

INTRODUCTION TO USING  
INFORMATION AND COMMUNICATION TECHNOLOGY  
IN EDUCATION

A HANDOUT FOR DIPLOMA IN BASIC EDUCATION

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**INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)**

What is a computer? In general terms, a **computer** is an electronic **device** used to process **data**, converting the data into information that is useful to people. Any computer--regardless of its type--is controlled by programmed instructions, which give the machine a purpose and tell it what to do.

A computer can also be seen an electronic device capable of accepting data in a convenient form, which is automatically processed following sequential set of instruction called program, which is also stored in a device, and producing results known as output or information.

In other words, a computer is any electronic device that takes an input in some logical or mathematical manner and producing the resulting output to the environment. The **memory** and the **processor** are responsible for transforming data into information.

Computers come in many varieties, including the personal computer, tiny computers built into appliances and automobiles, and mainframe machines used by many people simultaneously to run a business. Despite their differences in size and use, all these computers are part of a system. A complete **computer system** consists of four parts: **hardware**, **software**, people, and data.

The mechanical devices that make up the computer are called hardware. In other words, hardware is any part of the computer you can touch. Hardware consists of interconnected electronic devices that you can use to control the computer's operation, input, and output. (The generic term *device* refers to any piece of hardware.)

Software is a set of electronic instructions consisting of complex codes (also known as **programs**) that make the computer perform tasks. In other words, software tells the computer what to do. Some programs exist primarily for the computer's use and help the computer perform tasks and manage its own resources. Other types of programs exist for the user and enable people to perform tasks such as creating documents.

People are the computer operators, also known as **users**. It can be argued that some computer systems are complete without a person's involvement; however, no computer is totally autonomous. Even if a computer can do its job without a person sitting in front of it, people still design, build, program, and repair computer systems. This lack of autonomy is especially true of personal computer systems, which are the focus of this book and which are designed specifically for use by people.

Data consists of raw facts, which the computer stores and reads in the form of numbers. The computer manipulates data according to the instructions contained in the software and then forwards it for use by people or another computer. Data can consist of letters, numbers, sounds, or images. No matter what kind of data is entered into a computer, however, the computer converts it to numbers. Consequently, computerized data is **digital**, meaning that it has been reduced to digits, or numbers.

Within the computer, data is organized into files. A computer **file** is simply a set of data or program instructions that has been given a name. A file that the user can open and use is often called a **document**. Although many people think of documents simply as text, a computer document can include many kinds of data. For example, a computer document can be a text file (such as a letter), a group of numbers (such as a budget), a video clip (which includes images and sounds), or any combination of these items. Programs are organized into files as well, but because programs are not considered data, they are not document files.

The computer itself--the hardware--has many parts, but the critical components fall into one of four categories;

1. Processor
2. Memory
3. Input and output devices
4. Storage

While any type of computer system contains these four types of hardware, this pamphlet focuses on these types from the perspective of the personal computer.

The procedure that transforms raw data into useful information is called **processing**. To perform this transformation, the computer uses two components: the **processor** and memory.

The processor is like the brain of the computer in the way that it organizes and carries out instructions that come from either the user or the software. In a personal computer, the processor usually consists of one or more **microprocessors** (sometimes called "chips"), which are slivers of silicon or other material etched with many tiny electronic circuits. To process data, the computer passes electricity through the circuits to complete an instruction.

The microprocessor is plugged into the computer's **motherboard**. The motherboard is a rigid rectangular card containing the circuitry that connects the processor to the other hardware. The motherboard is an example of a **circuit board**. In most personal computers, many internal devices--such as video cards, sound cards, disk controllers, and other devices--are housed on their own smaller circuit boards, which attach to the motherboard. Newer microprocessors are large and complex enough to require their own dedicated circuit boards, which plug into a special slot in the motherboard. (Older microprocessors were single chips.) You can think of the motherboard as the master circuit board in a computer. Note, however, that in newer personal computers, some devices are built directly onto the motherboard instead of attaching to it as a separate circuit board. This development promises to make computers smaller, faster, and less expensive.

A personal computer's processor is usually a single chip or a set of chips contained on a circuit board. In some powerful computers, the processor consists of many chips and the circuit boards on which they are mounted. In either case, the term **central processing unit (CPU)** refers to a computer's processor. People often refer to computer systems by the type of CPU they contain. A Pentium system, for example, uses a Pentium-class microprocessor as its CPU.

**Memory** is like an electronic scratch pad inside the computer. When you launch a program, it is loaded into and run from memory. Data used by the program is also loaded into memory for fast access. As you enter new data into the computer, it is also stored in memory--but only temporarily. The most common type of memory is called **random access memory**, or **RAM**. As a result, the term memory is commonly used to mean RAM. (It is also sometimes called read/write memory.) Data is both written to and read from this memory.

Perhaps the most important thing to remember about RAM is that it is volatile, so it needs a constant supply of power. When you turn off a computer, everything in RAM disappears. As you will soon learn, this is why you frequently have to save your data files to a storage device.

One of the most important factors affecting the speed and power of a computer is the amount of RAM it has. Generally, the more RAM a computer has, the more it can do and the faster it can perform certain tasks. The most common measurement unit for describing a computer's memory is the **byte**--the amount of memory it takes to store a single character, such as a letter of the alphabet or a numeral. When people talk about memory, the numbers are often so large that it is useful to use terms such as **kilobyte**, **megabyte**, **gigabyte**, and **terabyte** to describe the values (see Table 1.1).

Unit	Abbreviation	Pronounced	Approximate Value (bytes)	Actual Value (bytes)
<b>Kilobyte</b>	KB	KILL-uh-bite	1,000	1,024
<b>Megabyte</b>	MB	MEHG-uh-bite	1,000,000 (1 million)	1,048,576
<b>Gigabyte</b>	GB	GIG-uh-bite	1,000,000,000 (1 billion)	1,073,741,824

<b>Terabyte</b>	TB	TERR-uh-bite	1,000,000,000,000 (1 trillion)	1,099,511,627,776
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Table 1.1  
Units of Measure for Computer Memory and Storage

Today's personal computers commonly have from 64 to 128 million bytes of memory (or 64 to 128 MB). Newer systems seldom have less than 64 MB; many newer systems feature 256 MB or more. Newer generations of PCs feature more RAM than previous generations did because newer versions of operating systems and application software require ever-increasing amounts of RAM to operate efficiently. As a rule of thumb, the more RAM a computer has, the better. Adding RAM is a relatively inexpensive way to boost a system's overall performance. It is usually possible to add more RAM to a standard computer. (You will learn more about the various types of RAM and other kinds of computer memory later.

### Input and Output Devices

Computers would be useless if they did not provide interaction with users. They could not receive instructions or deliver the results of their work. **Input devices** accept data and instructions from the user or from another computer system (such as a computer on the Internet). **Output devices** return processed data back to the user or to another computer system.

The most common input device is the **keyboard**, which accepts letters, numbers, and commands from the user. Another popular input device is the **mouse**, which lets you select options from on-screen menus. You use a mouse by moving it across a flat surface and pressing its buttons. Other popular input devices are **trackballs**, **touchpads**, **joysticks**, **scanners**, **digital cameras**, and **microphones**.

The mouse, trackball, and touchpad enable you to draw or point on the screen. The joystick is especially well suited for playing fast-moving video games. A scanner can copy a printed page of text or a graphic into the computer's memory, eliminating the time-consuming step of typing input or creating an image from scratch. Digital cameras record live images that can be viewed and edited on the computer. A microphone or CD player attached to the computer enables you to add the sound of a voice or a music selection.

The function of an output device is to present processed data to the user. The most common output devices are the display screen, known as the **monitor**, and the **printer**. The computer sends output to the monitor when the user needs only to see the output. It sends output to the printer when the user needs a paper copy--also called a "hard copy." Just as computers can accept sound as input, they can use stereo speakers or headphones as output devices to produce sound.

Some types of hardware can act as both input and output devices. One example is the **touch screen**, a type of monitor that displays text or icons you can touch. Touch screens are popular in museums and libraries, where they help direct people to specific areas. In bookstores and music stores, touch screens enable customers to locate an item quickly without wandering the aisles or searching through catalogs. Touch screens are even used in gambling casinos, where they provide a fun and nonmechanical interface to slot machines. When you touch the screen, special sensors detect the touch, and then the computer calculates the point on the screen where you placed your finger. Depending on the location of the touch, the computer determines what type of information to display next.

The most common types of devices that can perform both input and output are **communications devices**, which connect one computer to another--a process known as networking. Among the many kinds of communications devices, the most common are modems, which enable computers to communicate through telephone lines or cable television systems, and network interface cards (NICs), which let users connect a group of computers to share data and devices.

## Storage

A computer can function with only processing, memory, input, and output devices. To be really useful, however, it also needs a place to keep program files and related data when it is not using them. The purpose of **storage** is to hold data permanently.

Think of storage as an electronic file cabinet and RAM as an electronic worktable. When you need to work with a program or a set of data, the computer locates it in the file cabinet and puts a copy on the table. After you have finished working with the program or data, you put it back into the file cabinet. If you make changes to data while working on it, the changed data replaces the original data in the file cabinet (unless you put it in a different place in storage). There are three major distinctions between storage and memory:

- There is more room in storage than in memory, just as there is more room in a file cabinet than there is on a tabletop.
- Contents are retained in storage when the computer is turned off, whereas the programs or the data you put into memory disappear when you shut down the computer.
- Storage is very slow compared to memory, but it is much cheaper than memory.

Remember the distinction between storage and memory. Their functions are similar, but they work in different ways. Novice computer users often use the term *memory* when they actually mean *storage* or *disk*. This mistake can cause confusion.

The most common storage medium is the **magnetic disk**. A disk is a round, flat object that spins around its center. **Read/write heads**, which are similar to the heads of a tape recorder or VCR, are used to read data from the disk or write data onto the disk.

The device that holds a disk is called a **disk drive**. Some disks are built into the drive and are not meant to be removed; other kinds of drives enable you to remove and replace disks. Most personal computers have at least one nonremovable **hard disk** (or **hard drive**). In addition, there is also a **diskette drive**, which allows you to use removable **diskettes**. A hard disk can store far more data than a diskette can, so the hard disk serves as the computer's primary filing cabinet. Diskettes are used to load new programs or data onto the hard disk, trade data with other users, and make backup copies of the data on the hard disk.

Because you can remove diskettes from a computer, they are encased in a plastic or vinyl cover to protect them from fingerprints and dust. Because the cover used in early diskettes was thin, the diskette was flimsy, or "floppy." As a result, they came to be called **floppy disks**

The **CD-ROM drive** is the most common type of storage device after the hard and diskette drives (see Figure 1.10). **Compact disks (CDs)** are a type of optical storage device, identical to audio CDs, that can store about 74 minutes of audio or 650 MB of data, or about 450 times as much information as a diskette. The type used in computers is called **Compact Disk Read-Only Memory (CD-ROM)**. The

name implies that you cannot change the information on the disk, just as you cannot record over an audio CD.

If you purchase a **CD-Recordable (CD-R) drive**, you have the option of creating your own CDs. A CD-R drive can write data to and read data from a compact disk. To use a CD-R drive, you must use a special CD-R disk, which can be written on only once, or a **CD-ReWritable (CD-RW)** disk, which can be written to multiple times, like a floppy disk.

An increasingly popular data storage technology is the **Digital Versatile Disk or Digital Video Disk (DVD)**, which is revolutionizing home entertainment. Using sophisticated compression technologies, a single DVD (which is the same size as a standard compact disk) can store an entire full-length movie. DVDs can hold a minimum of 4.7 GB of data and as much as 17 GB. Future DVD technologies promise much higher storage capacities on a single disk. DVD drives can also locate data on the disk much faster than standard CD-ROM drives.

DVDs require a special player. The new players, however, can play audio, data, and DVD disks, freeing the user from the necessity of purchasing different players for each type of disk. DVD drives are now standard equipment on many new personal computers. Users not only install programs and data from their standard CDs, but they can also watch movies on their PCs by using a DVD.

Other types of storage devices include **tape drives**, **optical drives**, **removable hard drives**, and many others.

*Answer the following questions by filling in the blank(s).*

1. A(n)-----is an electronic device used to process data.
2. There is more room in storage than in-----in a computer.
3. A device that holds a disk is called a(n)-----.

Computers are general-purpose machines. This means that a computer can be applied to many different types of tasks. Whether you need to write a report, draw a magazine illustration, edit videotape, manage a network, or play a chess game with someone on the other side of the world, a computer can help you do it.

Of course, the computer itself--the hardware--cannot do any of these things. The ingredient that enables a computer to perform a specific task is software, which consists of electronic instructions. These instructions tell the machine's physical components what to do; without them, a computer could not do anything at all. It would just be a box of metal and plastic.

As you saw earlier in this lesson, a set of instructions that drives a computer to perform specific tasks is called a program. When a computer uses a particular program, it is said to be **running** or **executing** that program. This section introduces you to the two main categories of software, and explains the purpose of each kind.

Although the array of available programs is vast and varied, most software falls into two major categories: **system software** and **application software**. One major type of system software, the **operating system**, tells the computer how to use its own components. Examples of operating systems include Windows 2000, Windows NT, the Macintosh Operating System, UNIX, Linux, OS/2, and DOS.

Application software tells the computer how to accomplish specific tasks, such as word processing or drawing, for the user. Examples of popular application programs are Microsoft Word, CorelDRAW, AutoCAD, and Netscape Navigator.

### Operating Systems (system Software)

When you turn on a computer, it goes through several steps to prepare itself for use. The first step is called the **power-on self test (POST)**. The computer identifies the devices attached to it, identifies the amount of memory available, and does a quick check to see whether the memory is functioning properly. This routine is initiated by a part of the system software located in **read-only memory (ROM)**, a chip that contains brief, permanent instructions for starting the computer.

Next, the computer looks for an operating system, which is usually stored on the hard disk. The operating system tells the computer how to interact with the user and how to use devices such as the disk drives, keyboard, and monitor. When it finds the operating system, the computer loads a portion of it into memory. (The portion loaded includes essential commands that the computer needs to perform basic operations. It also includes the user interface and instructions that enable the computer to find other commands and operating system elements on disk when needed.) Because the operating system is necessary for controlling the computer's most basic functions, it continues to run until the computer is turned off.

Step	Source of Instruction	Type of Instruction
1	ROM	System self-check
2	Hard disk	System software loaded into memory
3	User	Controls hardware by issuing operating system commands or loads an application from a disk

Table 1.2  
The Startup Process

After the computer finds and runs the operating system, it is ready to accept commands from an input device--usually the keyboard or a mouse--or from a program. At this point, the user can issue commands to the computer. A command might, for example, list the programs stored on the computer's disk or make the computer run one of those programs. Table 1.2 shows the process the computer follows at startup.

### Application Software

The operating system exists mostly for the benefit of the computer. Other programs are required to make the computer useful for people. Programs that help people accomplish specific tasks are referred to as **application software**. Application software has been written to do almost every task imaginable, from word processing to selecting a college to attend. A special type of application software, called utility software, helps you to fine-tune the performance of a computer, prevent unwanted actions, or perform special, system-related tasks such as checking for viruses or sending a fax.

Thousands of applications are available for many purposes and for people of all ages. Here are some of the major categories of these applications

Word processing software is designed for creating documents that consist primarily of text. New word processors also let you include graphics and sounds in your documents, and they provide sophisticated layout features that enable you to create brochures, newsletters, business documents, and more.

Spreadsheet programs are designed to work with numbers and are used in business to create budgets, payrolls, and analytical documents. Your document can contain text, numbers, and formulas for calculating numbers. Spreadsheet programs also let you create colorful charts from your data.

This screen shows a database of products sold by a company. Database management software makes it easy to reorganize data. For example, you can rearrange this list by product names or by categories. Large companies and government agencies use enormous databases containing millions of lines of information about people, products, and more.

Graphics software lets you create and edit images of all types. Some graphics programs are specially designed to work with electronic photographs, while others excel at manipulating line drawings or text. Such programs are essential in document design, Web site design, multimedia authoring, and game and movie production.

Presentation software is most often used for creating sales presentations, although it can be effective for any type of electronic slide show.

Using a Web-page design program, you can create colorful documents for publication on the World Wide Web. These programs enable you to add different fonts, graphics, and hyperlinks to your Web pages.

Web browsers have quickly become one of the most commonly used—and important—types of application software. Using a Web browser and an Internet connection, you can view documents (called "Web pages") from around the world.

There are hundreds of utility programs available for personal computers. This one is an "uninstaller" program, which completely removes installed programs and their associated files from a hard disk.

Multimedia programs can feature content stored on a disk (such as a CD-ROM-based encyclopedia) or "streaming" data received over the Internet. The application shown here can play many types of audio and video files from a disk or the Internet.

## **BASIC OPERATIONS OF THE COMPUTER**

The computer is capable of performing specific operations or functions. These operations include the following:

1. **Input operations:** allow data to be entered into the computer for processing.
2. **Arithmetic operations:** involve performing addition, subtraction, multiplication and division calculations.
3. **Logical operations:** allow the computer to compare data and determine if one value is less than, equal to, or greater than another value.
4. **Output operations:** make information generated from the processing on the computer available for use.
5. **Storage operations:** electronically stores data on an external device for future use.

## **WARES OF A COMPUTER**

A computer system is made up of **three** wares namely **live-ware (user or end-user)**, **software** and **hardware**.

**Live-ware:** This is the user of the computer. Without the user (person), the computer will not be able to work.

**Software:** They are the programs or list of instructions that makes the computer run. They are therefore, the parts of the computer that cannot be seen or touched; they are not physical. Without the software the computer will not work. The **three types are the system software, application software and programming software**.

**Hardware:** They refer to the physical components or devices of the computer system. That is the things that one can see and touch. Examples include the keyboard, printer, mouse, scanner, monitor, and the joystick. The inputs, outputs and backing storage units connected to the computer are referred to as **peripheral devices**.

## **CLASSIFICATION OF COMPUTERS**

Computers can be classified in **three** ways namely,

- (i) **Capacity**      (ii) **Type and**      (iii) **Purpose**

### **BY CAPACITY/SIZE**

Computers come in many different **sizes and ranges of power**, and different types of computer systems have varying capabilities.

