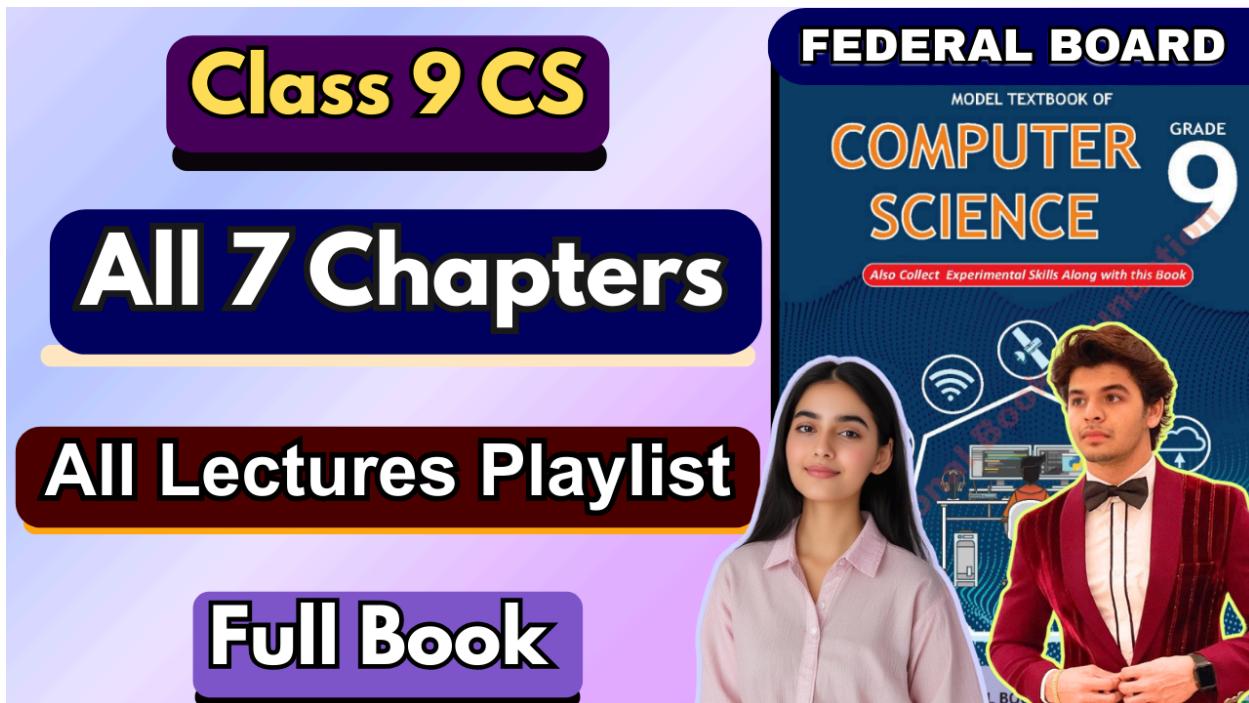


Chapter 2: Computational Things & Algorithms

All Lectures Uploaded on YouTube:

<https://tinyurl.com/fkm9-cs>



A computer is a machine that is used to solve problems by accepting inputs, performing operations, and presenting outputs. Computers can't think but can perform those operations that are written by us in the form of algorithms and fed into the computer in the form of programs.

2.1 Problems

A **problem** is a situation or task that requires a solution. In computer science, a problem is something that can be solved using logical steps and computing techniques.



- A problem has:
 - **Input** (data given)
 - **Processing** (steps to solve)
 - **Output** (final result)
- Not all problems are computing problems.
- A problem must be **clearly defined** to be solved by a computer.

Example

- Finding the **average marks** of a student
- Checking whether a number is **even or odd**

2.2 Identifying a Computing Problem

A **computing problem** is a problem that can be solved using a **computer or algorithm**.

