

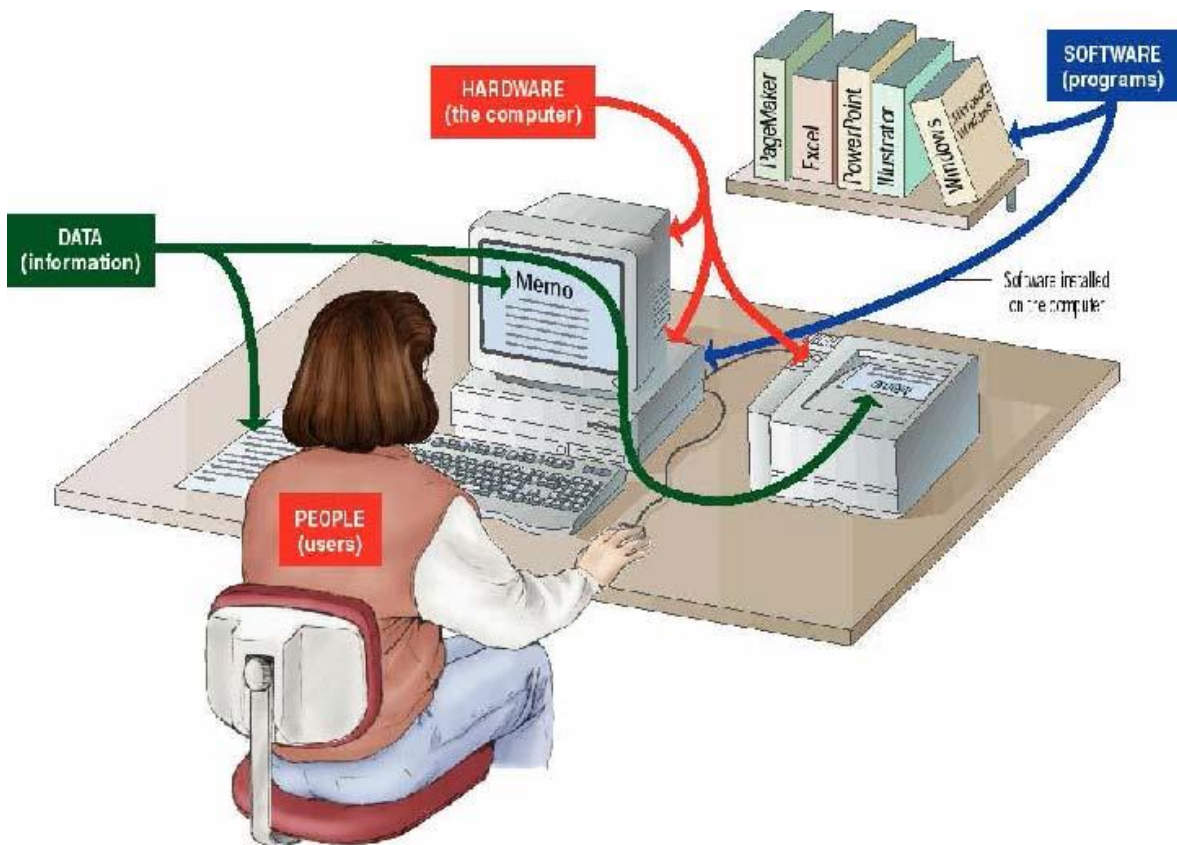
Chapter 1

An Overview of the Computer System

What is a computer?

