

■ Computer Programming ■

Lecture # 1
Chemistry Dept.

2nd Class
Instructor :- Yahiea Al-Naiemy

► Requirements and Grading:

First term Exam: 15 %, Second term Exam: 15 %
Final Exam: 50 %
Homeworks, Quizzes and Class attendance: 4 %
Laboratory: 16%

► Course Materials:

Suggested references that covers Computer Science & Programming (any textbook).
Also, some useful web sites:

<http://computer.howstuffworks.com/>
<http://www.cgw.com/>
<http://www.computerworld.com/>
<http://www.computerandvideogames.com>
<http://www.apple.com/mac/>
<http://www.microsoft.com/en/us/default.aspx>
<http://www.pcmag.com/>
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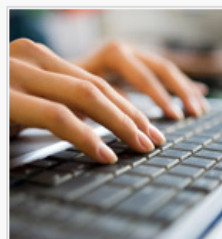
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C Program



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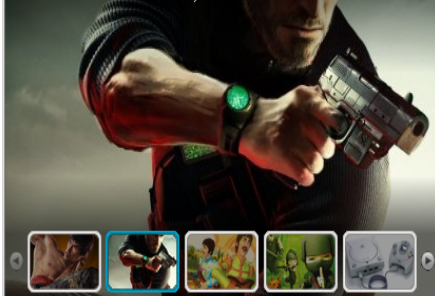
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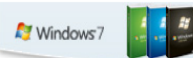
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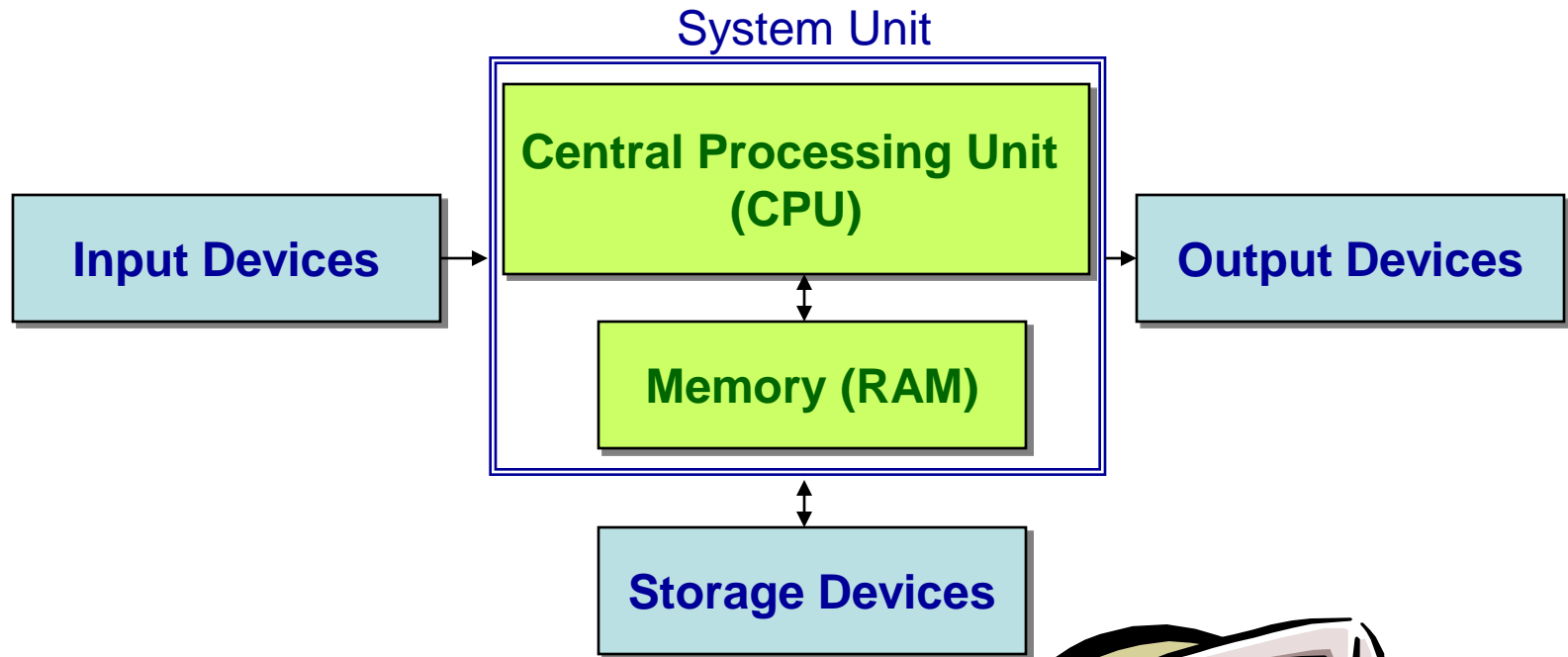
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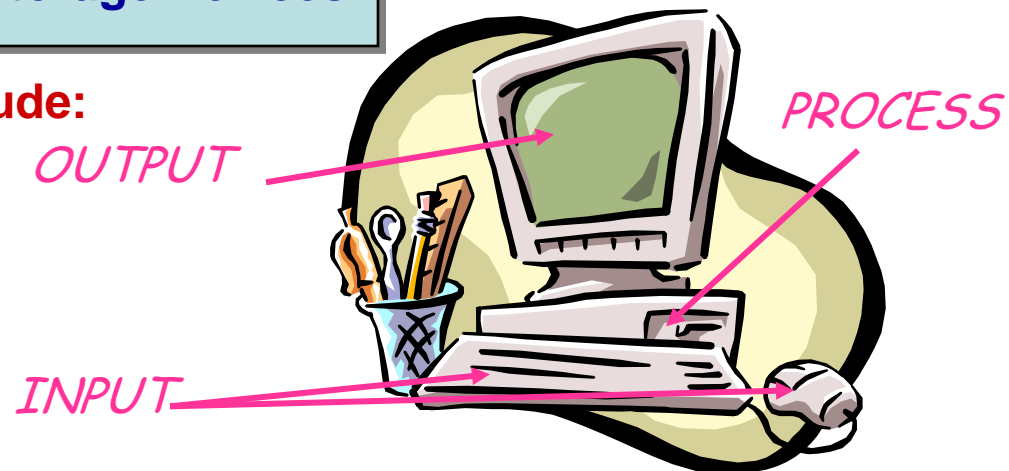
Introduction:

