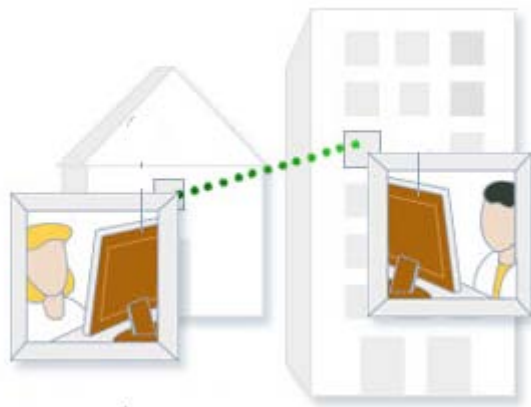


Technology University
Building and Constructions Engineering Department

Computers Principles-First Class

INTRODUCTION TO COMPUTERS



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Introduction to Computers

What are Computers?

Computers are machines that perform tasks or calculations according to a set of instructions, or programs. The first fully electronic computers, introduced in the 1940s, were huge machines that required teams of people to operate. Compared to those early machines, today's computers are amazing. Not only are they thousands of times faster, they can fit on your desk, on your lap, or even in your pocket.

Computers work through an interaction of hardware and software. **Hardware** refers to the parts of a computer that you can see and touch, including the case and everything inside it. The most important piece of hardware is a tiny rectangular chip inside your computer called the Central Processing Unit (CPU), or microprocessor. It's the "brain" of your computer—the part that translates instructions and performs calculations. Hardware items such as your monitor, keyboard, mouse, printer, and other components are often called hardware devices, or devices.

Software refers to the instructions, or programs, that tell the hardware what to do. A word-processing program that you can use to write letters on your computer is a type of software. The [operating system](#) (OS) is software that manages the computer and the devices connected to it. Windows is a well-known operating system.

What can do with computers?

In the workplace, many people use computers to keep records, analyze data, do research, and manage projects. At home, you can use computers to find information, store pictures and music, track finances, play games, and communicate with others—and those are just a few of the possibilities.

You can also use your computer to connect to the Internet, a network that links computers around the world. Internet access is available for a monthly fee in most urban areas, and increasingly, in less populated areas. With Internet access, you can communicate with people all over the world and find a vast amount of information.

Here are some of the most popular things to do with computers: **the web, E-mail, Instant messaging, Pictures, music, movies, and gaming.**

Types of Computers

Computers range in size and capability. At one end of the scale are supercomputers, very large computers with thousands of linked microprocessors that perform extremely complex calculations. At the other end are tiny computers embedded in cars, TVs, stereo systems, calculators, and appliances. These computers are built to perform a limited number of tasks.

The personal computer, or PC, is designed to be used by one person at a time. This section describes the various kinds of personal computers: **desktops, laptops, handheld computers, and Tablet PCs.**

- **Desktop computers**

Desktop computers are designed for use at a desk or table. They are typically larger and more powerful than other types of personal computers. Desktop computers are made up of separate components. The main component, called the system unit, is usually a rectangular case that sits on or underneath a desk. Other components, such as the monitor, mouse, and keyboard, connect to the system unit.



Desktop computer

- **Laptop computers and small notebook PCs**

Laptop computers are lightweight mobile PCs with a thin screen. Laptops can operate on batteries, so you can take them anywhere. Unlike desktops, laptops combine the CPU, screen, and keyboard in a single case. The screen folds down onto the keyboard when not in use.

Small notebook PCs (often referred to as mini-notebooks), are small, affordable laptops that are designed to perform a limited number of tasks. They're usually less powerful than a laptop, so they're used mainly to browse the web and check e-mail.



A laptop computer and a small notebook PC

- **Smart phones**

Smart phones are mobile phones that have some of the same capabilities as a computer. You can use a smart phone to make telephone calls, access the Internet, organize contact information, send e-mail and text messages, play games, and take pictures. Smart phones usually have a keyboard and a large screen.



