CSC 1100
Computer Literacy

Lecture 1
Introduction to Computers

Lecture objectives

- Define the term computer
- Categories of Computers
- Importance of computers in our society
- Define the term “computer system”
- Components of computer system

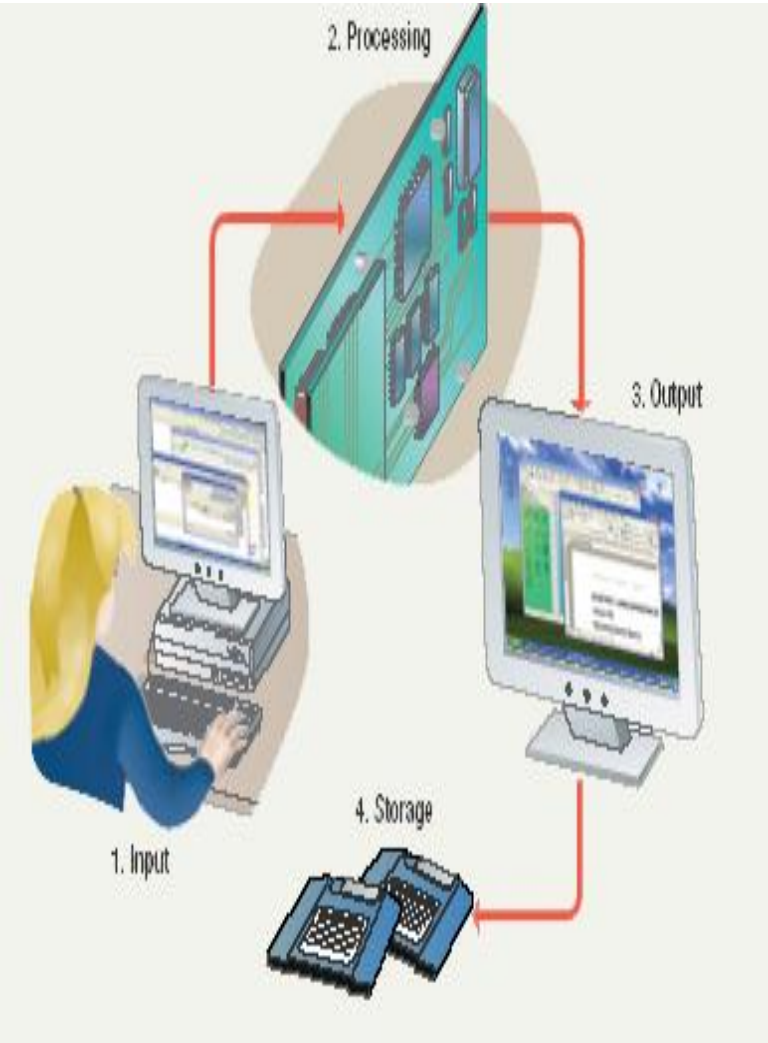
Definition of a computer

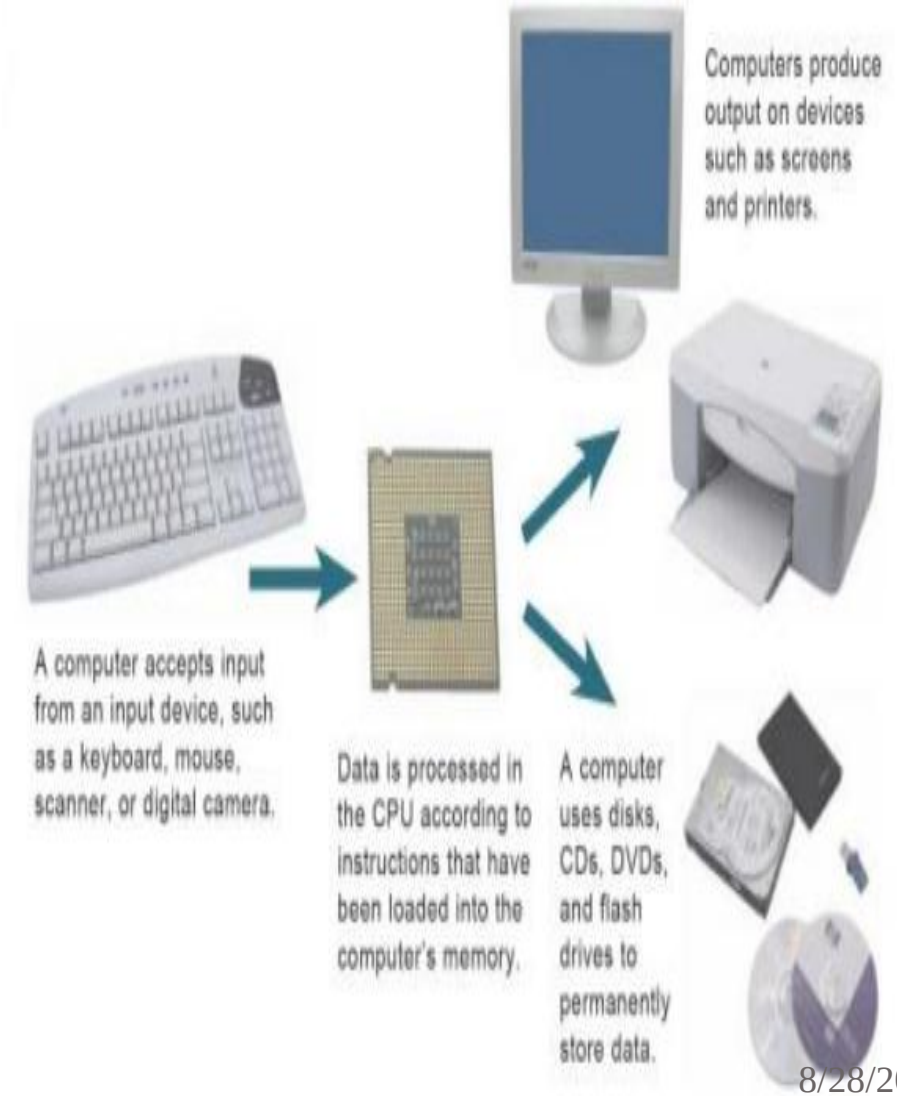
- By definition, a computer is an **electronic device** that processes data, converting it into information that is useful to people.

- Computers are controlled by programmed instructions that transform the data into meaningful information.

- Generally a Computer is a **device** that accepts **input**, **processes** it, **stores** data, and produces **output**.

Input, processing, storage, output





Input

- **Input**: Is whatever is typed, submitted or transmitted to a computer by a person, the environment, or another computer.

Examples of **Input**

- words and symbols
- numbers
- pictures
- audio signals from a microphone
- signals from another computer
- temperature, speed, pressures, etc. from sensors

Processing

- **Processing** - manipulation of data.
  - **Data** are symbols that represent raw facts, objects, and ideas about people, places, events, and things that are of importance in an organization.
  - A **computer program** or **software** is a series of instructions that tell a computer how to carry out a processing task.
- Examples of **Processing**
  - Arithmetic calculations
  - Sorting a list
  - Modifying pictures
  - Drawing graphs

Output

- Output - the result produced by a computer after processing the data.

- Output device –displays, prints, or transmits the results after processing.

- Examples of Output
  - images on a monitor
  - printed documents
  - sounds

Memory and Storage

- **Memory** - the area of a computer that temporarily holds data that is being processed or waiting to be processed, stored, or output.

- **Storage** - The area where data can be left on a permanent basis while it is not needed for processing.

- Examples of **Storage**
  - CD-ROM (Compact Disk Read-Only Memory)
  - Flash disks
  - Hard disks

Classification of Computers

- Computers are classified according to;
  - **Size:** Some computers are designed for individual use while others are for organizations.
  - **Technology:** Some computers are more powerful than others in terms of the speed at which they operate as well as the technologies they use.
  - **Purpose:** Some computers are designed to handle lighter tasks compared to others that can handle heavier tasks
- Because of the above factors, we have computers of different prices, having different hardware as well as compatible with different software.

Classification of Computers According to size

Supercomputers

- The most powerful computers made.
- Handle large and complex calculations.
- Because of their size and expense, supercomputers are relatively rare.
- These are used by research institutions, government agencies, and large businesses.

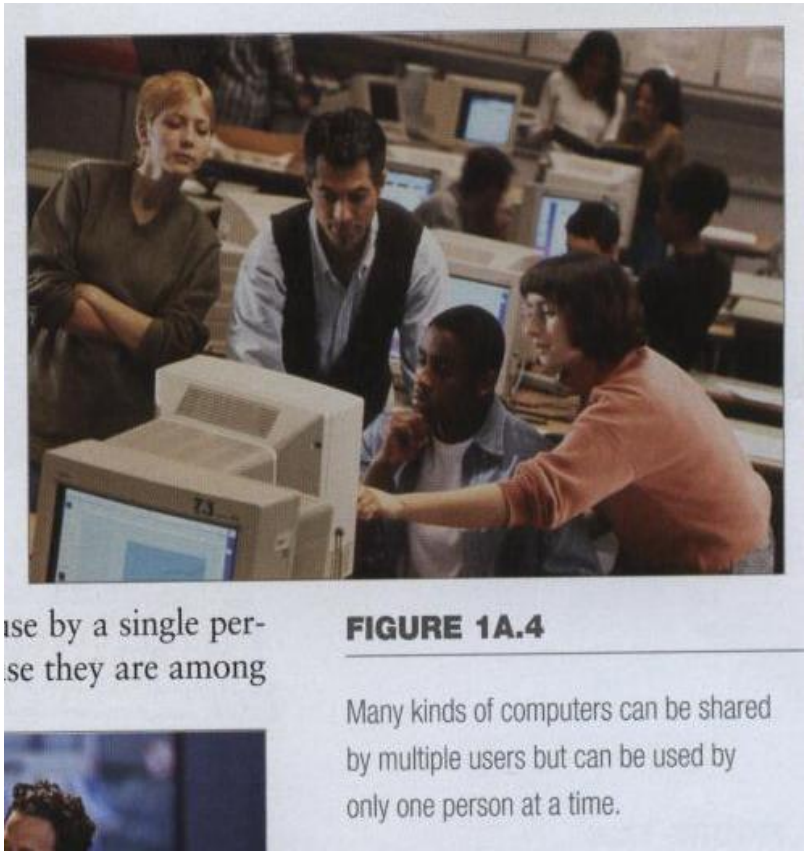
Classification of Computers According to size

- **Mainframe Computers**
  - Are slower, less powerful and less expensive than supercomputers.
  - Are used by banks and many businesses to update inventory etc.
  - Are used in large organizations where many users need access to shared data and programs.
  - Can support thousands of users, handling massive amounts of input, output, and storage.

Micro computers/Personal Computers

- Computers can be shared by multiple users but can be used by only one person at a time.

