

## Optimization and Data Science

### 3. Homework exercises

#### Theoretical exercise 1:

*Examine the following function regarding minima and maxima.*

$$f : \mathbb{R}^2 \rightarrow \mathbb{R}, f(x, y) := (e^x + y)y - x^3$$

#### Theoretical exercise 2:

*Examine the following function, called Roosenbrock function, regarding minima and maxima.*

$$f : \mathbb{R}^2 \rightarrow \mathbb{R}, f(x, y) := 100(y - x^2)^2 + (1 - x)^2$$

#### Theoretical exercise 3:

*Examine the following function, called Bazaraa-Shetty function, regarding minima and maxima.*

$$f : \mathbb{R}^2 \rightarrow \mathbb{R}, f(x, y) := (x - 2)^4 + (x - 2y)^2$$

#### Theoretical exercise 4:

*Examine the following function regarding minima and maxima.*

$$f : \mathbb{R}^2 \rightarrow \mathbb{R}, f(x, y) := x^2 - 2xy + y^2$$

#### Programming exercise 1:

*Implement and visualize the Roosenbrock function and the Bazaraa-Shetty function and mark their minima in the visualization.*

Silvester's criterion might be useful for solving the theoretical exercises.

The solutions of the theoretical exercises will be discussed on 27. April 2020.