Modern Optimization Techniques - Exercise Sheet 1

Lydia Voß

voss@ismll.de

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Solutions need to be handed in until **Tuesday, October 27th, 2015 at 10:00**

Exercise 1: Optimization Problems (10P)

For the following real valued functions, find their associated minimum $x^\star$ and the minimal value $p^\star$, if they exist. Is $x^\star$ unique?

a) $f_1 : (a, b) \longrightarrow \mathbb{R}$ with $f_1(x) = x$

b) $f_2 : \mathbb{R} \longrightarrow \mathbb{R}$ with $f_2(x) = c \cdot sin(x) \qquad c > 0$

c) $f_3 : [0, 2\pi] \longrightarrow \mathbb{R}$ with $f_3(x) = cos(x)$

d) $f_4 : \mathbb{R} \longrightarrow \mathbb{R}$ with $f_4(x) = (x - a)^2 + b \qquad a, b \in \mathbb{R}$

Exercise 2: Convexity and Linearity (10P)

Let f_i be the functions defined above for $i = 1, 2, 3, 4$. Answer the following questions for all f_i by either providing a proof or a counterexample.

a) Is f_i a linear function?

b) Is f_i a convex function (use the definition of a convex function)?