A **computer** is a machine that manipulates data according to a set of instructions. A computer is an *electronic machine* that can be programmed to *accept data (input)*, *process* it into *useful information (output)*, and *store* it in a **storage** media for future use.



Computer Data Processing could include:

- Arithmetic Operations.
- Logical Comparison.
- Transmitting Info.
- Receiving Info.
- Storing Info.



Von Neumann Model

Every computer today is based on the von Neumann Model. It is based on 3 ideas:

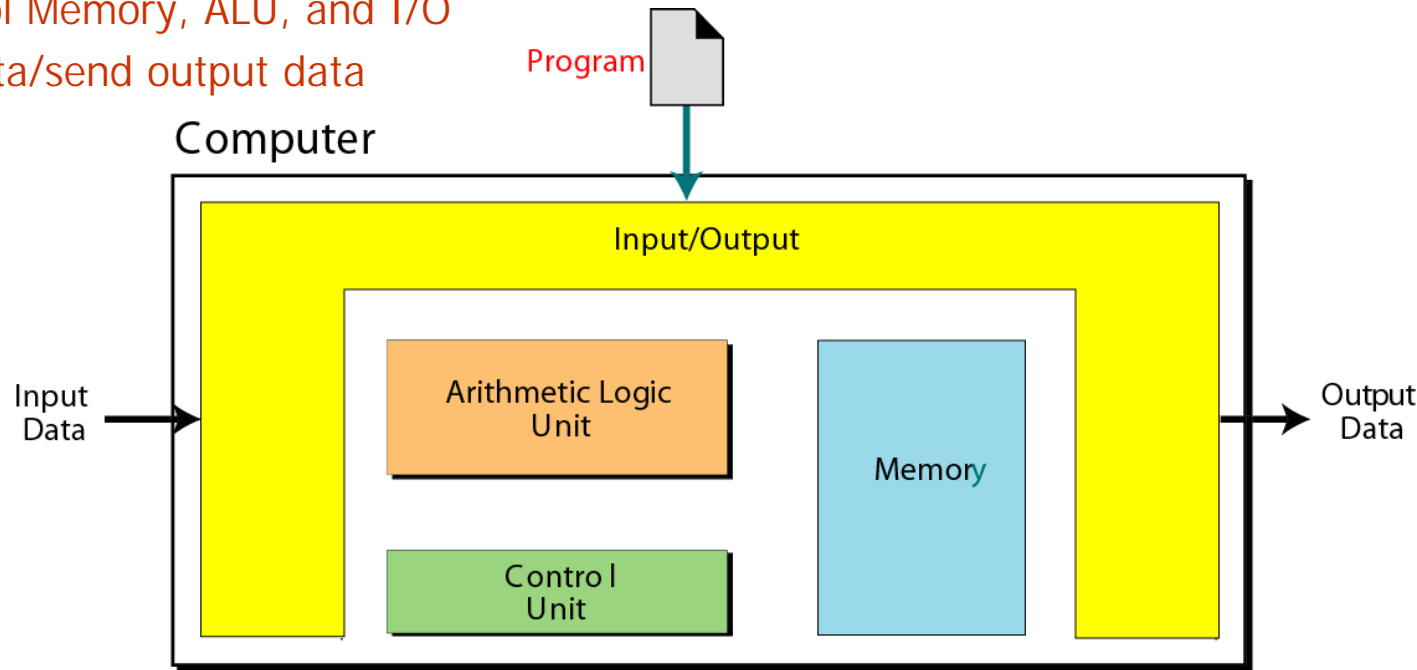
❑ Four subsystems.

