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Tutorials for "Automated Reasoning II"
Exercise sheet 5

Exercise 5.1:
In Sect. 3.3 it is stated that the ordering restrictions of the inference rules of the superposition calculus must be satisfied *after applying the mgu to the premises.* Give a simple example that shows that a literal may be maximal in a clause, but that the maximality requirement may be violated after applying the mgu.

Exercise 5.2:
Compute the rewrite systems R_C and R_∞ for the set of ground clauses N:

$$f(a) \approx d \lor f(a) \approx c \qquad (1)$$
$$a \not\approx d \lor f(b) \approx f(d) \qquad (2)$$
$$f(c) \approx f(d) \qquad (3)$$
$$f(d) \approx d \lor f(d) \approx b \qquad (4)$$
$$a \approx b \qquad (5)$$
$$c \approx d \qquad (6)$$

Use the KBO with $f > a > b > c > d$ and weight 1 for all symbols as term ordering. Which is the smallest clause $C \in N$ such that C is neither productive nor true in R_C? Use it to show that N is not saturated up to redundancy.

Exercise 5.3:
Prove the lifting lemma (Lemma 3.7) for the equality factoring inference rule.

Exercise 5.4:
Find an unsatisfiable clause set consisting of two unit clauses $s \approx t$ and $u \not\approx v$ and a term ordering $\succ$ such that the only inference that neither violates the ordering restrictions of the superposition calculus nor yields a tautology is a positive superposition inference in which the left-hand side of $s \approx t$ is unified with the right-hand side of a renamed copy of $s \approx t$.

Bring your solution (or solution attempt) to the tutorial on June 17.