MINISTRY OF SECONDARY EDUCATION

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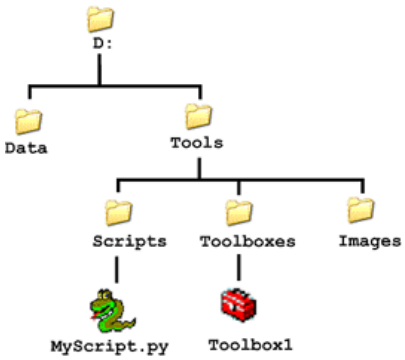

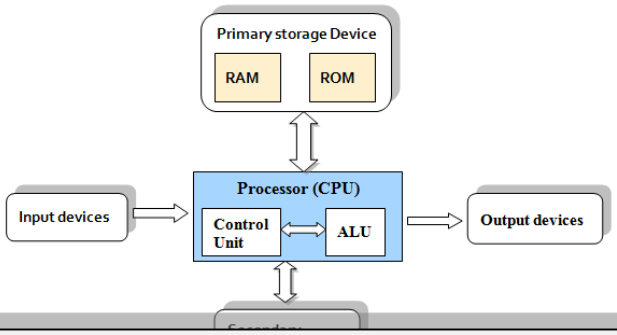

COMPUTER SCIENCE HANDOUT

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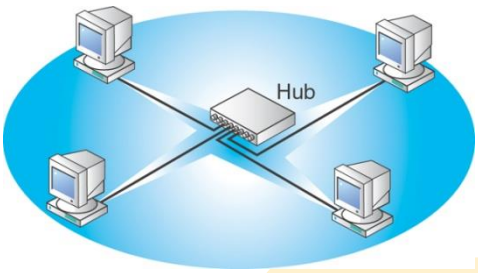

SCHOOL YEAR 2014/2015

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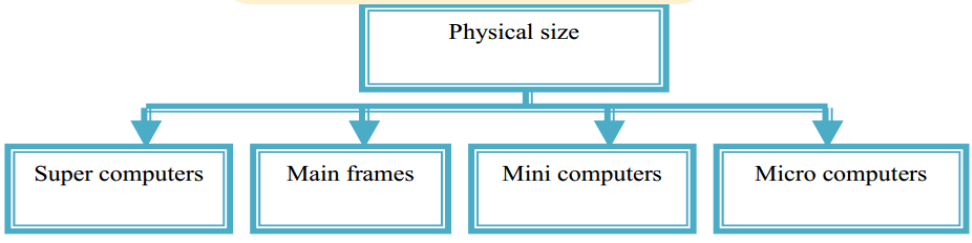

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CHAPTER 1: BASIC COMPUTER CONCEPTS

Computers have become a ubiquitous feature of modern life. It would be difficult to get through a day without some activity involving a computer, be it composing e-mail on a computer sitting on a desk, using a computer hidden inside a cell phone, or receiving a bill generated by a computer at the power company.

Learning objectives

After studying this topic, student should be able to:

- Define computer and give its characteristics
- Classify computers according to size, functionality and purpose
- Describe the main components necessary for the functioning of the computer

Contents

I. KEY TERMINOLOGY AND CONCEPTS

Here are some words and expressions related to the concepts of computer and computer science.

1) **Computer:** The word "**computer**" comes from the word "**compute**", which means "**to calculate**". ***A computer is then an electronic device for performing logical and mathematical operations based on its programs.***

2) **Program:** The set of instructions provided to the computer to solve a certain problem is called a **program**, and the one who develops this program is called a **programmer**.

3) **Data: Data** is what we feed into the computer. There are raw facts (text, image, sound, …) that still need to be processed (organized and arranged) into a form that can be understood

and used, and later stored. **Examples**: population statistics, blood samples in a hospital, pictures, …

4) **Data processing:** Computer data processing is any manipulation that uses a computer program to enter data and summarize, analyze or otherwise convert data into usable information.

5) **Information:** This is meaningful and useful material that is derived from the processing of data. Information is what comes out as output. **Example:** Result of laboratory test, the percentage of success on GCE, …

6) **Computing:** This is the act of developing and using the computer to perform an activity. It includes the designing and building of hardware and software systems for a wide range of purposes, processing and managing various kind of information, doing scientific studies using computers, …

7) **Computer science:** Computer science is a branch of science that studies the principles and use of computers

8) **ICT:** This is the application of modern communications, computing and digital technologies to create, store, exchange and use information in it various forms.

9) **Computer user: :** That is somebody with little or no technical knowledge of computers, but who can use the computer to create specific documents and to communicate.

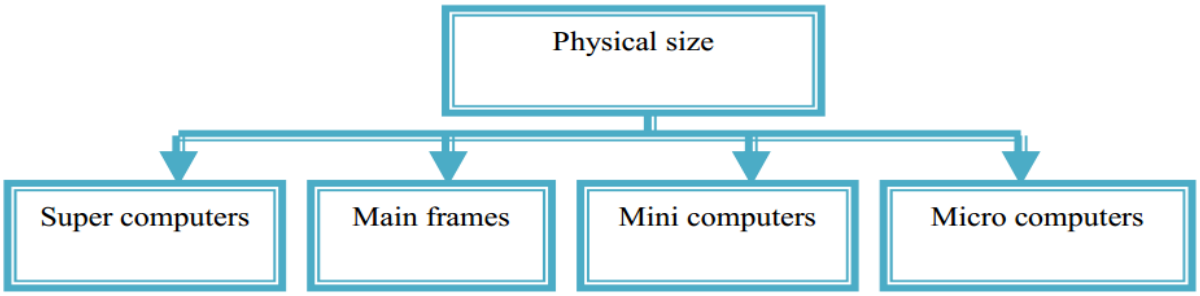
10) **Computer Literacy:** Computer literacy is defined as the knowledge and ability to utilize computers and related technology efficiently. It can also refer to the comfort level someone has with using computer programs and other applications that are associated with computers. Another valuable component is understanding how computers work and operate.

II. CLASSIFICATION OF COMPUTERS

Computers can be classified according to physical size, functionality and purpose

II.1- Classification according to physical size

Computers are classified according to their physical size and bulk as shown below:

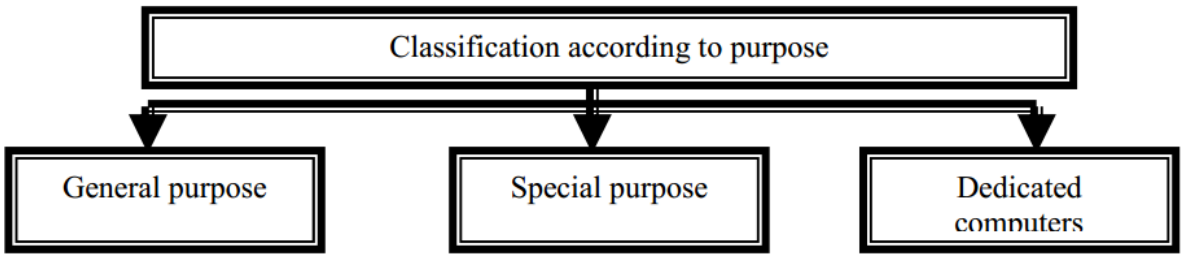


Description of computers according to physical size

Size	Characteristics	Uses
Super computers	Lardest, fastest, powerful and most expensive. They generate a lot of heat	Used for advanced scientific research such as nuclear physics
Mainframes	Less powerful and less expensive than supercomputers. They also have a large storage capacity	Used to handle all kings of problems whether scientific or commercial, i.e. performing complex mathematical calculations. They are mostly found in banks, hospitals, airport, etc.
Minicomputers	Smaller ans less powerful than the mainframe	Used in scientific laboratries, research institution, engineering plants and places where processing automation is required
Microcomputers	Smallest, cheapest, and relatively less powerful. Uses a microprocessor to process data. Example: desktop, Laptop, Personal disgital assistant (PDA)	Used to perform a variety of task including research, communication, banking, learning institutions, libraries, …

II.2- Classification according to purpose

According to purpose, we can distinguish three types of computers: ***General purpose computers,*** ***Special purpose computers*** and ***dedicated computer***

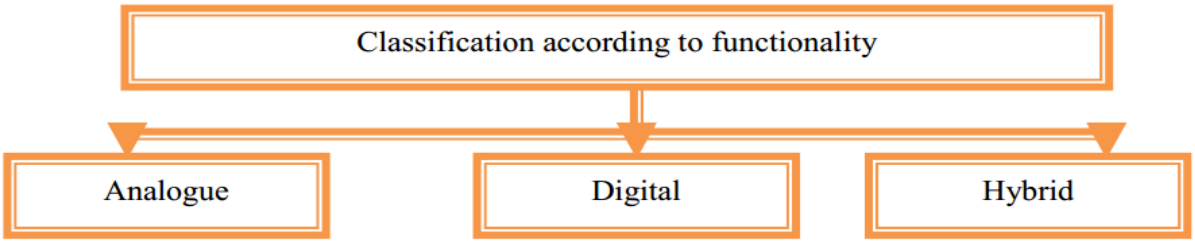


Description of computers according to purpose

Computer	Uses	Examples
General purpose	Designed to perform a variety of tasks	PCs, cell phones, notebooks etc.
Special purpose	Designed specifically for one task	Calculators, robots, cell phones, thermometers etc
Dedicated computers	Designed as a general purpose but dedicated to perform a specific task	PCs used for learning environment, banking, communication etc.

II.2- Classification according to purpose

According to functionality, there exist three types of computers: digital computers, analogue computers and hybrid computers



Description of computers according to physical size

Computer	Characteristics	Uses
Analogue	Process data that is discrete in nature	Used by PCs, home appliances, TVs, Microwaves, wall clocks etc
Digital	Process data that is continuous in nature	Used in manufacturing process control like monitoring temperatures, pressures, density etc
Hybrid	Designed to process both analogue and digital data	Used on manufacturing process control. And returns a digital value. Examples are:- a digital weighing machine, digital thermometer etc

III. CHARACTERISTICS OF COMPUTERS

1. Its ability to execute the instructions loaded into it in autonomously manner.
2. High speed processing
3. High precision in getting results
4. Large storage capacity and rapid fetching of needed information.
5. Ability to connect to remote peer machines and exchange information

IV. BASIC FUNCTIONNING OF A COMPUTER

Computer is made up of two parts: hardware and software.

- **Hardware** refers to all the physical devices that make up a computer system, both those inside the computer "case" and those outside the case, like monitor, keyboard, and mouse.
- **Software** refers to the programs the computer executes. For example, the word processor Microsoft Word, or the computer game "Half-Life," is software, as is a program that enables a cell phone display so the user can select a new ring-tone

Every task given to a computer follows an **Input- Process- Output** Cycle (IPO cycle). It needs certain data, processes that data and produces the desired information. The **input unit** takes the input (data), the **central processing unit** (CPU) does the processing of data and the **output unit** produces the output (information). The **memory unit** holds the data and instructions during the processing.

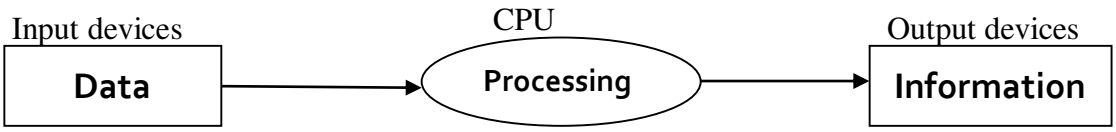


Fig: functioning of a computer.

EXERCISES

1- Define or explain the following words or expressions: computer science, computer, computer literacy, information, data, data processing, program and ICT.

2- Briefly state, with appropriate examples, the difference between the following concepts:
- Information and data
- Analogue computer and digital computer
- General purpose computer and special purpose computer
- Special purpose computer and dedicated computer
- Supercomputer and mainframe computer.
- Hardware and software.

3- Explain using a diagram how data processing is carrying out inside a computer

CHAPTER 2: COMPUTER HARDWARE SYSTEM

Computer Hardware is the physical part of a computer, as distinguished from the computer software that executes or runs on the hardware. The hardware of a computer is infrequently changed, while software and data are modified frequently. The term soft refers to readily created, modified, or erased. These are unlike the physical components within the computer which are hard.

Learning objectives

At the end of the lesson student should be able to:

- Describe the principle of functioning of a computer
- Describe with appropriate examples different external components of a computer particularly input devices, output devices and storage devices

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I. BLOG DIAGRAM OF A COMPUTER

As you know, computer is an electronic device, it comprises of many units. These units work in coordination with each other to perform the given task. Block diagram of computer is shown in figure 1 below.

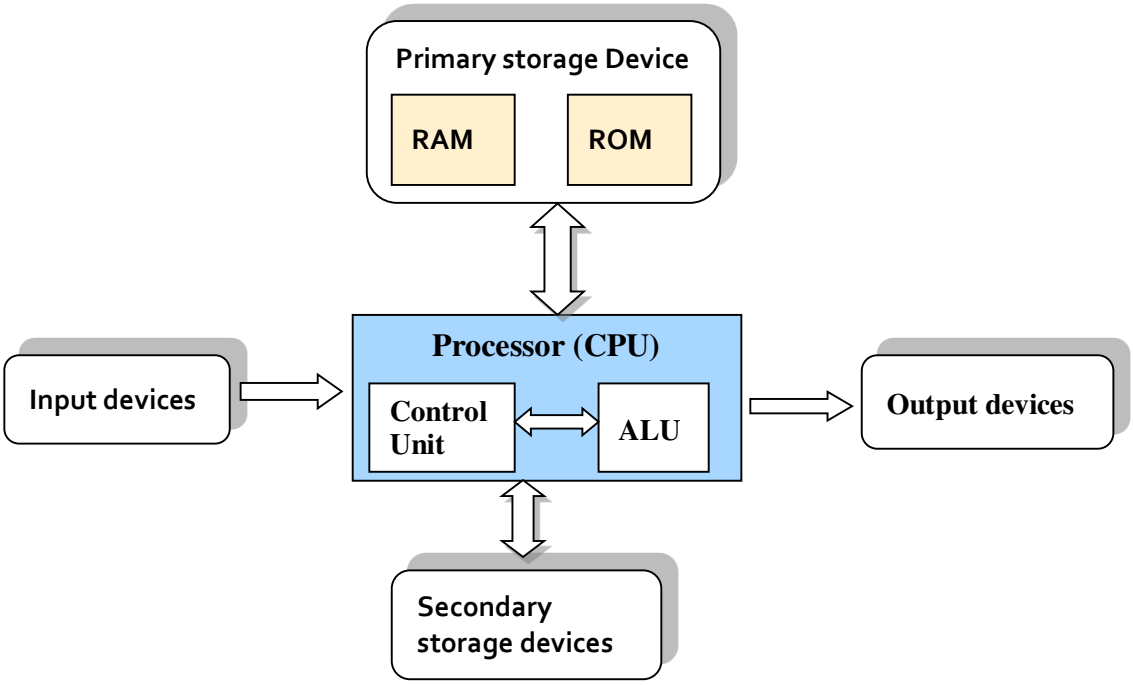


Fig 1: Blog Diagram of the computer

Refer this figure and note that computer comprises of the following six primary components:

- input devices,
- the processor (control unit and arithmetic/logic unit),
- memory,
- output devices,
- storage devices, and
- communications devices

The processor, memory, and storage devices are housed in a box-like case called the **system unit**

II. INPUT DEVICES

An input device is any a peripheral device that allows you to enter data, programs, commands, from the user and translates the information into a form, which the computer can interpret. It is devices that convert input data from human readable form into machine readable form

- Human readable form is a kind of language that the user understands i.e. Kiswahili, English etc
- Machine readable form this is a language that the computer understands i.e. binary language, assembly language etc

Examples of input devices include: Keying, Pointing and Scanning devices, Digitizers, Digital Camera, Voice input etc.

II.1 Keying devices

These are devices that convert typed numbers, letters and special characters into machine readable form examples: keyboard and keypad

II.1.1 Keyboard

This is the most commonly used keying method with desktop and laptop computers. There are different types of keyboard layouts such as QWERTY, DVORAK and AZERTY. But the most common used are QWERTY and AZERTY.

II.1.2 Keypad

This is a small keyboard used with hand held devices i.e. cell phones, calculators, notebooks etc

II.2 Pointing devices

These are devices used to control the pointer/cursor on the screen. Examples: mouse, joystick, trackball, light pen etc

II.2.1 Mouse

It is a small handheld device which is moved across a mat or flat surface to move the cursor on a computer screen. Usually, a mouse contains two or three buttons, which can be used to input commands or the data. The mouse may be classified as a mechanical mouse or an optical mouse, based on the technology it uses.

- A **mechanical mouse** uses a rubber ball at the bottom surface, which rotates as the mouse is moved along a flat surface to move the cursor. It is the most common and least expensive pointing device.
- An **optical mouse** uses a light beam instead of a rotating ball to detect the movement across a specially patterned mouse pad. As the user rolls the mouse on a flat surface, the cursor on the screen also moves in the direction of the movement the mouse.

Mouse terminologies: Some of the common mouse actions are listed as follows:

Action	***meaning***	***Operation carried out***
Pointing	Moving the mouse pointer to the designated target on the screen.	Identify an object or to execute a command
Clicking	Pressing the left button of the mouse and releasing it immediately	Select an object
Double Clicking	Pressing the left button of the mouse twice, in quick succession	Open a folder Execute a program
Drag and Drop	Moving the mouse, with its left button pressed	Select many objects Move an object
Right-click	To press the right button of the mouse once	Show the contextual menu of an object
Scrolling wheel	Roll up and down the scroll wheel	used to move hidden text up and down the screen of an active window

II.2.2 Track ball

This is just like a mouse whose ball is located at the top. The pointer on the screen is moved as the user moves the ball with a finger.

II.2.3 Joy stick

Looks like a car gear. When the lever like part is moved, the pointer moves on the screen. It is mostly used to play games.

II.2.4 Light pen and stylus

A light pen, also called a selector pen, is a computer input device in the form of a light-sensitive wand used in conjunction with a computer's CRT display. It allows the user to point to displayed objects or draw on the screening a similar way to a touch screen but with greater positional accuracy

II.2.5 T**rackpad**

Also referred to as touchpad is a stationary pointing device that works by sensing the movement of fingers across a small sensitive surface (1.5 or 2 in.) and translating them into the pointer movement on the screen. It is generally used in laptops, but can also be connected to the PC through a cord

II.3 Scanning devices

These are devices that capture data directly into the computer. They can also be defined as devices that use a magnetic or photo-electric source to scan and convert images into electric signals that can be processed by an electronic apparatus, such as a computer. Scanning devices are commonly used to:

- Convert a text document into an electronic file;
- Convert a photograph into an electronic graphic file;
- Sense an image to be sent over a voice frequency
- Circuit, such as a fax machine;
- Reproduce text and images, as with a copier.

