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Universität des Saarlandes
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Bromberger/Möhle/Schwarz/Weidenbach **January 19, 2023**

Tutorials for "Automated Reasoning WS22/23"
Exercise sheet 12

Exercise 12.1:
Construct a first-order logic with equality clause set where exhaustive application of Equality Resolution and deleting the respective parent clause turns an unsatisfiable clause set into a satisfiable one.

Exercise 12.2:
Construct two equational clauses and select an ordering $\succ$ such that all conditions of the inference rule Superposition Right except the ordering conditions $t\sigma \not\preceq t'\sigma$, $s\sigma \not\preceq s'\sigma$ are met, and, $t \not\preceq t'$, $s \not\preceq s'$.

Exercise 12.3:
Construct $N_{\mathcal{I}}$ for the ground clause set

$$N = \{f(a) \approx b \vee f(b) \approx a,\ f(f(b)) \approx a,\ f(f(b)) \not\approx a \vee a \approx b\}$$

with respect to a KBO where all function symbols have weight 1 and $f \succ b \succ a$ and nothing is selected. Find the minimal false clause, perform the respective superposition inference and recompute the partial model with respect to the extended clause set.

Exercise 12.4:
Use superposition to show that the following set of (implicitly universally quantified) clauses is not satisfiable:

$$f(a, x) \approx x$$
$$x \approx a \vee x \approx g(a)$$
$$x \not\approx g(x)$$
$$f(a, g(a)) \approx g(b)$$
$$b \not\approx a$$

Use the LPO with precedence $f \succ g \succ a \succ b$. Compute only inferences that are required according to the ordering restrictions of the superposition calculus.

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