A computer is an electronic device used to process data. A computer can convert data into information that is useful to people. A complete computer system includes four distinct parts:

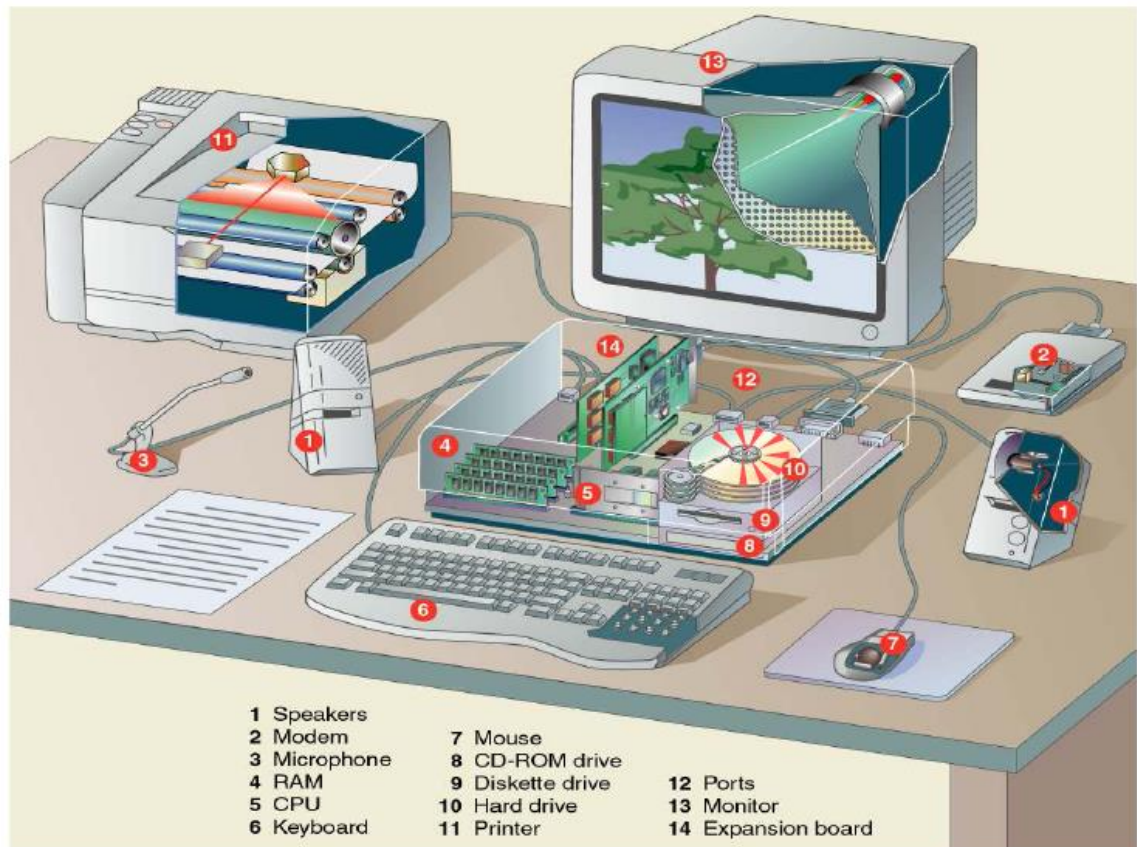
- Hardware
- Software
- Data
- User



The Parts of a Computer System/ Hardware

- A computer's hardware consists of electronic devices; the parts you 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.



The Parts of a Computer System/ Software:

- Software – also called programs – consists of organized sets of instructions for controlling the computer.
- Some programs exist for the computer's use, to help it manage its own tasks and devices.
- Other programs exist for the user, and enable the computer to perform tasks for you, such as creating documents.

The Parts of a Computer System/ Data:

- Data consists of raw facts, which the computer can manipulate and process into information that is useful to people.
- Computerized data is digital, meaning that it has been reduced to digits, or numbers. The computer stores and reads all data as numbers.

- Although computers use data in digital form, they convert data into forms that people can understand, such as text, numerals, sounds, and images.