Scanners are classified according to technology used to capture data namely: optical and magnetic scanners.

II.3.1 Optical scanners

These scanners capture data using optical or light technology. Examples of optical scanners

SCANNER	TECHNOLOGY	USES
Optical Mark Recognition (OMR)	They capture inked marks on paper by passing infrared light over them	Making multiple choice questions

Optical Bar Recognition (OBR)	Used to capture barcodes	Supermarkets for transactions
Optical Character Recognition (OCR)	Convert handwritten, typewritten and printed text and images into machine readable form. E.g. flat bed scanner	Schools, library, banks to scan photos and documents

II.3.2 Magnetic scanners

These scanners use magnetic technology to capture handwritten and magnetic strip data. Some examples of optical scanners are:

→ **MICR:** These scanners are used to read characters written using magnetic ink as shown left. Mostly used in banks to read cheques
→ **Digitizers:** also known as graphic tablet, allows a user to draw an image using a stylus
→ **Digital camera**: Also known as a digicam. Is a camera that takes video or still photographs by recording images on an electronic image sensor
→ **webcam** (short form of web camera) is a portable video camera, which captures live video or images that may be viewed in real time over the network or the Internet. It is just a small digital camera that is either in-built in your computer (in most laptops) or can be connected through a USB port.

II.4 Other input devices

Other input devices of computer include:
→ **Touch screen**: It is an electronic visual display that can detect the presence and location of a touch within the display area
→ **Voice input**: also known as speech recognition(SR). Is the translation of spoken words into text
→ **Interactive whiteboard (IWB):** This is a large interactive display that connects to a computer and projector. A projector projects the computer's desktop onto the board's surface where users control the computer using a pen, finger, stylus, or other device. The board is typically mounted to a wall or floor stand.

III. OUTPUT DEVICES

An **output device** is any piece of computer hardware equipment used to communicate the results of data processing carried out by an information processing system (such as a computer) which converts the electronically generated information into human-readable form. The output produced by the output devices can be of the following forms

Generally, there are two basic categories of output:

➢ **Hard Copy**: The physical form of output is known as hard copy. In general, it refers to the recorded information copied from a computer onto the paper or some other durable

surface such as microfilm. The principal examples of output are printouts, whether text or graphics from printers.

- **Soft Copy**: Softcopy refers to intangible output that can be seen or heard i.e. screen display or sound. Examples include: ***monitors, LCD projectors, and speakers***.

Some examples of output devices include:

III.1 Printers

A printer prints information and data from the computer onto a paper. Printers are divided into two basic categories: impact printers and non-impact printers.

III.1.1 Classification according to printing mechanism

- **Impact printers** use some sort of physical contact with the paper to make a mark onto it. Example: ***Dot Matrix Printers, Daisy Wheel Printer, Drum Printers***
- **non-impact printers** use techniques other than physically striking the page to transfer ink onto it. Example: ***Ink-jet Printers, Laser Printers, Hydra Printer***

IMPACT PRINTER	NON-IMPACT PRINTER
Slow	Faster
Use inked ribbons	Use thermal, photo and electrostatic principles
Multiple copy production possible	Multiple copy production impossible
Cheaper	Costly
Noisy	Quiet
Examples: *Dot Matrix Printers, Daisy Wheel Printer, Drum Printers*	**Examples**: *Ink-jet Printers, Laser Printers, Hydra Printer*

III.1.2 Classification of printers according to the speed of printing

→ **Character printers**: Provide one character at a time and are hence comparatively slow and less costly than the line or page printers. Examples: ***daisy wheel printer, golf ball printer:***

→ **Line printers:** Provide one whole line of print at a time. Hence they are more expensive than the character printers. Examples: ***Thermal printer, Injek printer, electrostatic***

→ **Page printers:** Page printers provide one whole page of print at a time, hence faster than both line and character printers, relatively more expensive and produce high quality printouts. Example: ***xenographic printer, laser printer, electrostatic printer***

III.2 Monitors

The monitor is the most frequently used output device for producing soft copy output. A monitor or display (also called screen or visual display unit (VDU)) is an electronic peripheral device used to display information in the form of text, pictures and video, enabling the user to monitor what is going on in the computer. Monitors are available in various sizes like 14, 15, 17, 19 and 21 inches.

III.2.1 Terminologies used with screen display

- **Pixel**- stands for picture elements. These are tiny dots which form images displayed on the screen.
- **Color depth**-in computer graphics, color depth or bit depth is the number of bits used to indicate the color of a single pixel in a bitmapped image or video frame buffer.
- **Resolution**-this is the number of pixels per inch on the screen usually measured in ***dots per inch*** (dpi) or bits. The higher the resolution, the more the number of pixels per square inch, hence clearer the images.
- **Display size**-is the measure in inches as the diagonal length ofthe screen measured from top right to bottom left.
- **DirectX**- This is a software that enhances the multimedia capabilities of your computer. DirectX provides access to the capabilities of your display and audio cards, which enables programs to provide realistic three-dimensional (3-D) graphics and immersive music and audio effects.

III.2.2 Examples of video adaptors include:

- **Color Graphic Adaptor**(CGA)-display text and images up to 16 colors
- **Enhanced Graphic Adaptor** (EGA)-an improvement of CGA but also displays in 16 colors
- **Video Graphic Array**(VGA)-display text, graphics and video using 256 colors
- **Super Video Graphic Array**(SVGA)-displays text and graphics using more than 16 million colors, has a minimum resolution of 800x 600 pixels
- **Extended Graphic Array** (XGA)-has a resolution of up to 1024 x 1280 pixels and is popular with 17 and 19 inch monitors.
- **Super Extended Graphic Arra**y(SXGA)-has a resolution of 1280 x 1024 pixels and is popular with 19 and 21 inch monitors.
- **Ultra Extended Graphic Array**(UXGA)- is the latest and highest standard

III.2.3 Types of monitor

There exist various types of monitor: **CRT**-*cathode ray tube*, **LCD**-*liquid crystal display*, **GPD**- *gas plasma display*.

a) **Cathode Ray Tube** Monitors:

CRT was the most used in most computer monitors before the advent of plasma screens, LCD, DLP, OLED displays, and other technologies. The basic operation of these tubes is similar to that in television sets.

b) **Liquid Crystal Display** Monitors:

With the widespread use of smaller computers like PDAs and laptops, a new type of display liquid crystal display (LCD) has made a big impact on computer market. LCD is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a

light source or reflector. It uses very small amounts of electric power, and is therefore suitable for use in battery-powered electronic devices. Example: TFT-thin film transistor

c) Plasma display

A plasma display is an emissive flat panel display where light is created by phosphors, excited by a plasma discharge between two flat panels of glass. The gas discharge contains no mercury a mixture of noble gases (neon and xenon) is used instead.

d) Surface-conduction electron-emitter display (SED)

SED is a flat-panel, high-resolution display. Some SEDs have a diagonal measurement exceeding one meter (approximately 40 inches). The SED consists of an array of electron emitters and a layer of phosphor, separated by a small space from which all the air has been evacuated.

e) Digital Light Processing (DLP)

DLP is a technology used in projectors and video projectors. In DLP projectors, the image is created by microscopically small mirrors laid out in a matrix on a semiconductor chip, known as a Digital Micro mirror Device (DMD).

f) organic light-emitting diode (OLED)

This is a thin-film light-emitting diode (LED) in which the emissive layer is an organic compound OLED technology is intended primarily as picture elements in practical display devices. These devices promise to be much less costly to fabricate than traditional LCD displays.

Differences Between LCD and CRT

- **Size**: An LCD is lightweight and compact, which saves desktop space as compared to a CRT.
- **Resolution**: An LCD is designed to work in a single resolution, while CRT is designed for many resolutions.
- **Pixel Density**: Pixel density of LCD is generally not as tight as the dot pitch in CRT, but for most applications, the density is acceptable.
- **Brightness:** The illuminated phosphor of a CRT is not nearly as bright as what the LCD can produce with its florescent backlight.
- **Power Consumption**: An LCD consumes significantly less power than CRT and has a low emission risk. Typically, the LCD consumes approximately half of the power of a typical CRT.
- **Viewing Angle:** A CRT can be viewed at almost any angle, but an LCD is best viewed 'head on'.
- **Cost:** Prices for LCD screens are quite high but they are coming down. They are still much more expensive than a CRT.

IV. STORAGE DEVICES

A *storage device* is any computing hardware that is used for storing, porting and extracting data files and objects. It can hold and store information both temporarily and permanently, and can be internal or external to a computer, server or any similar computing device.

There are two different types of storage devices:

- **Primary Storage Devices**: Generally smaller in size, are designed to hold data temporarily and are internal to the computer. They have the fastest data access speed, and include ***RAM, ROM, Registers*** and ***cache memory***.

- **Secondary Storage Devices**: These usually have large storage capacity, and they store data permanently. They can be both internal and external to the computer. External storage devices are also called **offline devices**. There are two main types of secondary storage: **Magnetic** (***Hard disk*** and ***floppy disk***) and **Optical device** (***CD, DVD, USB flash, ...***)

IV.1 Hard Disk/HDD

Alternatively referred to as a **hard disk drive** and abbreviated as **HD** or *HDD*, the hard drive is the computer's main storage media device that permanently stores all data and programs on the computer. A hard disk, for example, can store anywhere from 10 to more than 100 gigabytes, whereas most floppies have a maximum storage capacity of 1.4 megabytes.

IV.2 Floppy disk

A **floppy disk**, or **diskette**, is a disk storage medium composed of a disk of thin and flexible magnetic storage medium, sealed in a rectangular plastic carrier lined with fabric that removes dust particles. Floppy disks are read and written by a **floppy disk drive** (FDD). Floppy disk exist in various sizes: **8 inch**, **5¼-inch** and **3½-inch**

IV.3 Compact Disk (CD) / Digital Video Disk (DVD) / Blu-ray Disc (BD)

The **Compact Disc**, or CD for short, is an optical disc used to store digital data. It can have a storage capacity of 700MB or 80 minutes of continuous play.

DVD, initially called digital video disk, is a high-capacity data storage medium. A singe layer DVD can hold only 4.7 GB of data.

A **Blu-ray Disc** is a high density optical disc storage medium. The single layer Blu-ray disc can store up to 27 GB data.

Those disks exist in various types:

→ **CD-ROM / DVD-ROM / BD-ROM**: They come with pre-recorded data by the manufacturer and can be read but cannot be altered.

→ **CD-R / DVD-R / BD-R**: Type of **WORM** (***write once-read many***) disk that allows you to record your own data. Once written, the data on the CD-R can be read but cannot be altered.

→ **CD-RW / DVD-RW / BD-RW**: Disk is rewritable, which means, it allows writing, erasing and rewriting of the data several times, using a special peripheral device known as CD/DVD/BD-writer (or burner).

IV.4 Flash disks

A **USB flash drive** is a data storage device that includes flash memory with an integrated Universal (USB) interface. USB flash drives are typically removable and rewritable, and physically much smaller than a floppy disk. Most weigh less than 30 g. As of September 2011 drives of 256 gigabytes (GB) are available.

a) Memory card

A **memory card** or **flash card** is an electronic flash memory data storage device used for storing digital information. They are commonly used in many electronic devices, including digital cameras, mobile phones, laptop computers, MP3 players and video game consoles. They are small, re-recordable, and able to retain data without power. Their storage capacities range from 32MB up to 2TB (terabytes).

EXERCISES

1- Draw and describe the block diagram of a computer.
2- What do you understand by keyboard layout? Give two examples.
3- State, with appropriate examples, the difference between the following concepts:
   - Keyboard and keypad
   - Impact printer and non-impact printer
   - Mechanical mouse and optical mouse
   - Cd and DVD
   - DVD-ROM, DVD-R and DVD-RW
   - BD and DVD
4- Explain the following mouse actions: pointing, clicking, right-clicking, double-clicking.
5- Give two examples of
   - Keying device,
   - Pointing device
   - Scanning device
6- Explain the following acronym related to input devices: OMR, OBR, OCR, MICR
7- Explain the following acronym related to storage devices: DVD, BD, RAM
8- Explain the following terminologies related to video characteristics: VGA, EGA, CRT, LCD, LED, SXGA, Pixel, screen resolution, Direct-X
9- Explain with examples, the two categories of output device, ie hardcopy and softcopy

CHAPTER 3: INTRODUCTION TO COMPUTER SOFTWARE

Computer hardware is only as effective as the instructions we give it, and those instructions are contained in software. Software not only directs the computer to manage its internal resources, but also enables the user to tailor a computer system to provide specific business value. This chapter aims to:

- Define software and state the main difference between hardware and software
- give the main differences between application software and system software
- Classify the different type of application software by categories with examples in each category

Contents

I. DEFINITION OF SOFTWARE

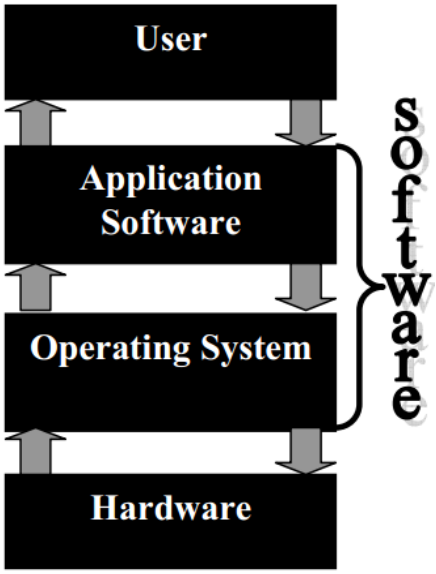
Computer software, or just **software**, is a collection of computer programs and related data that provides the instructions for telling a computer what to do and how to do it.
Software does nothing more than tell the computer how to accept some type of input, manipulate that input, and spit it back out again in some form that humans find useful.

II. .CLASSIFICATION OF SOFTWARE

Computer software can be organized into categories based on common function, task, or field of use. We can then categorize software in different ways.

II.1 Classification of software based on task

Based on the kind of task they perform, software can be divided into two major groups: **System software** and **application software.** A layer structure below shows where the operating system software and application software are situated while running on a typical desktop computer



II.1.1 System software

System software *is a type of computer software that controls the operation of the computer and provides facilities that extend the general capabilities of the machine*. This provides the basic functions for computer usage and helps to run the computer hardware and system. It includes a combination of the following:

1) Operating system

An operating system is a group of computer programs that coordinates all the activities among computer hardware devices. This is the most important type of system software in a computer. A user can't run an application program on the computer except it is self booting without the Operating System. Operating systems are contained in almost all devices including mobile phones.

Functions of an operating system

An operating system executes many functions to operate computer system efficiently. Among them, four essential functions are the followings.

- **Resource Management:** An operating system manages a collection of computer hardware resources by using a variety of programs. It manages computer system resources, including its CPU, primary memory, *virtual memory*, secondary storage devices, input/output peripherals, and other devices. For example, most operating systems now are **plug and play** which means a device such as a printer will automatically be detected and configured without any user intervention.

- **Task Management:** The function of the operating system that controls the running of many tasks. It manages one program or many programs within a computer system simultaneously.

- **File management:** This is a function that manages data files. An operating system contains file management programs that provide the ability to ***create, delete, enter, change,*** and **access** of files of data. The operating system keeps track of where files are located on the hard drive through the type of file system. The type two main types of file system most used are ***File Allocation table*** (**FAT**) or ***New Technology File system*** (**NTFS**).

- **User Interface:** It is a function of an operating system that allows users to interact with a computer. The two main types of user interfaces are: ***command line Interface (CLI)*** and a ***graphical user interface*** (GUI). With a command line interface, the user interacts with the operating system by typing commands to perform specific tasks. An example of a command line interface is **DOS** (disk operating system). With a graphical user interface, the user interacts with the operating system by using a mouse to access windows, **icons**, and **menus**. An example of a graphical user interface is Windows Vista or Windows 7.

Examples of popular modern operating systems include *Android*, *BSD*, *iOS*, *Linux* ***(ubuntu, Knoppix, Dreamlinux, …)*** *OS X*, *QNX*, *Microsoft Windows*(*Windows 95, 2000, Vista, 7, 8, ...*), *Windows Phone*, and *IBM z/OS*. All these, except Windows, Windows Phone and z/OS, share roots in UNIX.

2) Utility program

This is system software designed to help analyse, configure, optimise or maintain a computer. A single piece will be called a utility or tool. Some Well-known utility software include :

- **Antivirus programs:** They are used to detect and eliminate computer viruses and related malicious software. Some examples are: avast, AVG, Avira, BitDefender, Norton
- **Backup programs:** They help to make copies of all information valuable to a computer or information system and store it safe. The information can be restored in the event of disk failure or other accidents that will lead to data loss.
- **Data Recovery**: As the name implies, data recovery programs are used to recover data. Since disk drives or other hardware may fail, these utilities are essential to recover data in such a scenario.
- **Data Compression programs:** They make the data more compact, reducing the space occupied by the data.
- **Disk cleaner** scan find files that are unnecessary to computer operation, or take up considerable amounts of space. Disk cleaner helps the user to decide what to delete when their hard disk is full.
- **Cryptographic utilities** encrypt and decrypt streams and files.
- **Disk defragmenters** can detect computer files whose contents are broken across several locations on the hard disk, and move the fragments to one location to increase efficiency.
- **The Server:** In the context of client-Server architecture, a server is a computer program running to serve the requests of other programs – "the clients". The clients may run on the same systems or through networks.

3) Programming software

*I*t is the type of software that is used for creating other software. Another name for programming software is ***Integrated Development Environment*** (IDE). An IDE normally consist of a source code editor, a translator (compiler or interpreter) and a debugger.

- **Editor:** It is a programming tool that is used for creating and modifying application programs. It helps the computer user to enter, search, delete, replace, copy and insert text or sections of a text in a desired position.
- **Compiler:** It is used to convert a complete program written in a high-level language (such as Pascal and C) into a program in machine language.
- **Debugger:** It is a program that is used for locating and correcting programming errors.

4) Device driver

Device drivers are computer programs that allow the Operating System to communicate and interact with a hardware device. A new device connected to the computer should not work until its driver is installed.

II.1.2 Application software

Although system software has the vital job of controlling and managing the computer, it is the application software that lets you carry out the tasks for which the system was purchased. It enables the end users to accomplish certain specific tasks. Business software, databases and educational software are some forms of application software. Different word processors, which are dedicated to specialized tasks to be performed by the user, are other examples of application software.

a) General purpose software

A general purpose application, sometimes known as '**off-the-shelf**' is the sort of software that you use at home and school for different types of tasks

There are several good reasons for using general purpose software:

- It is relatively cheap
- It is easily available from most computer shops
- It will have been thoroughly tested so there won't be any serious problems or bugs
- There will be lots of user support i.e. books, user guides, online help and discussion forums on the Internet

Examples of General Purpose Application Software:

✓ **Desktop Publishing Software** - Often used to create graphics for point of sale displays, promotional items, trade show exhibits, retail package designs and outdoor signs. In very simple words, it could be said that it is a page maker application.

