Introduction to Computer Science

Lecture 1

Topics covered in the lecture

What is Computer?

Benefits and Social Repercussions

Major Components of Computer

- Hardware
  - Input devices
  - Processing Devices
  - Storage
  - Output devices
  - Communication devices
- Software
  - System Software
  - Application Software

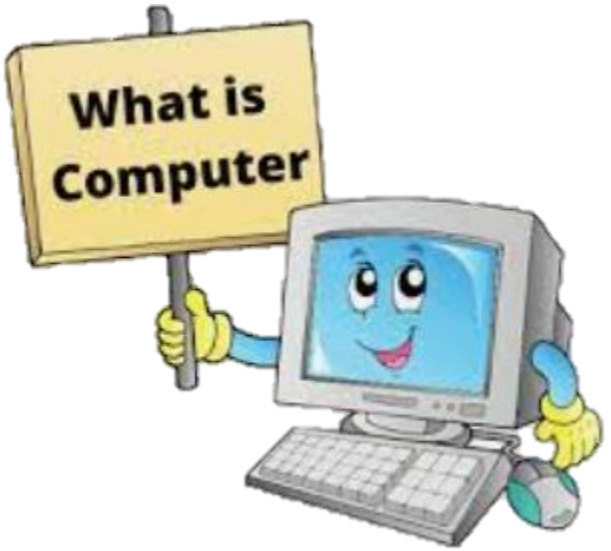
Hardware components of Computer System

Types of Computers

- Analogue
- Digital
  - Super computer
  - Mainframe computer
  - Mini computer
  - Micro computer
- Hybrid

What is a Computer?

- An electronic device that is programmed to accept data, process data into useful information and store it for later use



Advantages

- Speed
- Consistency
- Reliability
- Storage
- Communication

Disadvantages

- Privacy
- Public Safety
- Health Risks
- Impact on Labor
- Impact on Environment

Major Components

- **Hardware**

The physical, touchable, electronic and mechanical parts of a computer system.

