Tutorials for "Automated Reasoning WS24/25"
Exercise sheet 1

Exercise 1.1:
Consider a strict ordering $\prec$ on a set M and prove or refute by a counter-example:

1. if for any elements $m_1, m_2 \in M$ there is an element $m \in M$ so that $m_1 \prec m$ and $m_2 \prec m$ then $\prec$ is total

2. if there exists an infinite ascending chain $m_0 \prec m_1 \prec m_2 \prec \ldots$ then $\prec$ is not well-founded

3. if $\prec$ is well-founded then $\prec$ is total

Exercise 1.2:
Prove by induction that for any propositional formula the number of closing parentheses is equal to the number of opening parentheses (see Definition 2.1.1).

Exercise 1.3:
Determine which of the following formulas are valid/satisfiable/unsatisfiable using propositional semantics, i.e., the definition of $\models$:

1. $\neg\big(P \vee \neg(P \wedge Q)\big)$

2. $(P \vee Q) \rightarrow (P \wedge Q)$

3. $\neg(P \rightarrow \neg P)$

4. $(P \vee \neg Q) \wedge \neg(\neg P \rightarrow \neg Q)$

5. $\neg(P \vee Q) \leftrightarrow (\neg P \wedge \neg Q)$

It is not encouraged to prepare joint solutions, because we do not support joint exams.