Smartphone

- **Handheld computers**

Handheld computers, also called personal digital assistants (PDAs), are battery-powered computers small enough to carry almost anywhere. Although not as powerful as desktops or laptops, handheld computers are useful for scheduling appointments, storing addresses and phone numbers, and playing games. Some have more advanced capabilities, such as making telephone calls or accessing the Internet. Instead of keyboards, handheld computers have touch screens that you use with your finger or a stylus (a pen-shaped pointing tool).



Handheld computer

- **Tablet PCs**

Tablet PCs are mobile PCs that combine features of laptops and handheld computers. Like laptops, they're powerful and have a built-in screen. Like handheld computers, they allow you to write notes or draw pictures on the screen, usually with a [tablet pen](#) (the pen that come with table and is used to interact with items in the screen) instead of a stylus. They can also convert your handwriting into typed text. Some Tablet PCs are “convertibles” with a screen that swivels and unfolds to reveal a keyboard underneath.



Tablet PC

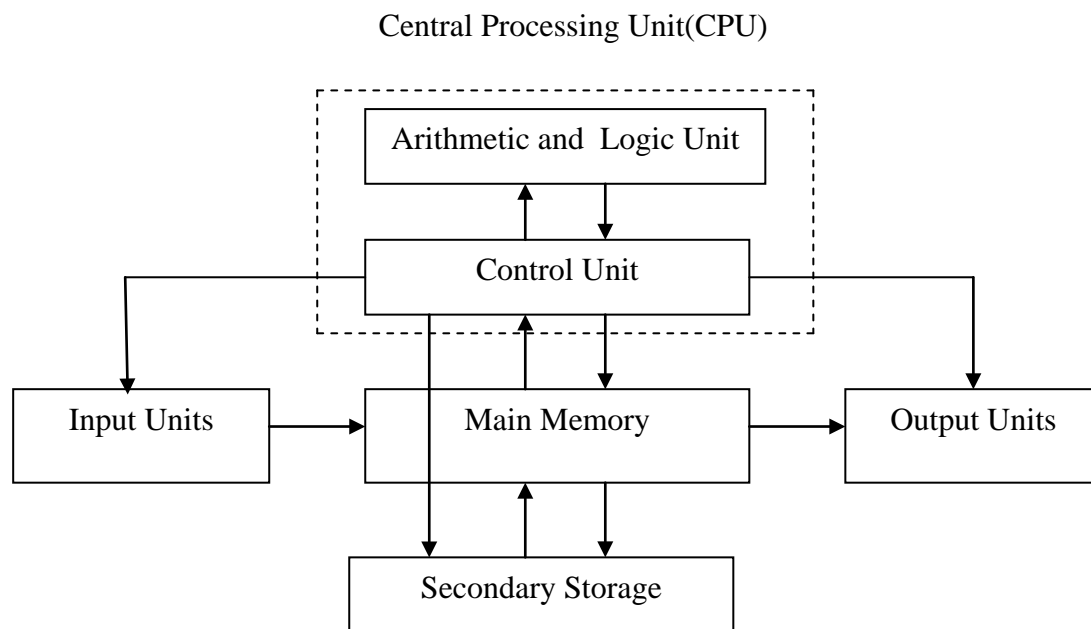
ENIAC

Introduced in 1946, ENIAC (Electronic Numerical Integrator and Computer) was the first general-purpose electronic computer. It was built for the United States military to calculate the paths of artillery shells. Physically, ENIAC was enormous, weighing more than 27,000 kilograms (60,000 pounds) and filling a large room. To process data, ENIAC used about 18,000 vacuum tubes, each the size of a small light bulb. The tubes burned out easily and had to be constantly replaced.

Computers Operations

All computers execute three basic operations:

1. Input data and instruction by input unit.
2. Save and process data and instruction by memory unit and central processing unit.
3. Output results and instruction by output unit.