- Types of computers in this category include;
  - Desktop computers
  - Notebooks/Laptops
  - Tablet computers
  - Smart phones



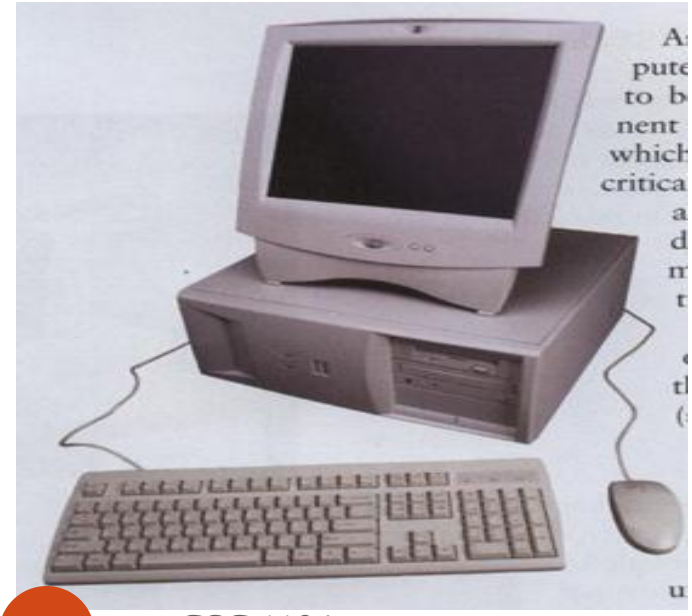
se by a single per-
se they are among

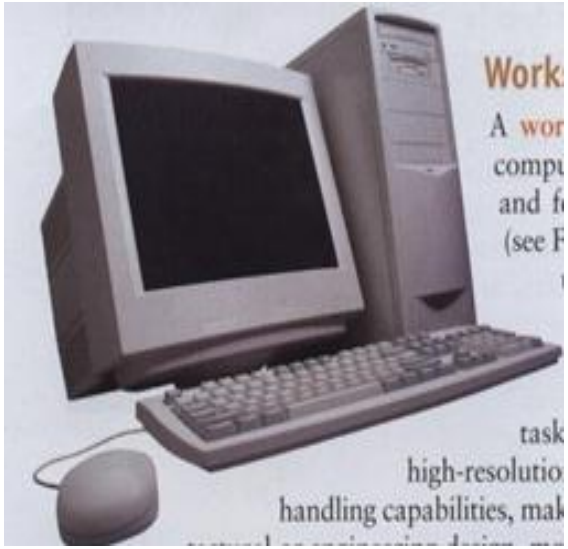
FIGURE 1A.4

Many kinds of computers can be shared by multiple users but can be used by only one person at a time.

Microcomputers

- **Desktop computers**
  - The most common type of computer
  - Sits on the desk or floor
  - Performs a variety of tasks including producing music, edit photographs and videos, play sophisticated games and videos





Microcomputers

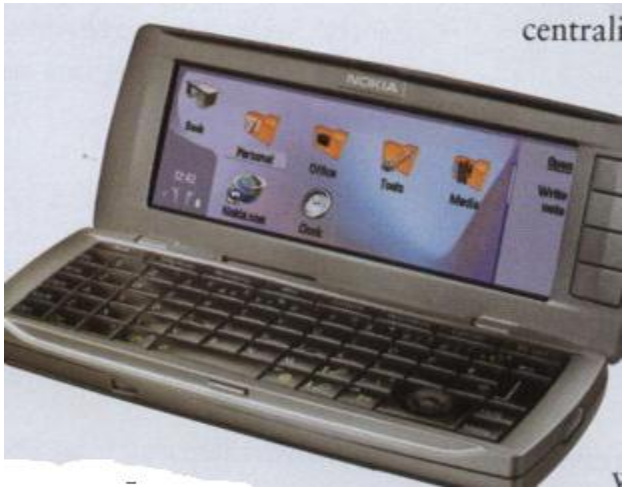
- **Notebook computers/ Laptops**
  - Small portable computers
  - Weighs between 3 and 8 pounds
  - People frequently set these devices on their laps hence **laptop computers**
  - Operate on alternating current or special batteries
  - When not in use, device folds up for easy storage.

Microcomputers

- **Tablet computers**
  - One of the new development in portable computers
  - Run specialized versions of office products

Microcomputers

- **Handheld computers**
  - Smallest and designed to fit in one hand
  - **Smart phones** are the mostly used hand held computers



Uses of Computers

- **Discuss the different uses of computers.**

Personal and Home Uses of Computers

Computers allow people with disabilities to do normal activities.

- Shopping online
- Playing games with other people
- Work from home
- Entertainment such as listening to music, watching videos etc.
- Enable communication through the use of (electronic mails) e-mails , chats etc.

Business Uses of Computers

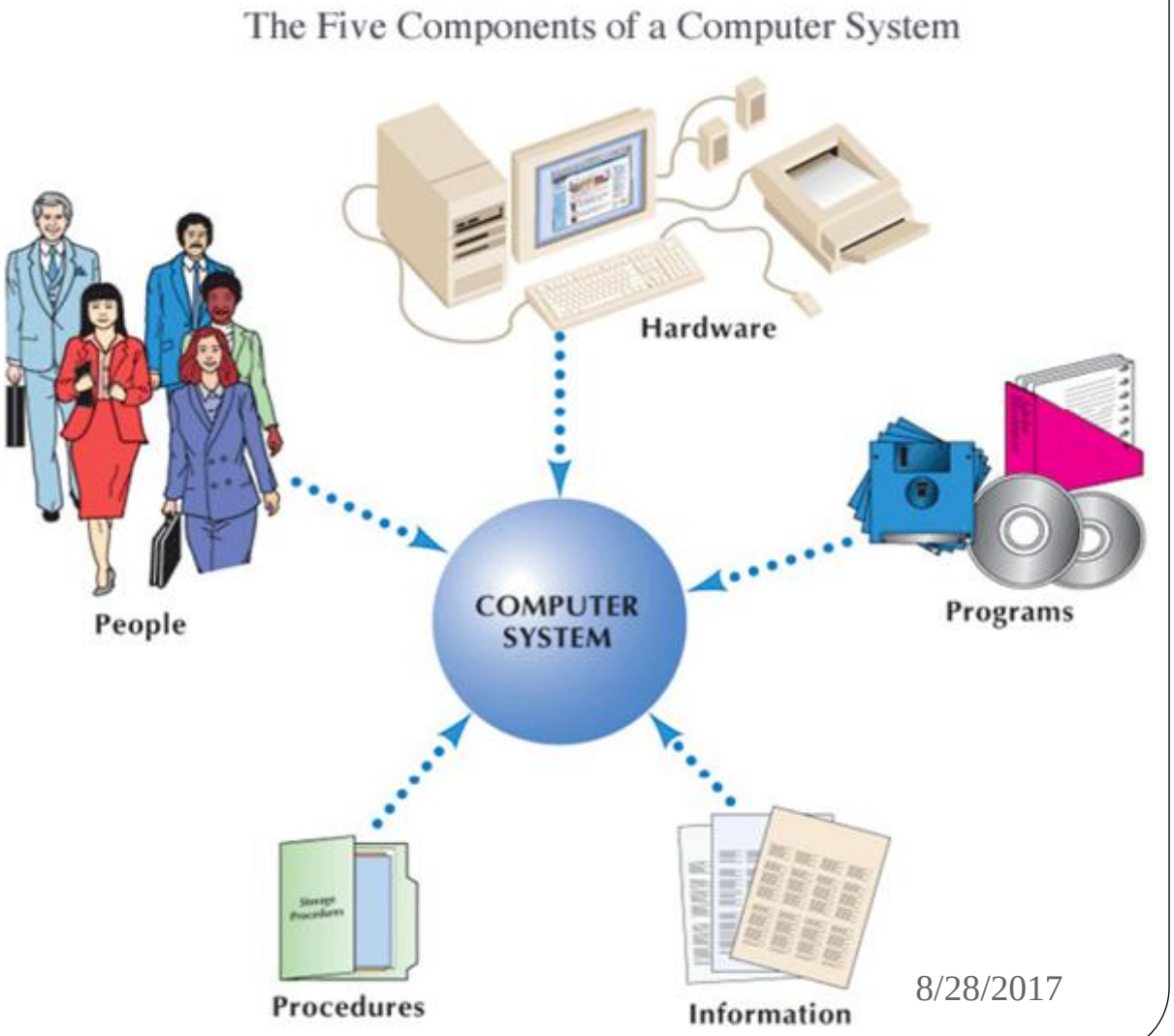
- Computers allow companies to keep large amounts of information at hand by using databases
- Makes ordering and tracking resources quicker and easier.
- Allows people to have meetings from different locations.
- Helps in information management which eases the process of decision making .

Educational Uses of Computers

- The Internet allows access to hundreds of online research materials.
- Allows colleagues to correspond quickly about ongoing research.
- Eases the process of analyzing research data.

Computer system

- **Computer System:** A computer and all the hardware interconnected with it**.**
  - Hardware
  - Software/Programs
  - Data/Information
  - People
  - Procedures



Parts of a computer system: Hardware

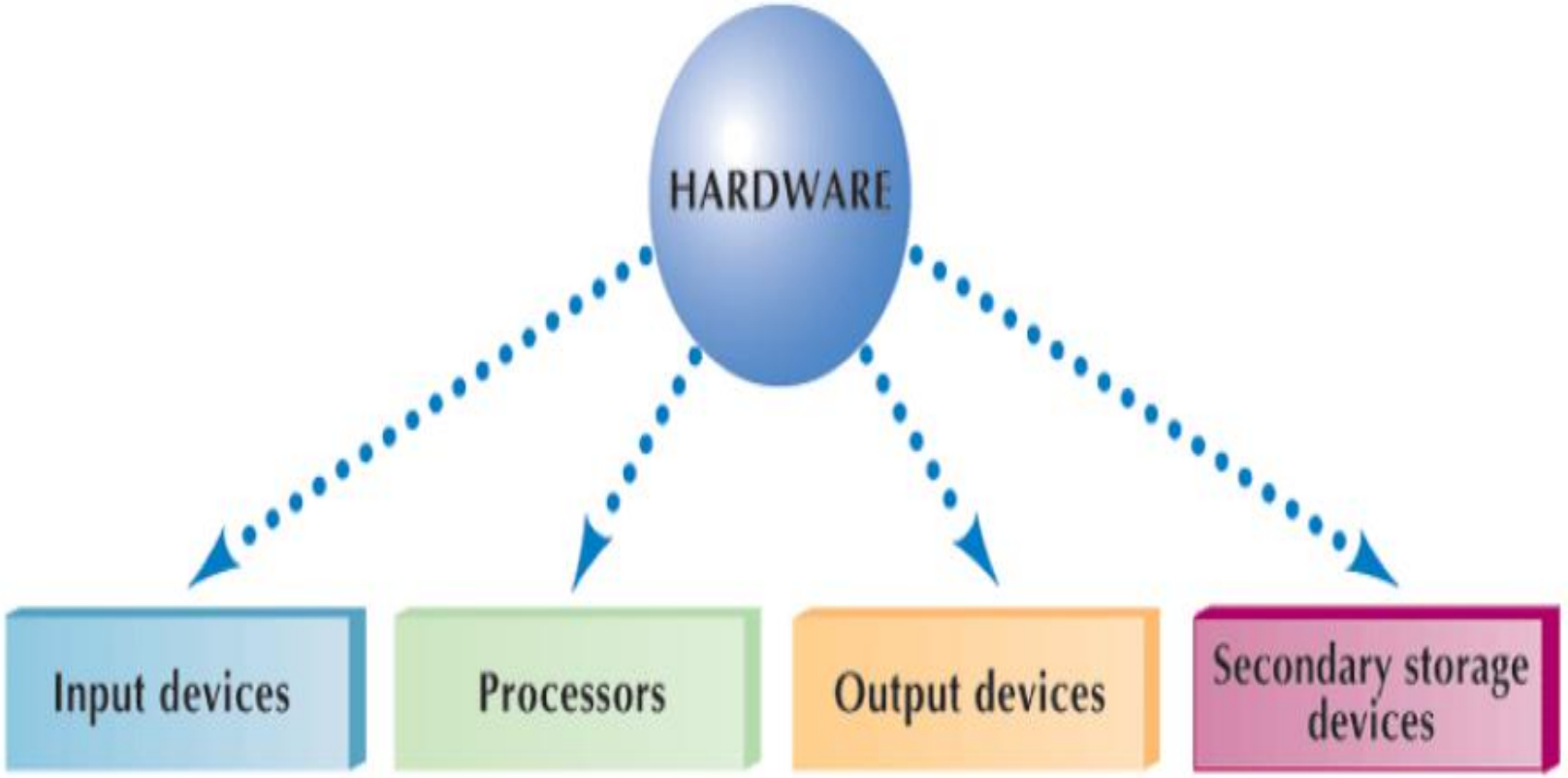
- A computer's hardware consists of electronic devices; the parts you can see and touch. In other words these are tangible parts of a computer.

