नीति आयोग
National Institution for Transforming India

AIM
ATAL INNOVATION MISSION

COMPUTATIONAL THINKING

UNDERSTANDING FLOWCHARTS & ALGORITHMS

LEARNING OBJECTIVE

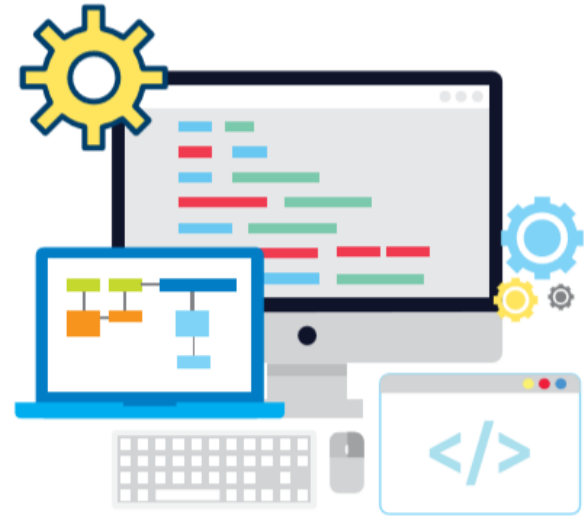**1** To gain hands-on experience on hardware and coding.

2 To learn about the process of analyzing a problem and find solutions.

3 To understand the role of algorithm and flowcharts in problem analysis and solutions.

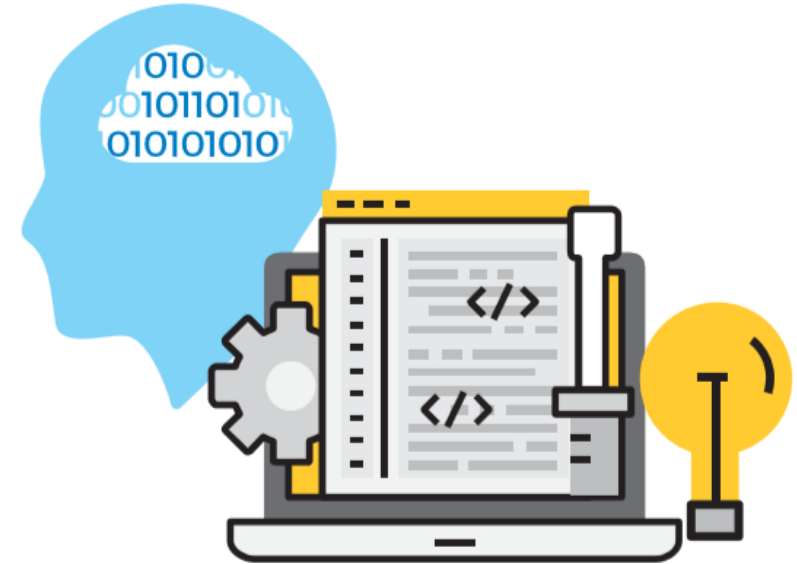**4** To know about the process of prototyping through the principles of sensor and sensor based data processing.

WHAT IS COMPUTATIONAL THINKING ?

> An approach to breaking down complex problems,

> Understand what the problem is &

> Develop possible solutions using various tools & techniques

FOUR KEY TECHNIQUES OF COMPUTATIONAL THINKING

1 **Decomposition** - breaking down a complex problem or system into smaller, more manageable parts

2 **Abstraction** – focusing on the important information only, ignoring irrelevant detail

3 **Pattern Recognition** – looking for similarities among and within problems

4 **Algorithms** - developing a step-by-step solution to the problem, or the rules to follow to solve the problem
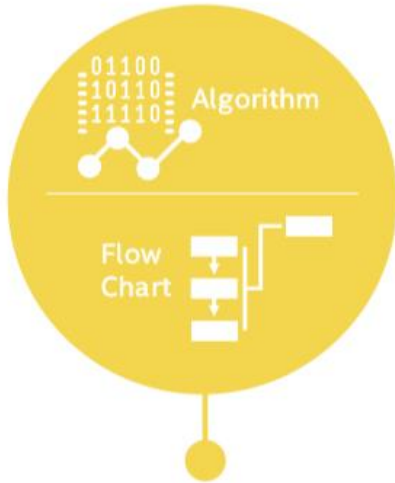
NOW LETS FOCUS ON

> Developing a step-by-step solution to the problem with **Algorithms & Flowcharts**

