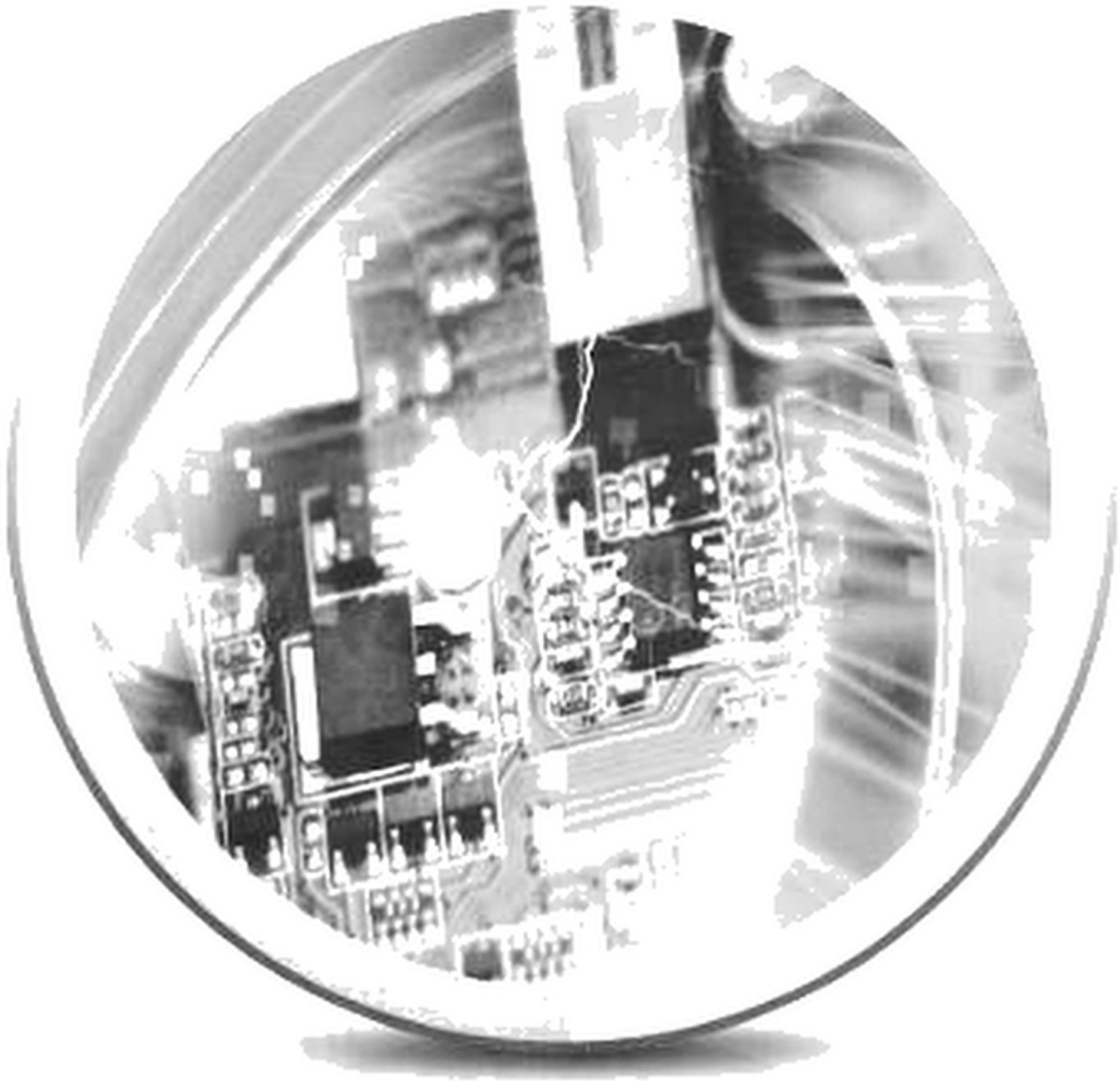
COMPUTER SCIENCE

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(September 25, 1947, Karachi)

Quaid-e-Azam
Muhammad Ali Jinnah
Founder of Pakistan



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A Textbook of Computer Science

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CHAPTER 1 Basics of Information Technology

Overview

We are living in the Information Age of a Global Village today. That means Information is the key factor in this era and it is rightly said that "Information is the most precious commodity of today's day-to-day business". Everything evolves around it whether it is education, medicine, history, geographical phenomena, sports, research or business. You name the system and Information is there to play a key role in its functionality and existence.

Information can be defined as the facts and figures about anything i.e. The know-how about any object that exists and plays its role in any system. The system is any identified and known work that accepts data / information into itself, manipulates in the shape of certain output(s) and delivers so that it becomes useful and meaningful. And precisely, that is what is known as "Data processing" or "Computing", for which we need a computer to accomplish the task.

Few years back, this accomplished task was available to the computer users/clients in a prescribed locality only. That locality could be his own office or organization. But with the advent of Communication technology, our globe has become virtually a one-community area i.e. Global Village. The organizations expanded to remote cities and countries and it was felt to make the data/**information** and the ultimate accomplished task available to them where-ever they are. There came communication **technology** to our rescue and a new term emerged i.e. "Information Technology" that can be precisely defined as:

"Information Technology is the technology that merges computing with high-speed communication links carrying data in the form of text, sound, images, video etc", from place to place over this global village. For this purpose, the computer systems are networked in such a way that the data/information stored/processed on them is always available from anywhere, at any place, at any moment. Thus, the computer users are almost always sharing and exchanging their information in such a manner as if they are sitting in a drawing room face to face. So in short, Information Technology enables the heterogeneous types of industries and institutions to a phenomenon known as digital convergence. The digital convergence is the technological merger of various industries/enterprises through some electronic gadgets that exchange information between them. The industries are computers, electronics, telecommunications, and mass media etc. It has tremendous significance in modern scenario. It means that from a common electronic base, information can be

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Modern Scenario

The modern impact of Information Technology has broadened the base of computing and communication through satellite, fiber-optic, mobile phone, fax machine, multi-media/hyper-media, e-commerce, m-commerce etc. Thus enhancing the implications of this shift from single isolated technologies to a unified digital convergence and enabling the computer users to experience a beautiful and fantastic scenario of computer utilization in the fields like:

(i) Artificial Intelligence
(ii) Web-based Applications
(iii) E-commerce, M-commerce (Mobile Commerce)
(iv) Computer Animation
(v) Multi-media, Hyper-media
(vi) Distributed Computing

There are numerous fields of computer applications, but we need not to go into the details of all those as it is beyond the scope of this book. What we need to know here is that the Information Technology has brought about a revolution in our life style. We may call it the Computer Revolution, Information Revolution, Communications Revolution, Internet Revolution, Multi-media Revolution or whatsoever. So it is beyond any doubt that today, we are living in a society that is making use of "Information Highway" which is heading towards a real future "Global Village" of the human history.

1.1 Hardware and Software

"A computer is a machine that can be programmed to accept data (input), process it into useful information (output), and store it away (in a secondary storage device) for safekeeping or later reuse". We have four words in this definition which are of prime importance in the whole computing process i.e. **machine, program, input** and **output**. By conventions, machine is called **hardware**, whereas a program is known as **software** in the discussion of computer science. Here, input and output devices are part of the machine that can now be called as a complete Computer system. So, to function, a computer system requires four main aspects of data handling i.e. input, processing, output and storage (figure 1.1). The hardware, responsible for these four areas, operates as described below:

- Input devices accept data in a form that the computer can use, and then sends it to the processing unit
- The processor (CPU), has the electronic circuitry that manipulates input data into the form of useful information. The processor actually executes the instructions (Programs) in a logical sequence.

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- Storage usually means secondary storage, which consists of secondary storage devices, such as hard disk, floppy diskettes, CDs etc. which can store data and programs outside the computer itself. These devices actually *supplement* main memory, which can hold data and programs only temporarily.

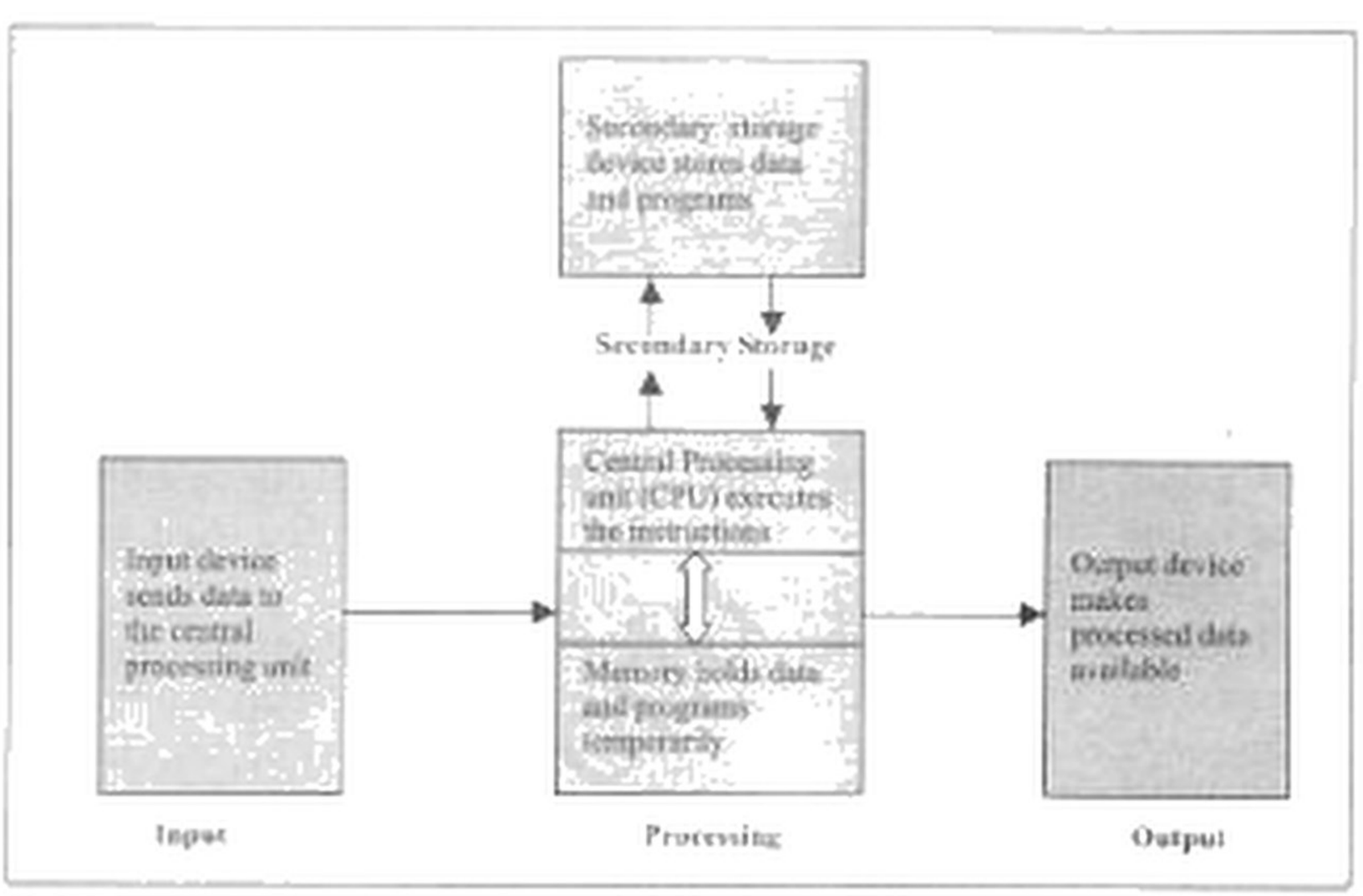


Figure 1.1: A generalized Computing Environment

1.1.1 Hardware Devices

Following are the main hardware devices in any computer system:

- Input Devices i.e. Keyboards, Mouse, Microphones etc.
- Output Devices i.e. Printers, Speakers, Monitors etc.
- Main Memory comprising of RAM and ROM
- I/O Device i.e. Terminals, Touch Screen etc.
- Secondary Memory i.e. Hard disk, Floppy disk, Compact disk, Tape etc.
- Inter-connectors i.e. Cables, Ports, Buses etc.
- Networking Devices i.e. Modem, Bridge, Router etc.

1.1.2 Software Classification

Software can be classified into following main two categories:

- System Software
- Application Software

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System Software: System software is used to control the usage and allocation of different hardware components and enables the other application programs to execute. For example.

- Operating Systems
- Utility Programs (Backup/Restore)
- Drivers

The system software may be a combination of many such programs

Application Software: Application software is the software that has been developed to solve a specific problem or to provide audio, video, or multimedia entertainment to the users. It may be categorized as under

- Custom-built
- Packaged

Custom-built software: This is the software that is designed and developed for a particular customer. The custom-built software is discussed in detail in the section 1.6 (Systems Development).

Packaged software: This software is the kind of **off-the-shelf** programs or components, developed for sale to the potential software developers/users for their use. The examples are: MS-Word, MS-Power point, Personal Oracle etc. few of these are discussed in the coming chapters.

1.2 Input and Output devices

We need some, device(s) to enter the data into the computer (Input devices) and some device(s) to see the outcome (or processed information) of the computer (Output devices). Both discussed as below:

1.2.1 Input devices

Sometimes, the data is entered directly to the computer and sometimes indirectly. In the first case, the data goes directly to the computer from the source and in the second case; we have to carry out some intermediate handling. In either case the task is to gather data to be processed by the computer. There are three general types of input hardware, namely:

- Keyboards
- Pointing devices
- Source data-entry devices

Keyboard: The keyboard may look like a typewriter keypad to which some special keys have been added. The keys normally available on the keyboards are Numeric, Alphabetic, Function and additional Special-purpose keys,

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numeric keys, and status lights in the upper-right corner. This standard keyboard is also called "QWERTY", which describes the beginning keys in the top row of alphabetic letters.

Function Keys: The function keys are an easy way to give certain commands to the computer. The particular software we use defines what each function key does.

Main Keyboard: The main keyboard includes the familiar keys found on a typewriter keypad, as well as some special command keys. The command keys have different uses/effects that depend on the software being used. Some of the most common uses are listed here:

101-Key "Enhanced" Keyboard Layout extra buttons and keys are based on this layout.



Figure 1.2: A 101-key 'Enhanced' keyboard, showing the layout of the various key groups.



The **Escape key**, is used in different ways by different programs; often it allows to "escape" to the previous screen of the program.



The **Tab key**, is used to tab across the screen and set tab stops as on a typewriter.



When the **CapsLock** key is pressed, upper case letters are produced. Numbers and Symbols are not affected. The number or symbol shown on the bottom of a key is still produced. When the CapsLock is pressed, the status light under

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The **Shift key** is pressed in combination with other keys to produce upper case letters and the upper symbols shown on the keys.



The **Control key** is pressed in combination with other keys to initiate commands as specified by the software.



The **Alternate key** is also used in combination with other keys to initiate commands.



The **Backspace** is used to delete a character to the left of the cursor, moving the cursor back one position. The cursor is the flashing indicator on the screen that shows where the next character will be inserted.



The Enter key moves the cursor to the beginning of the next line. For instance it is used at the end of a paragraph.

Numeric Keys: The **numeric keys** serve one of the two purposes, depending on the status of the Num Lock key. When the computer is in the Num Lock mode, these keys can be used to enter numeric data and mathematical symbols (/ for "divided by", * for "multiplied by", - for "subtraction" and + for "addition"). In the Num Lock mode, the status light under "Num Lock" key lights up. When the computer is not in the Num Lock mode, the numeric keys can be used to move the cursor and perform other functions, as given below.



In some programs, the End key moves the cursor to the bottom-right corner of the screen.



This key moves the cursor down one line.



The Page Down key advances one full screen while the cursor stays at the same place.

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This key moves the cursor one character to the left.



This key moves the cursor one character to the right.



In some programs, the Home key moves the cursor to the top-left corner of the screen.



This key moves the cursor one line up.



The Page Up key backs up to the previous screen while the cursor stays at the same place.



The Insert key, when toggled off, causes keyed characters to override/affix with the existing characters.



The Delete key deletes a character, space, or selected text.

Extended keyboards include additional keys that duplicate the cursor movement functions of the numeric keys. Users who enter a lot of numeric data can leave their computers in the Num Lock mode and use these additional keys to control the cursor.

The **Arrow keys**, to the left of the numeric keys, move the cursor position, just as the numeric keys 2,4,6, and 8 do when they are not in the Num Lock mode.

Just above the Arrow keys are six keys --- **Insert, Delete, Home, End, Page Up, and Page Down** --- which duplicate functions of the numeric keys 0, decimal point (Del), 7,1,9, and 3.

At the top of the keyboard, to the right of the function keys, are keys that perform additional tasks, as mentioned below:



The **Print Screen** key causes the current screen display to be taken a copy of information or image on the screen.

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The **Scroll Lock** key causes lines of text images - not the cursor – to move. When the computer is in the Scroll Lock mode, the status light under "Scroll Lock" lights up.



The **Pause key** causes the screen to pause when information is appearing on the screen too fast to read.

Function Keys: These keys are at the top of a computer keyboard labelled F1, F2, F3, F4, F5, F6, F7, F8, F9, F10, F11 and F12. The functional keys are an easy way to give certain commands to the computer, which are usually operated by keyboard commands. They have different functions in different program. These functions are particularly important in an application program.

Pointing devices: Pointing devices control the position of the cursor or pointer on the screen. They include the following:

- Mouse
- Pointing Stick
- Touch Screen
- Digitizing/Graphic tablet
- Trackball
- Touch pad
- Light pen
- Pen-based system

A brief description is given as under:

Mouse: A **mouse** is an input device that looks a little bit like a mouse. It has a ball on its underside that is rolled on a flat surface or mouse-pad. The rolling movement causes a corresponding cursor movement on the screen. It enables us to reposition the cursor (or pointer) on the screen where ever we want. It also has buttons on its top which communicate certain commands to the computer while pressed. In particular, button is often used to click on an **icon** (icon represents a computer activity or command) to invoke the command.

Trackball: The **trackball** is a movable ball, on top of a stationary device, that is rotated with fingers or palm of the hand. Its popularity surged with the advent of laptop computers where traveling users found themselves without a flat surface to roll the traditional mouse. It looks like the mouse turned upside down and likewise, has additional buttons whose functions vary depending on the software.

Pointing Stick: A **pointing stick** is a pointing device that looks like a pencil eraser protruding from the keyboard between the **G, H,** and **B** keys. We move the pointing stick with our forefinger while using the thumb to press buttons located in front of the space bar. Another device like a Pointing stick is the **Joystick**. It is a pointing device that consists of a vertical handle like a

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gearshift lever mounted on a base with one or two buttons. It is basically used in video games and in some computer-aided design systems.

Touch pad: The **touch pad** is a small, flat surface over which we slide our finger, using the same movements as we would with a mouse. As we move the finger, the cursor follows the movement. We "click" by tapping the finger on the pad's surface or by pressing button positioned close by the pad. Touch pads are now common on the portable computers (laptops).

Touch Screen: A **touch screen** is a video display screen that is sensitized to receive input from simply touching our fingers onto it. It is covered with a plastic layer, behind which are invisible beams of infrared light. We simply touch the provided buttons or menus and get the information on the display screen accordingly.

Light Pen: The **light pen** is a light-sensitive stylus, or pen-like device, connected by a wire to the computer terminal. The user brings the pen to a desired point on the display screen and presses the pen button, which identifies that screen location to the computer. Engineers, graphic designers, and illustrators use light pens.

Digitizing/Graphic Tablet: A digitizing tablet consists of a tablet connected by a wire to a stylus or puck. A **stylus** is a pen-like device with which the user "sketches" an image. A **puck** is a copying device with which the user copies an image, such as an architectural drawing or a civil engineering map. A puck looks a bit like a mouse but has different types of buttons and a clear plastic section extending from one end with crosshairs printed on it. The intersection of the crosshairs points to a location on the graphics tablet, which in turn is mapped to a specific location on the screen.

Digitizing tablets are used primarily in design and engineering. When used with drawing and painting software, a digitizing tablet and stylus allow us to do shading and many other effects similar to those artists achieve with pencil, pen, or charcoal. Alternatively, when we use a puck, we can trace a drawing laid on the tablet, and a digitized copy is stored in the computer.

Pen-Based Systems: In the next few years, students may be able to take notes in class without ink and paper, if pen-based computer systems are introduced. These computers use a pen-like stylus to allow people to enter handwriting and marks onto a computer screen rather than typing on a keyboard. This system connects an instructor's electronic "whiteboard" on the classroom wall with student's pen computers, so that the students could receive notes directly, without having to copy information word for word. "The idea is that the students should concentrate on the lecture listening only".

Source Data-Entry Devices: These devices are used for direct data entry to

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Scanning Devices:

- Bar-Code Reader
- Mark- and character-recognition device
  - MICR (Magnetic-Ink Character Recognition)
  - OMR (Optical Mark-Recognition)
  - OCR (Optical Character-Recognition)
  - Magnetic-stripe cards
  - Smart cards
- Fax machine
- Imaging system
- Audio/Video Devices
  - Audio-input device
  - Video-input device
  - Digital camera

NOTE : Scanners use laser beams and reflected light to translate images of text, drawings, photos, and the like into digital form.

Scanning Devices

Bar-Code Reader: Bar codes are the vertical zebra-stripped marks we find on most of the manufactured products in the market. This bar-code system is also called the "Universal Product Code". These are read by bar-code readers, photoelectric scanners that translate the bar-code symbols into digital code, which is then fed to the computers for further processing.

MICR: It is a method of machine-reading characters made of magnetized particles. MICR characters, which are printed with magnetized ink, are read by MICR equipment, producing a digitized signal, which goes to the computer as data for further processing.

OMR: Optical recognition systems use a light beam to scan input data to convert it into electrical/digital signals, which are then sent to the computer for processing. The most well known example is the OMR technology used to read the SAT and GRE test marks.

OCR: It uses a device that reads preprinted characters in a particular font and converts them to digital code. The common examples are some utility bills and price tags in the department stores.

Magnetic-strip cards: A magnetic-strip card has a strip of magnetically encoded data on its back. They are used for personal identification during driving, in the stores, at public places etc.

Smart cards: It looks like a credit card but a microprocessor and memory chip have been added additionally. When inserted into a reader, it exchanges

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some basic information also. A Mobile-SIM card and an ATM card are good examples of this type.

Fax Machine: The fax or facsimile transmission machine scans an image and sends it as electrical signals over telephone lines to a receiving fax machine, which re-creates the image on paper. We have two types of fax machines i.e. dedicated fax machines and fax modems. Dedicated fax machines are the normal fax machines whereas, the fax modem is a circuit board inside the system unit. It has a capability to send signals directly to someone else's fax machine or computer fax modem, from computer to computer.

Imaging System: Image scanner (graphic scanner) converts text, drawings, and photographs into digital form and stores it to the computer system for further processing. The system scans each image (color or black and white) with light and breaks the image into light and dark dots or color dots, which are then converted to digital form. This is also called **raster graphics,** which refers to the technique of representing a graphic image as a matrix of dots.

Audio/ Video Input Devices

Audio-Input device: An audio-input device records analog sound and translate it for digital storage and processing. The principal use of audio-input devices is to provide digital input for multimedia computers, which incorporate text, graphics, sound, video and animation in a single digital presentation. Sound (analog form) goes through a special circuit board called an audio board, which converts analog sound to digital form and stores it for further processing and/or plays it back. Microphone is mostly used as an audio-input device.

Video-Input device: Films and video images from VCR or camcorder are converted to digital form with the help of a special digitizing card (called video-capture card). It has two types:

Frame-grabber video card: It can capture and digitize only a single frame at a time.

Full-motion video card: Also known as **adapters,** can convert analog to digital signals at the rate of up to 30 frames per second, giving the effect of a continuously flowing motion picture.

Digital Camera: A digital camera uses a light-sensitive processor chip to capture photographic images in digital form on a small diskette inserted in the camera or on flash-memory chips. The digital form is then uploaded to the computer for manipulation and printing out.

1.2.2 Output Devices

The information processed by the computer is translated into a form

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Softcopy refer to data that is shown on a display screen or is in audio or voice form. This kind of output is not tangible; it cannot be touched. Virtual reality and robots might also be considered softcopy devices. **Hardcopy** refer to printed output. The principal examples are printouts, whether text or graphics, from printers, plotters etc.

Display Screens: Also known as CRTs, Monitors, or simply screens, differ in **size, color, resolution, and video display adapter card**. These are used for inputting the data or displaying the information after processing.

Size: Monitor come in different sizes, from small screen built into palmtops and laptop to extra large monitors used for special purposes.

Color: Many monitors display color. These RGB displays can create 256 colors and several thousand variations on them by blending shades of **Red, Green, and Blue** (RGB). Monochrome displays show information using a single foreground color on a contrasting background color.

Resolution: All the characters and images on a monitor are made up of dot patterns; the number of dot, or **pixels**, per inch determines resolution, or the sharpness of the image. A higher number of pixels means a shaper image.

Video Display Adapters: To display graphics, a display screen must have a video display adapter attached with the computer. It is known as a video graphics card, and is a circuit board that determines the resolution, number of colors, and speed with which images appear on the display screen. So far, there are three types of graphics cards introduced in the market.

- **VGA:** Video Graphics Array, support 16-256 colors, depending on screen resolution. At 320 x 200 pixels, it will support 16 colors and at 640 x 480 pixels, 256 colors. It is called 4-bit color.



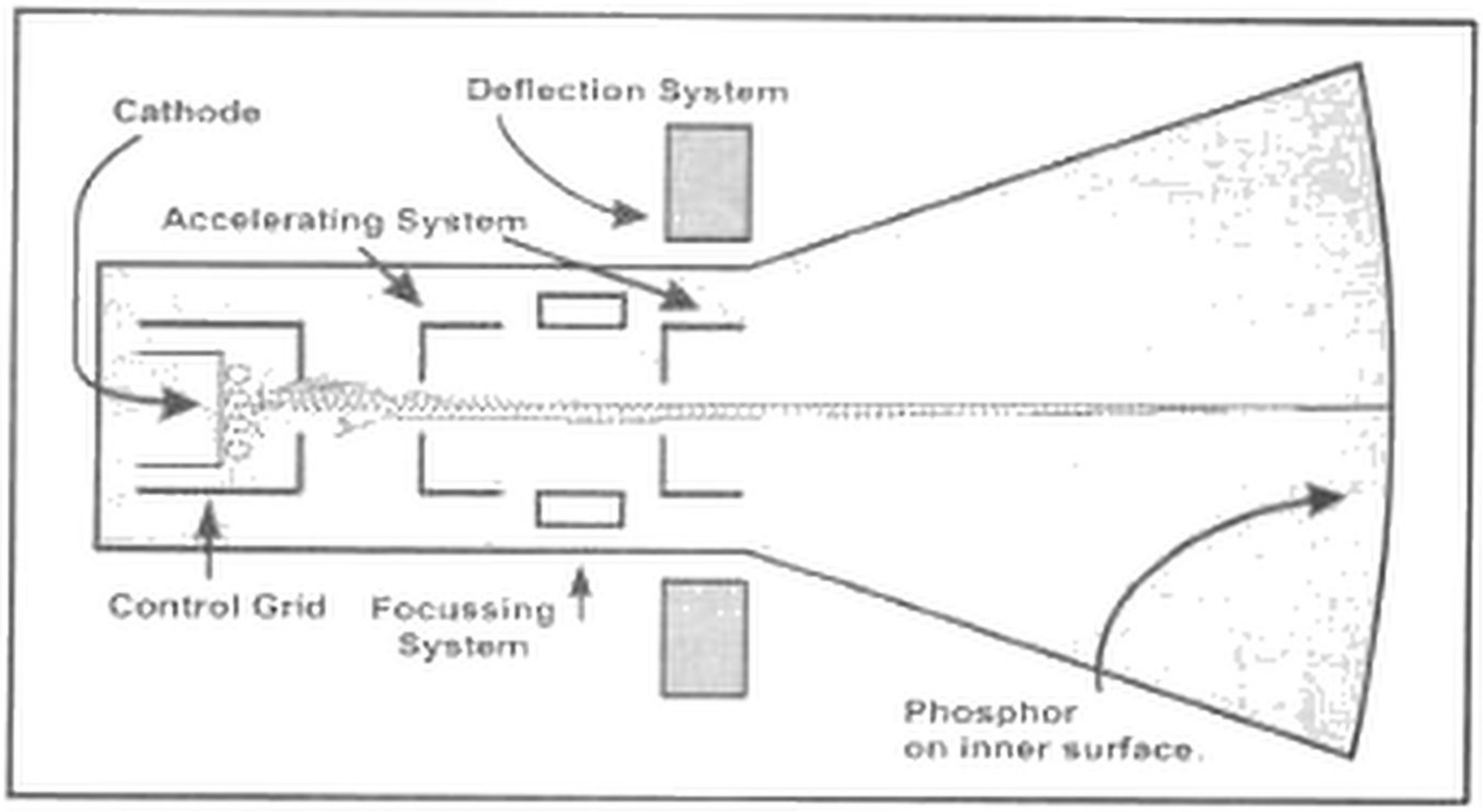
- **SVGA:** Super Video Graphics Array, support 256 colors at higher resolution than VGA. It has two graphics modes: 800 x 600 pixels and 1024 x 768 pixels. It is called 8-bit color.
- **XGA:** Extended Graphics Array, supports up to 16.7 million colors at a resolution of 1024 x 768 pixels. Depending on the video display adapter

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Types of Screen: Display screens are of two types i.e. Cathode-Ray Tubes and Flat-Panel Displays.

CRT (Cathode-Ray Tubes): The most common form of display screen is the CRT. A Cathode-Ray tube is a vacuum tube used as a display screen in a computer or video display terminal. This same kind of technology is found not only in the screens of desktop computers but also in television set and in fight-information monitors in airport. A stream of bits defining the image is sent from the computer (from the CPU) to the CRT's electron gun, where the bits are converted to electrons. The inside of the front of the CRT screen is coated with phosphor. When a beam of electrons from the electron gun (deflected through a yoke) hits the phosphor, it lights up selected pixels to generate an image on the screen.



how CRT screen work

Flat-Panel Displays: The flat-panel displays are much thinner, weightless, and consume less power to CRT. Thus, they are better for portable computers. Flat-panel displays are made up of two plates of glass with a substance in between them, which is activated in different ways. There are three types of technology used in flat-panel display screens: **LCD (Liquid-Crystal Display)** consists of a substance called liquid crystal, the molecules of which line up in a way that lighting behind the screen is blocked or allowed through to create an image. **EL (Electro- Luminescent Display)** contain a substance that glows when it is charged by an electric current. **Gas-plasma display** is like a neon bulb, in which the display uses a gas that emits light in the presence of an electric current.

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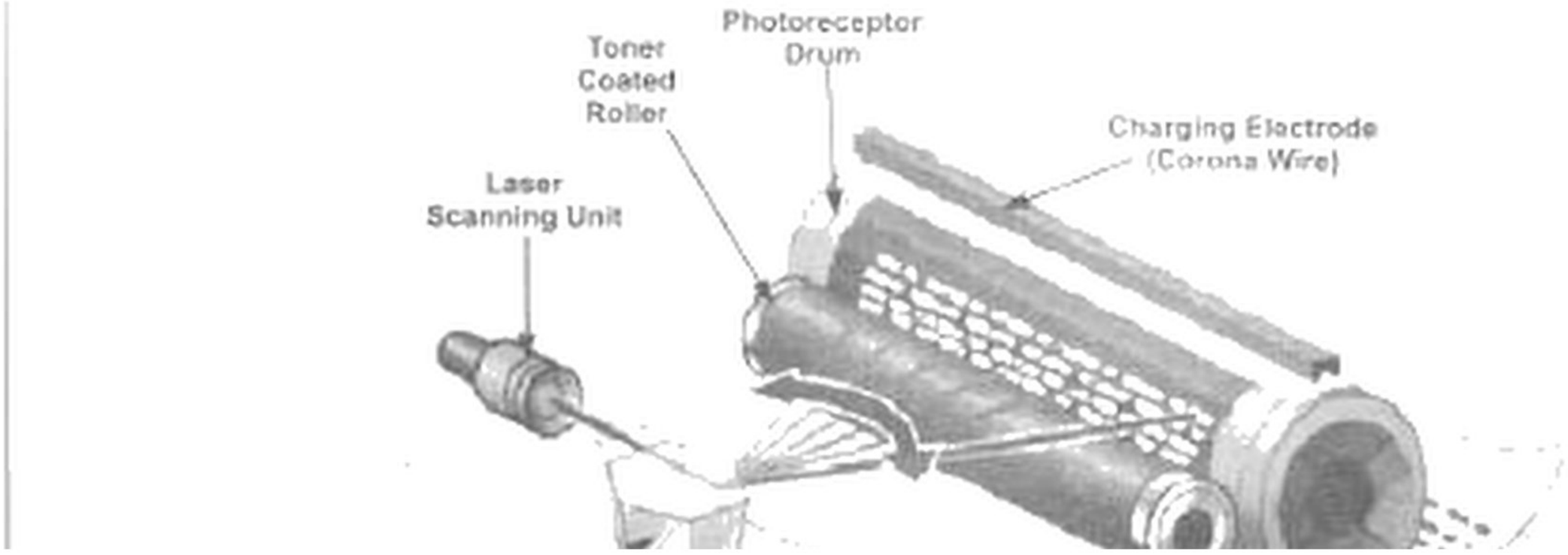
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Printers: Printers are used to print characters, symbols, and graphics on paper. They are divided into two categories:

- Impact printers
- Non-impact printers

Impact Printers: An impact printer forms characters or images by striking a mechanism such as a print hammer or wheel against an inked ribbon, leaving an image on the paper. Following are a few types of impact printers:

- **Dot-Matrix printer:** It contains a print head of small pins, which strike an inked ribbon against paper, forming characters or images. Print heads are available with 9, 18, or 24 pins, with the 24-pin head offer the best quality prints.
- **Daisy-Wheel printer:** This printer uses a mechanism in the shape of a series of petals arranged on a petal wheel, having a character at the end of each petal. A character comes into a print position by wheel rotation and an image is formed by the hammer strike on the desired character; It is slower than dot-matrix printer but better in quality.
- **Line printer:** This type of printer is normally used by mainframe and minicomputers. It prints a whole line of characters at once rather than a single character at a time. Some of these can print up to 3000 lines per minute. It is of two types: chain printer and band printer.
- **Non-Impact Printers:** Non-impact printer forms characters or images without making direct physical contact between printing mechanism and paper. There are three types in this category.
- **Laser Printer:** It is similar to a photocopying machine and it use the principle of dot-matrix printers of creating images with dots. These images are created on a drum, treated with a magnetically charged ink-like toner



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(powder), and then transferred from drum to paper. The laser printer can produce high quality images of both text and graphics (ranging from 300 dpi to 1200 dpi). Its speed varies from 4-32 text-only pages per minute for microcomputers and up to 200 pages per minute for mainframes.

- **Ink-jet Printer:** Ink-jet printer sprays small, electrically charged droplets of ink from four nozzles through holes in a matrix at high speed on to paper. It is cheaper compared to laser printer but lower in resolution (300-720 dpi) and is slower also (1-6) text-only pages per minute. It has another type of printer i.e. bubble-jet printer, which uses miniature heating elements to force specially formulated inks through print heads with 128 tiny nozzles.
- **Thermal Printer:** Thermal printer uses colored waxes and heat to produce images by burning dots on to special paper. The colored wax sheets are not required for black-and-white output. It produces a high quality printout but is quite expensive compared to other non-impact printers.

Plotters: A plotter is used to produce high-quality graphics in many colors and used for specialized applications i.e. architectural drawings, maps, graphs, and charts. Plotters are of two basic kinds:

- Flatbed plotter
- Drum plotter

Flatbed Plotter: A flatbed plotter is the one, which has a paper lying flat on a table-like surface. The bed-size varies according to the need. One to four color pens move across the paper and the images are printed by the computer accordingly.

Drum Plotter: It works like a flatbed plotter with a difference that the paper is mounted over a drum, enabling a continuous output. A typical usage is to track an earthquake readings.

Sound Output: Speakers are most commonly used to have this type of output.

Speaker: As we use microphone to input audio data to the computer, conversely we use speaker to get audio output from the computer. It works on the same principles to convert sound data into machine usable form. A variety of speakers are available in the market to satisfy the requirements of the users.

1.3 System Software vs Application Software

Generally speaking, a computer is a "deaf and dumb" machine, which cannot do anything at its own unless it is told to do so. We instruct it to do some number

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and so on. So this instruction(s) is the driving force that allows a computer to perform a certain task and known as "a **Program** or a **Software**". It is this "**Software**" that tells the machine's physical components what to do and how to do.

The software falls into two major categories i.e. System Software and Application Software. They are discussed as below:

1.3.1 System Software

The system software basically manages and monitors the different resources of the whole computer system i.e. Operating system, Backup and Restore utility program, drivers etc.

Operating system is the main and foremost part of the system software. It is discussed in chapter 7.

1.3.2 Application Software

Computer Programs or Application software is basically a set of programs that are used to accomplish a given task. It is basically designed and implemented by the computer users or different software houses. The application software is available in many forms/categories i.e. Commercial software, scientific software, Financial packages, Games etc. A comprehensive discussion, about how to design and implement the software, is given under the topic "Systems Development" in section 1.5.

1.4 Basic Units of Data Storage

The memory (main or secondary) is composed of an electronic circuitry, which is a combination of "On" and "Off" switches. This On/Off state has been conceived by the computer's manufacturers as the numbers "1" and "0", as the circuit can show 1 (on state) or 0 (off state) at a given time. Based on these two numbers i.e. 1 and 0 (the binary numbers), the computer can construct sophisticated ways of representing data in the memory. Thus, converting the numbers, alphabets, and characters (and their combinations) into binary digits enable us to represent them in the computer memory.

1.4.1 Bit

The binary number 1 or 0 is called a **bit** (for **b**inary dig**it**), which is the basic unit for storing data in the computer memory. The circuit being on or off at a time, a bit in the memory is always storing some kind of data.

1.4.2 Byte

A byte is a combination of 8-bits, that can store a single character of data (a letter, numeral or special character). The capacity of the memory or the storage is expressed in terms of number of bytes it can hold or store. The following table shows the commonly used storage capacity terms:

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Unit	Abbreviation	No. of bytes (approx)	No. of bytes
Kilobyte	K or KB	$(2)^{10}$	1024
Megabyte	M or MB	$(2)^{20}$	About one million
Gigabyte	G or GB	$(2)^{30}$	About one billion
Terabyte	T or TB	$(2)^{40}$	About one trillion

Table 1: Storage Capacity Terms

Example: Convert 240 MB of memory in bytes and kilo-bytes?

Solution:

Number of bytes in one MB = 2^{20}

Total number of bytes in 240 MB = 240 * 2^{20} bytes

Number of Kilo-bytes in one MB = 2^{10} KB = 1024 KB

Total number of Kilo-bytes in 240 MB = 240 * 1024 KB

1.4.3 Word

A computer word, typically the size of a register, is defined as the number of bits that constitute a common unit of data, as defined by the computer system. The length of a word varies from computer to computer. Generally, the larger the word, the more powerful is the computer. The following table illustrates this factor:

No. of bytes/words	Number of bits	Era of computer
One byte	8	Very early personal computers
Two byte	16	Traditional micro-computers
Single word	32	Mainframes, some mini-computers, and some micro-computers
Double word (DW)	64	Super computers and some micro-

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Example: Convert 60 GB of memory into words?

Solution:

Number of bytes in one GB = 2^{30}

Number of bytes in 60 GB = $60 * 2^{30}$

Number of words in 4 bytes = 1 W

Number of words in 60 GB = $60/4 * 2^{30}$

= $15 * 2^{30}$ words

Remember that: An 8-bit machine could handle only one-byte (a character) at time, whereas a 64-bit machine handles two words or 8 bytes at a time, making its processing speed eight times faster.

1.5 System Development

1.5.1 System Components

The system comprises of the following necessary components

(i) Hardware

(ii) Software

(iii) People / Users

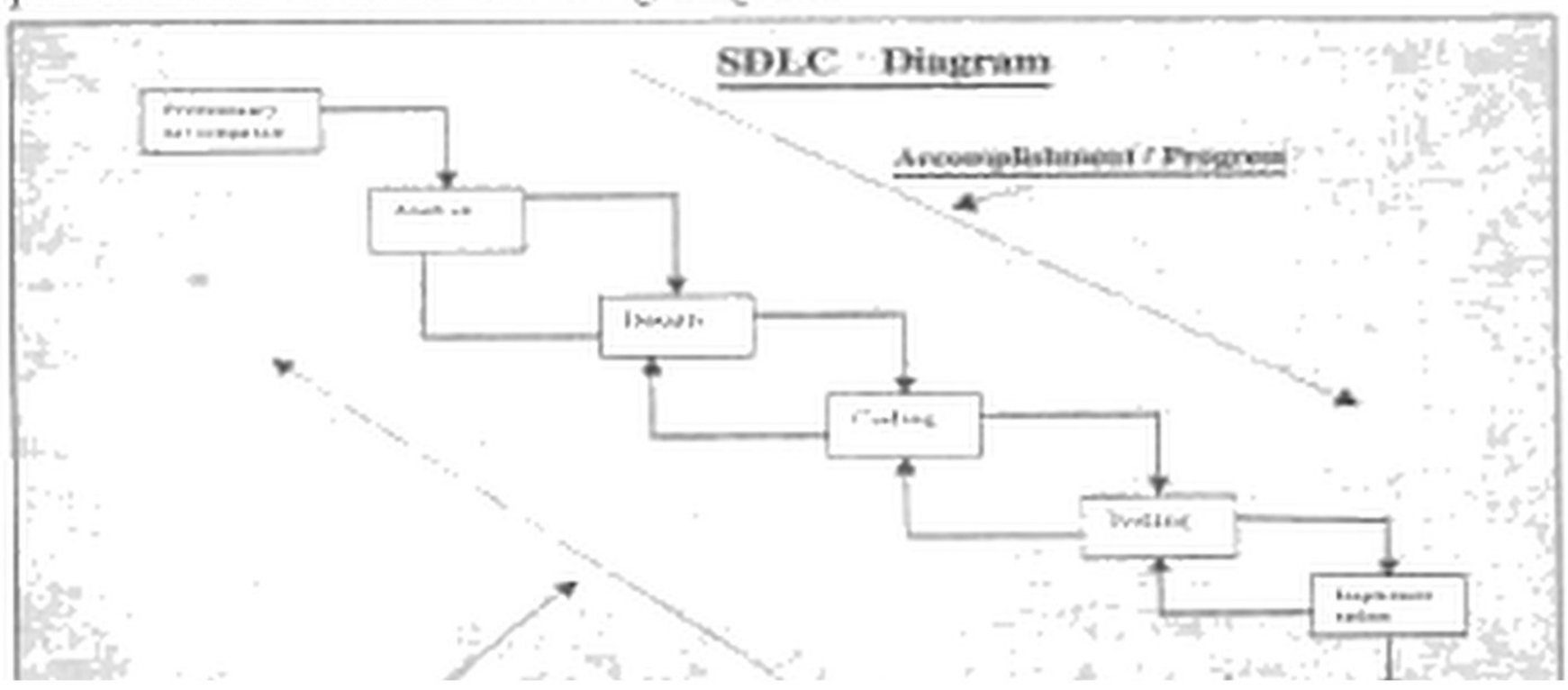
(iv) Data / Information

(v) Communication setup

Our main discussion here is focused on the Application Software development process, leaving aside the software packages (which are always available in the market).

What is a System?
A system can be defined as a combination of some related components that interact with each other to perform some specific tasks.

To develop a system, several distinct phases are to be worked out. For this purpose, **SDLC** (Software Development Life Cycle) was developed, which is an organized way to develop a successful system. It involves five phases as shown in the following diagram.



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1.5.2 System Development Life Cycle

Preliminary Investigation: The objective of preliminary investigation is to conduct an initial analysis and findings of the system as discussed below:

- **System Identification:** The system is to be identified at this stage. This is very important step as everything done in future will depend on the basis of this definition.
- **System Scope:** The scope of the system is established at this stage. Sometimes, it becomes necessary to curtail the projects to certain limits due to financial, political, or time constraints.
- **Alternate solutions:** There may be alternate solutions to develop the system. Identify all those and choose the best one. The best strategy in this regard would be to interview the concerned people inside the organization, clients or customers of the system, suppliers and consultants. We can also watch what the competitors are doing for the same type of systems.
- **Feasibility study:** We have to see the financial, political, and time-frame viabilities to go ahead for the system. There may be some social and technical constraint to be considered also.
- **Preliminary plan:** Here, we need to wind up all the findings and submit as a written document for approval. The readers of this document (also known as **feasibility report**) are top managers who will then decide about the future actions to be taken, based on this report. They might would like to make few amendments in the project or shelve it, depending on the whole preliminary investigation.

Systems Analysis: Here, the analyst will conduct the following activities:

Needs Analysis: This activity is also called Requirements Analysis. Here, the analyst would sum up the requirements of the system from the users and the managers. The developed system should satisfy these requirements during testing phase.

Data Gathering: For this activity, the systems analyst uses different tools and methods, depending on the situation. They are discussed as under:

- **Written documents:** In case we want to computerize the existing manual system or upgrade the existing computer-based system, much of the handful information can be made available using these documents. They are the reports, forms, memos, business plans, policy statements, organizational charts and many others.
- **Interviews:** Interviewing the managers, users/clients, suppliers, and competitors will help the analysts/designers to gain more knowledge about the system. The emphasis is on the fact that the questions to be asked from

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- **Questionnaires:** It may be difficult to interview many people, so it is better to design some questionnaires to collect the information from as many people as we like. This is very convenient and inexpensive method to collect handful of data but sometimes the response may be ambiguous and insufficient.
- **Observations:** The analyst or his team may go and watch the working, behavior, and similar things to know more about the similar systems around. He may be a participant or non-participant observer depending on the permission he got from the other party.
- **Sampling:** If there were a large number of people or events involved in the system, it would be better to work on a portion of all of them to save time.

Data Analysis: As we are living in the **"Information age"** so it is generally believed in today's computing scenario that data or information is the most precious commodity. Therefore, data must be accurate, complete, and readily available in the systems we design. So to keep it in proper shape, we have many tools available. For example: DFDs (Data Flow Diagrams), System Flowcharts, Connectivity Diagrams, Grid Charts, and Decision Tables etc. It is beyond the scope of this course to discuss them in details here.

Analysis Report: Once the analysis work is over, we need to document it in a presentable form to the higher management for their review and approval of the project. This report should have three parts : First, it should explain how the current system (manual or automated if exists) works. Second, it should explain the problems in the existing system, and finally it should describe the requirements for the new system and make recommendations for future.

Design: In this phase of SDLC, the analyst works on the preliminary (Logical) design, detail (Physical) design, and then writes a detailed report.

- **Logical design:** It describes the general functional capabilities of a proposed system. It reviews the system requirements and considers the major system components. Case tools and project management software (MS-Project, Gantt chart, PERT chart etc) may be used to accomplish this task. You will learn about these tools and software in some advanced course.
- **Physical design:** It describes how a proposed system will deliver the general capabilities described in the Logical design. It will address the following points: Output requirements, input requirements, storage requirements, processing requirements, and system control and backup/recovery.
- **Report:** A detailed report on logical, physical design is to be submitted to

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Coding: This is the core area of the system development process. It consists of writing the segments and programs, which will be coupled together in the shape of a complete system. It needs a lot of time, effort and budget to acquire a workable system. The program specifications, algorithms, flowcharts are given to the programmers/ software engineers to code the required programs. Off-the-Shelf-Components (already written programs) can also be used and embedded in the system to save time and effort.

