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VORTRAG

Metaheuristics for Routing Problems with Profits

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Abstract
We study different problems belonging to the class of Vehicle Routing Problems with Profits (VRPPs). Contrary to what happens in classical Vehicle Routing Problems (VRPs) where all the customers have to be served, in VRPPs a profit is associated to each customer and the problem is to choose a subset of customers to serve and construct vehicle routes. Different problems belong to the class of VRPPs and they differ each other on the basis of the objective function and route constraints. In this study we analyze the Team Orienteering Problem (TOP), the Capacitated Team Orienteering Problem (CTOP) and the Capacitated Profitable Tour Problem (CPTP). In the TOP a limited fleet of vehicle is available and maximum duration for each vehicle route is given. The objective is to identify the set of customers to serve which maximize the total collected profit while satisfying the given time limit for each vehicle. The CTOP is a generalization of the TOP where a demand is associated to each customer and vehicles have a limited capacity. The objective is still to maximize the profit while satisfying capacity and duration constraints for each vehicle route. Finally, in the CPTP each vehicle has a capacity constraint while there is no time limit restriction. The objective is to find the set of routes which maximizes the difference between the total collected profit and the total traveling cost. We propose three different metaheuristic approaches to solve these problems: two variants of a generalized tabu search algorithm and a variable neighbourhood search algorithm. Each approach has a general structure which is adapted for the characteristics of each problem. Different computational tests have been performed to prove the effectiveness of the algorithms. For the TOP, we compare our approaches with heuristic algorithms existing in the literature obtaining very good results, in terms of solution quality, within a reasonable amount of time. For the CTOP and CPTP we instead compare the results with optimal solutions obtained through a branch and price algorithm: again, the results prove the high performance of our approaches.