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Tutorials for "Automated Reasoning WS18/19"
Exercise sheet 5

Exercise 5.1 (2.56):
Show unsatisfiability of the below clause set N via the superposition calculus based on the atom ordering $P_1 \succ P_4 \succ P_5 \succ P_2 \succ P_3$.

(1)	$P_1 \vee P_2 \vee P_3$	(2)	$\neg P_1 \vee \neg P_2$	(3)	$\neg P_2 \vee \neg P_3$
(4)	$\neg P_1 \vee \neg P_3$	(5)	$P_4 \vee P_5 \vee P_1$	(6)	$\neg P_4 \vee P_1$
(7)	$\neg P_4 \vee P_2$	(8)	$\neg P_5 \vee P_2$	(9)	$\neg P_5 \vee P_3$
(10)	$\neg P_1 \vee P_4$				

Exercise 5.2 (New):
Consider the ordering $P_1 \prec P_2 \prec P_3 \prec P_4$. Compute $N_{\mathcal{I}}$ on the below clause set, determine the minimal false clause, compute the respective inference, add the clause to the clause set and then recompute $N_{\mathcal{I}}$ on the updated clause set.

(1)	$\neg P_1 \vee \neg P_2$	(2)	$P_3 \vee P_2 \vee P_4$	(3)	$P_2 \vee \neg P_4$
(4)	$\neg P_3 \vee P_2$	(5)	$P_1 \vee P_2 \vee P_3$		

Exercise 5.3 (3.1):
Let $a :\rightarrow S$ and $R \subseteq S \times T$. Complete the sort information for g, f, P and variables x, y such that the following formula is well-sorted: $\forall x, y.(R(x, g(x)) \rightarrow (f(g(x), a) \approx y \vee P(y) \vee R(x, y)))$.

Exercise 5.4 (3.3):
Check whether the following first-order formulas are satisfiable, valid or unsatisfiable, where a and b are constants and g is a unary function symbol. Assume a one-sorted universe.

1. $(\forall x.\exists y.R(x, y)) \rightarrow R(a, b)$
2. $(P(a) \wedge \forall x.(P(x) \rightarrow P(g(x)))) \rightarrow P(g(g(a)))$
3. $(\exists x.P(x)) \rightarrow P(b)$

4. $P(b) \rightarrow (\exists x.P(x))$

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