- **Software**

Software is a set of instructions that tells a computer what to do

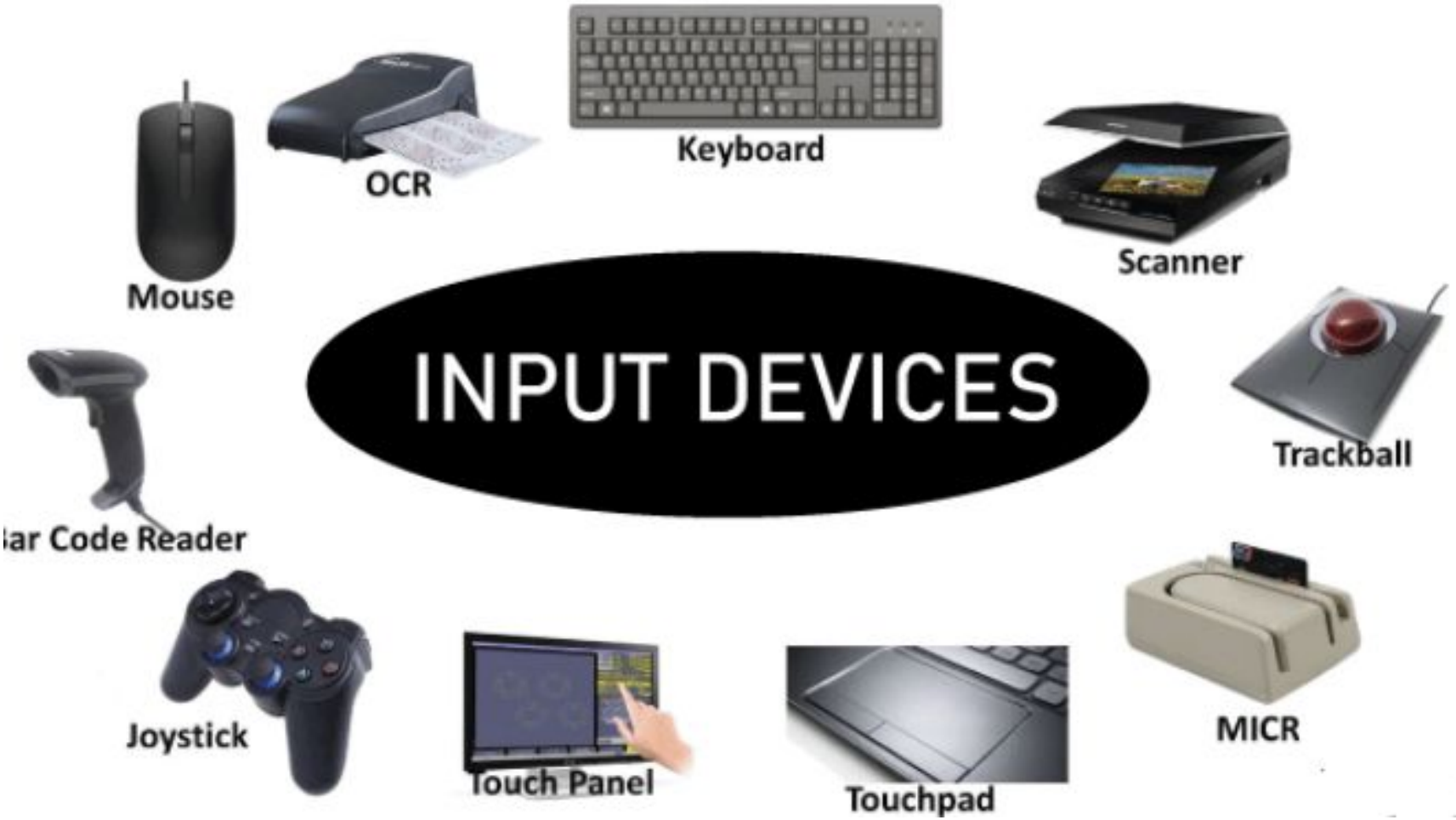
HARDWARE COMPONENTS

Five main categories of hardware components in a computer system:

- Input
- Processing
- Storage
- Output
- Communication devices.

Input Devices

The devices that are used to enter data and instructions into the computers



CPU (Central Processing Unit)

The processor is the main “brain” or “heart” of a computer system. It performs all of the instructions and calculations that are needed and manages the flow of information through a computer.

Primary storage

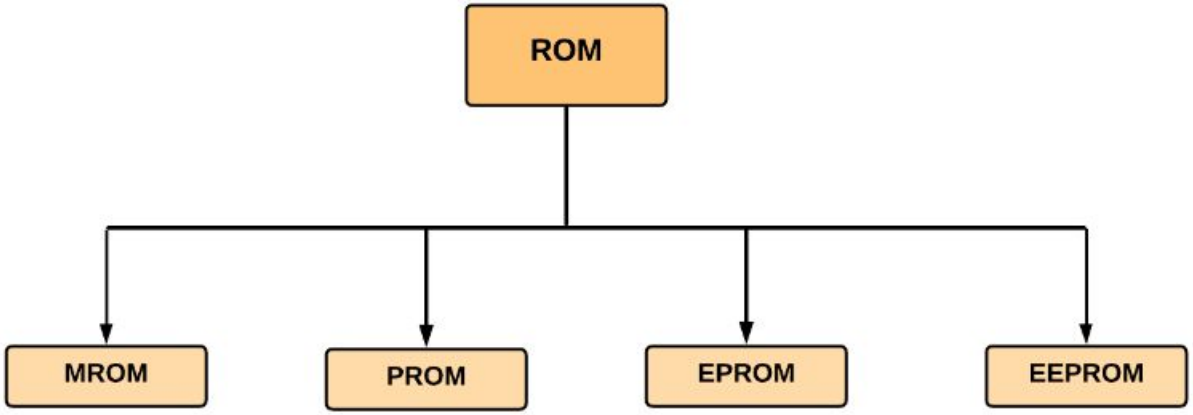
(Internal storage, Main Memory or memory) is the computer's working storage space that holds data, instructions for processing and processed data (information) waiting to be sent to secondary storage. Physically, primary storage is a collection of RAM chips.

Types of Memory

ROM – (Read Only Memory) ROM is nonvolatile, meaning it holds data even when the power is ON or OFF.

Types:

1. **MROM** (Mask ROM)
2. **PROM** (Programmable ROM)
3. **EPROM** (Erasable Programmable ROM)
4. **EEPROM** (Electrically Erasable Programmable ROM)



Types of RAM

RAM – (Random Access Memory) RAM is volatile, meaning it holds data only when the power is on. When the power is off, RAM's contents are lost.

1. Static RAM (SRAM)
2. Dynamic RAM (DRAM)

DRAM	SRAM
1. Constructed of tiny capacitors that leak electricity.	1.Constructed of circuits similar to D flip-flops.
2.Requires a recharge every few milliseconds to maintain its data.	2.Holds its contents as long as power is available.
3.Inexpensive.	3.Expensive.
4. Slower than SRAM.	4. Faster than DRAM.
5. Can store many bits per chip.	5. Can not store many bits per chip.
6. Uses less power.	6.Uses more power.
7.Generates less heat.	7.Generates more heat.
8. Used for main memory.	8. Used for cache.