1. Memory – the storage area of programs and data.

2. ALU – arithmetic/logic operations take place

3. Control Unit – control Memory, ALU, and I/O

4. I/O – accept input data/send output data



❑ Stored Program Concept.

❑ Sequential Execution of Instructions.

One or more pieces of data are *read* from memory (one at a time), The data is processed in the CPU, The results are *written* back into memory (one at a time)

Computer Components

Hardware: Electronic devices and Mechanical parts.

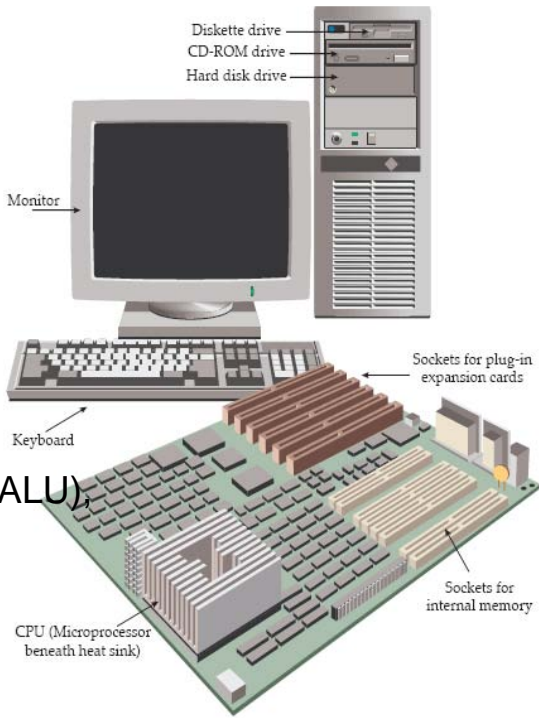
Software: Instructions.

Hardware

consists of three groups according to functionalities:

- Central Processing Unit (CPU).
- Memory Unit.
- Input/Output Unit (I/O)

A general purpose computer has four main components: the arithmetic logic unit (ALU), the control unit, the memory, and the input and output devices (I/O). These parts are interconnected by busses, often made of groups of wires. Inside each of these parts are thousands to trillions of small electrical circuits which can be turned **off** or **on** by means of an electronic switch. Each circuit represents a bit (binary digit) of information so that when the circuit is on it represents a "1", and when off it represents a "0" (in positive logic representation). The circuits are arranged in logic gates so that one or more of the circuits may control the state of one or more of the other circuits. The control unit, ALU, registers, and basic I/O are collectively known as a central processing unit (CPU).



Control Unit: The control unit manages the computer's various components; it reads and interprets (decodes) the program instructions, transforming them into a series of control signals which activate other parts of the computer.

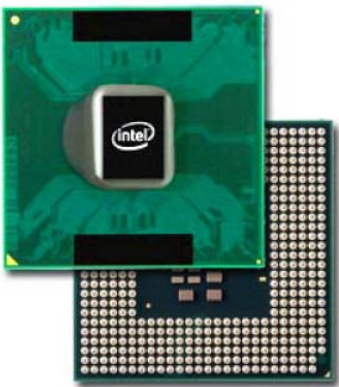
Arithmetic Logic Unit : The ALU is capable of performing two classes of operations: arithmetic and logic.

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 by a power	≤, ≤ less than or equal to, not less than or equal to

Central Processing Unit (CPU)

It is the *brain* of the computer, responsible for execute given instructions, and for arithmetic & logical processing, and control other hardware. **CPU examples:** Intel ® Core™, Intel Pentium, AMD Athlon™.

CPU Chip Type	386	486	P1	P4
No. Transistors	275,000	1,200,000	3,100,000	50,000,000
Frequency (MHz)	16-14	25-100	60-120	1000-3000
MIPS	11.4	54	112	9000
MIPS: millions of instructions per second				



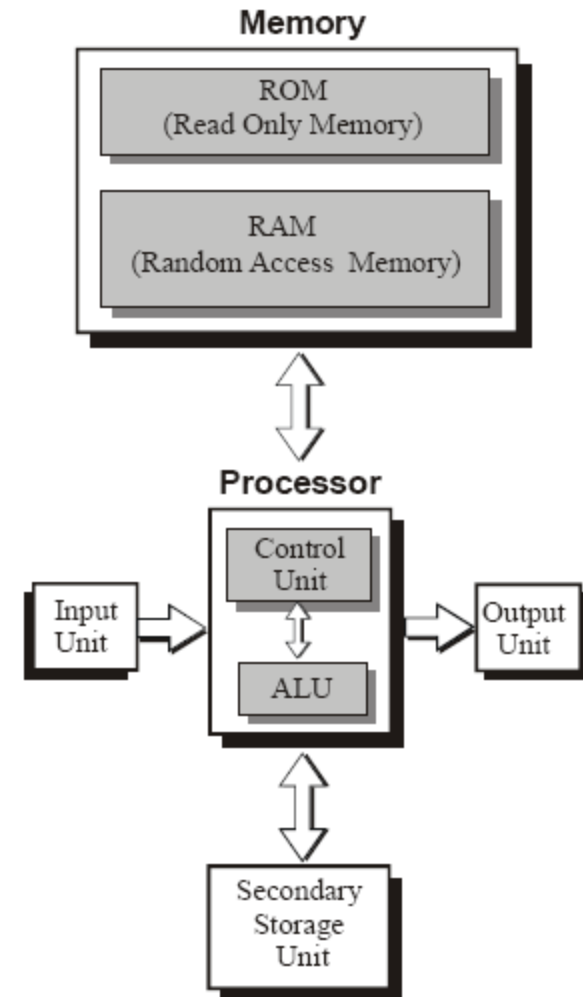
Some facts about CPU:

► The CPU speed is not controlled by the microprocessor itself, but by an external **clock** located on the *motherboard*. The speed of the processor is determined by the frequency of the clock signal. It is typically expressed in megahertz (**MHz**), and the higher the number, the faster the processor.

Memory Unit

The information stored in memory may represent practically anything. Letters, numbers, even computer instructions can be placed into memory with equal ease. Since the CPU does not differentiate between different types of information, it is the software's responsibility to give significance to what the memory sees as nothing but a series of numbers.

In almost all modern computers, each memory cell is set up to store binary numbers in groups of eight bits (called a byte). Each byte is able to represent 256 different numbers ($2^8 = 256$); either from 0 to 255 or -128 to +127. To store larger numbers, several consecutive bytes may be used (typically, two, four or eight). A computer can store any kind of information in memory if it can be represented numerically. Modern computers have billions or even trillions of bytes of memory. The CPU contains a special set of memory cells called registers that can be read and written to much more rapidly than the main memory area. Registers are used for the most frequently needed data items to avoid having to access main memory every time data is needed. As data is constantly being worked on, reducing the need to access main memory (which is often slow compared to the ALU and control units) greatly increases the computer's speed.



There are two types of memory:

⚙️ **Main memory:**

Main memory is temporary storage (e.g. current program), faster, more expensive.

Two types of memory are available: RAM and ROM.

1. Random-Access Memory (RAM):

RAM provides the bulk of the memory in a computer, can be read from and written to by the user. The information (program or data) is lost after the system is powered off. The more RAM a computer has, the more capacity the computer has to hold and process large programs and files. RAM can be installed on the motherboard, either as a permanent fixture, or in the form of small chips, referred to as Single Inline Memory Modules (SIMMs) or Dual Inline Memory Modules (DIMMs).

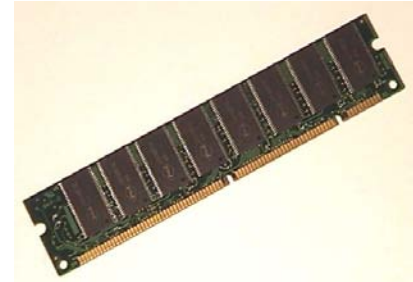
2. Read-Only Memory (ROM):

The contents of **ROM** come from the manufacturer; users are only allowed to read from it, but not write to it. A good example is the ROM-BIOS chip, which contains read only software. Often network cards and video cards also contain ROM chips. **ROM** is typically used to store the computer's initial start-up instructions.

In general, the contents of RAM are erased when the power to the computer is turned off, but ROM retains its data indefinitely. In a PC, the ROM contains a specialized program called the [BIOS](#) that loading the computer's [Operating System](#) from the hard disk drive into RAM whenever the computer is turned on or reset. In [Embedded computers](#), which frequently do not have disk drives, all of the required software may be stored in ROM.

Software stored in ROM is often called [Firmware](#), because it is notionally more like hardware than software.

[Flash memory](#) blurs the distinction between ROM and RAM, as it retains its data when turned off but is also rewritable. It is typically much slower than conventional ROM and RAM however, so its use is restricted to applications where high speed is unnecessary.



❁ Secondary memory:

Store data, slower, cheaper. Secondary memory like: Flash Memory, Floppy Disk, Hard Disk, Compact Disk (CD), Digital Video Disk (DVD). It holds data when the power is off.

Hard Disk Drive (HDD):

The HDD has a much larger storage capacity than the floppy for long-term storage. It stores programs and files, as well as the operating system. Typically, the HDD is an internal drive that cannot be removed from the computer.

