU). The CPU is the most important component of a computer's hardware. The ALU performs the arithmetic operations such as addition, subtraction, multiplication and division, and the logical operations such as: "Is $A = B$? (Where A and B are both numeric or alphanumeric data), "Is a given character equal to M (for male) of F (for female)?" The control unit interprets instructions and produces the respective control signals.

All the arithmetic and logical operations are performed in the CPU in special storage areas called registers. The size of the register is one of the important considerations in determining the processing capabilities of the CPU. Register size refers to the amount of information that can be held in a register at a time for processing. The larger the register size, the faster may be the speed of processing. A CPU's processing power is measured in Million Instructions Per Second (MIPS).

How can instructions and data be put into computers? The instruction and data are to be supplied by external environment. Therefore, an input module is needed. Main responsibility of input module will be to put the data in the form of signals that can be recognised by the system. Similarly, we need another component that

will report the results in proper format and form. This component is called output module. These components are referred together as input/output (I/O) components.

Are these two components sufficient for a working computer? No, because, input devices can bring instructions or data only sequentially and a program may not be executed sequentially as jump instructions are normally encountered in programming. In addition, more than one data element may be required at a time. Therefore, a temporary storage area is needed in a computer to store instructions and data temporarily. This component is referred to as memory. It was pointed out by Von Neumann that the same memory can be used for storing data and instructions. In such case, the data can be treated as data on which processing can be performed, while instructions can be treated as data, which can be used for the generation of control signals.

The memory unit stores all the information in a group of memory cells, also called memory locations, as binary digits (bits). Each memory location has a unique address and can be addressed independently. The contents of the desired memory locations are provided to the central processing unit by referring to the address of memory location. The amount of information that can be held in the main memory is known as memory capacity. The capacity of the main memory is measured in Kilobytes (KB) or Megabytes (MB). One kilobyte stands for 2^{10} bytes, which is 1024 bytes (or approximately 1000 bytes). A megabyte stands for 2^{10} kilobytes, which is approximately little over one million bytes.

In addition, to transfer the information, the computer system internally needs interconnections. The most common interconnection structure is the Bus structure. A bus is a set of wires (Lines) which you can visualise on the motherboard of a computer. It is a shared media. A bus connecting the CPU, memory and I/O components is called a system bus. A system bus may consist of 50 to 100 separate lines.

Let us summarise the key features of a Von Neumann machine. The hardware of the Von Neumann machine consists of:

- A CPU which includes a ALU and CU
- A main memory system
- An Input/output system
- The Von Neumann machine use stored program concept, i.e., the program and data are stored in the same memory unit. The computers prior to this idea used to store programs and data on separate memories. Entering and modifying these programs is very difficult as they were entered manually by setting switches and plugging and unplugging.
- Each location of the main memory of Von Neumann machine can be addressed independently.
- Execution of instructions in Von Neumann machine is carried out in a sequential fashion (unless explicitly altered by the program itself) from, one instruction to the next.

Figure 1 shows the basic structure of a conventional Von Neumann machine.

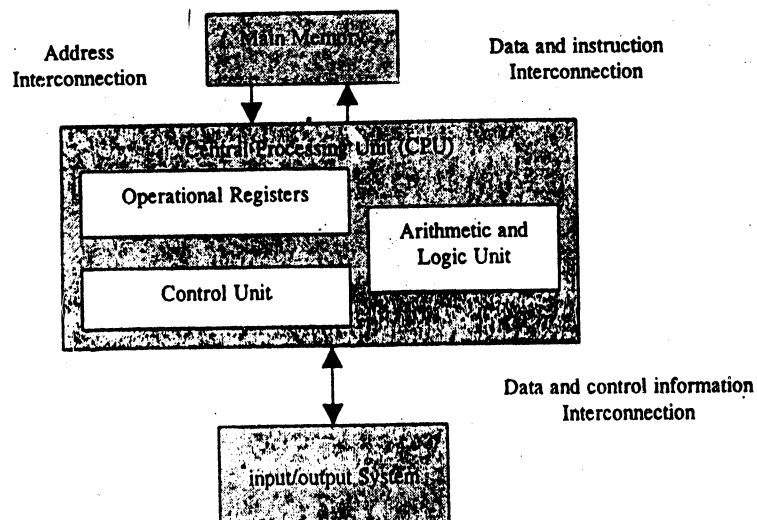


Figure 1: Structure of a computer

A Von Neumann machine has only a single path between main memory and control unit (CU). This feature/constraint is referred to as Von Neumann bottleneck. Several other architectures have been suggested for modern computers.

Check Your Progress 1

State True or False.

1. A byte is equal to 8 bits and can represent a character internally.
True False
2. A word on PC386 is equal to one byte.
True False
3. Von Neumann architecture specifies separate memory for data and instructions. The memory which stores data is called data memory and the memory that stores instructions is called instruction memory.
True False
4. In Von Neumann architecture each bit of memory can be accessed independently.
True False
5. A program is a sequence of instructions designed for achieving a task/goal.
True False
6. One MB is equal to 1024 KB.
True False

1.2.1 The Computer and Integrated Circuit Technology

But before we discuss about the relation of computers to integrated circuit technology, let us explore more about the term Integrated Circuit (IC).

In an integrated circuit, the components such as transistors, resistors and conductors are fabricated on semiconductor material such as silicon. Thus, a desired circuit can be fabricated in a tiny piece of silicon rather than assembling several discrete components into the same circuit. Hundreds or even thousands of transistors could be fabricated on a single wafer of silicon. In addition, these fabricated transistors can be connected with a process of metalisation to form logic circuits on the same chip they have been produced.

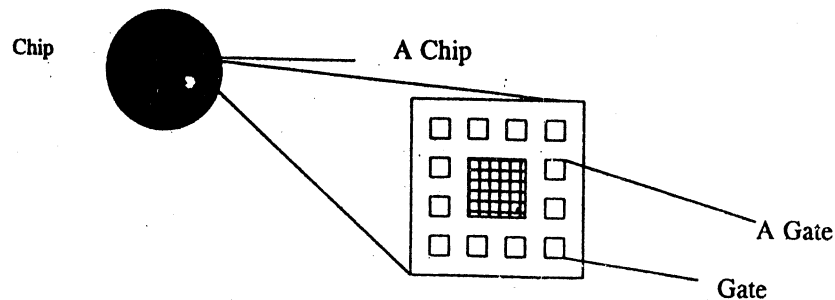
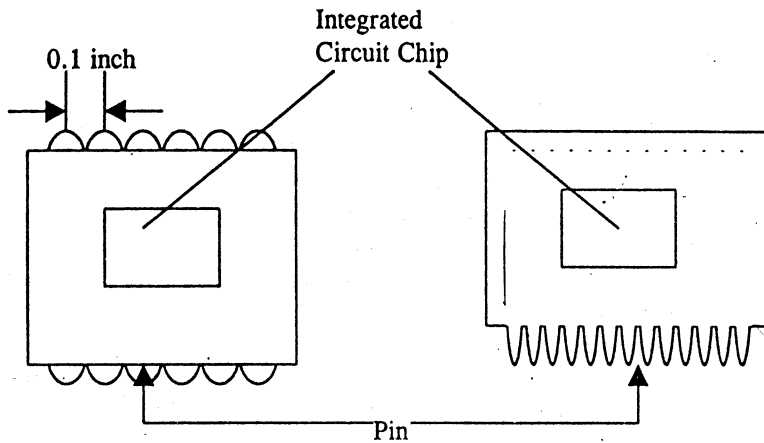


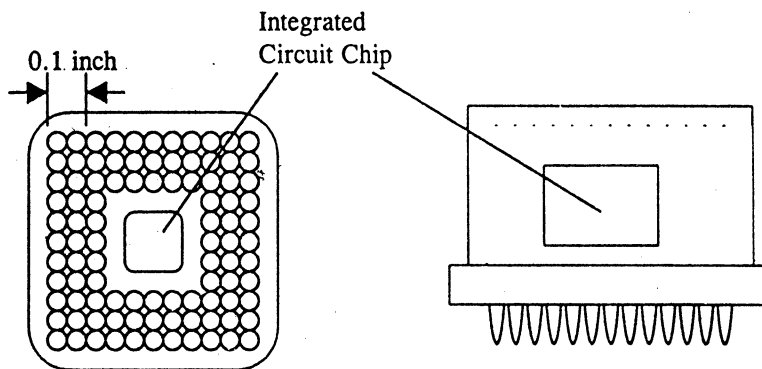
Figure 2: Wafer, Chip and Gate

An integrated circuit is constructed on a thin wafer of silicon that is divided into a matrix of small areas (size of the order of a few millimetres squares). An identical circuit pattern is fabricated on each of these areas and the wafer is then broken into chips (Refer figure 2). Each of these chips consist of several gates, a useful logic component, and a number of input and output connection points. Each of these chips, then, can be packaged separately in a housing to protect it. In addition, this housing provides a number of pins for connecting this chip with other devices or circuits. The pins on these packages can be provided in two ways:

- In two parallel rows with 0.1 inch spacing between two adjacent pins in each row. This package is called dual in-line package (DIP) (Refer Figure 3 (a)).
- In case, more than hundred pins are required, then pin grid array (PGA) is used where pins are arranged in arrays of rows and columns, with spacing between two adjacent pin of 0.1 inch (Refer Figure 3(b)).



(a) A 24 pin dual in-line package (DI)
(Contains dual rows which are in-line)



(b) 144-pin Pin Grid Array (PGA) package

Figure 3: Integrated Circuit Packages

Different circuits can be constructed on different wafers. All these packaged circuit chips then can be interconnected on a printed-circuit board to produce several complex electronic circuits such as computers.

Initially, only a few gates were integrated reliably on a chip and then packaged. This initial integration was referred to as small-scale integration (SSI). Later, with the advances in microelectronics technologies the SSI gave way to Medium Scale Integration where 100s of gates were fabricated on a chip. Then came Large Scale Integration (1,000 gates) and very large integration (VLSI 100,000,000 components) are expected to be fabricated on a single chip. According to this, expected projections is that, in near future, almost 10,000,000,000 components will be fabricated on a single chip.

What are the advantages of having densely packed Integrated Circuits? These are:

Low cost: The cost of a chip has remained almost constant while the chip density (number of gates per chip) is ever increasing. It implies that the cost of computer logic and memory circuitry has been reducing rapidly.

Greater Operating Speed: More is the density, the closer are the logic or memory elements, which implies shorter electrical paths and hence the higher operating speed.

Smaller computers: Better portability, Reduction in power and cooling requirements.

Reliability: The integrated circuit interconnections are much more reliable than soldered connections. In addition, densely packed integrated circuits enable fewer inter-chip connections. Thus, the computers are more reliable.

One of the major milestones in this technology was the very large scale integration (VLSI) where thousands of transistors can be integrated on a single chip. The main impact of VLSI was that, it was possible to produce a complete CPU or main memory or other similar devices on a single IC chip. Let us discuss some of the important breakthroughs of VLSI technologies.

Semiconductor Memories

Initially, the IC technology was used for constructing processor, but soon it was realised that same technology can be used for construction of memory. The first memory chip was constructed in 1970 and could hold 256 bits. Although the cost of this chip was high, but gradually the cost of semiconductor memory is coming down. The memory capacity per chip has increased for e.g. 1k, 4K, 16K, 64K 256K and 1M bits.

Microprocessors

Keeping pace with electronics as more and more component were fabricated on single chip, fewer chips were needed to construct a single processor. Intel in 1971 achieved the breakthrough of putting all the components on a single chip. The single chip processor is known as a microprocessor. The Intel 4004 was the first microprocessor. It was a primitive microprocessor designed for a specific application. Intel 8080 that came in 1974 was the first general purpose microprocessor. It was an 8 bits microprocessor. Motorola is another manufacturer in this area. At present 32 and 64 bit general purpose microprocessors are already in the market. For example, Intel Pentium is a 32 bit processor, similarly Motorola's 68000 is a 32 bit microprocessor. P6 that is announced by Intel 1995 can process 64 bit data at a time. Figure 4 shows the Intel family of microprocessors.

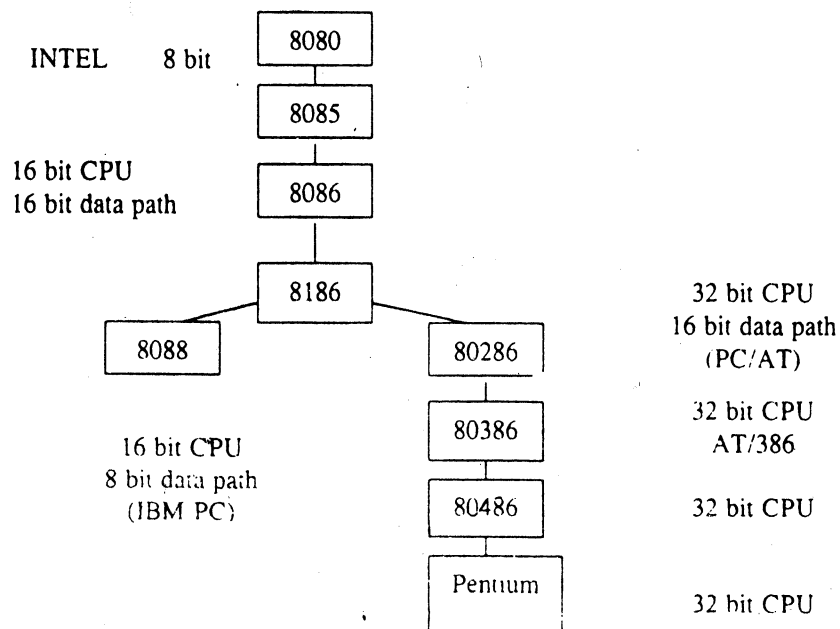


Figure 4: Intel Microprocessor Families

The VLSI technology is still evolving and more and more powerful microprocessor and more storage space now is being put in a single chip.

1.2.2 Classification of Computers

One question which we have still not answered is, Is there any classification of computers? Well for quite sometime computers have been classified under three main classes. These are:

Microcomputers
Minicomputers
Mainframes

Although with development in technology the distinction between these is becoming blurred. Yet it is important to classify these, as it is sometimes useful to differentiate the key elements and architecture among the classes.

Microcomputers

A microcomputer's CPU is a microprocessor. The first microcomputers were built around 8-bit microprocessor chips. What do we mean by an 8-bit chip? It means that the chip can retrieve instructions/data from storage, manipulate, and process an 8-bit data at a time or we can say that the chip has a built-in 8-bit data Transfer path. An improvement on 8-bit chip technology was seen in early 1980s, when a series of 16-bit chips namely 8086 and 8088 were introduced by Intel Corporation, each one with an advancement over the other. 8088 is a 8/16 bit chip i.e. an 8-bit path is used to move data between chip and primary storage (external path), at a time, but processing is done within the chip using a 16 bit path (internal path) at a time. 8086 is a 16/16 bit chip i.e. the internal and external paths both are 16 bit wide. Both these chips can support a primary storage capacity of upto 1-megabyte (MB).

Most of the popular microcomputers are developed around Intel's chips, while most of the minis and superminis are built around Motorola's 68000 series chips. With the advancement of display and VLSI technology now a microcomputer is available in very small size. Some of these are laptops, notebook computers etc. Most of these are of the size of a small notebook but equivalent capacity of an older mainframe.

Minicomputer

The term minicomputer originated in 1960s when it was realised that many computing tasks do not require an expensive contemporary mainframe computers but can be solved by a small, inexpensive computer. Initial minicomputers were 8 bit and 12 bit machines but by 1970s almost all minicomputers were 16 bit machines. The 16 bit minicomputers have the advantage of large instruction set and address field; and efficient storage and handling of text, in comparison to lower bit machines. Thus, 16 bit minicomputer was more powerful machine which could be used in variety of applications and could support business applications alongwith the scientific applications.

With the advancement in technology the speed, memory size and other characteristics developed and the minicomputer was then used for various stand alone or dedicated applications. The minicomputer was then used as a multi-user system, which can be used by various users at the same time. Gradually the architectural requirement of minicomputers grew and a 32-bit minicomputer, which was called supermini, was introduced. The supermini had more peripheral devices, large-memory and could support more users working simultaneously on the computer in comparison to previous minicomputers.

Mainframes

Mainframe computers are generally 32-bit machines or on the higher side. These are suited to big organisations. to manage high volume applications. Few of the popular mainframe series are IBM, HP, etc. Mainframes are also Used as central host computers in distributed systems. Libraries of applications programs developed for mainframe computers are much large than those of the micro or minicomputers because of their evolution over several decade as families of computing. All these factors and many more make the mainframe computers indispensable even with the popularity of microcomputers.

Supercomputer

The upper ends of the state of the art mainframe machine are the supercomputer. These are amongst the fastest machines in terms of processing speed and use multiprocessing techniques, where a number of processors are used to solve a problem. Lately ranges of parallel computing products, which are multiprocessors sharing common buses, have been in use in combination with the mainframe supercomputers. The supercomputers are reaching upto speeds as well over 25000 million arithmetic operations per second. India also has its indigenous supercomputer.

Supercomputers are mainly being used for weather forecasting, computational fluid dynamics, remote sensing, image processing, biomedical applications, etc. In India, we have one such mainframe supercomputer system- CRAY XMP-14, which is at present, being used by Meteorological Department.

Check Your Progress 2

1. What is a general-purpose machine?

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.....
.....

Define the following terms briefly:

- (i) Microprocessors
- (ii) Laptop
- (iii) Supercomputer

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.....

1.3 MEMORY SYSTEM

Memory in a computer system is required for storage and subsequent retrieval of the instructions and data. A computer system uses variety of devices for storing the instructions and data, which are required for its operations. Normally we classify the information to be stored on computer in two basic categories: Data and the Instructions.

"The storage device along with the algorithm or information on how to control and manage these storage devices constitute the memory system of a computer." A memory system is a very simple system yet it exhibits a wide range of technology and types. But unfortunately, faster memory technology is more expensive. In addition, fast memories require power supply till the information need to be stored. Both these things are not very convenient, but on the other hand the memories with less cost have very high access time, that is the time taken by CPU to access a location in the memory in high, which will result in slower operation of the CPU. Thus, the cost versus access time anomaly has lead to a hierarchy of memory where we supplement fast memories with larger, cheaper, slower memories. These memory units may have very different physical and operational characteristics, therefore, making the memory system very diverse in type, cost, organisation, technology and performance. This memory hierarchy will be fruitful if the frequencies of access to slower memories are significantly less than the faster memories.

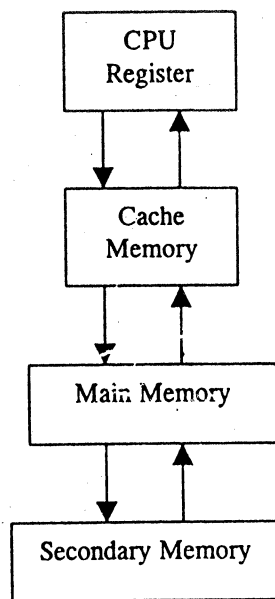


Figure 5: The Memory Hierarchy

Thus, a memory system can be considered to consist of three groups of memories. These are:

- (a) **Internal Processor Memories:** These consist of the small set of high speed registers which are internal to a processor and are used as temporary locations where actual processing is done.
- (b) **Primary Memory or Main Memory:** It is a large memory, which is fast but not as fast as internal processor memory. This memory is accessed directly by the processor. It is mainly based on integrated circuits.
- (c) **Secondary Memory/Auxiliary Memory/Backing Store:** Auxiliary memory in fact is much larger in size than main memory but is slower than main memory. It normally stores system programs (programs which are used by system to perform various operational functions), other instructions, programs and data files. Secondary memory can also be used as an overflow memory in case the main memory capacity has been exceeded. (How? The answer is not supplied in the block. You need to refer to further readings to get this answer). Secondary memories cannot be accessed directly by a processor. First the information of these memories is transferred to the main memory and then the information can be accessed as the information of main memory.

There is another kind of memory, which is increasingly being used in modern computers and this is called Cache memory. It is logically positioned between the internal memory (registers) and main memory. It stores or catches some of the content of the main memory, which is currently in use of the processor.

Before discussing more about these memories let us first discuss the technological terms commonly used in defining and accessing the memory.

1.4 CHARACTERISTIC TERMS FOR VARIOUS MEMORY DEVICES

The following terms are most commonly used for identifying comparative behaviour of various memory devices and technologies.

Storage Capacity: It is a representative of the size of the memory. The capacity of internal memory and main memory can be expressed in terms of number of words or bytes. The storage capacity of external memory is normally measured in terms of bytes.

Access Modes: A memory is considered to consist of various memory locations. The information from these memory locations can be accessed in the following ways.

- **Random Access Memory (RAM):** It is the mode in which any memory location can be accessed in any order in the same amount of time. Ferrite and Semiconductor memories, which generally constitute main memory, are of this nature. The storage locations can be accessed independently and there exist separate access mechanism for each location.
- **Sequential Access:** On the other hand we have memories which can be accessed in a pre-defined sequence for example, the songs stored on a cassette can be accessed only one by one. The example of sequential access memory is Magnetic Tape. Here the access mechanism need to be shared among different locations. Thus, either the location or the read/write head or both should be moved to access the desired location.
- **Direct Access:** In certain cases the information is neither accessed randomly nor in sequence but something in between. In direct access, a separate read/write head exist for a track and on a track the information can be accessed serially. This semi-random mode of operations exists in magnetic disks.

Access Time: The access time is the time required between the request made for a read or write operation till the time the data is made available or written at the requested location. Normally it is measured for read operation. The access time depends on the physical characteristics and access mode used for that device.

Permanence of Storage: Some memories loose information over a period of time. For example, there can be some memories where the stored data bit value 1 loses its strength to become 0 over a period of time. These kinds of memories require refreshing. The memories, which require refreshing, are termed as dynamic memories. In contrast, the memories, which do not require refreshing, are called static memories. Another factor, which can destroy the contents, is the presence and absence of electricity. The memories, which loses their content on failure of power are termed as **volatile** memories, those, which do not are called **non-volatile**. Magnetic memories are non-volatile and semi-conductor main memories are volatile in nature.

Physical Characteristics: In this respect the memory devices can be categorised into four main categories viz., electronic, magnetic, mechanical and optical. One of the requirements for a storage device is that it should exhibit two well-defined physical states, such that 0 and 1 can be represented in those two states. The Data transfer rate of the memory depends on the how quickly the state can be recognised and altered. The following table lists some of the memory technologies along with their physical and other important characteristics.

Technology	Access time (in seconds)	Access Mode	Performance of Storage	Physical nature of storage medium	Average cost (Rs/bit) (Approx.)
Semiconductor memories	10^{-8}	Random	Volatile	Electronic	10^{-2}
Magnetic disk	10^{-2}	Direct	Non-volatile	Magnetic	10^{-5}
Magnetic tape	10^{-1}	Sequential	Non-volatile	Magnetic	10^{-5}
Compact disk ROM	Approx. 10^{-1}	Direct	Non-volatile	Optical	10^{-7}

Figure 6: Characteristics of some memory technologies

The physical size of memories should be small and it must consume less power. Higher power consumption may result in more costly equipment for internal cooling of computer. The storage devices, which require mechanical motion e.g. hard disks are more prone to failure rather than the semiconductor memories which

Check Your Progress 3

1. State True or False.

(a) Memory hierarchy is built in computer system, as the main memory can not store very large data.

True False

(b) The secondary memory is slower than that of main memory but has a larger capacity.

True False

(c) In Random access Memory any memory location can be accessed independently.

True False

2. What are the differences in:

(a) Volatile versus Non-volatile memory

.....
.....

(b) Static versus dynamic memories

.....
.....

1.5 MAIN MEMORY OR PRIMARY STORAGE

Primary memory consists of semiconductor memory chips and is used to store the data and programs currently in use. Each storage element of memory is directly (randomly) accessible and can be examined and modified without affecting other cells and hence primary memory is also called Random Access Memory (RAM). Main memory stores a variety of critical information required for processing by the CPU. How does it store the information? Please answer it yourself.

The memory unit stores all the information in memory cells also called memory locations, in binary digits. Each memory location has a unique address. The contents of the desired memory locations are provided to the central processing unit by referring to the address of the memory location. The amount of information that can be held in the main memory is known as memory capacity. The capacity of the main memory is measured in kilobytes (KB) or Megabytes (MB).

All modern computers use semiconductor memory as its main memory. Semiconductor memory is known as Random Access Memory (RAM) since any part of the memory can be accessed for reading and writing. Another part of main memory is Read Only Memory (ROM). ROMs (Read Only Memories) are the memories on which it is not possible to write the data when they are on-line to the computer. They can only be read. The ROMs can be used in storing programs provided by the manufacturer of computer for basic operations. ROMs are non-volatile in nature and need not be loaded in a secondary storage device. ROMs are fabricated in large number in a way where there is no room for even a single error.

ROMs can be written only at the time of manufacture. Another similar memory is PROM. PROMs are also non-volatile and can be programmed only once by a special write device hence the name Programmable ROM (PROM). The writing process in PROM can be performed electrically by the supplier or the customer.

Special equipment is needed to perform this writing operation. Therefore, PROMs are more flexible and convenient than ROMs.

The ROMs/PROMs can be written just once (in ROMs at the time manufacture and PROMs at any time later also), but in both the cases once whatever is written on, cannot be changed. But what about a case where you read mostly but write only very few times. This lead to the concept of Read mostly memories and the best examples of these are EPROMs (Erasable PROMS) and EEPROMs (Electrically erasable PROMS). The EPROMs can be written electrically. But, the write operation is not simple. It requires erasure of whole storage cells by exposing the chip to ultra violet light, thus bring them to same initial state. This erasure is a time consuming process. Once all the cells have been brought to same initial state, then the EPROM can be written electrically. EEPROMs are becoming increasingly popular as they do not require prior erasure of previous contents. However, in EEPROMs the writing time is considerably higher than reading time. The biggest advantage of EEPROM is that it is non-volatile memory and can be updated easily, while the disadvantages are the high cost and at present they are not completely non-volatile and the write operation takes considerable time. Figure 7 summarise the features of these read only and read mostly memories.

Memory Type	Write Time	Order of Read Time	Number of Cycles allowed
ROM	Once at the time of manufacture	Nano seconds	ONE
PROM	Hours	Nano seconds	ONE
EPROM	Minutes (including time of ensure)	Nano Seconds	HUNDREDS
EEPROM	Milliseconds	Nano seconds	THOUSANDS

- Common features
- * Non-destructive
 - * Long data life
 - * Non-volatile

Figure 7: Features of Read Only and Read Mostly Memories

1.6 EXTERNAL/AUXILIARY MEMORY

As discussed earlier the cost of RAM is very high and the semiconductor RAMs are mostly volatile, therefore, it is highly likely that a secondary cheap media should be used which should show some sort of permanence of storage and should be relatively inexpensive. The magnetic material was found to be inexpensive and quite long lasting material. Therefore, became an ideal choice to do so. Magnetic tape and magnetic disks are commonly used as storage media. With the advancements in the optical technology now the optical disks are trying to make inroads as one of the major external memory. We will discuss about the characteristics of these memories in this section.

1.6.1 Magnetic Disk

A magnetic disk is a circular platter of plastic, which is coated with magnetised material. One of the key components of a magnetic disk is a conducting coil named as Head which performs the job of reading and writing on the magnetic surface. The head remains stationary while the disk rotates below it for reading or writing operation.

Data Organisation and Format

The head of disk is a small coil and reads or writes on the position of the disk rotating below it, therefore, the data is stored in concentric set of rings (refer figure 4). These are called tracks. The width of a track is equal to the width of the head. To minimise the interference of magnetic fields and to minimise the errors of misalignment of head, the adjacent tracks are separated by inter track gaps. As we go towards the outer tracks the size of a track increase but to simplify electronics same number of bits are stored on each track.

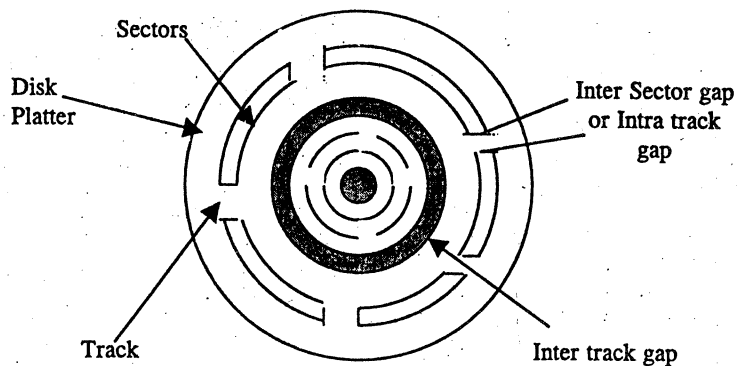


Figure 8: Logical layout of Magnetic Disk

The data is transferred from and to the disks in blocks. Block is a section of disk data and is normally equal to a sector. A track is divided into 10-100 sectors and these sectors should be either fixed or variable length sectors. Two adjacent sectors are separated by intra-track gaps. This helps in reducing the precision requirements of sectors. To identify the sector position normally there may be a starting point on a track or a starting and end point of each sector.

Floppy disks

A floppy disk is made of a flexible thin sheet of plastic material with a magnetic coating and grooves arranged in concentric circles with tracks. Floppy disk becomes a convenient recording medium to transport information from one location to another. Disk is removable from the reading device attached to the computer and therefore provides unlimited storage capacity. The floppy disks of today are available in two sizes 5.25 inches and 3.5 inches and their capacity ranges from 360 KB to 1.44 MB per disk.

1.6.2 Winchester Disk

This is a sealed rigid magnetic oxide medium disk, which typically holds 10 MB to 10 GB of data. Winchester disks are not removable from the drive and since they are sealed dust and other contaminations, which are likely in a floppy disk, are minimised. These provide substantially faster data access compared to floppy disk and provide very large data storage for on-line retrieval.

Sides: The magnetic coating if applied to both the sides of the platter is called as double sided disks. The data can be recorded on either side of these disks. Some inexpensive disks were initially single sided.

Platters: Some disks have single platter e.g. floppy disks while some disks have multiple platters which are stacked vertically, normally at a distance of an inch. This is known as disk pack. In disk pack one additional term cylinder is defined which is the ring of all co-centric tracks (Figure 9). A disk pack can contain multiple heads mounted with the same arm.

Access time on Disk

Disk operates in semi-random mode of operation and normally is referenced block wise. The data access time on disk consists of two main components.

Seek time: Time to position the head on a specific track. On a fixed head disks it is the time taken by electronic circuit to select the require head while in movable head disk it is the time required to move the head to a particular track.

Latency time: The time required by a sector to reach below the read/write head. On an average it is half of the time taken for a rotation by the disk.

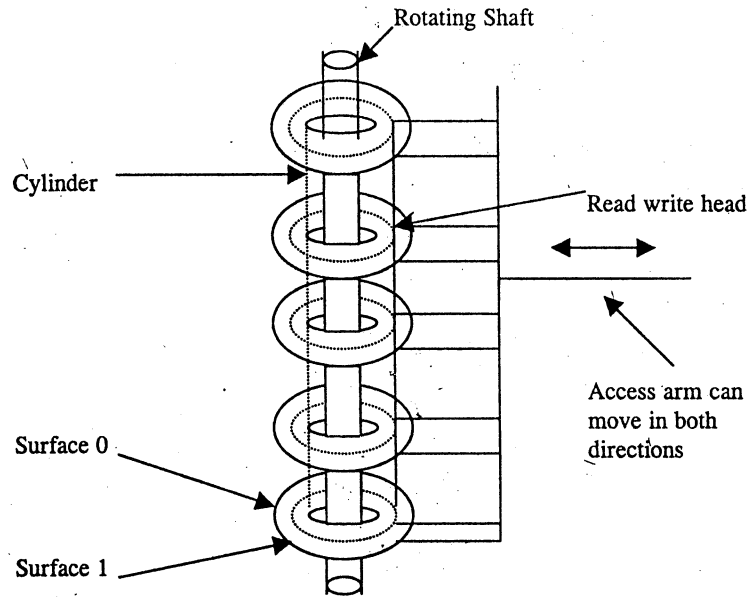


Figure 9: The Disk Pack

In addition to these two times the time taken to read block of word can be considered but normally it is too small in comparison to latency and seek time and in general the disk access time is considered to be sum of seek time and latency time. Since, access time to disks is large, therefore, it is advisable to read a sizable portion of data in a single go and that is why the disks are referenced block wise.

1.6.3 Magnetic Tape

Magnetic tapes are mounted on reels or a cartridge or a cassette of tape to store large volumes or backup data. These are cheaper and since these are removable from the drive, they provide unlimited storage capacity. Information retrieval from tapes is sequential and not random. These are not suitable for on-line retrieval of data, since sequential searching will take long time. These are convenient for archival storage, or for backup. The tapes are one of the earliest storage devices. They are low cost, low speed, portable and are still widely used because of their low cost.

1.6.4 Optical Memories

Optical memories are alternate mass storage devices with huge capacity. The advent of compact disk digital audio system, a non-erasable optical disk, paved the way for the development of a new low cost storage technology. In optical storage devices the information is written using laser beam. These devices which are memories can store large amount of data. We will discuss here three optical memory devices, which are now becoming increasingly popular in various computer applications.

CD-ROM

The CD-ROM (Compact disk read-only memory) is a direct extension of audio CD. CD-ROM players are more rugged and have error-correction facility. This ensures proper data transfer from CD-ROM to the main

memory of the computer. CD-ROM is written into during the process of manufacture by a high power laser beam. Information is retrieved from a CD-ROM using a low power laser, which ingenerate in an optical disk drive unit. In CD-ROMs the information is stored evenly across the disk in segments of the same size. Therefore, in CD-ROMs data stored on a track increases as we go towards outer surface of disk. Thus, the CD-ROMs are rotated at variable speeds for the reading process.

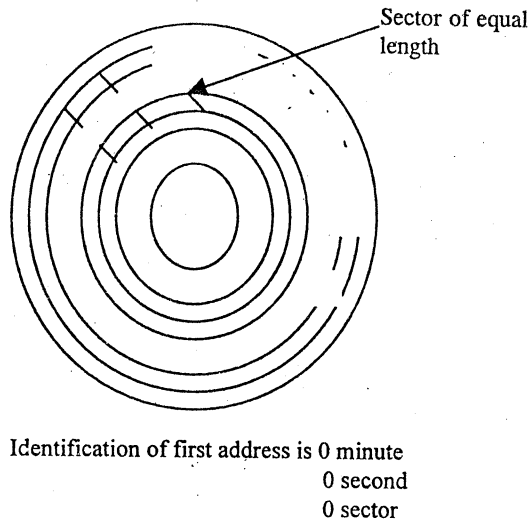


Figure 10 : A CD-ROM's disk layout

Figure 10 indicates the layout used for CD-ROMS. As discussed earlier, the data is stored sequentially along a spiral track. In this disk random access becomes more difficult because locating a desired address involves first moving the head to the specific area then adjusting the rotation speed and then reading the address, and then to find and access the specific sector.

CD-ROMs are very good for distributing large amount of information or data to large number of users. The three main advantages of CD-ROMs are:

- Large data/information storage capacity
- Mass replication is inexpensive and fast
- These are removable disks, thus, are suitable for archival storage

The disadvantages of CD-ROMs are:

- It is read-only; therefore, cannot be updated
- Access time is longer than that of a magnetic disk

WORM

In certain applications only few copies of compact disks are to be made which makes the CD-ROMs production economically unviable. For such cases write-once, read-many CD has been developed. WORM disks are prepared in such a way that they can be written only once subsequently by a laser beam of modest intensity. The disk controller of WORM is more expensive than that of CD-ROM. WORM uses sector structures same as that of magnetic disks. High power laser first prepares the WORM disk. A CD writer can write them into once.

Erasable Optical Disk

The most recent development in optical disks is the erasable optical disk. The data in these disks can be changed repeatedly as the case with any magnetic disk. A feasible technology that has proved commercially feasible for erasable optical disk is the magneto-optical system. In such systems, a laser beam is used along with a magnetic field to read or write the information on a disk, which is coated with a magnetic material.

The erasable optical disk is a true secondary storage device (unlike CD-ROMs and WORM). The main advantages of erasable optical disk over magnetic disk are:

- The capacity of an erasable disk is very high in comparison to magnetic disk. For example, a 5.1/4 inch optical disk can store around 650 Mbytes of data while the Winchester disks normally can store a maximum capacity of 512 MB.
- The erasable optical disks are portable while a Winchester disk is not.
- The erasable optical disks are highly reliable and have a longer life.
- Erasable optical disk also uses format that makes semi-random access feasible.

The only disadvantage of this disk is the high cost. This disadvantage will disappear in near future.

Check Your Progress 4

1. Compare and contrast RAM and ROM.

.....
.....

2. What is the importance of read mostly memories?

.....
.....

3. What is the head of a disk?

.....
.....

4. Match the following pairs

- | | |
|-----------------------------------|-------------------|
| (i) Variable rotation speed | (a) Magnetic tape |
| (ii) Low cost, low speed devices | (b) Floppy disks |
| (iii) Double sided double density | (c) CD-ROM |

1.7 HIGH SPEED MEMORIES

The Need: Why the high speeds memories? Is the main memory not a high-speed memory? The answer to second question is definitely "No", but why so, well for this we have to go to the fundamentals of semiconductor technology that is beyond the scope of the unit then if the memories are slower then how slow are they? It has been found that the access of main memories is slower than the speed of the processor. Since each instruction require several memory accesses therefore, faster memories will be of tremendous help in increasing the overall throughput of a computer.

There are four possible ways to increase the memory speed.

- a) Decrease the memory access time, use a faster but expensive technology for main memory probably it will be feasible after few years.
- b) Access more words in a single memory access cycle. That is instead of accessing one word from the memory in a memory access cycle, access more words. This is termed as memory interleaving.
- c) Insert a high-speed memory termed as Cache between the main memory and processor.
- d) Use associative addressing in place of random access.

In this section we will only discuss about one of the most popular technology the cache memory. You can refer to further reading for most details on other terms mentioned in this section.

Cache Memory

These are small fast memories placed between the processor and the main memory. Caches although are fast yet are very extensive memories and are used in only small sizes. For example caches of sizes 64 K, 128K, 256 KB, etc. are normally used in typical PC-486 and Pentium based PCs while they can have 1 to 64 MB RAMs or even more. Thus, small cache memories are intended to provide fast speed of memory retrieval without sacrificing the size of memory (because of main memory size). If we have such a small size of fast memory how could it be advantageous in increasing the overall speed of memory reference? The answer lies in the principles of locality, which says that if a particular memory location is accessed at a time then it is highly likely that its near by locations will be accessed in the near future. Cache contains a copy of certain portions of main memory. The memory read or writes operation is first checked with cache and if the desired location data is available in cache then used by the CPU directly. Otherwise, a block of words is read from main memory to cache and CPU uses the word from cache. Since cache has limited space, so for this incoming block a portion called a slot need to be vacated in Cache. The contents of this vacating block is written back to the main memory at the position it belongs to. The reason of bringing a block of words to cache is once again locality of reference. We expect that next few addresses will be close to this address and, therefore, the block of word is transferred from main memory to cache. Thus, for the word, which is not in cache, access time is slightly more than the access time for main memory without cache. But, because of locality of references, cache performs better. For example, if memory read-cycle takes 100 nos and a cache read cycle takes 20 nos, then for four continuous references (first one brings the main memory content to cache and next three from cache).

The time taken with cache	(100+20)	+20 × 3
	For the first	for last three
	read operation	read operation
	120+60	180 nos
Time taken without cache	100 × 4	400 nos

Thus, the closer are the reference, better is the performance of cache and that is why structured code is considered to be a good programming practice, since it provides maximum possible locality-

Check Your Progress 5

1. State True or False.
 - (a) High speed memories are needed to bridge the gap of speed between I/O device and memory

True	<input type="checkbox"/>	False	<input type="checkbox"/>
------	--------------------------	-------	--------------------------
 - (b) Cache memory increases load on main memory.

True	<input type="checkbox"/>	False	<input type="checkbox"/>
------	--------------------------	-------	--------------------------
 - (c) The principle of locality says that all the references to data have to be to the same memory location.

True	<input type="checkbox"/>	False	<input type="checkbox"/>
------	--------------------------	-------	--------------------------

- | | |
|---|-------------------------------------|
| (ii) Temporary storage | (ii) Permanent storage |
| (iii) Normally faster than non-volatile types | (iii) Slower than volatile memories |

(b) Static memory

- (i) Loses its signal
- (ii) Periodic refreshing of memory is needed
- (iii) Expensive
- (iv) Used as Cache

Dynamic memory

- (i) Does not lose signal strength
- (ii) No refreshing
- (ii) Cheap
- (iv) Used as main memory

Check Your Progress 4

- | | |
|---|---|
| <p>1. RAM</p> <ul style="list-style-type: none"> • Read-write memory • Semi-Conductor memories • Volatile • Can be used by user programs and system programs | <p>ROM</p> <ul style="list-style-type: none"> Only can be read Semi-Conductor memories Non-Volatile Cannot be used for user programs |
|---|---|
2. They are better than ROMs and PROMs for rewriting purposes, however, can be used in similar ways.
3. Head is conducting coil in a disk which performs the job of reading or writing data on a disk using magnetic effects of electricity.
4. (i) - (c), (ii) - (a), (iii) - (b)

Check Your Progress 5

1. (a) False (b) False (c) False

1.10 FURTHER READINGS

1. Stallings, William, *Computer Organisation and Architecture*, Third edition, Maxwell Macmillan International Editions.
2. Mano, M. Morris, *Computer System Architecture and Organisation*, Second Edition, McGraw-Hill International Editions, 1988.

UNIT 2 INPUT /OUTPUT ORGANISATION & NEW TECHNOLOGIES

Structure

- 2.0 Introduction
- 2.1 Objectives
- 2.2 Input/Output Devices (Peripherals)
 - 2.2.1 Input Device
 - 2.2.2 Output Devices
- 2.3 Input/Output Module Interface
- 2.4 External Interfaces
- 2.5 What is Parallel Processing?
- 2.6 Pipelining
- 2.7 Vector Processing
- 2.8 Introduction to RISC
 - 2.8.1 Reasons for Increased Complexity
 - 2.8.2 Principles of RISC
- 2.9 Summary
- 2.10 Model Answers
- 2.11 Further Readings

2.0 INTRODUCTION

Till now we have discussed about various components and memory system for a computer. We have also introduced one interconnection structure called the Bus. In this unit we will discuss more about the input/output organisation and newer technologies in computer hardware. We will discuss briefly about input/output devices, two popular device interfaces and the concepts of parallel organisation. We will also discuss about the concepts of pipelining, vector processing and the concepts relating to Reduced Instruction Set Computers (RISC) architecture.

2.1 OBJECTIVES

At the end of this unit you should be able to:

- identify some of the Input/output devices
- identify the serial and parallel interfaces
- define the Flynn's classification of computers
- list the characteristics of multiprocessor systems
- define pipelining and vector processing
- define the concepts relating to RISC.

2.2 INPUT/OUTPUT DEVICES (PERIPHERALS)

The computer will be of no use if it is not communicating with the external world. Thus, a computer must have a system to receive information from outside world and must be able to communicate results to external world. Thus, a computer consists of an I/O system. This system includes two basic components, one is the I/O devices and another called I/O module, which not only connects an I/O device with the system bus, but plays a very crucial role in between. A device, which is connected to an I/O module of computer, is called a

peripheral. Let us discuss few Input/Output devices in this section and we will define the I/O module in the subsequent sections.

2.2.1 Input Devices

Input technologies are rapidly developing. These, as the name suggests, are used for transferring user command or choice or data to the computer.

Keyboard

The keyboard is one of the most common input devices for computers. The layout of the keyboard is like that of the traditional QWERTY typewriter, although there are some extra commands and function keys provided for. Substantial development has taken place in the ergonomics of keyboard design to ensure that operator strain is minimal.

Pointing Devices

The keyboard provides facility to input data and commands to computer in text form. We find that, while working with a display based packages, we are mostly pointing to some area in the display to select an option and move across on the screen to select subsequent options. For such cases pointing devices are very useful. There are several pointing devices, some of them are:

- (a) **Mouse:** Mouse is a handy device which, can be moved on a smooth surface to simulate the movement of cursor that is desired on the display screen. Mouse could be optical; offering quite and reliable operation, or mechanical, which is cheaper but noisier. User can move the mouse, stop it at a point where the pointer is to be located and, with the help of buttons, make selection of choices.
- (b) **Light Pen:** This is a pen shaped device allowing natural movement on the screen. The pen contains the light receptor and is activated by pressing the pen against the display screen. Receptor is the scanning beam which, helps in locating the pen's position. Suitable system software is provided to initiate necessary action when we locate an area on the display surface with the help of the light pen.

There are a few other pointing devices known as track balls and joysticks, which are used more on entertainment usage, like games. We will not discuss them in this section.

Voice/Speech Input

One of the most exciting areas of research is in recognising human voices/speech so that this could from input to computer directly. This approach will eliminate the need for keying in data and will facilitate casual users to use the computer very easily. There are several problem areas for research since speech recognition system should be able to identify who is speaking and what the message is. Voice recognition techniques along with several other techniques to convert the voice signals to appropriate words and derive the correct meaning of words are required for a commercially viable comprehensive speech recognition system. We have found limited success in this area and today devices are available commercially to recognise and interpret human voices within limited scope of operation.

Scanners

Scanners facilitate capturing of the information and storing them in graphic format for displaying back on the graphical screen. Scanner consists of two components, the first one to illuminate the page so that the optical image can be captured and the other to convert the optical image into digital format for storage by computer.

The graphic image scanned can now be seen and processed directly by the computer. Substantial research work is going on to establish methods by which the scanned image can be automatically converted into equivalent text for further processing.

Source Data Automation

Most recent trends for data input are towards source data automation. The equipment used for source data automation capture data as a by-product of a business activity thereby completely eliminating manual input of data. Some examples are:

1. Magnetic Ink Character Recognition (MICR) devices are generally used by the banking industry to read the account numbers on cheques directly and does the necessary processing.
2. Optical Mark Recognition (OMR) devices can sense marks on computer readable papers. This kind of device is used by academic and testing institutions to grade aptitude tests where candidates mark the correct alternatives on a special sheet of paper. The optical mark recognition devices then directly read these answer sheets and the information sent to a computer for processing.
3. Optical Bar Code Reader (OBR) scans a set of vertical bars of different widths for specific data and are used to read tags and merchandise in stores, medical records, library books, etc. These are available as hand held devices.

2.2.2 Output Devices

The output normally can be produced in two ways; either on a display unit/device or on a paper. Other kinds of output such as speech output, mechanical output is also being used in certain applications. In this section, we will discuss only the display and printing output devices.

Display Devices

One of the most important peripherals in computer is the graphic display device. Conventional computer display terminals known as alphanumeric terminals, display characters (images) from a multi-dot array (normally 5×7 or 7×9). These are used to read text information displayed on the screen. However, there are increasing demand for display of graphics, diagrams and pictures to make the visual presentation of information more effective for user interaction and decision making.

Graphic display is made up of a series of dots called 'pixels' (picture elements) whose pattern produces the image. Each dot on the screen is defined as a separate unit, which can be directly addressed. Since each dot can be controlled individually there is much greater flexibility in drawing pictures. There are three categories of display screen technology:

1. Cathode Ray Tube (CRT)
2. Liquid Crystal Display (LCD)
3. Projection Displays

CRT Displays

The main components of a CRT terminals are the electron gun, the electron beam controlled by an electromagnetic field and a phosphor coated display screen.

The electromagnetic field in order to create an image (Refer figure 5). There are two types of CRT displays

- (a) Vector CRT displays in which the electron beam is directed only to the places where the image is to be created.
- (b) Raster displays in which the image is projected on to the screen by directing the electron beam across each row of picture elements from the top to the bottom of the screen. This type of display provides a high dynamic capability since image is continuously refreshed and it allows for continual user input and output. It offers full colour display at a relatively low cost and is becoming very popular.

First introduced in watches and clocks in 1970s, LCD is now applied to display terminals. The major advantage of LCD is the low energy consumption. The CRT (Cathode Ray Tube) is replaced by liquid crystal to produce the image. This also have colour capability but the image quality is relatively poor. These are commonly used in portable devices because of compactness and low energy requirements.

Projection Displays

The personal size screen of the previous displays is replaced by a large screen upon, which images are normally used for large group presentation. These systems can be connected to computer and whatever appears on the computer terminal gets enlarged and projected on a large screen. Another popular method is to connect computer to a LCD flat screen, and to project the LCD image using Overhead Projector. These are popularly used for seminars, classrooms, marketing presentations, etc.

Printers

Printers are used for producing output on paper. There are a large variety of printing devices, which can be classified according to the print quality and the printing speeds. Current estimates indicate that about 1500 types of printers are commercially available conforming to about 15 different printing technologies. The following categories of printers are identified.

(a) Printing Technology - impact printers vs. non-impact printers

Impact printers use variations of standards typewriter printing mechanism where a hammer strikes Paper impact printers use variations of standards typewriter printing mechanism through inked ribbon. Non-impact printer uses chemical, heat or electrical signals to etch or induce symbols on paper. Many of these require special coated or treated paper.

(b) Character forms-fully formed characters vs. dot matrix

Fully formed characters are constructed from solid lines and curves like the characters of typewriter whereas a dot-matrix character is made up from a carefully arranged sequence of dots packed very close to each other. Obviously print quality of a dot matrix printer will be poorer compared to that from fully formed characters.

(c) Printing sequence - serial vs. line vs. page

This indicates the amount of information of printer can output within a single cycle of operation. Serial printing is done character by character whereas line printing forms an entire line and prints a line at a time whereas a page printer outputs a whole page of character and images simultaneously during one cycle. Clearly the speed of output will depend upon the printing sequence incorporated in the printing device. We will now look at three of the most popular printers:

Dot Matrix Printers

This is one of the most popular printers used for personal computing systems. These printers are relatively cheaper compared to other technologies. This uses impact technology and a print head containing banks of wires moving at high speeds against inked ribbon and paper. Characters are produced in matrix format. The speeds range from 40 characters per second (CPS) to about 1,000 cps. A disadvantage of this technology is that the print quality is low.

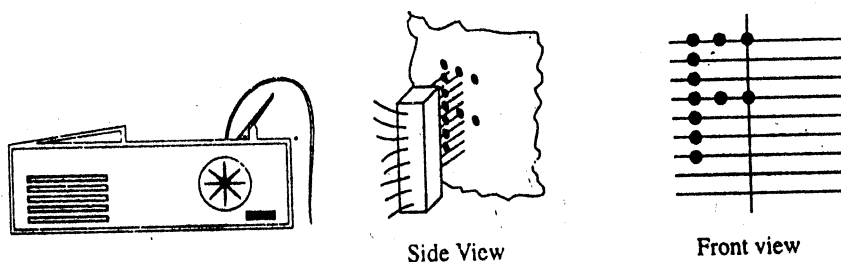


Figure 1: Dot Matrix Printer

Ink Jet Printers

These print by spraying a controlled stream of tiny ink droplets- accurately on the paper forming either dot matrix or solid characters. These are non-impact and hence relatively silent and high quality printers. The typical speeds range from 50 cps to above 300 cps and this technology has been used well for production of colour printing and elaborate graphics.

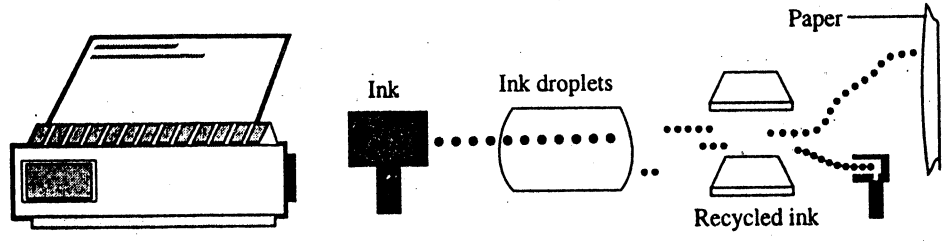


Figure 2: Inkjet Printing

Laser Printers

This is a high quality, high speed, and high volume technology, which works in non-impact fashion on plain paper or pre-printed forms. Printing is achieved by deflecting laser beam on to the photosensitive surface of a drum and the latent image attracts the toner to the image areas. The toner is then electrostatically transferred to the paper and fixed into a permanent image. Speeds can range from 10 pages a minute to about 200 pages per minute. This technology is relatively expensive but is becoming very popular because of the quality, speed and noiseless operations.

These three printers are compared in figure 3.

Plotters

To produce graphical output on paper the plotters are used.

After discussing so much about the I/O devices, let us come back to one of the basic question: How does I/O devices are connected to computers? We will try to answer the question in the next section.

Style of Printing	Print quality
Dot matrix	Low quality but steadily improving. Very useful for high-volume work (low quality) because of great speeds and low printing cost. Lack of descenders on letters (many models rectify inability to reproduce well on a photocopier are major this) and the problems. Dot Matrix Printers have the ability to produce multiple copies of documents in a single print
Ink-jet	High-quality print character sets; choice of type set is controlled by program; print quality quite good than dot matrix; cheap; useful for low volume applications; high printing cost;
Laser	Very high quality, prints at speeds unapproachable by other technologies. Price is affordable. Excellent for high volume high quality works.

Figure 3: Some Printer Technologies

Check Your Progress 1

1. State True or False.

(a) In case where graphical user interfaces are common mouse should not be used.

True False

(b) Keyboard is one of the most common input device.

True False

(c) Scanners are devices used for outputting pictures.

True False

(d) Projection displays can be used for classroom teaching.

True False

(e) Keyboard, VDU and printers are essential for computers.

True False

2. Differentiate between the CRT display and LCD display.

.....
.....

3. Compare and contrast the Laser and Dot Matrix Printers.

.....
.....

4. Define the term "Source Data Automation". Give two examples.

.....
.....

2.3 INPUT/OUTPUT MODULE INTERFACE

The input/output module interfaces (I/O module) is normally connected to the computer system on one end and one or more Input/Output devices on the other. Normally, an I/O module can control one or more peripheral devices. An I/O module is needed because of:

- (a) Diversity and variety of I/O devices makes it difficult to incorporate all the peripheral device logic (i.e. its control commands, data format etc.) into CPU. This in turn will also reduce flexibility of using any new development
- (b) The I/O devices are normally slower than that of memory and CPU, therefore, it is suggested not to use them on high-speed bus directly for communication purpose.

- (c) The data format and word length used by the peripheral may be quite different than that of a CPU. An I/O module is a mediator between the processor and an I/O device/devices. It controls the data exchange between the external devices and main memory; or external devices and CPU registers. Therefore, an I/O module provide an interface internal to the computer which connect it to CPU and main memory and an interface external to the computer connecting it to external device or peripheral. The I/O module should not only communicate the information from CPU to I/O device, but it should also co-ordinate these two. In addition since there are speed differences between CPU and I/O devices, the I/O module should have facilities like buffer (storage area) and error detection mechanism.

If an I/O. module takes more processing burden then it is termed as I/O channel or processor. The primitive I/O modules, which require detailed control by processor, are called I/O controller or device controller. These I/O controllers are normally used in micro-computers, while I/O processors are mainly used for Mainframe, because the I/O work for microcomputer is normally limited to single user's job. Therefore, we do not expect a very huge amount of I/O to justify the investment in I/O processor, which are expensive.

2.4 EXTERNAL INTERFACES

Our discussion on I/O system will not be complete if we do not discuss about external interfaces. External interface is the interface between the I/O module and the-peripheral devices. This interface can be characterised into two main categories: (a) parallel interface (b) serial interface. Figure 4 gives a block diagram from these two interfaces.

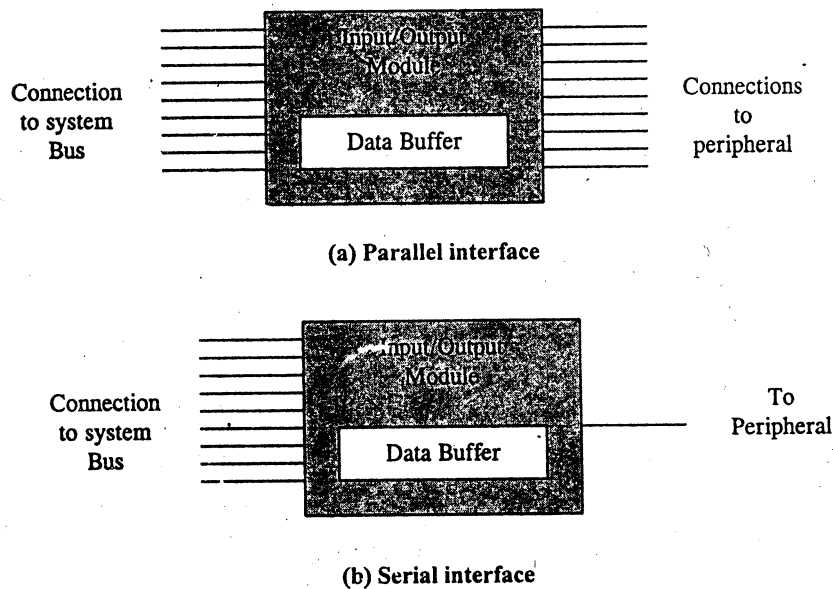


Figure 4: Parallel and Serial Interface

In parallel interface multiple bits can be transferred simultaneously. The parallel interfaces are normally used for high-speed peripherals such as tapes and disks. The dialogue that takes place across the interface includes the exchange of control information and data. A common parallel interface is centronics.

In serial interface only one line is used to transmit data, therefore, only one bit is transferred at a time. Serial interface is used for serial printers and terminals. The most common serial interface is RS-232-C.

Check Your Progress 2

1. State True or False.

(a) Devices are normally connected directly to system bus.

True False

(b) Input/output Module is needed only for slower I/O devices.

True False

(c) Data buffering is helpful for smoothing out the speed difference between CPU and input/output devices.

True False

(d) Parallel interfaces are commonly used for connecting printers to a computer.

True False

2. What is a device controller?

.....
.....

2.5 WHAT IS PARALLEL PROCESSING?

In the previous section, we have defined the Input/Output interfaces of a computer. Let us now, explore about the newer technologies and trends in computers.

The computers can be made faster by increasing their clock speed or by using improved VLSI technology. But there is a practical limitation to both of them. The only way, that seems possible, theoretically, that can increase the speed in an unlimited fashion is to have multiple modules, that is break the original problems into independent modules and execute them simultaneously. More the number of processors doing the job simultaneously more the speed up will be. Parallel processing is a term used to denote a large class of techniques that are used to provide simultaneous data processing tasks for the purpose of increasing the computational speed of a computer.

One of the most popular classifications of parallel computer is by M.J. Flynn, called Flynn's Classification, and is based on the multiplicity of instruction streams and data streams in a computer system. The sequence of instruction read from the memory constitute the instruction stream, and the data they operate of in the processor constitute the data stream. Flynn's classification divides the computers into four categories:

- single instruction single data (SISD)
- single instruction multiple data (SIMD)
- multiple instruction single data (MISD)
- multiple instruction multiple data (MIMD)

SISD organisation is available in most serial computers today. Instructions are executed sequentially, though may be overlapped in their execution stage (pipelining). All the functional units are under the supervision of one control unit. The von Neumann architecture falls under this category.

SIMD organisation consists of multiple processing elements supervised by the same control unit. All processing units receive the same instruction broadcast but work on different data streams. One of the very common examples is the execution of a 'for' loop, in which the same set of instructions are executed for, may be a different set of data.

MISD organisation consists of N processor units, each working on a different set of instructions working on the same set of data. The output of one unit becomes the input to the other unit. There is no commercial computer of this kind.

MIMD organisation implies interactions between N processors because all memory streams are derived from the same data stream shared by all processors. If the interaction between the processors is high, it is called a tightly coupled system, or else it is called a loosely coupled system. Most multiprocessors fit into this category.

Parallel processors can be categorised into several categories. These include:

- Array Processors
- Distributed Architecture
- Multiprocessors
- Data flow Architectures

Array processors are parallel architectures, which deal with repetitive operations. These are an example of SIMD architecture, with applications varying from mathematical array operations and in structures in which data objects are known well in advance.

Distributed Architecture are composed of relatively autonomous subsystems which are capable of handling complete system and execution functions, and which cooperate together to run a large application.

Multiprocessors are architectures composed of multiple computing units, which operate in a synchronous mode. Generally, both shared and local memory can be available for these processors. The communication between the processors takes place either through the shared memory area or through the interprocessor messages.

Dataflow Architectures are functionally distributed architectures, in which the operations are triggered with the arrival of data at these processors. They may be viewed as very general MIMD parallel architectures.

Most of these parallel processor computers follow an important concept called pipelining. In the subsequent sections, we will discuss some of the newer technological concepts.

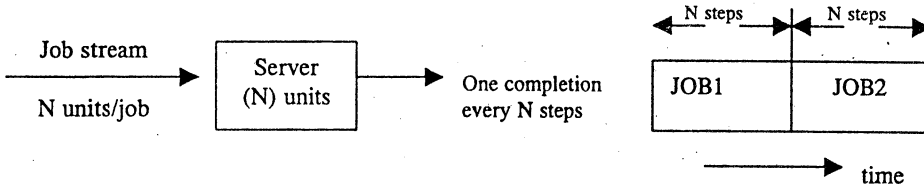
2.6 PIPELINING

The basic idea behind pipeline design is quite natural; it is not specific to computer technology. In fact the name pipeline stems from the analogy with petroleum pipelines in which a sequence of hydrocarbon products is pumped through a pipeline. The last product might well be entering the pipeline before the first product has been removed from the terminus. The key contribution of pipelining is that it provides a way to start a new task before an old one has been completed. The concept can be better understood by taking an example of an industrial plant. To achieve pipelining, one must subdivide the input task into a sequence of subtasks, each of which can be executed by a specialised hardware stage that operates concurrently with other stages in the hardware. Successive tasks are streamed into the pipe and get executed in an overlapped fashion at the subtask level. Hence the completion rate is not a function of total processing time, but rather of how soon a new process can be introduced.

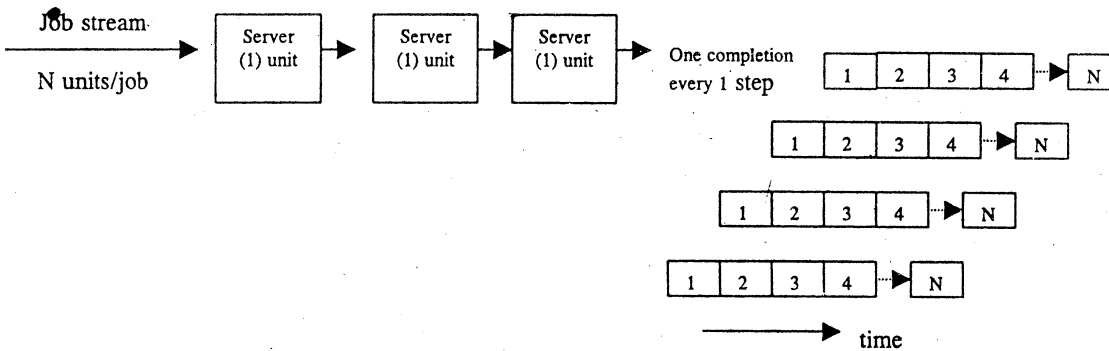
The subdivision of labour in assembly lines has contributed to the success of mass production in modern industry. By the same token, pipeline processing has led to the tremendous improvement of system throughput in modern digital computers.

Now consider for execution of an instruction a computers performs N processing steps. A server unit as represented in figure 5(a) can perform any one of the N steps in one unit time. If we process M instructions by this server, then the rate of completion is one instruction of every N steps, and the time behaviour of the job stream is as described in Figure 5(a). Compare Figure 5(a) with Figure 5(b) which shows N servers concatenated in a sequence each performing only a single step, the job flows through the collection of servers by visiting server 1, then server 2, and so on, and finally emerging from server N after N steps. The time behaviour of this system is described by figure 5(b).

Figure 5(b) is an ideal model of a constant speed assembly line, such as an automobile assembly plant.



(a) Sequential execution with N-unit server



(b) Pipelined execution with 1-unit servers

Figure 5: Two ways of executing N-unit jobs in a stream

Thus, any arithmetic task is divided into steps. Thus, a sort of concurrent operation can be obtained in the pipeline. This will help in increasing the throughput of the system.

Though, superficially it seems that it should be possible to execute any application in various pipeline stages, it is not actually so. Only those applications, which can be broken into independent subtasks, can take the advantage of pipelining. It is most efficient for those applications that need to repeat the same task many times with different sets of data.

2.7 VECTOR PROCESSING

Some of the applications such as

- weather forecasting
- petroleum explorations

- seismic data analysis
- flight simulations
- artificial intelligence and expert systems
- image processing and its applications

are so complex that without the use of sophisticated computers it would not be possible to complete these in reasonable amount of time.

These computational problems are beyond the capabilities of a conventional computer, as these problems require a vast number of computations that may take a conventional computer days or even weeks to be completed. The vector computers have emerged as the most important high performance architecture for numerical problems. It has two key qualities of efficiency and wide applicability.

These scientific problems may involve manipulations of large arrays, where the same computational are carried out with different sets of data. These numbers can be easily formulated as vectors and matrices of floating point number (real numbers). A vector can be defined as an ordered set of a one-dimensional array of data items. Each element in a vector is a scalar quantity, which may be floating point number, an integer, a logical value, or a character (byte).

Supercomputers

A commercial computer with vector instructions and pipelined floating-point arithmetic operations is referred to as a supercomputer. Supercomputers are very powerful, high-performance machines used mostly for scientific computations. To speed-up the operation, the components are packed tightly together to minimise the distance that the electronic signals have to travel.

A supercomputer is a computer best known for its high computational speed, fast and larger memory systems, and the extensive used of parallel processing. It is equipped with multiple functional units and each unit has its own pipeline configuration. Although the supercomputer is capable of general purpose applications found in all other computers, it is specifically optimised for the type of numerical calculations involving vectors and matrices of floating point numbers.

A measure used to evaluate computers in their ability to perform a given number of floating point operations per second is referred to as flops. The term megaflop is used to denote million flops and gigaflops to denote billion flops. A typical supercomputer has a basic cycle time of 4 to 20 nsecs. If the processor can calculate a floating-point operation through a pipeline each cycle time, it will have the ability to perform 50 to 250 mflops. This would be sustained from the time the first answer is produced and does not include the initial setup time of the pipeline.

2.8 INTRODUCTION TO RISC

Aim of the computer architect -is to design computers, which are more cost effective than their predecessors. Cost effectiveness includes:

1. Cost of hardware to manufacture the machine
2. Cost of programming
3. Cost incurred in correcting both the initial hardware and subsequent programs on account of the new/old/compatible architecture.

2.8.1 Reasons for Increased Complexity

Let us see what are the reasons for increased complexity that leads to complex instruction set computers (CISC) and what exactly we mean by this.

1. Speed of memory Vs. the speed of CPU

The CPU, in general, was about 10 times as fast as main memory. Thus, more and more instructions were put into hardware. Since then many higher level instructions have been added to machines in an attempt to improve performance. This trend began towards the imbalance in speed.

The advances in semiconductor memory have made several changes to the assumptions about the relative difference in speed between CPU and the main memory. Semiconductor memories are both fast and relatively inexpensive. Cache memories have further reduced the difference between the CPU and the memory Speed.

2. Code density

With early computers memory was very expensive. It was therefore cost effective to have very compact programs. It was assumed that more instructions would result in small programs. While code compaction is important, however, the cost of 10 percent more memory is often far cheaper than the cost of squeezing code by 10 percent out of the CPU architecture innovations.

3. Support for high level language

With the increasing use of more and more high level languages, manufacturers have become eager to, provide more powerful instructions to support them. It is argued that richer instruction set would alleviate the software crisis and would simplify the compilers. However, RISC designers did not agree to it. They conducted research to find out what constructs are most frequently used in average programs.

Their research shows that integer constants appeared almost as frequently as arrays or structures; more than 80 percent of the scalars were local variables to subroutines; and more than 90 percent of the arrays or structure were global variables.

In addition it was found that procedure calls and returns are an important aspect of High-level language programs. These are also the most time consuming operations in compiled high-level language programs. Thus, it will be profitable to consider ways of implementing these operations efficiently. Two aspects are significant in this respect: the number of parameters and variables that procedure dealt with; and the depth of nesting.

Further, it has been statistically found that 98% of dynamically called procedures pass lower than six arguments, and 92% of them use fewer than six scalar variables.

Thus, in the 1980s, a new philosophy evolved called RISC. These machines would have fewer instructions - (reduced set) and the instructions would be simple and would generally execute in one cycle, hence, the reduced instruction set computers (RISCs). Optimising compilers are used in these machines to compile the programs into simple machine instructions.

2.8.2 Principles of RISC

The following are the characteristics of RISC architecture:

1. Hardware Instructions should be kept simple unless there is a very good reason to do otherwise.
2. Microcode, a programming way of implementing control unit, is not magic. Moving software into microcode does not make it better, it just makes it hard to change.

Simple decoding and pipelined execution are more important than program size. At the peak rate a new instruction is started every cycle. Pipelined execution gives a peak performance, of one

instruction every step, so the longest piece determines the performance rate of the pipelined machine. So ideally each piece should take the same amount of time.

4. The large number of registers should be utilised optimally.

Check Your Progress 3

State True or False.

1. Vector processors are most suited for high performance computations.
True False
2. Pipelined processing improves the system throughput.
True False
3. Applications, which can be broken into subtask, can be implemented as pipelined system.
True False
4. 80486 is a RISC processor.
True False

2.9 SUMMARY

In this unit, we have discussed about the Input/Output devices, input/Output module and interfaces. The discussion is only at the introductory level, however, you can refer to further readings for more details. The input/output technologies are developing all the time with the advancement of technology. Some newer technologies such as data gloves, virtual reality are already available and more and more sophisticated technologies will be available in near future, however all the new things can be categorised under one of the techniques we have discussed in the unit.

In addition in this block, we have introduced the concepts of pipelining; vector processing and Reduced Instruction Set Computers.

2.10 MODEL ANSWERS

Check Your Progress 1

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

2.

	CRT	LCD
(i)	CRT is bulky	LCD is compact
(ii)	High energy requirement	Low energy requirement
(iii)	Normally high resolution graphics	Low resolution

3.

