

Introduction to basic concepts of computers

(Introduction to basic concepts, Nature of computers, Capabilities & limitations of computers, Advantages & Dis-advantages of Computerization)



Lecturer: K. P. Ghosh

What Is A Computer?



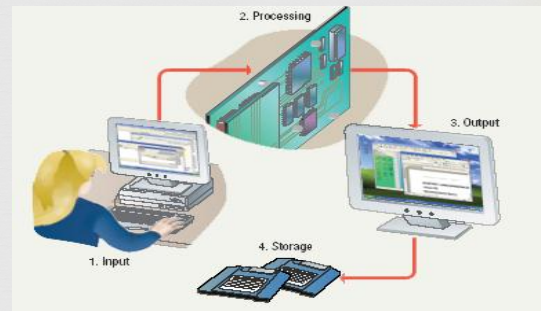
- ❧ A computer is an electronic device,
 - ❧ operating under the control of instructions (software)
 - ❧ stored in its own memory unit,
 - ❧ that can accept data (input),
 - ❧ manipulate data (process),.
 - ❧ and produce information (output) from the processing.



What Does A Computer Do?

Computers can perform four general operations, which comprise the information processing cycle.

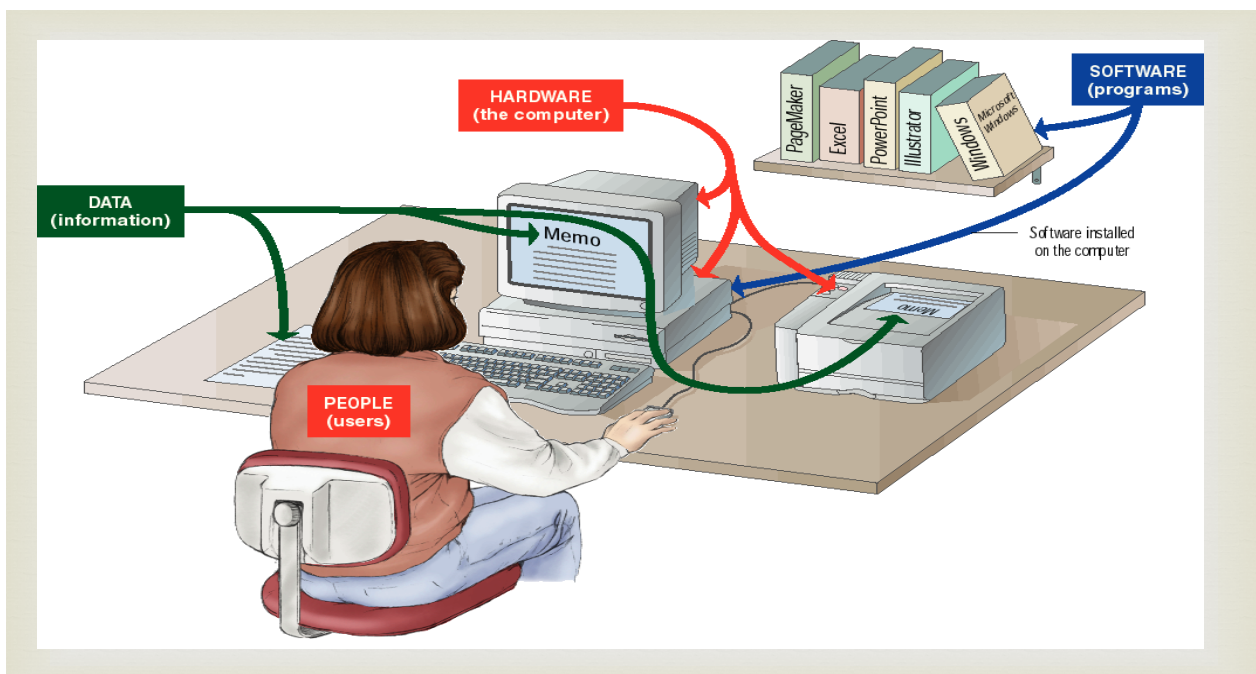
- Input
- Process
- Output
- Storage



Parts of a computer

A complete computer system includes four distinct parts:

