Branch-Cut-and-Price for Scheduling Deliveries with Time Windows in a Direct Shipping Network

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Abstract

In a direct shipping (or point-to-point) network, individual deliveries are round trips from one supplier to one customer and back to either the same or another supplier, i.e., a truck can only visit one customer at a time before it has to return to a supplier. We consider the multiple sources, multiple sinks case, where a given set of direct deliveries from a set of suppliers to a set of customers must be scheduled such that the customer time windows are not violated, the truck fleet size is minimal, and the total weighted customer waiting time is as small as possible. Direct shipping policies are, for instance, commonly employed in just-in-time logistics (e.g., in the automotive industry) or in humanitarian logistics. We present an exact branch-cut-and-price algorithm for this problem, which is shown to perform well on instances from the literature and newly generated ones. We also investigate under what circumstances bundling suppliers in so-called supplier parks actually facilitates logistics operations under a direct shipping policy.

Keywords: direct deliveries, branch, cut, and, price, weighted customer waiting times, just, in, time logistics

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