Input/Output
Organisation
New Technology

	Laser printer	Dot Matrix Printer (DMP)
(i)	High Cost	Low Cost
(ii)	Form Characters using laser beam	Use Dot Matrix to print characters
(iii)	Non-impact printer	Impact printer
(iv)	High quality output	Output is of low quality
(v)	Noiseless operation	Noisy
i)		Produces multiple copies in a single print

4. In source data automation data is entered essentially where it is being produced through automatic devices. Examples are OMR & OBR.

Check Your Progress 2

1. (a) False (b) False (c) True (d) True
2. A device controller is an I/O module, which interacts with the I/O devices as per the instructions provided to it by the CPU.

Check Your Progress 3

1. True
2. True
3. True
4. False

2.11 FURTHER READINGS

1. Stallings, William, *Computer Organisation and Architecture*, Third edition, Maxwell Macmillan International Editions.
2. Mano, M. Morris, *Computer System Architecture and Organisation*, Second Edition, McGraw-Hill International Editions, 1988.

UNIT 3 SOFTWARE CONCEPTS AND TERMINOLOGY

Structure

- 3.0 Introduction
- 3.1 Objectives
- 3.2 Computer Software
 - 3.2.1 System Software
 - 3.2.2 Application Software
- 3.3 Categories of Languages
 - 3.3.1 Machine
 - 3.3.2 Assembly
 - 3.3.3 High Level
 - 3.3.4 Fourth Generation Language
- 3.4 Elements of Programming Language
 - 3.4.1 Variables, Constants, Data Type, Array and Expressions
 - 3.4.2 Input and Output Statement
 - 3.4.3 Conditional and Looping Statement
 - 3.4.4 Subroutine and Functions
- 3.5 Summary
- 3.6 Model Answers
- 3.7 Further Readings

3.0 INTRODUCTION

A computer contains two basic parts: (i) Hardware and (ii) Software. In the first two units we touched upon hardware issues in quite detail. In this unit and also in the rest of the units of this block we will discuss topics related to software. Without software a computer will remain just a metal. With software, a computer can store, retrieve, solve different types of problems, create friendly environment for software development etc.

The process of software development is called programming. To do programming one should have knowledge of (i) a particular programming language, (ii) set of procedures (algorithm) to solve a problem or develop software.

The development of an algorithm is basic to computer programming and is an important part of computer science studies. Developing a computer program is a detailed process, which requires serious thought, careful planning and accuracy. It is a challenging and exacting task, drawing on the creativity of the programmer.

Once an algorithm is obtained, the next step for a solution using a computer would be to program the algorithm using mathematical and data processing techniques. **Programming languages constitute the vehicle for this stage of problem solving.** The development of programming Languages is one of the finest intellectual achievements in Computer Science. It has been said "to understand a computer, it is necessary to understand a programming language. Understanding them does not really mean only being able to use them. A lot of people can use them without really fully understanding them".

An Operating System is system software, which may be viewed as an organised collection of software consisting of procedures for operating a computer and providing an environment for execution of programs. It acts as an interface between users and the hardware of a computer system.

There are many important reasons for studying operating systems. Some of them are:

- (1) User interacts with the computer through operating system in order to accomplish his task since it is his primary interface with a computer.
- (2) It helps users to understand the inner functions of a computer very closely.
- (3) Many concepts and techniques found in operating system have general applicability in other applications.

In this unit, we will discuss about the concepts relating to a programming language and in the next unit we will deal with the operating system concepts.

3.1 OBJECTIVES

After completion of this unit, you should be able to

- define the terms system and application software
- define various categories of language
- define the terms such as computers, interpreters, fourth generation languages
- define the elements of programming languages such as arrays, expressions, variables, input-output statements
- define conditional and looping structures, and
- define subroutines and functions.

3.2 COMPUTER SOFTWARE

Computer software consists of sets of instructions that mould the raw arithmetic and logical capabilities of the hardware units to perform.

In order to communicate with each other, we use natural languages like Hindi, English, Bengali, Tamil, Marathi, Gujarati etc. In the same way programming languages of one type or another are used in order to communicate instructions and commands to a computer for solving problems. Learning a programming language requires learning the symbols, words and rules of the language.

Program and Programming: A computer can neither think nor make any judgement on its own. Also it is impossible for any computer to independently analyse a given data and follow its own method of solution. It needs a program to tell it what to do. A program is a set of instructions that are arranged in a sequence that guides the computer to solve a problem.

The process of writing a program is called **Programming**. Programming is a critical step in data processing. If the system is not correctly programmed, it delivers information results that cannot be used. There are two ways in which we can acquire a program.. One is to purchase an existing program, which is normally referred to as packaged software and the other is to prepare a new program from scratch in which case it is called customised software.

A computer software can be broadly classified into two categories-**System Software and Application Software**.

Today, there are many languages available for developing programs software. These languages are designed keeping in mind some specific areas of applications. Thus, some of the languages may be good for writing system **programs/software** while some other for **application software**. Since a computer can be used for writing various types of application/system software, there are different programming languages.

- i) **System Programming Languages:** System programs are designed to make the computer easier to use: An example of system software is an operating system, which consists of many other programs for controlling input/output devices, memory, processor etc. To write an operating system, the programmer needs instruction to control the computer's circuitry (hardware part). For

example, instructions that move data from one location of storage to a register of the processor. C and C++ languages are widely used to develop system software.

- ii) **Application Programming Language:** Application programs are designed for specific applications, such as payroll processing, inventory control etc. To write programs for payroll processing or other applications, the programmer does not need to control the basic circuitry of a computer. Instead the programmer needs instructions that make it easy to input data, produce output, do calculations and store and retrieve data. Programming languages that are suitable for such application programs support these instructions but not necessarily the types of instructions needed for development of system programs.

There are two main categories of application programs: business programs and scientific application programs. Most programming languages are designed to be good for one category of applications but not necessarily for the other, although there are some general purpose languages that supports both types. Business applications are characterised by processing of large inputs and large outputs, high volume data storage and retrieval but call for simple calculations. Languages, which are suitable for business program, development, must support high volume input, output and storage but do not need to support complex calculations. On the other hand, programming languages that are designed for writing scientific programs contain very powerful instructions for calculations but rather poor instructions for input, output etc. Amongst traditionally used programming languages, COBOL (Commercial Business Oriented Programming Language) is more suitable for business applications whereas FORTRAN (Formula Translation - Language) is more suitable for scientific applications. Before we discuss more about languages let us briefly look at the categories of software viz. system and application software.

3.2.1 System Software

Language Translator: A language translator is a system software which translates a computer program written by a user into a machine understandable form. We will discuss more about them in the next section.

Operating System

An operating system (OS) is the most important system software and is a must to operate a computer system. An operating system manages a computer's resources very effectively, takes care of scheduling multiple jobs for execution and manages the flow of data and instructions between the input/output units and the main memory. Advances in the field of computer hardware have also helped in the development of more efficient operating systems. More details on operating systems are given in unit 4 of this block.

Utilities

Utility programs are those which are very often requested by many application programs. A few examples are:

SORT/MERGE utilities, which are used for sorting large volumes of data and merging them into a single sorted list, formatting etc.

3.2.2 Application Software

Application software is written to enable the computer to solve a specific data processing task. A number of powerful application software packages, which does not require significant programming knowledge, have been developed. These are easy to learn and use as compared to the programming languages. Although these packages can perform many general and special functions, there are applications where these packages are not found adequate. In such cases, application program is written to meet the exact requirements. A user application program may be written using one of these packages or a programming language. The most important categories of software packages available are:

- Data Base Management Software
- Spreadsheet Software

- Word Processing Desktop Publishing (DTP) and presentation Software Graphics Software
- Data Communication Software
- Statistical and Operational Research Software.

Data Base Management Software

Databases are very useful in creation maintaining query, the databases and generation of reports. Many of today's Database Management System are Relational Database Management System's. Many RDBMS packages provide smart assistants for creation of simple databases for invoices, orders and contact lists. Many database management systems are available in the market these days. You can select any one based on your needs, for example, if you have only few databases then package like dBase, FoxPro etc. may be good. If you require some additional features and moderate work load then Lotus Approach, Microsoft Access are all-right. However, if you are having high end database requirements which requires multi-user environment and data security, access right, very good user interface etc. then you must go for professional RDBMS package like Ingress, Oracle, Integra etc.

Accounting Package

The accounting packages are one of the most important packages for an office. Some of the features, which you may be looking on an accounting, may be:

- tax planner facility
- facility for producing charts and graphs
- finding accounts payable
- simple inventory control facility
- payroll functions
- on-line connection to stock quotes
- creation of invoices easily

One of the good packages in this connection is Quicken for windows.

Communication Package

The communication software includes software for fax. The fax-software market is growing up. Important fax software is Delrina's WinFax PRO 4.0. Some of the features such as Remote Retrieval and Fax Mailbox should be looked into fax software. These features ensure that irrespective of your location you will receive the fax message. Another important feature is fax Broadcast. This allows you to send out huge numbers of faxes without tying up your fax machine all day.

If you have to transfer files from your notebook computer to a desktop computer constantly then you need a software program that coordinates and updates documents. On such software is Laplink for Windows. This software offers very convenient to use features. For example, by simply dragging and dropping a file enables file transfer. This software can work if a serial cable or a Novell network or a modem connects you.

Desktop Publishing Packages

Desktop Publishing Packages are very popular in Indian context. Newer publishing packages also provide certain in built formats such as brochures, newsletters, flyers etc., which can be used directly. Already created text can be very easily put in these packages, so are the graphics placements. Many DTP packages for English and languages other than English are available. Microsoft Publisher, PageMaker, Corel Ventura

are few popular names. Desktop publishing packages, in general, are better equipped in Apple-Macintosh computers.

Information Providers

One of the very interesting information provider which will become popular in India also is Automap road atlas by Microsoft. This package may provide city-to-city driving instructions and maps. You may also get the best route, calculate the time it will take.

Many information providers are the Internet access programs. Today, the Internet access packages comes as a part of operating system however, many other packages can be used for accessing information on the World Wide Web. One very simple to use popular tool of browsing Internet is Netscape Navigator.

Organisers, Contact Managers, PIMs

Some of the tasks of an office manager can be able to:

- track contacts
- balance schedules
- manage projects, and
- prioritize tasks.

These things can be easily done using organisers programs, which have a phone book model for maintaining lists of contacts. They also have a calendar for entering appointments and to-dos. Some of these packages are Okna's DeskTop Set for Windows, Lotus organiser, Microsoft Outlook, etc.

If you are interested in knowing more, then only names and addresses about your contacts such as details like the industry they are working with, the products they are manufacturing, their business with you last year, when did you last spoke to them etc., then you must look to a contact management software. One such software is "Symantec Act! for Windows".

If you want to go even further then you can look for a personal information manager (PIM). PIM is a tool that stores virtually any information such as reference materials, project details etc. The PIM document contains outlines, folders and links. Most of the data in the PIMs is presented as an outline, for example, the clients may represent the top level, the date of an appointment with him at the next level, and the details of the meeting indented further below. This item can be linked to any other, allowing data to be entered only once and linked up to all other appropriate places.

Suites

Suites are a set of packages sold as a group package mainly for the business user. The suite package includes programs for Word-processing, Electronic Spreadsheet, Databases, and Presentation Graphics software and may be a mail software. For example, Microsoft Office Professional for Windows includes programs as Microsoft Word, Microsoft Excel and Microsoft Access, and a license for Microsoft Mail etc. The word-processing, spreadsheet, and presentation-graphics software interfaces in a suite are well-integrated allowing easy data transfer among these applications. Today there is a growing family of Office-compatible products, which will be included in suites.

In the fast developing software era the list discussed above cannot be complete. Please refer to latest PC journals for most recent software trends.

Check Your Progress 1

1. What is computer software?

.....
.....

2. Explain the following terms in one or two sentences each.

(a) Operating Systems

.....

(b) Database Management Software

.....

3.3 CATEGORIES OF LANGUAGES

We can choose any language for writing a program according to the need. But a computer executes programs only after they are represented internally in binary form (sequences of 1s and 0s). Programs written in any other language must be translated to the binary representation of the instructions before the computer can execute those. Programs written for a computer may be in one of the following categories of languages.

3.3.1 Machine Language

This is a sequence of instructions written in the form of binary numbers consisting of 1s, 0s to which the computer responds directly. The machine language was initially referred to as code, although now the term code is used more broadly to refer to any program text.

An instruction prepared in any machine language will have at least two parts. The first part is the command or Operation, which tells the computer what functions, is to be performed. All computers have an operation code for each of its functions. The second part of the instruction is the operand or it tells the computer where to find or store the data that has to be manipulated.

Just as hardware is classified into generations based on technology, computer languages also have a generation classification based on the level of interaction with the machine. Machine language is considered to be the first generation language.

Advantage of Machine Language

It is faster in execution since the computer directly starts executing it.

Disadvantage of Machine Language

It is difficult to understand and develop a program using machine language. Anybody going through this program for checking will have a difficult task understanding what will be achieved when this program is executed. Nevertheless, the computer hardware recognises only this type of instruction code.

The following program is an example of a machine language program for adding two numbers.

0011	1110	Load A register with
0000	0111	value 7
0000	0110	Load B register with 10
0000	1010	A = A + B
1000	0000	Store the result
0011	1010	into the memory location

0110	0110	
0000	0000	whose address is 100 (decimal)
0111	0110	Halt processing

3.3.2 Assembly Language

When we employ symbols (letter, digits or special characters) for the operation part, the address part and other parts of the instruction code, this representation is called an assembly language program. This is considered to be the second-generation language.

Machine and Assembly languages are referred to as low level languages since the coding for a problem is at the individual instruction level.

Each machine has got its own assembly language, which is dependent upon the internal architecture of the processor.

An assembler is a translator, which takes its input in the form of an assembly language program and produces machine language code as its output.

The following program is an example of an assembly language program for adding two numbers X and Y and storing the result in some memory location.

LDA, 7	Load register A with 7
LDB, 10	Load register B with 10
ADD A, B	$A \leftarrow A + B$
LD (100), A	Save the result in the location 100
HALT	Halt process

From this program, it is clear that usage of mnemonics in our example (LD, ADD, HALT are the mnemonics) has improved the readability of our program significantly.

A machine cannot execute an assembly language program directly, as it is not in a binary form. An assembler is needed in order to translate an assembly language program into the object code executable by the machine. This is illustrated in the figure 1.

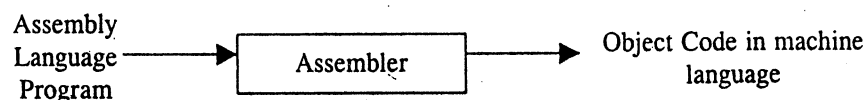


Figure 1: Assembler

Advantage of Assembly Language

Writing a program in assembly language is more convenient than in machine language. Instead of binary sequence, as in machine language, it is written in the form of symbolic instructions. Therefore, it gives a little more readability.

Disadvantages of Assembly Language

Assembly language (program) is specific to particular machine architecture. Assembly languages are designed for specific make and model of a microprocessor. It means that assembly language programs written for one processor will not work on a different processor if it is architecturally different. That is why the assembly language program is not portable.

Assembly language program is not as fast as machine language. It has to be first translated into machine (binary) language code.

3.3.3 High-level Language

We have talked about programming languages as COBOL, FORTRAN and BASIC. They are called high level programming languages. The program shown below is written in BASIC to obtain the sum of two numbers.

```

10      LET      X      =      7
20      LET      y      =      10
30      LET      sum    =      X+Y
40      PRINT    SUM
50      END

```

The time and cost of creating machine and assembly languages was quite high. And this was the prime motivation for the development of high level languages.

Since a high level source program must be translated first into the form the machine can understand, this is done by a software called Compiler which takes the source code as input and produces as output the machine language code of the machine on which it is to be executed. This is illustrated in figure 2.

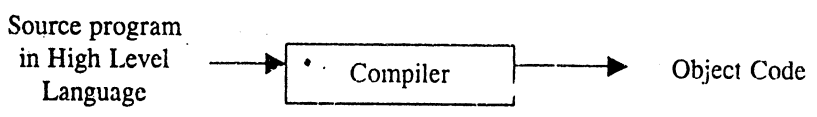


Figure 2: Compiler

During the process of translation, the Compiler reads the source programs statement-wise and checks the syntax (grammatical) errors. If there is any error, the computer generates a printout of the errors it has detected. This action is known as diagnostics.

There is another type of software, which also does the translation. This is called an Interpreter. The Compiler and Interpreter have different approaches to translation. The following table lists the differences between a Compiler and an Interpreter.

Compiler	Interpreter
1) Scans the entire program first and then translates it into machine code	Translates the program line by line.
2) Converts the entire program to machine code; when all the syntax errors are removed execution takes place.	Each time the program is executed, every line is checked for syntax error and then converted to equivalent machine code.
3) Slow for debugging (removal of mistakes from a program)	Good for fast debugging
4) Execution time, is less	Execution time is more.

Advantages of High-level Programming Language

There are four main advantages of high-level programming languages. These are:

- i) **Readability:** Programs written in these languages are more readable than assembly and machine language.
- ii) **Portability:** Programs could be run on different machines with little or no change. We can, therefore, exchange software leading to creation of program libraries.
- iii) **Easy debugging:** Errors could easily be removed (debugged).
- iv) **Easy Software development:** Software could easily be developed. Commands of programming language are similar to natural languages (ENGLISH).

High level languages are also called Third generation languages.

3.3.4 Fourth Generation Language

The fourth generation of programming languages is not as clearly defined as are the other earlier generations. Most people feel that a fourth generation language, commonly referred to as 4GL is a high level language that requires significantly fewer instructions to accomplish a particular task than a third generation language does. Thus, a programmer should be able to write a program faster in 4GL than in third generation language.

Most third generation languages are procedural languages. This means that the programmer must specify the steps, that is the procedure, the computer has to follow in a program. By contrast, most fourth generation languages are non-procedural languages. The programmer does not have to give the details of procedure in the program, but instead, specifies what is wanted. For example, assume that a programmer needs to display some data on a screen, such as the address of a particular employee (SANTOSH) from the personal file. In a procedural language, the programmer would have to write a series of instructions in the following steps:

- Step 1 Get a record from the personal file
- Step 2 If this is the record for SANTOSH, display the address
- Step 3 If this is not the record for SANTOSH, go to Step 1.

In a non-procedural language (4GL), however, the programmer would write a single instruction that says:

Get the address of Santosh, from personal file.

Major fourth generation languages are used to get information from files and data bases, as in the previous example and to display or print the information. These fourth generation languages contain a query language which, is used to answer queries or questions with data from a database. For example the following figure shows a query in a common query language SQL,

```
SELECT ADDRESS FROM PERSONNEL  
WHERE NAME = "SANTOSH"
```

Some fourth generation languages are used to produce complex printed reports. These languages contain certain types of program called generators. With a report generator available, the programmer specifies the headings, detailed data and totals needed in a report. Thus, the report generator produces the required report using data from a file. Other fourth generation languages are used to design screens to be used for data input and output and for menus. These languages contain certain types of programs called screen painters. The programmer designs how the screen is to look and, therefore, we can say that the programmer paints the screen, using the screen painter program. Fourth generation languages are mostly machine independent. Usually they can be used on more than one type of computer. They are mostly used for office automation or

business applications, but not for scientific programs. Some fourth generation languages are designed to be easily learnt and used by end users.

Check Your Progress 2

1. What are the differences between a compiler and an interpreter?

.....
.....

2. State True or False.

- (a) Assembly language programs are machine independent.
True False
- (b) Machine language programs are machine independent.
True False
- (c) High level languages are machine independent.
True False
- (d) All programs are machine independent.
True False
- (e) 4th generation languages are dependent on databases they are using.
True False

3.4 ELEMENTS OF A PROGRAMMING LANGUAGE

Learning a programming language requires understanding of concepts such as representation of different types of data in the computer, various methods of expressing mathematical and logical relationship among data elements and the mechanics for controlling the sequence in which operations can be executed for inputting, processing and outputting of data.

3.4.1 Variables, Constants, Data type, Array and Expressions

These are the smallest components of a programming language.

Variable: The first thing we must learn is how to use the internal memory of a computer in writing a program. Memory may be pictured as a series of separate memory cells as shown in figure 3. Computer memory is divided into several locations. Each location has got its own address.

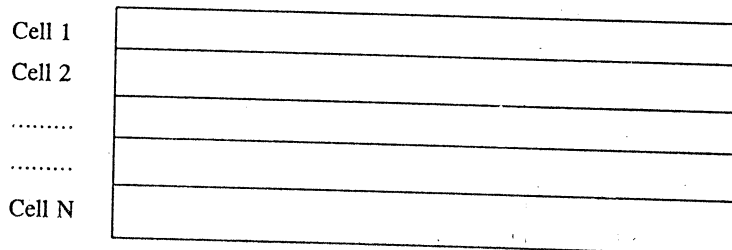


Figure 3: Memory Organisation

Each storage location holds a piece of information. In order to store or retrieve information from a memory location, we must give that particular location a name. Now study the following definition.

Variable: It is a character or group of characters assigned by the programmer to a single memory location and used in the program as the name of that memory location in order to access the value stored in it.

For example in expression $A = 5$, A is a name of memory location i.e. a variable where 5 is stored.

Constant: It has fixed value in the sense that two cannot be equal to four. String constant is simply a sequence of characters such as "computer" which is a string of 8 characters. The numeric constant can be integer representing whole quantities or a number with a decimal point to represent numbers with fractional part. Constant would be probably the most familiar concept to us since we have used it in doing everything that has to do with numbers. Numeric constants can be added, subtracted, multiplied, divided, and also compared to say whether two of them are equal, less than or greater than each other.

A's string constants are a sequence of characters, a related string constant may be obtained from a given one, by chopping off some characters from beginning or end or both or by appending another string constant at the beginning or end. For example, from 'Gone with the wind', we can get 'one with ', 'Gone with wind', and so on. String constants can also be compared in a lexicographic (dictionary) sense to say whether two of them are equal, not equal, less than or greater than each other.

Data type: In computer, programming, the term data refers to anything and everything processed by the computer. There are different types of data processed by the computer, numbers are one type of data and words are of another type. In addition, the operations that are performed on data differ from one type of data to another type. For example multiplication applies to numbers and not words or sentences.

Data type defines a set of related values/integers, number with fraction, characters and a set of specific operations that can be performed on those values.

In BASIC a statement $LET A = 15$ denotes that A is a numeric data type because it contains numbers but in a statement $LET A\$ = "BOMBAY"$, A\$ is a variable of character data type. Data type also defines in terms of contiguous cells should be allocated for a particular variable.

Array: In programming we deal with large amount of related data. To represent each data element we have to consider them as separate variables. For example if we have to analyse for the sales performance of a particular company for the last 10 years, we can take ten different variables (names) each one representing sales of a particular year. If we analyse sales information for more than 10 years, then accordingly number of variables will further increase. It is very difficult to manage with large number of variables in a program. To deal with such situation an array is used.

An array is a collection of **same type of data** (either string or numeric), all of that are **referenced by the same name**.

For example, list of 5 years sales information of a company can be referred to by same array name A.

A(1)	A(2)	A(3)	A(4)	A(5)
50,000	1,00,000	5,00,000	8,00,000	9,00,000

A(1) specifies Sales information of a first year

A(2) specifies Sales information of a second year

A(3) specifies Sales information of a fifth year

Expression: We know that we can express intended arithmetic operations using expressions such as $X + Y + Z$ and so on. Several simple expressions can even be nested together using parentheses to form complex expressions. Every computer language specifies an order by in which various arithmetic operators are evaluated in a given expression. An expression may contain operators such as

Parentheses	()
Exponentiation	^
Negation	-
Multiplication, division	*, /
Addition, subtraction	+, -

The operators are evaluated in the order given above. For example, the expression

$$2+8*(4 - 6/3)$$

can be considered to be evaluated as follows:

$2+8*(4 - 6/3)$	Sub expression $(4 - 6/3)$ taken up first
$2+8*(4 - 2)$	division $6/3$ within $(4 - 6/3)$ has higher priority than $4 - 6$
$2+8*2$	Subtraction $(4 - 2)$ is performed next $(4 - 6/3)$ is now complete.
$2+8*2$	$8*2$ will be executed first then its result will be added with 2 that is $16 + 2 = 18$

It is useful to remember the order of priority of various operators. But it is safer to simplify expressions and enclose them in parentheses to avoid unpleasant surprises. So far we have focused on arithmetic expressions. But expression is a very general concept. We mentioned earlier that apart from arithmetic operations we could compare numbers or strings. We do it by using relational operators in expressions.

The following is a list of relational operators:

=	equal to
<>	not equal to
<	less than.
>	greater than
<=	less than or equal to
>=	greater than or equal to

These operations have the same level of Priority among themselves but a lower priority than arithmetic operators mentioned earlier. The relational expressions result in one of the truth-values, either TRUE or FALSE. When a relational expression such as $(3 > 5)$ is evaluated to be FALSE by such languages, a value 0, that is false, is assigned, whereas $(5, < 7)$ will be evaluated to be TRUE, and value 1 will be assigned.

Note that relational expressions are capable of comparing only two values separated by appropriate relational operator. If we want to express an idea such as whether number 7 happens to be within two other numbers 4 and 10, we may be tempted to write relational expression $4 <= 7 <= 10$. Such reasonable expectation from us may be a bit too complex for a computer language. In such cases, we need to explain our idea in terms of simple relational expressions such as $(4 <= 7)$ AND $(7 <= 10)$ which means that 7 is between 4 and 10. To combine several relation expressions for expressing complex conditions, we use logical operators such as AND or OR operators. Among other logical operators NOT simply negates a truth value in the sense that NOT TRUE is FALSE, and NOT FALSE is TRUE. The logical operators have lower priority than relational

operators. Among themselves they have the following order of priority during evaluation of logical expressions.

Operator	Meaning
NOT	Simply negates a truth-value. NOT (2 > 5) is TRUE
AND	TRUE is both adjoining expressions are TRUE otherwise it is FALSE. For example (4 < 7) and (7 < 10) is TRUE whereas (4 > 7) and (7 < 10) is FALSE
OR	FALSE is both adjoining expressions are FALSE otherwise it is TRUE For example (4 < 2) OR (7 > 2) is FALSE whereas (4 > 2) OR (7 > 2) is TRUE
XOR	TRUE only if one of the adjoining expressions is TRUE and other is FALSE. The XOR has same priority as OR. (4 < 7) XOR (7 < 10) is FALSE.

Of the four logical operators NOT, AND and OR are sufficient to express any logical condition.

Expressions would be our basic programming unit. Our Programs would be full of them, and while executing the program, computer would be preoccupied most of the time evaluating them. But the computer would also be doing other things such as taking some values as input from an input device, assigning a value or result of an expression to a variable, send a value for display to a display unit, pondering to be or not to be on some conditional expression, Repeating some tasks until we are satisfied, and calling some slave-programs to perform specific tasks. In the following discussion we shall elaborate on these actions.

3.4.2 Input and Output Statement

Syntax: input list of variables

Input statements are normally used for supplying values to a list of variables through an input device such as a keyboard. On execution, a question mark? (in BASIC) would be displayed on the screen, in response to which we are expected to supply a sequence of desired values matching appropriately the type (i.e. integer, floating-point or string type) and the number of variables in the list. For example in BASIC, INPUT A, B, C is an input statement with list of 3 variables A,B,C.

Assignment Statement

Syntax: variable=expression

This is the most obvious statement used, for assigning value to an identifier (i.e. variable). In BASIC languages this is also known as LET ' statement though the key word 'LET is optional in most of them. Note the use of = as assignment operator. You would recall that it was also used as relational operator. Some purists justifiably object to ambiguous use of =. In Pascal, := is used for assignment instead of just = which is used as relational operator. In language C '=' is used for assignment but for relational operator == is used. Few examples of assignment statement in BASIC are given below.

```
LET SUM = X+Y
```

```
LET X = 5
```

SUM and X are called variables whereas A + B is called an expression.

Print Statement

Syntax: print list of variables

This is again an obvious way to display values of specified list of variables on display screen. We shall make use of print to represent generic output statement independent of any particular output device such as display

screen, printer and so on. Computer languages normally provide very rich facilities for making the display as attractive as possible. An Example of print statement in BASIC is PRINT A,B,C, which will display values of A,B,C on display screen.

3.4.3 Conditional and Looping Statement

Conditional Statement

If then_else structure

Syntax: if (condition)

Then

statement(s) for Task A

else

statement(s) for Task A

endif

This is one of the most important program-structures that enable a modern programmer to develop well-structured programs. Note that we are calling it as structure rather than statement. As structure it accommodates statements corresponding to alternate tasks to be performed depending upon truth-value of the condition. The structure has three components: a conditional expression the truth-value of which determines the action, a then-clause denoting task to be performed if the condition is TRUE (Task A), and an optional else clause with task to be performed if the condition is FALSE.

Looping Statement

Obviously, the purpose of a loop structure is to repeat certain tasks until no more repetition is desired. We shall be presenting several variations of loop structure appropriate to handle different situations.

While-end While:

Syntax: WHILE (While Condition)

statement(s) for task being
repeated

end while

A loop structure is characterised by the body of statements to be repeated, and the condition for termination of loop. In while-end-while version the condition is tested before every execution of the body. The body is executed if the condition is found to be TRUE. The loop is active as long a condition evaluates to be TRUE and terminates when the condition is evaluated to be FALSE. In case the condition is found to be FALSE for the first time, the body will be skipped.

for-endfor structure

Syntax: for var = Start to Finish step incr do

Body of Statements

endfor

This loop structure is distinctly different from the while condition - end while we have discussed so far. Unlike it, the for-end-for structure counts the number of times the body is to be executed on the basis of the number of times a control variable is incremented from start to finish in specified steps. Managing the control variable is the responsibility of the for-end-for structure. So we need not and should not worry about assigning any value to it in the body of statements. Any attempt to do so may land us in trouble. This loop structure is so famous that it is available in all languages, structured or not. As usual, key words provided may be different. The Microsoft BASIC calls it for-next, and optionally provides for specification of control variable after next. Many other languages insist on mention of the control variable after next.

We have discussed program structures quite elaborately. Let us turn our attention to data structures that hold our values. So far we have been dealing with simple variables that hold only one value of a desired type. So we have integer variable, floating-point variable, and string variable holding only one value on the corresponding type at any moment. Can we have data structures that are capable of holding more than one value? Programming languages do offer complex data structures required for advanced programming. Array and record are two of them. A detailed discussion of these topics is beyond this unit, however you can refer to further readings for more details.

3.4.4 Subroutine and Functions

When writing a program sometimes, it is necessary to repeat a statement or group of statements at several - points. For example, it may be necessary to perform the same computation several times. Repeating the same, statement in a program each time makes a program lengthy and also gives poor readability. These problems could be sorted out if the necessary statements could be written (coded) once and then referred to each time they are needed.

This is the purpose of subroutine and function. Subroutine and function consist of one or more basic statements that can be referred to at different points in a program. Each time a subroutine and function is referenced, we say it is *called*.

A subroutine is a group statement that can be executed from different points in a program. Syntax for defining subroutine varies from one language to another language.

Functions: The word function in programming means essentially what it does in mathematics. Function is a rule or series of rules that assign one and only one value Y to a given value X. Thus, X and Y is called variables. Value of Y is dependent upon value of X. Variable X is also called the argument of the function. The notation used for function should already be quite familiar to you.

$$Y = F(X)$$

In this notation "F" is the name of the function. Consider a specific example

$$Y = F(X) = 3X + 3$$

If we let X equal 3, then this rule or function directs us to compute 12 for Y. If we assign the value of X = - 3, then Y is - 6. Using function notation, $F(3) = 12$ and $F(-3) = -6$. Each language has different rules to define a function.

Library functions: These are functions supplied with your language compiler interpreter. The code for a library function does not appear in the program. The computer inserts it when the program is translated into machine language. Some built-in functions in C programming language are Printf, Scanf etc.

Check Your Progress 3

Question 1. What is the purpose of a looping statement in a programming language?

.....
.....

Question 2. What is the advantage of using an array in a programming language?

.....
.....

Question 3 What is the difference between subroutine and function ?

.....
.....

3.5 SUMMARY

In this unit, we have introduced you many aspects relating to computer software and programming languages. We have defined the terms system and application software giving details on specific application software. We have also discussed about various categories of programming languages starting from machine language to fourth generation language. The concepts of compilers and interpreters have also been introduced along with this discussion. Finally we have discussed about basic elements of any programming language. The concepts introduced are variables, constants, arrays, expressions, input output statements, assignment statements, conditional and looping structures and subroutine functions. These concepts are essential to acquire a proper know-how about any programming language. You can refer to further readings for more details.

3.6 MODEL ANSWERS

Check Your Progress 1

1. It consists of sets of instructions, which enable hardware unit to perform.
2. (a) Operating System is a system software for effective management of computer resources. It is a must to operate a computer system.

(b) A software that maintains and integrates large volume of data and provide simpler user interaction.

Check Your Progress 2

- | | |
|---|--|
| 1. Compiler

Scans the entire program in a single go
Displays all syntax errors
Slow for debugging
Execution time is less | Interpreter

Scans line by line
Stops on the first syntax error
Fast in debugging
Execution time is high |
|---|--|
2. (a) False (b) False (c) True (d) False (e) False

Check Your Progress 3

1. Looping statements are used to execute a set of instructions repeatedly.

2. Arrays are simple and efficient way of referring to and performing computation on data of similar type.
3. Mainly the number of values which are returned. Functions return only a single value.

3.7 FURTHER READINGS

1. R.J. Dromey, *How to solve it by computers*, Prentice Hall of India
2. Pratt, *Programming Languages*, Prentice Hall of India

UNIT 4 OPERATING SYSTEM CONCEPTS

Structure

- 4.0 Introduction
- 4.1 Objectives
- 4.2 What is an Operating System?
- 4.3 Evolution of Operating Systems
 - 4.3.1 Serial Processing
 - 4.3.2 Batch Processing
 - 4.3.3 Multiprogramming
- 4.4 Types of Operating System
 - 4.4.1 Batch Operating System
 - 4.4.2 Multiprogramming Operating System
 - 4.4.3 Network Operating System
 - 4.4.4 Distributed Operating System
- 4.5 Summary
- 4.6 Model Answers
- 4.7 Further Readings

4.0 INTRODUCTION

An Operating System is a system software which may be viewed as an organised collection of software consisting of procedures for operating a computer and providing an environment for execution of programs. It acts as an interface between users and the hardware of a computer system.

There are many important reasons for studying operating systems. Some of them are:

- (1) User interacts with the computer through operating system in order to accomplish his task since it is his primary interface with a computer.
- (2) It helps users to understand the inner functions of a computer very closely.
- (3) Many concepts and techniques found in operating system have general applicability in other applications.

In the previous unit, we mainly introduced different types of software and categories of programming languages. All these software have been developed under a particular operating system environment. The introductory concepts and principles of an operating system will be the main issues for the discussion in this unit. Evolution and types of operating systems will also be broadly covered here.

4.1 OBJECTIVES

After going through this, unit, you should be able to:

- list and interpret the basic functions of operating systems
- to make comparison among different types of operating systems
- list future trends in operating system
- trace the history of operating systems.

4.2 WHAT IS AN OPERATING SYSTEM?

An operating system is an essential component of a computer system. The primary objective of an operating system is to make computer system convenient to use and utilise computer hardware in an efficient manner.

An operating system is a large collection of software, which manages resources of the computer system, such as memory, processor, file system and input/output devices. It keeps track of the status of each resource and decides who will have a control over computer resources, for how long and when. The positioning of operating system in overall computer system is shown in figure 1.

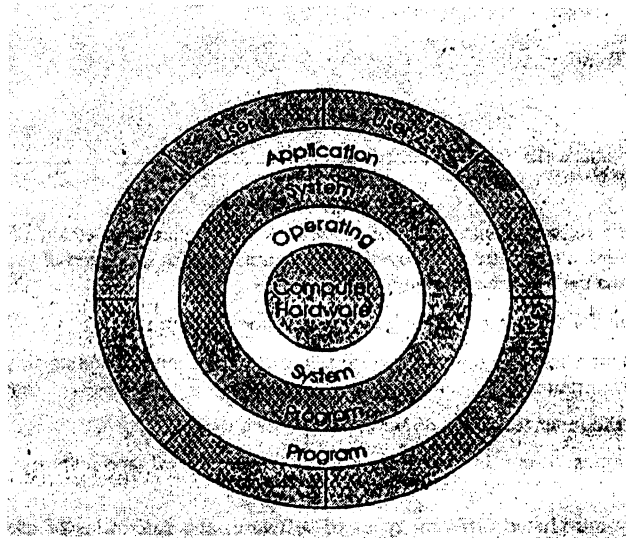


Figure 1: Component of computer system

From the figure, it is clear that operating system directly controls computer hardware resources. Other programs rely on facilities provided by the operating system to gain access to computer system resources. here are two ways one can interact with operating system

- (i) By means of Operating System Call in a program
- (ii) Directly by means of Operating System Commands.

System Call: System calls provide the interface to a running program and the operating system. User program receives operating system services through the set of system calls. Earlier these calls were available in assembly language instructions but now a days these features are supported through high-level languages like C, Pascal etc., which replaces assembly language for system programming. The use of system calls in C or Pascal programs very much resemble pre-defined function or subroutine calls.

As an example of how system calls are used, let us consider a simple program to copy data from one file to another. In an interactive system, the following system calls will be generated by the operating system:

- Prompt messages for inputting two file names and reading it from terminal.
- Open source and destination file.
- Prompt error messages in case the source file cannot be open because it is protected against access or destination file cannot be created because there is already a file with this name.
- Read the source file.
- Write into the destination file.

- Display status information regarding various Read/Write error conditions. For example, the program may find that the end of the file has been reached or that there was a hardware failure. The write operation may encounter various errors, depending upon the output device (no more disk space, physical end of tape, printer out of paper and so on).
- Close both files after the entire file is copied.

As we can observe, a user program takes heavy use of the operating system. All interaction between the program and its environment must occur as the result of requests from the program to the operating system.

Operating System Commands: Apart from system calls, users may interact with operating system directly by means of operating system commands.

For example, if you want to list files or sub-directories in MS-DOS, you invoke `dir` command. In either case, the operating system acts as an interface between users and the hardware of a computer system. The fundamental goal of computer systems is to solve user problems. Towards this goal computer hardware is designed. Since the bare hardware alone is not very easy to use, programs, (software) are developed. These programs require certain common operations, such as controlling peripheral devices. The command function of controlling and allocating resources are then brought together into one piece of software; the operating system.

To see what operating systems are and what operating systems do, let us consider how they have evolved over the years. By tracing that evolution, we can identify the common elements of operating systems and examine how and why they have developed as they have.

4.3 EVOLUTION OF OPERATING SYSTEMS

An operating system may process its task serially (sequentially) or concurrently (several tasks simultaneously). It means that the resources of the computer system may be dedicated to a single program until its completion or they may be allocated among several programs in different stages of execution. The feature of operating system to execute multiple programs in an interleaved fashion or in different time cycles, is called as **multiprogramming systems**. In this section, we will try to trace the evolution of operating system. In particular, we will describe serial processing, batch processing and multiprogramming.

4.3.1 Serial Processing

Programming in 1s and 0s (machine language) was quite common for early computer systems. Instruction and data used to be fed into the computer by means of console switches or perhaps through a hexadecimal keyboard. Programs used to be started by loading the program counter register (a register which keeps track of which instruction of a program is being executed) with the address of the first instruction of a program and its result (program) used to be examined by the contents of various registers and memory locations of the machine. Therefore, programming in this style caused a low utilisation of both users and machine.

Advent of input/output devices, such as punched cards paper tapes and language translators (Compiler/Assemblers) brought a significant step in computer system utilisation. Program, being coded into programming language, is first changed into object code (binary code) by translator and then automatically gets loaded into memory by a program called **loader**. After transferring a control to the loaded program, the execution of a program begins and its result gets displayed or printed. Once in memory, the program may be re-run with a different set of input data.

The Process of development and preparation of a program in such environment is slow and cumbersome due to serial processing and numerous manual processing. In a typical sequence first the editor is called to create a source code of user program written in programming language, translator is called to convert a source code into binary code and then finally loader is called to load executable program into main memory for execution. If syntax errors are detected, the whole process must be restarted from the beginning.

The next development was the replacement of card-decks with standard input/output and some useful library programs, which were further linked with user program through a system software called **linker**. While there was a definite improvement over machine language approach, the serial mode of operation is obviously not very efficient. This results in low utilisation of resources.

4.3.2 Batch Processing

Utilisation of computer resources and improvement in programmer's productivity was still a major prohibition. During the time that tapes were being mounted or programmer was operating the console, the CPU was sitting idle.

The next logical step in the evolution of operating system was to automate the sequencing of operations involved in program execution and in the mechanical aspects of program development. Jobs with similar requirements— were batched together and run through the computer as a group. For example, suppose the operator received one FORTRAN program, one COBOL program and another FORTRAN program. If he runs them in that order, he would have to set up for FORTRAN program environment (loading the FORTRAN compiler tapes) then set up COBOL program and finally FORTRAN program again. If he runs the two FORTRAN programs as a – batch, however he could set up only once for FORTRAN, thus, saving operator's time.

Batching similar jobs brought utilisation of system resources quite a bit. But there were still problems. For example, when a job is stopped, the operator would have to notice that fact by observing the console, determine why the program stopped and then load the card reader or paper tape reader with the next job and restart the computer. During this transition from one job to the next, the CPU sat idle.

To overcome this idle time, a small program called a **resident monitor** was created which is always resident in the memory. It automatically sequenced one job to another job. Resident monitor acts according to the directives given by a programmer through **control cards** which contain information like marking of job's beginnings and endings, commands for loading and executing programs, etc. These commands belong to **job control language**. These job control language commands are included with user program and data. Here is an example of job control language commands.

- \$COB - Execute the COBOL compiler
- \$JOB - First card of a job
- \$END - Last card of a job
- \$LOAD - Load program into memory
- \$RUN - Execute the user program

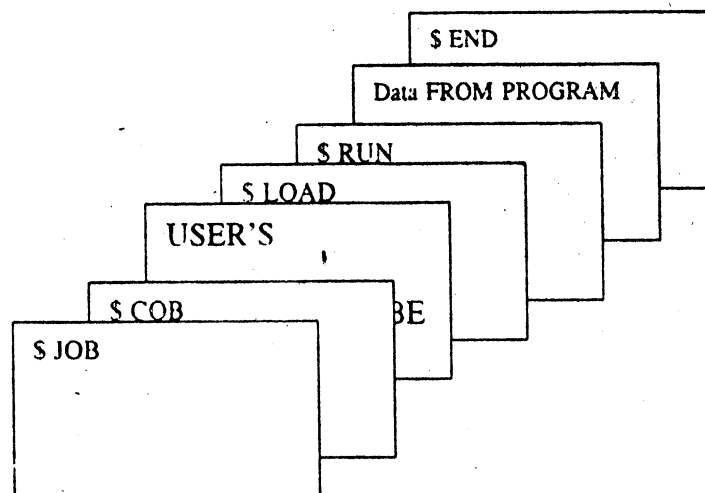


Figure 2: Card deck for Cobol Program for a simple batch system.

With sequencing of program execution mostly automated by batch operating system, the speed discrepancy between fast CPU and comparatively slow input/output devices such as card readers, printers emerged as a major performance bottleneck. Even a slow CPU works in the microsecond range, with millions of instructions per-second. But, fast card reader, on the other hand, might read 1200 cards per minute. Thus, the difference in speed between the CPU and its input/output devices may be three orders of magnitude or more.

The relative slowness of input/output devices can mean that CPU is often waiting for input/output. As an example, an Assembler or Compiler may be able to process 300 or more cards per second. A fast card reader, on the other hand, may be able to read only 1200 cards per minute. This means that assembling or compiling a 1200 card program would require only 4 seconds of CPU time but 60 seconds to read. Thus, the CPU is idle for 56 out of 60 seconds or 93.3 per cent of the time. The resulting CPU utilisation is only 6.7 per cent. The process is similar for output operations. The problem is that while an input/output is occurring, the CPU is idle, waiting for the input/output to complete; while the CPU is executing, input/output devices are idle.

Over the years, of course, improvements in technology resulted in faster input/output devices. But CPU speed increased even faster. Therefore, the need was to increase the throughput and resource utilisation by overlapping input/output and processing operations. Channels, peripheral controllers and later dedicated input/output processors brought a major improvement in this direction. DMA (Direct Memory Access) chip which directly transfers the entire block of data from its own buffer to main memory without intervention by CPU was a major development. While CPU is executing, DMA can transfer data between high-speed input/output devices and main memory. CPU requires to be interrupted per block only by DMA. Apart from DMA, there are two other approaches to improving system performance by overlapping input, output and processing. These are buffering and spooling.

Buffering is a method of overlapping input, output and processing of a single job. The idea is quite simple. After data has been read and the CPU is about to start operating on it, the input device is instructed to begin the next input immediately. The CPU and input device are then both busy. With luck, by the time that the CPU is ready for the next data item, the input device will have finished reading it. The CPU can then begin processing the newly read data, while the input device starts to read the following data. Similarly, this can be done for output. In this case, the CPU creates data that is put into a buffer until an output device can accept it.

If the CPU is, on the average much faster than an input device, buffering will be of little use. If the CPU is always faster, then it always finds an empty buffer and have to wait for the input device. For output, the CPU can proceed at full speed until, eventually all system buffers are full then the CPU must wait for the output device. This situation occurs with input/output bound jobs where – the amount of input/output relation to computation is very high. Since the CPU is faster than the input/output device, the input/output device controls the speed of execution, not by the speed of the CPU.

More sophisticated form of input/output buffering called SPOOLING, (simultaneous peripheral operation on line) essentially use the disk as a very large buffer (figure 3) for reading and for storing output files.

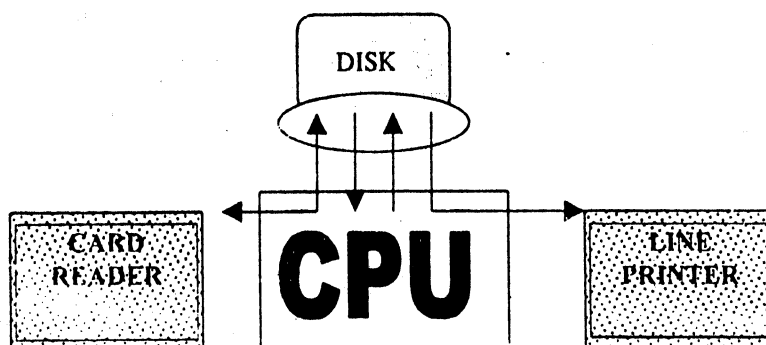


Figure 3: Spooling

Buffering overlaps input, output and processing of a single job whereas Spooling allows CPU to overlap the input of one job with the computation and output of other jobs. Therefore this approach is better than buffering. Even in a simple system, the spooler may be reading the input of one job while printing the output of a different job.

4.3.3 Multiprogramming

Buffering and spooling improve system performance by overlapping the input, output and computation of a single job, but both of them have their limitations. A single user cannot always keep CPU or I/O devices busy at all times. Multiprogramming offers a more efficient approach to increase system performance. In order to increase the resource utilisation, systems supporting multiprogramming approach allow more than one job (program) to utilise CPU time at any moment. More number of programs competing for system resources, better will be resource utilisation.

The idea is implemented as follows. The main memory of a system contains more than one program (Figure 4).

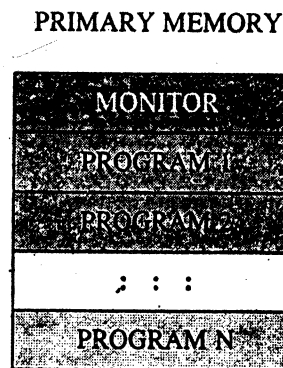
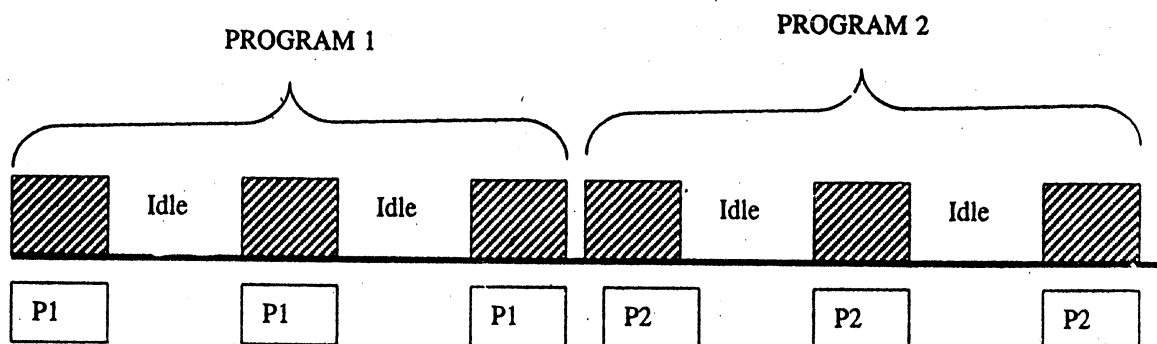
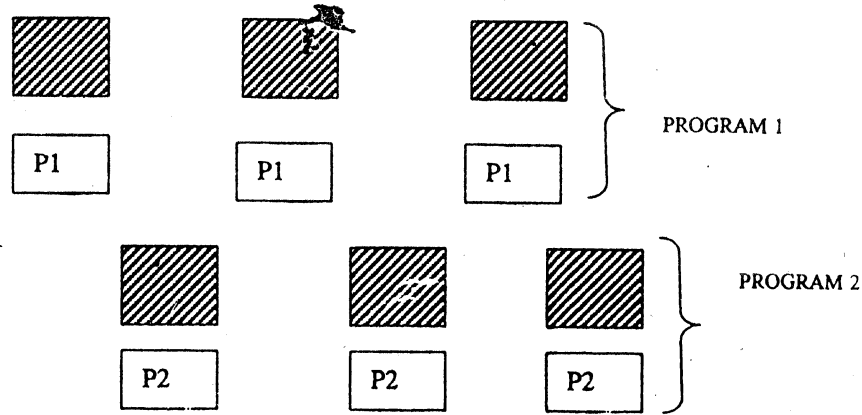


Figure 4: Memory layout in multiprogramming environment

The operating system picks one of the programs and start executing. During execution process (program) 1 may need some I/O operation to complete. In a sequential execution environment (Figure 5a), the CPU would sit idle. In a multiprogramming system, (Figure 5b) operating system will simply switch over to the next process (program 2).



(a) Execution in sequential programming environment



(b) Execution in multiprogramming environment

Figure 5: Multiprogramming

When that program needs to wait for some I/O operation, it switches over to Program 3 and so on. if there is no other new program left in the main memory, the CPU will pass its control back to the previous programs.

Multiprogramming has traditionally been employed to increase the resource utilisation of a computer system and to support multiple simultaneously interactive users (terminals).

Compared to operating system which supports only sequential execution, multiprogramming system requires some form of CPU and memory management strategies which is beyond the scope of this block.

Check Your Progress 1

1. What is a system call?

.....

2. Define the essential difference between

(a) Spooling

(b) Buffering

.....

3. What are the main advantages of multiprogramming ?

.....

4.4 TYPES OF OPERATING SYSTEM

In this section, we will discuss general properties, types of applications advantages, disadvantages and basic requirements of different types of operating systems.

4.4.1 Batch Operating System

As discussed earlier during batch processing environment it requires grouping of similar jobs, which consist of programs, data and system commands.

The suitability of this type of processing is in programs with large computation time with no need of user interaction or involvement. Some examples of such programs include payroll, forecasting, statistical analysis, and large scientific number crunching programs. Users are not required to wait while the job is being processed. They can submit their programs to operators and return later to collect them.

But it has two major disadvantages:

- (i) Non-interactive environment
- (ii) Off-line debugging.

Non-interactive environment: There are some difficulties with a batch system from the point of view of user. Batch operating systems allow little or no interaction between users and executing programs. The time taken between job submission and job completion in batch operating system is very high. Users have no control over intermediate results of a program. This type of arrangement does not create flexibility in software development.

The second disadvantage with this approach is that programs must be debugged which means a programmer cannot correct bugs the moment it occurs.

4.4.2 Multiprogramming Operating System

Multiprogramming operating systems compared to batch operating systems are fairly sophisticated. As illustrated in figure 5, multiprogramming has a significant potential for improving system throughput and resource utilisation with very minor differences. Different forms of multiprogramming operating system are **multitasking, multiprocessor** and **multi-user operating systems**. In this section, we will briefly discuss the main features and functions of these systems.

Multitasking Operating Systems: A running state of a program is called a process or a task. A multitasking operating system supports two or more active processes simultaneously. Multiprogramming operating system is operating system which in addition to supporting multiple concurrent process (several processes in execution states simultaneously) allows the instruction and data from two or more separate processes to reside in primary memory simultaneously. Note that multiprogramming implies multiprocessing or multitasking Operation, but multiprocessing operation (or multitasking) does not imply multiprogramming. Therefore, multitasking operation is one of the mechanism that multiprogramming operating system employs in managing the totality of computer related resources like CPU, memory and I/O devices.

Multi-user operating system allows simultaneous access to a computer system through two or more terminals. Although frequently associated with multiprogramming, multi-user operating system does not imply multiprogramming or multitasking. A dedicated transaction processing system such as railway reservation system that supports hundreds of terminals under control of a single program is an example of multi-user operating system. On the other hand, general-purpose time sharing systems (discussed later in this section) incorporate features of both multi-user and multiprogramming operating system. Multiprocessor operation without multi-user support can be found in the operating system of some advanced personnel computers and in real systems (discussed later).

Time Sharing System: It is a form of multiprogrammed operating system, which operates in an interactive mode with a quick response time. The user types a request to the computer through a keyboard. The computer processes it and a response (if any) is displayed on the user's terminal. A time sharing system allows the many users to simultaneously share the computer resources. Since each action or command in a time-shared system take a very small fraction of time, only a little CPU time is needed for each user. As the CPU switches rapidly from one user to another user, each user is given impression that he has his own computer, while it is actually one computer shared among many users.

The term **multitasking** is described any system that runs or appears to run more than one application program one time. An effective multitasking environment must provide many services both to the user and to the application program it runs. The most important of these are resource management which divides the computers time, memory and peripheral devices among competing tasks and interprocess communication, which lets tasking co-ordinate their activities by exchanging information.

Real-time Systems: It is another form of operating system which are used in environments where a large number of events mostly external to computer systems, must be accepted and processed in a short time or within certain deadlines. Examples of such applications are flight control, real time simulations etc. Real time systems are also frequently used in military application.

A primary objective of real-time system is to provide quick response times. User convenience and resource utilisation are of secondary concern to real-time system. In the real-time system each process is assigned a certain level of priority according to the relative importance of the event processes. The processor is normally allocated to the highest priority process among those, which are ready to execute. Higher priority process usually pre-empt execution of lower priority processes. This form of scheduling called, priority based pre-emptive scheduling, is used by a majority of real-time systems.

4.4.3 Network Operating System

A network operating system is a collection of software and associated protocols that allows a set of autonomous computers which are interconnected by a computer network to be used together in a convenient and cost-effective manner. In a network operating system, the users are aware of existence of multiple computers and can log into remote machines and copy files from one machine to another machine.

Some of typical characteristics of network operating systems which may be different from distributed operating system (discussed in the next section) are the followings:

- Each computer has its own private operating system instead of running part of a global system wide operating system.
- Each user normally works on his/her own system; using a different system requires some kind of remote login, instead of having the operating system dynamically allocate processes to CPUs.
- Users are typically aware of where each of their files are kept and must move file from one system to another with explicit file transfer commands instead of having file placement managed by the operating system.

The system has little or no fault tolerance; if 5% of the personnel computers crash, only 5% of the users are out of business.

Network operating system offers many capabilities including:

- Allowing users to access the various resources of the network hosts
- Controlling access so that only users in the proper authorisation are allowed to access particular resources.
- Making the use of remote resources appear to be identical to the use of local resources
- Providing up-to-the minute network documentation on-line.

4.4.4 Distributed Operating System

A distributed operating system is one that looks to its users like an ordinary centralised operating system but runs on multiple independent CPUs. The key concept here is transparency. In other words, the use of multiple processors should be invisible to the user. Another way of expressing the same idea is to say that user views the system as virtual uniprocessor but not as a collection of distinct machines. In a true distributed system, users are not aware of where their programs are being run or where their files are residing; they should all be handled automatically and efficiently by the operating system.

Distributed operating systems have many aspects in common with centralised ones but they also differ in certain ways. Distributed operating system, for example, often allow programs to run on several processors at the same time, thus requiring more complex processor scheduling (scheduling refers to a set of policies and mechanisms built into the operating systems that controls the order in which the work to be done is completed) algorithms in order to achieve maximum utilisation of CPU's time.

Fault-tolerance is another area in which distributed operating systems are different. Distributed systems are considered to be more reliable than uniprocessor based system. They perform even if certain part of the hardware is malfunctioning. This additional feature supported by distributed operating system has enormous implications for the operating system.

Advantages of Distributed Operating Systems

There are three important advantages in the design of distributed operating system.

1. **Major breakthrough in microprocessor technology:** Micro-processors have become very much powerful and cheap, compared with mainframes and minicomputers, so it has become attractive to think about designing large systems consisting of small processors. These distributed systems clearly have a price/performance advantages over more traditional systems.
2. **Incremental Growth:** The second advantage is that if there is a need of 10 per cent more computing power, one should just add 10 per cent more processors. System architecture is crucial to the type of system growth, however, since it is hard to give each user of a personal computer another 10 per cent.
3. **Reliability:** Reliability and availability can also be a big advantage; a few parts of the system can be down without disturbing people using the other parts; On the minus side, unless one is very careful, it is easy for the communication protocol overhead to become a major source of inefficiency.

Check Your Progress 2

1. Define the essential differences between the time-sharing and real time operating systems.

.....

.....

.....

2. List the main differences between network operating systems and distributed operating systems.

.....

.....

.....

4.5 SUMMARY

Operating system is an essential component of system software, which consists of procedures for managing computer resources. Initially computers were operated from the front console. System software such as Assemblers, Loaders and Compilers greatly improved in software development but also required substantial set-up time. To reduce the set-up time an operator was hired and similar jobs were batched together.

Batch systems allowed automatic job sequencing by a resident monitor and improved the overall utilisation of systems greatly. The computer no longer had to wait for human operations - but CPU utilisation was still low because of slow speed of I/O devices compared to the CPU. A new concept buffering was developed to improve system performance by overlapping the input, output and computation of a single job. Spooling was another new concept in improving the CPU utilisation by overlapping input of one job with the computation and output of other jobs.

Operating systems are now almost always written in higher level languages (C, PASCAL etc.). UNIX was the first operating system developed in C language. This feature improves their implementation, maintenance and portability.

Operating system provides a number of services. At the lowest level, there are system calls, which allow a running program to make a request from operating system directly. At a higher level, there is a command interpreter, which supports a mechanism for a user to issue a request without writing a program.

In this unit, we began with tracing the evolution of operating system through serial processing, batch processing and multiprogramming. On the basis of these characteristics different types of operating systems were defined and characterised.

At the end we presented a list of clear trends which will dominate the future operating system design.

4.6 MODEL ANSWERS

Check Your Progress 1

1. System call is a way of acting with the operating system of a computer
2. Buffering and spooling both tries to smooth out speed difference between the CPU and I/O devices, however, buffering does it only for a single job ongoing which SPOOLING allows input of one job with the computation and output of other job.
3. The main advantages of multiprogramming are:
 - better CPU throughput
 - better resource utilisation
 - can supports multiple users at a time.

Check Your Progress 2

1. The essential difference between time sharing and real, line systems are the way CPU time is utilised. In time sharing system jobs are given equal time slot, whereas in real time system a priority scheme exist and the jobs with high priority are given time first.

• A single machine has its own O.S.	All the machines are controlled by single c
• The files of a user are kept on known machine.	Files of a user can be on any machine. but will get it as and when desired.
• Less efficient processing.	More efficient processing.

4.7 FURTHER READINGS

1. Milan Milenkovic, *Operating Systems Concepts and Design*, Second Edition, Tata McGraw-Hill.



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Block

2

**COMPUTER FUNDAMENTALS: COMMUNICATION,
NETWORKING, SECURITY**

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UNIT 2

Introduction to Computer Networks and Emerging Trends 16

UNIT 3

**The Management of Computer Security and Principles of
Cryptography 34**

UNIT 4

Computer Virus

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BLOCK INTRODUCTION

From the computers being used usually in an isolated manner, the trend is now of a greater communication between computers. It is expected that with better communication infrastructure becoming available in this country, network based computers will be present everywhere. A computer could be connected to other computers in the same room in the same building in the same campus in the same town in the same country or even globally. As an organisation becomes more dependent on computer systems, it must plan for contingencies.

This block provides a brief glimpse of the Fundamentals of Data Communication, which are covered in Unit 1. The various networking technologies and some of the emerging trends are covered in Unit 2.

The third unit covers some methods of cryptography and various ways in which loss or corruption of data can occur and the means by which this can be avoided. Amongst other topics, it specifically deals with DES and RSA-129. Both terms have recently received lot of attention. While the unit directs itself towards PCs, the measures discussed are useful for larger systems even more.

The fourth and last unit of this block touches upon the area of computer virus. While the list of new virus(es) is ever increasing, the unit tries to give a flavour of the widespread variety.

In most of the units of this block instead of check your progress, we have given some open ended questions, as this block is just an introduction to the concept and terminology in the areas of data communication, networking and computer security. This is fundamentally the fastest growing area, therefore, for keeping yourself upto date on various concepts, you must refer to computer journals. You will also undergo a detailed course on data communication and networks later in your programme.

UNIT 1 FUNDAMENTALS OF DATA COMMUNICATION

Structure

- 1.0 Introduction
- 1.1 Objectives
- 1.2 Definitions
- 1.3 Concept of Data Communication
 - 1.3.1 Data Communication Codes (Data encoding)
 - 1.3.2 Communication Speed or Rate
 - 1.3.3 Private vs. Switched Channels
 - 1.3.4 Analog and Digital Transmission
 - 1.3.5 Parallel and Serial Transmission
 - 1.3.6 Tariff
 - 1.3.7 Communication Protocols/Standard
- 1.4 Data Communication Modes
 - 1.4.1 Synchronous and Asynchronous Transmission
 - 1.4.2 Simplex, Half Duplex and full Duplex Communication
- 1.5 Communication Hardware
 - 1.5.1 Sender/Receiver Hardware
 - 1.5.2 Communication Devices
 - 1.5.3 Communication Channels
- 1.6 Summary
- 1.7 Model Answers
- 1.8 Further Readings

1.0 INTRODUCTION

A standalone computer in today's context is not very useful, but coupled with communication technology, it opens up an enormous repository of information to its users. Information is carried in data communication systems as signals between two or more points, which could be at a distance of a few inches or several thousand kilometers.

These signals are subject to various effects while they are in transit which alter their characteristics to some degree. The data communication technology ensures that information between two communicating entities is transferred in a reliable and orderly manner.

To understand transmission one needs to study electrical form that messages take while they are in transit and of media and communication technologies that ensure error-free transmission. In our subsequent units we would be discussing the basic concepts of electronic communications.

Data Communication is also well known as DATACOMM.

1.1 OBJECTIVES

At the end of this unit, you would be able to:

- Define the basic concepts of Data Communication
 - Define various terminology of Data Communication
 - State the functions of the following Data Communication Hardware
 - Nodes and Workstations
 - Modem and Codes, Multiplexers and Communication Channels
 - Describe the implication of Data Communication.

1.2 DEFINITIONS

In data communications, four basic terms – Data, Signal, Signalling and Transmission are frequently used.

Data are entities that convey meaning. Information is obtained by processing data using desired functions.

Signals are electric or electromagnetic encoding of data, and signalling is propagation of signal along suitable communication medium.

Transmission is communication of data achieved by the propagation and processing of signals.

1.3 CONCEPT OF DATA COMMUNICATION

The concept of Data communication evolved from sharing the computation power of a computer along with various resources available in a computer environment such as printers, Hard-disk etc. With increasing demand for exchange of information across the globe, the need for data communication has increased in many folds. Due to physical constraints involved in connecting two remote points physically data communication has emerged as an instant solution.

1.3.1 Data Communication Codes (Data encoding)

The first step towards understanding communications is to look at computer data at its base level. As all of us know computer and computer device manage store and exchange data using electronic pulses or digital signals, that come in two varieties, the binary digit '0' indicates the absence ("OFF") and '1' indicates ("ON") the presence of electric current. A series of ONs and OFFs in various combinations can be sent on the communication channels to represent any character.

Every character (letter, numeral, symbol, or punctuation mark) is composed of a group of bits called codes. To avoid incompatibility between systems, the computer industry has created a number of standards that establish relationships between bit combinations and their corresponding characters.

The most widely used codes are the American Standards Code for Information Interchange (ASCII) and the IBM standard, Extended Binary Coded Decimal Interchange Code (EBCDIC). Some of the characteristics of these codes are tabled below:

Data Codes

	ASCII	EBCDIC
Controlling authority	ANSI	IBM
Number of bits	7	8
Number of Character	128	256

To ensure successful transmission of data between two points, the sender and receivers should use the same code, or they can use translators to aid in communication. Translation is data communication software, which translates the sender's data into the codes receiver understands.

1.3.2 Communication Speed or Rate

The speed at which two computers exchange or transmit data is called communication rate or transmission speed. The unit of measurement of the speed is measured using bps (bits per second) or baud (both are not same, for more details refer to further readings). Normal PC based communication station transferred, using 300 to 9600 bps, whereas a main frame computer uses 19,200 baud or more.

1.3.3 Private vs. Switched Channels

Private leased lines are permanently connected circuits between two or more points. These lines are available for private use by the leasing party.

Whereas, switched lines or dial up lines are available to any subscriber. For example, telephone connection in our home or office is a dial up lines as we dial up a number to use a particular circuit.

1.3.4 Analog and Digital Transmission

One of the fundamental concepts in data transmission is to understand the difference between Analog and digital signals.

An analog signal is one that is continuous with respect to time, and may take on any value within a given range of values. Human voice, video and music when converted to electrical signal using suitable devices produce analog signals.

A digital signal may take on only a discrete set of values within a given range. Most computers and computer-related equipment are digital.

Irrespective of original form of the message, the actual transmission of signal could be either in analog or digital form. Figure 1 shows the two possible transmission methods:

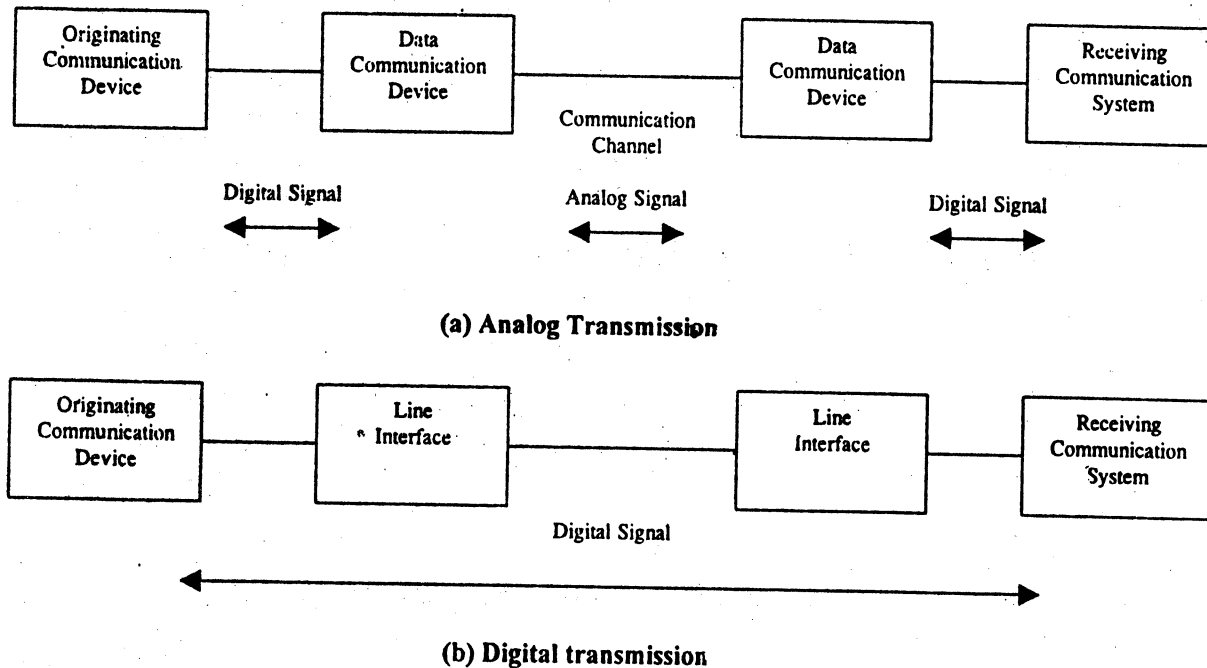


Figure 1: Analog and Digital Transmission

1.3.5 Parallel and Serial Transmission

In parallel data transmission, there are multiple parallel lines connecting the transmitting and receiving units. Each wire carries a bit of information. Normally, one character is transferred in one go.

In serial data transmission, each bit is sent sequentially one after another and it requires only one pair of wire conductors for connecting the receiving and transmitting units.

Serial transmission is slower than parallel transmission, which is used primarily for transferring data between devices at the same site; most common example is Personal Computer to Printer. Communication between computers is almost always serial.

1.3.6 Tariff

As most of the data communication is being done using public channels such as telephone lines, a user has to pay for the use of channels. The tariff is generally calculated taking various data communication parameters into consideration such as volume of data transferred, communication rate or transmission rate and time utilised on the communication channel.

1.3.7 Communication Protocols/Standard

There are several manufacturers of computer hardware and software across the globe. For successful data communication these products should be compatibles with each other or they should conform to certain set of rules so that any one can use them. These sets of rules are known as communication protocols or communication standards.

In other words, protocols are technical customs or guide lines that govern the exchange of signal transmission and reception between equipments.

Communication protocols are usually defined and approved by some international body such as ISO, CCITT or IEEE. At times protocols defined by certain manufacturer of computers or networking products become so widely accepted, that they become 'defactor' standard even though these protocols may not have approval of any standardisation body. Some of the functions that communication protocol regulates are:

- Control of information transfer
- Structure and formats of data
- Error recoveries
- Re-transmission control
- Interface management.

Only communication devices using same protocols can communicate with each other.

