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TB3 TSP and its variants

Chairperson: Yuval Cohen

The Asymmetric Steiner Traveling Salesman Path Problem ASTSPP - open and closed tours' efficient determination in general digraphs. P. Richter

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The ASTSPP has been unattended in the past despite its high practical importance for real-time navigation in digital traffic nets! We are given a graph G with asymmetric arc weights, start point s, target point t, and a subset $S \subseteq V(G)$. The objective is to find a shortest route from s to t in G visiting all nodes of S at least once. The proposed deterministic solution approach relies (a) on an Advanced Scan of Spanning Trees applied to approximate Steiner trees $T \subset G$ spanning S, (b) on a Tree Structure Adaption that overcomes "flaws" of T hampering good results and (c) on a Confined Complete Enumeration that rearranges the sequence of the last $n \leq 6$ stopovers of S, each time a new successor $x \in S$ has been found. The implemented algorithm shows a maximal sample standard deviation q-max $\leq 1{,}86$ % and it remains real-time capable for $|S| < 150$. It complies with demands for using graphs that must not necessarily be complete (e.g. traffic maps), that have generally asymmetric arc weights, and that have not to comply with the triangle inequality. It satisfies the request to evenhandedly compute near-optimal round trips ($s = t$) as well general routes ($s \neq t$) without any special precaution.

Keywords: Asymmetric Steiner Traveling Salesman Path Problem.

IP formulations for equitable Traveling Salesman Problems. V.H. Nguyen, T.Q.T. Vo

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We consider several equitable versions of the Traveling Salesman Problem where the equity is based on the cost of the edges taken by the tour. One of these versions is the balanced traveling salesman problem defined by Larusic and Punnen (COR, vol. 38, pp 868-875 2010) where the objective is to minimize the difference between the maximum cost and the minimum cost of the edges in the tour. We also consider the OWA (ordered weighted averaging) TSP which favors tours with similar costs on the edges while assuring a degree of efficiency on the total cost. We propose MIP formulations for those problems where the equity constraints are formulated as linear constraints. Moreover, no additional integer variable is needed with respect to the IP formulation of the original TSP. We also present numerical experiments where, to our knowledge, optimal solutions for several instances of the balanced TSP are proved for the first time.

Keywords: Traveling salesman problem, Equity, Ordered weighted averaging, Mixed integer linear programming.

An improved penalty heuristic for the generalized assignment and the TSP. Y. Cohen, J. Reis, F. Pilati

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This study examines several significant improvements to the penalty method suggested by Martello and Toth (1981) for the assignment problem. It is shown that these improvements reduce the possible effect of worst case scenarios. Based on the principles of the improved assignment, a heuristic procedure is proposed for solving the TSP. Again, it is shown that the effect of worst case scenario is greatly reduced by using this heuristic when compared to the Nearest Neighbor approach.

Keywords: Penalty, Assignment, TSP, Traveling Salesman, Myopic, Heuristic.