Characteristics of a Computing Problem

- Inputs are clearly defined
- Output is well defined
- Solution can be expressed as step-by-step instructions
- Can be automated using a computer

Types of Computing Problems

1. Decision Problems

Problems in which the output is either **Yes/No** or **True/False**.

Characteristics

- Result is a decision
- Often uses comparison or conditions

Examples

- Is a number **prime**?
- Is a student **pass or fail**?
- Is a person **eligible to vote**?



2. Search Problems

Problems that involve **finding a specific item or value** from a collection of data.

Characteristics

- Searches within a list, array, or database
- Result is the location or existence of data

Examples

- Searching a name in a class list
- Finding a phone number in contacts
- Searching a word in a document

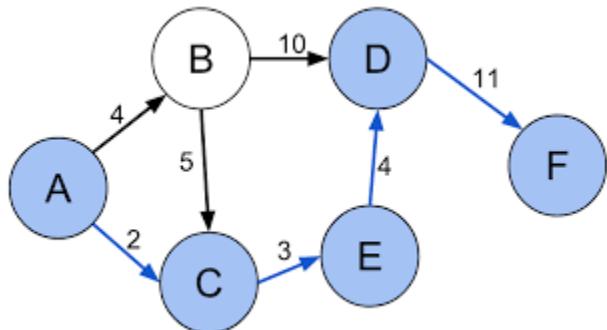


3. Counting Problems

Problems that involve **counting the number of possible solutions or items.**

Characteristics

- Output is a number
- Often used in statistics and data analysis



Examples

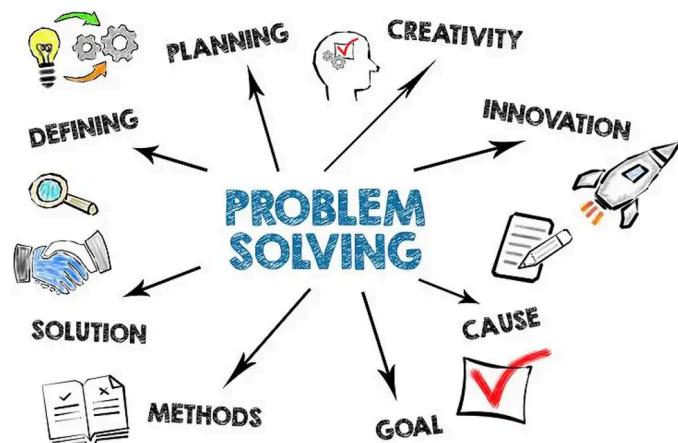
- Counting total students in a class
- Number of even numbers between 1 and 100
- Counting vowels in a word

2.3 Problem Solving

Problem solving is a systematic approach to understand a problem, design a solution, and implement it.

Steps of Problem Solving

1. Understand the problem
2. Identify inputs and outputs
3. Design a solution (algorithm/flowchart)
4. Implement the solution
5. Test and debug
6. Evaluate results