To make sure that the bits (or characters) are transmitted through the channel or line, we need a link level protocol between two computers. Some of the main functions to be performed by such a link level protocol are:

- Assuring the data to be transmitted is split into data blocks with beginning and ending markers. This is called framing and the transmission block is called a frame.
- Achieving data transparency. This allows a link to treat a bit pattern, including normally restricted control characters, just as pure data.
- Controlling the flow of data across the Link. It is essential not to transmit bits faster than they can be received at the other end. Otherwise, the receiver overflows and the data is overrun, or all buffering capacity is used up, leading to loss of data.
- Controlling errors. This involves detection of errors using some kind of redundancy check. It also involves acknowledgement of correctly received messages and requests for retransmission of faulty messages.

There are basically two classes of link protocols. They are, BInary SYNchronous protocols (BISNYC) and High Level Data Link Control (HDLC) protocols. BISYNC is based on charecter control, where as HDLC is a bit oriented protocol. In fact, HDLC is widely used in most link protocols of computers. You can refer to further readings for more details.

So far, we have discussed a method of transferring information electronically and various aspects involved in it such as, data characters in a computer system are represented using codes such as ASCII or EBCDIC. The exchange of information can take place only if a facility exists to send information from one end, character by character and also to receive it at the other end in the same manner or sequence. Hence we must understand how the characters are transmitted over the transmission medium.

1.4.1 Synchronous and Asynchronous Transmission

The mode of transmission is the way in which coded characters are assembled for the process of transmission and permits the receiving devices to identify where the coding for each character begins and ends within the format of bits. When two computers communicate, they must have a way to synchronise the flow of data so that the receiving computer can read at the same speed at which the sending computer transmits. The principal modes are asynchronous and synchronous.

In synchronous transmission characters are transmitted as groups, with control characters in the beginning and at the end of the bit train. The transmission and receiving intervals between each bit are precisely timed permitting the grouping of bits into identifiable characters. In synchronous mode, intervals between characters are uniform with no space between consecutive bytes.

In asynchronous transmission, each character is transmitted separately, that is, one character at a time. Each character begins with a start bit, which tells the receiving device where the character coding begins and ends with a stop bit, which tells the receiving device where the character coding ends. Then, the next character is sent, with start and stop bits. The start and stop bits and the interval of time between consecutive characters allow the receiving and sending computers to synchronise the transmission. The parity bit is used for error checking while transmission of data.

Asynchronous communication is slower than synchronous communication, it is typically used at communication rates lower than 2400 bits per second. Asynchronous communication does not require complex and costly hardware as required by synchronous communication and is the mode most widely used with microcomputers.

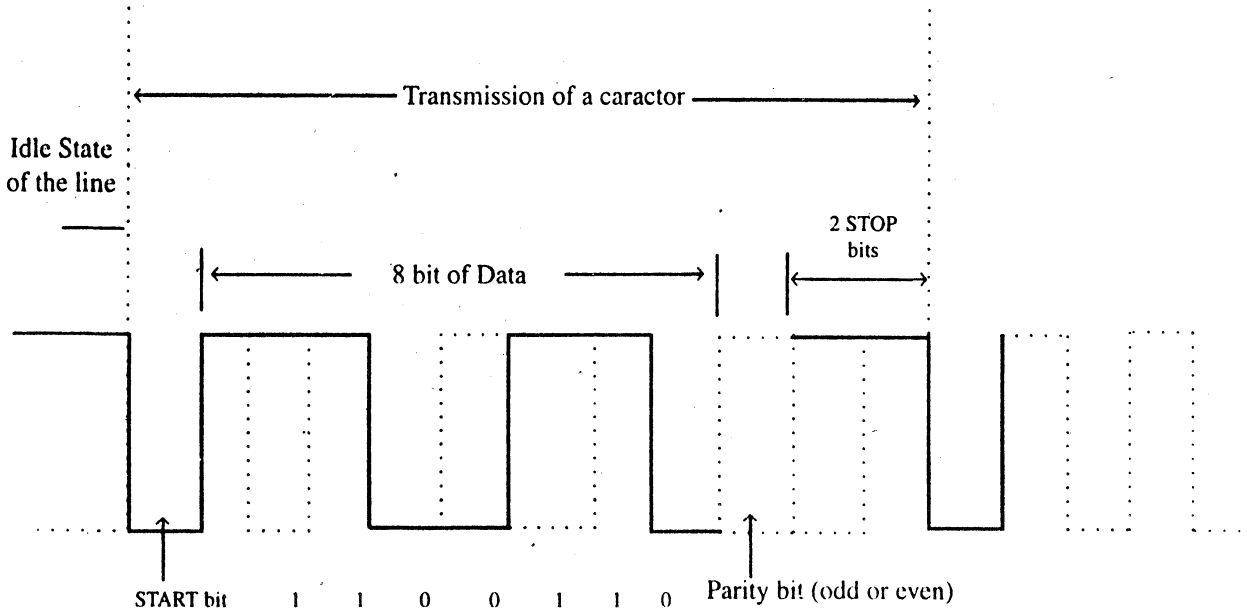


Figure 2(a): Asynchronous Serial Transmission

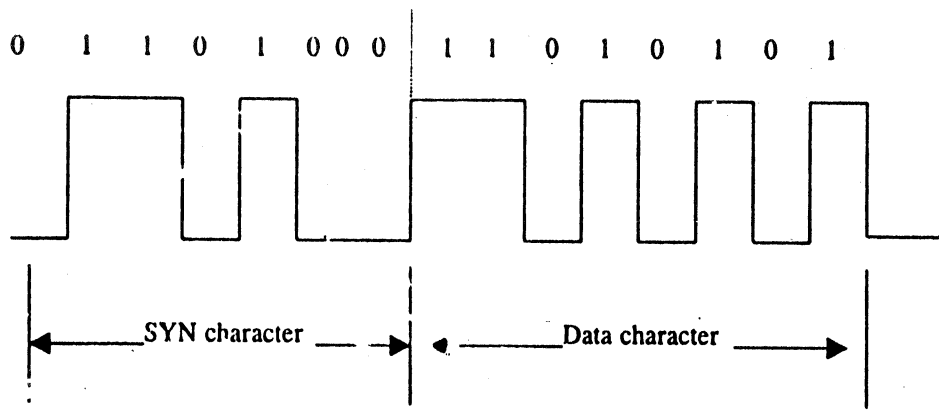


Figure 2(b) Synchronous data character format

1.4.2 Simplex, Half-duplex and Full duplex Communication

The direction in which information can flow over a transmission path is determined by the properties of both the transmitting and the receiving devices. There are three basic options:

In **Simplex** mode, the communication channel is used in one direction. The receiver receives the signals from the transmitting device. A typical use is to gather data from a monitoring device at a regular interval. The simplex mode is rarely used for data communication.

In **Half-duplex** mode, the communication channel is used in both directions, but only in one direction at a time. This requires the receiving and transmitting devices to switch between send and receive modes after each transmission. The analogous example of this mode is the old wireless system (walkie-talkie), which is used in either transmit mode or receive mode.

In **Full-duplex** mode, the communication channel is used in both directions at the same time. Typical example of this mode of transmission is the telephone in which both parties talk to each other at the same time.

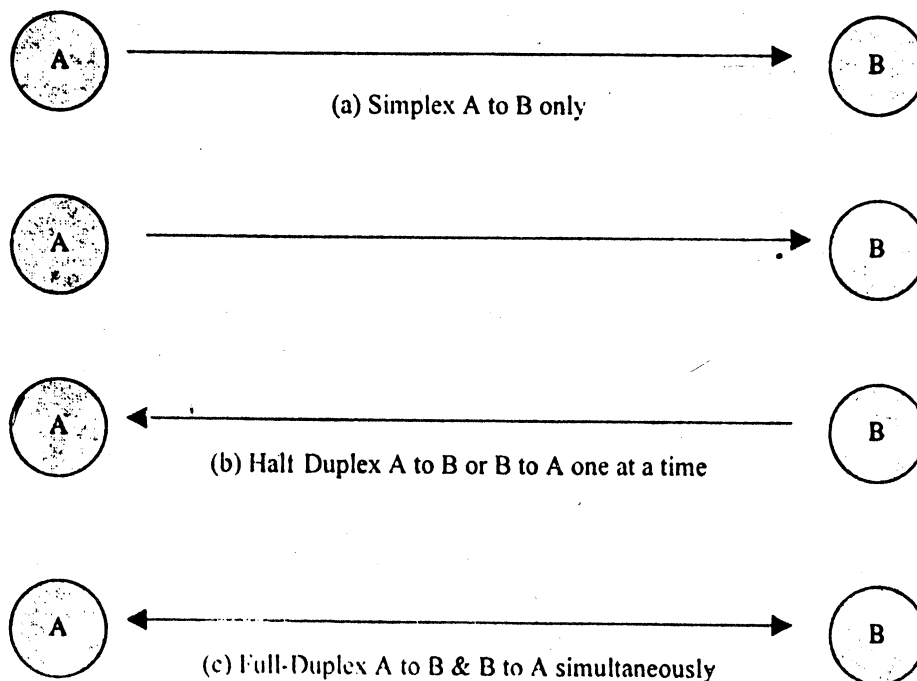


Figure 3: Modes of Transmission

We have already discussed about communication codes; units of measurement; data transmission methods such as analog and digital, parallel and serial; data transmission modes such as synchronous and asynchronous simplex, half duplex and full duplex; the transmission error control and protocols. All this was intended to lay the foundation for all that is going to follow.

For any basic data communication process, the hardware required are:

- Sender and Receiver Hardware
- Communication Devices
- Communication Channels

1.5.1 Sender and Receiver Hardware

Sender and Receiver Hardware are used for handling Communication messages, data transfer etc.

Nodes and Workstations

Data Communication is done using various communication devices and software inter-connected for information exchange. The devices used to communicate in a data communication network are called workstations. These workstations may include computer, terminal, printer, and any other communication devices. Each workstation is connected to something called a data communication network node.

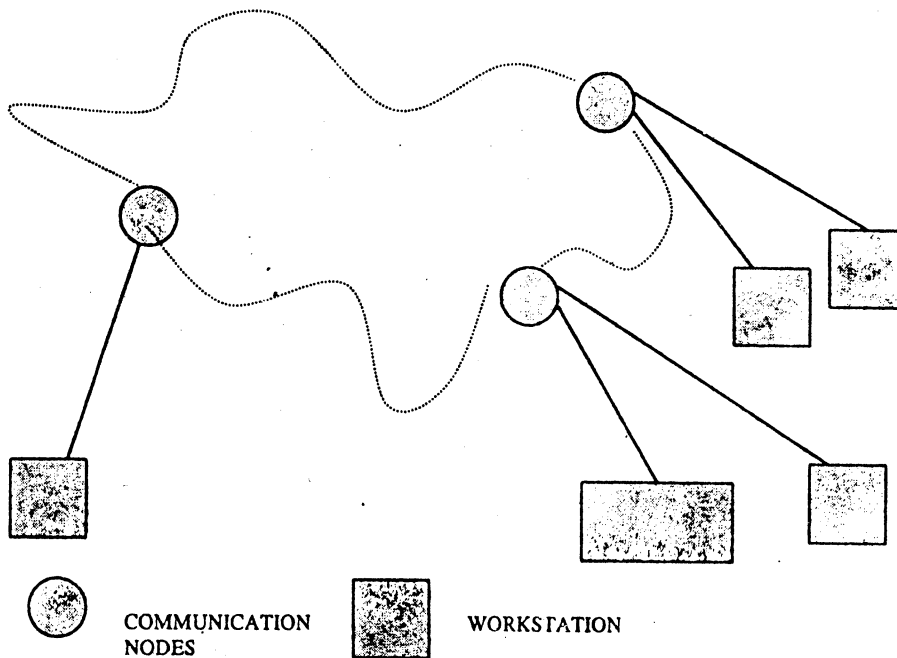


Figure 4: Communication nodes and workstations

Multiplexer

As the name suggests, multiplexing is a form of data transfer in which communication channels are used for several transmissions. For example, the telephone lines that we use for daily conversation can carry hundreds or even thousands of conversation using multiplexing. In other words multiplexing is a type of network mechanism, which allows a number of simple, low cost terminals to share each communication line, introduces almost no delay and requires no special computer software.

Multiplexing is used in two ways:

- (a) By dividing a communication channel into various smaller segments of different frequencies.

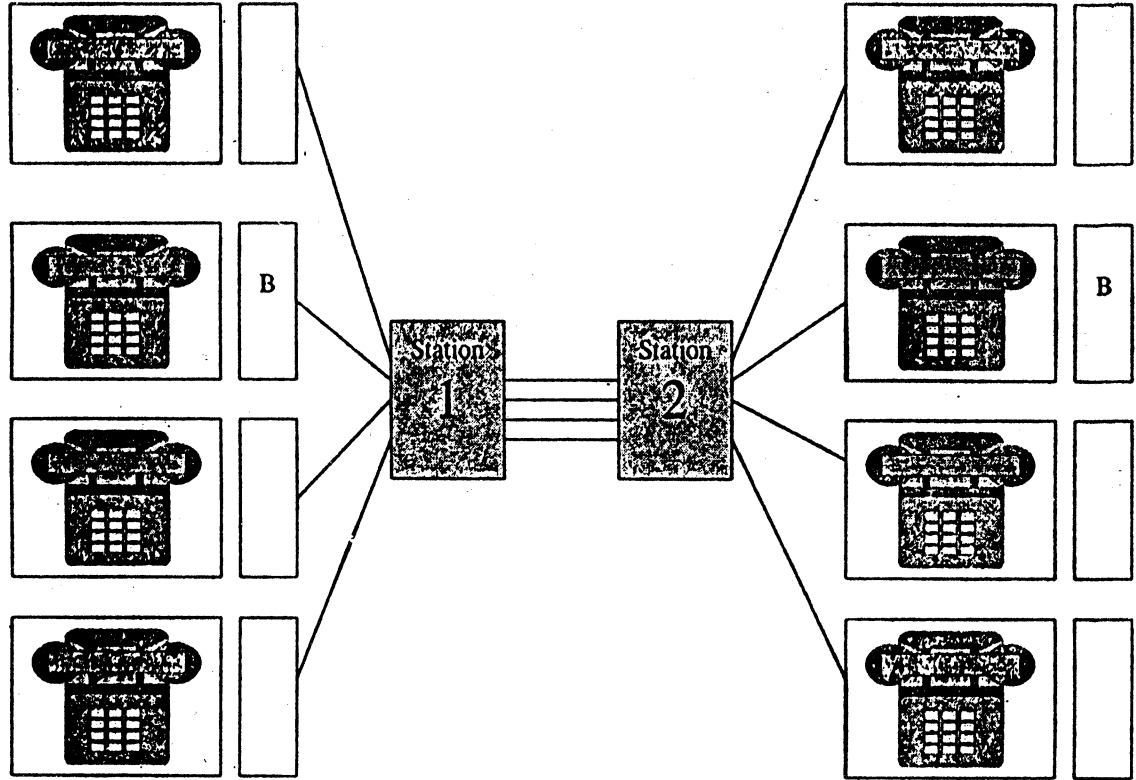


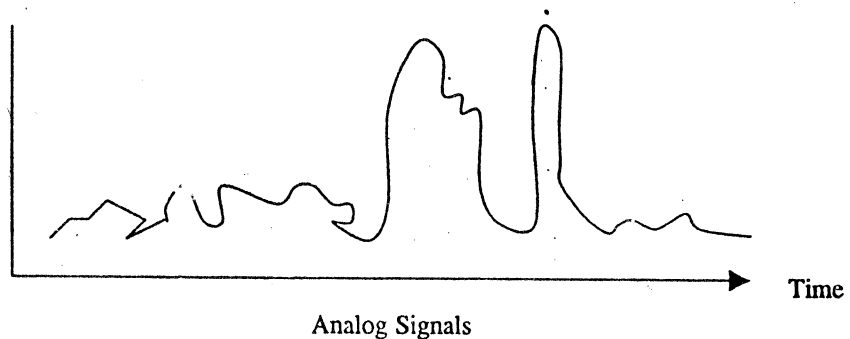
Figure 5: Multiplexing

- (b) By taking groups of bytes from each sender and send or transmit them over the channel one after another. Each group of data bytes are tagged at the beginning and end with start and end control bytes. These by data bytes are then separated at the receiving end and sent to their respective places. This type of multiplexing occurs so fast that the transmission seems continuous.

1.5.2 Communication Devices

There are several types of communication devices or interface used in data communication. These interfaces are connection between receiver and sender hardware involved in data communication and the communication network. Some of these interface or communication devices are discussed below.

- (a) **Modems** or modulator - demodulators are devices which convert digital signals into analog for transimssion over analog transmission facilities such as telephone lines. At the receiving end, a modem performs the reverse function and converts analog signal into digital form.



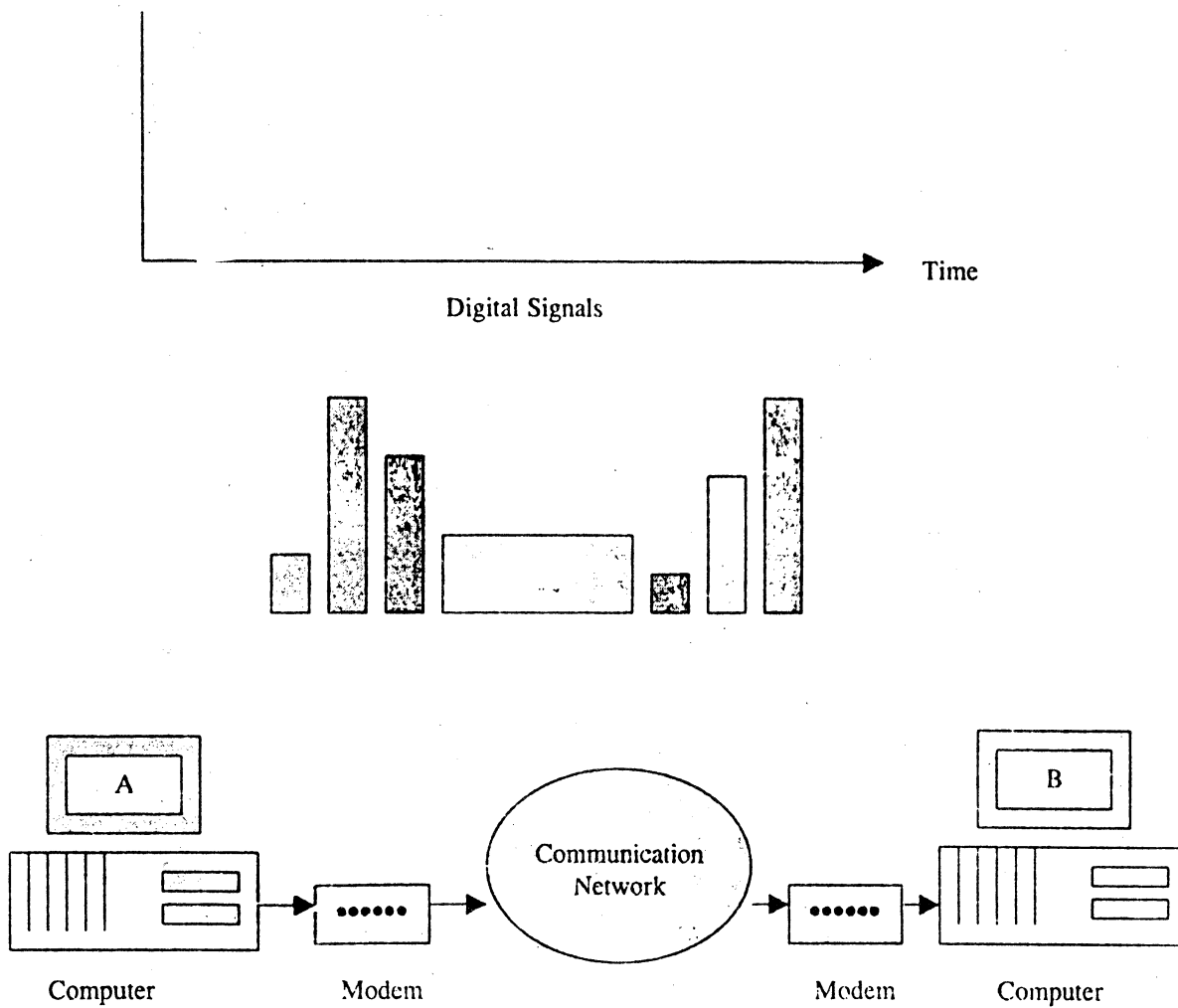


Figure 6: Data Communication using Modem

Line drivers are simple devices used to transmit digital signals over short distances. These devices do not modulate or demodulate signals, but use filters to reduce the high frequency component and the modified signal is transmitted directly over the media. These devices are used for distances of upto 1 Km and can achieve data transfer rates of upto 19200 bps. It is mainly used for connecting VDU terminals with a computer at a distance of more than 100 feet or so.

(b) **Codec** performs the opposite function of a modem.

A communication Port/adaptor is a connector on the computer which is used as an entry to departure point for data involved in Data communication. A common type of communication port is RS 232C. This adapter is used for transfer of data between the computer and the telephone line. During transmission process it adds start and stop bits and controls the communication rate or it strips the start and stop bits where it receives data.

1.5.3 Communication Channels

The most basic hardware required for communication is the media through which data is transferred. There are several types of media, and the choice of the right media depends on many factors such as cost of transmission media, efficiency of data transmission and the transfer rate. We will describe some of these transmission media.

1. Two wires open line

This is the simplest of all the transmission media. It consists of a simple pair of metallic wires made of copper or sometimes aluminium of between 0.4 and 1 mm diameter, and each wire is insulated from the other. There are variations to this simplest form with several pairs of wire enclosed in a single protected cable called a multicore cable or moulded in the form of a flat ribbon.

This type of media is used for communication within a short distance, upto about 50 meters, and can achieve a transfer rate of upto 19200 bits per second.

2. Twisted Pair Cable

A twisted pair consists of a pair of insulated conductors that are twisted together. The advantage of a twisted pair cable over the two wire open lines is, it provides better immunity from spurious noise signals. As the two wires are close to each other, both pick equal interferences caused by extraneous signal sources and this reduces the differential signal added by the noise.

Twisted pair cable is used for communications upto a distance of 1 Km, and can achieve transfer rates of 1-2 Megabytes per second. But, as the speed increased the maximum transmission distance is reduced, and may require repeaters.

Twisted pair cable is widely used in telephone networks and is increasingly being used for data. The hub based ethernet normally use UTP (Unshielded Twisted Pair) cable.

3. Coaxial Cable

A coaxial cable consists of a solid conductor running coaxially inside a solid or braided outer annular conductor. The space between the two conductors is filled with a dielectric insulating material. Larger the cable diameter, lower is the transmission loss, and higher transfer speeds can be achieved. A coaxial cable can be used over a distance of about 1 Km, and can achieve a transfer rate of upto 100 megabytes per second.

A coaxial cable is of two types - a 75-ohm cable, which is used by the cable TV operators and the 50-ohm cable which is used in high-speed broadband networks and are low loss cables.

4. Fibre Optic Cables

A fibre optic cable carries signals in the form of fluctuating light in a glass or plastic fibre. An optical fibre cable consists of a glass or plastic core surrounded by a cladding made of a similar material but with a lower refractive index. The core transmits the light while the change in refractive index between the core and the cladding causes total internal reflection, thus minimising the loss of light from fibre.

As light waves gave a much wider bandwidth than the electrical signal and are immune from electromagnetic interferences, this leads to high data transfer rates of about 1000 megabytes per second and can be used for long and medium distance transmission links.

5. Radio, Microwave and Satellite Channels

Radio, microwave and satellite channels use electromagnetic propagation in open space. The advantage of these channels lies in their capability to cover large geographical areas and being inexpensive than the wired installation.

The demarcation between radio, microwave and satellite channels lie in the frequencies in which they operate. Frequencies below 1000 MHz are radio frequencies and higher are the microwave frequencies.

Radio frequency transmission may be below 30 MHz or above 30 MHz and thus the techniques of transmission are different. Owing to the characteristics of the ionosphere, frequencies below 30 MHz are reflected back towards the surface of the earth. Above 30 MHz propagation is on line-of-sight paths. Antennas are placed in between the line-of-sight paths to increase the distance. Radio frequencies are prone to attenuation and, thus, they require repeaters along the path to enhance the signal. Radio frequencies can achieve data transfer rates of 100 Kbps to 400 Kbps.

Microwave links would invariably use line-of-sight transmission with repeaters placed every 100-200 kms. Microwave links can achieve data transfer rates of about 1000 Mbps.

Satellite links use microwave frequencies is the order of 4-12 Ghz with the satellite as a repeater. They can achieve data transfer rates of about 1000 Mbps.

Check Your Progress

1. Match the followings:

- | | |
|---------------------------|---|
| (i) Modem | (a) baud |
| (ii) Multiplexer | (b) formalised set of rules |
| (iii) Protocols | (c) translate data into same type of code |
| (iv) Translators | (d) volume of data transferred |
| (v) Communication Rate | (e) data link |
| (vi) Communication tariff | (f) Multiple Communication in one channel at the same time. |

Fill in the blanks

2. allows one single communication channel to send many transmission at the same time.
3. Any subscriber can use lines.
4. is a unit of measurement for communication rate.

1.6 SUMMARY

In this Unit we discussed the concept of data communication and defined the process involved in data-communication. Various Hardware and Software concepts were also discussed alongwith the digital and analog signals. It also introduced you to various types of communication devices and also explained what is transmission protocols.

1.7 MODEL ANSWERS

1. (i) (e), (ii) (f), (iii) (b), (iv) (c), (v) (a), (vi) (d)
2. Multiplexer 3. Switched line/ dial up 4. Baud/bps

1.8 FURTHER READINGS

1. William Stallings, *Data and Computer Communication*, Prentice-Hall of India.

UNIT 2 INTRODUCTION TO COMPUTER NETWORKS AND EMERGING TRENDS

Structure

- 2.0 Introduction
- 2.1 Objectives
- 2.2 Network Concept and Classification
- 2.3 Local Area Network (LAN)
 - 2.3.1 LAN Topology
 - 2.3.2 LAN Access Method
 - 2.3.3 Communication Architecture for Networks
 - 2.3.4 LAN Hardware and Software
 - 2.3.5 LAN Software/Operating System
- 2.4 Wide Area Network (WAN)
 - 2.4.1 Communication Switching Techniques
 - 2.4.2 WAN Devices/Hardware
 - 2.4.3 Types of Wide Area Networks
- 2.5 Few Applications
 - 2.5.1 E-Mail (Electronic Mail)
 - 2.5.2 EDI
- 2.6 Networking Scenario
 - 2.6.1 Internet
 - 2.6.2 BITNET (Because its Time Network)
 - 2.6.3 CompuServe
 - 2.6.4 ISDN (Integrated Services Digital Network)
 - 2.6.5 NICNET
- 2.7 Open Indent Questions and Activities
- 2.8 Summary
- 2.9 Model Answers
- 2.10 Further Readings

2.0 INTRODUCTION

Today, Computer networks form the backbone of most enterprises big or small around the world. Computer networks allow people remote to the computer to access the information available to that computer. Computer networks are being used to provide resource sharing between systems separated from a few feet to thousands of kilometres. This technology is leading many corporations to take advantage of the reduced price and increased performance in the workplace. In the first unit of this block, we have discussed about the data communication, in this unit we will discuss networking and how it plays an important role in information exchange. Impact of networking be it LAN or WAN and data communication has been felt across the globe, in various sectors such as education, medicine, transport, etc. This trend of information sharing in most sophisticated manner has completely revolutionised the concept of communication. It brings with it increased access to people in different fields.

2.1 OBJECTIVES

At the end of the unit, you would be able to:

- define LAN and WAN
- define topology and its characteristics
- define a Network Interface Unit (NIU) and communication architecture
- list and distinguish devices used in WAN
- understand and define the trends and impact of data communication and networking in various fields
- describe E-Mail, EDI, present scenario of networking in India and explain the term Internet.

2.2 NETWORK CONCEPT AND CLASSIFICATION

Communication using computer has brought a revolution in the world of Information Technology, particularly in the field of personal computer. We have always heard of networking or the term network. A network is a way or means of transmitting or receiving (exchange) information from one or more sources.

As an example, car salesmen, after years in the business, have developed a network of associates. When the car salesman needs to locate a car to make a sale, the car salesman calls out to his network to retrieve information on the location of the car. Employment agents also develop a network. Their customers become their networks. Employment agents will frequently keep in touch with their clientele for possible openings or to locate a candidate for an opening. Without the capability of networking, these two people would have a difficult time. It is the same in computing. Networks provide the means for locating and transporting information.

In computing networks, the origin of the information request utilises the services of a network to locate and return the information. This is done with addresses. In the two previous examples of the car salesman and the employment agent, a telephone number can be considered the address of their associate or client. Addresses in computer networking are used in the same manner. These addresses identify the network resource. There are two popular architectures for networking - hierarchical and peer.

Peer networking does not need pre-defined network addressing. Instead, each resource on the network is seen as a peer. Each network resource is a peer to the other network resources. When a new network resource joins the network it introduces itself and notifies its peer of any other network resources that it knows about - peer networks are open and share network information.

The entire computer network can be classified into two broad categories (However, elaborate categorisation exists). They are:

- (a) LAN (Local Area Network)
- (b) WAN (Wide Area Network)

2.3 LOCAL AREA NETWORK (LAN)

As number of systems grows within an organisation, a need is felt for sharing expensive resource and exchanging data and information between systems. This need of information exchange and resource sharing within an organisation has resulted in development of Local Area Network or LAN.

A LAN is a data communication network, which connects many computers or workstations (computers terminal, printer etc.) and permits exchange of data and information among them, within a localised area, typically confined to a building, or a cluster of buildings. The distance between two communication points connected on the same LAN channels, is usually upto 02-05 kms.

LANs are not rigidly defined but tend to share most of all of the following characteristics:

- (a) All the connected devices in the network share the transmission media.
- (b) Each device connected in the network can either operate standalone or in the network.
- (c) Area covered is small.
- (d) Data transfer rates are high, usually 1Mbps-100Mbps (Million of bits per second)
- (e) Each device connected in the network can communicate with any other device in network.
- (f) Cost of setting up the network is usually low.

2.3.1 LAN Topology

A network topology refers to the physical layout of the network in which all the devices are connected. This includes all the hardware that makes up the network. The points of connection to the network by the stations are called Nodes or link stations. There are several types of topographical design and strategies used to implement LAN. The majority of these are based on three types of topologies:

- (a) Star
- (b) Bus
- (c) Ring

Each topology has its advantages and disadvantages.

Star Topology

A star topology is shown in Figure 1. In this topology, a number of stations are connected directly to a central station or controller. Communications on the connecting links between the stations and the central station of a star topography can be bi-directional and are point-to-point. A station on this type of network passes an information frame to the central controller, which then forwards the information to the destination station. The central controller manages and controls all communications between stations on the network.

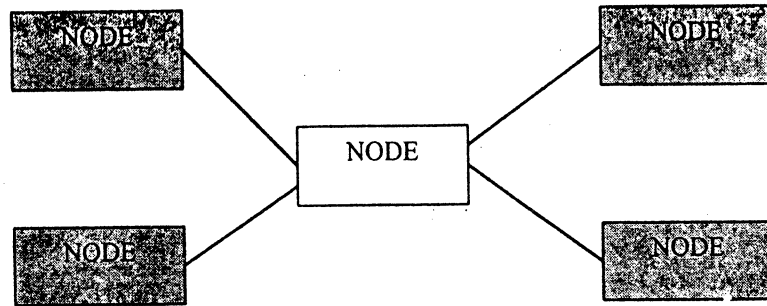


Figure 1: Star Network

Failure of a station on a star network is easy to detect and can be removed from the network. However, failure of the central controller will disable communication throughout the whole network.

Bus Topology

A bus topology is shown in Figure 2. All stations are connected to a single communication line. This single communication line is referred to as a bus. Information frames originating at a station are propagated away from the station in both directions on the bus. Each station on the bus interrogates the information frame destination address field for its own address. If the destination field does not match the station's address, the station discards the information frame back on to the bus. If the destination address matches the station address, it accepts the information frame and processes the frame.

An extension to the bus topology is tree topology and is depicted in Figure 2. Tree topology extends the branches of the bus topology allowing more stations to access the bus.

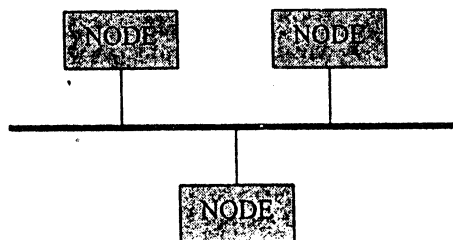
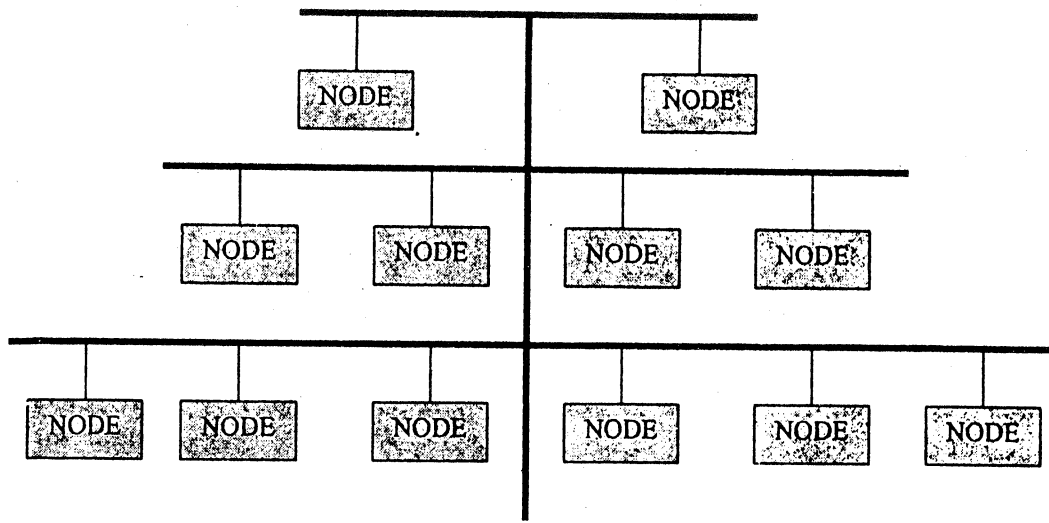


Figure 2 (a)



(b)

Figure 2: (a) Bus Network (b) Tree Network

On a bus or tree network, there is no central point for management and control. These functions are distributed to each station on the bus. A break in the bus can be difficult to locate but limits the range of communications between stations that traverse the broken point.

Ring Topology

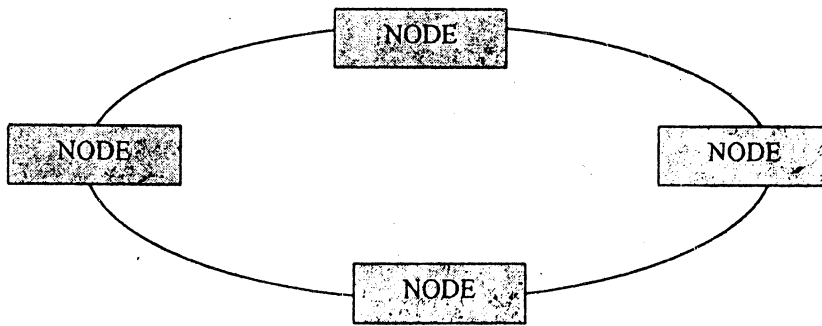


Figure 3: Ring Network

A ring topology is shown in figure 3. Local area networks that have each station attached to an adjacent station using point-to-point links form a physical ring. Each station attached and active to the ring regenerates the information frame, then re-transmits the information frame on the ring. The ring itself is logically circular and the information travels in one direction.

Failure of a station in a ring topology disrupts the ring because the information frame is not regenerated. Additions or deletions of stations to the ring can be disruptive, if the changes are not managed properly.

2.3.2 LAN Access Method

A discipline must be imposed on devices connected to the network to ensure a controlled access to the media. Access methods are the means or ways by which stations actually gain the use of the common channel to transmit messages. The right to transmit is an issue only in broadcast where workstations share a signal channel.

Many techniques have been proposed, but two of these are commonly used

- (i) Carrier-Sense Multiple Access with Collision Detection (CSMA/CD)
- (ii) Token passing

CSMA/CD

CSMA/CD access method is used with bus networks. The bus operates in a Multiple Access (MA) mode. A node is allowed to transmit on the bus, if it senses that the medium is free (carrier sense). Occasionally two or more nodes may simultaneously sense that the medium is free and begin to transmit. This creates a collision, as the contents of transmitted information frames will collide resulting in corruption of the information frame. This collision is detected (collision detect) by the transmitting node. The two (or more) nodes involved then wait for a further short random time interval before trying to retransmit a frame once again.

Token Passing

Another way of controlling access to a shared medium is by the use of a control (permission) token. The control token is passed from one node to another according to a defined set of rules understood and adhered to by all nodes. A node may transmit a frame when it is in possession of the token and after it had transmitted the frame, it passes the token to the next device in a predetermined sequence.

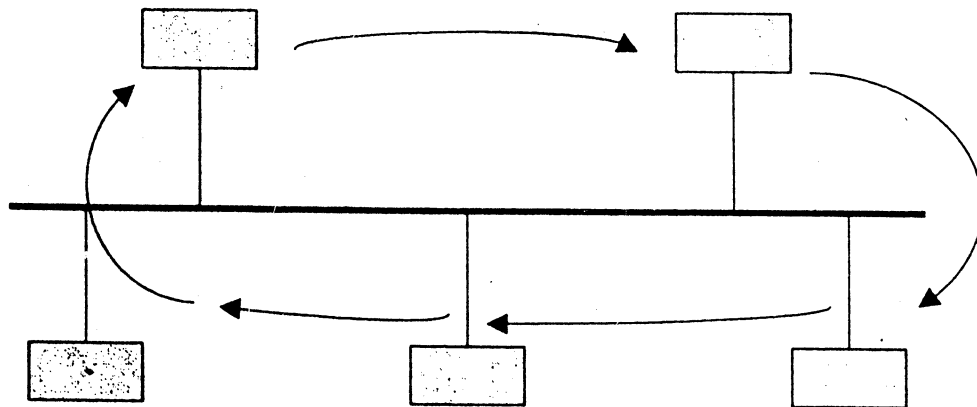


Figure 4: Token bus

In token passing, a logical ring of all nodes connected to the physical medium is first established and a single token is generated; the control token passes from one node to another traversing the logical ring. The token keeps on circulating the logical ring until it is received by a node waiting to send a information frame. After receipt of the token, waiting station transmits the waiting frames on the physical medium after which it passes the control token to the next node in the logical ring.

For token passing, the physical medium need not be a ring topology, it can be used to control access to a bus network also.

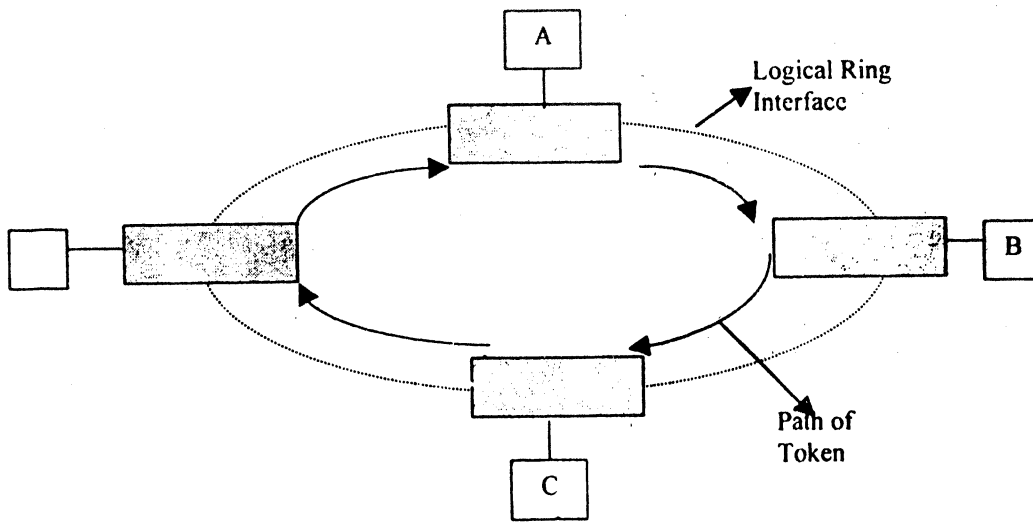


Figure 5: - Ring Token

2.3.3 Communication Architecture for Networks

The task of achieving data communication is a Herculean one. Instead of using entire data communication as a single module, the task is broken into various subtasks. And each subtask operates separately by different layers of the communication architecture.

Systems that follow the OSI (Open System Interconnecting) standard are said to be open to one another at different layers and thus called open systems. The communication architecture specifies independent layers that contain modules for performing defined functions. The architecture defines the functions of the module and relationship between them. Each layer in an open system, which communicates with its equal in another open system by using protocols defined in OSI standard.

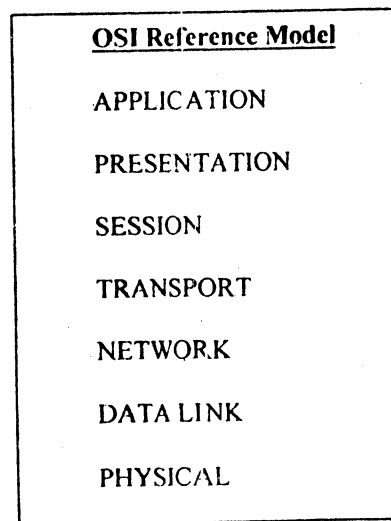


Figure 6: Seven layers of the OSI reference model

The OSI reference model was accepted by ISO as an international standard in 1983. The details on these layers will be dealt with in later courses. However, a brief introduction of these layers is presented here.

Application Layer: This layer supports semantic exchanges between applications existing in open systems. This layer also provides access to the lower OSI functions and services.

Presentation Layer: This layer concerns itself with the representation of the data to the end user or application. This includes data conversions and code translation (e.g. ASCII to EBCDIC).

Session Layer: This layer provides the mechanism for organising and structuring interaction between applications and/or devices.

Transport Layer: This layer is responsible for transparent and reliable transfer of data. The lower layers handle the attributes of the transfer medium.

Network Layer: This layer is the agent for establishing connections between networks. The standard also includes operational control procedures for inter-network communications as well as routing information through multiple networks.

Datalink Layer: This layer provides the functions and protocols to transfer data between network resources and to detect errors that may occur in the physical layer.

Physical Layer: This layer defines the mechanical, electrical, functional and procedural standards for the physical transmission of data over the communications medium.

As we have seen communication architecture is a common set of rules that define the rules on which all connected nodes in a network should communicate with each other. The communication architecture defines two kinds of relationship between functional modules, interfaces and protocols.

Interfaces are rules for communicating or exchanging information between dissimilar modules are process, whereas protocols are rules for communication between similar types of modules or process.

The following figure explains the difference between interface and protocols.

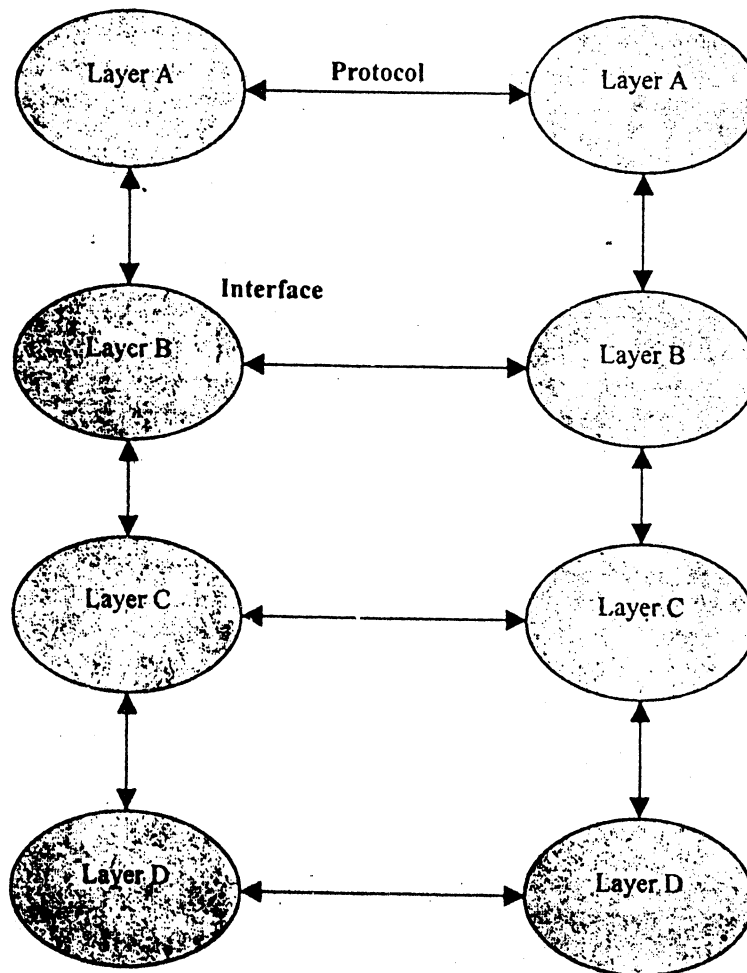


Figure 7: Interfaces and Protocols

2.3.4 LAN Hardware and Software

As we have seen so far, to realise a LAN process, several functions are to be performed. These are so specialised in nature that they require hardware specially built for such purpose. Here we will discuss briefly the basic hardware components of LAN, these are:

- (a) Transmission channel
 - (b) Network Interface Unit (NIU)
 - (c) Servers
 - (d) Workstations
- (a) **Transmission Channel**

Generally following four types of channels are used for data communication in a LAN. These are already discussed in section 1.5.3.

- (b) **Network Interface Units (NIU)**

Network interface units connect each device in the LAN network to shared transmission device. It contains the rules or logic to access the LAN. NIU is also used to implement LAN protocols and for device attachments. Its function depends on the type of topology used in LAN. In microcomputers, NIU may be installed as an add-on card.

- (c) **Servers**

One of the major benefits of implementation of LAN is sharing expensive resources such as storage devices, printer etc. This is achieved through providing servers on the LAN. It is a dedicated computer, which controls one or more resources. This contains both hardware and software interface for LAN. Three major categories of servers used in LANs are:

- (i) File Server
- (ii) Printer Server
- (iii) Modem Server

In a networking file server is used to share storage space for files. Besides providing storage space for files in a LAN environment, it is used for taking periodical backup, and also to provide gateway to other servers within and between LANs.

Similarly printer server is used to handle printing works of all workstation connected in the network.

In LAN environment also modem is required to get connected to other network or simply to use a telephone. A modem server is used to share few telephone lines and modems by all connected workstations in a network.

2.3.5 LAN Software/Operating System

As the name suggests, LAN Operating System is required to operate on the LAN system, manage the tremendous work load with a number of various types of server attached to it. It has basically two aspects (i) Server software (ii) workstation software. As in case of other multi-user operating systems, LAN operating system also facilitates the sharing of expensive resources such as printer, storage space etc. among all LAN users, provides security for data and permits connection to other networks.

There are various types of LAN operating system for example Novel Netware, WINDOWS NT, etc.

2.4 WIDE AREA NETWORK

As the name suggests, WAN spread across countries and continents, satellites being one of the transmission media.

A Wide Area Network or WAN, is a network that links separate geographical locations. A WAN can be a public system such as the Public Switched Telephone Network (the PSTN) or one of the various packet switched services provided by the public telecommunication authorities. WANs can also use most other types of circuit including satellite networks, ISDN, Value Added Networks (VANs/VADs).

The network can be a private system made up from a network of circuits leased from the local Telephone Company or set up using public systems as virtual private networks. A Virtual Private Network is one which operates in the same way as a private network but which uses public switched services for the transmission of information.

The main distinguishing feature between a WAN and LAN is that, the LAN is under the complete control of the owner, whereas the WAN needs the involvement of another authority like the Telephone Company. LANs are also able to handle very high data transfer rates at low cost because of the limited area covered. LANs have a lower error rate than WANs.

2.4.1 Communication Switching Techniques

In a WAN, two computing devices are not connected directly. A network of switching nodes provides a transfer path between the two devices. The process of transferring data blocks from one node to another is called data switching.

There are three switching techniques commonly employed, and these are:

1. Circuit Switching

In circuit switching there is a dedicated communication path between the sending and receiving devices. The dedicated path is a connected sequence of links between switching nodes. A conventional telephone network, where a dedicated path is set between the caller and the called party for the duration of a telephone call is an example of circuit switching.

Communication viz. circuit switching involves three steps:

Circuit establishment; data transfer; and circuit termination

Circuit switching is mainly used for voice telephone network, but is not all that effective for data communication networks, as channel capacities are not fully utilised, as data communication equipments do not generate data continuously.

2. Message Switching

Message switching is an alternative switching technique, where it is not necessary to establish a dedicated path between the sending and receiving devices. In Message Switching, the sending device appends the destination address to the message and passes it to the network; the message is then passed through the network from one node to another till it reaches the intended destination. Each switching node receives a message, stores it briefly and then transmits it to the next node. Examples of a message are electronic mails, computer files, telegrams and transaction queries and responses. A complete exchange may consist of several messages.

The basic disadvantage of message switching is the variable delay at intermediate switching nodes.

3. Packet Switching

Packet Switching combines the advantages of message and circuit switching. Packet Switching is functionally similar to message switching, in which data is transmitted in block, stored by the first switching

node it meets in the network and is forwarded to the next and subsequent downstream nodes until it reaches the destination. The length of data block is limited in a packet switching network. Typical maximum length of packets is between 128 bytes to 4096 bytes. There are two approaches to packet switching

- Datagram
- Virtual circuit

In datagram approach, each packet is treated independently and may follow a different path through the network. Packets may be re-ordered, dropped or delivered in wrong sequence. The communication protocols provide the error recovery and sequencing of packets at the receiving device.

In virtual circuit approach, a fixed logical path through the network from the sender to the receiver is established before any packets are sent. This path remains unchanged for the duration of the session. This is quite like circuit switching, but no resources are reserved along the path. Packets are buffered at intermediate nodes awaiting transmission.

2.4.2 WAN Devices/Hardware

The switching techniques utilise the routing technology for data transfer. Routing is responsible for searching a path between two computing devices that wish to communicate and for forwarding the data packets on this path. Devices such as bridges, router and gateways provide this routing function.

1. Bridges

Bridges are used to connect two LANs that use identical LAN protocols over a wide area. The bridge acts as an address filter which picks up packets from one LAN that are intended for a destination on another LAN and passes these packets on the network. Bridges operate at the data link layer (layer 2) of the OSI model. As all devices use the same protocols, the amount of processing required at the bridge is minimal. If the distance between the two LANs is large, the user would require two identical bridges at either end of the communication link.

Besides a point-to-point link, the intervening communication facility can be a network such as a wide area packet switching network in such cases the bridges need to add X.25 link layer header and trailer.

2. Routers

Routers can be used to connect networks that may not be similar. Routers provide connectivity between two LANs or two WANs over large geographical distances. Routers operates at the network layer (layer 3) of the OSI model. All routers participate in a routing protocol to access the network topology, and based on this information routers compute the best route from a sender to the receiver.

For large Wide Area Networks spanning thousands of kilometers, the normal practice is to put network routers at suitable locations to minimise link costs for leased lines and provide adequate reliability from link failures. Networks and other system are then connected to the nearest router.

3. Gateways

Gateways are used to connect two dissimilar LANs. The term gateways and routers are used interchangeably, though there is a subtle difference between the two. A router operates at the network layer (layer 3) of the OSI model, whereas a gateway operates on, the application layer (layer 7) of the OSI model. A gateway is required to convert data packets from one protocol format to another before forwarding it, as it connects two dissimilar networks.

While discussing the WAN devices we referred to X.25; what is it? X.25 is a set of recommendation by International Telegraph and Telephone Consultative Committee for packet switched network. You can refer to further readings for more details.

2.4.3 Types of Wide Area Networks

The essential purpose of Wide Area Networks, regardless of the size or technology used, is to link separate locations in order to move data around. A WAN allows these locations to access shared computer resources and provides the essential infrastructure for developing widespread distributed computing systems. We will now discuss the different types of WAN, which are commonly used.

1. Public Networks

Public Networks are those networks, which are installed and run by the telecommunication authorities and are made available to any organisation or individual who subscribe it. Examples include Public Switched Telephone Networks (PSTN), Public Switched Data Networks (PSDN), Value Added Services (VANs/VADs) and the Integrated Services Digital Networks (ISDN). We would be discussing the main features of these services.

Public Switched Telephone Network (PSTN)

The features of the PSTN are its low speed, the analog nature of transmission, a restricted bandwidth and its widespread availability. As PSTN is designed for telephones, modems are required when it is used for data communication.

The PSTN is most useful in wide area data communication systems as an adjunct to other mechanisms. It is seldom advisable to use PSTN as the sole communications medium for building a network system. Costs are high, as data connections last for a considerable time. Also, the links set up are unreliable and can terminate without warning.

PSTN connections are usually easy to obtain at short notice, and are widely available and cover almost every location where people live and work. PSTN is most useful for occasional user or as backup to private circuits. It is also used for facsimile (FAX) machines.

Public Switched Data Networks (PSDN)

The term PSDN covers a number of technologies, although currently it is limited to Public Packet Switched Networks available to the public. The main features of all PSDNs are their high level of reliability and the high quality of the connections provided. They can support both low and high speeds at appropriate costs.

Like the PSTN, a PSDN is very useful and adjunct to a private network for backup and occasional access purposes. It can also be used to link computer systems and networks of one organisation to several other organisations. PSDN is very popular for connecting public and private mail systems to implement electronic mail services with other companies.

Value Added Services (VANs/VADs)

In Value Added Services, the provider of such services must process, store and manipulate the data that is carried on the network, that is, add value to it. The technique can be used in specific types of business in which it is advantageous to be able to share information with other companies in the same line.

Electronic Data Interchange (EDI) is one area for Value Added Services in which two trading partners exchange trading documents such as purchase orders, invoices, transportation etc. using electronic means. In India, Videsh Sanchar Nigam Ltd. is a service provider.

Integrated Services Digital Network (ISDN)

The ISDN is a networking concept providing for the integration of voice, video and data services using digital transmission media and combining both circuit and packet switching techniques. The motivating force behind ISDN is that telephone networks around the world have been making a transition towards utilising digital transmission facilities for many years.

Users in shops or small offices can use their digital connection to Telephone Company for transmitting both voice and data over the same twisted pair cable which connects their telephone. As information from the telephone /PC/Stereo/TV/PABX are all seen as bit streams by the networks switch, they can be switched and transported by the same network.

2. Private Networks

The basic technique used in all forms of private WAN is to use private (or more usually leased) circuits to link the locations to be served by the network. Between these fixed points the owner of the network has complete freedom to use the circuits in any way they want. They can use the circuits to carry large quantities of data or for high-speed transmissions.

Check Your Progress

1. Which of the following networking solution is suitable for networking within a building?
 - (a) WAN
 - (b) LAN
 - (c) MAN
 - (d) None of the above

2. Data transfer rate for LAN is normally:
 - (a) 1-100 Mbps
 - (b) 1-2 Mbps
 - (c) 1-10 Mbps
 - (d) None of the above

3. Which of the following topology share a single channel on which all stations can receive and transmit data?
 - (a) LAN
 - (b) BUS
 - (c) TREE
 - (d) None of the above

4. In which topology data packet is removed by the source destination
 - (a) RING
 - (b) BUS
 - (c) STAR
 - (d) None of the above

5. Which of the following LAN access method uses the right to transmission by a special bit pattern?
 - (a) CSMA/CD
 - (b) RING topology
 - (c) Token Passing
 - (d) None of the above

6. Which of the following topology is least affected by removal/addition of workstations?
 - (a) RING
 - (b) STAR
 - (c) BUS
 - (d) None of the Above

7. Protocol is used to communicate between
 - (a) similar module
 - (b) dissimilar module
 - (c) both (a) and (b)
 - (d) None of the above

8. The maximum length of a data packet in packet switching methods is
 - (a) 1 bytes
 - (b) 128-4096 bytes
 - (c) 10 MB
 - (d) None of the above

9. Which of the following takes a fixed logical path through network in packet switching method?
 - (a) Datagram
 - (b) Virtual circuit
 - (c) LAN topology
 - (d) None of the above

10. Which of the following is used to connect two LANs using same LAN protocols over a wide area?
 - (a) Router
 - (b) Bridges
 - (c) Gateways
 - (d) None of the above

2.5 FEW APPLICATIONS

Networking revolution has swept the country and slowly but steadily more and more enterprises are beginning to rely more on various form of electronic data exchange.

2.5.1 E-Mail (Electronic Mail)

E-Mail system is basically used for sending message electronically to individuals or group of individuals in an inter and intra office environment. It requires networks to connect them. In the world of information technology E-Mail is consider to be first experience and exposure to the field of data communication and networking.

But an E-Mail system can do more than just send message back and forth. Applications that will be build on the messaging infrastructure include multimedia mail, database access, document sharing, fax routing, scheduling etc. The most promising areas are workflow, deviation support, task automation information routing etc.

Every day E-Mail vendors coming up with their new version of E-Mail system. Let us discuss few important aspect of a good E-Mail systems.

The E-Mail should contain the feature to compose and send messages easily. Message editing and the ability to easily send attachments that can be quickly opened and read by the recipient are important to improve productivity and use of an E-Mail system.

- (a) Automatic differentiation of text created when typing, from initial message.

An e-mail system should provide support for OLE object linking and embedding, which allows user to incorporate graphics, sound and text into in message.

Attaching a file or object to an E-Mail message is the faster way to route information to a workgroup.

One of the advantages of E-Mail is that it gives users the ability to review, respond to a file, and discard incoming message quickly. E-Mail is fast becoming more than just a way to route electronics notes. It is becoming an important communication medium and infrastructure for workgroup applications that make it easier for people to work together.

2.5.2 EDI

Electronic Data Interchange is the inter-organisational exchange of business documentation in structured, machine-processable form.

EDI is often viewed as simply a way of replacing paper documents with electronic documents, and replacing traditional methods of transmission such as mail, phone, or in-person delivery with electronic transmission. However, EDI is actually a way of replacing manual data entry with electronic data entry. The purpose of EDI is not to eliminate paper, but rather to eliminate processing delays and data re-entry.

Electronic data interchange can be used to electronically transmit documents such as purchase orders, invoices, shipping notices, receiving advices, and other standard business correspondence between trading partners. EDI can also be used to transmit financial information and payments in electronic form. When used in this application, EDI is usually referred to as EFT, Electronic Funds Transfer.

What is Application-To-Application EDI?

Figure shows the use of EDI in place of traditional methods for the transmission of a purchase order between a buyer and seller and demonstrates the key concept behind EDI. Once data are entered into the buyer's computer system, the same data are electronically entered into the seller's computer, without the need for rekeying or re-entry. This is normally referred to as application-to-application EDI. When EDI is fully integrated with application programs, not only do data flow electronically between trading partners without the need for rekeying, data also flow electronically between internal applications of each of the trading partners.

The repeated rekeying of identical information in the traditional paper-based method business communication creates a number of problems that can be eliminated or significantly reduced through the usage of EDI. These problems include—

- Increased time
- Low accuracy
- High labour charges
- Increased uncertainty

EDI has become a major means of business communications among large companies in the U.S. EDI can do, for communications between unrelated companies, what Electronic Funds Transfer (EFT) has done for transactions between large financial organisations—substitute electronic transactions for paper ones.

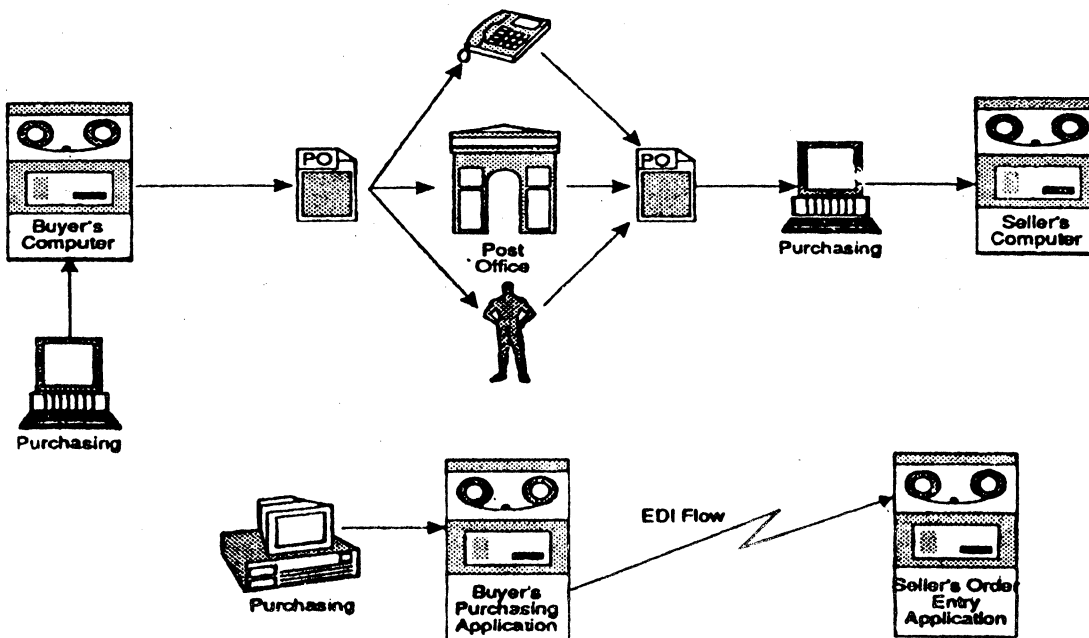


Figure 8: EDI vs. traditional methods

EDI consists of standardised electronic message formats (called transaction sets) for common business documents such as Request for Quotation, Purchase order, Purchase Change Order, Bill of Lading, Receiving Advice, Invoice, and similar documents. These electronic transaction sets enable the computer in one company/organisation to communicate with the computer in another company/organisation without actually producing paper documents. The human effort required to read, sort and physically transport such documents is eliminated. The documents just mentioned, for which standard EDI formats are either in existence or under development, constitute about 85% of the official communications associated with commercial transactions between business, government educational institutions, and non-profit establishments in U.S. and most of the industrialised world.

To take full advantage of EDI's benefits, a company must computerise its basic accounting records. Trading partners are individual organisations that agree to exchange EDI transactions. EDI cannot be undertaken unilaterally but requires the co-operation and active participation of trading partners. Trading partners normally consist of an organisation's principal suppliers and wholesale customers. Large retail stores, because they transact business with a large number of suppliers, were among the early supporters of, and participants in EDI.

Benefits of EDI

The use of EDI eliminates many of the problems associated with traditional information flow.

- The delay associated with order making are eliminated, time required to re-enter data is also eliminated.
- Since data is not repeatedly keyed, the chances of error are reduced.
- As data is not re-entered at each step in the process, labour costs can be reduced.
- Because time delays are reduced, there is more certainty in information flow.

The other advantage in the use of EDI is that it generates the functional acknowledgement whenever an EDI message is received, and it is electronically transmitted to the sender. This acknowledgement states that the message is received.

Therefore, the core concept of EDI is that data are transferred electronically in machine processable form, i.e the EDI message can be immediately processed by receiving computer without, any human intervention, or interpretation or rekeying.

Therefore, EDI is most suited in the areas where any of the following characteristics exist:

- Handles a large volume of repetitive standard action.
- Operates on very tight margin.
- Faces strong competition requiring significant productivity improvements.
- Operates under time constraints.

EDI eliminates the paper documents associated with common business transactions. Consequently, the handling, filing, and transportation necessitated by the existence of the paper documents are also eliminated. Electronic documents (messages) can be duplicated and routed (transmitted) instantly to anyone in the organisation with a need to see them. Where a hard copy of a document is desired or required by law, a paper copy can be produced. Space that normally would be occupied by files of multiple paper copies can be devoted to more productive use and the manual filing operations eliminated entirely.

All of the above benefits result in a more efficient operation and usually provide identifiable cost savings to the company that implements EDI. In addition, eliminating the time required for the preparation and physical movement of paper documents speeds up the entire process of information transfer between companies.

These benefits are so compelling that companies must soon adhere to EDI standards if they expect to sell to large U.S. organisations such as Fortune 1000 companies, where the volume of these documents is always burdensome. The alternative will be to send paper documents to a third party (service bureau) where the document is converted to an EDI message acceptable to the addressed company. Such service bureaus are already in operation in U.S.A. It is this kind of computerisation which is forcing India as country to adopt EDI technology for international transactions.

2.6 NETWORKING SCENARIO

We have seen what electronic data communication is and how it plays a crucial role in the success of organisations. Its impact has been felt across in globe, let us take a look at some of the networks.

2.6.1 Internet

Internet is the world's largest networks, originated out of a US department of defence funded project. It is a unique collection of networks with vast proportions of its own kind. It has evolved into one of the technologies greatest democracies, permitting the passage of all kinds of information exchange with full freedom. The first result of the project funded by US defence department for a fault tolerant networking system, is Arpanet, which in terms become the largest, the most potent aid definitely most uncontrollable force in the world.

The networks or computers operating in different platform are connected to Internet by a common protocol known as TCP/IP Transmission control protocol/Internet protocol. Internet provides the following services.

(a) Global Electronic Mail

As we have already discussed e-mail permits user to send and receive messages electronically to an individuals or a group. Internet mail makes delivery of area of message more wide and reliable.

(b) USENET-Views and News

Views and News or USENET is the BBS (Bulletin Board Service) of Internet. The messages in this BBS are organised into thousands of News groups, which cover specific areas of interest.

(c) TELNET-Remote Login

Telnet allows an Internet user to access a remote host. After properly connecting and logging into the remote host, the use can enter data, run programs or do any other operation.

(d) FTP-File Transfer Protocol

It permits an Internet user to move or transfer a file from one computer to another even if they are running on different platform (or operating system). The files may have data, graphics, text etc.

(e) Navigators-Information Servers

More than 1000 new users are joining Internet each month making it a global information ocean. This also makes difficult to find any thing specific on Internet. There are several powerful tools used on Internet for searching information. These information-tracking utilities are means to develop easy method of discovering, locating, and retrieving information on various objects freely available on Internet. Some of the well-known utilities are Gopher, Archie, Hytelnet, WAIS, and WWW. The WWW out of these is the most popular and, have resulted in the massive growth of Internet resources. You can obtain more information on Internet in further readings.

2.6.2 BITNET (Because-Its Time Network)

City University of New York and University of Yale established BITNET basically to exchange information between universities. The basic series provided by BITNET are:

- (a) Exchange of electronic messages (datafile)
- (b) Electronic student admission
- (c) Remote job entry and storing research information

A counterpart of BITNET in India is ER Net, which is established for educational and research purposes.

2.6.3 CompuServe

CompuServe is a commercial network based in US. It uses telephone lines and microwave for communication. CompuServe user can easily communicate with each other, around the world. Following are the services offered by CompuServe:

- (a) Electronic Mail box for message transfer
- (b) Bulletin Board Services
- (c) News report alongwith report on sports and weather
- (d) Information on computer hardware and software.

2.6.4 ISDN (Integrated Services Digital Network)

ISDN is basically used for Communication of both data and voice. ISDN was first launched in Singapore in 1990. It has the following features:

- (a) Transmission and processing of digital data
- (b) Processing of various types of information data, voice, video etc.
- (c) Electronic mail box
- (d) Tele-conferencing
- (e) Telefax, videofax, etc.

2.6.5 NICNET

NICNET is a satellite-based nationwide network of NIC (National Information Centres). The basic idea of interviewing NICNET is to extract data from each village, district and city of India. It consists of earth of stations in almost all districts, state capitals, regions and NIC headquarter in Delhi. The basic objectives of NICNET are:

- (a) To help government in better planning administration
- (b) To help government maintain communication in times of national emergencies and natural disasters.

In India, many other Government owned network exist.

2.7 OPEN INDENT QUESTIONS AND ACTIVITIES

1. Explore whether there is any E-Mail service provider in your town and if so obtain the rates for various services. Make a comparison with charges for similar work if it had been done through Ordinary mail, Speed post, International Air mail or through Fax.
2. Explore with some business organisations to which you have access, whether they are aware of EDI. If so, are they contemplating moving towards it?
3. If you find that not many businesses are aware of the potential of EDI, what would you attribute this to?
4. Try to visit an organisation within your reach and find whether they are connected to a National or International network?

2.8 SUMMARY

In this unit you learned about networking concept and its utilisation. It also explained various kind of networking such as LAN and WAN. It defines what is LAN, its topology, hardware and software for LAN, and also talked about WAN in details. You have also been conveyed the functions of E-Mail and Electronic Data Inter-change. The difference between the two has to be appreciated. Some description of the various standards that exist as well as their need in case of EDI was presented. A brief description of some of the well known networks, both in India and abroad, were presented.

2.9 MODEL ANSWERS

Check Your Progress

1. (b) 2. (a) 3. (b) 4. (a) 5. (c) 6. (a) 7. (a) 8. (b) 9. (b) 10. (b)

2.10 FURTHER READINGS

1. Andrew S. Tanenbaum, *Computer Networks*, Third Edition, Prentice-Hall of India.
2. William Stalling, *Linux and Computer Communication*, Prentice-Hall of India.

UNIT 3 THE MANAGEMENT OF COMPUTER SECURITY AND PRINCIPLES OF CRYPTOGRAPHY

Structure

- 3.0 Introduction
- 3.1 Objectives
- 3.2 Definitions
- 3.3 Security Status on PC
- 3.4 Breaches of Security
- 3.5 Security Measures
 - 3.5.1 Physical Security
 - 3.5.2 Software Security
 - 3.5.3 Network Security
 - 3.5.4 Password Security
- 3.6 Cryptography: A Brief History
- 3.7 Cryptography
 - 3.7.1 Cipher Systems
 - 3.7.2 Data Encryption Standard (DES)
 - 3.7.3 RSA Approach to Encryption
- 3.8 Cryptanalysis
- 3.9 Open Questions and Activities
- 3.10 Summary
- 3.11 Further Readings

3.0 INTRODUCTION

In this unit we will describe the various ways in which loss or corruption of data can occur and the means by which this can be avoided. Our main thrust would be directed towards PCs, but we would also look at the measures available on larger machines. We will also discuss about cryptography.