- The term "device" refers to any piece of hardware used by the computer, such as a keyboard, monitor, modem, mouse, etc.

- These are mechanical devices that make up the computer.

Examples of Hardware

Categories of hardware



Hardware cont'd..

input devices

- ***Input:*** The data or information entered into a computer or the process of entering data or information into the computer for processing, storage and retrieval, or transmission.
  - Keyboards
  - Mouse
  - Touch screen
  - Digital camera
  - Scanner
  - Point of sale terminals
  - Bar code reader, microphones, prerecorded sources lie CD & DVS

Hardware cont'd..

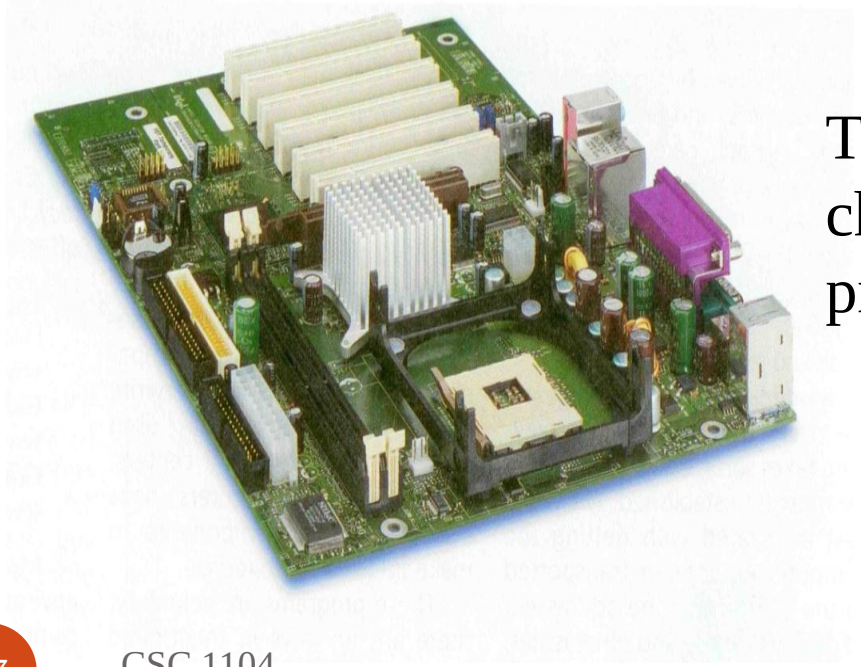
- ***Processor/Central Processing Unit (CPU):*** A set of electronic circuits that perform the computer's processing actions. In microcomputers, the processor is a microprocessor – a central processor contained on a single computer chip.

- A chip is a collection of electronic components in a very small, self-contained package. Chips perform the computer's processing actions, including arithmetic calculations and the generation of lines, images, and sound.

- Examples of chips include sound chips which generate signals to be output as tones.

System board

- The processor/CPU can take several forms. Microcomputers contain a specific micro-processor chip as their CPU. This is put into a protective package, and then mounted onto a board contained within the computer. This board is called a **system board or a mother board.**



The system board contains other chips and circuitry that carry out processing.

Hardware cont'd

- **Memory devices**
  - Memory is made up of one or more sets of chips that Store data or program instructions either temporarily or permanently. No processing takes place in memory. Instead, memory stores data, information and instructions. Memory is divided into **two types**:

a) **Random Access Memory (RAM)**

- RAM holds data and program instructions temporarily while the CPU works with them.
- RAM is volatile, meaning it holds data only when the power is on. When the power is off, RAM's contents are lost.
- More RAM results in a faster system.

Hardware cont'd

b) Read Only Memory (ROM)

- Permanent storage of programs.
- ROM is called non-volatile memory because it never loses its contents.
- Holds instructions that the computer needs to operate.
- This type of memory lets you store the data needed to start up or boot the computer
- Essential start-up data contained in ROM is a computer BIOS
- The BIOS includes instructions on how to load basic computer hardware and includes a test referred to as a POST (Power On Self Test) that helps verify the computer meets requirements to boot up properly.

Hardware cont'd

b) Read Only Memory (ROM)

- Permanent storage of programs.
- ROM is called non-volatile memory because it never loses its contents.
- Holds instructions that the computer needs to operate.

- Memory is measured interms of:
  - Kilobyte (KB) - 1,000 bytes
  - Megabyte (MB) - 1,000,000 bytes
  - Gigabyte (GB) - 1,000,000,000 bytes
  - Terabyte (TB) - 1,000,000,000,000 bytes.

Hardware cont'd..

Output Devices

- Output: The results of inputting and processing data and information returned by the computer, either directly to the person using the system or to secondary storage.

- Common forms of output are reports, schedules, budgets, newsletter s among others. Examples of output devices include:
  - Printers
  - Speakers
  - Monitor
  - Microphones
  - Projectors

Note: Communications devices (such as modems and network interface cards) perform both input and output, allowing computers to share information.

Hardware cont'd

- **Storage Devices**
  - The purpose of storage is to hold data permanently, even when the computer is turned off.
  - 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, and an optical disk drive.
  - The most common optical storage devices are CDROM and DVD-ROM drives.

Hardware cont'd

- Three major **distinctions** between **storage** and **memory**.
  - There is more room in storage than in memory.
  - Contents are retained in storage when the computer is turned off, whereas programs or the data in memory disappear when you shut down the computer.
  - Storage devices operate much slower than memory chips, but storage is much cheaper than memory.

Peripherals

- A **peripheral device** designates equipment that might be added to a computer system to enhance its functionality.

- A peripheral device can be attached, either physically or in a wireless fashion to a computer system.
- Examples:
  - Printer
  - Digital camera
  - Scanner
  - Joystick

- Any device that is ready to communicate to a computer is said to be online. One that is not ready to communicate is said to be offline.

Computer Software

- **Software** is a set of instructions that drive a computer to perform specific tasks.
- These instructions tell the machine's physical components what to do.
- 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**.

Computer Software

1) **System software**: Is any program that controls the computer's hardware or that can be used to maintain the computer in some way so that it runs more efficiently.

- There are three basic types of system software:
  a) An **operating system** tells the computer how to use its own components. All computers require an operating system.
     - The OS tells the computer how to interact with the user and its own devices.
     - OS controls and ensures that the computer operates in the way intended in a systematic, reliable and efficient manner.
     - Examples of operating systems include Windows, Macintosh operating system and Linux.

Computer Software

b) A **network operating system** allows computers to communicate and share data across a network while controlling network operations and overseeing the network's security. Example is Windows server 2003.

b) A **utility** is a program that makes the computer system easier to use or performs highly specialized functions.

- Utilities are used to manage disks, troubleshoot hardware problems, and perform other tasks that the operating system itself may not be able to do. For example a Symantec antivirus, Partition Magic etc.

Computer Software

2) **Application Software:** Tells the computer how to accomplish specific tasks, such as word processing or drawing, for the user. Some of the major categories of these applications include:

- Word processing software for creating text-based documents
- Spreadsheets for creating numeric-based documents such as budgets.
- Presentation programs for creating and presenting electronic slide shows.
- Graphics programs for designing illustrations or manipulating photographs, movies etc.
- Database management software for building and manipulating large sets of data such as names, addresses etc.

Data and Information

- **Data** are the words, numbers, symbols and graphics that describe people, events, things, and ideas. Data becomes information when it is used as the basis for initiating some action or for making a decision.

- **Information** are the words, numbers, and graphics used as the basis for human actions and decisions.

  - A set of data that has been given a name is called a file.
  - A file that a user can open and use is called **document**.
  - A **folder** is a place where groups of computer files and other folders can be kept and organized.

Files

- A **file** is a named collection of data, stored on a storage medium such as a hard disk.

- There are two types of **files**
  - **Data files** contains text, images, or other data that can be used by a program.
  - **Executable files** contains programs or instructions that tell the computer how to perform a task.

- **Filename extensions** describe a file's contents. For example Executable files usually end in .exe, word files end in .doc, adobe acrobat documents end in .pdf etc.

How Computers Represent Data

- The computer reads and stores data of all kinds in form of numbers.
- Computers use the **binary number system** while humans normally use **decimal number system**.

  - **Binary** number system
  - Has two distinct digits, 0 and 1
  - 0 and 1 combine to make numbers.

  - **Decimal** number system
  - Contains ten distinct digits e.g. 0 up to 9.
  - Digits combine to make larger numbers.