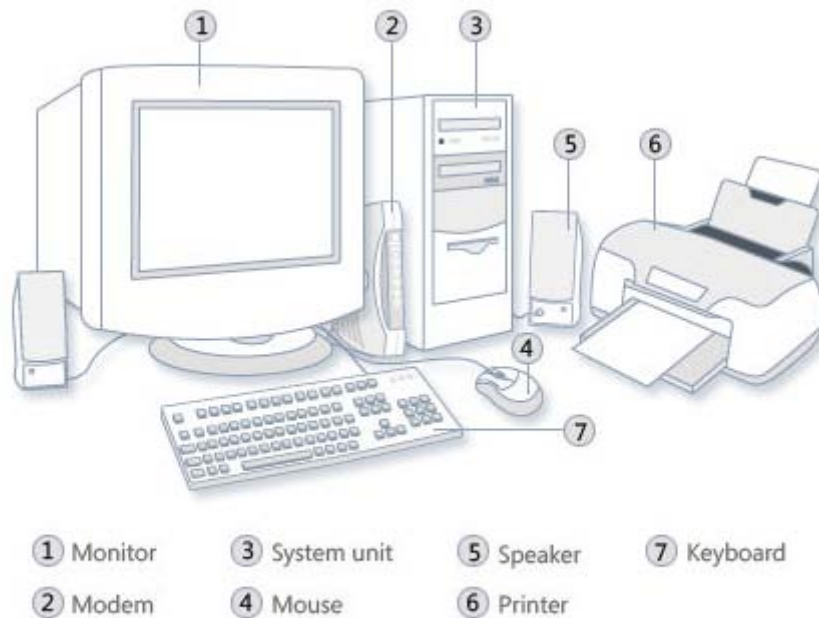


Computer Hardware Diagram

Computer Hardware

If you use a desktop computer, you might already know that there isn't any single part called the "computer". A computer is really a system of many parts working together. The physical parts, which you can see and touch, are collectively called hardware. (Software, on the other hand, refers to the instructions, or programs, that tell the hardware what to do.)

The following illustration shows the most common hardware in a desktop computer system. Your system might look a little different, but it probably has most of these parts. A laptop computer has similar parts but combines them into a single, notebook-sized package. Let's take a look at each of these parts.



Desktop computer system

Input / Output Units

- **Mouse**

A mouse is a small device used to point to and select items on your computer screen. Although mice come in many shapes, the typical mouse does look a bit like an actual mouse. It's small, oblong, and connected to the system unit by a long wire that resembles a tail. Some newer mice are wireless.

A mouse usually has two buttons: A primary button (usually the left button) and a secondary button. Many mice also have a wheel between the two buttons, which allows you to scroll smoothly through screens of information.

When you move the mouse with your hand, a pointer on your screen moves in the same direction. (The pointer's appearance might change depending on where it's positioned on your screen.) When you want to select an item, you point to the item and then click (press and release) the primary button. Pointing and clicking with your mouse is the main way to interact with your computer.



Mouse

- **Keyboard**

A keyboard is used mainly for typing text into your computer. Like the keyboard on a typewriter, it has keys for letters and numbers, but it also has special keys:

- The function keys, found on the top row, perform different functions depending on where they are used.
- The numeric keypad, located on the right side of most keyboards, allows you to enter numbers quickly.
- The navigation keys, such as the arrow keys, allow you to move your position within a document or webpage.

You can also use your keyboard to perform many of the same tasks you can perform with a mouse.

