

# **Mid Assessment | Spring 2023**

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**CSE - 21<sup>st</sup> Batch | Course Title: Algorithm**

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## Answer to the Question no- 1

(a)

### **What is an Algorithm?**

An algorithm is a set of instructions for solving a problem or accomplishing a task. One common example of an algorithm is a recipe, which consists of specific instructions for preparing a dish or meal.

### **Categories of Algorithm-**

Here are 7 types of algorithms:

- Brute Force Algorithm
- Recursive Algorithm
- Dynamic Programming Algorithm
- Divide and Conquer Algorithm
- Greedy Algorithm
- Backtracking Algorithm
- Randomized Algorithm

### **Characteristics of an algorithm:**

1. **Precision** – the steps are precisely stated.
2. **Uniqueness** – results of each step are uniquely defined and only depend on the input and the result of the preceding steps.
3. **Finiteness** – the algorithm stops after a finite number of instructions are executed.
4. **Input** – the algorithm receives input.
5. **Output** – the algorithm produces output.
6. **Generality** – the algorithm applies to a set of inputs.

**(b)**

## **Advantages And Disadvantages Of Algorithms:**

### **Advantages Of Algorithm-**

- This is a step-by-step presentation of a solution to a given problem
- Algorithms follow a definite process
- The algorithm is easy to understand without programming knowledge because it isn't dependent on any programming language.
- It is easy to debug algorithms since they have logical reasons for each step.
- The algorithm divides the problem into smaller ones, so that each can be solved easily.

### **Disadvantages Of Algorithm-**

- Algorithms take a lot of time
- Problems cannot be reduced to algorithms, which makes them difficult
- In the Algorithm, it is difficult to show loops and branches

(c)

## Categories of Algorithm-

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### Greedy Algorithm:

In this algorithm, a decision is made that is good at that point without considering the future. This means that some local best is chosen and considers it as the global optimal.

There are two properties in this algorithm-

- **Greedly choosing** the best option
- **Optimal substructure property:** If an optimal solution can be found by retrieving the optimal solution to its subproblems.

Greedy Algorithm does not always work but when it does, it works like a charm! This algorithm is easy to device and most of the time the simplest one. But making locally best decisions does not always work as it sounds. So, it is replaced by a reliable solution called Dynamic Programming approach.

## Answer to the Question no- 2

(a)

### **Searching Algorithm:**

A search algorithm is the step-by-step procedure used to locate specific data among a collection of data. It is considered a fundamental procedure in computing. In computer science, when searching for data, the difference between a fast application and a slower one often lies in the use of the proper search algorithm.

The two most classical examples of that is the binary search and the merge sort algorithm.

### **Sorting Algorithm:**

A sorting algorithm is a method for reorganizing a large number of items into a specific order, such as alphabetical, highest-to-lowest value or shortest-to-longest distance. Sorting algorithms take lists of items as input data, perform specific operations on those lists and deliver ordered arrays as output.

(b)

### **Huffman coding:**

Huffman coding is a lossless data compression algorithm. In this algorithm, a variable-length code is assigned to input different characters. The code length is related to how frequently characters are used. Most frequent characters have the smallest codes and longer codes for least frequent characters.

There are mainly two parts. First one to create a Huffman tree, and another one to traverse the tree to find codes.

(c)

### **Mathematical Algorithm**

An algorithm in math is a procedure, a description of a set of steps that can be used to solve a mathematical computation.

For example, a step-by-step procedure used in long divisions is a common example of a mathematical algorithm.

### **Graph Algorithm**

An algorithm is a mathematical process to solve a problem using a well-defined or optimal number of steps. It is simply the basic technique used to get a specific job done.

A graph is an abstract notation used to represent the connection between all pairs of objects. Graphs are widely-used mathematical structures visualized by two basic components: nodes and edges.

Graph algorithms are used to solve the problems of representing graphs as networks like airline flights, how the Internet is connected, or social network connectivity on Facebook. They are also popular in NLP and machine learning to form networks.