Testing: Having proper hardware acquired, the programs can be tested in two stages:

- **Unit-testing:** It is also called modular testing where individual modules, programs can be tested using test (sample) data.
- **System-testing:** In this, parts or modules are linked together to test their workability as a one system. Actual data may be used to do the system testing and at the same time, erroneous data can also be used to check whether the system fails or not.

If the system passes all the tests, we can implement the system on the servers, so that the organization and other clients can use it.

Implementation: This activity consists of transferring the hardware, software and data (files, database etc) to the new working environment (server). Users of the system are also trained in this phase. Implementation may be achieved in five approaches.

- **Direct Implementation:** In this way, the users start using the new system right away and stop working on the old one.
- **Parallel Implementation:** Using this approach, the new and old systems are used side by side until it is felt that the new system is quite reliable.
- **Phased Implementation:** In this approach, parts of the system are implemented from time to time, until the whole system is implemented.
- **Pilot Implementation:** This type of implementation allows us to implement the complete system but to a selected group of users or selected departments.
- **Users Training:** Involving the users in the SDLC process from the beginning and ensuring their proper training is very much essential throughout the system design activity. A variety of methods/tools are used to do so i.e. Instruction Manual, Videotapes/CDs, and Lectures etc. The training may be

Comment: In general, the pilot and phased implementation are the most favored and popular approaches to implement the systems. **Phased** approach is preferable for organizations where different types of functions are carried out whereas **Pilot** approach is preferred where almost same

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Maintenance: The last phase adjusts and improves the system by considering the users evaluation, feedback, and enhancements based on their due recommendations. In this phase, due maintenance and help is also provided to the users against their queries, problems, and ambiguities.

Exercise 1C

1. Fill in the blanks:

(i) A bridge is used where the _____ type of networks are to be joined together.

(ii) WAN stand for_____.

(iii) A set of instruction given to the computer to solve a problem is called _____.

(iv) _____ and _____ printer are non impact printer.

(v) Trackball is popular among user of _____ computer.

(vi) SVGA stands for _____.

(vii) 1024 GB are equal to _____.

(viii) OMR reads _____ marks and converts them into computer-usable form.

(ix) LCD stands for _____.

(x) Fax stand for _____.

(xi) Dot matrix printer is a (n) _____ type printer.

2. Choose the correct option:

(i) The name for the screen clarity:

(a) Resolution (b) Discrete

(c) Pixel (d) LCD

(ii) Another word for pointer:

(a) Monochrome (b) Pixel

(c) Cursor (d) None of the above

(iii) A device used for optical-character recognition is a:

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(iv) Imaging uses what device to input data:

(a) scanner (b) icon

(c) bar code reader (d) tablet

(v) An ink-jet printer is an example of a(n)

(a) Laser printer (b) Impact printer

(c) COM printer (d) Non-impact printer

(vi) Soft copy refer to:

(a) Screen output (b) Peripheral devices

(c) OCR (d) None of the above.

(vii) Smallest unit of memory is:

(a) Byte (b) Bit

(c) Character (d) Word

(viii) The printer which can print one complete line at a time is:

(a) Dot matrix printer (b) Daisy wheel printer

(c) Laser printer (d) Line printer

(ix) The microphone converts the sound into:

(a) Mechanical signals (b) Electrical signal

(c) Computer file (d) Software

(x) An input device, which is used for playing computer games:

(a) Light Pen (b) Mouse

(c) Joy Stick (d) Scanner

3. Write T for true and F for false statement:

(i) The keyboard arrangement provided as standard on most keyboard is the QWERTY arrangement.

(ii) A picture element on the screen is called a pixel.

(iii) CRTs are used on portable computers.

(iv) Audio-output device can output only music.

(v) Non-impact printers are quitter than impact printers.

(vi) A trackball is a pointing input device almost like a mouse turned upside

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(vii) The disk drives are known as I/O devices.

(viii) Function keys are used the same way with every software application.

(ix) EGA stand for Extended Graphic Adapter.

(x) The two basic types of plotter are the Drum plotter and the Flatbed plotter.

4. What is the difference between hardware and software?

5. What is information Technology? Describe it in detail?

6. What implementation? Describe it Approaches.

7. What is the usage of an input device? List few of them.

8. Describe the enhanced Keyboard and it segment?

9. Write the name of the Input device that can control the cursor movement?

10. What is the function of an output device? List few of them.

11. Describe the functioning of a Laser printer. Name few of them.

12. What is the usage of a plotter? Name its different kinds.

13. Define the term "Operating System" in your own words.

14. Describe the function of the following input device?

(i) Mouse (ii) Joystick (iii) Trackball

(iv) Scanner (v) Light Pen (vi) Digital Camera

15. What do you understand by "SDLC"? Define its steps properly.

Answers

1. (i) Similar (ii) Wide Area Network (iii) Program (iv) Inkjet, Laser

(v) Laptop (vi) Super Video Graphic Array (vii) On Tara Byte

(viii) SAT or GRE (ix) Liquid Crystal Display (x) Facsimile (xi) Impact

2. (i) a (ii) c (iii) d (iv) a (v) d

(vi) a (vii) b (viii) d (ix) b (x) c

3. (i) T (ii) T (iii) F (iv) F (v) T

(vi) T (vii) T (viii) F (ix) F (x) T

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CHAPTER 2 Information Networks

Overview

Information networks, or computer networks, are at the convergence of two important technologies: **computing** and **telecommunications**. This convergence has resulted in local area networks (LANs), metropolitan networks (MANs), wide-area networks (WANs), and the Internet. Computer networks were originally research experiments between the computer scientists, telecommunication engineers, and other researchers. These scientific and engineering experiments, however, have since become immense social experiments as well. Information networks have brought many useful benefits. At the same time, however, they have given rise to some problems as well.

Information networks such as the World Wide Web are characterized by the interplay between heterogeneous content and a complex link structure involved. Link structure can be a powerful source of information about the underlying content in the network. We can think of a network as a large circulatory system, through which information continuously flows. This diffusion of information can happen rapidly or slowly; it can be disastrous -- in a panic or failure -- or beneficial -- as in the spread of innovations. So, In the context of the Web, we can try to identify high-quality information resources it contains.

The information networks can be examined from many points of view, partly because of the cultural meaning we ascribe to computing and telecommunications and the central role that they play in politics, social interactions, and commerce etc. As international business information is fast becoming a prime commodity, so information based networks are being frequently developed to help small and medium enterprises communicate about business needs, expand their markets, share their resources, knowledge and experience.

2.1 Workgroup Computing

Workgroup computing is highly important aspect of modern world computing in today's business, academic, technological and research oriented atmosphere. It is also known as ***collaborative computing*** and it enables the individuals and teams of certain projects to use computer networks for the purpose of cooperation, consultation, and information sharing. With the help of groupware, many users or researchers can work on their projects by sharing the same domain of information online. It also permits the individuals to collaborate with their colleagues to work on company information over the network. At the same time, they can also link to other

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The information may reside on heterogeneous type of databases, it may be made available using altogether different operating systems, and it may be using different platforms. But as long as the users are communicating with each other through a common shareware and they belong to same group, they will keep on working without any hassles and problems. In fact, it is the smart service of **communication technology** that has brought about a revolution in this type of computing. The concept of "**global village**" has become a reality now and the computer community is "**chatting**" with each other as if they are sitting face to face.

2.2 E-mail and its benefits

E-mail or **Electronic mail**, is the process of sending messages directly from one computer to another (linked through wired or wireless connections) . The sender and receiver may be sitting in the same building or anywhere in the world. It works perfectly only if the intended receiver has the e-mail facility to which the sender is connected. It reaches to many people with the same message, reduces the paper flood, and does not interrupt meetings as the ringing phone does. The e-mail allows users to send text messages, documents, and images anywhere over the network. This facility in mostly provided by some specialized websites called E-mail servers i.e. Yahoo, Hotmail, Gmail etc, and it works purely in a client-server computing environment.

Benefits: E-mail has a number of advantages over other communication methods such as:

- We of communication with anyone has nothing to do with distance or the size of can communicate quickly with any one on the internet. E-mail usually reaches its destination in a matter of minutes or seconds.
- The cost the message It is cost-effective way to communicate with friends, colleagues, or business associates regardless of where they are physically located.
- We can send letters, notes, files, data, or reports all using the same techniques. Once we learn how to use the e-mail program, everything is sent the same way.
- The recipient, working on the computer, is not interrupted by the arrival of the e-mail. It is put in his mail box (on the server) and can be seen and worked upon later, using the e-mail program.
- The user's computers may be off when the mails arrive (all will stay in the server) and can be read anytime.
- E-mails are not anonymous, they always carry an address of the originator. Therefore, we are always sure about where it is coming from and where it is going to.

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2.3 Internet

The **Internet** is a wonderful and amazing arena where we can find information about almost any thing of the world. On the Internet, we have ocean of knowledge about the books, magazines, encyclopedia, and any other type of reference material readily available. In addition, we can have expert opinions on any topic and can communicate with world community on all ranges of subjects. Essentially, the Internet has brought the world nations to the realization of a "**Global Village**", in which we feel, everyone as close as our neighbor.

The Internet is not a real entity or a place that has a building or a place. Instead, it is the result of a collaborative effort of people and computers throughout the world. The end result is an electronic link to the world of information and entertainment. In simple words, the Internet is a network of connected computers that provide us a facility of exchange data, messages, and files with other computers that are connected to the Internet.

2.3.1 Birth of Internet

During late 1960s, it was designed as ARPANET (**A**dvanced **R**esearch **P**roject **A**gency **NET**work) by the US Department of Defense – DARPA, in collaboration with other universities and research organizations. In the beginning, ARPANET was used mainly for communication technology research and development, with scientists at various sites connected through a network, to share the information.

Later, throughout 1970s and 1980s, ARPANET evolved into several other networks dedicated mostly to military use. In 1989, all the previous networks, created for military use, were abandoned and replaced by National Science Foundation's NSFNET. This was the turning point, as the Internet began serving the civilian community along with the military as well. Now the service was available to anybody in the community and people started patronizing and monitoring the Internet. Today, even the Internet has become too much commercialized; NSF is still donating a lot of fund to it.

The Internet has grown rapidly since 1990. According to the Internet Society (the monitoring organization), the number of computer networks in the Internet is more than Two Million and the number of computers that connect to these networks is more than Hundred Million. To understand how the Internet works, we need to have a sufficient knowledge of "Networking" i.e. the connectivity of computers.

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2.3.2 How the Internet is Useful

The basic understanding of a lay man about the Internet is "What kind of information is available on the Internet and how". Before 1998, people used to think about Internet as having only one specific segment i.e. the World Wide Web. But actually, the Internet has many more components of immense utilization. Few of them are as given below:

- **World Wide Web(www):** www is a collection of millions of uploading web pages/web sites. It organizes the Internet-related resources so that we can easily access the information available on the Internet.
- **Electronic mail (e-mail):** As defined earlier, it is the process of sending and receiving messages and files among the Internet users.
- **Telnet:** It is the software tool that allows one computer to connect to another computer and make use of the other computer's information.
- **File Transfer Protocol (FTP):** It is also an Internet software tool for transferring files from one computer to another. The process of transferring a file from a remote computer to our local computer is called **downloading.** The process of transferring a file from our own computer to the remote computer (on the Internet) is called **uploading.**
- **Gopher:** It is an access and retrieval system covering a wide range of information, from reference materials to magazine articles to government documents and speeches.
- **Chat groups:** The Internet users with similar interests, form up their forums, to have online real-time discussions over the Internet.
- **Intranet:** An intranet is a privately owned, secure, business network based on Internet technology, although not necessarily connected to the Internet. The term "intranet" appeared when companies discovered that they could use Internet technologies to make company-internal information available to all employees, no matter where the employees were located or what kind of hardware they were using; that they could still secure the information from unwanted access by outsiders; and that, along with these advantages, they could make the information available at the lowest possible.
- **Extranet:** An "extranet" is two or more intranets connected in such a way that they enable collaboration among the companies that own the separate intranets. On an extranet each connected company usually makes some

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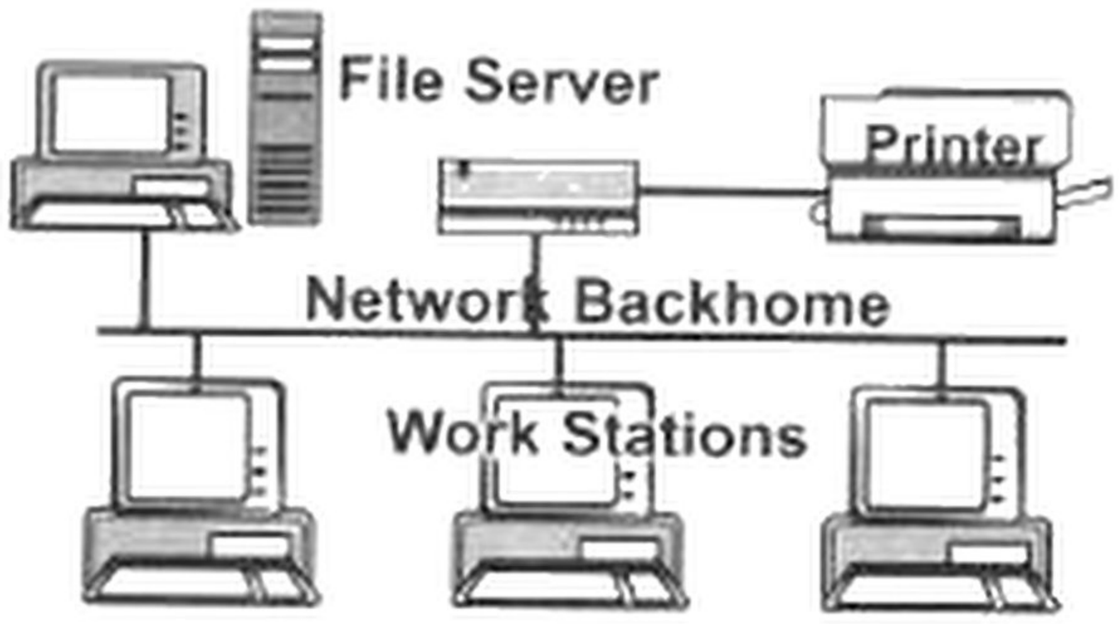
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to consolidate data gathering and share data, to jointly develop and share training programs and other material, or to coordinate project management for a common work project. On an extranet each company uses the security inherent in its own intranet to the keep employees of other companies from accessing information they do not need to see.

The collaborative business application is a powerful extranet tool cost.

2.4 Components of network

LANs do not use the telephone network. Its networks are constructed with standard set of components, as discussed below:



Local Area Network (LAN)

Note: It is high time to mention here is that although Chatting facility is of immense importance and use, our youth, especially the students, are misusing it for hours and hours thus, wasting their precious time of study.

- All networks need some system for interconnection. In some LANs, a shared network cable connects the nodes. Low-cost LANs are connected with twisted wire pairs, but many LANs use coaxial cable or fiber optic cable, which are both more expensive and faster. Some LANs are wireless, using infrared or radio wave transmissions instead of cables. Wireless networks are easy to set up and reconfigure, since there are no cables to connect the devices, but they have slower transmission rates and limit the distance between nodes.
- A **network-interface-card (NIC),** connects each computer to the wiring in the network. NIC is a circuit board that fits in one of the computer's internal expansion slots. Some computers have built in NIC.
- Similar networks can be connected by a **bridge,** which recognizes the messages on a network and passes on those addressed to nodes in other network.

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gateway, for example, could connect an attorney on a local area network to a legal service offered through a wide-area-network (WAN will be discussed after this topic).

- A **router** is a device that connects two or more networks it consist of a combination of hardware and software. The hardware can be a network server, a separate computer, or a special black box device. The hardware includes the physical interfaces to the various networks in the internetwork. These interfaces can be Token Ring, Ethernet, T1, Frame Relay, Asynchronous Transfer Mode (ATM), or any number of other technologies. The two main pieces of software in a router are the operating system and the routing protocol. Management software can be another software component of a router.

LAN's Protocols: Networks have certain rules, called **Protocols,** to send and receive data, and it is defined in the network software. The most common of them are explained as under:

- **Ethernet:** Currently, this is the most commonly used protocol. It uses a high-speed network cable and bus topology, so it is relatively simple and cheaper. Since all the nodes (computers) use the same cable to send and receive data, they must follow a set of rules about when to communicate, otherwise, two or more computers could transmit at the same time, causing lost messages. Before transmitting the data, a node listens" to find out if the cable is in use. If so, the node must wait. When the cable is free from other transmission, the node can begin transmitting immediately. This process is also known as **CSMA/CD** (Carrier Sense Multiple Access with Collision Detection).

  If by chance, two nodes transmit data at the same time, the messages collide. When a collision occurs, a special message, lasting a fraction of a second, is sent out over the network to indicate that it is jammed. Each node stops transmitting, waits a random period of time, and then transmits again. Since the wait period for each node is random, it is unlikely that they will begin transmitting at the same time again.

- **Token Ring:** It is closely associated with IBM, works on the concept of a ring network topology and a token (a kind of electronic signal). The method of controlling access to the shared network cable is called **token passing**.

- Only one token is available on the network. When a node on the network wishes to transmit, it first captures the token, only then it can transmit data. When the node has sent its message, it releases the token back to the network. Since only one token is circulating around the network, only one

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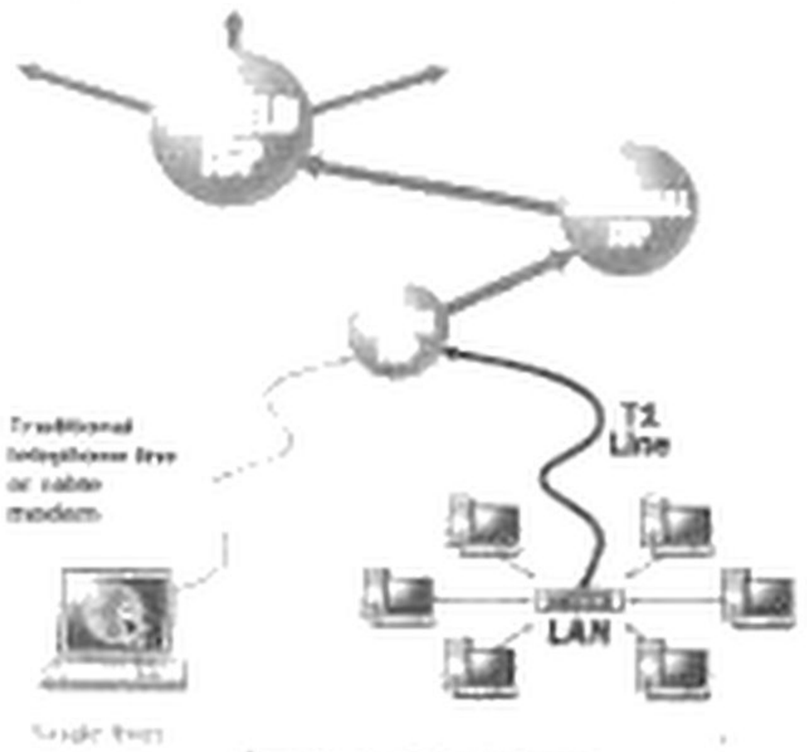
- **ARCnet:** The ARCnet (**A**ttached **R**esource **C**omputer **net**work) has both a topology and networking technology all its own. It uses either twisted-pair wire or coaxial cable, and the star topology is informed with hubs attached to the network.

  The original ARCnet protocol was very slow, but it became popular because it was inexpensive, reliable, and easy to set up and to expand. Fast ARCnet increased the transmission rate to 100 Mbits per second and includes the capability to use fiber optic cable.

- **TCP/IP** (Transmission Control Protocol / Internet Protocol): TCP/IP is the protocol used by every computer on the Internet. A protocol is a set of rules and procedures that defines how computer receive and transmit data over the network. Every computer on the Internet must have TCP/IP configured.
  - TCP/IP ensures a reliable connection between the computers communicating over the Internet. It also defines a mechanism through which every computer on the Internet is identified separately.
  - TCP/IP software differs for different computers but it always present the same interface to the network. It does not matter if the system on the other end is a supercomputer, a mainframe, minicomputer or microcomputer; as long as it is using TCP/IP, it can send and receive data through the Internet.

- **ISDN**(Integrated Serarues Digital Network): ISDN is a set of international communication standreds for software control of transmitting voice, vidoe, and data simulaneously as digital signals over twisted-pair telephone lines. Basic rate ISDN provides better quality than analog connections and more relible digital connections at higher speeds than those offered by analog connections

- **DSL** (Digital Subscriber Line): DLS provide high speed, digital data trandmission from homes and businesses over existing telephone lines. The exiting lines are analog and the transmission is digital, so modems are necessary with DSL technology. DSL is a popular alternative to ISDN.



Structure of the Internet

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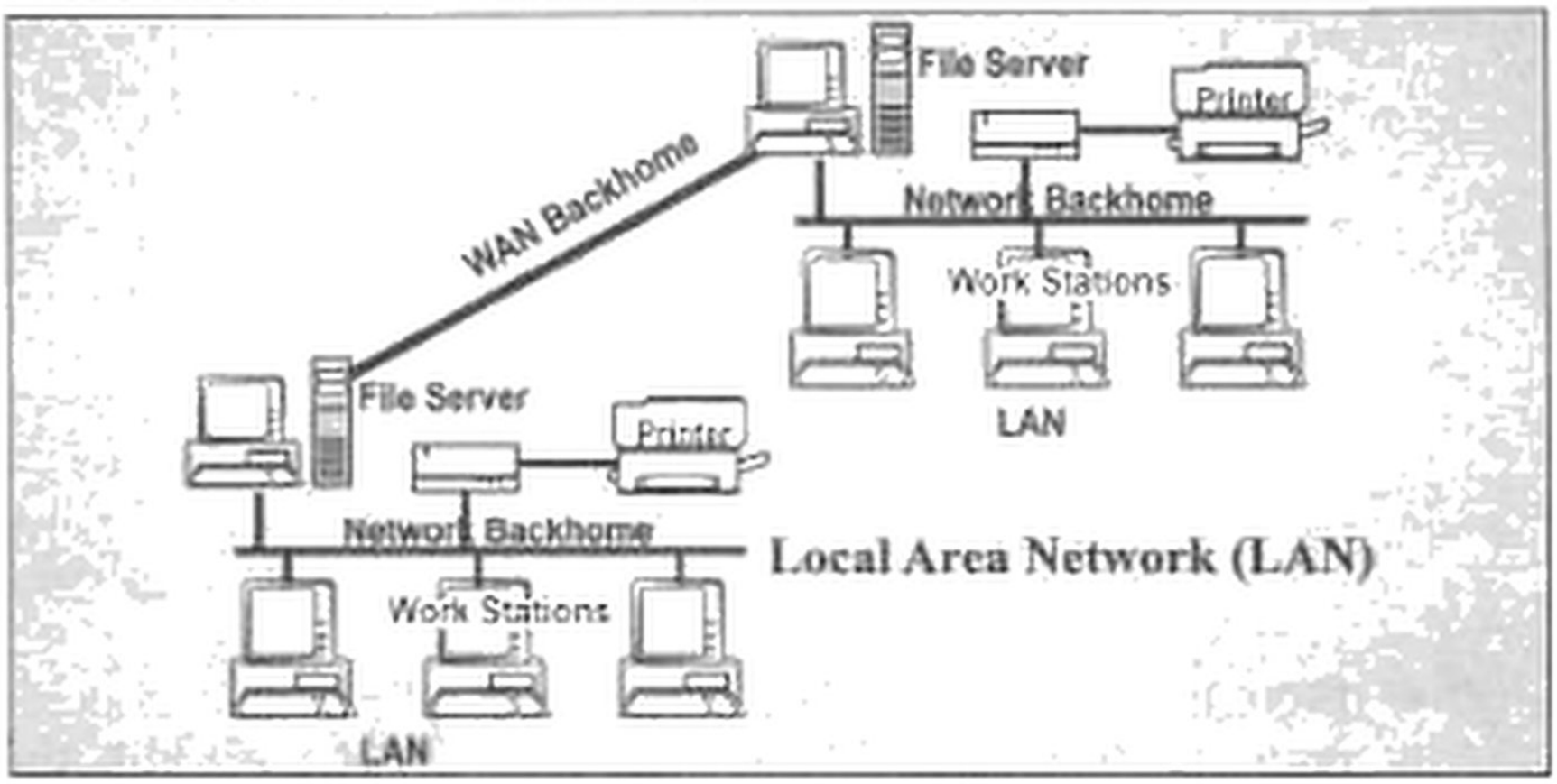
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2.5 LAN VS WAN

2.5.1 Local Area Network (LAN)

A local area network is a collection of computers, usually microcomputers, that share hardware, software, and data. In simple terms, LANs hook personal computers together through communications media so that each computer can share the resources of others. As the name implies, LANs cover short distances, usually one office or building or a group of buildings that are close to each other.

2.5.2 Wide Area Network (WAN)



A wide area network is a network of geographically distant computers terminals. In practice, a personal computer sending data to some remote area is probably sending it to the mainframe or minicomputer. Since the larger computers are designed to be accessed by terminals, a PC can communicate with larger computers only if the PC imitates to be a terminal. This is made possible by using **terminal emulation software** on the PCs. The larger computers then consider the PC or workstation as just another input/output device i.e. a terminal.

The larger computer to which the terminal or PC is attached is called the **host computer.** If a PC is being used as a terminal, **file transfer software** permits users to download data files from the host or upload data files to the host. To **download** a file means to retrieve it from another computer and to send it to the computer of the user who requested the file. To **upload** a file, a

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All the communication across the WAN is made possible via ordinary telephone lines, microwave or satellite links.

Typically, a WAN is two or more LANs connected together across a wide geographical area using the connectivity mentioned above. The Internet is the ultimate WAN because it connects many thousands of computers and LANs around the world, ultimately making it as WWW (World Wide Web).

2.5.3 Metropolitan Area Network (MAN)

A metropolitan area network (MAN) is a communications network covering a geographical area the size of a city. The purpose of a MAN is often to bypass local telephone companies when accessing long distance services. Mobile phones (Cellular) systems are often MANs.

2.6 Networking Concepts

A **network** is a way to connect computers together so that they can communicate, exchange information and pool their resources amongst each other.

In business or education, scientific or technological research, educational institutes or office atmosphere, networks have revolutionized the use of computer technology. Be it a local area or wide area network, the world community has come closer to each other. The ocean of information is virtually on our table, using the smart powers of browsing and surfing the resources of world's largest network i.e. **Internet.**

2.6.1 Uses of Networks

Following are few uses of a Network:

- Networks allow users simultaneous access to shared programs and data.
- Networks also allow users to share peripheral devices, such as printers and hard disks.
- Networks usually include the capability to send e-mail along with big attachments (files etc.)
- Some networks also aid communication by providing tools for teleconferencing and videoconferencing

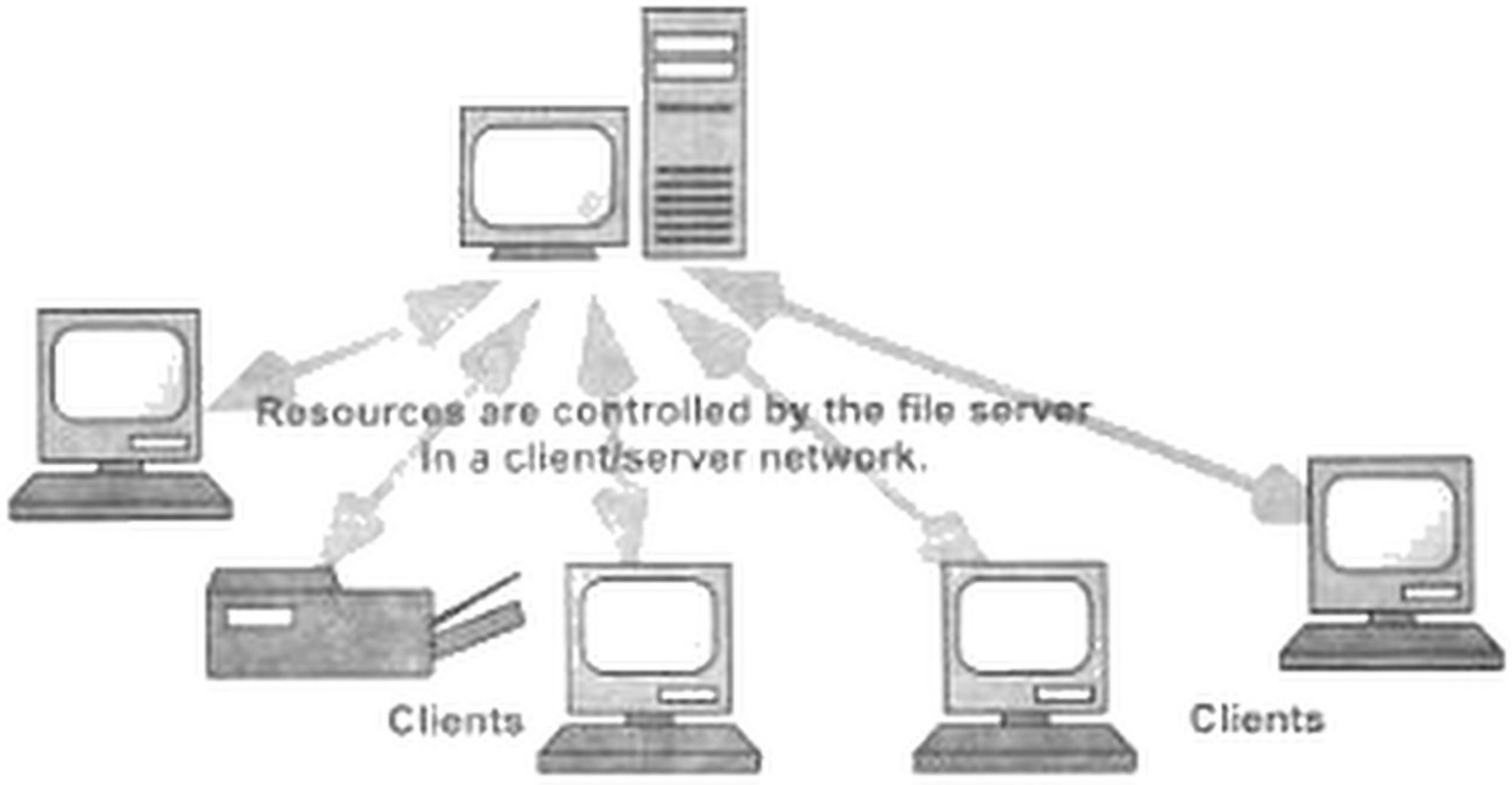
2.6.2 Network Modal

We have basically two types (modals) of network modals, as

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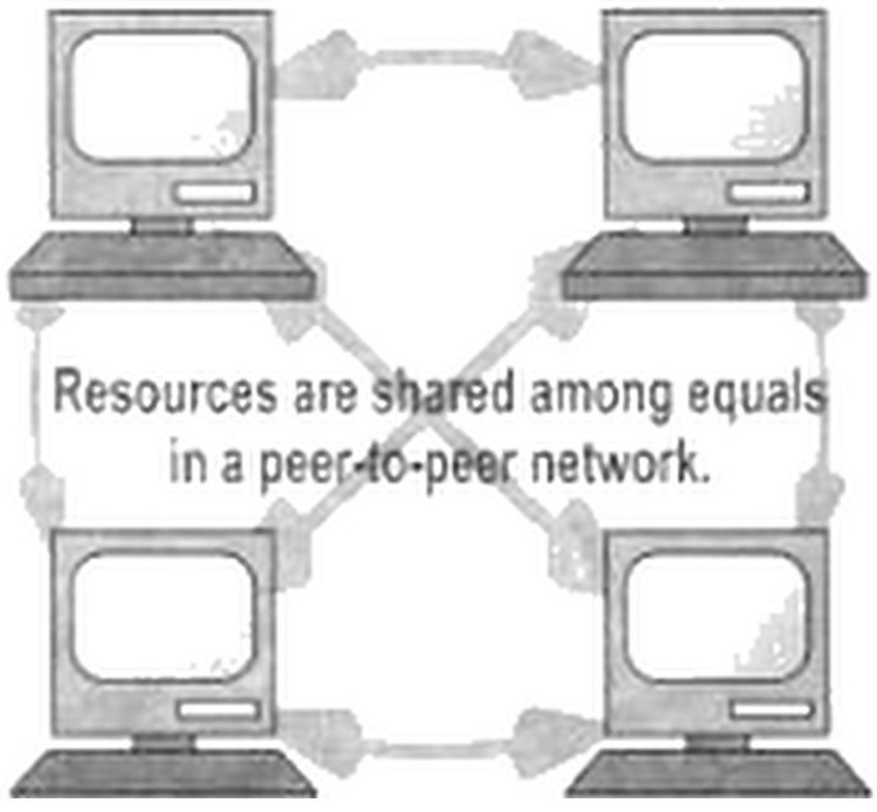
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Client / Server (Dedicated Server Network): This arrangement involves a **server**, which is a computer that controls the network. In particular, a server has the hard disks holding shared files/databases and often shared quality printer, which can be used by all nodes, as shown in the figure below:



The clients are all the other computers on the network. Under this arrangement, the server usually does processing. Client / Server has attracted a lot of attention because a well-designed system reduces the volume of data traffic on the network and allows faster response at each node. (Also, since the server does most of the heavy work, less expensive computers clients can be used as nodes.)

Peer-to-Peer: All computers in a peer-to-peer arrangement have equal status. No one has control over others. With all files and peripheral devices distributed across several computers, users share each other's data devices as needed. The main disadvantage in this approach is lack of speed as most peer-to-peer networks slow down under heavy use. Its main disadvantage is the lack of security.



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Hybrid: Many networks are hybrid i.e. a combination of both client/server and peer-to-peer approaches. This approach takes the advantages of both the above mentioned models.

2.6.3 Network Standards

The standards are the precise documents containing technical and physical specifications about the network being designed. Normally those standards are taken into considerations, which are worldwide, acceptable.

By following certain standards, the networks can be reliable, efficient and trustworthy. Normally, two types of standards given below are followed :

De Facto standard: De facto means "by tradition" or "by facts". These standards are most commonly used by the organizations worldwide.

De jure standard: De jure means "according to law or regulation". The networks governing body have properly approved these standards. Few of these governing bodies are:

- American National Standard Institute (ANSI)
- The Institute of Electrical and Electronics Engineers (IEEE)
- The International Standard Organization (ISO)
- The International Telecommunication Union-Telecommunication standardization Sector (ITU-T, formally CCITT) consultative committee for international telegraphy and Telephony.
- The Electronic Industries Association (EIA)
- Telcordia

2.6.4 Network Topologies

In networking, the term topology refers to the layout of connected devices on a network. One can think of a topology as a network's "shape".

Network topologies are categorized into the following basic types:

Bus , Ring , Star , Tree and Mesh.

More complex networks can be built as hybrids of two or more of the above basic topologies.

Bus: Bus networks (not to be confused with the system bus of a computer) use a common backbone to connect all devices. A single cable, the backbone functions as a shared communication medium, that devices attach or tap into with an interface connector. A device wanting to communicate with another device on the network broadcast message onto the wire that all other devices see, but only the intended recipient actually accepts and processes the message.

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("ThickNet") both were popular Ethernet cabling options years ago. However, bus networks work best with a limited number of devices. If more than a few dozen computers are added to a bus, performance problems will likely result. In addition, if the backbone cable fails, the entire network effectively becomes unusable.

CSMA/CD (Carrier Sense Multiple Access/Collision Detection): It is a local area network access method in which contention between two or more stations is resolved by collision detection. When two stations transmit at the same time, they both stop and signal a collision has occurred. Each then tries again after waiting a predetermined time period. To avoid another collision, the stations involved each choose a random time interval to schedule the retransmission of the collided frame. To make sure that the collision is recognized, Ethernet requires that a station must continue transmitting until the 50 microsecond period has ended. If the station has less than 64 bytes of data to send, then it must pad the data by adding zeros at the end. Used with Ethernet.

CSMA/CS (Carrier Sense Multiple Access/Carrier Sense): A node listens to the bus for a predetermined amount of time before transmitting and waits until the talking node has completed transmission.

CSMA/CR (Carrier Sense Multiple Access/Collision Resolution): It allows multiple devices to talk at once, a protocol determines which device receives priority.

Ring: In a ring network, every device has exactly two neighbors for communication purposes. All messages travel through a ring in the same direction (effectively either "clockwise" or "counterclockwise"). A failure in any cable or device breaks the loop and can take down the entire network. Token passing scheme is used in this topology, which has been discussed earlier.

Star: Many home networks use the star topology. A star network features a central connection point called a "hub" that may be an actual **hub** or a **switch**. Devices typically connect to the hub with Unshielded Twisted Pair (UTP) Ethernet. Compared to the bus topology, a star network generally requires more cable, but a failure in any star network cable will only take down one computer's network access and not the entire LAN. If the hub fails, however, the entire network also fails.

Tree: Tree topologies integrate **multiple** star topologies together onto a bus. In its simplest form, only hub devices connect directly to the tree bus, and each hub functions as the "root" of a tree of devices. This bus/star hybrid approach supports future expandability of the network much better than a bus

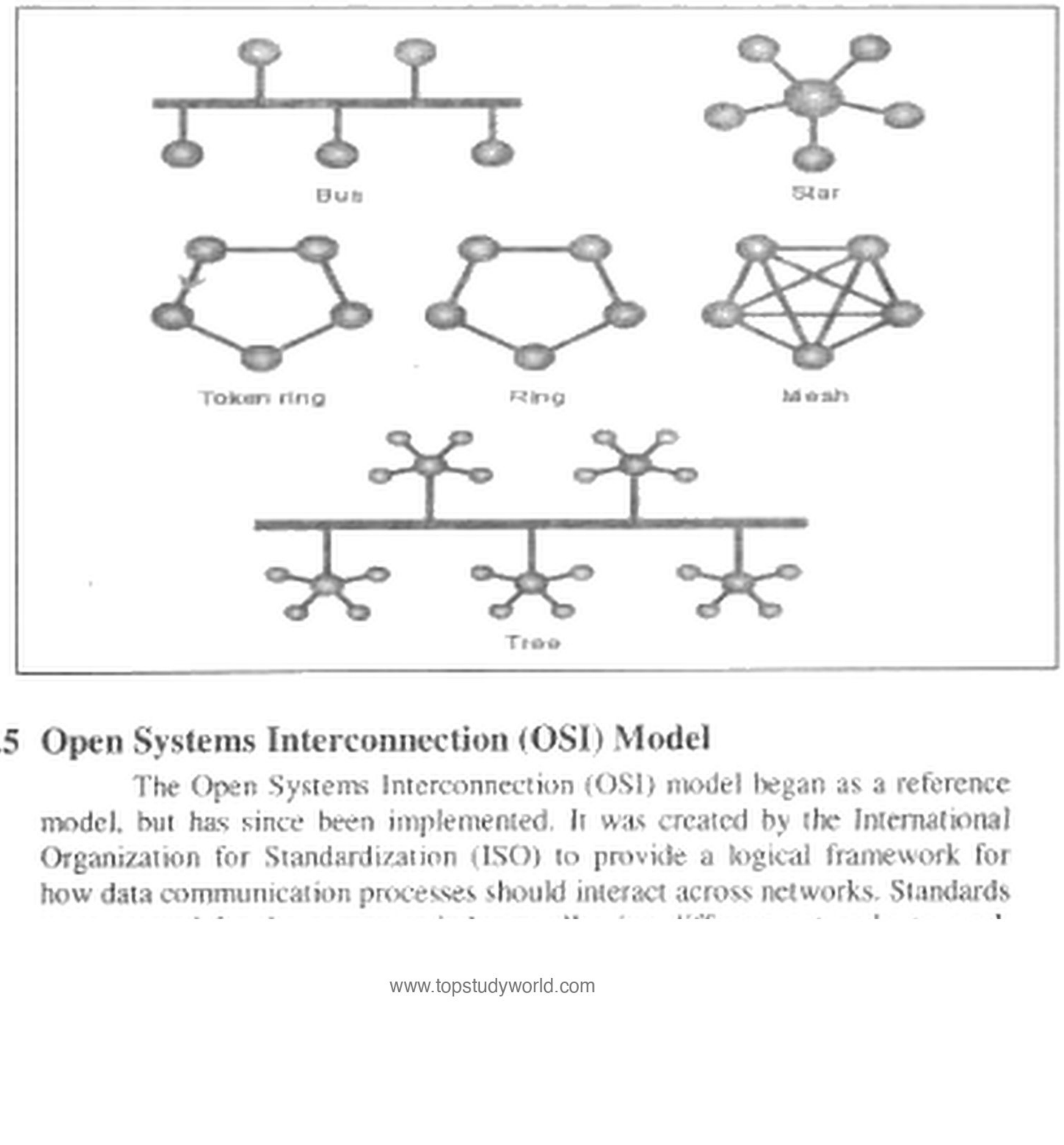
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Mesh: Mesh topologies involve the concept of routes. Unlike each of the previous topologies, messages sent on a mesh network can take any of several possible paths from source to destination. (Recall that in a ring, although two cable paths exist, messages can only travel in one direction.) Some WANs, like the Internet, employ mesh routing. A mesh offers several advantages over other network topologies.

- Mesh network has high fault tolerance due to multiple links.
- Due to multiple links mesh network can work fine even under severe loads.
- Troubleshooting of mesh network is easy as compared to other networks. If data is not communicated between any two computer then it means that there is some fault in direct links between them.

Disadvantages include the difficulty of installation and reconfiguration, as well as the cost of maintaining redundant links.



2.6.5 Open Systems Interconnection (OSI) Model

The Open Systems Interconnection (OSI) model began as a reference model, but has since been implemented. It was created by the International Organization for Standardization (ISO) to provide a logical framework for how data communication processes should interact across networks. Standards

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There are 7 layers in the OSI model. Each layer is responsible for a particular aspect of data communication. For example, one layer may be responsible for establishing connections between devices, while another layer may be responsible for error checking during transfer.

The layers of the OSI model are divided into two groups: the upper layer and lower layer. The upper layers focus on user applications and how files are represented on the computers prior to transport. For the most part, network engineers are more concerned with the lower layers. It's the lower layers that concentrate on how the communication across a network actually occurs.

Application Layer: Provides network services to user applications. It is responsible for exchanging information between programs running on the machine, such as an e-mail program, and other services running on a network, such as a print server or another computers' application.

Presentation Layer: Concerned with how data is converted and formatted for data transfer. Examples of format conversions include ASCII text for documents and .gif and JPG for images. This layer performs code conversion, data translation, compression and encryption

Session Layer: Determines how two devices establish, maintain and manage a connection - how they talk to each other. These connections are called sessions.

Transport Layer: Responsible for breaking the data into segments, establishing an end-to-end logical connection between machines, and providing for error handling.

Network Layer: Responsible for determining addressing on the network, determining the routes that information will take on its journey, and managing network traffic congestion. Data at this level is packaged into packets.

Data Link Layer: Provides the link for how data, packaged into frames is communicated through hardware to be transported across a medium. It communicates with network cards, manages physical layer communications between connecting systems and handles error notification.

Physical Layer: Specifies how data is processed into bits and physically transferred over medium, such as cables. It's responsible for activating and maintaining the physical link between systems.



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Exercise 2C

1. Fill in the blanks:

(i) Collection of raw facts is called_____.

(ii) A receiver is also called _____.

(iii) Two forms of data transmission are_____ and _____.

(iv) TCP/IP stands for _____.

(v) Data in _____ can travel in both direction but not at the same time.

(vi) _____ ensures that data are transmitted without any error.

(vii) Data transmission through a medium can be either synchronous or _____.

(viii) WAN stand for_____.

(ix) A _____ is a microwave station placed in outer space.

(x) A router is also used as a _____ device used for interconnecting different types of networks together.

2. Choose the correct option:

(i) A LAN is a combination of

(a) Network adapter cards (b) LAN cables

(c) LAN application software (d) All of above

(ii) What layer of OSI model does data compression

(a) Network (b) Presentation (c) Data Link (d) Physical

(iii) Cabling on a linear bus topology can be extended using which of following?

(a) Terminator (b) Barrel connector

(c) Network adapter card (d) Medium attachment

(iv) The Media Access Control sub layer resides in which layer ?

(a) Physical (b) Data link (c) Network (d) Transport

(v) FDDI is a

(a) Ring network (b) Star network (c) Mesh network (d) Bus network

(vi) How many pairs of computers can simultaneously communicate on Ethernet LAN?

(a) 1 (b) 2 (c) 3 (d) Multiple

(vii) One or more computers connected to a hub computer is a

(a) Ring network (b) Node (c) Information utility (d) Star network

(viii) Project 802 defines standards for which layers of the OSI model?

(a) Application and presentation layers (b) Physical and Data Link layers

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(ix) Terminal is a

(a) Device to give power supply to computer

(b) Point at which data enters or leaves the computer

(c) The last instruction in a program (d) Any input/output device

(x) Software to peruse the internet

(a) Gateway (b) EFT (c) Browser (d) Teleconferencing

3. Write T for true and F for false statement:

(i) E-mail is short for electronic mail.

(ii) Teleprocessing allows a user to make queries of a computer 1000 miles away.

(iii) An Ethernet system (IEEE 802.3 protocol) uses packet switching technique.

(iv) ISDN modems can communicate only with other ISDN modems.

(v) 16 bit and 32 bit are currently the two most popular bus width.

(vi) FTP, short for File Transfer Protocol is a tool that lets users transfer files across the internet.

(vii) DSL modem uses the cable TV network for data transmission.

(viii) A WAN is usually limited to one office building.

(ix) A gateway connects two similar computers.

(x) A bus network uses a central computer as the server.

4. What is the difference between LAN and WAN?

5. What method does an Ethernet network use to control access to the network?

6. What is Topology? Describe the types of topology. **7.** What is www?

8. Describe the OSI Model and types of layers of OSI Model.

9. Difference between Intranet and Extranet.

10. Difference between FTP and HTTP. **11.** Define the gateway and router.

12. Define the term "Operating System" in your own words?

13. Describe the function of (i) Dedicated Server Network (ii) Peer – to - Peer

Answers

1. (i) Data (ii) Sink (iii) Serial, Parallel

(iv) Transmission Control Protocol / Internet Protocol (v) Half Duplex Mode (vi) Data Link Layer

(vii) Asynchronous (viii) Wide Area Network (ix) Satellite (x) Intermediate

2. (i) d (ii) b (iii) b (iv) b (v) a

(vi) d (vii) d (viii) b (ix) d (x) c

3. (i) T (ii) F (iii) F (iv) F (v) F

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CHAPTER 3 Data Communications

Overview

In this chapter, we will describe how we have arrived at this electronic global village. Computers, telephones, and wireless devices are being linked by network everywhere in the world of connectivity. We are rapidly coming into an era in which we can find almost anything we want online and reach almost anywhere, anytime. When we collaborate, we are sharing information. This sharing can be local or remote. Between individual, local communication usually occurs face to face, while remote communication takes place over distance. **Data Communications** is the exchange of data between two devices via some form of transmission media such as a wire cable. In other words, we can say that transfer of information or data from one location to another is called Data Communications. The term data communication can generally be defined as the movement of encoded information by means of electrical transmission systems from one computer or device to other computer or device through communication channels (such as cables, wireless media etc.).



