A Computational Study for the 2-Edge-Connectivity Augmentation Problem

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Abstract

We consider the 2-edge-connectivity augmentation problem: given a graph $S = (V, E)$ which is not 2-edge-connected and a set of edges $E' \subseteq V \times V$ with non-negative weights, find a minimum cost subset X of E' such that adding the edges of X to S results in a 2-edge-connected graph.

We solve the problem for general and large-scale instances using both exact and heuristic methods. Given that the problem admits also a set covering formulation, we exploit both the graph and the set covering representation. In particular, we develop a shortest path reconstruction algorithm which has a promising impact on both construction and local search heuristic paradigms. Computational results indicate that the set covering representation leads to the best algorithms and that an exact solution via integer programming is practicable even for large random graphs with 800 vertices. The best heuristic is an advanced heuristic algorithm based on sub-gradient optimization and iterated greedy.