

Assignment 3

CSC 226

Theoretical Part

Question 1. When solving the single source shortest path problem using Dijkstra's algorithm for an *undirected* graph with positive edge weights, the paths found result in a spanning tree T . Is T a minimum spanning tree for G ?

Question 4. Argue convincingly: Dijkstra's algorithm works for *directed* graphs with positive edge-weights.

Question 3. In pseudocode, describe an algorithm that finds all shortest paths *to* a given vertex from each other vertex of a weighted *directed* graph with nonnegative edge-weights.

Question 4. Let $G = (V, E)$ be a *directed* graph where each edge has either weight 1 or weight 2. Further, let $v, w \in V$. Describe an algorithm that determines a shortest path from vertex v to destination vertex w , where the time complexity is $O(|V| + |E|)$.

Question 5 (Bonus question, up to 6 bonus marks). Describe three problems in application areas where Dijkstra's algorithm can be used.