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THE INVERSE 1-MEDIAN PROBLEM ON A PLANE AND ON A CYCLE WITH NEGATIVE WEIGHTS

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Abstract

This article considers two problems, the first one is the inverse Fermat-Weber problem, provided the Euclidean 1-median is a vertex and the second one is the inverse 1-maxian problem on cycles. For any two problems, the aim is to change the vertex weights at minimum total cost with respect to given modification bounds such that a prespecified vertex becomes 1-median. If the prespecified point coincides with one of the given n points in the plane, it is shown that the corresponding inverse problem can be written as convex problem and hence is solvable in polynomial time to any fixed precision. We show that the inverse 1-maxian problem on a cycles with positive edge-lengths and unit cost can be solved in $O(n^2)$-time.

1. Introduction

In recent years inverse optimization problems found an increased interest. The *inverse optimization problem* consists in changing parameters of the problem at minimum cost such that a prespecified solution

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* Speaker.

becomes optimal. Recently, inverse p-median problem has been investigated by Burkard, Pleschiutsching and Zhang [2]. They showed that the discrete inverse p-median problem with real weights can be solved in polynomial time provided p is fixed and not an input parameter. They presented a greedy-like $O(n \log n)$-time algorithm for the inverse 1-median problem in the plane provided the distances between the points are measurde in the Manhattan or maximum metric. Also, they showed that the inverse 1-median problem on a cycle with positive vertex weights can be solved in $O(n^2)$ time. The inverse Fermat-Weber problem was studied by Burkard, Galavii, and Gassner [1]. The authors derived a combinatorial approach which solves the problem in $O(n \log n)$-time for unit cost and under the assumption that the prespecified point that should become a 1-median does not coincide with a given point in the plane. Galavii [4] showed that the inverse 1-median problem on a tree with positive weights can be solved in linear time. In this paper we investigate the inverse Fermat-Weber problem on a plane, provided the Euclidean 1-median is a vertex and also the inverse 1-median problem on cycles with negative weights.

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A QUADRATIC L-SHAPED ALGORITHM FOR TWO-STAGE STOCHASTIC LINEAR PROGRAMMING (SLP)

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Abstract

Stochastic programming is a technique for optimization in the presence of uncertainty which typically leads to very large problem sizes. Here, we present a modified version of the L-shaped method and reduce linear master and linear recourse programs to unconstrained maximization of concave differentiable piecewise quadratic functions.

1. Introduction

In mathematical linear programming, matrix of coefficients and vectors are exact values. However, in practice, the problem data are not definite because of many reasons like error in measurement, incomplete information about future and events which have not occurred yet. In stochastic programming, some data are random variables with a specific possibility distribution. Before presenting the mathematical formulation of the two-stage stochastic linear program (SLP) model, we introduce some notation. Let $(\Omega; \vartheta; P)$ be a discrete probability space and consider $\Omega = \{\omega_1, \omega_2, \ldots, \omega_N\}$ as the set of scenarios with

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associated probabilities $\{\rho_1, \rho_2, \ldots, \rho_N\}$ such that $\sum_{i=1}^{N} \rho_i = 1$. In this paper, consider the following two-stage stochastic linear program (SLP) with fixed recourse and a finite number of scenarios [2]:

$$\min_{x \in X} \quad f(x) = c^T x + \phi(x), \quad X = \{x \in \mathbb{R}^n : Ax = b, x \geq 0\}, \tag{1.1}$$

where

$$\phi(x) = E(Q(x, \omega)) = \sum_{i=1}^{N} Q(x, \omega_i)\rho_i,$$

and

in which $\beta, \hat{y}$ are constants and

$$S(p, \beta, \hat{y}) = (h - Tx^\nu)^T p - \frac{1}{2}\|(\hat{y} + W^T p - \beta \hat{q})_+\|^2. \tag{1.2}$$

Also, assume that the solution set Y_* of (**??**) is non-empty and the rank of sub-matrix W_l of W corresponding to nonzero components of $\hat{y}_*$ (the projection of $\hat{y}$ on Y_*) is m_2. In such a case, there is β^* which for all $\beta \geq \beta^*$, $\hat{y}_* = (\hat{y} + W^T p(\beta) - \beta \hat{q})_+$ where $p(\beta)$ is the point obtained from solving (**??**).

$$\Delta_1 = \|Ax - b\|_\infty, \Delta_2 = \max_i \|T_i x + W y_i - h_i\|_\infty, \Delta_3 = |c^T x + \sum_{i=1}^{N} \hat{q}_i y_i - f^*|,$$

where f^* is the optimal value of (**??**). Also, d and d_2 are the density of matrices A and W respectively.

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