2.4 Input-Processing-Output (I-P-O) Model

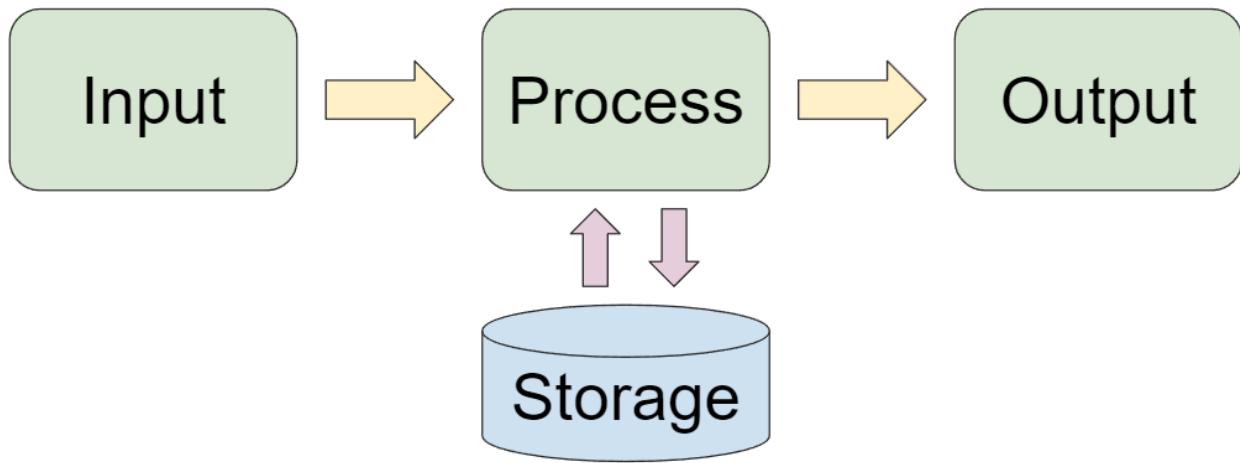
Definition

The **I-P-O model** explains how data flows in a computer system.

Components

Component	Description
Input	Data entered into the system
Processing	Operations performed on data
Output	Final result produced

Example



- Input: Marks of 5 subjects
- Processing: Add marks and divide by 5
- Output: Average marks

2.5 Input-Processing-Output (I-P-O) Chart

Definition

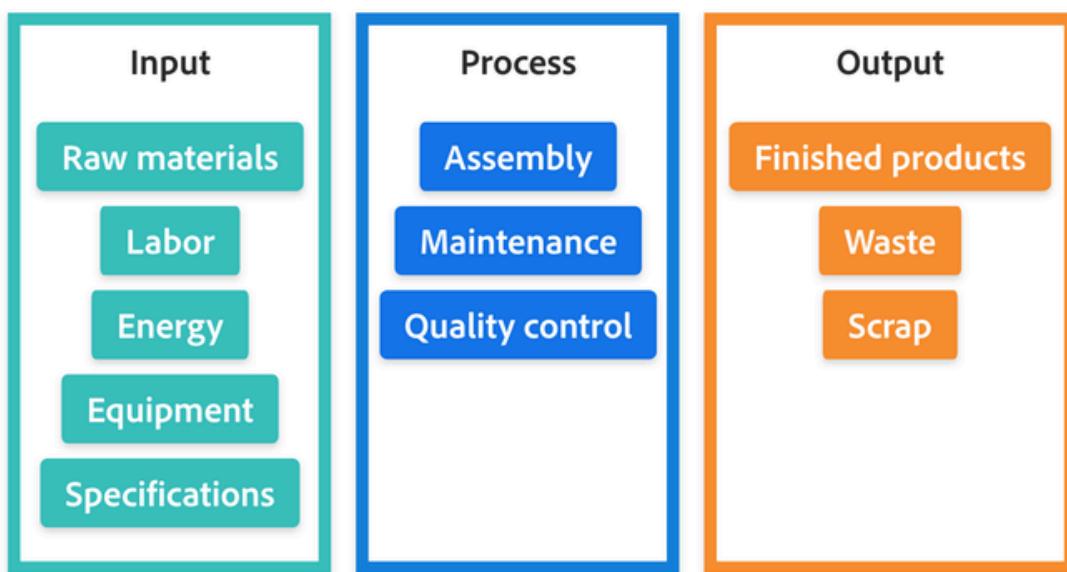
An **I-P-O chart** is a table that clearly shows **inputs**, **processing steps**, and **outputs** of a problem.

Structure

Input	Processing	Output
Number	Check remainder	Even / Odd

Importance

- Helps in understanding the problem clearly
- Makes algorithm design easier
- Reduces errors



2.6 Computational Thinking

Computational thinking is a problem-solving approach that involves breaking problems into parts and solving them logically so that a computer can help.

