



Bromberger/Möhle/Weidenbach

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Tutorials for “Automated Reasoning WS22/23”  
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  $m_0 \prec m_1 \prec m_2 \prec \dots$  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.  $\neg(P \vee \neg(P \wedge Q))$
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.