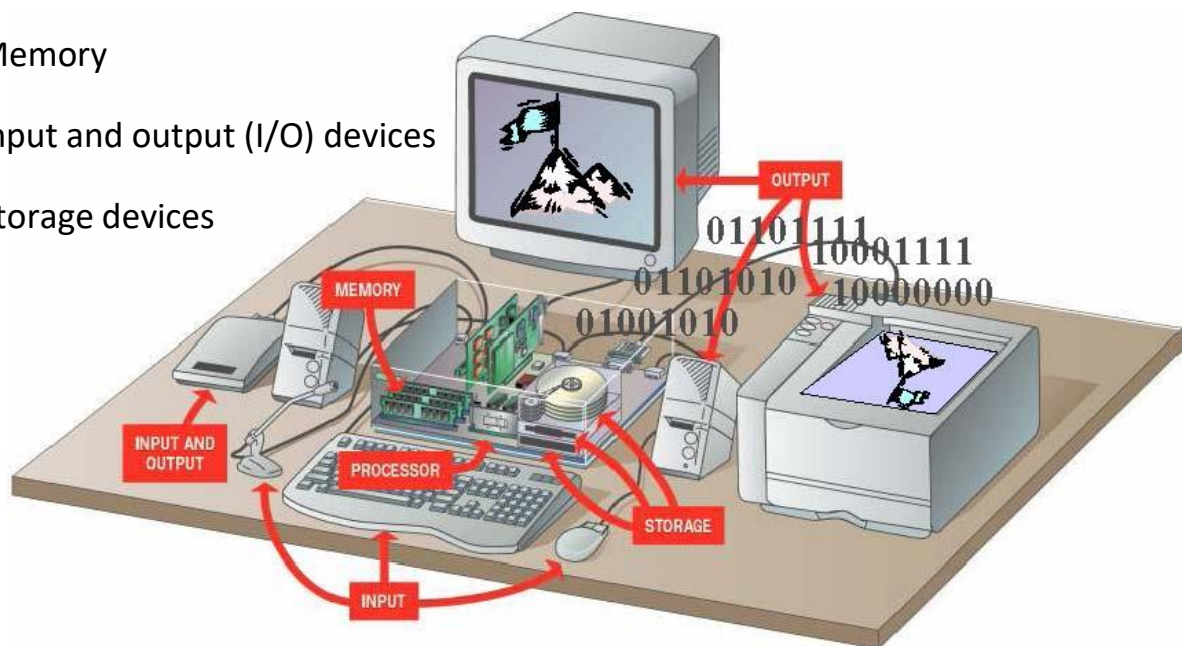
The Parts of a Computer System / Users:

- People are the computer's operators, or users.
- Some types of computers can operate without much intervention from people, but personal computers are designed specifically for use by people.

Looking Inside the Machine – Types of Hardware

A computer's hardware devices are categorized as follows:

- Processor
- Memory
- Input and output (I/O) devices
- Storage devices



Looking Inside the Machine / The CPU:

The procedure that transforms raw data into useful information is called processing. This function is divided between the computer's processor and memory.

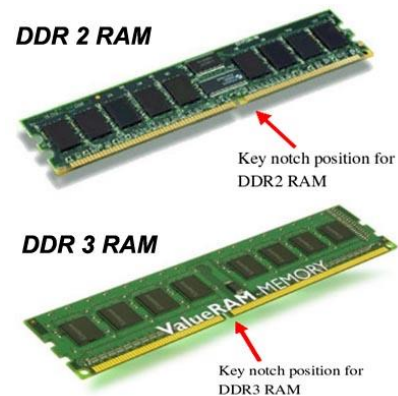


The processor is also called the central processing unit (CPU). It manages all devices and performs the actual processing of data.

The CPU consists of one or more chips attached to the computer's main circuit board (the motherboard).

Looking Inside the Machine / Memory:

- Memory also consists of chips attached to the motherboard.
- Memory holds data and program instructions as the CPU works with them. This memory is called Random Access Memory (RAM).
- The CPU can find any piece of data in RAM, when it needs it for processing.
- RAM is volatile, meaning it holds data only when the power is on. When the power is off, RAM's contents are lost.