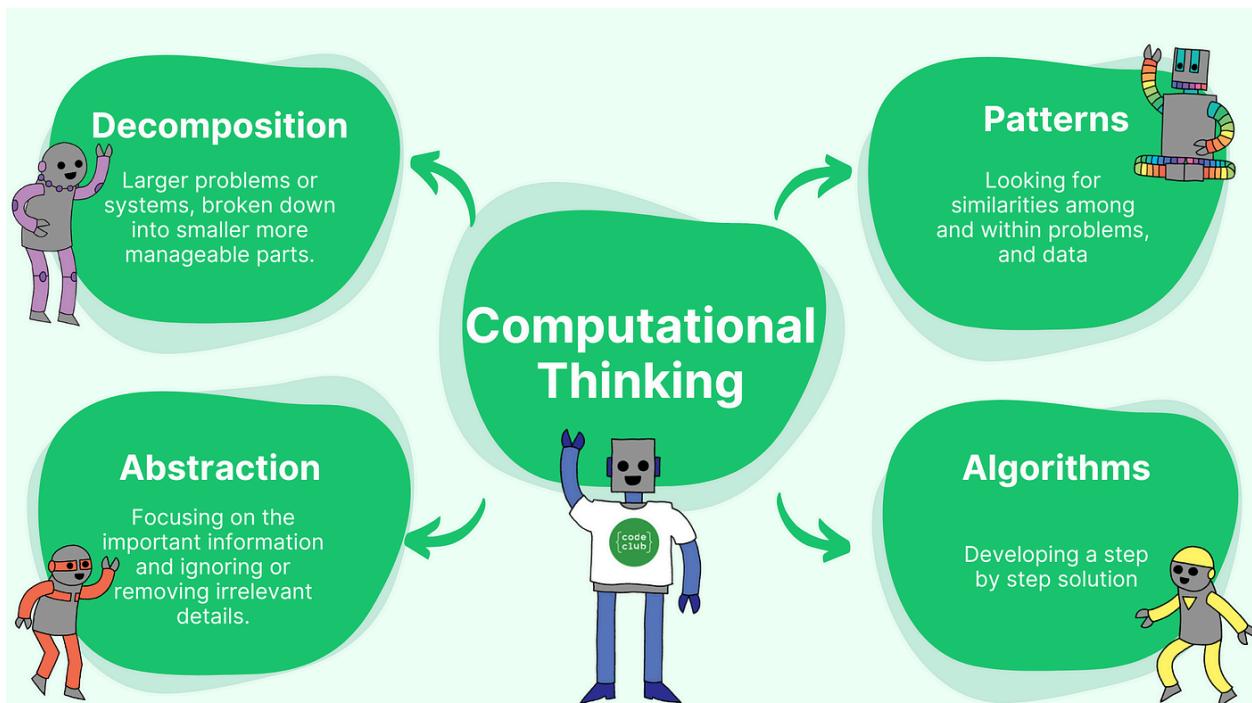
2.6.1 Importance of Computational Thinking

- Improves **logical reasoning**
- Helps solve **complex problems**
- Encourages **step-by-step thinking**
- Essential for **programming and algorithms**

- Useful in daily life problem solving

2.6.2 Properties of Computational Thinking

1. **Decomposition** – Breaking a big problem into smaller parts
2. **Pattern Recognition** – Finding similarities or trends
3. **Abstraction** – Focusing on important details only
4. **Algorithm Design** – Creating step-by-step solutions



2.7 Principles of Computational Thinking

2.7.1 Logical Thinking

Logical thinking means solving problems using **reasoning and logic**.

