
Unpredictability and inconsistency - routing in the domain of security services

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Abstract

Based on the most recent literature covering consistency, security aspects and surveillance tasks with respect to vehicle routing problems, we provide multiple problem formulations for two general routing problems in the domain of security related operations that cover a wide range of different applications as well as an easily accessible definition of the term inconsistency. While consistency tries to generate similarities in at least one of many criteria between different solutions, we assume inconsistency to aim for solutions with differences in at least one criterion. We present mathematical formulations to obtain those differences in two different criteria: node (time) inconsistency or arc (route) inconsistency as well as a combination of those. Our main focus in terms of the formulation was to deliver an assessment of the trade-off between additional routing costs and diversity in the set of found routes. An analysis of the two problem variants is given concerning their advantages in direct comparison against each other and their deterministic and stochastic formulation. We also considered other problems that were accessible with our formulation (e.g., robust production planning, routing in disaster relief). Since this work focuses on a new problem class, we tried to open the field of security related routing to the research by offering new test instances based on input and data from one of the biggest Austrian security service providers, a broad range of formulations, and first benchmarks with different solution approaches (with focus on matheuristic approaches).

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