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3.1 Component of Data Communication

There are five components (see Figure 3.1) in data communication.

- **Message:** The message is the information (data) to be communicated. It can consist of text, number, pictures, sound, video or any combination of these.
- **Sender:** The sender is the device that sends the data. It can be computer, workstation, telephone, video camera and so on.
- **Receiver:** The receiver is the device that receives the data. It can be computer, workstation, telephone, television and so on.
- **Communication Channel:** The Communication channel is the physical path by which a data travels from sender to receiver. It can be a twisted – pair wire, coaxial cable, fiber optic cable, or microwave etc.
- **Encoder and Decoder:** The encoder converts digital signals to a form, which can pass through transmission medium and decoder again coverts signal from encoded form into digital form, which is understandable for receiver. Without these, two devices may be connected but not communicating, such as a student speaking Urdu cannot understand a student who speaks only German without a translator.

3.2 Signals

The electromagnetic or light waves representing data are called signals. These are used to transfer data from one device to another device through a communication medium. Data communication signals can be in analog or digital form.

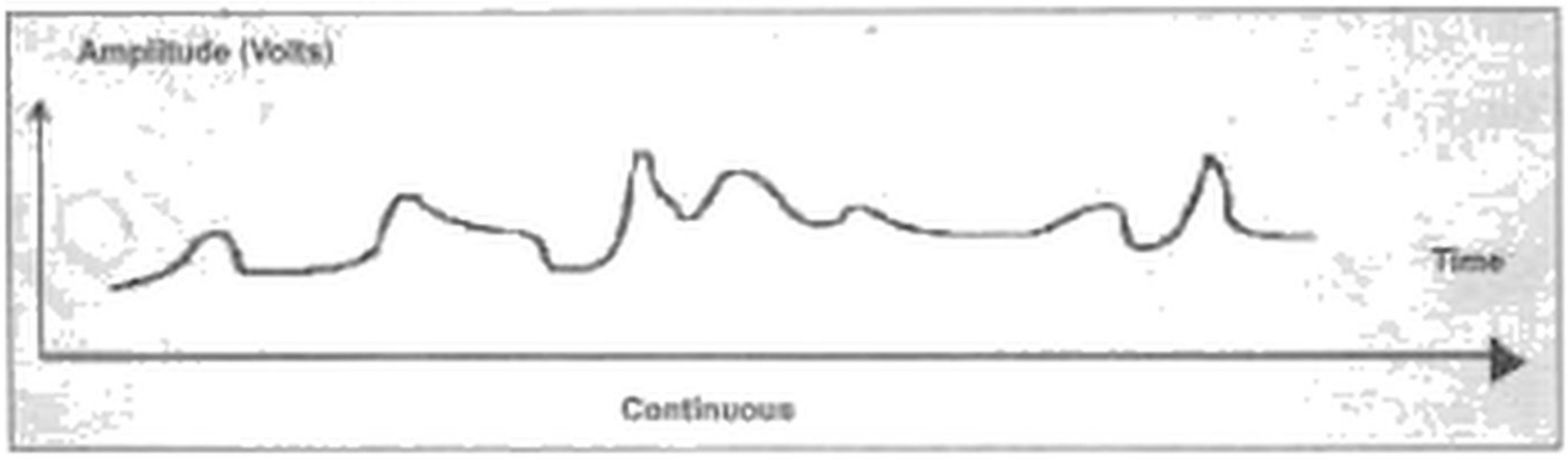
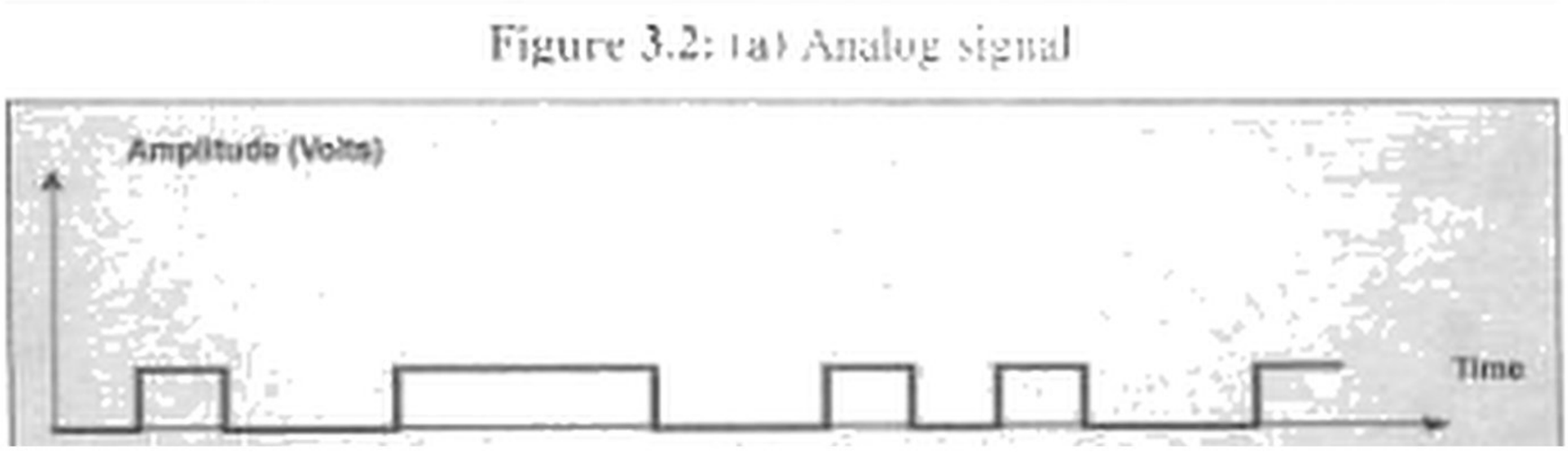


Figure 3.2: (a) Analog signal



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- **Analog:** The analogue data signals are continuous electrical signal in the form of wave. This wave is called a carrier wave. Two characteristics of analogue carrier waves that can be altered are frequency and amplitude (Figure 3.2.a). **Frequency** is the number of times a wave repeats during a specific time interval. **Amplitude** is the height of wave within a given period of time.
- **Digital:** A digital signal uses on-off electrical pulses in discontinuous, or discrete form. Most computers are digital in nature, represent data as patterns of binary numbers (Figure 3.2.b).

3.3 Type of Data

Data can be represented in different ways such as in data communication, numbers, images, audio, and video etc.

- **Text:** The text consists of words, sentences, and paragraphs. Text processing refers to the ability to manipulate words, lines, and pages. Typically, the term text refers to text stored as ASCII codes that is, without any formatting. Objects that are not text include graphics, numbers and program code.
- **Numeric:** Numeric data consist of digits from 0 to 9. +(positive) or – (negatives) sign and a decimal point .It can be integer type or real type data.
- **Image:** This type of data includes chart, graph, pictures and freehand drawings. The information in this form is more comprehensive. The data are sent as contiguous bits, which, for transfer, are packed into the 8-bit transfer bytes. The receiving site must store the data as contiguous bits.
- **Audio:** Sound is a representation of audio. It is converted into digital code by sampling the sound waves 44,056 times per second and converting each sample into a 16- bit number.
- **Video:** Video can be produced either as a continuous entity (by a camera), or it can be a combination of images, each a discrete entity, arrange to convey the idea of motion. Video creates action and movements.

3.3.1 Data Representation

The computer works with binary numbers, binary means two digits. These are 0 and 1. An electrical pulse inside the computer represents each binary number. 1 is represented by a pulse of electrical inside the computer and 0 by an absence of a pulse. Each binary digit is called bit and it is the smallest element of data.

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3.4 Encoding of Data

The computer works with binary digits only. Therefore, all data, numeric or non-numeric, must be converted into binary digits before the computer can understand it. Computers transmit data in the form of binary codes. Both sender and receiver of the data should have same standard rules for both to understand it.

A coding scheme for communications is a binary system, that is used in the computer systems. The system consists of groups of bits (0 or 1) that represent characters. Some codes use different number of bits such as 5, 7, 8 or 9 to represent that during data communication. The following are some coding schemes to represent data.

- **BCD Code:** (Binary Coded Decimal) is 4 bits code. A few early computer s processed BCD numbers but were slower and more complicated than a modern computer, which are able to process alphanumeric (alphabet letters, numbers and other symbols).
- **EBCDIC Code:** Extended Binary Coded Decimal Interchange Code is an 8 – bit code primarily used by International Business Machine (IBM). This type is intended for efficient transfer between hosts, which use EBCDIC for their internal character representation. For transmission, the data are represented as 8-bit EBCDIC characters. The character code is the only difference between the functional specifications of EBCDIC and ASCII types.
- **ASCII Code:** ASCII (American Standard Code for Information Interchange) is a 7-bit code and makes 128 character combinations, whereas an 8-bit can make 256 combinations. It was developed by American National Standards Institute (ANSI) and can handle alphanumeric data. It is intended primarily for the transfer of text files, except when both hosts would find the EBCDIC type more convenient.
- **Unicode: Universal Code** is a 16-bit code and can represent up to 65,536 symbols. Unicode has started to replace ASCII at all levels. It supports a comprehensive set of mathematical and technical symbols to simplify scientific information With the UTF-8 (Unicode Transformation Format-8) encoding. Unicode can be used in a convenient and backwards compatible way in environments that were designed entirely around ASCII.

3.5 Modes of Data Communication

When a person is giving a lecture or speech, information is primarily conveyed in one direction. During a conversation spoken messages (information) are usually exchanged in both directions. These messages are normally exchanged alternately but, can of course, are exchanged simultaneously! Similarly, when data is

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transmitted between two pieces of equipment, three types of data transmission modes can be used.

- **Simplex:** Simplex is a mode in which data flows in one direction only (Figure 3.3). Because most modern communication systems require a two-way interchange of data, this mode of transmission is not as popular as it once was. However, one current usage of simplex communications in business involves certain point-of-sale terminals in which sales data is entered without a corresponding reply other examples include radio and T.V transmissions.

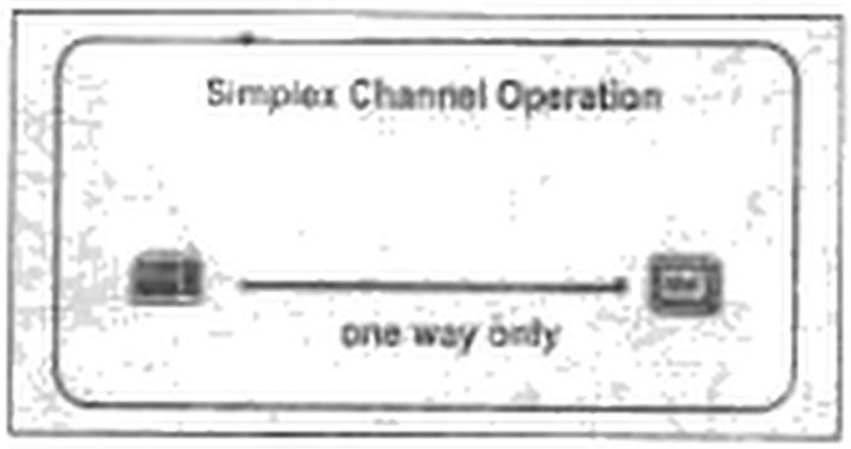


Figure 3.3: Simplex Communication.

- **Half-duplex:** In half-duplex transmission, data can be sent and received in both directions, but not at the same time. It's like a one-lane bridge where two-way traffic must give way in order to cross (see figure 3.4). Only one end transmits at a time, the other end receives. In addition, it is possible to perform error detection.



Figure 3.4: Half duplex communication

and request the sender to retransmit information that arrived corrupted. In some aspects, you can think of Internet surfing as being half-duplex, as a user issues a request for a web document, then that document is downloaded and displayed before the user issues another request e.g. walkie talkie etc.

- **Full Duplex:** The directional mode of communication is full-duplex. Here, data is transmitted in both directions simultaneously on the same channel (see figure 3.5). Thus, this type of communication can be thought

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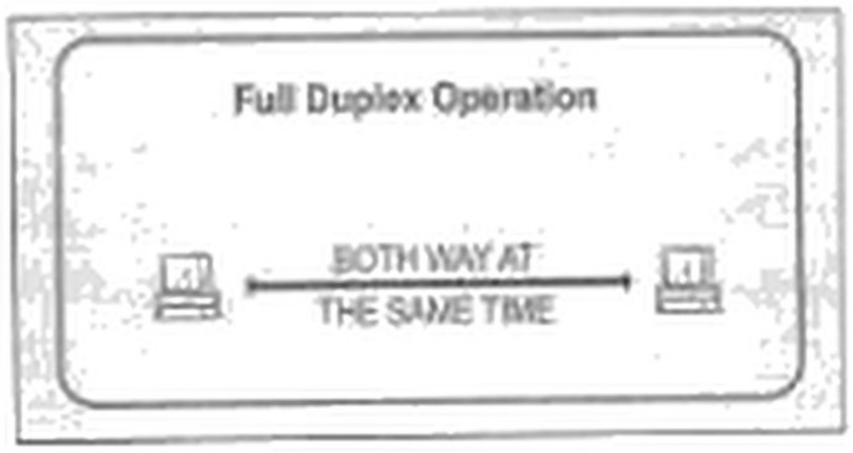


Figure 3.5: Full Duplex communication

Full-duplex communication is made possible by devices called multiplexers. Full-duplex communication is primarily limited to mainframe computers because of the expensive hardware required to support this bi-directional mode e.g. telephone system.

3.6 Types of Data Transmission

There two types of data transmission modes (see figure 3.6.) parallel transmission and serial transmission.

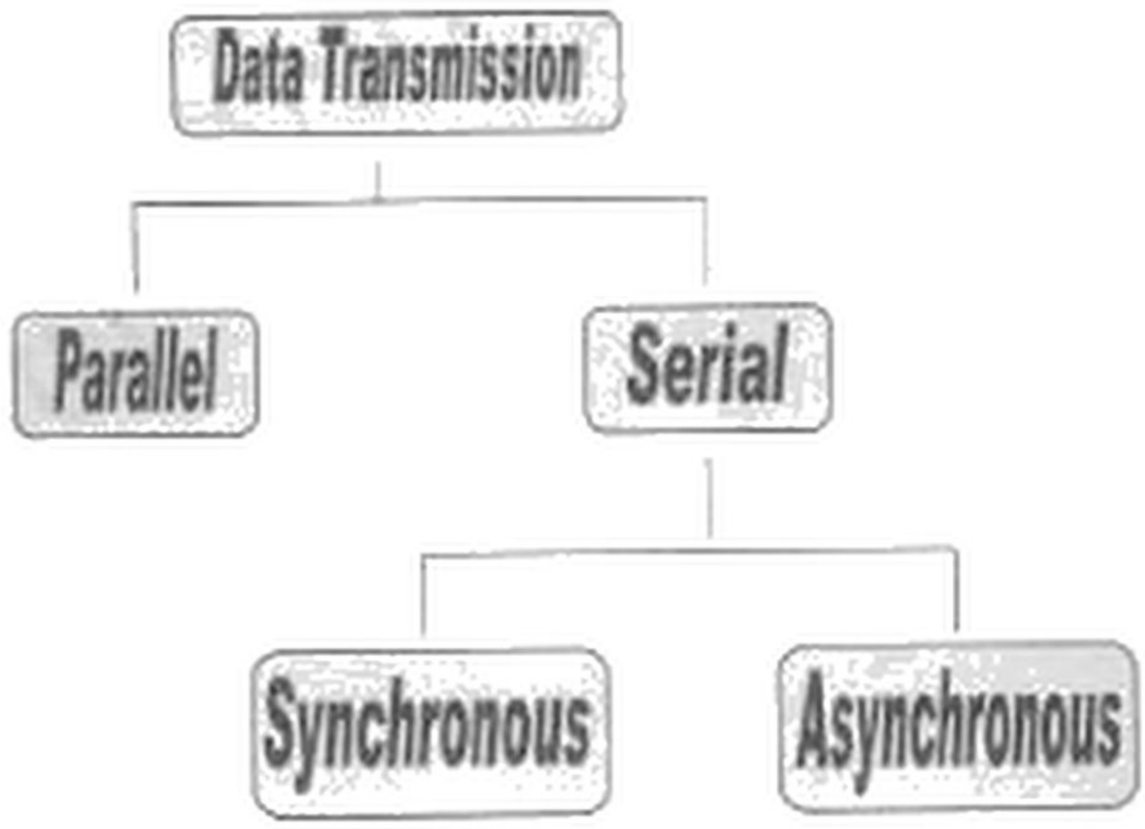


Figure 3.6: Data Transmission

- **Parallel Transmission:** Parallel data transmission involves the concurrent flow of bits of data through separate communications lines (see figure 3.7). This pattern resembles the flow of automobile traffic on a multilane highway. Internal transfer of binary data in a computer uses a parallel mode. If the computer uses a 32-bit internal structure, all the 32 bits of data are transferred simultaneously on 32 lane connections.

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computer, because parallel cables need many wires and may not work stably in long distance.

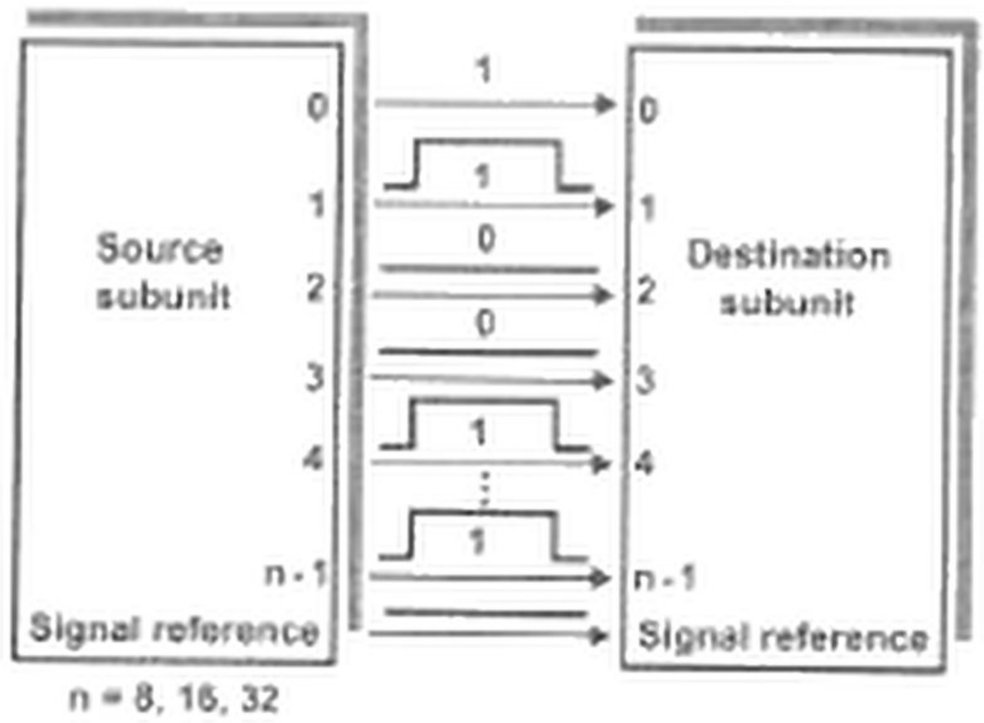


Figure 3.7: Parallel Transmission Mode

- **Serial Data Transmission:** Most data transmitted over telephone lines use a serial pattern. That is, each individual bit of information travels along its own communications path; the bits flow in a continuous stream along the communications channel. This pattern is analogous to the flow of traffic down a one-lane residential street (see fig 3.8). Serial transmission is typically slower than parallel transmission, because data are sent sequentially in a bit-by-bit fashion. Another way of classifying data communications flow is synchronous or asynchronous.

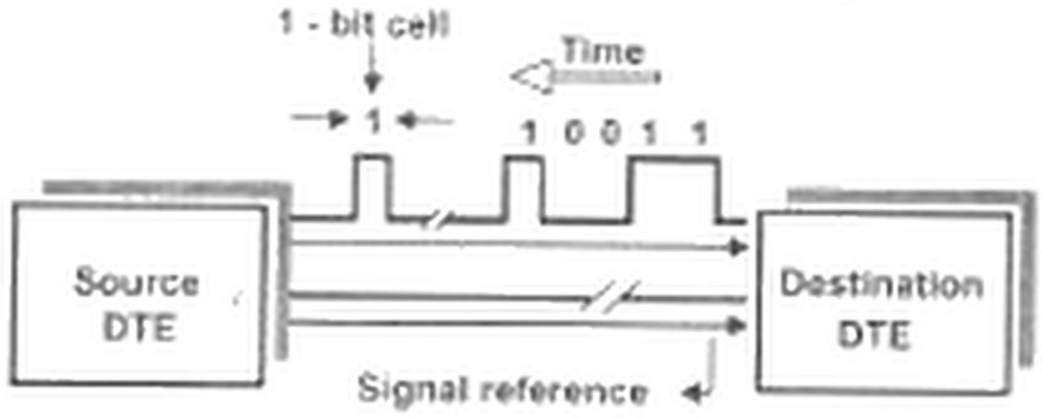


Figure 3.8: Serial Transmission Mode

- **Asynchronous Transmission:** *A type of communication that sends data using flow control rather than a clock to synchronize data between the source and destination.* When **asynchronous transmission** (also called **start/stop transmission**) is used, a special start signal is transmitted at the beginning of each group of message bits. When a character is about

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Figure 3. 9 (a): Asynchronous transmission uses start/stop signals surrounding each character.

to be transmitted, a start bit is sent. A start bit has a value of 0, (also called a space state). Thus, when the line switches from a value of 1 to a value of 0, the receiver is alerted that a data character is about to come down the line. An asynchronous line that is idle is identified with a value of 1, (also called a mark state). By using this value to indicate that no data is currently being sent, the devices are able to distinguish between an idle state and a disconnected line. Conversely, asynchronous transmission involves the sending and receiving of one byte of data at a time. This type of transmission is most often used by computers and other systems characterized by slow speeds.

- **Synchronous Transmission:** *A type of transmission that uses a clock to control the timing of bits being sent.* Large volumes of information can be transmitted at a single time with synchronous transmission. This type of transmission involves the simultaneous flow of several bytes of data. Because a large block of data being sent synchronously cannot be



Figure 3.9 (b): Synchronous Transmission can be transmitted between start and stop characters.

interrupted, a synchronized clock is necessary to carefully schedule the transmission of information. This special communications equipment is expensive; but this cost can be made up in part by faster, less expensive transmission of information.

3.6.1 Bandwidth

Each type of communications media has different transmission speed. The bandwidth is a measure of the transmission rate of communications channels.

- **Baseband:** Digital signals are commonly called baseband signals. **Baseband** is a communications technique in which digital signals are placed onto the transmission line without change in modulation. It transmits up to a couple of miles, and does not require the complex

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- **Broadband:** Broadband is a technique for transmitting large amounts of data, voice and video over long distances simultaneously by modulating each signal onto a different frequency. Using the FDM (Frequency division multiplexing) technique, several streams of data can be transmitted simultaneously.

  Broadband is the bandwidth used for direct communication between very high-speed computers (e.g., large mainframe computers). This bandwidth includes microwave, satellite, coaxial cable, and fiber-optic media.

3.6.2 Communication Media

For data to be transmitted from one location to another, some of pathway or medium must be used. These pathways are called communication channels. The communication channels can be divided into two types of media.

- **Guided Media:** It refers to channels that allow the transmission of data through a physical media such as a twisted pair wire, coaxial cable, or fiber optic cable. These are also called bounded media.



Figure 3.10: Twisted pair cables.

1. **Twisted Pair:** The telephone lines used to carry most of the voice and data communications consist of a pair of thin-diameter insulated copper wires (called twisted pairs) see in fig 3.9. The wires are twisted around each other to minimize interference from other twisted pairs in the cable. Twisted pairs have fewer bandwidths than coaxial cable or optical fiber. They have been the standard communication channels for voice, data and information, but are now diminishing because of more reliable media such as coaxial cable, optical fiber, microwave, or satellite.

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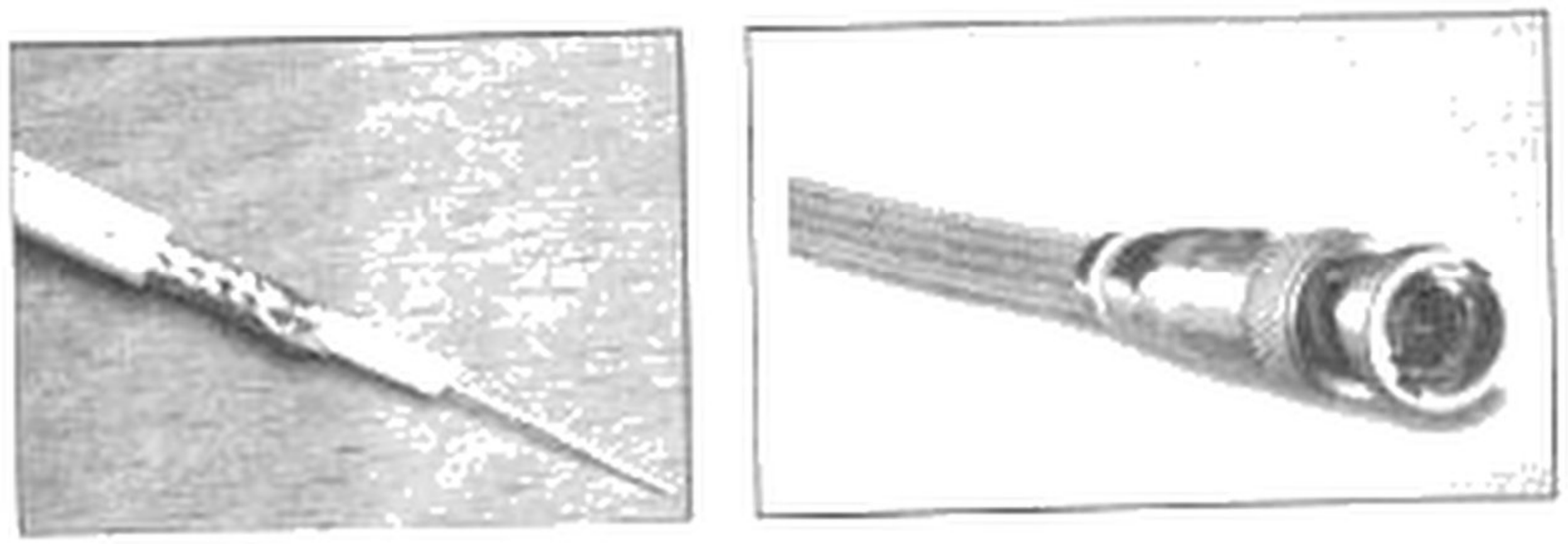


Figure 3.11: Coaxial Cable

2. **Coaxial Cable:** Coaxial cable can be used for telephone lines for transmission at a high frequency. Coaxial cable consists of a single core of solid copper (see fig 3.10.). A coaxial cable can handle 80 times as many telephone transmissions as twisted pair media. Many computers in local area networks are linked by coaxial cables. Because of its sturdiness, coaxial cable is often used for telephone lines that must be carried under water. Because coaxial cables have very little distortion and are less prone to interference, they have low error rates. Coaxial cable contains from four to twenty-two coaxial units called tubes. Each coaxial tube consists of a 0.100-inch copper inner conductor kept centered within a 0.375-inch cylindrical copper outer conductor by polyethylene insulating disks spaced about 1 inch apart. The outer conductor is formed into a cylinder around the disks and is held closed by interlocking serrated edges along its longitudinal seam. Two steel tapes are wound around the outer conductor for added strength.

   In addition to coaxial tubes, coaxial cable contains a small number of twisted wire pairs and single wires that are used for maintenance and alarm important advantage coaxial cable has over paired cable is its capability to operate at very high frequencies.. Coaxial, the unique operating environment dictates design, operational, and reliability requirements different from those for cable used on land.

3. **Fiber-Optic Cable:** A fiber-optic cable consists of tubes of glass through which data are transmitted as pulses of light. Optical fiber consists of thin glass fibers that can carry information at frequencies in the visible light spectrum and beyond. The typical optical fiber consists of a very narrow strand of glass called the core. Around the core is a concentric layer of glass called the cladding. A typical core

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has a diameter of 125 microns. Coating the cladding is a protective coating consisting of plastic, it is called the Jacket.



Figure 3.12: Fiber Optic Cables

An important characteristic of fiber optics is refraction. Refraction is the characteristic of a material to either pass or reflect light. When light passes through a medium, it "bends" as it passes from one medium to the other. An example of this is when we look into a pond of water. Although a fiber- optic cable is diametrically smaller than a human hair, it has 26,000 times the transmission capacity of twisted pair media. A major advantage of fiber-optic media is its high level of security. These communications channels are not susceptible to electronic interference. Therefore, they are a more reliable form of data transmission. Fiber-optic cables are also significantly less expensive than coaxial cable.

- **Unguided Media:** It refers to those channels that transmit data and information in the form of wave. Unguided transmission media consists of a means for the data signals to travel but nothing to guide them along a specific path. The data signals are not bound to a cabling media and are therefore often called unbound media. The atmosphere and the space are example of unguided media such as microwave, or satellite.

  1. **Microwave**: Microwave data transmission differs from the previously mentioned communications channels in that data is transmitted through the air instead of through cables or wires(see in fig 3.13). Microwaves are high-frequency radio waves that can only be directed in straight lines. Consequently, microwave transmission is usually limited to communications occurring within the limits of a particular

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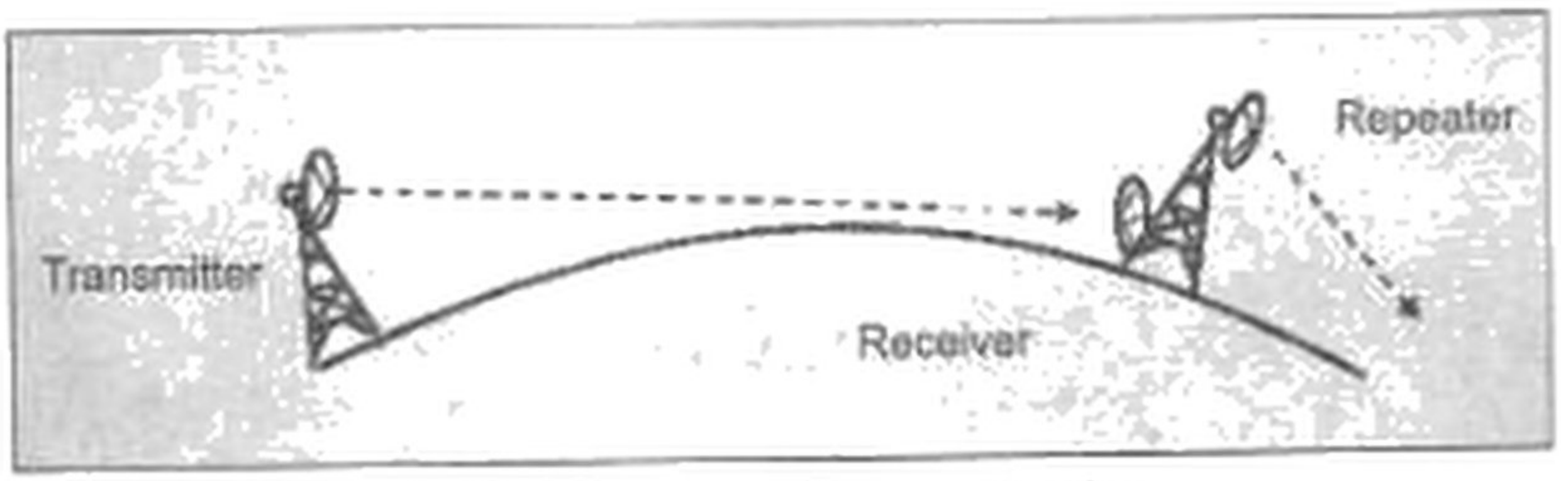


Figure 3.13: Microwave Communication.

city or community. For microwave transmissions to be able to occur over larger distances, data messages must be relayed from one location to another using antennas placed at high altitudes usually twenty to thirty miles apart.

2. **Satellites**: Instead of antennas, satellites can also be used to transfer microwave messages from one location to another. Satellites rotate approximately 23,300 miles above the earth in precise locations. Satellite transmission stations that can both send and receive messages are known as earth stations. A major advantage of satellite transmission is that large volumes of data can be communicated at once. A particular drawback is bad weather can severely affect the quality of satellite transmissions. Another one is that it has a serious security problem, because it is easy to intercept the transmission as it travels through the air

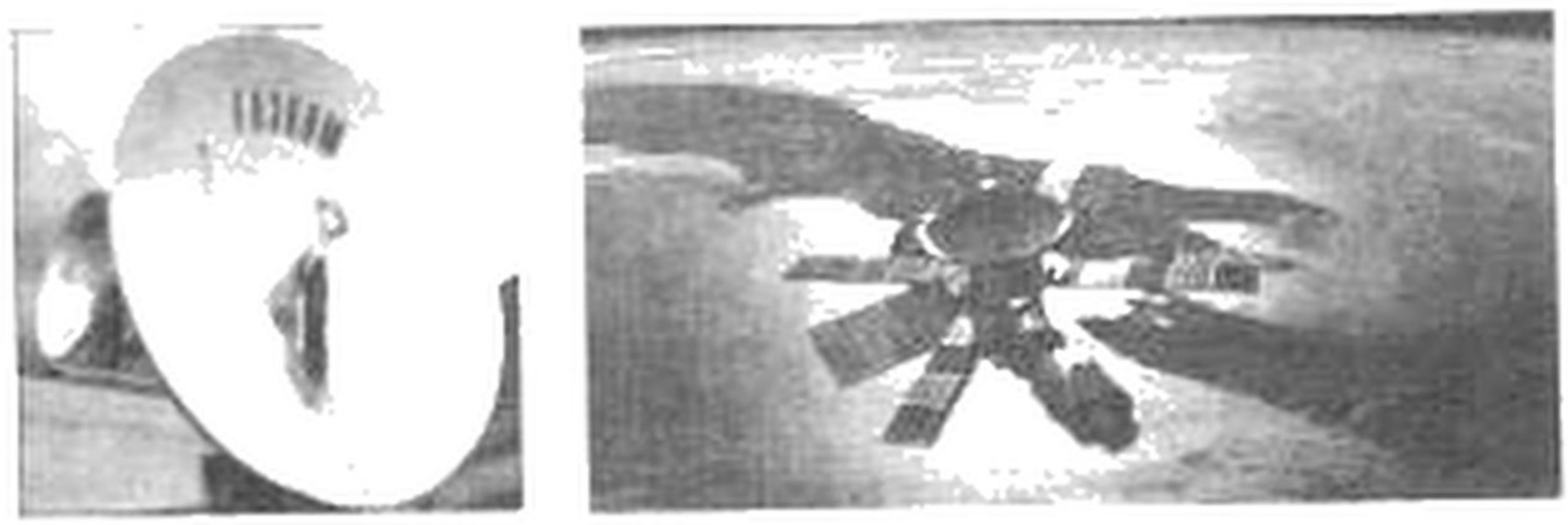


Figure 3.14: Satellite Communication.

Satellite Communications is the generic term for communication via satellite. Transmitting a signal from the earth station upto a satellite and then receiving that signal back at earth. The satellite does not have to be a huge expensive array of electronics and solar panels. In fact the moon was used, in the early years of satellite communications

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satellite delay and is still present today in all our satellite communications. This wide range broadcasting ability has given rise to a multitude of different satellites carrying all kinds of information such as telephone calls, television channels, Internet traffic military communications, weather data, and even radio stations.

3. **Mobile Communication:** It is radio-based networks that transmit data to and from mobile computer. Computer can be connected to the network through wired ports or through wireless connections.

3.7 Modem

Modem (**MO**dulate/**DEM**odulate) is a device that converts digital signals into analog form (a process known as modulation) to send over phone lines, a receiving modem at the other end of phone line then converts the analog signal back to a digital signal (a process known as demodulation). It enables users to transmit data from one computer to another by using standard telephone lines instead of special communication lines such as fiber optic or cable. Telephone lines can carry analog singles (see figure 3.15).



Figure 3.15: Modem communication

- **Transmission Rate:** It can be described, as modems high-speed or low speed to indicate how many bits per second a specific device is capable of transmitting or receiving.
- **Speeds:** The specific techniques used to encode the digital bits into analog signals are called modulation process. The various modulation standards define the exact methods of encoding and the data transfer speed. The raw speed (the speed without data compression) of a modem is determined by the modulation standards. A 2400 bps modem with data compression that can theoretically yield a 9600 bps throughput is not a high-speed modem. High-speed modems are modems that feature modulation at 9600 **bps** and above (the speed at which data is transmitted in bits per second) or higher.

3.7.1 Types of Modems

In terms of physical size and shape modems can be divided into following categories:

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jack by another cable. The modem is a self contained unit which is connected to the PC using a serial cable to the COM1 or COM2 port. It needs an external power supply, and is easy to set up(see figure3.16.a) .

- **Internal Card**: An internal modem is a circuit board (a modem card) that can be added to the system unit through an expansion slot. The modem cannot be moved easily from one PC to another. It is more difficult to set up than other types of modem(see figure3.16.b).
- **Wireless Modems**: Wireless modems transmit the data signals through the air instead of by using a cable(see figure3.16.c). They sometimes are called a radio-frequency modem. This type of modem is designed to work with cellular technology, and wireless local area networks.



Figure 3.16(a):
External Modem



Figure 3.16(b):
Internal Modem Card



Figure 3.16(c):
Wireless Modem

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Exercises 3C

1. Fill in the blanks:
   (i) In _____ transmission, a start bit and a stop bit frame a character byte.0
   (ii) Date communication signals can be in _____ or _____ form.
   (iii) Modem is an electrical device that converts digital signal into analog signals, which is called _____.
   (iv) The _____ transmission involves the concurrent flow of bits of data through separate communications lines.
   (v) ASCII is _____ bit(s) code.
   (vi) A television broadcast is an example of _____ transmission.
   (vii) In _____ transmission data is transmitted character by character.
   (viii) The data is transmitted in both directions simultaneously on the same channel_____.
   (ix) Fiber optic cable is better for very high speed, high-capacity data transmission than _____ cable because of the lack of attenuation and the purity of the signal.
   (x) The number of frequencies that can fit on a link at one time is called _____.

2. Choose the correct option:
   (i) Microwave transmission, coaxial cables, and fiber optics are examples of.
      (a) Modems (b) Communication links
      (c) Getways (d) Ring network
   (ii) Data communication requires only a:
      (a) Sender (b) Receiver
      (c) Transmission Medium (d) All of the above
   (iii) BIT stands for _____.
      (a) Binary Integer (b) Binary digit
      (c) Binary interval. (d) None of the above.
   (iv) Communication between a computer and a keyboard involves_____ transmission.
      (a) Simplex (b) Half-duplex

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(v) The _____ is the physical path over which a message travels.

(a) Protocol (b) Medium

(c) Single (d) All the above

3. Write T for true and F for false statement:

(i) An internal modem is a circuit board that can be added to the system unit of the computer.

(ii) In full transmission, the channel capacity is shared by both communicating devices at all time.

(iii) A fiber-optic cable consists of tubes of glass through which data are transmitted as pulses of light.

(iv) Normally, modem transmission is asynchronous.

(v) Transmission of signals across communication medium is called signaling.

(vi) The voice channel has a bandwidth of 0·233 kHz.

(vii) Synchronous transmission is much faster than asynchronous.

4. What is data communication? Define the basic component of communication network.

5. Define the modem and its types.

6. Differentiate between Asynchronous and Synchronous.

7. Briefly explain the various communication media.

8. Define the Modem.

9. What is bandwidth? Explain bandwidth briefly.

10. Differentiate between guided media and unguided media.

Answers

1. (i) Asynchronous (ii) Digital, Analog (iii) Modulation (iv) Parallel
(v) 7 (seven) (vi) Simplex (vii) Serial (viii) Full Duplex
(ix) Coaxial (x) Bandwidth

2. (i) b (ii) d (iii) b (iv) a (v) b

3. (i) T (ii) T (iii) T (iv) T (v) F
(vi) F (vii) T

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CHAPTER 4 Applications and Uses of Computer

Overview

The computer technology is vital for every functional area of an organization and IT systems are integral to every functional area. In finance and accounting, for example, managers use such systems to forecast revenues and business activity, determine the best sources and uses of funds, manage cash and other financial resources, analyze investments, and perform audits to ensure that the organization is fundamentally sound and that all financial reports and documents are accurate. At home, computers can help us to shop, determine our bank balance and pay bills. At work place, computer skills are needed for success in almost every occupational area. For businesses, with today's increased competition and global markets, it is almost impossible for an organization to stay competitive without the widespread use of computer technology. Another advantage of computer technology on working practices is the move towards the paperless office in which all data is held in computer files and there is no hard copy at all. The typical traditional office with filing cabinets full of files, trays of documents and correspondence awaiting or having received attention, desktops strewn with sea of paper would be a thing of the past. An empty desk with telephone and computer terminal would be all that was required. The writer does not believe that many, if any, organizations have actually achieved this but it's supposed to be the coming thing. In the field of education, teaching and learning are being profoundly influenced by the possibilities introduced by computer technology.

Significant changes have also taken place through the impact of interactive technology web-cams, video conferencing and so on. Not so long ago if it was necessary to talk with a group of clients the only way to do it was either to arrange a meeting that all of them could attend (always a tough thing to do) at a reasonably central venue to which every body had to travel too far, travel there (perhaps involving an overnight stay) and confer, or to hold series of telephone conversations with each one individually and keep on getting back to them until the matter was settled to everybody's satisfaction. Now, through the Internet and web cams a video conference can be set up in which everybody can take part without leaving their own office. This doesn't even take into account the overall impact of the Internet on the information levels available to businesses. The following are some of the major applications.

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4.1 Uses of Computers in different Fields

Our daily encounters with and dependence upon technology is almost invisible as it takes the shape of electronic climate control systems, wireless communication systems such as phones and pagers, automatic tellers to dispense money, magnetically striped cards to facilitate consumer transactions, cable and satellite television, and automobiles and mass transit. Free trade agreements have led to globalization of commerce and increased competitiveness in labor markets. We listen to political and scientific debate about global warming and the effect of our modern use of fossil fuels, nuclear weapons, chemical warfare, and contamination of food and water supplies. In the past several decades we have gone from space exploration to space colonization, intelligent machines, and virtual reality that will lead us into the next millennium. The jobs of the future may not even exist today. Let us see the use of computer technology in our daily life.

4.1.1 Business

The Businesses must understand and adapt in the new source of competitive advantage by connecting to the core competencies and customer interaction on global scale, global market place. In the global business world, global interaction is very important. In every organization there are major business processes that provide the critical tasks such that customer bills, analyzing sales of various products in different locations etc. In business, computers are used as given below.

- **Marketing:** Marketing applications provide information about the organization's products, its distribution system, its advertising and personal selling activities, and its pricing strategies. Marketing applications help managers to develop strategies that combine the four major elements of marketing: Product, Promotion, Place, and Price.
- **Stock Exchanges:** Stock markets around the world are in transition. On some trading floors, paper is disappearing. In fact, the trading floor itself is disappearing in some places because many stock markets lunched the computerized system that makes it possible for stockbrokers to do all their trading electronically. Brokers interconnected through a data communications network submit and receive bids using their computer workstations or interconnected computer display screens, where brokers match buyers with sellers, so that neither trading floor nor slips of paper are necessary.

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Figure 4.1: (Use of computer in stock exchange market)

- **Banks:** Computerized banking have provided several benefits such as save the time and convenience for customer. International banking and the abilities to handle trading in multiple currencies are critical for international trade. The cheques are read by MICR (Magnetic Ink Character Reader, a device used to allow the data on cheques to be read by machines) see in fig 4.2. Bank use mainframe computer to maintain their customer accounts by dealing with the transaction generated as a result of withdrawals and deposits. Some banks are used to operate a network of ATMs (Automated Teller Machine) see in figure 4.3. Although some international retail purchasing can be done by giving a credit card number.



Figure 4.2: ATM



Figure 4.3: Automated Teller Machines (ATM) and usage of machine

- **Departmental Store:** People at the store level, cashiers enter sales data into sale terminals by waving a bar code scanner across a package's bar-coded prices and stock numbers. Bar codes are read by bar -code readers, photoelectric scanners that translate the bar code symbols into digital

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and on our receipt. Store and department manager who received report of store and department sales and inventory levels are indirect end users. Record of sales are input to the store's computer and used for accounting, restocking store inventory, and weeding out products that sell well. A Security VCR (video cassette recorder) is widely used in department stores and other locations where aesthetics are a priority. It is virtually impossible to tell where the camera is pointed, which makes it difficult for would-be camera avoiders to stay out of the camera's view range; that are equipped with a camera, and lens can be augmented with dummy cameras. VCRs use the tapes, hook up the same way, and have all of the standard features of today's consumer VCRs. Most importantly, they are just as easy to use. Security cameras are everywhere these days and the reason is quite clear: there is simply no better way to monitor home or business operations and ensure safety. Now computer hard disk has took place of VCR.



Figure 4.4: Use of bar code reader

- **Office Automation:** Office Automation (OA) refers to the movement toward automating office tasks. An office where workers performs different tasks. The management and administrative tasks performed in an office five general categories of activities like decision-making, data manipulation, document handling, communication, and storage. Many offices have used advance computer technologies to perform various tasks in an office system such as for document management system, message-handling system, and office support systems.

  1. **Document Management Systems (DMS):** DMS include word processing, desktop publishing, reprographic, image processing, and archival storage applications. Word processing enable documents to be created and edited electronically as well as help to produce high quality memos, letters, proposals, reports, newsletters and brochures etc., which are used to send business community. Desktop publishing

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used to create a table of columns and rows used by people responsible for tracking revenues, expenses, profits, loses, statistical, mathematical and logical processing etc. Reprographics is the process of reproducing multiple copies of a document. Image processing allow document to be scanned and stored in image oriented databases.

2. **Message-handling systems:** It enables to send messages or documents from one location to other location through facsimile (fax), electronic mail (e-mail), Voice Mail etc.
3. **Office Support Systems enable:** It to coordinate and manage the activities of work group. Groupware and desktop organizers are some examples of office support systems.

4.1.2 E-commerce

E-commerce (electronic commerce) describes the buying, selling, and exchanging of products, services, and information via computer network. The term e-commerce as describe transactions, conducted between business partners. There are many application of e-commerce, such as home banking, shopping in electronic malls, buying stocks, finding a job, conducting an auction, collaborating electronically with business partners around the globe, marketing & advertising and providing customer service. There are several types of e-commerce like collaborative commerce, Business to commerce, consumer to consumer, and Mobile commerce etc. Mobile satellite communications also promise to extend the global reach of voice, data and other services. The following services of e-commerce are used most frequently in e-business.