**Basically**, today's computer systems fall into one of the following categories:

- **Supercomputers**
- **Mainframe computers**
- **Minicomputers, or midrange computers**
- **Workstations**
- **Microcomputers, or personal computers**

All of these computers can be connected to form networks of computers, but each individual computer, whether or not it is on a network, falls into one of these five categories. As you will see, some of these categories--especially microcomputers--can be divided into subcategories, some of which are growing rapidly enough to become major categories in their own right.

### Lesson Objectives

- List the five most common types of computer systems.
- Identify two unique features of supercomputers.
- Describe a typical use for mainframe computers.
- Differentiate workstations from personal computers.
- Identify four types of personal computers.

**Supercomputers** are the most powerful computers made, and physically they are some of the largest

These systems are built to process huge amounts of data, and the fastest supercomputers can perform more than 1 trillion calculations per second. Some supercomputers--such as the Cray T90 system--can house thousands of processors. This speed and power make supercomputers ideal for handling large and highly complex problems that require extreme calculating power.

Supercomputers are the most powerful computers made. This supercomputer is the Cray T90. Scientists and engineers frequently build models of complex processes, then simulate the processes on a supercomputer. These computers help analyze and forecast global weather patterns, for example, while shedding light on related issues such as pollution, global warming, and the depletion of the earth's ozone layer. Nuclear scientists use supercomputers to create and analyze models of nuclear fission and fusion, predicting the actions and reactions of millions of atoms as they interact.

Supercomputers are also being used to map the human genome, or DNA structure. The Human Genome Project, for example, uses supercomputing resources around the world in the hope of discovering all the human genes. Scientists estimate there are from 80,000 to 100,000 human genes, made up of more than 3 billion chemical bases. If printed, the human DNA sequence would fill about 200,000 pages.

Supercomputers can cost tens of millions of dollars and consume enough electricity to power dozens of homes. They are often housed in protective rooms with special cooling systems, power protection, and other security features. Because of their size and cost, supercomputers are relatively rare, used only by large corporations, universities, and government agencies that can afford them. Supercomputing resources are often shared to give researchers access to these precious machines.

The largest type of computer in common use is the mainframe. **Mainframe computers** are used in large organizations like insurance companies and banks where many people need frequent access to the same data, which is usually organized into one or more huge databases.

Airlines use large mainframe systems for flight scheduling, reservations, ticketing, and meeting a range of customer service needs. Government agencies--such as the Internal Revenue Service, Federal

Aviation Administration, and the Census Bureau--use mainframes to track information about large populations, individual tax records, payroll, and more. Many large grocery and retail chains interconnect their stores with a mainframe, which immediately registers every sale, oversees stock, and manages inventory levels.

Mainframes are being used more and more as specialized servers on the World Wide Web, enabling companies to offer secure transactions with customers over the Internet. If you purchase an airline ticket over the Web, for example, there is a good chance your transaction is being handled by a mainframe system. In this type of application, the mainframe system may be referred to as an enterprise server or an electronic commerce (e-commerce) server.

In a traditional mainframe environment, each user works at a computer **terminal**. A terminal is a monitor and a keyboard (and sometimes a pointing device, such as a mouse) wired to the mainframe. There are basically two types of terminals used with mainframe systems. A dumb terminal does not have its own CPU or storage devices; these components are housed in the mainframe's system unit and are shared by all users. Each dumb terminal is simply an **input/output (I/O) device** that functions as a window into a computer located somewhere else. An intelligent terminal, on the other hand, has its own processor and can perform some processing operations. Intelligent terminals, however, do not usually provide any storage.

First released in the 1960s, **minicomputers** got their name because of their small size compared to other computers of the day. The capabilities of a minicomputer are somewhere between mainframes and personal computers. (For this reason, minicomputers are increasingly being called midrange computers.) Like mainframes, minicomputers can handle much more input and output than personal computers can. Although some "minis" are designed for a single user, most are designed to handle multiple terminals. The most powerful minicomputers can serve the input and output needs of hundreds of users at a time.

Minicomputers are commonly used as servers in network environments that handle the data-sharing needs of other computers on the network. Dozens or hundreds of personal computers can be connected to a network with a minicomputer acting as a server. Like mainframes, midrange computers are used more and more as Web servers, handling thousands of transactions per day. Single-user minicomputers are commonly applied to sophisticated design tasks, such as animation and video editing. Minicomputers cost anywhere from \$18,000 to \$500,000 and are ideal for many organizations and companies that cannot afford or do not need a mainframe system.

A powerful mainframe system can support the processing and output needs of thousands of users spread over a wide geographic area. Many enterprises are now connecting personal computers and personal computer networks to their mainframe systems. This connection gives users access to mainframe data and services and also enables them to take advantage of local storage and processing, as well as other features of the PC or network.

A mainframe system can house an enormous volume of data, containing literally billions of records. Large mainframe systems can handle the input and output requirements of several thousand terminals. The largest IBM S/390 mainframe, for example, can support 50,000 users simultaneously while executing more than 1,600,000,000 instructions per second.

Depending on their size, capabilities, and the number of users they must support, mainframe systems can cover a huge price range. Mainframe systems start at around \$30,000; extensive mainframes can cost several million dollars.

It used to be common for mainframe computers to occupy entire rooms or even an entire floor of a high-rise building. Typically, they were placed inside glass offices with special air conditioning to keep them cool and on raised floors to accommodate all the wiring needed to connect the system. This setup is not used much anymore. Today, a typical mainframe computer looks like an unimposing file cabinet--or a row of file cabinets--although it may still require a somewhat controlled environment.

*Answer the following questions by filling in the blank(s).*

1. The fastest supercomputers can perform.....calculations per second.
2. A(n).....is simply an input/output (I/O) device that connects to a mainframe computer system.
3. Minicomputers are referred to more and more as.....

## WORKSTATIONS

. Somewhere between multi-user midrange computers and personal computers are **workstations**. Workstations are specialized, single-user computers with many of the features of a personal computer but with the processing power of a minicomputer. These powerful machines are popular among scientists, engineers, graphic artists, animators, and programmers--users who need a great deal of number-crunching power. Workstations typically use advanced processors and feature more RAM and storage capacity than personal computers.

Although it looks like a personal computer, this system is actually a powerful Ultra 60 workstation from Sun Microsystems. Workstations often have large, high-resolution monitors and accelerated graphics-handling capabilities, making them perfect for advanced design, modeling, animation, and video editing. Although workstations are often found in single-user applications, they are more and more often used as servers on personal computer networks and as Web servers.

Until a few years ago, the term *workstation* implied certain differences in terms of chip design and operating system, making it distinct from a personal computer. (The term *workstation* is also used to describe a single computer on a network. In this context, a workstation is usually a personal computer.) Today, the differences between minicomputers, workstations, and personal computers are becoming blurred. Low-end minicomputers and high-end workstations are now similar in features and capabilities. The same is true for low-end workstations and high-end personal computers.

## MICROCOMPUTERS, OR PERSONAL COMPUTERS

The terms **microcomputer** and **personal computer** are interchangeable, but **PC**--which stands for *personal computer*--sometimes has a more specific meaning. In 1981, IBM called its first microcomputer the IBM-PC. Within a few years, many companies were copying the IBM design, creating "clones" or "compatibles" that were meant to function like the original. For this reason, the term *PC* has come to mean the family of computers that includes IBMs and IBM-compatibles. The vast majority of microcomputers sold today are part of this family. The Apple Macintosh computer,

however, is neither an IBM nor a compatible. It is another family of microcomputers made by Apple Computer. Even though it is accurate to say that a Macintosh such as the iMac is a personal computer, some people consider it misleading. This book uses the term *PC* as a simple abbreviation for *personal computer*. When discussing Macintosh computers, this course refers to them by name.

One source of the PC's popularity is the rate at which improvements are made in its technology. Microprocessors, memory chips, and storage devices make continual gains in speed and capacity, while physical size and price remain stable--or in some cases are reduced.

The iMac is one of the more recent lines of personal computers from Apple. For example, compared to the typical PC of ten years ago, a machine of the same price today will have about ten times as much RAM, about 100 times more storage capacity, and a microprocessor at least 100 times as fast. What's more, many analysts believe that this pace of change will continue for another 10 or 20 years.

One result of increasing PC power is that the differences among mainframes, minis, and microcomputers are not as great as they once were. In fact, the processing power of PCs often rivals that of current mainframes. Mainframes are still popular because they can handle the input and output needs of many users at once, so they are still the right choice for the massive databases that many people need to use at the same time. Another reason for the continued popularity of mainframe systems is their reliability. Mainframes are known for their robustness and ability to handle tremendous loads without failing.

The microcomputer category has grown tremendously in the past decade. There are now several specific types of microcomputers, each with its own capabilities, features, and purposes. Within each subcategory of microcomputer, you can find dozens or even hundreds of unique systems. This range of options makes the microcomputer "the computer for the masses" and explains why so many systems have appeared in offices, homes, briefcases, and even pockets over the past few years.

Microcomputers include the following types:

- Desktop models, including tower models
- Notebook computers, also called laptop computers
- Network computers
- Handheld personal computers (H/PCs) of all types

## Desktop Models

The first style of personal computer introduced was the desktop model. In common usage, the term *desktop system* means a full-size computer that is small enough to be used at a desk but too big to carry around. Traditionally, a desktop computer's main case (called the system unit) is horizontally oriented, meaning it can lie flat on a desk or table.

A variation of the desktop system is the tower model, where the system unit sits vertically and has more space for devices. Because of its design, the system unit is often placed on the floor to preserve desk space, allowing more room to place external components, such as removable disk drives or scanners, on the desktop. Tower models have become increasingly popular in recent years--so much so that some PC makers have stopped offering horizontally oriented desktop systems.

Personal computers can cost anywhere from \$600 to \$7500, depending on the capabilities and capacity. The most popular models cost between \$1000 and \$3000. The tremendous growth and potential of the PC market has brought many manufacturers into this arena.

#### Notebook Computers, or Laptop Computers

**Notebook computers**, as their name implies, approximate the shape of an 8.5- by 11-inch notebook and can fit inside a briefcase easily. Also called **laptop computers**, they can operate on alternating (plug-in) current or special batteries. Notebooks are fully functional microcomputers; the people who use them need the power of a full-size PC wherever they go.

Some notebook systems are designed to be plugged into a **docking station** (also called an expansion base which may include a large monitor, a full-size keyboard and mouse, or other devices such as an additional hard drive or backup tape unit. Docking stations also provide additional ports that enable the notebook computer to be connected to different devices in the same manner as a desktop system. Some expansion bases also feature built-in networking cards so one is not required in the notebook computer.

Because of their size, notebook computers often feature a smaller display, less memory, and less storage space than a full-size PC. The most expensive notebooks, however, can be configured with just as much memory and storage space as a desktop system. Notebook systems are also available with the same processing power as the most powerful full-size PCs. Also because of their size, notebook computers tend to be more expensive than comparably equipped desktop computers. Depending on its features, a fully equipped notebook computer can cost between \$500 and \$5000.

#### Network Computers (NCs)

In some situations, a user does not need all the power and features provided by a personal computer. If you want to use only the Internet, for example, or if your job involves data entry, then you may not need the processing power, memory, and storage capacity of a fully equipped PC. In this instance a **network computer (NC)** becomes useful.

A network computer is a less powerful version of a personal computer, with minimal processing power, memory, and storage. (Some types of network computers provide no storage at all.) Network computers are designed to be connected to a network, a corporate intranet, or to the Internet. The NC relies on the network for software and data storage and may even use the network's server to perform some processing tasks.

In the mid-1990s, the concept of network computers became popular among some PC manufacturers, who pronounced the NC as the future of computing. However, no single NC standard emerged as various hardware and software makers fought to command this new market. As a result, several variations on the network computer quickly became available, and consumers almost immediately became confused about their differences and special purposes. While network computers have gained some market share in business, they have not succeeded to the extent their makers anticipated.

In business, variations of the network computer are thin clients, diskless workstations, Windows terminals, and NetPCs. Some network computers are designed to be connected only to the Internet or

to an intranet. These devices are sometimes called Internet PCs, Internet boxes, Internet appliances, or set-top boxes. In home settings, some network computers do not even include a monitor; instead, they connect to the user's television, which serves as the output device.

A popular example of a home-based network computer is WebTV, which enables the user to connect a television to the Internet and enjoy both standard television programming and Internet services. The WebTV service uses a special set-top box to connect to the Internet and provides a set of simple controls to enable the user to navigate the Internet, send e-mail, and perform other tasks on the network while watching television.

Many large companies have adopted network computers for their users because they have a lower **total cost of ownership (TCO)** than standard personal computers. NCs are cheaper to purchase, operate, and maintain than normal PCs. Because most users' systems are connected to a company network anyway, users can take advantage of the network server's speed and storage capacity and can often access the Internet through the company's network connection.

In corporate settings, network computers such as the Sun JavaStation offer several other advantages:

- **Enhanced Data Security.** Because NCs have no floppy disk drive or CD-ROM drive, it is impossible for users to install programs or copy data files directly to or from a network computer. This feature enhances the security of sensitive business data and prevents users from filling disks with unneeded programs.
- **Reduced Threat of Viruses.** Because individual users cannot install files at the NC, there is little risk that users will introduce computer viruses into the network by copying files from infected disks.
- **Centralized Software.** It is less expensive to purchase software for network computers because software must be installed only on the server rather than on each individual NC. Some types of NCs can store and run an operating system and applications locally but not to the extent that a full-fledged PC can. Thus, software costs are greatly reduced.
- **Limited Upgrades.** A large company no longer must individually upgrade the operating systems and applications in thousands of PCs every two or three years.

### Handheld Personal Computers (H/PCs)

Since the mid-1990s, many new types of small personal computing devices have been introduced, and all fall under the category of **handheld personal computers** (H/PCs). These tiny systems are also called **palmtop computers**. A handheld PC can be any sort of computer that fits in the user's hand, such as a(n):

- Personal digital assistant (PDA)
- Cellular telephone with Internet, e-mail, and fax capabilities
- H/PC Pro device

Many H/PCs look like miniature notebook computers, with small displays and keyboards, but are much smaller than even the tiniest full-featured notebook PC. (Some of these systems are not much larger than a checkbook.) This type of H/PC is sometimes called a mini-notebook computer. Most H/PC systems do not provide disks, but memory can be added through PC cards or other means.

Software is abundant for these devices, most of which are Internet-capable and can connect to a full-size computer to exchange data.

Handheld Personal Computers (H/PCs): Personal Digital Assistants (PDAs)

**Personal digital assistants (PDAs)** are among the smallest of portable computers. Often, they are no larger than a small appointment book, but they are much less powerful than notebook or desktop computers. PDAs are normally used for special applications, such as taking notes, displaying telephone numbers and addresses, and keeping track of dates or agendas. Many PDAs can be connected to larger computers to exchange data.

Most PDAs come with an **electronic pen** that lets the user write on a touch-sensitive screen. (These systems are sometimes called **pen-based organizers**.) Even though they do not include real keyboards, some of these devices provide a graphical keyboard that appears on the screen; you type by tapping the desired keys with the unit's pen. Depending on the model, PDAs may include the following features:

- Built-in microphone and speaker, enabling the user to record speech digitally
- Personal information management (PIM) software
- Miniaturized versions of personal productivity applications
- Internet, fax, or e-mail software

### **CLASSIFICATION BY TYPE/NATURE**

Basically there are **three** types of computers under this classification, and these are, Analog, Digital and Hybrid. This classification is done using the **manner in which data are computed**.

#### **Analog computers**

Analogs are so named because they perform computations by setting up physical situations that are analogous to mathematical situations. Analog computers calculate by measuring the continuous variation in some physical quantity such as pressure, temperature and speed. The computers are essentially measuring devices like speedometer, thermometer, and voltmeters. The **thermometer** for instance compares or draws an analog between the expansion of mercury in it and the surrounding temperature. The speedometer in a car for instance computes speed in miles per hour by measuring how fast the car's wheels are rotating. As the car goes faster, the movement of speedometer needle shows the computed speed. The oil-pressure gauge in the car is another example. Analog computers usually have pointers for reading values anytime.

The output is often in the form of smooth graph from which information can be read. Many physical phenomena may be used to construct analog computers but since electrons are so mobile, analog computers perform mathematical operations with the aid of electronic circuits. Vannevar Bush, an American scientist built the first analog computer. Analog computers are used mainly for **scientific and engineering purposes**.

#### **Digital computers**

As the name suggests, digital computers are basically **counting devices**. The digital computer solves problems by counting precisely, adding, subtracting, multiplying, dividing and comparing. It is the

most common computer used in data processing environments. Since most business data are in discrete form, the digital computer is readily adaptable to **business data processing applications**. The speedometers of some car models are digital. Eg. They are general purpose computers.

Differences between analog and digital computers

<b>Analog computers</b>	<b>Digital computers</b>
1. Measurement is always involved	1. Numbers are used
2. Data change smoothly	2. Data change in discrete steps
3. Results must be read off a scale	3. Results are given by means of are presentation for the digits of the number.
4. There is a limit to the accuracy Obtainable.	4. The accuracy obtainable is theoretically unlimited.

### **Hybrid computers**

Although computers are basically of analog and digital make, there is a third type in the market known as hybrid computer. Hybrid computers combine analog and digital capabilities in the same computer system. This type of computer usually finds applications in the industries.

### **CLASSIFICATION BY PURPOSE**

Depending on the **flexibility of operations or ease of adaptability**, computers are divided into **special** or **general purpose**.

#### **Special Purpose Computers or Dedicated Computers**

These are most of the time designed to perform a task or restricted number of tasks. That is to say that the computer may have been designed to solve a problem or do a job or so. In this case a set of instructions that the computer follows to solve a problems may be built into the hardware. Many of these computers are used in the following areas:

1. For military operations
2. As control device in industries that processes steel or chemical.
3. They are also employed in manufacturing and designing in the form of Robotics.
4. All automobiles have one or more computers to control such activities as fuel consumption.
5. Many home appliances such as refrigerators, TVs, heaters and microwave ovens contain small computers to control the appliance.
6. Most cameras have device that controls the shutter amount of light reaching the film
7. Monitoring and controlling the operation of a nuclear power plant, oil refinery or steel plant.
8. Controlling a military weapon system.
9. Regulating city traffic control operations
10. Directing operations of spacecraft, airplanes, tankers, ship submarines.
11. Managing manufacturing machinery.