Once more and more information is kept in digital form, the protection of data in computer systems begins to pose challenges to designers, researchers and system managers. It is clear that when such data involves financial transaction, there has to be complete reliability. Even in University examination systems, the security of the data is very important. In an information society, even for businesses the competition would be on the basis of the information available. Therefore, pilfering of information or eavesdropping when data is being communicated from one part of the organisation to another, can be a serious threat.

One of the methods adopted from time immemorial -relates to jumbling up- the message so that-it cannot be easily understood. Of course, persons wanting to get the information, would want to break through the jumbled message, and will try to find a meaningful content.

The field of cryptography (from the Greek kryptos, "hidden" and Graphein, "to 'write'"), deals with the methodologies involved in creating cryptograms i.e. messages which should appear to be meaningless, except for those who have been provided the means to extract the original text from the jumbled up text.

3.1 OBJECTIVES

At the end of this session, you should be able to:

- define the computer security
- give various security measures to be undertaken
- explain physical security and software security
- appreciate the possible approaches to cryptography
- define the concepts of cryptanalysis.

3.2 DEFINITIONS

Generally the terms privacy, integrity and confidentiality are loosely construed to be synonymous with security. These however have different connotations with respect to data or information. They also address different areas of information systems. To better understand the measures and to ensure protection in each area, let us see their definitions.

SECURITY: "Data or information security is the protection of data against accidental or intentional, destruction, disclosure or modification". Computer data security refers to the technological safeguards and managerial procedure, which can be applied to computer hardware, software and data to ensure that organisational assets and individual privacy are protected.

PRIVACY: "Is a concept applied to an individual". It is the right of an individual to decide what information he/she wishes to share with others or is willing to accept from others.

3.3 SECURITY STATUS ON PC

Before studying the ways in which security can be compromised, let us see what some of the leading magazines have to say about PC security.

The "New Scientist" in its issue of 7 July 83 warned: "New PC users beware ! PCs are the biggest threat to Computer Security. Micros are left in unguarded offices or at home, where data snoopers may steal confidential files or data, if not the machine itself".

A few years later "PC Week" in its issue of 7 May 85, Cautioned: " The PC has NO inherent security". For a user with confidential data, the data stored in the PC is vulnerable because anyone can walk up and turn the switch ON and access information.

The same article had this to say for networked PCs: "Put your PC on-line and you are open to a New World of terrors. A LAN is an open opportunity for mischievous or disloyal co-workers to get confidential information. A telephone connection can invite everyone from the 10-year-old down the street to the KGB -to intercept your communiqes and romp through your memory banks, borrowing a file here, erasing others there, until the only memory you have of your data is an ulcer".

The article Digital defence in the February 7-21, 95 issues of Business Today has the following to say "If you marvel at the speed, efficiency, and ease-of-use with which your computer system crunches, sorts and spews out data, remember this: it's just as simple for a digital desperado on the prowl to coax out the same data from

3.4 BREACHES OF SECURITY

The above warnings paint a fairly bleak picture for PC users. Some of the ways in which data loss or manipulation can occur have been hinted at in these articles. Let us look at the details of the manner in which losses can occur.

Theft of PC and Media: May sound preposterous but it is a distinct possibility. A smart person with a false calling card can take away the PC for repairs and of course never show his face again ! However, electronic media like floppies and CD-ROMs are slightly safe as it is far easier to lock up floppies in a safer place.

Damage due to Breakage: Floppies are easily breakable. It is hard to visualise dropping PCs but it can happen if they are shifted from one place to another. More likely is that something may get dropped on the PC resulting in damage. Damage can also occur due to natural causes such as storms or floods, or due to electrical or other fires.

Environmental Damage: The manufacturer recommends some environmental conditions like temperature and humidity ranges, voltage limits, dust micron limits etc. If the conditions in your office remain outside - these limits the PC and media are likely to get damaged.

Inadvertent Corruption/Loss: This can occur due to:

- Usage of inferior media : If sub-standard media is used, as it would be generally cheaper, after using it for some time it may develop faults and data held on it may become unusable. One hears about frequent corruption of data on inferior floppies.
- Erasure of Files : Files may get erased from the media due to incorrect actions by the operator. Corruption may occur due to the PC being subjected to frequent power failures, wrong programming techniques or defective software.

Environmental losses: Excessive dust or humidity can result in corruption of disc surfaces or read/write heads resulting in loss of data.

Malicious damage/Leakage: We now turn to the real problem of computer installations, be they stand alone PCs or large main frames with hundred of terminals. It is not necessary that outsiders would do this; it is equally possible that some unhappy or impish insiders may wreck havoc.

Unauthorised Access: As the saying goes "Curiosity killed that Cat", but it does not stop the human from trying to look at things they should not or need not. Information on personnel, finance, products or assets can be accessed and copied for malafide use.

Modifications Erasures etc.: The person accessing data files may be authorised to read the data only, but he would like to alter, modify or erase the data by writing into that file.

Computer Viruses: This is the latest threat to computer users. These can be introduced deliberately or unknowingly by anyone at anytime and the consequences to the user would be equally disastrous. The problems created by viruses include:

- Destruction of file Allocation Table (FAT) - user loses everything on his media;
- Erasing of specific programs and/or data on discs
- Alter contents of fields in the file;
- Suppress execution of RAM resident programs;
- Destroy parts of programs/data held on disc by creating bad sectors;
- Reduction of free space on disc;
- Formatting of discs or tracks on discs in a different way;
- Overwriting of entire disc directories;
- "Hang" the system at periodic intervals so that keyboards become inoperative;
- Automatic copying of results obtained by other programs into some designated areas.

Data Tapping: In large computer systems or when systems are networked, data has to travel between the processing unit and terminals, or different processors, over communication lines. Any person trying to get access to data can intercept the traffic on the circuit by tapping into the cable at convenient points. This may even enable him to send spurious channel over the network and access the computer itself by emulating terminal responses. Very sophisticated means have been developed which allow a person to 'listen' to the traffic on a line even without physically connecting into it. Thus the data following over communication lines is ever susceptible to "eavesdropping".

3.5 SECURITY MEASURES

The measures for data protection taken by an organisation reflect its awareness and attitude towards information and Information Technology. If top management treats computers as a dehumanised, intangible, but necessary evil, the measures taken to protect data, individual privacy and data integrity would, at best, be lackadaisical. On the other hand, if the management considers information as an important resource and computers as an aid in decision making one would find a positive approach and involvement by the management towards security of information. This attitude naturally percolates down to the lower levels and the workers consider the computer correspondingly as an enemy or an ally.

One of the best and first steps in ensuring data security is to create an awareness and develop a culture within the organisation towards the ways in which information can be lost/alterd and what would be the consequences, of such an occurrence, to the organisation and individuals. The other steps that can be taken are:

- **IT Planning:** the organisation must decide on a policy for introduction of IT. This must be done at the highest level and should address issues such as level of protection for various aspects of information relating to the organisation;
- **Selection of technology:** keeping in mind obsolescence due to new innovations and necessity for keeping in step;
- **Identification of points of exposure of weak links to device means to plug them;**
- **Physical protection of machine and media.**

Control and Monitoring the access to data, its usage by persons and its integrity must be clearly defined and responsibility for ensuring these must rest on persons designated for these tasks; an audit procedure would go a long way in ensuring adherence to laid down guidelines. While the above are relevant for any computer based MIS implementation, in case of PCs, the rules for acquisition and use must be unambiguously stated. Additional points to be looked into are:

- **Information classification;**
- **Responsibilities for Security;**
- **User training to increase security awareness and propagation of "do's and don'ts"**
- **Guidelines for creation and changes to passwords etc.**

There are four time-honoured principles for ensuring security and recovery in case of breaches of security:

Prevent: The best method is of course stopping all breaches of security before they occur. 'Need-to know' policy is an offshoot of the principle of prevention.

Detect: Howsoever, one may try to ensure it, total security is almost impossible. The next principle, therefore, is that you must be able to detect breaches to security, whenever they occur, within the shortest possible time. This helps in damage assessment and also in devising further preventive measures.

Minimise Damage: The aim here is to contain the damage, when losses occur, to reduce the adverse effects of such damage.

Recovery: There must be enough resilience in the system to recoup the losses/damage and become functional, by reinstating the status, at the earliest.

We would now look at the various measures available to the PC user, to ensure security of machine and data, relating to the principles enumerated above.

3.5.1 Physical Security

These measures are for PCs being used in offices. The PC may be in use by an individual or being shared between two or more users. The measures available are:

- Physically bolt down the PC to a table so that it cannot be casually lifted and taken away;
- Locate the PC in such a way that it is conveniently accessible to the user, but hidden from casual passers-by;
- Have lockable cupboards for floppies and keep them locked at all times, except when used;
- Keyboard and PC locking devices can be fitted so that the PC cannot be operated unless these locks are opened;
- Keep a record of all floppies in use; do not permit alien floppies into the organisation;
- Use lockable rooms for PCs, specially those handling sensitive data. Make it a practice to lock the room when leaving it for even a short time.
- The above apply to server, gateways and the like.

Environmental Conditions: The PCs are fairly rugged and can tolerate wide ranges of temperatures, humidity and voltages. However, to ensure trouble free and prolonged life, consider the following measures:

- Have temperature and humidity gauges placed in the close proximity of PC; and keep a casual watch to ensure that conditions are within limits. Switch off if the limits are exceeded;
- If your normal electrical supply is subject to large variations of voltage and frequency or spikes, it is prudent to have voltage and frequency stabilizers for the PC;
- Ensure that excessive dust or paper scrap does not accumulate near the PC;
- The plug sockets should fit snugly and cables leading to terminals and printers should be secured properly and not left hanging;
- You may consider putting a thin transparent plastic cover on the key board if it does not hamper your handling the keyboard;
- The most important is the use of a vacuum cleaner at regular intervals.

3.5.2 Software Security

As is apparent from the views on security of various leading magazines, provided on PCs, there is hardly any security provided on the PC. There are some measures you can take to ensure that data is not corrupted or modified by unauthorised users and to re initiate the database to its known status in case this happens and these are:

- Use original software for Operating System, compilers or software packages. You may have to pay for it, but you can then be sure that it would be bug-free, known also as "licensed" software;
- Use correct procedures for shutting down the PC so that all files etc. would be properly closed;

- If you develop your own applications introduce passwords to access your application; these passwords should not be visible on the screen when keyed-in;
- Keep back-ups of all your files. Whenever you operate on any file, (especially in update/append/alter mode), if you have your own programs - they should include a "copy" procedure; this ensures that a back up of your data files would always be automatically taken.

3.5.3 Network Security

The protection required for networked systems is much more extensive as physical security measures are totally inadequate. It is also extremely difficult to know- who, when and how someone is accessing your data. In LANs, generally there would be one server which holds the shareable data on network and services the requests of various nodes. The normal method used is password identity for permitting access; the measures that can be adopted for additional security are:

- Keep the servers away and limit physical access to them.
- Run servers in the background mode; thus the server can be booked on, for use in the network, but, for direct use of the server, a separate password would be necessary;
- Some networks provide auditing facilities, which can be used to advantage;
- Be aware that the network cables can be tapped, so try and shield or conceal them to prevent easy access; if possible use optical fibre;
- Use codes and ciphers in data communication; remember, however, that this would impose considerable overheads on your resources;
- Use fibre-optic cables for highly sensitive networks as they are difficult to tap; however, here too it may be possible to steal data through sensing the perturbations of the fibre itself;
- Prohibit the use of passwords embedded in communication access scripts; if this is unavoidable, use encryption for passwords;
- Consider the use of see-through devices for any system accessed through networks or through dial up.

Protection against virus: A number of measures are available for reducing the risk of being attacked by virus:

- Build employee awareness of the risk;
- Do not allow the use of outside programs for company PCs, or networks;
- Do not interface company networks to outside "Bulletin Boards";
- Make system/server files "Read only";
- Try and obtain source code for important software in use and compile it in-house;
- If source code is difficult to follow, it should ring a warning bell in your head;
- Check executable code using "debug" or separate utilities to study code structure and check spaces for viruses.

3.5.4 Password Security

In most organisations or computer systems, the only authorisation for data access is giving the correct password; rightly speaking, this is only one step; the whole process would be:

Identification: An identification user code only indicates an object with a unique identity assigned to it. Thus it should not become authorisation to access data without further checks, if some measure of security is desired;

Authentication: This process verifies that a person or object is who he, she or it claims to be. This could be achieved by asking some standard questions (from a large selection) and getting answers to them. If the answers match with those held on the systems, the person or object is authenticated. Biometric and other physical authentication processes are also popular in systems where security is a primary concern.

Authorisation: This is the last step in the process. Through this you can ensure that only a given user, terminal or other resource can access data to which permission has been granted to read, write or alter. Thus a matrix can be created to indicate which users have access to which file, records or fields. If the user request passes the matrix he is allowed access, otherwise he is denied access to some parts of the database.

Other Aspects

We have had a fairly close look at the measures for data protection available on stand alone as well as networked PCs. Some of the measures that we studied can be implemented only on mini and mainframe systems easily, while trying to introduce them on PCs may incur too much of resource overheads. We would now take a quick look at the protection, detection and recovery mechanisms available on large systems. This is in order to give you pointers for discerning when to go in for a larger system rather than a PC LAN and what facilities to look for.

Database Access: Larger systems provide various mechanisms to prevent access to data. User classes can be defined automatically prohibiting access to data by user class. User can be given only "query view" of the data so that he can have only "read" access to a limited amount of data. In some systems, certain terminal numbers can display or access only some parts of database, thus, even a user, with higher access permissions cannot access some data on those terminals.

Access to Operating Systems: In some systems the operating system is written in a lower level language and users are not given the use of that language. Thus, the user cannot alter any part of the operating system. Some operating systems follow the concept of access control levels. In this any program which has equal or higher access control level cannot access any routines which are below that level. The operating system routines are placed at much lower level and paths are predefined for access to these, which incidentally, are via other system routines placed at a high level. From this point of view 'UNIX' is not a secure Operating System as, 'C', which is the language in which 'UNIX' is written, is also available to the user as a programming language, however, it have many good security features.

Access Control Cards: This is the latest method and is also available on PCs. Here an additional card is inserted on the PC. This card has its own memory and software. The user can program upto ten complex account codes. Anyone wanting access to a PC has first to pass through authentication routines through this card. Only when he passes, he is allowed to access the PC itself. These codes can be reprogrammed whenever required. Thus the basic problem of preventing access to the operating system of the PC can be solved to a large extent.

3.6 CRYPTOGRAPHY: A BRIEF HISTORY

In the current scenario of computer usage that predict is that networks are likely to be present everywhere, security has become much talked about issue. Especially, with the relatively easy access to the Internet, the confidence in the sanctity of the data is a major concern.

However, the science of Cryptology is at least 4,000 years old. Cryptology is defined as "the design and analysis of codes and ciphers." In its first 3,000 years, Cryptology was developed independently in several, ancient cultures, including Egypt, India and Mesopotamia. Perhaps the oldest evidence of Cryptology is an ancient inscription, carved about 1900 BC, in the main chamber of an Egyptian tomb. It used some unusual hieroglyphic symbols in place of more ordinary symbols. Although the inscription utilised one of the important methods of cryptography transformation of the text-it was not secret writing. The intention appears to have been to impart authority and dignity to the writing.

However, rather better known technique is attributed to Julius Caesar, who used a simple cipher system more than 2,000 years ago to conceal military information. The method consisted of replacing the letters of alphabets in the original text by letters that are a fixed number of places away. For example, 'A' could be replaced by 'D', 'B' by 'E' and so on. Thus, the key for the cipher would be as follows:

Plain: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Cipher: D E F G H I J K L M N O P Q R S T U V W X Y Z A B C

Using this system, the secret message "ZHOFRPH WR WKH FRPSXWHU FRXUVH" would actually mean "Welcome to the Computer course". There were of course other systems developed around the similar time in history which included approaches such as:

- Writing secret messages backwards.
- Writing messages vertically rather than horizontally.
- Substituting dots for vowels.
- Using alphabets of other languages such as Greek or Hebrew.
- Substituting special symbols for the normal letters of the alphabets.

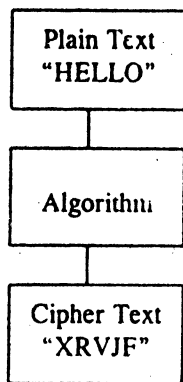
A Caesar type encryption mechanism can be easily is detected by trying all possible displacements till the message becomes meaningful.

3.7 CRYPTOGRAPHY

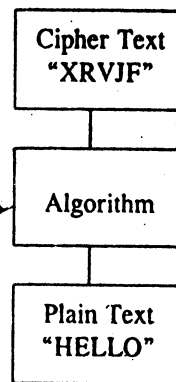
Cryptography is the process of transforming plain text or original information into an unintelligible form (cipher text) so that it may be sent over unsafe channels of communication. A data string (key) controls the transformation process. Anyone getting hold of the cipher text while it is on the unsafe channel would need to have the appropriate key, to be, able to get to the original information. The authorised receiver is assumed to have that key. This is illustrated in the following figure:

Encryption Process

ENCRYPTION



DECRYPTION



The stage of conversion of the plain text into a cryptogram is called Encrypting or enciphering or encoding. Reconverting the cryptogram back into the original form, when done by the authorised person is called decrypting or deciphering or decoding.

3.7.1 Cipher Systems

Although there may appear to be many variations, there are mainly two basic classes of cipher systems. These two classes are called transposition and substitution.

Transposition Cipher

A transposition involves rearrangement or change in the sequence of the letters of the plain text message without any change in their identity. However, the substitution involves a replacement of the plain text letters by other letters (or other symbols) without any change in their sequence. Transposition and substitution may be combined in a single cryptosystem.

The Caesar Cipher mechanism was described earlier and is a specific case of what may be called a "transposition type cipher".

Code System

A code system is a specialised form of substitution in which entire words, long phrases or even sentences of the plain text are replaced by arbitrarily selected equivalents. These may be other words, groups of letters, groups of figures or some combination of these. It is only in rare cases that the substitution process is applied to elements smaller than whole words.

A code system, therefore, makes use of a codebook in which the words, phrases and sentences of the vocabulary are listed in an organised manner and accompanied by their equivalent code groups. Many large commercial firms have their own private codes, constructed especially for their use.

In modern times, communication does not take place only through the passage of text. The same general ideas of substitution and transposition, which were used for literal cryptosystems, are also used for encryption, for speech (ciphony), facsimile (cifax) and television (civision). In literal cryptosystems, the unit of encryption is usually a single character. But in ciphony, cifax, or civision, the relevant unit is a timed portion of the continuously varying audio or image-scanning signal. Ciphony, cifax, civision system are categorised as privacy system or security systems. Privacy system mainly offers the protection against direct listening or direct viewing. The security systems, on the other hand, offer greater protection which actually in some cases will attempt protection against analysis as well.

3.7.2 Data Encryption Standard (DES)

IBM developed the Data Encryption Standards (DES) algorithm in the early 1970s. DES specifies a method for encrypting 64-bit blocks of clear data plain text into corresponding 64-bit blocks of cipher text employing a user-specified 56-bit key. DES may be double-or triple-encrypted for additional security, with the user employing a different key after each transmission.

Because 2^{56} combinations of the keying variable are possible (and these keying variables can be changed readily), the algorithm is deemed by some experts to be highly secure. Cryptography experts in industry and government agencies maintain that DES is still a reliable standard. Operating at one try per microsecond, it would require approximately 2,284 years to break the code. Another consideration is the effect on security if the length of time the key is operative is shorter than the time it would take to search for the key.

DES is commonly used in the design, generation, and verification of personal identification numbers (PINs). These personal passwords are at the heart of the security scheme for validating ownership of automatic teller machine (ATM) debit cards. Message authentication also uses the DES algorithm.

Some experts believe that the DES is breakable. It may be possible for a parallel processor using special integrated circuits to go through all the permutations of a single DES transmission in one day. Although DES offers a high degree of security for commercial threats, the security of DES is lower for national or military threats.

The two main components of the DES-based system are an algorithm and a key. The DES algorithm is a complex interactive process comprised of substitutions, permutations, and mathematical operations. The important feature about the DES approach is that the algorithm is fixed and is public information. However, the actual key used is shared secret between the originator and the receiver of a transmission. Advances in DES include lengthening a key to 128 bits and the multi-pass DES, which involves several passes usually three of encryption and decryption using different keys.

3.7.3 RSA Approach to Encryption

In its continuing search for a truly secret code, another encryption method which is now known as the RSA after its three inventors from the Massachusetts Institute of Technology, namely, Ronald Rivest, Adi Shamir and Leonard Adelman is now considered an important standard. The principle behind the RSA method is that it is easier to multiply two numbers than to factorise their product. This is even more so if the two numbers in question are large prime numbers. For example, it is easy to multiply the prime numbers 11,927 and 20,903 and get the number 249, 310,081. But if you are given the number 249, 310, 081 it is rather difficult to find its prime factors. But if the number is small, such as 35, it is easy to see that its prime factors are 5 and 7. The factoring of 29083 into 127 and 229 comes somewhere in between in terms of level of difficulty. There are an infinite number of prime numbers, and there is no known pattern to them except that they are prime.

Relying on this difficulty, Rivest and his colleague in the year 1977 had proposed the system, which is now known as RSA-129. RSA-129 is a 129 digit number given below which was open to challenge by anyone in the world factorise into its prime factors. This challenge stood unbroken for about 17 years. But in 1993 it was broken through a cooperative effort of academics and hobbyists using over 1500 computers working for over 8 months on the Internet. The RSA-129, 114, 381, 625, 757, 888, 867, 669, 235, 779, 976, 146, 612, 010, 218, 296, 721, 242, 362, 562, 561, 842, 935, 706, 935, 245, 733, 897, 830, 597, 1239 563, 958, 705, 058, 989, 075, 147, 599, 290, 026, 879, 543, 541, factors into the following two prime numbers, one of which is the following number of 64 digits, 3, 490, 529, 510, 847, 650, 949, 147, 849, 619, 903, 898, 133, 417, 764, 638, 493, 387, 843, 990, 820, 577 and the other 32, 769, 132, 993, 266, 709, 549, 961, 988, 190, 834, 461, 413, 177, 642, 967, 992, 942, 539, 798, 288, 533 of 65 digits.

The episode about the RSA is an interesting one to show that what may be considered difficult and impenetrable today may actually be rather easily broken into by more and more powerful computers of tomorrow.

The pursuit of truly secret code, physicists have been contemplating new approaches based on quantum keys. These ideas are still at a theoretical stage but with the kind of development seen in the past in other aspects of the computer industry, it may not be difficult to imagine that this approach of quantum cryptography can become a reality in the coming decade.

3.8 CRYPTANALYSIS

The interpretation of secret communications without any previous knowledge of the system or the key is called cryptanalysis. In the case of modern cryptosystem, this requires extensive theoretical study, unusual power of observation, inductive and deductive reasoning, great concentration and perseverance. Also necessary are vivid imagination guided by good judgment. This has to be supplemented by a special aptitude and intuition gained from long and varied practical experience. It is possible that isolated, short cryptogram may resist solution indefinitely, even if it is in a fairly simple system.

However, a large volume of material even in a very complex cryptosystem-may well be solved with time and effort, and especially with the help of modern powerful computers.

In general, the art of cryptanalysis may be reduced to three basic steps:

- (a) arrangement and rearrangement of data to disclose non-random characteristics or manifestations (e.g., in frequency counts, repetitions, patterns, and symmetrical phenomena);
- (b) recognition of the non-random characteristics or manifestations when disclosed;
- (c) an explanation of the non-random characteristics when recognised. The requirements for the first step are experience or ingenuity and time-which may be appreciably reduced by the use of machine aids; for the second step, experience or statistics; and for the third step, experience or imagination, and intelligence.

3.9 OPEN QUESTIONS AND ACTIVITIES

1. Explore about the basic requirements for your account and password from the system administration of your LAN.
2. Explore the backup policy of your centre.
3. Explore the encryption standards followed if any.

3.10 SUMMARY

It is becoming increasingly essential for all organisations to ensure data security. Ensuring data security on PCs and LANs is a major problem as, inherently, very few mechanism are provided to guard against data loss, corruption, misuse or eavesdropping. Unless the organisation creates security awareness in its work force, any measures for data security are not likely to prove successful.

The organisation must decide on the IT and security policy at the highest level and ensure its strict implementation for a reasonably successful outcome. There are a number of measures available to the organisation, especially on larger system, to ensure data security. Equal attention, however, needs to be paid to PC security, as there is an increasing use of PCs as terminals. That is where, this unit will bring awareness.

In this unit, the major approaches to cryptography have been illustrated. From the elementary Caesar Cipher to the RSA-129, is the range covered. An idea has also been given about the concept of cryptanalysis. This unit only introduces you to these concepts and we do not expect that you will an expert in Cryptography.

3.11 FURTHER READINGS

1. Andrew S. Tanenbaum, *Computer Networks*, Third Edition, Prentice-Hall of India.
2. William Stalling, *Data and Computer Communication*, Prentice-Hall of India.

UNIT 4 COMPUTER VIRUS

Structure

- 4.0 Introduction
- 4.1 Objectives
- 4.2 The Evolution of Virus
- 4.3 The Menace
- 4.4 The Process of Infection
- 4.5 Classification of Viruses
 - 4.5.1 Boot Infectors
 - 4.5.2 System Infectors
 - 4.5.3 General .COM or .EXE infectors
- 4.6 Some Viruses
- 4.7 Prevention
- 4.8 The Cure
- 4.9 Open Indent Questions and Activities
- 4.10 Summary

4.0 INTRODUCTION

The world of computers and Information Technology is going through an era of electronic terrorism, in the form of virus. It is a problem that is potentially so dangerous that it threatens the proper functioning of the computer system in today's information age.

In this unit, we would discuss about the evolution of virus, the menace caused by them, the process of infection, classification of viruses, types of viruses, the prevention and the cure against them.

4.1 OBJECTIVES

At the end of this unit you should be able to:

- define computer viruses and its evolution
- explain the damage a virus can do
- define the process of virus infection
- identify different types of viruses depending on their area of operation/infection
- describe/apply virus preventive measures.

4.2 THE EVOLUTION OF VIRUS

The concept of virus dates back to 1949, when John Von Neumann submitted a paper putting forward the concept of a "Self Replicating" program; the idea seemed impossible and was dropped. Subsequently, the first virus like program appeared in the form of a recreational game called "CODE-WARS" at the Bell Labs of American Telephone and Telegraph Company. In "Code-wars" two players were to code a set of programs that would destroy the other players programs. Realising the potential danger of such programs, the authors did not reveal the presence of such programs. Concurrently, at Massachusetts Institute of Technology, students were carrying out experiments with computer, which no body had ever tried. Their relatively harmless hobby of messing up with other programs gave rise to the idea and concept of computer viruses.

The first commercial application of viruses was in 1985, when two Pakistani brothers, in order to keep track of software piracy used Brain Virus (also known as Pakistani virus) on their low cost software sold from their outlet in Lahore. Hidden in nearly every disk they sold, was an extra program not supplied by the original

manufacturer a snippet of computer code, self-replicating in nature that would infect an unauthorised user's computer by disrupting his operations. These self-replicating programs multiplied so fast that, today, they are a threat to the smooth operation of a computer.

4.3 THE MENACE

The virus, whether biological or electronic is an information disorder. Biological viruses are tiny genetic codes DNA or RNA that take over the machinery of a living cell and are capable of making thousands of replicas of the original virus. Like its biological counterpart, a computer virus carries in it an instructional code that makes copies of itself.

Lodged in a host computer, the typical virus takes temporary control of the computer disk operating system. When the infected system comes in contact with an uninfected computer, the virus passes onto the uninfected machine and, thus spreads like a forest fire, infecting machines after machine with which it comes in contact.

Computer viruses are computer programs, which are a collection of coded instructions. The basic difference between a normal program and a virus is that viruses are self-replicating, they have the capability of executing themselves without being asked for. Computer virus is a very broad term in itself and includes not only viruses, but also Worms and Trojans.

Trojans are similar to viruses. They move around as valid programs, sometimes getting executed with flashy opening screens describing them as- "Word Processor" or a "Database package". Trojans are programs that claim to do something but do something completely different and in the process damage information stored on a computer system. Trojans do not infect other software.

Worms travel longer distances by storing themselves in critical areas of the disk from where they get loaded and have with them sufficient code to transfer themselves outward from the system they infect. Worms have been known to damage and infect entire LANs.

Apart from self-replication, another devastation caused by viruses is data loss. A virus can also take steps to avoid its detection. That makes viruses even more dangerous, because you may come to know about the infection when it has struck. Even though all viruses are developed with a specific characteristic, most of them result in data-loss.

Most viruses are designed to perform simple feats but in order to do so, they:

- Corrupt the most sensitive area of the disk the File Allocation Table (FAT) or the directory area.
- Modify the interrupt organisation of the system, meaning when a read or write to screen operation takes place, it is routed through the virus code in the memory resulting in unresolvable interrupt clashes where a program opens up a file simultaneously for read-write access and the virus interrupts every operation.

Even though the virus may have no instructions built into it to destroy data, it can nevertheless render a disk full of files absolutely useless.

4.4 THE PROCESS OF INFECTION

To understand how a virus infects a system, we go back to the elementary working of a computer. On booting, the system carries out the ROM instructions, the first being the power on Self Test (POST), which is followed by the bootstrap process of reading the boot record and loading of the disk operating system. In MS-DOS, it involves the loading of IBMDOS.COM, IBMBIO.COM and COMMAND.COM along with some optional files like CONFIG.SYS and AUTOEXEC.BAT. The booting process culminates into the system prompt displayed on the VDU.

The infection may begin as soon as a computer system boots from a contaminated disk or executes an infected program. Whatever viruses are present gets activated, which immediately begin to spread throughout the system.

Another important aspect that needs mention here is the Interrupt mechanism. All input/output activities on a PC are carried out by interrupts. The interrupt mechanism in itself is very complex. We will try to understand it with an example. Let us say, a user wishes to save his program and presses the required keys on the key board. This treated as an interrupt. The main memory has specific routines to handle these user requests. One such set of routines exists in the ROM-BIOS and the another is in the DOS program in the memory, loaded from IBMBIO.COM. The routine that services the interrupt requests are termed as Interrupt Service Routines (ISR's) and are located in the memory with their addresses. Then interrupt request activates a number and not the routine address, thus, there exists a table with the interrupt numbers and the corresponding routine address in DOS. When an interrupt request is made, the CPU looks up the table performs the required routines and transfers the control back to the program.

The contents of ISR address table being in the RAM is vulnerable to modification by user programs and that is what a virus does-modify the ISR's address.

4.5 CLASSIFICATION OF VIRUSES

Viruses are classified on the basis of their mode of existence and there are three categories of viruses:

1. BOOT Infectors
2. SYSTEM Infectors
3. GENERAL EXECUTABLE PROGRAM Infectors.

4.5.1 BOOT Infectors

As the name suggests, they are characterised by the fact that they physically reside in the boot sector [0 (zero)] sector of the disk. A system infected by such a virus will have the virus residing in a particular area of the disk rather than in a program file. These viruses get loaded soon after the Power on Self-Test and control the system and remains in control at all times. They sometimes have the capability to trap soft booting (i.e. CTRL ALT DEL) and remain in control even if the system is booted from a non-infected floppy, thereby contaminating the clean floppy.

Boot infectors displaces information originally residing on the location, which they occupy. While writing onto the boot sector, the virus ensures that the boot record is not deleted. Once the virus is loaded, it automatically transfers control to the area where the boot record is available. The reason behind doing this is that the boot record contains instructions to read IBMBIO.COM and IBMDOS.COM and if these files are not readable, access to the disk is not possible, and so the virus becomes ineffective.

Boot infectors typically create "Bad sectors". Boot infectors are the types, which, once loaded would stay in the memory until the system is shut off, and until the disk reformats.

4.5.2 SYSTEM Infectors

This second category of viruses' deals with the components of the system itself. All machines without exception require an operating system in order to create an environment in which the operator works. In MS-DOS, COMMAND.COM contains all the internal commands. If no such command file exists, commands such as COPY, DIR etc. are not loaded onto the memory when the machine is booted. The System Infectors attach themselves to a file such as COMMAND.COM or other memory resident files and manipulate these files.

System infectors differ from Boot infectors in the sense that system infectors gain control after the computer is booted: and infects the hard disk or bootable floppies, which contain the appropriate system files only. They have another peculiarity that they may activate after a given period of time or may instantly begin subtle modifications in system processing such as, increasing the time to perform system functions, scrambling of data, or modification of systems error messages or information messages.

4.5.3 GENERAL .COM or .EXE Infectors.

From the infection point of view, these viruses are most dangerous and devastating of the three classes of viruses. They attach themselves to program files and can spread to almost any executable program in any system. These viruses change the original program instructions into a "jump" to its own code and follows that code with a return to the original program. As a result, whenever the program is executed, the virus gets loaded and executed first and then allows the original program to proceed. It remains memory resident and infects each and every program that is loaded for execution.

By attaching themselves to EXE or COM files, they alter the file size and sometimes multiple infections renders program files too large to be accommodated in the memory.

4.6 SOME VIRUS

The virus list has become a non-ending entity with new viruses joining the list every other day. We would be discussing some of the most commonly prevalent viruses in the computer industry. However, this list is incomplete.

1. Scores Virus

These viruses are prevalent in Macintosh machines. Scores virus has a built in time trigger that activates at two, four and seven days after the disk has become infected. The consequences are varied ranging from printing problems, system crashes and malfunctioning of disk operations. This virus does not directly affect data files, but erasure of this virus requires deletion of all files.

2. Brain Virus

This is one of the first viruses that came into being. Also known as the Pakistani virus, it was developed by the Pakistani brothers to keep track of low cost software, those were sold out of their outlet in Lahore. The virus pops up a screen saying "Welcome to the Dungeon". This virus is known to destroy data and are highly contagious.

3. Lehigh Virus

This virus originated at the Lehigh University Computer Centre. This virus stays in the stack space of COMMAND.COM. With the booting of a PC from an infected disk, the virus is spread through commands such as COPY, TYPE, DIR etc. On any other disk with COMMAND.COM the virus code gets copied to the other disk and a counter is incremented on the parent. When the counter reaches a value of 4, all files of the disk gets erased. The boot sector gets ruined and also the FAT.

4. Friday the 13th

This virus attacks not only the COMMAND.COM but also other executable files. When a .COM or .EXE file is executed for the first time after booting, the virus captures a specific interrupt and inserts its own code; after which, whenever any .EXE file is executed, the virus code is written to the end of the file resulting in increase in size of the file by 1808 bytes. In COM files the virus code is written to the beginning of the file.

The increase in size of the EXE and COM files causes the program to become too large to be loaded into the memory. Also after a certain interval of time, delays are inserted resulting in considerable slowing down of the programs. The worst disaster occurs, if the infected .EXE or .COM is executed when the system date is Friday the 13th, all files get deleted.

5. Sunnyvale Slug

This does a variety of things like displaying a message "Greetings from Sunnyvale. Can you find me?" and also sometimes modifies the COPY Command resulting in deletion of files instead of copying.

6. Raindrops

This virus infects COM files. It intercepts the load and execute function of MS-DOS. It checks whether the file is EXE or not, if the file is not an EXE file, the first three bytes of the file are replaced by a jump instruction at the end of the file, where it gets attached after encryption. This results in dropping or showering of characters on the screen like raindrops and is also accompanied by appropriate sound effects.

7. Happy Birthday 30th

This virus gets activated on January 5th, if any of the infected program get executed, and will ask the user to type "Happy Birthday 30th". It might destroy all the data stored on a disk. The symptoms of this virus are that the computer memory is reported 6KB less than actual e.g. 634 KB instead of 640 KB.

Following is a list of prominent viruses that have created havoc on many machines across the globe. A comprehensive list cannot be built as every other day a new virus gets included into it.

Name	Also known as	Name	Also known as
Marijuana	(Stoned)	Tequila	
Joshi	(Happy Birthday Joshi)	Slow	
Flip		BFD	
Eddie	(Dark Avenger)	World peace	
Jerusalem	(Jerusalem Ver A to E, Friday the 13th)	Kanishka	
		Disk-washer	
Serum	(Yankee Doodle, Version A, B)	Alfa	
Kinky	(Fellowship)	Trikal	
V2000		Mummy	
Zealot	(Keypress)	Mubank	
Changu-Mangu		Charas	
March-6th	(Michael Angelo)	Feist	
Frodo	(4096, 100 Years)	Boabob	
Desi	(Made in India)	Monkey	
Datalock		ExeBug	
Gravity	(Raindrops, 1701,17XX) (1701/1704 Version A, B)		
		Feist	
Hong_Kong		NewBug	
Liberty		1403	
Form			
Pronto	(15XX)	G3	
Taiwan		Cansu	
Invader	(And-CAD)	Dong_2	
Generic	(Keydrop)	Long-1	
Possessed	(Poss)	Khobar	
Black Monday		PFO	
Plastique		Die-Hard-2	
Bosh		Bloomington	
Dir-2		Fat-avenger	
Gumnam		Green-Catapillar	
		Angelina	

4.7 PREVENTION

Even though the computer industry has found a somewhat plausible solution to the virus problem in the form of vaccines, it is always advisable to follow the dictum "Prevention is better than cure". Moreover, the viruses are made faster than the vaccines. It is a good practice to follow some simple precautionary measures, which can reduce the possibility of a virus attack. The precautionary measures are:

- The CHKDSK command can be incorporated to the AUTOEXEC.BAT to check the disk. If the number of hidden files increase, the matter should be looked into
- Do not copy pirated software on your system.
- Write protect tags should be used on the original software diskettes.
- Proper backup of all data and program files should be kept.
- Copying of files should be done carefully, a better practice is to write the COPY command in a batch file with CHKDSK command.
- Used floppies should be reformatted.
- Avoid letting the system to be used by unauthorised users.
- Restrict the use of outside floppies
- Do not download suspicious shareware programs.

4.8 THE CURE

The viruses are not omnipotent. Viruses can be cured with anti-viral programs. The anti-viral programs perform one or more of the following functions:

- prevention
- detection
- vaccination
- inoculation
- identification, and/or
- damage control.

A good anti-viral utility is one which checks whether the system has been infected or not. These programs stop the virus from infecting the system. They do not allow the modification of executable files, so that a file virus cannot get a foothold.

Some of them refuse to let any program make itself resident in RAM unless allowed by the user. Others do not allow the user to run a program unless it is on a list of approved and tested applications. The detectors warn the user of the presence of a virus after it is loaded into the machine or disk. These programs maintain a file with a list of checksum values of the executable files. The identifiers rely on the fact that when the virus replicates, it makes a copy of itself.

The vaccinators inject some code into the executable files. When the vaccinated file is run, the injected code performs an integrity check on the program being executed and warns if any changes have been made.

The innoculators insert the virus signature into infected areas or files at appropriate locations. When the virus performs their self-detection, they find their signature and believe that the memory disk file is already infected and so do not infect.

The better equipped anti-viral programs control damages. They may be preventive or restorative. Preventive techniques include stopping attempts at direct access such as formatting and deleting, or even write protecting the hard disk while testing unfamiliar software. The restorative process is achieved by maintaining a copy of the CMOS information, boot sector information, the file allocation table etc. in a safe area like a floppy.

As a virus can hide itself in many different ways, it is difficult to detect all viruses with just one anti-viral program. Moreover, the virus writers keep altering the viral code, so that any existing anti-viral programs cannot detect it. The point to remember is that there is no cent per cent foolproof anti-virus program available at all, in principle there never will be.

4.9 OPEN INDENT QUESTIONS AND ACTIVITIES

1. Make a list of at least 10 viruses with their characteristics.
2. Make a list of anti-virus packages you are using at your centre.

4.10 SUMMARY

This unit discussed about the threat faced by computer virus. It explains the evolution characteristics of the virus and the damage they can do to a computer. We studied different types of viruses and their characteristics. It also discussed about different preventive measures, that should be taken to get rid of computer viruses. With the development of computer field, new viruses/vaccine software may come.

Therefore, one has to keep track of latest development in this field and know how to counter these problems.





U P RAJARSHI
TANDON OPEN UNIVERSITY

BCA-1.1 Computer Fundamentals & PC Software

Block

3

A GRAPHICAL USER INTERFACE

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BLOCK INTRODUCTION

The advent of Graphical User Interfaces has made computer popular among masses, as computers have become more users friendly. This block provides an introduction to the theoretical and practical aspects of graphical user interface.

The first unit of this block is devoted towards the theoretical aspects of graphical user interfaces, while remaining units mainly focus on a popular GUI Windows 95.

In the first unit, the definition, evolution of GUIs, the terminology associated with GUIs and terminology related with Windows, has been discussed.

The second unit presents the system setting and disk utilities of Windows 95, a popular GUI. Please note that the purpose of this unit is to provide you information about various system management utilities of Windows that you can use whenever the need be.

The third unit deals with the use of file systems in Windows. It presents the utilities available in Windows 95 for handling various files and folders. This is also a practical unit.

Fourth, fifth and sixth units are also practical oriented and cover aspects relating to, how to run various programs, accessories, configuring computer on a network, working in networked environment, and multimedia tools available with Windows 95.

UNIT 1 INTRODUCTION TO GRAPHICAL USER INTERFACE (GUI)

Structure

- 1.0 Introduction
- 1.1 Objectives
- 1.2 What is Graphical User Interface?
- 1.3 Evolution of the Human and Machine Interaction
- 1.4 Common Graphical User Interface Terms
- 1.5 Microsoft Windows (MS-Windows)
 - 1.5.1 Structure of a Window
 - 1.5.2 Basic Techniques for Working in Windows
 - 1.5.3 Using Menus
- 1.6 Working with a Dialog Box
- 1.7 Starting Windows 95
 - 1.7.1 Task Bar
 - 1.7.2 Start Menu
 - 1.7.3 Shortcut Menus
 - 1.7.4 Setup Screen Saver
 - 1.7.5 How to get Help?
 - 1.7.6 Shut Down Windows 95
- 1.8 Summary
- 1.9 Model Answer

1.0 INTRODUCTION

The Graphical User Interface (GUI) is one of the most revolutionary changes to occur in the evolution of modern computing system. In less than 10 years, the expectation of what the interaction between human and computer would be like was changed from a terse, character-oriented system to the now more graphics-oriented system. This revolution has increased the accessibility and usability of computer systems to the general public.

In this unit, we will look at another type of software, which helps users to interact with the system easily and to perform a complex task with little knowledge of operating system or memorised commands. The software providing such features supports Modern User Interface concept such as desktop metaphor, which makes computer available to the majority of people who are either novice or non-programmers. The personal computer was invented for these users.

In this unit, we will look at several aspects of GUI, starting from common GUI terms, major components of GUI, its history and finally a popular package supporting GUI - MS-Windows.

1.1 OBJECTIVES

After going through this unit, you will be able to:

- define what is GUI and how it is different from character oriented system,
- define all the terms related with GUI
- identify important features of GUIs
- identify resources available in MS-Windows, and
- identify various dialog-box options.

1.2 WHAT IS GRAPHICAL USER INTERFACE?

The terms “user interface” originated in the engineering environment in the late 1970s. Virtually every one who interacted directly with computers had been engineers and programmers, but a new kind of users was emerging: the non-programming user. These users often reacted more negatively to difficulties in dealing with a machine. New forms of interaction was needed, new interfaces were required and attention flowed to “the user interface”.

With the introduction of the Macintosh in 1984, Apple Computer popularised the user interface as it is known today. Apple’s use interface is now commonly referred to as a Graphical User Interface or GUI. The GUI has become associated with a common feature set available in a number of product offerings. Common features include:

- secondary user-input devices. Usually a pointing device and typically a mouse,
- point and shoot functionality with screen menus that appear or disappear under pointing-device-control,
- windows that graphically display what the computer is doing,
- icons that represent files, directories and other application and system entities,
- dialog boxes, button, sliders, check boxes and many other graphical metaphors that let the programmer and user tell the computer what to do and how to do it. ..

Today’s GUIs have expanded basic functionality to support not only graphics but also dimensions, colour, height, video and highly dynamic interaction. Modern user interfaces can simulate a very realistic view of a real, three-dimensional world.

1.3 EVOLUTION OF THE HUMAN AND MACHINE INTERACTION

The primary means of communication with computer until recently has been through command-based interfaces. In command interfaces, users have to learn a large set of commands to get their job(s) done. In early computer systems paper tapes, cards and batch jobs were the primary means of communicating these commands to the computers. Later, time-sharing systems allowed the use of CRT terminals to interact/communicate with the computer. Users trying to share precious computer resources such as CPU and peripherals heavily burdened these early systems.

The batch system and time sharing led to command-driven user interfaces. Users had to memorise commands and options or consult a large set of user manuals. The early mainframe and minicomputer systems required a large set of instruction manuals on how to use the system. In some systems, meaningful terms were used for command names to help the end-user. But in other systems the end-user had to memorise several sequences of keystrokes to accomplish certain tasks.

Early users of computers were engineers and what we now call expert users; users that had a lot of interest in knowing more about the computer systems and the technology. Command line interfaces were acceptable by the majority of these users. In the 1970s, computers were introduced to a new class of users: secretaries, managers and non-technical people. These new users were less interested in learning computer technology and more interested in getting their jobs done through the machine. The command based interfaces caused many of these new users to develop computer phobia. Imagine the thought of memorising commands made up of “Control-Alt-Del” to boot the system.

To make life easier for the end-user, a large collection of devices have been invented to control, monitor and display information. The early (and still widely used) peripherals are the keyboard and the video terminal. But, it was not until the late 70s, research projects at some universities led to the invention of pointing devices

and windowing systems. The mouse and joystick were among some of the few pointing devices that were invented in this period. Also, research pioneers invented the notion of splitting the screen to allow multiple windows and direct manipulation of objects.

In the 70s, researchers designed powerful new workstations armed with graphical user-interfaces. The basic assumption of these new workstations was that one user could have a powerful desktop computer totally dedicated to that user's task. Thus, the computer is not only used to perform the task, but can also provide a much more intuitive and easy-to-use environment.

Instead of memorising commands to each stage, the user selects a command from a menu bar displaying a list of available commands. For example, Figure 1 displays the menu bar. This menu bar displays a list of commands available such as File, Edit and view. When the mouse is clicked on any one of these menu commands the appropriate action is taken.

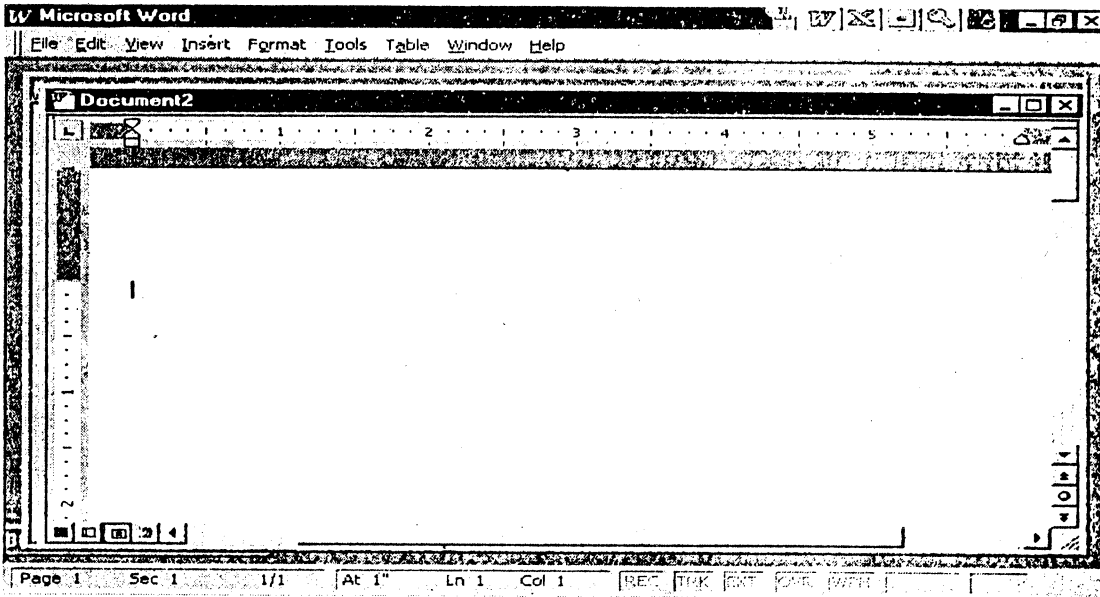


Figure 1: Menu Bar

Pull-down and pop-up menus display option commands available for each selection. Figure 2 shows the pull-down menu displayed when the file menu item is selected. The user can then select from different file related activities.

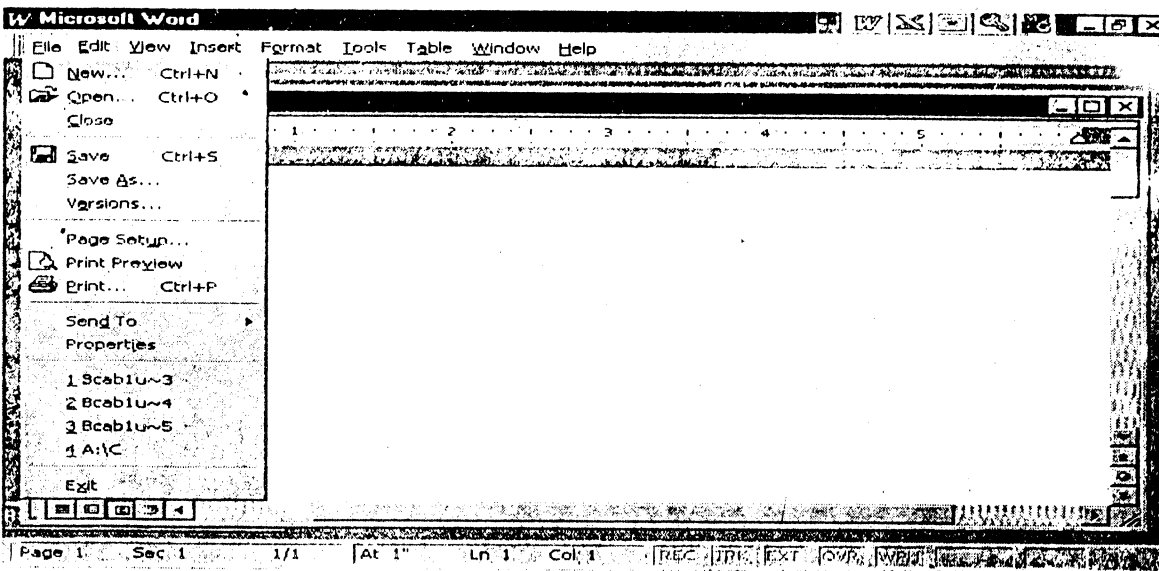


Figure 2: Pull-down Menu

Dialog boxes allow more complex interaction between the user and the computer. Dialog boxes employ a large collection of control objects such as dials buttons, scroll bars and editable boxes. For example, in figure

3, a dialog box is used to open a file. This dialog box is composed of two buttons called Open and Close and edit box that allows a file name to be entered and a scroll region that allows navigation through the list of files and directories available on the disk. Clicking on the open button causes the file to be viewed.

In graphical user-interfaces, textual data is not the only form of interaction. Icons represent concepts such as file folders, waste baskets, and printers etc. Icons symbolize words and concepts commonly applied in different situations. Figure 4 shows the paint utility with its palette composed of icons. Each one of these icons represents a certain type of painting behaviour. Once the pencil icon is clicked, for example, the cursor can behave as a pencil to draw lines.

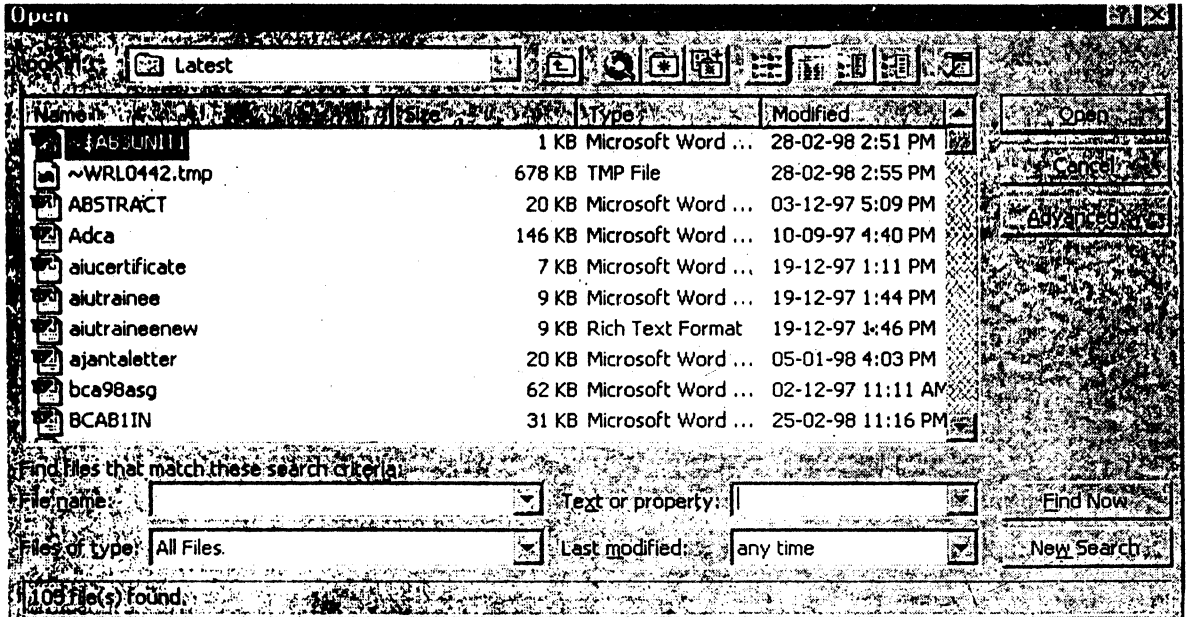


Figure 3: Dialog box

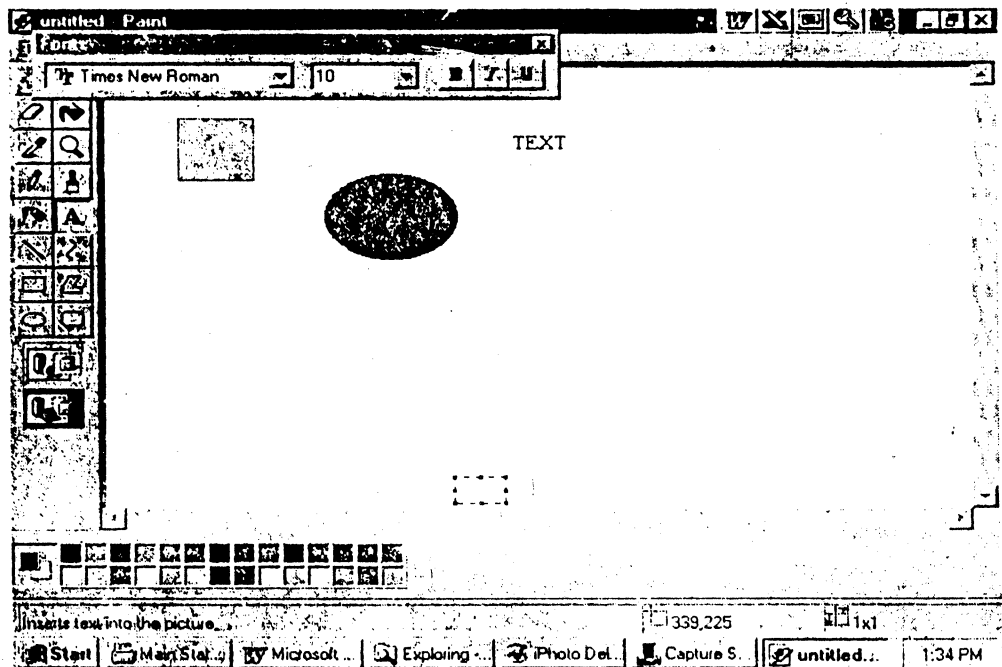


Figure 4: Paint Palette

The idea of metaphors has brought the computer closer to the natural environment of the end-user. The concept of physical metaphor paradigm developed by Alan Kay, initiated most of the research for graphic

user interfaces based on new programming approach called **object oriented programming**. Discussion on this subject is beyond this unit. This will be covered in detail in **C++ and object oriented programming** course. The physical metaphor is a way of saying that the visual display of a computer system should present the images of real physical objects.

For example, the wastepaper basket icon can be used to discard objects from the system by simply dragging the unwanted objects into the wastepaper basket, as in real life. The desktop metaphor probably has been the most famous paradigm. Because of the large set of potential office users, this metaphor can have the most dramatic effect. In this paradigm, the computer presents information and objects as they would appear and behave in an office, using icons for folders, in-baskets, out-baskets and calendars.

1.4 COMMON GRAPHICAL USER INTERFACE TERMS

This section presents a list of terms and commonly with the graphical user interface (GUI).

1. Pointing devices

Pointing devices allow users to point at different parts of the screen. Pointing devices can be used to invoke a command from a list of commands presented in a menu. They can also be used to manipulate objects on the screen by:

- Selecting objects on the screen
- Moving objects around the screen, or
- Merging several objects into another object.

Since 1960s, a diverse set of tools have been used as pointing devices include the light pen, joystick, touch sensitive screen and the popularity of the mouse is due to optimal coordination of hand and easier tracking of the cursor on the screen.

2. Bit-mapped displays

As memory chips get denser and cheaper, bit displays are replacing character-based display screens. Bit-mapped displays made up of tiny dots (pixels) that are independently addressable and provide much finer resolution than character displays. Bit-mapped displays have advantages over character displays. One of the major advantages includes graphic manipulation capabilities, which present information in the final form on paper (also called WYSIWYG: What You See Is What You Get).

3. Windows

When a screen is split into several independent regions, each one is called a window. Several applications can display results simultaneously in different windows. Figure 5 presents a screen with two windows.

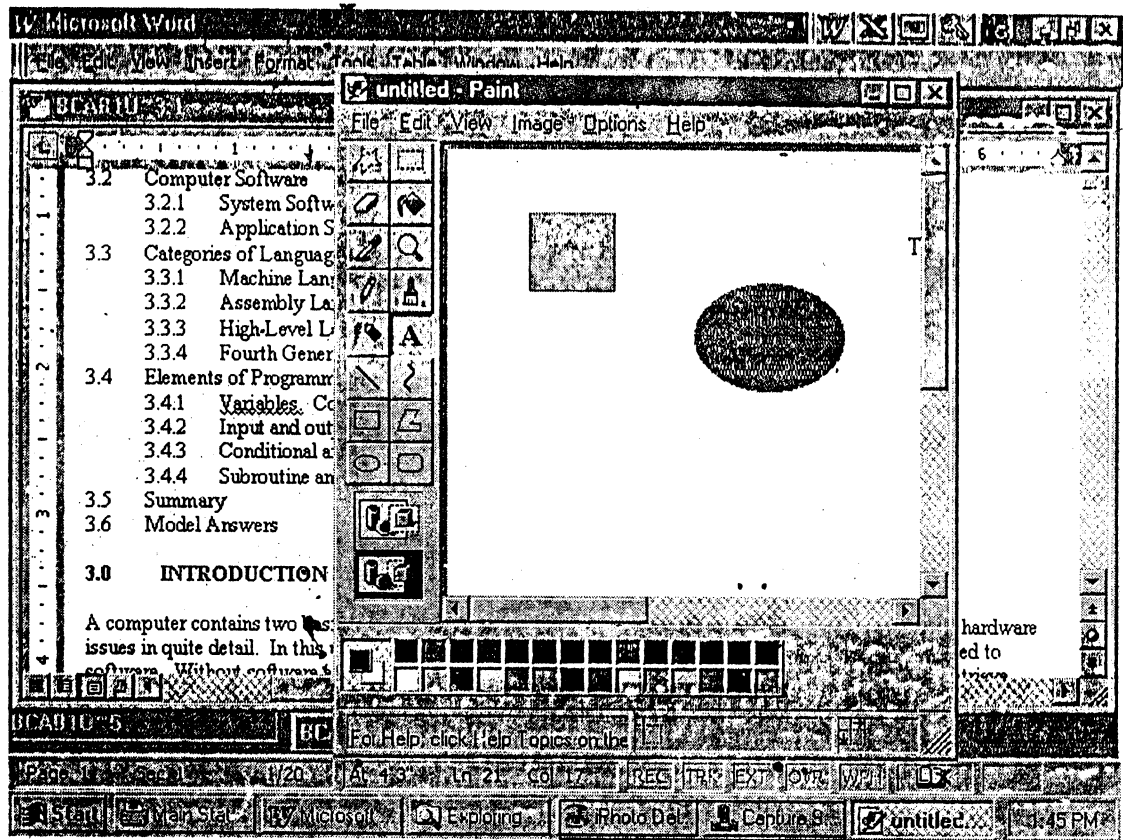


Figure 5: Screen with two windows

The end-user can switch from one application to another or share data between applications. Windowing systems have capabilities to display windows either tiled or overlapped (Figure 6 and Figure 7). Users can organise the screen by resizing the window or moving related windows closer.

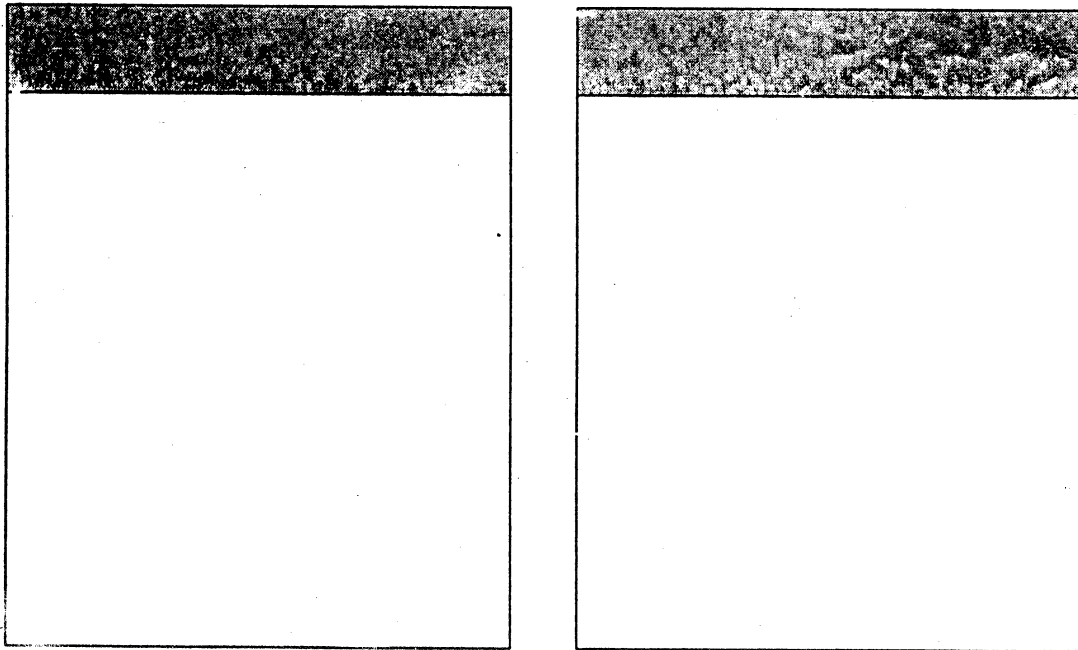


Figure 6 : Tiled Windows

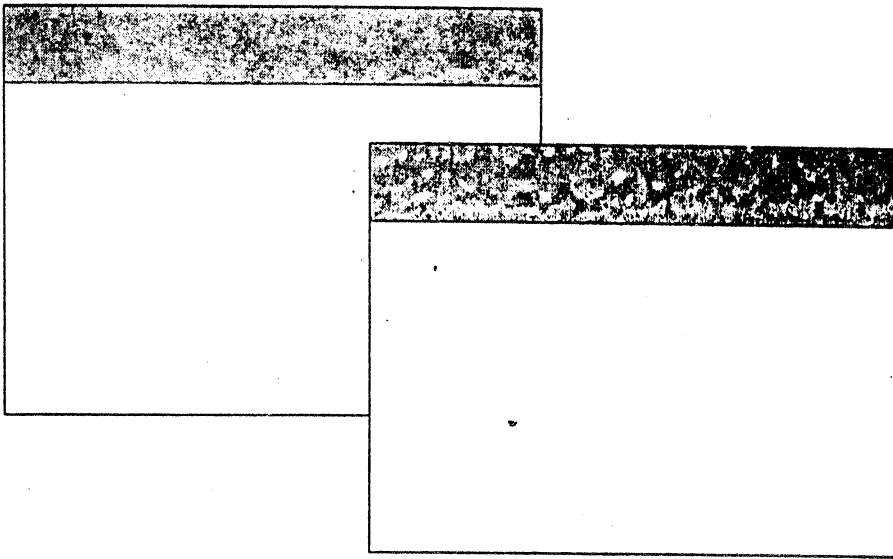


Figure 7: Overlapped Windows

4. Menus

A menu displays a list of commands available within an application (Figure 1). From the menu, the end-user can select operations such as File, Edit, view. Instead of remembering commands at each stage, a menu can be used to provide a list of items. Each menu item can be either a word or an icon representing a command or a function. Menu item can be invoked by moving the cursor on the menu item and selecting the item by clicking the mouse.

When a menu icon is invoked it could cause other menus, called **pull-down menus**, to appear. **Pull-down menus** (Figure 2) are used to present a group of related commands or options for a menu item. Figure 2 presents the File pull-down menu.

5. Dialog boxes

Dialog boxes are used to collect information from the user or to present information to the user. For example, when printing a file, (Figure 8) a dialog box is displayed to get additional information.

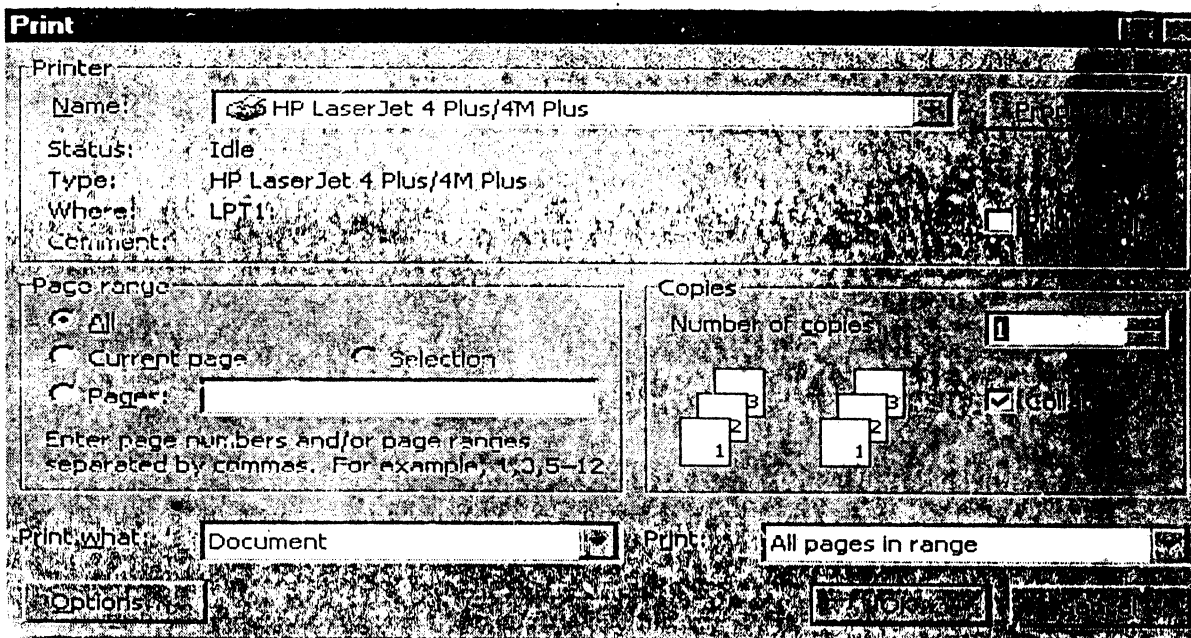


Figure 8: Dialog box

Some of the information obtained is the number of copies and page numbers to be printed. Dialog boxes are also used to indicate error messages in the form of alert boxes. Dialog boxes use a wide range of screen control elements to communicate with the user.

6. Icons

Icons are used to provide a symbolic representation of any system/user-defined object such as file, folder, address, book, applications and so on. A specific type of icon represents different types of objects. In some GUIs, documents representing folders are represented by a folder icon (Figure 9). A folder icon contains a group of files or other folder icons. Double clicking on the folder icon causes a window to be opened displaying a list of icons and folder icons representing the folder's contents.

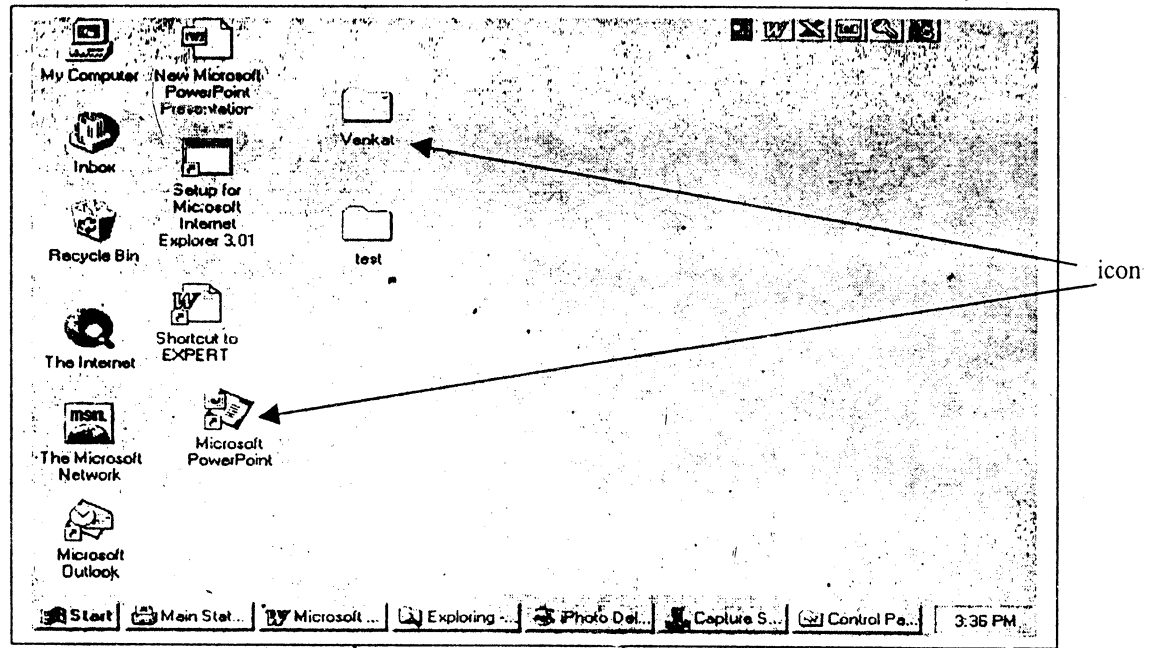


Figure 9: Icons

7. Desktop metaphor

In the desktop metaphor, users are not aware of applications. Users deal with files, folder, drawer, a clipboard and an out-box. Instead of starting the word processor and loading file, users merely open the report document, which implicitly invokes the word processor. Clicking the mouse on an icon representing the report cause word processor to get started and to load the report file implicitly. Today, several computing environments provide this capability.

