Fakultät MI, Fachrichtung Mathematik
Prof. Dr. Frank-Olaf Schreyer
Dr. Michael Hoff

UNIVERSITÄT DES SAARLANDES

Mathematics for computer science 1

Winterterm 2019/20

Hand in your solution sheet in the mailboxes (next to Zeichensaal U.39, building E2 5) by Jan. 15 **before the lecture**.

All exercise sheets and course information can be found at: www.math.uni-sb.de/ag/schreyer/

Sheet 10 8. January 2019

Exercise 1 (Growth behavior at infinity)**.** Sort the following functions

$$\begin{array}{ll} f_1(x) = x^{\ln x} & f_4(x) = 3^x \\ f_2(x) = e^{x \ln x} & f_5(x) = x^3 \\ f_3(x) = x^x & f_6(x) = e^x \ln x \end{array}$$

with respect to the growth $x \to \infty$ (Explain your sorting!).

Exercise 2 (Approximation)**.** Write two programs which compute $\sqrt[k]{a}$. Use the interval bisection algorithm and the Newton method. Count how many iterations both methods need in order to approximate $\sqrt[4]{3}$ with an error of at most 10^{-5}. Use $[1, 2]$ as the starting interval of the interval bisection method and 2 as the starting value of the Newton method.

Exercise 3 (Optimization)**.** A can of 320 ml should be sized such that the material consumption is minimal. We assume that the can is a perfect cylinder. What height and diameter does the can have?
Note: You may use the formulas known from high school for the volume and the lateral surface of a cylinder.

Exercise 4 (Curve sketching)**.** Determine all zeros, local minima and maxima, inflection points, pols, the domain and the asymptotic behavior of the following functions. Sketch a graph of each of these functions.

$$\begin{aligned} f_1(x) &= \frac{x^3 - 3x}{x^2 - 4} \\ f_2(x) &= xe^{-\frac{1}{x}} \\ f_3(x) &= 2\cos x - x^2 \end{aligned}$$