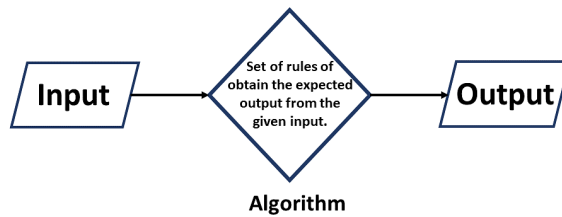


Victoria University of Bangladesh
Name: Md. Ziaul Hoque "Sohel"
Student ID: 2221220031
Course Title: Algorithm
Course Code: CSI 227
Batch: 22nd (evening)
Semester: Spring-2023

Ans to the Que No 1(A)

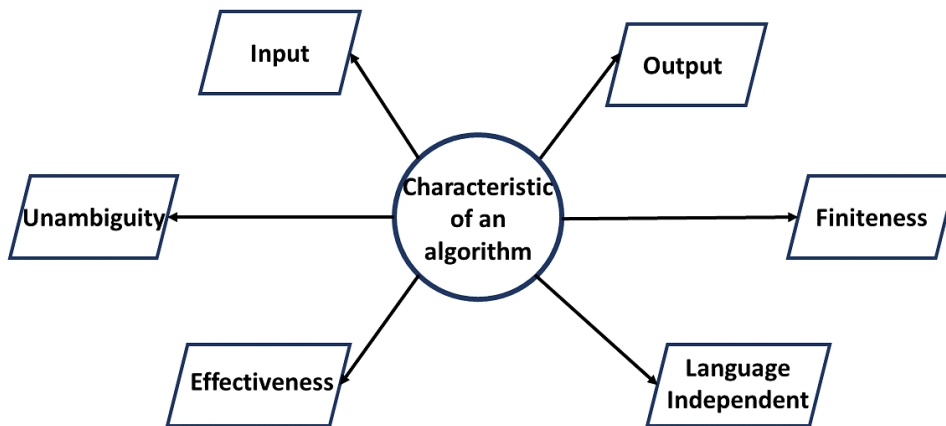
Algorithm:

An algorithm is a set of commands that must be followed for a computer to perform calculations or other problem-solving operations. According to its formal definition, an algorithm is a finite set of instructions carried out in a specific order to perform a particular task. It is not the entire program or code; it is simple logic to a problem represented as an informal description in the form of a flowchart or pseudocode.



Categories and Characteristics of an Algorithm:

An algorithm has the following characteristics:



- Input: An algorithm requires some input values. An algorithm can be given a value other than 0 as input.
- Output: At the end of an algorithm, you will have one or more outcomes.
- Unambiguity: A perfect algorithm is defined as unambiguous, which means that its instructions should be clear and straightforward.
- Finiteness: An algorithm must be finite. Finiteness in this context means that the algorithm should have a limited number of instructions, i.e., the instructions should be countable.
- Effectiveness: Because each instruction in an algorithm affects the overall process, it should be adequate.

- Language independence: An algorithm must be language-independent, which means that its instructions can be implemented in any language and produce the same results.

Ans to the Que No 1(B)

Advantages of Algorithms:

1. It is a step-wise representation of a solution to a given problem, which makes it easy to understand.
2. An algorithm uses a definite procedure.
3. It is not dependent on any programming language, so it is easy to understand for anyone even without programming knowledge.
4. Every step in an algorithm has its own logical sequence so it is easy to debug.
5. By using algorithm, the problem is broken down into smaller pieces or steps hence, it is easier for programmer to convert it into an actual program.

Disadvantages of Algorithms:

1. Algorithms is Time consuming.
2. Difficult to show Branching and Looping in Algorithms.
3. Big tasks are difficult to put in Algorithms.

Ans to the Que No 1(C)

Types Of Algorithms:

1. Brute Force Algorithm
2. Recursive Algorithm
3. Randomized Algorithm
4. Sorting Algorithm
5. Searching Algorithm
6. Hashing Algorithm

Greedy Algorithm:

In the Greedy Algorithm, the solution is built part by part. The decision to choose the next part is done on the basis that it gives an immediate benefit. It never considers the choices that had been taken previously.

Some common problems that can be solved through the Greedy Algorithm are Dijkstra Shortest Path Algorithm, Prim's Algorithm, Kruskal's Algorithm, Huffman Coding, etc.

Ans to the Que No 2(A)

Searching Algorithm:

Searching is the process of finding a particular item in a collection of items. A search typically answers whether the item is present in the collection or not. Searching requires a key field such as name, ID, code which is related to the target item. When the key field of a target item is found, a pointer to the target item is returned. The pointer may be an address, an index into a vector or array, or some other indication of where to find the target. If a matching key field isn't found, the user is informed.

The most common searching algorithms are:

- Linear search
- Binary search
- Interpolation search
- Hash table

Sorting Algorithm:

Sorting is the process of placing elements from a collection in some kind of order. For example, a list of words could be sorted alphabetically or by length. Efficient sorting is important to optimize the use of other algorithms that require sorted lists to work correctly.

Importance of sorting

To represent data in more readable format.

Optimize data searching to high level.

The most common sorting algorithms are:

- Bubble Sort
- Insertion Sort
- Selection Sort
- Quick Sort
- Merge Sort
- Shell Sort

Ans to the Que No 2(B)

Huffman coding:

Huffman coding is a method of data compression that is independent of the data type, that is, the data could represent an image, audio or spreadsheet. This compression scheme is used in JPEG and MPEG-2. Huffman coding works by looking at the data stream that makes up the file to be compressed. Those data bytes that occur most often are assigned a small code to represent them (certainly smaller than the data bytes being represented). Data bytes that occur the next most often have a slightly larger code to represent them. This continues until all of the unique pieces of data are assigned unique code words. For a given character distribution, by assigning short codes to frequently occurring characters and longer codes to infrequently occurring characters, Huffman's minimum redundancy encoding minimizes the average number of bytes required to represent the characters in a text. Static Huffman encoding uses a fixed set of codes, based on a representative sample of data, for processing texts. Although encoding is achieved in a single pass, the data on which the compression is based may bear little resemblance to the actual text being compressed. Dynamic Huffman encoding, on the other hand, reads each text twice; once to determine the frequency distribution of the characters in the text and once to encode the data. The codes used for compression are computed on the basis of the statistics gathered during the first pass with

compressed texts being prefixed by a copy of the Huffman encoding table for use with the decoding process. By using a single-pass technique, where each character is encoded on the basis of the preceding characters in a text, Gallager's adaptive Huffman encoding avoids many of the problems associated with either the static or dynamic method.

Ans to the Que No 2(C)

Graph Algorithm:

A Graph is a non-linear data structure consisting of vertices and edges. The vertices are sometimes also referred to as nodes and the edges are lines or arcs that connect any two nodes in the graph. More formally a Graph is composed of a set of vertices(V) and a set of edges(E). The graph is denoted by $G(E, V)$.

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.