Difference between SRAM and DRAM

Module-Sim Ram

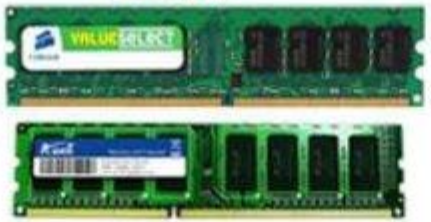
SD Ram

DDR1

DDR2

EDO Ram

DDR3



DDR3

Sodimm DDR2

Sodimm SD Ram

Sodimm DDR1

Sodimm DDR3

Secondary Storage

Currently, there are two common types of hard drive:

1. Hard Disk Drive (HDD)
2. Solid State Drive (SSD)

INTERFACES – the connecting part between the computer and the hard drive.

Types of interfaces hard drive have

1. Parallel Advanced Technology Attachment (PATA)
2. Serial ATA (SATA)
3. Small Computer System Interface (SCSI)
4. NVMe (Non-volatile Memory Express)

Output Devices

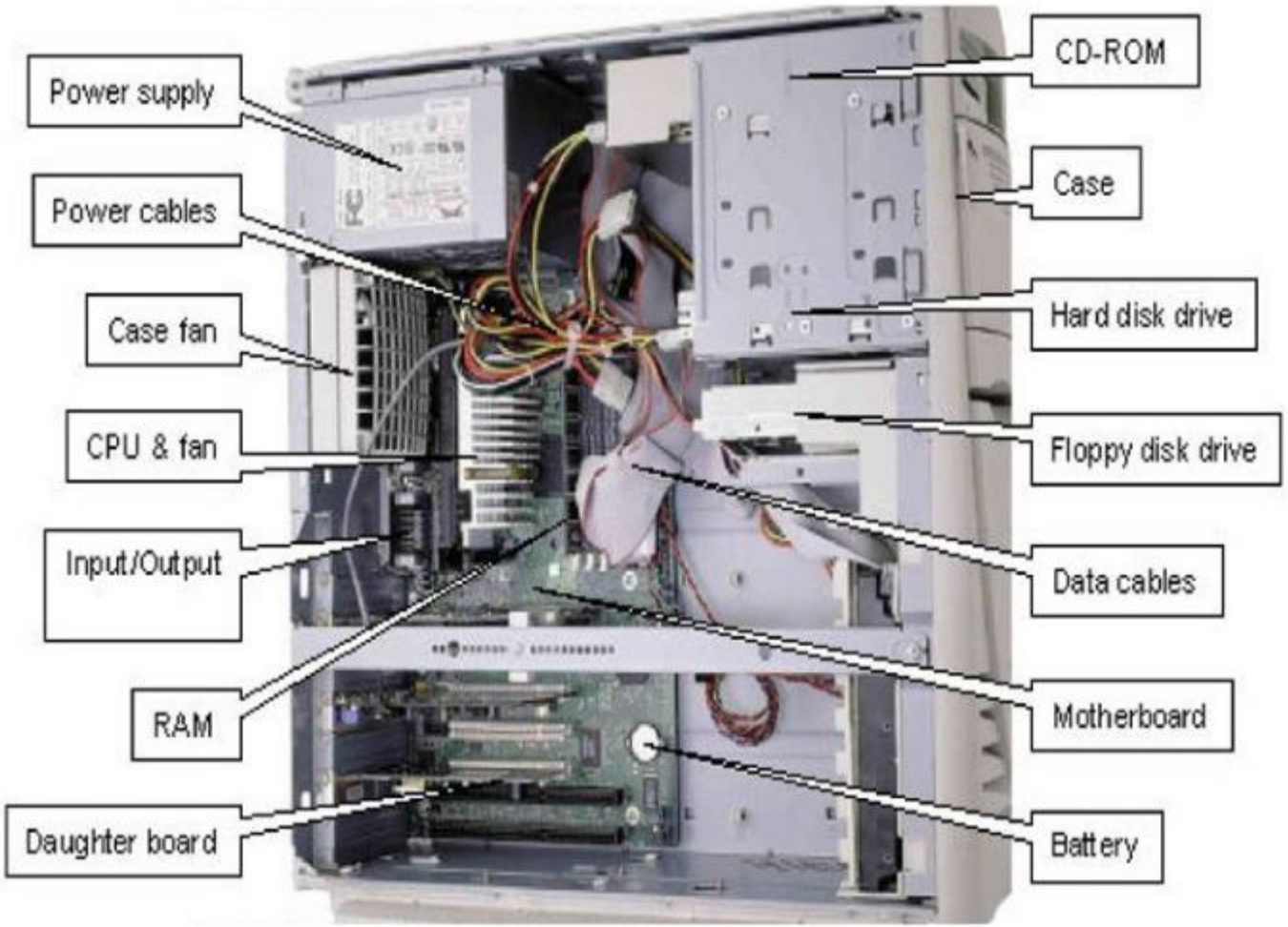
Output devices are used to display processed data to the user