- **Electronic Mail (E-mail):** The e-mail is a service that transports text messages from a sender to one or more receivers via computer. Voice mail systems capture, store, and transmit spoken messages.
- **Video conferencing**: Video conferencing is a type of conferencing in which video cameras and microphones capture sight and sound transmission over networks. It is a advance form of teleconferencing. Videoconferencing should provide a complete simulation of a normal meeting environment, enabling both parties to see, hear and present material, just as if they were in the same room. It can speed up business process and procedures in the same way that the fax and the e-mail have revolutionized the way we share information. Tangible benefits are most easily related to actual cost savings. The most obvious quantifiable saving is the cost of travel and the cost of the time wasted during travel.

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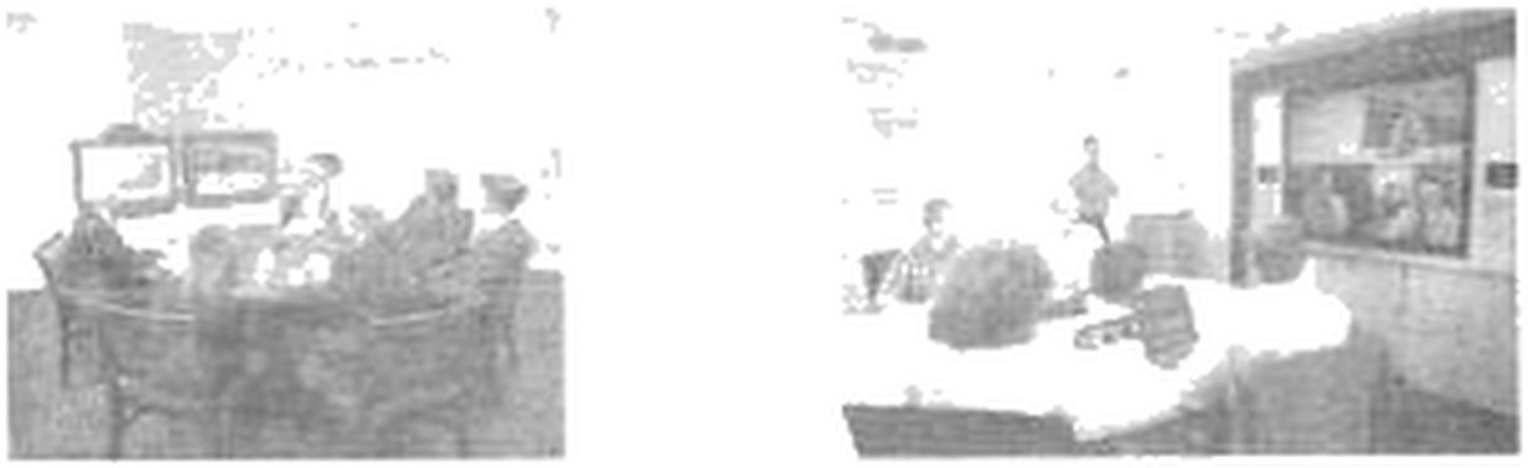


Figure 4.5: *Video Conferencing actual cost saving meeting in different places*

- **Electronic-shopping (E-shopping):** Many business now have website that allow Internet users to buy their goods or services. Shopping can take place using a computer at home, from work or at a mobile phone and e-shop can be anywhere in the world working 24 hours a day.
- **Electronic Banking:** An electronic banking is also known as cyber-banking or online includes various banking activities conducted from home, a business, or on the road instead of a physical bank location.

4.1.3 Industry

Computers are used to control manufacturing system and continuous running of the machinery. These are also help in monitoring temperature, pressure, and also check the quality and accuracy, measurement needed in the manufacturing process.

- **Robots:** A robot is an automatic programmable machine that moves and performs mechanical tasks (see Fig 4.6.). Robots are used in hundreds of applications from assembling and spray-painting cars, carrying out maintenance on overhead power cables, to testing blood samples, outer space experimental programs, in artificial satellites, and radioactive environments etc. Robots can work in environment that are hazardous to humans, it can perform repetitive and boring task continuously without a break at high level of accuracy than human.



Figure 4.6(a): Renuk RX 32 three-axis servo robot, which



Figure 4.6(b): M-16iB/20T. from FANUC Robotics, which can carry 20



Figure 4.6(c): W625H side-entry

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4.1.4 Computer Aided Design (CAD) & Computer-Aided Manufacture (CAM)

CAD are used for display designs and build production prototypes in software, test them as a computer object according to following given parameters.

- Compile parts and quantities lists.
- Outline production and assembly procedures
- Transmit the final design directly to machines.

CAD has many different applications some of them like designing new car or aircraft, bridge and building. Making changes to a design requires a large number of complex calculations. A CAD (see in fig 4.7.a) system needs



Figure 4.7(a): Using of Computer Aided Design software (CAD).

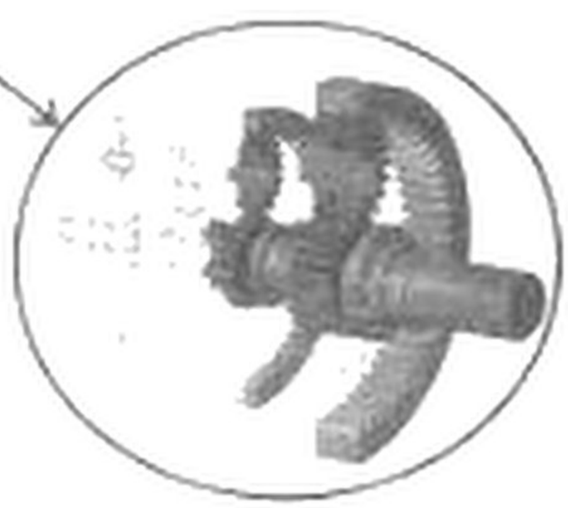


Figure 4.7(b): Computer Aided Design (CAD)

a high-resolution monitors, input devices (such as mouse, keyboard, graphic tables, and scanners etc.), and output devices (such as printers and plotters). CAD (see in fig 4.7.b) use often has the capability of displaying a three–dimensional object and speedily rotating it in any direction using controls on the keyboard.

Computer-Aided manufacture (CAM) is used to control all the part of a manufacturing process. CAM software uses digital design output, such as that from a CAD system, to directly control production machinery. CAM systems are manufactured following goods.

- Product can be made very accurately and consistently.
- Around the clock production is much cheaper.
- A product's design can be modified without the need of bringing production to a computer standstill.

4.1.5 Simulations

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used to train peoples how to deal with situations that are too difficult, expensive or dangerous to recreate and practice for real. For example a flight simulation, which is used to train, pilots how to deal with situation that would be expensive and dangerous to practice using a real aircraft. A flight simulator consists of a working replica of the flight deck of an airplane.

4.1.6 Medical

The computers are commonly used in some area of medical fields such as laboratories, researches, scanning, monitoring, pharmacy etc., which are helping the doctor to diagnose an illness.

- Patient Monitoring: Computers are used in hospitals to monitoring critically ill patients in intensive care units. The patients have sensors attached to them, which detect changes in heart rate, pulse rate, blood pressure, breathing and brain activity If any reading dislocates or reaches misbalancing level, the computer activates an alarming device to create sound and alerts the medical staff. The data is also logged and used to analyze the changes in a patient's condition over a period of time.
- Patient Records: Computerized databases are used to store information about patients, doctors, medicines and other chemicals and equipments. Storing information in proper order to provide the convenient way of arrangements for hospital staff. It makes easy to organize records than paper-based records that are not constantly following patients around the hospital. For example if a patient is admitted in one ward but being seen by a consultant and receiving treatment in other parts of the hospital; their details can be viewed and updated at any terminal in the hospital's LAN network.

  The computerized databases are used to help match patients who are waiting for organ transplants such as a new kidney, liver or heart with suitable organs from donors.
- Diagnosis: It will come as no surprise that hospitals and clinics use computers to keep records and generate invoices. One common use of computer is to scan the body of the patient. A scanner sends electromagnetic rays through a patient's body and sensors detect that how much patient's body have affected to any type of cancer. Actually the body scanner helps the doctor to treat any type of tumors or cancers. For example, the CAT scanner passes rays over the patient; it displays an image that enables physicians to look beneath the patient's skin. As the scanner passes over the patient, it displays an image of bone and tissue structure on a computer screen (see figure 4.7).

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Figure 4.7: Computed axial topography (CAT) still uses X-rays to see inside the body. But instead of using a single beam, a CAT scanner takes many X-rays around the body. The scanner's computer then builds up pictures of a 'slice' through the body and combines them to give a 3D image. Scientists used CAT to carry out the first detailed studies of the brain, before even more powerful techniques were developed.

4.1.7 Airline System

In airline system computers are used to control passenger aircrafts and vehicles. Early aircraft were controlled by moving parts attached to the controls using cables. In modern, fly - by -wire system, electronic singles from the cockpit are sent to that adjusts the flight surfaces. Computer is embedded in the pilot's or driver's controls. It is linked up among different cities and gives full information about its flight and seat reservation.

4.1.8 Education

Computers are used in many colleges to provide the methods of teaching in different ways. The computer education is very familiar and rapidly increasing the graph of computer students. There are number of methods in which educational institutions can use computer to educate the students. Many computer-based educational programs software are available, which students can learn to read, to count, or to speak a foreign language. Software that combines the thrills of games with real information content is becoming more popular. Some organizations are using information technology in their employee training programs.

- **Computer Aided Learning (CAL):** Computer Aided Learning (CAL) could be described as the use of information technology to assist in the

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teaching materials (one 'document' for lecture materials/reference notes/study aids). It is also reducing the administrative load associated with teaching and research.

- **Computer-Based Training (CBT):** CBT or Computer Based Training is a difficult term to adequately define because it encompasses various modes of instruction and has evolved from the simplest definition. *An interactive learning experience between the learner and computer in which the computer provides the majority of the stimulus, the learner must respond, and the computer analyzes the response and provides feedback to the learner.* Computer-Based Training is about using computers to help train people. It is not necessarily about training people to use computers. Computer based training works, compared with traditional techniques; it can bring many additional benefits to any organization, their training department and their students. For example:

(i) Students can readily acquire new skills at their own pace and at times that do not conflict with their work schedules.

(ii) Training times can usually be reduced.

(iii) Retention of course material is usually greater.

(iv) Interactive, visually stimulating, easily absorbed and easily available material encourages students to undertake training.

(v) Planning and timetabling problems can be reduced or eliminated.

(vi) Essential skills can be taught and refreshed whenever and wherever needed.

(vii) The quality and consistency of the training material is maintained throughout.

(viii) It is a highly cost-effective way to train large number of students, locally or at remote places.

(ix) Timely and high-quality training on demand leads to increased efficiency.

Compared to traditional classroom training methods, students using Computer-based training absorb similar material faster and retain more of the information they are taught.

4.1.9 Weather Forecasting

Computer based weather forecasting depends on accurate collection of data from weather stations, airports, satellites, different sensitive devices (which are situated on huge towers and buildings etc.) all around the world.

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temperature, season and so on. Once this is done, the data is collected on atmospheric phenomena over a region. The computer model then generates a forecast of how the air will change. The necessary parameters can never be measured with total accuracy and it is impossible to make a perfect representation of all the factors that affect weather. Some businesses, however, are so dependent on the weather that they need constantly updated information. SPARCO Weather forecasting department offer analysis of live weather data, and provide help to make business decisions based on weather forecasting.



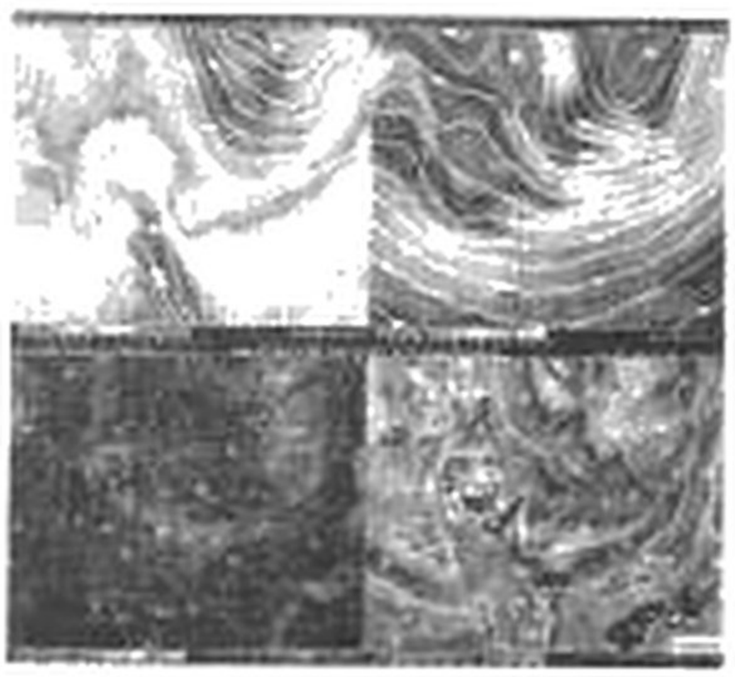


Figure 4.9: Weather over casting provides weather forecasting and decision making support to farmers and flight scheduling etc

4.1.10 Home

Nowadays many people have computers at home and it has become a necessity electrical home appliance used in home Children play games, keep track of the stamp collections, draw pictures, play music, view movies and do some sort of reading and writing according to their needs. A typical domestic system consists of a PC with a relatively small hard disk; printer, modem and CD-ROM drive etc. People can utilize computers for keeping records, making home budgets, using electronic mail and Internet services to learn and increase their knowledge. The uses of microprocessor technology in manufacturing of electronic home appliances like microwave, air-conditioning, washing machine, sewing machine etc., have completely changed our way of life.

4.2 Computer Assistance simplifying our work practices

Mostly people think that computer have a brain and can think and decide what to do, this is not true they are primarily machines, whereas the real thinking is done by human beings who feed the computers with information and program them to

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of these are listed below.

(i) Computers can work much faster than human's work.
(ii) Computers never get tired or need a rest.
(iii) Computers can do jobs that it would be dangerous for a human to do.
(iv) Computers can store large amount of information.
(v) Computers can retrieve information very quickly.
(vi) Computers never lose or misplace information.

Computers linked through communications systems offer major personal and business benefit to users like speed, consistency, precision, and reliability etc.

- **Speed:** Computer can perform calculations or process at a very high speed in a fraction of a second like nano second or even pico second. Computer can perform complex calculations, recall stored information, transmit information from one location to another and move objects around a computer screen almost instantaneously.
- **Consistency:** People often have difficulty repeating their actions exactly. Indeed, doing something once is not nearly as difficult as doing it the same way, and with the same result repeatedly.

  Computer excels at repeating actions consistently. Whether using a spell checker built into a word processor or playing multimedia animation for training purposes, a computer will carry out the activity the same way every time.
- **Precision:** In addition to being fast and consistent, computers are extremely precise. They can detect minute differences that people cannot see. In manufacturing an automobile, for example, the precise placement of a part as directed by a computer, may make the difference between long use and early wear. Computers excel in managing the smallest differences in being precise.
- **Reliability:** With speed consistency, and precision come reliability. When we know that the same procedure will be followed rapidly, consistently, and precisely, we can expect reliability of result i.e, we can depend on getting the same result again and again with any error.

Exercise 4C

1. Fill in the blanks:

(i) CAD stands for_____.
(ii) Electronic banking allows individuals to obtain cash instantly from _____.
(iii) CAT stands for _____.

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(v) A robot is an automatic programmable machine that moves and performs _____ tasks.

(vi) An electronic banking is also known as _____ .

(vii) The cheques are read by _____ machine in computerized bank.

(viii) The _____is a type of conferencing in which video cameras and microphones capture sight and sound transmission over networks.

(ix) Office Support Systems enable to coordinate and manage the activities of _____.

(x) FAX stands for _____.

2. Choose the correct option.

(i) CBT stands for:

(a) Computer Based Trade (b) Computer Based Training

(c) Certificate Based Training (d) None of the above.

(ii) The benefit of CAD may be summed up as:

(a) Accuracy (b) Repeatability.

(c) Speed and flexibility of production (d) All of the above.

(iii) Computer at home can be used:

(a) Keeping records (b) Making budgets

(c) Watching Movies (d) All of the above

(iv) A word processor can be used to:

(a) Write Text (b) Edit Text (c) Print Text (d) All of the above

(v) CAL stands for:

(a) Computer Aided Learning (b) Computer Assist Learning

(c) Computer Added Learning (d) None of the above

(vi) Typically, an ATM can be used to:

(a) Keeping records (b) Making budgets

(c) Watching Movies (d) None of the above

(vii) Modern computer can perform calculations or process at _____ high speed.

(a) per second (b) per minute (c) nino second (d) None of the above

(viii) CAT stands for:

(a) Computerised Axial Topography (b) Computer Axial Topography

(c) Computer Aided Topography (d) None of the above.

(ix) Computer based weather forecasting depends on accurate collection of data from:

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(x) MICR stands for:

(a) Magic in Character Redo (b) Magnetic Ink Character Recorder

(c) Magnetic Ink Character Reader (d) None of the above

3. Write T for true and F for false statement

(i) CBT is more expensive than non-CBT training.

(ii) Videoconferencing is an advanced form of teleconferencing.

(iii) The e-shop has opened for limited time period on the web sits.

(iv) CAL could be described as the use of information technology to assist in the teaching and learning processes.

(v) Bar Code Reader can be read all types of ink characters.

(vi) Fax machine can be inserted inside computers.

(vii) A robot is an automatic programmable machine.

(viii) A computer simulation is a special type of computer hardware.

(ix) An electronic banking is also known as cyber-banking.

(x) Modern computer can perform calculations at a second.

5. Explain the term Computer Aided Manufacturing process.

6. What is meant by computer simulation?

7. What is an ATM?

8. Explain how computer can be useful in business.

9. Explain how computer can be useful in medical field.

10. Define the role of E-Commerce in our daily life.

11. How computer can be useful in weather forecasting?

12. Define the CBT training.

13. Describe the online shopping and banking.

14. Define the Videoconferencing.

Answers

1. (i) Computer Aided Design (ii) ATM (iii) Computerized Axial Topography

(iv) Video Cassette Recorder (v) Mechanical (vi) Cyber Banking (vii) MICR

(viii) Video Conferencing (ix) Workgroup (x) Facsimile

2. (i) b (ii) d (iii) d (iv) d (v) a

(vi) d (vii) d (viii) a (ix) b (x) c

3. (i) T (ii) T (iii) F (iv) T (v) F

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CHAPTER 5 Computer Architecture

Overview

In 1951, Van Neumann and his team proposed a design of a **stored program computer.** According to his design a sequence of instructions (called a Program) and the data are stored in the memory of the machine. The machine reads the instructions one by one and executes these instructions accordingly. This seemingly simple design is proved to be very powerful and general purpose. It is the basis of most modern day computers.

If we consider the architecture of the modern stored program machine the following are most important components

Control Unit (CU): The control unit reads the instructions from the memory and decodes these instructions. This unit uses other components of the computer to execute the instructions given to the computer

Arithmetic and Logical Unit (ALU): As the general-purpose computer can perform different arithmetic operations on the data so it has a special unit that has electronic circuits to perform the basic arithmetic and logical operations on the data. This is called the Arithmetic and Logical Unit or ALU.

Main Memory: The stored program computer has another very important component that is use to store program and data while these are being executed. This unit is commonly known as the Main Memory of the computer. Sometimes we also call it the working area of the computer

I/O Unit: This handles the processor's communication with its peripherals. For example, Disc drive, monitor, printer etc. There are registers to hold the data coming in or going out and a peripheral device selection unit which determines which interface to send the data to. As the data and instructions should be in the memory before the computer can start executing it so to place data and instructions in the memory this stored program computer also has some I/O devices.

Bus Interconnection: This is another important component of the basic architecture and this component is used to connect different parts of the computer together.

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The figure given below shows clearly the main components in the architecture of the computer.

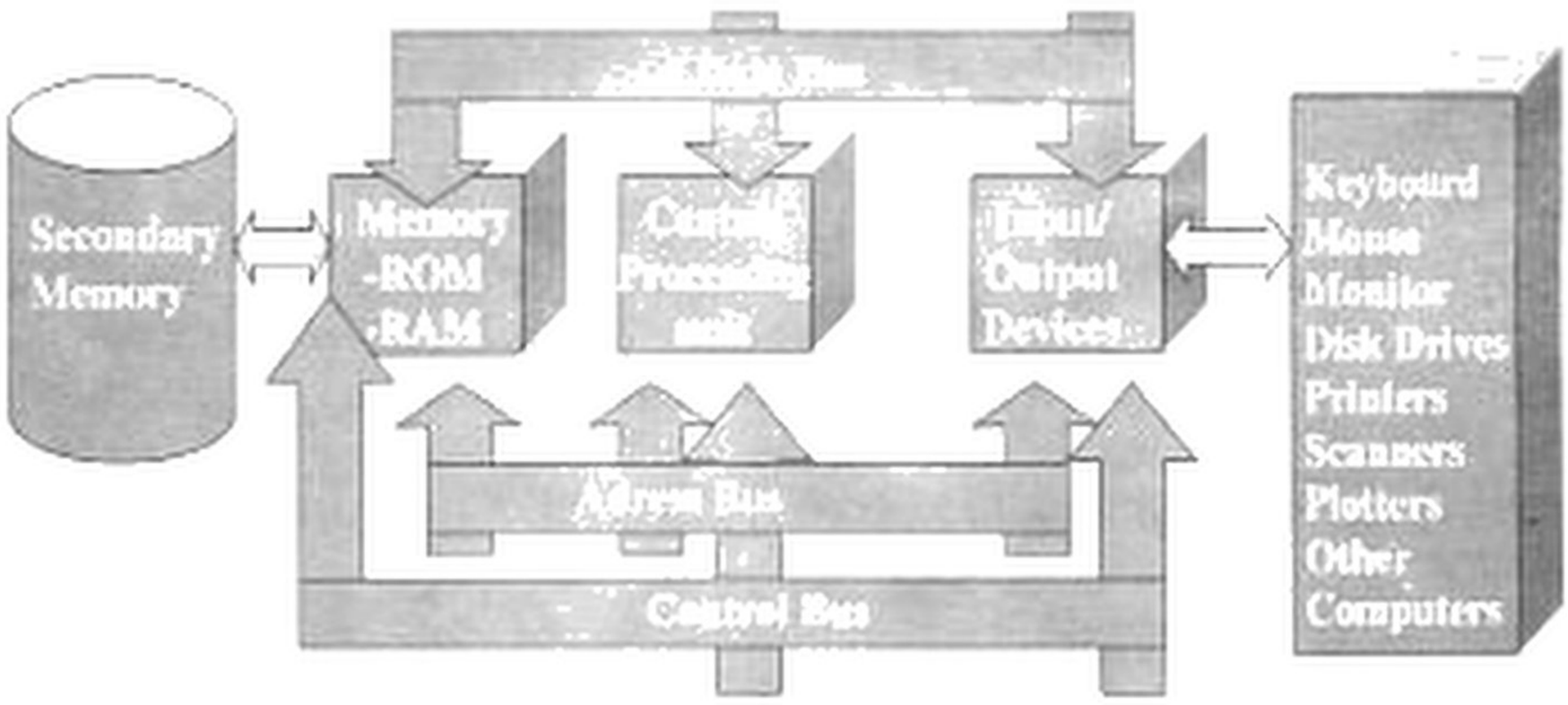
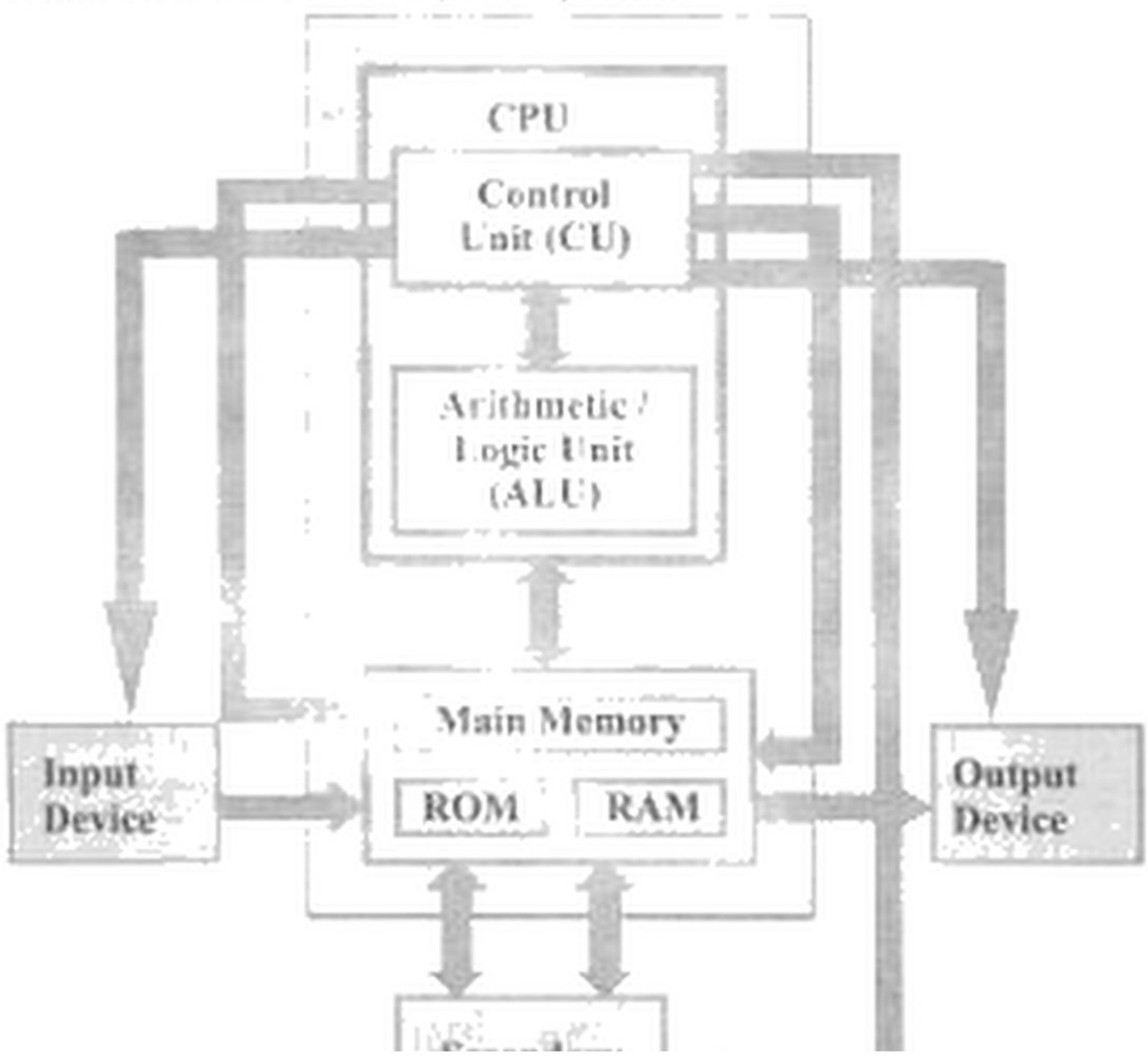


Figure 5.1: Architecture of main Components of Computer

The CPU

The CPU is the brains of the computer. In terms of computing power, the CPU is the most important element of a computer system.



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The CPU is centrally located on the motherboard. Since the CPU carries out a large share of the work in the computer, data pass continually through it. The data come from the RAM and the units (keyboard, drives etc.). After processing, the data is send back to RAM and the units.

The CPU continually receives *instructions* to be executed. Each instruction is a data processing order. The work itself consists mostly of *calculations* and *data transport:*

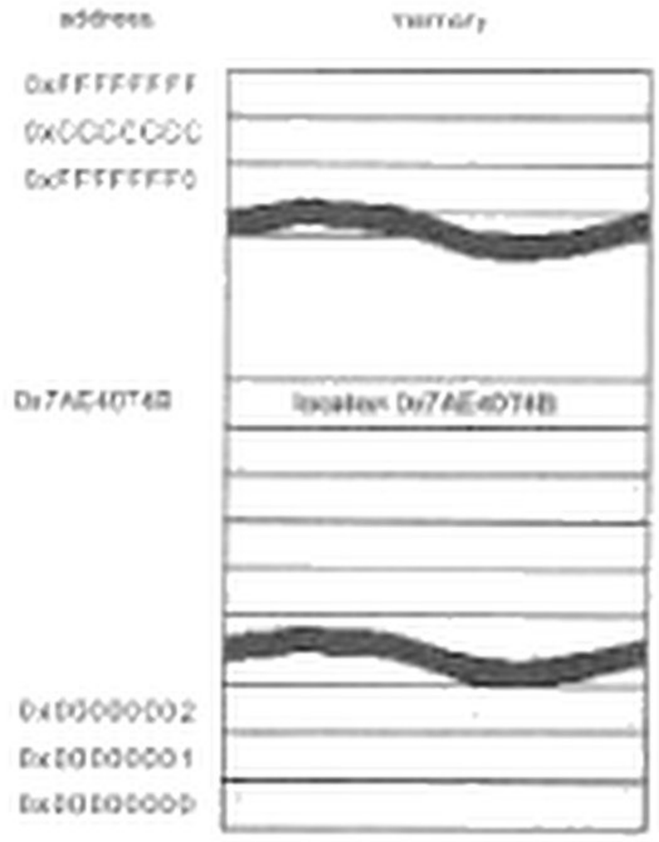
On large machines, CPUs require one or more printed circuit boards. On personal computers and small workstations, the CPU is housed in a single chip called a microprocessor. Two typical components of a CPU are:

The arithmetic logic unit *(ALU)*: The ALU part of a computer that performs all arithmetic computations, such as addition and multiplication, and all comparison operations. The ALU is one component of the CPU.

The ***control unit(CU)***, which extracts instruction from memory and decodes and executes them, calling on the ALU when necessary.

Main Memory: As mentioned earlier, a computer executes a program in its main memory, which is another very important component of the **stored program computer.** A computer cannot work without having some kind of main memory in it. In these section, we will learn more about different types of memories used in a computer and their working.

Mostly the modern computer memory is built in the form of a chip of a semi conductor material. It is built in the form of thousand or even millions of cells each capable of storing a bit i-e a 0 or 1. This is shown in figure 5.3. below.



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These cells are logically organized into group of 8 bits called a byte. Each byte in the memory has a unique number assigned it is called the address of that byte. This scheme of arranging cells into a byte and bytes into memory chip is shown in the figure 5.4 below.

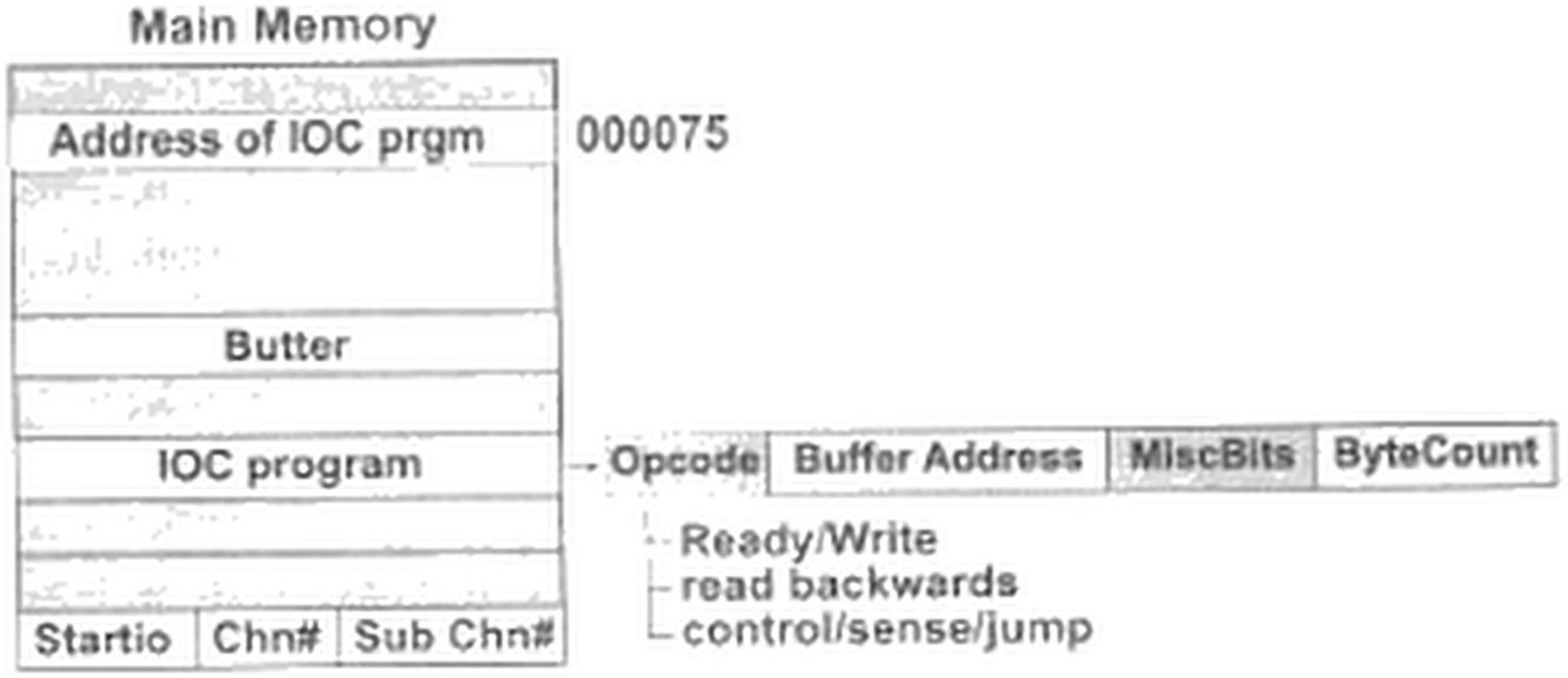


Figure 5.4: Main Memory

From this figure, it is obvious that a memory is sequence of bytes. Also the CPU or any other component of the computer can access any byte from the main memory by specifying its address. Different bytes of the main memory can be accessed directly at random the memory is build from electronic components so accessing any part of the memory takes equal amount of time. So the main memory is direct access storage device. As no mechanical movement is involved in accessing any byte of the memory so the main memory of the computer is very fast as compared to other storage devices like the magnetic and optical disks. There are two types of main memory.

RAM (Random Access Memory): It is usually build by using two different technologies.

DRAM (Dynamic RAM): DRAM stands for dynamic random access memory, a type of memory used in most computers. Dynamic Random Access Memory must have an electric current to maintain electrical state.

SRAM (Static RAM): In SRAM technology, the memory cells are made form digital gates and each cell can hold its value without any need to refresh the data as long as the power is supplied to it. As no refreshing is required to SRAM, these chips are faster than the DRAM chips also utilize less power. Because of these reasons the design of SRAM chip is more complex than the design of DRAM chips. Hence the SRAM chip is more expensive than the DRAM chip. In most modern computers this technology is used to build very

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Cache memory usually has a very small size as compared to the main memory in the computer but plays a very important role in increasing the performance of a computer system. This memory arrangement is shown in the figure 5.5 below:



Figure 5.5: Memory arrangements

It is important to note that the main memory is **volatile (unstable)** and the contents of the memory are lost as soon as the electricity supply is cut-off. The CPU can not only read the data stored in RAM but also can write data in the RAM, so RAM is read/write memory. It is used to store all data and instruction of a program while it is being executed.

ROM (Read Only Memory): As is obvious from this name the contents stored in this memory can be read but new data can not be written onto it so it is read only. The manufacturer of the ROM writes the data and programs permanently onto it and this data and programs cannot be changed afterwards. ROM contains frequently used instructions and data.

Another commonly found form of **ROM** is **PROM** (Programmable **R**ead **O**nly **M**emory). This form of ROM is initially blank and the user or manufacturer can write data onto it by using special devices. Once the program/data is written onto PROM it can be changed or altered. It is obvious that this kind of ROM will be used for storing user made programs and data and the data should have a very long life time as the data written onto this kind of ROM can not be changed.

Another important form of Read Only Memory is **EPROM** (Erasable Programmable **R**ead **O**nly **M**emory). Like PROM it is initially blank. Programs and data can be written on it by the manufacturer or by the used by using special devices. Unlike PROM, the data written on it can be erased by using special devices using ultraviolet rays. So data/program written on it can be changed and new data can also be added on this form of ROM. As the data written on this kind of ROM can be changed so data that is to be updated can be written onto it but frequently changing data should not be written on this ROM.

Yet another form of ROM is **EEPROM** (Electrically Erasable

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using electrical devices and so data stored on this ROM can be easily modified.

It is important to note that all the forms of ROM described above are non-volatile so the data stored on these chips is not lost when electricity is cut-off. Mostly ROM chips are used to store frequently used programs like operating system routines and data, which is not changed for longer periods of time.

5.1 Bus Interconnection

We know that a computer consists of a CPU, Main Memory and I/O unit. For data to flow between these components we need some kind of interconnections, which is another very important component of the overall computer architecture.

These components are interconnected by using a set of parallel lines (**Conducting Wires**). Each of these lines can be used to transfer a sequence of bits from one component of the computer to the other component. This set of parallel lines is called **BUS**. This kind of a bus is shown in the figure 5.6 below:

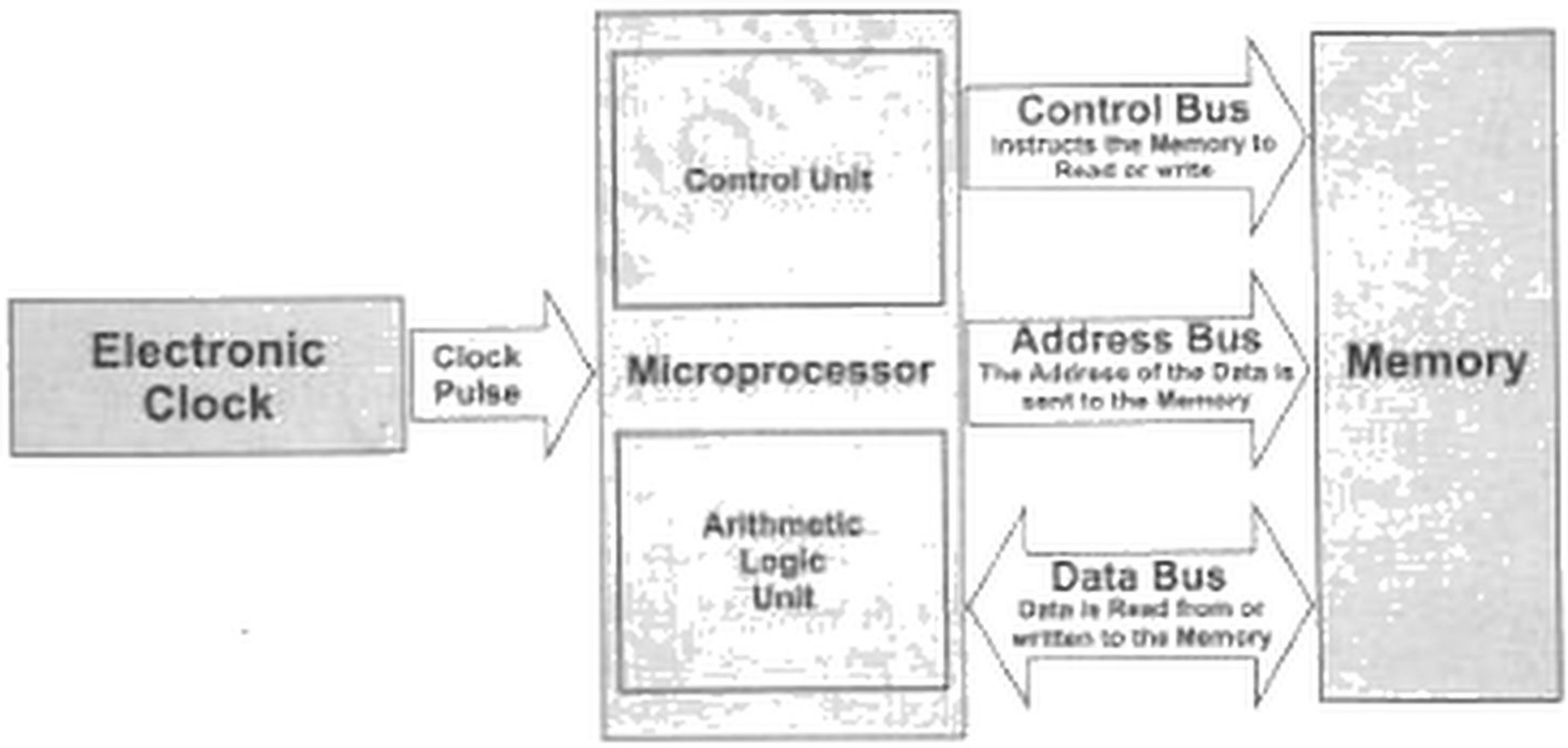


Figure 5.6: Bus interconnection

Generally a computer has more than one bus interconnection. The bus used to connect the main components of a computer is called the **system Bus**. General-purpose computers have a 70-100 line system bus. The system bus is divided into three main categories.

Control Bus: These lines are used to transmit different commands from one component to the other. For example, if the CPU wants to read data from the main memory; it will use the control bus to send the **memory read** command

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when CPU give a command to the main memory for writing data, the memory sends a acknowledgement signal to the CPU after writing the data successfully so that the CPU can move forward and perform some more actions. A few commonly used commands and their purpose are given in the table below.

MEMORY WRITE	This command is used to write some data to a given location in the main memory.
MEMORY READ	This command is used to read some data from a given location in the main memory.
I/O WRITE	This command is used to write some data to a given output device.
I/O READ	This command is used to read some data from a given input device.
BUS REQUEST	This command is used to request for a control on the bus so that the requesting device can use it to transmit data.
BUS GRANT	This command is used by the bus controller to indicate the grant of the bus to a device.
TRANSFER ASK	This command is used deliver information that the data was read by the devices.

Data Bus: On the system bus 32 or 64 lines are reserved to transfer data from one component to the other. These lines are commonly known as the data bus. A 64-line data bus can transfer 64 bits of data simultaneously so it is not difficult to see that the width of the data bus has a direct impact on the performance of the computer

Address Bus: As we know that many components are connected to one another through the system bus so it is important to assign a unique ID to each component. This ID is called the address of that component. When a computer component wants to communicate with another, it uses a few of the system bus lines to specify the destination component by using its address. These lines are commonly known as the address bus. Not only the address is used to identify different components of a system but it is also used to specify

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For example; if the CPU wants to write some data at a location 9872 in the main memory it places the address of main memory and location (i.e. 9872) on the address bus. When the main memory sees its address on the address bus it reads the data from the data bus and writes it to the specified location with in the main memory.

As the number of components connected to the system bus increases more components will be trying to use the system bus simultaneously. This will slow-down the computer as components will have to wait longer to get access to the bus. To solve this problem only the major components of the computer are connected to the system bus and remaining components are connected to another bus usually known as the expansion bus. The expansion bus is connected to the system bus. This is shown in the figure 5.7 below.

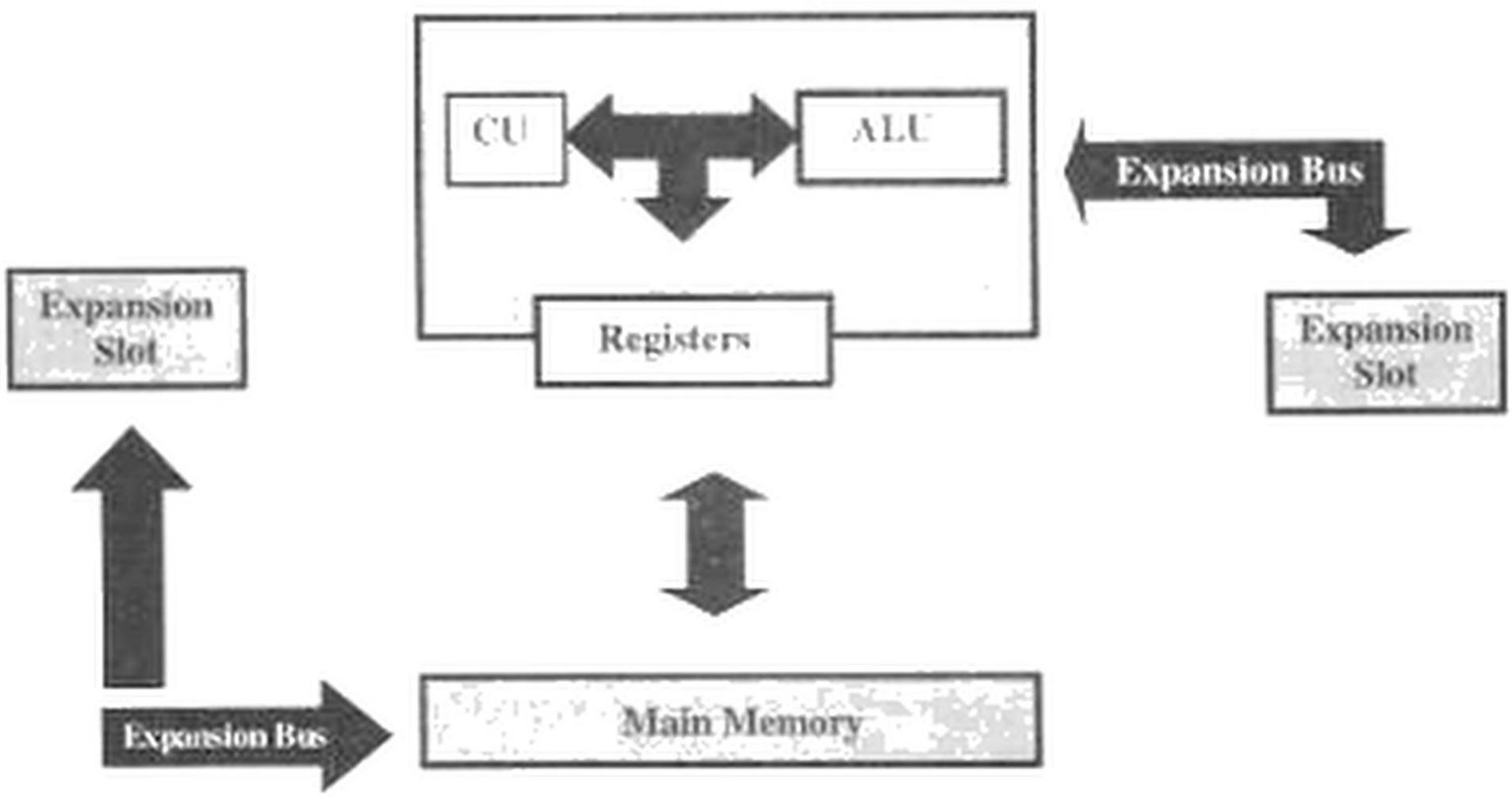


Figure 5.7: Expansion Bus

5.2 The I/O Unit

The I/O Unit is another very important component of a computer. Now a days we have many input/output devices like keyboard, mouse, disks etc. All these devices are very different from one another in their organization. Also these devices can handle different data-transfer rates and support different data formats. Because of all

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bus. It is not sensible to require the CPU to control these devices directly as they will take a lot of CPU time and will fill the system bus capacity.

To avoid these difficulties, a special hardware component I/O unit is used. Only the I/O unit is connected to the bus and the processor and all other devices are connected to it as shown 5.8 below.

