max planck institut informatik

SAARLAND UNIVERSITY
COMPUTER SCIENCE

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Exercises for Optimization

http://www.mpi-inf.mpg.de/departments/d1/teaching/ss12/OPT

Exercise sheet 12 Due: **Tuesday, July 17, 2012**

You need to collect at least 50% of all points on the first six exercise sheets, and at least 50% of all points on the remaining exercise sheets. You are allowed to hand in homework in teams of two.

Exercise 1 (*10 points (Disjunctive constraints)*)

We saw in class a method to model the situation where at least one of the constraints $a^T x \geq b$ and $c^T x \geq d$ should hold, for the case where $a \geq 0$ and $c \geq 0$. Show that this method fails if a or c may have negative entries by giving an example where a feasible problem is turned into an infeasible problem by introducing the binary variable y. Keep your example as simple as possible.

Exercise 2 (*5 points*)

Consider the potential reduction algorithm that we discussed in class. Show that to achieve a polynomial running time, it would be sufficient to decrease the potential by some value $\eta = O(n^{-c})$ in every step, where c is a constant. Assume that the running time per step does not change.

Exercise 3 (*15 points (BT 10.1)*)

Suppose that we are given m constraints $a_i^T x \geq b_i$, $i = 1, \ldots, m$, but without the restriction $a_i \geq 0$. Model the requirement that at least k of them are satisfied. Assume that there exists a number f such that $a_i^T x \geq f$ for $i = 1, \ldots, m$ and for all feasible x.

Exercise 4 (*10 points (BT 10.5)*)

Suppose that you are planning to move out to your new house. You have n items of size a_j, $j = 1, \ldots, n$, that need to be moved. You have rented a truck that has size Q and you have bought m boxes. Box i has size b_i, $i = 1, \ldots, m$. Formulate an integer programming problem in order to decide whether the move is possible.