

**Name: Adebayo Oluwamotemi Liberty**

**MATRIC NO: BU22SEN1005**

**COURSE: SEN208**

**Assignment: form a note on algorithms:**

An algorithm is a sequence of well-defined instructions typically used to solve a problem or perform a computation. It's a step-by-step guideline for calculations, data processing, and automated reasoning tasks.

**Importance**

Algorithms are fundamental to computer science and technology. They provide a clear set of instructions for processing data, solving problems, and performing calculations.

- To predict the behavior of an algorithm without implementing it on a specific computer.
- It is much more convenient to have simple measures for the efficiency of an algorithm than to implement the algorithm and test the efficiency every time a certain parameter in the underlying computer system changes.
- It is impossible to predict the exact behavior of an algorithm. There are too many influencing factors.
- It is easy to understand.
- An algorithm is a step-wise representation of a solution to a given problem.
- In an Algorithm the problem is broken down into smaller pieces or steps hence, it is easier for the programmer to convert it into an actual program.

**Definition of All Types**

- Geometric algorithms: Geometric algorithms are a type of algorithm that deal with solving problems related to geometry. These algorithms are used to solve various geometric problems such as computing the area of a polygon, finding the intersection of geometric shapes, determining the convex hull of a set of points, and many other tasks related to geometric objects and their properties. Geometric algorithms are important in various fields such as computer graphics, computer-aided design, robotics, and geographical information systems.

- Recursion Algorithms: The process in which a function calls itself directly or indirectly is called recursion. Using a recursive algorithm, certain problems can be solved quite easily. Examples of such problems are Towers of Hanoi (TOH) Tree Traversals, DFS of Graph, etc.

- Sorting Algorithms: Arrange data in a particular order (ascending or descending). For Example: The below list of characters is sorted in increasing order of their ASCII values. That is, the character with a lesser ASCII value will be placed first than the character with a higher ASCII value.

- Search Algorithms: Searching algorithms are essential tools in computer science used to locate specific items within a collection of data. These algorithms are designed to efficiently navigate through data

structures to find the desired information, making them fundamental in various applications such as databases, web search engines, and more.

- Shortest Path Algorithms: Determine the shortest path between two points in a weighted graph.

- Greedy algorithms: Greedy algorithms are a class of algorithms that make locally optimal choices at each step with the hope of finding a global optimum solution. In these algorithms, decisions are made based on the information available at the current moment without considering the consequences of these decisions in the future. The key idea is to select the best possible choice at each step, leading to a solution that may not always be the most optimal but is often good enough for many problems.

- Minimum Spanning Tree Algorithms: Connect all points in a graph with the minimum total weight for the edges.

**Summation in Algorithms**: Summation in the context of algorithms refers to the process of adding up a sequence of values, typically encountered when analysing the running time costs of programs with loop constructs.

### **Recursion**

Recursion is a programming technique in which a function calls itself directly or indirectly to solve a problem. This technique involves breaking down a complex problem into simpler subproblems, solving these subproblems, and then combining the solutions to obtain the final result.

### **Sorting**

These algorithms are used to arrange data in a specific order, such as ascending or descending. Examples of sorting algorithms are Bubble Sort, Insertion Sort, Merge Sort, Quick Sort, and Heap Sort.

### **Search**

These algorithms are used to find a specific element or data within a dataset. Examples of search algorithms include Linear Search and Binary Search.

### **Shortest Path**

The shortest path algorithm is a method used to find the most efficient path between two points in a network or graph. It was developed in 1956 by Edsger W. Dijkstra and is the basis for many applications that show the shortest route from one place to another.

### **Minimum Spanning**

A minimum spanning tree (MST) or minimum weight spanning tree is a subset of the edges of a connected, edge-weighted undirected graph that connects all the vertices together, without any cycles and with the minimum possible total edge weight.

### Differences Between Algorithms (Table)

<u>Algorithm Type</u>	<u>Purpose</u>	<u>Example</u>
Summation	Calculate total sum	Arithmetic series
Recursion	Solve problems using self-reference	Factorial calculation
Sorting	Order elements	QuickSort
Search	Locate elements	Binary search
Shortest Path	Find shortest route	Dijkstra's algorithm
Minimum Spanning	Connect all vertices with minimum weight	Kruskal's, Prim's algorithm

### Similarities

- Deterministic: They have a clear starting and ending point.
- Universal: Can be applied across various fields and disciplines.
- Efficient: Designed to perform tasks in the least amount of time and with minimal resources.

### Turing Machines

A Turing machine is a theoretical computing machine invented by Alan Turing, which can use a predefined set of rules to determine a result from a set of input variables.

### Halting Problem

The halting problem is a decision problem that determines whether a given computer program will eventually halt (stop running) or continue to run indefinitely.

### Problem

Algorithms are designed to address specific problems by providing a structured approach to achieve a desired outcome.