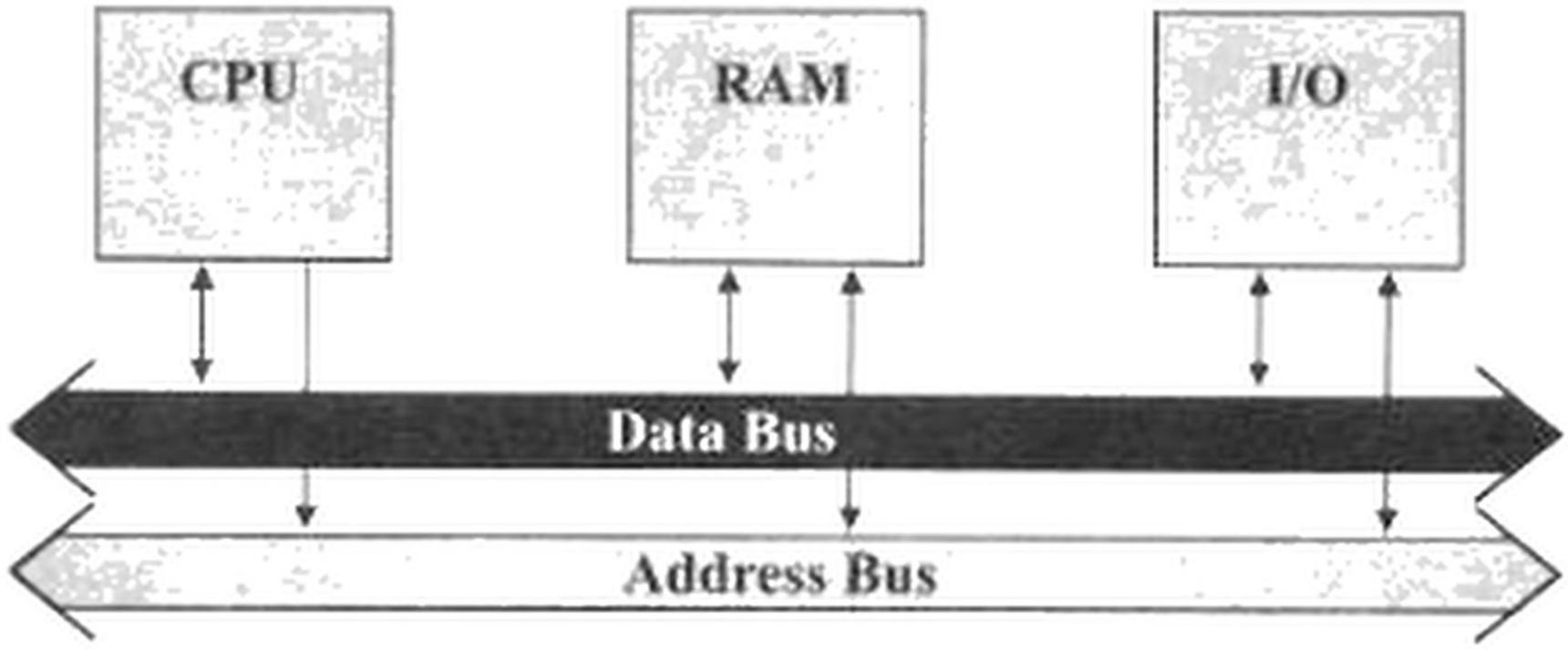


Figure 5.8: Hardware Components

The I/O unit is responsible for keeping the track of states of different devices attached with it. It is also responsible for compensating the speed difference between the processor and the I/O devices. There are two main ways of transferring data from the peripherals into the computer.

Interrupts: In this scheme the processor issues the command to the I/O devices. When the devices get ready, they generate an interrupt signal for the processor. On sensing this signal, the processor suspends all other processing and performs the I/O operation. The disadvantage of this scheme is that it reduces the over all performance of the processor.

DMA: The second scheme is DMA. In this scheme the processor issues the I/O command and then gets busy in some other useful task. The special hardware gets the data from the I/O device and uses the system bus to place if in the main memory. It is useful to note that the data is transfused when the processor does not need the system bus. So the processor does not have to wait for the I/O operation to complete. The disadvantage of this scheme is that it is more complex and extensive, as more hardware is needed.

5.2.1 CPU Registers

The program is stored in the main memory of the computer on contiguous memory locations. The data is also loaded into the computer's

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The CPU needs storage areas where the data can be stored temporarily. As these storage areas are used frequently, so for efficiency these special-purpose temporary storage areas are provided within the CPU for enhancing the performance of the CPU. These special purpose storage areas are called **registers**. The figure 5.9 given below shows the most commonly used CPU registers.

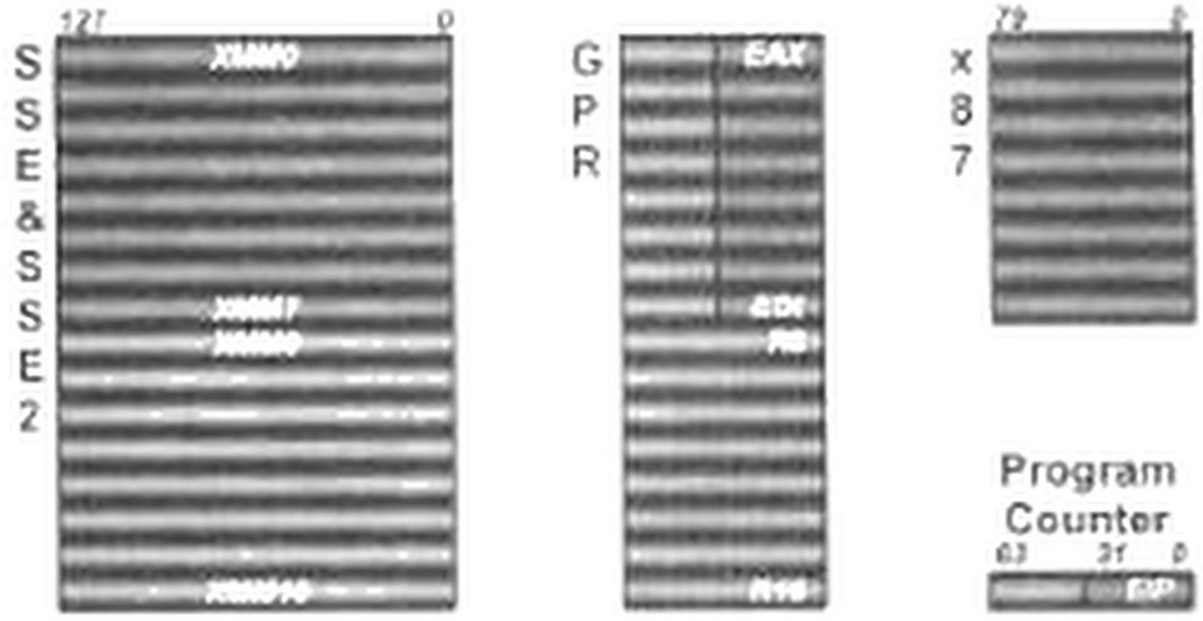


Figure 5.9: CPU Register

PC (Program Counter): This register holds the address of the next instruction to be fetched for execution. As soon this instruction is fetched, its value is incremented so that it still has the address of next instruction.

IR (Instruction Register): Once the instruction is fetched it is stored in the **IR** where this instruction is decoded.

MAR (Memory Address Register): When the CPU wants to store some data in the memory or reads the data from the memory, it places the address of the required memory location in the MAR.

MBR (Memory Buffer Register): The CPU uses this register to store data coming from the memory or going to the memory.

Stack Pointer: To understand the purpose of this register it is important to understand a very important data structure (Arrangement of data) called a Stack.

GPR(General Purpose Registers): These registers are called EAX, EBX, ECX, EDX and can be used for any mathematical or logical operations. These are used for arithmetic and data movement purposes. Each can be divided into an upper case and lower byte called AH, AL, BH, BL, CH, CL, DH, DL respectively. A stand for Accumulator, B for base, C for count and D for data Each of these registers can alternately be used as one byte, two byte, or four byte registers. AL (1 byte), AH (1 byte),AX (2 byte), EAX (4 byte),We

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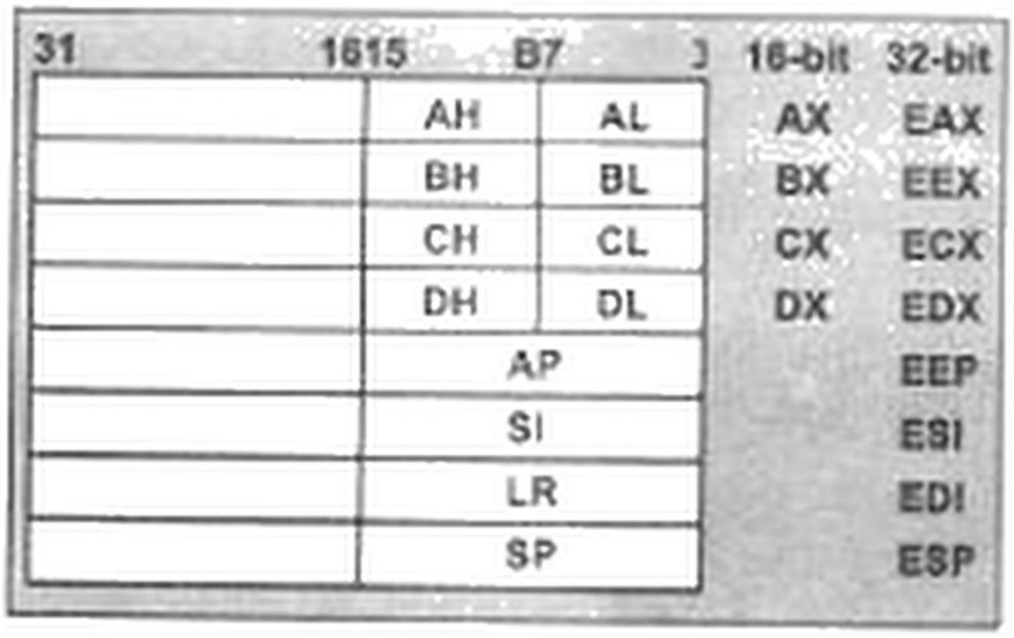


Figure 5.10: General Purpose Registers

AX (Accumulator Register): Used for arithmetic and data operations.

BX (Base Register): Used for arithmetic and data movement and special addressing abilities.

CX (Counter Register): Used for counting purpose. Acts as a counter for repeating or looping.

DX (Data): Has special role in division and multiplication.

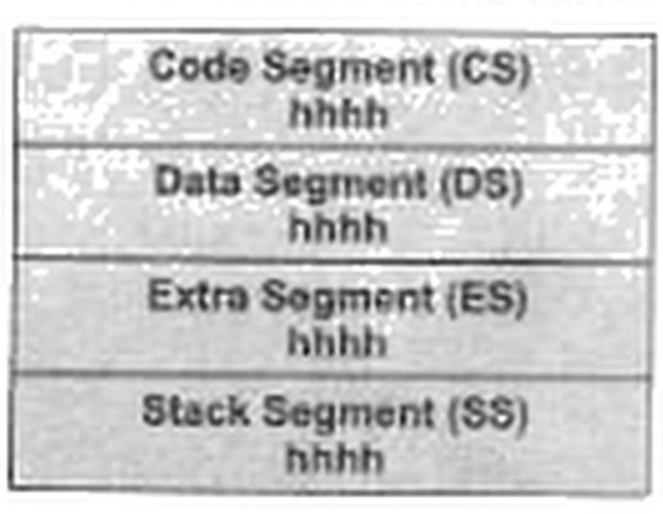
Address or Segment Registers: The address or segment register is a group of 4, some times registers named CS, DS, ES, SS. The segment register used as base location for program instruction, data, and the stack.

CS(Code Segment): The CS register holds the base location of all executable instructions (code) in the program.

DS(Data Segment): The DS register is the default base location for memory variables. The CPU calculates the offsets of variables using the current value of DS.

ES(Extra Segment): The ES register is an additional base location for the memory variables.

SS(Stack Segment): The SS register contains the base location of the current program stack.



Each has 2-byte. These registers are called segment register and are used in conjunction with either the IP register or two index registers DI and SI to address various areas of computer memory .CS is the primary register or two index register used to fetch instruction in conjunction with the IP register. DS is the primary register used to point out data in the

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5.3 Computer Operations and the instruction format

We know the basic architecture of a computer. now we will learn about different types of operations performed by the computer.

Data transfer instructions: All CPUs provide different instructions for the transfer of data from and to the memory. A programmer can use these instructions to bring data into the CPU and copy data from the CPU to the main memory. Instructions have the following format.

Arithmetic and Logical instructions: Another important category of operations a CPU can do is Arithmetic and logical operations. Most CPU provides the basic arithmetic operations of add, subtract, multiply and divide for signed numbers and floating point numbers. Logical operations of comparing two numbers, performing XOR of number, shifting and rotating a number are some common form of logical operations provided by the CPU.

I/O Instructions: Every CPU provides if users with the operations of reading data from a peripheral device and writing data to a peripheral device. To use these operations a programmer may use input and print commands provided by the CPU.

Control Transfer: In all real world programs, given to the CPU must be repeated a number of times. To support such operations, all CPUs provide its programmiers with control flow operations some examples of these operations are:

Jump, Jumpz (Jump if zero)

Instruction set: Each CPU provides its users with a number of instructions so that the users can perform different operation supported by the CPU. The set of all instructions provided by a CPU is commonly known as the ***instruction set*** of that CPU. In this section we will take an overview of the instruction set provided by the most modern CPU manufacturers and see how these instructions are used to solve different problems. Most commonly the CPU provides the following instructions to the programmers.

5.4 Instruction Format

A computer will usually have a variety of instruction code formats. It is the function of the control unit within the CPU to interpret each instruction code and provide the necessary control functions needed to process the instruction.

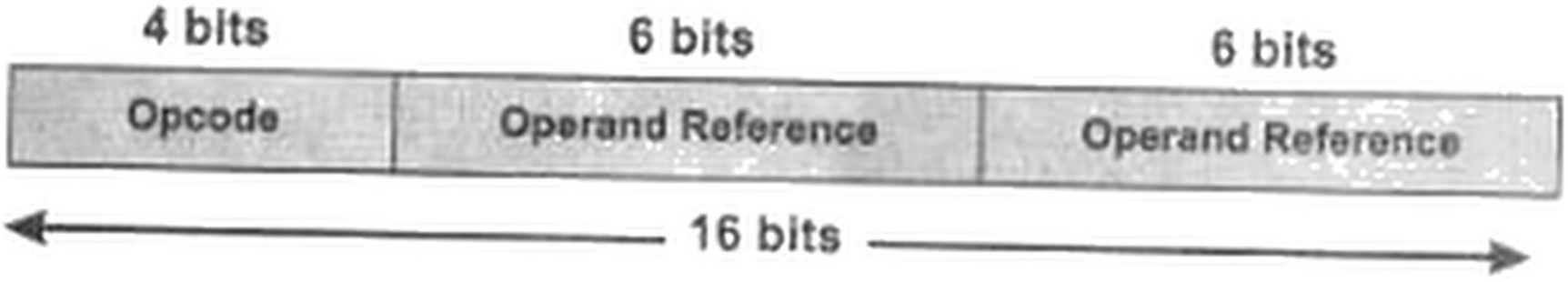
Each instruction for the CPU is specified by giving.

- A code for the instruction (opcode).
- Address of the operands

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Although other things (like addressing mode) are also specified but in most general form the instruction is specified in the format given in the figure below



Zero-Address Instruction Format: The name **"zero-address"** is given to this type of computer because of the absence of an address field in the computational instructions. A stack-organized computer does not use an address field for the instructions ADD and MUL. The PUSH and POP instruction, however, need an address field to specify the operand that communication with the stack.

One-Address Instruction Format: One-address instructions use an implied accumulator (AC) register for all data manipulation. For multiplication and division there is a need for a second register.

Two-Address Instruction Format: For two addresses instruction, each address field can again specify either a possible register or a memory address. Two-address instructions are the most common in commercial computers. Examples of such instructions are MOV, ADD, CMP and BIS.

Three Address Instruction: Computer with three-address instruction formats can use each address field to specify either a processor register or memory operand. The advantage of the three-address format is that it results in short programs when evaluating arithmetic expression. The disadvantage is that the binary-coded instructions required too many bits to specify three addresses. The instruction formats in the computer are restricted to either three register address fields or two register address fields and one memory address field.

Fetch-decode-Execute cycle: Now that you know the basic architecture let us see how the CPU enacts the instructions, specified in a program.

When we want to execute a sequence of instructions those instructions/data are first of all loaded into the main memory of the computer by using some I/O device. Once these instructions have been loaded into main memory, the address of the first instruction is copied into the program counter and the control is given to the CPU. The CPU performs the following steps:

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This fetching of instruction involves the following steps:

- Copy the contents of PC into the MAR and request a memory read.
- Copy the data read from the memory into MBR and instruction then in the IR. Increment PC so that it points to the next instruction.

Decode Instruction: Once the fetching of instruction is completed the CU decodes the instruction by analyzing the opcode of the instruction. It also reads the values of operands specified in the instruction. Decoding means activating the appropriate circuit to execute the instruction.

Execute Instruction: After decoding the instruction the processor executes the instruction by using the activated circuit. Then the results of the execution are written back to registers and memory.

The CPU repeatedly does these steps. These steps are known as **Fetch-Decode-Execute** Cycle.

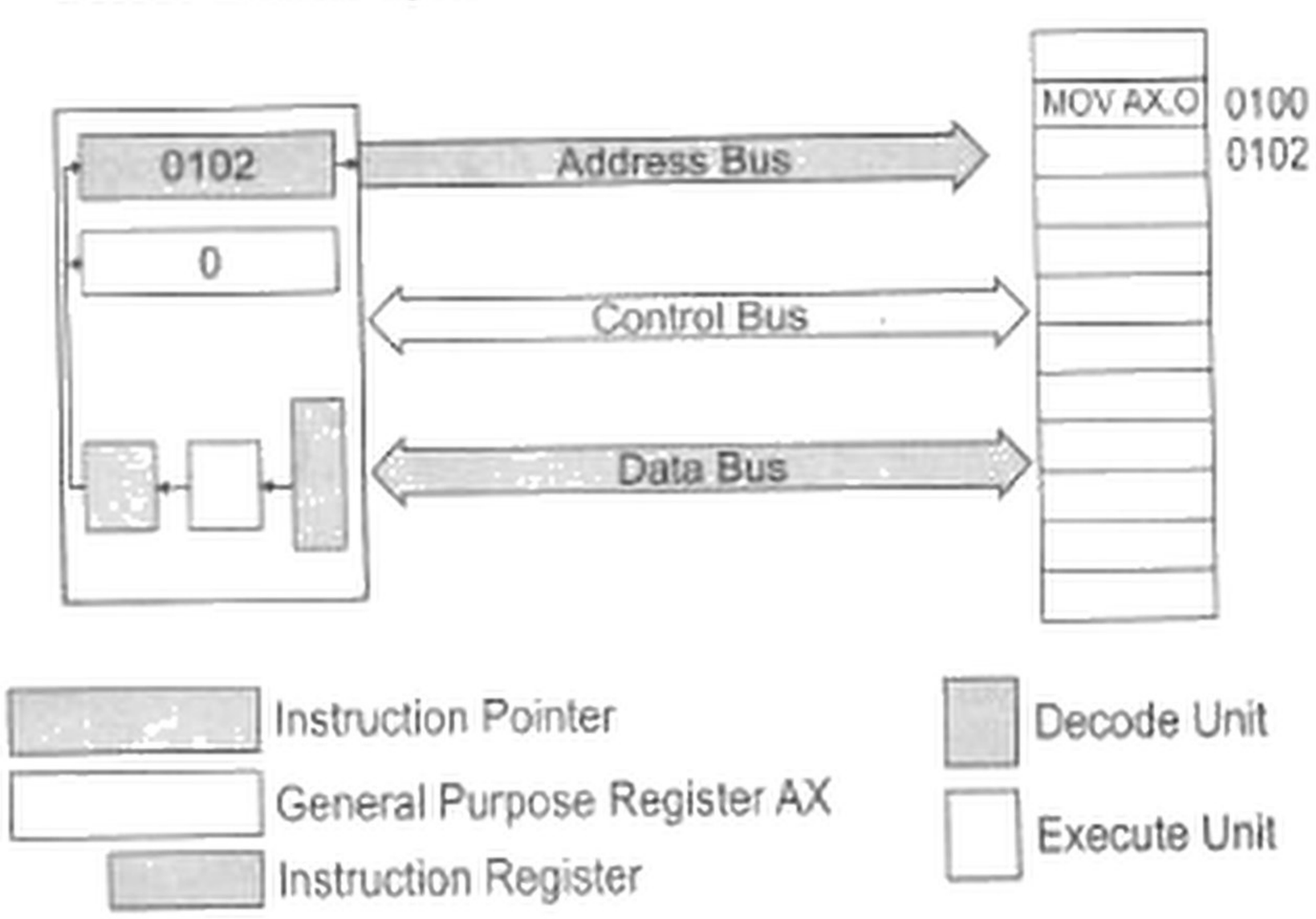


Figure 5.11: Fetch-Decode-Execute

5.5 Software

The term software is used for a sequence of instruction given to the computer to perform a specific task. Software consists of the step-by-step instructions that tell

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performs useful work on general-purpose tasks. System software, which includes operating system, enables the application software to interact the computer.

Application Software: Application software is defined as software that can perform useful work on general-purpose tasks. It may be either customized or packaged.

- **Customized software** is software designed for a particular customer. The program can be developed by a single computer professional programmer or by a team of programmers depending upon the requirements.
- **Package software** is the kind of "off" the "self" program developed for sale to the general public. Package software includes word processing, spreadsheet, database manager, graphics, and communications programs. These are the software development by experts in high/low level languages for non-experts. It is to facilitate all the fields of life.

5.5.1 Operating Systems

It is obvious that to solve some problem on a computer a programmer will write instructions. But other than writing instructions for solving the problem every programmer will also have to write instructions for the following tasks.

- Read data from the input devices
- Show results on the output devices
- Perform memory management tasks (more details latter)
- Organize data on the storage devices.

These tasks are very complex and only expert programmers can write these instructions. From this discussion it is obvious that only expert programmers can write programs and use computers. To overcome this difficult situation some programs (instructions) can be written only once and can be stored in the computer so that every programmer does not have to write these instructions but rather use the stored instructions. This set of programs evolved and became what is known as an operating system (OS). We can define an OS as **a set of programs running in the background on a computer system and providing an environment in which other programs can be executed and the computer system can be used efficiently.**

In this section we will discuss the main functions of an operating system and see how the OS provides these facilities. Some of the programs are stored in the processor memory and provide the basic utilities to the users. The remaining programs are stored on the hard disk or backing store of the computer and are loaded in the memory of the computer when these are

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command to the OS and OS can do the rest. So we can visualize as if the OS is sitting between the hardware and the application program or user. This is shown in the figure below. From this figure it is obvious that the OS will not only provide programs for doing different tasks but will also provide an interface to its users (i.e. programs, programmers etc)



Functions of Operating Systems: In this section we will discuss the main functionality provided by the OS to its users.

Manage Hardware Resources: The operating system must provide programs for managing the hardware resources of the computer like disks, memory, and CPU.

Memory Management: In the stored program computer every program has to be loaded into the computer's main memory during the execution. If there are several programs simultaneously loaded in the main memory, as is the case when time-sharing is used, the program and its data must be protected from the actions of other programs.

Load and Execute programs: As we know that a program has to be loaded into the main memory before the processor can execute it. The OS provides the facility of easily loading a program into memory and starts its execution.

Data Security: The OS must also protect the user data against illegal access and modification.

Providing interface to the users: The OS must provide an interface between the user and the computer and also between software and the computer. Most Operating systems provide the following two types of interfaces to their users.

Command prompt: In such interfaces the users communicate with the operating system by typing commands using a keyboard. Each command given to the OS activates one of the many programs in the OS. Example of such an interface is the command prompt provided by MS-DOS to its users.

Graphical User Interface (GUI): The GUI interface consists of Window, Menus, Icons and pointers. The user of the system communicates with the OS by selecting commands from the menus or by selecting different Icons with the pointing device. MS-Windows is a well-known example of the OS with a

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5.6 The Translators and their functions

Interpreters and Compilers

In the early days of computers the programs had to be written in machine code. The machine code instructions are the instructions provided as the instruction set of the machine and these codes are represented by a binary pattern in the computer. To write a program the programmer had to write the instructions in binary. This was a very complex task and even writing very simple programs took a log time. It was very difficult to produce correct programs as detecting errors in the programs and correcting these errors (Debugging the program) was very difficult. A program that produces the binary instruction for a given assembly language program is called an **Assembler.**

Each assembly instruction maps to a single machine instruction so it is very easy to translate a program written in assembly language to machine code. Writing programs in assembly language is very easy but is still a tedious work and took a long time.

The program that translates a high-level language program into machine language is called a **compiler**. Once a program has been translated into machine code it can be loaded into the main memory and executed by the CPU. The high-level language version of the program is usually called the **source code** and the resulting machine code program is called the **object code** The relationship between the source code and the object code is shown in the figure below:



A more appropriate definition of a compiler is that it is a program that takes as input a high-level language program and generates an object program. This object program may or may not be the absolute machine code.

Another useful translator is an **interpreter**. An interpreter takes as input a high-level language program and performs the following actions.

- It repeatedly reads instructions (one at a time) and translates it to machine code.
- It then executes the instruction

One difference between a compiler and an interpreter is that a compiler converts each instruction only once but an interpreter may translate an instruction several times. Clearly if an instruction has some error an interpreter can easily identify it. Also an interpreted program runs slower than a compiled program as once a program is compiled it does not need any further translation but the original

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Exercise 5C

1. Fill in the blank:

   (i) DMA stands for _____ .

   (ii) In _____ mode, data can be transmitted in both directions simultaneously.

   (iii) The lexical analyzer also commonly known as a_____.

   (iv) The _____reads the instructions from the memory and decodes these instructions.

   (v) The _____interface consists of Window, Menus, Icons and pointers.

   (vi) EEPROM stands for _____.

   (vii) Stack pointer register is used for _____.

   (viii) DRAMs require _____ refreshing to maintain data storage.

   (ix) _____language was developed for business applications.

   (x) _____ register is used in mathematical or logical operations.

   (xi) DVD stands for _____.

   (xii) BIOS stands for _____.

   (xiii) Initial work on the internet was done in _____ operating system.

   (xiv) The instructions that are used to transfer data from one unit to another during program execution are called _____.

   (xv) _____ registers are used in mathematical and logical operation.

2. Choose the correct answer.

   (i) Data and program not being used by computer are stored in:

   (a) Secondary storage (b) cache (c) Primary storage (d) printer

   (ii) A set of instructions that run the computer are:

   (a) hardware (b) document. (c) CPUs (d) software

   (iii) The program that contains instructions to operate a device is called.

   (a) Device driver (b) Device operator (c) Device linking (d) Device system

   (iv) CPU is an example of:

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(v) The address of instruction under the processor execution is contained within:

(a) Program Counter (b) Current Instruction register.

(c) Memory Address register (d) Memory Buffer register

(vi) A computer drives its basic strength from

(a) Speed (b) Memory

(c) Accuracy (d) All of above

(vii) The arithmetic/logic unit performs the following actions

(a) Control computer operations

(b) Perform arithmetic functions such as addition and subtraction etc.

(c) Perform logical comparisons such as equal, greater than, less than

(d) Both b and c

(viii) Which is a storage device

(a) CPU (b) Clock (c) Floppy disk (d) Bus

(ix) Which component is responsible for comparing the contents of two pieces of data

(a) ALU (b) Control unit (c) Memory (d) None

(x) Which one is faster

(a) RAM (b) Cache (c) Register (d) Hard disk

3. Write T for true and F for false statement.

(i) Bps stands for byte per second.

(ii) In simplex transmission mode, communication can take place in both directions.

(iii) Random access memory is volatile memory.

(iv) Operating system is an application program.

(v) External buses and internal buses are similar.

(vi) Accumulator register is used to control the stacks in the computer.

(vii) LIFO stands for Last-in-first-off.

(viii) Expansion slot is a place where an expression card is fitted.

(ix) Static Ram holds the data as long as power is supplied to it.

(x) The clock of the computer ticks once in one second just like an ordinary clock.

(xi) VDU is an input device.

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4. What is CPU? Describe briefly.
5. Explain the architecture of computer system.
6. Differentiate between the following.
   (i) PROM and EPROM
   (ii) Address Bus and Control Bus
   (iii) Serial and Parallel Ports
   (iv) Linker and Loader
   (v) CU and ALU
7. Differentiate b/w Compiler and Interpreter.
8. How to transfer data from CPU to memory explains in steps?
9. Define the different types of RAM.
10. Define the general-purpose registers.
11. Describe the Bus and its types.
12. Define the machine Instructions.
13. Differentiate between Fetch instruction and Decode instruction.
14. Differentiate between ROM and RAM.

Answers

1. (i) Direct Memory Access (ii) Full Duplex (iii) Lexer (iv) Control Unit
   (v) Graphical User (vi) Electrically Erasable Programmable Read Only Memory
   (vii) Maintaining Stack (viii) Periodic (ix) COBOL (x) General Purpose
   (xi) Digital versatile disk (xii) Basic Input/Output System (xiii) Unix
   (xiv) Read/Write Instruction (xv) General Purpose

2. (i) a (ii) d (iii) a (iv) c (v) a
   (vi) d (vii) d (viii) c (ix) a (x) c

3. (i) T (ii) F (iii) T (iv) F (v) F
   (vi) F (vii) F (viii) F (ix) F (x) F

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CHAPTER 6 Security, Copyright and The Law

Overview

Security is a system of safeguards designed to protect a computer system and data from intentional and accidental damage or access by unauthorized persons.

How does a computer system detect whether you are the person who should be allowed access to it? Various means have been devised to give access to authorized people. For this, we have four approaches, as discussed below:

- **What you have:** *You may have a key, badge, token, or plastic card to give you physical access to the locked-up server room or computer building.*
- **What you know:** *Standard user-ids and passwords or some special combination of numbers are given to the users to logon the machine.*
- **What you do:** *Normally, the users put their* ***signatures*** *on the documents to confirm their legitimacy as an authorized user.*
- **What you are:** *Some security measures are* ***biometrics*** *- biological means of identification i.e. fingerprints, voice recognition, eye retina etc.*

6.1 Virus and Antivirus issues:

To fully understand the concept of a virus (or worm), first recall the concept of a computer program, what can a program do, and how a program is executed? A program is a sequence of instructions given to a computer. These instructions are for some sort of processing. By processing we mean performing arithmetic and logical operations on the data in the computer memory, manipulating data is storing and arranging two data item to see if they are equal or not, and transmitting data is sending data from one computer to some other computer on a network or via internet. A **virus** is a program that attaches itself with other executable files by modifying them so that the

Note :
(i) Some systems use a combination of the above mentioned techniques for individual's identification.
(ii) Loss of hardware is not a major problem in itself; it can be recovered by insurance, and the hardware can be replaced. The loss of software is also not a big issue, as if it has been backed up properly, can be re-installed in case of loss. The actual problem lies in the loss of data. It is difficult (though not impossible) to recover it in time in case of transactions

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performs destructive operation by deleting or modifying (unknowingly) data stored on the storage devices attached to the computer. It is very important to note that a virus is a set of instructions so it cannot physically destroy a hardware (a common misconception).

We can formally describe a virus as "A destructive program containing code that can generate copies of itself and attaches itself with other program so that it is automatically executed when those programs are executed".

It is important to know exactly how a virus reaches from one computer to another. As the virus attaches itself with files present on a system so the only way, a virus can reach from one computer to another, is when some data is exchanges between these computers either through usb, disks, or the network.

6.1.1 Causes of Viruses

Following are the means through which a virus reaches from one computer to another.

- **Email:** Now a days, most of the virus programs spread by attaching themselves with email messages. When a user opens such an infected message, the virus is also loaded into the computers memory and attaches copies of itself with many files. Then this virus gets itself attached with email message sent from the infected computer and infects other computers.
- **Networks:** Another way of spreading virus is by using Internet and other networks. For example when you download some executable file or data from the Internet or from a shared disk on the Network, the infected files may be attached with the downloaded data that ultimately infects the computer.
- **Removable storage media:** One important means of exchanging data is through the use of removable media like memory cards CDs and flash devices. So, when you copy the data from one computer to another by using a removable media, the infected files may get transferred.
- **Pirated Software:** Another important but not so common way the virus infects your computer is through the use of pirated software. Some companies may intentionally put some virus program into their software. This program will only activate when it does not find some special files like license files on your computer.

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6.1.2 Types of Virus

Following are some important types of viruses:

- **Boot sector virus:** We know that the disk is divided into tracks and sectors. The disk on which the operating system has been loaded, has a special program in its first sector called the boot sector. When the computer is turned on, the program in the boot sector is automatically loaded into the memory. This program then loads the operating system into the memory after performing some initial tasks. The boot sector virus modifies the program in the boot sector and is loaded into memory whenever computer is turned on. The virus is attached with the executable files i.e. **.exe**, **.com** an **.dll** files. When the user uses these executable files, the virus attached with these files is also activated and then it infects other files and also performs destructive commands and destroys the data files also.

- **Chernobal Virus :** The famous **chernobal** virus deletes all the Microsoft office files and also the partition information form the disk hence causing a major loss of data.

- **Logic bomb:** Logic bomb, differ from other viruses in that they are set to go off at a certain date and time. A disgruntled programmer, for a defense contractor created a bomb in a program that was supposed to go off two months after he left. Designed to erase in inventory tracking system, the bomb was discovered only by chance.

- **Trojan horse:** the Trojan horse covertly places illegal, destructive instructions in the middle of a legitimate program, such as a computer game. Once you run the program, the Trojan horse goes to work, doing its damage while you are blissfully unaware. An example of a Trojan horse is FormatC.

- **Redlof:** The Redlof virus is a polymorphic virus, written in Visual Basic Script. The virus relies on the Microsoft ActiveX Component vulnerability to automatically execute itself. When executed the virus locates Folders.htt and infects that file, the Folder.htt is part of Microsoft Windows Active Desktop feature. It searches the users hard-drive and locates infectable files and appends itself to them.

- Some viruses may make unnoticeable changes hence corrupting the data being used and some viruses may even make data unusable.

- A virus program may detect some special information like passwords, or

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example a virus program may read the Pin code or credit card number entered by a user and then send this information to another user.

- Another interesting thing a virus can do is that it may make resources unavailable to the users. For example, a virus after copying itself on all computers on a network will start sending data on the network so that other users cannot use the network.

6.1.3 How to safeguard against viruses?

Following are the few ways following which you can save your computers from getting infected by a virus. Never open unknown email messages, and also scan (for virus) all email messages even if you know the sender of the message. You should also minimize the data transfer between computers through the use of floppy disks and other removable media. While using the Internet, do not download free-ware programs without first checking it for virus. Always use a virus detecting software i.e. Norton, McAfee, Dr. Solomon's, toolkit or IBM's antivirus programs to detect and to delete the infected programs from your system. You should periodically update these programs as more and more viruses are discovered over the time, so older versions of these programs may not detect the new viruses. Another important way to save yourself from the destruction of virus attack is that you should always keep backup of your data. The backup will be useful if a virus attack deletes your data or modifies it.

6.2 DATA SECURITY

The organization obtaining the data is responsible for the security of data and will be liable to prosecution for the lapses in the security of data and updating it improperly.

You can use Internet to connect to a network in any part of the world and see any data on that network. Today many organizations heavily depend upon fast computer processing and if some one enters into their network and make it unavailable, the working of the entire organization will halt. Many organization store data of their customers online for providing fast services. For example a credit card company may put data of its customers online. A bank providing online services will be using online data storage for the records. A university may provide the facility of viewing results online. People take online exams like GRE, GAT etc. As it is clear from the above examples, some really sensitive data is available online. All these advances in data manipulation have given birth to a new issue known as **Data Security**. If some unauthorized user views or obtains this data, the whole organization may suffer irrepairable losses ultimately.

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It is obvious from the above discussion that the security of data is necessary for the existence of many organizations and for all kinds of online services. To understand the process of making the data secure, let us first see in what ways the data can be misused if not secured properly. In recent years, the computer technology has become available to everybody at a very cheap cost. Also specialized software packages are producing all kinds of solution at a very low price. The result of all the advancement in the technology and its affordability has made it possible to use computers in all fields of life. For example computers are being used to monitor weather conditions, to monitor defense projects in controlling sensitive process like controlling atomic reactors etc. Business people are using computers for performing calculation, keeping records of employees, recording of customers transactions and provide them better services throughout the country or world. Hospitals are keeping patient records, sorted and updated by using different criteria. Schools and universities are keeping all records of students, examinations, accounts, libraries etc on a computer to provide instantaneous access of data to administrators and the students. You name any field of life and computers are there to be used, to efficiently process data accordingly.

Internet has connected millions of computers and people together and it has made possible the e-commerce, m-commerce etc. Now you can purchase books, clothes, and all kinds of stuff online, by using credit cards. In today's world, online markets are available for all kind of shopping like software, hardware, electronics, medical equipment etc.

In today's world, many networks are connected together and are sharing all kinds of information amongst the users, using email, SMS and other programs for instantaneous communication across the world.

6.2.1 Security Violations

Following are some of the ways in which the security of data may be violated.

- Someone may break into the computer room and take away all storage devices housing sensitive data.
- Unauthorized users may take access to personal data of someone and then use it to gain some advantage. For example if someone gets access to your credit card number then he can use it to do online shopping from your account.
- An unauthorized user may use an online mail server, like mail.yahoo.com to view email message of other users hence causing privacy issues.
- Someone can send a virus onto a network causing the network to

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- Some users may gain unauthorized access to bank accounts and transfer a large amount of money from other accounts to his personal account.
- A person may make a computer so busy by sending many requests so that the computer becomes unavailable to authorized users. This is called denial of service situation.

6.2.2 Security Threats

Following are the main threats to Data Security:

- Some authorized user of the data may unintentionally delete or change sensitive data. There are two solutions to this problem. Firstly, the users must be assigned proper rights to minimize such events. Only the authorized users with certain rights may be allowed to delete or modify data after following a step-by-step process. Secondly, periodic backup of data should be taken to recover from this sort of situation.
- Another solution to these types of problems is that proper password protection should be used to use any resource. A log file should also be maintained to keep track of all the activities on the data/files.
- Some strong encryption algorithm should be used, so that if someone gets access to the data, he / she should not be able to make any sense out of it.
- The solution to infected data is that proper virus scanning software should be used to scan all data coming into the organization.
- Computers and all backing storage devices should be placed in locked rooms with only authorized access to these resources.
- Authorized users must be asked to change their passwords periodically. Very short and common passwords should be avoided.

6.2.3 Data Protection

As discussed in the beginning of this chapter, many organizations gathered data about their employees customers. Some of this data is needed for (purely) efficiently processing the business transactions. For example, a hospital having data about the disease history of patients. All the personal data kept by different organizations may by disclosed by the organization for some legal purposes. For example in the hospital case, the medical researches may use the patient personal data, like his medical history, or any other fields to draw some conclusions. But if the hospital management distributes that data

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case when the patient has some mental disorder or has a bad history. The data protection rules refer to such a case, it means that any personal data kept by some organization should never be disclosed to unauthorized persons / organization under any circumstances.

6.2.4 Privacy Issue

An individual has a right to see the data kept about him. For this, he has the right to submit an application to view that data any time.

He also has the right to stop the processing of his data by the organization. He also has a right to claim a compensation from the organization for any kind of disclosure of data disallowed by the law.

No worker of the organization is allowed to disclose or use the data kept by its organization and if he fails to abide by, he is committing a crime.

It is clear from this discussion that data protection act tries to minimize the misuse of personal information to provide a safeguard against such crime. Also an organization collecting data should collect only the data adequate necessary for its working and should not collect un-necessary data.

The following points should be considered to ensure the individual's privacy.

- The organization is responsible for keeping the data updated.
- The organization should keep data for the specified period of time only and can not keep it longer than necessary.
- At no point during the processing of data, the rights of the subject should be violated.
- The organization is responsible for all kinds of security of data.

6.3 Data Protection Legislation and Copyright Issues

The data legislation is being improved with the time and may include many more laws for the protection of data in future but the underlying basic principle (legislation) are same for all new laws.

6.3.1 Legislation

The data protection legislation defines the laws that ensure data protection. Many countries have defined the data protection legislation and in some advanced western countries; this law is enforced properly as well. The data protection legislation of different countries is based on same basic principles. In this section, we will discuss these basic principles so that you can get some idea of why data protection act is needed. The detailed Data

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The principles of Data Protection Acts are as follows:

- The purpose of keeping and distrusting personal data must be clearly defined by organization obtaining that data.
- The individual about whom data is kept, must be informed about the identity of the organization / individual. The processing is necessary to fulfill of the contract between two parties. The processing is required by law or is necessary to carry out interest of the individual.

6.4 Important Privacy Acts

Note: In this regard Acts may also be consulted.

The **1980 Privacy Protection Act**, which prohibits agents of federal government from making unannounced, searches of press office if no one there is suspected of a crime.

The **1984 Cable Communications Policy Act**, which restricts cable companies in the collection and sharing of information about their customers. It was the first piece of legislation to regulate the use of information, which is processed on computer. The "Data Protection Act 1984" is intended to protect the individual from unauthorized use and disclosure of personal information held on a computer system. It consists of the following eight principles:

- The information to be contained in personal data shall be obtained and the data shall be processed, fairly and lawfully.
- Personal data shall be held only for one or more specified and lawful purposes.
- Personal data held for any purpose shall not be used or disclosed in any manner incompatible with that purpose or those purposes.
- Personal data held for any purpose shall be adequate, relevant and not excessive in relation to that purpose or those purposes.
- Personal data shall be accurate and, where necessary, kept up to date.
- Personal data held for any purpose or purposes shall not be kept for longer than is necessary for that purpose or those purposes.
- An individual shall be entitled, at reasonable intervals and without undue delay or expense, to be informed by any data user whether he holds personal data of which that individual is the subject, to have access to any such data, and where appropriate, to have such data corrected or erased.
- Appropriate security measures shall be taken against unauthorized access

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The **1987 Computer Security Act**, which makes actions that affect the computer security files and telecommunication illegal.

The **1988 Video Privacy Protection Act 1988,** which prevents retailers from disclosing a person's video rental records without a court order; privacy supporters want the same rule for medical and insurance files. Another step in that direction is the Computer **Matching and Privacy Protection Act of 1988,** which prevents the government from comparing certain records in an attempt to find a match. However, most comparisons are still unregulated.

The **Computer Misuse Act 1990** to make provision for securing computer material against unauthorized access or modification; and for connected purposes. The **Computer Misuse Act 1990** was passed to deal with the problem of hacking of computer systems. In the early days of hacking the problem wasn't taken very seriously – it was seen as mischievous behaviour, rather than as something, which could cause serious loss or problems to companies, organizations and individuals. However, with developments in technology the issue has become more serious and hence legislation was introduced to recognize three key offences:

- Unauthorized access to computer material.
- Unauthorized access with intent to commit or facilitate commission of further offences.
- Unauthorized modification of computer material.

The **1998 Data Protection Act** came into force early in 1999 and covers how information about living identifiable persons is used. It is much broader in scope than the earlier 1984 act, but does contain some provision for a transitional period for compliance with the new requirements. The 1998 Act applies to:

- computerised personal data ;
- personal data held in structured manual files .

It applies to anything at all done to personal data ("processing"), including collection, use, disclosure, destruction and merely holding personal data.

6.5 The Copyright Act

The principal law governing software piracy is the "Copyright Act 1976". Some amendments were made in this in 1983 and now **software piracy** is believed to be a punishable crime involving huge amounts of penalties. It is justified because software is believed to be an "intellectual property" that has been developed and brought into market after a lot of effort and cost. So, its future financial interests must

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Exercise 6C

1. Fill in the blanks:

(i) Making illegal copies of copyrighted software is called_____

(ii) A special program that can detect and remove viruses from computer is called _____

(iii) Software that is available free for a limited period is called_____

(iv) When the virus starts to impact on data, it is known as_____

(v) IR stands for_____

(vi) _____ is a software used for data compression

(vii) The right to use the software on the computer is called _____

(viii) Software is a _____ of person who developed it.

2. Choose the correct option:

(i) A virus program is usually hidden in

(a) The operating system only

(b) An application program only

(c) The disk drive

(d) The operating system or application programs

(ii) Most computer crimes are committed by

(a) Hackers

(b) International spies

(c) Highly trained computer consultants

(d) Company insiders who have no extraordinary technical ingenuity

(iii) Types of software that can be freely distributed without violating copyright laws are called

(a) Shareware (b) Public domain

(c) Copy protected (d) a and b

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(iv) Information is

(a) A marketable commodity

(b) Can be stolen while leaving the original behind

(c) Should be free, according to the original hacker ethic

(d) All of above

(v) A virus that replicates itself is called a

(a) Bug (b) Worm

(c) Vaccine (d) Bomb

(vi) Another name for free software

(a) Encrypted software (b) Copy protected software

(c) Public domain software (d) Shareware

(vii) Another name for anti virus is

(a) Vaccine (b) Worm

(c) Trojan horse (d) DES

(viii) Security protection for personal computers include

(a) Internal components (b) Locks and cables

(c) Software (d) All of these

(ix) A secret word or numbers to be typed in on a keyboard before any activity can take place are called

(a) Biometric data (b) Data encryption

(c) Password (d) Private word

(x) What is the most common computer crime of these listed below

(a) Extortion of bank funds (b) IRS database sabotage

(c) Putting people on junk mailing lists (d) Software piracy

3. Write T for true and F for false statements:

(i) Software error can result in data loss

(ii) Any person can change password

(iii) All viruses activate in exactly the same manner

(iv) A full backup means that once a week you can perform a complete

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(v) IR stands for intellectual rights

(vi) A computer virus is a part of hardware

(vii) Passwords, auditor checks and separation of employee functions are data protection techniques

(viii) No one has ever been able to read encrypted messages without key

(ix) It is legitimate to make a copy of software for backup purpose

(x) The computer fraud and abuse act of 1984 defines software piracy as crime

4. What is computer virus?

5. Define the anti-virus software.

6. How viruses may damage computer system?

7. Define Data protection Piracy acts.

8. Describe the Legislation and Copyright Issues.

9. Define the types of viruses.

10. What is a password?

11. Write the names and define briefly the antivirus.

12. Describe the exemption of 1990 act.

Answers

1. (i) piracy (ii) anti-virus (iii) shareware
(iv) virus attack (v) input request (vi) winzip
(vii) licence (viii) property

2. (i) d (ii) c (iii) b (iv) d (v) b
(vi) c (vii) a (viii) d (ix) c (x) c

3. (i) T (ii) F (iii) F (iv) F (v) F
(vi) F (vii) T (viii) F (ix) T (x) T

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CHAPTER 7 Windows Operating System

Overview

An **operating system** is system software that provides an interface for the user to interact with the computer. Without a computer Operating System a computer would be useless. The purpose of an operating system is to organize and control hardware and software so that the devices it manages behave in a flexible but predictable way.