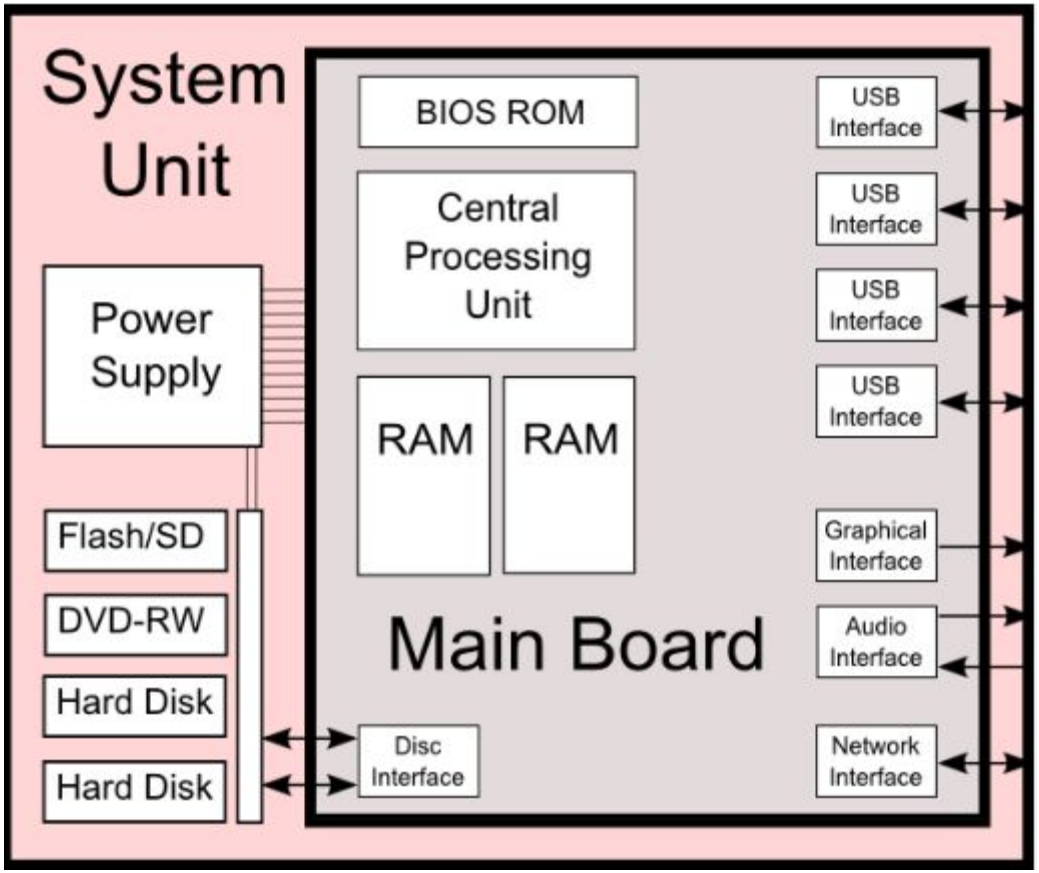
HARDWARE COMPONENTS OF A COMPUTER SYSTEM

System Unit

The main part of a microcomputer, sometimes called the chassis.
It includes the following parts:

- Motherboard
- Microprocessor
- Memory Chips
- Buses
- Ports
- Expansion Slots
- Cards



