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Tutorials for "Automated Reasoning WS20/21"
Exercise sheet 7

Exercise 7.1:
Refute the following set of clauses using resolution.

$N = \{P(a) \vee P(b),\ \neg P(x) \vee \neg P(f(x)) \vee Q(f(a)),\ \neg P(x) \vee P(f(x)),\ Q(a),\ \neg Q(f(x)) \vee \neg Q(x),\ Q(f(x)) \vee \neg P(x)\}$

Exercise 7.2:
Compute all possible resolution inferences out of the below clauses:

$$(1) \quad P(x,x) \vee P(h(x',b), h(c,x''))$$
$$(2) \quad \neg P(y, f(y)) \vee Q(g(y))$$
$$(3) \quad \neg Q(z) \vee P(d,z).$$

Do not compute recursive inferences, i.e., consider only inferences with parents (1), (2), (3).

Exercise 7.3:
Let $\Omega = \{f,\ g,\ h,\ b,\ c\}$ with g arity 2, f and h arity 1 and b and c constants. and let

$$\begin{aligned} t_1 &= g(h(x), h(c)), \\ t_2 &= g(x,x), \\ t_3 &= g(b, f(x)), \\ t_4 &= f(g(x,y)), \\ t_5 &= h(g(x,c)). \end{aligned}$$

Determine for each $1 \leq i < j \leq 5$ whether t_i and t_j are incomparable or comparable (and if so, which term is larger) with respect to

1. a lexicographic path ordering with precedence $f > g > h > b > c$,

2. a Knuth-Bendix-ordering with precedence $h > f > g > b > c$, where h has weight 0 and all other symbols have weight 1.

Exercise 7.4:
Prove or provide a counter example for the following statements.

1. If two terms are comparable with respect to an LPO instance, then they are comparable with respect to a KBO instance.
2. If two terms are comparable with respect to a KBO instance, then they are comparable with respect to an LPO instance.

Exercise* 7.5:
Prove that LPO is well-defined, i.e., the overlaps between the cases 2.x lead to unique results.

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