How computers represent Data cont'd

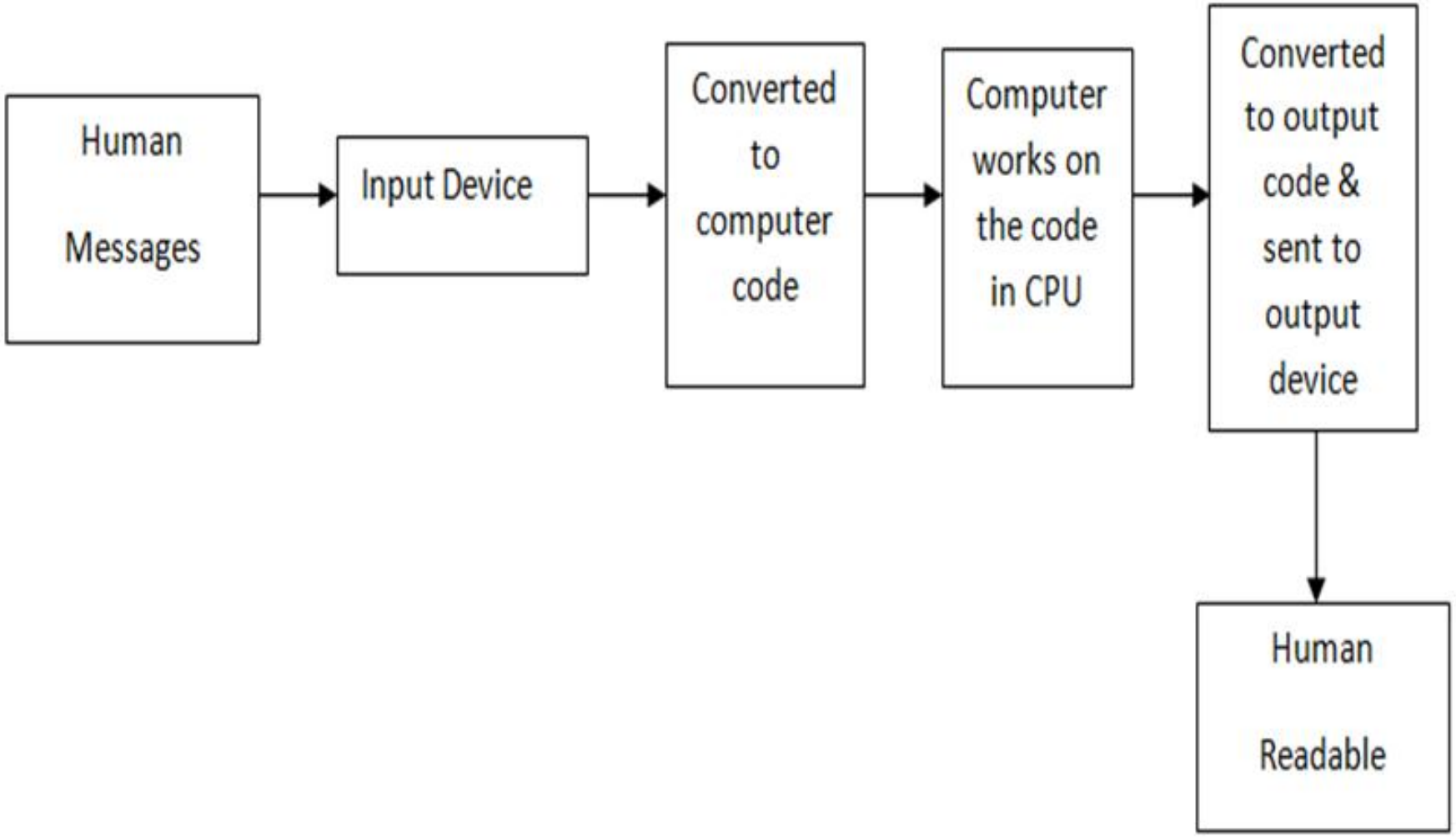
- The limitation of a computer to understand the human languages necessitated the changing of data to binary form, known as ***coding*** of data.

- In other words, to make communication possible between a computer and man, data must be coded in a form understandable to the computer.

- The information also supplied by the computer as a result of processing must be ***decoded*** in the form understandable to the user.

- The responsibility of coding and decoding in a computer system lies with the input and output devices.

How computers represent Data cont'd



Digital Data Representation

- The form in which information is conceived, manipulated and recorded.

- **Bit** (binary digit)
  - It is the smallest possible unit of data a computer can recognize or use.
  - Inotherwords, it is the Smallest unit of data representation.
  - 0 (off, No) OR 1 (on, Yes).

- **Byte**
  - The Smallest unit of data Storage.
  - A byte is 8 bits, about one character of data.
  - Half a byte is a nibble.

Bits and Bytes

- One **bit** is a single 0 or 1.
- One **byte** consists of 8 bits.
- One **kilobyte** consists of 1,024 bytes approximately 1000 bytes.
- One **megabyte** is 1,024 kilobytes or approximately 1 million bytes.
- One **gigabyte** is 1,024 megabytes or approximately 1 billion bytes
- One **terabyte** is 1,024 gigabytes or approximately 1 trillion bytes.

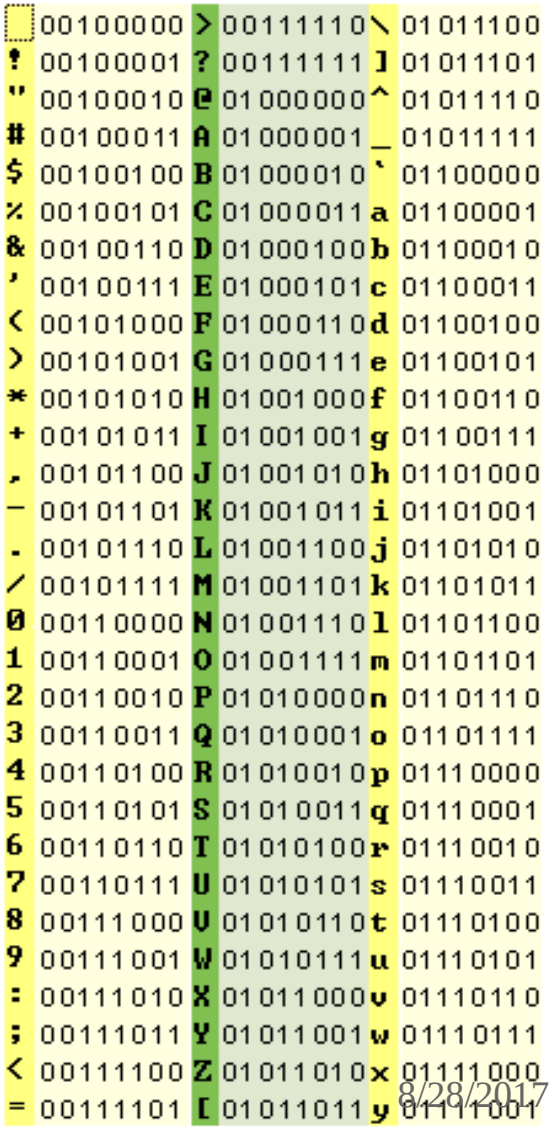
Numeric Data Representation Codes

- **Numeric data** consists of numbers that represent quantities and that might be used in arithmetic operations
- Binary (0, 1) vs. decimal number system (0-9)

Decimal (Base 10)	Binary (Base 2)
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000
9	1001
10	1010
11	1011
1000	1111101000

Character Data Representation Codes

- **Character data** is composed of letters, symbols, and numerals that will not be used in mathematical operations.
- The following are the most popular text code systems:
- **ASCII** (American Standard Code for Information Interchange) uses 7 bits to represent data.
- **Extended ASCII** uses 8 bits to represent data.
- **EBCDIC** (extended binary-coded decimal interchange code) uses 8 bits to represent data (used on old IBM mainframes)
- **Unicode** uses 16 bits to represent each letter, number or symbol.

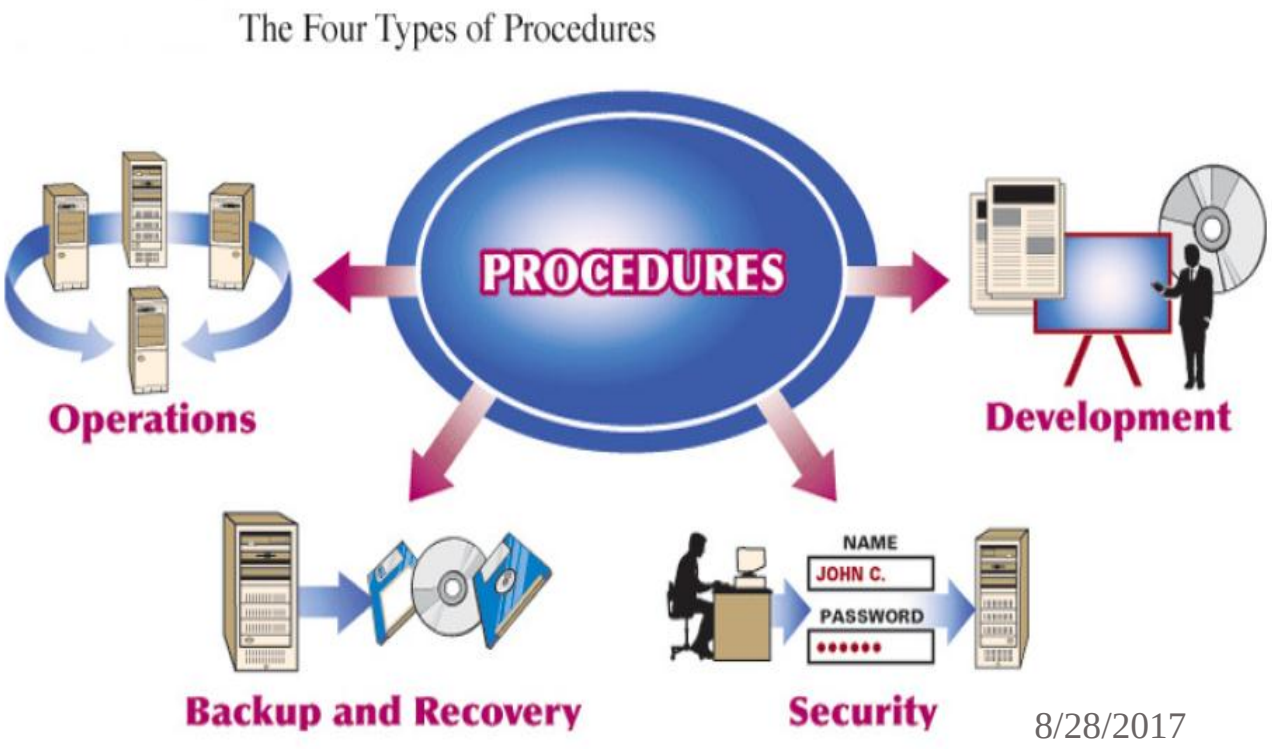


Components of a computer system : People

- Users and Creators of IT Applications
  - User (End User): The people who use computers in their jobs or personal lives
  - Programmer/Analyst: A person who has joint responsibility for determining system requirements and developing and implementing the systems.
  - Computer Engineer: Professional who designs, develops, and oversees the manufacturing of computer equipment.
  - Systems Engineer: Professional who installs and maintains hardware.

Components of a computer system: Procedure

- Procedure: A step-by-step process or a set of instructions for accomplishing specific results.
  - Operations
  - Backup and Recovery
  - Security
  - Development



Procedures cont'd…

- *Operations Procedure*: A procedure that describes how a computer system or application is used, how often it can be used, who is authorized to use it, and where the results of processing should go.

- *Backup Procedure*: A procedure that describes how and when to make extra copies of information or software to protect against losses.

- *Recovery Procedure*: An action taken when information or software must be restored.