- Hardware
- Software
- Data
- People / User



Hardware



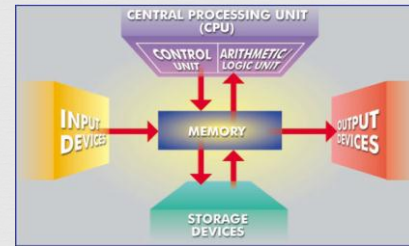
- ❧ A computer's hardware consists of electronic devices; the parts we can see and touch.
- ❧ The term "device" refers to any piece of hardware used by the computer, such as a keyboard, monitor, modem, mouse, etc.

Devices that comprise a computer system



What Are The Primary Components Of A Computer ?

- ❧ Input devices
- ❧ Central Processing Unit
(containing the control unit and the arithmetic/logic unit)
- ❧ Memory
- ❧ Output devices.
- ❧ Storage devices



Input Devices

❧ Keyboard



The most commonly used input device is the keyboard on which data is entered by manually keying in or typing certain keys. A keyboard typically has 101 or 105 keys.

❧ Mouse

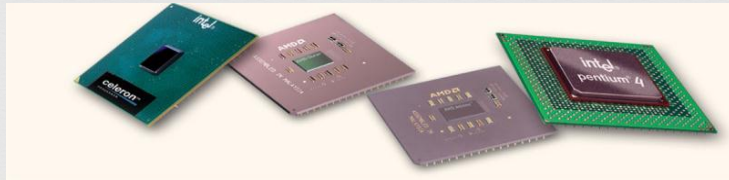


Is a pointing device which is used to control the movement of a mouse pointer on the screen to make selections from the screen. A mouse has one to five buttons. The bottom of the mouse is flat and contains a mechanism that detects movement of the mouse.

The Central processing Unit



- ☞ The central processing unit (CPU) contains electronic circuits that cause processing to occur. The CPU **interprets instructions to the computer**, *performs the logical and arithmetic processing operations*, and causes the input and output operations to occur. It is **considered the “brain” of the computer**.



Memory



- ☞ Memory also called Random Access Memory or **RAM (temporary memory)** is the main memory of the computer. It consists of electronic components that store data including numbers, letters of the alphabet, graphics and sound. Any information stored in RAM is lost when the computer is turned off.



- ☞ Read Only Memory or **ROM** is memory that is etched on a chip that has start-up directions for your computer. It is **permanent memory**.

Output Devices



- Output devices make the information resulting from the processing available for use. The two output devices more commonly used are the **printer** and the computer **screen**.



- The printer produces a hard copy of your output, and the computer screen produces a soft copy of your output.

Storage Devices



- Auxiliary storage devices are used **to store data**. The most common types of auxiliary storage used on personal computers are floppy disks, hard disks and CD-ROM drives.

FLOPPY DISK



- A floppy disk is a *portable, inexpensive storage* medium that consists of a thin, circular, flexible plastic disk with a *magnetic coating* enclosed in a square-shaped plastic shell.

HARD DISK

- Another form of auxiliary storage is a hard disk. A hard disk consists of one or more rigid *metal plates* coated with a metal oxide material that allows data to be *magnetically recorded* on the surface of the platters.



- The hard disk platters spin at a high rate of speed, typically 5400 to 7200 revolutions per minute (RPM).
- Storage capacities of hard disks for personal computers range from 10 GB to 500 GB (one billion bytes are called a gigabyte).

Storage Devices (Cont..)

Compact Discs:

- ❧ A compact disk (CD), also called an *optical* disc, is a flat round, portable storage medium that is usually 4.75 inch in diameter.
- ❧ Uses the laser technology.
- ❧ CD-R/RW
 - ❧ 650-800MB (Read/Write)
- ❧ DVD-R/RW
 - ❧ 4.6GB single layer
 - ❧ 8.5GB dual layer



Capacity

The amount of information that can be stored on the medium.

