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The Multi Trip Vehicle Routing Problem with Time Windows and Release Dates

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In this paper, we introduce the Multi Trip Vehicle Routing Problem with Time Windows and Release Dates (MTVRPTWR) and propose a memetic algorithm for its heuristic solution.

This problem arises in the context of MODUM[1] project (founded by The French National Research Agency - ANR). In MODUM the development of an efficient system of mutualized distribution is studied. Carriers allowed to enter city centers (*vans* in the following) are parked at platforms located around the beltway where trucks *continuously* arrive during the day and are unloaded. Then, not all goods are available at the platforms at the beginning of the working day. This justifies the introduction of the concept of *release date* associated with the merchandise. Precisely, the release date represents the time merchandise is available at the platform for final delivery.

Final distribution to customers is made by vans with limited capacity, due to laws restriction imposed and the narrowness of streets that characterize historical parts of downtowns. Then, they are allowed to accomplish several trips during the working day. This introduces the multi trip aspect.

More formally, in the MTVRPTWR, a fleet of identical vehicles with limited capacity is based at the depot. A set of customer demands have to be fulfilled during the working day. The MTVRPTWR calls for the determination of a set of routes and an assignment of each route to a vehicle, such that the total routing cost is minimized and each customer is visited by exactly one route respecting capacity constraints on vehicles and time windows on customers. Moreover, each vehicle cannot leave the depot before the maximal release date associated with merchandise to be delivered in the trip vehicle is going to accomplish.

The MTVRPTWR is an extension of the Multi Trip VRP with Time Windows (MTVRPTW, Hernandez et al., 2011) that is in turn an extension of the Multi Trip VRP (Taillard et al., 1996).

An adaptation of the Split procedure introduced by Prins, 2004, in the VRP context, is used to evaluate chromosomes and obtain MTVRPTWR solutions from them.

A set of instances for the MTVRPTWR is introduced and the efficiency of the procedure is proved by result comparison on MTVRPTW instances with Hernandez et al., 2011.

References

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[1] http://www-lipn.univ-paris13.fr/modum