Modern Optimization Techniques - Exercise Sheet 10

Lydia Voß

voss@ismll.de

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Solutions need to be handed in until Tuesday, February 26, 2015 at 10:15

Exercise 1: Barrier Methods in General (10P)

- a) Explain in your own words how the barrier method works for a general constrained minimization problem!
- b) Consider the simple optimization problem:

 $\begin{array}{ll}\text{minimize} & x^2 + 1\\ \text{subject to} & x \in [2, 4] \end{array}$

Plot $tf_0(x) + \phi(x)$ for values of t = 1, 5, 10, 20. Label $x^*(t)$ in your plots. Does it converge (in the sense of t) to the minimizer of the original problem?

c) Derive the dual feasible pair $\lambda^*(t), \nu^*(t)$ if instead h(u) = -1/u is used in the definition of barrier function

$$\phi(x) = \sum_{i=1}^{m} h(f_i(x))$$

Exercise 2: Applying the Barrier Method (10P)

What happens if the barrier method is applied to the following optimization problem:

$$\begin{array}{ll} \text{minimize} & x_2\\ \text{subject to} & x_1 \leq x_2\\ & 0 \leq x_2 \end{array}$$

Formulate the optimization problem into the standard form to then write down the derived optimization problem. Solve it by using a Newton step as centering step. Start in the feasible point x = (-0.5, 1), use a step size of $\mu = 0.05$ and t = 10. Plot the iterates and explain what is happening.