- ✓ **Word-Processing Software** - Used for the production (including composition, editing, formatting, and possibly printing) of any sort of printable material. This software enables users to create, format, edit and print electronic documents (Letters, reports, articles, …). The most popular examples of this type of software are ***MS-Word, WordPad and Word Perfect, Libreoffice writter***.
- ✓ **Spreadsheet Software** - A spreadsheet is an interactive computer application program for organization and analysis of data in tabular form. Spreadsheets developed as computerized simulations of paper accounting worksheets. The program operates on data represented as cells of an array, organized in rows and columns. ***Microsoft Excel, Lotus 1-2-3 Apple Numbers and*** **VisiCalc** are some examples of spreadsheet
- ✓ **Database software: Database** is a structured collection of data. A computer database relies on database software to organize data and enable database users to perform database operations. Database software allows users to store and retrieve data from databases. Examples are *Oracle, MSAccess, EasyPhp*, etc.
- ✓ **Graphic package** Allow you to create pictures and edit photographs. Example software: ***CorelDraw. Paint Shop Pro***.
- ✓ **Presentation Software:** The software that is used to display information in the form of a slide show is known as presentation software. This type of software includes three functions, namely, editing that allows insertion and formatting of text, methods to include graphics in the text and a functionality of executing slide shows. Microsoft ***PowerPoint*** and ***Micromedia*** director are the best example of presentation softwareWeb design application

b) Specific purpose software

They are highly specialized software that are designed to handle specific tasks. They're more limited in what they can do. They usually do only one thing, but they usually perform much better than a general purpose program in a specific task.

Some examples of specific software are

- ✓ **Communications software**: Used to send messages and emails Example software: MS Outlook Express. MS Messenger.
- ✓ **Desktop publishing programs**: Used to combine and control graphics and text in a single document. Example software: Adobe PageMaker. MS Publisher.
- ✓ **Web browser**: Computer program that enables internet users to access, navigate, and search World Wide Web sites. It is also called browser. Ex: *Mozilla Firefox, Internet explorer, Opera, Google chrome*
- ✓ **Enterprise Software:** It deals with the needs of organization processes and data flow. Customer relationship management or the financial processes in an organization are carried out with the help of enterprise software. Ex: Sage Saari
- ✓ **Multimedia Software:** They allow users to create and play audio and video files. They are capable of playing media files. Audio converters, audio players, burners,

video encoders and decoders are some forms of multimedia software. Examples of this type of software include *Real Player* and Windows *Media Player*.

c) Bespoke software

Although most organisations use general purpose software, some organisations will find that it just doesn't do exactly what they want or it doesn't work with their current systems. In this case, they might decide to have the software system they need designed and developed specifically for them. This is called 'tailor-made' or 'bespoke' software. ***Bespoke application software*** is tailor made for a specific user and purpose. For example a factory may require software to run a robot to make cars; however, it is the only factory making that car in the world, so the software required would have to be specially built for the task.

II.2 Classification of software based on source

Based on code source, we distinguish two types of software: Open Source Software and Closed Source Software.

II.2.1 Closed source software

Also called **proprietary software**, it is software with restricting on using, copying and modifying the source code as enforced by the proprietor. In other words, computer users do not have any access to the source code of the proprietary software. Well known examples of proprietary software include: ***Windows, RealPlayer, Adobe Photoshop, Mac OS***, ...

II.2.2 Open source software

It is the type of software that has no proprietary restriction attached to it, particularly the restriction about the access to the source code. In other words, open source software is designed in such a way that computer users can freely access and modify the source code to suit their individual need. It is also called non-proprietary software. E.g. ***Linux, Open Office, VLC player, Dev C++***

II.3 Classification of software based on licence

The term **licence** refers to a legal document or agreement giving someone permission to do and use something. A software licence comprises the permissions, rights and restriction imposed on a piece of software. Under a software licence, the Licensee is permitted to use the licence software in compliance with a specific term on the licence. Based on licence, computer software may be divided into the following:

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II.3.1 Freeware

This is a Copyrighted software given away for free use and distribution by the author. Although it is available for free, the author retains the copyright, which means that you cannot do

anything with it that is not expressly allowed by the author. Usually, the author allows people to use the software, but not sell it.

II.3.2 Shareware

Shareware (also termed trialware or demoware) is proprietary software that is provided freely to users on a limited duration (regularly 30 days) and only for a certain limited trial basis. After the 30 days, the user must buy it before being able to use it again

II.3.3 Crippleware

The shareware version of a program whose most advanced and most desirable features have been disabled with the intention of increasing users apetite for the better version. If the fee is paid, a code is acquired, which uncripple the program.

II.3.4 Nagware:

Nagware (also known as annoyware) is a type of shareware, that reminds —or nags— the user to register it by paying a fee. It usually does this by popping up a message when the user starts the program or, worse, intermittently while the user is using the application. These messages can appear as windows obscuring part of the screen or message boxes that can quickly be closed. Some nagware keeps the message up for a certain time period, forcing the user to wait to continue to use the program

II.3.6 Adware:

Advertising-supported software is any software package which automatically plays, displays, or downloads advertising material to a computer after the software is installed on it or while the application is being used.

II.3.7 Liteware

This is the free version of a program, that does not contain those features that are attractive to frequent or heavy user.

II.3.8 Vapoware

Vaporware (or vapourware) is software or hardware which is announced by a developer well in advance of release, but which then fails to emerge, either with or without a protracted development cycle.

II.4 Other type of software

Custom Software: Software that is developed for a specific user or organization is custom software. Since it is built for a specific user, its specifications and features are in accordance with the user's needs.

Off-the-Shelf Software: As opposed to custom software, off-the-shelf software is standard software bought off the shelf. It has predefined specifications that may or may not cater to any specific user's requirements. When you buy it, you agree to its license agreement.

Tailor Made Software**:** Tailor made software is software that is made to the specifications of a client. In other words it is custom made, bespoke, or 'tailored' to address a specific need ***Retail Software:*** While shareware is provided as a trial version to users, retail software is sold to end users.

Firmware**:** Firmware is a combination of software (generally, system software) permanently stored in the memory (hardware). As the name suggests, it is a program or data that has been written onto the read-only memory (ROM). For example, the BIOS (which is installed inside a computer on a chip) checks different parts of the system before loading the operating system into the memory.

Liveware: People who write programs, operate and maintain the computers are collectively known as liveware, humanware or peopleware; for example, programmers, system analysts and hardware engineers.

II.5 Software package and software suite

A **software package** is an assemblage of files and information about those files. Word processing, spreadsheets and databases are examples of different types of software packages. Licensed software such as Microsoft Office, and open source Linux software which is available for free are also examples off different types of software packages.

A **software suite**, also known as **application suite** generally consists of two or more software programs delivered within a single executable and installable file. So;e example of software suites are:

- Microsoft office suite (Microsoft word, Microsoft excel, Microsoft access, Microsoft PowerPoint, …)
- Open office suite
- Google doc suite
- WordPerfect Office X3

EXERCISES

1- Explain the following types of software:
   - Application software
   - System software
   - Bespoke software

- Tailor-made software
- Off-the-shell software
- Operating system
- Utility software
- Firmware
- Liveware
- Custom software

2- What is an Operating System? Give two functions of OS and four examples of OS.
3- Give and describe briefly the types of system software.
4- Give the use of each of the following utility software with an example in each case:
   - Disk cleaner
   - Antivirus
   - Backup program
   - Disk defragmenter
5- What is the use of a device driver?
6- Give the difference between the following concepts:
   - Application software and system software
   - FAT and NTFS
   - CLI and GUI
   - General purpose software and specific purpose software
   - Open source software and proprietary software
   - Freeware, shareware, crippleware and nagware
   - Software package and software suite
7- Give two examples of:
   - Presentation software
   - Desktop publishing software
   - Word processing software
   - Spreadsheet software
   - Graphic software
   - Web browser
   - Open source software
   - Closed source software
   - Freeware
   - Software suite

CHAPTER 4: INTERNAL COMPONENTS OF A COMPUTER

Learning objectives

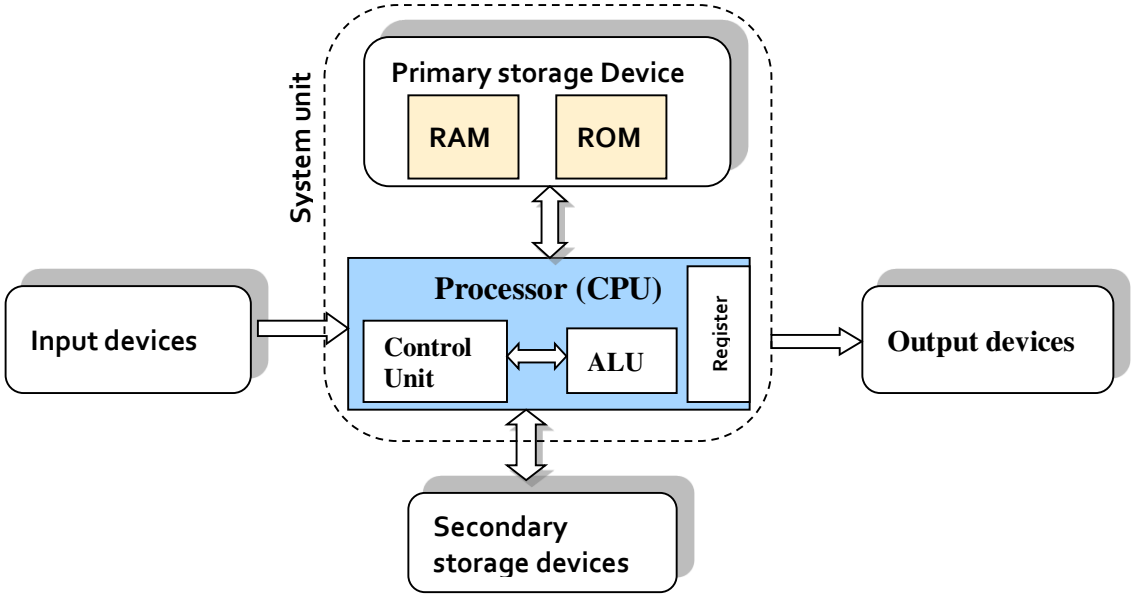
After studying this topic students will be able to:

- Learn about a microprocessor and its characteristics
- Learn the various units of memory
- Understand and give examples of expansion cards such as NICm video card, …

Contents

INTRODUCTION

The system unit represents a case containing the main components of the computer. When the system unit (case) is opened, we can identify three main sectors: The power supply unit, the disk drives case and the motherboard or planar board. This chapter aims to study each of internal components of the computer as it is described by the diagram below.



I. THE MOTHERBOARD

A **Motherboard** or **system board** is the main circuit board in an electronic device such as microcomputers. The motherboard contains sockets enabled to connect other components of the computer such as: processor, main memories, buses, expansion cards, …

II. THE CENTRAL PROCESSING UNIT (CPU)

I.1- Definition

The **CPU** also known as the **processor** is mounted on the system board (mother board) inside the system unit. It's regarded as the brain of the computer because it does all the processing activities in the computer. It interprets all the instructions given to it and carries out these instructions.

I.2- Parts of the CPU

There are different parts of the CPU which are:

- **Control unit** which coordinates all the processing activities in the CPU as well as input, storage and output operations.
- **Arithmetic and logic unit:** This is a unit in the CPU where all the logical and arithmetic operations are carried out. It does this by decoding instructions from the control unit to processes data. Some of the arithmetic operations include: addition, subtraction, division, multiplication etc. logical operations include: less than, equal to, greater than, sorting, filtering etc

- **Cache memory and register:** They are special purpose memories located in the processor

I.3- Characteristics of the CPU

The common characteristics of a CPU can affect it in many different ways to help your computer: A microprocessor can be characterized by:

- **Instruction Set**: It is the set of instructions that the microprocessor executes
- ***Number of cores:*** The core fetches and decodes instructions. So if you add more than one it will increase the speed of performance of the computer system.
- ***Cache size***: Therefore, having a larger cache size on the CPU can improve the performance of the computer.
- **The clock speed**: The microprocessor's pace is controlled by the System Clock. The System Clock is an electronic circuit that generates pulses. The number of pulses generated by the clock per unit of time is its Clock speed., faster is the CPU. The speed of the CPU is measured in MEGAHERTZ (MHz), which corresponds to the million of cycles per second (1 MHz = 1 million of cycle per second = number of instructions per second).

I.4- Types of the CPU

Microprocessors can also be classified according to their ability of some CPUs to work on multiple instructions at the same time. Also, some CPUs are ***CISC*** (*Complex Instruction Set Computing*), while others are ***RISC*** (*Reduced Instruction Set Computing*). RISC chips have a smaller set of simpler instructions; they need multiple instructions to perform an action that a CISC chip does with one instruction, but the RISC chip is faster overall at completing the operation.

I.5- Examples of CPU

The most commonly used CPU in PCs are made by **Intel**. Since IBM chose the **Intel 8088** chip for the original IBM PC, most PC clones have used one of the Intel series of CPUs:

→ **8088** - used in IBM PC
→ **80286** - used in IBM PC AT
→ **80386** - used in first PC clone from Compaq
→ **80486** - you heard phrases like "I have a 486 PC"
→ **Pentium** - Intel couldn't trademark a number, such as 80586
→ **Pentium II** - (Hexium or sexium just wouldn't sound right)
→ **Pentium III**
→ **Pentium 4** - Most desktop PCs in 2004 used the P4 chip.
→ **dual core, core i3, i5, i7…**

Another manufacturer of microprocessors for the PC is **AMD** (Advanced Micro Devices, Inc.). Their line of **Athlon** processors have been successful in taking a substantial fraction of the PC CPU market away from Intel.
The Macintosh series of computers from Apple originally used the **Motorola 68000** series of microprocessors.

III. THE MAIN MEMORY

II.1- Definition

The **main memory** is also called **primary storage**. It stores data that is directly accessible by the CPU. The main memory of a computer can be classified as **RAM** (*random access memory*) and **ROM** (*read only memory*)

II.2- Memory capacity

The smallest unit that can be directly addressed by the computer. is called **bit** (binary unit). Memory quantities can be expressed in Byte (which corresponds to 1 character) or multiple of byte.

→ **1 byte = 8 bits**
→ **Kilobyte** (KB): 1KB = 1024 bytes approx 1000 bytes
→ **Megabyte** (MB): 1MB = 2^{10} bytes approx 10^6 bytes
→ **Gigabyte** (GB): 1GB = 2^{30} bytes approx 10^9 bytes
→ **Terabytes** (TB): 1TB = 2^{40} approx 10^{12}bytes

Application exercises:

1. Calculate in byte and in bit the memory capacity needed to store the following information: "*Computer science is my best subject; I love it.*"
2. The capacity of a DVD-Rom is 4.7GB and the one of a CD-ROM is 700 MB. How many CD-ROM do we need to store the content of a full DVD-ROM?

II.2- Random Access Memory (RAM)

RAM (random access memory) is the place in a computer where the operating system, application programs, and data in current use are kept so that they can be quickly reached by the computer's processor. RAM is much faster to read from and write to than the other kinds of storage in a computer, the hard disk, floppy disk, and CD-ROM. RAM is **volatile**, that is it loses its content when the computer is switched off.

Types of RAM

There exist two main types of RAM: Static RAM and Dynamic RAM

- **Static RAM** (SRAM): It is the RAM that retains data bits in its memory as long as power is being supplied. Static RAM provides faster access to data and is more expensive than DRAM. SRAM is used for a computer's cache memory
- **Dynamic RAM** (DRAM): It is the most common kind of RAM for personal computers and workstations. It needs to have its storage cells refreshed or given a new electronic charge every few milliseconds.

SRAM	DRAM
Faster	Slower
Expensive	Cheaper
Does not refresh contents	Refresh contents over times
Less memory per chip	More memory per chip

II.3- Read Only Memory (ROM)

As the name suggests, a **ROM** is a type of memory that can perform read operation only. The contents of ROM are written by the manufacturer and come along with the computer. It is a **non-volatile** memory, which means that contents stored in it are not lost even when the power to the computer is switched off. Instructions that are needed to start the computer are also stored in the ROM. ROMs are slower as compared to RAMs and are available in various types. There exist several types of ROM.

- **Programmable Read Only Memory** (**PROM)**: This type of ROM can be programmed even after its manufacture using a PROM programmer circuit. But once a PROM is programmed, it becomes just like ROM i.e. it cannot be changed.
- **Erasable Programmable Read Only Memory** (EPROM): In this type of ROM, the contents can be erased and the memory can be reprogrammed. To erase the data, an EPROM is exposed to ultraviolet light and then it can be reprogrammed using a PROM programmer circuit.
- **Electrically Erasable Programmable Read Only Memory** (EEPROM): The contents of this type of ROM can be erased and then reprogrammed using electric signals. Nowadays RAMs and EEPROMs are integrated in a single chip.

II.4- Special purpose memories

These are types of memories housed in the CPU, system board, input and output devices to enhance performance. There exist different types of special purpose memory

- ✓ **Buffers:** A buffer is a region of physical memory storage used to temporarily hold data while it is being moved from one place to another.
- ✓ **Cache memory**: The CPU cache is a memory buffer that sits between the processor and the main memory. As the microprocessor processes data, it looks first in the cache memory and if it finds the data there (from a previous reading of data). Cache memory is sometimes described in levels of closeness and accessibility to the microprocessor.

- ✓ **Registers**: A processor register is a small amount of storage available as part of a CPU or other digital processor. There exist different types of register: **Instruction Register** (IR), **Address register**

IV. THE EXPANSION CARDS

Expansion cards are also called **expansion boards**, **controller cards**, **plug-in boards**, **adapter cards**, or **interface cards**.
Expansion boards are printed circuit boards used to provide additional functionalities to a computer. They are plugged into **expansion slots.** There exist many types of expansion card:

- **Video Card:** A **video card** (also known as **graphics card**) is an expansion card whose function is to generate and output images to a display.
- **Sound Card: A sound card** is an expansion card that facilitates the input and output of audio signals to/from a computer. Many computers have sound capabilities built in, while others require additional expansion cards to provide for audio capability.
- **Network Card:** A **Network Interface Card** (*NIC*), also called **Ethernet card**, is an expansion card that allows computers to communicate over a computer network. Every Ethernet network card has a unique 48-bit serial number called a **MAC address**, which is stored in ROM carried on the card.
- **TV Card**: A TV tuner card is a kind of television tuner that allows television signals to be received by a computer. Most TV tuners also function as video capture cards, allowing them to record television programs onto a hard disk much like the digital video recorder does.