12. Operating hospital procedures such as CT Scanners.
13. Navigational system of an atomic submarine.

## General-Purpose Computers

These are designed to solve a wide range of problems. They can perform any task required simply by changing the application program stored in their main memory. This makes it possible to use such a computer for task such as banking, accounting, and scientific analysis. For instance, a desktop computer can be used to play games, write letters, draw pictures, or solve mathematical problems.

### Computer Brands/Models/Specification

Eg. Macintosh, Dell, Ibm, Compac, Toshiba, Hp,

Specification: P1,P2,P3,Pentium M. (Pentium By Intel Manufacturing Comp. Called Their Products Pentiums) Amd Celeron Cyrix -

## The Keyboard and the Mouse

If the CPU is the brain of the computer, then the input devices are its eyes and ears. From the user's point of view, input devices are just as important as the CPU--more so, in fact. After you have purchased and set up the computer, you can take the CPU for granted because you interact directly with input devices. Your ability to use input devices is critical to your overall success with the whole system.

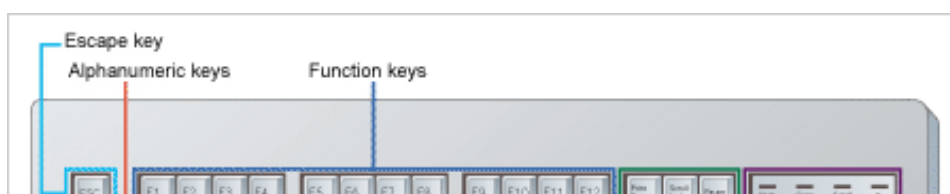
An input device does exactly what its name suggests; it enables you to input information and commands into the computer. The most commonly used input devices are the keyboard and mouse. In fact, if you buy a new personal computer today, it will include a keyboard and mouse unless you specify otherwise. As you will see, many other types of input devices are available, including variations of the mouse and specialized "alternative" input devices such as microphones and scanners.

This lesson introduces you to the keyboard and mouse. You will learn the importance of these devices, the way the computer accepts input from them, and the many tasks they enable you to perform on your PC.

### The keyboard

The keyboard was one of the first peripherals to be used with computers, and it is still the primary input device for entering text and numbers. A relatively simple device, a standard keyboard includes about 100 keys, each of which sends a different signal to the CPU.

If you have not used a computer keyboard or a typewriter, you will learn quickly that you can use a computer much more effectively if you know how to type. The skill of typing, or **keyboarding**, as it is often called today, implies the ability to enter text by using all ten fingers--and without having to look at the keys. Certainly, you can use a computer without being able to type, and many people do. Some people claim that when computers can understand handwriting and speech, typing will become unnecessary. But for now and the foreseeable future, keyboarding remains the most common way to



enter text and other data into a computer.

## The Standard Keyboard Layout

Keyboards for personal computers come in many styles. The various models differ in size, shape, and feel, but except for a few special-purpose keys, most keyboards are laid out almost identically. Among IBM-compatible computers, the most common keyboard layout is the IBM Enhanced Keyboard. It has 101 keys arranged in five groups, as shown in the Figure below. In Macintosh computers, the keyboard layout is close to the IBM Enhanced Keyboard, but there are a few differences.

The **alphanumeric keys**--the parts of the keyboard that look like a typewriter--are arranged the same way on almost every keyboard. Sometimes this common arrangement is called the **QWERTY** (pronounced KWER-tee) layout because the first six keys on the top row of letters are Q, W, E, R, T, and Y.

For decades, many expert typists have supported a different arrangement for alphanumeric keys called the DVORAK (pronounced de-VOR-zhak) keyboard. This keyboard layout (designed in the 1930s by a teacher named August Dvorak) places the most commonly used letters in the middle row of keys, making them easier to reach. Special DVORAK keyboards are available for computer systems but they are not standard equipment. A few keyboard manufacturers now offer keyboards that can be switched from QWERTY to DVORAK configurations.

Along with the keys that produce letters and numbers, the alphanumeric key group includes a few additional keys, with specific functions. These keys are similar to those found on a typewriter:

- Tab. The Tab key moves you to predefined tab stops in many application programs (such as word processors). In dialog boxes, you can press Tab to move from one option or field to another.
- Caps Lock. As the name implies, this key lets you "lock" the alphabet keys so they produce only capital letters. Caps Lock does not affect the numeric keys or the keys that produce punctuation or special characters.

- Backspace. This key enables you to erase characters you have just typed. For example, in a word processing program, you can press Backspace to "back over" an incorrect character and delete it.
- Enter. The Enter key (labeled "Return" on some keyboards) lets you finalize data entry in many types of application programs. You can also use Enter to choose commands and options in many programs and at various places in an operating system's interface.

A keyboard's **modifier keys** are so named because they are used to modify the input of other keys. You press another key while holding down one of the modifier keys. On a PC, the modifier keys are as follows:

- Shift. A computer's Shift keys have the same function as a typewriter's Shift keys; when pressed in conjunction with an alphanumeric key, Shift forces the computer to output a capital letter or symbol. Shift also acts as a modifier key on some programs. In most word processors you can press Shift along with various cursor-movement keys to select text for editing.
- Ctrl. This key (labeled with an abbreviation of the word *control*) produces different results depending on the program you are using. In many Windows-based programs, Ctrl-key combinations provide shortcuts for menu commands. For example, the Ctrl-key combination Ctrl+O enables you to open a new file.
- Alt. This key (called the Alternate key) operates like the Ctrl key, except that it produces a different set of results. In Windows-based programs, Alt-key combinations enable you to navigate menus and dialog boxes without using a mouse.

A Macintosh keyboard.

Macintosh computers also use Shift and Ctrl keys, and they function in much the same manner as their IBM-compatible counterparts. Macintosh systems also offer two additional modifier keys.

- Command. The Command key (sometimes called the Apple key) functions like the IBM-compatible PC's Alt key in many programs. Depending on the computer's age, this key may be labeled with a symbol that resembles a four-leaf clover, a picture of an apple, or both.
- Option or Alt/Option. This button lets you change quickly the function of other designated keys on the keyboard.

The **numeric keypad**, usually located on the right side of the keyboard, looks like an adding machine, with its ten digits and mathematical operators (+, -, \*, and /). The numeric keypad also features a Num Lock key, which works like the Caps Lock key in the alphanumeric key group, to force the numeric keys to input numbers. When Num Lock is deactivated, the numeric keypad's keys perform cursor-movement control and other functions.

The fourth part of the keyboard consists of the **function keys**. The function keys are usually arranged in a row along the top of the keyboard. They allow you to input commands without typing long strings of characters or navigating menus or dialog boxes. Each function key's purpose depends on the program you are using. When you press it, a special window appears to display information about the program you are using. Most IBM-compatible keyboards have 12 function keys; most Macintosh systems have 15.

The fifth part of the keyboard is the set of **cursor-movement keys**. They let you move around the screen. In many programs and operating systems there is a mark on the screen where the characters you type will be entered. This mark, called the **cursor** or **insertion point**, can appear on the screen as a small box, a vertical line, or some other symbol that indicates your place in a document or command line. Figure 3.3 shows a cursor in a document that is being edited in a desktop publishing program called FrameMaker.

Most keyboards include the following standard cursor-movement keys:

- **Arrow Keys.** Each of these four keys is labeled by an arrow pointing in a specific direction. The arrow keys move the cursor up or down a single line, or left or right one character space. Depending on the program you are using, you may be able to use the Shift and/or Ctrl keys to modify the arrow keys' behavior--for example, to move a greater distance or to select text for editing.
- **Home/End.** Depending on the program you are using, you may be able to press Home to move the cursor to the beginning of a line, and End to move to the end of a line. Used in conjunction with modifier keys, Home and End may move the cursor greater distances.
- **Page Up/Page Down.** These keys are sometimes abbreviated as PgUp and PgDn. Typically, they let you "flip" through a document, screen by screen, like turning the pages of a book. Press Page Up to jump to the previous screen; press Page Down to jump to the next. Their functions may be affected by modifier keys, depending on the program you are running.

In addition to the five groups of keys described earlier, all IBM-compatible keyboards feature six special-purpose keys, each of which performs a specialized function.

- **Insert.** Although it is included in the cursor-movement keys, Insert does not really control the cursor's movement. Insert may be used to switch a program from "insert mode" (where text is inserted into the document at the cursor) to "overtyping mode" (where new text is typed over existing text), and vice versa. Like other keys, the function of Insert depends on the program and may be affected by using the modifier keys.
- **Delete.** As its name implies, Delete is used to delete characters from a document. Used alone, Delete removes a single character at a time at the cursor's location. In conjunction with modifier keys and depending on the program you are using, Delete may be able to remove multiple characters of text. The Delete and Backspace keys function in opposite ways. Delete erases characters to the right of the cursor, and Backspace erases characters to the left of the cursor.
- **Esc.** This key's function depends on your program or operating environment. Typically, the Esc key is used to "back up" one level in a multilevel environment.
- **Print Screen.** This key allows the user to capture whatever is shown on the screen as an image. The image can then be printed, pasted into a document, or manipulated in various ways by the software.
- **Scroll Lock.** Despite its name, the Scroll Lock key does not necessarily make the screen's contents scroll. Its purpose may vary with the operating system and application in use. Usually, this key controls the functions of the cursor-movement keys. With some programs, Scroll Lock causes the cursor to remain stationary on the screen, and

the document's contents move around it. When Scroll Lock is turned off, the cursor moves normally. This key does not function at all in some programs.

- Pause. In some programs, the Pause key can be used to stop a command in progress.

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## Ergonomic and Specialty Keyboards

Many variations have been made on the standard keyboard, primarily for the sake of comfort and the reduction of repetitive stress injuries. People who type a great deal are susceptible to arm and hand fatigue and strain. New, ergonomically correct keyboards can help reduce those problems.

Ergonomically correct keyboards are designed to help the user's hands stay positioned correctly, reducing bending and strain. An ergonomic keyboard may be curved in some way, or it may be broken into two separate sections so the user can place them most comfortably on the desktop.

## Overview of Printers

A dot matrix printer forms a character by creating a series of dots. **Dot matrix printers** are commonly used in workplaces where physical impact with the paper is important, such as when the user is printing to carbon-copy/pressure-sensitive forms. These printers can produce sheets of plain text very quickly. They are also used to print very wide sheets, as data processing departments often use when generating large reports with wide columns of information.

**Ink jet printers** create an image directly on the paper by spraying ink through tiny. The popularity of ink jet printers jumped around 1990 when the speed and quality improved and the price plummeted. Today, good ink jet printers are available for as little as \$100. These models typically attain print resolutions of at least 360 dots per inch, comparable to that of most laser printers sold before 1992. These same models can print from two to four pages per minute (only slightly slower than the slowest laser printers).

**Laser printers** are more expensive than ink jet printers, their print quality is higher, and most are faster. As their name implies, a laser is at the heart of these printers. A separate CPU and memory are built into the printer to interpret the data that it receives from the computer and to control the laser. The result is a complicated piece of equipment that uses technology similar to that in photocopiers. The quality and speed of laser printers make them ideal for office environments, where several users can easily share the same printer via a LAN.

## HOW COMPUTERS REPRESENT DATA

### Some Basic Terminologies on Memory Capacity

How many 0's and 1's will a computer's main memory or a storage device such as a hard disk hold? The following terms are used to denote capacity:

1. **Bit:** It is a binary digit (0 or 1). It is the smallest unit of measurement.
2. **Nibble:** It is half a byte. In other words, it is a group of 4 bits.
3. **Byte:** A group of 8 bits is called a byte, and a byte represents one **character**, digit, or other value. The capacity of computer's memory or a diskette is expressed in numbers of bytes or generally in multiple of bytes.
4. **Kilobyte:** A kilobyte (K, KB) is about 1000 bytes. (Actually, its precisely  $2^{10} = 1024$  bytes but the figure is commonly rounded).
5. **Megabyte:** A megabyte (M, MB) is about 1 million ( $10^6$ ) bytes (i.e.  $2^{20} = 1\,048\,576$  bytes).
6. **Gigabyte:** A gigabyte (G, GB) is about 1 billion ( $10^9$ ) bytes (i.e.  $2^{30} = 1\,073\,741\,824$  bytes).
7. **Terabyte:** A terabyte (T, TB) represents about 1 trillion ( $10^{12}$ ) bytes (i.e.  $2^{40} = 1,009,511,627,776$  bytes).
8. **Petabyte:** A new measurement accommodates the huge storage capacities of modern databases a petabyte represents about million gigabytes ( $10^{15}$ ) bytes or ( $10^6$ ) gigabytes (i.e.  $2^{50} = 1,125,899,906,844,624$ ).
9. **Word:** A computer **word** is the number of bits that make up a unit of data as defined by the computer system. Common word length is usually related to the capacity of the **computer's bus or bus lines**. Examples of word sizes are 8 bits word, 16bits word, 32 bits word, and 64 bits word.

### Fixed Point numbers and Floating Point Numbers

These are the **two** main types of numbers used on the computer system. Fixed-point numbers are numbers, which have their binary or decimal point, fixed in position in relation to the digit. Examples are fractions and integers. (0.1, 0.01, 0.345, 1.0, 10.0, 1053.0). For integers, the point is fixed at the extreme right but for fractions at the extreme left. Since the position of the point is fixed and predefined, it is not stored on the computer.

With floating point numbers the position of the point varies from number to number. It is therefore used to represent mixed numbers (numbers that have an integer part and a fraction part). This concept

is used in scientific notation.  $43 \times 10^{-2}$ . Examples include 437.5, 43.75, and 4.375. Since the position of the point is not fixed or predefined it is necessary for the computer to store this position.

To a computer, everything is a number. Numbers are numbers; letters and punctuation marks are numbers; sounds and pictures are numbers. Even the computer's own instructions are numbers. When you see letters of the alphabet on a computer screen, you are seeing just one of the computer's ways of representing numbers. For example, consider this sentence:

*Here are some words.*

It may look like a string of alphabetic characters to you, but to a computer it looks like the string of ones and zeros shown below.

H	0100 1000	0
e	0110 0101	1
r	0111 0010	2
e	0110 0101	3
	0010 0000	4
a	0110 0001	5
r	0111 0010	6
e	0110 0101	7
	0010 0000	8
s	0111 0011	9
o	0110 1111	1 0
m	0110 1101	1 1
e	0110 0101	-
	0010 0000	-
w	0111 0111	-
o	0110 1111	9 8
r	0111 0010	9 9
d	0110 0100	1 0 0
s	0111 0011	1 0 1
.	0010 1110	

Ten different symbols in the decimal system.

1s digit  
10s digit  
100s digit

Numbers above 9 use more than one digit.

Computer data looks especially strange because people normally use base 10 to represent numbers. The system is called base 10, or the **decimal number system** (*deci* means "10" in Latin) because ten symbols are available: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. When you need to represent a number greater than 9, you use two symbols together, as in  $9 + 1 = 10$ . Each symbol in a number is called a digit, so 10 is a two-digit number.

In a computer, however, all data is represented by the state of the computer's electrical switches. A switch has only two possible states--on and off--so it can represent only two numeric values. To a computer, when a switch is off, it represents a 0; when a switch is on, it represents a 1 (see Figure 7.2). Because there are only two values, computers are said to function in base 2, which is also known as the **binary number system** (*bi* means "2" in Latin).

In a computer, data is represented by the state of electrical switches. An on switch represents a 1. An off switch represents a 0.

When a computer needs to represent a quantity greater than 1, it does the same thing you do when you need to represent a quantity greater than 9: it uses two (or more) digits. To familiarize yourself with the binary system, look at Table 7.1.

<b>Base 10</b>	0	1	2	3	4	5	6	7	8	9	10
<b>Base 2</b>	0	1	10	11	100	101	110	111	1000	1001	1010

## Counting in Base 10 and Base 2

### Bits and Bytes

When referring to computerized data, the value represented by each switch's state--whether the switch is turned on or off--is called a **bit**. The term *bit* is a combination of *binary digit*. A bit is the smallest possible unit of data a computer can recognize or use. To represent anything meaningful (in other words, to convey information), the computer uses bits in groups.

A group of 8 bits is called a **byte**. With one byte, the computer can represent 1 of 256 different symbols or characters because the eight 1s and 0s in a byte can be combined in 256 different ways.

The byte is an extremely important unit because there are enough different 8-bit combinations to represent all the characters on the keyboard, including all the letters (uppercase and lowercase), numbers, punctuation marks, and other symbols. In Figure 7.1, you will notice that each of the characters (or letters) in the sentence *Here are some words.* is represented by 1 byte (8 bits) of data.

### Text Codes

Early programmers realized that they needed a standard **text code**--a system they could all agree on--in which numbers represented the letters of the alphabet, punctuation marks, and other symbols. This standard code system would enable any programmer or program to use the same combinations of numbers to represent the same individual pieces of data. EBCDIC, ASCII, and Unicode are three of the most popular text code systems invented.

#### Text Codes: EBCDIC

The BCD (binary coded decimal) system, defined by IBM for one of its early computers, was one of the first complete systems to represent symbols with bits. BCD codes consisted of 6-bit codes, which allowed a maximum of sixty-four possible symbols. BCD computers could work only with uppercase letters and with very few other symbols; thus, this system was short-lived.

The need to represent more characters led to IBM's development of the EBCDIC system. **EBCDIC** (pronounced EB-si-dic) stands for Extended Binary Coded Decimal Interchange Code. EBCDIC is an 8-bit code that defines 256 symbols. EBCDIC is still used in IBM mainframe and midrange systems, but it is rarely encountered in personal computers. By the time small computers were being developed, the American National Standards Institute (ANSI) had begun to define new text code standards for computers.

#### Text Codes: ASCII

ANSI's solution to representing symbols with bits of data was the **ASCII** character set. ASCII (pronounced AS-key) stands for the American Standard Code for Information Interchange. Today, the ASCII character set is by far the most commonly used in computers of all types. Table 7.2 shows the first 128 ASCII codes.