> Getting introduced to **Hardware/ Software** - understand their usage
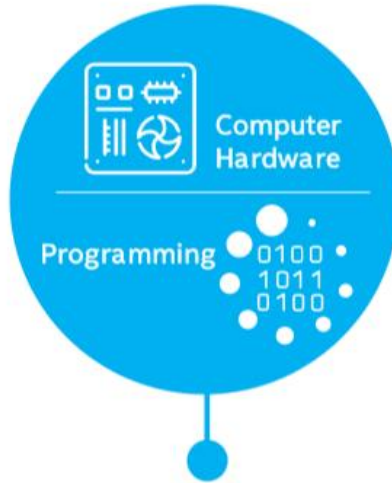
> Learning the basic concept of **Programming**

HOW TO APPLY COMPUTATIONAL THINKING

Algorithm

01100
10110
11110

Flow Chart

Think about steps need to solve a problem

Computer Hardware

Programming

0100
1011
0100

Apply technical skills to make computer solve a problem

Arrive at the solution

ALGORITHMS

An **algorithm** is a set of step by step instructions to solve a problem.

For example, a computer program, mathematical calculations etc.

> For example
> a recipe for baking a cake is an algorithm.

Melt chocolate and butter

Stir sugar into melted chocolates

Add two **eggs** and add flour

Bake it for 40 minutes
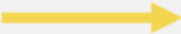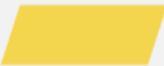
Cool it in a pan before eating.

FLOWCHART

A **flowchart** is a diagrammatic representation of an algorithm, workflow or process.

This graphical representation can help in understanding a problem.

Some of the symbols used in flowcharts

Name	Symbol	Description
Start/End		An oval represents Start and End in the flowchart
Arrow		An arrow line is a connector that shows relationship between the shapes
Input / Output		A parallelogram represents the input/output for the system
Process		A rectangle represents a process
Decision		A diamond indicates a decision

Example 1: Find the average of two numbers

Algorithm:

Input: two numbers x and y

Output: the average of x and y
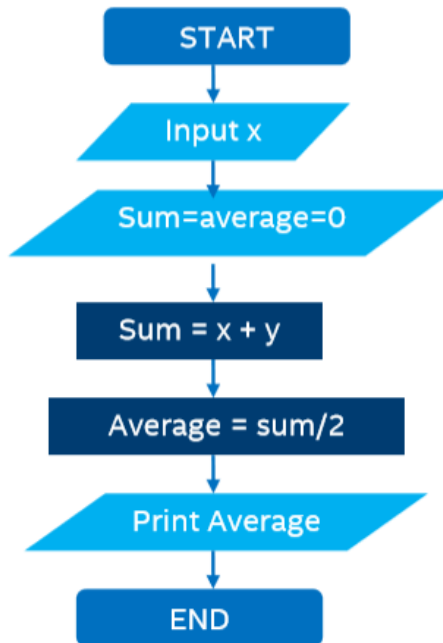
Step 1 : input x,y

Step 2: sum=0,average=0

Step 3: sum = x + y

Step 4: average = sum /2

Step 5: print average

```
START
  ↓
Input x
  ↓
Sum=average=0
  ↓
Sum = x + y
  ↓
Average = sum/2
  ↓
Print Average
  ↓
END
```

Example 2: Find the maximum of two numbers
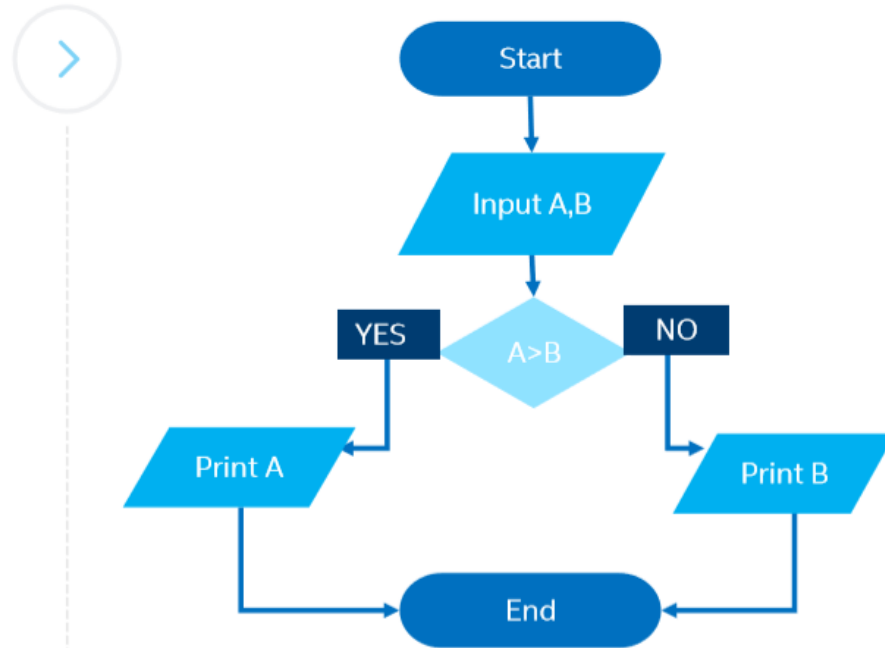
Let A and B be two integer number