V. BUS

A *bus* is a collection of wires through which data is transmitted from one part of a *computer* to another. There are many types of bus:

- the **data bus** carries the actual data being processed
- the **address bus** carries the information on which device the CPU is communicating with
- A **control bus** is (part of) a computer bus, used by CPUs for communicating with other devices within the computer.

VI. OTHER INTERNAL COMPONENTS OF THE COMPUTER

VI.1 Hard Disk Drive (HDD)

The Hard Disk drive is a type of permanent computer data storage. It is the component containing all users' data and programs install in the computer. Nowadays hard drive can be more than 500GB and it is one of the criteria to consider while purchasing a computer.

VI.2 CD-ROM Drive

A CD Rom drive is a drive that reads compact discs only, but now expands to DVDs as well. CDs are available in a range of sizes but by far the most common is 700 MB. The DVD (Digital Versatile Disc) can have a capacity of 4GB and more. Another type of optical disk is **Blu-Ray Disk** which can have a capacity greater than 16 GB.

VI.3 Power Supply

The power supply maintains all of the power coming in and out of the computer, keeping the right voltage while cooling the computer down at the same time. The power supply, when all connected up properly provides power to the computer, if something went wrong, like it broke; there would be no power going to the computer.

VI.4 Fan

A fan inside a computer is a fan that sucks cool air into the PC case and blows hot air out of the case and stops any key components overheating. This is an essential part of a computer's cooling system.

VI.5 Computer ports

In computer hardware, a **port** serves as an interface between the computer and other computers or peripheral devices. Following are few important types of ports:

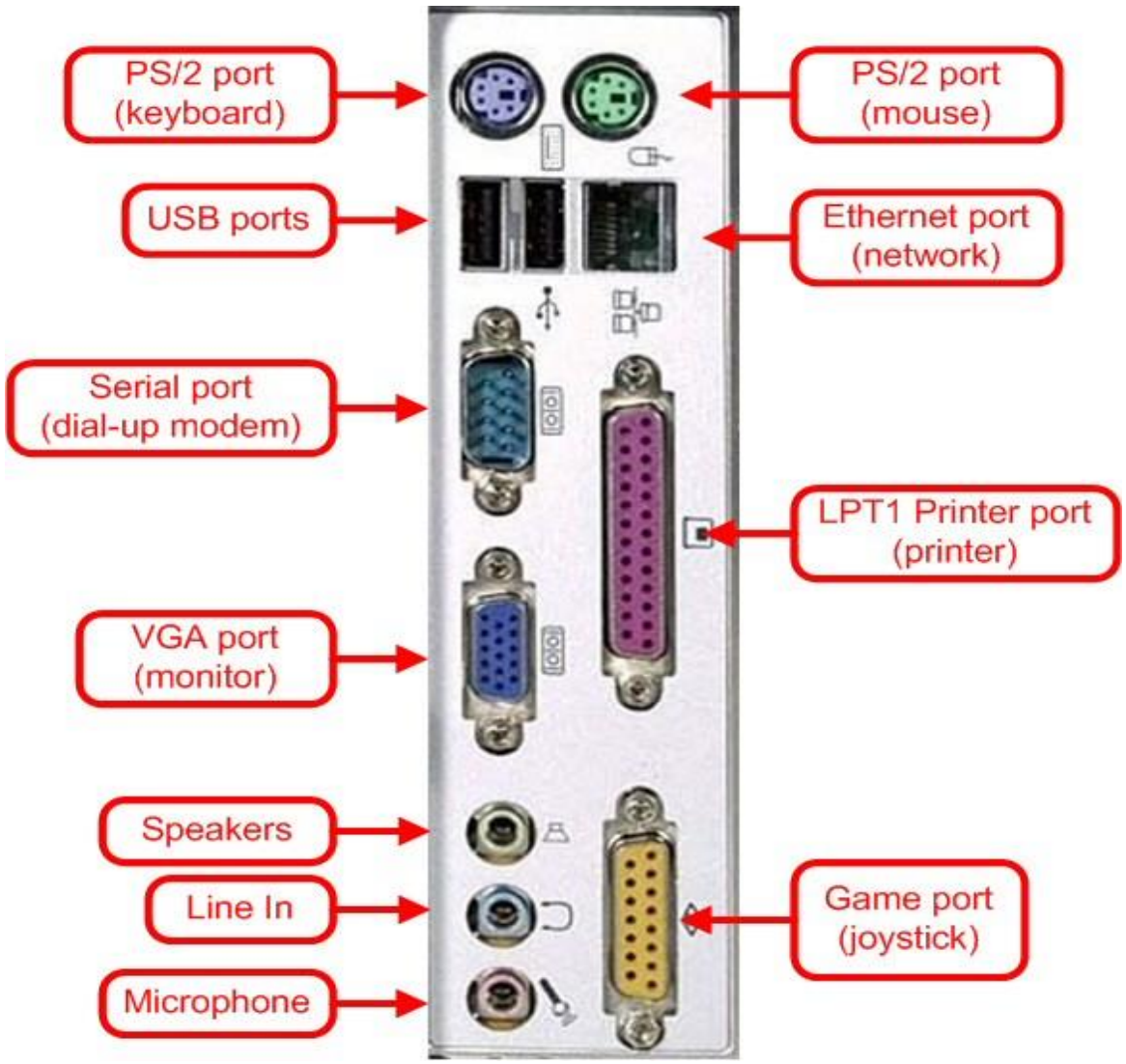
- ✓ **Serial Port**: Used for external modems and older computer mouse.
- ✓ **Parallel Port:** Used for scanners and printers
- ✓ **PS/2 Port**: Used for old computer keyboard and mouse
- ✓ **Universal Serial Bus (or USB)** Port: Can connect all kinds of external USB devices such as external hard disk, printer, scanner, mouse, keyboard, etc.
- ✓ **VGA Port:** Connects monitor to a computer's video card.
- ✓ **Power Connector:** Connects to the computer's power cable that plugs into a power bar or wall socket.
- ✓ **Modem:** Connects a PC's modem to the telephone network.
- ✓ **Ethernet Port or RJ45 port:** Connects to a network and high speed Internet.
- ✓ **Game Port:** Connect a PC to a joystick, now replaced by USB.
- ✓ **Digital Video Interface,** DVI port: Connects a Flat panel LCD monitor to the computer's high-end video graphic cards.
- ✓ **Sockets:** Connect microphone, speakers to sound card of the computer

EXERCISES

1- Give the role of the following part of the CPU
   - ALU
   - Control unit
   - Register

- Cache memory

2- Name and explain two characteristics of the processor
3- Classify the following CPU in order of performance: 80246, 8086, Pentium III, Core i5, core i7, Dual core, Pentium 4
4- Calculate in Megabyte, in Kilobyte and in bit the size of memory occupied by a book of 100 pages, each page having 1024 characters.
5- Give the difference between:
   - RAM and ROM
   - SRAM and DRAM
6- State and explain the different types of ROM
7- What is the use of the following memory: Buffer, Cache memory, register?
8- What is an expansion card? Give four examples
9- What is a BUS? Explain the three types of BUS.
10- Name five examples of computer ports
11- State two ways in which a hard disk is different from a CD-ROM.



CHAPTER 5: FILES AND FOLDERS MANAGEMENT

Learning objectives
After studying this lesson, student should be able to:

- Understand files and folders
- Classify files according to their extension
- Differentiate between relative and absolute file path

Contents

I. NOTION OF FILE

I.1 Definition of File

File can be defined as a collection of related information recorded on secondary storage (e.g., disks). Almost all information stored in a computer must be in a file.
Every file has the following details:

1. Size, date, and time the file was created or modified
2. A unique name and an optional extension. The name and **extension** are separated by a period (.) e.g. filename.exe.

I.2 File extension

A **file extension** is the ending of a file that helps identify the type of file in operating systems such as Microsoft Windows. n Microsoft Windows. The file extension is a period that is often followed by three characters, but may also be one, two, or four characters long. For example, the filename "myfile.txt" has an extension of ".txt", which is a file extension associated with text files.

I.3 Files attributes

File attributes are settings associated with computer files that grant or deny certain rights to how a user or the operating system can access that file. For example, IBM compatible

computers running MS-DOS or Microsoft Windows have capabilities of having read, archive, system, and hidden attributes.

- **Read** - Only allows a file to be read, but nothing can be written to the file.
- **Archive** - Tells Windows Backup to backup the file.
- **System** - System file.
- **Hidden** - File will not be shown when doing a regular dir from DOS.

As new versions of Windows came out, Microsoft has added to the inventory of available attributes on the NTFS file system, including but not limited to:

- **Compressed:** When set, Windows compresses the hosting file upon storage. For more information,
- **Encrypted:** When set, Windows encrypts the hosting file upon storage to prevent unauthorized access. For more information,
- **Indexed:** When set, Indexing Service or Windows Search do not include the hosting file in their indexing operation.

I.4 File operations

The most basic operations that programs can perform on a file are:

- **Create a new file**: You create a file any time you use an application program like MicroSoft Word, or PowerPoint.
- **Change the access permissions and attributes** of a file
- **Open** a file, which makes the file contents available to the program
- **Read** data from a file
- **Write** data to a file
- **Close** a file, terminating the association between it and the program

I.5 File type and File format

A **file type** is a name given to a specific kind of file. For example, a Microsoft Word document and an Adobe Photoshop document are two different file types. While these file types are associated with individual applications, other file types, such as rich text RTF files and MP3 audio files are standard file types that can be opened by multiple programs.

Computer file types can be characterized in a few major groups:

- **System File** - is a computer file important to the operating system.
- **Application File** –hold programs and are executable
- **Data Files** – contain user's specific data. Some examples of data files are: ***text file, image file, audio file, video file, ...***

A **file format** is a standard way that information is encoded for storage in a computer file. It is the specific structure or arrangement of data code stored as a computer file. A file format tells the computer how to display, print, and process, and save the data. Each file format is associated to an extension.

The terms "*file type*" and "*file format*" are often used interchangeably. However, a file format technically describes the structure and content of a file. For example, the file format of an image file "Bitmap" or JPEG.

The table below describe the file type, file format and corresponding programs.

File type	**Extension**	**Signification**	**Associated program**
Text Files	Txt	Plaint text file	Bloc note, Wordpad
	Doc, docx	Microsoft Word Document	Microsoft office word
	.pdf	Portable Document Format.	
	.rtf	Rich Text Format File	Wordpas, Ms Word
Data Files	.dat	Data File	
	.pps	PowerPoint Slide Show	Microsoft Power point
	.xls, .xlsx	Excel file	Microsoft excel 2007
	.tar	Consolidated Unix File Archive	
Audio Files	.wma	Windows Media Audio File	Windows MediaPlayer VLC player AIMP player
	.wav	WAVE Audio File	
	.mp3	MPEG-1 Audio Layer-3.	
	.m3u	Media Playlist File	
Video Files	.3gp	3GPP Multimedia File	Windows MediaPlayer VLC player
	.avi	Audio Video Interleave File	
	.flv	Flash Video File	
	.mp4	MPEG-4 Video File	
	.MPG, .MPE, .MPEG	Moving Picture Experts Group.	
Image Files	.bmp	Bitmap Image File	Paint Office Picture Manager Windows Photo Viewer
	.gif	Graphical Interchange Format File	
	.jpg, .jpeg	JPEG Image	
	.tiff	Tagged Image File Format	
	.png	Portable Network Graphic	
Executable Files	.exe	Windows Executable File	
	.jar	Java ARchive	
Web Files	.htm, .html	Hypertext Markup Language File	Any browser
	.css	Cascading Style Sheet	Notepad Block note
	.js	JavaScript File	

System Files	.lnk	Windows File Shortcut	
	.sys	Windows System File	
	.dll	Dynamic Link Library	
	.ico	Icon File	
Compressed Files	.7z	7-Zip Compressed File	Winrar, Winzip
	.rar	WinRAR Compressed Archive	Winrar
	.zip	Zipped File	Winzip
	.tar.gz	Compressed Tarball File	

I.6 Notion of file system

(FS, or "filesystem") 1. A system for organizing directories and files, generally in terms of how it is implemented in the disk operating system. Some example of file systems are:

1. FAT8, FAT16, FAT32
2. NTFS
3. EXT2, EXT3, EXT4, ...
4. HFS (***Hierarchical File System***.) used in Macintosh computers

II. FILE MANANAGEMENT AND DIRECTORY

A **directory** is a location for storing files on your computer. In a Graphical User Interface (GUI), it referred to as a **Folder.** A directory that is located within another directory is called a **subdirectory**. In the way the term **subfolde**r is used to describe a folder beneath another folder in a graphical user interface (GUI). Unlike files, directories and folders have no extension. Below are some additional directory related terminologies.

→ **Root directory**: The root is also the highest level in a directory hierarchy. For example, in MS-DOS, the root or root directory of the primary hard drive would C:\.

→ **Current directory**: Alternatively referred to as the **working directory**, the **current directory** is the directory or folder that is currently open.

→ **Parent directory**, this refers to a directory that contains the current directory. For example, the MS-DOS path

→ A **child directory** is a sub process of the main parent process. It is common for the parent process to remain active or open until the child process is completed.

Example: "***C:\Windows\System32***" contains the directories '**Windows'** and '**System32**', the **'Windows' directory** is the parent directory of the 'System32' directory and **C:** is the root directory.

III. FILE AND FOLDER MANAGEMENT

File management refers to the ability to read and modify files on storage devices and to create and delete files. In a computer file system that is organized as a hierarchy or tree, the ***root directory*** is the directory that includes all other directories.
On most computers (**C:**) is your primary storage for all of the programs, folders and files on your system. But we can also have a second hard drive (**D:**), which is used as a recovery area and DVD-ROM drive (**E:**).

Folders hierarchy

Most file systems are based on a hierarchical model in which files are grouped into directories, and directories are organized in a hierarchy. This organization is called a **directory tree**. At the top of the hierarchy is the "**root" directory**. The figure below shows two examples of representations of the same file hierarchy.

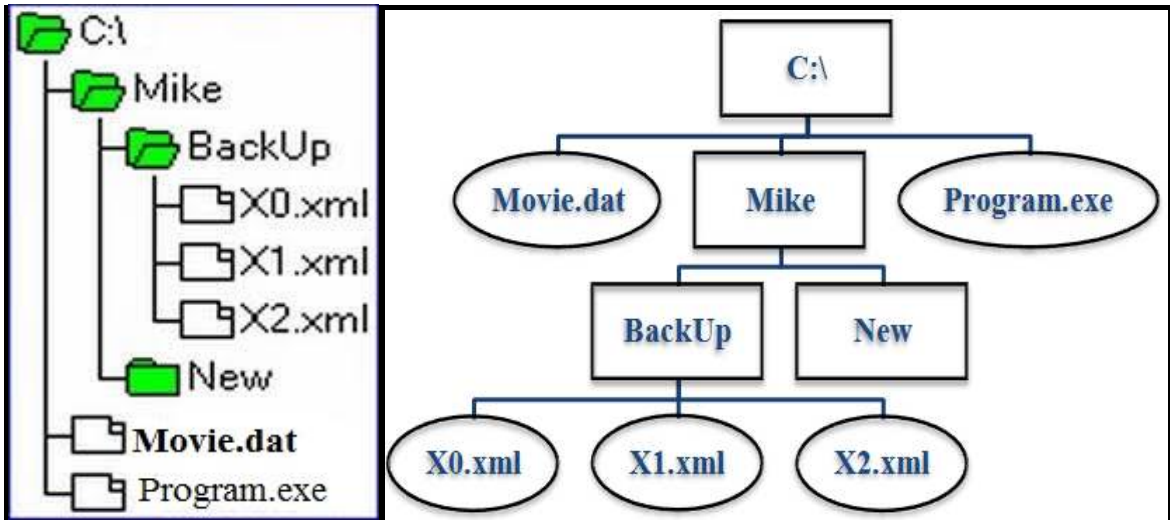


Figure: A directory tree

The above hierarchy is made up by four folders (***C:, Mike, BackUp and New***) and five files (***movie.dat, Program.exe, X0.xml, X1.xml and X2.xml***)

a) **C:** is the file root directory, it contains one folder (Mike) and two files (Movie.dat and Program.exe)
b) The folder "movie" has two subfolder "BackUp" and "New". We can also say that "Movie" is the **parent directory** of "Backup" and "New".

IV. FILE PATH

Alternatively referred to as the **pathname**, the **path** is the complete location or name of where a computer, file, web, or other object is located. When working with a MS-DOS, Windows, or Windows command line path the drives, directories, and files are all separated by a **backslash** (\) whereas in Linux they are separated by a **slash** (/). The URL path uses also slash to separate

folders and files both in Linux and Windows. Here below are two examples of path both in Linux and in Windows OS.

→ In Windows : **C:\Windows\calc.exe**

→ In Linux : **/home/users/c/computerhope/path.htm**

→ A URL path **: http://www.computerhope.com/jargon/p/path.htm**

Absolute path

Alternatively referred to as the **file path** or **full path**, the **absolute path** is a path that contains the root directory and all other subdirectories that contain a file or folder.

Examples: 1) All the file paths given previously are absolute file.

2) In the directory tree above, the absolute path of the file "X1.xml" is ***C:\Mike\BackUp\X1.xml***

Relative path

Alternatively referred to as a **partial path** or **non absolute path**, a **relative path** is only a portion of the full path. Relative paths make use of two special symbols, a dot (.) and a double-dot (..), which translate into the current directory and the parent directory. Double dots are used for moving up in the hierarchy. A single dot represents the current directory itself.

Examples. In the directory tree above,

c) If the current directory is "Mike", then the relative path of the file "X1.xml is **.\BackUp\X1.xml**.

d) If the current directory is "New", then the relative path of the file "X1.xml is **..\BackUp\X1.xml**.

APPLICATION EXERCISES

Exercise 1:

1- Define the following: File, directory, file extension, file attribute, file path

2- List and explain four operations an operating system can perform on a file

3- Explain the following acronyms: WMA, GIF, HTML, FLV, MPEG, TIFF, JPEG, DLL

4- What is an encrypted file?

