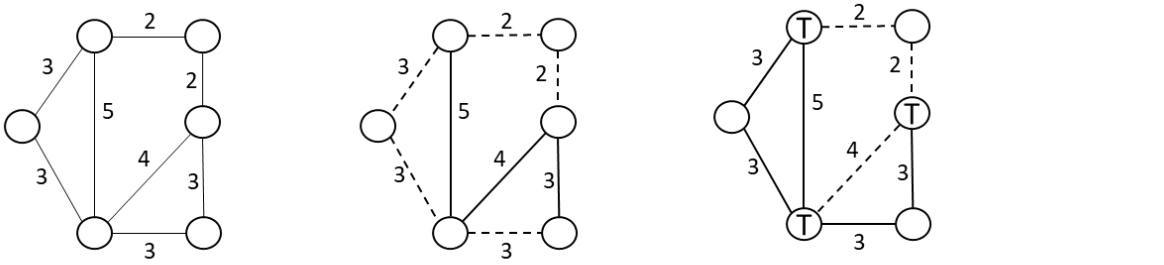
IE552 Homework Assignment 1 Deadline: 21.11.2022

1)

Minimum Spanning Tree: A minimum-weight tree connecting all vertices in an undirected, weighted graph.

Minimum Steiner Tree: A minimum-weight tree connecting a designated set of vertices, called terminals, in an undirected, weighted graph.

Example: The dashed edges constitute the tree.



a) Original Graph b) Minimum Spanning Tree c) Minimum Steiner Tree (3 terminals)

The goal of this exercise is to design your own greedy heuristic for the Steiner tree problem and compare it with the heuristic described below.

(a) Given the problem, construct a graph where the only nodes are the terminals. The weight associated with an edge connecting two terminals represents the value of the shortest path between those terminals in the original graph.

(b) Generate a minimum spanning tree from this graph using the Kruskal algorithm.

(c) From the edges obtained from the spanning tree, redesign the original graph using those selected edges and find the Steiner tree.

First provide a pseudocode for your heuristic.

Second generate 3 small graphs. (Total number of nodes could be from 5 to 10 and the number of terminals could vary from 3 to 5)

Third Apply your algorithm and the one given in the question on these graphs. State which one performs better on these graphs and discuss why.

2) For a well-known optimization problem such as TSP and VRP, find a simulated annealing code written in any programming language and indicate the steps of the algorithm on this code. For example, which lines generate the initial solution, which lines update the solution, which loop is for temperature update etc.
Do not forget to provide the code with its source.