Procedures cont'd…

- *Security Procedure*: A procedure designed to safeguard data centers, communications networks, computers, and other IT components from accidental intrusion or intentional damage.

- *Security Software*: Software that is designed to protect systems and data.

- *Development Procedure*: A procedure that explains how computer literates should describe user needs and develop applications to meet those needs.

Chapter Review Questions

1. Why are there different types of input devices?
2. Do all computers, regardless of size, have a processing unit? Why or why not?
3. Discuss the relationship between hardware and software.
4. Why do computers use binary numbering system?
5. What is the difference between data and programs?
6. What is the purpose of RAM? What is its relationship with secondary storage?
7. Why are some devices called peripheral equipment?
8. Why are procedures needed when managing computer systems?

Lecture 1 Part 2
Central Processing Unit (CPU)

- Components of CPU
- Data Processing in CPU
- Determining processor Speed

The Central processing Unit

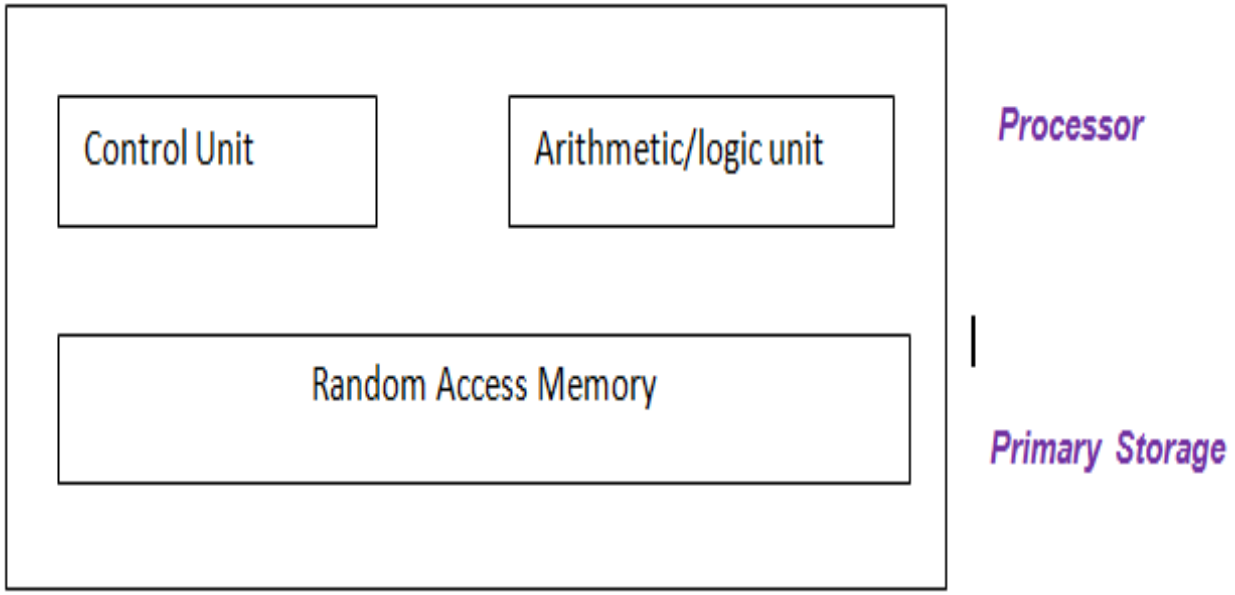
- The central processing unit (CPU): The heart and brain of the computer. It receives data input, processes information and executes instructions.

- It is the center of all processing activities. It is here that all processing is controlled, all data are manipulated, arithmetic computations are performed and logical comparisons are made.

  - System Unit: The hardware unit that houses a computer's processor, memory chips, ports, and add-in boards.

CPU components

- The most important components of the CPU are the ***Processor*** which comprises of the arithmetic /logic unit (ALU) and the control unit (CU) and the ***Primary storage or memory***.



Control Unit

- ***The Control Unit*** regulates the computer operations much as a "traffic cop" would. Its main functions are:
  - select and interpret instructions and to send appropriate signals to other units in the computer for their execution.
  - direct the flow of data through the CPU, and to and from other devices.
  - control, supervise, and oversees all the activities of a computer and monitors the execution of any program processed.
- The control unit can execute only one instruction at a time, but it can execute instructions so quickly (millions per second) that it can appear to do many different things simultaneously.

Arithmetic/Logic Unit

- The ***arithmetic/logic unit*** (ALU) performs the four basic arithmetic operations of addition, subtraction, multiplication and division as well as the logical operations of the comparison between two pieces of data i.e. Greater Than (>), Less Than (<), Equal To (=)

- All computer applications - from weather predictions to word processing are achieved through these five simple operations.

- The ALU operations are performed sequentially (one after another), based on instructions from the control unit.

Primary Storage

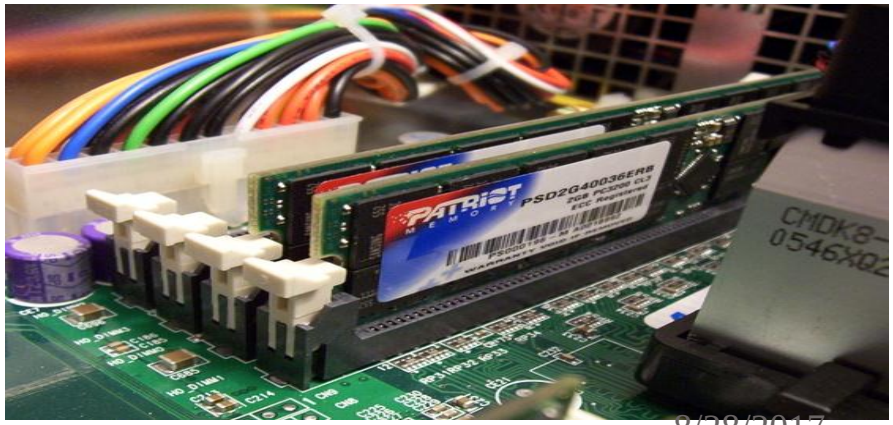
- Primary storage or main memory (RAM) stores data and program statements for the CPU. It has four basic purposes;

  - To store data that have been input until they are transferred to the arithmetic/logic unit for processing.
  - To store data and results during intermediate stages of processing.
  - To hold data after processing until they are transferred to an output device.
  - To hold program statements or instructions received from input devices and from secondary storage.

Primary Storage cont'd

- The larger the memory area, the larger the programs that can be stored and executed.

- In the earlier days, it was common to find personal computers with 4MB of RAM but as multi media (graphics, animation and video), becomes common in the market place, personal computers require high capacity of RAM i.e 128MB, *256MB*, *512MB*, *1GB*, *3GB*, *ITB etc*



The processing sequence - Machine cycle

- The CPU follows a set of steps-called a ***machine cycle*** for each instruction it carries out.

- By using a technique called pipelining, many CPUs can process more than one instruction at a time.

- *The machine cycle includes two smaller cycles*:
  - *The instruction cycle*
  - *The execution cycle.*

Instruction cycle

- *Fetching:* Before the CPU can execute an instruction, the control unit must retrieve (or "fetch") a command or data from the computers memory.

- *Decoding:* Before a command can be executed, the control unit must break down (decode) the command into instructions that correspond to those in the instruction set, and then sends to ALU.

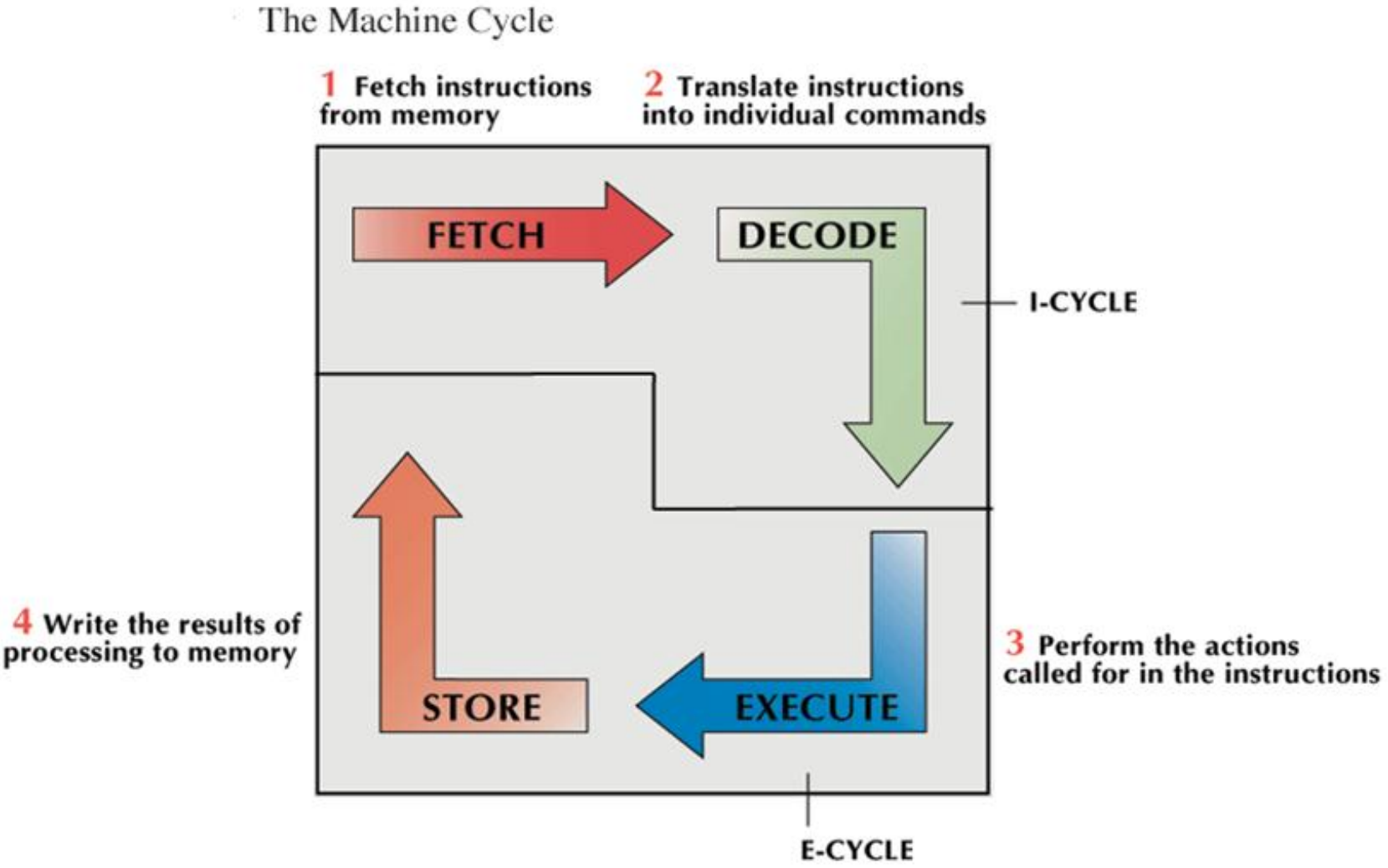
Execution cycle

- *Execution cycle.* The data is manipulated (worked on) by the computer.