5- What is a file system? Give three examples

6- Explain the following: Root directory, current directory, Parent directory

7- Give the difference between the following

a) File type and file extension

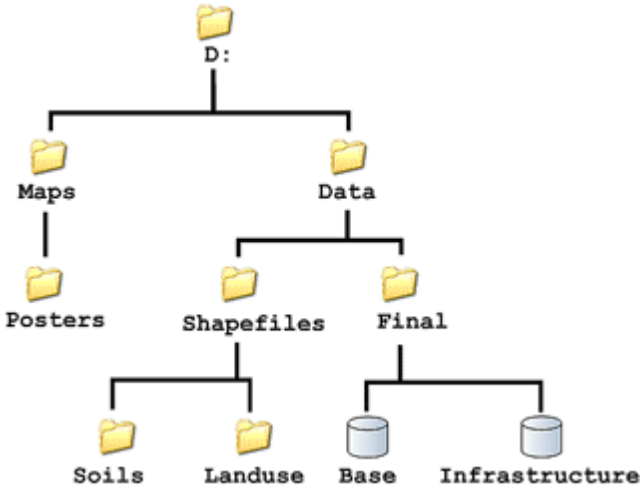
b) File type and File format

c) Folder and directory

d) File system and system file

e) Absolute path and relative path

Exercise 2: Let's consider the following folders hierarchy. Observe it carefully and answer the questions below.



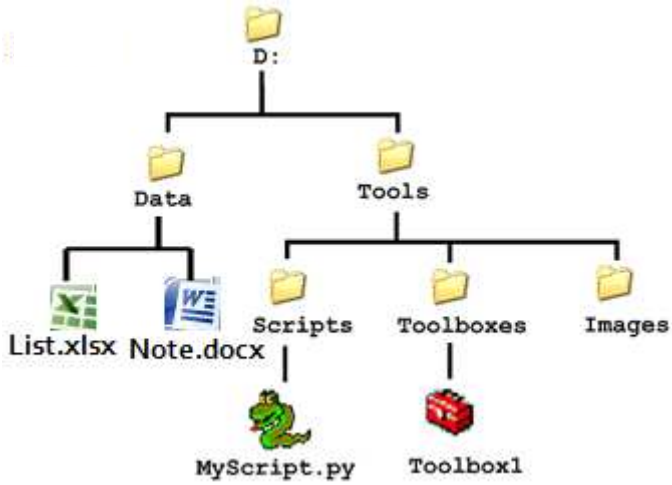
1. What is the root directory?
2. Name the parent directory of the directory called "Maps" and one child directory of the directory called "Shapefiles"
3. Give the absolute path of the following directories: Data, Poster and Infrastructure
4. Give the relative path of the folder "Soils" in each of the following cases:
   a) The current folder is "Data"
   b) The current folder is "Maps"
   c) The current folder is "Final"
   d) The current folder is "Base"
5. Add the following folders on the tree given their paths below
   a) The absolute path is: C:\Maps\Card
   b) The absolute path is: C:\data\Final\Exam
   c) The relative path from the "Soils" folder is ..\Drawing

Exercise 3

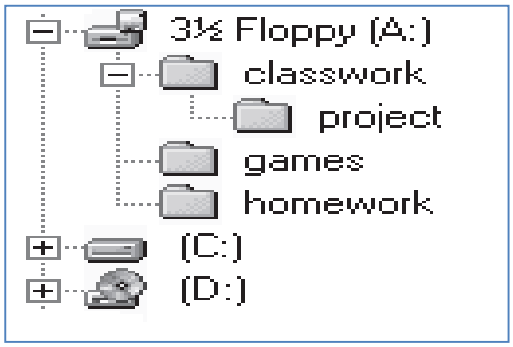
1- Name the directories and the files present in this arborescence

2- Let's consider the files "list.xlsx" and "Note.docs".
   a) Give the absolute path of each.
   b) What is the file type of each?
   c) Suggest a program to use to open each of the file.

3- The folder "Images" contain a subfolder called "picture", which in turn contain a file named "logo.jpg".
   a) What is the path of the file "logo.jpg"



b) Suggest a program used to open “logo.jpg”



Exercise 4

The diagram below shows part of a directory structure displayed by an operating system.

1- State any two root directories.

2- Name two sub-directories of $3\frac{1}{2}$ floppy(A)

CHAPTER 6: REPRESENTATION OF INFORMATION

Since the early days of human civilization, people have been using their fingers, sticks and other things for counting. As daily activities became more complex, the numbers became more important in trade, time and distance, and in all other spheres of human life. It became apparent that we needed more than our fingers and toes to keep track of the number in our daily routine. In 3400 BC, the ancient Egyptians started using special symbols for writing the numbers. This was a major advancement, because it reduced the number of symbols required. However, it was difficult to represent large or small numbers by using such a graphical approach.

Learning objectives

After studying this lesson, student should be able to:

- Learn about binary, octal, decimal and hexadecimal number systems
- Learn conversions between two different number systems
- Understand internal storage encoding of characters: ASCII, ISCII and UNICODE

Contents

V. WHAT IS A NUMBER SYSTEM?

A **number system** defines a set of values that is used to represent quantity. Each number system has a **base** also called **a Radix**. It represents the number of symbols used in the

number system. Eventually, the number systems that are generally used by the computers are as follows:

→ A **decimal number system** is a system of base 10;
→ **binary** is a system of base 2;
→ **octal** is a system of base 8; and
→ **Hexadecimal** is a system of base 16.

The base of a number system is indicated by a subscript (decimal number) and this will be followed by the value of the number. The following are few examples:

- ✓ $(7592)_{10}$ is of base 10 number system.
- ✓ $(214)_8$ is of base 8 number system.
- ✓ $(123)_{16}$ is of base 16 number system

Number System	Radix Value	Set of Digits	Example
Decimal	r = 10	0, 1, 2, 3, 4, 5, 6, 7, 8, 9	$(25)_{10}$
Binary	r = 2	0, 1	$(11001)_2$
Octal	r = 8	0, 1, 2, 3, 4, 5, 6, 7	$(31)_8$
Hexadecimal	r = 16	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F	$(19)_{16}$

Table 1. Types of Number Systems

The table below shows the conversion of the some numbers in the four various bases

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

Table 2: Conversion of tables

Factorisation.

Let consider the number N of n digits in base b written as follow: $(\boldsymbol{D_{n-1} \dots D_2 D_1 D_0})_{\boldsymbol{b}}$. N can be also written

$$\boldsymbol{N = D_{n-1}b^{n-1} + \cdots + D_i b^i + \cdots + D_2 b^2 + D_1 b^1 + D_0 = \sum_0^{n-1} D_i b^i}$$

VI. CONVERSION BETWEEN NUMBER BASES

We have discussed earlier that internally the computer uses binary numbers for data representation, whereas externally it uses decimal numbers. However, any number in one number system can be represented in any other number system. Conversion between number systems can be classified into three types: Coding, decoding and encoding.

II.1. Coding

Coding is the conversion from decimal base (base 10) to any non-decimal base b ($b \neq 10$).

II.1.1 Coding of whole numbers

The method used for the conversion of a decimal number to a non-decimal base b is often called the remainder method.

This method involves the following steps:

1. Begin by dividing the decimal number by b (the base of the number).
2. Note the remainder separately as the rightmost digit of the equivalent.
3. Continually repeat the process of dividing by b until the quotient is zero and keep writing the remainders after each step of division (these remainders will less than b).
4. Finally, when no more division can occur, write down the remainders in the reverse order (last remainder written first).

Examples: **a)** Determine the binary equivalent of $(36)_{10}$.
b) Convert (671)10 into base 6, then in Base 16.

2	
36	
18	**0**
9	**0**
4	**1**
2	**0**
1	**0**
0	**1**

Remainders

Taking remainders in the reverse order, we have

6	
671	
111	**5**
9	**0**
4	**1**
2	**0**
1	**0**
0	**1**

Remainders

$(36)_{10}=(100100)_2$

Taking the remainders in the reverse order, we have **$(670)_{10}=(100105)_6$**

16	
671	
41	**15=F**
2	**9**
0	**2**

Taking the remainders in the reverse order, we have

$(670)_{10}=(29F)_{16}$

II.1.2 Conversion of Decimal Fractions

The method used for the conversion of decimal fractions is similar to the above technique except that instead of division, the mathematical process of multiplication is used. Moreover, instead of looking for a remainder, we will look for a whole number. This method involves the following steps:

1. Multiply the decimal fraction by the base b.

2. If a whole number is generated, place that integer in that position, if not then place 0.
3. Remove the whole number and continue steps 1 and 2 with the fraction value until it becomes 0.
4. Finally, when no more multiplication can occur, write down the remainders in the downward direction (as shown by the arrow mark).

Examples:

a) Determine the binary equivalent of $(0.375)_{10}$.

$0.375 \times 2 = 0.750 \quad 0$
$0.75 \times 2 = 1.50 \quad 1$
$0.5 \times 2 = 1.0 \quad 1$ ↓

Finally, $\mathbf{(0.375)_{10} = (0.011)_2}$

b) Determine hexadecimal conversion of $(671.175)_{10}$

We have already noticed in the previous question that $(671)_{10} = (29F)_{16}$. Now let convert $(0.175)_{10}$ in base 16

$0.175 \times 16 = 2.8 \quad 2$
$0.8 \times 16 = 12.8 \quad C$
$0.8 \times 16 = 12.8 \quad C$ ↓
....

Finally, $\mathbf{(671.175)_{10} = (29F.2CCC...)_{16}}$

II. 2. Decoding

To decode is convert from a non-decimal base b ($b \neq 10$) to the decimal base (base 10).

II.2.1 Conversion of whole numbers

In this case, each digit of the binary number is multiplied by its weighted position, and each of the weighted values is added together to get the decimal number.

Examples:

a) Convert 235_8 into base 10.

$8^2\ 8^1\ 8^0$
2 3 5

The Process:
Above each of the digits in your number, list the power of the base that the digit represents. See the example on the left. It is now a simple process of multiplication and addition to determine your base 10 number. In this example you have

$5 \times 8^0 = 5$ **$3 \times 8^1 = 24$** **$2 \times 8^2 = 128$**	Now simply add these values together. **$5 + 24 + 128 = 157$** **Answer: $235_8 = 157_{10}$**

**Remember: any number to the zero power equals one.

b) Convert 1011_2 to base 10.

$1 \times 2^0 = 1$
$1 \times 2^1 = 2$
$0 \times 2^2 = 0$
$1 \times 2^3 = 8$

$1 + 2 + 0 + 8 = 11$

Answer: $1011_2 = 11_{10}$

c) Convert $1C4_{16}$ to base 10.

$4 \times 16^0 = 4$
$C \times 16^1 = 12 \times 16^1 = 192$
$1 \times 16^2 = 256$

$4 + 192 + 256 = 452$

Answer: $1C4_{16} = 452_{10}$

II.2.2 Conversion of non-decimal fractions to decimal fraction

The conversion of fractions is similar to the decimal numbers. The only difference is the negative exponents, which are used to denote the negative powers of b. Here, instead of a 'decimal' point we have a 'binary' point. The exponential expressions of each fractional placeholder are $\mathbf{b^{-1}}$, $\mathbf{b^{-2}}$, and in this way the exponent notation proceeds. The steps involved in the conversion process are as follows:

1. Write the weight value of each bit of the non decimal fractional number.
2. Multiply the weighted position with the respective bit of the non decimal fractional number.
3. Add all the weighted values to get the decimal number.

Examples:

a) Determine the decimal equivalent of $(0.01101)_2$.

Number	0	1	1	0	1
Weight of Each Bit	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}
Weighted Value	1/2 × 0	1/4 × 1	1/8 × 1	1/16 × 0	1/32 × 1
Solved Multiplication	0	1/4	1/8	0	1/32

Thus, the decimal equivalent of $\mathbf{(0.01101)_2}$ is $\mathbf{(0.40625)_{10}}$.

b) Determine the decimal equivalent of $\mathbf{(237.04)_8}$.

Octal Number	2	3	7	0	4
Weight of Each Bit	8^2	8^1	8^0	8^{-1}	8^{-2}
Weighted Value	64 × 2	8 × 3	1 × 7	1/8× 0	1/64× 4
Solved Multiplication	128	24	7	0	0.0625

Sum of weight of all bits = **128 + 24 + 7 + 0 + 0.0625 = 159.0625**
Thus, the decimal equivalent of $\mathbf{(237.04)_8}$ is $\mathbf{(159.0625)_{10}}$.

c) Determine the decimal equivalent of $\mathbf{(45C.8BE3)_{16}}$.

Hexadecimal Number	4	5	C = 12	8	B = 11	E = 14	3
Weight of Each Bit	16^2	16^1	16^0	16^{-1}	16^{-2}	16^{-3}	16^{-4}
Weighted Value	256 × 4	16 × 5	1 × 12	1/16 × 8	1/256 × 11	1/4096 × 14	1/65,536 × 3
Solved Multiplication	1024	80	12	0.5	.0429687	.0034179	.0000457

Sum of weight of all bits = **1024 + 80 + 12 +0.5 + .0429687 + .0034179 + .0000457= 1116.5464323**

Thus, the decimal equivalent of **$(45C.8BE3)_{16}$ is $(1116.5464323)_{10}$.**

II.3. Encoding

Encoding is the conversion from a non-decimal base to a non-decimal base. Some special cases would be distinguished.

II.3.1 Conversion of Binary to Hexadecimal

The conversion of an integer binary number to hexadecimal is accomplished by the following steps:

1. Break the binary number into four-bit sections starting from the LSB to the MSB.
2. Convert the four-bit binary number to its hexadecimal equivalent.

For whole numbers, it may be necessary to add a zero to the MSB to complete a grouping of four bits.

NOTE: By adding a zero, the MSB will not change the value of the binary number.

Examples:

a) **Determine the hexadecimal equivalent of** $(1010111110011011001)_2$

Binary Number	0010	1011	1100	1101	1001
Decimal Number	2	11	12	13	9
Hexadecimal Number	2 (MSB)	B	C	D	9 (LSB)

The hexadecimal equivalent of $(1010111110011011001)_2$ is $(2BCD9)_{16}$.

b) **Determine the hexadecimal equivalent of** $(1100001.101011110011)_2$.

Binary Number	0110	0001	1010	1111	0011
Decimal Number	6	1	10	15	3
Hexadecimal Number	6	1	A	F	3

The hexadecimal equivalent of **$(1100001.101011110011)_2$** is **$(61.AF3)_{16}$.**

II.3.2 Conversion of Hexadecimal to Binary

Converting a hexadecimal (base 16) number to a binary (base 2) number is a precise process. Since a single digit in a hexadecimal number corresponds directly to a four-digit binary number, to convert the hexadecimal number into its binary equivalent, the following steps are involved:

1. Convert each hexadecimal digit to its four-bit binary equivalent.
2. Combine the four-bit sections by removing the spaces to get the binary number.

Examples:

a) Determine the binary equivalent of $(5AF)_{16}$.

Hexadecimal Number	5	A	F
Binary Coded Value	0101	1010	1111

Combining the four bits of the binary-coded values, we have **010110101111**.

Thus, the binary equivalent of $\mathbf{(5AF)_{16}}$ is $\mathbf{(010110101111)_2}$.

b) **Determine the binary equivalent of** $(2B.6C)_{16}$.

Hexadecimal Number	2	B	6	C
Binary Coded Value	0010	1011	0110	1100

Combining the four bits of the binary-coded values, we have 00101011.01101100.

Thus, the binary equivalent of $\mathbf{(2B.6C)_{16}}$ is $\mathbf{(00101011.01101100)_2}$.

II.3.3 Conversion of Octal to Hexadecimal

Octal and hexadecimal have certain relations with binary, that is, the first digit in octal corresponds to the first three digits in its binary equivalent and so on. The same is true for hexadecimal and this time each digit represents four binary digits. This makes the conversion of octal to hexadecimal and vice versa quite easy. This conversion involves the following steps:

1. Convert each octal digit to three-bit binary form.
2. Combine all the three-bit binary numbers.
3. Divide the binary numbers into the four-bit binary form by starting the first number from the right bit to the first number from the left bit.
4. Finally, convert these four-bit blocks into their respective hexadecimal symbols.

Examples:

a) Determine the hexadecimal equivalent of $(2327)_8$.

Octal Number	2	3	2	7
Binary Coded Value	010	011	010	111

Combining the three-bit binary blocks, we have 010011010111.

Dividing the group of binary numbers into the four-bit binary blocks and by converting these blocks into their respective hexadecimal symbols, we have:

0100	1101	0111
4	D	7

Thus, the hexadecimal equivalent of $(2327)_8$ is $(4D7)_{16}$.

b) Determine the hexadecimal equivalent of $(31.57)_8$.

Octal Number	3	1	5	7
Binary Coded Value	011	001	101	111

Combining the three-bit binary blocks, we have 011001.101111.

Dividing the group of binary numbers into the four-bit binary blocks and by converting these blocks into their respective hexadecimal symbols, we have:

0001	1001	1011	1100
1	9	B	C

Thus, the hexadecimal equivalent of $(31.57)_8$ is $(19.BC)_{16}$.

II.3.4 Conversion of Hexadecimal to Octal

This conversion follows the same steps of octal to hexadecimal conversion except that each hexadecimal digit is converted into a four-bit binary form and then after grouping of all the four bit binary blocks, it is converted into the three-bit binary form. Finally, these three-bit binary forms are converted into octal symbols.

Examples:

a) Determine the octal equivalent of $(5DE247)_{16}$.

Hexadecimal Number	5	D	E	2	4	7
Binary Coded Value	0101	1101	1110	0010	0100	0111

Combining all the four-bit binary blocks, we have **010111011110001001000111**.

Dividing the group of binary numbers into the three-bit binary blocks and by converting these blocks into their respective octal symbols, we have:

010	111	011	110	001	001	000	111
2	7	3	6	1	1	0	7

Thus, the octal equivalent of $(5DE247)_{16}$ is $(27361107)_8$.

b) Determine the octal equivalent of $(7B.64D)_{16}$.

Hexadecimal Number	7	B	6	4	D
Binary Coded Value	0111	1011	0110	0100	1101

Combining all the four-bit binary blocks, we have 01111011.011001001101.

