Institute of Applied Mathematics
University of Erlangen-Nürnberg
Prof. Dr. K. Klamroth

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Location Analysis
WS 2004/2005
Homework 4

To be discussed in the tutorial on January 13, 2005.

13. Consider a problem of type $2/P/\bullet/l_1/\sum$ with existing facility locations $a_1 = (5;13), a_2 = (7;11), a_3 = (5;11)$ and weights $w_{1,11} = 4, w_{1,12} = 1, w_{1,13} = 1, w_{1,21} = 1, w_{1,22} = 3, w_{1,23} = 1, w_{2,12} = 1$.

    a) Determine an approximate solution with Approximation Algorithm 4.3. (Handout 3).

    b) Try to improve this solution applying Approximation Algorithm 4.4. (Handout 3).

    c) Find the linear programming formulations of section 4.2. for $k = 1, 2$.

    d) Determine the exact optimum of the problem.

14. Develop an LP formulation for a problem of type $m/P/\bullet/l_1/\max$ directly, i.e., without using the transformation T from $m/P/\bullet/l_\infty/\max$.

15. Consider the following problem of type $1/P/\bullet/l_\infty/\max$: Existing facility locations $a_1 = (1;1), a_2 = (2;4), a_3 = (5;2)$, weights $w_1 = 2, w_2 = 1, w_3 = 4$.

    a) For $k = 1, 2$, graph the functions $A^+_{jk}(z), A^-_{jk}(z), A^+_k(z)$ and $A^-_k(z)$.

    b) Solve the problem using the algorithm for $1/P/\bullet/l_\infty/\max$ on Handout 4.

    c) For the same existing facility locations, solve the problem with $w_1 = w_2 = w_3 = 1$ using the algorithm for $1/P/w_j = 1/l_\infty/\max$ on Handout 4.

    d) Graph the situation for both cases (i.e., existing facility locations and optimal solutions in $\mathbb{R}^2$).

    e) What would be the set of optimal solutions of the corresponding Weber problems (i.e., of $1/P/\bullet/l_\infty/\sum$ and $1/P/w_j = 1/l_\infty/\sum$, respectively)?