max planck institut informatik

Universität des Saarlandes
FR Informatik

Christoph Weidenbach **January 27, 2015**

Tutorials for "Automated Reasoning"
Exercise sheet 12

Exercise 12.1: *(4+4 P)*
Compute the clause normal form of the following first-order formulas using the algorithm cnf.

1. $\forall x.\exists y.\exists z.(R(y,z) \lor \neg(R(x,y) \rightarrow P(y)))$
2. $\exists x.\forall y.\exists z.(R(x,y) \leftrightarrow ((P(x) \lor P(y)) \rightarrow Q(x,y,z)))$

Exercise 12.2: *(2+2 P)*
Provide a Herbrand model for the following two clause sets, where it is sufficient to consider the signature symbols occurring in the respective clause sets. There is only one sort S involved.

1. $\{\neg P(x) \lor Q(x),\ \neg Q(b),\ P(a),\ \neg P(x) \lor P(g(x)),\ P(b) \lor P(c)\}$
2. $\{\neg R(x,y) \lor \neg R(y,z) \lor R(x,z),\ R(x,g(x)),\ R(a,b)\}$

Exercise 12.3: *(3 P)*
Consider a sentence $\forall x_1,\dots,x_m.\phi$ where ϕ does not contain any quantifier nor any function or constant symbol. Prove that testing satisfiability of $\forall x_1,\dots,x_m.\phi$ is an NP-complete problem.

Submit your solution in lecture hall E1.3, Room 002 during the lecture on February 3. Please write your name and the date of your tutorial group (Mon, Thu) on your solution.

Joint solutions are not permitted, please submit individually. However, I encourage you working and solving the exercises in a group.