Dividing the group of binary numbers into the three-bit binary blocks and by converting these blocks into their respective octal symbols, we have:

001	111	011	011	001	001	101
1	7	3	3	1	1	5

Thus, the hexadecimal equivalent of (7B.64D)16 is (173.3115)8

VII. ARITHMETIC OPERATIONS IN NUMBER SYSTEMS

VII.1 Binary addition

- **0 + 0 = 0**
- **0 + 1 = 1**
- **1 + 0 = 1**
- **1 + 1 = 0, and carry 1 to the next more significant bit**

Examples,

a) 00011010 + 00001100 = 00100110

```
    1 1    carries
  0 0 0 1 1 0 1 0  =  (26)10
+ 0 0 0 0 1 1 0 0  =  (12)10
  0 0 1 0 0 1 1 0  =  (38)10
```

b) 00010011 + 00111110 = 01010001

```
    1 1 1 1 1    carries
  0 0 0 1 0 0 1 1  =  (19)10
+ 0 0 1 1 1 1 1 0  =  (62)10
  0 1 0 1 0 0 0 1  =  (81)10
```

VII.2 Binary Subtraction

Rules of Binary Subtraction

0 - 0 = 0

0 - 1 = 1, and borrow **1** from the next more significant bit

1 - 0 = 1

1 - 1 = 0

Examples,

a) 00100101 - 00010001 = 00010100

```
        1   borrows
 00100101  =  (37)10
- 00010001  =  (17)10
 00010100  =  (20)10
```

00110011 - 00010110 = 00011101

```
        11   borrows
 00110011  =  (51)10
- 00010110  =  (22)10
 00011101  =  (29)10
```

VII.3 Binary Multiplication

The multiplication process for binary numbers is similar to that for decimal numbers. Partial products are formed, with each product shifted one place to the left. This is illustrated below.

$$\begin{aligned} 0 \times 0 &= 0 \\ 0 \times 1 &= 0 \\ 1 \times 0 &= 0 \\ 1 \times 1 &= 1 \end{aligned}$$

Rules of Binary Multiplication

Example, a) **111 x 101**

$$\begin{array}{rrrrrr} & & & 1 & 1 & 1 \\ & & \times & 1 & 0 & 1 \\ \hline & & & 1 & 1 & 1 \\ & & 0 & 0 & 0 & 0 \\ + & 1 & 1 & 1 & 0 & 0 \\ \hline 1 & 0 & 0 & 0 & 1 & 1 \end{array}$$

b) 101001 × 110 = 11110110

```
   101001  =  (41)10
×     110  =  (6)10
   000000
  101001
 101001
 11110110  =  (246)10
```

III.4 Binary division

Binary division follows a similar process to that of decimal division.

Example: Divide **(a)** $(15)_{10}$by $(5)_{10}$ in binary form, and **(b)** $(15)_{10}$ by $(6)_{10}$ in binary form.

(a)

```
          1 1
1 0 1 | 1 1 1 1
        1 0 1
        -----
          1 0 1
          1 0 1
          -----
          0 0 0
```

(b)

```
              1 0 .1
1 1 0 | 1 1 1 1 .0
        1 1 0
        -----
            1 1 0
            1 1 0
            -----
            0 0 0
```

VII.5 Operation in octal and hexadecimal

For the other bases, the process is the same. The following table below show table those various operations in different basis.

+	0	1	2	3	4	5	6	7
0	0	1	2	3	4	5	6	7
1	1	2	3	4	5	6	7	10
2	2	3	4	5	6	7	10	11
3	3	4	5	6	7	10	11	12
4	4	5	6	7	10	11	12	13
5	5	6	7	10	11	12	13	14
6	6	7	10	11	12	13	14	15
7	7	10	11	12	13	14	15	16

A (header row); Sum (body); B (first column)

Octal addition

x	1	2	3	4	5	6	7
1	1	2	3	4	5	6	7
2	2	4	6	10	12	14	16
3	3	6	11	14	17	22	25
4	4	10	14	20	24	30	34
5	5	12	17	24	31	36	43
6	6	14	22	30	36	44	52
7	7	16	25	34	43	52	61

octal multiplication (Base 8)

+	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10
1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11
2	3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12
3	4	5	6	7	8	9	A	B	C	D	E	F	10	11	12	13
4	5	6	7	8	9	A	B	C	D	E	F	10	11	12	13	14
5	6	7	8	9	A	B	C	D	E	F	10	11	12	13	14	15
6	7	8	9	A	B	C	D	E	F	10	11	12	13	14	15	16
7	8	9	A	B	C	D	E	F	10	11	12	13	14	15	16	17
8	9	A	B	C	D	E	F	10	11	12	13	14	15	16	17	18
9	A	B	C	D	E	F	10	11	12	13	14	15	16	17	18	19
A	B	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A
B	C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B
C	D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C
D	E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D
E	F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E
F	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20

Hexadecimal Addition Table

*	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
2	0	2	4	6	8	A	C	E	10	12	14	16	18	1A	1C	1E
3	0	3	6	9	C	F	12	15	18	1B	1E	21	24	27	2A	2D
4	0	4	8	C	10	14	18	1C	20	24	28	2C	30	34	38	3C
5	0	5	A	F	14	19	1E	23	28	2D	32	37	3C	41	46	4B
6	0	6	C	12	18	1E	24	2A	30	36	3C	42	48	4E	54	5A
7	0	7	E	15	1C	23	2A	31	38	3F	46	4D	54	5B	62	69
8	0	8	10	18	20	28	30	38	40	48	50	58	60	68	70	78
9	0	9	12	1B	24	2D	36	3F	48	51	5A	63	6C	75	7E	87
A	0	A	14	1E	28	32	3C	46	50	5A	64	6E	78	82	8C	96
B	0	B	16	21	2C	37	42	4D	58	63	6E	79	84	8F	9A	A5
C	0	C	18	24	30	3C	48	54	60	6C	78	84	90	9C	A8	B4
D	0	D	1A	27	34	41	4E	5B	68	75	82	8F	9C	A9	B6	C3
E	0	E	1C	2A	38	46	54	62	70	7E	8C	9A	A8	B6	C4	D2
F	0	F	1E	2D	3C	4B	5A	69	78	87	96	A5	B4	C3	D2	E1

Hexadecimal Multiplication Table

VIII. BINARY CODING SCHEMES

A code is made by combining bits of definite size. Binary Coding schemes represent the data such as alphabets, digits 0-9, and symbols in a standard code. A combination of bits represents a unique symbol in the data. The standard code enables any programmer to use the same combination of bits to represent a symbol in the data.

The binary coding schemes that are most commonly used are

- Binary Coded Decimal (BCD)
- American Standard Code for Information Interchange (ASCII)
- Extended Binary-coded Decimal Interchange Code (EBCDIC)

VIII.1- BCD

Binary Coded Decimal (BCD) is a method of using binary digits to represent the decimal digits 0–9. Binary code decimal digits (0–9) are represented by using four bits. The valid combinations of bits and their respective values are shown in the table below.

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

Table. Binary-coded Decimal

VIII.2 EBCDIC

EBCDIC is a single byte (8 bit) character encoding standard that is used in the IBM mainframe environment. EBCDIC uses 8 bits (4 bits for zone, 4 bits for digit) to represent a symbol in the data. It allows 2^8= 256 combinations of bits

VIII.3 ASCII

It is a character encoding standard developed several decades ago to provide a standard way for digital machines to encode characters. ASCII codes are of two types –ASCII-7 and ASCII-8. **ASCII-7 can represent 128 characters. Out of 7 bits, 3 are zone bits and 4 are numeric bits. ASCII-8 can represent 256 characters. It is an extended form of ASCII-7.**

EXERCISES

MCQ

1. Choose the correct answer from below for the result of the binary multiplication 1101 × 110.
(a) 1001111, (b) 1010110, (c) 1001110, (d) 1011111.

2. Choose the correct answer from below for the result of the binary division 11011 ÷ 1001.
(a) 10, (b) 101, (c) 11, (d) 110.

3. Which of the following is the binary product 1001 × 111?
(a) 110111 (b) 111111, (c) 111011, (d) 111110.

4. Which of the following is the binary product 1101 × 1011?
(a) 10101111, (b) 10001111, (c) 10101011, (d) 10111011.

5. Which of the following is the binary division 10101 ÷ 11?
(a) 100, (b) 110, (c) 101, (d) 111.

6. Which of the following is the binary division 100011 ÷ 1010?
(a) 10.1, (b) 11.11, (c) 11.01, (d) 11.1.

Exercise 1.

(a) Convert the binary number 1011 into decimal form.
(b) Convert the binary number 1.011 into decimal form.
(c) Convert the numbers 15 and 12 into binary form, add the two binary numbers together and convert the answer to decimal form to check that the sum is correct.
(d) Convert the numbers 9 and 6 into binary form. Use this to find $9 - 6$ in binary form. Check that the answer is correct by converting the binary answer into decimal form.

Exercise 2.

In each of the questions below, a product is written in decimal form. In each case, convert both numbers to binary form, multiply them in binary form and check that the solution is correct by converting the answer to decimal form. (Click on the green letters for solutions.)

(a) 3×2, **(b)** 4×4, **(c)** 5×10, **(d)** 6×7, **(e)** 9×6, **(f)** 11×7

Exercise 3.

In each of the questions below, a division is written in decimal form. In each case, convert both numbers to binary form, perform the division in binary form and check that the solution is correct by converting the answer to decimal form. (Click on the green letters for solutions.)

(a) $6 \div 2$, **(b)** $8 \div 2$, **(c)** $9 \div 3$, **(d)** $10 \div 4$, **(e)** $21 \div 7$, **(f)** $18 \div 8$.

CHAPTER 7: INTRODUCTION TO COMPUTER NETWORK

Networking is the concept of sharing resources and services. A network, therefore, is a set of interconnected systems with something to share. We can have for instance, a telephone network, a railway network, a roadmap network. When the things to share are computers or computer devices, it is called a computer network. This chapter describes the basics of what computer network is and how it works.

Learning objectives

After studying this topic, student should be able to:

- Define computer network and classify types of network according to certain criteria
- Define and name some example of network device
- Give the different network topologies, advantages an d disadvantage of each

Contents

I. BASIC NETWORKING CONCEPTS

I.1- Definition and Network Basics

Networking is the concept of sharing resources and services. A **network** is a set of interconnected objects (roads, computers, …) with something to share. A **computer network** is therefore a group of interconnected systems sharing resources and interacting using a shared communications link. All networks must have the following:

- A resource to share (resource)
- A pathway to transfer data (transmission medium)
- A set of rules governing how to communicate (protocols)

Having a transmission pathway does not always guarantee communication. When two entities communicate, they do not merely exchange information; rather, they must understand the information they receive from each other. The goal of computer networking, therefore, is not simply to exchange data but to understand and use data received from other entities on the network.

I.2- BENEFITS OF COMPUTER NETWORK

One of the main reasons to build computer network is to share things. Specifically, networks are about sharing three things***: information, resources***, and ***applications***.

- **Sharing information**: networks allow users to communicate with each other in various ways: email, chat, forums, etc.
- **Sharing resources**: Certain computer resources, such as printers or hard drives, can be set up so that network users can share them. Sharing hard drives involves also sharing of files and folders. A network can be used to share an Internet connection.
- **Sharing applications:** One of the most common reasons for networking in many businesses is so that several users can work together on a single business application. For example, an accounting department

Apart from sharing, other benefits of a computer network are:

- **Flexible Access**: Networks allow their users to access files from computers throughout the network.
- **Reducing of cost**: Instead of buying a printer for each computer of a big network, a single printer can be shared, and then cost is considerably reduced

I.3- DOWNSIDES (SHORTCOMMINGS) OF NETWORKING

Although networks are one of the best things that ever happened to computers, not everything about networks is rosy. The following sections describe some disadvantages of using a network:

- ✓ **Viruses:** If a virus is introduced to the network, either intentionally or unintentionally, it will rapidly spread around all of the workstations and could start to cause havoc to peoples' files or to the efficient working of the network.
- ✓ **Network failure:** If the file server fails then no-one on the network can access any files or folders. This means that nobody can do any work. For an organization, this would be extremely costly and disruptive.
- ✓ **Slow service:** As more users log onto the network and request files, send things to be printed and open more software applications, the network can start to slow down.
- ✓ **Cost:** Building a network isn't cheap.

I.4- Networking hardware

Networking hardware includes all computers, peripherals, interface cards and other equipment needed to perform data-processing and communications within the network. Some examples of networking hardware are: ***File Servers, Workstations, Network Interface Cards, Hubs, Switches, Repeaters, Bridges, and Routers***:

a) **Workstations:** Each user computers connected to a network is called **workstations**. A typical workstation is a computer that is configured with a network interface card, networking software, and the appropriate cables.
b) **Network Interface Cards(NIC):** It is an internal device that provides the physical connection between the network and the computer workstation.
c) **Hub:** It is the most basic networking device that connects multiple computers or other network devices together.
d) **Switch.** Switches (or concentrators) work the same way as hubs, but they can identify the intended destination of the information that they receive, so they send that information to only the computers that are supposed to receive it.
e) **Repeaters:** Since a signal loses strength as it passes along a cable, it is often necessary to boost the signal with a device called a **repeater**. The repeater electrically amplifies the signal it receives and rebroadcasts it.
f) **Bridges:** A bridge is a device that allows you to segment a large network into two smaller, more efficient networks
g) **Routers:** A **router** is a device that forwards data packets between computer networks, creating an overlay internetwork.
h) **Gateway:** A gateway is a network point that acts as an entrance to another network. On the Internet, a node or stopping point can be either a gateway node or a host (end-point) node.
i) **Firewall:** A software utility or hardware device that limits outside network access to a computer or local network by blocking or restricting ports. Firewalls are a great step for helping prevent un-authorized access to a company or home network.
j) **Modem: (*Modulator – Demodulator*)** The Modem is a hardware device that enables a computer to send and receive information over telephone lines. It converts the digital data used by your computer into an analog signal used on phone lines and then converting it back once received on the other end.

II. CLASSIFICATION OF COMPUTER NETWORK

Computer networks can be classify in different ways: according to the geographical area covered, the strategy used or type of connection

II.1 ACCORDING TO THE TYPE OF CONNECTION

According to the type of connection, there exist two types of connections. Wired connection and wireless connection

II.1.1 Wired connection

A wired home network is when you physically connect your computer or other compatible device to your Super Hub with an Ethernet cable.

II.1.2 Wireless connection

A wireless network, as its name would suggest, is a network of computers and computer peripherals that are connected to each other without wires.

II.2 ACCORDING TO THE GEOGRAPHICAL AREA COVERED

According to the geographical area covered, there exist three main types of network: LAN, MAN and WAN

II.2.1 Local Area Network (LAN)

A LAN is a computer network that spans only a small geographical area such as an office, home or building. The infrastructure in a LAN is private. The distance between computers in a LAN cannot be more than 15 Km. **Ex**: A school network

II.2.2 Metropolitan Area Network (MAN)

A MAN is a network of computers spread over a city or closed cities. It may be a single network such as a cable television network, or it may be many LANS connected together. It can be either a private network or a public network. **Ex:** A network of all the agencies of CAMCCUL in Bamenda

II.2.3 Wide Area Network (WAN)

A WAN is a system of interconnecting many computers over a large geographical area such as states, countries or even the whole world. These kinds of networks use telephone lines, satellite link and other long-range communication technologies to connect. For instance a company like Express Union with agencies at Fundong, Bamenda, Douala, Bafoussam, Yaoundé use a WAN to connect all its agencies. Although a WAN may be owned or rented by private business, it is usually a public network, designed to connect LANs or MANs together. The most known and the largest WAN is **Internet**.

II.2.4- Other types of network

- **PAN** (**Personal Area Network**). A LAN own by an individual

- **CAN** (**Campus Area Network**): It s the type of LAN limited to a campus

II.3 ACCORDING TO THE STRATEGY USED

According to the strategy used there exist two main types of network: Client/Server network and Peer to Peer (P2P) network:

II.3.1 Client/server networks

Computers that provide services to the other workstations in a network are called **servers**. Computers that use the services of a server are called **clients**. Networks in which servers control access to network storage and other network resources are called **client/server networks**. In a Client/server network, the role of the server is to provide services demanded by client computers

II.3.2 Peer-to-peer networks

Computers that perform similar functions on a network are called **peers**. Networks in which no single, centralized computer controls network functions are called **peer-to-peer** networks. The idea of peer-to-peer networking is that each computer on the network can be both a server and a client. All computers are considered to have equal, or peer, status.

II.3.3 Comparison between Peer to Peer network and Client/Server network

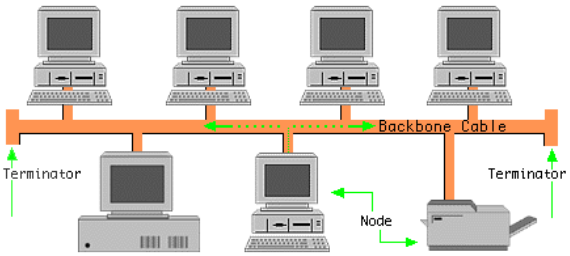
Strategy	**Advantages**	**Disadvantages**
Client/Server	· Heavy processing power can be localized when needed. · Overall installation costs are less than a hierarchical network. · Servers provide clients with access to shared printers, network storage (including shared applications), network security features, and other network resources.	· Administrative tasks not entirely centralized. · Expensive to add nodes.
P2P	· Relatively inexpensive to implement, can often be implemented on existing equipment. · Potentially, all resources can be made available over a network. · Processing power can be localized to the point of need.	· Decentralized administration. · Security can be difficult to control

III. NETWORK TOPOLOGIES

Network topology is the layout pattern of interconnections of the various elements (links, nodes, etc.) of a computer network. Network topologies may be physical or logical. **Physical topology** refers to the physical configuration of a network that determines how the network's computers are connected. **Logical topology** refers to how data is actually transferred in a network as opposed to its physical design.

The main types of physical topologies are: ***Bus Topology***, ***Star Topology***, ***Ring Topology***, ***Mesh Topology***, ***Tree Topology***, ***Hybrid Topology***

III.1- Bus Topology



Bus Topology is the simplest of network topologies. In this type of topology, all the nodes (computers as well as servers) are connected to the single cable (called **bus**), by the help of interface connectors. A signal from the source is broadcasted and it travels to all workstations connected to bus cable. A terminator is added at ends of the central cable, to prevent bouncing of signals. A barrel connector can be used to extend it.

Advantages (benefits) of Linear Bus Topology

1) It is easy to set-up and extend bus network.
2) Cable length required for this topology is the least compared to other networks.
3) Bus topology costs very less.
4) Linear Bus network is mostly used in small networks. Good for LAN.

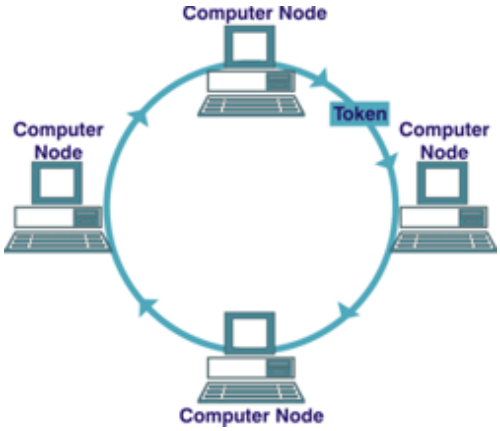
Disadvantages (Drawbacks) of Linear Bus Topology

5) There is a limit on central cable length and number of nodes that can be connected.
6) If the main cable (i.e. bus) encounters some problem, whole network breaks down.
7) Efficiency of Bus network reduces, as the number of devices connected to it increases.
8) It is not suitable for networks with heavy traffic.
9) Security is very low because all the computers receive the sent signal from the source.