The characters from 0 to 31 and 127 are control characters; from 32 to 64, special characters and numbers; from 65 to 96, uppercase letters and a few symbols; from 97 to 126, lowercase letters plus a handful of common symbols. Because ASCII, an 8-bit code, specifies characters up to only 127, there are many variations that specify different character sets for codes 128 through 255. The International Standards Organization (ISO) standard expanded on the ASCII character set, to offer different sets of characters for different language groups. This organization works to establish international standards and publishes documents describing each technology. For example, ISO 8859-1 covers Western European languages. There are many other character sets for languages that use a different alphabet.

<b>ASCII Code</b>	<b>Decimal</b>	<b>Equivalent Character</b>	<b>ASCII Code</b>	<b>Decimal</b>	<b>Equivalent Character</b>
<b>0000 0000</b>	0	Null	<b>0100 0000</b>	64	@
<b>0000 0001</b>	1	Start of heading	<b>0100 0001</b>	65	A
<b>0000 0010</b>	2	Start of text	<b>0100 0010</b>	66	B
<b>0000 0011</b>	3	End of text	<b>0100 0011</b>	67	C
<b>0000 0100</b>	4	End of transmit	<b>0100 0100</b>	68	D
<b>0000 0101</b>	5	Enquiry	<b>0100 0101</b>	69	E
<b>0000 0110</b>	6	Acknowledge	<b>0100 0110</b>	70	F
<b>0000 0111</b>	7	Audible bell	<b>0100 0111</b>	71	G
<b>0000 1000</b>	8	Backspace	<b>0100 1000</b>	72	H
<b>0000 1001</b>	9	Horizontal tab	<b>0100 1001</b>	73	I
<b>0000 1010</b>	10	Line feed	<b>0100 1010</b>	74	J
<b>0000 1011</b>	11	Vertical tab	<b>0100 1011</b>	75	K
<b>0000 1100</b>	12	Form feed	<b>0100 1100</b>	76	L
<b>0000 1101</b>	13	Carriage return	<b>0100 1101</b>	77	M
<b>0000 1110</b>	14	Shift out	<b>0100 1110</b>	78	N
<b>0000 1111</b>	15	Shift in	<b>0100 1111</b>	79	O
<b>0001 0000</b>	16	Data link escape	<b>0101 0000</b>	80	P
<b>0001 0001</b>	17	Device control 1	<b>0101 0001</b>	81	Q
<b>0001 0010</b>	18	Device control 2	<b>0101 0010</b>	82	R
<b>0001 0011</b>	19	Device control 3	<b>0101 0011</b>	83	S
<b>0001 0100</b>	20	Device control 4	<b>0101 0100</b>	84	T
<b>0001 0101</b>	21	Negative acknowledge	<b>0101 0101</b>	85	U
<b>0001 0110</b>	22	Synchronous idle	<b>0101 0110</b>	86	V

<b>0001 0111</b>	23	End transfer block	<b>0101 0111</b>	87	W
<b>0001 1000</b>	24	Cancel	<b>0101 1000</b>	88	X
<b>0001 1001</b>	25	End of medium	<b>0101 1001</b>	89	Y
<b>0001 1010</b>	26	Substitution	<b>0101 1010</b>	90	Z
<b>0001 1011</b>	27	Escape	<b>0101 1011</b>	91	[
<b>0001 1100</b>	28	File separator	<b>0101 1100</b>	92	\
<b>0001 1101</b>	29	Group separator	<b>0101 1101</b>	93	]
<b>0001 1110</b>	30	Record separator	<b>0101 1110</b>	94	^
<b>0001 1111</b>	31	Unit separator	<b>0101 1111</b>	95	—
<b>0010 0000</b>	32	Blank space	<b>0110 0000</b>	96	`
<b>0010 0001</b>	33	!	<b>0110 0001</b>	97	a
<b>0010 0010</b>	34	"	<b>0110 0010</b>	98	b
<b>0010 0011</b>	35	#	<b>0110 0011</b>	99	c
<b>0010 0100</b>	36	\$	<b>0110 0100</b>	100	d
<b>0010 0101</b>	37	%	<b>0110 0101</b>	101	e
<b>0010 0110</b>	38	&	<b>0110 0110</b>	102	f
<b>0010 0111</b>	39	'	<b>0110 0111</b>	103	g
<b>0010 1000</b>	40	(	<b>0110 1000</b>	104	h
<b>0010 1001</b>	41	)	<b>0110 1001</b>	105	i
<b>0010 1010</b>	42	*	<b>0110 1010</b>	106	j
<b>0010 1011</b>	43	+	<b>0110 1011</b>	107	k
<b>0010 1100</b>	44	,	<b>0110 1100</b>	108	l
<b>0010 1101</b>	45	-	<b>0110 1101</b>	109	m
<b>0010 1110</b>	46	.	<b>0110 1110</b>	110	n
<b>0010 1111</b>	47	/	<b>0110 1111</b>	111	o
<b>0011 0000</b>	48	0	<b>0111 0000</b>	112	p
<b>0011 0001</b>	49	1	<b>0111 0001</b>	113	q
<b>0011 0010</b>	50	2	<b>0111 0010</b>	114	r
<b>0011 0011</b>	51	3	<b>0111 0011</b>	115	s
<b>0011 0100</b>	52	4	<b>0111 0100</b>	116	t
<b>0011 0101</b>	53	5	<b>0111 0101</b>	117	u

<b>0011 0110</b>	54	6	<b>0111 0110</b>	118	v
<b>0011 0111</b>	55	7	<b>0111 0111</b>	119	w
<b>0011 1000</b>	56	8	<b>0111 1000</b>	120	x
<b>0011 1001</b>	57	9	<b>0111 1001</b>	121	y
<b>0011 1010</b>	58	:	<b>0111 1010</b>	122	z
<b>0011 1011</b>	59	;	<b>0111 1011</b>	123	{
<b>0011 1100</b>	60	<	<b>0111 1100</b>	124	
<b>0011 1101</b>	61	=	<b>0111 1101</b>	125	}
<b>0011 1110</b>	62	>	<b>0111 1110</b>	126	~
<b>0011 1111</b>	63	?	<b>0111 1111</b>	127	Delete or rubout

### Text Codes: Unicode

An evolving standard for data representation, called the Unicode Worldwide Character Standard, provides 2 bytes--16 bits--to represent each letter, number, or symbol. With 2 bytes, enough **Unicode** codes can be created to represent more than 65,536 different characters or symbols. This total is enough for every unique character and symbol in the world, including the vast Chinese, Korean, and Japanese character sets and those found in known classical and historical texts.

One major advantage that Unicode has over other text code systems is its compatibility with ASCII codes. The first 256 codes in Unicode are identical to the 256 codes used by ASCII systems. Unicode then extends far beyond the standard ASCII character set.

The Unicode standard was developed in 1991 by a joint engineering team from Apple Computer Corporation and Xerox Corporation. It has been updated continually since its inception. In fall 1999, version three of the worldwide Unicode standard was released by the Unicode Consortium, a group of developers, corporations, researchers, and other groups working in conjunction with the ISO. In version three, the Unicode standard includes a total of 57,709 16-bit code values.

Many software publishers, including IBM, Microsoft, Netscape, and others, encourage their developers to use Unicode in their programs. Unicode is supported by some operating systems (such as Windows 2000 and OS/2) and applications. Even so, it has not yet been universally adopted by software developers. Still, the goal is a worthwhile one. If a single character set were available to cover all languages, computer programs and data would be interchangeable.

**Two** components handle processing in a computer: the central processing unit, or CPU, and the memory. Both are located on the computer's circuit board that connects the CPU to the other hardware devices.

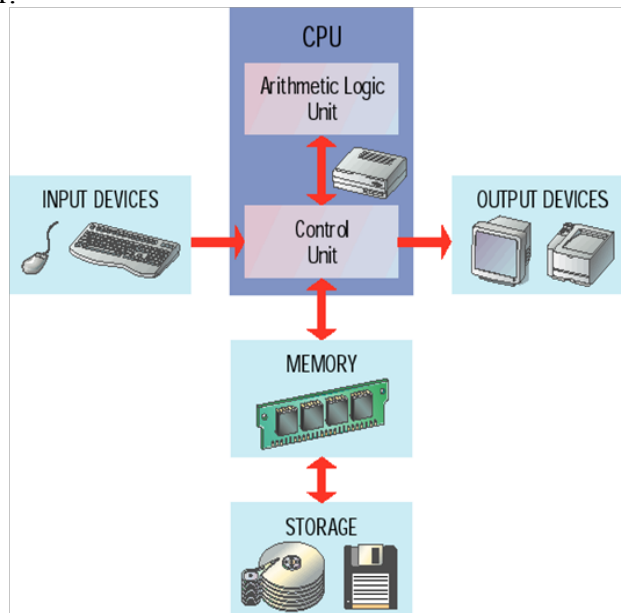
### The CPU

The CPU is the "brain" of the computer, the place where data is manipulated. In large computer systems, such as supercomputers and mainframes, processing tasks may be handled by multiple processing chips. (Some powerful computer systems use hundreds or even thousands of separate processing units.) In the average microcomputer, the entire CPU is a single unit, called a microprocessor.

Most microprocessors are single chips mounted on a piece of plastic with metal wires attached to it. Some newer microprocessors include multiple chips and are encased in their own cover, which fits into a special socket on the motherboard. Regardless of its construction, every CPU has at least two basic parts: the control unit and the arithmetic logic unit.

### The Control Unit

All the computer's resources are managed from the **control unit**. Think of the control unit as a traffic cop directing the flow of data through the CPU, and to and from other devices. The control unit is the logical hub of the computer.



All the data that flows through the computer is directed by the control unit in the CPU.

The CPU's instructions for carrying out commands are built into the control unit. The instructions, or **instruction set**, list all the operations that the CPU can perform. Each instruction in the instruction set is expressed in **microcode**--a series of basic directions that tells the CPU how to execute more complex operations.

### The Arithmetic Logic Unit

Because all computer data is stored as numbers, much of the processing that takes place involves comparing numbers or carrying out mathematical operations. In addition to establishing ordered sequences and changing those sequences, the computer can perform two types of operations: **arithmetic operations** and **logical operations**. Arithmetic operations include addition, subtraction, multiplication, and division. Logical operations include comparisons, such as determining whether one number is equal to, greater than, or less than another number. Also, every logical operation has an

opposite. For example, in addition to "equal to" there is "not equal to." Table 1.3 shows the symbols for all the arithmetic and logical operations.

Remember that some of the logical operations can be done on text data. For example, when you want to search for a word in a document, the CPU carries out a rapid succession of "equals" operations to find a match for the sequence of ASCII codes that make up the word for which you are searching.

Arithmetic Operations		Logical Operations	
+	add	= , ≠	equal to, not equal to
—	subtract	> , ≮	greater than, not greater than
X	multiply	< , ≯	less than, not less than
/	divide	≥ , ≯	greater than or equal to, not greater than or equal to
^	raise to a power	≤ , ≯	less than or equal to, not less than or equal to

Table 1.3

#### Operations performed by arithmetic logic units

Many instructions carried out by the control unit involve simply moving data from one place to another--from memory to storage, from memory to the printer, and so forth. When the control unit encounters an instruction that involves arithmetic or logic, however, it passes that instruction to the second component of the CPU, the **arithmetic logic unit**, or **ALU**. The ALU actually performs the arithmetic and logical operations described earlier.

The ALU includes a group of **registers**--high-speed memory locations built directly into the CPU that are used to hold the data currently being processed. For example, the control unit might load two numbers from memory into the registers in the ALU. Then it might tell the ALU to divide the two numbers (an arithmetic operation) or to see whether the numbers are equal (a logical operation).

#### THE INFORMATION PROCESSING CYCLE

The sequence of events in processing information includes (1) input, (2) processing, (3) storage and (4) output. These four stages are represented by **I-P-O-S**. The **input stage** can be further broken down into **acquisition**, **data entry** and **validation**. The output stage can also be further divided into **interactive**, **queries** and **routine reports**.

A **fifth** stage is often attributed to this cycle, which is the **archiving or deletion of unwanted data**.

#### DATA PROCESSING

Data processing is the manipulation of data into meaningful information by manual, mechanical or electronic method. It is also referred to as the conversion of data into a more refined form (information).

## DATA PROCESSING STAGES

### 1. Origination of data /Source Document

Input of raw materials (data) for data processing originates from various business forms and other materials referred to as source document. These are normally hand written or type written or prepared in a variety of other ways.

The originations of data or source documents are important for two reasons:

- i. They provide materials for cross checking or verification.
- ii. They are the basis for all-further processing.

### 2. Recording of Data (INPUT)

This step is essentially putting data into a more convenient form that permit convenient handling in whatever data processing methods is used. This might involve punching holes in cards, manual entry with the keyboard or using special equipment such as optical character reader or scanner.

- a. **Editing:** this is the process of selecting significant data and eliminating those, which does not need further process. It is a process of further reducing the amount of data to be recorded.
- b. **Coding:** the most familiar types of codes used are: **Alphabet codes:** which consists of letters presenting an idea or observation; **numeric codes:** which uses numbers to represent an idea or observation; **alpha numeric codes:** which involves both numbers and alphabets.
- c. **Classification:** It is the process of identifying one or more common characteristics to be used as categories.
- d. **Conversion:** It is a means of transferring data from one recorded form to another or changing from one medium to another. For example data on disk can be converted onto magnetic tape.

### 3. Manipulation (PROCESSING)

The original form of data is usually not disputable for any action to be taken, decision to be made, knowledge to be acquired. So there must be a form of conversion of the original data into a more useful form. The manipulation is accomplished by means of one or more of the following procedures.

- i. **Sorting:** it is the process of arranging or selecting data according to order or rank or common characteristic. **Sorting by rank** is known as sorting in sequence and it takes place when data is arranged in numeric or alphabetic sequence. Sorting according to common characteristics is known as sorting **by classification** and it takes place when data is arranged into similar groups.
- ii. **Comparing and analyzing:** by this process we determine such factors as the nature, proportion, relationship or the relative of data.
- iii. **Calculating:** this refers to the arithmetic process of addition, subtraction, division and multiplication or converting data into a more significant form.
- iv. **Summarizing:** it is the process of considering data so that only main points are emphasized. This could be done in two ways: Reducing the data in the logical sense, which involves the listing and tabulation of data; and accumulating data in the mathematical sense, which involves totaling. For example a balance sheet of a company is the summary

of the whole accounting system of the company for is the summary of the whole accounting system of the company for a period.

- v. **Report preparation:** the processed data that results from the data processing cycle is referred to as output. This output will include documents such as payroll slip or statement of accounting. The means by which data is finally recorded is known as the **output medium**.

#### 4. Communication of Information

It is the process of transferring data or information from one point to another during the data processing cycle or delivering the results to the users. Methods used to communicate data ranges from **transporting**, which involves usually the use of conveyor mechanism, or by **hand delivery**. Communication could also be done by the use of electrical transmission of coded data. This transmission could be achieved by the use of telephone or telegraph circuit, microwaves or radio transmission, and sometimes through satellite.

#### 5. Storage of Data /information

At the end of the processing cycle or at the point of intermediate results, during the processing of data, information must be stored. Storage must be done in such a way that retrieval is easy. The storage of data is very important since we may fall on stored data or information for action. The storage technique depends on the type of information as well as its volume. In electronic data processing for example, storage could be done in two ways: **internal storage**, where data is stored in the computer memory; **external storage**, where data is stored on a disk drum, tape card, etc.

#### LITERACY

Literacy is the ability to read and write. In modern context, the word means reading and writing in a level adequate for written communication and generally a level that enables one to successfully function at certain levels of a society.

There are **so many** types of literacy such as business, media, information, computer, technology, visual, and health but for the purpose of this course in computing the following will be considered:

- i. Computer literacy
- ii. Information Literacy
- iii. Integration Literacy

#### Computer Literacy

It is the level of expertise and familiarity someone has with computers. Computer Literacy generally also refers to the ability to use application rather than to program. Individuals who are very computer literate are sometimes called power users. In other words, it is the knowledge and ability to use a computer and its software efficiently to accomplish practical tasks.

It refers to the comfort level one has with using computer programs and other applications that are associated with computers. Such a person should know how computers work and operate.

### **Information Literacy**

Information Literacy is defined as the ability to know when there is a need for information, to be able to identify, locate, evaluate, and effectively use that information for the issue or problem at hand.

Information is expanding at an unprecedented rate, and enormously rapid strides are being made in technology for storing, organizing, and accessing the ever-growing tidal wave of information. The combined effect of these factors is an increasingly fragmented information base, a large component of which is available only to people with money and/or acceptable institutional affiliations. In the recent past, the outcome of these challenges has been characterized as the "digital divide."

### **Integration literacy**

Integration literacy refers to one's ability and level of competence to incorporate technology resources and technology-based practices into **daily routines, work, and management of schools**. Technology resources are computers and **specialized software, network-based communication systems, and other equipment and infrastructure**. Practices include collaborative work and communication, Internet-based research, remote access to instrumentation, network-based transmission and retrieval of data, and other methods.

It is important that the integration is **routine, seamless**, and both **efficient and effective in supporting school goals and purposes**. The conditions necessary in a school to support the integration of technology are the **physical facilities, capacity, and conditions, curricular connections, teacher actions and characteristics, student activities, and support**.

## **IMPORTANCE OF COMPUTER LITERACY TO THE TRAINED TEACHER**

1. Computer skills are taught as a subject in schools.
2. Computers are used in teaching and learning.
3. Computers are also used in research especially on the internet.

