The heterogeneous dial-a-ride problem with reconfigurable vehicle capacity

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Abstract

Various forms of the Dial-a-Ride Problem (DARP) have been studied during the last decade. Most recently, various user types (heterogeneous users) and adapted vehicle fleets have been considered. This paper introduces a new version of the heterogeneous DARP in which a vehicle capacity can be modified during its route by reconfiguring its interior to satisfy different user demands.

The work is motivated by the daily transport of children with disabilities at Lyon. A fleet of configurable vans is available each day to transport children to and from medical-social establishments for rehabilitative treatment. Nevertheless, today, route planners do not consider reconfiguration opportunities when designing routes.

The problem is modeled as a mixed-integer program derived from the heterogeneous DARP model, but with an extra index representing the current vehicle configuration. The considered number of passengers and vehicle fleet size make this problem virtually intractable for exact solving approaches. Thus, a meta-heuristic based on large neighborhood search is proposed and evaluated on randomly generated and real life instances.

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