

The Static and Stochastic VRPTW with both random Customers and Reveal Times

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Unlike its deterministic counterpart, static and stochastic vehicle routing problems (SS-VRP) aim at modeling and solving real-life operational problems by considering uncertainty on the data. We consider the SS-VRPTW-CR introduced in [1]. Like the SS-VRP introduced by [2], we search for optimal first stage routes for a fleet of vehicles to handle a set of stochastic customer demands, *i.e.*, demands are uncertain and we only know their probabilities. In addition to capacity constraints, customers are also constrained by time windows, just as in [3]. Unlike all SS-VRP variants, the SS-VRPTW-CR does not make any assumption on the time at which a stochastic demand is revealed, *i.e.*, the reveal time is stochastic as well, hence preserving nonanticipativity constraints. To handle this new problem, we introduce waiting locations: Each vehicle is assigned a sequence of waiting locations from which it may serve some associated demands, and the objective is to minimize the expected number of demands that cannot be satisfied in time.

In this paper, we propose two new recourse strategies for the SS-VRPTW-CR, together with their closed-form expressions for efficiently computing their expectations: The first one allows us to take vehicle capacities into account; The second one allows us to optimize routes by avoiding some useless trips. We propose two algorithms for searching for routes with optimal expected costs: The first one is an extended branch and cut algorithm, based on a stochastic integer formulation, and the second one is a local search based heuristic method. We also introduce a new public benchmark for the SS-VRPTW-CR, based on real-world data coming from the city of Lyon. We evaluate our two algorithms on this benchmark and empirically demonstrate the expected superiority of the SS-VRPTW-CR anticipative actions over a basic "wait-and-serve" policy.

References

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