III.2- Ring Topology

In Ring Topology, all the nodes are connected to each-other in such a way that they make a closed loop. Data travels around the network, in one direction. Sending and receiving of data takes place

by the help of **TOKEN**. Token contains a piece of information which along with data is sent by the source computer.



Advantages of Ring Topology

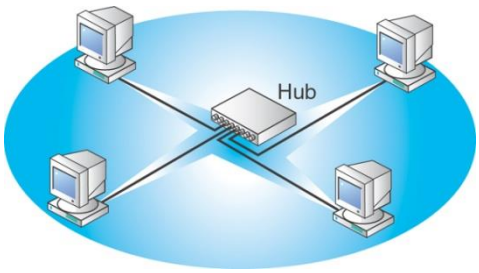
1) No collision possible.
2) The performance doesn't depend on the number of nodes.
3) Each computer has equal access to resources.

Disadvantages of Ring Topology

1) It is slower than Star topology.
2) If one workstation or port goes down, the entire network gets affected.
3) Network is highly dependent on the wire which connects different components.

III.3- Star Topology

In Star topology, all the components of network are connected to a central device which may be a hub, a router or a switch. All the data on the star topology passes through the central device before reaching the intended destination.



Advantages of Star Topology

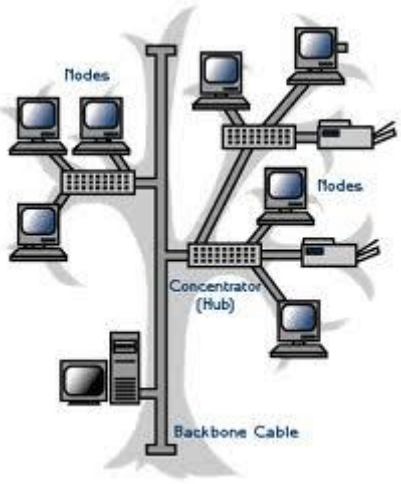
1) Easy to add or to remove nodes or devices.
2) Centralized management. It helps in monitoring the network.
3) Failure of one node or link doesn't affect the rest of network.

Disadvantages of Star Topology

1) If the central device fails, the whole network goes down.
2) Very expensive to set up.

III.4- Tree Topology

Tree Topology integrates the characteristics of Star and Bus Topology. In Tree Topology, a number of Star networks are connected using Bus. It is also called **Expanded Star Topology**.



Advantages of Tree Topology

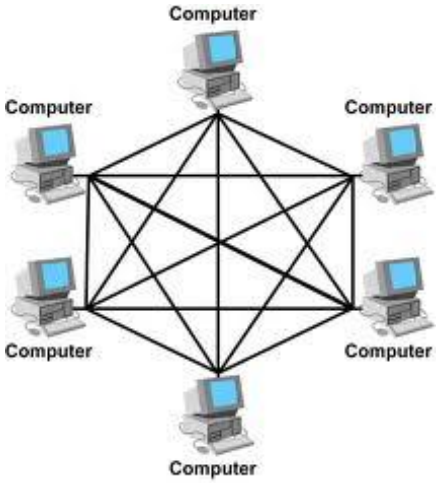
1. Expansion of Network is possible and easy.

2. Error detection and correction is easy.
3. If one segment is damaged, other segments are not affected.

Disadvantages of Tree Topology

1. If the main bus cable breaks, the whole network is crippled.
2. Maintenance is difficult.

III.5- Mesh topology



In a mesh network topology, each of the network node, computer and other devices, are interconnected with one another. In fact a **true mesh** topology is the one where every node is connected to every other node in the network.

Advantages of Mesh topology

1) Data can be transmitted from different devices simultaneously.
2) Even if one of the links fails there is always an alternative present. So data transfer doesn't get affected.
3) Expansion and modification in topology can be done without disrupting other nodes.

Disadvantages of Mesh topology

1) There are high chances of redundancy in many of the network connections.
2) Overall cost of this network is way too high as compared to other network topologies.
3) Set-up and maintenance of this topology is very difficult. Even administration of the network is tough.

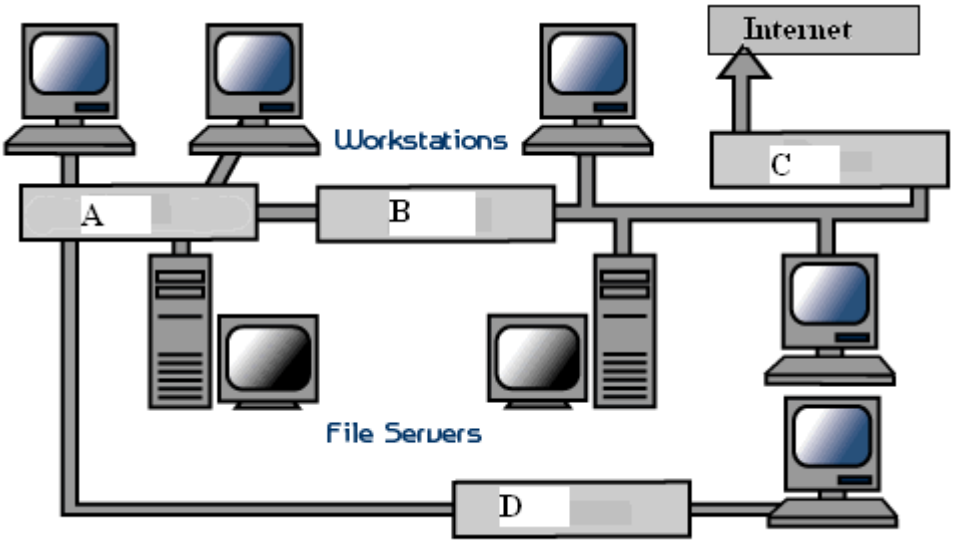
EXERCISES

1- What is a computer Network? Give three advantages and three disadvantages to network computers.
2- Give the role of each of the following network devices: Modem, Gateway, Router, Bridges, Switch, Repeater and firewall
3- Define the following terms in relation to computer network: Workstation, Server, Client, client/server, network topology
4- State the difference between the following concepts:
- Wired connection and wireless connection
- LAN, MAN, and WAN

- Client/server and Peer to peer network
- Physical topology and logical topology

5- Choose three network topologies and give a short description, two advantages and two disadvantages of each

6- The diagram below represents a computer network.



a) Name the network devices represented by the letters A, B, C and D
b) State the function of the devices labelled C and D
c) Explain any two network topologies that have been employed in the above network.
d) State two functions of the devices labelled 'file servers'.

7- Define local area network and State any **two** components of a local area network.

CHAPTER 8: INTRODUCTION TO INTERNET

The term **Internet** is the short form of the expression "***Inter-connecting Network***". It can be defined as a giant computer network that results from the global interconnection of millions of computers and related equipment based on the TCP/IP protocol. The Internet contains vast information quantities that are constantly changing and extending. It is used by many individually companies, school and even government agencies.

Learning objectives

After studying this lesson, student should be able to:

- Define Internet and understand what is internet and e-mail and its uses in modern communication
- Discuss techniques of internet connections
- Discuss some Internet services (web, chat; VoIP, social networking, …)
- Differentiate Internet and intranet, intranet and extranet

Content of this topic

I. BRIEF HISTORY OF INTERNET

In 1969, the US Department of Defense started a project to allow researchers and military personnel to communicate with each other in an emergency. The project was called **ARPAnet** and it is the foundation of the **Internet**. Throughout the 1970's, what would later become the Internet was developed. While mostly military personnel and scientists used it in its early days, the advent of the **World Wide Web** in the early 1990's changed all that.

Today, the Internet is not owned or operated by any one entity. This worldwide computer network allows people to communicate and exchange information in new ways. According to www.commerce.net, in April of 1999, there were 92.2 million Internet users over the age of 16 in the United States and Canada. **By 2005, it is predicted 75% of the total US population will be online**.

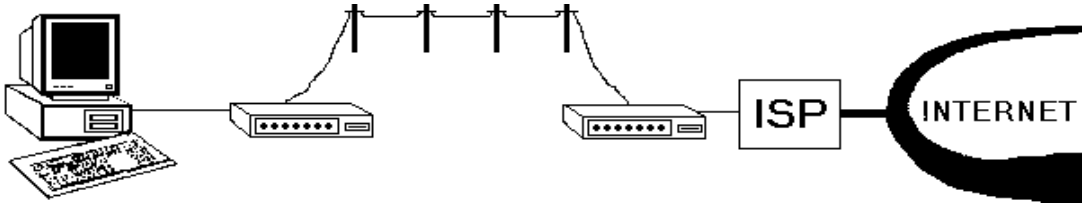
II. INTERNET AND INTERNET TERMINOLOGIES

The **Internet** in simple terms is a network of the interlinked computers all over the world, which is accessible to the general public. Internet is used for various important functions which include the several means of communications like the ***file transfer***, ***the online chat*** and even the sharing of the documents and web sites on the WWW(World Wide Web).

→ A person who makes use of the Internet is called an **Internet user**.
→ Anything that the Internet provides for users to consume (e.g. information, program or services) is referred to as an **Internet resource**.
→ The ability to explore, evaluate, and exploit Internet resource is known as **Internet literacy**.
→ A community that is made up of Internet users and Internet resources is called a **cyberspace**.
→ A business enterprise where Internet access is available for public use is called a **cybercafé**.
→ A person or a computer that is connected to the Internet is said to **be online**.
→ To **Download** refers to the act of transmitting data from a remote computer on the Internet or other network to one's own computer.
→ **Upload** is just the opposite of download. Upload refers to the act of transmitting data from local computer to any other computer on the Internet or network.

III. HOW TO CONNECT TO INTERNET

The basic requirements are ***a modem***, ***a phone line***, and a c***ontract*** with an Internet Service Provider (ISP) in addition to your ***computer***:



a) **Computer** - Generally any computer purchased in the last three years, particularly a Pentium, should have no problems in supporting the software you need to install.
b) A **phone line**: As a phone line, you can use your ordinary telephone line at home if you already own one.

c) A **modem (modulator/demodulator):** A modem is a hardware, which converts digital data into analog signals (i.e. modulation) that can be sent over an analog telephone line and convert the analog signal back into digital data (i.e. demodulation).
d) **An Internet account**. It is an account that can be opened with an Internet service Provider. The process of going to an ISP and getting an access account is refered to as subscription. An ***Internet Service Provider*** (**ISP**) is a company or organization that provides Internet Access to user in return for money. Some examples of ISP are: ***CamNet, Camtel, Africom, MTN, Orange, Ringo, YoMee***

IV. USES AND SHORTCOMINGS OF THE INTERNET

IV.1- Uses of Internet

Internet is undoubtedly the most crucial technology of the modern world, the useful application has not only made our lives easier than ever before but it also plays a very important role in the future developments. The various uses of Internet include the following.

a) Educational purposes: For the students and educational purposes the internet is widely used to gather information so as to do the research or add to the knowledge of any sort of subject they have. **E-leaning** enables Internet users to have a full training on a certain domain through the Internet.
b) **Entertainment:** Not to forget internet is useful in providing with most of the fun these days. May it be all the games, and networking conferences or the online movies, songs, dramas and quizzes, internet has provided the users with a great opportunity to eradicate the boredom from their lives.
c) **Sharing of resources**: Many resources like files, video or audios can be easily shared over the Internet
d) **Faster Communication**: With Internet, you can communicate in a fraction of second with a person who is sitting in the other part of the world.
e) **Information Resources**: Information is probably the biggest advantage that Internet offers. Internet is a virtual treasure trove of information. Any kind of information on any topic under the sun is available on the Internet. The **search engines** like **Google**, **Yahoo** are at your service on the Internet.
f) **Online Services**: The Internet has made life very convenient. With numerous online services you can now perform all your transactions online. You can book tickets for a movie, transfer funds, pay utility bills, taxes etc., and right from your home. Services like **e-commerce** are also available to enable people buying and purchasing online.

IV.2- Shortcomings of Internet

Following are the disadvantages of Internet:

a) **Spamming**: Spamming denotes distribution of unsolicited e-mails in large numbers. They are meaningless and they unnecessarily block the whole system. These activities are treated as illegal.
b) **Theft of personal details** While using the Internet, there is high probability that your personal details like name, address and credit card number may be accessed by con artists and used for fraudulent purposes.
c) **Pornography:** Pornography is definitely harmful for your children. There are numerous pornographic sites available over the Internet and watching any of those can have very bad influence on the mental health of your children.
d) **Virus threat** Virus is a program that interrupts the usual operation of your personal computer system. PCs linked to the Internet have high probability of virus attacks and as a result of this your hard disk can crash, giving you a lot of trouble.
e) **Social Disconnect**: Thanks to the Internet, people now only meet on social networks. More and more people are getting are drifting apart from their friends and family. Even children prefer to play online games rather than going out and mingling with other kids.

V. INTERNET PROTOCOLS

A protocol is a standardized way in which a specific procedure is performed. When people agree upon protocols it enables them to communicate and perform various tasks together. Some examples of Internet protocols are:

→ **HTTP:** The protocol commonly known as HTTP is an acronym ***for Hyper Text Transfer Protocol***. These four letters are used to tell the browser how to properly process the data on the page and display the data to a computer user.
→ **FTP: (**File Transfer Protocol) The primary protocol used to transfer large amounts of data from place to place across the Internet is known as FTP. FTP is an acronym that appropriately stands for File Transfer Protocol.
→ **TCP/IP:** The network protocol suite that is primarily responsible for the transfer of raw data across the Internet is known as TCP/IP. The acronym stands for a combination of ***Transfer Control Protocol*** and ***Internet Protocol***.

VI. INTERNET SERVICES

Once you are hooked up (connected) to the Internet, this giant network provides you with its numerous resources. Apart from just sending and receiving e-mails, there are many other things that can be done on the Internet. The ***World Wide Web***, the ***e-mail***, ***live messenger*** and ***search tools*** are popular Internet services.

VI.1 World Wide Web

The **WWW** or the Web is the user-friendly graphical interface to Internet resources. It is made of several interconnected electronic documents (called **Web documents**) stored on Internet computers. These web documents are all interconnected by means of pathways called **hyperlinks** or **links**. A document that contains links to other text documents is called **hypertext**. The one that contains links to multimedia documents is known as **hypermedia**. A software program which allows you to gain access to and explore the web, is called a **web browser** *(e.g. Microsoft Internet Explorer, Mozilla Firefox, Netscape, Opera, Google chrome, …)*. Information is presented to the visitor in an aesthetic and readable manner in a document called **Webpage**. A named collection of related web pages that are created and/or maintained by the same person or organizations is known as a **Website** or **site**.

Notion of URL

Short for **Uniform Resource Locator**, a **URL** or **Internet address** is a standardized naming convention used to locate a resource over the Internet or Intranet. A resource can be a specific Web page, a document, or an image. An example of URL is: http://www.computerhope.com/Jargon/start/main.htm **.** It can be divided into four main parts:

- **Protocol**: ***http*** stands for **HyperText Transfer Protocol** and enables the browser to know what protocol it is going to use to access the information specified in the domain.
- **Web Server Name/Domain Name**: ***www.computerhope.com****(*unique reference that identifies a **website** on the internet.)
- **Path*: /Jargon/start/*** (The folder in which the page is found on the web)
- **File Name or webpage name**: *main.htm*

VI.2 Electronic Mail

a) Definition

An electronic mail (e-mail) is a text message or letter that is sent through a computer network such as Internet. An image, music or a video can be attached to an e-mail as an e-mail attachment.

b) E-mail addresses

E-mails are sent and received with the use of E-mail addresses. An e-mail address is just a group of character, which identifies a sender or receiver of an e-mail. An e-mail address has two parts separated by the symbol @. The part before the @ is called the **username** or user ID; the portion after the @ is called the **location address** or the **domain name**. It is the name of the computer that handles your mail. Example: In the e-mail address pchs@yahoo.com, pchs is the username and yahoo.com is the location address.

c) Advantages of Email

The e-mail has numerous advantages:

- **Low cost**: the cost of sending an e-mail is very low

- **High-speed**: An e-mail takes only a few seconds to reach a destination
- **World-wide access**: You can access or open your e-mail account from any computer in the world that is connected to the Internet.
- **Time independent**: E-mail can be sent or received at any hour of the day.
- **Distance independent**: The cost of sending e-mail does not depend on the distance of the receiver.
- **Attachment:** In addition to pure messages, an e-mail can also graphics, musics, speech and video
- **Multiple destinations**: A single e-mail message can be sent to several people at the same time.

VI.3 Instant Messaging or chat

Also called Online Chat, **Instant messaging** (IM) is a form of communication over the Internet, that offers quick transmission of text-based messages from sender to receiver. Popular IM applications include ***MSN Messenger, Yahoo Messenger*** and ***AOL Messenger***.

VI.4 Online Social Networking

Online Social Networking has become very popular during the past few years. It is the use of a dedicated Web site to communicate informally with other members of the site. These websites are known as **social sites**. Some examples of online social networking website are:

a) Facebook

Facebook is a social networking service which was founded by **Mark Zuckerberg** and launched in February 2004. Facebook allows registered users to create profiles, upload photos and video, send messages and keep in touch with friends, family and colleagues.

b) Twitter

Twitter is an online social networking service and microblogging service that enables its users to send and read text-based messages of up to 140 characters, known as "**tweets**". It was created in **March 2006** by **Jack Dorsey** and launched that July.

VI.5 Search tools

There are many tools and services designed for searching the Internet for sites and resources. Search tools can be classified as ***search engine*** and ***meta-search engine :***
A **web search engine** is designed to search for information on the World Wide Web. information may be a specialist in web pages, images, information and other types of files. Some examples are: **Google** (www.google.com), **bing, yahoo seach; altavista, livesearch, …**

A **meta-search engine** is a search tool that sends user requests to several other search engines and/or databases and aggregates the results into a single list or displays them according to their source. Some examples of mete search engine are: **Vivisimo, Clusty, Dogpile,** ...

VI.6 VoIP (Voice over IP):

This is a technology that allows voice conversations to be transmitted over the Internet as opposed to traditional phone lines. VoIP is often used as a voice extension of instant messaging services like Yahoo! Messenger. The most known example of VoIP is **Skype**:

VI.7 Weblog

A **weblog** or a **blog** is a shared online diary where people can post daily entries about their personal experiences and hobbies. Some examples of weblog servers are. Overblog(www.overblog.com), Blog4ever (www.blog4ever.com), Blogger (www.blogger.com)

VI.8 Video Conferencing

Video conferencing uses the same technology as IRC, but also provides sound and video pictures. It enables direct face-to-face communication across the networks. It uses VoIP software like Skype.

VI.9 Newsgroups (Usenet)

Newsgroups are international discussion groups that focus on a particular topic and helps in gathering information about that topic. The topics discussed here cover all the fields such as politics, computers, technology and many more.