### **WHY ARE COMPUTERS SO POWERFUL?**

The following are some of the things that make computers **powerful/advantageous**:

1. **Speed**: computers can calculate tens of millions of times faster than the human brain and in seconds solve problems that would take dozens of experts some years to complete: Computer speeds are measured in four or more ways:
  - Millisecond (one-thousandth of a second =  $1 \times 10^{-3}$  second)
  - Microsecond (one-millionth of a second =  $1 \times 10^{-6}$  second)
  - Nanosecond (one-billionth of a second =  $1 \times 10^{-9}$  second)
  - Picosecond (one-trillionth of a second =  $1 \times 10^{-12}$  second)
  - Femtosecond (one-quadrillionth of a second =  $1 \times 10^{-15}$  second)

2. **Accuracy:** Even the fastest machine in the world would be of little use if it made mistakes that human had to check and correct. Fortunately, computers are accurate machines that can process large volumes of information according to complex and receptive procedures. Remember that whenever your computer gives you the wrong result it implies that the computer had a wrong data from you hence “**GIGO**” (**Garbage In Garbage Out**).
3. **Economy:** Computers are economical. Businesses using computers operate more efficiently and effectively since they can reduce labour costs, improve customer service and provide management with fast, accurate information about customers, products and sales. When we go to some hospitals, you will see a room full of patients records and fetching takes time.
4. **Reliability:** Computers can always be counted on to perform. They operate consistently and accurately without fail for long periods of time. They have built-in, self –checking features that assist in their maintenance. Because of it’s accuracy, computers are reliable. Reliability in processing information can result in the saving of lives.
5. **Versatility:** the computer can be used to solve many problems provided a suitable program can be written. It is not like the human who is restricted to only one or two professions.
6. **Communication:** The computer receives and shares information with other computers.
7. **Storage:** With computers, records are stored on the diskettes that don’t occupy any significant space on the table. In fact billions of characters are stored on disks that virtually occupy a small space.

#### **DISADVANTAGES OF COMPUTERS**

1. **Computer breakdown:** when a computer system breaks down or when there is power failure, the computer cannot be used and that highly hinders the work of an organization.
2. **Extensive system analysis and programming:** The computer is run by software which is prepared by skilful system’s analyst and programmers. Several years of investigation and preparation may have elapsed before the software becomes operational.
3. **Computer fraud:** It refers to the illegal use of the computer system or the manipulation of computer programs for personal gains.
4. **Invisible processing:** Data being operated or processed by the computer is invisible by the human who is using the system or machine. Therefore, he or she cannot appreciate the work of the computer.
5. **Initial cost:** The initial cost of a large installation is very high. Therefore, it may scare many people and organizations from computerizing their operations.
6. **Dislocation of employees:** Since computers can combine the work of several employees into software, such employees may be redundant.

## WHY USE COMPUTERS IN EDUCATION?

1. Computers help to improve both teaching and students achievement. Thus, helping them to develop self-control.
2. Work with computers particularly using the Internet brings students valuable connection with teachers, other schools and students and a wide network of professionals around the globe. These connections spice the school day with a sense of real world relevance and broaden the educational community.
3. Computer systems aid students in making career choices, for administering aptitude tests and psychological profiles.
4. Computers are used extensively in educational administration to keep track of everything from student records to employee payrolls.
5. Specialized applications called Computer-Managed Instruction (CMI) programs are used by teachers to create, deliver and score tests, to keep track of student grade and to create student progress reports.
6. Computers help students to understand issues relating to the appropriate use of technology in an educational setting.
7. To make tomorrow's workforce competitive in an increasingly high technological world, learning computer skills must be a priority.
8. Computers through the Internet would make students get interested in foreign cultures and people.
9. Computers through the net would enable students to design lessons for children which are appropriate.

## WHAT IS CURRICULUM?

In education, a curriculum (plural curricula) is the set of courses and their contents offered by an institution such as a school or university. In some cases, a curriculum may be partially or entirely determined by an external body (such as the Curriculum Research Development Division (CRDD) of the Ghana Education Service (GES) in Ghana.

### Types of Curriculum

There are basically **seven** types of curriculum. These are:

1. **The written (actual) curriculum**, which gives the basic lesson plan to be followed, including objectives, sequence, and materials. This provides the basis for accountability.
2. **The hidden curriculum** includes the norms and values of the surrounding society. These are stronger and more durable than the first two, and may be in conflict with them. [I would add that it is something that is not explicitly taught, but that is part of what moulds the school/university environment].
3. **The co-curriculum** is the planned experiences outside of the specific educational session.
4. **Formal** is the accepted, committee passed, written documents that are supposed to guide practice. Here at OLA we might find some of this in the code of ethics book.

5. **Informal curriculum** is those activities that happen that are not designed, planned, or formally accepted by the school.
6. **The null curriculum** consists of what is not taught. Consideration must be given to the reasons behind why things are not included in the official or operational curriculum.
7. **The operational curriculum** is what the teacher teaches, and how it is communicated. This includes what the teacher teaches in class and the learning outcomes for the student.

### EXERCISE 1

1. What is the difference between computer literacy and information literacy? How do computers relate to information literacy?
2. **Name any four** characteristics that make the computer such a powerful tool? Describe each.
3. State the **three** classifications of computers. Briefly describe each.
4. What is computer software? How is system software different from application software?

### Fill, in the Blanks

1. A (n) ..... is an electronic device, operating under the control of instructions stored in its memory unit, that can accept input, process the input arithmetically and logically, produce output from the processing, and store the results for future use.
2. The four operations of the information processing cycle are: ....., ....., ....., and .....
3. During information processing, the computer manipulates..... – raw facts given to a computer during the input operation to create ..... that has been converted into a form that has meaning and is useful.
4. The central processing unit (CPU) contains a (n) ..... That executes program instructions and a (n) ..... That performs mathematical and logical operations.
5. Collectively the equipment that performs the **four** operations of the information processing cycle is called a (n) ....., and the input devices, output devices, and secondary storage devices that surround the system unit are referred to as.....
6. The information processing cycle consists of four operations: ....., ....., ....., and .....
7. In the information processing cycle, the ..... Operation must take place before any data can be processed and any information produced and stored.

8. A (n) ..... is a pointing device that, by moving it across a flat surface and pressing buttons, can be used to move the pointer and select options on the screen.
9. Each **off** or **on** digital value is called a (n) ..... and a group of eight off or on digital values, called a (n) ..... can represent 256 different data possibilities.
10. ...., the most widely used coding system to represent data, is used primarily on personal computers and minicomputers, while ..... is a coding system used primarily on mainframe computers.
11. The four steps of the machine cycle are: ....., ....., ....., and ..?
12. The two parts of a machine language instruction are (n) ..... This tells the computer what to do and matches one of the commands in the instruction set and (n) ..... That specifies the data or location of the data that will be used by the instruction.

### Short Answer

1. What is the difference between computer literacy and information literacy? How do computers relate to information literacy?
2. **Name any four** characteristics that make the computer such a powerful tool? Describe each.
3. How are computers generally classified? What are the five major categories of computers? Briefly describe each. Why is it difficult to make firm definitions of these categories?
4. What is computer software? How is system software different from application software?
5. What is data accuracy important? What does the computer jargon term GIGO mean?
11. What is a parity bit?

## COMPUTER COMPONENTS 1

The following components will be considered in this section.

1. SYSTEM SOFTWARE
2. SYSTEM UNIT
3. STORAGE DEVICES

### SECTION 1 SYSTEM SOFTWARES

**Definition:** These are computer **programs** that (start up the computer and) function as the principal coordinator of all hardware components and application software programs and the user. Without system software loaded into RAM of your computer, your hardware and applications software are useless. In other words, system software works “behind the scenes” and it underlines application

software. System software deals with the physical complexities of computer hardware by telling the computer:

1. How to interpret data and instructions;
2. How to communicate with peripheral equipment like printers, keyboards, and disk drives;
3. How to manage files; and
4. How to use the hardware in general.
5. It allows the user to interact with the computer.

### **SOME SYSTEM SOFTWARES ARE BUILT INTO THE COMPUTER**

1. ROM chips and BIOS (Basic Input Output System).
2. Helps to setup the computer and start it.

### **COMPONENTS (CATEGORIES) OF SYSTEM SOFTWARES**

There are **three** basic types of system software. The types are:

1. Operating systems
2. Utility programs and
3. Language translators.

### **OPERATING SYSTEMS**

**What is it?** These are programs that operate your microcomputer.(IT CONTROLS YOUR APPLICATION SOFTWARE AND MANAGES HOW YOUR HDWARE DEVICES WORK TOGETHER. THE BASIC SOFTWARE OF ANY COMPUTER SYSTEM. EG. WIDOWS, LINUX, DOS, MacOS AND UNIX). The operating system is the most important system software component. It consists of master programs, called the supervisor that manages the basic operations of the computer. The operating system allows you to concentrate on your own tasks or applications rather than on the complexities of managing the computer. Interpreting the commands you give, the operating system runs programs and allows you to interact with the programs while they are running.

The same part of the operating system is automatically loaded into the RAM soon after you turn on, or “**boot**” the computer. The parts of the operating system that always remain in memory while the computer is on are called “**resident**”. Less-frequently-used parts of the operating system are copied from disk when needed and are called “**non-resident**” or “**transient**”. The operating system includes **BIOS (Basic Input Output System)**, which manages the essential peripherals such as the keyboard, monitor, disk drives and ports.

Every operating system performs **three** functions:

1. Managing resources;
2. Providing a user interface; and
3. Running applications.

**1. Resources:** These programs coordinate the entire resources of the computer including keyboard, mouse, printer, monitor, storage devices, and memory.

2. **User interface (UI):** This enables user to interact with applications software and hardware. Almost all operating systems today provide a windows-like **Graphical User Interface (GUI)** in which icons are used to represent features.
3. **Applications:** these programs load and run applications. Most operating systems have the ability to run more than one applications at a time. That is what is called **multitasking**. The most common operating systems for microcomputers are **windows, Mac Operating system** and **UNIX**.

## THE ROLE OF THE OPERATING SYSTEMS

The operating system is usually located on a disk.

- Can be on either the hard disk drive, a floppy disk, or CD-ROM disk.
  - Must be loaded into RAM before it can be used.
1. Used by the computer's hardware to work with its parts.
    - Tells the computer how to:
      - Display information on the screen.
      - Use a printer.
      - Store information on a secondary storage device.
    - The system software that controls peripherals are called drivers.
  2. An operating system works with application software.
    - Does basic tasks, like printing a document or saving a file
    - The operating system starts (launches) the application software so that it can be used.

## THE USER INTERFACE

**The user interface is how the computer's operating system presents information to the user and the user gives instructions (commands) (interacts and communicates) to the computer.**

There are **two** kinds of User Interfaces

- a. Text Interface
  - i. Presents information to the user in the form of text.
  - ii. Have to type in commands or select commands from a menu displayed as text on the screen.
  - iii. Hard to use or learn, because the user must memorize and type in commands.
  - iv. Examples:
    - MS-Dos (MicroSoft Disk Operating System)
    - ProDos (Professional Disk Operating System)
  - v. Many of the Text Interfaces had shells placed over them.
    - A shell was more of a Graphic User Interface.
    - Made using the Text Interface easier to use.

**ROLE:** 1. To interact with either the operating system or application software such as opening a directory and setting up one.

b. Graphic User Interface (GUI)

- i. Presents information to the user in the form of pull-down menus and icons.
  - Pull-down menus the user clicks on to display the menu
  - Icons are small pictures that stand for something, like a file, volume, trash, or program
- ii. The user gives commands to the computer by selecting items from a menu or by clicking on an icon when using a pointing device.
- iii. GUIs are easy to learn and use
- iv. Examples:
  - Windows 98
  - Windows 2000
  - MacOS

## UTILITY PROGRAMS

These are programs generally used to support, enhance or expand existing programs in a computer system. All Kinds of things can happen to the computer system such as internal hard disk crash, virus invasion, and “**freezing up**” (slow down of operations) and so on.(help in solving trouble shooting purposes such as internal hd crash, virus invasion and freezing up) These events can make computing frustrating but with utilities, you can weather the storm. Many operating systems have built-in utility programs while others such as **Norton system works** and **McAfee Office** are available separately.

### Examples of utility programs:

1. **Anti virus:** these guard the computer system against viruses or other damaging programs that can invade your computer system. Some anti-virus programs destroy the virus on the spot while others notify you of possible viral behaviour. New viruses are constantly being developed. Therefore you need the type of anti-virus software that can detect unknown viruses and that also offers frequent free updates. Examples are **Norton Antivirus**, **McAfee's virus scan**, **Dr. Solomon's Ant-virus**, **Webscan**, **Panda Anti-virus**, **KV 3000** and **PC-cillin**.
2. **Backup:** this enables users to make backup or duplicate copy of information on their hard disk, diskettes or other removable storage media such as a zip cartridge. Backup helps you to have access to your data in case the original ones are lost or damaged. Examples are **Norton Backup from Symantec** and **Colorado scheduler**.
3. **Data Recovery:** these are used to restore or resurrect data file that has been physically corrupted or has been accidentally deleted. Data can be damaged by viruses, bad sectors, hardware failure, and power fluctuations that occur while data is being written or recorded. Examples are the **recycle bin in windows** and **Norton unease wizard**.
4. **Disk Defragmentation:** These locate and eliminate unnecessary fragments, rearranges files and unused disk space to optimize operation. An example is **Windows Disk Defragmenter**.

5. **File Compression:** These reduce the size of files by removing redundant elements, gaps, and unnecessary data from the file so that they occupy less storage space and can be sent more efficiently over the internet or put on diskettes. Examples are Win Zip and WinRAR.

7. **Uninstall:** These allow you to safely and completely remove unneeded programs and related files from your hard disk.

### LANGUAGE TRANSLATORS

These are softwares that translate programs in a language such as C++ into machine language, which the computer can understand. All system softwares and application software must be turned into machine language for the execution by the computer. Language translators are of **three** types:

1. Assemblers (Assembly Language)
2. Compilers and
3. Interpreters

### Assembly Language

It is a type of low-level computer programming language in which each statement corresponds directly to a single machine instruction. Assembly languages are thus specific to a given processor. After writing an assembly language program, the programmer must use the assembler specific to the microprocessor to translate the assembly language into machine code. Assembly language provides precise control of the computer, but assembly language programs written for one type of computer must be rewritten to operate on another type. Assembly language might be used instead of a high-level language for any of three major reasons: speed, control, and preference. Programs written in assembly language usually run faster than those generated by a compiler; use of assembly language lets a programmer interact directly with the hardware (processor, memory, display, and input/output ports).

### Compilers

Compiler, in computer science, computer program that translates source code, instructions in a program written by a software engineer, into object code, those same instructions written in a language the computer's central processing unit (CPU) can read and interpret. Software engineers write source code using high level programming languages that people can understand. Computers cannot directly execute source code, but need a compiler to translate these instructions into a low level language called machine code.

Compilers collect and reorganize (compile) all the instructions in a given set of source code to produce object code. Object code is often the same as or similar to a computer's machine code. If the object code is the same as the machine language, the computer can run the program immediately after the compiler produces its translation. If the object code is not in machine language, other programs—such as assemblers, binders, linkers, and loaders—finish the translation.

Most computer languages use different versions of compilers for different types of computers or operating systems, so one language may have different compilers for personal computers (PC) and Apple Macintosh computers. Many different manufacturers often produce versions of the same programming language, so compilers for a language may vary between manufacturers.

Consumer software programs are compiled and translated into machine language before they are sold. Some manufacturers provide source code, but usually only programmers find the source code useful. Thus programs bought off the shelf can be executed, but usually their source code cannot be read or modified.

### **Interpreters**

Most programming languages—such as C, C++, and Fortran—use compilers, but some—such as BASIC and LISP—use interpreters. An **interpreter** analyzes and executes each line of source code one-by-one. Interpreters produce initial results faster than compilers, but the source code must be re-interpreted with every use and interpreted languages are usually not as sophisticated as compiled languages.

## **SECTION 2 THE SYSTEM UNIT**

### **The rectangular box which houses the main components of the computer.**

The system unit is made up of so many parts. The main ones are the following:

- I. Central Processing Unit/ **CPU** (Processor)
- II. Main memory/ primary storage/ RAM and
- III. **Motherboard/systemboard** - The motherboard is the main circuit board of a microcomputer, on which can found the processor, Cmos battery. It is also known as the main board or system board.
- IV. **Bus** - A bus is an electronic line that allows 1s and 0s to move from one place to another.
- V. **Expansion Slots** - Expansion slots appear on the motherboard. They are sockets into which adapters are connected.
- VI. **Ports and Connectors** - A port is a connector located on the motherboard or on a separate adapter.
- VII. **Bays** - A bay is a space inside the computer case where a hard drive, floppy drive or CD-ROM drive sits.
- VIII. **Power Supply** - A power supply changes normal household electricity into electricity that a computer can use.
- IX. **Sound Components** - A sound card lets a computer play and record high quality sound.

### **PROCESSOR (CENTRAL PROCESSING UNIT)**

The central processing unit (CPU) or processor is the main brain of a computer system and mostly consist mainly of **two** parts:

1. A control section/unit; (containing Registers, An internal bus. etc.)
2. An arithmetic/logic unit;

### **Characteristics of Control Unit**

The **control unit** contains circuitry that uses electrical signal to direct the entire computer system to carry out operation. I.e. it executes the program instructions. The control unit also controls the transfer of data to, from and within the working store as required by the program pulses to flow along the appropriate channel. The control unit also consists of the following components:

- i. **The instruction Register:** Generally, registers are temporary storage areas for instruction or data. They are not part of the memory; rather they are additional storage locations that offer the advantage of speed under the control of a control unit. The instruction Register, therefore receives instructions from the internal store in the sequence required for processing. The operation part of the instruction is then transferred to a decoder.
- ii. **The Decoder:** The decoder translates the operation to be executed, which causes the appropriate circuit to be connected for carrying out the operation in the ALU.
- iii. **The Address Register:** The address register makes the required circuit connections to enable the data contained in store location to be transferred to a specific calculator. That is, it keeps track of where a given instruction or piece of data is stored in the memory. An accumulator collects the results of computation.
- iv. **The Instruction Counter:** It is for recording the number of instructions executed and is incremented by one after each instruction is completed.

### The Machine Cycle

The key element in the most fundamental CPU operations is called machine cycle. The machine cycle has two parts: the instruction cycle (I-Cycle) and the execution cycle (E- Cycle). **I-CYCLE** - In this cycle an instruction is retrieved from the primary memory and decoded. **E-CYCLE** - In the E-Cycle, the required data are located, the instructions are executed and the results stored.