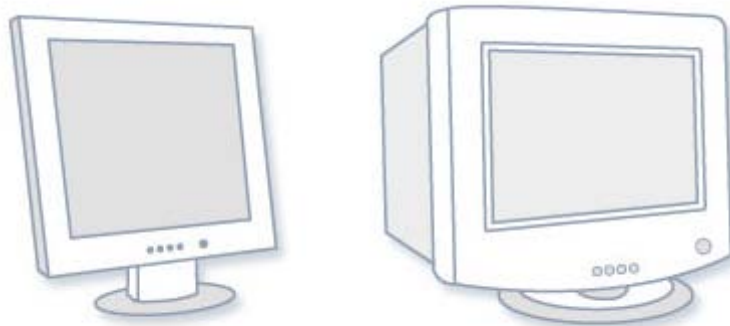


Keyboard

- **Monitor**

A monitor displays information in visual form, using text and graphics. The portion of the monitor that displays the information is called the screen. Like a television screen, a computer screen can show still or moving pictures.

There are two basic types of monitors: CRT (cathode ray tube) monitors and the newer LCD (liquid crystal display) monitors. Both types produce sharp images, but LCD monitors have the advantage of being much thinner and lighter.



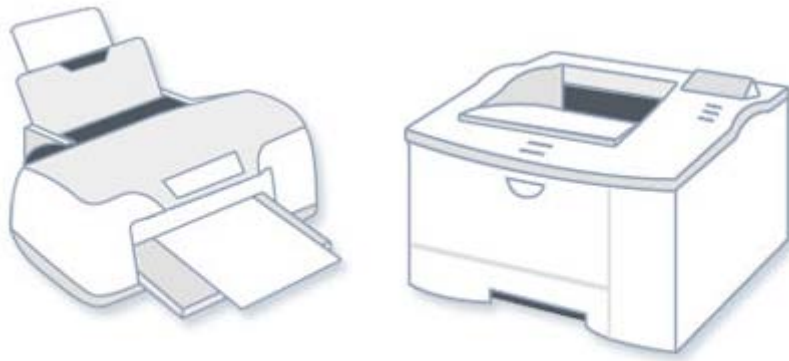
LCD monitor (left); CRT monitor (right)

- **Printer**

A printer transfers data from a computer onto paper. You don't need a printer to use your computer, but having one allows you to print e-mail, cards, invitations, announcements, and other material. Many people also like being able to print their own photos at home.

The two main types of printers are inkjet printers and laser printers. Inkjet printers are the most popular printers for the home. They can print in black and white or in full color and

can produce high-quality photographs when used with special paper. Laser printers are faster and generally better able to handle heavy use.



Inkjet printer (left); laser printer (right)

- **Speakers**

Speakers are used to play sound. They can be built into the system unit or connected with cables. Speakers allow you to listen to music and hear sound effects from your computer.



Computer speakers

- **Modem**

To connect your computer to the Internet, you need a modem. A modem is a device that sends and receives computer information over a telephone line or high-speed cable. Modems are sometimes built into the system unit, but higher-speed modems are usually separate components.

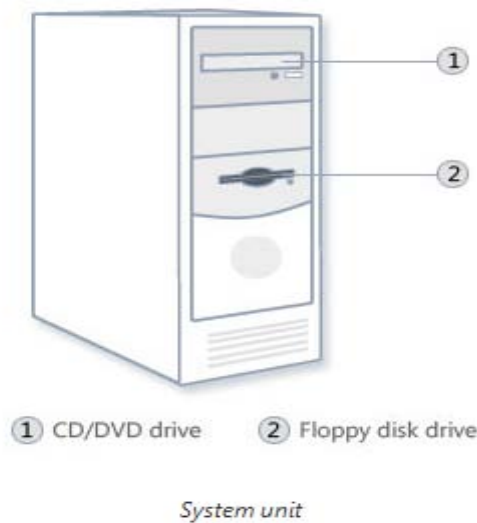


Cable modem

System Units

The system unit is the core of a computer system. Usually it's a rectangular box placed on or underneath your desk. Inside this box are many electronic components that process information. The most important of these components is the **Central Processing Unit (CPU), or Microprocessor**, which acts as the "brain" of your computer. Another component is **Random Access Memory (RAM)**, which temporarily stores information that the CPU uses while the computer is on. The information stored in RAM is erased when the computer is turned off.

