Logic Building Session 1

What is a program ?

A computer program is a collection of instructions that performs a specific task when executed by a computer.

What do you understand by programming?

Programming is the process of creating a set of instructions that tell a computer how to perform a task.

What are the four kinds of programming languages?

- Procedural Programming Language
- Functional Programming Language
- Object-oriented Programming Language
- Logic Programming Language
- Scripting Programming Language

Procedural Programming Language

The procedural programming language is used to execute a sequence of statements which lead to a result.

This type of programming language uses multiple variables, heavy loops and other elements, which separates them from functional programming languages.

Functions of procedural language may control variables, other than function's value returns. For example, printing out information.

It contains a systematic order of statements, functions and commands to complete a computational task or program.

Functional Programming Language

Functional programming (also called FP) is a way of thinking about software construction by creating pure functions. It avoid concepts of shared state, mutable data observed in Object Oriented Programming.
Functional langauges empazies on expressions and declarations rather than execution of statements. Therefore, unlike other procedures which depend on a local or global state, value output in FP depends only on the arguments passed to the function.

Ex: SQL, Scala

Object-oriented Programming Language

Object Oriented programming (OOP) is a programming paradigm that relies on the concept of classes and objects. It is used to structure a software program into simple, reusable pieces of code blueprints (usually called classes), which are used to create individual instances of objects. There are many object-oriented programming languages including JavaScript, C++, Java, and Python.

Scripting Programming Language

A scripting language or script language is a programming language for a runtime system that automates the execution of tasks that would otherwise be performed individually by a human operator.Scripting languages are usually interpreted at runtime rather than compiled.

Ex: Node js

Logic Programming Language

Logical Programming is a type of programming paradigm that uses logic circuits to control how facts and rules about the problems within the system are represented or expressed. In it, logic is used to represent knowledge, and inference is used to manipulate it. It tells the model about how to accomplish a goal rather than what goal to accomplish.

A language is a structured system to communicate.

What is computer language?

To communicate with the computers, we need some languages. These are computer languages.

There are mainly three different languages with the help of which we can develop computer programs. And they are –

- Machine Level language
- Assembly Level Language and
- High Level Language

Need of Computer Language

Difference between computer language and programming language?

What is logic

Programming logic is a set of principles that delineates how elements should be arranged so a computer can perform specific tasks.

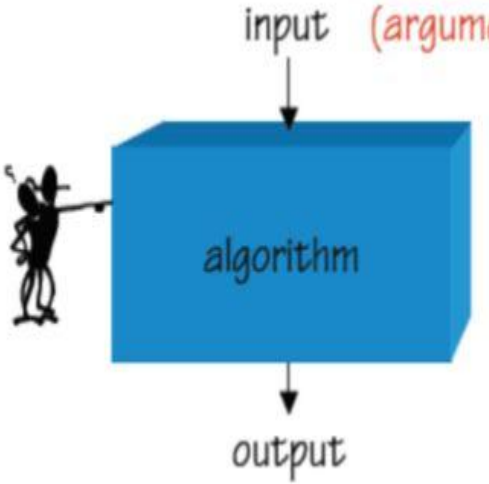
How to improve logic

- 1. Think to solve
- 2. Practice
- 3. Learn about Data Structures
- 4. Play Games
- 5. Learn programming paradigms
- 6. Look at other people’s code
- 7. Code Challenges
- 8. Read Books and solve Examples
- 9. Clean Code
- 10. Design Patterns

Algorithm

A process or set of rules to be followed in calculations or other problem-solving operations”.

Algorithm refers to a set of rules/instructions that step-by-step define how a work is to be executed upon in order to get the expected results.



