1996 Paper 3 Question 5

Data Structures and Algorithms

Describe and justify Dijkstra's algorithm for finding the shortest path between two vertices in a directed graph with non-negative lengths associated with its edges.

[8 marks]

How can this algorithm be extended to consider graphs with some negative lengths?

[6 marks]

By considering the graph on $\{A, B, C\}$ with $A \to B$ having length -2, $B \to A$ having length 1 and $A \to C$ having length 1, or otherwise, show that the "shortest path" is not always well defined if there are negative lengths. When is it well defined?

[6 marks]