Almost every other part of your computer connects to the system unit using cables. The cables plug into specific ports (openings), typically on the back of the system unit. Hardware that is not part of the system unit is sometimes called a peripheral device or device.



- **Central Processing Unit (CPU):** the main circuit chip in computer, it performs most of the calculations necessary to run computer. CPU speed measured by account of instructions that can execute in one secant, usually measured in (MHz). CPU contents two units:

1. **Control Unit (CU).**
2. **Arithmetic and Logic Unit (ALU).**

1. Control Unit (CU).

This unit control or supervised to all parts of computers such as:

- Control operation of transfers data and instruction from input unit to memory and from memory to output unit.
- Control operation of account executable instructions on ALU.
- Basic work of CU is interpreter the instructions that is mean data oriented to specific location on ALU. for example: if the instruction is (B+C) the B,C values transfers to (Adder) part, if the instruction is (BxC) the B,C values transfers to (Multiplier) part,

2. Arithmetic and Logic Unit (ALU).

This unit execute the following operations:

- Mathematical operations such as: add (+), abstract (-), multiplier (×), divide (÷).
- Logical operations: this is basic to account comparisons to choose true or false specific case, such as >, <, >=, <=, <>, = as a result of these comparisons specific instructions may be executable.
- Merge number of simple comparisons by specific tools such as: AND, OR, NOT.

What are Registers? CPU unit can do the most of it is work by using registers, registers are small and speed storage units, used on ALU and CU. the CPU contains many types of registers such as: *Accumulator, Data, address, program counter, instruction, statues, general purpose registers.*

What are Buses? The command received on CPU through buses, where the buses use to transfer electric impulse between different computer parts, as code signals therefore the buses are data path between the CPU and other computer parts such as input, output, and storage units. The one bus made of set of metal wires that sprawled over mother board. The types of buses are:

1. **Data Bus:** use to transfer data.
2. **Address Bus:** use to transfer storage location addresses.
3. **Control Bus:** use to transfer control signal and operation timer between computer parts.

System Board or Mother Board: the important part on computer loading the CPU, memories, and control circuit. it is allows to computer parts to exchange data to perform the required work, and coordinate computer parts, and memory organization.

- **Main memory:** refers usually to Random Access Memory (RAM) the temporary storage area the computer uses to run programs and store data .information store in RAM is temporary and is designed to be erased when computer turn off.**RAM** is a general indication of performance that is measured either in megabytes (MB) or gigabytes (GB): the larger the number, the faster some programs will run. Memory is set of electronic circuit named (**Cells**), each cell store 0 or 1, like (on or off),the single cell content named (**BIT**) which represent basic unit in process data, because all data transfer to set of bits in digital computers.(**BYTE**) term for eight Bit i.e:

$$1 \text{ Byte} = 8 \text{ Bit}$$

- Memory Capacity

Memory capacity units measured in **kilo Byte** which abstract by (**KB**) where:

$$\text{KB} = 2^{10} \text{ Bytes} = 1024 \text{ Bytes}$$

In memories has large capacity measured in **Mega Byte** which abstract by (**MB**) where:

$$1 \text{ MB} = 2^{20} \text{ Bytes} = 1048576 \text{ Bytes}$$

In larger memories capacity measured in **Giga Byte** which abstract by (**GB**) where:

$$1 \text{ GB} = 2^{30} \text{ Bytes} = 1073741824 \text{ Bytes}$$

In largest memories capacity measured in **Tiara Byte** which abstract by (**TB**) where:

$$1 \text{ TB} = 2^{40} \text{ Bytes} = 1099511627776 \text{ Bytes}$$

- **Memory Speed**

Memory speed measured in **WRITE** speed where write mean translate data operations from CPU to main memory also measured in **READ** speed where read mean translate data operations from main memory to CPU. read and write operations in memory named by **Access**. Because read and write operations generated by CPU therefore memory speed equal almost CPU speed.