8. Graphic User Interfaces

GUIs are systems that allow creation and manipulation of user interfaces employing windows, menus, icons, dialog boxes, mouse and keyboard. Macintosh toolbox, Microsoft windows and X-windows are some examples of GUIs.

Check Your Progress 1

1. What is GUI and what are its features?

.....

.....

.....

2. Define the features of the followings:

- (a) Windows
- (b) Pull-down menu
- (c) Dialog Box
- (d) Pointing devices

.....

.....

.....

.....

3. What is the difference between Bitmapped and character based displays?

.....

.....

.....

.....

1.5 MICROSOFT WINDOWS (MS-WINDOWS)

MS-Windows is the most popular GUI for personal computers. Windows provides an environment that enhances DOS in many ways. The major benefits of Windows are:

1. **Common Look and Feel :** All Windows applications have the same basic look and feel. Once you know one or two Windows applications, it is easy to learn another one.
2. **Device Independence :** Windows presents a device-independent interface to applications. Unlike most of today's DOS applications, a Windows application is not bound to the underlying hardware such as mouse, keyboard or display. Windows shields the applications from this responsibility. The application deals with the Windows API to manipulate any underlying devices.
3. **Multitasking:** Windows provides non-pre-emptive multitasking support, Users can have several applications in progress at the same time. Each application can be active in a separate window.
4. **Memory Management:** Windows also provides memory management to break the 640K limitation of MS-DOS. An application has the ability to use the extended memory, share data segments with other applications and swap unwanted segments to disk.
5. **Support for existing DOS applications :** Windows allow most standard DOS applications to run under it directly. Any application that does not control the PC's hardware, use the PC BIOS or MS-DOS software interrupts, can run in its own window.
6. **Data Sharing :** Windows allows data transfer between application Clipboard. Any type of data can be transferred from one window with the Clipboard. The Dynamic Data Exchange (DDE) protocol

defines how two applications can share information. Information such as bitmap, metafile, character strings and other data formats can be shared.

7. **Support for Object Orientation :** In order to create screen objects such as windows, the application developer defines a class (similar to record) specifying the necessary properties. Instances of class can then be created. Several applications can share the same windows simultaneously. To communicate with instances of a window class, messages are sent and received by a special function called the window function. The windows handles all messages such as re-drawing the screen, displaying icons or pop-up menus and changing the contents of the client area (refer to Figure 10). This facilitates the process of Application development. An application can choose to display the window, resize the window, display additional information in the client area, and so on.

1.5.1 Structure of a Window

For the sake of simplicity certain parts, such as title bar and menu bar, are common for most of the windows. Since the window parts of many of the window based application software are common, this makes a person to understand and memorise faster. You will see that the button to maximise or to minimise always appear on the right top corner in all the windows. Similarly the menu bar, the title bar, the control menu bar also appear at the same place for all the windows. This way if you get familiar to one window, you will get familiar with the other windows too as the meaning for each of the similar buttons remain the same. Depending upon the type of application all windows, however, may not have every element.

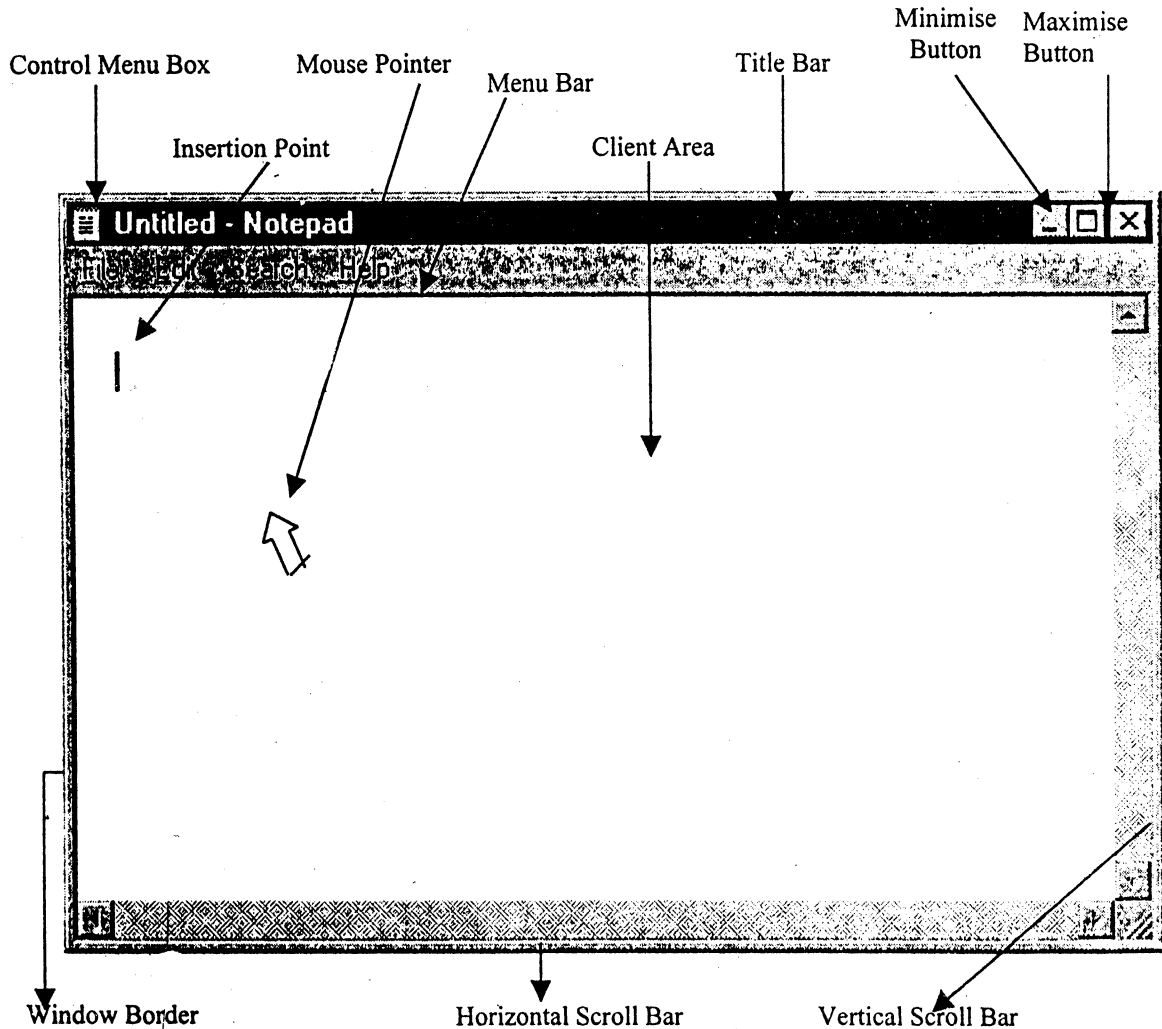


Figure 10: Parts of a Window

Control-menu box	It is in the upper-left corner of each window. Clicking on the Control-menu box opens the Control menu. The Control menu can be used to move, size, and close a window while working with the keyboard.
Title Bar	It shows the name of the application, document, or a folder name.
Menu Bar	It lists the available menus. A menu contains a list of actions or commands.
Scroll Bars	They are used to move through a document or a list when the entire document or list does not fit in the window.
Maximise Button	Clicking this button using the mouse enlarges the active window so that it fills the entire desktop.
Minimise Button	Clicking this button reduces the window to an icon and arranges it on the desktop. Minimising the application window does not quit the application.
Restore Button	The Maximise button is replaced by the Restore button after the window is enlarged. Clicking this button returns the window to its previous size.
Window Border	It is the outside edge of the window. The window can be resized by lengthening or shortening the border.
Insertion Point	It is a flashing vertical bar that marks the place where text or graphics are to appear on typing or drawing.
Mouse Pointer	An arrow used for pointing items. It appears if the mouse is installed on the system.
Client Area	Area inside the window which is under the application control.

Pop-up and Child Windows

Pop-Up and child windows are special types of windows, and are used to communicate information between the application and the end-user. They remain on the screen for a short period of time. Dialog boxes discussed in the next section, are more sophisticated form of pop-up windows. MS-Windows provides a collection of pre-defined child windows.

Resources

Resources are used to manage windows and user-defined objects. MS-Windows provides nine kinds of resources to application developers. These resources are : icons, cursors, menus dialog boxes, fonts, bitmaps, char strings, user-defined resources, and keyboard accelerators.

1. **Icons and cursors:** Windows defines a few types of icons and cursors. An icon or a cursor is essentially a bit-mapped region that is used to represent and symbolise a window or cursor. A developer can also define an original icon or cursor using the ICONEDIT utility.
2. **Menus :** Each window can have its own menu bar. A menu item can be a character string or a bitmap. Each item of a menu bar in turn can have a pop-up menu presenting a list of options. Currently, Windows does not support nesting of pop-up menus within other pop-up menus. (Windows 3.0 provides this functionality). But a pop-up menu can invoke a dialog box.
3. **Dialog boxes :** These provide another mechanism besides pop-up menu and menu bars to obtain information from the end-user. Dialog boxes are much more flexible than menu bars or pop-up menus. Dialog boxes usually contain a group of child windows such as buttons, scroll bars, and editable fields. Just like windows, dialog boxes have a function that is used to process messages received from the user upon selection of options.

4. **Fonts** : Windows provides a few families of fonts with different sizes and shapes : **modern, roman, Swiss, Helvetica, and script**. Application processors and desktop publishing can define additional fonts as needed.
5. **Bitmaps** : They are used to represent icons, cursors, or draw picture on the screen. Both mono and colour bitmaps can be defined.
6. **Character Strings** : Character strings are handled as resources mainly to provide a manageable solution to internationalisation of a window application.
7. **User-Defined Resources** : These can be used for any purpose and support any user-defined data type. Any arbitrary data can be managed as a user-defined resource.

1.5.2 Basic Techniques for Working in Windows

Windows offers an on-line Tutorial in which one can practice working with a mouse and performing basic Windows tasks. To run the Tutorial, choose the **Windows Tutorial** command from the **Help** menu.

Using a mouse is usually easier and faster than using the keyboard but one needs to know both mouse and keyboard techniques to work in Windows. Almost all the functions in Windows can be performed using either the keyboard or a mouse.

Basic Mouse Techniques

Generally the mouse has two buttons where one is the primary mouse button and the other is secondary. In Windows, the left mouse button is set as the primary button by default. The primary button is used to perform the majority of the tasks whereas the secondary button is used to display shortcut menu for the **current** window application.

Term	Meaning
Click	To quickly press and release the primary mouse button to select a single item.
Double-click	To click the primary mouse button twice in rapid succession to carry out an action after the item is selected.
Point	To move the mouse until the mouse pointer on the screen points to the item of choice.
Drag	To press and hold down the primary mouse button while moving the mouse.
Drag-and-Drop	Pointing to the item of choice, press and hold down the primary mouse button while moving the mouse. Release the mouse button on reaching the desired location to place the item.

The similar operations can be performed using keyboard also. For equivalent keyboard commands refer to your windows manual.

1.5.3 Using Menus

Each application window, and other windows as well, have *menu names* located on the *menu bar*. Commands, the actions that can be carried out in Windows, are listed on *menus*. Along with the menus on the menu bar, each window also has a control menu.

Menus on the Menu Bar

The menu on the menu bar can be selected and opened by pointing it and then clicking the primary mouse button. After opening the menu, a command or a menu item can be selected by dragging the selection cursor down or up the menu until the menu item is highlighted and release the mouse button to execute the command.

Clicking the menu name or anywhere outside the menu can close the menu. Pressing the ESC key on the keyboard can perform the same, but the control remains on the menu bar.

There are a number of menu conventions used in Windows, which are as follows:

Menu Convention	Meaning
Dimmed (or not visible) command	The command cannot be used with the application at the current time.
An ellipsis (...) following a command	A dialog box appears on choosing the command. The dialog box contains options need to be selected before carrying out the command.
A check mark (✓) to the left of a command	The command is in effect. By choosing the command again the check mark is removed and the command is no longer in effect.
A key combination to the right of a command	The key combination is a shortcut for choosing the command. Pressing the keys carry out the command without opening the menu.
A triangle (▶) to the right of a command	On choosing this command, a cascading menu appears, listing additional commands.

Control Menu

Application windows, document windows and their icons; and some dialog boxes have a Control menu. The commands on the Control menu allow one to work with a window. A window can be moved to a different location, or enlarged and even reduced to an icon using these commands. The commands that are on the Control menu and the way this menu is opened vary. The Control menu for windows and dialog boxes can be opened by selecting the Control-menu box in the upper-left corner of the window or dialog box. The Control menu for an icon is opened on selecting the icon. Some commonly found Control menu commands are as follows:

Use	To
Restore	Restore the window to its former size after it is reduced to an icon or enlarged.
Move	Move the window to another position by using the keyboard.
Size	Change the size of the window by using the keyboard.
Minimise	Reduce the window to an icon
Maximise	Enlarge the window to its maximum size.
Close	Close the window or the dialog box and even quit the application.

1.6 WORKING WITH A DIALOG BOX

A *dialog box* supplies additional information to a command, required for the completion of a task. An ellipsis(...) after a menu command indicates that a dialog box will appear on choosing this command. Most dialog boxes contain options that can be selected. After specifying the options, one can choose a command button to carry out the command. Some other dialog boxes may display information, warnings, or error messages. Moving a dialog box is just like moving a window - by dragging the title bar or using the Move command on the Control menu.

Types of Options

One may need to select one or more options within a dialog box and for this one need to move from one option to another. To move within a dialog box :

One can either click that option or press TAB to move to the next option and SHIFT+TAB to the previous option.

The currently selected option is marked by the selection cursor, which appears as a dotted rectangle, a highlight or both. The types of dialog box options are as follows :

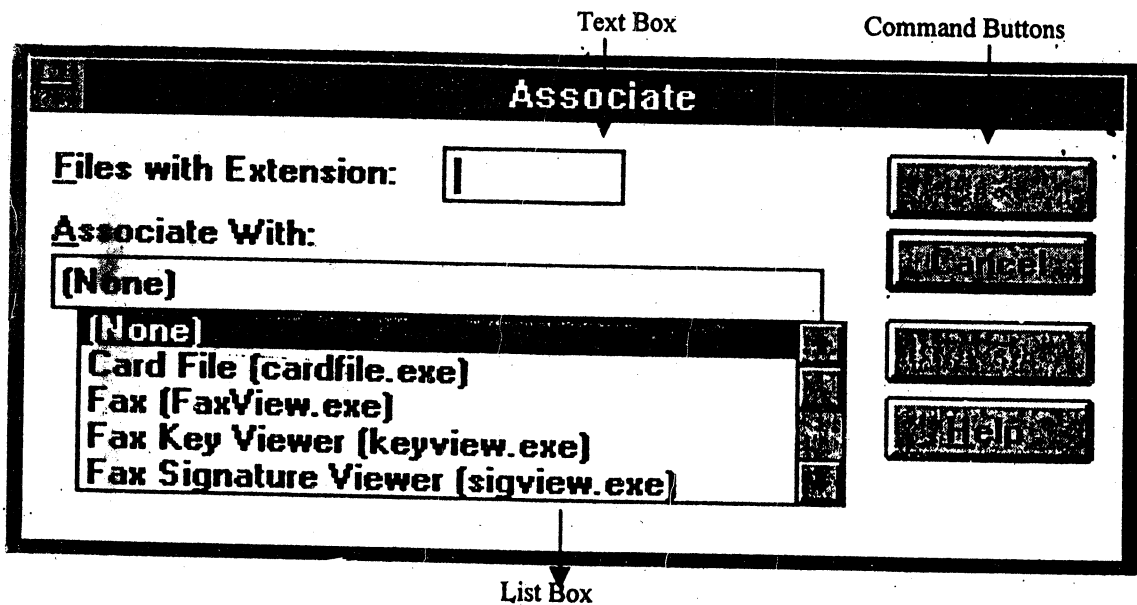


Figure 11: Dialog box options

Command Button

A Command Button initiates an immediate action, such as carrying out or canceling a command. The OK, Cancel and Help buttons are common command buttons. They are often located along the bottom or on the right side of the dialog box. Some command buttons are marked with greater-than signs (>>) which expands the active dialog box. A command button containing an ellipsis (...) opens another dialog box.

Text Box

A text box is used to type information. On moving to an empty text box, an insertion point appears to its far left side.

List Box

A list box displays a list of choices. If there are more choices than can fit in the box, scroll bars are provided to move quickly through the list.

Usually only one item can be selected in a list box; and in some cases, more than one item can also be selected.

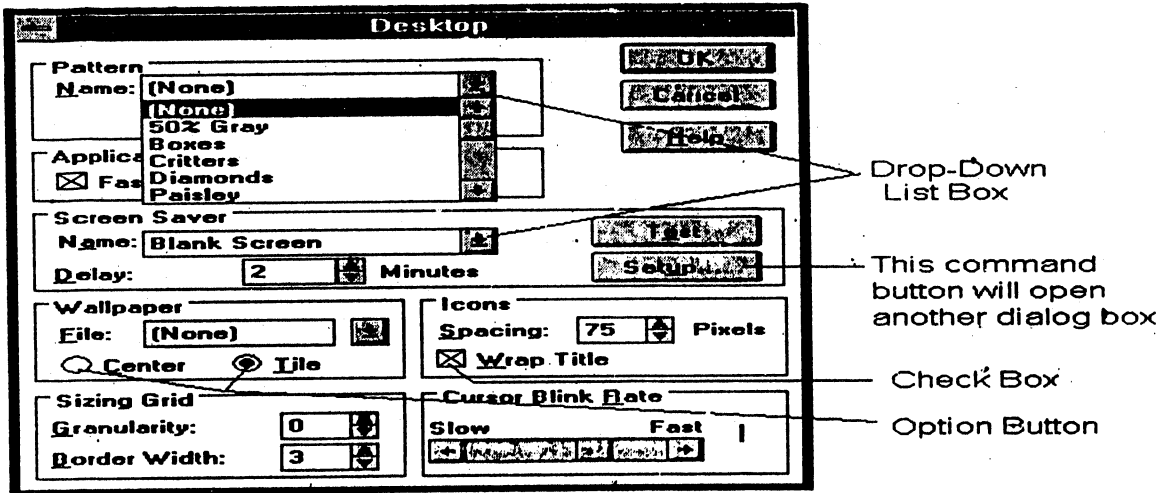


Figure 12: More Dialog box options

Drop-Down List Box

A drop-down list box appears initially as a rectangular box containing the current selection. On selecting the down arrow in the square box at the right, a list of available choices appears. If there are more choices than can fit in the box, scroll bars are provided.

Option Buttons

Option buttons represent a group of mutually exclusive options. Only one option can be selected at a time. The selected option button contains a black dot. If one option is already selected, then the current option replaces it.

Check Box

A check box presents non-exclusive options, that is, more than one option can be selected at a time. Selected check boxes contain an X.

Check Your Progress 2

1. What are the four major components of GUI? Explain the functioning of any one component.

.....

.....

.....

2. How does MS-Window enhance DOS environment?

.....

.....

1.7 STARTING WINDOWS 95

This section and onwards, we will be mainly discussing about the Windows 95 vision by Microsoft. For starting Windows 95, simply switch-on the computer and you will come directly to Windows 95 screen (as shown in the figure given below). This screen is called the desktop (metaphor), the settings of which can be changed as the user likes.

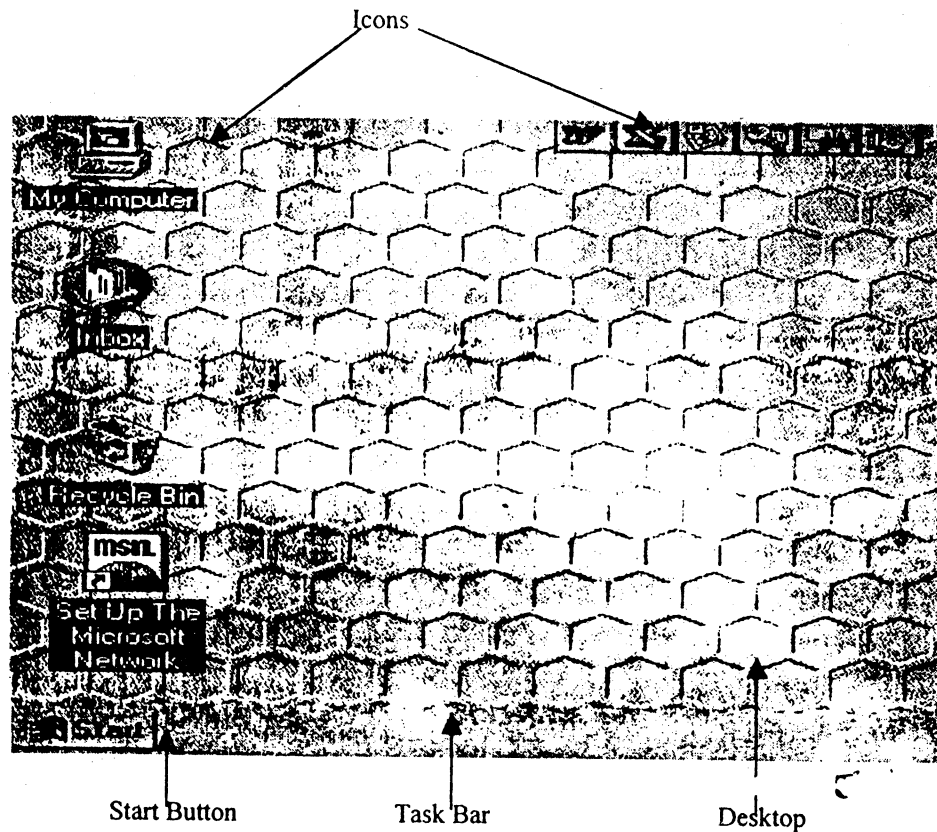


Figure 13: Start Window 95

To adjust settings such as desktop colour and background, use the right mouse button to click anywhere on the desktop, and then click **Properties**.

The icons on the left side represent some of the accessories and tools. They provide the short and easier access to the features that we will discuss in the later sessions. The bar that is at the bottom of the screen is called the taskbar.

1.7.1 Task Bar

The taskbar contains the **Start** button, which is used to quickly start a program or to find a file. It is also the fastest way to get Help. By default, the taskbar and the Start menu are always visible when Windows is running.

Also when you open a program, a document, or window, a button appears on the taskbar. You can use this button to quickly switch between the windows you have opened.

To customize the taskbar, right-click on it, and click on **Properties**.

Click on the **Start** button. The menu options (as shown in Figure) are popped-up above the taskbar. From here you can start your adventure with Windows 95.

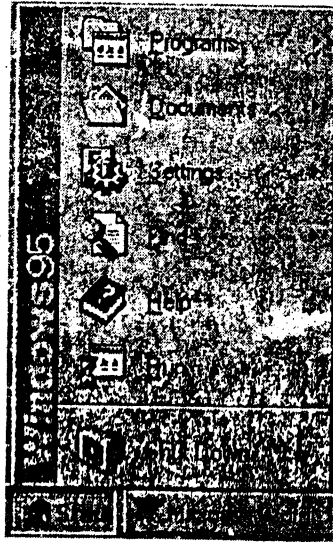


Figure 14: Start Menu

When you click on the option that has a right pointed arrow, a cascading menu appears. Depending on your computer and the options you have chosen, you may see additional items in these cascading menus. An overview of each command is shown below :

COMMAND	DOES THIS
Programs	Displays a list of programs you can start.
Documents	Displays a list of documents that you have opened previously.
Settings	Displays a list of system components for which you can change settings.
Find	Enables you to find folder, file, shared computer, or mail message.
Help	Starts Help.
Run	Starts a program or opens a folder when you type an MS-DOS command.
Shut Down	Shuts down or restarts your computer, or logs you off.

The Start menu can be customised (add/remove programs) in the following way:

1. Click the **Start** button, and then point to **Settings**.
2. Click **Taskbar**, and then click the **Start Menu Programs** tab.
3. Click **Add**, and then click **Browse**.
4. Locate the program you want to add, and then double-click it.
5. Click **Next**, and then double-click the menu on which you want the program to appear.

Type the name that you want to see on the menu, and then click **Finish**.

7. If Windows prompts you to choose an icon, click one and then click **Finish**.

1.7.3 Shortcut Menus

Use the right mouse button to click any item and see a shortcut menu. This menu contains common commands that you can use on the item you clicked. For example, by clicking on the blank area on the taskbar with your right mouse button, you can choose to arrange windows and customize taskbar.

To work with files and folders, instead of using the standard menus to find the command you need, use the right mouse button to click a file or folder. The menu that appears shows the most frequently used commands for that file or folder.

1.7.4 Setup Screen Saver

The screen saver is set to save the wear and tear of the screen. The screen saver starts if your computer is idle for the number of minutes specified in the Wait box. To clear the screen saver after it has started, move your mouse or press any key.

By default, only a limited set of screen savers is installed during Windows Setup. If you assign a password to a screen saver, people who do not know the password cannot clear the screen saver, and therefore cannot easily gain access to your computer.

To set-up the screen saver, follow the steps given below

1. Right-click on the desktop and select **Properties** OR Choose **Settings** option from the **Start** menu, then select **Control Panel** and choose **Display** from the displayed items.
2. Click on the **Screen Saver** tab.
3. Click on the down-arrow under **Screen Saver** field and browse through the different screen savers.
4. Choose the one that you like.
5. Click on **Settings...** button to customize the way it works.
6. You can set the password by choosing the option **Password Protected**.
7. **Set Password...** button is activated. Click on it and specify the password.
8. Preview the screen saver and set the timings, so that after the specified time, the screen saver will be activated.
9. Press **OK**.

1.7.5 How To Get Help?

If you do not know how to do something, you can look it up in Help. Just click the **Start** button, and then click **Help**.

You can get Help on each item in a dialog box by clicking the question-mark button in the title bar and then clicking the item.

To learn what any toolbar button is for, you can rest your mouse pointer on the button for a few seconds. Windows displays the button name.

To find a topic in Help, follow the tips given below:


1. Click the Contents tab to browse through topics by category. If your Help file does not have a Contents tab, click the Contents button to see a list of topics.
2. Click the Index tab to see a list of index entries: either type the word you are looking for or scroll through the list.
3. Click the Find tab to search for words or phrases that may be contained in a Help topic.

To search for words in a Help file, follow the steps given below:

1. In Help, click the Find tab. If this is the first time you have clicked the Find tab, follow the instructions on your screen to compile a word list.
2. In the first text box, type the word(s) you want to find. Matching words appear in the list below it.
3. In the list of matching words, click the word(s) you want to look for.
4. In the bottom list box, double-click a title to display the topic.

If you want to look for more than one word, separate them with spaces in the first text box. When you look for hyphenated words, be sure to type the hyphen. To set specific search criteria, click Options.

To get Help in a dialog box, follow the steps given below

1. Click  at the top of a dialog box, and then click the item you want information about. If the dialog box does not have the button, look for a Help button, or try pressing F1.
2. The pop-up window displays the related information. To close the pop-up window, click inside it.
3. If you want to print or copy the information in a pop-up window, use the right mouse button to click inside it, and then click Print Topic.

OR

Another way to get Help on an item on the screen is to use your right mouse button to click the area you want Help on, and then click the What's This? command.

1.7.6 Shut-Down Windows 95

To shut down your computer, click the Start button, click **Shut Down**, and then click **Shut Down The Computer**. Do not turn off your computer until the "You can now safely turn off your computer" message appears.

1.8 SUMMARY

In this unit, you learned:

1. What is a GUI?
2. What are the basic components of it?
3. What are the parts of Windows?
4. What are the basic techniques for working with Windows?
5. Icons are termed as objects in Windows 95 because of their properties.
6. Windows 95 properties can be easily customised according to the needs of the user.
7. Switch easily between windows through taskbar.
8. Use Screen savers to save your screen and work.
9. Always remember to shutdown the computer properly.

1.9 MODEL ANSWERS

Check Your Progress 1

1. GUI is a system that allows creation and manipulation of user interfaces employing windows, menus, icons, dialog boxes, etc. The basic features of GUI are :
 - Pointing device such as mouse, which controls cursor.
 - Point and shoot functionality under control of device which cause screen menus appear or disappear.
 - Support of windows which graphically display the status of a computer program.
 - Icons that represent files, directories and other application and system entities.
 - Support of graphical metaphors such as pull-down menus, dialog boxes, buttons, slides that let the programmer and user tell the computer what to do and how to do it.
2. When a screen is splint into several independent regions each one is called a window. Several applications can display results simultaneously in different windows. The user can switch from one window to another window. Windowing systems have capabilities to display windows either tiled or overlapped. Users can organise the screen by resizing the window or moving related windows closer.
3. Bit-mapped display is made up of tiny dots (pixels) that is an independently addressable and has much finer resolution than character displays. Bit-mapped displays have the advantages over character displays. One of the major advantages is of graphic capability.

Check Your Progress 2

1. There are four major components of GUI.
 - (i) A windowing system
 - (ii) An emerging model
 - (iii) An application program interface
 - (iv) A set of tools and frameworks for creating interfaces and developing integrated application.

The API (Application Program Interface) is a set of programming language functions that allow the programmer to specify how the actual application will control the menus scroll bars and icons that appear on the screen. Like windowing models, APIs align with particular GUIs. Its features vary from package to package.

2. There are several ways MS-Window enhances DOS environment.

- (i) Device independence. It presents a device independent interface to applications. Unlike most of today's DOS applications, a window application is not bound to the underlying hardware such as mouse, keyboard or display windows.
- ii) Multitasking. Users can have several applications in progress at the same time. Each application can be active in a separate window.
- (iii) Memory management. Windows also provide memory management the 640K limitation of MS-DOS. An application has the ability to extend memory and share data segments with other applications.
- (iv) Data sharing. Clipboard allow data transfer between application clipboard. Any type of data can be transferred from one window to another through the clipboard.

UNIT 2 MANAGE SYSTEM IN WINDOWS 95

Structure

- 2.0 Introduction
- 2.1 Objectives
- 2.2 My Computer
- 2.3 System Settings
 - 2.3.1 Control Panel
 - 2.3.2 Printers
- 2.4 Backup Your Data
- 2.5 Disk Drive Utilities
 - 2.5.1 Disk Defragmenter
 - 2.5.2 Check for Disk Errors
 - 2.5.3 Increase Disk Space
 - 2.5.4 Format Disks
- 2.6 Add/Remove Applications
- 2.7 Set-up Windows for Multiple Users
- 2.8 DOS Prompt
- 2.9 Summary
- 2.10 Model Answers

2.0 INTRODUCTION

In the previous unit, we have discussed about the features and components of GUIs. We have also introduced you to starting up of a powerful GUI based operating system Windows 95. In this and subsequent units, we will be focussing mainly on the practical aspects of Windows 95 package. Since these units are more practical in nature, we will expect you to use these units during your practical sessions also.

Windows 95 provide a lot of utilities for managing your system. These utilities like Disk utilities help to maintain disks and access the maximum available space on the disk. If multiple users are using the same system, they have the advantage of setting the system as they like. Different persons can specify their logins on the same system and switch over to their settings. In this unit our focus will be on system settings, backup and disk management utilities.

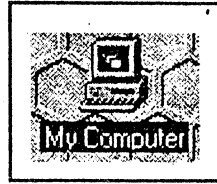
2.1 OBJECTIVES

This unit is a practical workbook for:

- personalising your system settings
- adding and removing hardware/software
- setting up printers
- taking data backup
- managing your disk
- setting up windows if multiple users are sharing a computer.

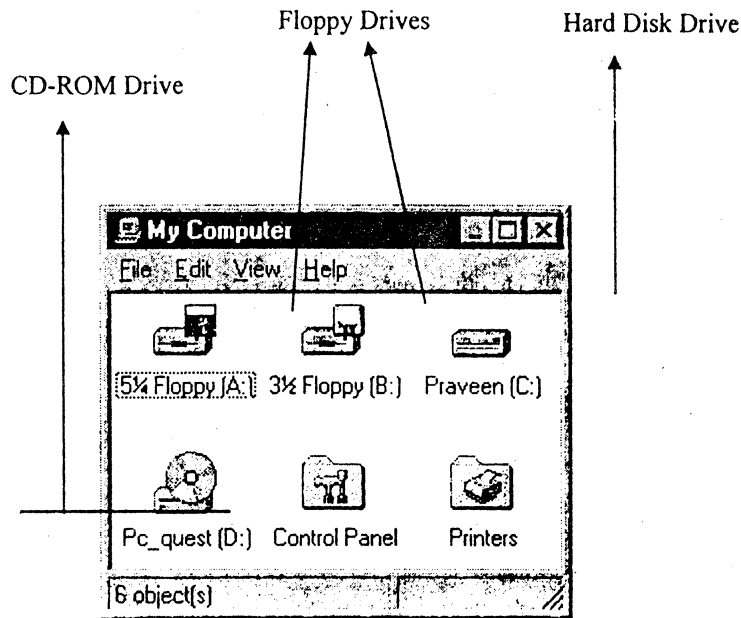
2.2 MY COMPUTER

In Windows 95, the things you have on computer, like programs, documents, and data files, are all accessible from one place called My Computer. You can find its icon on the desktop.



To see what is on your computer, follow the steps given below :

Double-click the **My Computer** icon. It opens the window that looks like the figure shown below



1. Double-click the icon for the drive you want to look at.
2. Windows displays the files and folders on the drive. Folders can contain files, programs, and even other folders.
3. To open a file or folder, or start a program, double-click it.

The information can also be displayed about the different drives, Control Panel, and Printer(s) that are installed on your system. When an object (any of the above mentioned things) is selected, the related commands are highlighted in the File menu. Select any drive and click on File menu. The different options that are displayed are :

- | | |
|----------------|--|
| Open | Opens the selected object in a window. |
| Explore | Opens the explorer to see the file structure of the drive. |

Find	Helps you search for files on the selected drive or anywhere on the filing system.
Sharing	Lets you share the selected drive with other users in your organization that are connected on your computer.
Format	Erases or formats the selected floppy drive.
Create Shortcut	Places a shortcut for the object on Windows 95 Desktop for quick access.
Properties	Displays information about the selected object.
Close	Closes the open window.

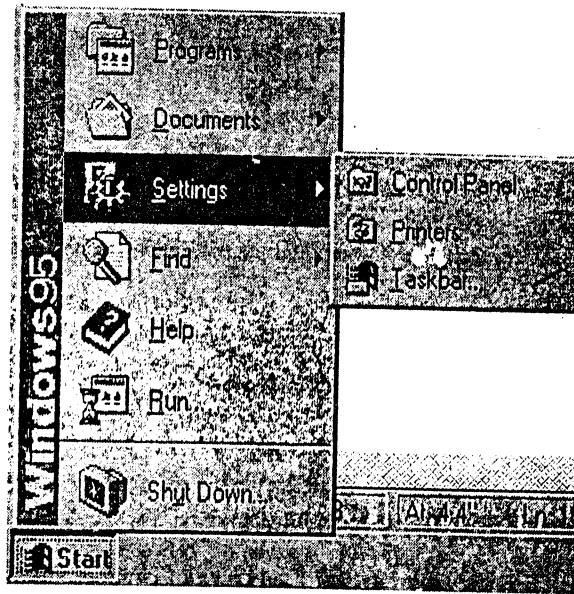
2.3 SYSTEM SETTINGS

The System can be personalized by making interesting and useful changes to Windows 95 settings. For example, you can :

- Adjust the double-click speed for your mouse.
- Change number, currency, time, and date settings.
- Change printer settings.
- Change settings for network service.
- Change background of your desktop.
- Change the capacity of the Recycle Bin.
- Change the number of colors your monitor displays.
- Have your monitor automatically turn off.
- Change the screen resolution.
- Change display fonts.
- Protect your screen by setting-up a screen saver.
- Configure multimedia devices.
- Enable multiple users to personalize settings.
- View or change resource settings for a hardware device.

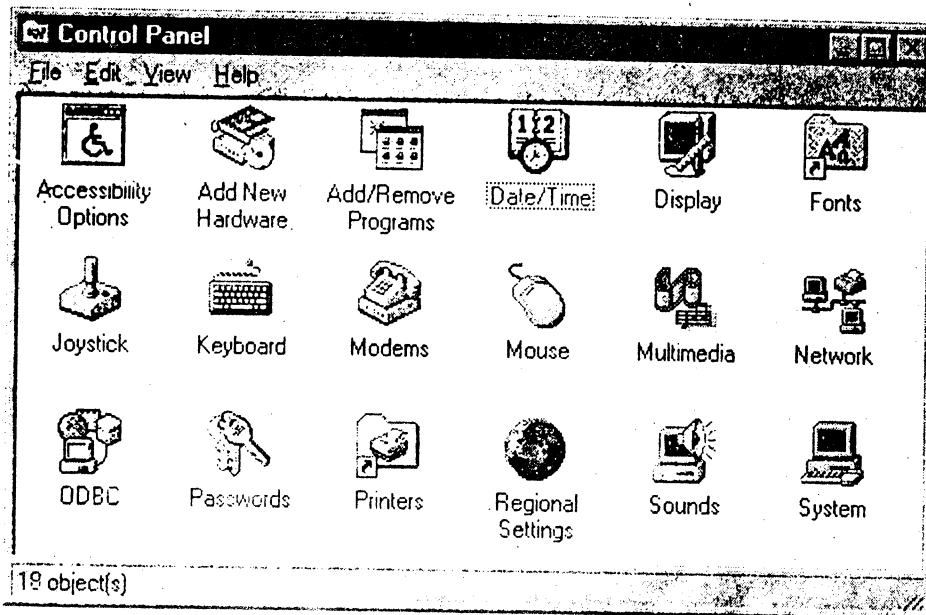
Above mentioned are some of the changes you can make to make your workplace more interesting. Some of them are explained below, while other things are left to be tried out on your own (as per your requirement).

You can start with clicking on the **Start** menu and then choose **Settings** option. A cascading menu is displayed as shown below :



2.3.1 Control Panel

When you click on the option **Control Panel** from the cascading menu of **Settings**, a window is opened that contains the icon of the utilities for changing hardware configurations or customising the Windows 95 graphical interface as shown below :



You can also access the utilities of Control Panel, if you click on **My Computer** and then on **Control Panel** icon.

Date & Time

To update date and time settings of the system, follow the steps given below :

1. Select **Date/Time** icon from the displayed icons that will open-up the window displaying the current date and time.

OR

Double-click on the clock on the right-most corner of the taskbar.

2. Click the down-arrow in the month field to choose the correct month.
3. Click the up or down-arrow in the year field to choose the current year.
4. Click the current day in the calendar.
5. Set the new time-field by clicking the up or down-arrow

OR

Click anywhere in the text-box and type a new number.

6. To set the correct time zone, click the **Time Zone** tab and then click your current location on the map of the world that is displayed.

Looks of Windows

The looks of Windows include wallpaper and pattern in the background of the desktop, cursor blink rate or item size, color and fonts.

To change the background of your desktop

- In the **Pattern or Wallpaper** list, click the pattern or wallpaper you want to use.
- To cover your entire screen with a small wallpaper image, click **Tile**.
- To center a wallpaper image, click **Center**.

To change the way the items on your desktop look

- If you want to change the appearance of only one screen element, click that element in the **Item** list. Then change the settings in the **Item Size and Color** and **Font Size and Color** areas.
- If you want to change the appearance of all screen elements simultaneously, click an appearance scheme in the **Scheme** list.

To use larger or smaller display fonts

- In the **Font Size** box, click the size you want your displayed fonts to be.
- To customise the size of displayed fonts, click **Custom**.
- If the **Font Size** area is unavailable, make sure your **Desktop Area** setting is higher than 640 by 480 pixels. If 640 by 480 pixels is the only setting available to you, you cannot change your display font.

To adjust the rate at which your cursor blinks

- Drag the slider in the **Cursor Blink Rate** area.

Add New Hardware

To set up new hardware

Click on the **Add New Hardware** icon (as shown) to start the Add New Hardware wizard.



**Add New
Hardware**

Simply, follow the instructions on your screen.

It is recommended that you let Windows detect your new hardware. Make sure you have connected your hardware or installed its components in your computer before running the wizard.

Fonts

There is a collection of fonts with Windows 95. You can use these to format text in documents. The fonts can be viewed, added, or removed from the available font list.

To view fonts on your computer

1. Double-click the **Fonts** icon to open the Fonts folder.
2. To look at a sample of a font, double-click the icon for the font.

When you install a printer, it may include several printer fonts. These do not appear in the Fonts folder, but they do appear in the Font list of Windows-based programs such as WordPad.

To add a new font to your computer

1. Open the **Fonts** folder.
2. On the **File** menu, click **Install New Font**.
3. Click the drive and folder that contain the fonts you want to add.
4. Double-click the icon for the font you want to add.

To select more than one font to add, press and hold down the **CTRL** key, and then click the fonts you want.

To select a range of fonts in the list, press and hold down the **SHIFT** key while dragging the cursor over the fonts.

To delete a font from your computer

1. Open the **Fonts** folder.
2. Click the icon for the font you want to delete.

3. On the **File** menu, click **Delete**.

To select more than one font to delete, press and hold down the **CTRL** key, and then click the fonts you want.

Keyboard

Keyboard layouts vary to accommodate the special characters and symbols used in different languages. This affects which characters appear when you press the keys on your keyboard. After you change your keyboard layout, the characters that appear on your screen may no longer correspond to the characters that are printed on your keyboard's keys.

To change the keyboard layout

1. In the list, click the language whose keyboard layout you want to change, and then click **Properties**.
2. Select a different keyboard layout.

To change the way your keyboard responds

1. If you want to adjust how much time elapses before a held-down key begins repeating, drag the **Repeat Delay** slider.
2. If you want to adjust how quickly characters repeat when you hold down a key, drag the **Repeat Rate** slider.

You can test the repeat delay and repeat rate by clicking the box below the sliders, and then holding down a key.

Mouse

The settings for the mouse include the button configuration, double-click speed of the mouse, pointer speed and pointer trail, mouse pointer shapes, and switching over to different mouse driver.

To change the settings, double-click the **Mouse** object. The displayed window shows four tabs - **Buttons**, **Pointers**, **Motion**, and **General**. These tabs are for different purpose of settings.

To reverse your mouse buttons

1. Select the **Buttons** tab.
2. In the **Button Configuration** area, click **Right-Handed** or **Left-Handed**.

To adjust the double-click speed for your mouse

1. Select the **Buttons** tab.
2. In the **Double-Click Speed** area, drag the slider.
3. To test the speed, double-click the image in the **Test area**.

To change the appearance of your mouse pointer

1. Click the **Pointers** tab.
2. To change all your pointers at one time, select a different scheme in the **Scheme** list.
3. To change only one pointer, click it, click **Browse...**, and then double-click the filename of the pointer you want to use.

By default, only a limited set of mouse pointer schemes is installed during Windows Setup.

To adjust the speed of your mouse pointer

1. Select the **Motion** tab.
2. In the **Pointer Speed** area, drag the slider.

Changing the speed of your mouse pointer causes the pointer to respond more quickly or slowly to the movements of the mouse itself.

To turn on and adjust the mouse pointer trail

1. Click the **Motion** tab.
2. In the **Pointer Trail** area, make sure the **Show Pointer Trails** box is checked.
3. To adjust the length of the pointer trail, drag the slider.

To switch over to the different model of the installed mouse

1. Click the **General** tab.
2. Select the type of mouse you have installed from the list box.

Regional Settings

While installing Windows 95, you have to select a country, on which depends the number formats, currency, time and date formats. These formats are used in various windows programs.

To change the settings

1. Select the object **Regional Settings** from the Control Panel window.
2. The **Regional Settings Properties** window is opened in which you can select the formats appropriate for your country.
3. Click on the **Regional Settings** tab.
4. On the map displayed, click the region and Windows 95 changes its formats to match that region.
5. For special adjustments, click the **Number**, **Currency**, **Time**, or **Date** tab and change settings.

System

Using the **System Properties** dialog box can modify the System configuration once set. For this, click on the object **System** from the **Control Panel** window. From this dialog box, you can view or modify your computer's hardware settings.

Click on the **General** tab to display the configuration of your computer, the operating system that is being used, and the name of the person and organization to whom the software is registered.

Click on the tab **Device Manager** to view the devices that are connected to your computer either by their types or by their connections.

If you click on the tab **Hardware Profiles**, you are provided with a way to create hardware configurations that you can choose from at startup. Though there are very few instances in which there is any need to create hardware profiles.

To enable or disable hardware in a hardware profile

1. Click the plus sign next to the hardware type, and then double-click the hardware.
2. In the **Device Usage** area, click to place a check mark next to each hardware profile in which you want to enable the hardware, or clear the check box to disable the hardware for that hardware profile.
3. If you see a message prompting you to restart your computer, click **Yes**.

Click on the **Performance** tab to display the **Performance Status** of your computer system. For example : total memory, percentage of free system resources at that instant, File System, virtual memory, information about Disk Compression and PC cards.

2.3.2 Printers

Windows 95 has significant advances in printing features. These are :

- It supports bi-directional communication with printers so that printers can provide Windows 95 with information about their current state and attributes.
- The Windows 95 printing system also returns control to users more quickly after a job is sent to the printer due to a new print spooler.
- Mobile and remote users can defer their printing job until later if they are not connected to a printer. Print jobs are stored in a local queue and automatically sent to the printer when they reconnect with the printer or reconnect to a network that has printers.

To change printer settings

1. Select the object **Printers** from the **Control Panel** window.
2. From the **Printers** window, click the icon for the printer you are using.
3. On the **File** menu, click **Properties**.
4. The settings you can change depend on the type of printer you have. Click the different tabs to see all of the options you can set.

Changing the printer properties will change them for all documents you print on this printer. To change these settings for one document, use the **Page Setup** or **Print Setup** command on the **File** menu in your program.

To set up a new printer

1. Select **Add Printer** icon from the **Printers** window.
2. **Add Printer Wizard** is opened, and follow the instructions on the screen.
3. If you want to print a test page, first make sure your printer is on and ready to print.

If you want to use a shared network printer, you can set it up quickly by browsing for it in **Network Neighbourhood**, clicking the printer's icon, and then clicking **Install** on the **File** menu.

2.4 BACKUP YOUR DATA

You can use Backup to back up files on your hard disk. You can back up files to floppy disks, a tape drive, or another computer on your network. When you have made a backup file, you can restore it if your original files are damaged or lost.

There are two ways you can backup your files :

- You can backup files on your hard disk to a floppy disk or other media by using simple copy techniques.
- The Microsoft Backup utility can also be used, which compresses files and puts them in an archive. These compressed files can be copied to a floppy drive, tape drive or other backup device.

To start the Backup utility

1. Click **Start** and select **Programs**.
2. Select **Accessories** from the cascading menu, and then click on **System Tools**.
3. Now click on **Backup**.

If this utility is not present in the cascading menu of System Tools, then probably this utility was not installed when you set up the system.

To install the Backup utility, follow the instructions given below :

1. Start the **Add/Remove Programs** utility from the **Control Panel** window.
2. Click the **Windows Setup** tab and click the **Disk Tools** option in the window.
3. Then click **OK** to install the **Backup** utility, and then follow the instructions on the screen.

While restoring backup files, again the Microsoft Backup utility is used. Restoring the files may pose a problem if you need to restore them on a system that does not have this utility or is not running Windows 95. In that case, other backup method may be used.

2.5 DISK DRIVE UTILITIES

Windows 95 includes utilities to format diskettes, Check diskettes and hard drives for errors, defragment disks, and do other types of maintenance. Some of these utilities are discussed below.

To access these utilities

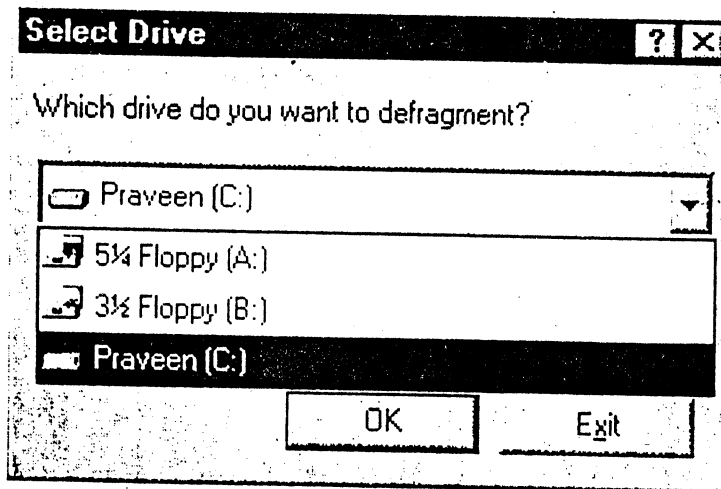
1. Open the **Start** menu and select **Programs**.
2. Choose **Accessories** and then **System Tools**. The cascading menu that appears includes the various Disk Drive utilities.

2.5.1 Disk Defragmenter

Disk Defragmenter is used to rearrange files and unused space on the hard disk so that programs run faster.

To speed up your hard disk by using Disk Defragmenter, follow the instructions given below :

1. From the cascading menu of **System Tools**, select **Disk Defragmenter**. **Select Drive** dialog box is opened to select the drive you want to defragment.



2. Click the drive you want to defragment, and then click **OK**.
3. If you want to change the settings that Disk Defragmenter uses, click **Advanced...**
4. Click **Start**.

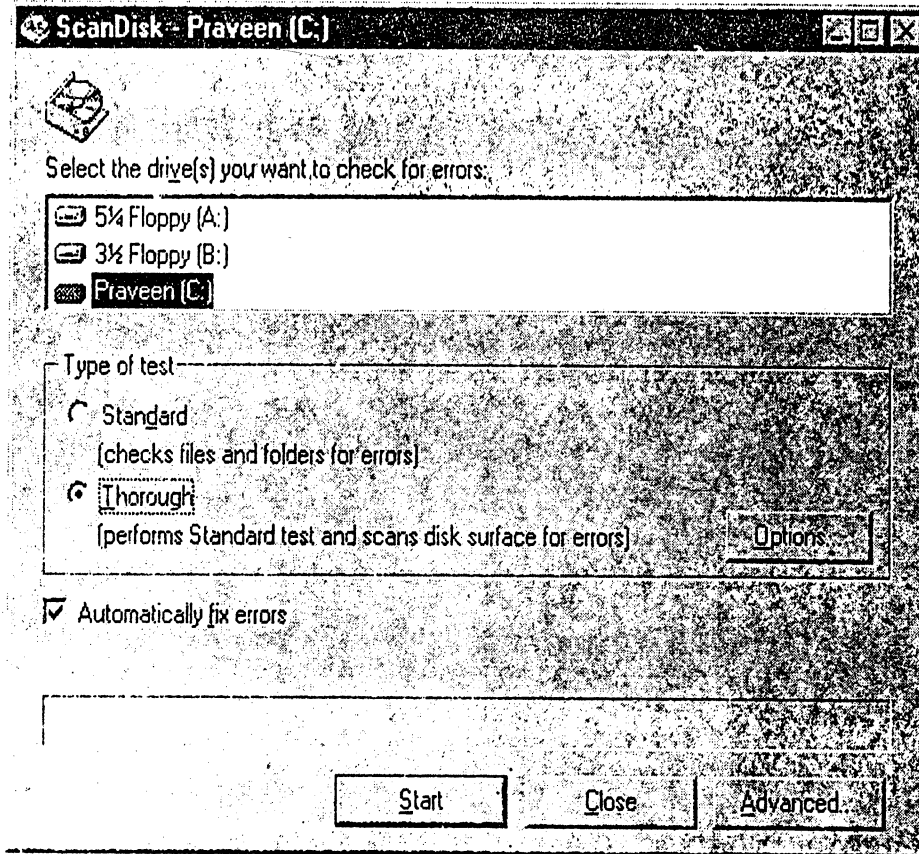
While Windows defragments the selected disk, the computer can safely carry out other tasks. However, the computer will operate more slowly. To temporarily stop Disk Defragmenter so you can run other programs at full speed, click **Pause**.

2.5.2 Check for Disk Errors

You can use ScanDisk to check your hard disk for logical and physical errors, and then repair the damaged areas.

To check your disk's surface, files, and folders for errors

1. Select the option **ScanDisk** from the cascading menu of **System Tools**.
2. Click the drive you want to check.
3. Click **Thorough**. If you want to change the settings ScanDisk uses when checking the disk's surface, click **Options**. If you want to change the settings ScanDisk uses when checking files and folders, click **Advanced**.
4. Click **Start**.



If you want to specify how ScanDisk repairs any errors it finds, make sure that the **Automatically Fix Errors** box is not checked.

The **Standard** type of test is only to check errors in files and folders, but does not check the disk surface.

2.5.3 Increase Disk Space

You can use DriveSpace to compress both hard and floppy disks to create more free space for files. You can also use DriveSpace to configure disk drives that you have already compressed by using DoubleSpace or DriveSpace.

To determine how much space is available on a disk

1. Double-click the **My Computer** icon, and then click the disk you want to check.
2. On the **File** menu, click **Properties**. A pie chart shows how much free and used space is on the disk.

To create more disk space by using DriveSpace

1. In the **Drives On This Computer** list, click the drive you want to compress.
2. On the **Drive** menu, click **Compress**.
3. Click **Start**.
4. If you have not backed up your files, click **Back Up Files**, and then follow the instructions on your screen. When you are done, proceed to step 6.
5. Click **Compress Now**.
6. If Windows prompts you to restart your computer, click **Yes**.
7. If you want to free up more disk space after your computer restarts, start the **Disk Space Troubleshooter** again.

2.5.4 Format Disks

Formatting a disk means establishing the tracks and sectors on the disk where files will be stored. Be aware that formatting a disk removes all information from the disk, you cannot format a disk if there are files open on that disk. If the disk has been compressed, use DriveSpace, or other compression software, to format the disk.

To format a disk

1. If the disk you want to format is a floppy disk, insert it into its drive. Otherwise, go to step 2.
2. Double-click the **My Computer** icon, and then click the icon for the disk you want to format. Be sure not to double-click the disk icon, because you cannot format a disk if it is open in My Computer or Windows Explorer.
3. On the **File** menu, click **Format**.

The various options for formatting disks are:

Capacity	It could be low-density or high-density.
Format Type : Quick(erase)	Formats the disk without checking for errors.
Format Type : Full	Checks for the disk errors and then reformats it.
Format Type : Copy System Files Only	Copies the system files to the formatted disk to make it bootable.
Label	Type the label name for the disk.
No Label	This option is selected if you do not require the label name for the disk after formatting it.

Display Summary when Finished

To get information about the bad sectors (if any) after the disk is formatted.

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Manage System in
Windows 95

Copy System Files

Copies the system files during the formatting process.

2.6 ADD/REMOVE APPLICATIONS

The Windows 95 components, accessories, or other applications can be added or installed, and removed by using the **Add/Remove Programs** utility from the **Control Panel** window. The advantage of using this utility is that Windows 95 maintains control over the installation process by making proper entries into the registry.

To install an application, click on **Install...** button. While installing the application, the wizard helps you to complete the process step-by-step.

To add a program, select it from the displayed list of programs and then click on **Add/Remove** button.

To remove the application, again select it from the displayed list of applications and programs and click on **Add/Remove** button.

2.7 SET-UP WINDOWS FOR MULTIPLE USERS

If more than one person uses the same computer, each one can customise the settings according to his/her needs. The important fact is that, each user has to create a profile so that when he/she logs on, their personal windows settings are used.

To set-up user profiles

1. Click the **Password** object from the **Control Panel**.
2. Select the 2nd option under **User Profiles**. When it is selected, the options under the head **User Profile Settings** are highlighted.
3. Choose the options as you require.
4. Click **OK**.

This enables multiple users to personalise settings.

To log off your computer so someone else can use it

1. Click the **Start** button, and, then click **Shut Down**.
2. Then click **Close All Programs And Log On As A Different User**.

2.8 DOS PROMPT

At times, you may require to work in MS-DOS environment.

To start an MS-DOS window

1. Click the **Start** button, and then point to **Programs**.
2. Click **MS-DOS Prompt**.

To switch between a full screen and a window, press **ALT+ENTER**. To quit MS-DOS, click or type **Exit** at the command prompt.

Check Your Progress

1. What is "My Computer" ?

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.....
.....

2. What do you understand by the phrase "Personalise the System Settings"?

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.....

3. What are the improvements that are made in printing features of Windows 95 ?

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4. Name the various disk drive utilities.

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.....
.....

5. How can you add Windows 95 components or accessories that were not installed before ?

.....

2.9 SUMMARY

In this session you learned :

1. In Windows 95, all the things you have on computer, like programs, documents, and data files, are accessible from one place called My Computer.
2. The System can be personalised by making interesting and useful changes to Windows 95 settings.
3. Windows 95 has utilities for changing hardware configurations or customising the Windows 95 graphical interface.
4. The System configuration once set can be modified.
5. While installing Windows 95, you have to select a country, on which depends the number formats, currency, time and date formats that are used in various windows applications.
6. Changing the printer properties will change them for all documents you print on this printer.
7. The Microsoft Backup utility compresses files and puts them in an archive. These compressed files can be copied to a floppy drive, tape drive or other backup device.
8. While restoring backup files, again the Microsoft Backup utility is used.
9. Windows 95 includes utilities to format diskettes, Check diskettes and hard drives for errors; defragment disks, and do other types of maintenance.
10. The Windows 95 components, accessories, or other applications can be easily added or installed, and removed.
11. If more than one person uses the same computer, each one can customise the settings according to his/her needs by creating a profile for every user so that when he/she logs on, their personal Windows settings are used.
12. You can easily switch over to MS-DOS prompt to work with DOS-based applications.

2.10 MODEL ANSWERS

The questions given in the 'Check Your Progress' have been designed only at the conceptual level and the answers to these questions are directly available in the unit. Therefore, Model Answers have not been provided. However, as this block is more practical oriented, therefore, students are advised to try the commands given, on their terminals.

UNIT 3 FILES AND FOLDERS

Structure

- 3.0 Introduction
- 3.1 Objectives
- 3.2 Windows Explorer
- 3.3 Working with Files
 - 3.3.1 File Naming Conventions in Windows 95
 - 3.3.2 Finding a File
 - 3.3.3 Creating a File
 - 3.3.4 Copy/Move Files
 - 3.3.5 Associating Files & Programs
 - 3.3.6 Delete Files
 - 3.3.7 Find Information on a file
- 3.4 Working with Folders
 - 3.4.1 Creating and Renaming Folders
 - 3.4.2 Deleting Folders
 - 3.4.3 Viewing Folders
 - 3.4.4 Organising Files with Folders
 - 3.4.5 Controlling Access to a Folder
- 3.5 Recycle Bin
- 3.6 Summary
- 3.7 Model Answers

3.0 INTRODUCTION

The Windows 95 file system is based on folders. Folders hold files and other folders, so the system is inverted tree-structured. In this unit, we will discuss about the management of files and folders in Windows 95. In previous versions of Windows, folders were called directories. The benefit of creating folders and files under them is *better organisation of your information*.

3.1 OBJECTIVES

At the end of the unit, you should be able to work with:

- the files and folder of Windows 95
- basic file operations
- the windows explorer
- organisational and access related aspects of files.

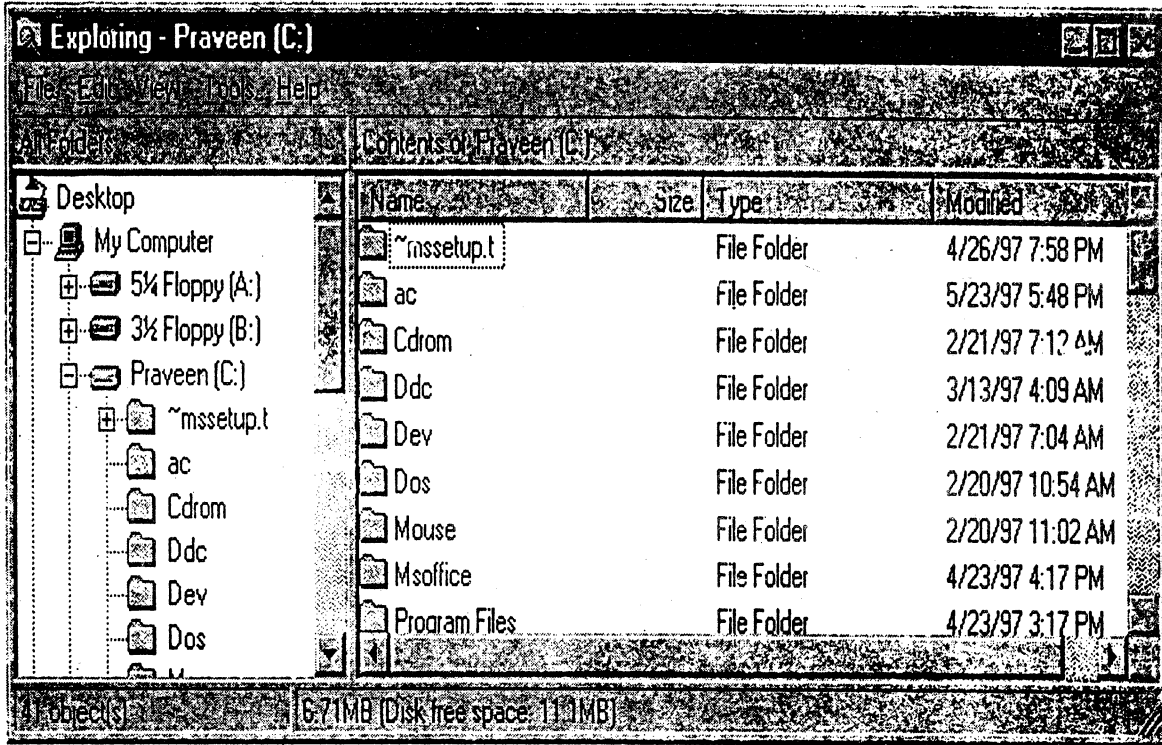
3.2 WINDOWS EXPLORER

Windows Explorer is a file-management utility that provides an alternate method of accessing the Windows 95 file system. This utility is in the place of File Manager that was in the previous versions of Windows.

Explorer gives you a view of your entire file system, as well as file systems on other computers if you are connected to a network.

To start Explorer

1. Select **Programs** from the **Start** menu.
2. Select **Windows Explorer** from the cascading menu of **Programs**.



On the left of the Explorer window, you can view the desktop, and drives and folders under **My Computer**. When you click a drive and folder, its contents are displayed on the right part of the window.

From this window, you can easily copy, move files by simply dragging it to the folder where you want to place it. To delete the file, drag it to Recycle Bin heading on the left side of the window.

3.3 WORKING WITH FILES

Files contain information like text, graphics, and numeric data. Initially they are created in the memory of the system, but then they are saved to a disk storage device.

There are different types of files that are categorised by the type of information they hold. These categories are :

FILES	TYPE OF INFORMATION	EXAMPLE
Program Files	Contain computer-readable code written by programmers.	Calc.exe, Clock.exe, Dialer.exe, Winword.exe

Support Files	Some programs store information in these files, but they cannot be executed or started. These files have the extension names as .OVL, .SYS, .DRV, and .DLL.	Wphelp.hlp, Config.sys
Text Files	Contain alphanumeric characters that follow the ASCII format.	Relnotes.rtf, Sample.txt Autoexec.bat,
Graphics Files	Contain visual or graphic information.	Rivets.bmp, Thatch.bmp
Multimedia Files	Hold sound and video information in digital form.	Passport.mid, Tada.wav
Font Files	Contain information about various fonts,	Coure.fon, Courbd.ttf
Other Data Files	Contain numbers, names, addresses, and other information created by database and spreadsheet programs.	

3.3.1 File Naming Conventions in Windows 95

There are certain guidelines to be followed while working with files in Windows 95. These are:

1. Files in the same folder cannot have the same name.
2. Windows 95 supports 256-character filenames in both upper and lower case.
3. The drive and folder location of the file is important.
4. You can use multiple period-separated extensions, like **Budget.Sales.1997**. This is also a strategy for long filenames.
5. Names can include spaces but not the special symbols as shown
? \ * " | < >
6. Windows 95 does not use uppercase or lowercase formats to distinguish filenames.
7. Wildcard characters can be used to search for filenames.

3.3.2 Finding a File

To find a file or folder, follow the given steps:

1. Click the **Start** button, and then point to **Find**.
2. Click **Files Or Folders**.
3. In the **Named** box, type all or part of the file's name.
4. If you do not know the name of a file or want to refine the search, click the **Date Modified** or **Advanced** tabs.

5. If you type upper- and lowercase letters in the **Containing Text** box on the **Advanced** tab, and you want the search to be case-sensitive, click the **Options** menu and make sure the **Case Sensitive** box is checked.
6. If you want to specify where Windows should begin its search, click **Browse...**
7. Click **Find Now**.
8. If you want to save the results of a search along with the search criteria, click **Options**, and then click **Save Results**.
9. If you want to save only the search criteria, make sure the **Save Results** box is clear.
10. Click the **File** menu, and then click **Save Search**. An icon representing the search results or search criteria appears on your desktop.

3.3.3 Creating a File

You can use Notepad to create or edit text files that do not require formatting and are smaller than 64K. Notepad opens and saves text in ASCII (text-only) format only. To create or edit files that requires formatting or is larger than 64K, use WordPad.

WordPad is a text editor for short documents. You can format documents in WordPad with various fonts and paragraph styles.

We will learn to use Notepad and WordPad in the next unit.

3.3.4 Copy/Move Files

The files can be copied or moved from one destination to another. This can be done either through menus using cut and paste technique or by using drag and drop technique.

To copy a file, follow the given steps:

1. In **My Computer** or **Windows Explorer**, click the file you want to copy. To select more than one file to copy, hold down the **CTRL** key, and then click the items you want.
2. On the **Edit** menu, click **Copy**.
3. Open the folder or disk where you want to put the copy.
4. On the **Edit** menu, click **Paste**.

To copy a file to a floppy disk, the steps are:

1. Insert the disk in the floppy disk drive.
2. In **My Computer** or **Windows Explorer**, click the file you want to copy.
3. On the **File** menu, point to **Send To**, and then click the drive you want to copy the file to.

To move a file, the steps are:

1. In **My Computer** or **Windows Explorer**, click the file or folder you want to move. To select more than one file to move, hold down the **CTRL** key, and then click the items you want.
2. On the **Edit** menu, click **Cut**.
3. Open the folder where you want to put the file.
4. On the **Edit** menu, click **Paste**.

In drag and drop technique, you use the mouse to click a file or folder and drag it to new location. This technique is used when both the source file and the destination folder, drive or other object to move the source to are visible.

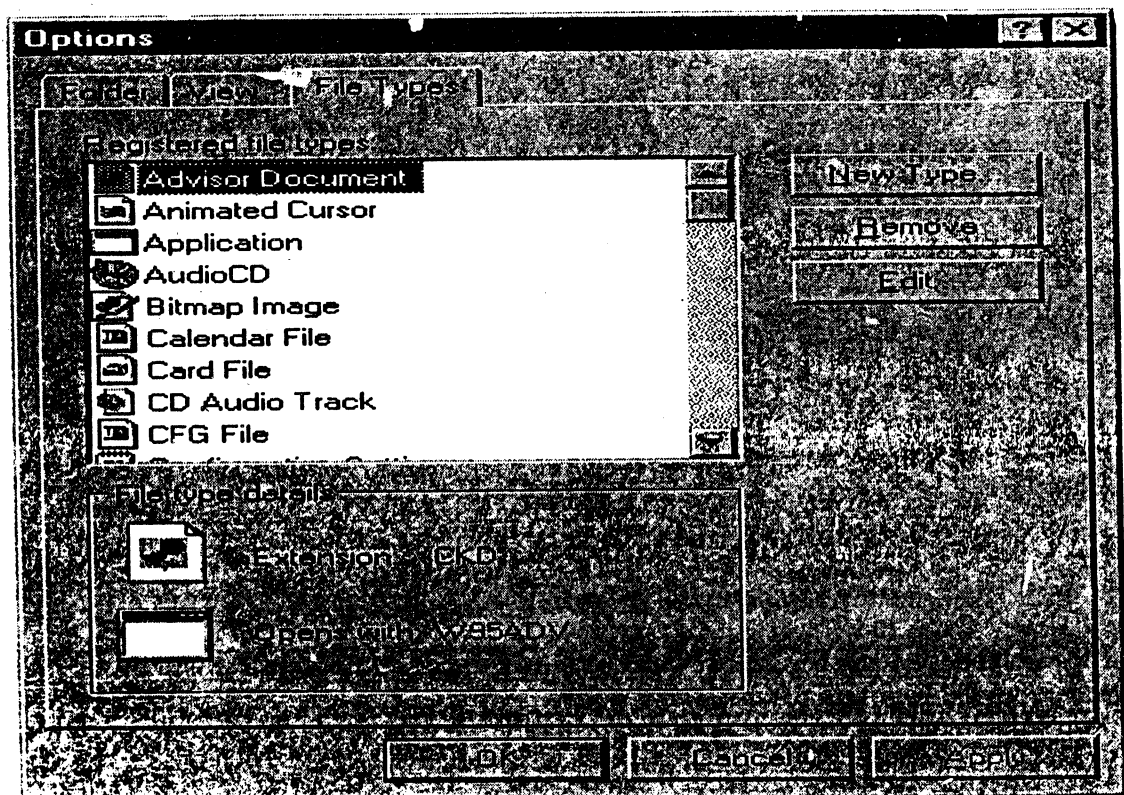
3.3.5 Associating Files & Programs

While saving the document file, most of the programs automatically add a filename extension to it. In Windows 95, certain extensions are associated with programs, so if you double-click a document with a certain extension, the program in which it was created starts and loads the document in its workspace. For example, .DOC files are associated with Microsoft Word.

