The Consistent Vehicle Routing Problem

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Abstract

In the small-package shipping industry (as in other industries), companies try to differentiate themselves by providing high levels of customer service. This can be accomplished in several ways including on-line tracking of packages, ensuring on-time delivery, and offering residential pick ups. Some companies want their drivers to develop relationships with customers on a route and would like the same drivers to visit the same customers at roughly the same time on each day that the customers need service. These service requirements together with traditional constraints on vehicle capacity and route length define a variant of the classical capacitated vehicle routing problem (VRP) that we call the Consistent VRP (ConVRP).

In this paper, we formulate the problem as a mixed integer program (MIP) and develop an algorithm to solve the ConVRP that is based on the record-to-record travel algorithm. We compare the performance of our algorithm to the optimal MIP solutions for a set of small problems and then apply our algorithm to five simulated data sets with 1,000 customers and a real-world data set with more than 3,700 customers. The solutions produced by our algorithm on all problem sets do a very good job of meeting customer service objectives with routes that have a low total travel time.

Keywords: Vehicle routing problem; heuristics; customer service

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