MATHEMATICAL MODEL FOR RETAIL STORES LOCATION IN COMPETITIVE ENVIRONMENTS

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ABSTRACT. *This article presents a mathematic model for new retail stores location. It considers interactions that occur between competitors with presence in the same market as well as the traditional distances between demand points and new stores. Game theory is used to include the competitive effects in location decisions. An exhaustive enumeration process is used in order to establish all the Stackelberg equilibrium points for new facilities location. The characteristics of the solutions are illustrated using selected scenarios.*
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1. **Introduction.** Real business environments are characterized by a high level of globalization, where it is usual to find several firms from different countries competing in the same market. This impels a high level of competition among the participants, and as a consequence, global standards improve in the areas of service levels, competitive pricing, and quality levels [1]. Location strategies are also influenced by these factors, becoming crucial for present and future operation [9]. We can find a vast research literature in this field, *cf.* [2,3,7,8]. Models have been proposed from many points of view, including merely geographical, purely mathematical, or even purely qualitative [14]. For instance, the sensor optimal allocation problem is studied by Y. Takeuchi in [18] as part of an optimization problem of the gain matrix, which is used in the linear observation for the Kalman filter. An integer ambiguity estimation and validation method in carrier phase differential GPS/GNSS positioning was proposed and examined by Y. Kubo *et al.* in [13]. The performance of a simple and easy-to-implement control design technique in the trajectory tracking control of robot manipulators is studied by K. Najim *et al.* in [15].

In this work we present a mathematical location model for retail stores which includes competitive aspects. One of the first approaches to this problem was proposed by Hotelling [10], who modeled competition between two firms in a straight line, where the main factors were price and position on the line [16]. For this type of problems we can use game theory in order to model competition between firms, assuming rational behavior in their

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