You can also create your own associations. If you have all your data files in Excel, you can save these files in Excel with the extension .DAT, then associate this extension with MS-Excel. After that, whenever you will double-click the file with the .DAT extension, Excel will start and load the document in its workspace.

To change which program starts when you open a file, follow the instructions given:

1. In **My Computer** or **Windows Explorer**, click the **View** menu, and then click **Options...**
2. Click the **File Types** tab.
3. Click the **New Type...** button to display the **Add New File Type** dialog box.



4. Type the description in the **Description of type** box.
5. Then type the new extension in the **Associated extension** box.
6. Click the **New...** button. This will open the **New Action** dialog box.
7. Type **Open** in the field **Action** and locate the application associated with the extension name by clicking on **Browse...** button.
8. Click **OK**
9. In the **Add New File Type** dialog box, click the two lower check boxes to enable these features.
10. Click **OK**.

3.3.6 Delete Files

To delete a file or folder, follow the steps given below :

1. In **My Computer** or **Windows Explorer**, locate the file you want to delete.
2. Click the file.
3. On the **File** menu, click **Delete**.

If you want to retrieve a file you have deleted, look in the **Recycle Bin**. Your deleted file remains in the **Recycle Bin** until you empty it.

You can also drag file or folder icons onto the **Recycle Bin** icon. If you press **SHIFT** while dragging, the item will be deleted from your computer without being stored in the **Recycle Bin**.

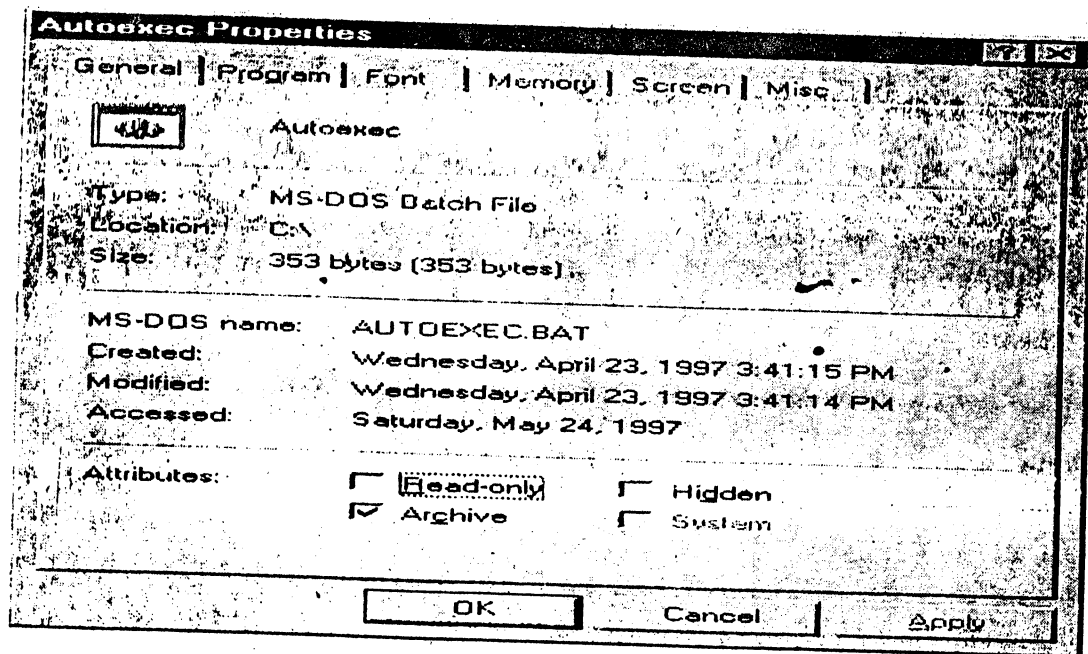
3.3.7 Find Information on a File

At some point of time you may need to get information about certain files, like :

- What type of file is this ?
- What is its size ?
- When was it created or last modified ?
- What are the attributes of the file ?

To get all this information

1. Right-click the file on which you want the information.
2. Select **Properties** from the short-cut menu that is displayed.



A dialog box appears that displays the information on the selected file.

3.4 WORKING WITH FOLDERS

Till now, we have done a lot of work with folders. The concept, being same as of directories, is not difficult to understand. Now, we will get to know better by creating, naming, deleting, controlling access to folders.

3.4.1 Creating and Renaming Folders

You can create a new folder directly on the desktop, at the root level of a disk drive, or within another folder.

To create a new folder, follow the steps given below :

1. In **My Computer** or **Windows Explorer**, open the folder in which you want to create a new folder.
2. On the **File** menu, point to **New**, and then click **Folder**. The new folder appears with a temporary name.
3. Type a name for the new folder, and then press **ENTER**.

To change the name of a file or folder, the steps are:

1. In **My Computer** or **Windows Explorer**, click the file or folder you want to rename. You do not need to open it.
2. On the **File** menu, click **Rename**.
3. Type the new name, and then press **ENTER**.

The name can contain up to 255 characters, including spaces. But, it cannot contain any of the following characters: \ / : * ? " < > |

3.4.2 Deleting Folders

Deleting a folder removes all files and subfolders within it.

To delete a file or folder, follow the given steps:

1. In **My Computer** or **Windows Explorer**, locate the folder you want to delete.
2. Click the folder.
3. On the **File** menu, click **Delete**.

OR

Right-click the folder and select **Delete** from the menu.

OR

Right-click and drag the folder to the **Recycle Bin**.

The deleted folders can be retrieved from the **Recycle Bin**. But if they are removed from there also, then it is not possible to recover the deleted folders.

3.4.3 Viewing Folders

To see the hierarchy of folders on a disk drive, the steps are :

1. Click the **Start** button.
2. Point to **Programs**, and then click **Windows Explorer**.
3. Click a folder on the left side of the window to display its contents on the right.
4. Click the plus signs (+) to display more folders.

To change the size of either side of the window, drag the bar that separates the two sides. To quickly open a folder and display its subfolders, double-click the folder on the left side of the window.

3.4.4 Organising Files with Folders

Folders are created within other folders to organise the file system. The advantages of doing this are :

- Most programs, when you install them, are automatically placed in their own folders.
- Creating separate document folders helps keep document files separate from program files.
- Backing-up files is easy.

3.4.5 Controlling Access to a Folder

You can control access to your folders by using passwords or by listing names of people you want to have access to these resources.

To control access to a folder, the steps are:

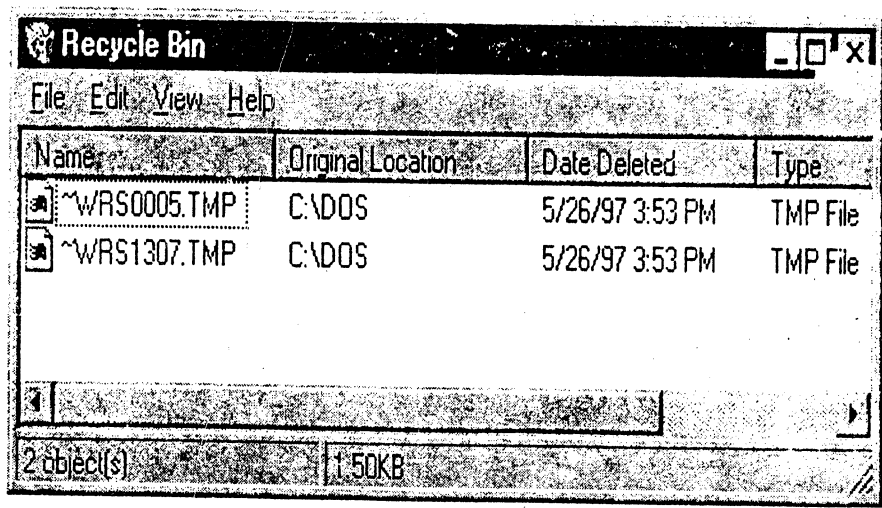
1. In **My Computer**, click the shared folder you want to limit access to.
2. On the **File** menu, click **Properties**.
3. Click **Sharing**.
4. If you are using user-level access control, click **Add** to specify the people you want to be able to use your resources.
5. If you are using share-level access control, type the **password** you want to use for the folder.

3.5 RECYCLE BIN

The Windows 95 Recycle Bin protects you from accidentally deleting files. This is located on the desktop. You can use it to retrieve files you deleted by mistake, or empty it to create more disk space.

If you have opened too many windows, and you cannot see the Recycle Bin, use right mouse button to click a blank area of the taskbar, and then click **Minimize All Windows**.

The Recycle Bin holds deleted files in a queue, with the most recently deleted files on the top. The oldest file is permanently deleted when the queue becomes full, as Recycle Bin has a limited amount of space.



The deleted files can be recovered by dragging them out of the Recycle Bin to an appropriate drive and folder.

The Recycle Bin folder has a menu with many familiar options, for example, the **View** option is to change the way files are listed or rearrange the order of files.

You can also click the buttons above each column to sort the file list on that column. If the width of the column is not enough to accommodate the entries, then point the mouse to the left or right side of a column button, and then click and drag to widen the button.

To clear out the Bin, choose **Empty Recycle Bin** from the **File** menu. Individual files can also be deleted by selecting them and choosing **Delete** on the **File** menu. This will permanently delete the files without any chance of recovering them.

To change the amount of disk space set aside for storing deleted files:

1. Right-click the **Recycle Bin** object and choose **Properties**.
2. In the **Properties for Recycle Bin** dialog box, you can adjust the amount of disk space to hold deleted files. The default disk space is 10% of the disk drive's total size. Decrease this value if you are running out of disk space, or increase it if you have a lot of disk space and want to make sure you can recover more files.

Check Your Progress

1. What was the name given to folders in the earlier versions of Windows?

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2. What is the function of Windows Explorer?

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3. What is a Recycle Bin?

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.....

3.6 SUMMARY

In this session, you have learned.

1. The Windows 95 file system is based on folders.
2. Folders hold files and other folders, so the system is inverted tree-structured.
3. Windows Explorer is a file-management utility that provides an alternate method of accessing the Windows 95 file system.
4. Files contain information like text, graphics, and numeric data.
5. Notepad can be used to create or edit text files that do not require formatting and are smaller than 64K.
6. WordPad can be used to create or edit files that require formatting or are larger than 64K.
7. The files can be copied or moved from one destination to another either through menus using cut and past technique or by using drag and drop technique.
8. In Windows 95, certain extensions are associated with programs, so if you double-click a document with a certain extension, the program in which it was created starts and loads the document in its workspace.

9. The deleted file remains in the Recycle Bin until you empty it.
10. Folders are created within other folders to organise the file system.
11. You can create a new folder directly on the desktop, at the root level of a disk drive, or within another folder.
12. Deleting a folder removes all files and subfolders within it.
13. You can control access to your folders by using passwords or by listing names of people you want to have access to these resources.
14. The Windows 95 Recycle Bin is located on the desktop.
15. The Recycle Bin protects you from accidentally deleting files, as you can use it to retrieve files you deleted by mistake, or empty it to create more disk space.

3.7 MODEL ANSWERS

The questions given in the 'Check Your Progress' have been designed only at the conceptual level and the answers to these questions are directly available in the unit. Therefore, Model Answers have not been provided. However, as this block is more practical oriented, therefore, students are advised to try the commands given, on their terminals.

UNIT 4 PROGRAM AND ACCESSORIES

Structure

- 4.0 Introduction
- 4.1 Objectives
- 4.2 Run your Programs
- 4.3 Windows 95 Accessories
 - 4.3.1 General Use
 - 4.3.2 Writing & Drawing
- 4.4 Briefcase
- 4.5 Summary
- 4.6 Model Answers

4.0 INTRODUCTION

Windows 95 comes with a set of programs called "Accessories". These accessories are used to write, paint, calculate, and perform a variety of other tasks. Some of these accessories were also in the previous version of Windows. Usually, they have common features, so they are easy to use. This unit will be discussing about the use of these accessories.

4.1 OBJECTIVES

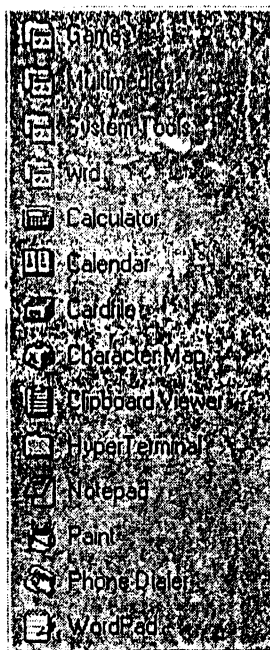
At the end of this unit, you should be able to deal with:

- Paint package
- Wordpad and Notepad
- Other accessories of Windows
- Briefcase utility of Windows 95


4.2 RUN YOUR PROGRAMS

To run the accessory programs, follow the instructions:

1. Click the Start button.
2. Then click on Programs, and then click on Accessories.
3. The cascading menu appears. Click on the program you want to run.



To run other programs, that have been created by the users :

1. Click on **Run...** option from the **Start** menu.
2. **Run** dialog box is opened. In the **Open** text box, enter the path name of the program you want to run.
3. If you do not remember the name of the file, click on **Browse...** button.
4. In the **Browse** window, look in text box lists the available drives, folders, and files. Click on the down-arrow.
5. To see inside a folder, click it. The box below shows the folders and files in the selected location.
6. Double-click a folder or file to open it.
7. To open the folder one level higher, click  on the toolbar.
8. Once the file is located, click on **Open** and then click on **OK** from the **Run** window.

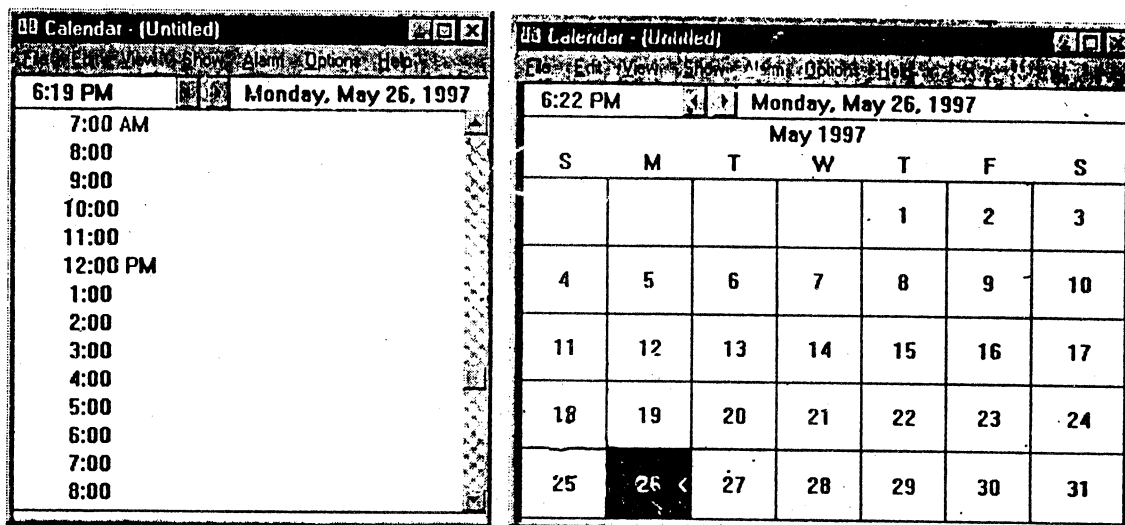
4.3 WINDOWS 95 ACCESSORIES

In the following session, we will discuss the various accessories in more detail.

4.3.1 General Use

The usual accessory programs that are used are easy and useful to work with. They are provided for performing certain day-to-day activities of the users.

Windows Calendar is used to view the current month's calendar that shows the day and date, and also the current day showing the timings to keep track of your appointments. To display either of the mentioned views, click on the View option, and select whichever you require.



Above given are the samples of two views. The left window displays the day schedule to track your appointments, whereas, the right window displays the month calendar.

Calculator

You can use Calculator in **standard** view to do simple calculations, or use it in **scientific** view to do advanced scientific and statistical calculations. You have been using this program in earlier versions of Windows also.

Character Map

Character Map works only with Windows-based programs. This is used to insert a special character into a document.

To insert a special character in the document, follow the given steps :

1. Select **Character Map** from the cascading menu of **Accessories**.
2. Click the **Font** box, and then click a font.
3. To magnify a character in Character Map, click it and hold down the mouse button. Double-click each character you want. The character(s) will appear in the **Characters To Copy** box.
4. Click **Copy**.
5. In your document, click where you want the character(s) to appear, click the **Edit** menu, and then click **Paste**.
6. Select the character(s), and then change them to the same font you used in Character Map.

Clipboard Viewer

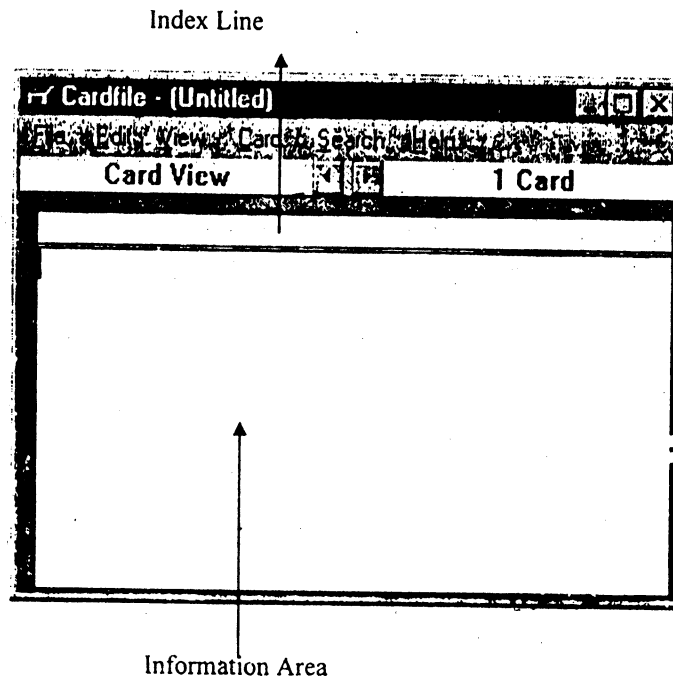
As we know from our earlier experiences, that clipboard is the invisible holding area for copy and cut operations, but you can save the information for later use. If the current information on the clipboard is not saved, it is lost the next time you copy new information to it.

Clipboard is mainly used to transfer information between applications.

Cardfile

You can use Windows Cardfile to organise and manage information, such as names, addresses, and phone numbers.

Card view displays your file as a series of cards. List view displays the index line of every card in the file in alphabetic order.



Index Line is the bar at the top of each card that contains the title of the card. Entering text in the index line is optional. In List View, the index line of every card in the file is displayed in alphabetic order.

The area of the text below the index line, into which you type information is the Information Area.

The options from the menu enable you to the usual tasks like, add or delete cards. Pictures and drawings can also be embedded or linked in cards.

MS Exposition

Microsoft Exposition is used to learn about Microsoft products, in categories such as Entertainment, Business, and Kids.

If you do not see any games on your Accessories menu, then you did not install any games when you installed Windows. Usually the games that come with Windows 95 software are Solitaire, FreeCell, Minesweeper, and Hearts.

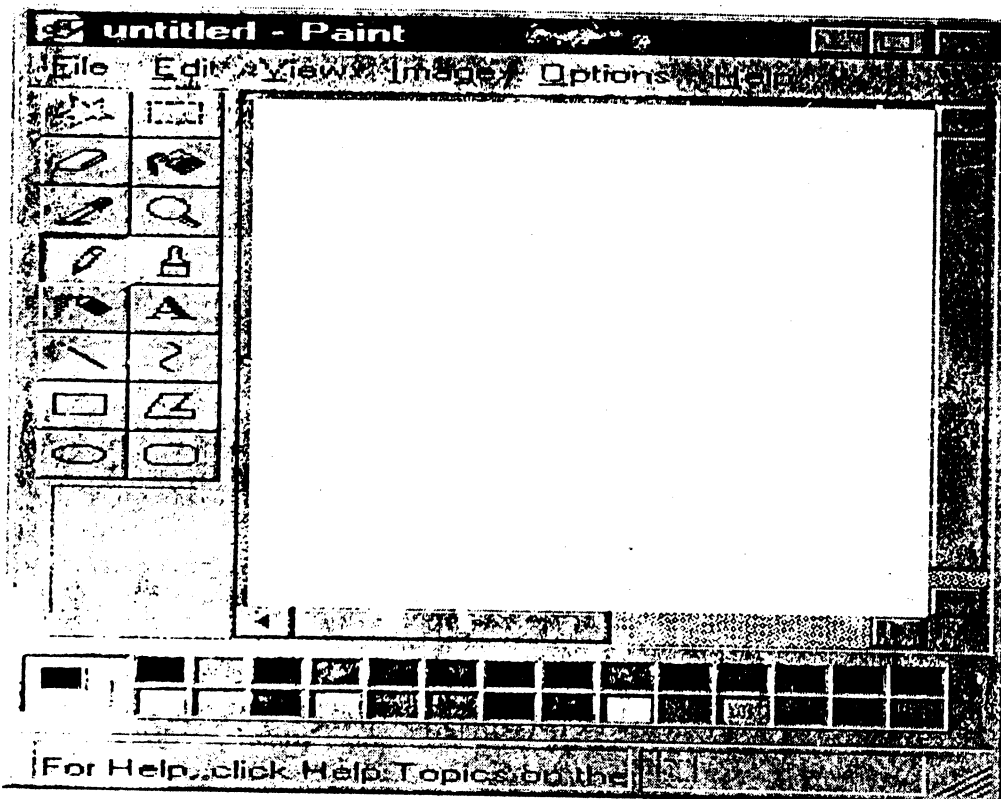
4.3.2 Writing & Drawing

Whereas, drawing brings out fun in the work, writing part is essential for all types of communications. The different tools that are provided with Windows 95 are WordPad in addition to Paint (Paint Brush in earlier versions of Windows), and Notepad that was there in earlier also. Let us look into these tools in detail.

Paint

Paint is a bitmap-painting program with a full set of painting tools and a wide range of colours. You can use it to create, edit, and view pictures. The pictures created by Paint can be pasted into another document you have created, or use it as your desktop background. You can even use Paint to view and edit scanned photos.

To start Paint, select Paint from the cascading menu of Accessories.

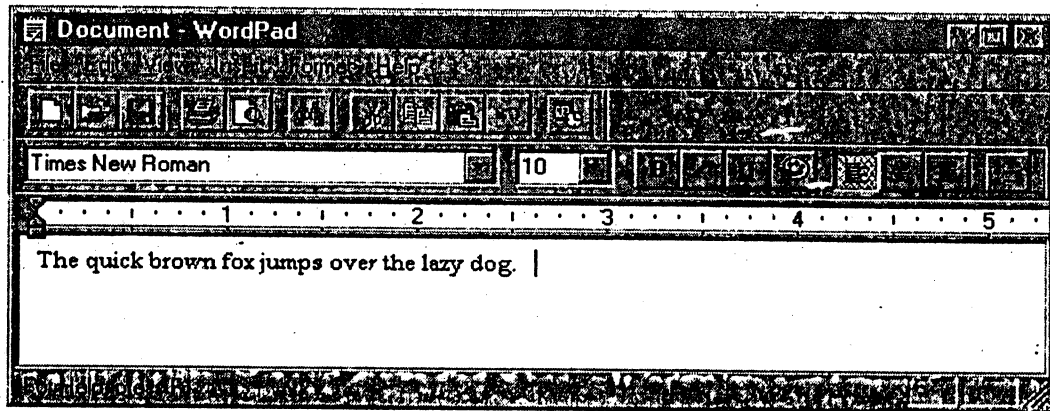


The Paint window consists of a workspace, or **canvas**, where you paint pictures. To the left of the canvas is the **Toolbox**, which contains a set of painting tools. The **colour palette** is at the bottom of the canvas. The **selection box** is on the left side, where you select the width of lines or pen tips to use for the Brush, Line, Eraser, and other tools. To paint, select a tool, a colour, and a line width, and then start painting on the canvas.

WordPad

WordPad is a text editor for short documents. Though, this accessory does not have the advanced features of full-blown word processors like MS-Word. You can format documents in WordPad with various fonts and paragraph styles.

To start WordPad, click on Start menu, then on Accessories, and then on WordPad.



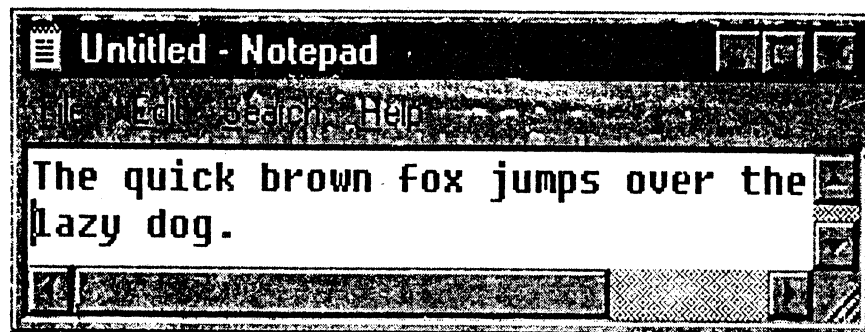
Once WordPad is running, you can do the following:

1. Specify the initial page layout for a document, such as paper size and margin settings.
2. Type, edit, and delete text, as well as copy or move text from one place to another. You can also copy or move text between two different applications.
3. Change the font, style, and size of characters, and change the alignment and indents of paragraphs. You can also set special tabs and create bulleted or numbered lists.
4. Search for previously typed text or replace text with new text.
5. Create compound documents that contain pictures, spreadsheet data, charts, sound, and video other applications.

Notepad

You can use Notepad to create or edit text files that do not require formatting and are smaller than 64K. Notepad opens and saves text in ASCII (text-only) format only. To create or edit files those require formatting or are larger than 64K, use WordPad. Notepad loads very quickly and is easy to learn and use.

To start Notepad, click on Notepad from the cascading menu of Accessories.



Now you can type text in the workspace and use standard editing techniques to insert, delete, and copy or move text.

4.4 BRIEFCASE

Briefcase is designed for mobile users who carry portable computers with them while travelling. These users work on files at home and while travelling on the road, therefore they can use Briefcase to help keep the various copies of the files updated.

The principle behind Briefcase is that, the user has multiple copies of files on different systems. The Briefcase keeps track of which files are the most recent and update the files that do not have the most recent data.

To use Briefcase, follow the steps given below:

1. Drag files from shared folders on your main computer to the **Briefcase** icon on your portable computer.
2. After you finish working on the files on the portable computer, reconnect to your main computer.
3. Click **Update All in Briefcase** to automatically replace the unmodified files on your main computer with the modified files in you Briefcase. The files on your main computer are automatically revised; you do not need to move the files you worked on out of Briefcase or delete the existing copies.

When you are copying files from your main computer into Briefcase, the two computers must be connected, either over a network or by a cable.

If you do not see a Briefcase icon on your desktop, follow the steps given below:

1. Click on **Settings** from the **Start** menu, then click on **Control Panel**, and finally double-click on **Add/Remove programs** object to open the **Add/Remove Programs** dialog box.
2. Click **Accessories**, and then click **Details**.
3. Click the check box for **Briefcase** to mark it for installation, and then click **OK**.

Check Your Progress

1. What are the "Accessories" of Windows?

.....
.....

2. Which programs are new in Windows 95 that were not there in earlier versions of Windows?

.....
.....

3. What is the function of the "Briefcase" in Windows 95?

.....
.....

4.5 SUMMARY

In this session you have learned:

1. Windows 95 comes with a set of programs called "Accessories".
2. Windows Calendar is used to view the current month's calendar that shows the day and date, and also the current day showing the timings to keep track of your appointments.
3. You can use Calculator in **standard** view to do simple calculations, or use it in **scientific** view to do advanced scientific and statistical calculations.
4. Character Map works only with Windows-based programs, that is used to insert a special character into a document.
5. Clipboard is the invisible holding area for copy and cut operations, and also to save the information for later use.
6. Clipboard is mainly used to transfer information between applications.
7. Windows Cardfile is used to organise and manage information, such as names, addresses, and phone numbers.
8. Microsoft Exposition is used to learn about Microsoft products, in categories such as Entertainment, Business, and Kids.
9. The pictures created by Paint can be pasted into another document you have created, or use it as your desktop background.
10. WordPad is a text editor for short documents.
11. Notepad is used to create or edit text files that do not require formatting and are smaller than 64K.
12. Briefcase is designed for mobile users who carry portable computers with them while travelling.
13. The Briefcase keeps track of which files are the most recent and update the files that do not have the most recent data

4.6 MODEL ANSWERS

The questions given in the 'Check Your Progress' have been designed only at the conceptual level and the answers to these questions are directly available in the unit. Therefore, Model Answers have not been provided. However, as this block is more practical oriented, therefore, students are advised to try the commands given, on their terminals.

UNIT 5 COMMUNICATION THROUGH NETWORK

Structure

- 5.0 Introduction
- 5.1 Objectives
- 5.2 Network Setup & Configuration
- 5.3 Logging onto the Network
- 5.4 Mapping Network Drives
- 5.5 Network Browsing
- 5.6 Sharing Folders & Printers
- 5.7 Connecting to another Computer on your Network
 - 5.7.1 Dial-up
 - 5.7.2 Using Cables
- 5.8 E-mail
- 5.9 Internet
- 5.10 Summary
- 5.11 Model Answers

5.0 INTRODUCTION

In many organisations today, computers are connected together by cable or by phone line in a network. In a network, a computer can be attached to computers in adjoining offices, adjoining buildings, and to computers around the globe. If you are connected to a network, you can open and save files on other computers or use resources attached to those computers, like printers and CD-ROM drive. Of course, you must have access permission.

Windows 95 has come up with another bonanza, that is, Network Communication with other users. The users can connect with other users to share data files and peripheral devices, like Printers.

The communication tools of Windows 95 include E-Mail and connection to Internet.

5.1 OBJECTIVES

At the end of this unit you should be able to:

- Set up the network configuration using Windows
- Share folder and printers over a network
- Browse the network
- Set up connection for dial-up connectivity

5.2 NETWORK SETUP & CONFIGURATION

Assuming that the network administrator has already installed the network and established your computer as a workstation, you should be able to identify your computer network settings, like - the network name, the workgroup it belongs to, and how folders, drives, and other resources are shared on your computer.

To access other computers on your network, open the Network Neighbourhood object on the desktop. If your network is large, you can view the computers in your immediate workgroup. A **workgroup** is a collection of computers and computer users that share similar resources and belong to the same group. Whereas, **domain** that is similar to a workgroup is much larger in scale. Each domain has its own computers and workgroups and is managed independently of other domain.

To find out the network settings, double-click the "Network" object from the Control Panel window. In the Network window that is opened up, you will find three tabs - Configuration, Identification, and Access Control.

Configuration will display the network components that are installed, or removed, or properties are viewed. These are:

Client Software - It enables you to use files and printers shared on other network computers.

An **Adapter** - It is a hardware device that physically connects your computer to the network.

A **Protocol** - It is the set of rules a computer uses to communicate over a network. All computers connected to the same network must use the same protocol to communicate with each other.

In the same window, the **Primary Logon** is the client that is used to validate your user name and password, process any login script, and perform other start-up tasks.

Identification tab will open up the dialog box that displays the information to identify your computer on the network. In this, the **Computer name** is the name of your computer that other people see when they browse the network. The **Workgroup** is the name of the local network that your network belongs to. The **Computer Description** text box provides the place to enter the description for your computer. Other users will view this information when they browse the network.

Access Control tab provides you the option to determine how the files on your computer and the resources attached to it are shared over the network. The two options are:

Share-level access control is used to specify the passwords that other network users must type to access the resources you share on your computer.

User-level access control enables you to validate or authenticate users before they can access your computer. This works only if your network has a special security server.

5.3 LOGGING ONTO THE NETWORK

The Network Administrator assigns the login name and the password to every person who will use the network.

If you are already working on Windows 95, to log on to the network, follow the given instructions:

1. Click the **Start** button, and then click **Shut Down**.
2. Click **Close All Programs and Log On As A Different User**.
3. Click **Yes**.
4. In the **Enter Network Password** box, type your user name and password.

5.4 MAPPING NETWORK DRIVES

In order to access folders on network drives from some applications, a drive letter must be assigned to these folders. These drives are not physical drives but the mapping is done for logical drives.

To map a drive letter to a network computer or folder, follow the given steps:

1. In **My Computer** or **Network Neighbourhood**, locate the folder you want to map.
2. Right-click the folder to open its context menu.
3. In the **Drive** box, the next recommended drive is displayed. You can click on the down-arrow button to choose a different drive letter. In any case, it should not be the drive letter that is already in use.
4. Type a path to the computer and folder in the **Path** field.
5. Click **OK**.

To disconnect a mapped drive to make it free for other mappings, follow the given steps :

1. Open the **My Computer** window.
2. Right-click the mapped object you want to disconnect.
3. From its context menu, select **Disconnect** to remove the mapping.

5.5 NETWORK BROWSING

Open the **Network Neighbourhood** window to browse the computers and resources on the network. Even it is easy to copy or move files on another network computer.

To locate a folder on another network computer, follow the given steps:

1. Open the **Network Neighbourhood** window in which computers in your network neighbourhood is displayed.
2. Locate and double-click the icon of the computer you want to access.
3. A window showing all the shared resources on that computer is opened. From here double-click the folder you want to work with.

In Windows 95 networks, the rights you have in a folder also apply to all the subfolders within the folder.

5.6 SHARING FOLDERS & PRINTERS

Folders and printers can be shared amongst different users on the network. Even you can share disk drives by using the method described below.

To share a folder with other people, follow the given steps :

1. In **My Computer**, click the folder you want to share.
2. On the **File** menu, click **Properties**.
3. Click the **Sharing** tab, and then click **Shared As**. If the **Sharing** tab is not visible, you need to enable file and print sharing services.
4. Choose options and fill out the options (described in detail below).
5. Click **OK**.

Fields in the **Shared As** area are:

Share Name - the name that will appear to other users when they browse the network.

Comment - to describe the object. Choose **List** from the **View** menu of a **Network Neighbourhood** window to see the shared resources and their comments.

Options of the **Access Type** area are:

Read-only - Other users can read files from the device but they cannot change them without copying them to their own computers first.

Full - Other users can read and write files to and from the device.

Depends on Password - The user has both **Read-only** and **Full** access rights for the device, but he must type the correct password to gain access.

Options in the **Password** area are:

Read-only Password - to gain read-only access to the device.

Full-access Password - to gain read and writes access to the device.

5.7 CONNECTING TO ANOTHER COMPUTER ON YOUR NETWORK

Connection to another computer on your network enables you to see files and folders on that computer only if they are shared. The connection can be either a **Dial-up** connection or through **Cables**. Both of these are discussed below.

5.7.1 Dial-up

To set up a network connection by using **Dial-Up Networking**, the steps are:

1. Double-click the **My Computer** icon, and then double-click **Dial-Up Networking**. If you do not see a **Dial-Up Networking** folder in **My Computer**, then it is not installed.
2. Follow the instructions on the screen.

If you have already set up one or more Dial-Up connections, you can double-click **Make New Connection** to create a new connection. To dial a connection that you have already set up, double-click its icon in the **Dial-Up Networking** window.

5.7.2 Using Cables

To set up a direct cable connection, the steps are:

1. Click the **Start** button, and then point to **Programs**.
2. Point to **Accessories**, and then click **Direct Cable Connection**. If you do not see **Direct Cable Connection** in your **Accessories** menu, then it is not installed.
3. Follow the instructions on the screen.

If you have already successfully run **Direct Cable Connection** on this computer, the connection wizard does not appear unless you click **Change in the Direct Cable Connection** dialog box. The wizard then starts, and you can change your previous settings.

5.8 E-MAIL

E-Mail is a sophisticated network communication. You can call it as an electronic postal system. The users can exchange messages within minutes. Even the data files and large documents can be sent through E-Mail. With Windows 95, this can be done either using **Microsoft Exchange** or **Microsoft Network**.

With **Microsoft Exchange**, you can send and receive electronic mail. You send messages from and store all messages in **Microsoft Exchange**, so there is one convenient place to look for all your messages. To open **Microsoft Exchange** to send or receive a message, double-click the **Inbox** icon on your desktop. If the **Inbox** icon is not on your desktop, then **Microsoft Exchange** is not installed.

Also an access to the **Microsoft Network**, a new on-line service, is a feature of Windows 95. With the **Microsoft Network**, you can exchange messages with people around the world; read the latest news, sports, weather, and financial information; find answers to your technical questions; download from thousands of useful programs; connect to the Internet, and more!

To start The **Microsoft Network**, double-click The **Microsoft Network** icon on your desktop.

5.9 INTERNET

The Internet is a global interconnected "web" of computers and computer networks. Schools, institutions, businesses, hospitals, research institutes, and other entities are connected to the Internet and make their systems available to the public. The underlying connections include the dial-up telephone network and satellite and ground-based microwave links. The new computers and networks are constantly added and the electronic pathways of information are constantly changing.

E-Mail services are available on the Internet. Your access to some of the information may be free and unrestricted, may depend on access privileges, or may be quite expensive.

Connecting to the Internet

There are many ways you can connect to the Internet using Windows. Two of these are:

1. You can sign up for The Microsoft Network on-line service.
2. You can create a Dial-Up Networking connection to an Internet access provider.

Following are the steps to follow, if you are creating Dial-Up Networking connection to an Internet access provider:

1. Getting an Internet account

When you call an Internet access provider to sign up for Internet account, make sure you get the following information:

- User name
- Password
- Access phone number
- Your host name and domain name
- Domain Name Server (DNS) server address

The access provider may also provide the following information:

- IP address and subnet mask
- DNS search order (if required)
- Gateway address
- Authentication procedure (whether or not they require a terminal window to log on)

Use a PPP account if your provider offers it. If your organisation has a direct connection to the Internet, you can skip this step.

2. Setting up your communications hardware

You need a modem (9600 bps or faster is recommended) to connect to the Internet. If your organisation has a direct connection to the Internet, you can use a network adapter card instead of a modem.

3. Make sure you have Dial-Up Networking installed

Double-click the My Computer icon on your desktop. If you do not see a Dial-Up Networking icon, then follow the given steps:

1. Display Add/Remove Programs window.
2. Click Communications, and then click Details.
3. Check Dial-Up Networking, and then click OK.

4. Install the Windows 95 TCP/IP protocol

Display Network properties. If you see (in the displayed list) that the Windows 95 TCP/IP protocol is not installed, then follow the given steps:

1. Click **Add**.
2. Click **Protocol**, and then click **Add**.
3. Click **Microsoft**, and then click **TCP/IP**.
4. Click **OK**.
5. Click **Dial-Up Adapter**, and then click **Properties**. If your organisation has a direct Internet connection, click your network adapter, and then click **Properties**.
6. Click the **Bindings** tab, and then make sure the **TCP/IP** check box is checked.

When you install TCP/IP, it is bound to all of your adapters by default. If you have a network card and do not use TCP/IP with it, click the **Bindings** tab, and then remove TCP/IP.

5. Entering TCP/IP information

1. Open up **Network properties**.
2. Click **TCP/IP** (If there is more than one TCP/IP entry, click TCP/IP -> Dial-Up Adapter), and then click **Properties**.
3. On the **IP Address** tab, if your provider gave you an IP address, click **Specify an IP Address**, and then type your IP address and subnet mask.
4. If your provider did not give you an IP address, click **Obtain an IP Address Automatically**.

6. Setting up a connection to your access provider

In Dial-Up Networking, double-click **Make New Connection**. (If it is your first Dial-Up Networking connection, you will be prompted automatically.) And follow the instructions on your screen.

1. Using your right mouse button, click the **Connection** icon, and then click **Properties**.
2. If your provider requires a terminal window to log in, click **Configure**. Click the **Options** tab, make sure **Bring Up Terminal Window After Dialling** is checked, and then click **OK**.
3. In the **Properties** for the connection, click **Server Type**, and then make sure the type of server is set to **PPP**.

You can decrease the time required to connect by making sure that the following options are not checked:

- Log On To Network
- NetBEUI
- IPX/SPX Compatible

7. Dialing your Internet access provider

Double-click the connection, enter your name and password, and then click **Connect**. Follow the instructions provided by your Internet access provider for browsing the Internet, reading e-mail, and accessing information.

Check Your Progress

1. What is a Computer Network ?

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.....

2. What are the advantages of Network ?

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.....

3. How can you find out about the other computers and the resources on your network ?

.....
.....

4. What are the different ways by which you can connect to the network ?

.....
.....

5. What is an E-mail service and where is it available ?

.....
.....

5.10 SUMMARY

In this session, you have learned:

1. The users can connect with other users to share data files and peripheral devices, like Printers.
2. The communication tools of Windows 95 include E-Mail and connection to Internet.
3. In a network, a computer can be attached to computers in adjoining offices, adjoining buildings, and to computers around the globe.
4. To access other computers on your network, open the Network Neighbourhood object on the desktop.
5. The Network Administrator assigns the login name and the password to every person who will use the network.

6. In order to access folders on network drives from some applications, a drive letter must be assigned to these folders.
7. The Network Neighbourhood window is used to browse the computers and resources on the network, and to copy or move files on another network computer.
8. In Windows 95 networks, the rights you have in a folder also apply to all the subfolders within the folder.
9. Connection to another computer can be either a Dial-up connection or through Cables on your network that enables you to see files and folders on that computer only if they are shared.
10. E-Mail is a sophisticated network communication that is also called as an electronic postal system, through which the users can exchange messages, data files and large documents within minutes. With Windows 95, this can be done either using Microsoft Exchange or Microsoft Network.
11. The Internet is a global interconnected "web" of computers and computer networks.
12. The two ways of connecting to the Internet using Windows are either you can sign up for The Microsoft Network on-line service, or you can create a Dial-Up Networking connection to an Internet access provider.

5.11 MODEL ANSWERS

The questions given in the 'Check Your Progress' have been designed only at the conceptual level and the answers to these questions are directly available in the unit. Therefore, Model Answers have not been provided. However, as this block is more practical oriented, therefore, students are advised to try the commands given, on their terminals.

UNIT 6 MULTIMEDIA IN WINDOWS 95

Structure

- 6.0 Introduction
- 6.1 Objectives
- 6.2 Multimedia in Windows 95
- 6.3 Multimedia Add-ons
- 6.4 Media Types
 - 6.4.1 Audio
 - 6.4.2 Visual
- 6.5 Multimedia Tools
 - 6.5.1 CD Player
 - 6.5.2 Media Player
 - 6.5.3 Sound Recorder
 - 6.5.4 Volume Control
- 6.6 Summary
- 6.7 Model Answers

6.0 INTRODUCTION

Multimedia is the term for different media like graphics, animation, sound, and video all wrapped in one interactive package. The basic idea is to manage and co-ordinate the various devices of communication and entertainment electronics with the PC as a central controller. Multimedia brings dazzle to presentations, actions to games, and fun to learning. It promises to play an important role in the communication systems of the future.

Multimedia uses the concept of digital information that has many advantages:

- The information like pictures and sound are stored in digital forms and can be copied without loss of quality.
- Digital information can be compressed to take up less space on a storage device.
- Information can be put on a CD-ROM, and CD-ROM's take up very little shelf space.
- Interactive computer programs that use digital media are excellent learning tools.

In this unit, we will discuss about multimedia tools in Windows.

6.1 OBJECTIVES

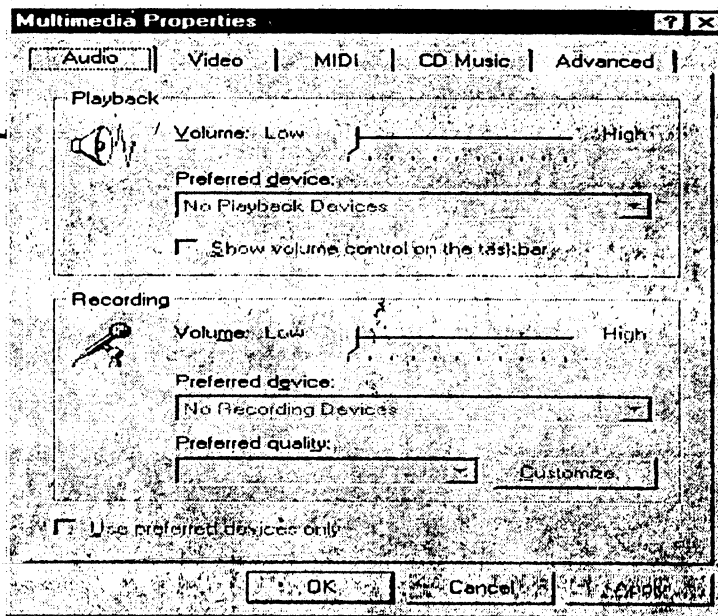
After going through this unit, you should be able to:

- define multimedia in Windows 95
- identify multimedia add-ons
- use the multimedia tools

The previous versions of Windows and DOS were not designed to support multimedia, therefore, the multimedia presentations were either not running or running very slowly. With Windows 95, things are improved as it supports multimedia at the base level, as discussed below:

- Multimedia presentations require more than one media, and Windows 95 is a 32-bit, multitasking and multithreading operating system. This assures playing more than one media smoothly, and more responsive to user interaction.
- During installation procedure of Windows 95, it automatically detects and configures itself for multimedia devices.
- Windows 95 allows you to create compound documents that include sound, video, graphics, charts, pictures, and other elements from various applications.
- A new CD-ROM file system in Windows 95 improves CD-ROM performance.
- An AutoPlay feature makes it easy to set up and play back programs on CD-ROM.
- The video standard in Windows 95 is widely supported in the computer industry.
- Windows 95 supports larger video windows and higher frame rates.
- Windows 95 supports Sony VISCA interface which means that you and your applications can control VCRs and laser disc players.
- New graphic programming interface improves the game performance in Windows 95.
- Windows 95 supports a variety of industry-standard sound and video compression codecs (coders, decoders). Codecs reduce the size of multimedia files.

All the multimedia controls can be changed or edited from the **Multimedia Properties** dialog box. To open this box, open the **Control Panel** and double-click the **Multimedia** utility.



6.3 MULTIMEDIA ADD-ONS

Multimedia add-ons are the hardware devices and software drivers that are required to convert a PC (Personal Computer) to a MPC (Multimedia PC). The Multimedia Marketing Council defines MPC specifications. The members of this council are a number of leading hardware and software manufacturers like - Microsoft, Tandy, Fujitsu, AT&T, Olivetti, Media Vision, Creative Labs, CompuAdd, NEC Technologies, and Headland Technology.

Following are the minimum requirement for running Windows 95 multimedia:

- An Inter 80486 CPU, though a Pentium system is recommended for digital video applications.
- A PCI bus to provide high data throughput for disk controllers and video cards.
- A high capacity HDD (in gigabyte range) is necessary while capturing high-quality digital video.
- A dual-speed, triple-speed, or quad-speed CD-ROM drive with front-panel volume control is required.
- Sound cards that provide 11.25-, 22.05-, and 44.1-Khz stereo sampling rates, multivoice and multitimbral capabilities, and internal mixing capabilities to combine input from multiple sources.
- Microsoft recommends VESA or PCI video cards for best performance. as the requirement is for VGA or better video hardware that can support 640 × 480 at 16 colors. Although the digital video looks best when supported by SVGA at 600 × 800, and 256 colors.
- An IBM-style analog or digital joystick port.
- A MIDI (Musical Instrument Digital Interface) port. MIDI is a standard for recording notes and related information that is played on electronic music devices like digital keyboards.

6.4 MEDIA TYPES

The different media types are either audio or visual. Multimedia information is stored in sound, video, or MIDI file format.

6.4.1 Audio

Recording and playing back sound were the first multimedia applications for personal computers. With the help of installed sound card, you could record a voice, store it in a file on disk, and play back the same sound on another computer. Music and sound can be recorded for computer-generated presentations.

There are basically two types of audio for multimedia:

Wave Audio - Actual sound waves are recorded and converted to digital data.

MIDI Audio - It is the recording of keystrokes or other actions that direct synthesizers and other MIDI-compatible electronic music devices to generate sound. Thus, these files are smaller in size.

6.4.2 Visual

This media includes the following files:

Animation - The first thing that comes in mind are the animation movies like Jungle Book. Animation is the images that move on the screen. The animation movies include these kinds of images and sound.

Video - The video pictures can be recorded from cameras or laser discs into a computer and store it on the disk. To capture high-quality video and store it efficiently, these files need to be compressed.

6.5 MULTIMEDIA TOOLS

Windows 95 offers accessories for editing and listening to sound, playing movies, and playing music CDs.

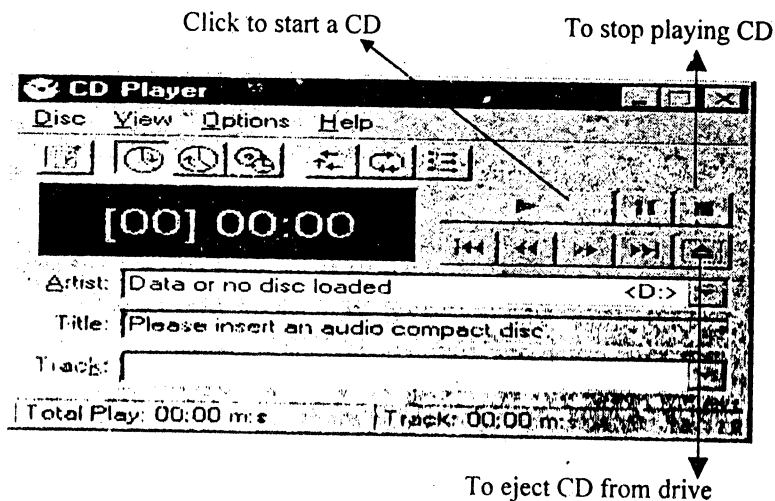
To access these accessories, follow the given steps:

1. Open the **Start** menu.
2. Select **Programs** from the menu.
3. From the cascading menu, click on **Accessories**.
4. Then click on **Multimedia** from the cascading menu of Accessories.

The options of the Multimedia menu are - CD player, Media Player, Sound Recorder, and Volume Control. Each of these is discussed in the subsections.

6.5.1 CD Player

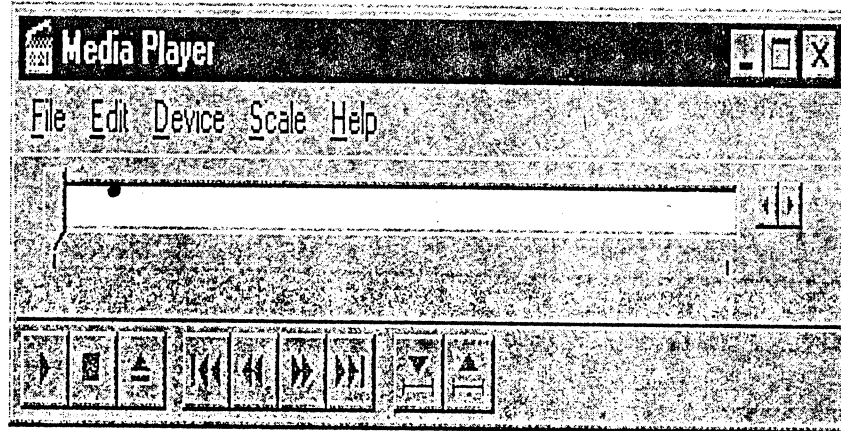
You can use CD Player to play audio compact discs from a CD-ROM drive connected to your computer. To use CD Player, you also need a sound card.



Before playing a CD make sure it is in the CD-ROM drive, and then click the start button as shown in Figure. Your CD continues to play even if you minimise CD Player.

6.5.2 Media Player

You can use Media Player to play audio, video, or animation files, and to control the settings for multimedia hardware devices. To use Media Player also, you should have a sound card.



6.5.3 Sound Recorder

The Sound Recorder is a handy but somewhat limited digital recorder. Using Sound Recorder you can record, play, and edit sound files. To use Sound Recorder, you must have a sound card and speakers installed on your computer. If you want to record live sound, you also need a microphone. This multimedia utility can be used to create recorded messages and include them in files or include them in electronic mail messages that you send to other users.

To record a new sound, follow the steps given:

1. Attach a microphone to the soundboard or a patch cable from another sound source, such as a CD audio player or stereo.
2. To customise recording options, choose **Properties** from the **File** menu.
3. Choose **recording format** in the **Format Conversion** field.
4. Click the **Convert now** button that opens the **Sound Selection** dialog box.
5. In the **Name** field, specify the quality of sound from the pull-down list - **CD Quality**, **Radio-Quality**, or **Telephone Quality**. For every option of the **Name** field that you select, note the contents of the **Format** and **Attributes** fields, which show the recording options and disk space requirements in seconds.

play the pre-recorded sound

1. Open the **File** menu from the **Sound Recorder** window.
2. Choose the **Open** command.
3. Open the **Media** folder that is the subfolder of the **Windows** folder.
4. Choose the wave file that you want to play.

5.4 Volume Control

If you have a sound card, you can use Volume Control to control the volume and speaker balance when you play audio files.

To adjust the volume for multimedia devices, open the **Multimedia Properties** dialog box. In the **Playback** or **Recording** area, drag the Volume slider.

Check Your Progress

1. What do you understand by the term Multimedia?

.....

What are the different types of media that you can use in Multimedia?

.....

3. Name the Multimedia Tools that are available with Windows 95.

.....

SUMMARY

In this session, you have learned:

Multimedia is the term for different media like graphics, animation, sound, and video all wrapped in one interactive package.

Multimedia uses the concept of digital information.

Multimedia presentations require more than one media, and Windows 95 is a 32-bit, multitasking and multithreading operating system.

4. Multimedia add-ons are the hardware devices and software drivers that are required to convert a PC (Personal Computer) to a MPC (Multimedia PC).

5. The Multimedia Marketing Council defines MPC specifications.
6. The different media types are either audio or visual.
7. Multimedia information is stored in sound, video, or MIDI file format.
8. There are basically two types of audio for multimedia, that is, Wave Audio and MIDI Audio.
9. The visual media includes either the Animation file or Video file.
10. Windows 95 offers accessories for editing and listening to sound, playing movies, and playing music CDs.
11. You can use Media Player to play audio, video, or animation files, and to control the settings for multimedia hardware devices.
12. The Sound Recorder is a handy but somewhat limited digital recorder.
13. Using Sound Recorder you can record, play, and edit sound files.
14. If you have a sound card, you can use Volume Control to control the volume and speaker balance you play audio files.

6.7 MODEL ANSWERS

The questions given in the 'Check Your Progress' have been designed only at the conceptual level and answers to these questions are directly available in the unit. Therefore, Model Answers have not been provided. However, as this block is more practical oriented, therefore, students are advised to try the commands given, on their terminals.



U P RAJARSHI
TANDON OPEN UNIVERSITY

BCA-1.1 Computer Fundamentals & PC Software

Block

4

SAMPLE GUI ORIENTED APPLICATIONS

UNIT MS-Word Basics	5
UNIT 2 Formatting Text	20
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BLOCK INTRODUCTION

In the previous block, we have discussed about the Graphical User Interfaces and have stated that one of the advantages of GUI is the common look and feel. In this block, we will demonstrate this feature without specific mention. This block presents two important applications, viz. Word Processing and Presentation Graphics, on Windows platform. This block although is practical oriented, yet we expect from you that you will try to relate the features discussed in this block to any other similar application on Windows platform.

This block mainly focuses on Microsoft Word, a full-featured Word Processor that can be used to create letters, memos, reports, newsletters and just about any other kind of document, and Microsoft PowerPoint, a package for creating presentations. The block consists of five units.

Unit 1 covers the fundamental features of Word, and explains the various typing and editing features in MS-Word.

Unit 2 covers the various character formatting and paragraph formatting features.

Unit 3 describes the various Page Design and Layout features, Table Creation and handling.

Unit 4 introduces you to Mail Merge and Macros. The various advanced techniques of Mail Merge have also been discussed. It also explains the document management.

The fifth unit covers the introduction to Business Graphics, how to create presentation slides, using tools like Wizards, creation of graphs and tables, and creating slide shows.

Please note the objective of this block is not to give you the complete functionality of these packages, but to provide the basic feel of it. However, you can experiment with the options once you are familiar with the basic concepts explained in the block.

UNIT 1 MS-WORD BASICS

Structure

- 1.0 Introduction
- 1.1 Objectives
- 1.2 Starting WORD
- 1.3 The WORD Screen
- 1.4 Getting to Word Document
- 1.5 Typing and Revising Text
 - 1.5.1 Typing Text
 - 1.5.2 Text Editing
 - 1.5.3 Copying and moving
 - 1.5.4 Typing Special Characters (Symbols)
- 1.6 Some Common Features
 - 1.6.1 Changing the CASE of text
 - 1.6.2 Moving & copying text with drag & drop
 - 1.6.3 Justifying text
 - 1.6.4 Creating Bulleted & Numbered lists
 - 1.6.5 Arranging & moving between documents
- 1.7 Finding and Replacing
- 1.8 Editing and Proofing Tools
 - 1.8.1 Using the Spelling Checker
 - 1.8.2 Checking Grammar
- 1.9 Summary
- 1.10 Model Answers

1.0 INTRODUCTION

Consider the following typed letter:

C-1/45
Janak Puri
Delhi-110 058

Dear Anu,

We both have holiday next Monday. What do you say to a trip to muree and a ramble in the gullies? We could start early, say 6 a.m., in my car, and take some group with us, and make a day of it up in the cool. It would be a change from this heat down here. If you agree, I will arrange the picnic, and be round at your house at a quarter to six on Monday morning. Bring your camera with you.

Yours

Rohit

Just notice, in this letter, there are some spelling errors, typing mistakes, missing words, missing lines, a paragraph to be moved down and so on.

In order to make the changes, the entire document has to be retyped and if there were many documents of this sort, the time and effort required to retype each would be phenomenal.

Such work, defined above, is called **Word Processing**.

A word processor is a software package, which helps enter and edit a document much faster than the usual manual ways. Most of the word processors today allow much more than allowing one to enter and edit a document.

The following is a list of some of the functions that are possible by using a Word Processor:

- Creating the document (typing in)
- Saving the document
- Opening an existing document
- Moving or copying paragraphs from one place in the document to another
- Finding the words and replacing them with another word
- Searching for spelling errors
- Printing the document etc.

In this block, we will describe the use of a word processor: Microsoft Word (MS Word). MS Word is a windows based application and is normally available as an icon in the Application group or the MS Office group. This unit describes the various features related to typing and revising text, selecting text as a group, instead of a letter or word at a time.

Most word-processing efforts, whether a note to yourself or an annual report, are created through an iterative process of typing & editing. In this unit, we briefly cover some simple ways of revising documents.

With Word, you can search a document for specific characters, formats, or styles using the Find & Replace command.

Various editing & proofing tools including spell check have been explained. Word's spelling feature is used to check an entire document or a block of selected text against Word's built-in dictionary or against specialized dictionaries that you create.

1.1 OBJECTIVES

After going through this unit, you will be able to

- start the WORD software package.
- create and edit document.
- print a document.
- create bulleted text.
- close and save the document.
- copy and move text
- finding and replacing text
- correct your typed document using spell checker.

1.2 STARTING WORD

As in the case with other window applications, to invoke MS Word, you click on the icon Microsoft Word. In application or MS Office group the following icon will be displayed. To invoke MS Word, double click on this icon.



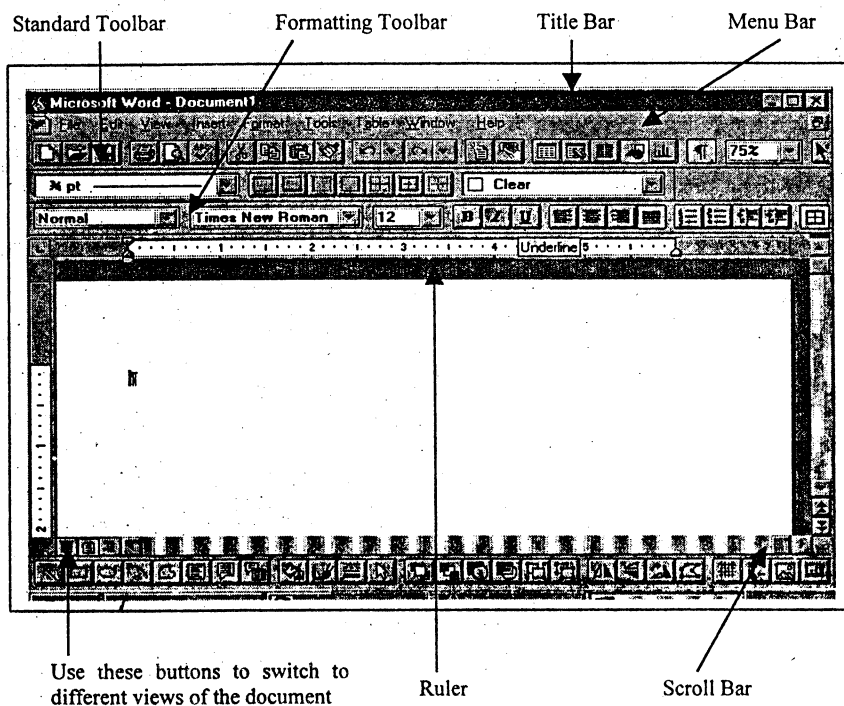
Starting Word and Opening a document

To start word and simultaneously open a word document, double-click the filename of the document in the File Manager.

1.3 THE WORD SCREEN

This section provides an overview of the major elements on the Word screen, such as menus, toolbars and status bar.

When the word is started, a new, blank document appears on the word screen. The following illustration identifies each part of the word screen.



The **(Menu bar)** provides access to the word commands. These commands are grouped together in menus, with only the group (menu) name displayed on the menu bar.

The "toolbars" contain buttons that provide quick access to commonly used commands.

Clicking a button has the same effect as selecting the command from the menus, but can be done in a single action.

The Ruler

The Ruler allows you to accurately set the layout of the document. It allows you to set tabs, indents, and change page margins.

1.4 GETTING TO WORD DOCUMENT

This section explains the basic procedures for creating new documents, saving your work, opening existing documents, and printing.

Creating a Document

To create a new document at any time, click the new button on the Standard toolbar. While creating a document such as memo, letter, report, or resume, one can often save time by using one of the wizards or templates that come with Word.

When you open a document it is placed on the top of any existing ones and becomes the active document.

The next step is to enter the text for the document.

Opening a Document

To quickly open one of the last documents you worked on, choose it from the bottom of the file menu. To open a document, click the Open button on the Standard toolbar. When the dialog box appears, select the document in the File Name box (Windows) and then choose the OK button.

Saving a Document

To save a document on disk, click the Save button on the Standard toolbar. When you save a document for the first time, Word displays the Save As dialog box so that you can type a name for the document.

Printing a Document

Before printing a document, Page breaks and choosing print preview from the File menu checks the overall appearance of the document. To view the document one page at a time, and also edit the text more easily, choose Page Layout from the View Menu. When ready to print, click the Print button on the Standard toolbar. Your default printer should be set using Windows program for printing.

Closing a Document and Quitting Word

When finished working in Word close the active document and then quit Word by choosing Exit (Windows) from the file menu. To work on another document in Word, close the active document by choosing Close from the file menu and then open the other document.

Also, several documents can be open at the same time. To work in a particular document, click anywhere in its window, or select the document name from the window menu.

When you open a new document in Word, the insertion point is at the top of the document, ready for you to begin typing. Word inserts a non-printing character called a paragraph mark at the end of a paragraph. This section gives the details about typing text and the various ways of revising text.

1.5.1 Typing Text

Typing text in MS-Word is very easy and straightforward task, because of the useful word processing features supported by it. When you create a new document in Word you can just start typing. Press the Enter key only when you have finished a paragraph.

MS-Word automatically moves the text to the next line when it reaches the right edge of the screen. This feature is known as word-wrap. When you end a paragraph, word inserts a non-printing character called a paragraph mark (¶). To display all non-printing characters, click the show/hide button on the standard toolbar.

1.5.2 Editing text

Editing Text includes selecting, deselecting, deleting, inserting, replacing text, which are described in this subsections.

The cursor changes shape to an I-beam when it is over the text work area (document page). However, when you move the cursor into the left margin it changes to a white arrow. The area of the page is known as the "selection bar" and allows you to select blocks of text easily.

1. Selecting text

You can select text by dragging over the text to select it, as well as clicking actions. The actions you perform depend on what you want to do. The options are:

Selecting a word; a complete line; an entire sentence; a paragraph; a block of text, the whole document.

- i) The easiest way to *select a word* is to double-click anywhere on the word. The selected text then appears reversed (or highlighted).
- ii) One way to *select a complete line* of text is to drag the cursor over it.

A simple way to achieve this is to click in the left margin beside the line (the cursor appears as a white arrow).

To select several lines drag the mouse in the left margin beside the text you require.

- iii) To select an *entire sentence* hold down the "CTRL" key and click anywhere in the sentence. Note that the punctuation mark (if any), and the space following the sentence is also selected.
- iv) You can *select a paragraph* by clicking three times anywhere within the paragraph. Alternatively, double clicking in the left margin beside the paragraph can do this.
- v) To select the block of text click at the beginning of the first line, then press "Shift" as you click at the end of the last line you wish to select.

vi) To select the whole document click three times in the left margin. Alternatively, you can do this by pressing the "CTRL" key and clicking in the left margin

2. *Deleting Text*

Text can be deleted by using either the "Delete" or "Backspace" keys. Delete removes single characters to the right of the cursor, while backspace removes single characters to the left.

Block deletions make it easy to delete sentences, paragraphs and sections of documents. Once you have selected the text you wish to remove, pressing the "Delete" or "Backspace" key removes it from the document.

3. *Inserting Text*

MS-Word offers several ways of inserting text into an existing document. The simplest among all, is to move the cursor to the required position and start typing. The existing text will be pushed and adjusted accordingly.

Place the mouse pointer (the I-beam) where you want to be inserting text.

Next, click the mouse button to move the insertion point to the desired locations.

4. *Replacing Text*

Word can combine the steps of deleting unwanted text, positioning the insertion point, and inserting replacement text. To replace text:

- Select the text to be removed
- Start typing the new text
- The selected text will be removed and the new text accommodated.

1.5.3 Copying and Moving

Word for windows supports all of the usual windows techniques for copying and moving information (text, graphics or an item inserted from other application)

- "Moving" means to remove (cut), the selected text or graphic from one location and insert it in another location.
- "Copying" means to make a copy of the selected text or graphic and insert it in another location, leaving the original unchanged.

Cut, Copy & Paste

The procedures used to cut, copy and paste are similar to window's editing procedures. If a portion of the text is to be moved to a different place, select the text to be moved and then use the cut option in the edit menu. The selected text will be copied to the clipboard in Windows. Now the Paste option is enabled in the Edit menu. To paste the text that is in the clipboard at some position in the document, place the cursor at the starting point of insertion and choose Edit → Paste. The text will be pasted there.

If the text to be pasted elsewhere is only to be copied but not removed from its original position then

- Select the text to be copied
- Choose the Edit → Copy option.

- Place the cursor at the insertion point.
- Choose the Edit → Paste option to paste a copy of the selected text.

The paste option can be repetitively used once the copy operation is made. To try these operations type the following lines of text:

Example:

If you choose to do a complete installation, can tell the installer which items want to install.

Now, select the word "you" from the example above. Choose Edit → Copy. The text will be copied to the Clipboard. Now place the cursor after the comma and choose the Edit → Paste option. Again place the cursor between the words items and 'want' and repeat the paste operation. The final text should look like this.

If you choose not to do a complete installation, you can tell the installer which items you want to install.

Copying From One Word Document to Another

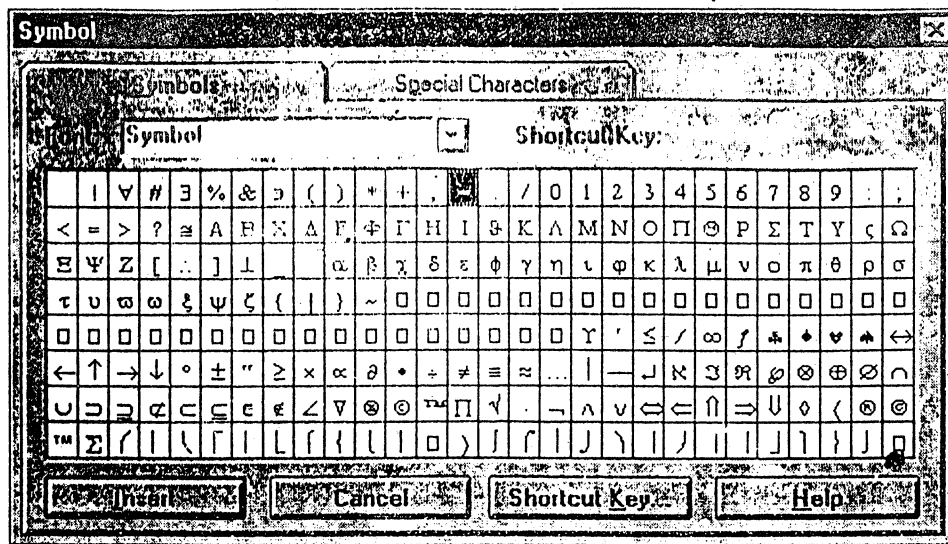
MS-Word provides facility to copy (portions or whole) one document to another. To do this, two documents should be opened first. To edit two documents at the same time do the following:

- Open any two documents one after the other using the File menu.
- Choose the Window → Arrange All option. The two documents are displayed in separate windows on the screen. The highlighted title bar indicates the active window.
- To activate a document window of your choice just click on that document with the mouse pointer. The individual documents can be re-sized according to convenience using the size-boxes in the lower-right corners of the window.
- Now copy the portion of the document desired to be copied to the other document on to the clipboard using Edit → Copy option.
- Change the focus of input to the other document and place the cursor at the point of insertion.
- Use Edit → Paste option to copy the document.

1.5.4 Typing Special Characters (Symbols)

MS-Word supports a set of special characters and symbols, which cannot be entered through the keyboard. To insert these special characters choose Insert → Symbol. The dialog box of all available symbols is displayed for respective fonts. Clicking on the symbol displays an enlarged version of the symbol. Double clicking inserts the characters at the current cursor position in the document.

If you don't see the symbol you're looking for, you may need to select a different font in the font box, which shows all of the fonts installed on your system. All fonts based on the ANSI or ASCII character set are listed as Normal Text.