- **Types of Memory**

Random Access Memory (RAM): in this kind of memory can read and write on it generated by CPU. This kind of memory used by user to store his programs on it. this memory is temporary storage ends when the process is end or when split electric power.

Read Only Memory (ROM): in this kind of memory can read only from it generated by CPU, but cannot write on it from this unit because store specific computer system software on this kinds of memories, such as: BIOS ,Start up Routine, Input/ output routine, Interpreter. This memory do not miss it is contents where split electric power.

What is BIOS?BIOS (Basic Input Output System):is a software that is built into computers and that is run when the computer first turn on. among other things this software starts the operating system and support transfer information between hard ware devices. BIOS is part of your computer's hardware and is separate from Windows.

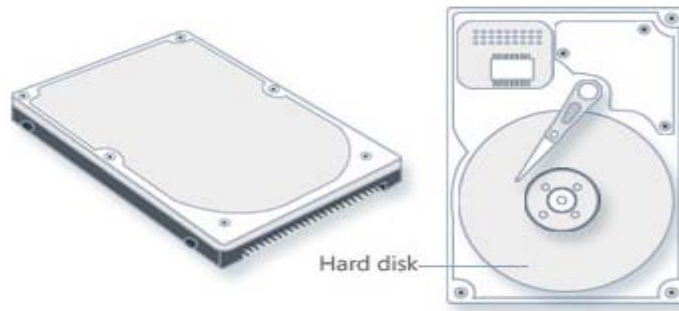
What is CMOS? Complementary metal-oxide semiconductor, or CMOS, typically refers to a battery-powered memory chip in your computer that stores startup information. Your computer's [basic input/output system \(BIOS\)](#) uses this information when starting your computer.

Storage Units

Your computer has one or more disk drives—devices that store information on a metal or plastic disk. The disk preserves the information even when your computer is turned off.

- **Hard disk drive**

Your computer's hard disk drive stores information on a hard disk—a rigid platter or stack of platters with a magnetic surface. Because hard disks can hold massive amounts of information, they usually serve as your computer's primary means of storage, holding almost all of your programs and files. The hard disk drive is normally located inside the system unit.



Hard disk drive

- **CD and DVD drives**

Nearly all computers today come equipped with a CD or DVD drive, usually located on the front of the system unit. CD drives use lasers to read (retrieve) data from a CD; many CD drives can also write (record) data onto CDs. If you have a recordable disk drive, you can store copies of your files on blank CDs. You can also use a CD drive to play music CDs on your computer. CD storage capacity less than 1GB.

DVD drives (Digital Video Disk) can do everything that CD drives can, plus read DVDs. If you have a DVD drive, you can watch movies on your computer. Many DVD drives can record data onto blank DVDs. DVD storage capacity may be 17 GB.

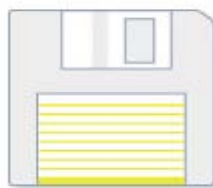


CD

- **Floppy disk drive**

Floppy disk drives store information on floppy disks, also called floppies or diskettes. Compared to CDs and DVDs, floppy disks can store only a small amount of data. They also retrieve information more slowly and are more prone to damage. For these reasons, floppy disk drives are less popular than they used to be, although some computers still include them.

Why are these disks called "floppy" disks? The outside is made of hard plastic, but that's just the sleeve. The disk inside is made of a thin, flexible vinyl material. Floppy disk storage capacity between 360 KB and 1.44 MB.



Floppy disk

Computer Software

Software refers to the instructions, or programs, that tell the hardware what to do.

Programs set of instructions that a computer uses to perform specific task such as word processing accounting or data management also called an application. software include:

1.Low Level Language: this language include:

- **Machine Language** the instructions input to computer must be written in binary system i.e.by [0,1] the unique language that computer understand .it is very complex.
- **Assembly Language** this language used simple words such as [**Jumb,Add,Move, Sub**] this lead to simplify computer using.

