Introduction to C++

Algorithm:

What is Algortihm?

✓The word Algorithm means " A set of finite rules or instructions to be followed in calculations or other problem-solving operations " Or " A procedure for solving a mathematical problem in a finite number of steps that frequently involves recursive operations".

✓An Algorithm is a process or step-by-step instruction for solving a problem.

✓They form the foundation of writing a program.

✓Therefore Algorithm refers to a sequence of finite steps to solve a particular problem.

Use of the Algorithms:-

- Algorithms play a crucial role in various fields and have many applications.
  Some of the key areas where algorithms are used include:

- Computer Science: Algorithms form the basis of computer programming and are used to solve problems ranging from sorting and searching to complex tasks such as artificial intelligence and machine learning.

- Mathematics: Algorithms are used to solve mathematical problems, such as finding the solution to a system of linear equations or finding the shortest path in a graph.

- Operations Research: Algorithms are used to optimize and make decisions in fields such as transportation, logistics, and resource allocation.

- Artificial Intelligence: Algorithms are the foundation of artificial intelligence and machine learning, and are used to develop intelligent systems that can perform tasks such as image recognition, natural language processing, and decision-making.

- Data Science: Algorithms are used to analyze, process, and extract insights from large amounts of data in fields such as marketing, finance, and healthcare.

- These are just a few examples of the many applications of algorithms. The use of algorithms is continually expanding as new technologies and fields emerge, making it a vital component of modern society.

- Algorithms can be simple and complex depending on what you want to achieve.

What is the need for algorithms:

1. Algorithms are necessary for solving complex problems efficiently and effectively.

2. They help to automate processes and make them more reliable, faster, and easier to perform.

3. Algorithms also enable computers to perform tasks that would be difficult or impossible for humans to do manually.

4. They are used in various fields such as mathematics, computer science, engineering, finance, and many others to optimize processes, analyze data, make predictions, and provide solutions to problems.

5. The Algorithm designed are language-independent, i.e. they are just plain instructions that can be implemented in any language, and yet the output will be the same, as expected.

Properties of Algorithm:

- It should terminate after a finite time.

- It should produce at least one output.

- It should take zero or more input.

- It should be deterministic means giving the same output for the same input case.

- Every step in the algorithm must be effective i.e. every step should do some work.

Example:

E1. Write an algorithm of adding 3 numbers.

Step 1: Start

Step 2: Read num1 , num2 , num3

Step 3: Result = num1 + num2 + num3

Step 4: Print Result

Step 5: Stop

Charactersistics:

What are the Characteristics of an Algorithm?

- As one would not follow any written instructions to cook the recipe, but only the standard one.

- Similarly, not all written instructions for programming is an algorithms. In order for some instructions to be an algorithm, it must have the following characteristics:

1. Clear and Unambiguous: The algorithm should be clear and unambiguous. Each of its steps should be clear in all aspects and must lead to only one meaning.

2. Well-Defined Inputs: If an algorithm says to take inputs, it should be well-defined inputs. It may or may not take input.

3. Well-Defined Outputs: The algorithm must clearly define what output will be yielded and it should be well-defined as well. It should produce at least 1 output.

Another Examples:

E2. Calculate an area of a triangle.

Step 1: Start

Step 2: Declare the variables

Step 3: Read the variables

Step 4: Area of Triangle = (1/2 (base * height))

Step 5: Print Area

Step 6: Stop

E3. Find the greater of two numbers.

Step 1: Start

Step 2: Declare variables a,b

Step 3: Read variables a ,b

Step 4: if(a>b)

              Yes, print a
              No, print b

Step 5: Stop

Flowchart

- Graphical representation of Algorithm.
- Programmers often use it as a program-planning tool to solve a problem.
- It makes use of symbols which are connected among them to indicate the flow of information and processing.
- The process of drawing a flowchart for an algorithm is known as "flowcharting".

Basic Symbols used in Flowchart Designs

1. Terminal:

➢The oval symbol indicates Start, Stop and Halt in a program's logic flow.

➢A pause/halt is generally used in a program logic under some error conditions.

➢Terminal is the first and last symbols in the flowchart.

2. Input/Output:

➢A parallelogram denotes any function of input/output type.

