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Attraction-Rejection Model for Facility Location

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Abstract. Location of small and large stores requires a market study to determine the demand for a product in a particular region, as well as the selection of the target population. However, it is common to forget analyzing the impact of the competition regarding the suitability of locating facilities. The objective of this work is to propose a model that can be a tool to study the market; analyzing both demands as attraction factor and competition as rejection factor. The methodology used consists on the proposal of an exact model and a group of tests to prove its functionality. The model has characteristics that have not been considering before like a service radio where a new location can be open and is affected by customers and competitors. The results obtained demonstrated that the model suggests opening the facilities with fewer competitors and higher demand. This model is new because no other model considers how a new location is affected by competitors (rejection) and by customers (attraction), both located in a service radio area.

Keywords. Attraction-rejection, facility location, service radius, localization of facilities, maximizing demand coverage.

1 Introduction

The competitive location models were first introduced by [13]. While [4] proposed the location-allocation problem to locate a set of new facilities to minimize the transportation cost from facilities to customers. This problem was extended to a weighted network [11]. Since then, it has been extensively addressed in the logistics area [2]. When looking for locating facilities in an optimum place, exact optimization models are used, like the Branch and Bound model [9]. On the other hand, when it is enough to locate the new facility in a right place (not the best), heuristic methods are used [19].

The problem of facility location consists in selecting the appropriate geographic location for one or more facilities. There are three different spatial representations: in continuous space, in the network and discrete space. Continuous space allows placing the facilities anywhere within a region [8], in the work of [29] it is used in a model for mixed-integer linear programming.

Differently, in network, it is possible to locate the installations in the periphery or intermediate points of a network as is shown in the work of Serra & Revelle [24, 25]. On the other hand, discrete space allows selecting where to locate facilities between a set of possible locations for instance, as it is shown in the work of [23], where it is used for the location of distribution centers for a beverage company selecting among some possible locations.

In the literature, the models of facility location for a new company assume that whoever is going to start a company sets the price and does not care about competition between companies [15], for this reason, many models do not consider the price within modeling.

In some way, it is a hierarchical model where the competitor decides first its locations, and later