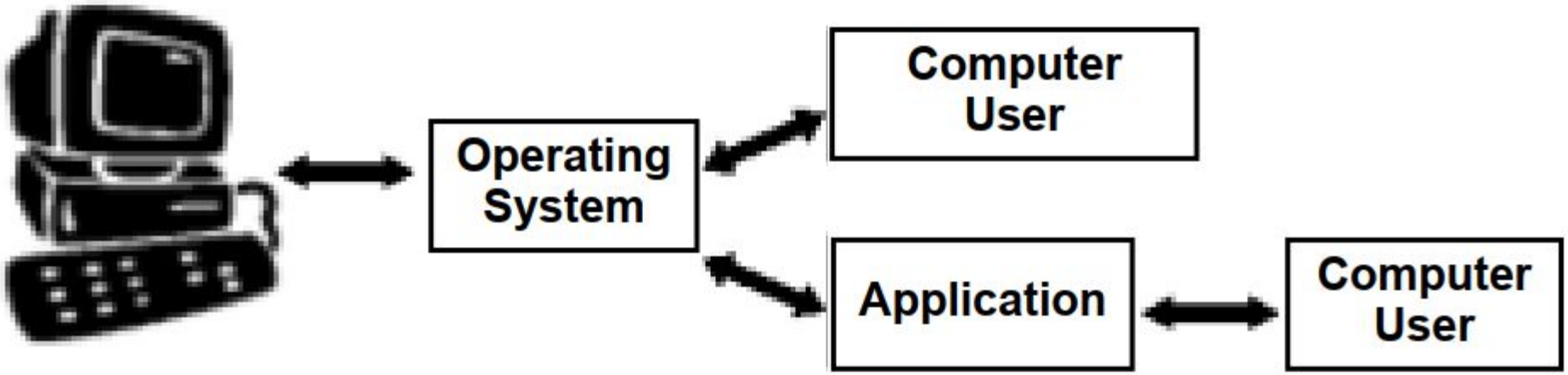

System Unit
BIOS ROM
Central Processing Unit
RAM
RAM
Main Board
Power Supply
Flash/SD
DVD-RW
Hard Disk
Hard Disk
Disc Interface
USB Interface
USB Interface
USB Interface
USB Interface
Graphical Interface
Audio Interface
Network Interface

SOFTWARE COMPONENTS

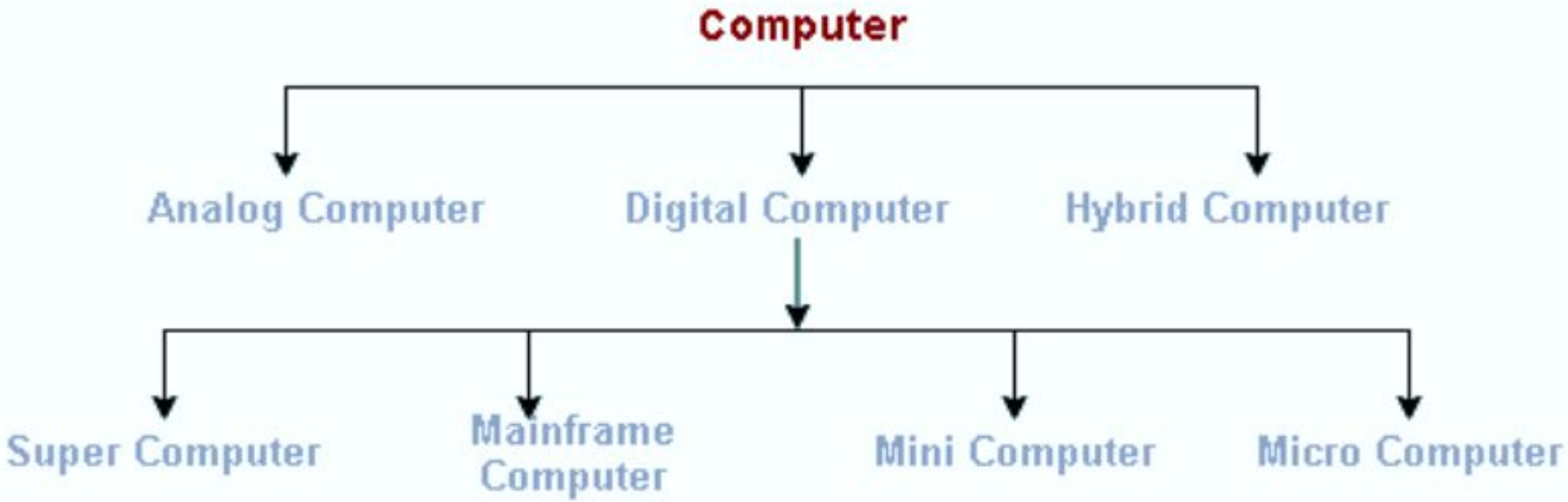
Software

Application Software

System Software



TYPES OF COMPUTER



Classification of the Computer

Algorithms

Terminology

- **Algorithm:** A set of steps that defines how a task is performed
- **Program:** A representation of an algorithm
- **Programming:** The process of developing a program
- **Software:** Programs and algorithms
- **Hardware:** Equipment

History of Algorithms

- The study of algorithms was originally a subject in mathematics.
- Early examples of algorithms
  - Euclidean Algorithm

The Euclidean algorithm

Description: This algorithm assumes that its input consists of two positive integers and proceeds to compute the greatest common divisor of these two values.