Features

- Uses conditions (if, else)
- Uses comparisons



- Avoids guessing

Example

If marks $\geq 50 \rightarrow$ Pass

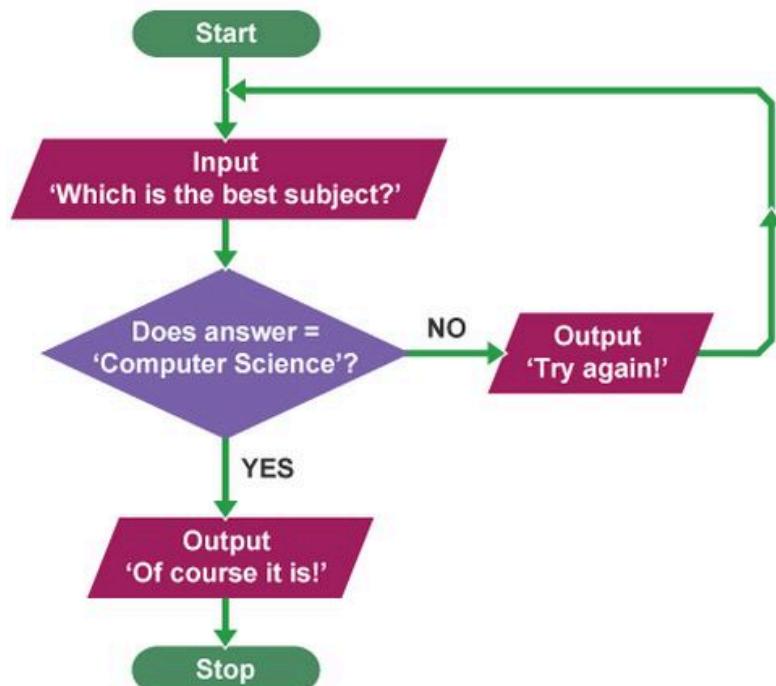
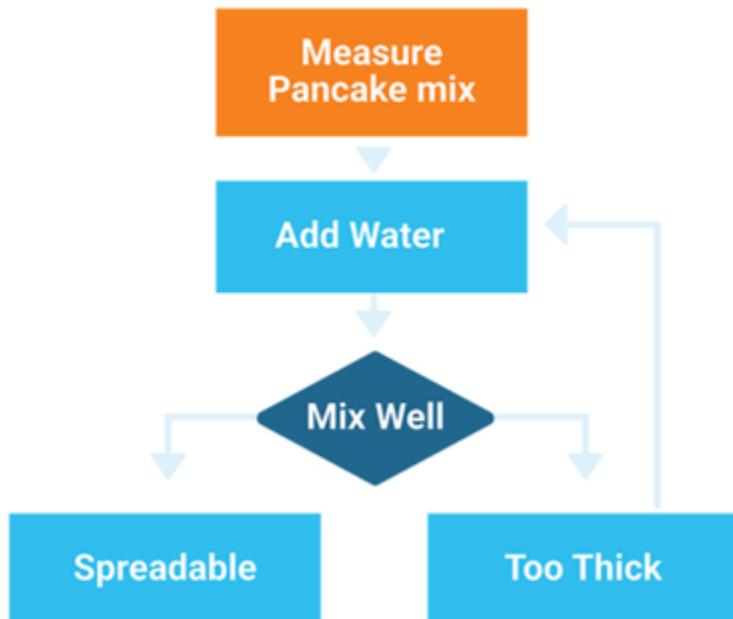
Else \rightarrow Fail

2.7.2 Algorithmic Thinking

Algorithmic thinking is the ability to **define a clear sequence of steps** to solve a problem.

Features

- Step-by-step instructions
- Clear beginning and end
- No ambiguity



2.8 Methods to Design a Solution

2.8.1 Flowcharts

A **flowchart** is a graphical representation of an algorithm using **symbols and arrows**.