- The results of the manipulations are *stored memory.*

- After the execution cycle, the process begins the next instruction. This process continues until the last instruction of the program has been executed.

The Machine Cycle cont'd



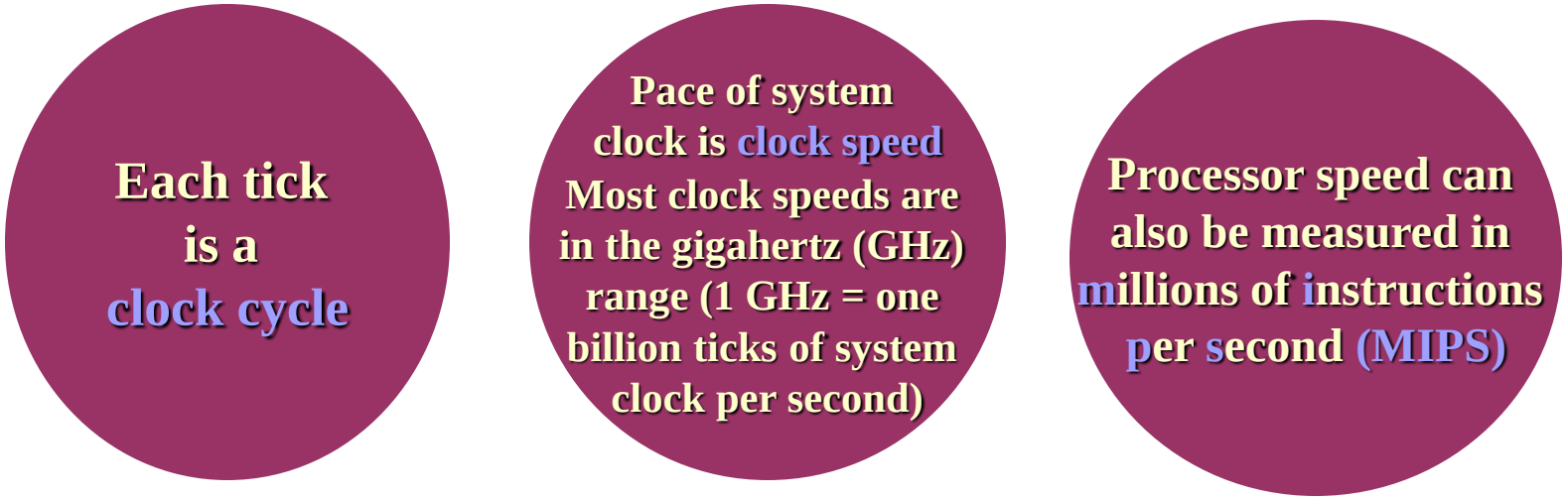
Processor Speed

Determining Processor Speed

- *5 elements:*
  - System Clock
  - Bus Width
  - Cache memory
  - registers
  - Available Memory (Internal Memory)

System Clock

- ***System clock*** is a component that provides the timing for all processor operations. It is located within the control unit.
- A single "tick" of the clock is the time required to turn a transistor off and back on. This is called a clock cycle.



If a computer has a clock speed of 300 MHz, then its system clock "ticks" 300 million times every second.

Clock speed has a tremendous impact on CPU performance. A CPU operating at 300MHz can process data nearly twice as fast as the same one operating at 166MHz

Bus Width

- ***A bus*** is a path between the components of a computer.
- There are two main buses in a computer: ***the internal (or system bus)*** **and the** ***external or (expansion) bus.***
  - The system bus resides on the motherboard and connects the CPU to other devices that resides on the motherboard.
  - An expansion bus connects external devices, such as keyboard, mouse, modem, printer, etc to the CPU.
  - The system bus has two parts: the data bus and the address bus.

Bus cont'd…

- The ***Data bus*** is an electrical path composed of parallel wires that connects the CPU, memory, and the other hardware devices on the motherboard.
- ***The address bus*** is a set of wires similar to the data bus. The address bus connects CPU to memory and carries only memory address
  - Requests for data are sent from the CPU to RAM along the address bus. The requests consist of a memory address.
  - The data comes back to the CPU via the data bus.
- The number of wires in the bus affects the speed at which data can travel between hardware components.
- Because each wire can transfer ***1 bit of data*** at a time, an 8-wire bus can move 8 bits at a time which is a full byte.

Registers

- **Registers are** high speed memory locations built directly into the ALU and used to hold instructions and data currently being processed.
- The size of the registers (also called word size) determines the amount of data with which the computer can work at any given time.
- The bigger the word size, the more quickly the computer can process a set of data.
- Today, most PCs have 32-bit registers, meaning the CPU can process four bytes of data at one time. Register sizes are rapidly growing to 64 bits.

Cache memory

- Moving data between RAM and the CPU's registers is one of the most time consuming operations a CPU must perform.
- A partial solution to this problem is to include a cache memory in the CPU.
- Cache memory is similar to RAM, except that it is extremely fast compared to normal memory and it is used in a different way.
- When a program is running and the CPU needs to read data from RAM, the CPU checks first to see whether the data is in cache memory.
- If the data is not there, the CPU reads it from RAM into its registers but also keeps a coy of the data in cache memory.

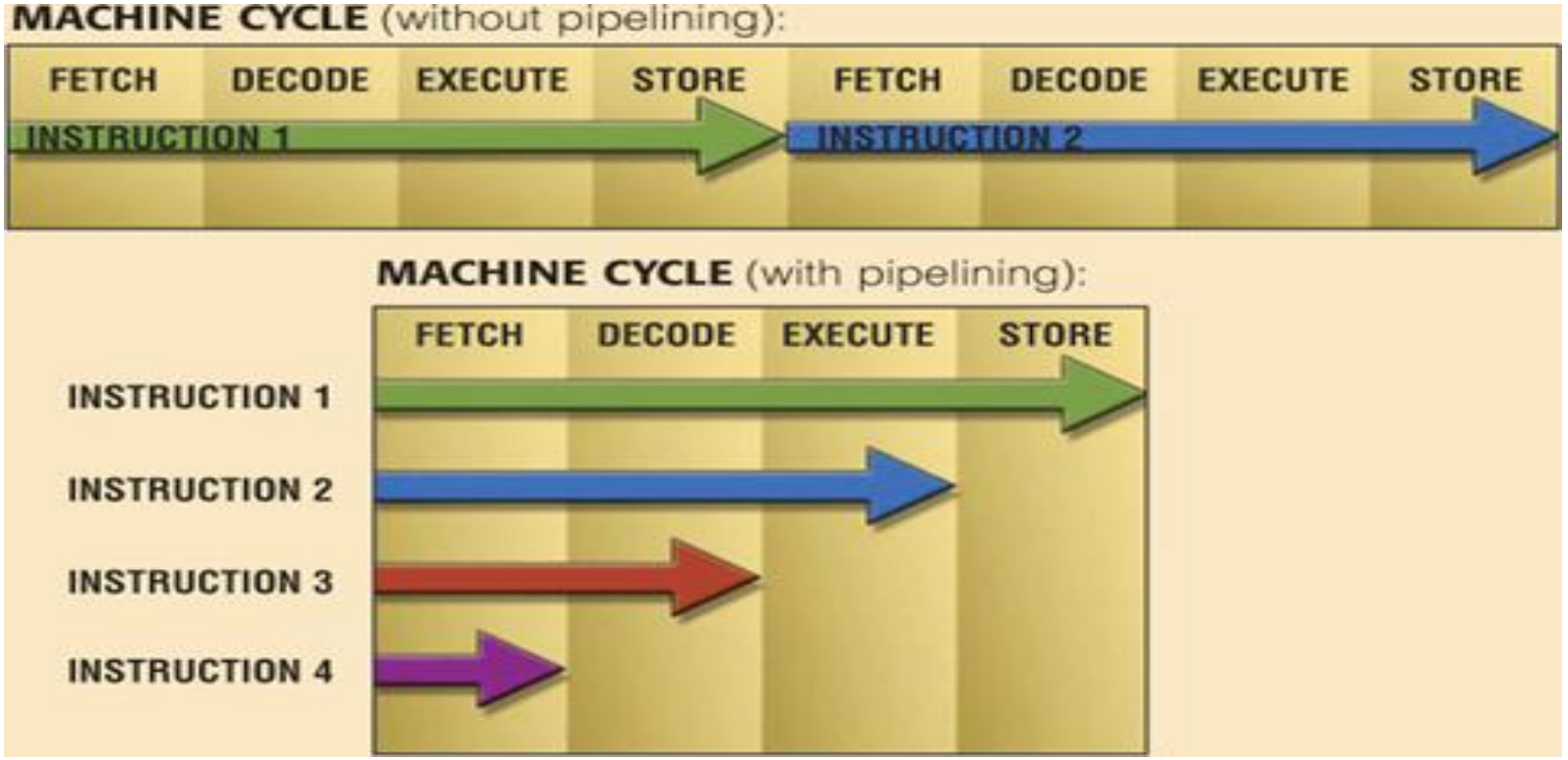
Cache memory

- The next time the CPU needs the same data, it finds it in the cache memory and saves the time needed to load that data from RAM.
- *Therefore, cache memory speeds up processing by storing frequently used data or instructions in its high speed memory.*
- Today, many CPUs have as much as 256KB cache memory built in.
- Cache memory is sometimes described in levels of closeness and accessibility to the microprocessor.

- Cache built into the CPU itself is referred to as *Level 1 (L1)* cache. Cache that resides on a the motherboard is also called *Level 2 (L2)* cache.