The Special Characters tab includes additional characters such as em and en spaces, em and en dashes, non-breaking hyphens, non-breaking spaces, ©, and ®.

To display and print a particular symbol, Word needs both the screen font and the printer font that contain that symbol. If you have installed only the printer font, the symbols may be printed properly but may not be displayed correctly.

1.6 SOME COMMON FEATURES

In this section, we will discuss some of the common features of the MS-Word.

1.6.1 Changing the Case of text

The "Change Case" command in the "Format" menu allow you to change the case of the characters in text without having to retype them.

In brief, to change the capitalization of text

1. Select the text you want to change.
2. From the Format menu, choose Change Case.
3. Select the option you want, and then choose the OK button.

For a quicker method of achieving the same results, select the text you want to replace and then press SHIFT+F3 until the text has the effect you want.

1.6.2 Moving and copying text with drag and drop

You can move text within a document by dragging it to a new location. This method of moving text is known as "drag and drop". When you move text its attributes (size, fonts, etc.) accompany it without changing the text in the new location.

To drag and drop, you first select the text you want to move, then drag it to the desired location. When the cursor is positioned over selected text it changes to a white left pointing arrow. Drag-and-drop editing is the easiest way to move or copy a selection a short distance and you can also drag and drop items between documents. However, to move or copy a selection a longer distance, the Cut, Copy and Paste commands are often more convenient.

To move text and graphics using drag-and-drop editing.

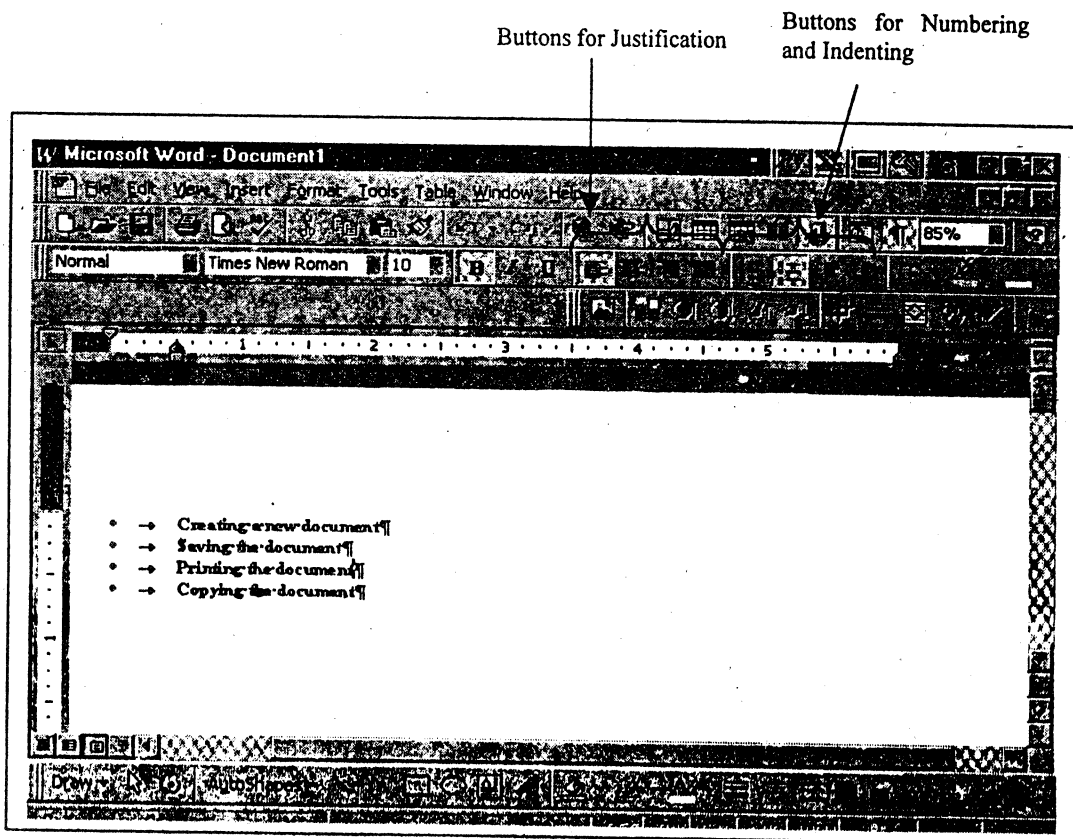
1. Select the text and graphics you want to move.
2. Point to the selected text and graphics, and then hold down the mouse button. When the drag-and-drop pointer appears, drag the dotted insertion point to the new location.
3. Release the mouse button to drop the text into the selected place.

To copy text and graphics using drag-and drop editing.

1. Select the text and graphics you want to copy.
2. In Windows, hold down the CTRL key, point to the selected text and graphics, and then hold down the mouse button while you drag the dotted insertion point to the new location.

1.6.3 Justifying text

Justification determines the way text is aligned with respect to the margins. The default for Word is left justification, which aligns text to the left margin. You can change the justification of text by using the Justification buttons on the toolbar from left to right they are:



1. Left – Justifies text on the left margin;
2. Center – Centers all lines of text;
3. Right – Justifies text on the right margin;
4. Justify – Justifies text on both left and right margins.

When you justify text the current paragraph or selected text is affected. The selected justification remains in affect for the document until you change it.

1.6.4 Creating Bulleted and Numbered lists

You can easily create a bulleted or numbered list by selecting a list and then clicking the Bullets button or the Numbering button on the formatting toolbar. Alternatively, you can click either of these buttons before you type a list. When you've finished typing the list, just press ENTER and click the same button again. The new text you type is not formatted with bullets or numbers.

1.6.5 Arranging and Moving between open documents

All the open documents can be viewed at the same time via the "Arrange All" command in the "Window" menu. The title bar of the active document becomes colored.

To move to another document, you click inside its window or via the window list in the "Window" menu.

Check Your Progress 1

1. Type in document given below (The content of check your progress) and perform the following operations:
 - i) Go to the third of the 1st paragraph and copy it at the bottom of the current page and at the beginning of the next page.
 - ii) Cut the first word of the paragraph and paste it at the end of the first sentence.
 - iii) Make the paragraph right justified.
 - iv) Split the screen to two portions. Set one portion of the document to the page layout view and the other to Normal view.
 - v) Type in the last paragraph of one portion to the other portion and watch the changes.
 - vi) List the steps to remove this split, bring the document to full screen view, then close the document and quit Word.
2. Click the appropriate answer
 - I. The toolbar in Word
 - a) provides a shortcut way of accessing commands
 - b) allow the current time to be displayed
 - c) help in displaying the position of the insertion point
 - d) allow you to move around in a document

- II. Print Preview is used to
- Save the document
 - Print the document
 - View how the document will appear when printed
 - Copy the document

- III The field for current time is displayed on
- the toolbar
 - the horizontal ruler
 - the status bar
 - the vertical ruler

3. What are the differences between viewing a document in Normal view and Page Layout view ?

.....

.....

.....

.....

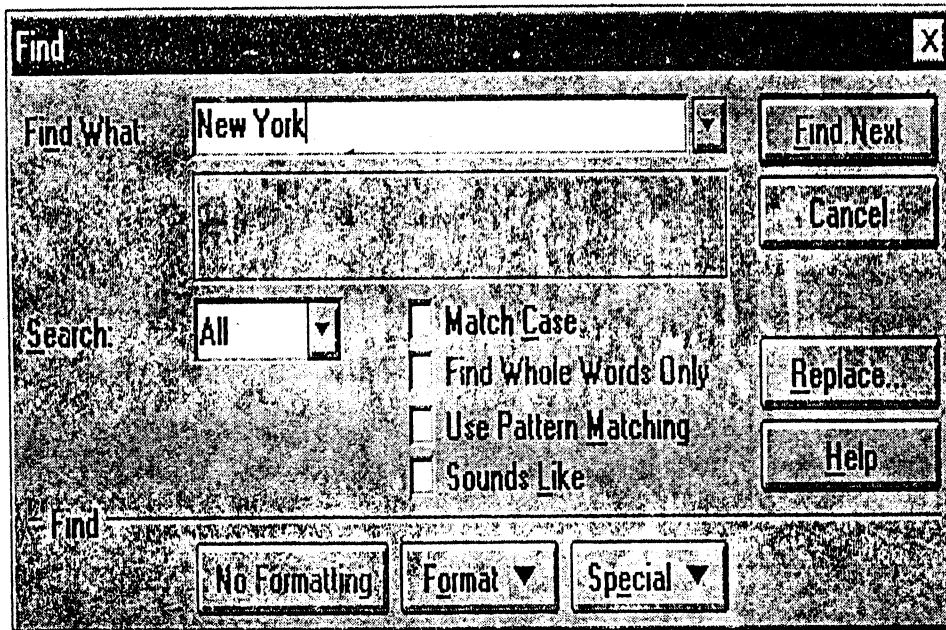
1.7 FINDING AND REPLACING

MS-Word provides some excellent features as **Find and Replace**, which may be used for a number of tasks, with high flexibility. Using these features it is possible to find a specific text in a document, search for a particular pattern of text etc.

Finding and Replacing Text and Formatting

To find a particular text in a document, choose the **Edit->Find** option. A dialog box like the one in example below appears. This dialog box can be used to specify the text to be found. The text found by this option can be changed, by clicking the mouse at the position required, in the document. The dialog box can be reused to fetch the next instance of the text.

Example:



The Find dialog box can be used to specify the direction in which the Find operation is to be done. To do this use the Search option in the dialog box.

Special search requests like Match Case or Use Pattern Searching can be used. If the Match Case option is not checked out then MS-WORD finds all the instances of the text specified, irrespective of upper or lower case characters. For example, if the text to be found is given as "New York" then "NEW YORK", "new york", are also found as matching text.

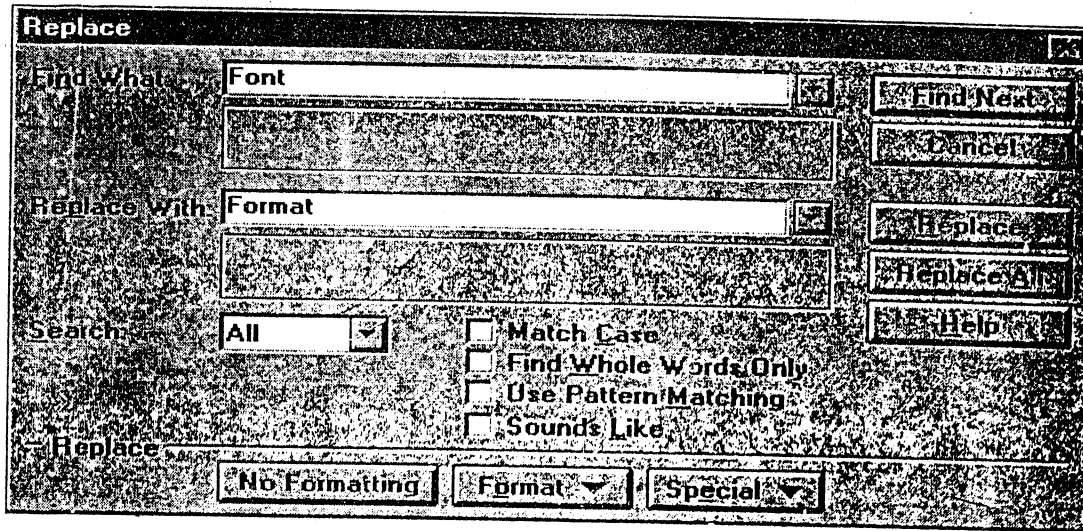
The **Find Whole Words Only** option can be used to make searches on complete words only. If not checked out, all matching patterns of texts are shown. For example, if the word "man" is to be searched and replaced by the word "woman", then if the above option is not checked, this would lead to a search for all words containing the word "man" (e.g., words like "human", "manner", "Manmohan" are also found by MS-WORD)

Finding Special Characters

To specify special characters like line break, tab character, white space, etc., in the Find Dialog box, choose the Special drop down list. Most of the special characters here are self-explanatory. Suppose it is required to find the words "Indian Team" with a white space in between (the white space might be a tab, a single space, 2 spaces etc.). Then the correct way to specify this is by typing the word "Indian" in the Find What box. Now choose **Special-> White Space** which inserts a (^W) in the Text box next to "Indian". Now type in "Team". So the correct search pattern would be "Indian^wTeam".

In the same manner the Any Letter and Any Digit options can be used.

Use the **Find->Replace** option to replace the text found, matching the specifications in the Find Dialog box. This is a very useful feature using which one can make fast editing in the existing document at specific locations. For example, a business letter can be addressed to a new person by replacing the old person's name with the new person's name but retaining the rest of the format and style.



In the Replace dialog box (example above) one can make a global replacement of text of the next pattern to verify if replacement is necessary and commit replacement.

1.8 EDITING AND PROOFING TOOLS

The editing and proofing tools in Word help to improve your writing and the readability of your text. These tools can:

- Find and correct spelling errors.
- Automatically correct typing and spelling errors that you've specified.
- Locate possible grammatical or stylistic errors, suggest improvements and help you evaluate the readability of your text.
- Look up synonyms, antonyms, and related words.
- Automatically hyphenate text.
- Check text in other language.
- Display document statistics such as word count or paragraph count.

1.8.1 Using the Spelling Checker

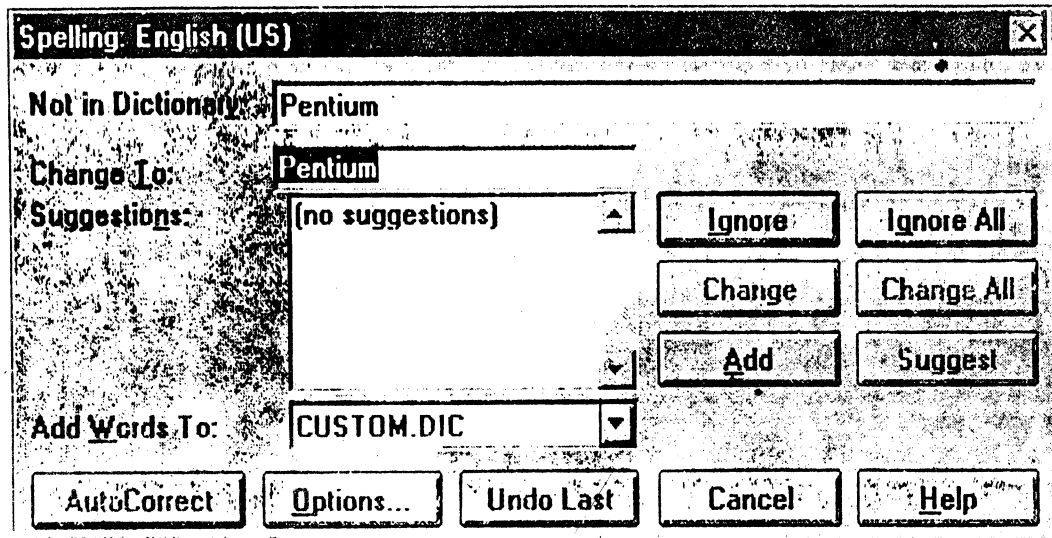
Spell check is one of the powerful features of MS-Word. It also provides to check the spellings of the entire document including the header, footer and the hidden text. Adding words to the dictionary is possible

The Spelling Checker provides a convenient way of correcting spelling mistakes in your documents. It compares the words in your document against its own dictionary.

You should always check your documents with the Spelling Checker before you print them.

You start the Spelling Checker via the "Spelling" command in the "Tools" menu or by clicking the "Spelling" button.

The Spelling Checker automatically checks the active document.



When the Spelling Checker locates a word it cannot find in the dictionary it stops, highlights the offending word, and display it on the "Not in Dictionary" line.

You have the option to:

1. Ignore its selection;
2. Manually type in a correction to the word;
3. Replace the word with a suggested word;
4. Add the word to the dictionary.

The "Suggestions" box lists possible alternatives to the word. If it cannot find a close match this box will be empty.

To retain the word, choose **Ignore** and to ignore the change at all its occurrences in the document Choose **Ignore All**.

To change the word, choose **Change** and to change the word at all its occurrences in the document choose **Change All**.

To add the current selected word into the dictionary chooses the **Add** button.

You have the choice to add the word to the default Word custom dictionary, or a new custom dictionary that you create. You create new customs dictionaries via the **Options** button.

Before you add a word to a dictionary, check that it is spelled correctly, otherwise it will be assumed that the misspelled word is correct.

If you have any doubts, check the word with a paper dictionary before you add it.

The Speller Checker is not foolproof and will not catch a mistake if you accidentally type in another word: The Spelling Checker does not understand the context in which the word is used in the sentence.

1.8.2 Checking Grammar

During a grammar check, Word identifies sentences that contain possible grammatical or stylistic errors and suggests improvements. For example, if you wrote "The project were completed by your team," Word could question the grammar, first for subject-verb agreement and then for passive voice. Word also question style errors, such as wordiness and the use of clichés.

You can determine how strictly Word observes grammar and style rules by using rule groups. Word provides three rule groups-formal, business, and casual-which you can customize to observe or ignore specific grammar or style rules. You can also create up to three of your own custom rule groups.

Check Your Progress 2

1. During spell check, Word uses the English (US) dictionary as its Main dictionary, supported by
 - i) US.DIC
 - ii) SCIENCE.DIC
 - iii) CUSTOM.DIC
 - iv) FRENCH.DIC

2. The keyboard shortcut keys for undoing the modifications made to a document are.
 - i) Alt+Z
 - ii) Shift+Z
 - iii) Tab+Z
 - iv) Ctrl+Z

1.9 SUMMARY

This unit, was an attempt to help you in editing text, finding and replacing word or text in the document; and making spelling and grammatical checks.

After going through this unit you must have become familiar with the features of Word which make it distinguished from the other Word processors. By now, you must know how Word document appears in different views. The various commands can be invoked either through the toolbar, menu or keyboard shortcut keep. In short, Word Processing job has been made easier and faster.

1.10 MODEL ANSWERS

The questions given in the 'Check Your Progress' have been designed only at the conceptual level and the answers to these questions are directly available in the unit. Therefore, Model Answers have not been provided. However, as this block is more practical oriented, therefore, students are advised to try the commands given, on their terminals.

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UNIT 2 FORMATTING TEXT

Structure

- 2.0 Introduction
- 2.1 Objectives
- 2.2 Formatting Text Characters
- 2.3 Formatting Paragraph
 - 2.3.1 Centering, Right Alignment and Left Alignment
 - 2.3.2 Indenting Text
 - 2.3.3 Tab Stops
 - 2.3.4 Line Spacing
 - 2.3.5 Paragraph Spacing
 - 2.3.6 Borders and Shading
- 2.4 Document Templates
 - 2.4.1 Template Wizards
 - 2.4.2 Starting a New Document from a template
- 2.5 Summary
- 2.6 Model Answers

2.0 INTRODUCTION

The formatting feature in Word sets each document apart from others. A well-designed document uses formatting to provide visual cues about its structure. For example, you can work through a document applying formats to headings and summary paragraphs one by one but Word provides an easier way to store custom combinations of formatting by defining the combination as a style. You can then apply that combination to a paragraph simply by selecting the style from the style list.

In this unit, we explore a few more formatting techniques and then show you how to turn combinations of formats into styles that you can apply with a couple of clicks of the mouse button.

In this unit, you'll learn how to produce attractive documents even when you're in a hurry using the AutoFormat command on the format menu. This unit introduces you to Templates and Wizards, which serve as models for new documents.

2.1 OBJECTIVES

After going through this unit, you will be able to

- format paragraphs, borders and shading
- align paragraphs in a document
- use templates
- create document using the existing templates.

2.2 FORMATTING TEXT CHARACTERS

Characters include letters, numerals, symbols (such as @, *, and &), punctuation marks, and spaces.

This section provides general information about character formatting. To change the appearance of text, select the text and then apply the formats you want. If you choose a command without first selecting text, Word applies the formats at the insertion point. Text that you type from that point forward has the new formatting until you change the format again. Text that you type takes on the formatting of the immediately preceding text.

You can also see which formats are applied to text by selecting the text and looking at the settings on the formatting toolbar or in the Font dialog box.

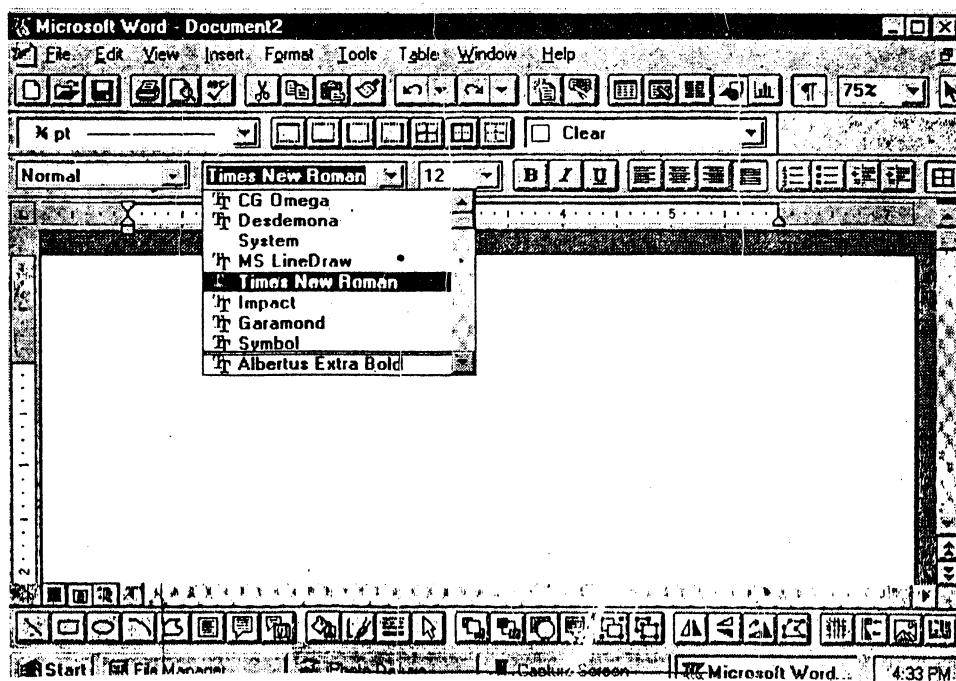
Characters formatting tools include:

- Pick fonts
- Pick fonts sizes
- Pick underline styles
- Add effects like superscript, subscript etc.
- Change default characters
- Change characters spacing
- Insert special characters and symbols
- Change case

Characters Formatting with Formatting Toolbar

This is used for modifying character appearances.

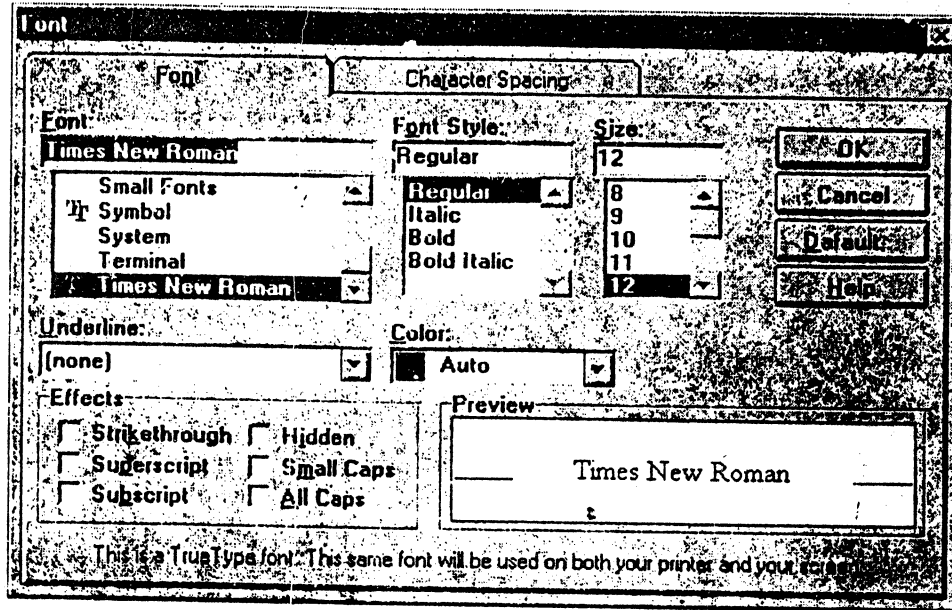
Example:



- Pick a Font from the formatting toolbar and set point size or toggle between bold, italic, underline as required.

Character Formatting Using Font Dialog Box

- Choose Format → font command.
- Choose Font, the style and size, underline and color settings. A sample is displayed at the bottom with the chosen settings applied.
- Effects boxes allow to specify Strike Through, Superscript, Hidden, All Caps etc.



The default button in the Font tab of the dialog box can be used to make the default settings.

Character Spacing

Spacing allows overriding the standard spacing between characters in terms of 1 point.

- Choose the text of interest.
- Select the character Spacing tab in the Font dialog box. Select Expanded/ Condensed from the Spacing list.
- Choose a new setting by typing in the By option box or clicking on the triangles and watch the preview change. Click OK to save changes.

Color Choice

- Choose text of interest
- Choose desired color from Color option box in the Font tab of the Font dialog box and click OK.

While printing the document on the printer, enable color setting of the printer.

Changing Case

- Select text and choose Format-> Change Case.
- Point to the desired option and click OK.

2.3 FORMATTING PARAGRAPH

In Word, a paragraph is any amount of text, graphics, object or other items that are followed by a paragraph mark. A paragraph mark is inserted each time while pressing the ENTER key. In order to change the formatting of a paragraph, select the paragraph and then apply the formats you apply. Paragraph formats affect the entire paragraph and new paragraphs keep the formatting of the preceding paragraph. Paragraph marks store the format of each paragraph, if the paragraph mark is deleted, the text in that paragraph becomes part of the next paragraph. The various ways in which the Paragraph formatting can be done is described in the following subsections:

2.3.1 Centering, Right Alignment and Left Alignment

By default, the text in Word is left aligned. These alignments can be changed as described in the previous unit.

2.3.2 Indenting text

Indenting a paragraph enables it to set off from other text.

- To indent paragraphs automatically, drag the top half of the triangular indent marker or the ruler to the right to the desired position. Alternatively, you can select Format → Paragraph and enter a setting in the first line Indent box in the Paragraph dialog box.
- To increase or decrease indents by one Tab stop, use the Increase Indent and Decrease Indent button on the formatting toolbar.
- To create a hanging indent (an indent that sticks out beyond the paragraph), drag the top half of the triangular indent marker to the left to the desired position. You can also select Format → Paragraph and enter a setting for the first line indent box in the paragraph dialog box that is farther left than the indent of the paragraph as a whole.

Notice the difference between left and right margin and the paragraph indentations.

The margins establish the overall width of the main text area and the space between the main text area and the edges of the page.

Left and right indents are measured from the left and right margins, respectively. The first line indent is measured relative to the left indent. The negative left-indent measurement for the text appears when the text runs into the left margin.

2.3.3 Tab Stops

By default, the Tab Stops are set at 0.5-inch intervals from the left margin. The insertion point can be moved to the next tab stop in the current paragraph by pressing the TAB key.

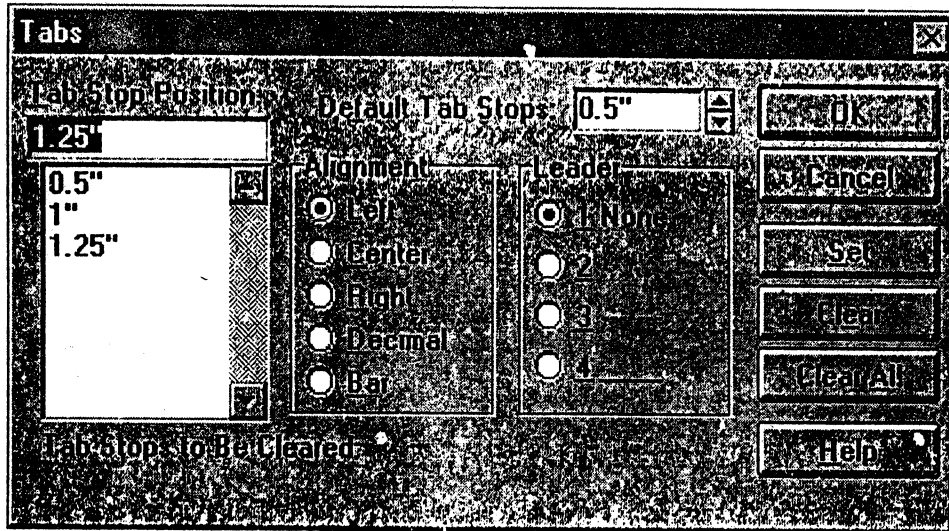
Use the ruler to set a tab stop at a particular position or to change the way text lines up at a tab stop.

To set tab stops

1. Select the paragraph in which you want to set or change tab stops.
2. To set or change the tab alignment, click the Tab Alignment button at the far left of the horizontal ruler until the tab alignment is the way you want it to be.

3. On the ruler, click where you want to set a tab stop.

Also you can set precise measurements for tab stops by using the Tabs command on the format menu.



To move a tab stop, point to the tab marker and drag it to a new position. To clear a tab stop, drag the tab marker off the ruler.

The spacing between the default Tab Stops can also be changed but this will affect only the active document.

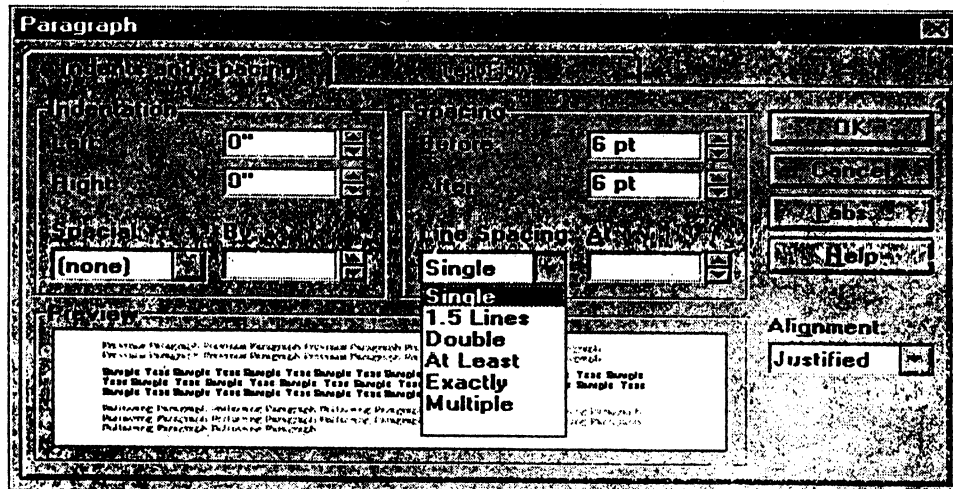
To do this, type or select the distance you want between the tab stops in the Default Tab Stops box and then click the OK button.

2.3.4 Line Spacing

Line Spacing determines the height of each line of text in the paragraph. The default (single line spacing) depends on the size of the font characters. Individual line spacing is easy to change.

The indents and spacing tab of the Paragraph dialog box provides a drop-down for simple but effective control of the space between lines under most circumstances. The preview area demonstrates the relative effect of single, one-and-a-half and double line spacing. Single spacing causes 12-point line spacing, 1½ line spacing is 18 points and double spaced lines will be 24 points apart.

Choosing the appropriate options from the Line spacing menu in the Paragraph dialog box can make all these line spacing settings.



2.3.5 Paragraph Spacing

Word enables each paragraph to give unique before and after spacing if you wish. The spacing settings can be in points (pt), inches (in), centimeters (cm) or lines (li).

One advantage to adding space this way is that the spacing before and after paragraphs does not change the point size of your text. Another advantage is that you can use different spacing combinations for different purposes.

Headings often have different spacing requirements for body text. For instance, you may require different before and after spacing designs for figures and figure captions as well. Also you can have unique spacing specifications as part of a style, making it easy to keep the look of your documents consistent.

The Paragraph command on the format menu can be used to add space before and/or the paragraph. The other advantages of using the Paragraph command are:

1. You can make precise adjustments to the spacing between the various text elements. For example, you can use paragraph spacing to clarify the relationship between headings and body text.
2. If the paragraph is moved or deleted, its spacing goes with it. The paragraph doesn't leave behind extra blank lines.
3. If you include spacing in the paragraph styles you use to format text, Word adds the space along with the other formatting. You need not add blank lines manually.

2.3.6 Borders and Shading

You can add borders, to any side of a paragraph, and you can add background shading. You can also add borders and shading to ordinary text and to the paragraphs in table cells and frames

2.4 DOCUMENT TEMPLATES

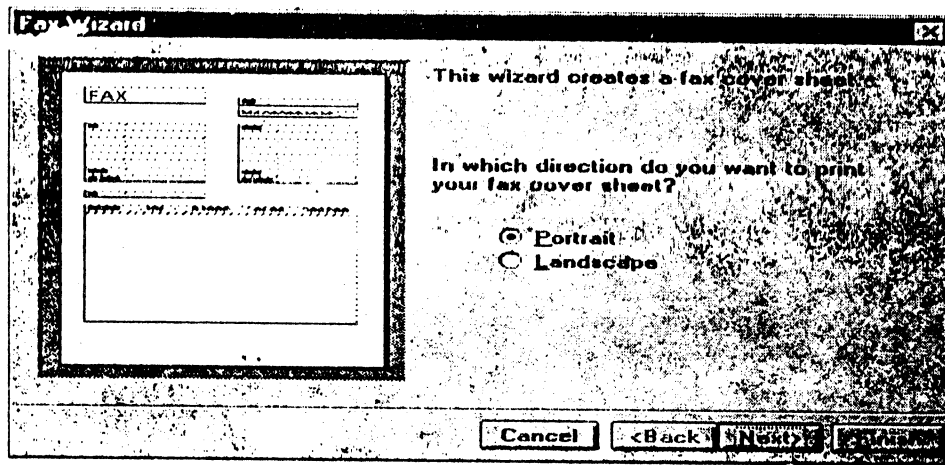
Document Templates serve as a boilerplate for a new document. It is basically a detailed document with preset text and formatting on which a new document can be based by amending them according to our requirement.

2.4.1 Template Wizards

To avoid the routine repetitive work of creating new documents, it is best to base them on templates designed for the types of documents you create most often.

A template is a blueprint for the text, graphics, and formatting of a document. A template also stores styles, macros, AutoText entries, and customized Word commands settings. These items can help you work faster on a particular type of document.

Word provides templates for common types of documents, such as memos, reports, business letters, fax forms, invoices etc. You can use any template as it is or tailor it to your specific requirements.

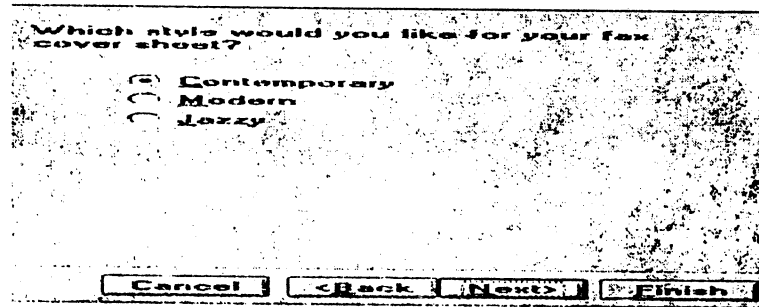


The first time you use the Fax wizard, you required to fill in your personal information and select options for the fax cover sheet. This information is then automatically placed on the fax cover sheet.

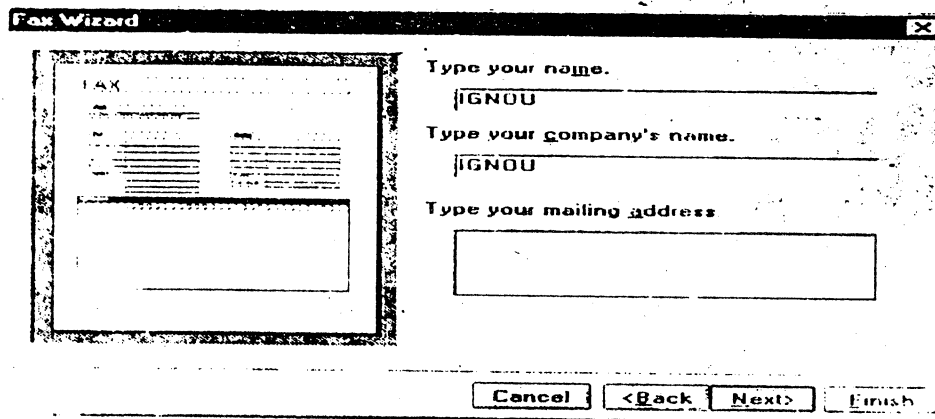
It is only necessary to enter your personal details the first time you use the fax wizard.

An example of how the fax cover sheet will look is displayed. You need to select whether you want it to be printed down the page (Portrait), or across the page (Landscape).

In this example, let us select the "Portrait" setting which is common for fax covers sheets and continue. Click the "Next" button in the dialog box. You can choose that from three styles for the fax cover sheet. The current one is the "Contemporary" style.



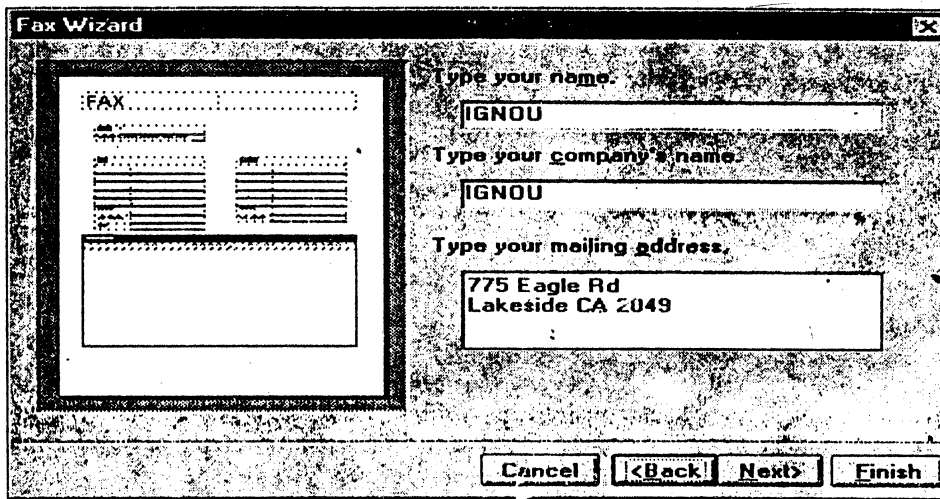
Let's create a fax cover sheet using the "Modern" style. Click the "Modern" style in the dialog box.



A preview of the "Modern" style fax sheet is displayed. Let's continue by clicking the next button in the dialog box. The name and company name that was entered during installation is automatically inserted into the "Name" and "Company Name" boxes. To change it, just enter the names you want in the relevant boxes.

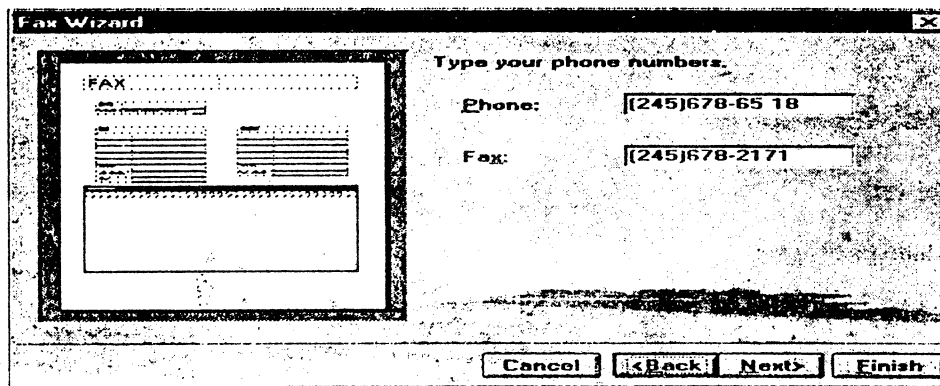
In this example, let's leave this unchanged and enter the mailing address. First, let's click inside the Address box. Let's enter the mailing address which is (775 Eagle Rd. Lakeside CA 2049) in this example.

Let's go to the next step by clicking the "Next" button in the dialog box.



The next step is to enter the fax and telephone number information in the relevant boxes.

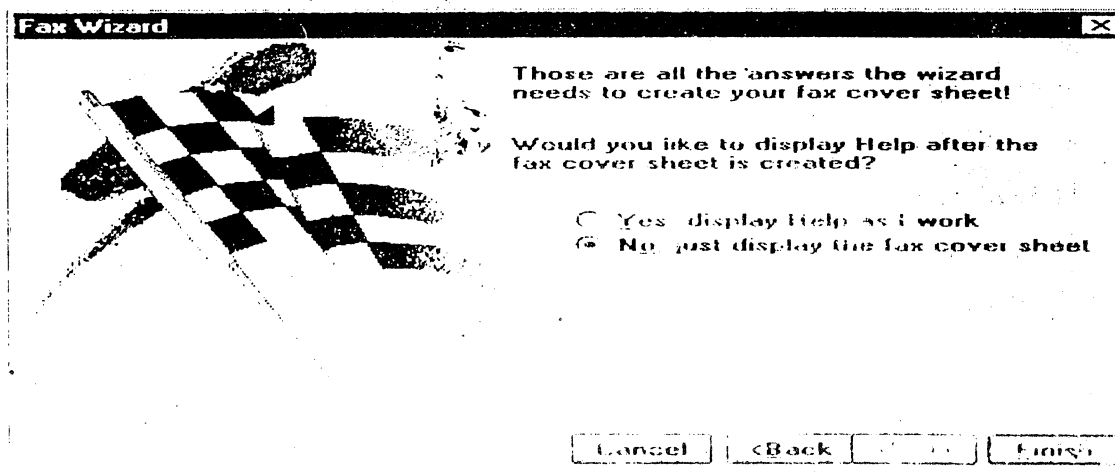
In this example, let's assume that our telephone number is (245) 678-6518 and enter it in the "Phone" box and enter the fax number, which is (245) 678-2171 in the "fax" box.



You can go back and change any of the information or selections you made in previous steps via the "Back" button.

The "Finish" button creates the fax sheet with the options and personal information you entered. You typically use this to create fax cover sheets after the first time, if none of your personal information has changed.

Let's go to the next step by clicking the "Next" button in the dialog box.



You are given the option of displaying Help after the fax cover sheet is created. Let's accept the default setting which is "No" and create the fax sheet.

A new document for the fax cover sheet has been created.

To display this document at full screen, click the "Full Screen" command in the "View" menu. You now save and name the document as you would any other.

The next time you create a fax sheet with the fax wizard you don't need to enter the sender information unless it has changed.

2.4.2 Starting a New Document from a Template

You can save time by basing new documents such as memos, letters, and reports on one of the templates that come with Word. From the File menu, choose New, and then select the template you want. The templates you can use are displayed alphabetically in the "Template" list. "Normal" Template is the default for Word and is the one you use when you click the "New Document" button.

A short description of the current template is displayed in the "Description" box. You select the template that matches the type of document you want to create. For example, if you want to create invoices you would use the "Invoice" template.

When you select a template, Word opens a copy of the template as a new document. All of the information in the template is copied into the new document.

Check Your Progress

1. To copy character formatting from place to place in a document, choose the
 - a) AutoFormat button
 - b) Format Painter button
 - c) Style command in Format menu
 - d) Style Gallery command in Format menu
2. You can use styles to
 - a) format your documents
 - b) Save changes to documents
 - c) Delete text in documents
 - d) Make copies of documents
3. To remove a tab from the ruler
 - a) Double-click the tab on the Ruler
 - b) Select the tab and press the Delete key
 - c) Select the tab and press the backspace key
 - d) Drag the tab from the ruler

4. The default line spacing for text is
 - 1) 0.5
 - 2) 1.0
 - 3) 1.5
 - 4) 2.0

5. Document templates allow you to
 - 1) Use pre-designed documents for specific purposes
 - 2) Create documents step by step after asking the questions
 - 3) Create and save the document automatically
 - 4) Save the changes to the document.

2.5 SUMMARY

In this unit, we have focused our main attention to formatting text, which includes the two kinds of styles:

1. The Paragraph Style
2. The Character Style

By using styles to format text, you can quickly produce professional looking documents and maintain consistent formatting. Various formatting techniques including embellishing individual characters, changing the indentation of paragraphs, adjusting the white space between lines and paragraphs etc. have been explained in this unit. The concept of templates has also been explained.

2.6 MODEL ANSWERS

The questions given in the 'Check Your Progress' have been designed only at the conceptual level and the answers to these questions are directly available in the unit. Therefore, Model Answers have not been provided. However, as this block is more practical oriented, therefore, students are advised to try the commands given, on their terminals.

UNIT 3 PAGE DESIGN AND LAYOUT

Structure

- 3.0 Introduction
- 3.1 Objectives
- 3.2 Page Setup
 - 3.2.1 Paper Size and Page Orientation
 - 3.2.2 Page Margins
 - 3.2.3 Headers and Footers
 - 3.2.4 Page Numbering
- 3.3 Tables
 - 3.3.1 Table Creation
 - 3.3.2 Table Modification
 - 3.3.3 Table Formatting
 - 3.3.4 Sorting & Numbering Cells
 - 3.3.5 Special Tasks with Tables
- 3.4 Summary
- 3.5 Model Answers

3.0 INTRODUCTION

In the last unit, we have described some of the formatting capabilities and how to combine formats to create professional looking documents in MS-Word. In this unit, we'll show you few more tricks for designing a document. For instance, the page setup options which included paper size and page orientation etc. are normally set at the beginning of a document can be easily changed at any time. We'll also define how to create tables to present facts and figures. If you've already set up your information in a spreadsheet program and don't relish the thought of having to recreate it in Word, you'll be pleased to know that you can import spreadsheet data directly into a word table.

3.1 OBJECTIVES

After going through this unit, you will be able to

- set up a page i.e. its layout, margins, paper size and its source
- page orientation i.e. portrait or landscape
- create mirror image of the page
- set up headers and footers
- create tables and enter text in the tables
- set rows and column width and set gutters.

Word for Windows gives you on-screen clue about how your document will look on paper. If you give Word some basic information, such as the paper size and the kind of printer you will be using, it can show you line endings, page endings, the relative size and placement of text, graphics, margins and so on. In order to do this, Word needs some information from you, such as the paper size and the kind of printer you will be using. The Page Setup dialog box allows you to give Word all the information it needs.

The Page Setup command in the file menu enables you to set the paper size, page orientation (portrait or landscape), the working of headers and footers, and similar options before you began a document. But you can easily change these and other settings at any time. You can also use sections and set different options for each section.

3.2.1 Paper Size and Page Orientation

The paper size tab in the Page Setup dialog box can be used for selecting the paper size. The options that are available depend on the capabilities of the printer you have selected.

To use a custom paper size, type the dimensions of the paper you want to use and also be sure that the printer is capable of feeding the custom paper size through its printing mechanism.

Once you specify the size of the paper on which you will print the document, Word calculates margins by measuring from the edges of the paper.

Page orientation can be vertical (Portrait) or horizontal (Landscape).

To select the paper size and page orientation follows these steps:

1. Select the text you want to have a different paper size or page orientation.
2. From the File menu, choose Page Setup and then select the Paper size tab.
3. Select the paper size on which you want to print and the page orientation.
4. In the Apply To box, select how much of the document you want to print on the selected paper size or in the selected orientation. Then click the OK button.

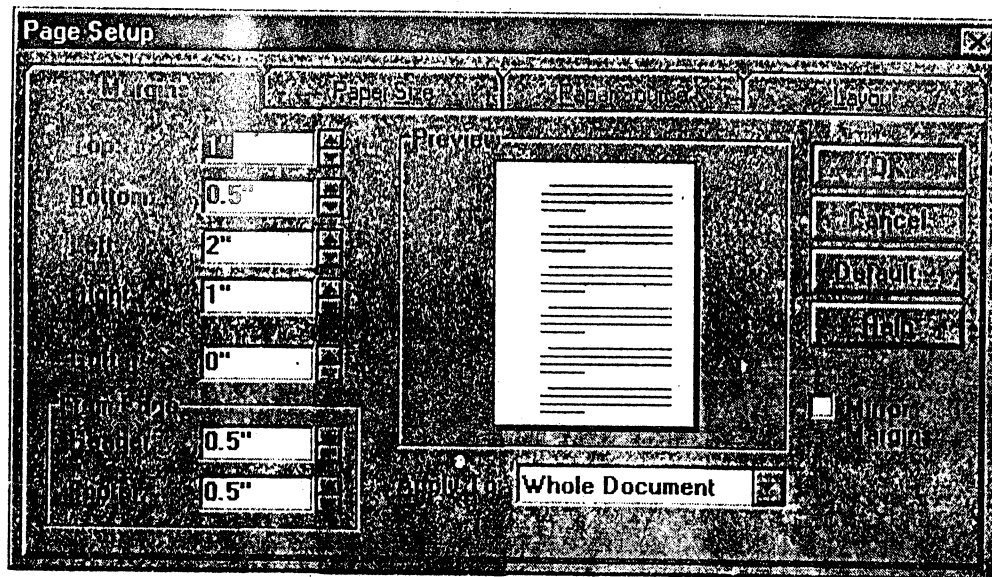
Also it is possible to change the default page size and orientation. Like, if you often print on paper other than the standard letter size - 8.5x11 inches or if you use landscape orientation more frequently than portrait orientation, you can save time by changing the default settings. After specifying the new settings, choose the default button. When Word asks you that you want to change the default, choose the Yes button. Word saves the new default settings in the template attached to the document.

3.2.2 Page Margins

Margins determine the distance between the text and the page of the paper. In Word, text and graphics are normally printed inside the margins while headers, footers, and page numbers are printed in the margins.

Document Margins

Word gives you three ways to set margins. The most straightforward method is to use, the Margins portion of the Page Setup dialog box, reached with the File → Page Setup command.



You can also drag margins using the rulers in Print Preview. This lets you see the results of margin changes after a slight repagination delay.

Finally, you can drag new margins with the rulers in Page Layout view. The margin brackets are located on the ruler. Let's look at all three techniques, starting with the dialog box.

Follow these general steps to change margins from within the Page Setup dialog box:

1. Place the insertion point on the page where you want margin settings to be changed (unless you plan to see the Whole Document choice)
2. Choose File → Page Setup.
3. If need be, change paper size and orientation by using the Paper Size tab.
4. Switch to the Margins tab if it is not already displayed.
5. Current settings are shown in the various margin dimension boxes.
6. Type the dimensions you desire, or click the little triangles to increase and decrease settings. The Preview will change as you work.
7. When satisfied, click OK.

Dimensional settings in most of Word dialog boxes can be expressed in inches (in), points (pt), centimeters (cm), picas (pi), and, frequently lines (li). For instance, to set a top margin's height to 12 points, you would type 12 pt in the Top margin box, to set a one-and-one half line top margin, you'd type 1.5 li, etc.

While you can type other measurements, Word will convert them to the default measurement when you close the dialog box. You change the default measurement in the General tab of the Options dialog box (Tools → Options).

Alternate Facing (Mirror) Margins

Select the Mirror Margins feature in the Margins tab of the Page Setup dialog box (File → Page Setup) when you want different left and right margin widths and your final output will be two-sided. Word makes inside margins of odd and even numbered pages the same size; and does the same with the outside margins of odd and even pages. This is how you get white space on the appropriate side of even and odd, two-sided pages.

When adjusting margins in Print Preview, if you've chosen the Mirror Odd/Even feature, display two pages in Print Preview so that you can see the different margins.

Gutter margins-additional white space in the inside margins-compensate for the paper tucked away in the binding of a two-sided book that would be unreadable. The gutter width, which you specify in the Margin tab of the Page Setup dialog box (File → Page Setup), reduces the text area. Instead of using gutters, you might simply want to increase the size of the inside margins to accommodate binding.

3.2.3 Headers and Footers

Headers and Footers are places to put repetitive information in a document's top and bottom margins-headers print at the top, footers at the bottom. You can use headers and footers to print something simple on each page, such as your name, or something complex, such as graphic. Stylized text, dates and automatic page numbering can all be included in headers and footers.

You can use identical headers and footers on all pages in your document, or you can specify different contents for each section of the document. Odd and even pages can have different designs if you wish. The first page of each document of each section can be unique.

In Word 6, header and footer editing always takes place in Page Layout view. You work right in the header and footer area of your document after double clicking to unhide it.

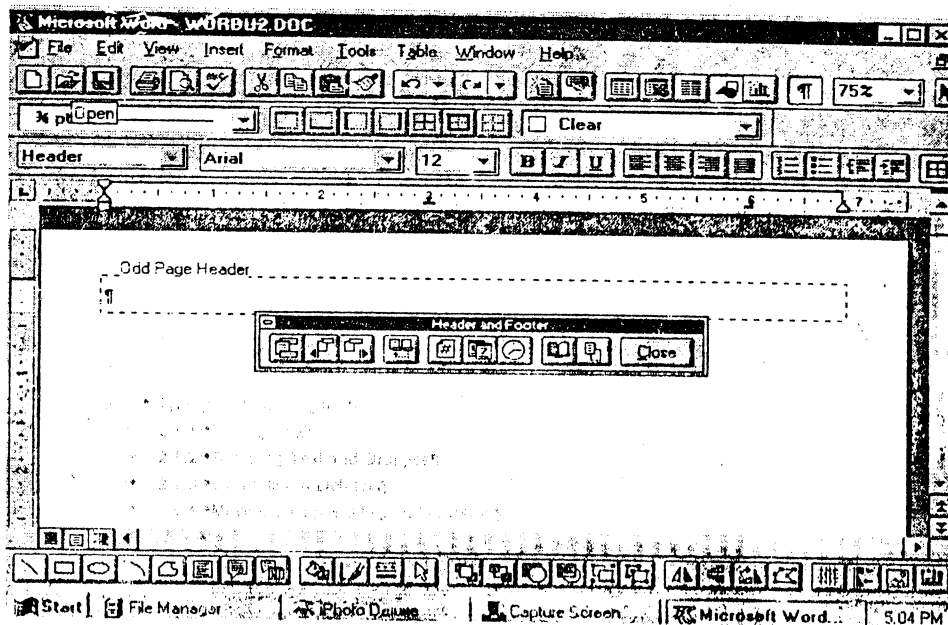
You can apply virtually any paragraph or character style to your headers and footers using the Formatting toolbar and rulers. They will repeat on all pages thereafter.

Once headers and footers have been added to a document, it is possible to see and edit them in Page Layout view. They are also displayed in Print Preview, but when you attempt to open a header or footer in Normal view or Print Preview, Word switches you to Page Layout view and displays the Header and Footer toolbar.

Creating Basic Headers and Footers

To enter a header that repeats on all pages in your document:

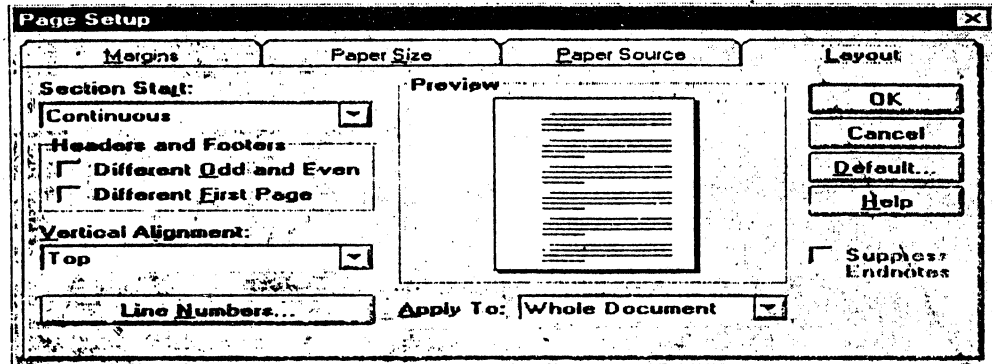
1. Choose View → Header and Footer or double-click in the header area of the first page to be modified in Page Layout view or Print Preview.
2. Word will switch to Page Layout view if it is not already there and display the Header and Footer toolbar.



3. Create and edit header text as you would any other. You can paste graphics, apply styles, and otherwise format you work normally.
4. Use the automatic page-number, time-stamping, and date-stamping features described later in this chapter.
5. Double-click in the main document to return to work there.

You enter footers the same way as headers, except that you work in a Footer window.

The Layout tab of the Page Setup dialog box helps in:



1. Creating Different Headers and Footers for Odd and Even Pages
2. Creating Different Headers and Footers for the First Page

3.2.4 Page Numbering

Word offers a variety of tools to help you automatically number pages. You can choose from many page numbering format and style choices and position page numbers nearly anywhere that pleases you. Let's explore these features and discuss the effects of document sections and pagination on page numbering.

If you plan to break a document into multiple section, you may want to insert page numbers before you split the document into sections. Otherwise, you will have to repeat the page numbering for each section of your document.

Page Breaks

Word uses "Soft" and "Hard" page breaks to indicate when one page ends and another begins. There are two categories of page breaks:

a) Soft Page Break

Soft Page Breaks are automatically inserted by Word, when text reaches the bottom of the page and are represented by a dotted line across the document. The text beneath it will appear on the second page if we print this document.

The position of Soft Page Breaks in a document automatically changes when text is added or deleted to reflect the new page boundaries.

b) Hard Page Break

You insert Hard Page Breaks when you want to end one page and begin another. This is done via the "Break" command in the Insert menu, or by pressing the "Ctrl+Enter".

Hard Page Breaks appear with the words "Page Break" on the line. They remain at the exact same spot in the document regardless of any text changes you make.

To remove a hard page break you position the cursor just after it and press the backspace key, or position the cursor at the start of the page break and press the "Delete" key.

Repagination

In order to display and print page breaks properly, Word must recalculate page endings after you've made changes. Normally, this is done automatically in the background whenever Word can steal some otherwise unused computer time. This process is called automatic repagination. Since page endings affect certain other features word always repaginates when you

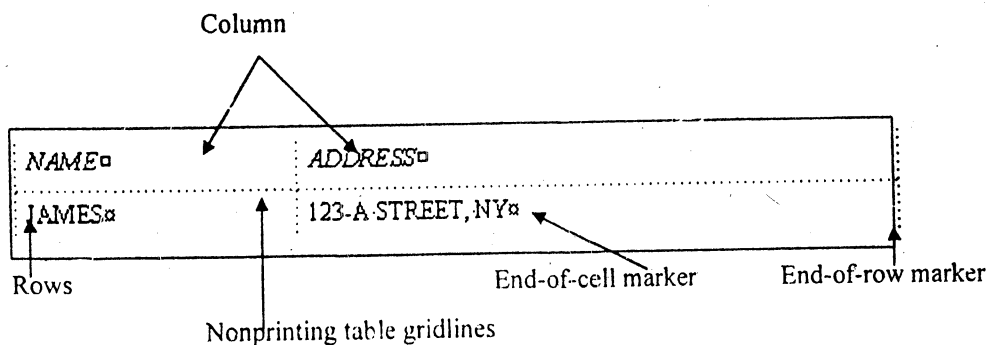
- ask it to print
- are in Print Preview or Page Layout view
- complete a Table of Contents or Index.

3.3 TABLES

Word's tables feature, enables you to arrange columns of numbers and text in a document without using tabs. It helps you to organize complex columnar information.

Tables also provides a convenient way to present text in side-by-side paragraphs as in a resume, or to arrange text beside graphics. You can use them to create such diverse documents as forms, television scripts, financial reports, parts catalog, and resumes. You can insert tables anywhere you need them in Word documents. Word's table feature and the terminology used to describe it, reminds you of a spreadsheet.

Word's tables consist of horizontal rows and vertical columns. You do the typing in areas called cells. Cells can column text, numbers or graphics. The text in cells is edited and embellished as usual with Word's formatting toolbar and ruler.



A number of table specific features let you control the size, shape, and appearance of cells. Border and Shading features are available. It is also easy to insert and delete rows and columns.

They can be created from existing text without needless retyping. Also the table feature can be used to organize information and then convert your table to text.

Another feature, Table Wizard, helps you automate table creation. The dotted lines around each cell represent nonprinting table gridlines.

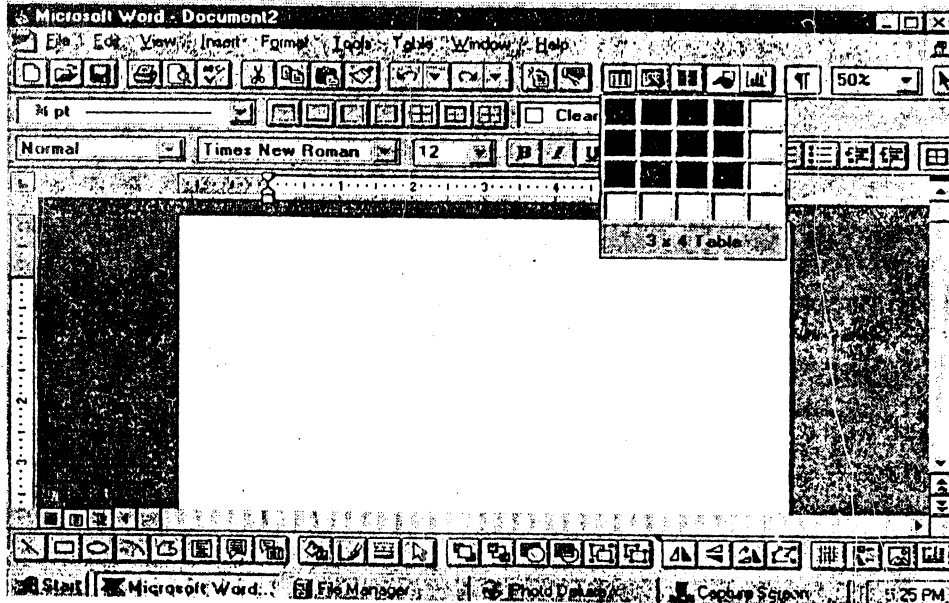
Format → Borders and Shading command can be used to add printing borders.

3.3.1 Table Creation

A simple table can be created with the Table button on the Standard toolbar and a complex table by the Insert Table command of the Table menu.

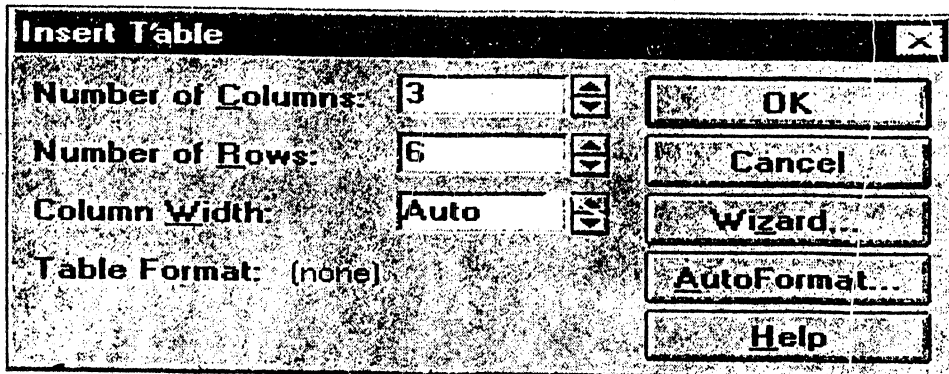
To create a table with the Table button

1. Place the insertion point where you want to insert a table.
2. Click the Table button on the Standard toolbar, then drag while holding down the mouse button to highlight the number of rows and columns you want in your table.
3. When the displayed grid represents the desired number of rows and columns release the mouse button. An empty table will be inserted at the insertion point when the mouse button is released.



To create a table using the Table menu

The Table → Insert Table command can be used to create more complex tables by specifying the Number of Columns and Rows in the Insert Table dialog box.



Entering and editing text in a Table

You navigate, enter and edit table text just as you do any other Word text. The mouse or arrow keys are used to position the insertion point. The cells are thought of as miniature pages and the cell borders as margins. Type the text normally within these cells and Word will automatically wrap text within the cell as you reach the right edge. Rows will automatically grow taller as necessary to accommodate your typing.

To move from cell to cell within a table, either use the Tab key to go forward and Shift+Tab to go backward.

Pressing Tab in the rightmost column will move down the insertion point to the beginning of the next row and pressing Shift+Tab past the leftmost column will move the insertion point to the end of the previous row.

The familiar character formatting toolbar, ruler and menu features work in the same manner to all or selected characters in a table.

A cell can contain more than one paragraph. Paragraph creation is done in the usual way and Word's paragraph format applies to paragraphs in cells.

Within a cell, you can have several different indent settings, line-spacing specification styles. etc.

Converting Text to or from a Table

You can convert text separated by paragraph marks, commas, or tab characters into cells in a table and also convert a table to ordinary text paragraphs.

This is required at times when you'll start a project using tabs and wish you'd created a table or a co-worker will give you same tabbed text.

Converting Text to Tables

To convert text to a table, highlight the text you want to turn into a table. Choose Table → Convert Text to Table... and click the appropriate option button in the resulting dialog box. Here's an explanation of the choices:

- Tab Lines of text separated by paragraph marks or the breaks will become rows in your table. Tab-separated strings of text within those lines will become cell entries in the row. Word will automatically create the necessary number of columns based on the maximum number of tabs in a line.
- Comma Lines of text separated by paragraph marks or line breaks will become rows in your table. Comma-separated strings of text within those lines will become cell entries in the row. Word will automatically create the necessary number of columns based on the maximum number of commas in a line. Beware of commas that might create unintentional cells.
- Paragraphs Word will propose a single column and create as many rows as you have paragraphs. Changing the number of columns will distribute paragraphs among the columns from left to right. In a two-column layout, the first paragraph would end up in the top-left cell of the new table, the second paragraph in the top-right cell, the third in the left cell of row two, and so on.

Converting Tables to Text

To convert an existing table to text, select the table cells you wish to convert, or Alt+double click to select the whole table. Choose Table → Convert Table To Text. Word will display a Table to Text dialog box, which asks if you want the table converted to paragraphs, tab-delimited text, or comma-delimited text. Pick one.

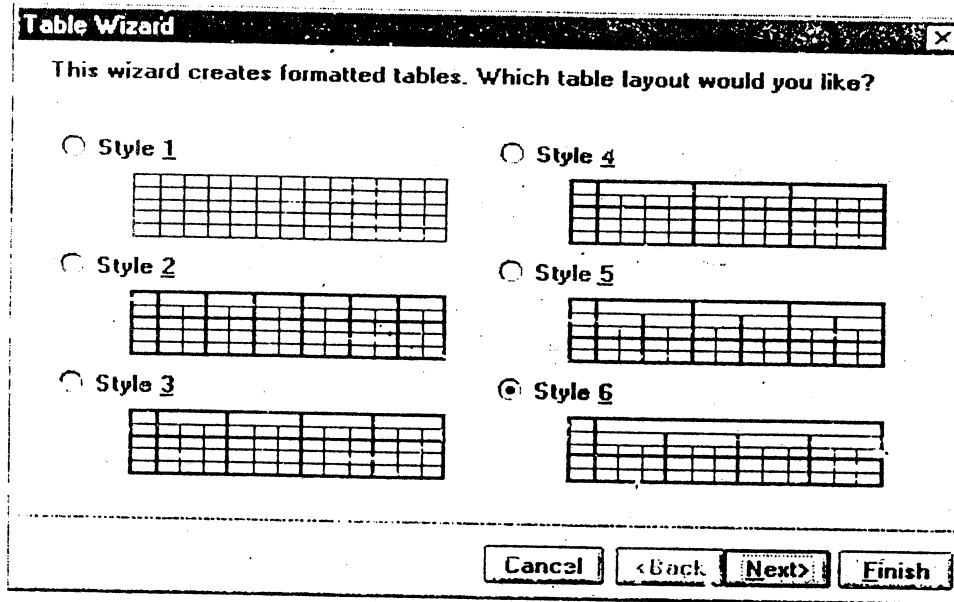
Choosing the paragraph option will convert each old table cell into at least one paragraph. If the table's cells contain multiple paragraphs, the paragraph marks are retained during the conversion, so some cells will create more than one new paragraph.

If you pick the comma or tab options. Word will convert each row of your table into the paragraph. Cells from the tables will be separated within the paragraphs by tabs or commas.

The Table Wizard

The Table Wizard will ask you some questions and format your table. Here are the basic steps to using the Wizard:

1. Place the insertion point where you want the table. Tap \downarrow once or twice if you've just opened a new document.
2. Choose Table \rightarrow Insert Table.
3. Click the Wizard button in the resulting dialog box. You will be presented with a number of screens asking you questions.
4. Look at each choice *carefully*, and select one of them.



5. Click the Next button after each choice or the Back button to back up one screen.
6. When the Wizard runs out of questions, click Finish. You'll be presented with the Table AutoFormat dialog box.
7. Cruise the format samples until you find just the right mode, then click OK.

3.3.2 Table Modification

Modifying a table involves selecting, inserting, deleting, copying and moving rows, columns and cells. It also describes how to change the spacing and column width and how to split a table.

1. *Selecting in Tables*

As already seen, you can select characters, words, and other items in table cells using Word's usual mouse and keyboard features. In addition, Word also provides table-specific selection tools enabling you to select whole cells, entire rows, columns, or areas. The area between the first character in a cell and the left edge of the cell is called the cell selection bar. When you point to it, the mouse pointer changes directions (points to the right). Clicking on it selects the contents of the entire cell.

To select a column, move the mouse pointer to the area called the column selection bar at the top of a column, when the pointer changes into a large, down-pointing arrow. Holding down the Alt key while clicking anywhere in a column will also select the entire column.

Selecting Rows

To select the entire row, double-click any cell selection bar. The same can be accomplished by selecting and dragging the leftmost or rightmost cell in a row.

Selecting Adjacent Groups of Cells

To select groups of adjacent cells, either drag through the cells or click in one cell and Shift+click in the others.

Selecting the Whole Table

To select an entire table, hold down the Alt key and double-click anywhere in the table. If your document contains multiple tables and they are not separated by paragraph marks, this technique will select all adjacent tables.

2. Inserting Cells, Rows and Columns

A new row can be inserted above the selected row, a new column to the left of the selected column and a new cell at the specified location. To insert a new cell, row or a column, first select an existing cell, row or column.

- a) To add cells to a table, select the number of cells from this table, next to which you want to add new cells and click the Insert Cells button on the Standard toolbar. The number of cells inserted will be the same as the number of cells selected in this table.
- b) To insert row in a table, select the same number of rows below which you want new rows to be added and click the Insert Rows button on the Standard toolbar. The number of rows will be same as those selected in this table.