2.High Level Language: the data and instruction using symbols and numbers and words written in language similar to human language. Each language has it is specific grammar. Example of these language: **BASIC,FORTRAN,COBOL, PASCAL, PL/1, ADA, RPG, LISP, FORTH, SNOBOL, APL, ALGOL, LOGO.**

3.Translation Programs: these programs transfer high level language or assembly language to machine language, these programs include:

- **Assembler:** program transfer the program written in assembly language to machine language.
- **Compiler:** program transfer high level language programs to machine language program, the program written in high level language named **Source Program**, after transfer it to machine language by compiler is named **Object Program**. when using compiler in transfer operation ,cannot execute the program unless complier all program sentences end.
- **Interpreter:** program written in machine language and store in ROM memory, it is work similar to compiler but differ from it where is compiler program sentences immediately.

4.Operating System program that manages all computer parts. The operating system allows you to use software programs , and coordinate the use of computer hardware(such as the keyboard and mouse).

Operating System Types:

1. **Single user Operating System:** by these systems can execute on program in one using one personal computer, MS.DOS example of this kind of operating system.
2. **Multi Tasking Operating Systems for Single User:** by these systems the user can use the personal computer to execute different types of programs in the same time, WINDOWS example of this kind of operating system.
3. **Multi user Operating Systems:** these operating system apply on many types of computers linked together, by these systems different users can use many computers in the same time, such as UNIX operating system.

Files Organization

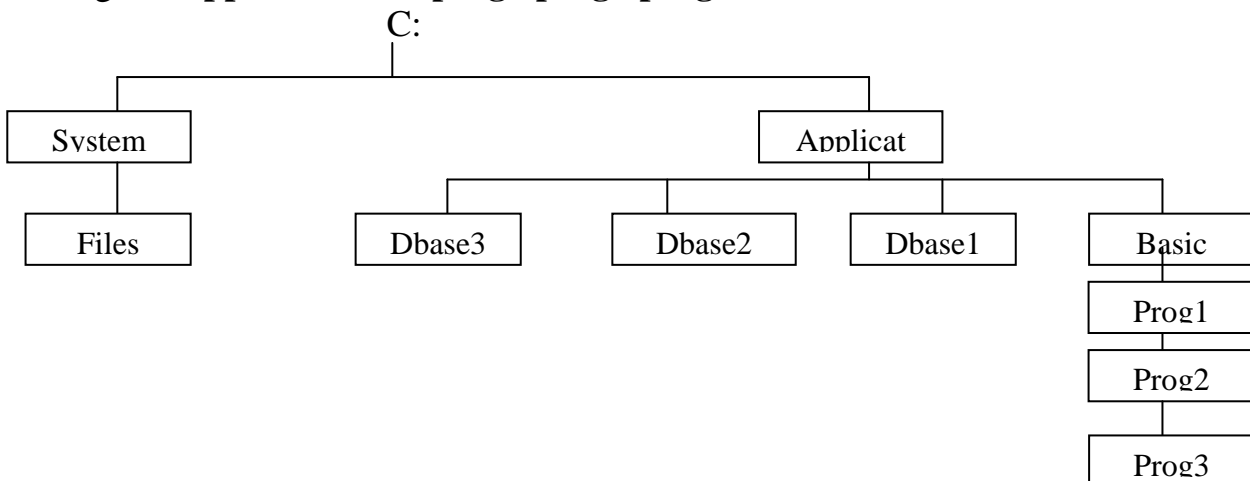
While you're working with a [file](#) in a [program](#), you should save it frequently to avoid losing data unexpectedly due to a power failure or other problems.

File: a collection of information that is stored on a computer under a single name. a file can be a text document, a picture, a program and so on. Files typically have a three letter file name extension that helps to indicate type. following file types and their extensions.