<i>Unit</i>	<i>Description</i>	<i>Approximate Size</i>
1 bit	1 binary digit	
1 nibble	4 bits	
1 byte	8 bits	1 character
1 kilobyte	1,024 bytes	≈1/2 page, double spaced
1 megabyte	1,048,576 bytes	≈500,000 pages
	1 million bytes	
1 gigabyte	1,073,741,824 bytes	≈5 million pages
	1 billion bytes	
1 terabyte	1 trillion bytes	≈5 billion pages

Why Is A Computer So Powerful Today?



- ❧ Speed
- ❧ Reliability
- ❧ Accuracy
- ❧ Huge power of Remembering
- ❧ Networking

Capabilities Of The Computer



- ❧ **Speed:** A computer can process data faster than any other machine designed to perform a similar task.
- ❧ **Repetitions:** A computer can tirelessly perform the same operations millions of times in exactly the same way without getting bored and tired the way a human clerk would.
- ❧ **Accuracy:** A computer's high-speed processing is accompanied by high-accuracy results. No other system can have as much accuracy as a computer system.
- ❧ **Logical Operations:** The computer can make decisions based on some conditions and take alternative course of action accordingly.
- ❧ **Store And Recall Information:** The computer is like human brain as it can store facts, instructions and information and recall them when needed.
- ❧ **Self-Checking:** The computer verifies the accuracy of its own work by means of a parity check.
- ❧ **Self-Operating:** Once the data and the program are fed into the computer's memory, the computer is capable of executing the instructions on its own, without human intervention.

Limitations of Computer



❧ No IQ

- ❧ Computer is a dumb machine and it cannot do any work without instruction from the user.
- ❧ We have to decide what to do and in what sequence.

❧ No Feeling

- ❧ It does not have feelings or emotion, taste, knowledge and experience.
- ❧ It does not distinguish between users.

Advantages of Computerization



- ❧ Faster and efficient in processing of information;
- ❧ Automatic generation of accounting documents like invoices, cheques and statement of account;
- ❧ With the larger reductions in the cost of hardware and software and availability of user-friendly accounting software package, it is relatively cheaper like maintaining a manual accounting system;
- ❧ More timely information can be produced;
- ❧ No more manual processing of the data- all automatically been posted to the various ledgers/accounts and
- ❧ Many types of useful reports can be generated for management to make decisions

Disadvantages of Computerization



- ❧ Power failure, computer viruses and hackers are the inherent problems of using computerized systems;
- ❧ Once data been input into the system, automatically the output are obtained hence the data being input needs to be validated for accuracy and completeness, we should not forget concept of GIGO (Garbage In(Input) Garbage out (Output);
- ❧ Accounting system not properly set up to meet the requirement of the business due to badly programmed or inappropriate software or hardware or personnel problems can caused more havoc;
- ❧ Danger of computer fraud if proper level of control and security whether internal and external are not properly been instituted.

Impact of Computer



Positive Impact of Computer

- ❧ The work can be done in very less time.
- ❧ More information can be stored in small space.
- ❧ Multitasking and multiprocessing capabilities of data.
- ❧ Easy to access data.
- ❧ Impartiality. Documents can be kept secret.
- ❧ Error free result.
- ❧ It can be used for various purposes. i.e. It can be used in any type of work.

Negative Impact of Computer

- ❧ Highly expensive.
- ❧ Accidents.
- ❧ Data piracy.
- ❧ Increased unemployment.
- ❧ Huge data and information can be lost sometimes.
- ❧ Fast changing computer technology.
- ❧ Service distribution.
- ❧ Illiteracy of computing and computers.

Important Definitions



Computer:

Computer is an electronic device which is capable of receiving information (data) in a particular form and of performing a sequence of operations in accordance with a predetermined but variable set of procedural instructions (program) to produce a result in the form of information or signals.

A computer generally means *a programmable machine*. The two principal characteristics of a computer are: it responds to a specific set of instructions in a well-defined manner and it can execute a prerecorded list of instructions (a program).