To add a row at the end of a table, position the insertion point in the last cell of the last row and then press the TAB key. The cells in the new row have the formatting of the cells in the preceding row.

- c) To insert columns in a table, select a column or group of columns to the right of which you want to insert a new column or columns and click the Insert Columns. Word inserts a column or columns to the left of the selected column or columns.

3. Deleting Cells, Rows and Columns

The Cells, Rows and Columns in a Table can be deleted by the Delete command on the Table menu, which changes according to what is selected.

4. Changing Column Width

The width of selected cells and entire columns can be changed by dragging the table column markers on the ruler or by dragging the column boundaries.

To change the column width automatically, use the AutoFit button to adjust the width of columns quickly.

5. Changing Row Heights

Normally, Word sets the height of each row automatically to accommodate the cell containing the tallest entry. For instance, if one cell in a row needs 2.0" to accommodate the text or graphic it contains, all of the cells in that row will be 2.0" high.

To drag a row to new heights, Click anywhere in the row you wish to resize. The Row heights can also be resized by the Table → Cell Height and Width.

6. *Splitting a Table*

To split a table, position the insertion point in the row where you want the new table to start and then choose split table from the Table menu.

3.3.3 Table Formatting

The readability of a table can be improved by formatting the text within the table, aligning text, creating column headings, and adding borders and shading. The AutoFormat command from the Table menu can also be used to automatically format the table for you.

Formatting Text in a Table

Text formatting within the table can be done in a similar manner as it is done with the rest of the text in the document i.e. by using the formatting toolbar, format menu commands, or the ruler.

The TAB key in a table cell has a different function. It will just move the insertion point between cells. To insert a tab character in a cell, press CTRL+TAB.

Centering a Table and Aligning Rows

To center a table or change row alignment

1. Select the entire table or rows you wish to align.
2. Choose Table → Cell Height and Width and select the Row tab.
3. The various options are listed below.
 - a) To center the table, choose the center option button under alignment.
 - b) To set an exact amount of indentation from the left margin, type or select a number in the Indent from left box.
 - c) To set the alignment in relation to the page margins, select the Left, Center or Right option button under Alignment.

Creation of Table Headings

Merging cells can create table Headings that span several columns. Use the Merge Cells feature to combine the contents of multiple cells - for example, to make a heading in one cell span an entire table or a selected group of columns. You select the cells to merge, then choose Table → Merge Cell, and the contents of the designated cells will merge. You may need to reformat text merged this way.

You can repeat table headings when a table is split between pages. Word automatically repeats table headings only for tables that are split by “soft” page breaks. If a “hard page” break is inserted within a table or the split Table command is used then the heading is not automatically repeated.

The Page Layout view, only displays the Repeated Table headings on each page.

Table Borders and Shading

An easy way to dress up a table is to add printing borders and shading. Select the cell or cells you wish to embellish, then use the line thickness portion of the Borders toolbar. Pick the desired combination of line thickness and apply the borders just as you would add them to word paragraphs. Add shading to some or all the cells.

Sunrise Special	Start the day with a sunrise breakfast sailing in a balloon!	Offers the best price for groups of four or fewer
School Day Special	Bring your class for a tour of the grounds and a short trip in a balloon	Special arrangements for the school groups include a box lunch

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School Day Special	Bring your class for a tour of the grounds and a short trip in a balloon	Special arrangements for the school groups include a box lunch

Before adding Borders and Shading

After adding Borders and Shading

AutoFormatting Tables

Word's Table → Table AutoFormat command attempts to pick cell settings that make a presentable table.

The basic steps for using Table AutoFormat are:

1. Enter, edit, spell-check, recognize and otherwise finish with your table.
2. Save the document.
3. Select the entire table.
4. Choose Table → Table AutoFormat to open the Table AutoFormat dialog box.
5. Preview the format choices from the scrolling list by highlighting their names one at a time.
6. Pick a style by highlighting it and click OK.

3.3.4 Shorting and Numbering Cells

Word's Table → Sort Text command will attempt to sort selected text alphabetically, numerically, or chronologically at your request. Sort can be up to three levels "deep".

To sort a table with this command, follow these steps:

1. Save the table.
2. Place the insertion point in the table you wish to sort.
3. Pick Table → Sort Text. Word will highlight (select) the entire table, and you will see the Sort Dialog box.
4. If you have labels at the top of your table, choose the option My List Has Header Row. There will be up to three drop-down lists containing the column labels or column numbers.
5. Specify the sort order by choosing the desired column for each sort level.

6. Choose a sort order for each column.
7. Tell Word, if the data in each column are text, numbers, or dates by choosing from the Type drop-down lists.
8. Click OK and Word will sort.

3.3.5 Special Tasks with Tables

The special tasks, which can be performed with tables, can be perform calculations, import data from Microsoft Excel, create a graph, or set up a database.

Performing Calculations in a Table

You can add subtract, multiply and divide numbers in a word table. You can also perform other calculations like averages, percentages, minimum and maximum values etc.

To sum a row or column of cells, position the insertion point in the last cell of a row or column. The cell does not have to be empty; however, if it contains a number and you want the result of the calculation to replace that number, you must select the number. Otherwise Word inserts the results without removing the original number in the cell. Choose the formula command from the Table menu. Click the expression in the formula box to make sure it will sum the numbers you want to add, then choose the OK button.

To perform other calculations, you specify which cells to use in the calculation and use the formula for each calculation. In the formula box, type between the parentheses, the cell references you want to use in the calculation.

Exchanging Data with Microsoft Excel

Word has a feature to pste Microsoft Excel Worksheet into a word document. Word then converts the worksheet to a word table. Word commands can then be applied to ~~w~~ork with the data. The reverse is also true.

In addition to copying and pasting worksheets, you can link and embed Microsoft Excel Worksheet.

Using a Table to Create a Graph

Word makes it easy to create a graph, or chart from data in a table. Select all or any part of the table and then click the Insert Chart button on the Standard toolbar. Word opens MS-Graph, which uses the selection to create a graph. You can use any of the commands in MS-Graph to format the graph. The graph appears immediately below the table you selected. The inserted graph is an embedded object.

Using a Table as a Database

Word table can be used as a simple database for storing information such as addresses or client records.

To use a table as a database, be sure that the insertion point is within the table, then click the Data Form button on the Database toolbar. Word displays the Data Form dialog box. Type information in the fields provided.

1. To view multiple columns on the screen, switch to
 - i) Page Layout view
 - ii) Normal View
 - iii) Outline View
 - iv) Master Document View
2. Which of the following is incorrect?
 - i) Page Orientation in the Page Setup command can be either Portrait or Landscape
 - ii) The Gutter feature in the Margins tab of the Page Setup dialog box allows you to set different left and right margin widths
 - iii) Header and Footer editing always takes place in Page Layout View
3. Choosing which of the following tabs in the option box can change the default units for the document margins?
 - i) View tab
 - ii) Edit tab
 - iii) General tab
 - iv) Print tab
4. The maximum number of columns in a table can be
 - i) 21
 - ii) 30
 - iii) 31
 - iv) 11
5. To insert a tab character in a cell
 - i) Press CTRL+TAB
 - ii) Press SHIFT+TAB
 - iii) Press ALT+TAB
 - iv) Press CTRL+ALT+TAB.

3.4 SUMMARY

The various options that affect the appearance of a document include the following:

- Paper size
- Page orientation (Portrait or Landscape)
- Margins
- Headers and Footers
- Page Numbers
- Line Numbers and number of newspaper style columns.

When you use the Page Setup command on the file menu to specify a paper size, the options that are available depend upon the capabilities of the printer you selected.

By the end of this unit, we have also described the creation and usage of Tables.

3.5 MODEL ANSWERS

The questions given in the 'Check Your Progress' have been designed only at the conceptual level and the answers to these questions are directly available in the unit. Therefore, Model Answers have not been provided. However, as this block is more practical oriented, therefore, students are advised to try the commands given, on their terminals.

UNIT 4 MAIL MERGE AND DOCUMENT MANAGEMENT

Structure

- 4.0 Introduction
- 4.1 Objectives
- 4.2 Mail Merge
 - 4.2.1 Data Sources & Main documents
 - 4.2.2 Starting and Editing the Main document
 - 4.2.3 Merge Printing Envelopes and Labels
- 4.3 Macros
 - 4.3.1 What are Macros?
 - 4.3.2 Recording a Macro
 - 4.3.3 Editing and Organising a Macro
 - 4.3.4 Assigning Macros to a menu, toolbar and shortcut keys
- 4.4 Protecting Document
- 4.5 Printing a Document
- 4.6 Summary
- 4.7 Model Answers

4.0 INTRODUCTION

This unit discusses two important concepts in world: Mailmerge and Macros. Word's Mail Merge feature is a quick and easy way for mass-producing form letters, envelopes, mailing labels, phone lists etc. By using Mail Merge, you can send the same letter to a number of people, without typing the original letter more than once.

A Macro is a sequence of actions that is named and stored. When you run a macro, Word performs all the assigned actions in sequence. You can assign a macro to a key, a combination of keys, a tool button, or a menu. The Macro feature basically helps in faster editing and formatting.

This unit also explains the details of managing Word documents; which includes creating, opening, saving and protecting documents.

The end product of a Word Processing session is usually a printed document. Before printing from Word for the first time, you must check that your printer setup is correct. And Word's Print Preview feature used before printing any documents, helps in checking that all its elements are in place. All these printing options have been explained in detail in this unit.

4.1 OBJECTIVES

After going through this unit, you will be able to

- create a data source for the document
- merge the addresses for printing on envelopes and labels
- create and run macros in Word
- protect your document
- print your document.

4.2 MAIL MERGE

Word's Mail Merge feature lets you quickly create personalized correspondence and other documents by combining information (merging) information from two different files.

For instance, you could merge a list of names and addresses from one file (your data document) with another file (your main document) to produce a number of personalized form letters.

You could also create catalogs, forms with variable information fields, or labels. You insert data instructions (fields) in the main document wherever you want data from the data source to appear in your merged documents.

Mail Merge feature can also be used to prepare other kinds of merged documents such as catalogs, parts lists, directory lists forms or invoices, print addresses on envelopes and mailing labels.

4.2.1 Data Sources and Main Documents

Data Sources are organized collections of information - databases-stored as Word tables. Word can also use data from other applications such as MS Excel or MS Access. After opening a data source in another application, make sure that the merge fields in your document match those in the data source. All data sources, no matter where they come from, contain records and fields. For example, an employee data source would contain one record for each employee. This record would contain multiples fields - one for the employee's first name, one for the middle initial, one for the last name, one for each part of the address and so on.

The data source contains the information that can vary in each version of a form letter, such as the names and addresses.

You can either open an existing data source or create a new one in Word.

Main documents as mentioned earlier contain the text of your project (the body of a letter), fields, and merge instructions.

Main Documents can be used from earlier versions of Word or from other Applications.

While using the Main document from other applications, open that documents in Word 6 and convert its contents to Word for Windows. However, field names and formatting from some applications may not translate well into Word for Windows format. Check the fields in your main document and adjust them if necessary before completing the merge or you can paste the main document into Word for Windows as plain text, then apply the formatting and centering the field names.

4.2.2 Starting and Editing the Main Document

Creating a merge main document, such as form letter, is a three-step process.

- Step 1: To set up the main document, which contains the text, punctuation, and other items that remain the same in each version of the form letter.
- Step 2: To set up a data source, which contains the information that varies in each version; This can be done either by opening an existing data source or creating a new one.

Step 3: To complete the main document by inserting merge fields and by typing or adding information you want to be the same in each form letter, such as the body of the letter, your address and your logs.

Step 1: To start the main document:

- i) Select the create button to start creating your main document. A list will drop down offering you four choices-Form Letters, Mailing Labels, Envelopes and Catalogs.
- ii) Select the type of main document you want. A dialog box appears offering you the choice of the active window or a new main document.
- iii) Choose the Active Window button if the active window contain information for your main document or choose the New Main Document button if the active window doesn't contain any information for the mail merge.

Whichever button you choose, Word will return to the Mail Merge Helper dialog box and the space below the create button now lists the information you've entered so far-the type of merge and the main document to use.

Step 2: Next, you need to specify the data source and arrange it in the fields that will be available to your main document for the merge.

- i) Click the Get Data button to display a list of options for your data source.
- ii) If you already have a data source that you want to use, select Open Data Source or if you want to create a new one, select Create Data Source.

Creating a Data Source

The Create Data Source dialog box that appears when you choose Create Data Source contains a list of commonly used field names under "Field Names in Header Row" box. The next step is to add field names in the data source. This can be done by selecting the field names from the Field Name in Header Row box or by adding the new ones to it. These field names can be upto 40 characters long and contain letters, numbers, and underscore (_). They cannot contain spaces and must start with a letter. The following operations on the field names can be done:

- 1. To delete a category from the data source, select it and choose Remove Field Name button.
- 2. To add a category to the data source, type the new field name in the Field Name box and then choose Add Field Name button.
- 3. To change the order of field names, select a field name in the field names in Header Row box, and then click the up or down arrow at the right of the list until the field name is in the desired position.

When you finish creating the field names, choose the OK button. Word then displays the Save Data source dialog box. You save the new data source by giving a new filename to it.

Word then displays a message asking you whether you want to edit the data source or edit the main document. Choose the Edit Data Source button to type the information that varies in each version. The Data form dialog box appears. Type the information you want in each data field box and then press ENTER. To move to the next or previous data field box, press TAB or SHIFT+TAB.

Continue typing information, choosing the Add New button to start each new record. Choose the OK button in the last.

Opening a Data Source

To open an existing data source, Select Open Data Source from the Get Data drop-down list. The Open Data Source dialog box that appears works just like the File Open dialog box. Select the document you want to use and click OK. Word will open the document and return you to the Mail Merge Helper dialog box.

Step 3: One you've completed the second step-Creating a new data source or Opening an existing data source-you can complete the main document by inserting merge fields and by typing or adding information you want to be the same in each form letter.

This can be done by:

a) Completing a form letter main document:

Type or add any text and graphics you want to include in each letter. Then insert a merge field where you want each category of addressee information to be printed. Place the insertion point in the document where you want to insert information from the data source, click the Insert Merge field button on the Mail Merge toolbar and then choose the appropriate merge field. Choose save from the file menu after editing the main document.

b) Merging the data source with the main document:

Before merging the main document with the data source, the following things should have been done:

1. All the addressee information in the data source should have been typed.
2. All the merge fields should have been inserted at the desired location into the main document.

To merge a data source with the main document

1. Click, the View Merged Data button on the Mail Merge toolbar while the main document is in the active window. Word displays information from the first data record in place of the merge fields in the main document text. To view information from other data records, click one of the arrow buttons on the Mail Merge toolbar, or type a record number in the Go To Record box.

4.2.3 Merge Printing Labels and Envelopes

Word's Mail Merge Helper can also be used to merge labels and envelopes. The procedures for merging labels and envelopes are very similar to those for form letters.

Printing Addresses on Envelopes

Word 6 offers the ability to print addresses on envelopes. This can be convenient for small number of envelopes but as most laser printers require you to feed envelopes in by hand, printing large numbers of envelopes can be a slow business.

To print envelopes by using the Mail Merge command

1. Select Tools → Mail Merge to fire up the Mail Merge Helper.
2. Click the Create button to drop down a list of options and select Envelopes from this drop-down list.

3. Arrange the data source as usual. Then click the Mail Merge Helper button on the Mail Merge toolbar and under Main document, choose the Set up button. In the Envelope options dialog box that appears, make the appropriate choices for your envelopes.
 - On the Envelope options tab, click the font button in the Delivery Address box or the font button in the Return Address box to change the font in which the addresses appear. You can also adjust the position of the delivery address or return address by entering from Top and from Left measurements in their boxes.
 - On the Printing Options Tab, select the feed method and the tray to feed from.
4. Choose OK to close the dialog box.
5. Next, the Envelope Address dialog box appears. Position the insertion point in the Sample Envelope Address box. Then choose the Insert Merge Field button and choose the appropriate merge fields. Type any spaces and punctuation you want between the merge fields, and press ENTER at the end of each line. Choose the OK button to close the Envelope Address dialog box.
6. In the Mail Merge Helper dialog box choose the Edit button under main document and then choose Envelope document from the list. Word displays the envelope main document in Page Layout view. If the user Info Tab in the Option dialog box (Tools menu) has an address specified in the Mailing Address box, then that address is used as the return address.
7. Check whether your printer is ready to print envelopes. Then click the Merge To Printer button on the Mail Merge toolbar.

Printing Labels on Laser Printers

The Mail Merge Helper makes merging labels on a laser printer deal simple. You use the Mail Merge Helper to create a main document containing a table with fixed-size cells and cell spacing that match the size and position of your blank labels, then insert merge instructions in each table cell.

1. Select Tools → Mail Merge to fire up the Mail Merge Helper.
2. Click the Create button to drop down a list of options.
3. Select Mailing Labels from the drop-down list.
4. Arrange the data source as usual. Word will then invite you to set up your main document. In the Label Options dialog box that appears, make the appropriate choices for your printer and labels:
 - In the Printer Information box, select Laser or Dot Matrix as appropriate.
5. When you've chosen the labels to use, choose OK to close the dialog box.
6. The Create Labels dialog box will appear. Position the insertion point in the Sample Label box. Choose the Insert Merge field button and choose the appropriate merge fields. Type any spaces and punctuation you want between the merge fields and press ENTER at the end of each line.
7. Open the Mail Merge Helper dialog box and choose the Merge button to merge your data source with the main document. Choose whether to merge to new document or to the printer. (You can also use the Merge to New Document and Merge to Printer buttons on the Mail Merge Toolbar here).
8. Save your documents with meaningful names.

4.3 MACROS

This section introduces you to Macros in Word.

4.3.1 What are Macros?

A Macro is a series of Word commands grouped together as a single document to make everyday tasks easier. It can be assigned to a toolbar, a menu, a shortcut key and run it by simply clicking a button, selecting a menu choice or pressing a key combination. Macros are instructions in Word's macro language, Word Basic.

Some typical uses of Macros are:

- To speed up routing, editing and formatting.
- To combine more than one command.
- To make an option in a dialog box more accessible.
- To automate a complex series of tasks.

4.3.2 Recording a Macro

It's easy to create a Macro: you start the Word macro recorder and record a sequence of actions, then stop the recorder and edit the macro if needed. You can then run the macro whenever you need to perform that same set of actions. For example, if you often need to display as much of a document as possible, you can record a macro that maximizes the document window and then hides the horizontal ruler, toolbars and scroll bars.

The macro recorder cannot record mouse actions in document text. You must use the keyboard when recording such actions as moving the insertion point and selecting text. However you can use the mouse to choose commands and select options when you're recording a macro.

There are three ways to start the macro recorder:

- Double-click REC on the status bar.
- Select Tools→Macro, then click the Record button in the Macro dialog box.
- Click the Record button on the Macro toolbar.

To Record A Macro

1. Start the macro recorder by selecting any of the three options described earlier. The Record Macro dialog box appears.
2. Enter a name for the Macro in the Record Macro Name box. If you don't give your macro a name, Word will name it Macro1, Macro 2 and so on. No spaces, commas, or period allowed in the name.
3. Enter a description of what the macro does in the Description box. This is optional and you can use up to 255 characters.
4. To assign a macro to a toolbar, a menu or a keyboard shortcut, click the appropriate button.

5. If the current document is attached to a template other than the Normal template, select either that template or Normal in the Make Macro available to box. If the current document is attached to the Normal template the macro is automatically stored in the Normal template.
6. Choose OK, then perform the actions you want to record.
7. To stop recording the macro, do one of following:
 - Double-click REC on the status bar.
 - Click the stop button on the Macro Recorder toolbar.

Running A Macro

Once you have recorded your macro, you can assign it to a toolbar, a menu or a shortcut key combination. You can then run it as you would a normal Word command or feature.

If you don't want to assign a macro to a toolbar, or key combination-perhaps you simply have too many macros, or use some of them too seldom to merit having them available all the time,-you can also run a macro by choosing Tools→Macro, selecting the macro name in the Macro dialog box, and clicking the Run button.

If you've got everything right, your macro will perform the actions you taught it to do. If something is wrong, you may have to edit it.

4.3.3 Editing and Organising a Macro

You can edit macros you write or record in a macro-editing window. To edit a macro:

1. Choose Macro from the Tools menu.
2. Select the list of macros you want to choose from, the Macros available inbox.
3. Select the macro you want to edit and then choose the Edit button.

Word new Organizer dialog box greatly simplifies managing your macros. You can use it.

1. To Copy Styles, AutoText entries, toolbars, or macros to the attached template from another template.
2. To Rename a macro
3. To delete a macro.

Copying, Renaming or Deleting A Macro

The Organizer dialog box can be used to manage your macros by copying them into different templates or renaming them.

You can copy styles, Auto Text entries, toolbars, and macros from one template to another. You can copy styles between templates and documents, but you can copy macros, Auto Text entries and toolbars only between templates.

To copy macros from one template to another:

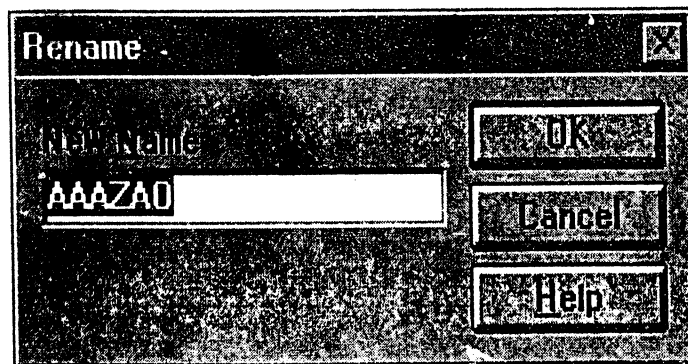
1. Select File→Templates. The Templates and Add-Ins dialog box will appear.
2. Click the Organizer button to display the Organizer dialog box.
3. Choose the Macros tab.
4. If necessary, close the open file, select the Open file button, and open the template or document containing the macro.
5. Select the macro you want to copy, then choose the Copy button.
6. Click the Close button when finished copying macros.

Renaming A Macro

You can use the Organizer dialog box to manage your macro by renaming them.

The steps to rename a macro are:

1. Select Tools→Macro. The Macro dialog box will appear.
2. Click the Organizer button. The Organizer dialog box will appear with the Macros tab selected.
3. In the left list box, choose the macro to rename. If necessary, choose a different template in the Macros available in listbox.
4. Click the Rename button. The Rename dialog box will appear:



5. Entering a new name for the macro and click OK. The macro will be named.

4.3.4 Assigning Macros to a Menu, Toolbar and Shortcut Keys

This subsection gives the detailed of how a macro can be assigned to a menu, a toolbar and shortcut keys.

Assigning a macro to menu:

1. From the Tools menu, choose Customize.
2. Select the Menus tab.
3. In the Categories box, select Macros.

4. In the box to the right of the categories box, select the macro name to be assigned to a menu.
5. In the Change What Menu box, select the name of the menu to which you want to assign the macro name.
6. In the Position On Menu box, do one of the following:
 - a) Select (Auto) to automatically position similar menus together, or
 - b) Select (At Top) or (At Bottom) to position the macro at the top or bottom of the menu or
 - c) Select the item below which you want to add the new item to position the item within the menu list.
8. In the Name On Menu box, accept the default name or type the name of the macro you want to appear on the menu.
9. Choose the Add button and click the Close button.

Assigning a Macro to a Toolbar Button

You can customize Word toolbars so that they contain buttons for the macros:

Follow the following steps for this:

1. Choose Customize→Tools.
2. Select the toolbars tab from the Customize dialog box.
3. In the Categories box, select Macros and choose the macro name to be assigned.
4. From the box to the right of the categories box, drag the macro name to the toolbar you want to add it to. As Macros don't have built-in button, a blank button appears on the toolbar and the custom button dialog box appears.
5. In the button box, select an image to place an image on the blank button.
6. Choose the Assign button and then the Close button.

Assigning Macro to a Shortcut Key

The steps followed to assign to a shortcut key are:

1. Choose Customize→Tools.
2. Select the keyboard tab.
3. In the Categories box, select Macros.
4. In the box to the right of the Categories box, select the macro name to be assigned.
5. In the Press New Shortcut key box, type the shortcut key you want to assign to the macro.
6. Choose the Assign button and Close button.

Check your Progress 1

1. While using the data from other applications in the data source file.
 - i) the records must contain multiple fields
 - ii) the merge fields in the documents must match those in the data source
 - iii) you must first click the Create Data Source button
 - iv) none of the above
2. The Date and Time command
 - i) inserts the date and time you can specify
 - ii) automatically adds the current date and time
 - iii) shows the date a file was created
 - iv) shows the date a file was last revised
3. The View Merged Data button
 - i) allows you to view all the records in the data source file
 - ii) allows you to insert records into the main document
 - iii) allows you to view how the form letter will appear
 - iv) allows you to select the records to be merged
4. The Macros can be assigned to a toolbar, a menu or shortcut keys by using
 - i) the Options command in Tools menu
 - ii) the Macro command in the Tools menu
 - iii) the Customize command in the Tools menu

4.4 PROTECTING DOCUMENTS

The major file management operations include creating, opening, saving, restoring and protecting documents. This detail about creating, opening and saving the documents have been explained earlier in unit 1. This section mainly deals with protecting documents.

Protecting a document

Protecting a document implies saving it from being changed either accidentally by some other user. A document can be protected in two ways:

1. Opening a document as read only.

When a document is opened as read-only, the user cannot make any changes to the document. This can be achieved by selecting the read-only check box in the Open dialog box. This read-only option will not allow any changes in the document to be saved.

2. Protecting a document with a password.

The other way to protect a document is to use the Protection Password, which is typed in the Protection Password box. In this way, the users who know the password can only open the document. These passwords can be changed and deleted too.

4.5 PRINTING A DOCUMENT

While printing a document, you can:

1. Print the entire document or only specific pages.
2. Print summary information, annotations or list of styles, AutoText entries or key assignments.
3. Print a draft copy, which omits graphics to allow faster printing.
4. Set printing options, such as number of copies.

You can also automatically create and print an envelope, using an address from a document or one that you type. You can either print directly on an envelope or store the information so that you can print the envelope later.

The printers you can use affect the way Word prints and displays text on the screen. Before you print a document, you must install and select the printer you intend to use to print the document.

Word displays a document, as it will look when you print it. If you want to preview a document before you print it, use page layout view or print preview. In each of these views, you can make last minute changes to text formatting, page breaks and margins.

Line breaks and page breaks should be the same on the screen and in the printed document. However, the fonts and view options you choose can affect the match between what you see on the screen and what appears on the printed page.

Three kinds of fonts affect your work in Word: Scaleable fonts, Printer fonts and Screen fonts.

Use scaleable fonts, such as True Type fonts to ensure that what you see on the screen is what appears on the printed page.

For using printer fonts, you must have a corresponding screen font and font size to display each font on the screen. If each screen font you use has a matching printer font, the screen display of the document will closely match the printed document.

The three basic steps for printing a document are:

1. Connecting the Printer:
Connect the printer either directly to your computer or to a network.
2. Selecting the Printer:
Choose Print from the file menu then choose the Printer button and select the printer you want to use.
3. Printing the Document:
Click the Print button on the Standard toolbar. In Windows, Word prints one copy of the active document using the word default print settings.

Check Your Progress 2

1. To prevent other users from opening a document which of the following should be clicked in the options command in Tools menu
 - i) Protection Password box
 - ii) Write Reservation Password box
 - iii) Read-only Recommended box
 - iv) Either (ii) or (iii)

2. While Saving a document, a filename without the extension can have maximum of
 - i) 15 characters
 - ii) 11 characters
 - iii) 8 characters
 - iv) 10 characters

3. List the steps followed for finding a document based on the search criteria.

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4.6 SUMMARY

Mail Merge has an advanced feature of printing envelopes and labels. This feature is not present in the Mail Merge feature of WordStar Macros in Word can be assigned to menu, keyboard-shortcut keys or toolbar. This can make the operation of the macro made faster and easier. We have also discussed the steps involved for protecting and printing documents.

4.7 MODEL ANSWERS

The questions given in the 'Check Your Progress' have been designed only at the conceptual level and the answers to these questions are directly available in the unit. Therefore, Model Answers have not been provided. However, as this block is more practical oriented, therefore, students are advised to try the commands given, on their terminals.

UNIT 5 PRESENTATION GRAPHICS AND POWERPOINT

Structure

- 5.0 Introduction
- 5.1 Objectives
- 5.2 What is Business Graphics?
 - 5.2.1 Types of Business Graphics
 - 5.2.2 How to make an effective presentation?
 - 5.2.3 Physical aspects of presentation
- 5.3 A Presentation Graphics Package: PowerPoint
- 5.4 Creating a Presentation
 - 5.4.1 Creating a Title Slide
 - 5.4.2 Creating a Graph
 - 5.4.3 Creating Tables
 - 5.4.4 Make Organization Chart
 - 5.4.5 Save and Close a Presentation
- 5.5 Working with Tools
- 5.6 Slide Show
- 5.7 Summary

5.0 INTRODUCTION

In the previous four units, we have focussed our attention on some of the features of a powerful Word Processing package. In this unit, we will introduce you to the concepts relating to presentation graphics.

This unit provides a brief introduction of Business Graphics and its types. It also introduces you to *PowerPoint* as one of the tools for making Business Presentations. A presentation graphics package allows you to produce a professional-looking presentation involving text, outlining, drawing, graphics, clip art, and so on. It also offers rich speaker support and aids to help you create truly effective presentations. It normally incorporates features for design and colour and a set of templates.

We will discuss some of the above mentioned aspects relating to PowerPoint in this unit.

5.1 OBJECTIVES

After going through this unit, you will be able to

- define different types of graphics
- appreciate physical aspects of presentation
- create a presentation
- create graphs as your slide
- change the layout of a slide
- change the fonts, size and color of text.
- add drawing objects in your slide.
- work with objects
- group or ungroup objects.

5.2 WHAT IS BUSINESS GRAPHICS?

A picture is worth a thousand words. We live in a visual world, and the human mind can comprehend and retain concepts learnt through visual depiction for longer time. In today's world, it is very critical for a person to put across ideas effectively, whether it is business or not. One way of putting across ideas effectively, is the use of visual images. And the best form of visual images is graphics and pictures. Graphics if used to convey ideas in business situations are known as Business Graphics.

5.2.1 Types of Business Graphics

There are three types of Business Graphics. They are:

Presentation Graphics, Analytic Graphics, and Design Graphics.

Presentation Graphics: Convincing the audience about an idea and putting your views across is the aim of any presentation. The main goal of presentation graphics is to get a message across. Examples of presentation graphics tools include Harvard Graphics, PowerPoint etc.

Analytic Graphics: Analytic Graphics presents the data and information in such a way that it helps in people analyzing it. Its aim is to show relationships in data and information.

Analytic Graphics need not have a very high quality. They are used to produce graphics from the data stored in database management systems like MS-Access and electronic spreadsheets like MS-Excel. They help in analyzing the data and taking a decision thereby. Graphics provided by spreadsheet packages like *Lotus 1-2-3*, *MS-Excel* are examples of analytic graphics.

Design Graphics: Design Graphics are used to create visual images of products, models, etc. Computer Aided Design (CAD) is an example of design graphic tool.

In this unit, we will discuss about a tool to create business graphics.

5.2.2 How to make an effective presentation?

Till now you have examined the different types of business graphics. Of all these, presentation graphics is the most commonly used one. To convince the audience about an idea, the presentation has to be effective. In other words, you can say that effective use of presentation graphics is a very important aspect of successful presentations. For this, ask yourself some questions while making the presentation like:

- Do I know about the people whom I am giving a presentation?
- You must be aware of the audience's level of knowledge on the topic about which you are making a presentation.
- Is my presentation simple? You can convince the audience only if they understand you. Your presentation should be simple enough, so that even a person who is totally new or who hardly knows anything about the topic also gets your point.
- Is the presentation to the point?

Take care of following points while making the presentation

- Start with what is familiar to the audience.
- Make each chart independent.
- Use space effectively.
- Use text and color judiciously.

5.2.3 Physical aspects of presentation

How the information has been displayed, is very important aspect of any presentation. Mostly slides, graphs, bar charts and pictures are used for displaying information. To be able to use slides meaningfully, the person must be familiar with the basic components of a slide.

A good slide communicates a message successfully.

The components of a slide are:

- **Title** : Title gives an idea of what the slide is all about.
- **Subtitle** : A subtitle emphasizes the slide's central idea.
- **Footnote** : A footnote indicates the source of the slide's data.
- **Border** : It acts like a frame for your slide.
- **X-axis, Y-axis, X-axis title, Y-axis title** (for the graph).

Slides are one of the most important components of a presentation. A slide may include

- Text highlighting the main ideas.
- **Charts** like Pie Chart, Bar and Column Chart, Area Chart, Line Chart, and Organization Chart, clarify the relationships in data and information.
- **Multimedia** components to enhance the quality of presentation.

5.3 A PRESENTATION GRAPHICS PACKAGE: POWERPOINT

PowerPoint is a powerful presentation graphics package. It allows the presenter to create his own high quality presentations. Don't worry about consistency in design and colour. PowerPoint can help you. If you don't consider yourself a designer, just apply one of the PowerPoint templates to your presentation and choose from among the thousands of color schemes available.

Whether you need quick overheads for a team briefing, slides for a sales meeting, or dazzling effects for an on-screen presentation, PowerPoint wizards, templates, and AutoLayouts help you get right to work; and a complete set of easy-to-use tools assures you have everything you need to get your point across and share information with others.

A PowerPoint presentation is a collection of your slides, handouts, speaker's notes, and your outline, all in one file. As you create slides, you're creating a presentation - you're designing how your presentation should look and giving it a format that carries through from beginning to end.

PowerPoint gives you the flexibility of switching between different views during the creation of slides for a presentation.

- **Slides** are the individual "pages" of your presentation. Soon, you'll be creating slides with PowerPoint. Slides can have titles, text, graphs, drawn objects, shapes, clip art, drawn art, and visual created with other applications and more.
- **Handouts** support your presentation. You have the option of providing handouts for your audience. Handouts consist of smaller, printed versions of your slides.
- **Speaker's Notes** can be created and printed. You'll see a small image of the slide on each notes page, along with any notes you type on the notes pages.
- **Outlines** As you're working on a presentation, you have the option of working with your presentation in outline view. In the outline, your titles and main text appear, but not your art or the text typed with the Text tool.

5.4 CREATING A PRESENTATION

In PowerPoint, your entire presentation is in one file - everything is "under one roof". That includes all the slides, the outline, the speaker's notes, and the handouts, as well as the formatting information you build into your presentation.

Using a slide layout is an easy way to begin building a presentation. You choose a slide layout by selecting **New Slide** from the Insert menu and then selecting the layout you want in the New Slide dialog box. There is a variety of slide layouts, some with placeholders in which you type text, and some with placeholders set up to make it easy to add graphs, charts, clip art, or other objects.

With PowerPoint, you can change the look of your presentation - the format, the colors, or the kind of output you want - anytime. You can always apply a new template or change the colour scheme.

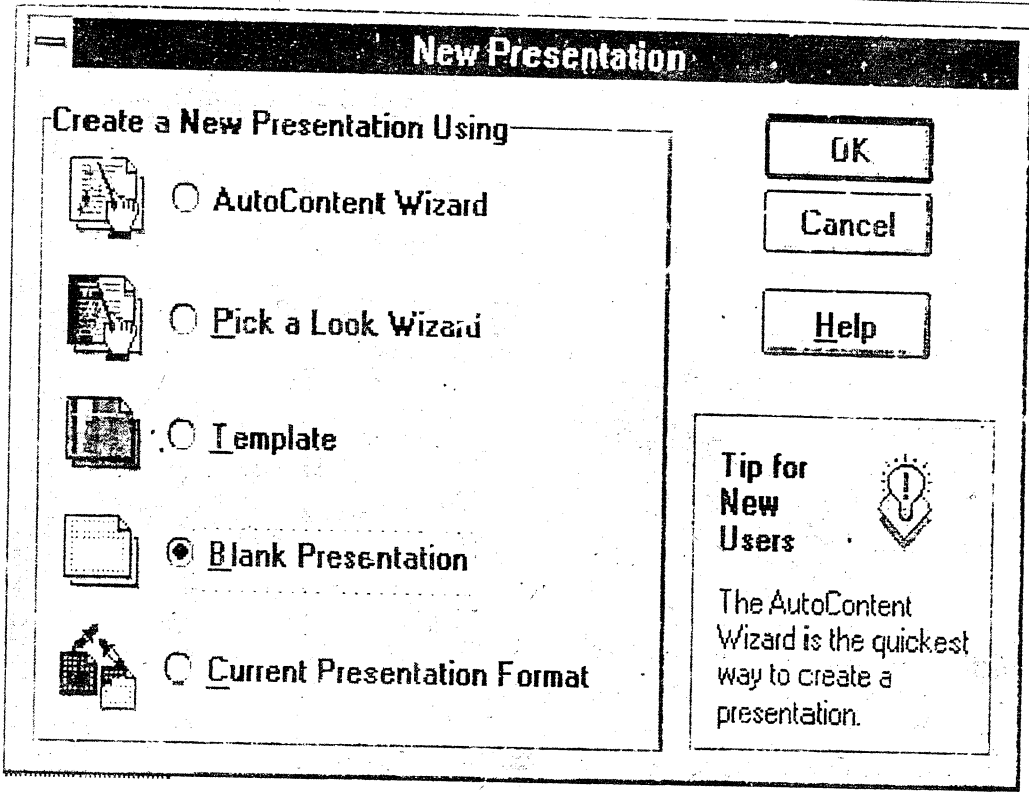
When you create a new presentation, you have choices about how to proceed. You can use the AutoContent wizard to help you organize what you want your presentation to say. You can use the Pick a Look wizard to help you apply a template and set up the masters. You can also start with a "blank" presentation if you want to use the default presentation - either the PowerPoint default or one that you set up.

5.4.1 Creating a Title slide

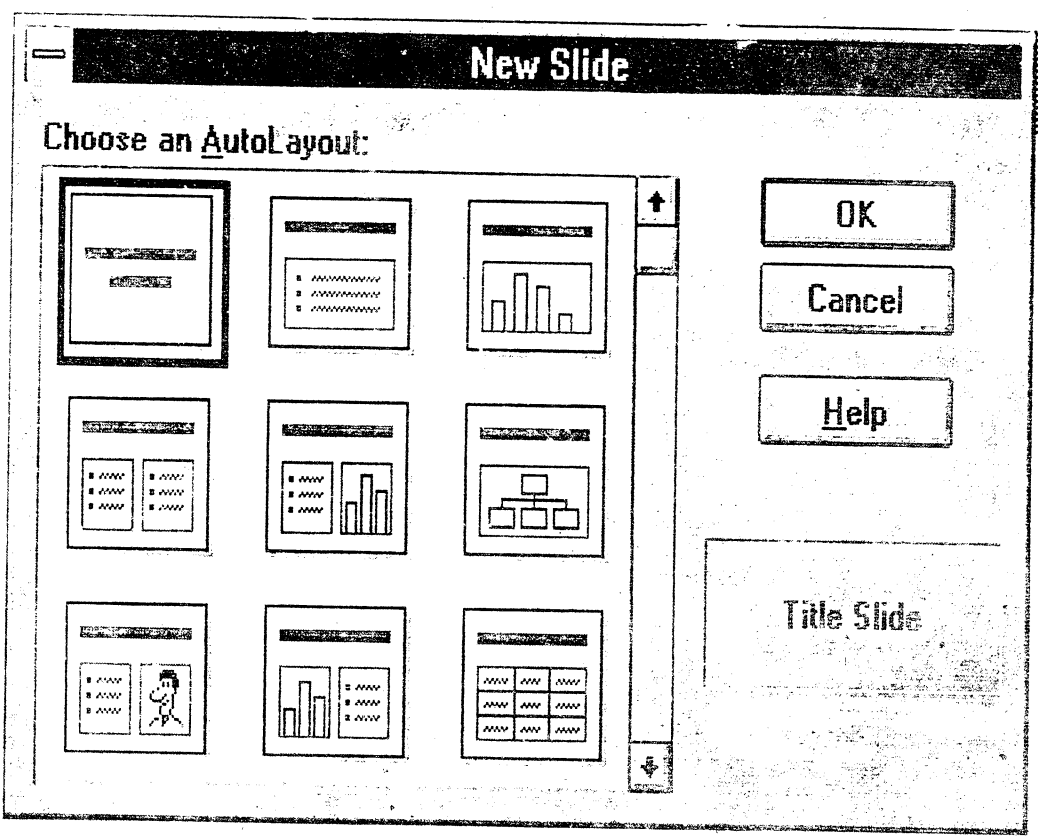
A Title slide is the first slide that will be displayed in your presentation. A Title slide is divided into two parts - the top part for the title and the bottom part for the sub-title or the topic.

To create a Title slide

1. Select **New** from the **File** menu, to display the presentation dialog box.
2. Click the **Blank Presentation**, and then **OK**.



3. Select Title slide from the AutoLayout dialog box and click on OK.



4. It will display the blank title slide to enter information.

5. Type the title and sub-title.

Add a new slide

PowerPoint presentation file is a collection of slides. Till now, you have created a slide. Now you want to expand the presentation to add more slides.

To add a new slide

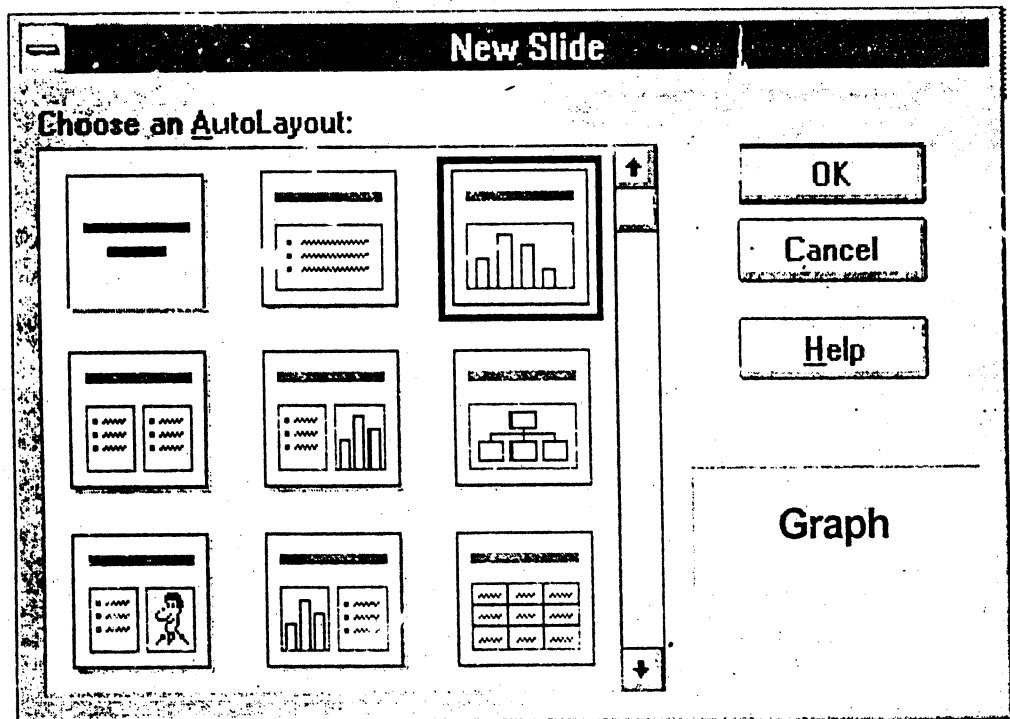
1. Select **New Slide** from the **Insert** menu to display AutoLayout dialog box.
2. Select the layout.
3. Click on **OK** to display blank slide layout to enter information.

5.4.2 Creating a graph

A graph can be created and viewed in different formats, as a pie, bar, column and so on. Legends, titles and data labels can be added to improve readability.

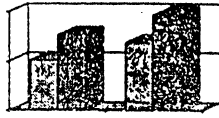
To create a graph

1. Click on new slide button on the status bar to display AutoLayout dialog box.
2. Select the slide as shown in the following figure.



3. Click your mouse cursor on the **OK** sign.
4. It will display the blank graph layout slide.

C l i c k t o a d d t i t l e



D o u b l e c l i c k t o a d d g r a p h

5. Double click on the graph box marked as “Double click to add graph” to go in the graph mode. Now you can create and modify the graph. You will see some data also in the **Presentation - Datasheet**. Please do not get disturbed. This is only a default data. You can put the new data i.e. modify the existing data as per your datasheet by taking the mouse cursor and clicking it once.
6. Whenever you change the values in the datasheet, it will change the graph automatically, displaying backside of the datasheet.

Change the graph type

You can change the graph type as per your requirement. There are two ways to change the graph type.

One way is

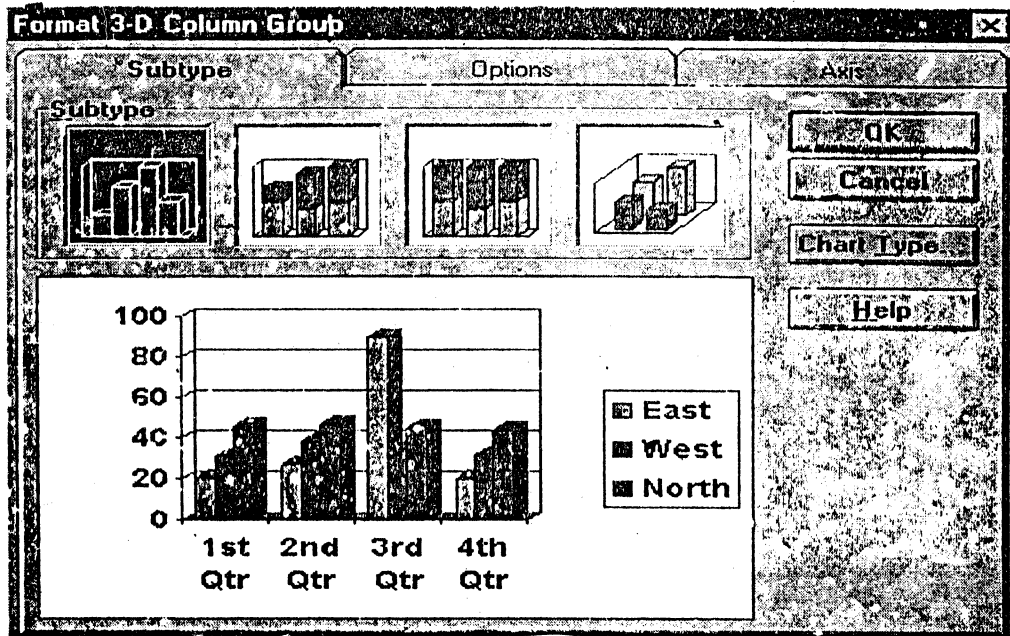
- Click on graph type list box. It will display you different types of graphs. You can choose any of them.

The second way is

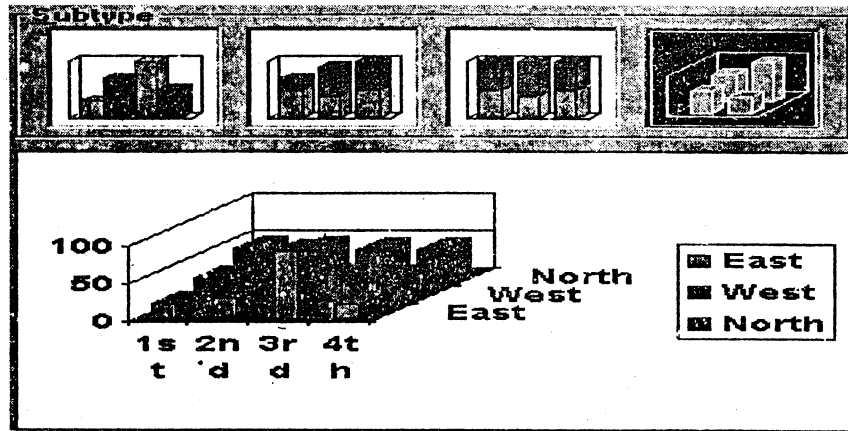
- Select **Chart Type** from the **Format** menu to display chart type dialog box.
- From the chart type dialog box, you can select 2D or 3D type graphs and click on OK.

Change the sub-type of the graph

- Select 3D column group from the **Format** menu.
- It will display a 3-D column group dialog box.



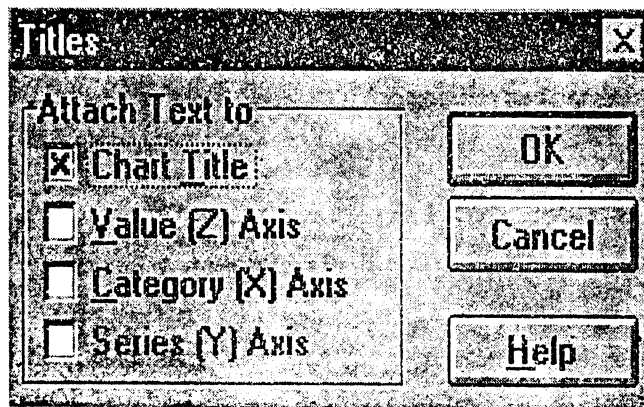
- Click on Subtype button and select the subtype graph and then click on OK. It will display you the preview of the graph.



Creating Titles

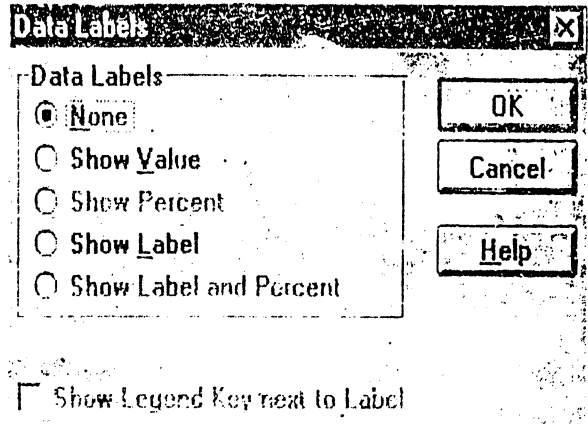
Sometimes you may want to include more than one graph on a single slide. In such cases, each individual graph will need to be identified. This can be done using titles.

- Select Titles from the Insert menu to display titles dialog box.
- Click on the check boxes in the dialog box, you can create titles in the graph.



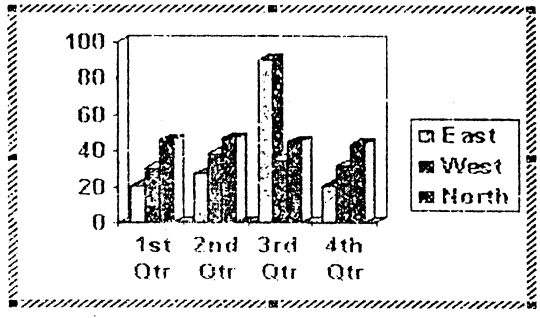
Add data labels in the graph

- Select Data Labels from the Insert menu to display a dialog box.
- You can show the value or label with the graph. Select any one and then click on OK. By default none is selected



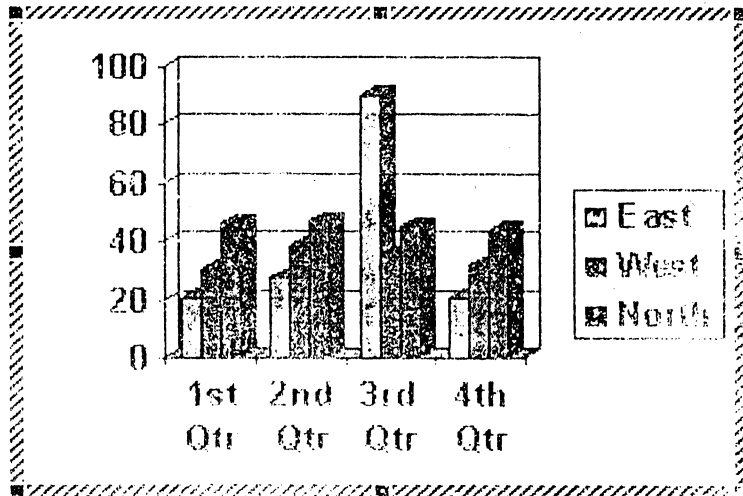
Display or hide the gridlines

Hidden gridlines



- Select Gridlines from the Insert menu to display a dialog box.
- Click on check box to hide or display the gridlines and then click on OK.

Display gridlines



5.4.3 Creating Tables

Tables are used to display data in a columnar form

To create a Table

1. Click on New slide button on the status bar to display AutoLayout dialog box.
2. Select Table layout from the AutoLayout list and then click on OK to display a blank Table presentation slide. From where you can add table.
3. Double click on Table box to display Insert table dialog box.
4. Type number of columns and number of rows in respective boxes of your requirement and click on OK to go in word table(rows and columns) form.
5. And lastly type your information in the cells.

Employ code	Name

5.4.4 Make Organisation Chart

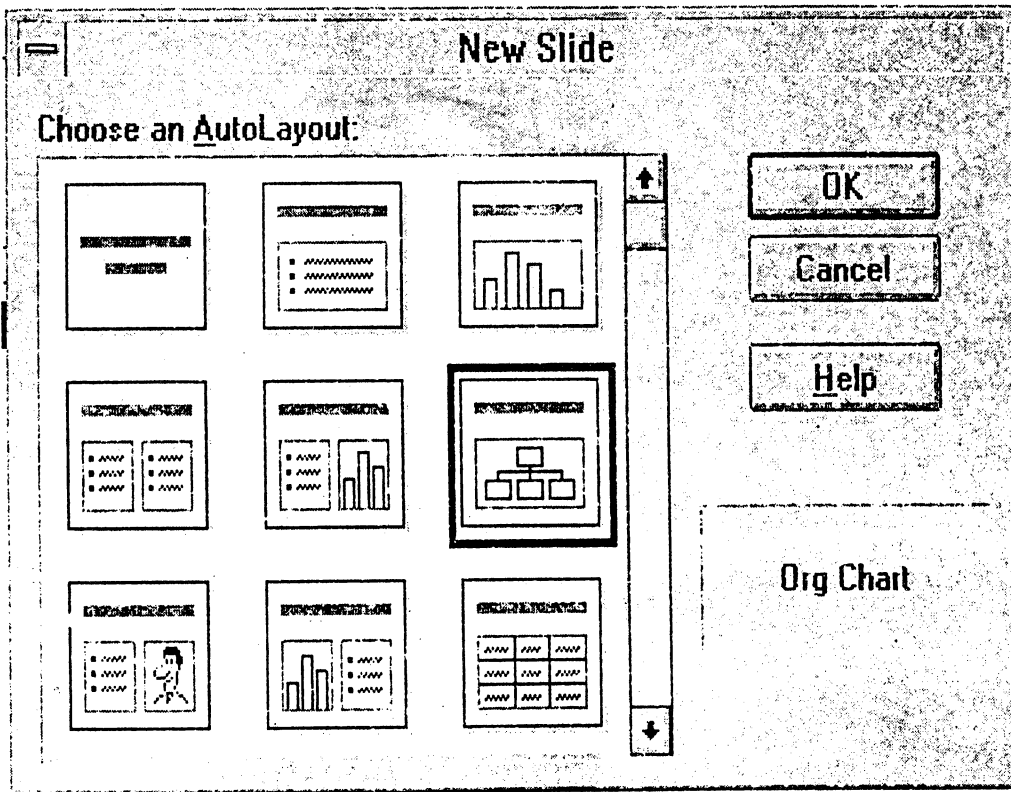
An organization chart shows the formal structure of a hierarchical group. An organization chart can be used to effectively depict a complex organization scheme as an easily comprehensible visual. These charts are ideal for all types of groups - clubs, companies and governments.

If the hierarchy of an organization is very complex, the Organization Chart that represents this organization may also become complex. In such a situation, it is better to create two organization charts. For example, if you have more than five boxes at the same level, then divide them between two charts and present the charts together. If the organization chart looks too crowded, use abbreviations for the names or titles displayed in the chart. Or, show only the names of people, not their titles.

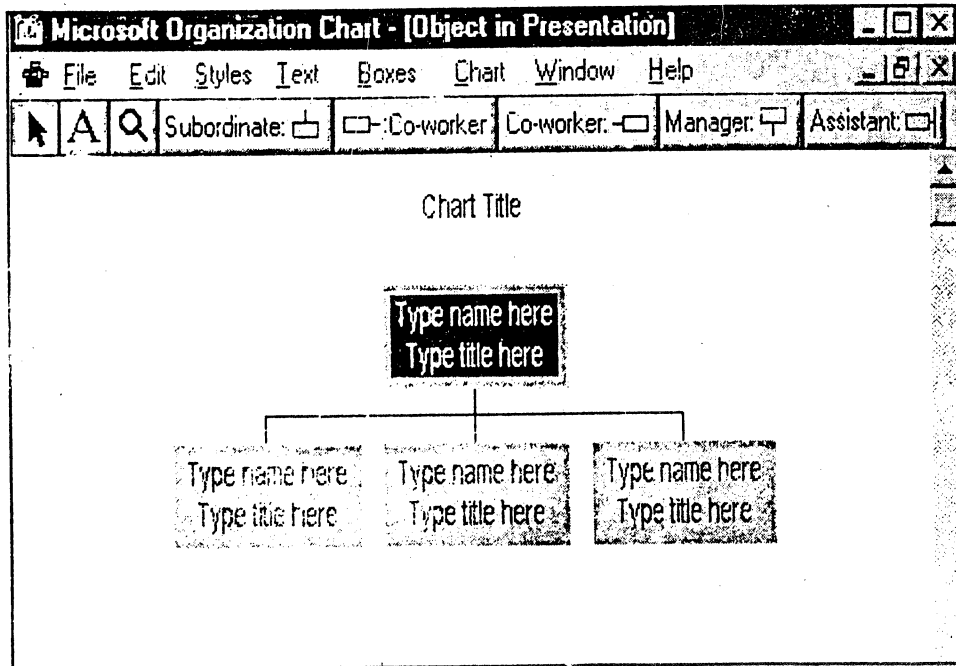
To create an organization chart

1. Click on New slide button on the status bar to display AutoLayout dialog box.

2. Select Org Chart layout from the AutoLayout list and then click on OK to display a blank Organization chart presentation slide.



3. Double click on Org. Chart box to display Organization chart window.
4. Click on box to type title and name in the box.



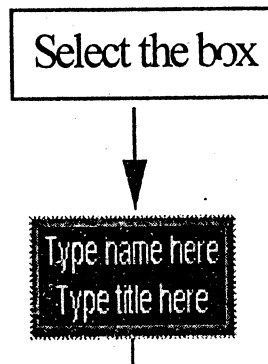
To change group styles

- Select on Styles menu to display different Group Styles. Select any of them



To change box border styles

- Click on box to select.



- Select Box Border from the Boxes menu to display different border styles. Select any one of them.

To change box shadow styles

- Click on box to select.
- Select Box Shadow from the Boxes menu to display different shadow styles. Select any one of them.

To change box colours

- Click on box to select.
- Select Box Color from the Boxes menu to display different colours. Select any one of them.

To change line thickness of the box

- Click on box to select.
- Select Line Thickness from the Boxes menu to display different line thickness. Select any one of them.

To change line styles of the box

- Click on box to select.
- Select Line Style from the Boxes menu to display different line styles. Select any one of them.

To change line colour of the box

- Click on box to select.

- Select Line Color from the Boxes menu to display different line colours. Select any one of them.

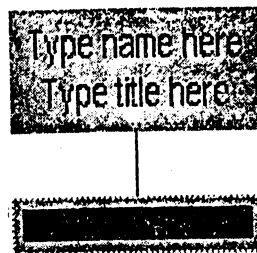
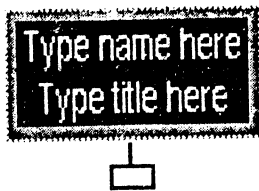
To add more boxes in organization chart

- Click on the appropriate button on the toolbar, to add Subordinate, Co-worker, Manager and Assistant boxes.

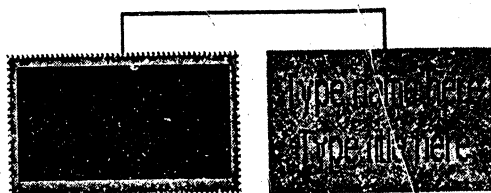
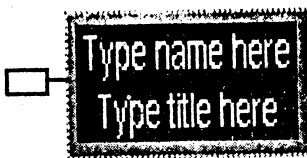


- Adding different boxes :

Subordinate



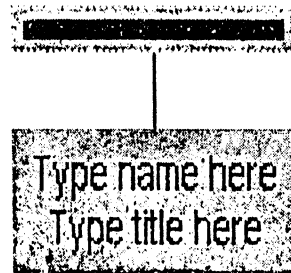
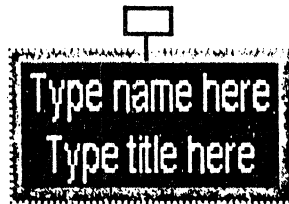
Co-worker



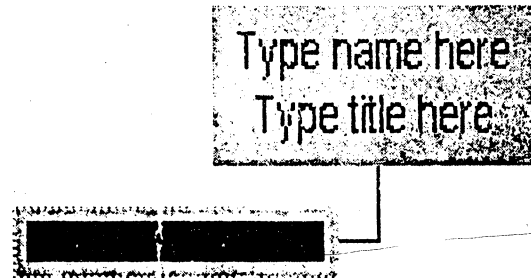
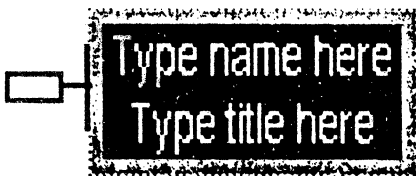
Co-worker



Manager



Assistant



5.4.5 Save and Close a presentation

After creating a slide, now you can save your presentation.

To save a presentation

1. Select **Save** from the File menu to display Save As dialog box.
2. This dialog box displays the current directory and the current drive in respective *directories* and *drives* boxes. Enter the name of the presentation in the *File name* box. No need to give extension because Microsoft PowerPoint automatically adds a .PPT extension to the name.
3. To store the presentation in a different directory, select the directory from the *directories list*.
4. Click **OK** to save presentation file.

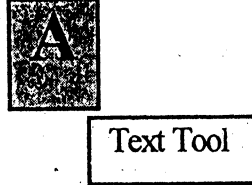
To close a presentation

- Select **Close** from the File menu to close the current presentation.

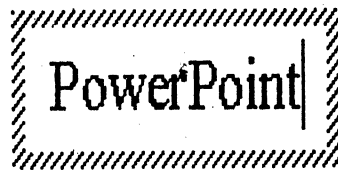
You can create a text object, edit text and move text object in a slide using text tools.

To create a text object

1. Select Text tool button from the toolbar.



2. Leave the tool on blank slide and type text on it.



3. When finish typing the text, click any where of the blank slide.

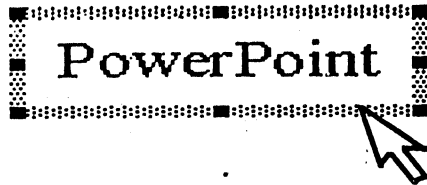
To edit the text object

- Click on the text object. While cursor is blinking on it, you can add more characters or using Del key / Backspace key to remove characters.



To move the text object

- Click on text object to select it. Move the mouse cursor to border of the text object and click on it and hold down the mouse button. Move the text object anywhere of the slide and leave the mouse button.

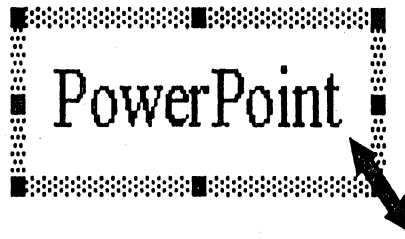


To delete the object

- Click on object to select . Press DEL key to delete.

To resize the object

- Click on object to select. Move the mouse cursor to the corner of the object, when cursor changes its shape, hold down the mouse button and drag it to increase or decrease the size.



Change fonts, size and colour of text

PowerPoint provides so many choices for the appearance of text object on slide. You can change the size of the text, change the font of the text and can make the text bold or italic. You can also fill color to background of the text, shadow the text and text color.

To make text bold, italic or colorful

1. Select the text object, to enables additional tools in the toolbar for changing the appearance of the text.
2. Click the bold or italic button to changes the text.

To change the font and size of a label

1. Select the text object.
2. Select font from the fonts list box of the toolbar to change the appearance of the text.
3. Select size from the size list box of the toolbar to resize the label text.
4. Using the mouse pointer to resize the control.

To fill the text background color

- Select the text object.
- Click on fill color button to display color lists and select to fill it.

To create or change the border color

- Select the text object.
- Click on border color button to display color list and select to create border of that color.

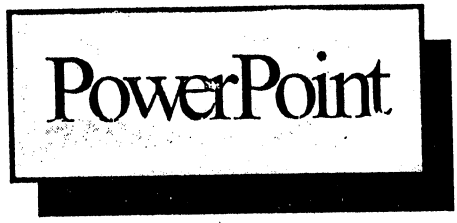
With border



To create or change the Shadow colour

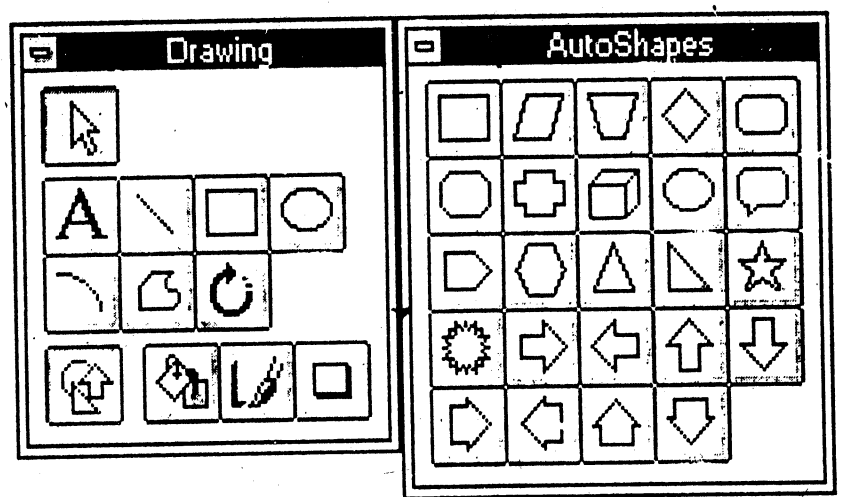
- Select the text object.
- Click on shadow color button to display color list and select to create shadow of that color.

With shadow



Working with graphic tools

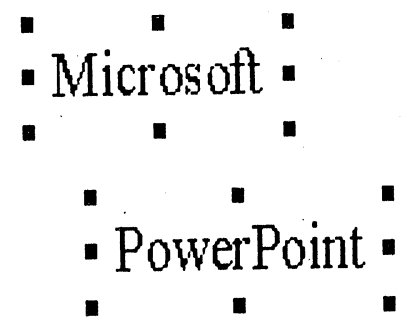
- Click on any drawing button from the Drawing or Drawing + toolbar.



- Draw any drawing object on the slide.

Align objects

- Select the first object, press and hold down the Shift key and click on the second object to align with first object.



- Select Align from the Draw menu to display another sub-menu.
- Select centers to align the objects in center.

Microsoft

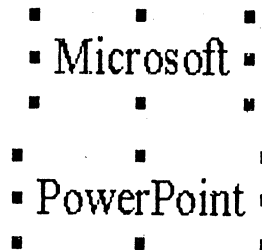
PowerPoint

Group or ungroup the objects

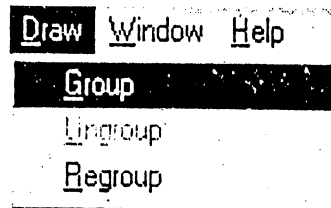
You can create a set of object to group them and separate them by Ungroup.

To group the objects

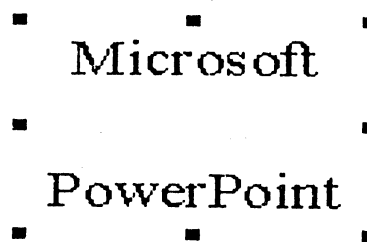
- Select the first object, press and hold down the Shift key and click on the second object to group with first object.



- Select Group from the Draw menu.



- It will group the objects.



To Ungroup the objects

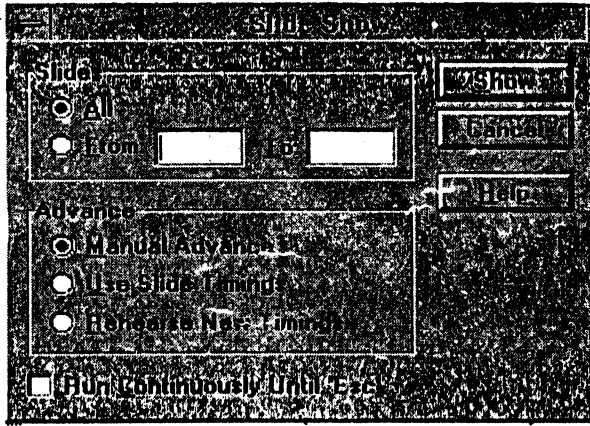
- Click on the grouped object to select. Select Ungroup from the Draw menu to Ungroup them

5.6 SLIDE SHOW

Till now you have learned about creating slides. Now you can show them by slide show.

- Select Slide show from the view menu to display a dialog box.

- Click on show button to display slide show.



You can setup timings for individual slide, can create animation in a slide and lot more. All this is beyond the scope of this unit. You can learn about other PowerPoint features by using them on the Microsoft PowerPoint itself.

5.7 SUMMARY

Business graphics can be categorized into

- Presentation graphics
- Analytic graphics
- Design graphics
- The various components of a slide are: Title, Subtitle, Footnotes, Border, X-axis and its Titles, Y-axis and its Titles.
- You can change the fonts, size and colour of text, you can add drawing objects in your slide by select the drawing shape from the drawing toolbar.
- You can align objects, group or ungroup objects in PowerPoint.
- Screen display effects can be added to enhance a presentation.
- To create a new presentation by select New from the File menu.
- Titles slides are used to display the title of a presentation.
- Bulleted lists are used to group related information on a slide.
- Slide show provides a way to appear slides on the screen one by one.