Procedure:

Step 1. Assign M and N the value of the larger and smaller of the two input values, respectively.

Step 2. Divide M by N, and call the remainder R.

Step 3. If R is not 0, then assign M the value of N, assign N the value of R, and return to step 2; otherwise, the greatest common divisor is the value currently assigned to N.

Computer Science

- The science of algorithms
- Draws from other subjects, including
  - Mathematics
  - Engineering
  - Psychology
  - Business Administration

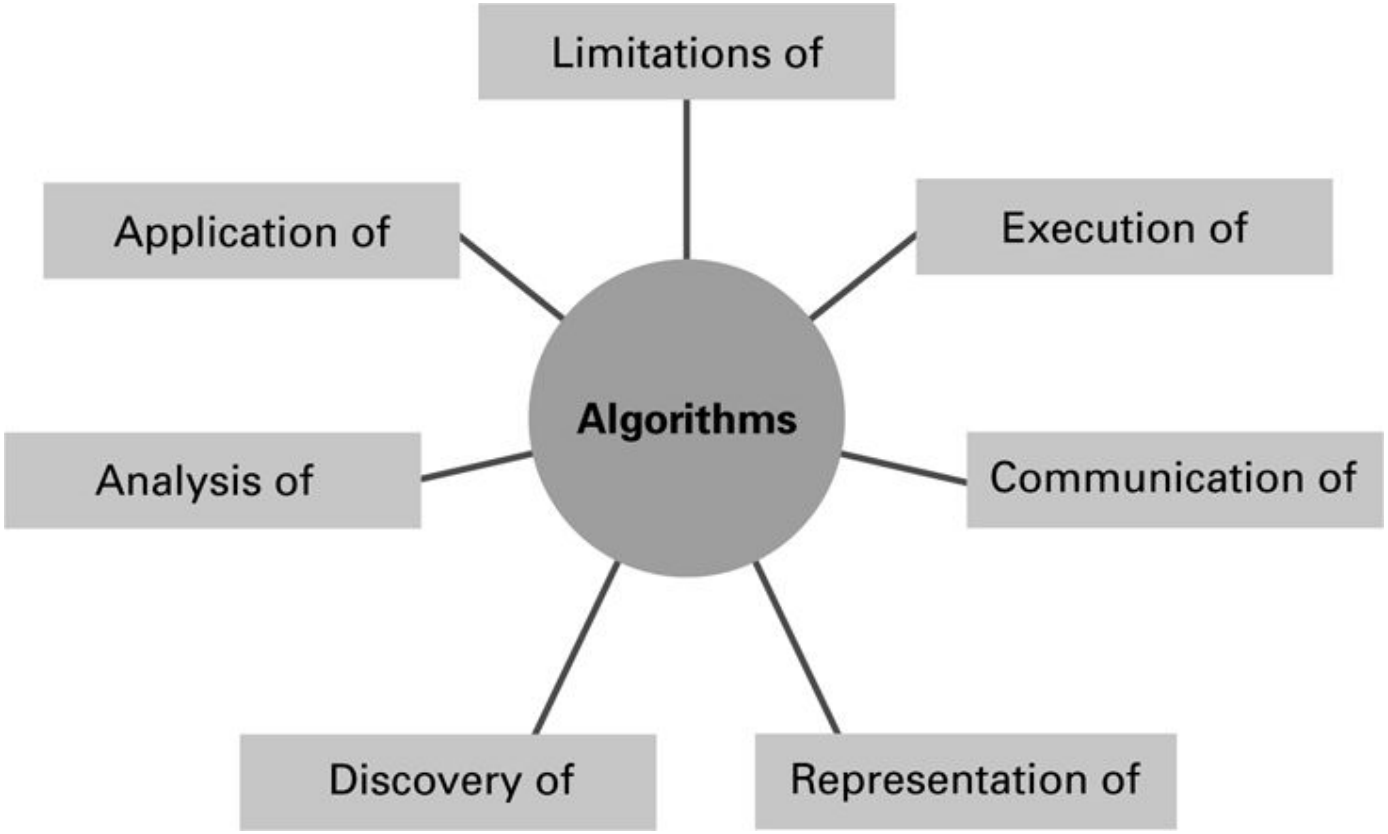
Central Questions of Computer Science

- Which problems can be solved by algorithmic processes?
- How can algorithm discovery be made easier?
- How can techniques of representing and communicating algorithms be improved?
- How can characteristics of different algorithms be analyzed and compared?

