

Fundamental Algorithms

Homework 8

Instructions

You do NOT need to submit solutions for this homework.

Problem 1

Let $G = (V, E)$ be an undirected connected graph where each edge has a weight from the set $\{1, 10, 25\}$. Describe an $O(|V| + |E|)$ time algorithm to find an MST of G .

Problem 2

Let $G = (V, E)$ be a weighted DAG, i.e., G is a directed acyclic graph that is also weighted. Develop an algorithm to find the length of the shortest paths from one vertex s to all other vertices in G in $O(|V| + |E|)$ time.

Hint: Use topological sorting.

Problem 3

You are given n balls and m boxes. Each ball has a diameter and each box has a length. You may assume you are given two arrays $D[1 \dots n]$ and $L[1 \dots m]$ where the diameter of the i^{th} ball is $D[i]$ and the length of the j^{th} box is $L[j]$.

The i^{th} ball can be stored in the j^{th} box if $D[i] \leq L[j]$. You cannot store more than one ball in each box. Develop a greedy algorithm to store the balls in the boxes in such a way that the number of balls stored is maximized.

Problem 4

Find a weighted graph with some edges assigned a negative weight on which Dijkstra's Algorithm fails. Justify your answer.