On unified solution approach for solving multi-constraint travelling salesman problems with profits

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Résumé

Although the Traveling Salesman Problem with Profits (TSP with profits) has been explored quite broadly as a field of study and practice, only very attention has been paid to multi-attribute TSP with profits, despite its large applicability. In this paper, we introduce a rich variant [1] of the TSP with profits dealing with a large class of temporal and physical incompatibility characteristics. This problem is too hard to be solved by exact methods. We therefore introduce a general multi-purpose hybrid math-heuristic based on routing heuristics and exact loading neighborhoods. To build and improve the customers' sequences, we propose a multi start-construction heuristic, a portfolio of removal and insertion heuristics and a broad range of local search procedures. A special attention has been paid to the loading aspect of the problem which was barely considered in previous works by solving the resulting loading problem exactly. Several data sets with instances of up to 288 customers were used to evaluate the unified math-heuristic from the Orienteering Problem [2,3] and the Orienteering Problem with Time Window literature [4,5]. Experimental results demonstrate that the proposed math-heuristic may compete with the best known state-of-the-art methods proposed for these problems. Expanded computational experiments on more complex generated instances substantiate the effectiveness of the proposed approach. Sensitivity analysis follows and reveals the importance of some algorithmic setups and loading neighborhoods components for reaching high quality solutions.

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