VI.10 Other services

The use of Internet is not limited only to browsing, searching, and exchange of messages. Other important uses of Internet include the following.

a) **Online game**: This is a type of game which is played on the Internet. They are different from video and computer game in the sense that they are not dependent of hardware or software a computer may have.
b) **Webcasting:** It is the process of broadcasting information over the Internet, rather than by radio or television.
c) **Online learning or E-learning**: This is a form of education r training that occurs on computer network such as the Internet.
d) **E-commerce**: This is the buying or selling goods and services on the Internet

e) **Online translation**: This is a service that translates a given piece of text from one language to another language with the help of special software called online translator (e.g. Google translate).

VII. INTRANET AND EXTRANET

An intranet is a private network that uses Internet protocols to provide Internet services restricted within an organization. Intranet enhances existing communication between employees and provides a common knowledge base and storage area for everyone in an organization or company. **An extranet** is a private network that enables an organization to communicate and collaborate more effectively with selected business partners, suppliers and customers. An extranet can play an important role in enhancing business relationships and improving management.

Comparison Internet-Extranet

An extranet is actually an Intranet that is partially accessible to authorized outsiders. There are many differences between extranet and intranet.

Intranet	**Extranet**
Not accessible beyond a company's firewall	accessible beyond a company's firewall
Is an entirely internal network	Has a portal to the outside world
More secure	Less secure
Easy to implement	Expensive to implement

EXERCISES

1- What is Internet? Give four advantages and four shortcomings of Internet.
2- Define or explain the following term or expressions related to Internet: Internet resource, website, webpage, browser, cyberspace, cybercafé, to download, to upload, to be online, search engine, e-learning.
3- Your father just buys a computer and wants to get it connected to Internet. He comes to see you as a computer specialist. Give him some advices related to:
   - Other devices or software he may need
   - How to subscribe to the service
4- State and describe four services provided by the Internet
5- What is a protocol? Give two examples and their role
6- State with appropriate examples the difference between the following terms or expressions:
   - Website and weblog
   - URL and Email address
   - Search engine and meta search engine

- Internet and Intranet
- Intranet and extranet
- Webpage and website

7- Describe the different parts of the following URL: www.gthsfundong.cm/registration/form.htm.

8- Describe the different parts of the following email address: dzplacide@gmail.com.

9- Give four advantages and four disadvantages of email.

10- Briefly describe each of the following Internet services and give An example of tool used in each service.

11- The protection of the environment must concern us all if we are to bequeath a better world for the future generation. Explain any two ways in which the Internet can be used to facilitate campaigns for environmental protection.

CHAPTER 9: BASIC COMPUTER MAINTENANCE

Computers are expensive, and with all big purchases you probably want to **protect your investment**. Luckily, it is not difficult to **keep your computer healthy** and in good working order. Maintaining a computer involves three things: keeping it **physically clean**, protecting it from **malware**, and **backing up** your important files. Maintaining your computer properly can help prevent major problems and should be incorporated as part of a semi regular schedule. This chapter am not going to tell you how often you must clean it but more towards what you can do to keep it clean and running. The aim of this chapter is to give the students basic notions concerning how to keep the computer healthy.

Learning objectives

After studying this lesson, student should be able to:

- Explain what is computer maintenance and the different types
- Explain the booting process of the computer and the importance on BIOS setup
- Give and explain some software and hardware maintenance tips
- Define computer virus and explain how it can be prevented or removed
- Identify some computer troubleshooting, their causes and their remedies

Contents

I. WHAT IS COMPUTER MAINTENANCE?

Computer maintenance is the practice of keeping computers in a good state of repair. This art encompasses ***computer cleaning, backup, disk maintenance and software update maintenance***. There are two types of maintenance that can be applied to a computer:

→ **Preventive Maintenance**: He applied to a PC in order to avoid future mistakes and

→ **Corrective Maintenance**: One who is oriented to diagnosis and repair of equipment when a technical problem. Some examples are : Find and remove viruses from your hard drive, find and correct errors in the physical and logical disk, disk defrag, clean up the motherboard and other cards to avoid technical problems due to dust, etc..

Computer maintenance can be broken down into 2 main areas. **Physical maintenance** and **Software based maintenance**.

→ **Physical maintenance** means to clean or repair the various external components such as the tower, monitor, printer, scanner, mouse and keyboard etc, or the internal components of you computer case.
→ **Software maintenance** is the regular virus scanning, spyware/malware scanning and backing up of critical data that we all should do.

II. BOOTING THE COMPUTER

II.1 What is computer booting?

The process of starting up a computer is referred to as booting. **Booting** can also be defined as the initial set of operations that a computer system performs when electrical power is switched on.
During the booting process, System will check all the hardware's and Software's those are installed or Attached with the System and this will also load all the Files stored in the ROM chip those are needed for running a system. The Operating system is then loaded into the memory; this will finish the initialization of the system.
There are two types of booting namely: cold booting and warm booting

→ **Warm Booting:** Refers to restarting a computer that is already turned on via the operating system. Restarting it returns the computer to its initial state but does not switch off the power unit. A warm boot is sometimes necessary when a program encounters an error from which it cannot recover. On PCs, you can perform a warm boot by pressing the Control, Alt, and Delete keys simultaneously.
→ **Cold Booting:** Starting the computer when its power is turned off. In the Cold Booting the System will be started from its beginning State means first of all, the user will press the Power Button. To perform a cold boot if the computer is still running, Shut Down must be selected from the menu first. Once the machine is off, turning it back on performs the cold boot.

II.2 The BIOS setup

Short for **Basic Input/Output System**, the **BIOS** is a chip located on all motherboards that contain instructions and setup for how your system should boot and how it operates. The BIOS includes instructions on how to load basic computer hardware. The four main functions of a PC BIOS

- **POST** (*Power On Self Test)* **that** helps verify the computer meets requirements to boot up properly. When power is turned on, POST (Power-On Self-Test) is the diagnostic testing sequence that a computer's BIOS runs to determine if the computer keyboard, RAM, disk drives, and other hardware are working correctly. If the computer does not

pass the POST, you will receive a combination of beeps indicating what is malfunctioning within the computer.

- **Bootstrap Loader -** Locate the operating system. If a capable operating system is located, the BIOS will pass control to it.
- **BIOS drivers -** Low level drivers that give the computer basic operational control over your computer's hardware.
- **CMOS Setup -** Configuration program that allows you to configure hardware settings including system settings such as computer passwords, time, and date. CMOS is the short form of *Complementary metal–oxide–semiconductor*

III. PHYSICAL MAINTENANCE

Also called **hardware maintenance**, computer physical maintenance involves taking care of the computer's physical components, such as its keyboard, hard drive and internal CD or DVD drives. Cleaning the computer, keeping its fans free from dust, cleanup and defragmenting its hard drives regularly are all parts of a computer hardware maintenance program. Preventative maintenance plays a role as well. Many medium and large companies rely on computer maintenance to ensure that their equipment is able to cope with demand. Some hardware maintenance tips involve:

1) Disk Cleanup and disk defragmentation

Disk cleanup removes selected unnecessary files on your hard drive, freeing up space. It may be performed as regular maintenance to remove these. Files may become fragmented and so slow the performance of the computer.

Disk Defragmenter reorganizes the files on your hard drive and helps it run more efficiently. It may be performed to combine these fragments and so improve performance. Please be aware that this process can take several hours, and you should not interrupt it while it is running.

If you are running a Windows operating system, you may want to run **Disk Cleanup** and **Disk Defragmenter**. To find these tools, click on **Start** (or the Windows button), and go to **My Computer** (or Computer). Right-click on the **Local Disk (C:)** and choose **Properties**. The **Disk Cleanup** option is displayed (under the **General** tab). Click on the **Tools** tab to locate the **Defragmenter**.

2) Registry cleanup:

Operating systems files such as the Windows registry may require maintenance in order to remove redundant items from it. A utility such as a registry cleaner may be used for this.

3) Keep your computer clean.

Dust, dirt, and debris may coat the interior of your PC and cause components to overheat. Excessive heat is leading cause of premature failure. If the cooling system is not filtered then regular Computer cleaning may be required to prevent short circuits and overheating. *NB:*

Before the computer cleanup should be done, turn off the computer at the wall and remove the power cable before starting. Use a flat paint brush to remove your collection of dust bunnies. Use a small artists brush to clean the fan grills. DO NOT use a damp cloth ANYWHERE on or near the motherboard.

4) **Be aware of all sounds.**

You will want to pay attention of the sounds your computer makes. Often, a strange sound may be the first indication of an impending problem. Clicking, whirling, squeaking, etc, are good signs that something is wrong. Try to isolate where the sound is coming from. If it's fan, replace it. If it sounds as if it is coming from a hard drive, get help right away.

5) **Use surge protection!**

There is no point in maintaining your computer system if it doesn't' work. Without proper surge protection you are only asking for trouble. System components are very voltage sensitive. Even a small static shock can wreak havoc on your computer. A spike in A/C current or other anomaly could be disastrous without surge protection.

IV. SOFTWARE MAINTENANCE

Computer hardware is generally reliable, and most computer problems are related to software issues. Maintaining and caring for computer software is a task that cannot be ignored by any user and / or computer owner, in order to maintain stability and even increase computer performance. Some software maintenance tips involve:

1) **Life and shut down the computer according to proper procedures.** On the Windows operating system, do always Shutdown process so that when you turn the computer back there was no trouble with the operating system.

2) **Download and Install Software Updates**: Frequent prompts to update your software and operating system can seem overwhelming; however, these updates make a difference and will improve your computer's overall performance. Typically patches and updates released by software manufacturers will increase the safety, efficiency and overall performance of their software.

3) **Restart Your Computer at Least Once a Week**: When you restart your computer, the operating system will perform diagnostics to determine whether anything is wrong, automatically fixing anything it can. Whenever you restart your computer, it is also a great time to update software, which often improves that software's performance and, as a result, your computer.

4) **Download and Install Software Updates**: Typically patches and updates released by software manufacturers will increase the safety, efficiency and overall performance of their software.

5) **Perform periodic data backup**. It is useful to maintain data security, reduce use of storage capacity and facilitate the distribution of data if needed.
6) **Make arrangements disk (hard disk drive) on a regular basis**. Because as has been described above, remove the write process on the storage media (hard diskdrive), resulting in the composition or structure of the files become irregular. Use the auxiliary programs such as **Scandisk** and **Defrag.**
7) **Protect your PC from cyber-threats:** The most important step in maintaining your computer's performance is **keeping your anti-virus and anti malware software up-to-date** and frequently scanning your computer for viruses. We recommend updating your anti-virus software at least once a week to help ensure the safety of your computer.

V. INTRODUCTION TO COMPUTER MALWARE

The word **Malware** is short for ***malicious software***, and is a general term used to describe all of the viruses, worms, spyware, and pretty much anything that is specifically designed to cause harm to your PC or steal your information.

V.1 What is a computer virus?

The term *computer virus* is often used interchangeably with *malware*, though the two don't actually have the same meaning. In the strictest sense, a virus is a program that copies itself and infects a PC, spreading from one file to another, and then from one PC to another when the files are copied or shared. Most viruses attach themselves to executable files, but some can target a *master boot record*, *autorun scripts*, *MS Office macros*, or even in some cases, arbitrary files. Many of these viruses, like CIH, are designed to render your PC completely inoperable, while others simply delete or corrupt your files

V.2 characteristics of the Computer Infected by Virus

If your computer is experiencing one of the characteristics below, there is the possibility of a virus on your computer, please update your antivirus and scan your computer to clean the virus. Here are some of the characteristics of the Computer Infected by Virus:

1) Your computer is running slower than usual.
2) Run menu, Search hidden by the virus.
3) CTRL + ALT + DEL can not be used.
4) ***Regedit*** and ***msconfig*** in the disabled
5) Original folders on your computer hidden and replaced with a file virus.
6) Computers are often stopped or not responding.
7) Computer suddenly restarts or crash and this happened a few minutes.
8) Computer applications are not running properly and often error.
9) File with Folder Icon Appears but has a file type. Exe
10) Hard drive or disk drive inaccessible.
11) Print activity is not working properly.
12) Frequent error messages are strange and unusual.

13) Often visible menu or dialog box is damaged.
14) There is a duplication of the name of the folder in the folder.
15) Computers are always issued a message of where the virus originated.

V.3 How to protect the computer from virus

No completely effective methods exist to ensure that a computer or network is safe from computer viruses. You can take precautions, however, to protect your home and work computers from virus infections. In order to protect a computer or computer data against viruses computer users can apply one or more of the following techniques

1) Install powerful antivirus software on your PC and update it regularly.
2) Always scan every storage medium from another PC before opening the file on it.
3) Use only software from legitimate source
4) Scan every Email attachment you receive before opening it
5) Avoid indiscriminate opening of files with erotic photographs attached to them. Most of these files are often infected with very dangerous malware
6) Do not run any suspicious programs
7) Educate yourself regularly on computer security issues

V.4 Other types of malware

1) **Worm:** A worm is a type of virus that can spread without human interaction. Worms often spread from computer to computer and take up valuable memory and network bandwidth, which can cause a computer to stop responding. Worms can also allow attackers to gain access to your computer remotely.

2) **Trojan horse:** A **trojan horse** is a program or utility that appears to be something useful or safe, but in reality is performing background tasks such as giving access to your computer or sending personal information to other computers. Trojan horses are one of the most common methods a criminal uses to infect your computer and collect personal information from your computer.

3) **Spyware: Spyware** is a term used to describe a software program that is intentionally installed on a computer by to monitor what other users of the same computer are doing.

4) **Adware; adware** is a program installed without a user's consent or knowledge during the install of another program. Much like spyware, adware tracks individuals Internet activities and habits to help companies advertise more efficiently.

V.5 Some common antivirus

An antivirus program protects a computer against viruses by identifying and removing any computer viruses found in memory, on storage media, or on incoming files. An antivirus program scans for programs that attempt to modify the boot program, the operating system, and other programs that normally are read from but not modified. Some popular antiviruses include:

→ **Microsoft Security Essentials** *Anti-Virus and Anti-Malware:*
→ **AVG** Anti-Virus:
→ **Avira AntiVir** Anti-Virus:
→ **avast!** Virus Cleaner and Anti-Virus programs:
→ **Malwarebytes** Anti-Malware programs:
→ **Spybot - Search & Destroy** Anti-Malware:

VI. FACTORS THAT SLOW BOOT UP PROCESS

Factor	Explanation	Remedies
Startup Programs	Some programs installed on your computer are automatically set to run on startup. They use a lot of memory which is requiredelsewhere. Such programs include: computer antivirus/virus, application software and networking software.	from start menu, click on run command. In the dialog box labeled run, type msconfig command on the open text boxthen click ok. In the system utility interface box that appears click the startup tab then uncheckthose programs you don't need at startup and clickok. Restart your computer for changes to take effect.
Damaged MBR (master boot record)	this is a memory storage area in the hard disk that keeps startup files. If damaged or corrupted by unprocedural shut down, viruses, dust and smoke, the computer fails or slows startup process.	run the disk defragmenter utility, scandisk and chkdsk commands or system registry repair software.
Low (RAM) memory	insufficient memory in the RAM causes the CPU to fetch one program after another from the virtual memory in the HDD (virtual memory is a memory location in the HDD set aside by the operating system to be used asif it's a RAM). This process delays the CPU in caching start up files.	upgrading your computer memory by adding higher modules.
Scattered system files	As files get used daily, they get scattered in the hard disk storage thus taking the CPU a lot of time to fetch them into the RAM. This slows the start up process.	run disk defragmenter utility and system registryrepair utility

VII. SOME COMMON TROUBLESHOUTS AND THEIR REMEDIES

The following are some of the top five common computer remedies, which you can give for the respective problems. Let's check them out:

Problem	Possible causes	Possible Remedies

BSoD (Blue Screen of Death)	This may be due to a spyware or computer viruses that have affected your computer.	You need to update your anti-spyware and scan your computer for any viruses.
	At times, BSOD may appear due to critical errors in the driver , software or registry problems.	Windows may have to repair or reinstall missing components.
Missing DLL (Dynamic-Link Library) **File**	The easiest possible cause of a DLL error like this is that you've deleted the DLL file without realizing it.	ecovering a DLL file with a file recovery program is a smart idea only if you're confident you've deleted the file yourself and that it was working properly before you did that.
Applications That Won't Install	it may be because your computer doesn't have enough hard drive space.	you need to free up some space.
Applications Run Slowly (You may notice your computer has slowed down considerably and even a simple command execution takes ages.)	This is because your computer is loaded with unnecessary files, fragmented data, corrupted registry, spyware programs, services, software, etc. that makes your computer slow down.	you need to manage your programs and delete unnecessary data and software that you do not use or need, clean your registry regularly to help boost at least 30% of your computer performance speed.
*Computer Gives Error Messages on Start-up(*These messages may appear such as, *abclink.xyz missing or damaged - press any key to continue*.)	This happens when you delete a program instead of actually un-installing it.	you need to press keys for about 8 to 10 times, before Windows actually resumes.
		go to Control panel ---> Programs ---> Programs and Features. Here, you will find a list of programs installed on your computer. Select the specific you wish to delete and click on Uninstall.
Computer Reboots Itself Again and Again	There is a hardware problem	You may have a faulty power supply, defective or dirty cooling fan, etc.,
	The dust that accumulates on the fan, makes it heat up faster and in order to cool down the computer automatically switches off.	Thus, clean the fan and check for power supply. Following these simple steps will help you to solve these problems with computer.
Computer Makes Strange Noises	Noises and vibrations from your computer are a hardware problem. Many electronic parts can make high pitch noises.	You need to switch off your computer and unplug it from the power supply. Now remove the case from the CPU and restart your computer. Locate the origin of noise and then switch off the computer and unplug it.

"Non-system disk or disk error" Message during the booting process	there is a **CD**, **DVD**, **USB flash drive**, or **floppy disk** in your computer, which is interfering with your computer's booting process.	Remove the disk from the drive, then **restart** the computer.
Windows shutting down message will not disappear	Windows freezed during the shutdown process.	To finish shutting down the computer, **press and hold** the power button for about 10 seconds, or until the computer turns off.

EXERCISES

1- What mean "booting a computer"? Give and explain the types of booting.
2- What is BIOS? Name and describe four functions of BIOS.
3- Explain the following disk management process and give an example of tool used in each case and the process to run it on windows 7:
- Disk cleanup
- Disk defragmenter
- Disk partitioning
- Registry cleanup

4- Give sis software maintenance tips
5- What is a virus? Give six characteristics of a computer infected by a virus.
6- State the difference between the following:
- Cold booting and warm booting
- Malware and computer virus

7- Give five measures taken to protect a computer from viruses.
8- Give a short description of the following computer malware: WORM, Trojan Horse, Spyware, adware.
9- What is an antivirus? Give three examples
10- Explain the meaning of BACKUP.

REFERENCES