Common Flowchart Symbols

Symbol	Name	Function
	Start/end	An oval represents a start or end point
	Arrows	A line is a connector that shows relationships between the representative shapes
	Input/Output	A parallelogram represents input or output
	Process	A rectangle represents a process
	Decision	A diamond indicates a decision

Steps for Drawing a Flowchart

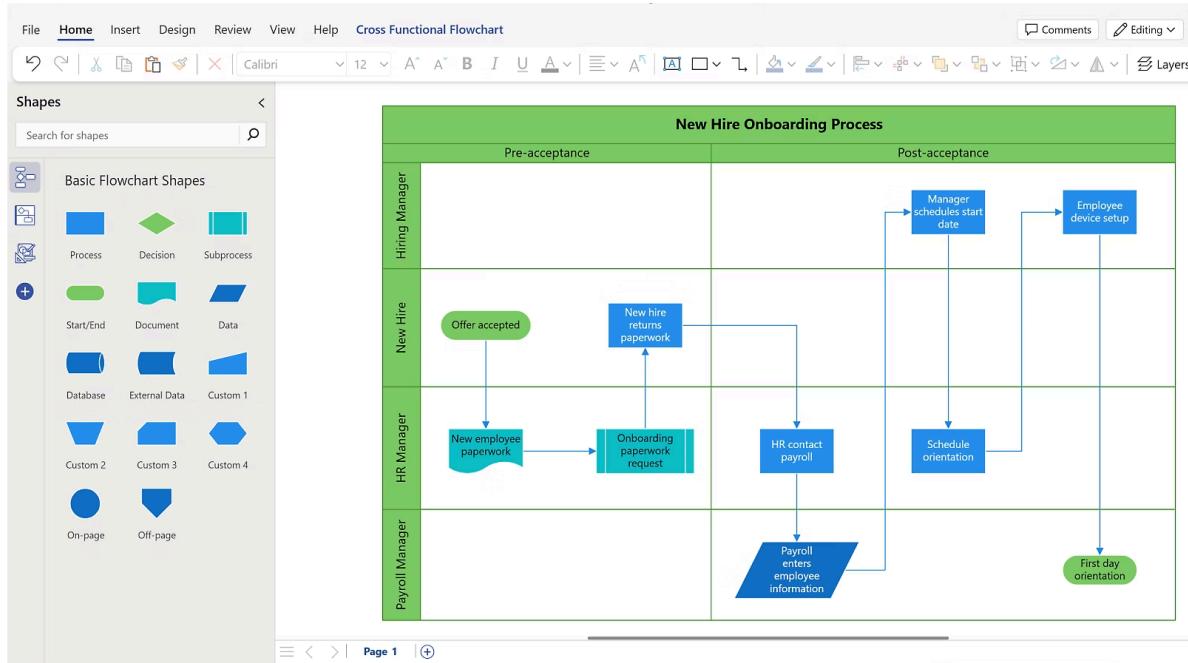
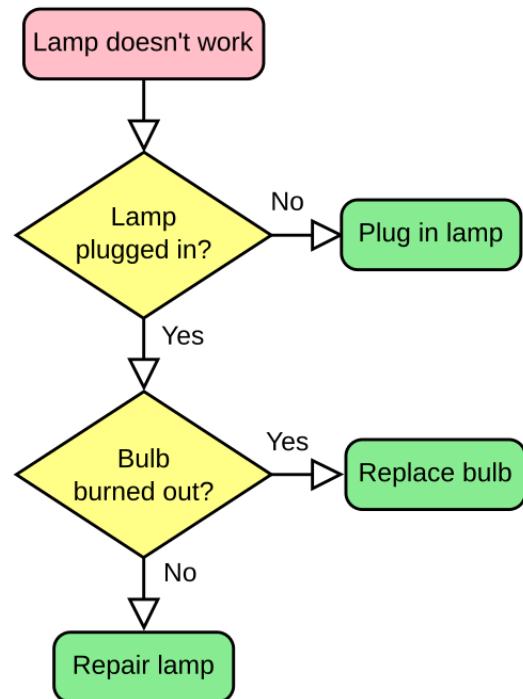
1. Start with **Start** symbol
2. Identify input
3. Show processing steps
4. Add decision symbols if needed
5. Show output
6. End with **Stop** symbol

Flowchart to Solve Problems

- Used for:
 - Finding greatest number
 - Checking even/odd
 - Calculating average
- Makes logic easy to understand

