The Sliding Shortest Path Problem

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Abstract

Given an undirected weighted graph and a pair of vertices s and t, connected by the shortest path, and a third vertex p not lying on the shortest path, what is the minimal change in the graph weights needed to cause the shortest path between s and t to pass through vertex p? This is the type of problem often faced by network administrators in the telecommunication world. In this paper, we provide an algorithm for solving this problem; the approach taken is one of replacement of the weights of a set of edges of minimum cardinality with weights of “infinity”. The algorithm determines the minimum cardinality set in polynomial time. Furthermore, it is shown that it is easily extensible to the case of where the shortest path between the given pair of vertices s and t is constrained to pass over a given edge, instead of the given vertex, a scenario that can also occur in telecommunication networks.