File type	Extension
Executable file	exe
Operating system file	sys
Text file	Doc / txt / Rtf
Picture file	Bmp/ jpg
Commands file	com
Program file	Prg
Backage file	Bat
Drawing file	Dwg/Gif
Help file	Hlp
Voice file	Mp3/wav

Location: any disk drive, folder ,or other place in which you can store files or folders. Programs will commonly ask you to choose a location to save files.

Path: a sequence of folders(directories) that leads to a specific file or folder .a backslash is used to separate each folder in the path. for Example: to access the file prog3 the path as following:**C:\ applicate\basic\prog1\prog2\prog3**



FAT32: a system used to store files on computer drive. FAT32 is based on file allocate table (FAT) file system, but it uses 32-bit values for storing files instead of 16-bit values used by original FAT file system. FAT32 uses drive space more efficiently than FAT and support volumes up to 2 terabyte (TB) in size.

NTFS: file system for formatting computer hard disks, so can store information. NTFS provides several improvements over earlier file allocation table (FAT) file, including file and folder permissions, encryption and file compression.

Numbering Systems

The computer work with numbers only, letters and symbols also the numbers transfer to specific numbers input to computer and process then output the results which transfer from machine language to language understand by humans, display on different output devices.

The most numbering systems used are:

1. **Decimal System**
2. **Binary System**
3. **Octal System**
4. **Hexadecimal System**

Following the properties of Numbering Systems:

1.Decimal System

The properties of decimal system as follows:

1. **Base is 10**
2. **set of used symbols are:(0,1,2,3,4,5,6,7,8,9)**

Example: The number in decimal system (**29029.98**)₁₀ is compute as follows:

$$2 * 10^4 + 9 * 10^3 + 0 * 10^2 + 2 * 10^1 + 9 * 10^0 + 9 * 10^{-1} + 8 * 10^{-2} = 29029.98$$

2.Binary system

The properties of Binary system as follows:

1. **Base is 2**
2. **Set of used symbols are:(0,1)**

Example: convert the number (10101.01)₂ From binary system to decimal system

$$1 * 2^4 + 0 * 2^3 + 1 * 2^2 + 0 * 2^1 + 1 * 2^0 + 0 * 2^{-1} + 1 * 2^{-2} = (21.25)_{10}$$

Example: convert the number (25)₁₀ from decimal system to binary system

Number	Number/2	Submit
25	12	1
12	6	0
6	3	0
3	1	1
1	0	1

The number in decimal system (25)₁₀ =(11001)₂ in binary system.

3.Octal System

The properties of octal system as follows:

1. **Base is 8**
2. **Set of used symbol are:(0,1,2,3,4,5,6,7)**

Example: convert the number: $(74211.03)_8$ from octal system to decimal system:

$$7 * 8^4 + 4 * 8^3 + 2 * 8^2 + 1 * 8^1 + 1 * 8^0 + 0 * 8^{-1} + 3 * 8^{-2} = (30857.05)_{10}$$

Example: convert the number $(30)_{10}$ from decimal system to octal system

Number	Number/8	Submit
30	3	6
3	0	3

The number in decimal system $(30)_{10} = (36)_8$ in octal system.

4.Hexadecimal System

The properties of hexadecimal system as follows:

1. Base is 16
2. Set of used symbol are: $(0,1,2,3,4,5,6,7,8,9, A,B,C,D,E,F)$
Where A=10, B=11, C=12, D=13, E=14, F=15

Example: convert the number from hexadecimal to decimal system $(F3B05.A2)_{16}$

$$15 * 16^4 + 3 * 16^3 + 11 * 16^2 + 0 * 16^1 + 5 * 16^0 + 10 * 16^{-1} + 2 * 16^{-2} = (998149.6)_{10}$$

Example: convert the number $(50)_{10}$ from decimal system to hexadecimal system

Number	Number/16	Submit
50	3	2
3	0	3

The number in decimal system $(50)_{10} = (32)_{16}$ in hexadecimal system.