Software Tools for Flowchart Designing

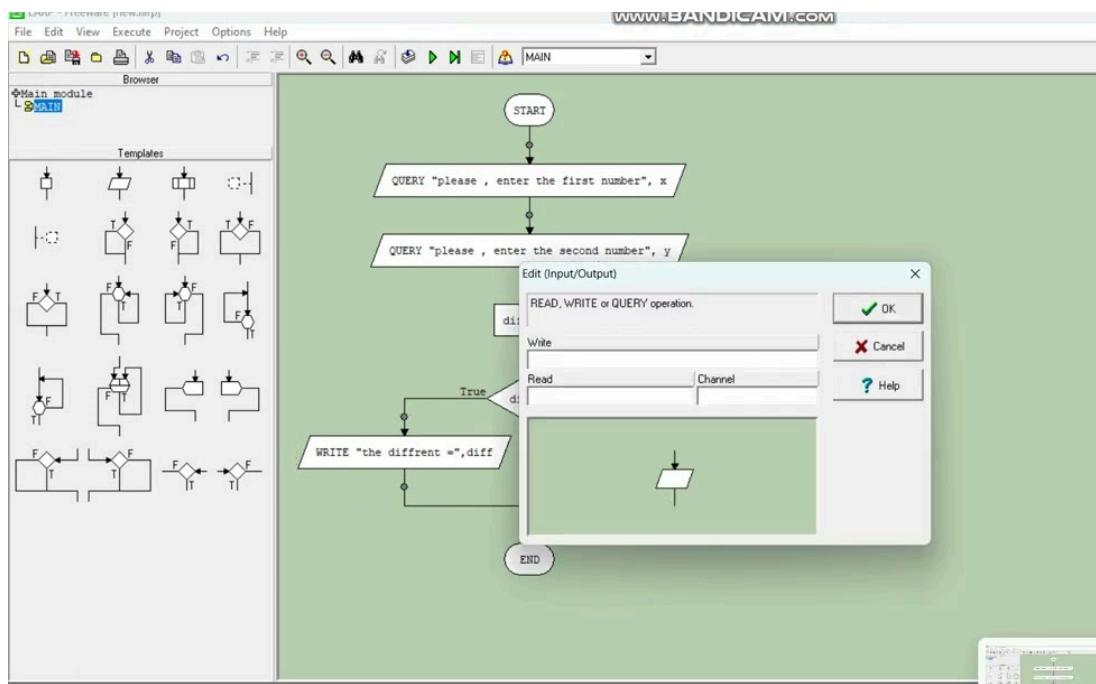
- Microsoft Visio
 - Start Microsoft Visio
 - Click on the category of Flowchart
 - Double-click the Basic Flowchart
 - Drag a relevant flowchart symbol and place it onto your drawing
 - Connect the flowchart shapes by holding the mouse pointer over the first symbol, and then releasing it on the other symbol
 - To place text into a shape, select it, and then type.



- Draw.io
- Lucidchart
- Flowgorithm

LARP (Input-Process-Output Concept)

LARP helps in solution design:



