
A Novel Formulation and a Column Generation Technique for a Rich Humanitarian Logistic Problem

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Abstract

We address a problem which is inspired by the logistic challenges of food banks in Israel and in the US. The food bank determines a vehicle route in order to collect products from suppliers in the food industry and deliver them to welfare agencies, and simultaneously sets allocation quantities so as to balance considerations of effectiveness and equity. Previous work has focused on modeling a suitable objective function so that the problem can be formulated as a MILP, and on developing an LNS metaheuristic based on the special structure of a sub-problem. In this work, we further exploit this structure to present a new mathematical formulation of the problem. We substitute the "classical" site-based routing decisions variables, i.e., whether the vehicle should proceed from a certain site to another, with new variables which indicate whether the vehicle should proceed from a certain *sequence of sites* to another. These sequences are chosen in a way that guarantees that the allocation decision which they dictate, can be made independently of the other sequences that are chosen in the solution. We believe that this novel approach, which has not been used previously in the literature, to the best of our knowledge, has two main advantages: (1) It provides a tighter bound compared to the site-based formulation used in previous work; (2) It gives rise to a new solution methodology for the problem, based on column generation. Numerical experiments to assess the performance of these methods are currently underway.

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