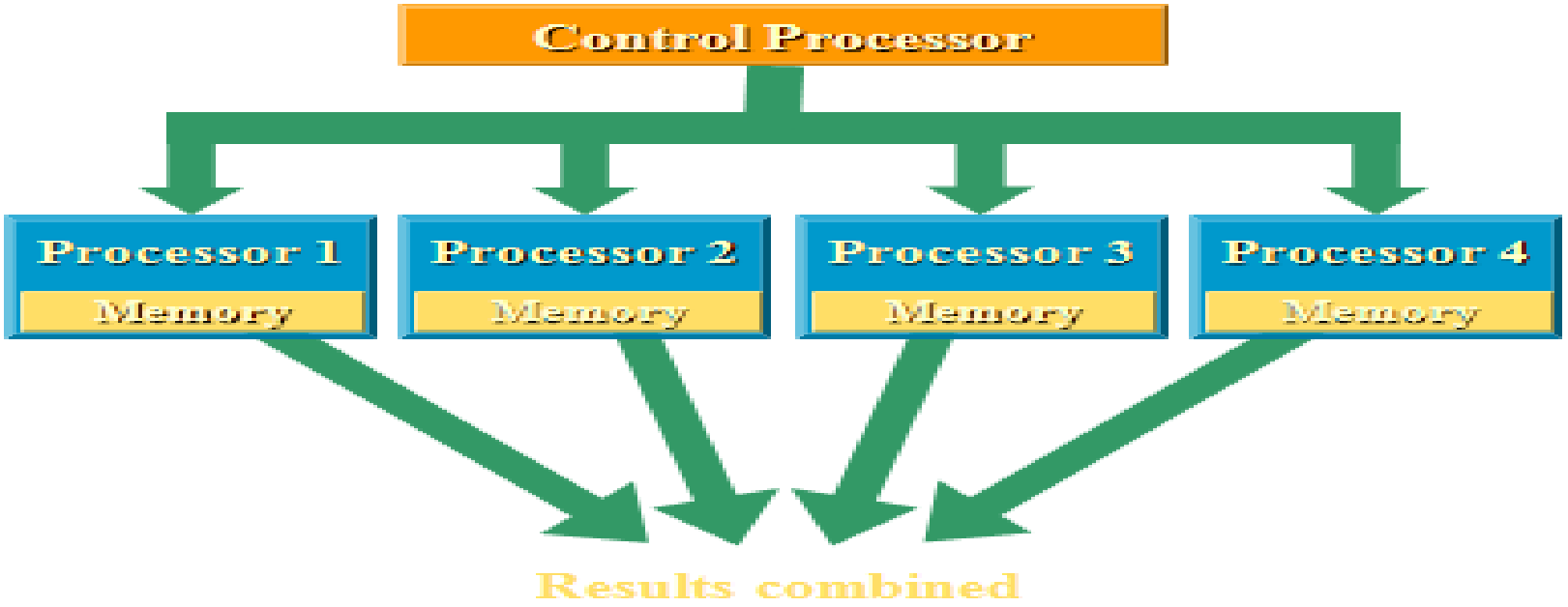
Pipelining

- ***Pipelining*** CPU begins fetching second instruction before completing machine cycle for first instruction
- Results in faster processing



Parallel processing

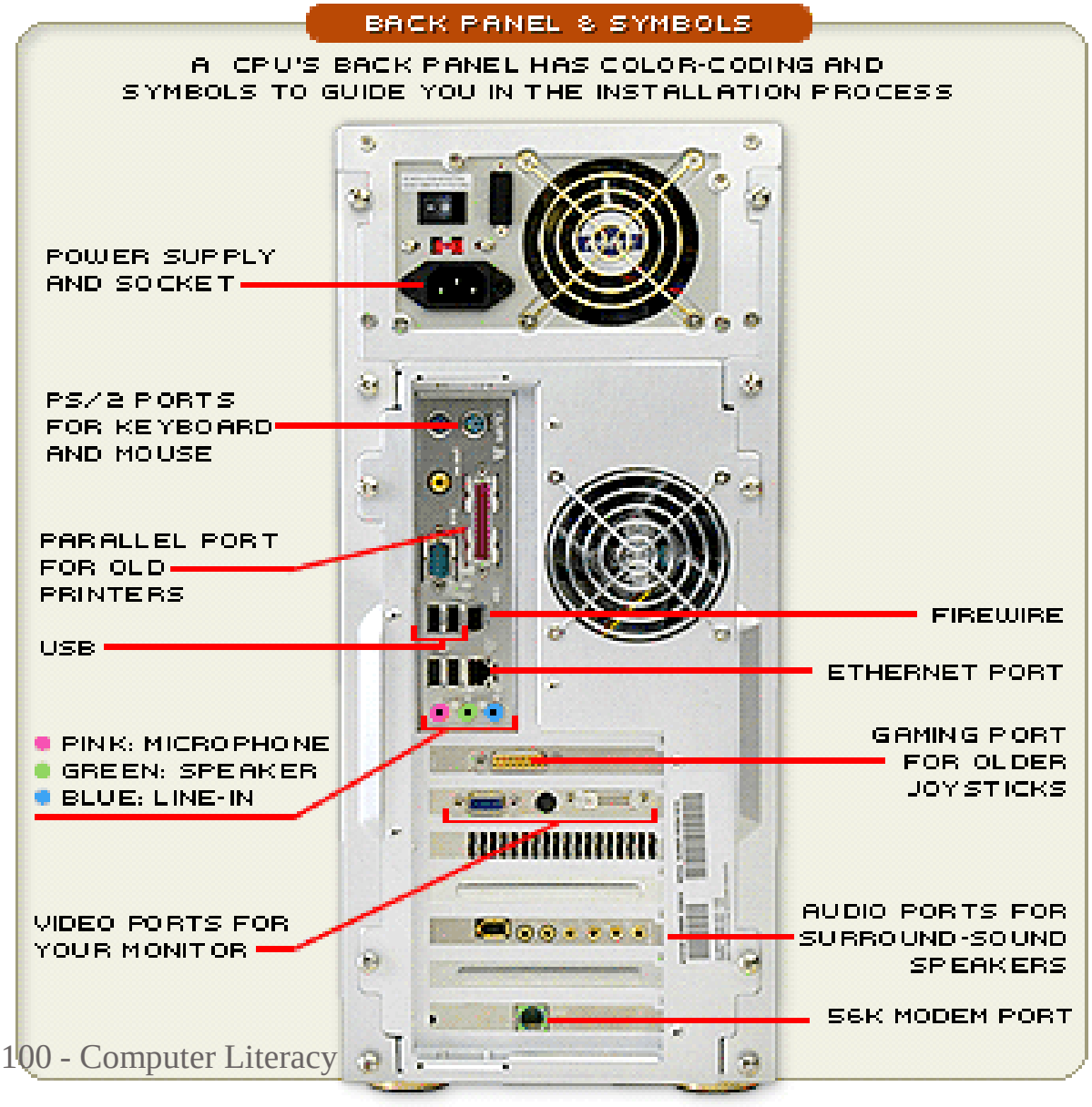
- ***Parallel Processing:*** Using multiple processors simultaneously to execute a program faster
- Requires special software to divide problem and bring results together.



Ports

- *Port:* A connector through which input/output devices can be plugged into the computer.

Ports cont'd


BACK PANEL & SYMBOLS
A CPU'S BACK PANEL HAS COLOR-CODING AND SYMBOLS TO GUIDE YOU IN THE INSTALLATION PROCESS
POWER SUPPLY AND SOCKET
PS/2 PORTS FOR KEYBOARD AND MOUSE
PARALLEL PORT FOR OLD PRINTERS
USB
PINK: MICROPHONE
GREEN: SPEAKER
BLUE: LINE-IN
VIDEO PORTS FOR YOUR MONITOR
FIREWIRE
ETHERNET PORT
GAMING PORT FOR OLDER JOYSTICKS
AUDIO PORTS FOR SURROUND-SOUND SPEAKERS
56K MODEM PORT

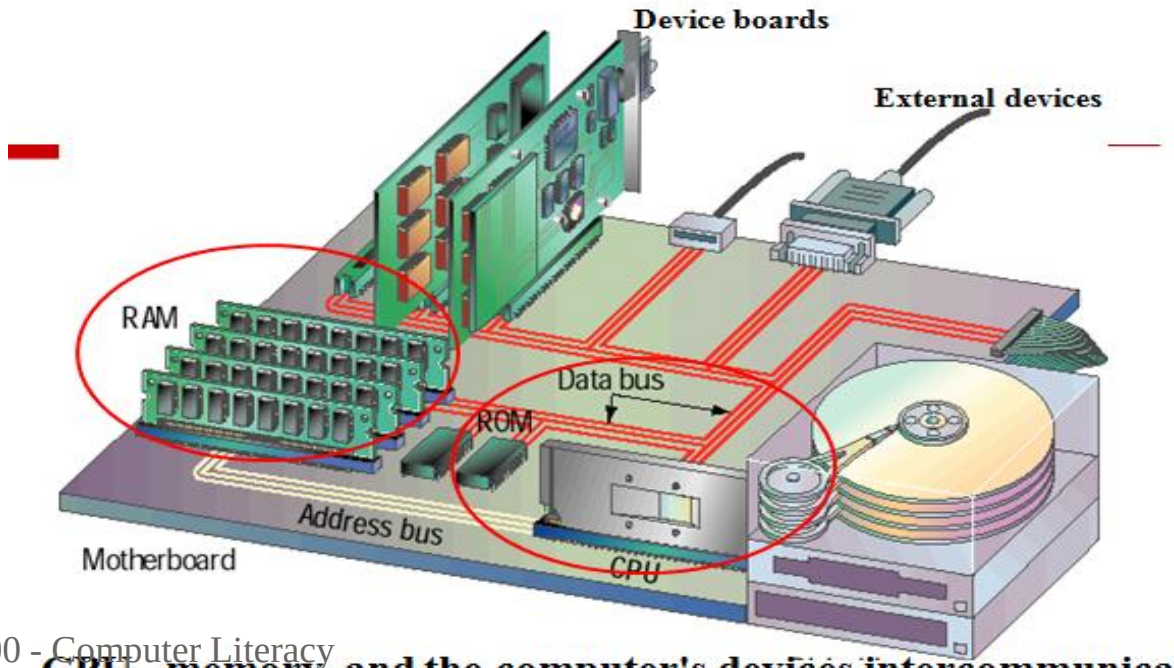
Universal Serial Bus

- *Universal Serial Bus (USB):* A general purpose port that can connect up to 128 devices, and also hot swappable, meaning that devices can be plugged in or unplugged without having to shut down or reboot the system.