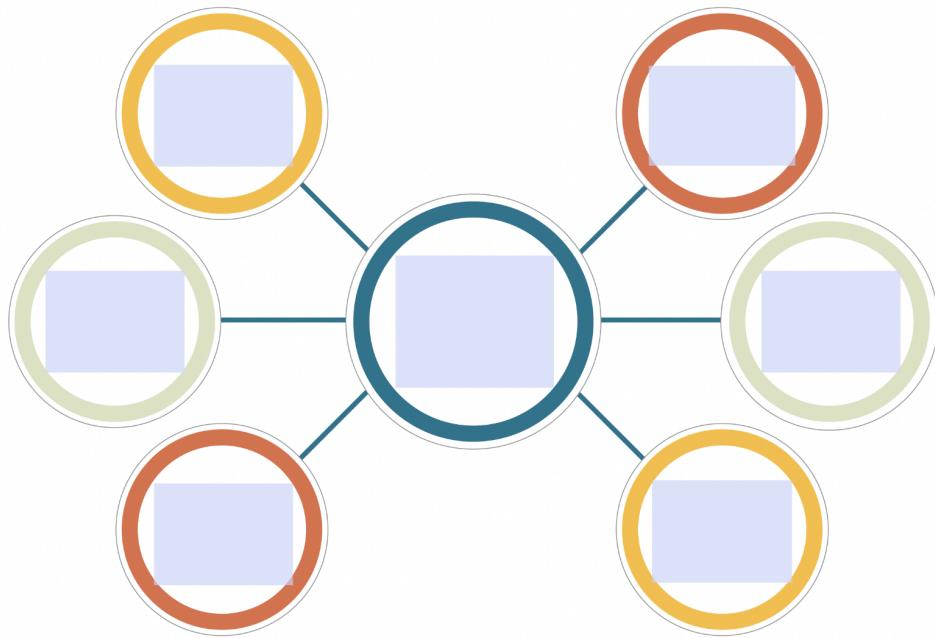
- **L:** Look at the problem
- **A:** Analyze inputs and outputs
- **R:** Represent solution (flowchart/algorithm)
- **P:** Perform and test

2.8.2 Concept Maps

A **concept map** is a diagram that shows **relationships between ideas or concepts**.

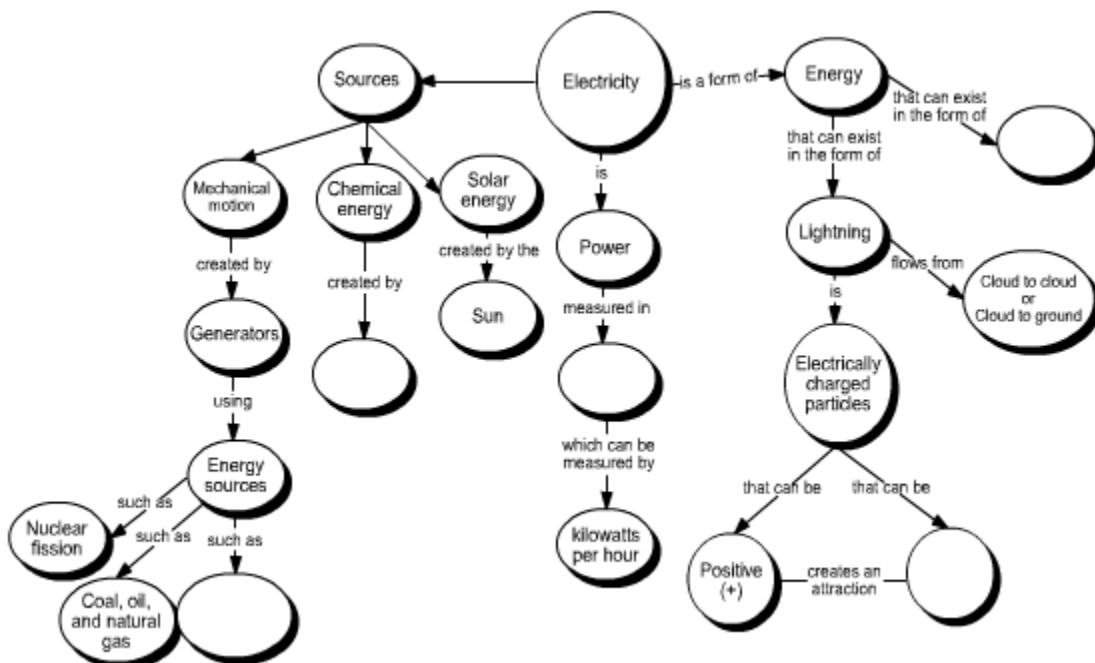
Uses

- Organizing information
- Understanding complex topics
- Linking related concepts



Advantages

- Improves memory
- Helps in revision
- Shows big picture clearly





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