Minimizing the logistic ratio in the inventory routing problem

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Abstract

The inventory routing problem combines two well-known problems, namely, vehicle routing and inventory management. We consider a single product and a single depot where the vehicles start and end their routes. The depot is located at the product supplier for which the quantity to be produced in each period of a planning horizon is known. The product is consumed by a set of customers and the quantity consumed in each period is known for each customer. Each customer has an inventory capacity that must be respected. At the supplier and at each customer, there might be an initial inventory. The inventory routing problem consists of determining in which period(s) each customer must be visited, the quantity delivered at each visit, and the delivery routes to perform in each period. Typically, the objective of the IRP consists of minimizing the sum of the routing costs and the holding costs. However, with this objective, there is no incentive to leave inventory at the customers where the unit holding cost is higher than at the supplier. In this paper, we consider a different objective that is also used in practice, namely, to minimize the so-called logistics ratio which is given by the total routing costs divided by the total delivered quantity. In this case, no holding costs are considered. The resulting problem is denoted inventory-routing problem with logistics ratio. We propose an exact algorithm to solve the problem and show computational results which provide some insights in the problem characteristics.

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