Computers: Hardware and Software

- A **computer** is a device that can perform computations and make logical decisions billions of times faster than human beings can.
- Many of today’s personal computers can perform several billion additions per second.
- Today’s fastest **supercomputers** can perform thousands of trillions (quadrillions) of instructions per second!
- To put that in perspective, a quadrillion-instruction-per-second computer can perform more than 100,000 calculations per second for every person on the planet!
 Computers: Hardware and Software (Cont.)

- Computers process data under the control of sets of instructions called computer programs.
- These programs guide the computer through orderly sets of actions specified by people called computer programmers.
- A computer consists of various devices referred to as hardware (e.g., the keyboard, screen, mouse, hard disk, memory, DVDs and processing units).
- The programs that run on a computer are referred to as software.
- Hardware costs have been declining dramatically in recent years, to the point that personal computers have become a commodity.
**Data** - raw facts

**Information** - meaningful data

(useful output)
Number Systems:

*Decimal Numbers*
- Base 10 Notation

*Binary Numbers*
- Base 2 Notation
Bits and Bytes:

- Bit = \textit{binary digit} - Smallest unit of data
- Byte = 8 \textit{bits}
Computers represent data with electrical switches.

On-off circuits are simple and are not prone to errors.

One byte is made up of 8 bits.

(binary 01001000 = decimal 72)

(ASCII 01001000 = the letter “H”)

= 1

= 0
Computer parts communicate using binary numbers.

The greater the number of bits moved at one time, the faster the processing speed.
Text Codes:

EBCDIC “EB-si-dic”
- (Extended Binary Coded Decimal Interchange Code)

ASCII “As-key”
- (American Standard Code for Information Interchange)

Unicode
- (Unicode Worldwide Character Standard)
CPU (Central Processing Unit) - the brain of the computer

Two parts:

- CU (Control Unit)
- ALU (Arithmetic/Logic Unit)
Control Unit

Controls the flow of data into and from the Central Processing Unit.
Arithmetic/ Logic Unit - Performs Arithmetic functions and Logical operations.
The CU and ALU are in the CPU.
Types of Memory:

**ROM** - Read Only Memory
(contains the basic input output system or BIOS)

**RAM** - Random Access Memory
(user programs and data go here)
The ROM is nonvolatile because it will not lose its contents when powered down.

RAM plugs into sockets on the motherboard.
Adding RAM often increases system performance.
The CPU can read RAM much faster than it can the hard disk.
Amount Of RAM In Computers

The amount of memory in computers is typically measured in kilobytes or megabytes. One kilobyte (K or KB) equals approximately 1,000 memory locations and one megabyte (M or MB) equals approximately one million locations. A memory location, or byte, usually stores one character.

Therefore, a computer with 8 MB of memory can store approximately 8 million characters. One megabyte can hold approximately 500 pages of text information.
Storage Devices

Auxiliary storage devices are used to store data when they are not being used in memory. The most common types of auxiliary storage used on personal computers are floppy disks, hard disks and CD-ROM drives.
Floppy Disks

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.
Structure Of Floppy Disks

- Initially Floppy disks were 8-inches wide, they then shrunk to 5.25 inches, and today the most widely used floppy disks are 3.5 inches wide and can typically store 1.44 megabytes of data.

- A floppy disk is a magnetic disk, which means that it used magnetic patterns to store data.

- Data in floppy disks can be read from and written to.

- **Formatting** is the process of preparing a disk for reading and writing.

- A track is a narrow recording band that forms a full circle on the surface of the disk.
The disk’s storage locations are divided into pie-shaped sections called **sectors**.

A sector is capable of holding 512 bytes of data.

A typical floppy stores data on both sides and has 80 tracks on each side with 18 sectors per track.
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 120 GB (one billion bytes are called a gigabyte).
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.

- A CD-ROM (read only memory), is a compact disc that used the same laser technology as audio CDs for recording music. In addition it can contain other types of data such as text, graphics, and video.

- The capacity of a CD-ROM is 650 MB of data.
CPU Manufacturers:

- Intel
- Motorola
- AMD
- Cyrix
### CPU Models:

<table>
<thead>
<tr>
<th>Model</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>8086</td>
<td>1978</td>
</tr>
<tr>
<td>8088</td>
<td>1979</td>
</tr>
<tr>
<td>80286</td>
<td>1982</td>
</tr>
<tr>
<td>80386</td>
<td>1985</td>
</tr>
<tr>
<td>80486</td>
<td>1989</td>
</tr>
<tr>
<td>Pentium</td>
<td>1993</td>
</tr>
<tr>
<td>Penium Pro</td>
<td>1995</td>
</tr>
<tr>
<td>Pentium II</td>
<td>1997</td>
</tr>
</tbody>
</table>
The Pentium II has 7.5 million transistors, more than double the number included on the original Pentium chip. It can operate from 233 MHz to 400 MHz and beyond.

About MHz: the faster the clock, the faster the processing speed. (1 MHz = 1 million clock cycles per second)