

# Disha College

## Data Structure BCA III

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# Unit 1

## Objective

- Algorithm
- Properties of algorithm
- Analysis of algorithm
- Complexity of algorithm
- Types of complexity

# Algorithm

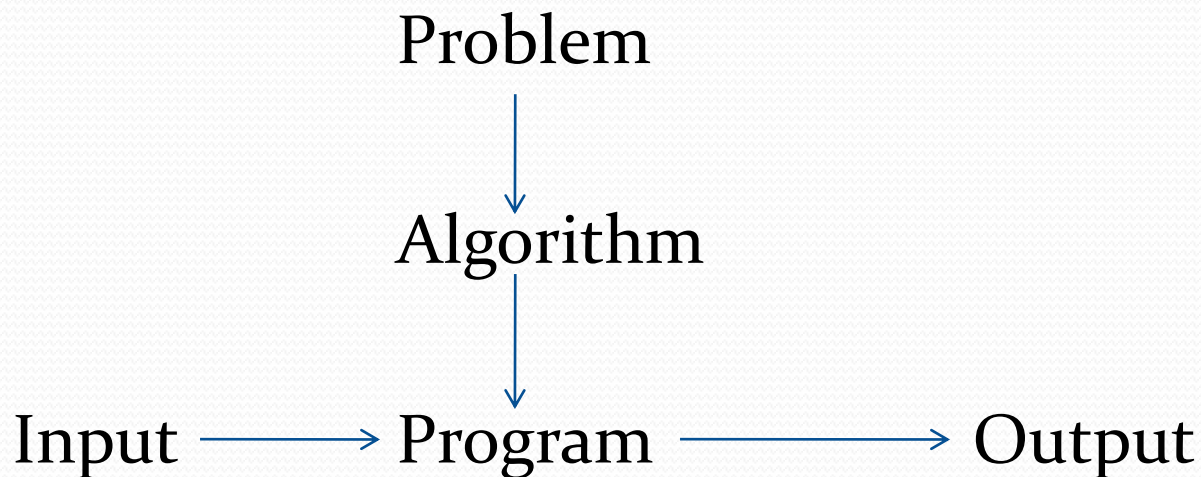
- A well-defined computational procedure that accepts input and produces output.
  - It can also be defined as sequence of computational steps to solve a particular problem.
- An algorithm can be expressed in three ways:-
- a) in any natural language such as English, called pseudo code.
  - b) in a programming language
  - c) in the form of a flowchart.

# Properties of an Algorithm

- Finiteness:- An algorithm must terminate after finite number of steps.
- Definiteness:-The steps of the algorithm must be precisely defined.
- Generality:- An algorithm must be generic enough to solve all problems of a particular class.
- Effectiveness:- The operations of the algorithm must be basic enough to be put down on pencil and paper.
- Correctness:- An algorithm must work correctly for all possible input

# Algorithm

Once the algorithm is designed, checked for its correctness, and proved that it is efficient, the next step is to write a computer program.



# Analysis of algorithm

Efficiency of the algorithm is the property which relate to the amount of resources (space and time) used by the algorithm.

The analysis of algorithm is a major task in computer science. To compare algorithms we must have some criteria to measure the efficiency of our algorithm.



There are several issues that may influence the efficiency:

- ❖ Input size
- ❖ Type of Computer used
- ❖ Method used to solve the problem

# Analysis of algorithm

- Two main measures for the efficiency of an algorithm are the time and space used by the algorithm.
- Time and space both are directly dependent on the input size  $n$  i.e. the number of data items used by the algorithm.
- So calculation of efficiency of algorithm is performed by using input size  $n$  as key factor.



# Complexity of algorithm

The complexity of an algorithm  $M$  is the function  $f(n)$  which gives the running and/or storage space requirement of the algorithm in terms of the size  $n$  of the input data.

The storage space required by an algorithm is simply a multiple of the data size  $n$ . Accordingly, unless otherwise stated or implied, the term complexity shall refer to the running time of an algorithm.

# Types of complexity

There are two types of complexity

- **Time Complexity**
- **Space Complexity**

# Time Complexity

The Time Complexity of an algorithm is a function of the running time of the algorithm. It gives the information about how much time is needed by the algorithm to complete its execution.

The time is measured by counting the number of key operations because the key operations are so defined that the time for other operations is much less than or at most proportional to the time for the key operations. In case of sorting and searching algorithms comparison is the key operation.

# Space complexity

- The Space Complexity of an algorithm is a function of the space needed by the algorithm to run to completion.
- The space required by an algorithm is simply a multiple of the data size  $n$ , so time complexity is taken into consideration all most of the times.
- Exact memory requirement for a program is to be known in advance as without sufficient memory either the program work slowly or may not work totally.
- When we design a program we must ensure that it should take minimum memory.