

# Approximate Solutions for a Inventory Routing Problem by Column Generation

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December 18, 2006

## Abstract

Inventory routing problems consists in managing simultaneously the routes for delivery or pickup of a good and its inventory on each customer site. We consider an application with deterministic consumption rate where an order-up-to-level policy is appropriate and the inventory cost are limited to those resulting from the transportation model. At the tactical level, the objective is to minimize the fleet size and an estimate of the distance traveled. Moreover, for practical purposes, routes must be geographically clustered and the planning must be repeated over the time horizon with constrained periodicity. We develop a truncated branch-and-price algorithm combined with rounding and local search heuristics that yield both primal solutions and dual bounds. On the large scale problems coming from industry this approach allows to obtain solutions within 10% deviation of the optimal. The comparison with industrial solutions also shows an improvement of roughly 10% in number of routes used and the distance traveled. The key to the success of the approach is the use of a state-space relaxation technique in formulating the master program to avoid the symmetry in time. The paper also includes a review of column generation based heuristics.

**Keywords:** Inventory routing, branch-and-price-and-cut, primal heuristic, symmetry.