Top (2008) 16: 164–194
DOI 10.1007/s11750-008-0040-9

ORIGINAL PAPER

# The single facility location problem with average-distances

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Received: 20 January 2007 / Accepted: 23 January 2008 / Published online: 19 February 2008


**Abstract** This paper considers a location problem in $\mathbb{R}^n$, where the demand is not necessarily concentrated at points but it is distributed in hypercubes following a Uniform probability distribution. The goal is to locate a service facility minimizing the weighted sum of average distances (measured with $\ell_p$ norms) to these demand hypercubes. In order to do that, we present an iterative scheme that provides a sequence converging to an optimal solution of the problem for $p \in [1, 2]$. For the planar case, analytical expressions of this iterative procedure are obtained for $p = 2$ and $p = 1$, where two different approaches are proposed. The paper ends with a computational analysis of the proposed methodology, comparing its efficiency with a standard minimizer.

**Keywords** Average distance · Weber problem · Weiszfeld algorithm

**Mathematics Subject Classification (2000)** 90B85

## 1 Introduction

In a classical single facility location problem we are given a finite set of points in a real normed space in order to minimize some function depending on the distances to those points (existing facilities or demand points). In the last years the assumption that facilities are represented by isolated points has been questioned by different authors and the natural extension of considering sets rather than points has attracted the attention of the researchers (Brimberg and Wesolowsky 2000, 2002; Carrizosa

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