7.1 Types of Operating System

Operating systems are classified on the basis of various features such as user interaction, how many tasks they can perform at a time, and how many processors they can support etc. On the basis of user interaction there are two types of operating system

- GUI (Graphical User Interface) Operating system
- Command Line Operating System

7.1.1 Graphical User Interface Operating System

A GUI operating system provides a graphical user interface to establish the user communication with the computer. The user does not require memorizing commands to perform various tasks such as copying a file, opening a document, printing a spreadsheet etc. The user uses graphical objects (e.g. icon, windows, buttons etc) to perform different tasks. He/She just requires recognizing various graphical objects and tasks that can be performed with them. Examples of GUI operating system are Windows, Linux, and Solaris etc.

7.1.2 Command Line Operating System

A command line operating system provides a command prompt to the user for typing different commands to interact with the computer. The user needs to memorize commands to perform deferent tasks. Examples of Command line operating system are DOS (Disk Operating System), Unix etc.

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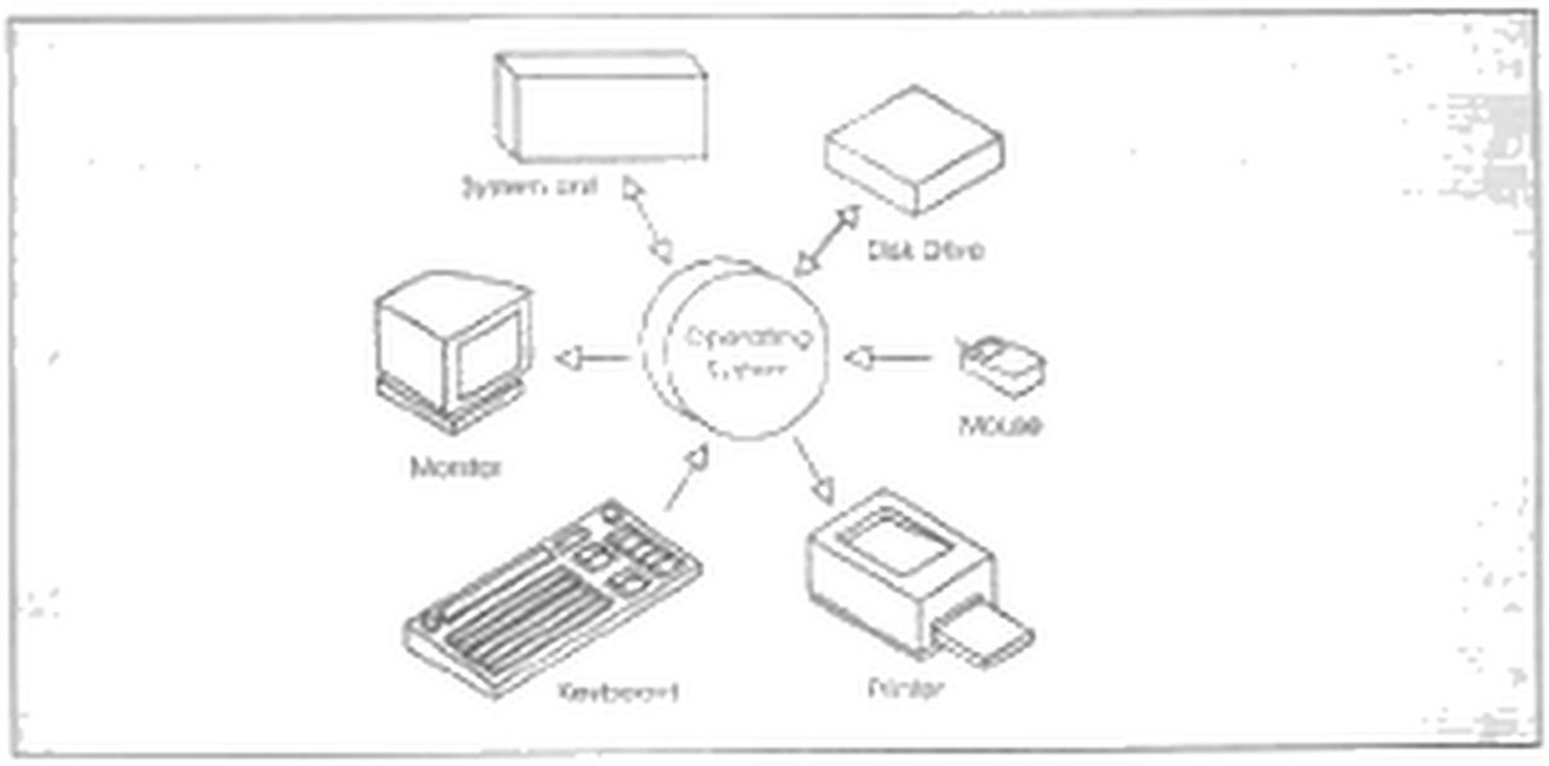


Figure 7.1: Operating System

7.1.3 Command Line Interface Operating System Vs Graphical User Interface Operating System

Feature	Command Line O.S.	GUI O.S.
Ease	Because of the memorization and familiarity needed to operate a command line interface new users find it much more difficult to successfully navigate and operate a command line interface.	Although new users may have a difficult at time learning to use the mouse to operate and use a GUI most users pick up this interface much easier when compared to a command line interface.
Control	Users have much more control of their file system and operating system in a command line interface. For example users can easily copy a specific type of file from one location to another with a one-line command.	Although a GUI offers plenty of control of a file system and operating system, often advance users or users who need to do specific task may need to resort to a command line to complete that task
Multitasking	Although many command line environments are capable of multitasking they do not offer the same ease and ability to view multiple things at once on one screen.	GUI users have windows that enable a user to easily view, control, and manipulate multiple tasks at once and are commonly much faster.
Speed	Because command line users	A GUI may be easier to use

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	command line interface and often only need to execute a few lines to perform a task. An advanced command line interface user would be able to get something done faster.	and/or keyboard to navigate and control your operating system for many tasks is going to be much slower in this case.
Scripting	A command line interface enables a user to easily script a sequence of commands to perform a task or execute a program.	Although a GUI enables a user to create shortcuts, tasks, or other similar actions to complete a task or run a program it doesn't even come close in comparison to what is available through a command line.

7.1.4 Purpose of Operating System

At the simplest level, there are two basic purpose of an operating system:

- It manages the hardware and software resources of the system. These resources include the processor, memory, disk space, etc.
- It provides a stable, consistent way for applications to deal with the hardware without having to know all the details of the hardware.

7.2 Starting to Use Windows Operating System

Windows is a GUI operating system developed by Microsoft Corporation. It is widely used in businesses, educational institutes, and research organizations. The first successful series of Windows was Windows 3.x series. Windows 3.x was not an operating system; it was rather an operating environment providing a GUI that runs on top of DOS, replacing the command line interface with a point-and-click system.

In 1995, Microsoft released **Windows 95,** a complete operating system for Personal computers. Windows 98 was an improved version of Windows 95 from Microsoft, released in 1998. Meanwhile Microsoft concentrated on incorporating networking features in Windows. So the company released Windows NT (New Technology) with extensive networking features. Since then, all recent versions of Windows i.e. Windows 2000 (server and professional), and Windows XP are based on NT Technology.

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7.2.1 Objects of Windows Operating System

Windows consists of number of graphical objects, which act as interface between user and the computer. It controls the overall working of the computer system, manages system resources, and provides a multitasking environment for the user to perform more than one task simultaneously.

The following are the basic components of Windows Operating System:

- **Desktop:** The on-screen work area on which windows, icons, menus, and dialog boxes appear is called desktop. The desktop is actually the entering point in Windows. The first object that you see on starting windows is the desktop (screen). It contains icons (images) for working with different applications that you need to interact with on regular basis.
- **My Computer:** On windows Desktop, you will see and icon captioned **My computer.** While installing windows, you divide the hard disk into multiple partitions; each one is referred to as a drive. When you double click the My Computer icon, it shows you all drives on your system including a floppy drive, and CD drive. These drives are represented as icons in a window.
- **Recycle Bin:** You may create new folders and files on any drive. It may be required to delete them. When you delete a file or folder, it does not remove from the hard disk permanently. Rather Windows maintain a storage area on the hard disk for storing the deleted items. This storage space is named as Recycle Bin. The deleted items are moved to Recycle Bin. You can permanently delete or restore them from Recycle Bin.
- **My Documents:** It a folder created by windows on installation time. It is the default folder for storing different kinds of documents. If you create a document in Microsoft Word or MS Excel and don't specify the location where it should be saved, then by default windows will save it in my documents folder.
- **Windows Explorer:** Windows Explorer acts as a directory browser and File Manager for Windows. It is an efficient way for locating and managing files on your computer. Using Explorer you can easily browse through all the drives and network resources available.
- **Internet Explorer:** Internet Explorer is web browser that is launched with Microsoft Windows Operating system. It is used to surf Internet. It is powerful web browser providing advance features to work on

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- **The Window:** The most important feature of windows operating system is a window. This is the basic building block of all graphical objects in Microsoft Windows. Windows view most of the graphical objects as a window such as button, menu, and toolbar etc. are treated as a separate window. Different applications starts in different window objects e.g. Internet explorer, windows explorer, MS Word, and MS Excel etc.
- **Control Panel:** Control Panel is the place where you can perform system management tasks such as installing/uninstalling new hardware devices, managing system resources through **Administrative tools**, sharing printers, and setting up date and time etc.
- **Start Button:** Start button is the gateway of accessing most of the programs installed on the computer. You can start any program by just making a mouse click, can open or find documents, can change windows settings, can get Help, can manage Files, can maintain system, and can do much more.

7.2.2 Working with Mouse and Keyboard

Mouse and keyboard are the basic input devices used with personal computers. Almost every operating system running on PCs provide interaction through these devices. Microsoft Windows captures different actions performed by the mouse and the keyboard. These actions are referred to as ***events.*** Here we discuss some important mouse and keyboard events:

Mouse Events: *Mouse events* are the action that can be performed by using the mouse. Following are the most common events triggered with a mouse:

- Left Click
- Right Click
- Drag etc.

Left Click: This event triggers when your press the left mouse button. Windows captures this event and performs certain tasks. Normally this event is used to select a graphical object such as a file icon or text in a document, or to press a button such as the start button and closing, opening or minimizing a window etc.

Right Click: This event triggers when you press the right mouse button. Most of the time, this event is used to view the properties of an object such as file, folder, desktop etc.

Drag: This event triggers when you press the left mouse button and move the mouse while keeping the left mouse button pressed. This event is used to select more than one items at a time, or to drop an object into another

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Keyboard Events: *Keyboard events* are the action that can be performed by using the keyboard. Different applications / programs perform different actions against these events Following are the most common events triggered with a mouse:

- Key Up
- Key Down etc.

Key Up: This event triggers when you release an already pressed key of the keyboard

Key Down: This event triggers when you press any of the keyboard's key.

7.2.3 Features of Windows

Microsoft Windows is a complete operating system. Their initial versions were lacking network support but almost all of the latest versions are providing networking features. We shall consider Windows 2000 while discussing features of Windows operating system.

- **Multitasking:** The capability of an operating system to load multiple programs into memory at one time and to perform two or more processes concurrently, such as printing a document while editing another is known as **multitasking**.

  Windows 2000 is a multitasking operating system. It let you execute multiple tasks at a time. And it responds to all tasks so quickly that it seems to be paying full attention to every task.

- **Multiprocessing:** Windows 2000 provide multiprocessing capability. It is capable of supporting and utilizing two or more microprocessors in a computer. A big task is divided into a number of small independent components, and each processor is assigned a different component. The processors work on different component in parallel. As a result the assigned task is completed in considerably short interval of time as compared to a single processing environment.
- **Multi-User Operating System:** Windows 2000 is a multi-user operating system. A multi-user Operating System allows for multiple users to use the same computer at the same time and/or different times.
- **Plug and Play:** Plug and Play refers to a set of specifications that allow a computer to automatically detect and configure a device, and install the appropriate device drivers.

  Windows 2000 is equipped with this feature. It has a mechanism defined that automatically detects a new hardware device. There are

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to install drivers for many devices, windows itself choose an appropriate one for you. However, sometimes you may need to install a driver for some devices if it is not available.

- **Networking:** Windows 2000 is equipped with full networking support. It provides features for establishing, maintaining and troubleshooting a network.

7.3 Disk Management

Windows has strong disk and file management capabilities. Before going into detail of Windows disk and file management features, it is important to understand some basic concepts about them.

Prior to Windows installation on a computer, the disk is divided into multiple partitions. A **partition** is a portion of physical disk that functions as though it were a physically separate disk.

Windows usually create two basic types of partitions, these are:

- Primary Partition
- Extended Partition

Primary Partition: A primary partition is one that can be used as the system partition. Windows 2000 and other operating systems can start from a primary partition. You can create up to four primary partitions on a basic disk, or three primary partitions and an extended partition. Primary partitions can be created only on basic disks and cannot be sub partitioned.

Extended Partitioned: Extended partition refers to a portion of a disk that can contain other partitions. Only one of the four partitions allowed per physical disk can be an extended partition, and no primary partition needs to be present to create an extended partition.

7.3.1 Disk Management Utility

The Disk Management utility gives you a graphical interface for viewing and performing maintenance on all of the hard drives and CD drives in your computer/server. You can see immediately whether your drives (both physical and logical) are healthy or not (figure 7.2).

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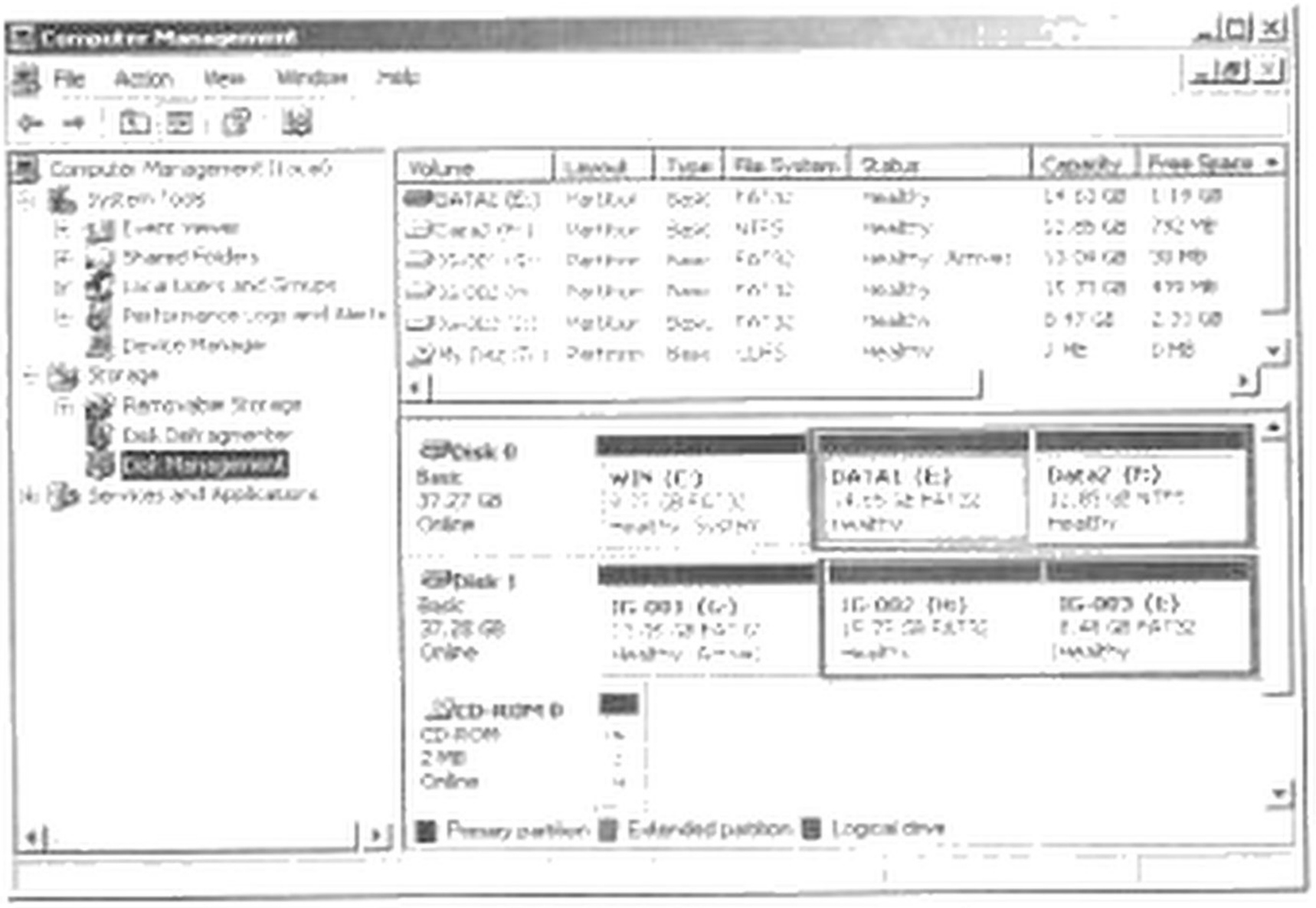


Figure 7.2: Disk Management Utility

As you can see, you can find the size of the drive, its size and file system and status at a glance. Disk management also indicates which drive contains the system partition. There are several different messages you can receive as to the status of the disks, and those are at times dependant on what type of disk it is.

7.4 File Management

Files are recognized by their extensions in Microsoft Windows. When you attempt to open a file, Windows checks the file extension against a database of registered file types (windows registry) to determine what action it should take. A registered file type can have multiple actions e.g. open and print etc. If windows does not recognize the file type, it offers a dialog box and lets you choose the appropriate applicatin to view the file (figure 7.3).

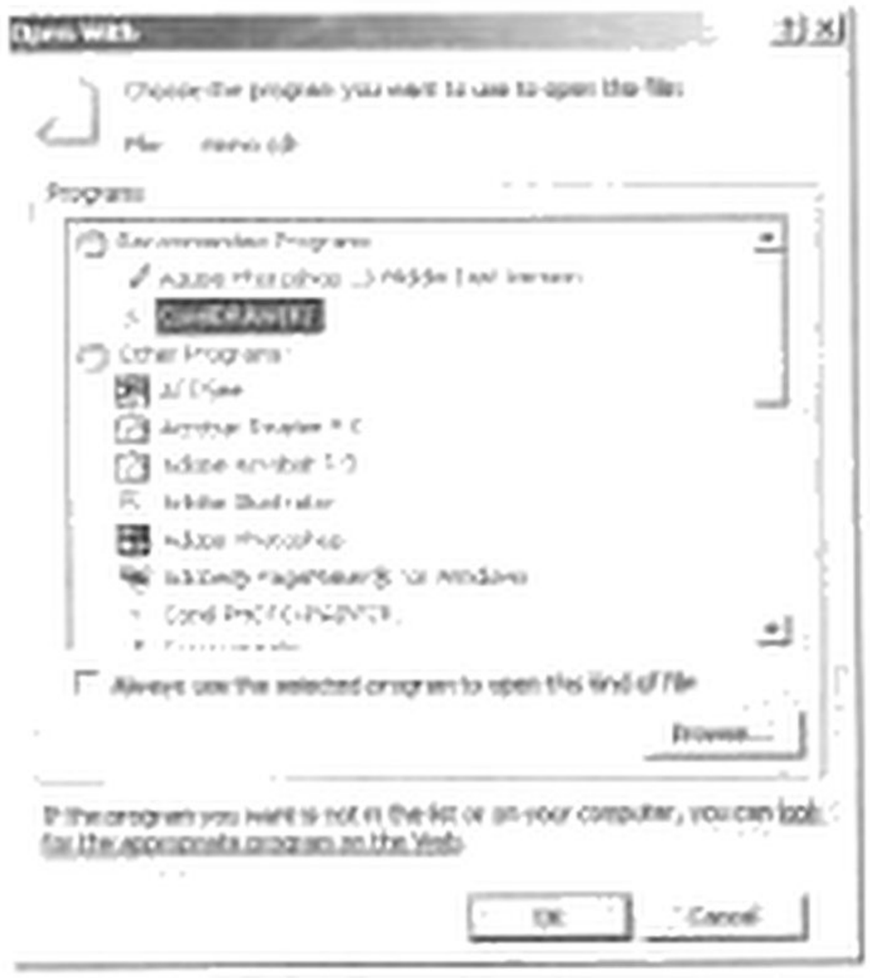


Figure 7.3: Opening document in

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7.4.1 Windows Explorer

Windows Explorer acts as a file manager in Windows Operating System. You can manage files and folders on your computer through Windows Explorer. Files and folders are the basic file management units in Window.

Windows explorer offers many actions that can be performed on files and folders. You can cut, copy, paste, rename or delete a file or folder from windows explorer. It shows files and folders in a hierarchical way. It contains two panes; left pane displays folders, and drives on your computer in a tree view shape whereas the right pane shows the detailed view of folder or drive selected in the left pane.

With windows explorer, not only you can manage the local files, folders and drives but also the remote files and folders.

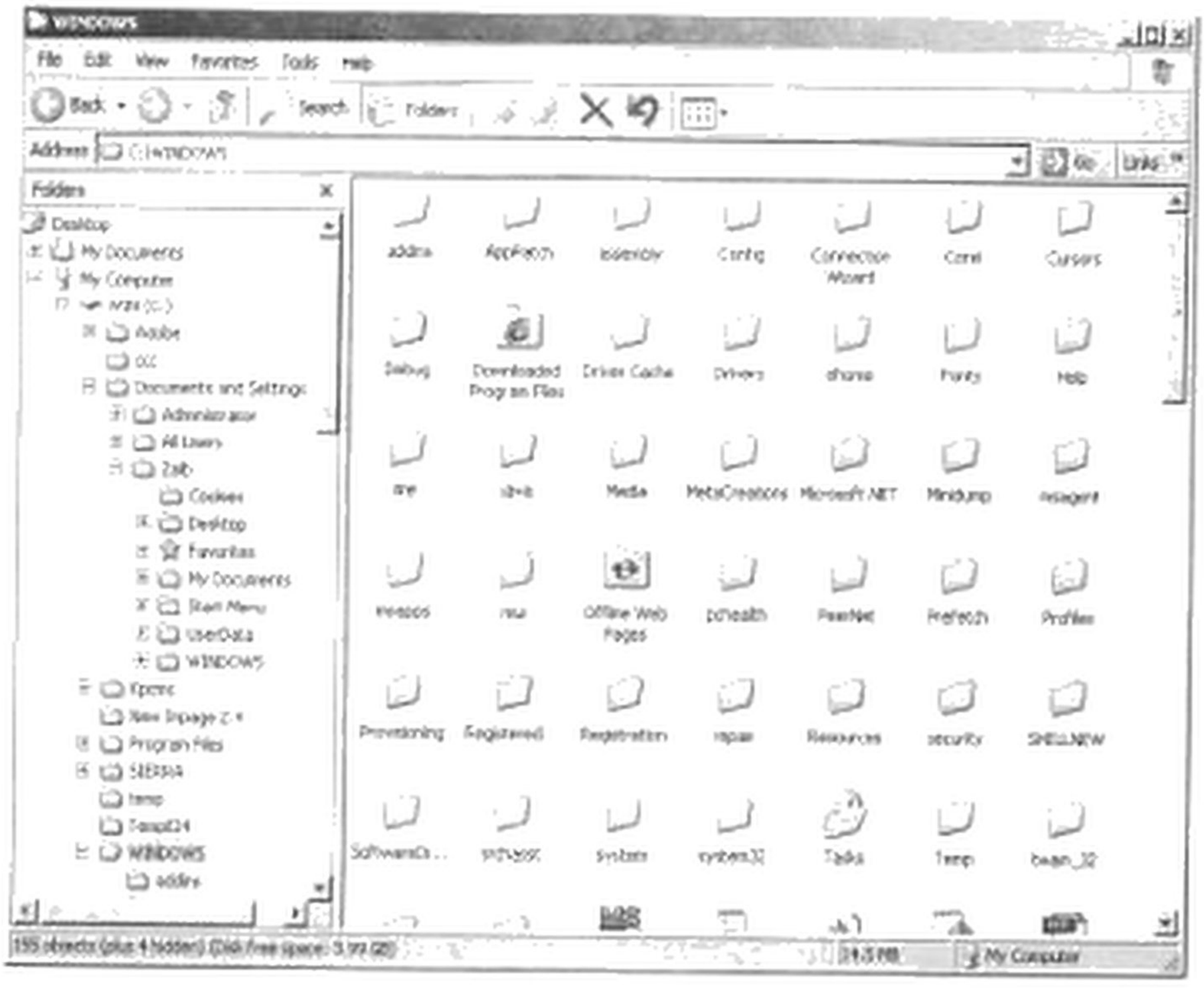


Figure 7.4: Windows Explorer

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7.5 Control Printing Jobs

Windows have powerful features to control printing jobs. Windows maintains a print queue for the jobs (documents) to be printed. You can share a printer on a network as well, so that the whole network can take advantage of the printer resource.

You can add multiple printers to your computer. But at a time only one of them will be assigned a default status. All jobs are directed to default printer by default. If you want to direct a particular job to another printer, you may specify at the time of printing. The default printer can be changed at any time by just selecting printers from the setting submenu of the **start** menu, and then setting on the option "set as default printer".

7.5.1 Adding a new printer

You can add a new printer to your computer by following these steps:

- Click **Start** button
- Follow the **settings** submenu
- Click **printer**
- A window will appear, double click the icon captioned **Add Printer**
- Follow the steps offered by the wizard to add a new printer

7.5.2 Print Queue

Windows maintain a print queue for all ongoing printing jobs. You can manipulate a printing job in multiple ways by just double clicking the printer icon (figure 7.5). You can follow the above-described steps to view the printer icon.



Figure 7.5: Printing options

You can cancel or stop a printing job at any time. Similarly many other printing options can be set such as changing the printing layout (landscape or

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Exercise 7C

1. Fill in the blanks:

(i) GUI stands for _____

(ii) The capability of an operating system to load multiple programs into memory at one time is called _____

(iii) With plug and play a computer can automatically _____ and _____ a device.

(iv) Multiple actions can be performed on a _____ file type _____ partition refers to a portion of a disk that can contain other partitions

(v) A _____ operating system allows multiple users to perform multiple tasks at the same time.

(vi) Windows explorer offers many actions that can be performed on _____ and _____

(vii) Windows maintain a _____ for all printing jobs.

(viii) All deleted items are stored in _____

(ix) The Disk Management utility gives you a _____ interface

2. Choose the correct option:

(i) An operating system is a

(a) System Utility (b) Application Software

(c) System software (d) Software package

(ii) Ctrl + Alt + Del is

(a) An invalid key combination (b) Recognized by windows only

(c) Used to close the active window (d) Both b and c

(iii) As compared to command line operating system, a GUI operating system is

(a) More efficient (b) Easier to use (c) More reliable (d) All of the above

(iv) The maximum number of primary partitions that can be created on a disk is

(a) Two (b) Three (c) Four (d) None of the above

(v) Windows explorer is used to

(a) Access the Internet (b) Explore system resources

(c) Perform maintenance on the hard disk

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Exercise 7C

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3. Write T for true and F for false statement:
   (i) Primary partitions can not be created on basic disks.
   (ii) Microsoft Windows is a single user operating system.
   (iii) In windows explorer, left pane displays folders and drives on your computer in a tree view shape.
   (iv) With Windows explorer, you can only manage the local files, folders and drives.
   (v) GUI was first introduced by Apple' s Macintosh computers.
   (vi) Operating system is responsible for the effective use of computer system.
   (vii) Maximum four primary partitions can be created on a basic disk.
   (viii) Windows checks the file extension against a database of registered file types.
   (ix) Disk management also indicates which drive contains the system partition.
   (x) Prior to Windows installation on a computer, the disk is partitioned.
4. Define operating system and discuss their types.
5. Give a comparison between Command Line operating system and Graphical User Interface.
6. Discuss different features of Windows 2000 operating system.
7. Write a short note on each of the following:
   • Disk Management Utility • Windows Explorer • Print Queue
8. What do you mean by *Plug and Play*? Does Windows 2000 provide this feature?
9. Define Partitioning. Briefly describe primary and extended partitioning.
10. Differentiate the following:
   • Multitasking and Multiprocessing • File Management and Disk Management
   • Single-User operating system and Multi-User operating system

Answers

1. (i) Graphical User Interface (ii) Multitasking (iii) Detect, Configure (iv) Registered
   (v) Extended (vi) Multi-User (vii) Files, Folders (viii) Print queue
   (ix) Recycle bin (x) Graphical
2. (i) c (ii) b (iii) b (iv) c (v) d
3. (i) F (ii) F (iii) T (iv) F (v) T

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CHAPTER 8 Word Processing

Overview

Word processing software is probably one of the most frequently used packages in any organization. People use it for everything from quick notes to complex, book-length documents. In fact, it has been estimated that more than 90 percent of all personal computers have a word processor installed. **Word processing** is more than just electronic typing. It involves creating, editing, formatting and printing documents in variety of form.

You may have observed hundreds of newspapers, magazines, letters and advertisements at your workplace, home and surrounding; these are all miracles of word processing software. Businesses, Government agencies, schools and individuals create thousands of documents for numerous purposes on daily basis. In this chapter we shall discuss different features of a word processor. To make clear concepts of these features we shall also discuss MS Word 2000 as an example.

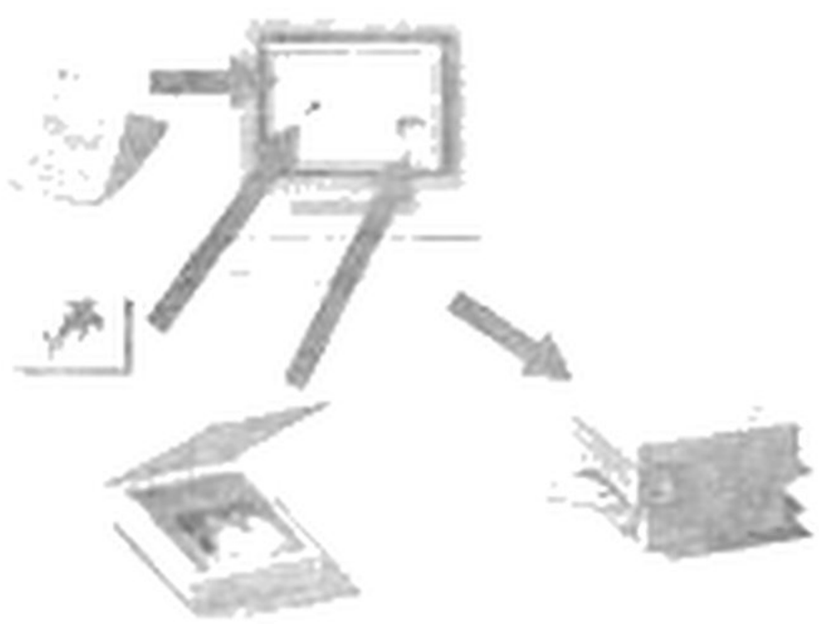


Figure 8.1: Word Processing

8.1 What is a Word Processor?

Word processor is an application (software) that provides extensive tools for creating all kinds of text-based documents. Word processor can manipulate not only the text but also it enables you to add images, sounds, charts and graphics in your document (figure 8.1). With some of advanced word processors you can embed video clips as well. Word processors can even create documents for publishing on the World Wide Web, complete with **hyperlinked*** text and graphics.

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The great advantage of word processing over using a typewriter is that you can make changes without retyping the entire document. If you make a typing mistake, you simply move back the cursor and correct your mistake. If you want to delete a paragraph, you simply remove it, without leaving a trace. It is equally easy to insert a word, sentence, or paragraph in the middle of a document. Word processors also make it easy to move sections of text from one place to another within a document, or between documents. When you have made all the changes you want, you can send the document to a printer to get a hardcopy.

8.2 A Simple Word Processor (Text Editor)

Word processors vary considerably, but all word processors support some basic features. Word processors that support only these basic features (and maybe a few others) are called **text editors** e.g. Word Pad, Note Pad etc. All word processors provide the following basic features:

- **Insert text:** Allows you to insert text anywhere in the document.
- **Delete text:** Allows you to erase characters, words, lines, or pages as easily as you can cross them out on paper.
- **Cut** and **Paste:** Allows you to remove (Cut) a section of text from one place in a document and insert (Paste) it somewhere else.
- **Copy:** Allows you to duplicate a section of text.
- **Page size and margin:** Allows you to define various page sizes and margins, and the word processor will automatically readjust the text so that it fits properly.
- **Search and Replace:** Allows you to direct the word processor to search for a particular word or phrase. You can also direct the word processor to replace one group of characters with another everywhere that the first group appears.
- **Word Wrap:** The word processor automatically moves to the next line when you have filled one line with text, and it will readjust text if you change the margins.
- **Print:** Allows you to send a document to a printer to get hardcopy.

8.3 Full-featured Word Processors

Most word processors, however, support additional features that enable you to manipulate and format documents in more sophisticated ways. These more advanced word processors are sometimes called **full-featured word processors**. Full-featured word processors usually support the following features:

- **File Management:** Many word processors contain file management capabilities that allow you to create, delete, move, and search for files.

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- **Font Specifications:** Allows you to change fonts within a document. For example, you can specify bold, italics, and underlining. Most word processors also let you change the font size and even the typeface.
- **Footnotes and Cross-references:** Automates the numbering and placement of footnotes and endnotes. Also lets you easily cross-reference other sections of the document.
- **Graphics:** Allows you to embed illustrations and graphs into a document. Some word processors let you create the illustrations within the word processor; others let you insert an illustration produced by a different program.
- **Headers, Footers, and Page Numbering:** Allows you to specify customized headers and footers that the word processor will put at the top and bottom of every page. The word processor automatically keeps track of page numbers so that the correct number appears on each page.
- **Layout:** Allows you to specify different margins within a single document and to specify various methods for indenting paragraphs.
- **Macros:** A *macro* is a character or word that represents a series of keystrokes. The keystrokes can represent text or commands. The ability to define macros allows you to save yourself a lot of time by replacing common combinations of keystrokes.
- **Merges:** Allows you to merge text from one file into another file. This is particularly useful for generating many files that have the same format but different data. Generating mailing labels is the classic example of using merges.
- **Spell Checkers:** A utility that allows you to check the spelling of words. It will highlight any words that it does not recognize.
- **Tables of Contents and Indexes:** Allows you to automatically create a table of contents and index based on special codes that you insert in the document.
- **Thesaurus:** A built-in thesaurus that allows you to search for synonyms without leaving the word processor.
- **Document Windows:** Allows you to edit two or more documents at the same time. Each document appears in a separate window. This is particularly valuable when working on a large project that consists of several different files.
- **WYSIWYG (What You See Is What You Get):** With WYSIWYG, a document appears on the display screen exactly as it will look when

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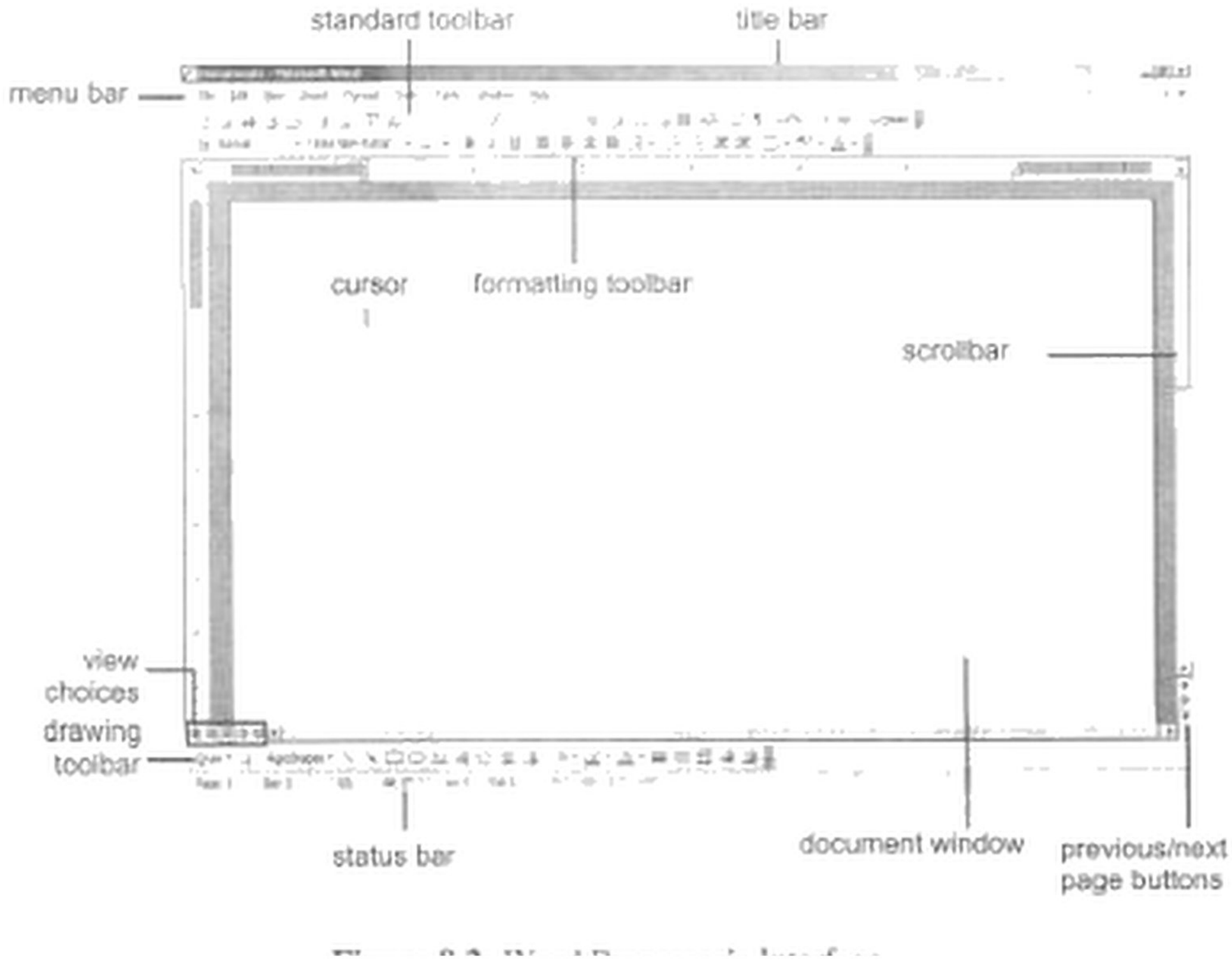
A full-featured word processor can even have many other features. Microsoft Word is one of the most popular full-featured word processors. To have practical knowledge of working with a word processor, let use explore MS Word.

8.4 Starting to Use Word Processor

To understand the working of a word processor you should be familiar with its **interface**. The interface represents the way through which you can interact with the word processing software.

8.4.1 The Word Processor's Interface

The word processor's interface consists of a main editing window that displays a document, and several tools to manipulate it. The tools, to work with the document, are grouped together in different toolbars (figure 8.2).



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Title Bar:	Displays the name of the active application and document along the top of a window.
Menu Bar:	Displays all menus
Standard Tool Bar:	Displays some of the most common word processing tasks, such as opening, copying and printing files etc.
Formatting Tool Bar:	The formatting toolbar contains buttons and options that can be used to apply commonly used text formats.
Ruler:	A ruler shows you the positioning of text, tabs, margins, indents and other elements on the page.
Document Window:	A rectangular portion of the screen in which you view and edit a document.
Status Bar:	Shows information and messages at the bottom of the window that Provides statistics about the position of the insertion point, the text you see on the screen, and the status of some important keys.

8.4.2 Entering and Editing Text

To create a document the text is entered by typing on the keyboard. The word processor places a blinking insertion point (also called a **cursor**) at the top left corner of the screen (document window). The cursor represents the position where the next character will be placed in the document. As you type the cursor moves forward onto the screen. On reaching at the end of the line the word processor automatically moves it to the start of the next line.

Unlike typewriter word processing software lets you change text without retyping the entire document. Changing an existing document is called **editing** the document. There are many ways to edit an existing document e.g. by typing new or by replacing an existing text with new one etc.

Typing Modes: All word processor provide two modes of typing:

- Insertion mode
- Overtype mode

In **insertion mode** the newly entered text is placed at the current position of the cursor whereas in case of **overtype mode** the newly entered text is written over the existing text.

Selecting Text: To change any attribute of the text it must be selected first. Select the text by dragging the mouse over the desired text while keeping the

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Erasing Text: Two keys on the keyboard are used to erase text from a document; these are **Delete** and **Back Space** keys. The Delete key erases the character to the right of the cursor whereas the Back Space key erases the character to the left of the cursor. Both the Delete and the Back Space keys erase just one character at a time. To erase more characters, select them first and then press the Delete key.

Undo and Redo: While editing you may need to reverse the changes you have made to the document. For this purpose the **undo** option can be used. If you *undo* a change and then decide that the change was more appropriate and it should be reflected to the document, use **Redo** to reverse the previous *undo*.

Formatting Text: The formatting of a document includes changing the appearance of the text, adding pictures and graphics and controlling the layout of the text on the page. The formatting toolbar is the easiest way to change any attribute of text (figure 8.3).

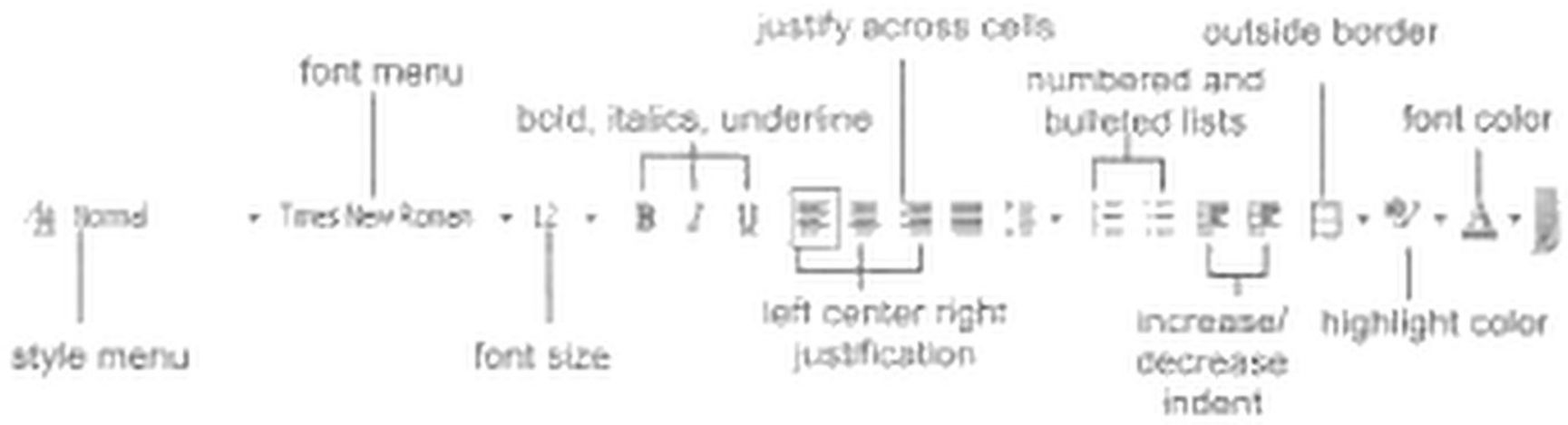


Figure 8.3: Formatting toolbar

8.4.3 Formatting Fonts

The font refers to the characteristics of letters, symbols, and punctuation marks in the document. Same characters in different fonts have different appearance. There are two general categories of fonts:

- Serif
- Sans-Serif

Serif fonts have curls or extra decorative lines at the ends of the strokes that make up each character e.g. Times New Roma; **sans-serif** fonts do not have e.g. Arial (figure 8.4).



Figure 8.4: Comparison of serif and sans serif fonts

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One of the major features of a word processor is its ability to work with fonts. Microsoft Word has number of features to manipulate fonts. The formatting toolbar contains a **font menu** through which many different types of fonts can be selected such as Courier, Book Antiqua, and Arial etc.

The following font characteristics greatly affect the appearance of text on the page

- **Font Size** can be set from the formatting toolbar (figure 8.3). Font size is measured in points. A common font size used in business documents is 12-points type.
- **Font Style** is used to bold, italicize and underline the text. Formatting toolbar contains separate buttons for all of these options.
- **Font Color** is used to change the color of the text.
- In addition to these basic characteristics many **effects** can also be applied to all types of fonts e.g. strikethrough, shadow, and outline etc.

The **Font** dialog box allows you to choose from a larger selection of formatting options. Select **Format|Font** from the menu bar to access the Font dialog box.

8.4.4 Formatting Paragraph

Paragraph is defined as a group of sentences. But to a word processor the word 'paragraph' have slightly different meanings. Word processors assume the start of a new paragraph every time you press the enter key. Paragraph formatting includes settings applied only to one or more entire paragraphs. The settings include line spacing, paragraph spacing, indents, alignment, tab stops, borders and shadings etc.

In **MS Word**, to format a paragraph, place the cursor within the paragraph and select **Format|Paragraph** from the menu bar. The following dialog box will appear:

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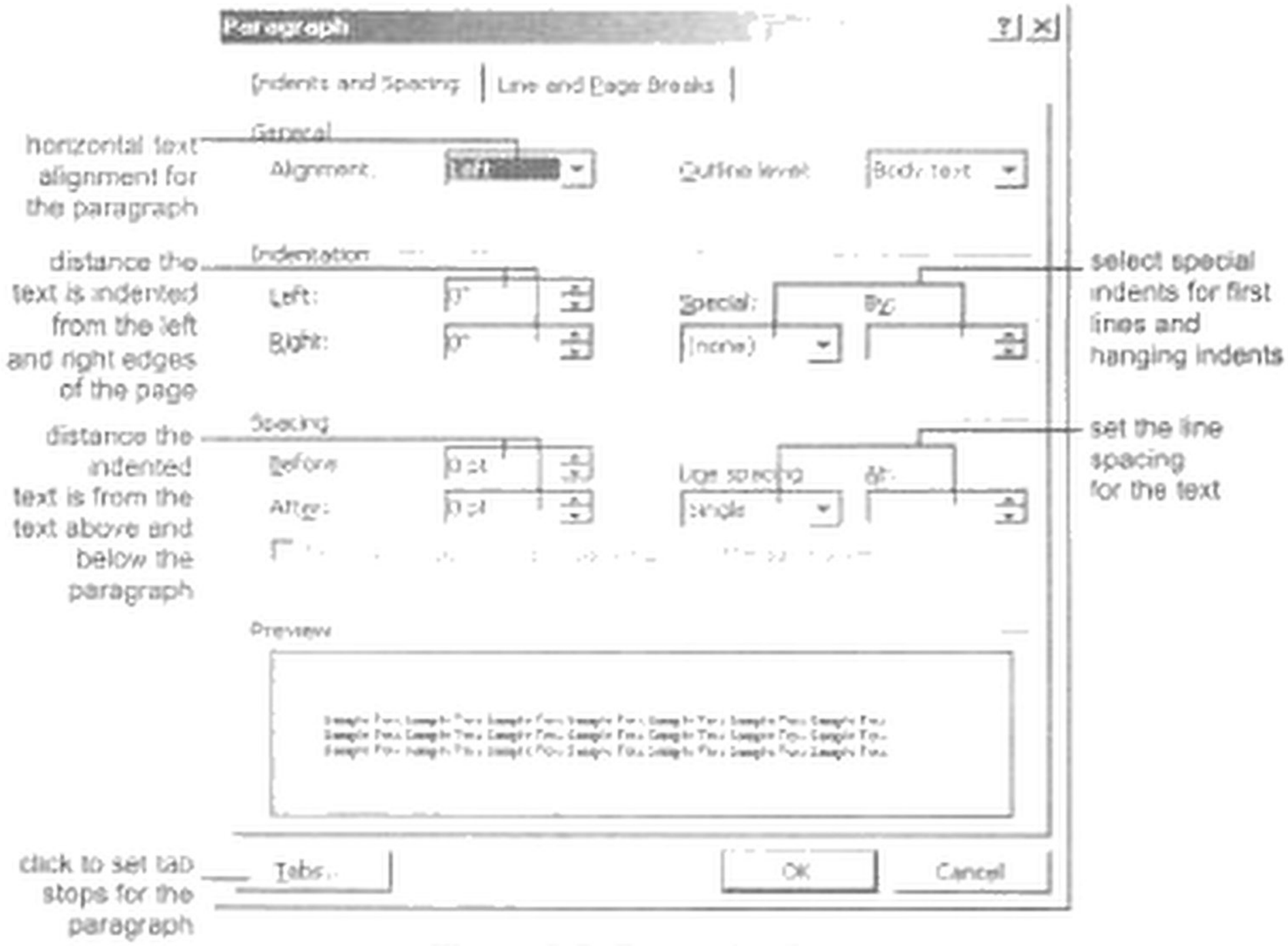


Figure 8.5: Formatting Paragraph

Here you can select the indentation (left and right), the special paragraph spacing (none, first line indent, or hanging indent), spacing **before** or **after** the paragraph, and the Line Spacing (single, 1.5, double, 2.5, triple, etc.).

