
Multi-item two-echelon capacitated vehicle routing problem with time windows

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Abstract

The multi-item two-echelon capacitated vehicle routing problem with time windows (MI2E-CVRPTW) is an extension of the capacitated vehicle routing problem with time windows (2E-CVRPTW) where each item (package) has a predetermined origin and destination. Similar to 2E-CVRPTW three sets of locations are considered. Depots are located at the first level and act as sources of all items. Satellites are situated at the second level and are used as intermediate facilities as consolidation centers. Customers at the last level are destinations of all items. There are two sets of vehicles which can be distinguished by their service. Urban vehicles are used as the first level vehicles which do the distribution of freight from depots to satellites. City Freighters are used at the second level for delivering freight from satellites to customers. In order to solve this problem to optimality, we will apply various path-based formulations. In the first path based formulation some feasibility issues are embedded inside the definition of columns, whereas the second path based formulation defines them as constraints. Specifically, timing of a city freighter service is left as a decision in the second formulation. In the numerical experiments we compare the path-based approaches, and we also consider the differences between the single-item situation and the multi-item situation.

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