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Tutorials for "Automated Reasoning II"
Exercise sheet 1

Exercise 1.1:
Prove that Knuth-Bendix completion terminates and produces a convergent TRS if the input consists only of ground equations, the term ordering is total on ground terms, and simplification inferences are computed eagerly (that is, Orient and Deduce may only be applied if none of the Simplify rules is applicable).

Exercise 1.2:
On page 4 of the lecture notes we have sketched a flattening operation for sets of equations. Formalize it using an appropriate transition system. (Remember that two different D-equations must always have different left-hand sides.)

Exercise 1.3:
Let $\Sigma = (\Omega, \Pi)$ and $\Sigma' = (\Omega', \Pi')$ be signatures such that $\Omega \subseteq \Omega'$ and $\Pi \subseteq \Pi'$. If $\mathcal{A}$ is a Σ-algebra and $\mathcal{B}$ is a Σ'-algebra such that $U_\mathcal{A} = U_\mathcal{B}$, $f_\mathcal{A} = f_\mathcal{B}$ for every $f \in \Omega$ and $P_\mathcal{A} = P_\mathcal{B}$ for every $P \in \Pi$, then $\mathcal{A}$ is called the Σ-reduct of $\mathcal{B}$ (denoted by $\mathcal{A} = \mathcal{B}|_\Sigma$).

Prove the following property: Let N be a set of closed Σ-formulas, let N' be a set of closed Σ'-formulas, and let F be a closed Σ-formula. If the Σ-models of N are exactly the Σ-reducts of Σ'-models of N', then $N \models F$ if and only if $N' \models F$.

Bring your solution (or solution attempt) to the tutorial on Oct. 31.