Memory:

Memory is the electronic holding place for instructions and data that your computer's microprocessor can reach quickly.

the power or process of remembering what has been learned,
 #something that is remembered,
 #the things learned and kept in the mind

Output device:

Any machine capable of representing information from a computer. This includes display screens, printers, plotters, and synthesizers.

Input device:

Any machine that feeds data into a computer. For example, a keyboard is an input device, whereas a display monitor is an output device. Input devices other than the keyboard are sometimes called *alternate input devices*. Mice, trackballs, and pens are all alternate input devices.

RAM:

RAM (random access memory) is the place in a computer where the operating system, application programs, and data in current use are kept so that they can be quickly reached by the computer's processor.

RAM (*pronounced ramm*) is an acronym for *random access memory*, a type of computer memory that can be accessed randomly; that is, any byte of memory can be accessed without touching the preceding bytes. RAM is the most common type of memory found in computers and other devices, such as printers.

ROM:

Read-only memory (ROM) is a class of storage medium used in computers and other electronic devices.

ROM is "built-in" computer memory containing data that normally can only be read, not written to. ROM contains the programming that allows your computer to be "booted up" or regenerated each time you turn it on. Unlike a computer's random access memory (RAM), the data in ROM is not lost when the computer power is turned off. The ROM is sustained by a small long-life battery in your computer.

If you ever do the hardware setup procedure with your computer, you effectively will be writing to ROM.

Evolution of computers

(Evolution, history & generation of computers)



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Evolution of computers



The Early Years

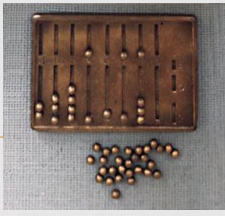
- ✧ In the early years, before the computer was invented, there were several inventions of counting machine
- ✧ 200BC-Chinese Abacus
- ✧ 500BC-Egyptian Abacus
- ✧ 1620-Napier's Bone (John Napier)
- ✧ 1653-Pascaline (Blaise Pascal)
- ✧ 1673-Leibniz's (Gottfried Wilhelm Von Leibniz)
- ✧ 1801-Weaving loom (Joseph Marie Jacquard)
- ✧ 1823- Mechanical Calculator Machine (Charles Babbage)
- ✧ 1941- Mark 1 (Harvard University)

First generation computers (1940-1956)

- ✧ 1941-huge, slow, expensive and often unreliable
- ✧ Presper Eckert and William Mauchly built the ENIAC (Electronic Numerical Integrator and computer)
- ✧ It used vacuum tube
- ✧ 1951- Eckert and Mauchly built the UNIVAC (Universal Automatic Computer)
- ✧ Can calculate 10000 Addition per second.



