# Solving Discrete Ordered Median Problems with Induced Order: Preliminary Results

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The Discrete Ordered Median Problem with Induced Order (DOMP+IO) is a multi-level version of the classical DOMP, which has been widely studied. In this work, a DOMP+IO with two types of facilites (levels) is considered and some preliminary results are provided.

## 1.     Introduction

Despite the multitude of location problems and extensions that have been developed, in some occasions it is possible to unify basic location problems that appear to be drastically different. A prominent development is the Discrete Ordered Median Problem (DOMP) [3], which is well known for its ability to generalize the $p$-median and $p$-center problems as well as define new problems based on the order of the demands in terms of their closest service distance or lowest cost. DOMP was introduced to provide a way to model many of the popular discrete location models, based upon ordering demand in terms of service by their respective closest facility. This ordered demand allows to represent intermediate hybrid problems between median and center problems.

However, many real world applications are concerned with finding more than one type of facilities, considering multiple levels of facilities and determining a hierarchical facility location problem. For instance, in health care systems, a common location problem usually consists in locating equipped

clinics and hospitals (medical stations) [4]. In education systems, primary schools and high schools are usually considered to be located [5]. Applications in emergency medical service systems consider distinct medical centers, which constitute the different levels of providing emergency assistance [6]. Most problems in computer/telecommunication networks consists in locating concentrators, routers and terminals [1].

In this work, a multi-level version of DOMP is addressed. Concretely, in this case two kinds of facilities are considered, since most recent papers are dedicated to two-level problems [2]. Therefore, the goal of the proposed DOMP with induced order (DOMP+IO) is to locate all the facilities in such a way that a client should not be far from a secondary facility if he/she is far from (near to) a primary facility. For instance, hospitals can be considered as primary facilities and heliports as secondary facilities in an emergency medical service system. Consequently, the generalization of DOMP is carried out by introducing an induced order on the secondary facilities.

# References

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