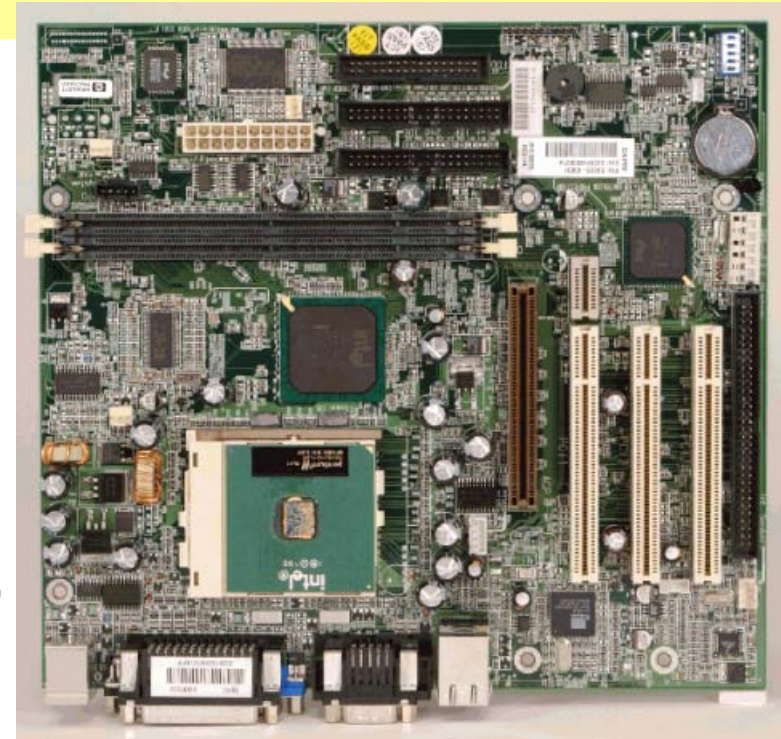


Motherboards

Knowledge of the **motherboard**, also called the system board or main board, is crucial because it is the nerve center of the computer system. Everything else in the system plugs into it, is controlled by it, and depends on it to communicate with other devices on the system.

It generally houses the CPU, the controller circuitry, the bus, RAM, expansion slots for additional boards, and ports for external devices.

In addition, it contains the CMOS and other ROM BIOS and support chips providing varied functionality.



Input/Output Unit

❑ **Input devices** take data into computer system like (Mouse, Keyboard, Joystick, Scanner, Web camera, Graphics Tablet, Microphone).

Scanner: allow to scan printed material and convert it into a file format that may be used within the PC.

Light Pens: Used to allow users to point to areas on a screen.

Touch Pads: A device that lays on the desktop and responds to pressure.

Joysticks: Many games require a joystick for the proper playing of the game.

Tracker Balls : an alternative to the traditional mouse and often used by graphic designers.



❑ **Output devices** provide data to outside of the systems (Printer, Monitor, Plotter, Speakers).

Printers: There are many different types of printers. In large organizations laser printers are most commonly used due to the fact that they can print very fast and give a very high quality output.

Plotters: A plotter is an output device similar to a printer, but normally allows you to print larger images and maps.

Speakers: Enhances the value of educational and presentation products.

Speech synthesizers: Give the ability to not only to display text on a monitor but also to read the text to the user.

Monitors

Computers are usually connected to a display, also called a monitor.

Some key monitor-related terms are: pixels, refresh rate, resolution, and size.



Pixels: Are picture elements. The screen image is made of pixels (tiny dots), which are arranged in rows across the screen. Each pixel consists of three colors: red, green, and blue (RGB).

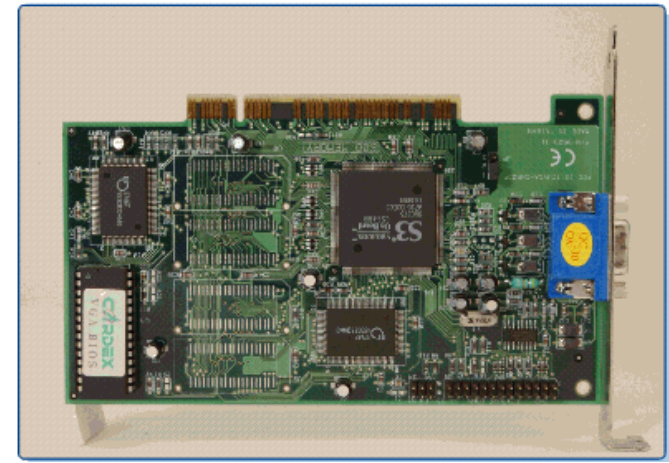
Dot pitch: A measurement of how close together the phosphor dots are on the screen. The finer the dot pitch, the better image quality (measured in millimeters).

Resolution: Varies based on the number of pixels. The more pixels in the screen, the better the resolution. Better resolution means a sharper image. The lowest screen resolution on modern PCs is 640 x 480 pixels, which is called Video Graphics Array (VGA). (This is the default resolution after installing a video card using Windows.)

Monitor screen sizes: Measured in inches. The most common sizes are 14", 15", 17", 19", and 21" screens, measured diagonally.

Video Cards: The video card or video adapter is the interface between the computer and monitor. The video card tells the monitor which pixels to light up, what color the pixels should be and the intensity of the color. The display capabilities of a computer depend on both the video adapter and the monitor.