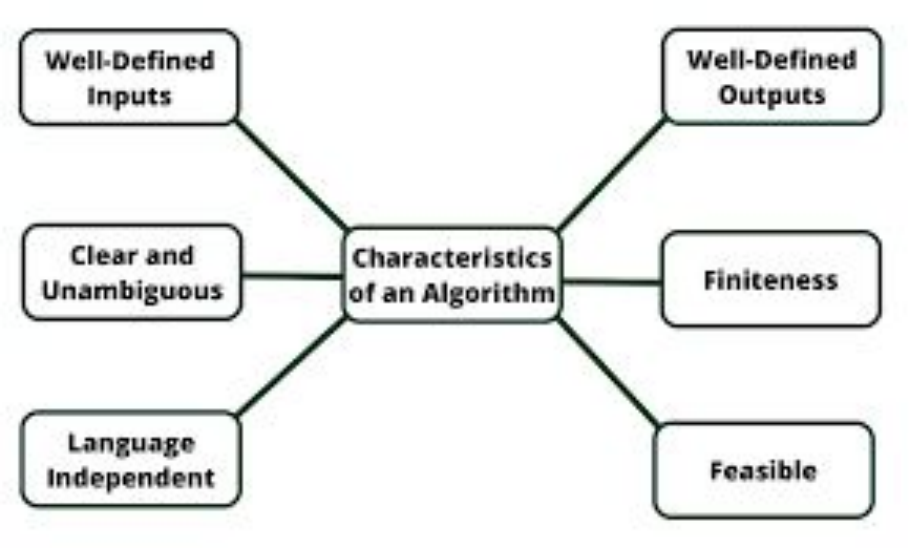
Problem: Complexity

Algorithm: Correctness
Complexity

Difference Between Program and Algorithm

Algo	Program
1. Design Phase	1. Implementation Phase
2. Written in any Language	2. Written in any Programming lang
3. Analyze the programs	3. Test the programs

What are the Characteristics of an Algorithm?



How to Design an Algorithm?

1. The **problem** that is to be solved by this algorithm.
2. The **constraints** of the problem that must be considered while solving the problem.
3. The **input** to be taken to solve the problem.
4. The **output** to be expected when the problem the is solved.
5. The **solution** to this problem, in the given constraints.

- **Step 1: Fulfilling the pre-requisites**

  As discussed above, in order to write an algorithm, its pre-requisites must be fulfilled.

  1. **The problem that is to be solved by this algorithm**: Add 2 numbers and print their sum.
  2. **The constraints of the problem that must be considered while solving the problem**: The numbers must contain only digits and no other characters.

1. **The input to be taken to solve the problem:** The three numbers to be added.
2. **The output to be expected when the problem the is solved:** The sum of the three numbers taken as the input.
3. **The solution to this problem, in the given constraints:** The solution consists of adding the 2 numbers. It can be done with the help of ‘+’ operator, or bit-wise, or any other method.

- **Step 2: Designing the algorithm**

Algorithm to add 2 numbers and print their sum:

1. START
2. Declare 2 integer variables num1, num2 .
3. Take the three numbers, to be added, as inputs in variables num1 and num2 respectively.
4. Declare an integer variable sum to store the resultant sum of the 2 numbers.
5. Add the 2 numbers and store the result in the variable sum.
6. Print the value of variable sum
7. END

- **Step 3: Testing the algorithm by implementing it.**

Flowchart

A flowchart is a pictorial (graphical) representation of an algorithm. A flowchart is drawn using different kinds of symbols. A symbol is used for a specific purpose. Each symbol has name.

Flowcharts use different shapes of boxes to denote different type of instructions. ANSI recommended a number of different rules and guidelines to help standardize the flowcharting process.

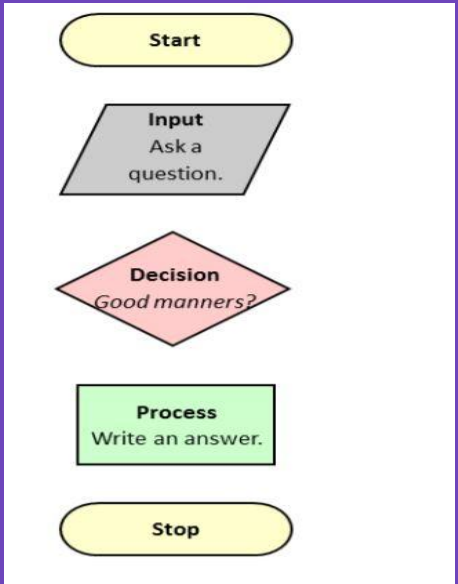
- Algorithms are represented using flowcharts
- Flowchart symbols are standardized by ANSI
- Flowchart helps to divide a large complex problem into small manageable ones
- Generally, algorithm is first represented as a flowchart and then expressed in a programming language
- While preparing a flowchart, the sequence, selection and iterative structures may be used wherever required