1. The control unit retrieves an instruction from the program stored in the primary storage.
2. The instruction is decoded and placed in a special instruction register. (Registers are special storage location in the ALU and the control unit that acts as a high-speed storage area. There are several different kinds of registers, such as instruction registers, address registers, accumulator).
3. The control unit breaks each instruction into two parts, the instruction and the address of the data to be used. The part of the instruction telling the ALU what to do next is placed in the instruction register. The part of the instruction specifying the address of the data to be used in the operation is put in the address register. A storage register is used to store the data that has been performed.
4. The data is then processed into information.
5. Lastly, the accumulator is used to store results of the operation. This is the machine cycle.

There are millions or hundred of millions of such cycle to be performed in a program. However, machines work very fast (Million of Instruction per second (MPS) and extremely large programs can be executed in no time.

### Characteristics of the Arithmetic Logic Unit (ALU)

It performs arithmetic operation, data handling operations and logic functions. The unit consists of electronic circuit, one or more working **registers** to which operands (figures) may be transferred while being operated upon and sometimes accumulators for storing results of calculation.

1. **Arithmetic operation:** This performs addition, subtraction, multiplication and division. However, subtraction is performed by the addition of the complement of the number to be subtracted. Similarly combinations of shift to the left and addition perform multiplication. Division is performed by the combinations of shift to the right and subtraction.

2. **Logic operations:** logic operations are concerned with comparing, selecting, matching, sorting and merging of data. When comparing data factors, the logical ability of the ALU differentiates between positive and negative differences in accordance with a result of the comparison. The alternative sequence of instructions to be executed is determined automatically. This is known as conditional transfer and it provides the needs for processing according to the circumstances disclosed by the data.

## TYPES OF PROCESSESORS

1. It can either be in the form of Pin Grid Array (PGA) and the Slot Type (SCC).

### Characteristics of Internal Bus

The last segment of a CPU chip or microprocessor is its internal bus, a network of communication lines that connects the internal elements of the processor and also leads to external connectors that link the processor to the other elements of the computer system. The three types of CPU buses are:

1. **A control bus** consisting of a line that senses input signals and another line that generates control signals from within the CPU;
2. **The address bus**, a one-way line from the processor that handles the location of data in memory addresses; and
3. **The data bus**, a two-way transfer line that both reads data from memory and writes new data into memory.

### \*THE MAIN MEMORY/PRIMARY MEMORY/ PRIMARY STORAGE

The main memory is the collection of slots each of which can store one byte of instruction or data. Each byte of memory has numeric labels called **address**. The user memory in most personal computers (PC) is limited to the address from 00000-9ffff that is six hundred and forty (640) kilobytes (KB). This limitation is placed by the operating system. The operating system is a program, which manages the hardware, software and information efficiently. It is responsible for:

- (i) Keeping track of resources,
- (ii) Allocation of resources,
- (iii) Reclaiming of resources, and
- (iv) Scheduling under a policy.

The **resources** are the memory, input or output device, information or stored data and the arithmetic logic unit. Examples of operating system include Ms DOS, Ms Windows, and Novel.

### OTHER FEATURES OF THE MAIN MEMORY

1. **Electronic:** Its operations are wholly electronics and consequently very fast and reliable. It is made up of semi- conductor storage, which consists of very small circuit (is a path through which electronic current passes).
2. **Immediate access:** Data is almost naturally accessible from the main memory because of its electronic operation. Data is also retrieved from main storage in much lesser time.
3. **Locations:** It contains several compartments called locations. Each location has a unique address.

## WHAT IS MEMORY?

**Memory** is the electronic holding place for instructions and data that your computer's microprocessor can easily reach. This type of memory is known as Random Access Memory (**RAM**) and Read Only Memory (**ROM**). (A third type of memory falls into the category of **storage devices** and these will be discussed later in this tutorial.)

When the computer receives information from input devices, the processor processes it, and it is fed back to the user through output devices. This cycle (input - process - output) would not be possible without a holding place for the information. This holding place is known as memory.

### CHARACTERISTICS OF RANDOM ACCESS MEMORY (RAM).

1. **The RAM can hold data and programs that can be written into its storage area.**
2. **New data and programs statement can overwrite existing ones or items.**
3. **It is volatile because data and programs held in it can be lost when power is switched off. This is due to the fact that data is stored using electrical signals.**
4. **RAM is measured in bytes. Some typical RAM capacities are**  
**Kb (kilobyte):  $2^{10}$  or 1024 bytes approximated to 1000.**  
**Mb (Gigabytes): 1 million bytes.**  
**Gb (Gigabyte): 1 billion bytes.**

### Significance of the RAM

Data and programs are held in RAM before processing can be done. The program and data should be of a size that the RAM can contain. (It is important to note that the application to be used and the operating system depends on the RAM size) If the size of the RAM is not enough to accommodate the operating system and still have enough space to hold other software and data, then the purpose of purchasing a computer system will not be achieved.

### Types of RAM

2. **SRAM (Static Random Access Memory):** It is a type of RAM, whose content remains in one position until the CPU explicitly changes it. As long as there is power, SRAM keeps the stored data so that no mechanism is required to refresh and charge it. However, it is expensive.
3. **DRAM:** It is an acronym of **Dynamic Random Access Memory**. It is a type of RAM, which is inexpensive. However, it is slow and the data stored dissipates faintly rapidly because the electric charge is small. Therefore, the computer must check each storage location frequently and refresh its charge.
4. **CMOS:** It is an acronym of **Complementary Metallic Oxides Silicon**. It uses battery or little power to store information. Usually, it is used to store machine configuration, settings such as the number of disks drives, memory size and input or output peripherals. It is volatile memory because when the battery runs down, the CMOS contents are lost.

### CHARACTERISTICS OF THE READ ONLY MEMORY (ROM)

1. It contains items, which have been permanently written into it. A specific function has been burnt into the chip at a time of manufacture.
2. It is non-volatile. It does not lose its data even when the computer is switched off. Because of this, it is used for permanent purposes such as control function.

### **Types of ROM**

1. **PROM** (Programmable Read Only Memory): In contrast to normal ROM in which the pattern of stored data is permanently incorporated into the chip, the PROM can be programmed by the user of the system by special device. It is an extension of ROM, which allows the user to program his own software for permanence and an unalterable. The danger with PROM is the possibility of errors and consequently the cost of correction.
2. **EPROM** (Erasable Programmable Read Only Memory): This can be read from and written to as well as erased. The erasing and the rewriting process are very slow compared to the reading, which limits the use. For this reason they are sometimes called Read Mostly Memory (RMM). It is erasable by means of ultraviolet light so that correction is less expensive.
3. **EAPROM** (Electrically Alterable Programmable Read Only Memory): It is similar to EPROM except that the program instructions are selectively erasable by electrical methods. This makes it more convenient.

### **USES OF THE MAIN MEMORY**

**It is used to store data requiring processing in order to achieve maximum processing speed. It therefore stores:**

1. **Instructions waiting to be obeyed.**
2. **Instructions currently being obeyed.**
3. **Data waiting processing.**
4. **Data currently being processed.**
5. **Data awaiting output.**

### **STORAGE DEVICES**

**What are storage devices?** Storage devices are any physical device in or on which computer information can be kept. Examples include hard disk, pen drive, floppy disk, compact disk and DVD.

### **DISKS AND STORAGE**

A disk is a place to store data. Although there are several types of disks, for the purposes of this tutorial, only the following types will be discussed: Hard Drive, Floppy Disk / ZIP Disk, and Compact Disk.

#### **HARD DRIVE [Local Disk (C :)]**

The hard drive is the primary device that a computer uses to store information. The hard drive stores programs, data files, saves files, and organizes files. The hard drive is located inside the computer case. The hard drive, magnetically stores data on stacks of rotating disks called platters.

The hard drive serves as a storage space for all of your documents, old email, and all applications (including the operating system). Hard drives are measured in terms of megabytes and gigabytes. When the hard drive reaches its capacity, files need to be moved to free up space. To free up space on the hard drive or to save files to a portable medium, files can be copied to a floppy disk.

### **Protecting the Hard Drive**

- Never move a computer while it is on. The hard drive is spinning and movement could cause the magnetic disks to become scratched.
- Shut down you computer properly.
- Regularly perform diagnostic tests of your hard drive using ScanDisk.

### **SECONDARY STORAGE DEVICES/ AUXILLIARY STORAGE DEVICES**

The secondary storage devices are used to store instructions, programs and data when they are not being used in the main memory of the computer. **Auxiliary or backing store** are alternative names for secondary storage because they support or back the main memory. Apart from keeping a copy of any important file, data and the like on the hard disk, it is always advisable to keep reserve copy as backup storage on another secondary storage device. This will enable you to have another copy in case the one you are using is deleted accidentally.

The process of retrieving information from a storage device is referred to as **reading**. When information is read from a secondary storage, it is copied from the storage device to primary storage (RAM). The phrases “**loading an application**” or “**opening a file**” is used to describe retrieving information from storage device. The process of **copying information** to a storage device is referred to as **writing**. The action of **saving a file or installing a program** involves writing to a storage device. In the context of computer storage, the mechanism that makes reading and writing possible is generally referred to as a **drive**. The following **drives** exist in most computers:

1. Magnetic tape
2. Magnetic disk and
3. Optical disk.

### **CHARACTERISTICS OF SECONDARY STORAGE DEVICES**

1. They are relatively long term storage devices;
2. It is outside the central processing unit;
3. They are non-volatile.
4. They are slower than the primary storage devices because of their electromechanical component; and
5. They are able to transfer large amount of data to the central processing unit.

### **MAGNETIC TAPE TECHNOLOGY**

This is the oldest and the least expensive form of storage devices. It is primarily use in older computers or when large amount of data must be stored at very low cost. A typical tape comes as ½ “wide and 2400ft long. Each byte of data utilizes one column on the tape. Each column consists of 7 bits including the parity bit. Data are stored on magnetic sports. **Vertical columns** are called **frames** (character frames) and there are often 800 or 1600 frames to the inch. **Horizontal columns** are called **channels** or tracks.

Data is written to and read from magnetic tape using a device called a **magnetic tape deck**. The tape decks are permanently linked to the CPU. When it is required to write data from the main store to magnetic tape, a reel of tape is loaded into the deck. The tape is threaded from the supply reel under the read/write head and wound round the take-up reel. The vacuum chambers on each side of the read/write head acts as reservoirs and ensure that the tape passes the head at a constant speed and that the tape does not tear when it is stopped or started. Characters are transferred from the CPU, translated into the appropriate magnetic tape code, and written to the tape, frame by frame, by the write head. Reading tape is accomplished in a similar fashion.

To enable the tape to be wound round the supply and take-up reels, lengths of the tape at both ends are not used for recording data. The point where recording can begin on the tape is shown by a reflective load point marker, which is sensed by **photoelectric cells**. An end-of-tape marker, which indicates the effective end of tape, works on the same principle.

When reading from a magnetic tape in response to a read instruction in the program, a number of characters are read into store at a time. Those frames transferred to the store at any one time make up a **BLOCK** and a block often consists of several records. When these records have been dealt with, the next block of records is read into store and it over-writes the previously stored records. Data is also written to magnetic tape a block at a time.

After a block of data has been read into the main store, the tape stops until the next read instruction is encountered in the program. The tape has, then, to accelerate to a given constant speed before reading can take place. To allow for this acceleration and for deceleration after a block has been read, gaps are left blank between blocks of data on the tape. These **INTER-BLOCK GAPS (IBGs)** are usually between  $\frac{1}{2}$ " and  $\frac{3}{4}$ " long. The same considerations apply when writing to a magnetic tape.

The smaller the block size on the magnetic tape, the less core store we use when writing to or reading from the tape. This could lead us to use single-record blocks that will give us **INTER RECORDS GAPS (IRGs)**. But this will mean that we would be constantly stopping and starting when reading the tape, and would increase the time needed to read a file of records. It would also mean that a great proportion to the tape would be taken up with IBGs, and so the amount of data held on a tape would be lowered. For these **two** reasons, we usually use **multi-record blocks, even though this means that we will use more core store.**

**BLOCKING FACTOR** is the number of record in a block.

IBG	R	R	R	R	R	IBG	R	R	R	R	R	IBG
-----	---	---	---	---	---	-----	---	---	---	---	---	-----

The above file is having a blocking factor of 5.

The capacity of reel of magnetic tape depends on **three factors**:

1. Its Length;
2. Its density; and
3. The amounts of tape taken up by inter-block gaps.

Assume that a tape is 2400 long, and that its density is 1600 frames per inch. Its theoretical capacity is thus 46,080,000 characters (2400x12x1600).

If, however the IBGs on the tape are half an inch long, and the file contains records which are 400 characters long, with a blocking factor of 4, then only 2/3 of the tape is used to hold data (1/2": 1" or 800:1600), and so only 30,720,000 characters can be held.

The time taken to read a file of records on magnetic tape depends on:

1. The time taken to read the data and
2. The time taken to stop and start between blocks.

If a tape has a density of 1600 frames per inch, and the tape deck has a transport speed of 200 inches per second, then the transfer rate is 320,000 characters per second (1600 x 200).

If a file on the tape contains 100,000 records, each of 500 characters, with a blocking factor of 5, and it takes .01 seconds to stop the tape and .01 seconds to start it, then:

There are 50,000,000 characters and so it takes:

156.25 seconds to read the data.

As there are 20,000 blocks to the file, it takes

400 seconds (20,000x 01 x 2) to stop and start.

The total time to read the file is thus **556.25** seconds.

Once a file of data has been written to magnetic tape, the reel of tape can be taken from the tape deck, stored in a tape library, and extracted for use when required. A tape can be read as often as necessary, for reading is non-destructive. When data on a tape is no longer needed, it can be overwritten by new data, as writing is destructive. Tapes can be re-used. Note that, after a tape has been written to or read from, it has to be re-wound before it can be used again.

#### Advantages of magnetic Tape

- i. It is inexpensive;
- ii. It is relatively a stable storage medium;
- iii. It is reusable;
- iv. It is appropriate for storing large amount of data in a relatively stable form and when sequential processing is desired;
- v. It is used as back up storage medium; and
- vi. It is easy to handle.

#### Disadvantages of magnetic Tape

- i. It can only store information sequentially
- ii. It is relatively slow
- iii. It is very labour intensive to mount and dismount the tape
- iv. Cannot be read by humans
- v. It is vulnerable to dust, heat and humidity.

### **MAGNETIC DISK**

This is the most popular and important secondary storage medium. It permits direct and immediate access to data.

There are **two types of magnetic disk: hard disk and floppy disk.**

#### **HARD DISK**

The hard disk is made up of thin steel platter with iron oxide coating. Several disks may be mounted together on a vertical shaft where they rotate as wheel of approximately 3500 revolutions per minute. The electromagnetic read/write heads is mounted on an access arm. The head flies over the spinning disks and read and write on the concentric circle called tracks.

Data are recorded on tracks as **tiny magnetized spot forming binary digits.** The read/ write head never touches the disk but hovers a few thousandth or millionth of an inch above it. A smoke particular or human hair on the disk surface will cause the head to crash into disk. The disk storage capacity depends on the type, quantity and the arrangement of disk in a unit. Capacity may range from several **megabytes to several gigabytes.**

Typical examples are the **removable pack** and the **Winchester disk.** The removable hard disk consists of number of individual units called a pack that can be mounted and removed as unit. A typical example is the **eleven digits.** Since each individual disk has two surfaces and the top and bottom are not recordable, we end up getting 20 surfaces. Each surface is divided into tracks where data are stored and each track can store thousands of bytes.

A cylinder represents circular tracks on the same vertical line within a disk pack. The Read/ write heads are directed to specific record consisting of a cylinder number, the recording surface number and the data record number.

The Winchester disk is **hermetically sealed units** of hard disk that cannot be removed from the disk drive. It has a very high rotational speed. The very high rotational speed plus the smaller distance between the r/w head and the disk surface translates into a very high-speed access time. The speed at which data can be located on the magnetic disk and loaded into memory or written on the disk itself is called the **disk access time.** The disk access time is determined by the **three** factors:

1. The access motion time;
2. The rotational delay; and
3. The data transfer rate.

A typical disk access time is 200 000 to 4 000 000 bytes per second.

## FLOPPY DISK

The floppy disk is an ideal medium for storing data programs that are not in constant use or for transporting data and programs. They are available in many different sizes: **(8 inches, 5 ¼ inches, and 3 ½ inches)**. The 8” and 5 ¼ “ are not popular anymore. The floppy disk use sector method. (Sectors are the basic unit for diskette storage). The disk surface is divided into sectors.

The actual number of sectors depends on the disk system being used. Each sector has the same storage capacity and assigned a unique number. Data is located using the address consisting of the **sector number** and the **data record number**. Alternatively, you can use the surface number, the track number and the sector number.

The exact storage capacity of each diskette can be determined by using the formula: Number of sectors X Number of bytes per sector = Number of bytes. (This gives total capacity of the disk). However, floppy disks have limited storage capacity -- generally 1.44 MB.

### Access time

The time required to access and retrieve data from the floppy disk is determined by **four** factors:

1. The time it takes to position the r/w head over the proper track.
2. **The latency period:** The time it takes for the sector that contains the data to rotate under the read/write head;
3. **The settling time:** The time required for the read/write head to be placed in contact with the disk;
4. **The data transfer rate:** the time required to transfer data from the floppy to the main memory.

### Advantages of floppy Disk

- i. High data density;
- ii. It is portable, inexpensive and easy to handle;
- iii. It is reusable;
- iv. It is direct access medium;

### Disadvantages of floppy Disk

- i. Not human readable;
- ii. It can be erased by a magnetic field; and
- iii. They are sensitive to dust, extreme temperature and humidity.

## ZIP DISK

ZIP disks are high capacity, removable, magnetic disks, which can be read or written by ZIP drives from Iomega Corporation. ZIP disks are similar to floppy disks, except that they are much faster, and have a much greater capacity. While floppy disks typically hold 1.44 megabytes, ZIP disks are available in many sizes, most commonly 100 megabytes and 250 megabytes.

### Protecting Your Floppy Disk and ZIP Disk

- Be careful not to touch the magnetic film on a floppy disk. Oil or dirt can damage floppy disks.