Central Questions of Computer Science (continued)

- How can algorithms be used to manipulate information?
- How can algorithms be applied to produce intelligent behavior?
- How does the application of algorithms affect society?

The central role of algorithms in computer science



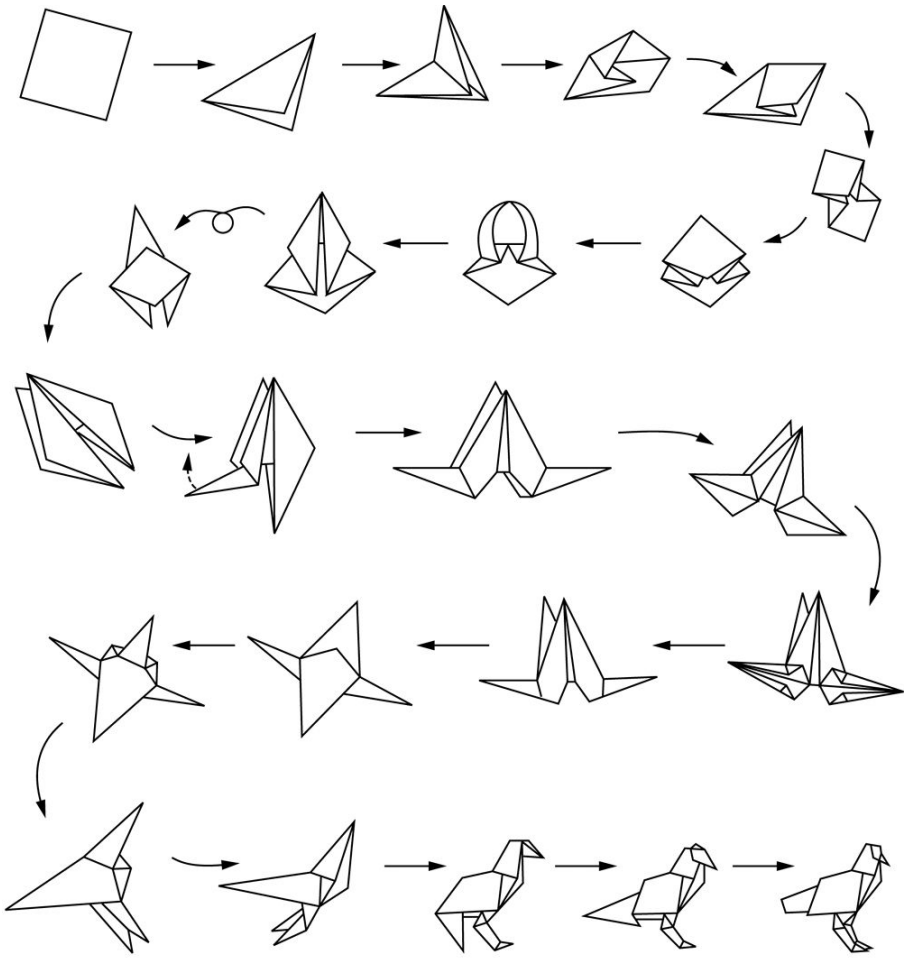
Definition of Algorithm

An algorithm is an **ordered** set of **unambiguous**, **executable** steps that define a **terminating** process.