200BC-Chinese Abacus



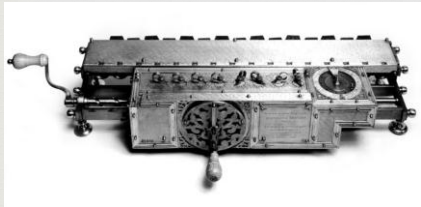
500BC-Egyptian Abacus



1620-Napier's Bone



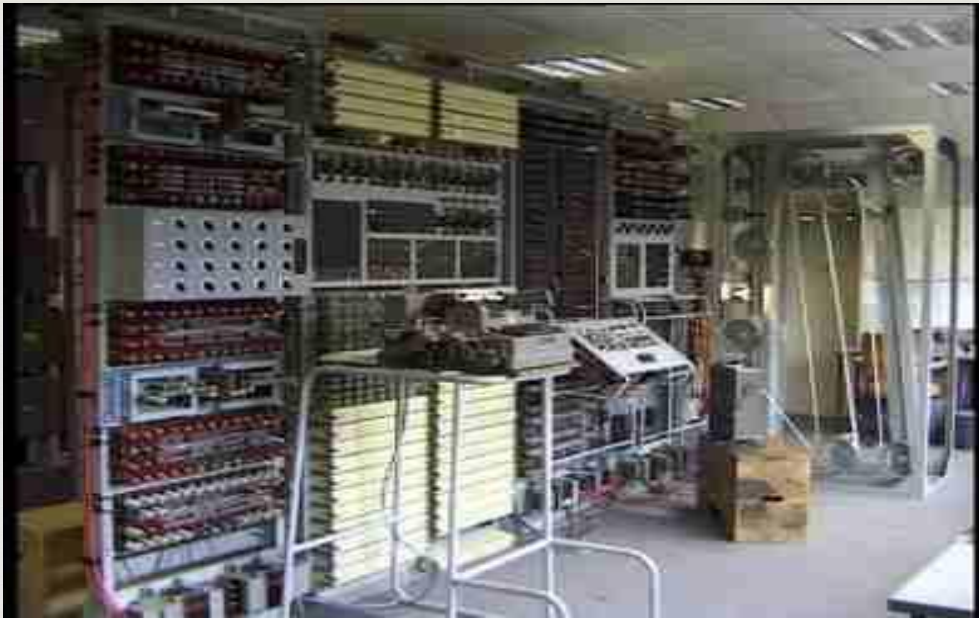
1653-Pascaline



1673-Leibniz's



1823- Mechanical Calculator Machine



MARK-1

Evolution of computers (Cont.)



Vacuum tube

- ✧ In a computer, a vacuum tube which is an electronic tube about the size of light bulbs, was used as the internal computer components. Thousands of them were used.
- ✧ Problems
 - ✧ The vacuum tubes generated a great deal of heat causing many problems in regulation and climate control
 - ✧ The tubes also burnt out frequently
 - ✧ People operating the computer did not know that the problem was in the programming machine.

Evolution of computers (Cont.)



Second generation computers (1956-1963)

- ✧ The famous computer scientist during the second generation era were :
 - ✧ John Bardeer
 - ✧ Walter Houser Brattain
 - ✧ William Shockley
- ✧ Transistor were smaller than vacuum tubes
- ✧ They needed no warm up time
- ✧ Consumes less energy
- ✧ Generated much less heat
- ✧ Faster and more reliable.

Third generations computer (1964-1971)

- ✧ The IBM 370 series were introduced in 1964. It came in several models and sizes.
- ✧ It was used for business and scientific programs. Other computer models introduced were CDC 7600 and B2500
- ✧ Silicone chips were manufactured in 1961 at the Silicone Valley
- ✧ Then came the integrated circuit technology which had reduced the size and cost of computers
- ✧ Other than that, the Magnetic Core Memory was replace by a device called the microchip

Evolution of computers (Cont.)



The Advantages of IC

- ❧ Silicone chips were reliable, compact and cheaper
- ❧ Sold hardware and software separately which created the software industry.
- ❧ Customer service industry flourished (reservation and credit checks)

Software Technology

- ❧ More sophisticated
- ❧ Several programs run at the same time
- ❧ Sharing computer resources
- ❧ Support interactive processing

Evolution of computers (Cont.)



Fourth generation computers (1971-Present)

- ❧ It took only 55 years for the 4 generations to evolve. The growth of the computer industry developed technologies of computer inventions. There are many types of computer models such as:
 - ❧ Apple Macintosh
 - ❧ Dell
 - ❧ IBM
 - ❧ Acer
 - ❖ 1971, Intel created the first microprocessor.
 - ❖ 1976, Steve Jobs built the first Apple computer. Then, in 1981, IBM introduces its first personal computer.
 - ❖ During the fourth generations hardware technology such as silicone chips, microprocessor and storage devices were invented.
 - ❖ A microprocessor specialized chip which is developed for computer memory and logic.
- The microprocessor is a large scale integrated circuit which contained thousands of transistor
 - The transistor on this chip are capable of performing all of the function of a computer's central processing unit.

Evolution of computers (Cont.)