- When labeling a new floppy disk, write on the label prior to attaching the sticker to the new disk.
- When labeling a disk with a label sticker already attached, use a soft felt tip pen to avoid damaging the thin magnetic film inside.
- Keep floppy disks out of extreme cold or hot temperatures. Disks become brittle in the cold and may warp in hot weather.
- Information on floppy disks is stored magnetically. To prevent disks from being erased or permanently damaged, avoid placing disks too close to magnetic objects (such as computer speakers).
- Store floppy disks in boxes or trays to protect them from scratches and dust. Transport floppy disks in carrying cases to prevent damage.

## OPTICAL DISKS

Today's optical disks can hold over **4.7 GB of data**, which is the equivalent of over 1 million typewritten pages. Therefore, Optical disks have a great impact on storage today. In optical disk technology, a **LASER** (Light Amplification by the Stimulated Emission of Radiation) beam alters the surface of a plastic disk to represent data. Data representation on optical disk is done by the use of reflected light. Data is stored on these disks in different ways or different formats, such CD and DVD.

### Compact Disk:

It is also known as CD. Typically, CD drives can store **650 MB of data** on one side. A CD consists of a single track spirals from the outside to the inside. A CD has about **600 tracks per linear inch of disk surface**. A laser beam is needed to detect the presence or absence of pits, which have been burned into this surface at the writing stage. There are **three** basic types of CDs: CD-ROM, CD-R, and CD-RW. CD-ROM is a device that reads information stored on a compact disc. CD-ROM stands for Compact Disc Read Only Memory. One CD is equal to the space in over 40 floppy disc.

1. **CD- ROM:** This stands for **Compact Disc Read Only Memory**. Read only means it cannot be written on or erased by the user. Therefore, the user has access only to the data copied into it by the creator of the content. CD-ROMs are used to distribute **large databases, references and large software application packages**. Microsoft Windows 95 for example was supplied on a **single CD-ROM or on 38 floppies**. Installing software on a hard disk from a CD-ROM is much faster and easier than doing the from floppies.

The user simply starts it up, enters any required information, and comes back later; it's no longer necessary to feed disk after disk into the computer. When they were introduced, CDs held large databases such as **encyclopedias**. Today they are used for every possible type of data from national phone directories and software libraries to collection of clip art, music, and games. Typically, a CD ROM holds up to **650 MB** of information.

2. **CD-R:** This stands for CD-Recordable and is also known as **WORM meaning write once, read many**, it is the type of CD that allows users with CD recorders (CD-R drives) to write data, only once, onto a specially manufactured disk that can then be read by a standard CD-ROM drive. Once the data is recorded, it can't be written over (changed). I.e. A CD-R is a one time recordable compact disc. CD-R can hold up to **700MB** of information.

3. **CD-RW:** This stands for **compact disk re-writable** and also known as **erasable optical disks**. This format allows users to erase data so that the disk surface of CD-RW is not permanently altered when data is recorded. Because they can be changed, CD-RWs are often used to create and edit multimedia presentations. I.e. A CD-RW allows you to read, write, erase and write again. Writing takes place in a single pass of the focused laser beam; this is sometimes referred to as direct overwriting and the process can be repeated several thousand times per disc.

The most common type of erasable and rewritable optical disk is probably the **magneto-optical (MO)** disk which uses a magnetic /optical technologies. Super Disk uses a magnetic /optical technology. Most MO disk holds about **250 MB**. CD-RW drives can also **accept CD-R disks and CD-ROMs**.

4. **DVD:** According to the various industries sponsoring it, DVD is not an abbreviation for anything. The letters used to stand for “Digital Video Disk” and later, when its diverse possibilities became obvious, for “Digital Versatile Disk”. DVD and DVD drives are very similar to CDs except that more data can be packed into the same amount of space.

The DVD drives can store **4.7-17 GB**, allowing great data storage, studio-quality, video images, and quality sound. The home entertainment version is called DVD while the computer version is called DVD-ROM disk. The data on a DVD are compressed over 30 fold, and the pits that represent the data are smaller than on a CD. Again while CD can record data only one side in one layer, DVD disks can put data on both sides with each side having one or two layers.

### **Protecting Your Compact Disc**

- Be careful not to touch the flat surface of a CD. The information on the CD is stored on the shiny metallic surface underneath the plastic protective coating. If the flat surface has smudges or scratches on it, the laser that reads the metallic surface is unable to penetrate the damaged area.
- Avoid extreme hot or cold temperatures. In cold temperatures, CDs may become brittle, in extreme heat, they become warped.
- Store CDs in trays or boxes to protect them from dust or scratches.
- Transport CDs in a protective jewel case or plastic sleeve to keep dust or scratches from damaging the flat surface.

## **COMPUTER SECURITY**

### **COMPUTER SECURITY RISKS AND SAFEGUARDS**

#### **1.1 Computer Security Risk:**

A **computer security risk** is any event or action that can cause a loss of or damage to computer equipment, software, data and information, or processing capability. Computer Security techniques are developed to safeguard information and information systems stored on computers. Potential threats include the destruction of computer hardware and software and the loss, modification, theft, unauthorized use, observation, or disclosure of computer data.

Computers and the information they contain are often considered confidential systems because their use is typically restricted to a limited number of users. This confidentiality can be compromised in a

variety of ways. For example, computers and computer data can be harmed by people who spread computer viruses and worms. A computer virus is a set of computer program instructions that attaches itself to programs in other computers. The viruses are often parts of documents that are transmitted as attachments to e-mail messages. A worm is similar to a virus but is a self-contained program that transports itself from one computer to another through networks. Thousands of viruses and worms exist and can quickly contaminate millions of computers.

## **Hackers**

People who intentionally create viruses are computer experts often known as hackers. Hackers also violate confidentiality by observing computer monitor screens and by impersonating authorized users of computers in order to gain access to the users' computers. They invade computer databases to steal the identities of other people by obtaining private, identifying information about them. Hackers also engage in software piracy and deface Web sites on the Internet. For example, they may insert malicious or unwanted messages on a Web site, or alter graphics on the site. They gain access to Web sites by impersonating Web site managers.

Malicious hackers are increasingly developing powerful software crime tools such as automatic computer virus generators, Internet eavesdropping sniffers, password guessers, vulnerability testers, and computer service saturators. For example, an Internet eavesdropping sniffer intercepts Internet messages sent to other computers. A password guesser tries millions of combinations of characters in an effort to guess a computer's password. Vulnerability testers look for software weaknesses. These crime tools are also valuable security tools used for testing the security of computers and networks.

An increasingly common hacker tool that has gained widespread public attention is the computer service saturator, used in denial-of-service attacks, which can shut down a selected or targeted computer on the Internet by bombarding the computer with more requests than it can handle. This tool first searches for vulnerable computers on the Internet where it can install its own software program. Once installed, the compromised computers act like "zombies" sending usage requests to the target computer. If thousands of computers become infected with the software, then all would be sending usage requests to the target computer, overwhelming its ability to handle the requests for service.

## **3.2 Safeguards (Prevention of Computer Crimes)**

A variety of simple techniques can help prevent computer crimes, such as protecting computer screens from observation, keeping printed information and computers in locked facilities, backing up copies of data files and software, and clearing desktops of sensitive information and materials. Increasingly, however, more sophisticated methods are needed to prevent computer crimes. These include using encryption techniques, establishing software usage permissions, mandating passwords, and installing firewalls and intrusion detection systems. In addition, controls within application systems and disaster recovery plans are also necessary.

### **Backup**

Storing backup copies of software and data and having backup computer and communication capabilities are important basic safeguards because the data can then be restored if it was altered or destroyed by a computer crime or accident. Computer data should be backed up frequently and should be stored nearby in secure locations in case of damage at the primary site. Transporting sensitive data to storage locations should also be done securely.

## **Encryption**

Another technique to protect confidential information is encryption. Computer users can scramble information to prevent unauthorized users from accessing it. Authorized users can unscramble the information when needed by using a secret code called a key. Without the key the scrambled information would be impossible or very difficult to unscramble. A more complex form of encryption uses two keys, called the public key and the private key, and a system of double encryption. Each participant possesses a secret, private key and a public key that is known to potential recipients. Both keys are used to encrypt, and matching keys are used to decrypt the message. However, the advantage over the single-key method lies with the private keys, which are never shared and so cannot be intercepted. The public key verifies that the sender is the one who transmitted it. The keys are modified periodically, further hampering unauthorized unscrambling and making the encrypted information more difficult to decipher.

## **Approved Users**

Another technique to help prevent abuse and misuse of computer data is to limit the use of computers and data files to approved persons. Security software can verify the identity of computer users and limit their privileges to use, view, and alter files. The software also securely records their actions to establish accountability. Military organizations give access rights to classified, confidential, secret, or top-secret information according to the corresponding security clearance level of the user. Other types of organizations also classify information and specify different degrees of protection.

## **Passwords**

Passwords are confidential sequences of characters that allow approved persons to make use of specified computers, software, or information. To be effective, passwords must be difficult to guess and should not be found in dictionaries. Effective passwords contain a variety of characters and symbols that are not part of the alphabet. To thwart imposters, computer systems usually limit the number of attempts and restrict the time it takes to enter the correct password.

A more secure method is to require possession and use of tamper-resistant plastic cards with microprocessor chips, known as "smart cards," which contain a stored password that automatically changes after each use. When a user logs on, the computer reads the card's password, as well as another password entered by the user, and matches these two respectively to an identical card password generated by the computer and the user's password stored in the computer in encrypted form. Use of passwords and "smart cards" is beginning to be reinforced by biometrics, identification methods that use unique personal characteristics, such as fingerprints, retinal patterns, facial characteristics, or voice recordings.

**Firewalls:** Computers connected to communication networks, such as the Internet, are particularly vulnerable to electronic attack because so many people have access to them. These computers can be protected by using firewall computers or software placed between the networked computers and the network. The firewall examines, filters, and reports on all information passing through the network to ensure its appropriateness. These functions help prevent saturation of input capabilities that otherwise might deny usage to legitimate users, and they ensure that information received from an outside source is expected and does not contain computer viruses.

## **Intrusion Detection Systems**

Security software called intrusion detection systems may be used in computers to detect unusual and suspicious activity and, in some cases, stop a variety of harmful actions by authorized or unauthorized persons. Abuse and misuse of sensitive system and application programs and data such as password, inventory, financial, engineering, and personnel files can be detected by these systems.

### **Application Safeguards**

The most serious threats to the integrity and authenticity of computer information come from those who have been entrusted with usage privileges and yet commit computer fraud. For example, authorized persons may secretly transfer money in financial networks, alter credit histories, sabotage information, or commit bill payment or payroll fraud. Modifying, removing, or misrepresenting existing data threatens the integrity and authenticity of computer information. For example, omitting sections of a bad credit history so that only the good credit history remains violates the integrity of the document. Entering false data to complete a fraudulent transfer or withdrawal of money violates the authenticity of banking information. These crimes can be prevented by using a variety of techniques. One such technique is *checksumming*. Checksumming sums the numerically coded word contents of a file before and after it is used. If the sums are different, then the file has been altered. Other techniques include authenticating the sources of messages, confirming transactions with those who initiate them, segregating and limiting job assignments to make it necessary for more than one person to be involved in committing a crime, and limiting the amount of money that can be transferred through a computer.

### **Disaster Recovery Plans**

Organizations and businesses that rely on computers need to institute disaster recovery plans that are periodically tested and upgraded. This is because computers and storage components such as diskettes or hard disks are easy to damage. A computer's memory can be erased or flooding, fire, or other forms of destruction can damage the computer's hardware. Computers, computer data, and components should be installed in safe and locked facilities.

## **COMPUTER VIRUSES, VIRUS DETECTION AND REMOVAL**

### **Computer Viruses**

It is a diabolic, self-duplicating computer program that interferes with a computer's hardware or operating system with the intention of causing a host of problems on a computer for the user. Viruses are designed to duplicate or replicate themselves and to avoid detection. Like any other computer program, a virus must be executed for it to function—that is, it must be located in the computer's memory, and the computer must then follow the virus's instructions. These instructions are called the **payload** of the virus. The payload may disrupt or change data files, display an irrelevant or unwanted message, or cause the operating system to malfunction.

### **How Infections Occur**

Computer viruses activate when the instructions—or executable code—that run programs are opened. Once a virus is active, it may replicate by various means and tries to infect the computer's files or the operating system. For example, it may copy parts of itself to floppy disks, to the computer's hard drive, into legitimate computer programs, or it may attach itself to e-mail messages and spread across computer networks by infecting other shared drives. Infection is much more frequent in PCs than in professional mainframe systems because programs on PCs are exchanged primarily by means of floppy disks, e-mail, or over unregulated computer networks.

Viruses operate, replicate, and deliver their payloads only when they are run. Therefore, if a computer is simply attached to an infected computer network or downloading an infected program, it will not necessarily become infected. Typically a computer user is not likely to knowingly run potentially harmful computer code. However, viruses often trick the computer's operating system or the computer user into running the viral program.

Some viruses have the ability to attach themselves to otherwise legitimate programs. This attachment may occur when the legitimate program is created, opened, or modified. When that program is run, so is the virus. Viruses can also reside on portions of the hard disk or floppy disk that load and run the operating system when the computer is started, and such viruses thereby are run automatically. In computer networks, some viruses hide in the software that allows the user to *log on* (gain access to) the system.

With the widespread use of e-mail and the Internet, viruses can spread quickly. Viruses attached to e-mail messages can infect an entire local network in minutes.

### **Limitations of a computer virus**

Viruses are programs that infect other programs, or files containing macros (a series of commands grouped together to automate a complex series of tasks) such as Microsoft Word files, Microsoft Excel files and executable files.

Computer viruses cannot, do not, and will not infect plain text files, such as e-mail messages and Web pages, nor can they infect pictures or chat groups.

A program is called a virus because it:

1. Attaches itself to other programs;
2. Reproduces itself;
3. Difficult to detect since they are to be hidden; and
4. Sometimes can cause damage to the computer

### Types of Viruses

**There are five categories of viruses: parasitic or file viruses, bootstrap sector, multi-partite, macro, and script viruses.**

**Parasitic or file viruses infect executable files or programs in the computer. These files are often identified by the extension .exe in the name of the computer file. File viruses leave the contents of the host program unchanged but attach to the host in such a way that the virus code is run first. These viruses can be either direct-action or resident. A direct-action virus selects one or more programs to infect each time it is executed. A resident virus hides in the computer's memory and infects a particular program when that program is executed.**

**Bootstrap-sector viruses** reside on the first portion of the hard disk or floppy disk, known as the boot sector. These viruses replace either the programs that store information about the disk's contents or the programs that start the computer. Typically, these viruses spread by means of the physical exchange of floppy disks.

**Multi-partite viruses** combine the abilities of the parasitic and the bootstrap-sector viruses, and so are able to infect either files or boot sectors. These types of viruses can spread if a computer user boots from an infected diskette or accesses infected files.

**Macro Viruses** infect programs that contain powerful macro *languages* (programming languages that let the user create new features and utilities). These viruses are written in macro languages and automatically execute when the legitimate program is opened.

**Script viruses** are written in script programming languages, such as VBScript (Visual Basic Script) and JavaScript. These script languages can be seen as a special kind of macro language and are even more powerful because most are closely related to the operating system environment. The "ILOVEYOU" virus, which appeared in 2000 and infected an estimated 1 in 5 personal computers, is a famous example of a script virus.

## 2.2 Virus Detection & Removal Preparation and Prevention

Computer users can prepare for a viral infection by creating backups of legitimate original software and data files regularly so that the computer system can be restored if necessary. Viral infection can be prevented by obtaining software from legitimate sources or by using a quarantined computer to test new software—that is, a computer not connected to any network. However, the best prevention may be the installation of current and well-designed antiviral software. Such software can prevent a viral infection and thereby help stop its spread.

### Virus Detection

**Antivirus programs** are software programs designed to detect, disinfect, and protect computers and networks from viruses. Antivirus programs work by looking for programs that attempt to modify the boot program, the operating system, and other programs that normally are read from but not written to. Most antivirus programs also have utilities to remove or repair infected programs and files. Examples of such programs are Norton's Antivirus, MacAfee, and Trojan Removal.

#### The Anti-Virus Toolkit

The Anti-Virus Toolkit combines this expertise in a cost-effective package which is simple to use and yet provides effective protection against known viruses. The Toolkit consists of **four** main modules for the detection and prevention of viruses. These are as follows: **Find Virus**, **Viverify**, **Virusguard**, and **Memory Check**.

#### Find Virus

The **Findvirus** program is a scanner. It is programmed to look for the patterns of bytes, which specific viruses create when they infect a disk or file. Its database contains information about thousands of viruses and is updated on a regular basis to keep abreast of new viruses as they are discovered. If a match is found, **Findvirus** will identify the virus and you can then use the virus encyclopedia to find out the procedure for removing it from the system. **Findvirus** contains specially optimized high speed searching routine to enable it to look for thousand of different virus patterns across the entire hard disk in a matter of seconds.

## **Viverify**

**Viverify** is a “fingerprinting” program. It detects any changes in the composition of program files and boot or partition sectors on hard and floppy disks. Generally speaking, program files remain exactly the same from the day they are installed. Any change to their contents should be regarded as suspicious, as it could signal a virus infection. The first thing that **viverify** does is to look at each program file and calculate a checksum, which is specific to that particular file and its contents.

Every time **viverify** is run from then on, the checksum will be calculated again and the result compared with that obtained the first time round. If there is any difference between the two results, the program file has been altered and the user is alerted as to the possibility of a virus. The suspect program can then be scanned to check it for known viruses and then appropriate action taken.

## **Virusguard**

Virusguard is a memory resident scanner. It intercepts system calls to enable it to check over program for known viruses before allowing it to be run or copied. This works in a similar way to find virus, except that it checks files only as you use them. Being automatic and very fast, it does not affect the way you run your programs.

## **Memory Check**

The entire Toolkit program incorporates Anti-Stealth-Methodology to combat sophisticated virus concealment techniques. Before installing or running, all toolkit programs scan the computer’s memory for resident viruses which may be trying to deceive the system about what is on the disks.

## **Integrity Check**

**Toolkit programs** also perform integrity self check to make sure that they have not themselves been infected. The toolkit menu provides direct access to the complete set of tools via easily understood icons. To run **FINDVIRUS**, simply select the option from the **scan menu**. The basic menu allows you to select which drives are to be scanned. The advanced menu allows you to control exactly which parts of the disk are to be scanned for viruses.