➢Program instructions that take input from input devices and display output on output devices are indicated with parallelogram in a flowchart.
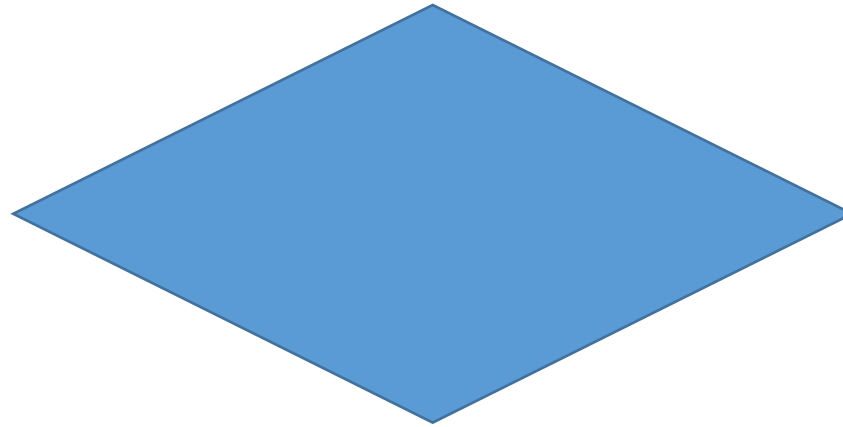
3. Processing:

➤ A box represents arithmetic instructions.

➤ All arithmetic processes such as adding, subtracting, multiplication and division are indicated by action or process symbol.
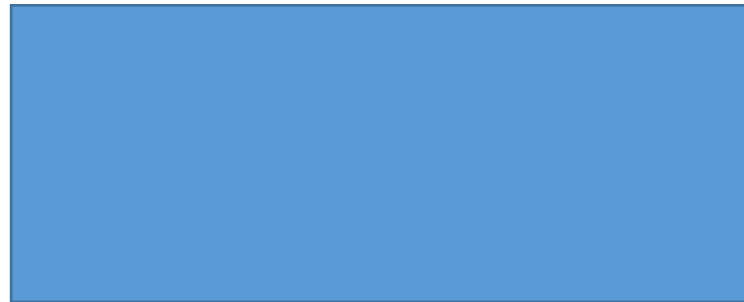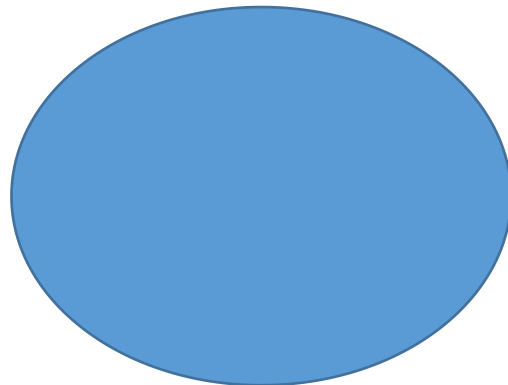
4. Decision:

➢Diamond symbol represents a decision point.

➢Decision based operations such as yes/no question or true/false are indicated by diamond in flowchart.

Connectors:

➢ Whenever flowchart becomes complex or it spreads over more than one page, it is useful to use connectors to avoid any confusions.

➢ It is represented by a circle.

Flow lines:

➢Flow lines indicate the exact sequence in which instructions are executed.

➢Arrows represent the direction of flow of control and relationship among different symbols of flowchart.

Write an algorithm and flowchart of addition of 2 numbers.
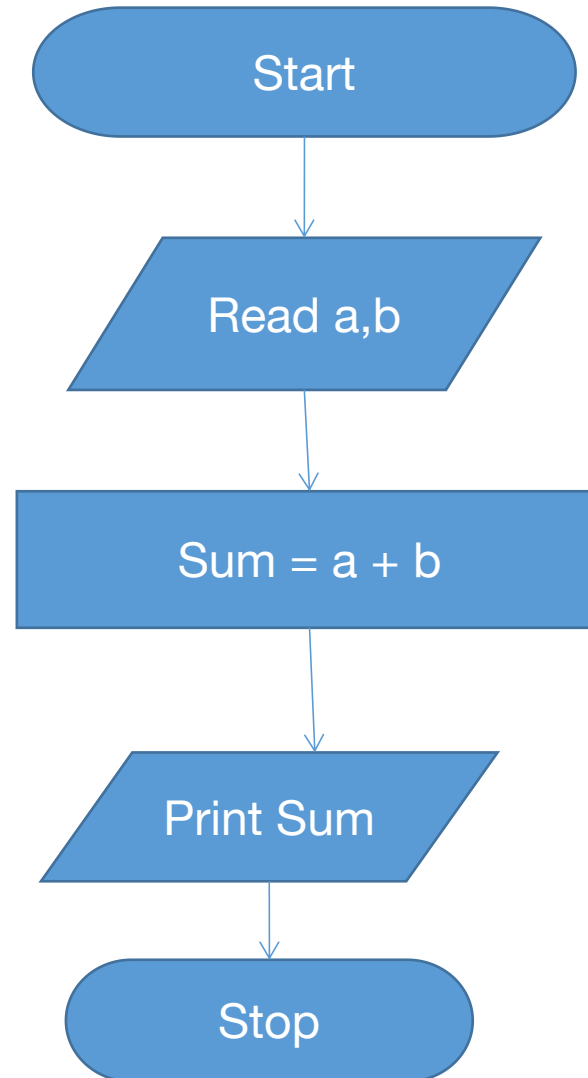
Algorithm

