Standort-Optimierung

Handout 2

Sommersemester 2010

Bergische Universität Wuppertal
Fachbereich C – Angewandte Mathematik / Optimierung und Approximation
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Algorithm 3.16: Boundary Search Algorithm for $1/P/R/l_p/\sum$

Input: Existing facilities $a_1, \dots, a_n \in \mathbb{R}^2$; weights $w_1, \dots, w_n > 0$, forbidden region $R = R_1 \dot\cup \cdots \dot\cup R_K \subset \mathbb{R}^2$ with R_k connected and closed, $\partial R_k = \{g_k(t) : t \in [0;1]\}$, $k = 1, \dots, K$.

Step 1: Determine an (approximate) optimal location x^* for $1/P/\bullet/l_p/\sum$.

Step 2: If $x^* \in \mathbb{R}^2 \setminus \operatorname{int}(R)$, set $x^*_R := x^*$, STOP.

Step 3: Determine $k \in \{1, \dots, K\}$ with $x^* \in \operatorname{int}(R_k)$.

Step 4: Solve the 1-dimensional optimization problem

$$\min\{W(g_k(t)) : t \in [0;1]\}$$

and set $x^*_R := g_k(t^*)$, STOP.

Output: Optimal solution (or approximation) x^*_R of $1/P/R/l_p/\sum$.

Algorithm 3.20: Construction Line Algorithm for $1/P/R\ convex/l_1/\sum$

Input: Existing facilities $a_1, \dots, a_n \in \mathbb{R}^2$; weights $w_1, \dots, w_n > 0$, convex forbidden region $R \subset \mathbb{R}^2$.

Step 1: Determine the set of optimal solutions $\mathcal{X}^*$ of $1/P/\bullet/l_1/\sum$.

Step 2: If $\mathcal{X}^* \cap (\mathbb{R}^2 \setminus \operatorname{int}(R)) \neq \emptyset$, set $\mathcal{X}^*_R := \mathcal{X}^* \cap (\mathbb{R}^2 \setminus \operatorname{int}(R))$, STOP.

Step 3: Determine the construction line grid

$$\begin{aligned} \mathcal{G}_{l_1} := &\{(x_1, x_2)^T \in \mathbb{R}^2 : x_1 = a_{j1},\ j \in \{1, \dots, n\}\} \\ &\cup \{(x_1, x_2)^T \in \mathbb{R}^2 : x_2 = a_{j2},\ j \in \{1, \dots, n\}\} \end{aligned}$$

and the intersection points $y_1, \dots, y_L$ of $\mathcal{G}_{l_1}$ with ∂R.

Step 4: Set $x^*_R := \operatorname{argmin}\{W(y_1), \dots, W(y_L)\}$.

Step 5: If $\mathcal{X}^*_R$ is sought, determine the level curve $L_=(W(x^*_R))$ and set $\mathcal{X}^*_R := (L_=(W(x^*_R)) \cap \partial R)$, STOP.

Output: Optimal solution(s) x^*_R ($\mathcal{X}^*_R$) of $1/P/R\ convex/l_1/\sum$.