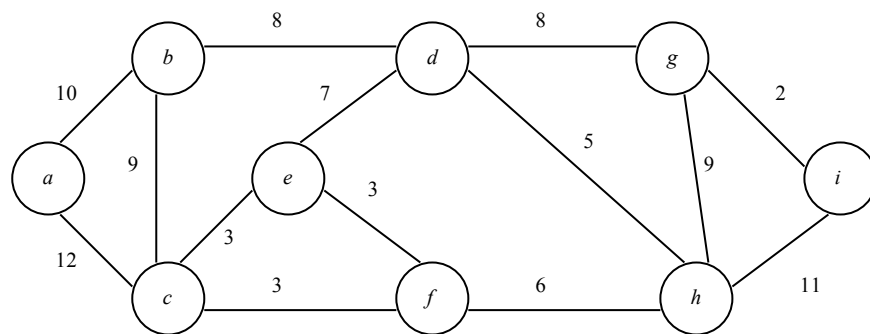


Design and Analysis of Algorithms (COMP3001)

Tutorial 6 Greedy Graph Algorithms

Question 1.

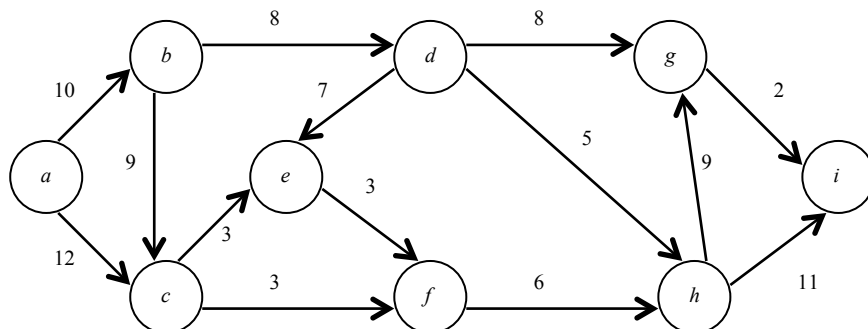
Consider the following weighted connected graph.



- Use Kruskal's algorithm to find the MST. Show all the steps.
- Use Prim's algorithm to find the MST. Show all the steps.

Question 2.

Consider the following weighted directed graph.



Use Dijkstra's algorithm to find the shortest paths from vertex *a*. Show all the steps.

Question 3.

Let (u, v) be a minimum-weight edge in a graph G . Show that (u, v) belongs to some minimum spanning tree of G .

Question 4.

Suppose that all edge weights in a graph are integers in the range from 1 to $|V|$.

- a) How fast can you make Kruskal's algorithm run?
- b) What if the edge weights are integers in the range 1 to W for some constant W ?
(Hint: Counting sort)

Question 5.

A clique of an undirected graph $G = (V, E)$ is a subset of vertices $C \subset V$ where each vertex in C is connected to every other vertex in C . A maximum clique is a clique with the most vertices, $|C|$.

- a) Devise a greedy heuristic for determining the maximum clique of a graph.
- b) Give an example on which your heuristic actually produces the maximum clique, and also an example for which it does not.
- c) What is the time complexity of your algorithm?