Step 1: Start

Step 2: Read variables a,b
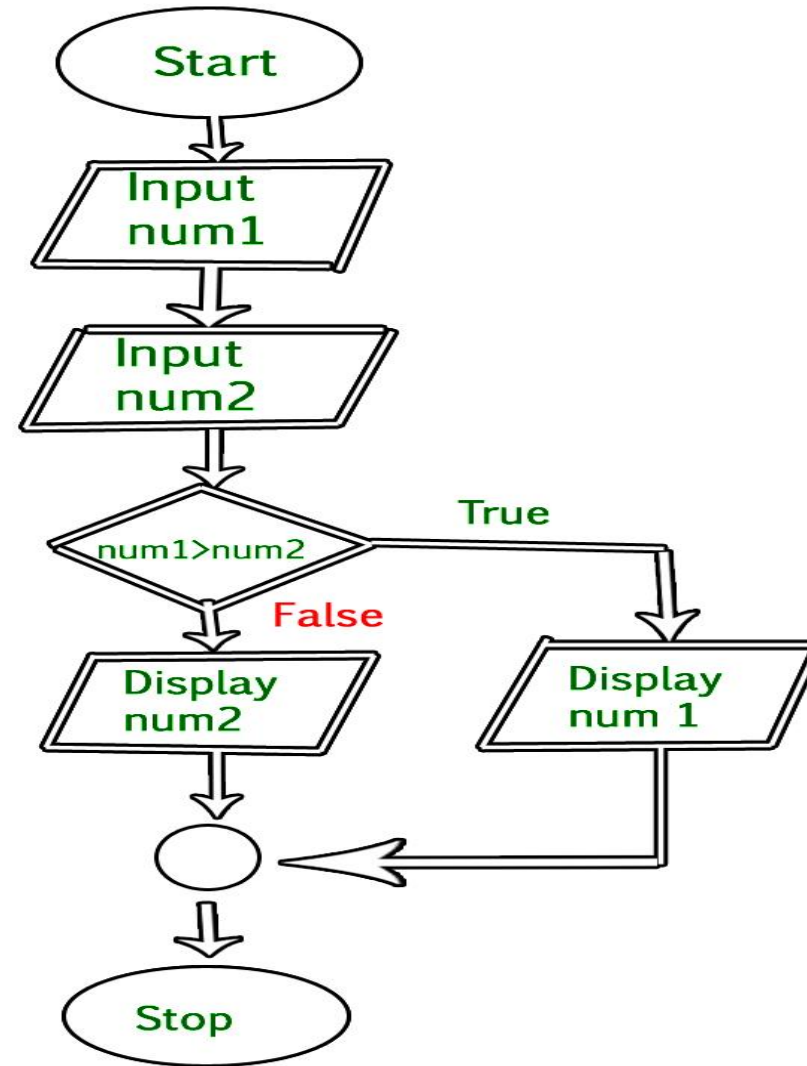
Step 3: Sum = a + b

Step 4: Print Sum

Step 5: Stop

Flowchart

Draw a flowchart to input two numbers from the user and display the largest of two numbers.
Write the algorithm for the same by yourself.(Task1)

Rules For Creating Flowchart :

- A flowchart is a graphical representation of an algorithm.it should follow some rules while creating a flowchart
- Rule 1: Flowchart opening statement must be 'start' keyword.
- Rule 2: Flowchart ending statement must be 'end' keyword.
- Rule 3: All symbols in the flowchart must be connected with an arrow line.
- Rule 4: The decision symbol in the flowchart is associated with the arrow line.