Assignment 1: Basics

Assignment 1 will be discussed in the tutorials taking place in the second week of the semester. You should prepare solutions, but you don't have to hand them in and they won't get marked.

Exercise 1 *Induction Proofs*

Recall the principle of doing proofs by mathematical induction.

1. Prove by mathematical induction that $n! \geq \text{fib}(n)$ for all $n \geq 0$. Note that $fib(n)$ denotes the nth Fibonnaci number.
2. Let a and $r \neq 1$ be real numbers. Prove by mathematical induction the geometric series, i. e. that
$$\sum_{i=0}^{n} a \cdot r^i = \frac{a(1 - r^{(n+1)})}{1 - r}$$
holds for all natural numbers n.

Exercise 2 *Big O-Notation*

Solve Exercise 2.1 in the book of Mehlhorn/Sanders (page 22).

Exercise 3 *Algorithm design (CLRS Exercise 2.3-7)*

Describe a $\Theta(n \log n)$-time algorithm that, given a set S of n integers and another integer x, determines whether or not there exist two elements in S whose sum is exactly x.