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

UNIVERSITÄT DES SAARLANDES

**Mathematics for computer science 1**

Winterterm 2019/20

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

## Sheet 0

**Exercise 1** (truth table)**.** Write the following logical formula in a truth table:

$$A \wedge \neg B \Rightarrow (C \vee A \Leftrightarrow (B \Rightarrow C \wedge A)) .$$

Is this formula a tautology, satisfiable or unsatisfiable?

**Exercise 2** (Logical expression)**.** Let $\overline{\wedge}$ be the logical expression for *not and*, that is, for two logical variables $A, B$ we have $A \,\overline{\wedge}\, B = \neg(A \wedge B)$.

(a) Express the three logical notations $\neg$, $\wedge$ and $\vee$ in terms of $\overline{\wedge}$ and parentheses.

(b) Let $X_1, ..., X_n$ be logical variables, and let $f(X_1, ..., X_n)$ be an arbitrary logical function with given truth table in $X_1, \ldots, X_n$. Show that $f$ can be expressed with $\overline{\wedge}$ and parentheses only.

**Exercise 3.** Prove by induction:

(a) $\sum_{k=1}^{n} (2k-1) = n^2$

(b) $\sum_{k=0}^{n} k^2 = \frac{n(n+1)(2n+1)}{6}$

**Exercise 4.** Find a closed formula only depending on $n \in \mathbb{N}$ for

$$\sum_{k=1}^{n} k^3$$

.