Standard	Resolution	# of pixels	Rec. Size	Refresh Rate
VGA	640 x 480	307,200	14"	60 - 72 HZ
SVGA	800 x 600	480,000	15", 17"	75 - 85 HZ
SVGA	1024 x 728	786,432	17", 19"	75 - 85 HZ
XGA	1152 x 864	995,328	17", 19", 21"	75 - 85 HZ
XGA	1280 x 1024	1,310,720	19", 21"	75 - 85 HZ
XGA	1600 x 1200	1,920,000	21"	75 - 85 HZ



Input / Output (I / O) Ports

All peripheral devices that connect to the computer such as printers, scanners, and so on, use connectors on the back of the computer known as ports. There are different types of ports on the computer that serve different purposes. An I/O port is a pathway into and out of the computer.

1. SERIAL PORTS

A serial port can be used to connect devices that use a serial interface such as a modem, scanner, mouse, etc. Generally, a PC can identify up to four serial ports, but the typical computer contains only two, referred to as COM1 and COM2. A serial port transmits data bits one after the other (serially) over a single line.



2. PARALLEL PORTS

A parallel port is a socket on the computer that is used to connect a printer or other peripheral device such as a portable hard disk, tape backup, scanner, or a CD-ROM. The parallel port contains eight lines for transmitting an entire byte (8 bits) across the eight data lines simultaneously. Parallel ports can be configured as LPT1, LPT2, or LPT3.



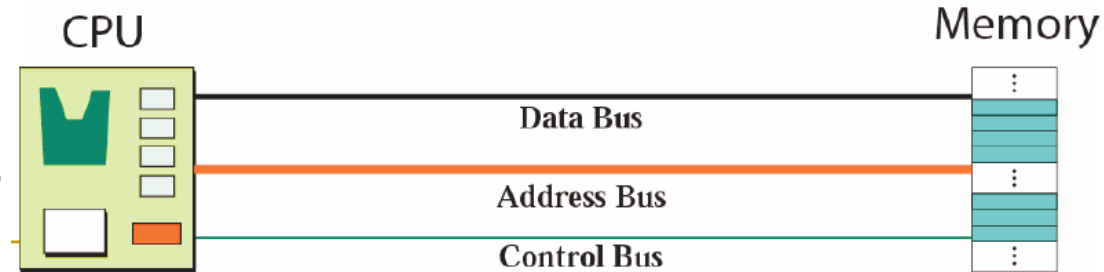
► Connecting CPU and Memory

A data bus, an address bus, and a control bus connect the CPU and the memory.

Bus: a group of wires, each carrying 1 bit at a time.

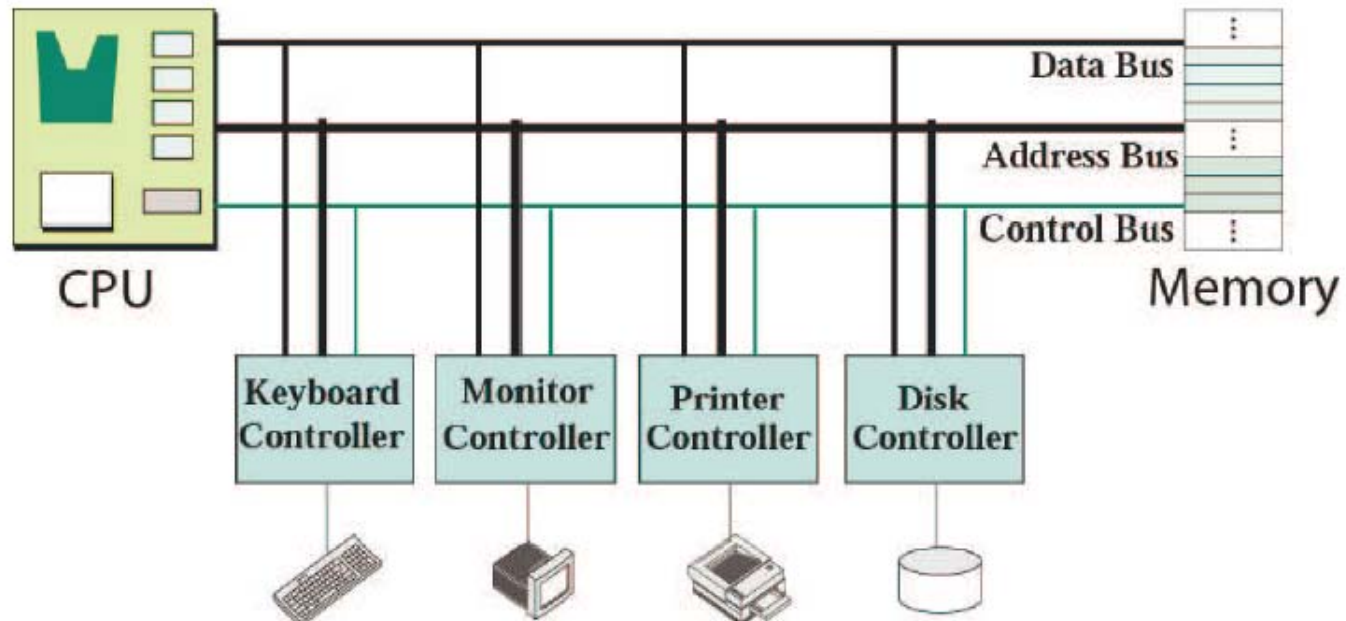
Number of wires of each bus:

- ◆ Size of the word.
- ◆ Address space of memory.
- ◆ Total number of control commands.