Advantages of Fourth generation computers

- ❧ Computers became 100 times smaller than ENIAC
- ❧ Gain in speed, reliability and storage capacity
- ❧ Personal and software industry boomed

Fifth generation computers (Present & Beyond)

- ❧ Are technologies more advance and still being developed so that it is more efficient
- ❧ The fifth generation computers are such as :
 - ❧ Silicone chips
 - ❧ Processor
 - ❧ Robotics
 - ❧ Virtual reality
 - ❧ Intelligent systems
- ❧ Programs which translate languages

New Era computers



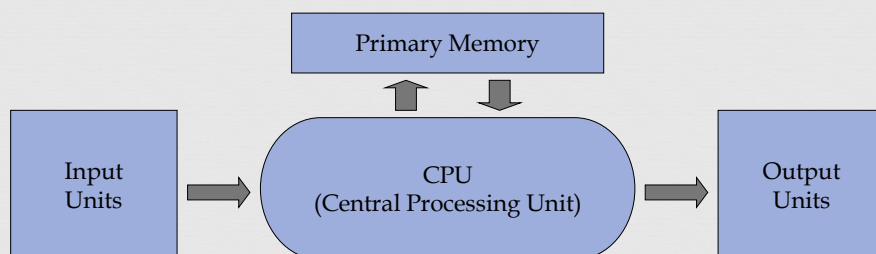
- ❧ The technology of computers are more advance, sophisticated and modern
- ❧ The latest invention of the new era are :
 - ❧ Supercomputers
 - ❧ Mainframe computers
 - ❧ Mini computers
 - ❧ Personal computer
 - ❧ Mobile computer

Input output devices



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Basic Concepts of Computer Hardware



- ❧ This model of the typical digital computer is often called the **von Neumann** computer.
- ❧ Programs and data are stored in the same memory: **primary memory**.
- ❧ The computer can only perform one instruction at a time.

Sources of Data for the Computer



- ❑ Two types of data stored within a computer:
 - **Original data or information:** Data being introduced to a computing system for the first time.
 - ❧ Computers can deal directly with printed text, pictures, sound, and other common types of information.
 - **Previously stored data or information:** Data that has already been processed by a computer and is being stored for later use.
 - ❧ These are forms of binary data useful only to the computer.
 - ❧ Examples: Floppy disks, DVD disks, and music CDs.

Input Devices



- ❧ Two categories of input hardware:
 - ❧ Those that deal with original data.
 - ❧ Those that handle previously stored data.
- ❧ Input hardware: Those that deal with original data.
 - ❧ Keyboard
 - ❧ Mouse
 - ❧ Voice recognition hardware
 - ❧ Scanner
 - ❧ Digital camera
- ❧ Digitizing: The process of taking a visual image, or audio recording and converting it to a binary form for the computer.
 - ❧ Used as data for programs to display, play or manipulate the digitized data.

Input Devices (Cont.)



☞ Connecting Hardware to the computer:

☞ Hardware needs access through some general input/output connection.

☞ **Port:** The pathway for data to go into and out of the computer from external devices such as keyboards.

☞ There are many standard ports as well as custom electronic ports designed for special purposes.

☞ Ports follow standards that define their use.

☞ SCSI, USB: Multiple peripheral devices (chain).

☞ RS-232, IDE: Individual peripheral devices.

☞ **Peripheral device:** A piece of hardware like a printer or disk drive, that is outside the main computer.

Input Devices (Cont.)



☞ Connecting Hardware to the computer: (continued)

☞ Hardware needs software on the computer that can service the device.

☞ **Device driver:** Software addition to the operating system that will allow the computer to communicate with a particular device.

☞ Common Basic Technologies for Storing Binary Information:

☞ Electronic

☞ Magnetic

☞ Optical

Input Devices (Cont.)

❧ Electronic Circuits

- ❧ Most expensive of the three forms for storing binary information.
- ❧ A flip-flop circuit has either one electronic status or the other. It is said to flip-flop from one to the other.
- ❧ Electronic circuits come in two forms:
 - ❧ Permanent
 - ❧ Non-permanent

❧ Optical

- ❧ Uses lasers to “read” the binary information from the medium, usually a disc.
- ❧ Millions of tiny holes are “burned” into the surface of the disc.
- ❧ The holes are interpreted as 1s. The absence of holes are interpreted as 0s.



Input Devices (Cont.)

