Two-echelon capacitated vehicle routing problem with time-windows

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Abstract

In a two-level distribution system with time windows, the first level involves trucks that ships goods from a distribution center to intermediate depots called satellites. The second level involves city freighters that are loaded with goods at satellites and deliver the customers. Each customer must be visited once and within its time-window. The two-echelon capacitated vehicle routing problem with time windows aims to minimise the total transportation cost in such a distribution system. Two quite similar variants of this problem have been treated in the literature. One variant [1] assuming that city freighters receive goods from only one urban truck is solved using an exact method. A second variant [2] assuming that city freighters do multi-trips is solved with a heuristic approach.

We present a path-based formulation for this problem where synchronisation constraints ensure that first-level routes deliver enough items before the departure of second-level routes. First-level routes and second-level routes are generated by pricing problems. Synchronisation constraints are separated because they are many of them. We tackle the problem with a branch-and-cut-and-price algorithm that uses significant improvements recently proposed in the literature for the standard vehicle routing problems [3]. We compare such algorithm and results with the two similar variants proposed in the literature.

Références

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