Universität Konstanz
Fachbereich Mathematik und Statistik
Prof. Dr. Stefan Volkwein
Sabrina Rogg

Sommersemester 2016

Optimierung

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

Sheet 1

Deadline for hand-in: 18.04.2016 at lecture

Exercise 1 (2 Points)
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 (2 Points)
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 nor minimum, but a saddle point. Sketch the contour lines of f (you can 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 through $\tilde{x}$ has a strict local minimum in $\tilde{x}$. Is $\tilde{x}$ a local minimizer of f?

Hint: The restriction of f on the line γ through $\tilde{x}$ is defined as $g(t) = f(\gamma(t))$, $t \in \mathbb{R}$, with $\gamma(t) := \tilde{x} + td$, where $d \in \mathbb{R}^2 \setminus \{0\}$ is an arbitrary but fixed direction.
For the last question: Take a look at a non-straight path.