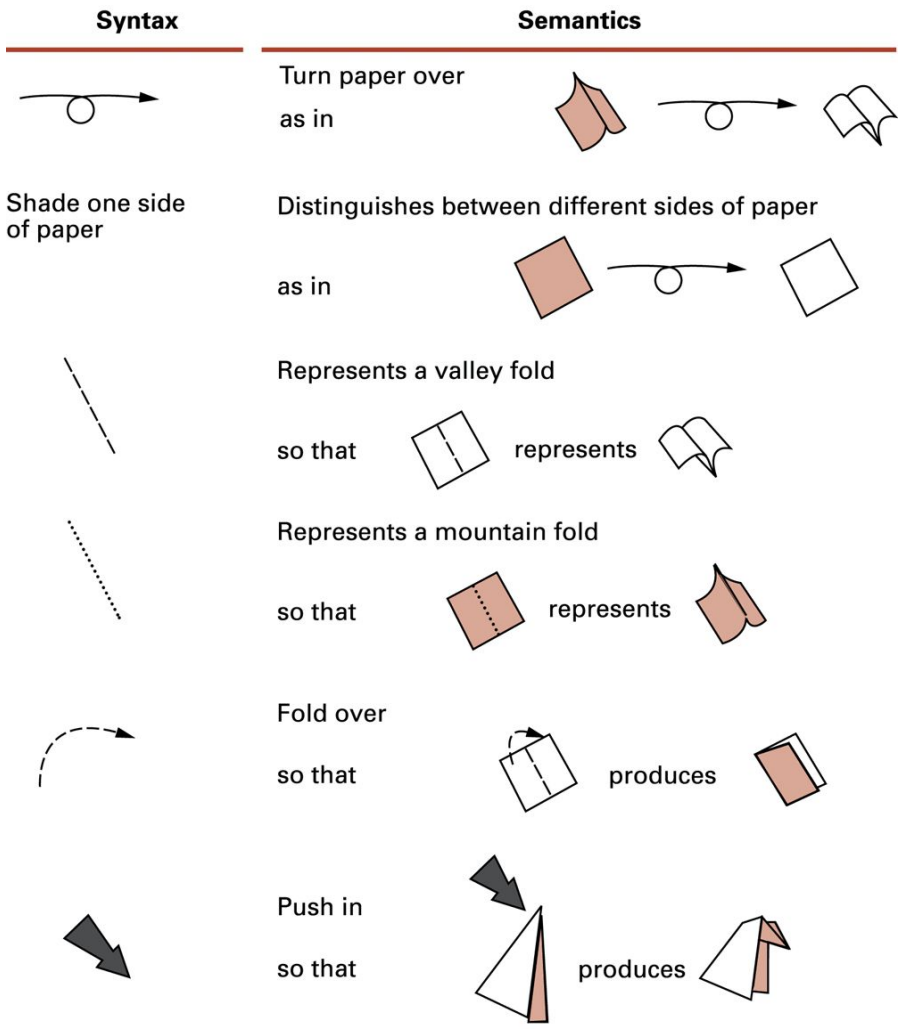
Algorithm Representation

- Requires well-defined primitives
- A collection of primitives constitutes a programming language.

Folding a bird from a square piece of paper



Origami primitives



Polya's Problem Solving Steps

- 1. Understand the problem.
- 2. Devise a plan for solving the problem.
- 3. Carry out the plan.
- 4. Evaluate the solution for accuracy and its potential as a tool for solving other problems.

Polya's Steps in the Context of Program Development

- 1. Understand the problem.
- 2. Get an idea of how an algorithmic function might solve the problem.
- 3. Formulate the algorithm and represent it as a program.
- 4. Evaluate the solution for accuracy and its potential as a tool for solving other problems.

Getting a Foot in the Door

- Try working the problem backwards
- Solve an easier related problem
  - Relax some of the problem constraints
  - Solve pieces of the problem first (bottom up methodology)
- Stepwise refinement: Divide the problem into smaller problems (top-down methodology)

Ages of Children Problem

- Person A is charged with the task of determining the ages of B's three children.
  - B tells A that the product of the children's ages is 36.
  - A replies that another clue is required.
  - B tells A the sum of the children's ages.
  - A replies that another clue is needed.
  - B tells A that the oldest child plays the piano.
  - A tells B the ages of the three children.
- How old are the three children?

Figure 5.5

a. Triples whose product is 36

(1,1,36)	(1,6,6)
(1,2,18)	(2,2,9)
(1,3,12)	(2,3,6)
(1,4,9)	(3,3,4)

b. Sums of triples from part (a)

1 + 1 + 36 = 38	1 + 6 + 6 = 13
1 + 2 + 18 = 21	2 + 2 + 9 = 13
1 + 3 + 12 = 16	2 + 3 + 6 = 11
1 + 4 + 9 = 14	3 + 3 + 4 = 10

An algorithm must possess following characteristics :

1. **Finiteness:** An algorithm should have finite number of steps and it should end after a finite time.
2. **Input:** An algorithm may have many inputs or no inputs at all.
3. **Output:** It should result at least one output.
4. **Definiteness:** Each step must be clear, well-defined and precise. There should be no any ambiguity.
5. **Effectiveness:** Each step must be simple and should take a finite amount of time.

Write the algorithms

1+2+3+….+100
Algorithm???

5,2,1,8,3
Algorithm???

THANK YOU