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# Inventory Routing Problem over the long term: a math-heuristic approach

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## Abstract

The problem we present is the object of the ROADEF Challenge 2016. It consists in an Inventory Routing Problem over a long time horizon with additional features: the objective function to minimize is fractional (cost per unit delivered); there is no prior assignment of drivers to trailers; the time is accurately modelled: non-constant hourly consumption of each customer is provided while minute-precise delivery planning needs to be determined; vehicles can perform multiple trips during the working day.

The problem calls for the determination of a delivery planning that respects operational constraints and avoids customer stockouts.

We propose a two-phase method. The first constructs journeys that are stored in a set  $S$ . The journeys are time-stamped and take into account the consumption of customers over the horizon, but delivered quantities are not fixed in a journey.

The second phase solves a restricted version of the problem by Integer Programming. The mathematical formulation introduced for the second phase is a path-based formulation where binary variables indicate whether a journey is selected in the solution. Additional variables determine delivered quantities.

Initially, only journeys in  $S$  can be selected to be part of the solution.

Then, the two phases are iteratively called adding and/or removing journeys from the model with the aim of improving the solution quality.

We deal with the non-linear objective function by applying, heuristically, the reformulation proposed by Charmes and Cooper (1962) for linear programs with fractional objectives.

Experimental results on the instances of the challenge will be presented.

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