Universität Konstanz Sommersemester 2014
Fachbereich Mathematik und Statistik
Prof. Dr. Stefan Volkwein
Roberta Mancini, Carmen Gräßle, Laura Lippmann, Kevin Sieg

Optimierung

http://www.math.uni-konstanz.de/numerik/personen/volkwein/teaching/

Sheet 1

Deadline for hand-in: 2014/05/07 at lecture

Note:

- Please write **each exercise** on a **separate sheet**!
- Remember to write **name, sheet number, exercise number** and your **group** on **each sheet**!

Exercise 1
Determine and identify the local critical point(s) of the Rosenbrock function

$$f : \mathbb{R}^2 \to \mathbb{R}, \qquad f(x_1, x_2) = 100\,(x_2 - x_1^2)^2 + (1 - x_1)^2.$$

Exercise 2
Show that the function

$$f : \mathbb{R}^2 \to \mathbb{R}, \qquad f(x_1, x_2) = 8x_1 + 12x_2 + x_1^2 - 2x_2^2$$

has only one stationary point, and that it is neither a maximum or minimum, but a saddle point. Sketch the contour lines of f (you can also use Matlab).

Exercise 3 (4 Points)
Consider the function

$$f : \mathbb{R}^2 \to \mathbb{R}, \qquad f(x_1, x_2) = 3x_1^4 - 4x_1^2 x_2 + x_2^2.$$

Prove that $\tilde{x} = (0, 0)$ is a critical point of f. Show further, that a restriction of f on any line[1] through $\tilde{x}$, has a strict local minimum in $\tilde{x}$. Is $\tilde{x}$ a local minimizer of f?

[1] The restriction of f on the line γ is defined as $g(t) = f(\gamma(t))$, $t \in [0, 1]$, with $\gamma(t) := \tilde{x} + td$, where $d \in \mathbb{R}^2 \setminus \{0\}$ is an arbitrary but fixed direction.