Algorithm:

Step 1 : input A,B

Step 2: compute the maximum number

If A is greater than B, then A

is the greater number else B

is greater number

Step 3: print maximum number
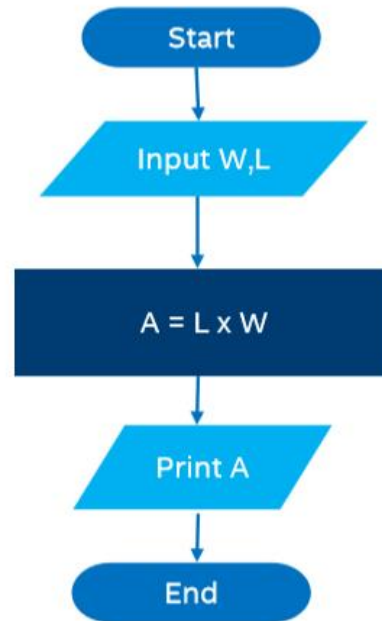
Example 3: Find the area of a rectangle

Let W=width
L=length
A=area of rectangle

Algorithm:

Step 1 : input W,L

Step 2: A=W*L

Step 3: print A

```
         ┌─────────────┐
         │    Start     │
         └─────────────┘
                │
          ╱─────────────╲
          │  Input W,L   │
          ╲─────────────╱
                │
         ┌─────────────┐
         │  A = L x W   │
         └─────────────┘
                │
          ╱─────────────╲
          │   Print A    │
          ╲─────────────╱
                │
         ┌─────────────┐
         │     End      │
         └─────────────┘
```
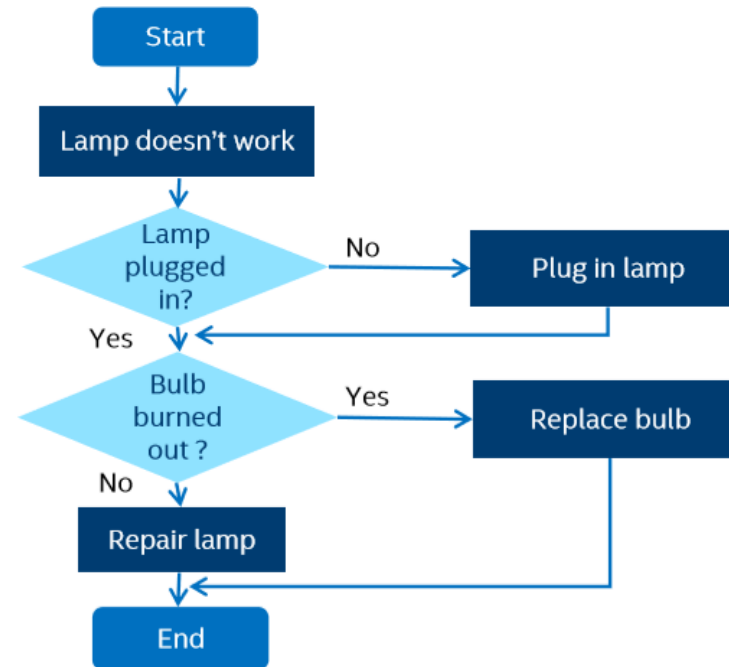
Example 4: A simple flowchart, which shows what to do, when a lamp does not work

Algorithm:

Step 1 : plug in the lamp

Step 2: check the bulb

If bulb is burned out, then replace bulb else repair lamp
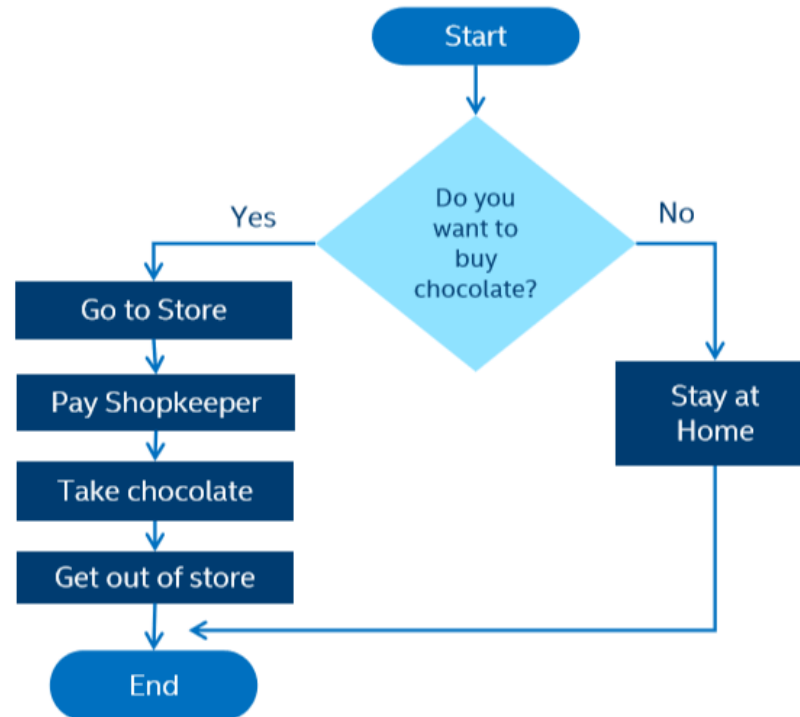
Example 5: Buying a chocolate from the market

Algorithm:

Step 1 : Think of chocolate you like

Step 2: Visit a shop

Step 3: Pay shopkeeper

Step 4: Buy chocolate

Step 5: Return home
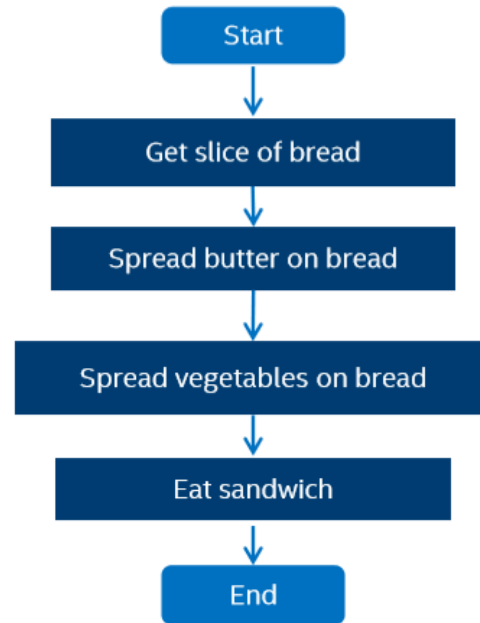
Example 6: Design a flowchart for making sandwich

Algorithm:

Step 1 : Get a slice of bread

Step 2: Spread butter on bread

Step 3: Spread vegetables on bread

Step 4: Eat Sandwich

```
        Start
          │
          ▼
   Get slice of bread
          │
          ▼
  Spread butter on bread
          │
          ▼
 Spread vegetables on bread
          │
          ▼
     Eat sandwich
          │
          ▼
         End
```
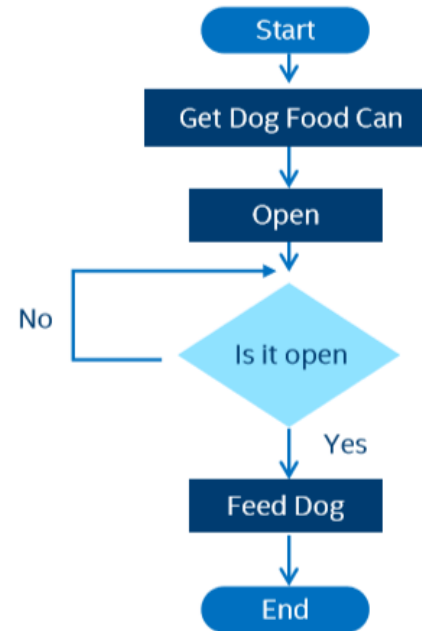
Example 7: To open a can of dog food

Algorithm:

Step 1 : Get the can and the can-opener

Step 2: Place can inside jaws of can-opener

Step 3: Close jaws

Step 4: Turn handle on can opener

Step 5: Keep turning until the can has made a complete circle

Step 6: Open the jaws of the opener

Step 7: Remove the can from the can-opener

Example 8: Design a flowchart for traffic light scenario

A good driver will always follow the traffic laws. Let us assume you are a car driver starting from your home and approaching the traffic light. Design a flowchart for the traffic light rules.

