Solving Discrete Ordered Median Problems with Induced Order*

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Ordered median functions have been developed to model flexible discrete location problems. A weight is associated to the distance from a customer to its closest facility, depending on the position of that distance relative to the distances of all the customers. In this paper, the above idea is extended by adding a second type of facility and, consequently, a second weight, whose values are based on the position of the first weights. An integer programming formulation is provided in this work for solving this kind of models.

1. Introduction

Discrete Location has a wide range of applications but is also an area that provides researchers with a rich variety of theoretical challenges. Discrete location problems involve a finite set of candidate sites where facilities can be installed, and a finite set of customers to be served from these facilities.

The increasing number of similar discrete location models made it necessary to develop new flexible location models. To that end, [5] dealt with an objective function that generalized the objective functions mentioned above. In order to accomplish this goal, a weight was applied to the allocation cost of each customer, depending on the position of that cost relative to the costs associated to the rest of customers. The inherent "sorting" aspect of the problem gave formulations and solutions a new dimension. The resulting problem, the so-called *Discrete Ordered Median Problem* (DOMP), has received considerable attention. Many papers have been devoted to the

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development of more tricky formulations and also to the study of several variants. For instance, in [1], the first integer programming formulations that could solve instances of medium size were presented. A successful formulation based on a different paradigm to sort binary vectors inside an integer programming formulation was the key that allowed to solve larger instances, see [3] and the improved version in [4]. Several alternative formulations and variations have been recently compared in [2], and a recent survey on the DOMP and related problems is [6].

All the aforementioned models share the common idea of sorting distances or costs and then multiply them, in the given order, by a previously known constant.

In this paper, we propose a generalization of this idea through the modification of the second stage. After sorting the customers, the given constants will be multiplied, in the order determined in the first stage, by a different measure of the customer. An integer linear programming formulation is presented to modelize the proposed generalization and some experimental results are discussed.

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