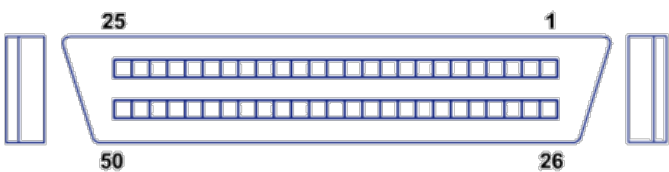


► Connecting I/O devices to the buses

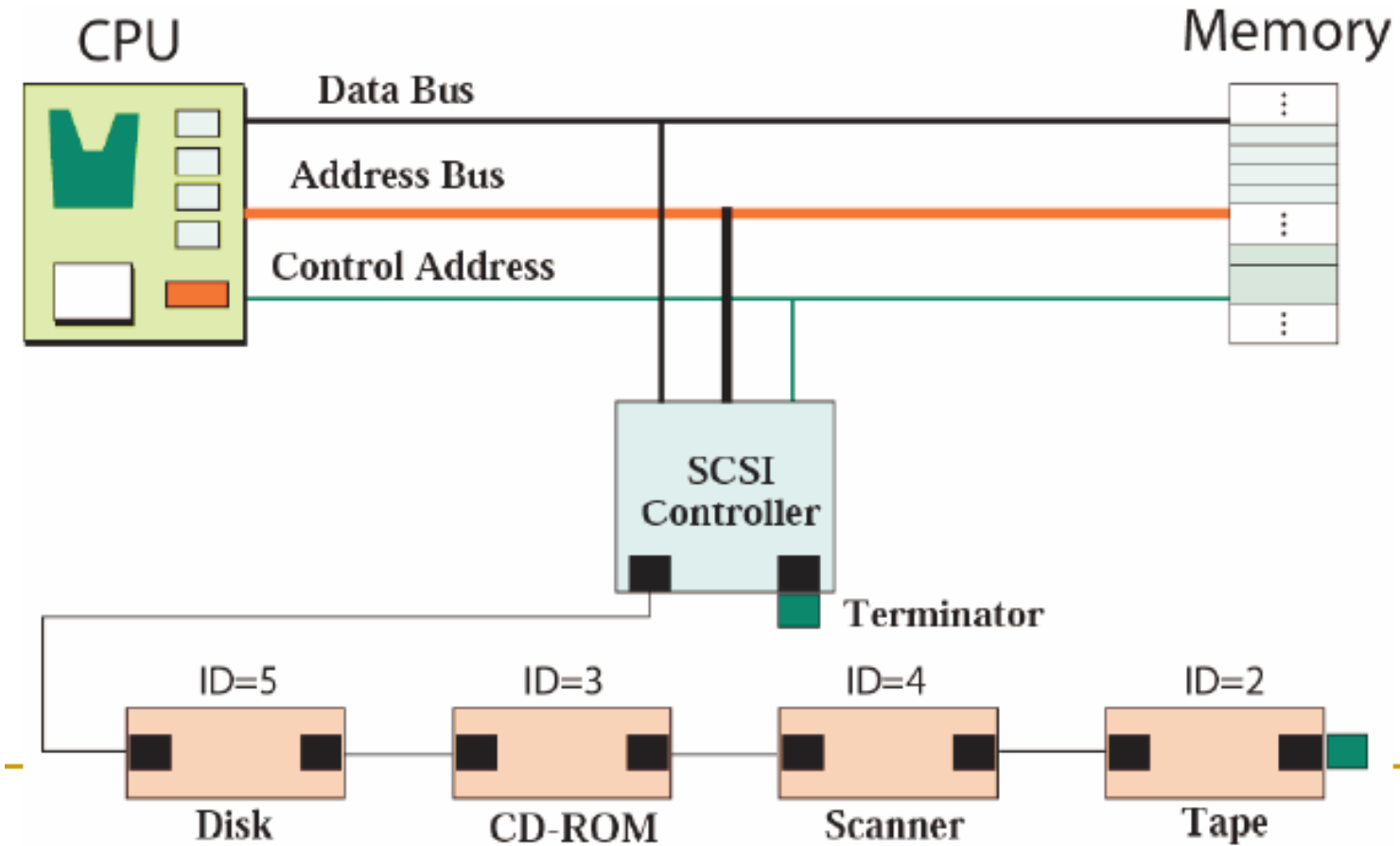
A controller handles the I/O operations between the CPU/memory and the much slower I/O devices. SCSI, FireWire, and USB are common controllers.



