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Theory and Methodology

On the lexicographic minimax approach to location problems [1]

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Abstract

When locating public facilities, the distribution of travel distances among the service recipients is an important issue. It is usually tackled with the minimax (center) solution concept. The minimax solution concept, despite the most commonly used in the public sector location models, is criticized as it does not comply with the major principles of the efficiency and equity modeling. In this paper we develop a concept of the lexicographic minimax solution (lexicographic center) being a refinement of the standard minimax approach to location problems. We show that the lexicographic minimax approach complies with both the Pareto-optimality (efficiency) principle (crucial in multiple criteria optimization) and the principle of transfers (essential for equity measures) whereas the standard minimax approach may violate both these principles. Computational algorithms are developed for the lexicographic minimax solution of discrete location problems. © 1997 Elsevier Science B.V.

Keywords: Location; Multiple criteria; Equity; Efficiency

1. Introduction

Public goods and services are typically provided and managed by governments in response to perceived and expressed need. The spatial distribution of public goods and services is strictly related to facility location decisions. A host of operational models has been developed to deal with the facility location optimization (cf., Love et al., 1988; Francis et al., 1992; Current et al., 1990). The location decisions involve, depending on character of the services, one of two fundamental considerations: spatial efficiency or geographical equity in the service provision (Morrill and Symons, 1977). It results in two corresponding major approaches to location problems: minisum (median) and minimax (center) approach. Most classical location studies focus on some aspects of these two approaches.

The minisum approach is primarily concerned with the spatial efficiency. Minisum models usually involve minimization of aggregate or average weighted distance. Since the minisum approach is based on averaging, it often provides solutions where remote and low-population density areas are discriminated in terms of accessibility to public facilities, as compared with centrally situated and high-population density areas. For this reason, an alternative approach, involving minimization of maximum distance (travel time) between any consumer and the closest facility, can be applied. This approach to location problems is referred to as minimax or center approach (Hakimi, 1965). As the minimax objective primarily addresses the geograph-

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