Modern Education Society's
Wadia College of Engineering, Pune-01
Department of Computer Engineering

NAME OF STUDENT:	**CLASS:**
SEMESTER/YEAR:	**ROLL NO:**
DATE OF PERFORMANCE:	**DATE OF SUBMISSION:**
EXAMINED BY:	**EXPERIMENT NO: 03**

TITLE: Implement Greedy search algorithm

PROBLEM STATEMENT: Implement Greedy search algorithm for any of the following application:

I. Selection Sort
II. Minimum Spanning Tree
III. Single-Source Shortest Path Problem
IV. Job Scheduling Problem
V. Prim's Minimal Spanning Tree Algorithm
VI. Kruskal's Minimum Spanning Tree Algorithm
VII. Dijkstra's Minimum Spanning Tree Algorithm

OBJECTIVES:

1. To understand Greedy approach of search algorithm

THEORY:

Greedy strategy:

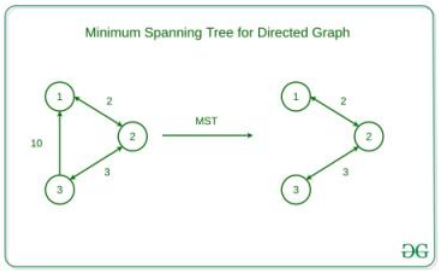
The **Greedy Method** is an optimization technique that builds a solution step by step, always choosing the most immediate benefit. It works best when **locally optimal choices** lead to a **globally optimal solution**. A **feasible solution** satisfies constraints, while an **optimal solution** is the best among them.

Selection Sort:

Selection Sort is a comparison-based sorting algorithm. It sorts an array by repeatedly selecting the **smallest (or largest)** element from the unsorted portion and swapping it with the first unsorted element. This process continues until the entire array is sorted.

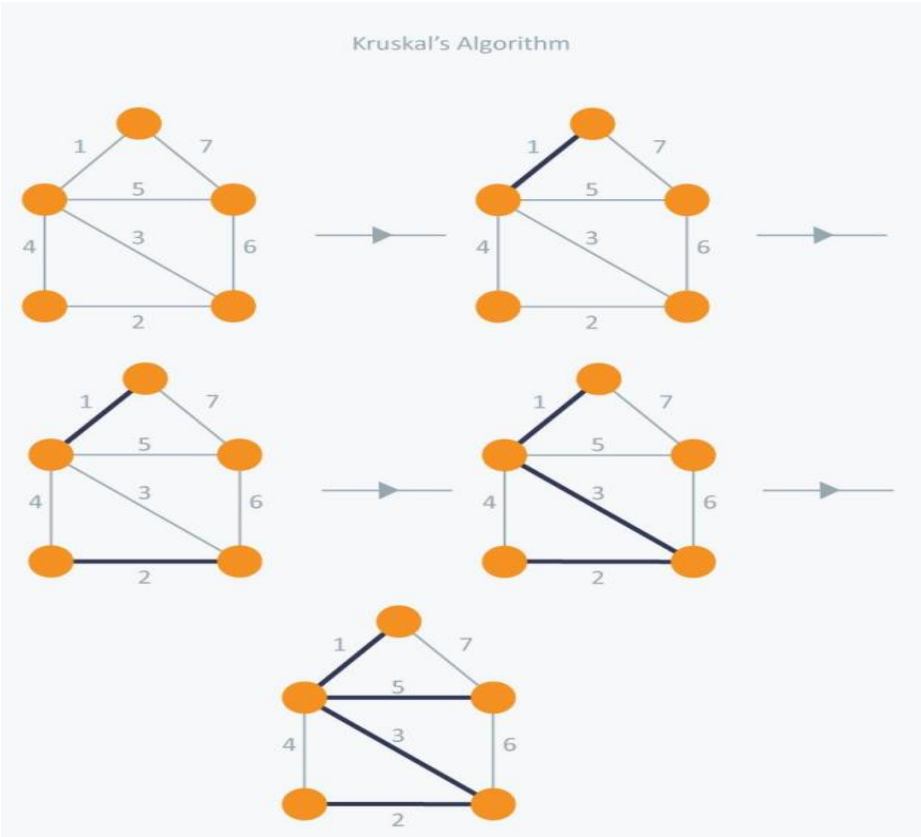
Minimum Spanning Tree (MST)

The cost of the spanning tree is the sum of the weights of all the edges in the tree. There can be many spanning trees. Minimum spanning tree is the spanning tree where the cost is minimum among all the spanning trees. There also can be many minimum spanning trees.