How Memory is Measured

- The smallest usable unit of measure for memory is the byte – the amount of memory required to hold one character, like the letter A or the numeral 2.
- Computers work with larger chunks of data, measured in multiple bytes, as shown below:

<i>Unit</i>	<i>Approx. Value (bytes)</i>	<i>Actual Value (bytes)</i>
Kilobyte (KB)	1,000	1,024
Megabyte (MB)	1,000,000	1,048,576
Gigabyte (GB)	1,000,000,000	1,073,741,824
Terabyte (TB)	1,000,000,000,000	1,099,511,627,776

Note/

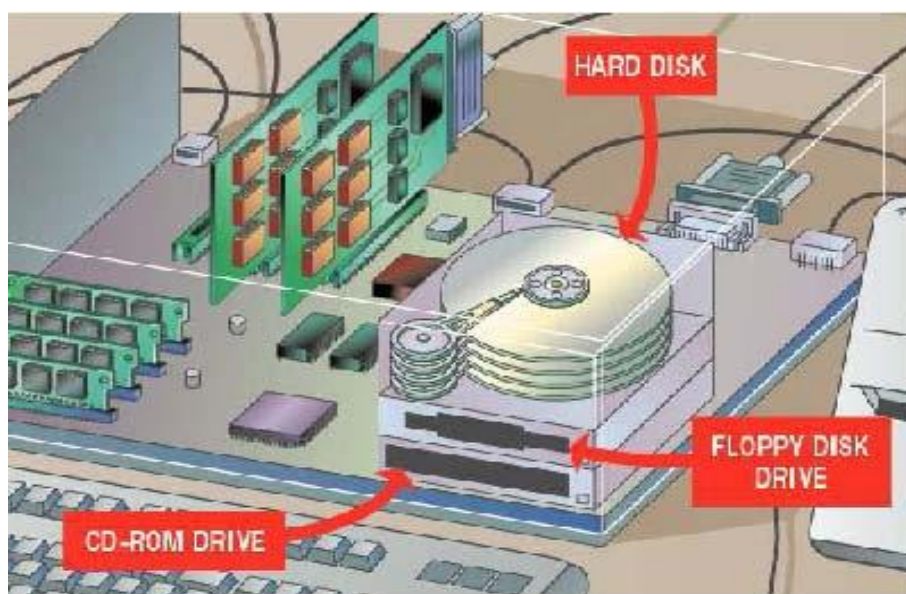
A bit is a single numeric value, either '1' or '0', that encodes a single unit of digital information. A byte is a sequence of bits; usually **eight** bits equal **one** byte.

Looking Inside the Machine/ Input and Output Devices

- Input devices accept data and instructions from the user or from another computer system. The keyboard and mouse are examples of input devices.
- Output devices return processed data back to the user or to another computer system. The printer and monitor are examples.
- Communications devices (such as modems and network interface cards) perform both input and output, allowing computers to share information.

Looking Inside the Machine / Storage Devices:

- Storage devices hold data not currently being used by the CPU. Data is commonly stored on a magnetic or optical disk.
- A disk drive is a device that reads data from and writes data to a disk. Most new computers feature a floppy disk drive, a hard disk drive, usb flash, and an optical disk drive.
- The most common optical storage devices are CD-ROM and DVD-ROM and Blue-ray drives.



Bringing the Machine to Life – What is Software?

- Software is a set of electronic instructions that tells the computer how to do certain tasks. A set of instructions is often called a program.
- When a computer is using a particular program, it is said to be running or executing the program.
- The two most common types of programs are system software and application software.

System Software:

- System software exists primarily for the computer itself, to help the computer perform specific functions.
- One major type of system software is the operating system (OS). All computers require an operating system.
- The OS tells the computer how to interact with the user and its own devices.
- Common operating systems include Windows, the Macintosh OS, OS/2, and UNIX

Applications:

- Application software tells the computer how to accomplish tasks the user requires, such as creating a document or editing a graphic image.
- Some important kinds of application software are:

Word processing programs, Database management, Presentation programs Graphics programs, Networking software, Web design tools and browsers Internet applications, Communications programs, Utilities, education, and Multimedia.

Chapter 2

What is a program?