Algorithm:
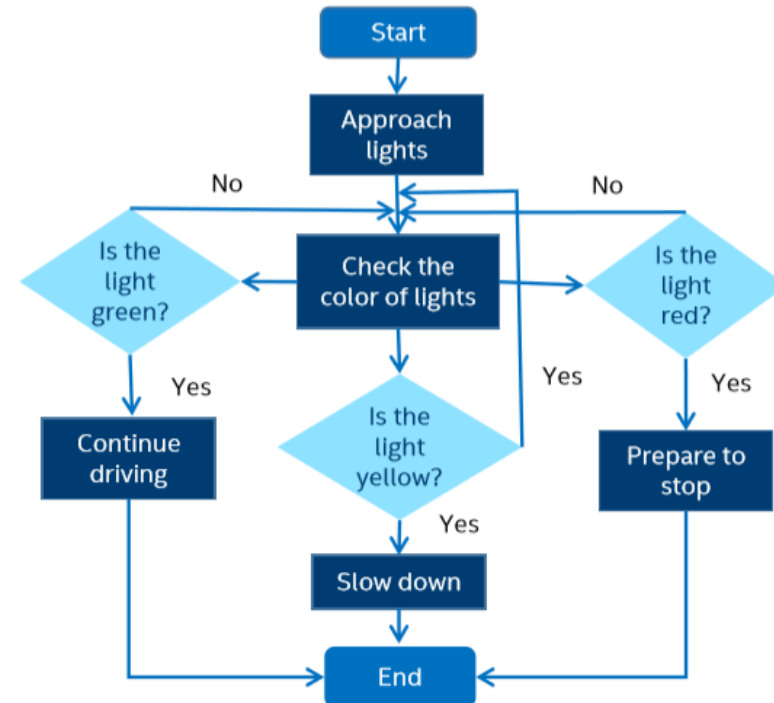
Step 1 : Start from your place and approach the light

Step 2: Check for the color of the light

Step 3: The decision is to be made on the bases of light color if color is

Red : Prepare to stop	
Yellow: Slow down	
Green: Continue driving	

Start

Approach lights

No → Is the light green? ← Check the color of lights → Is the light red? ← No

Yes ↓ Continue driving

Is the light yellow? → Yes

Yes → Prepare to stop

Yes ↓ Slow down

End

Exercise 1: Write missing steps to complete the algorithm to find minimum of two integers

Let A and B be two integer number

Algorithm:

Step 1 : input A,B

Step 2: Compute the minimum number

If A is smaller than B

then A is the smaller number

else B is smaller number

Step 3: Print minimum number

Exercise 2: Design a flowchart for the ATM system for withdrawal of cash based on the algorithm defined below
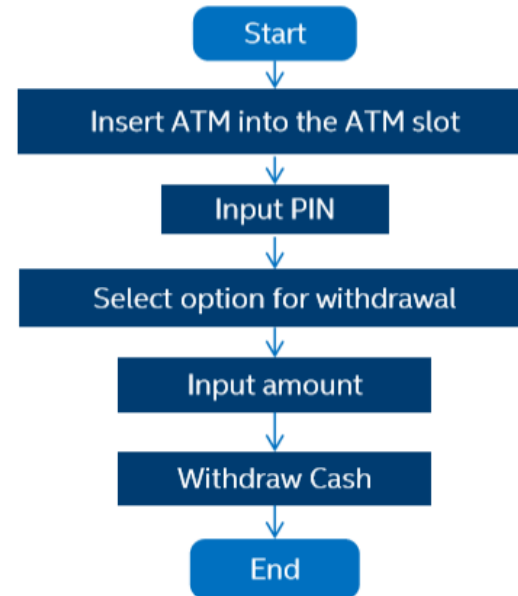
Suppose you went to the ATM to withdraw the amount

Algorithm:

Step 1 : Insert the ATM card into the ATM slot and remove

Step 2: Input PIN of ATM card

Step 3: Select option of withdrawal

Step 4: Input amount to be withdrawn

```
        Start
          ↓
Insert ATM into the ATM slot
          ↓
       Input PIN
          ↓
 Select option for withdrawal
          ↓
      Input amount
          ↓
     Withdraw Cash
          ↓
         End
```

THANK YOU