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A hybrid GRASP with Perturbations for the Steiner Problem in Graphs

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Abstract: We propose and describe a hybrid GRASP with weight perturbations and adaptive path-relinking heuristic (HGP-PR) for the Steiner problem in graphs. In this multi-start approach, the greedy randomized construction phase of a GRASP is replaced by the combination of several construction heuristics with a weight perturbation strategy that combines intensification and diversification elements, as in a strategic oscillation approach. The improvement phase circularly explores two different local search strategies: the first uses a node-based neighborhood for local search, while the second uses a key-path-based neighborhood. An adaptive path-relinking technique is applied to a set of elite solutions as a post-optimization strategy. Computational experiments on a large set of benchmark problems of three different classes are reported. We first illustrate the effectiveness of preprocessing procedures for several classes of test problems. Next, we present computational results illustrating the contribution of each algorithmic feature to the robustness of the complete algorithm. Finally, we show that our algorithm outperforms other heuristics in the literature, obtaining consistently better or comparably good solutions for all classes of test problems.