- **Line and Paragraph Spacing:** Line and paragraph spacing is well controlled in MS Word. You can define the space between different lines of text in a paragraph. The characteristic is known as **line spacing**. Lines can be single-spaced, double-spaced or set to any spacing you want. **Paragraph Spacing** refers to amount of space between paragraphs. By default the paragraph spacing is same as the line spacing but it can be changed.
- **Margins** define the boundaries of the text. The text cannot cross these boundaries. In every document all the four margins (top, bottom, left and right) can be the same or different.
- **Indents** determine the distance of each line of a paragraph to margins. You may indent some text in the document to highlight it. You can set

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can select the paragraph (or paragraphs) that you want to indent and use the **RULER** located above the document to create the indents.

- **Alignment** refers to the orientation of the lines of a paragraph with respect to the margins. There are four alignment options – left, right, center and justified. The text to be aligned is first selected then alignment can be set from the formatting toolbar by using any of the following buttons.

Left Align	Right Align	Center Align	Justify Align
			

- A **Tab stop** is a position in the document usually measured from left to right. The keyboard's **Tab** key moves the insertion point (Cursor) forward, to the right, until it encounters a **tab stop**.
- Paragraph can be formatted with **borders** or **Shading**.

8.4.5 Formatting a Page

Page formatting refers to the size of the page, its orientation, and headers and footers. There are many other features that can be applied to page formatting. For formatting a page in MS Word, Select **File | Page Setup** and choose the **Paper Size** tab.

- **Page Size** plays an important role in the formatting of the page. Page formatting changes according to size of the page. Changing the size of the page can disturb the formatting of the whole document. So it is strictly recommended to set the page size before going to format it.
- Document dimensions are also determined by the **orientation** of the paper. By default the documents are set to use **portrait** orientation, where the document is taller that it is wide. You can also use the **landscape** orientation, where the document is wider that it is tall.
- A **header** is text that is added to the top margin of every page such as a document title or page number and footer is text added to the bottom margin. Select **View | Header and Footer** from the menu bar. The Header and Footer toolbar will appear and the top of the page will be highlighted.
- Page numbers can be assigned to every page of the document. Select **Insert | Page Numbers** to number the pages of the document.

8.4.6 Introducing Columns

You may need to present the text in columns within your document. For example in most of the newspapers and in some of the magazines the text

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Columns are very effective format for certain types of documents. Presenting text in columns is a powerful feature of MS Word. It is very easy to make columns of the text. You can make two, three or more columns by just clicking a single button on formatting tool bar.

To place the text in columns, select **Format|Columns** from the menu bar. The **Columns** dialog box allows you to choose the properties of the columns (figure 8.6). Select the number and width of the columns from the dialog box.

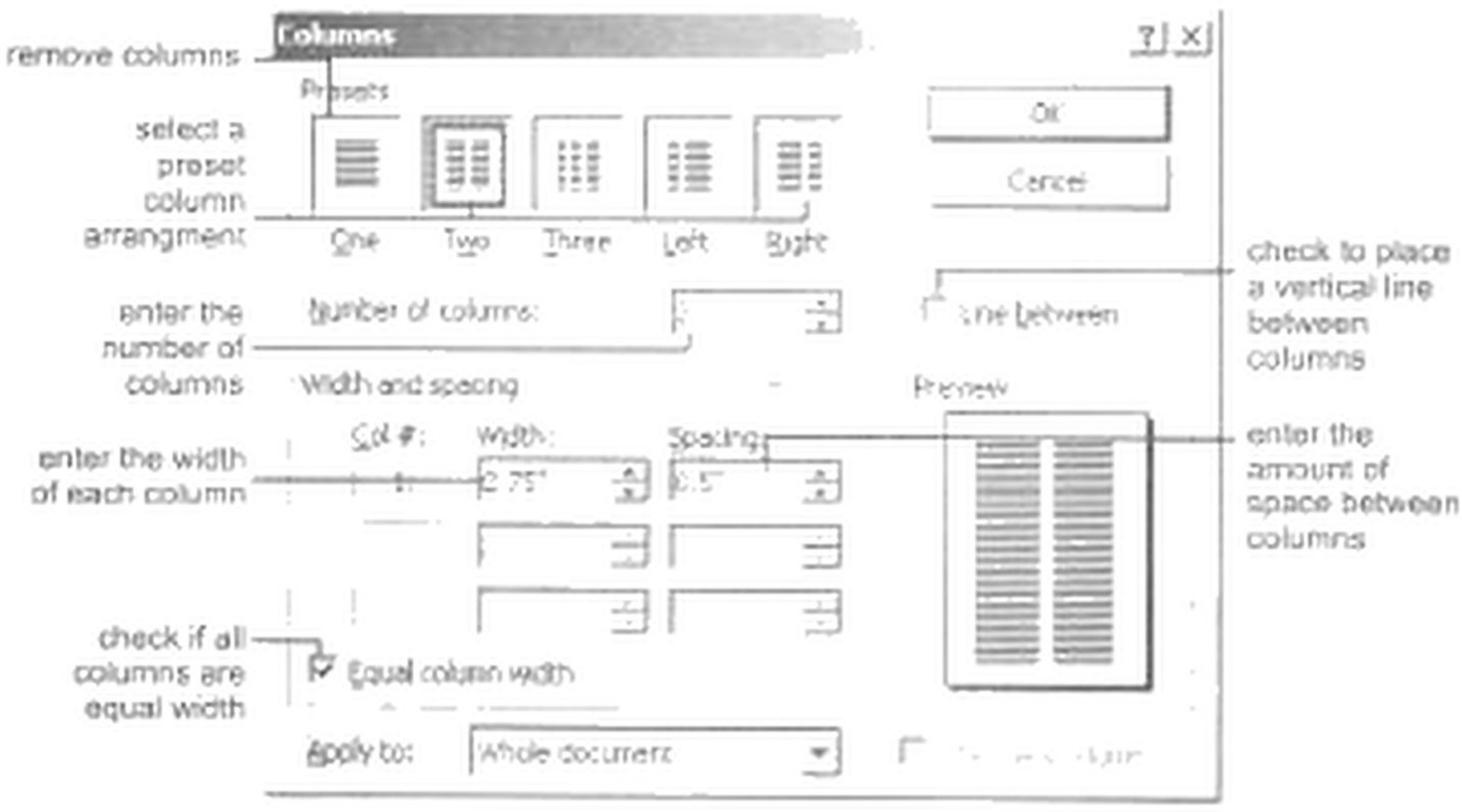


Figure 8.6: Making columns

8.4.7 Introducing Tables

Tables are used to display data. Most of the word processors provide you feature to create tables in few steps. The size of the table is limited to only by the amount of page space that can be devoted to it, and tables can be formatted in dozens of ways. Tables are also useful for arranging images and text on a page. You can intelligently use tables to create customized page layout.

- **Creating a Table:** There are multiple ways to create a table. The easiest one is to create from the menu bar. Select **Table|Insert|Table** from the menu bar. Select the number of rows and columns for the table and click **OK** (figure 8.7).

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Figure 8.7: Specifying number of rows and columns

- **Inserting Rows and Columns:** Once the table is created, additional rows and columns may be inserted into it. Place the cursor in the row or column you want to be adjacent to the new row or column, and Select **Table | Insert | Rows Above** or **Rows Below** or, Select **Table | Insert | Columns to the Left** or **Columns to the Right.**
- **Moving and Resizing a Table:** A four-sided moving arrow and open box resizing handle will appear on the corners of the table if the mouse is placed over the table (figure 8.8). Click and drag the four-ended arrow to move the table and release the mouse button when the table is positioned where you want it. Click and drag the open box handle to resize the table. Change the column widths and row heights by clicking the cell dividers and dragging them with the mouse.



Figure 8.8: Moving and resizing table

Moreover borders and shading can also be applied to the tables. You can even find many other options to work with tables.

8.4.8 Printing a Document

Once you have completed your document, you have the ability to print it out. All word processing programs provide this feature. Select **File|Print** from the menu bar (figure 8.9).

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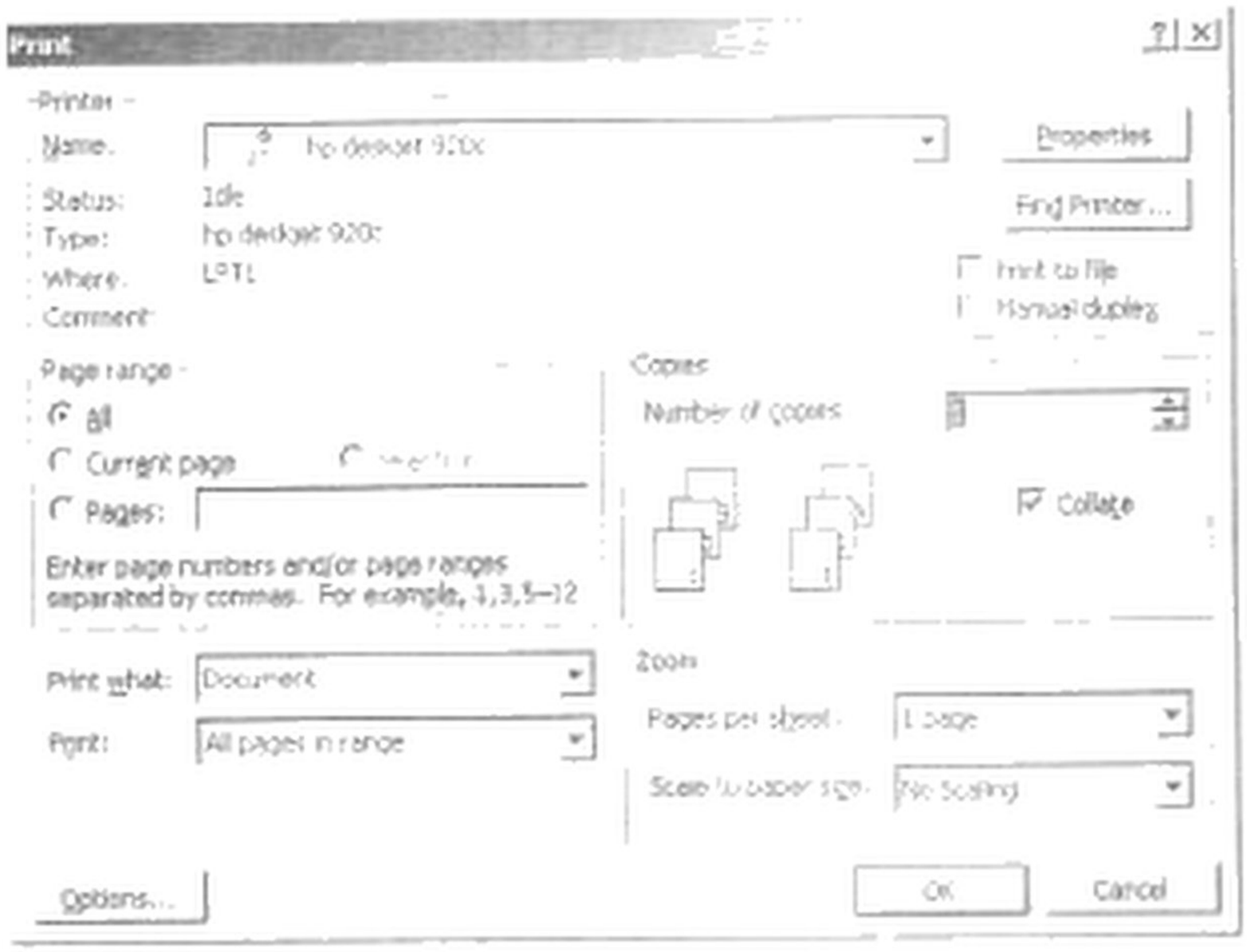


Figure 8.9: Print dialog box

The print dialog box specify many print options, such as pages per sheet, scaling, number of copies to be printed etc. you can print a document on the or to a file by just setting the **print to file** option.

8.4.9 Using Clipboard

The clipboard is a temporary holding space in the computer's memory for data that is being copied or moved. The Clipboard is used for storing text, graphics, sound, video or other data. After data has been placed in the clipboard, it can be inserted from the clipboard into other documents, in the same application or in a different application.

For example, if you want to move a paragraph in a document, select the paragraph, and then choose the **Cut** command; the data is removed from the document and placed on the Clipboard (If you don't want to remove the paragraph from the original document then use Copy command). After placing the insertion point in the document where you wand to place the paragraph, you choose the **paste** command; the data on the Clipboard is placed into the document. In the same way the Clipboard can be used to move data from one document to another. One important thing about the Clipboard is that it is part of the operating system; it is not a separate application.

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8.4.10 Using Text Boxes

Sometimes you need to move text around on a page, free of the usual constraint of paragraphs, margins and so on. For example, you might want to place attention-getting text in margins. Or you might want to create letterhead in which the body of letters wraps around the block of material containing your name, address, and so forth.

MS Word offers you considerable flexibility in sizing and positioning text boxes, bordering and shading text boxes, rotating the orientation of text with text boxes, and more. Text box can be created by selecting **Insert|Text Box** from the menu bar or by just clicking the textbox icon from the **drawing toolbar**.

The position of the text box within the text can be adjusted by first selecting the text box and then selecting the **format|text box** option from the format menu. Text boxes offer a handy way to highlight text in multicolumn documents by forcing a small block of text to span multiple columns (figure 8.10).

The clipboard is a temporary holding space in the computer's memory for data that is being copied or moved. The Clipboard is used for storing text, graphics, sound, video or other data. After data has been placed in the clipboard it can be inserted from the clipboard into other documents in the same application or in a different application. For example, if you want to move a paragraph in a document, select the paragraph, and then choose the Cut command, the data is removed from the document and placed on the Clipboard. If you don't want to remove the paragraph from the original document then use **Copy** command. After placing the insertion point in the document where you want to place the paragraph, you choose the **paste** command, the data on the Clipboard is placed into the document. In the same way the Clipboard can be used to move data from one document to another. One important thing about the Clipboard is that it is part of the operating system, it is not a separate application.

The Text Around

Figure 8.10: Text Box

8.4.11 Using Graphics and Word Art

The word processor remains incomplete without providing graphics handling features. Almost all word processors can handle text as well as graphics. MS Word contains number of tools for manipulating graphics. These

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vector images. Roughly speaking, bitmap graphics can be thought of as "painted" pictures, while vector graphics can be thought of as line drawings. Because of the technical difference between bitmap and vector images, different tools are used to work with each of them.

Pictures can be added to the document by selecting **insert|picture** option from the menu bar. Pictures can be inserted from a file, from Clip Art, from Scanner or Camera. Charts and Word Art can also be added to a document in the same way.

A picture toolbar is alternatively available to work with pictures in MS Word. This can be accessed by selecting **view|toolbars|picture** (figure 8.11). There are so many options in picture toolbar to manipulate a picture. You can work with the shape, color, brightness, and size etc. of the picture easily.



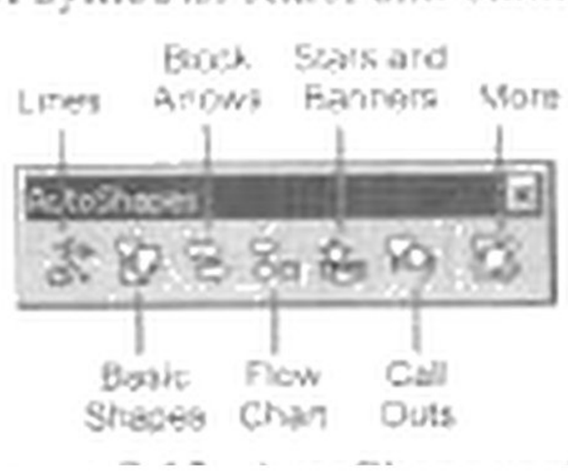
Figure 8.11: Picture toolbar

There are number of tools to work with vector images i.e. line drawings. Besides a drawing tool, Word provides basic shapes such as rectangle, and circle etc. that you can insert into your document. To work with the Word's Drawing tool select **view|toolbars|drawing**. The drawing toolbar contains many options for drawing lines and shapes as shown in figure 8.12.



Figure 8.12: Drawing Toolbar

There is an **AutoShapes** toolbar on the Drawing toolbar (figure 8.13). The AutoShapes toolbar will allow you to draw many different geometrical shapes, arrows, flow chart symbols, stars, and banners on the document.



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Word Art is a feature of Microsoft Word's drawing program. It transforms an ordinary text headline, word or phrase in a work of art. The text is transformed into an image that can be managed in variety of ways. The Word Art is done by selecting text, to be transformed into word art, and then selecting **insert | picture | Word Art**.

You have many options to select the Word Art style. To access it from the Drawing toolbar, go to the View menu and select **Toolbars | Drawing**. The Drawing toolbar appears at the bottom of the window. The Word Art button is a slanted **A** i.e.

. The Word Art can be launched by just pressing this button (figure 8.14).

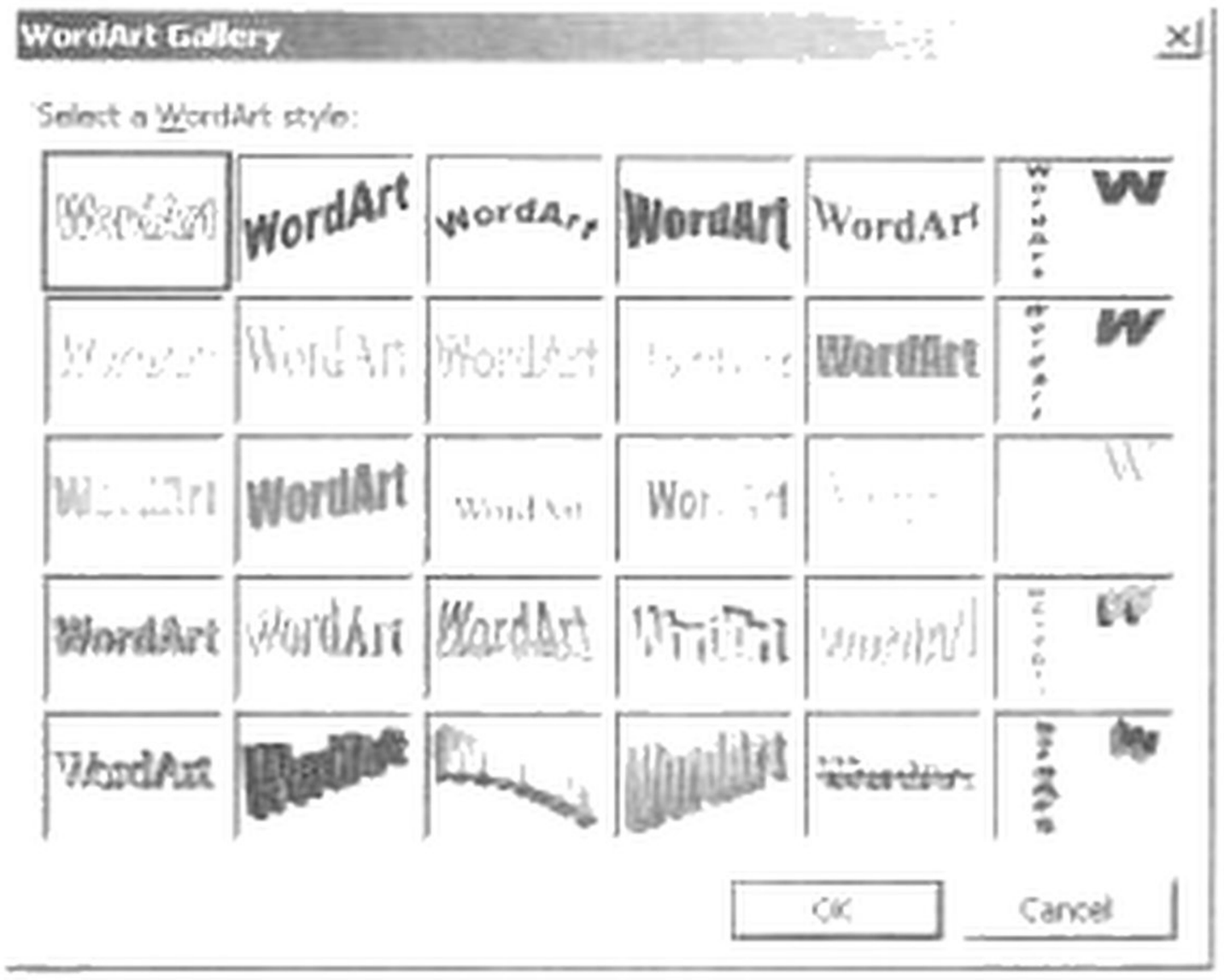


Figure 8.14: Word Art

On selecting a Word Art Style, the **Edit Word Art** dialog box appears. This allows you to **type in your text** and to **select the font** type, size and **to choose the style** i.e. bold, italic or underlined. As soon as you enter the text click the **ok** button, the **Word Art** toolbar will appear (figure 8.15). The toolbar contains buttons that will take you back to any of the steps you used to create WordArt.



Figure 8.15: Word Art Toolbar

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Exercise 8C

1. Fill in the blanks:

(i) The bar which contain the name of active application is known as _____

(ii) WYSIWYG stands for _____

(iii) The appearance or shape of a character is referred to as _____

(iv) The page orientation may be _____ or _____.

(v) _____ graphics can be thought of a painted pictures

(vi) The _____ automatically moves to the next line when you have filled one line with text.

(vii) A _____ is a character or word that represents a series of keystrokes

(viii) A built-in _____ allows you to search for synonyms

(ix) A _____ shows you the positioning of text, tabs, margins, indents and other elements on the page.

(x) In case of _____ mode the newly entered text is written over the existing text

3. Write T for true and F for false statement:

(i) Word processor is just an electronic typewriter.

(ii) The bar containing the drop down menus is called scroll bar.

(iii) Font face is shown on Formatting tool bar.

(iv) Footnote appears at the bottom of every page.

(v) The interface represents the way through which you can interact with the word processing software.

(vi) In insertion mode the newly entered text is placed at the current position of the cursor.

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(vii) Sans-Serif fonts have extra decorative lines at the ends of the strokes that make up each character

(viii) Alignment refers to the orientation of the lines of a paragraph with respect to the margins.

(ix) Line Spacing refers to amount of space between paragraphs

(x) Clipboard is managed by Microsoft Word

2. Select the correct option:

(i) Which of the following is a word processor

(a) Adobe Acrobat (b) Photo Express

(c) MS Excel (d) MS Word

(ii) Which of the following keyboard shortcuts is used to change the case?

(a) Ctrl + F3 (b) Shift + F3

(c) Alt + F3 (d) Ctrl + Shift + F3

(iii) In MS Word, the data that is being copied or moved is

(a) Temporarily stored in Recycle bin

(b) Permanently stored in Recycle bin

(c) Temporarily stored in Clipboard

(d) Permanently stored in Clipboard

(iv) Which of the following can be used to launch the Word Art

(a) Status bar (b) Ruler

(c) Standard toolbar (d) Drawing toolbar

(v) Which of the following feature enables you to reverse the changes you have made to the document?

(a) WYSIWYG (b) Redo

(c) Undo (d) GUI

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4. Write a note on the following:
   - Word processor
   - Clipboard
   - Word Art

5. What is a text editor? Describe its basic features.

6. Describe features of a full-featured word processor.

7. Define font and discuss its types.

8. Describe formatting features for paragraph formatting.

9. Draw the mark sheet showing your name, father name, school name, year of passing SSC examination, date of birth, list of all subjects and their respective marks, total marks, percentage and the overall grade. [**Hint**: You can draw a table to complete the task]

10. Arrange the text given in the following figure according to the mentioned format:

The clipboard is a temporary holding space in the computer's memory for data that is being copied or moved. The Clipboard is used for storing text, graphics, sound, video or other data. After data has been placed in the clipboard, it can be inserted from the clipboard into other documents, in the same application or in a different application. For example, if you want to move a paragraph in a document, select the paragraph and then choose the **Cut** command, the data is removed from the document and placed on the Clipboard (If you don't want to remove the paragraph from the original document then use **Copy** command). After placing the insertion point at the document where you want to place the paragraph, you choose the **paste** command, the data on the Clipboard is placed into the document. In the same way the Clipboard can be used to move data from one documents to another. One important thing about the Clipboard is that it is part of the operating system; it is not a separate application.

The Text Around

Answers

1. (i) Title Bar (ii) What You See Is What You Get (iii) Font
   (iv) Portrait, Landscape (v) Bitmap (vi) Word wrap (vii) Macro
   (viii) Thesaurus (ix) Ruler (x) Overtype

2. (i) d (ii) b (iii) c (iv) d (v) c

3. (i) F (ii) F (iii) T (iv) F (v) T
   (vi) T (vii) F (viii) T (ix) F (x) F

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CHAPTER 9 Spreadsheet Software

Overview

People work with numbers every day. Corporations track profits and losses; economists generate graphs of growth of the country's economy; statisticians calculate probability of crashing the market; and women manage their household budgets. To perform all these tasks, people use spreadsheet programs.

A **Spreadsheet program** is a software tool for entering, calculating, manipulating and analyzing sets of numbers. The specialty of spreadsheet software is working with numbers. It can hold large amount of data arranged in rows and columns. It can manipulate numbers and present information in numerous ways.

9.1 Features of Spreadsheet Software

Like Word Processors, the Spreadsheet software also varies significantly e.g. LOTUS 123, MS Excel etc. But all of them have the following basic features:

- **Grid of Rows and Columns:** The spreadsheet is a grid of rows and columns. Each row is assigned a number and each column a letter. The intersection of a row and a column forms a **cell**. Each cell has a reference number that is formed by combining the column number and row number e.g. A1, G18 etc. A cell contains labels or values. A label is a text entry such as "Gross Salary" whereas a value can be a number, a date, a formula or a formula's result.
- **Formulas:** Formulas are used to express mathematical relationships between cells.
- **Functions:** Functions are used to perform certain tasks
- **Commands:** Commands are used to manipulate the worksheet or its contents
- **Text Manipulation:** Some simple text manipulation can also be performed.
- **Print:** Allows you to send a document to a printer to get a hardcopy.

9.1.1 Starting to Use Spreadsheet

To understand the functionality of spreadsheet software you should be familiar with its **interface**. The interface represents the way through which

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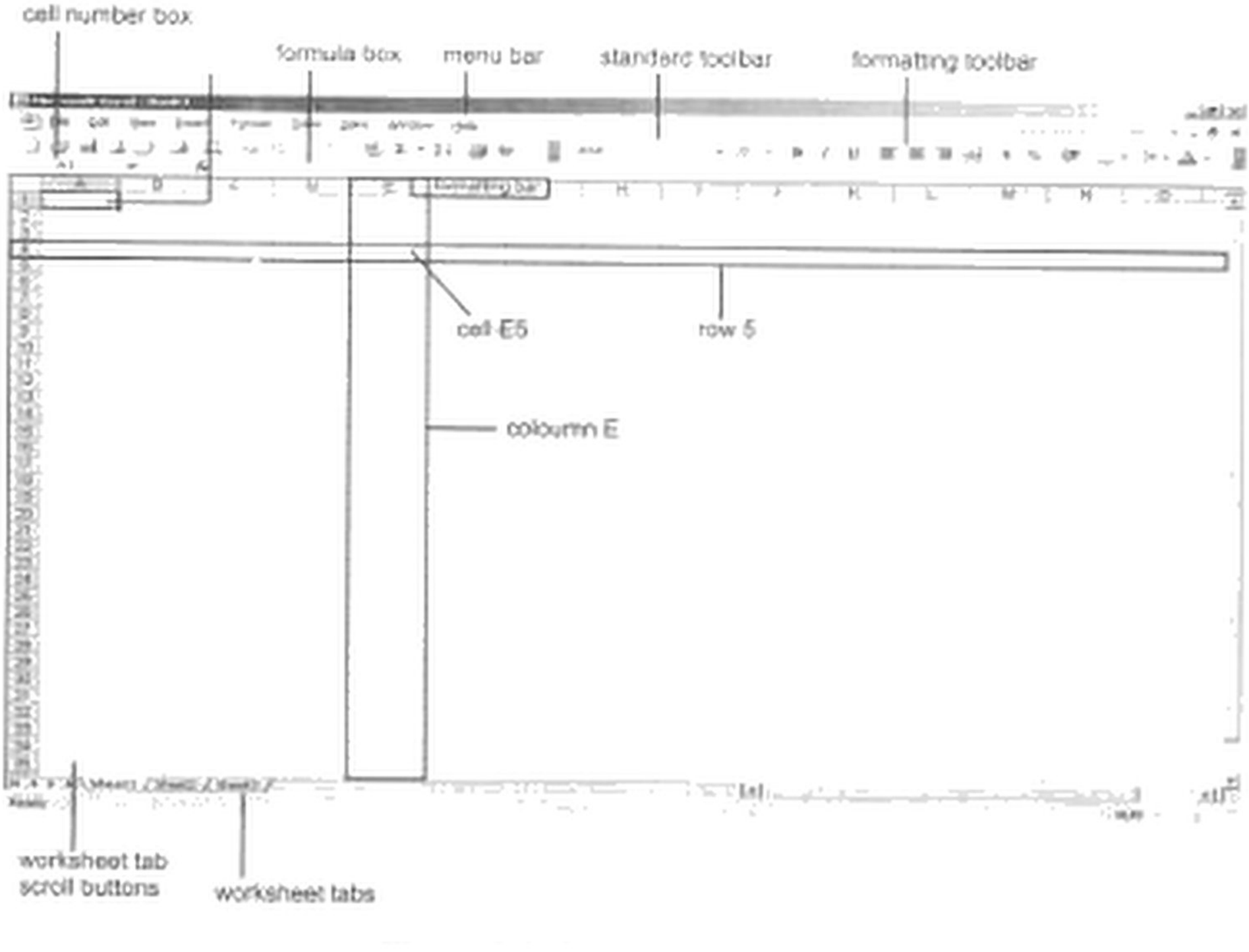
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9.2 The Spreadsheet's Interface

Like a word processor, a spreadsheet's interface consists of main document window, and set of various tools to manipulate data. In the document window the document is displayed. In a spreadsheet, you actually work in a grid of rows and columns called a **worksheet**. Collection of related worksheets forms a **workbook**. Spreadsheet software allows you to save the whole workbook, containing several worksheets, as a file.

In addition to document window, the spreadsheet's interface contains menu bar, toolbars, and a formula bar. Formula bar is used to apply certain formulas on different cells of the worksheet.

Unlike today's advance spreadsheet programs early spreadsheet programs provided only one worksheet at a time. The workbook could contain just one worksheet. New spreadsheets are rated as **3D-Worksheets**, which are like a pad of worksheets. It is due to this feature that the data in one worksheet can be used for calculations performed in another worksheet of the same or a different workbook.



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9.3 Entering Data in a Worksheet

Cell is the basic unit where the data is entered in a worksheet. The data can take variety of forms i.e. text, numbers, dates, and formulas. The cell also can hold graphics, audio files, and video or animation files. There are two states of a cell i.e. active and passive. Before entering data, the cell must be activated. Using the mouse or arrow keys, you can select a cell to make it active. A bold rectangular border indicates an active cell. Every cell in the worksheet has an address (figure 9.1).

When a cell is selected you can enter data by simply typing on the keyboard. You can also enter the data in an active cell through the formula bar. Similarly you can edit the contents of a cell in the formula bar. When a cell containing a formula is activated, its formula appears in the formula bar, which you can edit there.

Like word processors, the basic operations of **cut, copy** and **paste** work in the same way here in Worksheets. You can move data between the worksheets of the same or different workbooks by using these operations.

9.4 Basics of Worksheet

As it has been discussed that the data entered in a cell can take variety of forms but the most common of these are:

- Labels (Simple text)
- Values (numbers)
- Formulas

Labels are used to identify a value or a series of values. Labels are helpful in making the worksheet meaningful. It is important to note that formulas can be applied only on values; these cannot be applied on labels.

Values are just numbers that you enter in different cells of a worksheet. These can be whole numbers, decimals, negative numbers, currency and other types of values including scientific notations.

Working with **Formulas** is the most powerful feature of a spreadsheet. Formula can be calculated on the basis of values or formulas in other cells. Formulas can involve basic arithmetic operators. More complex formulas can even evaluate logical conditions and perform certain calculations on the basis of the result of the evaluation. Conditions may evaluate to true or false.

9.4.1 Cell References and Ranges

A cell reference tells formula to look up the contents of the referenced cell. This increases the flexibility of the formula. The change in the contents

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calculated on the basis of this cell. The cell is referred to by its address such as G8, AC5, and Y10 etc. there if you want to add values in cells G8 and Y10, your formula might look like = G8 + Y10

If your formula involves contiguous cells, you can refer to all the cells as **range**. The range is specified as follows:

address of the first cell : address of the last cell

For example, the cells D3, E3, F3, G3 can be referred to as **D3:G3**.

9.4.2 Relative and Absolute Referencing

Calling cells by just their addresses (such as "A1") is called **relative referencing**. When a formula contains relative referencing and it is copied from one cell to another, the spreadsheet does not create an exact copy of the formula. It will change cell addresses relative to the row and column they are moved to. For example, if a simple addition formula in cell C1 i.e. **=(A1+B1)** is copied to cell C2, the formula would change to **=(A2+B2)** to reflect the new row.

To prevent this change, cells must be called by **absolute referencing** and this is accomplished by placing dollar signs "$" within the cell addresses in the formula. Continuing the previous example, the formula in cell C1 would read **=(A1+B1)** if the value of cell C2 should be the sum of cells A1 and B1. Both the column and row of both cells are absolute and will not change when copied.

9.4.3 Named Ranges

Range names are names that you define to represent a cell or cell range on a worksheet. These range names can further be used in formulas instead of cell addresses or ranges. They also make it easier to use, maintain, and understand the formulas in the worksheet. e.g. the formula =C10*100/C8 calculate the percentage of marks. After giving names to cells, this can be expressed as = **Marks_Obtained * 100 / Total_Marks**

Defining Range Names

To define a name for a cell or range of cells select **Insert|Name|Define** from the menu bar. The following dialog box will appear.

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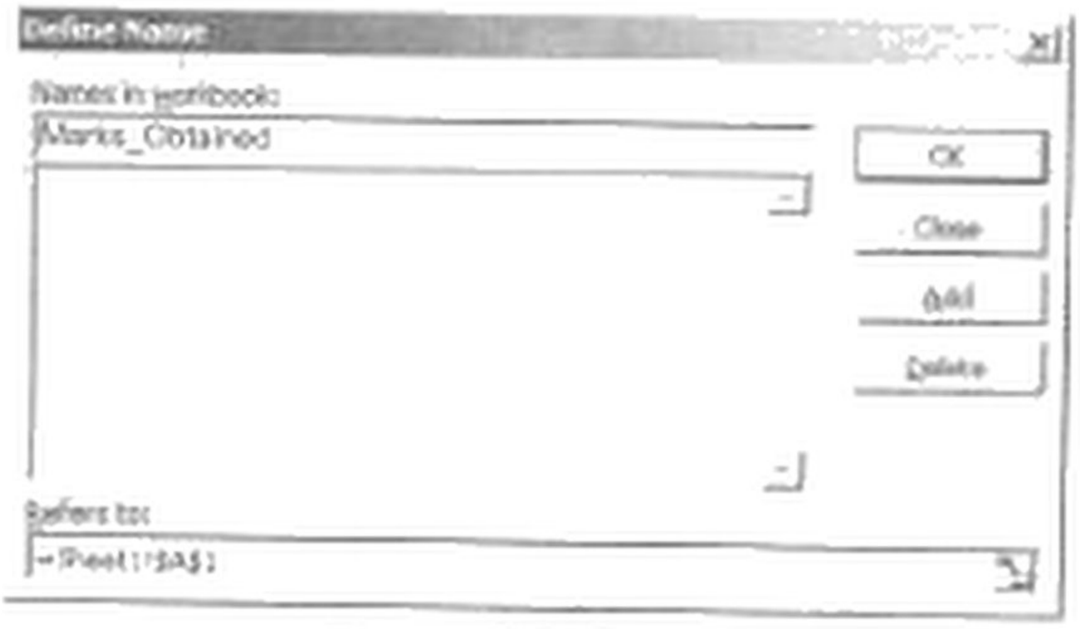


Figure 9.2: Range names

You can even give names to cells or cell ranges instead of using their address. After assigning names to cells or cell ranges you can use these names in formulas instead of the addresses, e.g. the above formula can be rewritten as = **Value1 + Value2** after assigning the name Value1 and Value2 to cell G8 and Y10 respectively.

9.5 Working with Formulas

The distinguishing feature of a spreadsheet program is that it allows you to create mathematical formulas and execute functions. Otherwise, it is not much more than a large table for displaying text.

Formulas are entered in the worksheet cells and must begin with an equal sign "=". The formula is written in the formula bar. The formula includes the addresses of cells whose values will be manipulated (figure 9.3). After the formula is applied on the cell, the calculation executes immediately. See the example below to view the formula for calculating the sub total for a number of textbooks. The formula multiplies the quantity and price of each textbook and adds the subtotal for each book.

9.5.1 Linking Worksheets

While applying a formula in a worksheet, you may want to use the value from a cell in another worksheet within the same workbook. For example, the value of cell A1 in the current worksheet and cell A2 in the second worksheet can be added using the format "**sheetname!celladdress**". The formula for this example would be **=A1+Sheet2!A2** where the value of cell A1 in the current worksheet is added to the value of cell A2 in the worksheet named "Sheet2".

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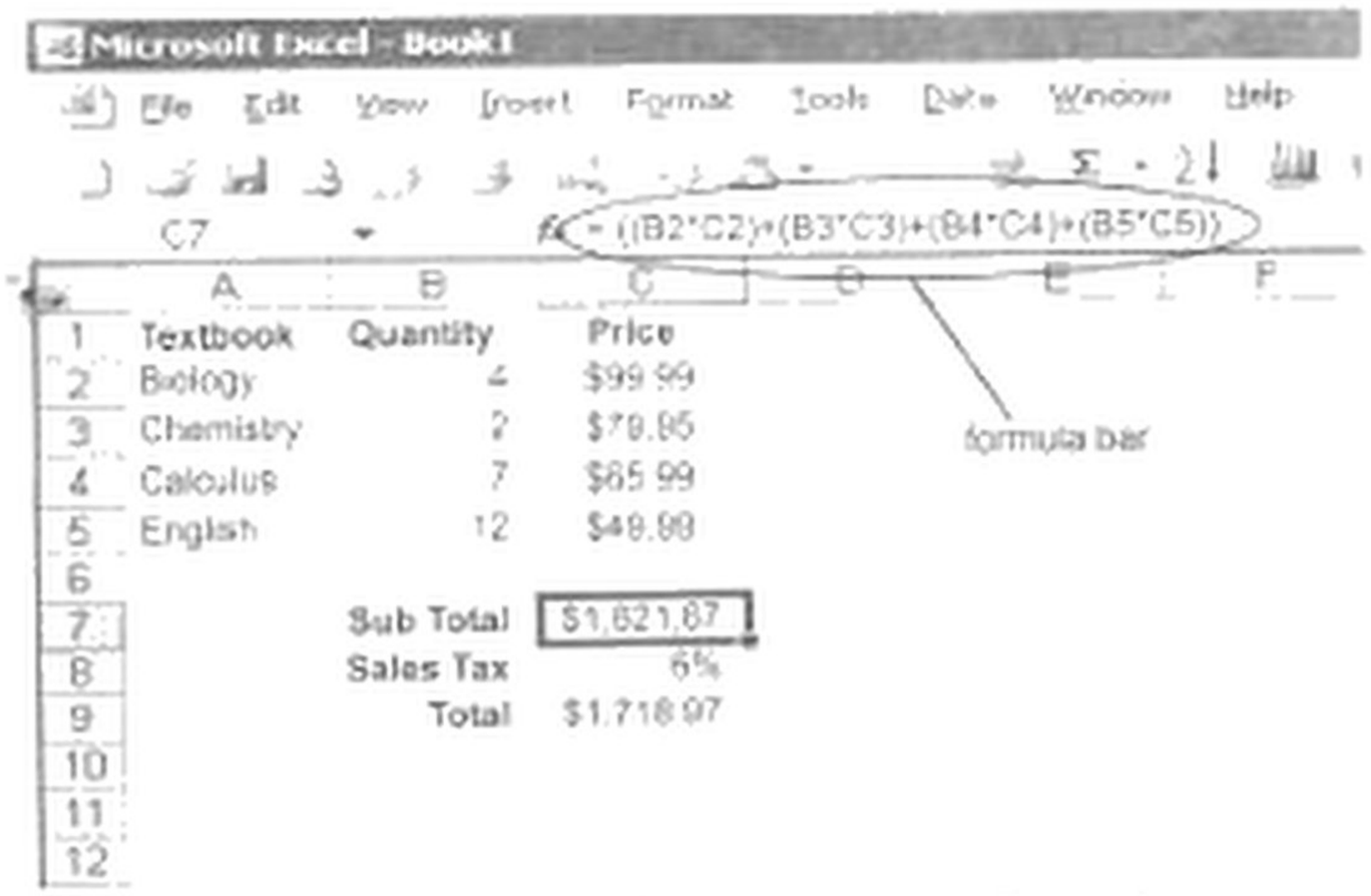


Figure 9.3: Calculating a Formula

9.6 Functions

In a spreadsheet, **Functions** are built-in formulas used to perform complex operations. Such as adding the contents of a range or finding the absolute value of a cell's contents. Every function returns a value and may accept one or more arguments. An argument is a value passed to the function to perform an operation. The arguments are passed to the functions within parenthesis. There are functions that are simple to execute whereas some are more complex.

Functions can be used in formulas. Functions can be a more efficient way of performing mathematical operations than formulas. For example, if you wanted to add the values of cells D1 through D10, you would type the formula=**D1+D2+D3+D4+D5+D6+D7+D8+D9+D10** A shorter way would be to use the **SUM** function and simply type =SUM(D1:D10). Some commonly used functions and examples are given in the table below:

Funciton	Example	Description
SUM	=SUM(A1:A100)	finds the sum of cells A1 through A100
AVERAGE	=AVERAGE(B1:B10)	finds the average of cells B1 through B10
MAX	=MAX(C1:C100)	returns the highest number from cells C1 through C100
MIN	=MIN(D1:D100)	returns the lowest number from cells D1 through D100
SQRT	=SQRT(D10)	finds the square root of the value in cell D10

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9.6.1 Function Wizard

To view all functions available in MS Excel (a spreadsheet) and to apply any of them, the function wizard can be used. To activate the function wizard select **insertlfunction**. The following dialog box will appear.



Figure 9.4: Function Wizard

You can select any function from the given list of functions. Click **Ok** to apply the selected function. The function wizard will ask you the argument(s) for the function. On supplying arguments the result will appear.

9.7 Formatting and Customizing Data

The contents of a highlighted cell can be formatted in many ways. Font and cell attributes can be added from shortcut buttons on the formatting bar (figure 9.5).

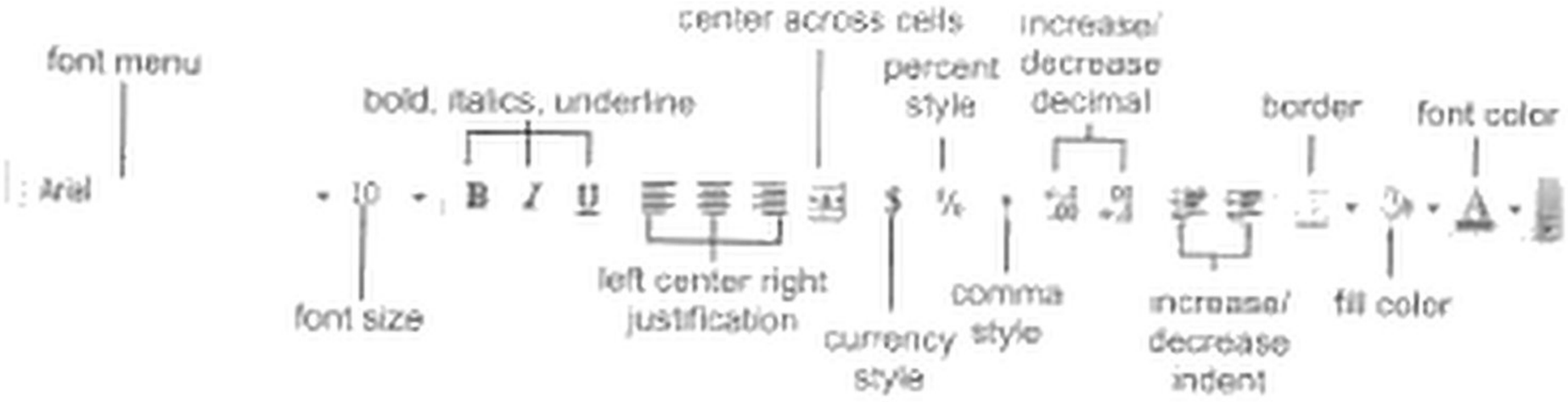


Figure 9.5: Formatting toolbar

9.7.1 Cell Formatting

The default number format assigned to a cell is the General format. General format displays whatever is entered in the cell with a couple of exceptions. If the cell is not wide enough to display a long decimal number, General format rounds off the number and uses scientific notation for

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To customize the format of the cell you can select **formatlcells** command. If the data is number, you will be presented twelve categories of format options as shown in figure 9.6.

9.7.2 Creating Custom Format

If you don't see the number format you would like among the listed categories, you can create a custom format. Click custom in the category list to create a custom format (figure 9.6).

