An Exact Solution Framework for Multi-Trip Vehicle Routing Problems with Time Windows

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Abstract

Multi-Trip Vehicle Routing Problems (MTVRP) generalize the well-known VRP by allowing vehicles to perform multiple trips per day. MTVRPs have received a lot of attention lately because of their relevance in real-life applications, e.g., in city logistics and last-mile delivery. Several variants of the MTVRP have been investigated in the literature, and a number of exact methods have been proposed. Nevertheless, the computational results currently available suggest that MTVRPs with different side-constraints require ad-hoc formulations and solution methods to be solved. Moreover, solving instances with just 25 customers can be out of reach for such solution methods. In this talk, we propose an exact solution framework to address four different MTVRPs proposed in the literature. The exact solution framework is based on a novel formulation that has an exponential number of variables and constraints. It relies on column generation, column enumeration, and cutting plane. We show that this solution framework can solve instances with up to 50 customers of four MTVRP variants and outperforms the state-of-the-art methods from the literature.

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