❧ Magnetic Technology

- ❧ Two parts to most of the magnetic forms of information storage:
 - ❧ The **medium** that stores the magnetic information.
 - ❧ Example: Floppy disk. Tiny spots on the disk are magnetized to represent 0s and 1s.
 - ❧ The **device** that can “read” that information from the medium.
 - ❧ The drive spins the disk.
 - ❧ It has a magnetic sensing arm that moves over the disk.
 - ❧ Performs nondestructive reading.



Input Devices (Cont.)



❧ Secondary Memory Input Devices

- ❧ These input devices are used by a computer to store information and then to retrieve that information as needed.
 - ❧ External to the computer.
 - ❧ Commonly consists of floppy disks, hard disk drives, or CD-ROMs.
- ❧ Secondary memory uses binary.
 - ❧ The usual measurement is the byte.
 - ❧ A byte consists of 8 binary digits (bits). The byte is a standard unit.

Input Devices (Cont.)



❧ The four most important characteristics of storage devices:

- ❧ Speed and access time
- ❧ Cost / Removable versus non-removable
- ❧ Capacity
- ❧ Type of access

❧ Type of Access

- ❧ Sequential - Obtained by proceeding through the storage medium from the beginning until the designated area is reached (as in magnetic tape).
- ❧ Random Access - Direct access (as in floppy and hard disks).

Primary Memory



- ❧ **Primary storage or memory:** Is where the data and program that are currently in operation or being accessed are stored during use.
- ❧ Consists of electronic circuits: Extremely fast and expensive.
- ❧ Two types:
 - ❧ **RAM (non-permanent)**
 - ❧ Programs and data can be stored here for the computer's use.
 - ❧ Volatile: All information will be lost once the computer shuts down.
 - ❧ **ROM (permanent)**
 - ❧ Contents do not change.

The Central Processing Unit



- ❑ The Central Processing Unit (CPU)
 - ❧ Often referred to as the “brain” of the computer.
 - ❧ Responsible for controlling all activities of the computer system.
 - ❧ The three major components of the CPU are:
 1. **Arithmetic Unit** (Computations performed)
Accumulator (Results of computations kept here)
 2. **Control Unit** (Has two locations where numbers are kept)
Instruction Register (Instruction placed here for analysis)
Program Counter (Which instruction will be performed next?)
 3. **Instruction Decoding Unit** (Decodes the instruction)

Motherboard: The place where most of the electronics including the CPU are mounted.

Output Devices



- ❧ Output units store and display information (calculated results and other messages) for us to see and use.
 - ❧ Floppy disk drives and Hard disk drives.
 - ❧ Display monitors: Hi-resolution monitors come in two types:
 - ❧ **Cathode ray tube (CRT)** - Streams of electrons make phosphors glow on a large vacuum tube.
 - ❧ **Liquid crystal display (LCD)** - A flat panel display that uses crystals to let varying amounts of different colored light to pass through it.
 - ❧ Developed primarily for portable computers.

Output Devices (Cont.)



- ❧ Audio Output Devices
 - ❧ Windows machines need special audio card for audio output.
 - ❧ Macintosh has audio playback built in.
 - ❧ Audio output is useful for:
 - ❧ Music
 - ❧ CD player is a computer.
 - ❧ Most personal computers have CD players that can access both music CDs and CD-ROMs.
 - ❧ Voice synthesis (becoming more human sounding.)
 - ❧ Multimedia
 - ❧ Specialized tasks (i.e.: elevator's floor announcements)

Output Devices (Cont.)



❑ Optical Disks: CD-ROM and DVD

✎ CD-ROM (Compact Disk - Read Only Memory)

- By its definition, CD-ROM is Read Only.
- Special CD drives “burn” information into blank CDs.
 - ❖ Burn: A laser is used to “burn” craters into the surface to represent a binary 1.
 - ❖ Two main types of CDs:
 - ✎ CD-R (Compact Disk - Recordable)
 - ✎ CD-WR (Compact Disk - ReWritable)
- It takes longer to write to a CD-R than a hard drive.
- Special software is needed to record.