Programming or **coding** is the set of instructions for carrying out a specific task.

Which is the process of writing, testing, debugging/troubleshooting, and maintaining the source code of computer programs. This source code is written in a programming language.

A **programming language** is an artificial language designed to express computations that can be performed by a machine, particularly a computer.

The programs are stored in memory, when first created and brought into main memory, during execution.

Basic steps in trying to solve a problem using computer are:

- Problem definition and analysis.
- Algorithm design and representation.
- Coding and debugging.

Programmers

Computer programmers are those who write computer software.

Numeral system

A numeral system (or system of numeration) is a linguistic system and mathematical notation for representing numbers of a given set by symbols in a consistent manner.

Bases used

Switches, replaced by their electronic successors built in modern technology of transistors, have only two possible states: "open" and "closed". Substituting **open =1** and **closed=0** yields the entire set of binary digits. This base-2 system (binary) is the basis for digital computers.

✚ Decimal numeral system

The natural Numerical system used in computing is **Decimal numeral system** with ten digits (**0,1,2,3,4,5,6,7,8 and 9**) and we know how to use arithmetic's {adding, subtracting, multiplication and division} on it. In addition, it contains **10** digits, so we say that its base is 10.

$$1=1_{10}, 2=2_{10}, \dots, 9=9_{10}$$

$$129_{10}=1 \times 10^2 + 2 \times 10^1 + 9 \times 10^0 \quad \text{and} \quad 56720_{10}=5 \times 10^4 + 6 \times 10^3 + 7 \times 10^2 + 2 \times 10^1 + 0 \times 10^0$$

✚ Binary numeral system

The binary numeral system, or base-2 number system, is a numeral system that represents numeric values using two symbols, usually 0 and 1.

The following sequences of symbols could all be interpreted as the binary numeric value of 667:

1	0	1	0	0	1	1	0	1	1
	-		-	-			-		
x	o	x	o	o	x	x	o	x	x
y	n	y	n	n	y	n	y	y	y

➤ Binary arithmetic

Arithmetic in binary is much like arithmetic in other numeral systems. Addition, subtraction, multiplication, and division can be performed on binary numerals.

❖ Addition:

The simplest arithmetic operation in binary is addition. Adding two single-digit binary numbers is relatively simple:

$$0 + 0 \rightarrow 0$$

$$0 + 1 \rightarrow 1$$

$$1 + 0 \rightarrow 1$$

$$1 + 1 \rightarrow 0, \text{ carry } 1$$

For example:

In decimal numeral system $5 + 5 \rightarrow 0, \text{ carry } 1 \text{ (since } 5 + 5 = 0 + 1 \times 10)$

$7 + 9 \rightarrow 6, \text{ carry } 1 \text{ (since } 7 + 9 = 6 + 1 \times 10)$

In Binary numeral system

$$\begin{array}{r}
 11111 \text{ (carried digits)} \\
 001101 \\
 + 010111 \\
 \hline
 = 0100100
 \end{array}$$

❖ **Subtraction:**

Subtraction works in much the same way:

$$\begin{array}{l}
 0 - 0 \rightarrow 0 \\
 0 - 1 \rightarrow 1, \text{ borrow } 1 \\
 1 - 0 \rightarrow 1 \\
 1 - 1 \rightarrow 0
 \end{array}$$

Example:

$$\begin{array}{r}
 * * * * \text{ (starred columns are borrowed from)} \\
 1101110 \\
 - 0010111 \\
 \hline
 = 1010111
 \end{array}$$

Example:

$$\begin{array}{r}
 * * \text{ (starred columns are borrowed from)} \\
 1000 \\
 - 0011 \\
 \hline
 = 0101
 \end{array}$$

Multiplication:

Multiplication in binary is similar to its decimal counterpart.

$$\begin{array}{l}
 0 \times 0 \rightarrow 0 \\
 1 \times 1 \rightarrow 1 \\
 1 \times 0 \rightarrow 0 \\
 0 \times 1 \rightarrow 0
 \end{array}$$