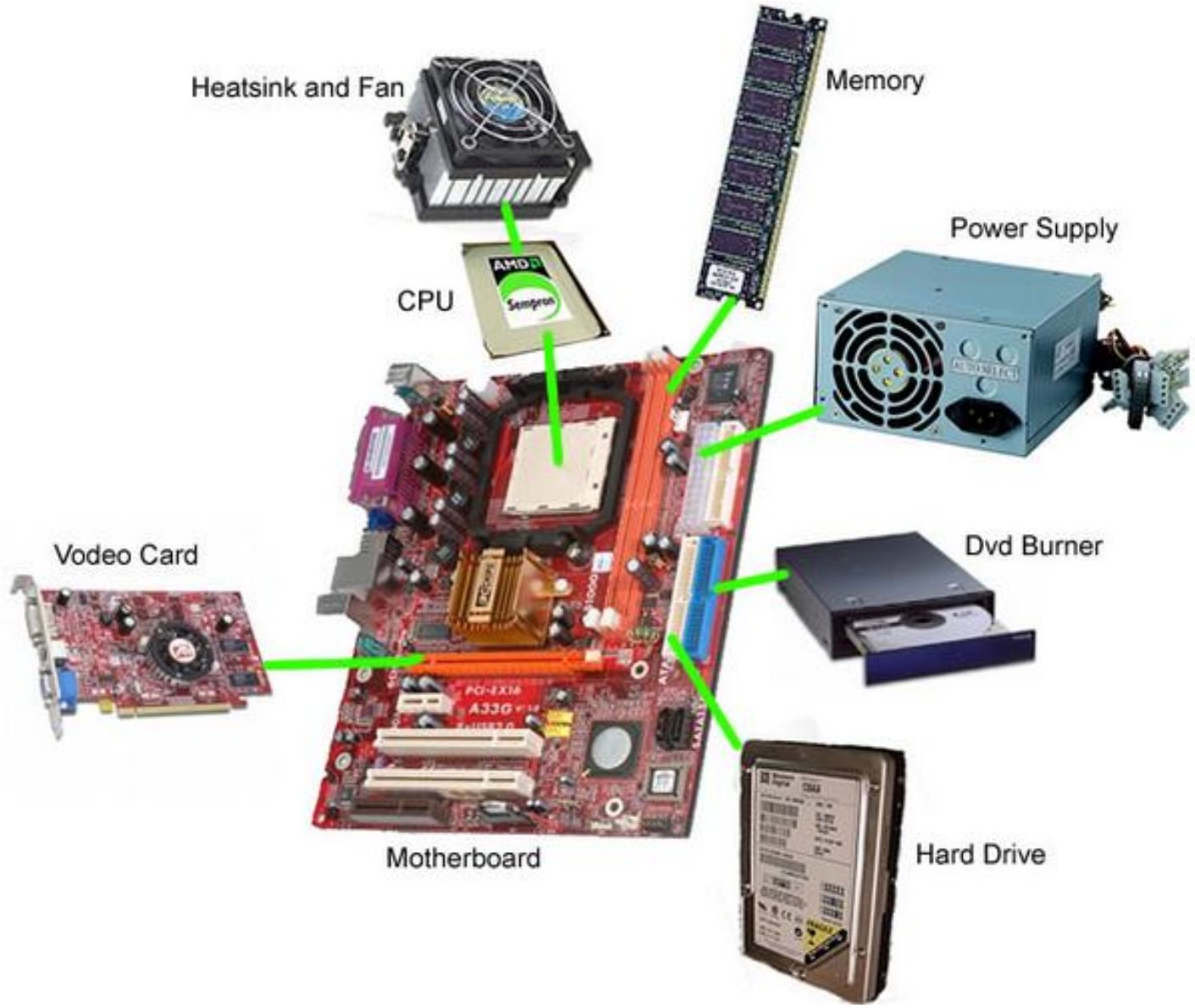
- **Plug and Play:** The ability to install devices into a computer when the computer itself makes any necessary internal adjustments.

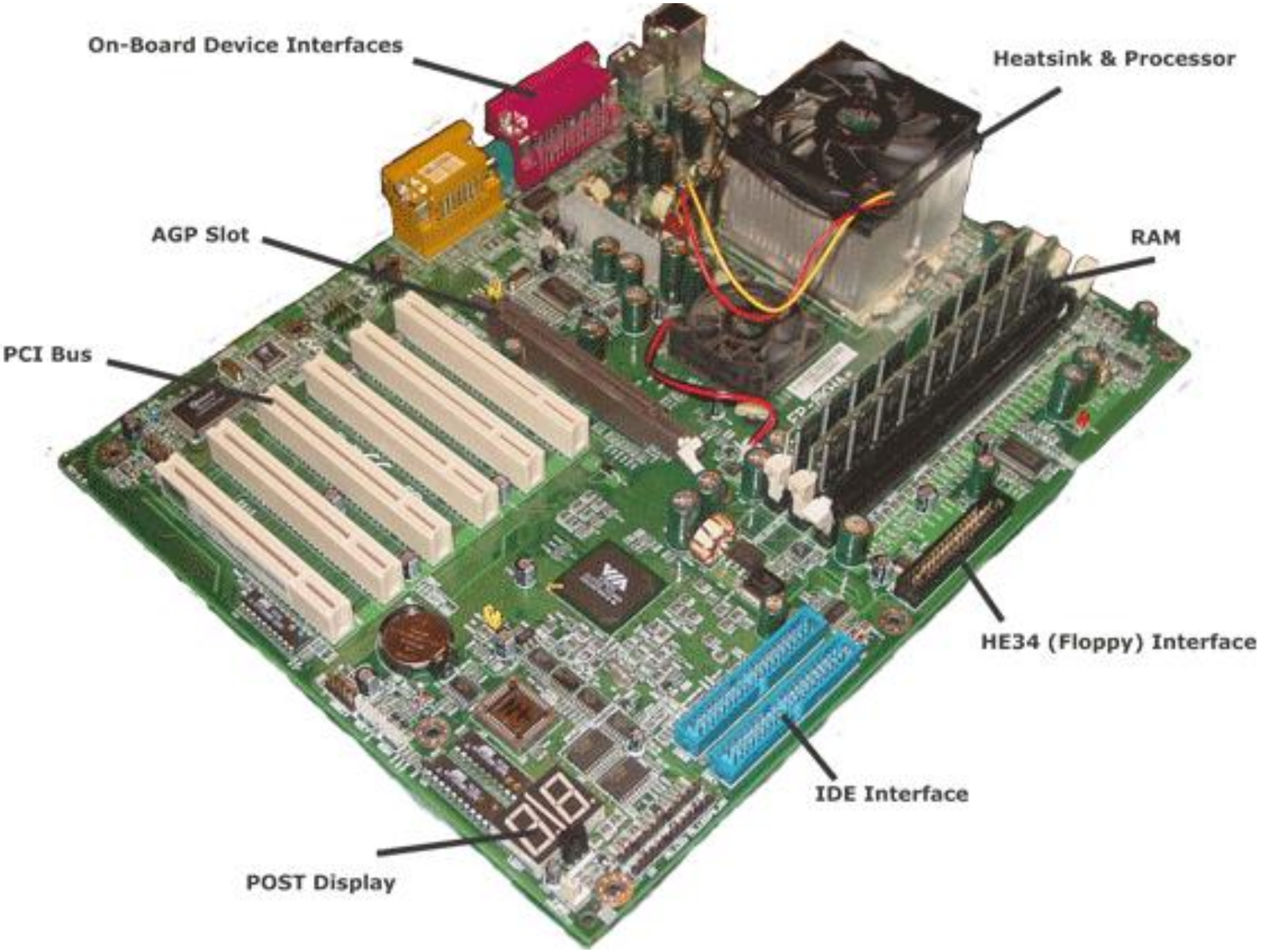
Note

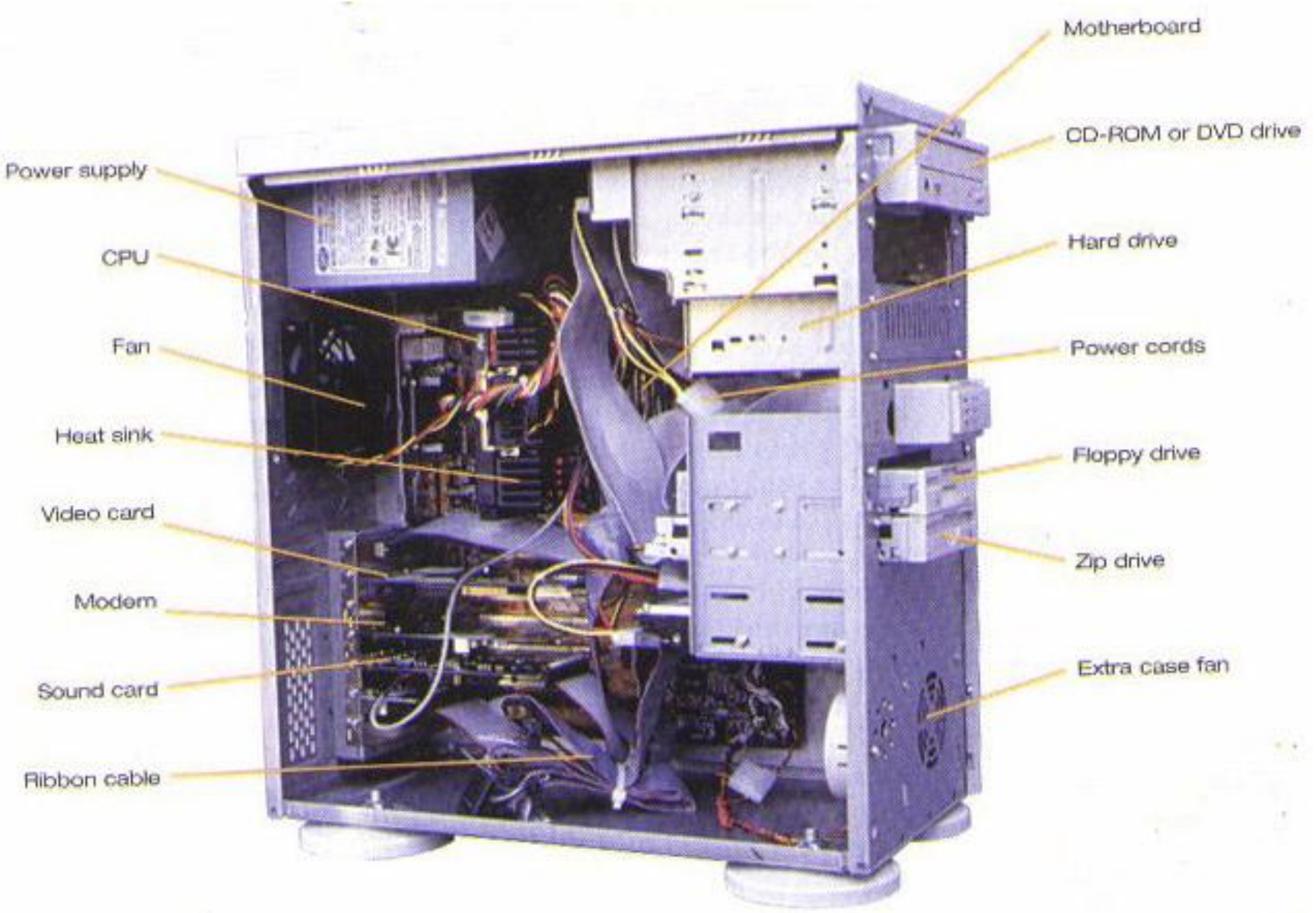
- Processing takes place in the PC's central processing unit (CPU). The system's memory plays a crucial role in processing data. Both the CPU and memory are attached to the system's motherboard, which connects all the computer's devices together, enabling them to intercommunicate.



CPU , memory and the computer's devices intercommunicate.


Heatsink and Fan
Memory
Power Supply
CPU
Vodeo Card
Dvd Burner
Motherboard
Hard Drive


On-Board Device Interfaces
Heatsink & Processor
AGP Slot
RAM
PCI Bus
HE34 (Floppy) Interface
IDE Interface
POST Display


Motherboard
CD-ROM or DVD drive
Power supply
Hard drive
CPU
Power cords
Fan
Heat sink
Floppy drive
Video card
Zip drive
Modem
Extra case fan
Sound card
Ribbon cable

Discussion questions

1. Discuss the different types of Random Access Memory (RAM)
2. Define the following computer concepts/terms
   - Motherboard
   - Smartphone
   - Teleworking
   - Spooling
3. State the difference between impact printers and non-impact printers?
4. Compare and contrast the features of CRT (Cathode Ray Tube) monitors and liquid crystal displays (LCD) monitors?
5. Discuss two ways to measure the performance of a hard disk?