Kruskal's Algorithm

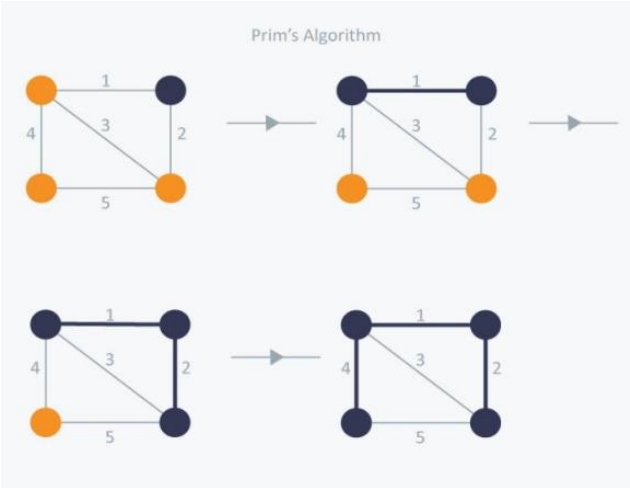
Kruskal's Algorithm builds the spanning tree by adding edges one by one into a growing spanning tree. Kruskal's algorithm follows a greedy approach as in each iteration it finds an edge which has least weight and adds it to the growing spanning tree.



Prim’s Algorithm

Prim’s Algorithm also use Greedy approach to find the minimum spanning tree. In Prim’s Algorithm we grow the spanning tree from a starting position. Unlike an **edge** in Kruskal's, we add **vertex** to the growing spanning tree in Prim's.

Consider the example below



Single-Source Shortest Path Problem

This problem involves finding the shortest path from a **single source node** to all other nodes in a **weighted, directed graph** G=(V,E)G = (V, E). The shortest path from uu to vv is the path with the **minimum total edge weight**.

Variants:

- **Single-Destination Shortest Path**: Finds the shortest path **to** a given destination from all nodes.
- **Single-Pair Shortest Path**: Finds the shortest path **between** two specific nodes.
- **All-Pairs Shortest Path**: Finds the shortest path **between every pair** of nodes.

Breadth-First Search (BFS) works for **unweighted graphs**, treating all edges as unit weight. However, in **weighted graphs**, algorithms like **Dijkstra's** (for non-negative weights) and **Bellman-Ford** (handles negative weights) are used. If a **negative cycle** exists, no shortest path is defined.

Job Scheduling Problem

Job scheduling aims to maximize profit by scheduling **N** jobs on a single processor, where each job has a **unit execution time**, a **profit**, and a **deadline**. A job earns profit only if completed on or before its deadline; otherwise, it incurs a penalty.

Problem Constraints:

- Each job has **deadline** di≥1d_i \geq 1 and **profit** pi≥0p_i \geq 0.
- **Only one job** can run at a time.

- A **feasible solution** ensures all selected jobs meet their deadlines.
- An **optimal solution** maximizes total profit.

Prim's Algorithm

Prim's algorithm is a minimum spanning tree algorithm that takes a graph as input and finds the subset of the edges of that graph which

- form a tree that includes every vertex
- has the minimum sum of weights among all the trees that can be formed from the graph

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Dijkstra's Algorithm

Dijkstra's algorithm allows us to find the shortest path between any two vertices of a graph. It differs from the minimum spanning tree because the shortest distance between two vertices might not include all the vertices of the graph.

Questions:

1. **What are the advantages and disadvantages of greedy method**
2. **What are the characteristics of Greedy algorithm?**