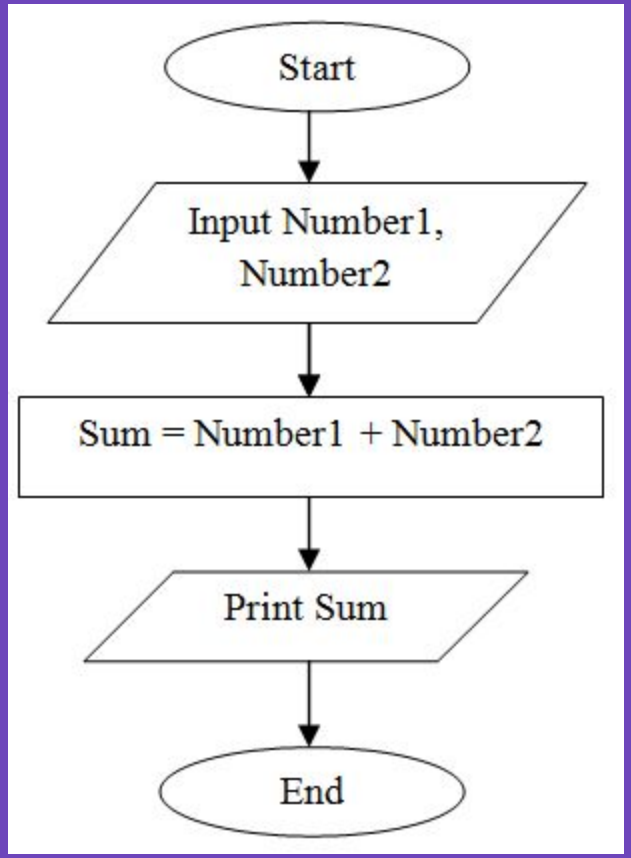
Rules for Drawing a Flowchart

- It should contain only one start and one end symbol
- The relevant symbols must be used while drawing a flowchart
- The direction of arrows should be top to bottom and left to right
- It should be simple and drawn clearly and neatly
- Be consistent in using names, variables in the flow chart
- Use properly labeled connectors to link the portions of the flowchart on different pages
- The branches of decision box must be label

Symbol	Name	Function
	Start/End	Flowchart terminator
	Arrows	A line is a connector that represent relationship between the representetive shapes and its flow direction
	Input/Output	A parallelogram represents input or output of your program
	Process	A rectangle represent a process
	Decision	A diamond indicates a decision

How Algorithms are Used or Works?



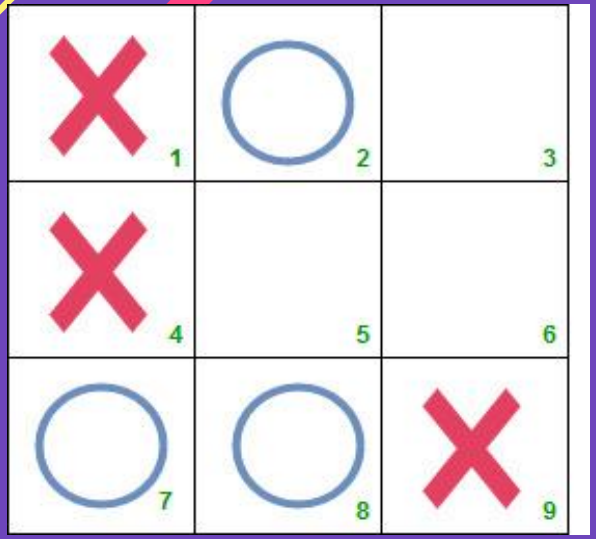

Start
Input Number1, Number2
Sum = Number1 + Number2
Print Sum
End

1. There are 5 lanes on a race track. One needs to find out the 3 fastest horses among total of 25. Find out the minimum number of races to be conducted in order to determine the fastest three.

2. There are 8 batteries, but only 4 of them work. You have to use them for a flashlight which needs only 2 working batteries. To guarantee that the flashlight is turned on, what is the minimum number of battery pairs you need to test?

3. A birthday cake has to be equally divided into 8 equal pieces in exactly 3 cuts. Determine the way to make this division possible.

4. There are 2 jugs with 4 litres and 5 litres of water respectively. The objective is to pour exactly 7 litres of water in a bucket. How can it be accomplished?



The game of Tic-Tac-Toe is being played between two players and it is in below state after six moves.

Can you answer following questions?

1. Who will win the game, O or X?
2. Which was the sixth mark and at which position?

- Write a program that prints ‘Hello World’ to the screen.
- Write a program that asks the user for their name and greets them with their name.
- Modify the previous program such that only the users Alice and Bob are greeted with their names.
- Write a program that asks the user for a number n and prints the sum of the numbers 1 to n
- Modify the previous program such that only multiples of three or five are considered in the sum, e.g. 3, 5, 6, 9, 10, 12, 15 for n=17

- 6. Write a program that prints a multiplication table for numbers up to 12.

- 7. Write a program that prints all prime numbers.

- 8. Write a guessing game where the user has to guess a secret number. After every guess the program tells the user whether their number was too large or too small. At the end the number of tries needed should be printed. It counts only as one try if they input the same number multiple times consecutively.

- 9. Write a program that prints the leap years.