The **FIND** icon starts the scanning operation. **FINDVIRUS** keeps you informed of its progress as each directory is scanned. When the scan is complete, a detailed report explains the results and a summary provides the most important information at a glance. **The fingerprint checker** is run in a similar way. It provides a set of options to calculate and verify fingerprints for all program files or specific files of your choice. The **third detection** option scans your **PCs memory for known virus patterns**. The memory resident fingerprinting program can also be set up from the Toolkit menu. [For fully automatic operation, the memory-resident check sum program needs to be loaded in your **AUTOEXEC. BAT file**]. The various options are simple to configure using conventional windows selection methods.

## **Containment and Recovery (Removal)**

Once a viral infection has been detected, it can be contained by immediately isolating computers on networks, halting the exchange of files, and using only write-protected disks. In order for a computer system to recover from a viral infection, the virus must first be eliminated.

Some antivirus software attempts to remove detected viruses, but sometimes with unsatisfactory results. More reliable results are obtained by turning off the infected computer; restarting it from a

write-protected floppy disk; deleting infected files and replacing them with legitimate files from backup disks; and erasing any viruses on the boot sector.

### **Protecting Your Computer from Viral Attack**

To prevent your computer from contracting a virus;

1. Use a virus protection program. Install current and well-designed antiviral software. Such software can prevent a viral infection and thereby help stop its spread.
2. Don't open email that is suspicious or that you don't recognize the senders name.
3. Keep up-dated on what viruses are going around.
4. Create backups of legitimate original software and data files regularly so that the computer system can be restored if necessary.
5. If your computer does contract a virus, be prepared to reformat and start all over again!
6. Obtain software from legitimate sources or by using a quarantined computer to test new software – that is, a computer not connected to any network.
7. Foreign diskettes are to be scanned before usage.
8. Scan all information / data daily.

### **Unauthorized Access and Use**

**Unauthorized access** is the use of a computer or network without permission. The term, **cracker** or **hacker**, refers to a person who tries to break into a computer often with the intent of stealing or corrupting its data. **Unauthorized use** is the use of a computer or data for unapproved or possibly illegal activities. **Unauthorized access** is prevented by establishing **access controls**, which are security measures that define who may access a computer or information.

### **Hardware theft and vandalism**

**Hardware theft** is the act of stealing computer equipment. The act of defacing or destroying computer equipment is known as **hardware vandalism**. **Precautions** to prevent hardware theft include the following:

1. Use physical access controls, such as locked doors, and windows.
2. Use cables to lock the equipment to desk, cabinet, or floor.
3. Install alarm systems for additional security.
4. Never leave a notebook computer or handheld computer unattended in a public place.
5. Use passwords, possessed objects, and biometrics as a method of security.
6. Back up all the files stored on the computer regularly.

### **Software Piracy/Theft**

It is the unauthorized duplication, distribution or use of computer software -- for example, making more copies of software than the license allows, or installing software licensed for one computer onto multiple computers or a server.

Copying software is an act of copyright infringement, and is subject to civil and criminal penalties. It's illegal whether you use pirated software yourself, give it away, or sell it. And aiding piracy by providing unauthorized access to software or to serial numbers used to register software can also be illegal.

### **Information theft**

There have been a growing number of cases of information theft over the past few years. While more and more electronic security measures have been going up to protect people's possessions and information, these new technologies have bugs and design flaws that are opening up whole new worlds for the technologically advanced criminal. The following are some examples of information thefts.

#### 1. Credit Card Number Theft

People are using credit cards for more and more of their purchases as time goes on. This is opening up a larger and larger arena for credit card fraud. Credit cards are especially easy to use fraudulently, because they require no extra identification number to use. All that a thief needs is pure information--they don't need the card, but just the number on the card. Recently, with people spending more on purchases transacted over the internet, credit card fraud is becoming easier. Now thieves never have to get within 5,000 miles of the people they are stealing from. All they would need is a quick and dirty web site (which could be hosted for free, and anonymously) advertising some fictional product, and including a form for buying online. Instantly the perpetrators would have a list of credit card numbers linked with names and mailing addresses, ready to use for anything they want.

#### 2. ATM Spoofing

These crooks have pulled some impressively intricate heists. One group of criminals set up a complete fake ATM machine inside a mall in Connecticut.. It looked and worked just like a real one, except that after giving it your card and typing in your pin, it would refuse you service saying it was out of order. It then had a record of the card and PIN numbers of all the people who tried to use the machine.

#### 3. PIN Capturing

Another group of criminals scoured the area across the street from a busy ATM, looking for the perfect spot to hide a video camera aimed at the keys on the ATM machine. They found such a spot and set up their camera. After each successful PIN number identification that they recorded, one of the group members would go check for a discarded receipt at the ATM. If they found one, the group had the card number and the PIN number.

#### 4. Database Theft

The previous criminal activities are all aimed at compiling databases of information obtained fraudulently from people one by one. This takes time, and these people only have limited amounts of time before their operations will be recognized and shut down. This limits the number of people whose information these criminals can obtain. There are, however, large databases of this kind of information that have been built up slowly and legally by mild-mannered, legitimate internet companies. For example, BMG Music Service lets customers give their credit card numbers when they sign up, so they don't need to bother each time they make a purchase. There are thousands of users of this service, many of whom likely use this feature. Combine this with the fact that hundreds of computer systems are hacked into every day, and we have a situation where hackers could steal an industrial-sized database of this kind of information, and run wild.

## System Failures and Backup Procedures

### System failure

A **system failure** is a computer malfunction as a result of electrical power problems, hardware component failure, or software error. An **undervoltage** occurs when the electrical power supply drops. An **overvoltage**, or **power surge**, occurs when the incoming electrical power increases significantly above the normal 120 volts. A **surge protector** keeps an overvoltage from damaging computer equipment.

### Backup procedures

A **backup** is a duplicate of a file, program, or disk that can be used if the original is lost, damaged, or destroyed. Files can be **restored** by copying the backed up files to their original location on the computer. Backup copies should be kept in a fireproof and heatproof safe or **offsite**.

### Three types of backup that can be performed are

1. **Full backup**, which copies all of the files in the computer.
2. **Differential backup**, which copies only the files that have changed since the last full backup.
3. **Incremental backup**, which copies only the files that have changed since the last full or last incremental backup.

Some users implement a three-generation backup procedure to preserve three copies of important files.

1. The **grandparent** is the oldest copy of the file.
2. The **parent** is the second oldest copy of the file.
3. The **child** is the most recent copy of the file.

### Why do you need to back up your computer?

The most important thing that you store on your computer is information. Often the contents of a hard disk can represent years of work. If the hard disk stops working one day you could lose all those years of work. For this reason it is VITAL that you take regular backups of the information that is stored on the computer. In large organizations this backup procedure is normally performed automatically by your computer support team, where the data is normally held on a centralized, networked computer.

### Why you should use 'off – site' storage?

It is no good backing up your data, only to leave the item that you backed up to next to the computer. Ideally, backups should be stored off-site at a safe location to prevent it from being stolen or catching fire. At the very least, consider storing your backups in a fireproof safe, which will give some protection against fire damage.

You should perform backups at night. If you backup your computer during the day (when you are using programs on the computer) then any program or data files that are in use at the time of the backup will not be backed up. The backup program will skip these ‘open’ files.

### **Information Privacy**

Intellectual property is a product someone creates based upon his or her thoughts or ideas. Copyright laws exist to protect those who create an idea or product. When using computers, one must respect the property, rights, and privacy of others.

One of the problems related to privacy is the tendency to regard anything displayed on a computer screen as public information. Although most people, including students, would never pick up and read a document lying on someone else's desk, many people do not hesitate to read someone else's computer screen. As word-processing and other tool software become more and more common, we must extend the courtesy of privacy from written documents to material displayed on computer screens or stored on disks.

### **Ethics and the Information Age**

Ethics are the standards of honesty, morality, and fairness. These standards relate to using computers. One has a responsibility to respect the property, rights, and privacy of others in the way you use computers. Today in the Information Age, one must follow a code of ethics to respect others properties and others personal information.

The legal aspects of computing are complex and multifaceted. Teachers can help society by practicing ethical computer use, avoiding software piracy, and providing direct instruction on ethical computing practices.

### **Data Protection and Privacy Issues**

If your computer system holds information about individuals then you have a moral and legal duty to treat that information with respect. For instance if a police force computer is used by unscrupulous people to gain unauthorized information about a person's private life that would be a clear breach of trust. In the same way doctors, government departments and credit agencies often hold vast amounts of information about the public, which is both sensitive and private. In a free society you have a right to ensure, that information held about you is not abused. In many countries, this right is enshrined under data protection laws.

### **Copyright in Digital Age**

**Copyright** is a branch of law granting authors the exclusive privilege to reproduce, distribute, perform, or display their creative works. The goal of copyright law is to encourage authors to invest effort in creating new works of art and literature.

Not every work of authorship is eligible for copyright. To qualify for copyright protection, a work must be both *fixed and original*. The law considers a work to be fixed if it is recorded in some permanent format. **Acceptable ways of fixing a work include writing it down, storing it on a computer floppy disk or compact disc (CD), recording it on videotape, or sculpting it in marble.** To be **original**, the work must **not** be copied from previously existing material and must display at least a reasonable amount of creativity.

When personal computers became widely available, however, the situation changed because computers stored information in the binary digits of computer code. End users of copyrighted works were suddenly able to reproduce copyrighted material digitally and to send the material instantly all over the world through the Internet. To combat unlawful copying of their works in this environment, some copyright owners began to use various protective measures. For example, some encrypted their works to make copying impossible. Others required that users enter a password to view or download a work. However, some users were able to bypass or circumvent these protective measures.

Another well-known copyright controversy in the digital age has involved **peer-to-peer file sharing**. This is the process of exchanging files—usually music files—with other people over the Internet. File swapping violates the copyright laws because the people sharing files are making unauthorized copies of protected works without permission and without paying. However, it has proven very difficult for copyright owners to stop this behavior.

Common sense and a constant awareness of the risks are the best preventive measures against theft of notebook computers and other portable equipment. **Software piracy** is the unauthorized and illegal duplication of copyrighted software. **Software piracy** is a violation of copyright law and is a federal crime. A **software license** is an agreement that provides specific conditions for use of the software, which users must accept before using the software.

## **ENSURING LONG LIFE OF YOUR COMPUTER**


1. Ensure that the computer is kept out from direct sunlight. Allow enough room around fans if they are in use for air to circulate freely. The system will stop running if it gets too hot.
2. Dust and other environmental contaminants can filter their way inside the computer. Therefore, make your work area/room/office as clean as possible.
3. Ensure your system is turned off before you connect or disconnect from it. If you just turned your machine off and want to turn it back on, wait for at least 15 seconds. The power supply needs a chance to reset itself.
4. Should it become necessary to move your system, be sure the power is turned OFF on every unit.
5. Unplug the power cords from the mains and disconnect all the peripheral cables from the back panel. Check the screws that hold your computer over to make sure they are secure.
6. Avoid sudden bumps and shocks.

**END OF FIRST SEMESTER EXAMINATION QUESTION 2005/2006**


**ANSWER ALL QUESTIONS**

**SECTION A** 2 mark each question. (There will be 20 questions in session A).

**Fill in the blanks**

1. The acronym **PC** stands for **Personal Computer**
2. To perform a “**warm boot**”, the keys **Ctrl + Alt + Del**.....are pressed.
3. In word the icon  is used for **Copy**.....
4. The computer keyboard is similar to the ...**typewriter keyboard**.
5. If you turn off the computer you will lose the information in the ...**RAM**
6. The TV like component of the computer is called the **Monitor/VDU**
7. A red wavy line under a word you have typed, means **Misspelled/ unknown word**.
8. Common pointing device found on PC is the **Mouse**

**Indicate as T (true) or F (false) in the space provided**

9. Application software is the same as system software..... **False**
10. Computer is made from wood..... **False**.....
11. Present day computes are faster than the older computers..... **False**
12. The computer can store information on human beings..... **True**.....
13. The icon  is used for typing the alphabets in capital letters..... **False**
14. The processing cycle is made up of input, process output..... **True**
15. A bit is the same as a byte.....**False**.....
16. Computers can be found in the homes and supermarkets.....**True**.....

**March the following (write the correct letter in the space provided)**

17. Another name for a file	<b>D</b>	a. Tape
18. Software for typing	<b>C</b>	b. Notebook
19. A storage device	<b>A</b>	c. Ms Word

20. A potable computer	<b>B</b>	d. Document
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**SECTION B** (Short answer question). 15 mark each. Answer the following questions as clearly as you can in the space provided.

1. **What is computer literacy? Why is it important to the trained teacher?**

**Computer Literacy** is the knowledge and ability a person has to use a computer and technology efficiently. Computer literacy can also refer to the comfort level someone has with using computer programs and other application that are associated with computers. Such a person must know how computers work and operate.

**Other Definition**

Computer literacy is an understanding of the concepts, terminology and operations that relate to general computer use. This includes being able to solve problems, adapt to new situations, keep information organized and communicate effectively with other computer literate people.

Computers are used in schools for many applications such as writing papers or searching the Internet for information. Computer skills are also a subject being specifically taught in many schools, especially from puberty onward – when the ability to abstract forms. Where there are widespread, they are also a very useful part of the education system in terms of teaching and learning. It has created a revolution in education and therefore the trained teacher need to be computer literate in education and therefore the trained teacher need to be computer literate in other to function professionally.

2. **Differentiate between the primary memory and secondary storage. List 3 examples of secondary storage devices.**

The **Main Memory** has 3 functions. It stores all or part of the programs being executed, it stores the operating system programs that manage the operating of the computer and holds data that are being used by the programs. The main memory is volatile.

**Secondary memory** is used to store information in a non-volatile state and to store volumes of data too large to fit into memory. Programs and data are stored here permanently and retrieved into memory and when required.

Examples of Secondary Memory are Hard Disk, Floppy Disk, CD ROM, and Flash

3. **What are computer viruses? How can you protect your PC against computer viruses?**

A virus is a piece of program code inserted into another program to cause some event to occur that would not be normal or desirable. The virus becomes active when its code is executed by the computer. Usually the person or organization that provides the file is unaware that it contains a virus.

### **Alternative Definition**

A **virus**, the most common type, is a computer program developed with the intent to replicate the pass itself undetected to multiple computers.

The best way to prevent viruses from infecting your computer files is to ensure that you have adequate virus-protection software installed on your computer. Since new viruses are constantly being discovered, you must keep both your anti-virus software package and your virus definitions up to date and scan your hard drive regularly.

### **Make regular backups**

### **Scan all floppy disks before use**

### **Download from trusted Web sites**

**Beware of e-mail attachments** – scan them first

**Delete junk e-mails** – don-t forward chain e-mail

## **4. What is a word processor? What are the main features of a modern word processor?**

A word processor (also more formally known as a document preparation system) is a computer application used for the production (including composition, editing, formatting, and possibly printing) of any sort of viewable or printed material.

**The main features are:**

**Inset text:** Allows you to insert text anywhere in the document.

**Delete text:** Allows you to erase characters, words, lines, or pages as easily as you can cross them out on paper.

**Cut and paste:** Allows you to remove (*cut*) a section of text from one place in a document and insert (*paste*) it somewhere else.

**Copy:** Allows you to duplicate a section of text.

**Page Size and Margins:** Allows you to define various page sizes and margins, and the word processor will automatically readjust the text so that it fits.

**Search and Replace:** Allows you to direct the word processor to search for a particular word or phrase. You can also direct the word processor to replace one group of characters with another everywhere that the first group appears.

**Word Wrap:** The word processor automatically moves to the next line when you have filled one line with text and it will readjust text if you change the margins.

**Print:** Allows you to send a document to a printer to get hardcopy.

Others are

**Headers and Footers:** option of creating standard blocks of text that will automatically appear at the top or bottom of each page in a document.

**Footnoting:** Automatic sequential numbering of footnotes and positioning of the footnotes at the bottom of their appropriate pages during pagination.

**Table of Contents and Index Generators:** Programs that create these based on the text of a document.



**Form letter Merging:** Automatic combining of a form letter with a mailing list to generate multiple copies of the letter with the different addresses and other variable information filled in.

**Automatic Spelling Checker and Corrector:** Program that compares words in the text against an on-line dictionary, flagging item not found in the dictionary and offering alternative spellings and a means of correcting the errors.

## SEPTEMBER 2006 RESIT PAPER GNS 211 INTRODUCTION TO ICT

ANSWER ALL QUESTIONS SECTION A (2 marks for each question)

### Fill in the blanks

1. The Computer is made up of the hardware and the .....
2. To perform a  “warm boot”, the keys ..... + ..... +..... are pressed.
3. In word the icon  is used for .....
4. The computer keyboard is similar to the .....
5. The .....memory of the computer is volatile.
6. The Computer Monitor is also called the.....
7. The Control Unit and the ALU together is called the.....
8. Apart from the keyboard the other common input device is the.....

### Indicate as T (true) or F (false) in the space provided

9. Windows is an example of Application software.....

10. The capacity of a floppy disk is 1,440 bytes.....
11. Mainframe computers are the oldest computers.....
12. Computers are more intelligent than human beings.....
13. The icon            is used for typing the alphabets in capital letters.....
14. The processing cycle is made up of input, process output.....
15. One thousand bytes is equivalent to 1 megabyte.....
16. Microsoft is a manufacturer of Computers.....

**Match the following (write the correct letter in the space provided)**

17. Presentation Package		a. Notebook
18. Word Processing Package		b. MS PowerPoint
19. A storage device		c. MS Word
20. A portable computer		d. Pen Drive

## **SECTION B**

**(Short answer questions) 15 marks each**

Answer the following questions as clearly as you can in the spaces provided

1. What is a Computer? List 4 components of the Personal Computers hardware.

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2. Define the following terms (i) Systems Software (ii) Application Software. Give 2 examples of each.

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3. What is a backup in Computing? When is backup used? How would you protect your data on the floppy diskette from being accidentally erased?

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4. What are **four** (4) advantages and **four** (4) disadvantage of application software?

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