Each number format consists of four parts. The first part describes the positive numbers, the second describe the negative numbers, the third describe zero values, and the fourth describe text values. Each part is separated from the other by a semicolon. You don't have to specify all parts of the format. If you specify only two, the first is used for positive numbers and zero values, and the second is used for negative numbers. Text values use general format. If you specify only one, all numbers use the same format, and text value use General format (table 9.1).

Symbols used in Custom Format

Symbol	Meaning	Example
0	A placeholder that determines how many digits display on either side of a decimal number.	If the custom format is **0000** then 12 will be displayed as 0012 450 will be displayed as 0450
#	A placeholder similar to the 0 character except that insignificant zeros do no appear if the number has fewer digits than the number of placeholders speified.	If custom format is **#,###** then 1500 will be displayed as 1,500
?	A place holder similar to the 0 character, except that space is left for insignificant zero characters on either side of a decimal point.	If the custom format is **0.???** then For 16.545 and 2.4 , if displayed vertically, the decimal point of 16.545 will become under the decimal point of 2.4

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. (period)	Indicate how many digits appear to the right of a decimal point. The cell display will round to the number of placeholders to the right of the decimal point in the format.	If the custom format is **###.00** then 1.2 will be displayed as 1.20 and 58 will be displayed as 58.00

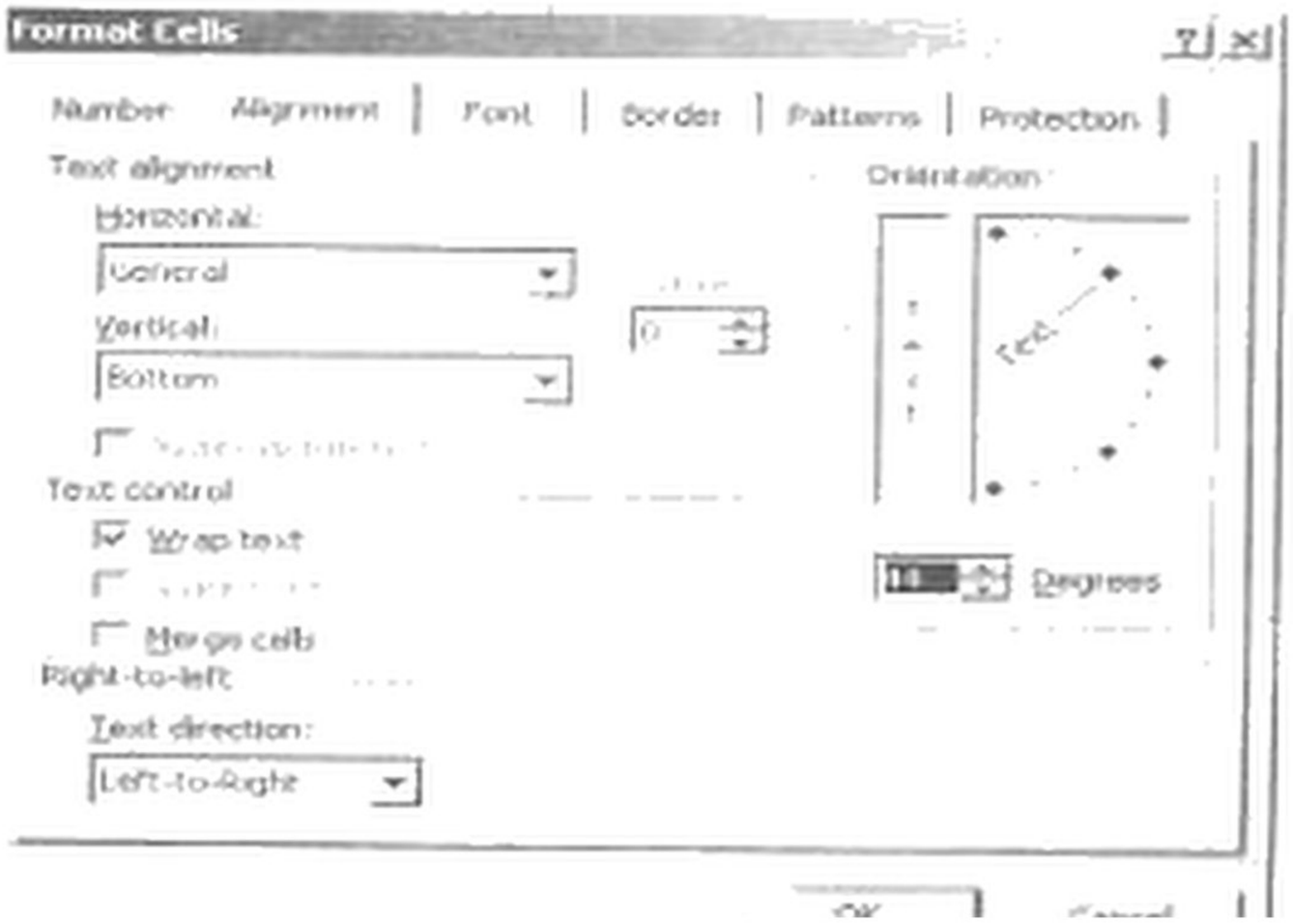
Table 9.1: Symbols for custom format

You can choose any format for the cell. The contents of the cell will appear accordingly. For example, selecting a **Currency** format that displays the currency symbol followed by a two-decimal number will show the value of 547.55 as $547.55. Similarly selecting date format for a cell as mm/dd/yy will convert the "January 16, 2005" to 1/16/2005 automatically.

9.7.3 Aligning Cell Contents

Alignment of the cell contents can be changed from the **Alignment tab** of the Cell Format dialog box (figure9.6). The default alignment of text and numbers in a cell is General. However you can change the alignment to **Left, Right, Center, Justified,** or **Fill**.

Similarly you may control the orientation of the worksheet from the Alignment tab of the Cell Format dialog box. You can set the cell contents to an angle of up to 180 degrees. This allows you to show long text vertically or diagonally. You can do this by rotating the needle on the alignment tab (figure 9.6).



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9.7.4 Merge Cells and Wrap Text

You can merge cells by first highlighting the cells to be merged and then just selecting the **Merge Cells** option from the Alignment tab of the Format Cells dialog box. In the same way, you may select the wrap text option from the alignment tab of the Format Cells dialog box to allow wrapping of text in a cell.

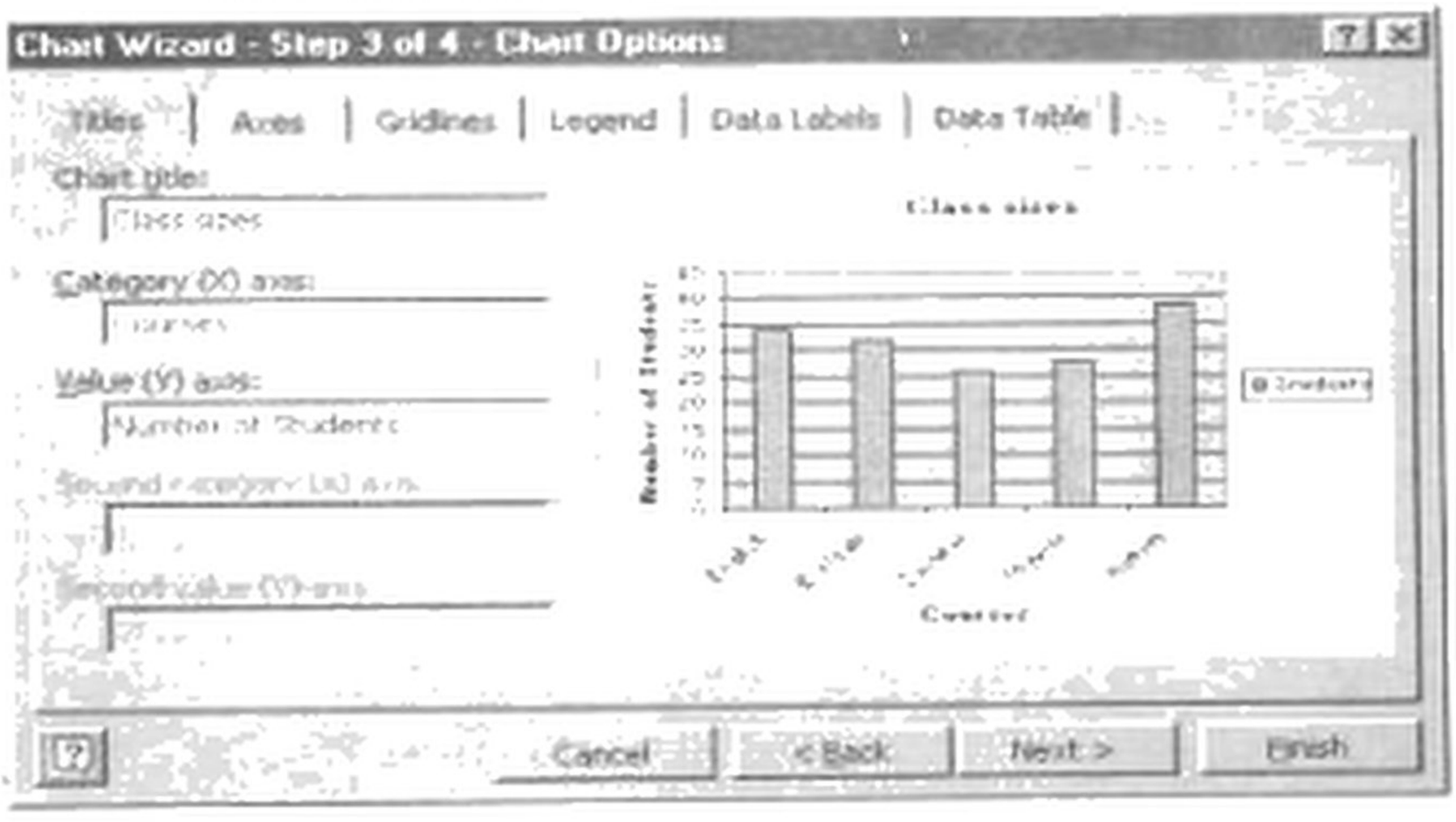
9.8 Introducing Charts

Charts allow you to present data entered into the worksheet in a visual format using a variety of graph types. Before you can make a chart you must first enter data into a worksheet. To generate a chart you can use chart wizard.

9.8.1 Chart Wizard

The Chart Wizard brings you through the process of creating a chart by displaying a series of dialog boxes.

- Enter the data into the worksheet and highlight all the cells (including headers) that will be included in the chart.
- Click the Chart Wizard button on the standard toolbar to view the first **Chart Wizard** dialog box. This will present you different chart types. You can choose any one e.g. PI Chart, Line, Bar, Radar etc. and Press the Next button.



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- This will lead you to another dialog box where you have to specify the source data for the chart (if it is different from one that is selected). After specifying the source data press **Next** button.
- The following dialog box will appear. Enter the name of the chart and titles for the X- and Y-axes. Clicking on the tabs can change other options for the axes, grid lines, legend, data labels, and data table. Press **Next** to move to the next set of options.
- You may insert the chart as an object in the same worksheet or it can be displayed separately on another sheet.
- Click **Finish** to exit the chart wizard

9.9 Printing Worksheets and Charts

The chart can be printed in the same way as a work sheet. You have several options while printing a worksheet. Before printing the format of the page must be set. Selecting File|Page Setup can set the page format. Set orientation of the page from the **page** tab, set **margins** and **add headers and footers** (figure 9. 8)

9.9.1 Page Orientation

Select the **Orientation** under the **Page** tab in the Page Setup window to make the page Landscape or Portrait. The size of the worksheet on the page can also be formatting under **Scaling**. To force a worksheet to print only one page wide so all the columns appear on the same page, select **Fit to 1 page(s) wide**.

9.9.2 Margins

Change the top, bottom, left, and right margins under the **Margins** tab. Enter values in the header and footer fields to indicate how far from the edge of the page this text should appear. Check the boxes for centering horizontally or vertically on the page.

9.9.3 Header/Footer

Add preset headers and footers to the page by clicking the drop-down menus under the Header/Footer tab.

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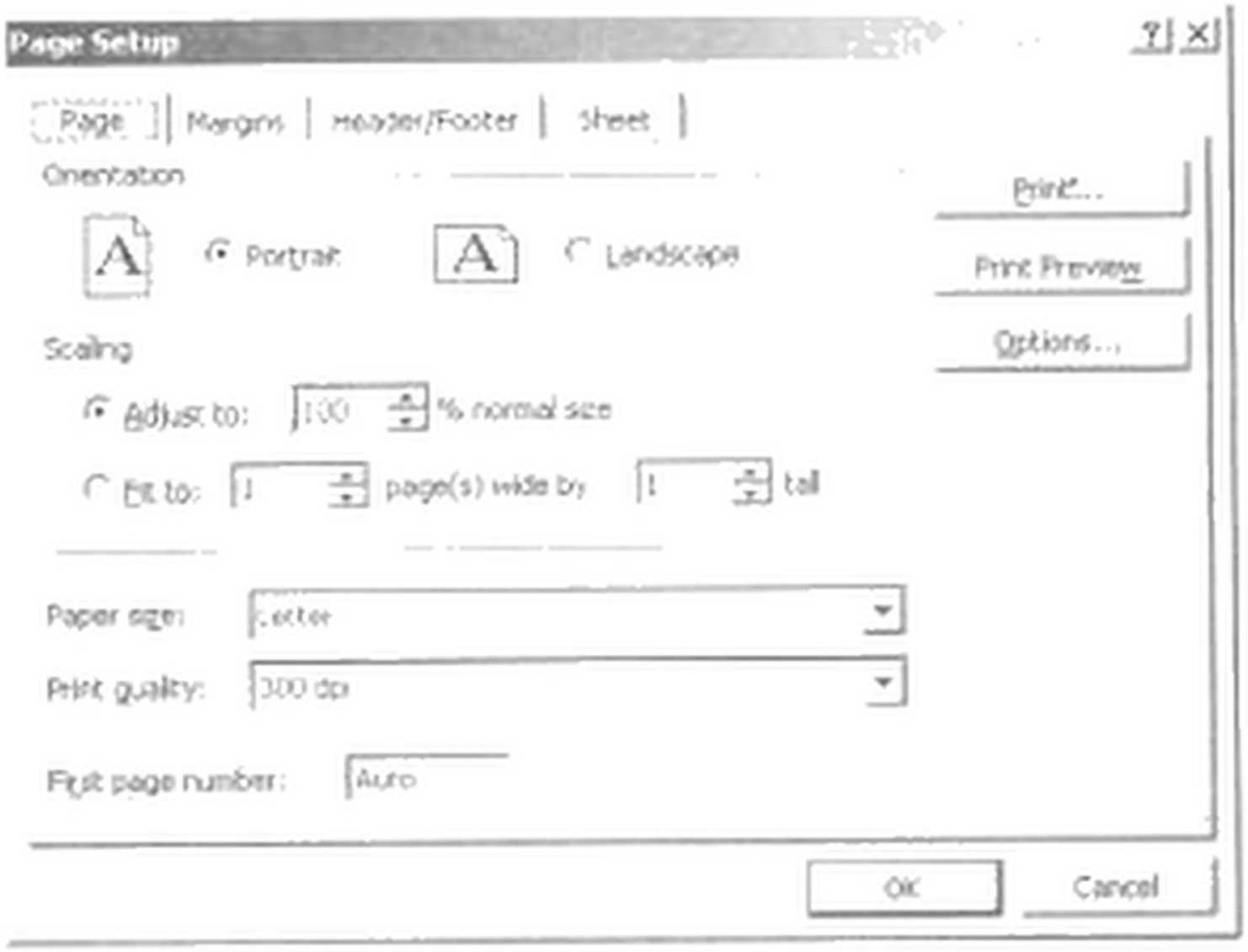


Figure 9.8: Page setup dialog box

9.9.4 Sheet

Check **Gridlines** if you want the gridlines dividing the cells to be printed on the page. If the worksheet is several pages long and only the first page includes titles for the columns, select **Rows to repeat at top** to choose a title row that will be printed at the top of each page.

After setting the page format, select **File|Print** option to print the worksheet. This is same as discussed in chapter 8 (word processing). You can take one or multiple copies of the worksheet.

Exercise 9C

1. Fill in the blanks:
   (i) For the custom format ##.000, the number 242.59 will appear as _____
   (ii) The intersection of a row and a column forms a **cell.**
   (iii) In a spreadsheet _____ are built in formulas
   (iv) **Labels** are used to identify a value or a series of values
   (v) _____ are names that you define to represent a cell or cell range on

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(vi) Calling cells by just their addresses (such as "A1") is called **relative referencing**

(vii) An _____ is indicated by a bold rectangular border.

(viii) _____ is a software for manipulating numbers

(ix) A _____ may contain multiple _____

(x) **0** is a placeholder that determines how many digits to display on either side of a decimal number.

2. Choose the correct option:

(i) Which of the following is a spreadsheet?

(a) MS Word (b) MS Excel

(c) MS Powerpoint (d) Both b a

(ii) The actual working area in Microsoft Excel is

(a) Workbook (b) Worksheet

(c) Spreadsheet (d) Note sheet

(iii) Which of the following is an absolute address?

(a) A1 (b) A1$

(c) A1 (d) None of the above

(iv) Formula can only be applied on

(a) Values (b) Labels

(c) Unmerged cells (d) None of the above

(v) Which of the following function is used to get the current date?

(a) Exact( ) (b) Today( )

(c) Month( ) (d) Year( )

3. Write T for true and F for false statement:

(i) Because Microsoft Excel is a spreadsheet, therefore it does not have a spellchecker component.

(ii) Functions can be a more efficient way of performing mathematical operations than defining your own formulas.

(iii) A formula can not manipulate labels.

(iv) Worksheet is the basic unit where the data is manipulated in a workbook

(v) Footnote can not be applied in a spreadsheet software.

(vi) By default, the numbers as well as the text is aligned RIGHT in a cell.

(vii) A formula containing relative referencing is not copied exactly.

(viii) # is a place holder similar to the 0 character, except that space is left for insignificant zero characters on either side of a decimal point.

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4. Define spreadsheet and discuss its basic features.
5. Differentiate the following:
   - Workbook and Worksheet
   - Active Cell and Passive Cell
   - Word Processor and Spreadsheet
   - Function and formula
   - Labels and Values
6. Every cell in a worksheet has a reference number, how is it calculated? Discuss with examples the major differences between Relative and Absolute referencing.
7. Create a Pie chart for the marks obtained by your class fellows in SSC examination.
8. What do you understand by the term **named ranges?** Can it be helpful in simplifying the worksheet?
9. What are the advantages of using a spreadsheet program?
10. Insert another worksheet in the workbook of Q.4 to develop a Pie chart for the marks obtained by the students of your neighboring section in SSC examination. Calculate overall pass percentage, and average marks of the students of both sections in another (third) worksheet.

    Hint: You have to insert three worksheets in a workbook. Construct a Pie chart for the marks of your class in sheet1. Similarly, construct another Pie chart in sheet2. In sheet3, you have to make the three worksheets linked. The data will be picked from sheet1 and sheet2 to calculate the average and pass percentage in the sheet3.

Answers

1. (i) 242.590 (ii) Cell (iii) Functions (iv) Label
(v) Named Ranges (vi) Relative Referencing (vii) Active Cell
(viii) Spreadsheet (ix) Workbook, Worksheet (x) 0

2. (i) b (ii) b (iii) c (iv) a (v) b

3. (i) F (ii) T (iii) T (iv) F (v) F
(vi) F (vii) T (viii) F (ix) F (x) T

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CHAPTER 10 Fundamental of the Internet

Overview

In 1969, Advanced Research Project Agency (ARPA) established a small computer network among different universities and defense organizations. The goal was to establish a large computer network that could survive in war times. Initially **ARPANET** was a wide area network connecting a small number of users. There were only four hosts (A host is a computer that provide services to other computers of the network). But the network grew rapidly and spanned over countries.

Meanwhile another research organization, National science foundation, joined the project. NSF established five supercomputing centers which were available to all researchers for academic purposes. To provide high speed access to its supercomputers, NSF established a separate high speed network called **NSFnet**.

During this period, some other small networks had also been established among various universities and organizations. The authorities decided to link ARPANET, NSFnet and other small networks so that they can communicate each other. This link among different networks is referred to as the **Internet.**

10.1 How the Internet Works?

The **Internet** is a huge collection of millions of computers, all linked together on a computer network. The network allows all of the computers to communicate with one another. A home computer may be linked to the Internet using a phone-line modem, DSL or cable modem that communicates to an Internet service provider (**ISP**). A computer in a business or university will usually have a network interface card (**NIC**) that directly connects it to a Local Area Network (**LAN**) inside the business. The business can then connect its LAN to an ISP using a high-speed phone line like a **T1 line**. A T1 line can handle approximately 1.5 million bits per second, while a normal phone line using a modem can typically handle 30,000 to 50,000 bits per second.

ISPs then connect to larger ISPs, and the largest ISPs maintain fiber-optic "backbones" for an entire region. Backbones around the world are connected through

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10.2 Addressing Schemes

The purpose of the Internet is to establish communication between widely spread computers. Computers can send and receive data to each other. Any computer may initiate a transaction at any time. For this reason the source machine (computer) must have a unique identification of the destination computer. On the Internet every computer has a unique address and can be contacted on this address.

There are two types of addressing schemes recognized on the Internet, these are:

(i) IP Addressing (ii) DNS Addressing

10.2.1 IP Addressing

To keep all of these machines straight, each machine on the Internet is assigned a unique address called an IP address. IP stands for Internet protocol, and these addresses are 32-bit numbers, normally expressed as four "octets" in a "dotted decimal number." A typical IP address looks like this:

216.27.61.137

The four numbers in an IP address are called octets because they can have values between 0 and 255, which are 2^8 possibilities per octet. Every machine on the Internet has a unique IP address. A server has a static IP address that does not change very often. A home machine that is dialing up through a modem often has an IP address that is assigned by the ISP when the machine dials in. That IP address is unique for that session; it may be different the next time the machine dials in. This way, an ISP only needs one IP address for each modem it supports, rather than for each customer.

As far as the Internet's machines are concerned, an IP address is all you need to talk to a server. For example, in your browser, you can type the URL **http:// 216.27.61.137** and arrive at the machine that contains the Web server for the specified IP-Address.

10.2.2 DNS Addressing

Because most people have trouble remembering the strings of numbers that make up IP addresses, and because IP addresses sometimes need to change, all servers on the Internet also have human-readable names, called **domain names**. For example, www.hotmail.com is a permanent, human-

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a host name and domain. The domain represents the institution which uses the address. These domain names are called top-level domain. Following is a list of top level domains:

Domain	Type of Institution
.com	Business (Commercial)
.edu	Educational institutes
.gov	Government organizations
.mil	Military organizations
.org	other organizations (non profitable)

Some large organizations divide their top level domain into sub domains. This let you organize their web references.

10.3 Web Browsing

Searching information on the World Wide Web is referred to as Web Browsing. A software known as **Web browser** is used to search and view web pages. Hundreds of thousands of web pages are available on the World Wide Web that covers information on almost every topic. Here we shall discuss important terminology regarding World Wide Web.

10.3.1 World Wide Web (WWW)

The World Wide Web was launched in 1989 at the European Particle Physics Laboratory in Geneva, for adding footnote, and cross references in hypertext documents. The www uses http (hyper text transfer protocol) to link hypertext documents (**web pages**) on the World Wide Web.

A web page is a document that is written in HTML (Hypertext Markup Language), in addition to simple text certain tags of HTML are included in the document. The language allows embedding **hyperlinks** (or simply link) in the document. A hypertext document is also called a **Web Page.** A collection of related web pages is called a **Web site.** Web sites are hosted on server computers on the internet. These computers are called **Web Servers.** The process of launching web page is called **publishing the page**.

10.3.2 URL (Uniform Resource Locator)

Every page has a unique address on World Wide Web. This is called

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World Wide Web, you will have to specify the URL of the required page in the web browser. The general format of the URL is as follows:

type://address/path/

The **type** specifies the type of the server on which the page is hosted, **address** specifies the address of the server and **path** is the path of the page on the disk of the server e.g. http://www.yahoo.com/

10.3.3 Search Engine

A website that uses powerful data searching techniques to help the user locate web sites containing specific types of contents or information is known as a Search Engine e.g. google.com, ask.com, altavista.com etc. are very popular search engines. Search engines have become very popular all over the world. Millions of people use Search Engines to find out information on various topics. Search Engines maintain a list of billions of web pages containing information on variety of topics. Search engines ask you to enter some key words about the data or information you want to search on the Internet. On the basis of your provided information, search engine traverse the list of web pages it maintain, and finally display the links of the web pages containing required information.

10.4 Email

Email is a system for delivering messages over the Internet. An e-mail sender or recipient can be anywhere in the world.

E-mail is the first really popular Internet application; it allows people to hold discussions over great distances

- E-Mail can take as little as *few seconds* to go across a country, or even around the world.
- It leaves a written record. You can keep copies of e-mail messages you send and receive, for your record.

To create, send and receive email you need email-program, also called **email client.** Once you send the message, your computer connects to your **email server** and transmits a copy of your message. Email Server is a host computer on the Internet which keeps track of information about millions of email account holders. The server checks the address you have typed and figures out where the recipient email server is.

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receiving email server has received the message, the recipient is able to retrieve the message when connected to the server.

Attachment is a powerful feature of email, which enables you to enclosed additional files with your email. You can attach word processing documents, spreadsheets, programs, images, even audio, to your email messages when using email programs that support the Internet protocol for multimedia attachments i.e. MIME (Multipurpose Internet Mail Extension). Most email clients allow you attach files to the message. In this way you can send and receive data as well as program files. Attachment size varies from one email service provider to the other e.g. for free email accounts, **Yahoo** allows a file of size up to 10MB to be attached. This limit varies for paid accounts.

10.4.1 Limitations on Email

- **Email is not necessarily private:** Since messages are passed from one system to another, and sometimes through several systems or networks, there are many opportunities for someone to intercept or read email. Many types of computer systems have protections built in to stop users from reading others' email, but it is still possible for a system administrator to read the email on a system or for someone to bypass the security of a computer system.
- **Some email systems can send or receive text files only:** Even though you can send and receive images, programs, files produced by word processing programs, or multimedia messages, some individuals may not be able to properly view your message.
- **It is possible to forge email:** This is not common, but it is possible to forge the address of the sender. You may want to take steps to confirm the source of some email you receive.
- **It is difficult to express emotion using email:** The recipient does not have the benefit of viewing your facial expressions or hearing your voice. You have to be careful with humor or irony, since it is easy for someone to take your message the wrong way.
- **You can receive too much or unwanted emails:** You can receive

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steps to delete the email you receive and try to stop it from being sent to you in the first place

- **You may not know about the person with whom you are communicating:** The communication is often in text and it is possible for us to get an incorrect impression of the person sending us email. Also, some people misrepresent themselves.

10.4.2 Email Address

To send and receive an email, you must have an email account on an email server. When you open an email account, you are assigned a unique email address. You receive all incoming emails on this account address and send email to others by specifying their email addresses. The general format of an email address is:

User name @ DNS Address

For example, pakCrick@hotmail.com, gsm@yahoo.com, info@ptcl.com.pk etc. In these examples pakCrick, gsm and info specify the user name whereas the second part after @ symbol specify the DNS address.

10.5 Newsgroups

These are discussion groups on the Internet (not on the Web, which is only one area of the Internet). Newsgroups are classified by subject and do not necessarily deal with journalism or "news". Health, hobbies, celebrities, and cultural events are the subjects of many newsgroups. Participants in a newsgroup conduct discussions by posting messages for others to read, and responding to the messages posted by others. Because you have time to think of what to write in a newsgroup posting, the discussions in newsgroups tend to be of a more serious nature, though not necessarily less amusing.

You need a software to obtain articles from the **news server**. A news server is a host computer that exchanges articles with other servers on the Internet. These servers use Network News Transfer Protocol (NNTP) to communicate. To view articles on a specific topic, you need to be subscribed on a news group.

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Exercise 10C

1. Fill in the blanks:

(i) Collection of related web pages is called _____

(ii) Initially ARPANET was a _____ connecting small number of users.

(iii) News server use _____ protocol to transfer articles among them

(iv) NSF established a separate high speed network called _____

(v) The LAN can be connected to ISP using a high-speed phone line called a _____

(vi) World Wide Web was established in _____

(vii) MIME stands for _____

(viii) The four numbers in an IP address are called _____

(ix) _____ address is easy to remember

(x) HTML stands for _____

2. Choose the correct option:

(i) A computer can be linked to the Internet through

(a) A phone-line modem (b) DSL

(c) Cable modem (d) All of the above

(ii) Which of the following is an email client?

(a) Internet Explorer (b) Outlook Express

(c) Google (d) None of the above

(iii) Which of the following protocol is used to access web pages on World Wide Web.

(a) TCP/IP (b) Gopher (c) HTTP (d) HTML

(iv) Which of the following is used to find information on World Wide Web?

(a) Web Browser (b) Web Site (c) Search Engine (d) Web Server

(v) The length of IP Address is

(a) 8 bit (b) 16 bit (c) 32 bit (d) 64 bit

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3. Write T for true and F for false statement:

(i) IP address is a 16-bit addressing scheme

(ii) Every computer on a network has a Network Interface Card that directly connects it to the other computers.

(iii) URL is used to locate a computer on the Internet

(iv) A hypertext document is also called web page

(v) email server is a software used to create, send and receive emails

(vi) Each computer on the Internet must have HTTP Server configured to connect to the Internet

(vii) NNTP stands for National News Transmission Protocol

(viii) On Internet, Junk mails are also called spam

(ix) News Server is used to streamline the news transmission of the local radio stations

(x) You can not attached a file larger than 20MB to an email

4. Briefly describe the history of the Internet.

5. Write a not on World Wide Web.

6. What do we mean by Addressing schemes? How many types of addressing is used on the Internet? Discuss briefly.

7. What do you know about Email? Discuss briefly.

8. Write a note on the following:

- Newsgroups
- Search Engine
- TCP/IP

9. Discuss limitations on email.

10. How the use of Internet is affecting our society? Give your comments.

Answers

1. (i) Web Site (ii) Wide Area Network (iii) NNTP (iv) NSFnet
(v) T1 line (vi) 1989 (vii) Multipurpose Internet Mail Extension
(viii) octets (ix) DNS (x) Hyper Text Markup Language

2. (i) d (ii) b (iii) c (iv) c (v) c

3. (i) F (ii) T (iii) F (iv) T (v) F

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GLOSSARY

A

Absolute referencing: Absolutely referring to a particular cell's contents is known as *absolute referencing*

Address Bus: It is the part of System bus. It carries the addresses of various memory locations to perform read or write operation

ALU: Arithmetic and Logic Unit – This unit performs arithmetic and logical operations within the CPU

Amplitude: It is the height of wave within a given period of time

Analog Signal: Analog signals are continuous electrical signals in the form of wave

Antivirus: It is a software which is used to detect and remove a virus from the computer

Application Software: Application software is developed to solve a specific problem.

ARPANET: *ARPANET* was a wide area network connecting a small number of users. There were only four hosts (A host is a computer that provide services to other computers of the network).

ASCII: American Standard Code for Information Interchange – a 7-bit coding scheme

Asynchronous Transmission: In this type of transmission the data is sent using flow control rather than a clock to synchronize data between the source and destination

B

Bandwidth: Bandwidth is a measure of the transmission rate of communication channel

Baseband: It is a communication technique in which digital signals are placed onto the transmission line without change in modulation

BCD: Binary Coded Decimal - a four bit coding scheme

Bit: The smallest unit of data representation with in the computer

Bridge: A device that recognizes the messages on a network and passes on those addresses to nodes in other network.

Broadband: It is a technique of transmitting a large amount of data, voice, and video over long distances simultaneously by modulation each signal onto a different frequency

Bus: It is also called System Bus. It is an electronic pathway to connect different parts of the computer together

Bus Interconnection: This unit is used to connect different part of the computer together

Bus Topology: In this topology, computers are connected in a series. A special device called terminator is connected on both ends of the series (bus) to absorb the signals.

Byte: Collection of eight bytes is referred to a byte

C

CAD: Computer Aided Design

CAM: Computer Aided Manufacturing

Client/Server Network: In this type of network, one or more computers are dedicated servers and the remaining computers work as clients. The server can't play the role of the client and vice versa.

Command line operating system: A *command line operating system* provides a command prompt to the user for typing different commands to interact with the computer.

Communication Channel: The communication channel is the physical path by which a data travels from sender to receiver

Computer: A computer is a machine that can be programm4ed to accept data (input), process it into useful information (output), and store it away (in a secondary storage device) for safekeeping or later use.

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Control Unit: Control Unit reads the instructions from main memory and decodes these instructions
CPU: Central Processing Unit – also known as brain of the computer. It controls the overall functioning of the computer
CRT: Cathode-Ray Tube – it is a vacuum tube used as a display screen in a computer or video display terminal
Custom-built Software: This software is developed for a particular customer

D

Data Bus: It is the part of overall system bus structure. It carries the actual data from the CPU to memory and I/O devices and vice versa
Data Communication: It is the exchange of data between two devices via some form of transmission media such as a wire cable
Decoder: Decoder converts the encoded signal to digital form
Desktop: The on-screen work area on which windows, icons, menus, and dialog boxes appear is called *desktop*.
Digital Signal: A digital signal uses on-off electrical pulses in discontinuous or discreet form
DMA: Direct Memory Access – This is a technique of performing an I/O operation in which I/O operation is completed without involving the CPU. The CPU just issues an I/O command and the rest of the work is completed with help of a special DMA module
Domain names: All servers on the Internet also have human-readable names, called *domain names*.
DOS: Disk operating system
DRAM: Dynamic RAM – Contents of this type of RAM need to be refreshed periodically
DSL: Digital Subscriber Line

E

EBCDIC: Extended Binary Coded Decimal Interchange Code – an 8-bit coding scheme
Email: *Email* is a system for delivering messages over the Internet.
E-mail: it is the process of sending messages electronically from one computer to the other on a computer network
Email client: It is software used to create, send and receive.
Email Server: This is the server computer on the Internet which is used to maintain email accounts and to streamline the email system.
Encoder: The encoder converts digital signals to a form, which can pass though transmission medium
Ethernet: It is a LAN protocol. It uses high speed network cable and bus topology, so it is relatively simple and cheaper.
Extended partition: Extended partition refers to a portion of a disk that can contain other partitions.
Extranet: Two or more intranet connected together in such a way that they enable collaboration among the companies that own the separate intranets

F

Fetch-Decode-Execute Cycle: This cycle describes the process of execution of an instruction within the computer
Frequency: Frequency is the number of times a wave repeats during a specific time interval
FTP: File Transfer Protocol – it is a protocol to transfer files from one computer to the other on a computer network
Full Duplex: It is a mode of data communication in which data can travel in both directions i.e. from sender to receiver and vice versa, simultaneously
Functions: In a spreadsheet, *Functions* are built-in formulas used to perform complex operations.

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G

Gateway: Gateway is a collection of hardware and software resources that let a node (Computer) communicate with a computer on another network

Gopher: It is an access and retrieval system covering a wide range of information, from reference materials to magazine articles to government documents and speeches

Groupware: Software which is used for workgroup computing

GUI operating system: A *GUI operating system* provides a graphical user interface to establish the user communication with the computer e.g. Windows 95, Windows 98, Windows NT, Windows 2000, and Windows XP

Guided Media: It refers to channels that allow the transmission of data through a physical media such as twisted pair wires, coaxial cable, or fiber optic cable

H

Half Duplex: It is a mode of data communication in which data can travels in both directions i.e. from sender to receiver and vice versa, but in one direction at a time

Hardcopy: Hardcopy refers to the printed output.

Hardware: Physical components of computer are called hardware

Hyperlink: A word, icon, or other object that when clicked jumps to another location on the document or another web page is called *hyperlink* or *link*

I

I/O Unit: Input/Output Unit – This unit handles the processor's communication with its peripherals.

Impact Printers: The printers which use a striking mechanism to print on the paper

Information Technology: Information Technology is the technology that merges computing with high speed communication links carrying data in the form of text, sound, image, video etc., from place to place.

Input devices: The devices which are used to give input to the computer are called input devices

Internet: The *Internet* is a huge collection of millions of computers, all linked together on a computer network. It is also called network of networks.

Interrupt: Interrupts are the signals, normally generated by I/O devices. These signals informs the CPU of the occurrence of a certain events such as completion of an I/O operation

Intranet: it is a privately-owned, secure, business network based on Internet Technology (use TCP/IP), although not necessarily connected to the Internet

IP Address: IP stands for Internet protocol. IP address is used to uniquely identify every computer on a computer network. These addresses are 32-bit numbers, normally expressed as four "octets" in a "dotted decimal number."

ISP: Internet service provider – A company that provides internet services

L

LAN: Local area network that spans a small geographical area such as a building or a campus consisting of few buildings in a small area.

LAN: Local Area Network – It spans a small geographical area such as an office or a group of buildings

LCD: Liquid Crystal Display – As compared to CRT, it uses a different technology to display text and graphics

M

Macro: A *macro* is a character or word that represents a series of keystrokes

MAN: Metropolitan Area Network – A Metropolitan Area Network connects an area larger than a

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Mesh Topology: In this topology every computer is directly connected to every other computer on the network.
Modem: It is a device that converts digital signals into analog signals and vice versa. It is used to connect to the Internet.
Multiprocessing: By multiprocessing, we mean having more than one processors in a single computer. The phenomenon of executing a process on two or more processors is called multiprocessing.
Multitasking: The capability of an operating system to load multiple programs into memory at one time and to perform two or more processes concurrently is called *multitasking*.
Multi-user Operating System: *A multi-user Operating System* allows for multiple users to use the same computer at the same time and/or different times.

N

Network: A group of computers connected together to communicate, exchange information, and pool their resources amongst each other
Network Topology: Arrangement of nodes in a computer network is referred to as network topology
News server: A news server is a host computer that exchanges articles with other servers on the Internet.
Newsgroups: These are discussion groups on the Internet
NIC: Network Interface Card – A card used in every computer on a network, it enable computers to establish a computer network.
Non-Impact Printers: The printers which do not use a striking mechanism to print on the paper

O

Operating system: *An operating system* is collection of operative programs that provide an interface for the user to interact with the computer.
Output devices: The devices which are used to get output from the computer are called output devices

P

Parallel Transmission: This transmission involves the concurrent flow of bits of data through separate communication lines
Partition: A *partition* is a portion of physical disk that functions as though it were a physically separate disk.
Peer-to-Peer Network: In this type of network, every computer can play the role of server or client depending on the nature of communication. There is no clear distinction between the server and client machines.
Pixel: Short for picture element, one spot in a rectilinear grid of thousands of such spots that form an image produced on the screen by a computer or on paper by a printer. A pixel is also called a pel.
Plug and Play: *Plug and Play* refers to a set of specifications that allow a computer to automatically detect and configure a device, and install the appropriate device drivers.
Primary partition: A primary partition is one that can be used as the system partition.
Program: Set of instructions given to the compater to solve a particular problem
Protocol: A protocol is a set of rules and procedures that defines how computer receive and transmit data over the network
Publishing the page: The process of launching web page is called *publishing the page*.

R

RAM: Random Access Memory – It is also called the main memory, program's instruction and data are stored temporarily in RAM

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Register: These are the high speed memory locations built into the microprocessor. The CPU uses these memory locations to store data and instructions temporarily, to accomplish certain operations
Relative referencing: Calling cells by just their addresses (such as "A1") is called *relative referencing*
Resolution: Pixels per inch on the screen (display screen) defines the resolution
Ring topology: In this topology, computers are connected in a ring shape.
ROM: Read Only Memory – It is permanent memory and contains the instructions required in booting process
Router: Router is a device that keep track of all possible routes (from source to the destination) that a message can follow to be delivered to the destination

S

Sans-serif fonts: *Sans-serif fonts* do not have curls or extra decorative lines at the ends of the strokes that make up each character e.g. Arial
Search Engine: A website that uses powerful data searching techniques to help the user locate web sites containing specific types of contents or information is known as a *Search Engine* e.g. google.com, ask.com, altavista.com etc.
Serial Transmission: In this transmission, each individual bit of information travels along its own communication path; the bits flow in a continuous stream along the communication channel
Serif fonts: *Serif fonts* have curls or extra decorative lines at the ends of the strokes that make up each character e.g. Times New Roman
Signal: The electromagnetic or light wave representation of data is called signal
Simplex: It is a mode of data communication in which data travels in one direction i.e. from sender to receiver. Receiver is not capable of sending data e.g. T.V. and Radio transmission
Simulation: It is a special type of computer model, which recreates a system that might exist outside the computer
Softcopy: Softcopy refers to the data stored electronically on a storage device.
Software: A computer program or a collection of computer programs combined together to perform certain tasks, is referred to as software
Software Packages: These software are off-the-shelf programs developed for potential users.
Spreadsheet: A *Spreadsheet program* is a software tool for entering, calculating, manipulating and analyzing sets of numbers.
SRAM: Static RAM – Contents of this type of RAM do not need to be refreshed
Star Topology: In this topology, all computers are connected to a central devices called hub.
SVGA: Super Video Graphic Array – it supports 256 colors at higher resolution than VGA
Synchronous Transmission: In this type of transmission, a clock is used to control the timing of bits being sent
System: A system can be defined as a combination of some related components that interact with each other to perform some specific tasks
System Bus: see bus
System Software: System Software is used to control the usage an allocation of different hardware components and enables the other application programs to execute.

T

T1 line: A *T1 line* can handle approximately 1.5 million bits per second
TCP/IP: Transmission Control Protocol/Internet Protocol – It is the protocol used by every computer on the Internet
Telnet: It is a protocol that allows you to remotely logging onto a computer
Token Ring: This protocol is designed by IBM for its mainframe computers to communicate with the terminals, in a ring topology network,
Tree Topology: Tree Topology integrate multiple star topologies together onto a bus

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Unguided Media: It refers to those channels that transmit data and information in the form of wave such as microwave and satellites

U

Unicode: Universal Code – a 16-bit coding scheme widely used in today's computers. It is capable of representing characters of many languages such as Japanese, Arabic, and French
URL: Uniform Resource Locator – This is actually the address of every web page on the World Wide Web. It uniquely identifies every web page on WWW.

V

VGA: Video Graphic Array – it supports 16 to 256 colors, depending upon the screen resolution
Video Conferencing: It is a type of conferencing in which video cameras and microphones capture sight and sound transmission over networks
Video Display Adapter: A card fixed into motherboard and controls the display on the monitor.
Virus: A virus is a program or a set of programs that can cause extensive damage to your computer system.

W

WAN: Wide Area Network – It spans a large geographical area such as among cities, countries or continents
Web browser: It is a software that is used to view web pages.
Web Page. A hypertext document is also called a *Web Page*.
Web Servers: The server computers on the Internet where the websites are hosted are called web servers
Web Site. A collection of related web pages is called a *Web site*.
Word: A group of bytes that constitutes a common unit of data as defined by the computer system
Word Art: *Word Art* is a feature of Microsoft Word's drawing program. It transforms an ordinary text headline, word or phrase in a work of art.
Word processor. *Word processor* is an application (software) that provides extensive tools for creating all kinds of text-based documents.
Workbook: Collection of related worksheets forms a *workbook*.
Workgroup computing: It is also known as *collaborative computing* and enables the individuals and teams of certain projects to use computer networks for the purpose of cooperation, consultation, and information sharing.
Worksheet: In a spreadsheet, you actually work in a grid of rows and columns called a *worksheet*.
WWW: World Wide Web – It is a collection of millions of linked web pages
WYSIWYG: A graphical user interface style stands for *What You See Is What You Get*

X

XGA: Extended Graphic Array – it supports 16.7 million colors at resolution of 1024 × 768 pixels

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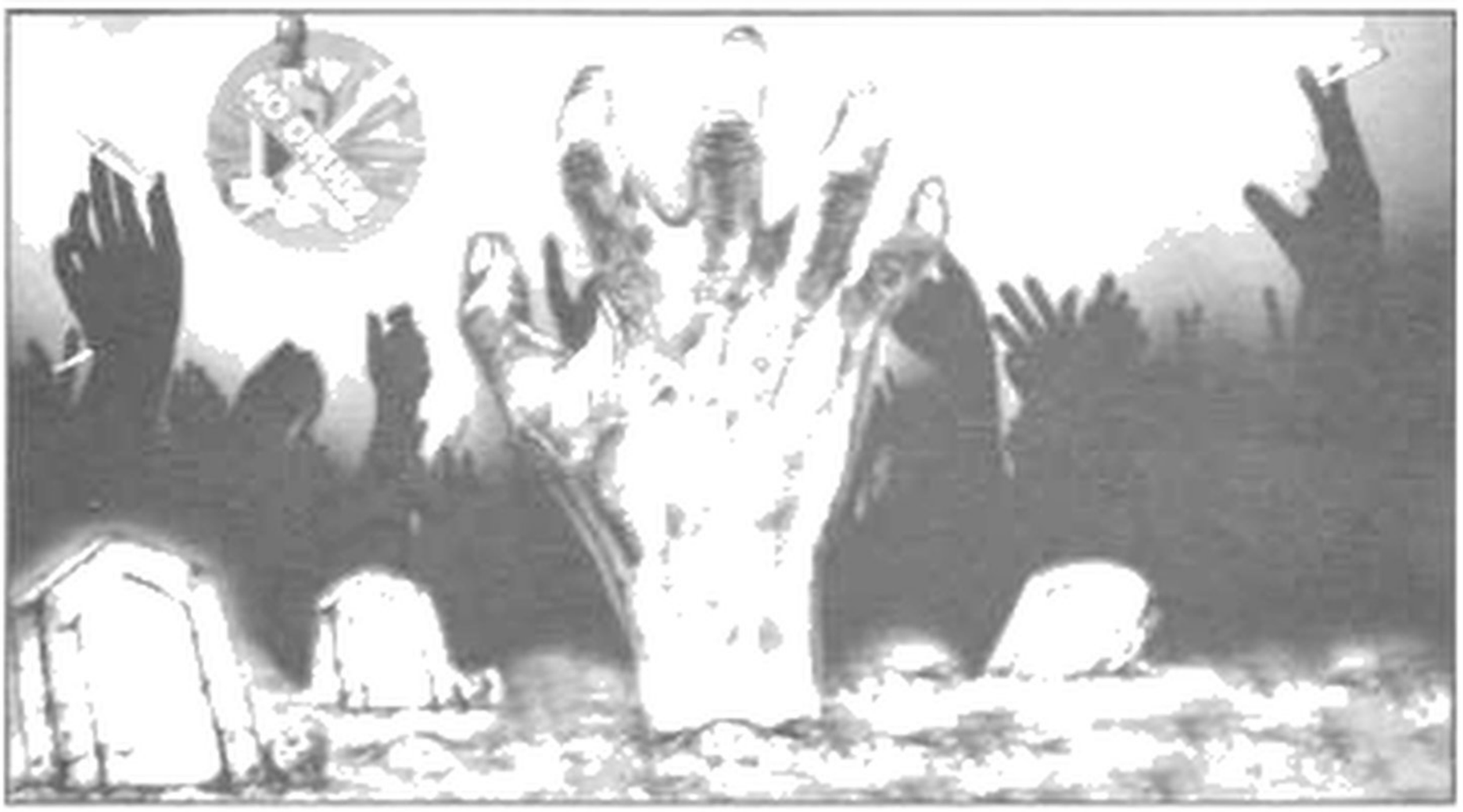
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