

## 1996 Paper 10 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  $A \rightarrow B$  having length  $-2$ ,  $B \rightarrow A$  having length 1 and  $A \rightarrow C$  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]