Sequential approaches to solve a multi-commodity transportation planning problem

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Abstract

We address a transportation planning problem with three sets of stakeholders: suppliers, distribution centers and customers. Different commodities have to be sent from suppliers to customers, using multiple distribution centers for consolidation.
Commodities are compatible and can be mixed inside the vehicles as long as the vehicle capacity is respected. Multiple visits to a customer are allowed to reduce transportation costs. However, a single commodity has to be delivered at once for the convenience of customers.

The operations are as follows: suppliers transport commodities to distribution centers with direct trips, while a fleet of homogeneous vehicles distributes commodities to customers. The problem concerns both collection and delivery operations. However, the objective is to optimize these two operations jointly. Note that collection decisions (which quantity of each commodity is delivered to which center) impact delivery operations. Thus, collection and delivery must be determined jointly.

In order to solve the whole problem, we consider two sequential solution approaches: first collection then delivery or first delivery then collection. In both cases, the solution of the first subproblem determines the quantity of each commodity that is required at each distribution center. The second subproblem takes this information and deals with delivery or collection accordingly. To solve the first subproblem, we propose several strategies in order to take into account the impact on the second subproblem.
A case study on a fresh local vegetable supply chain is studied. Results will be presented and analyzed for two types of clients: school catering and supermarkets.

Keywords: multicommodity, routing problem, collection, delivery, supply chain, sequential solving

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