1. The Small Computer Systems Interface (SCSI) controller



It has a parallel interface with 8,16, or 32 wires.
Provide a daisy chained connection. Each device must have a unique address.
Transfer rate for SCSI : SCSI-1: 5MB/sec
Ultra-320: 320MB/sec



2. Universal Serial Bus (USB) controller:

USB is serial controller used to connect slower devices to a computer. It has four wire bus, two carry power to the device. USB is an external port that allows the user to connect up to 127 external PC peripherals.

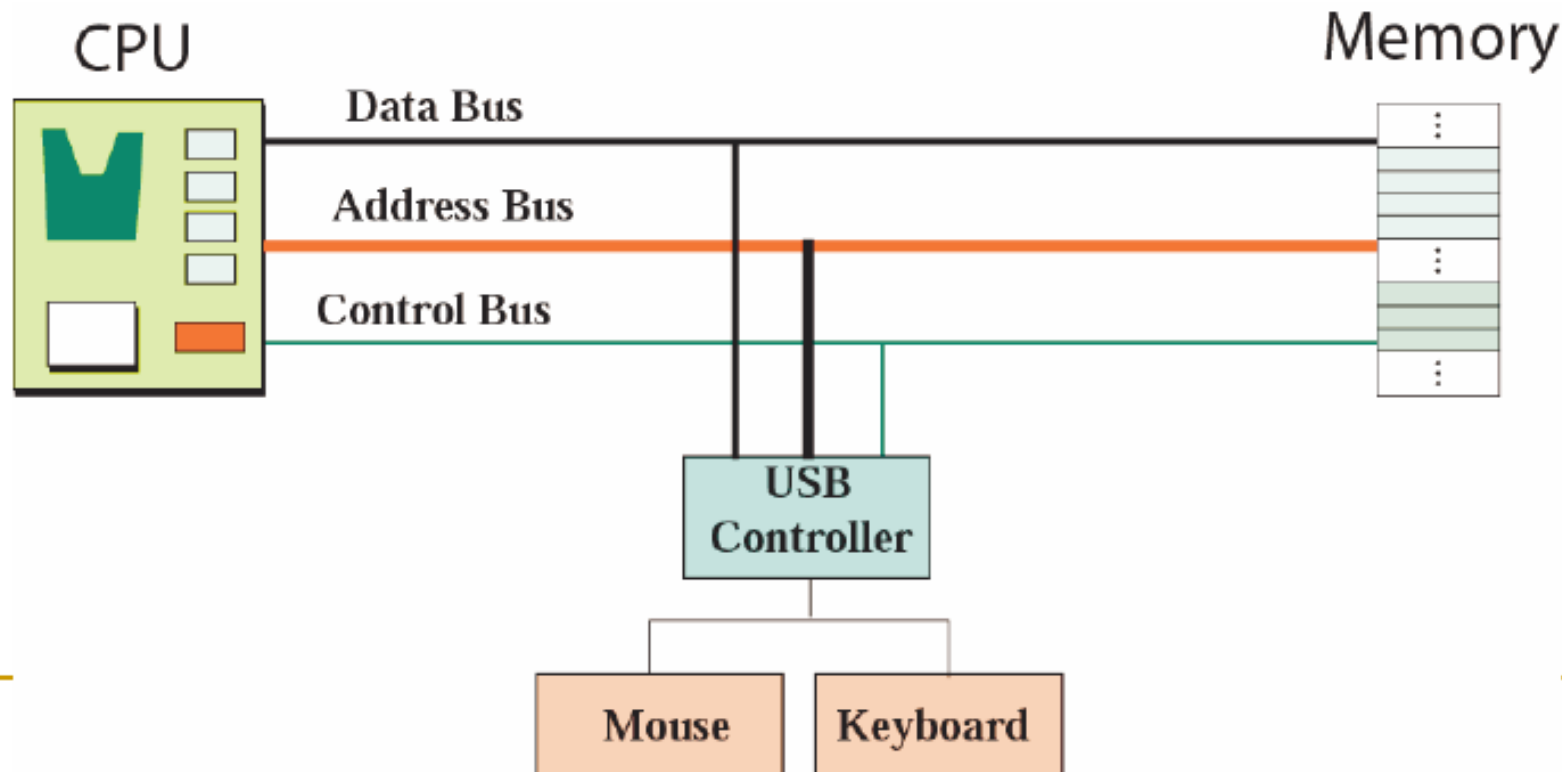
External peripherals include the following: USB keyboards, Mice, Printers, Modems, Scanners, Digital cameras, Digital video cameras, External disk drives.

Transfer Rate for USB:

Low Speed: 192 KB/sec.

Full Speed: 1.5 MB/sec.

Hi-Speed: 60 MB/sec.



3. FireWire controller

❑ High speed serial interface that transfers data in packets, also known as IEEE 1394.

- FireWire 400 (IEEE 1394a): 50 MB/sec.

- FireWire 800 (IEEE 1394b): 100 MB/sec.

❑ Connect up to 63 devices in a daisy chain or a tree connection.

