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Tutorials for "Automated Reasoning II"
Exercise sheet 4

Exercise 4.1:
In many applications of CDCL or CDCL(T), one does not only want a yes/no answer, but also an explanation for it. In the case of an unsatisfiable input, this explanation is an "unsatisfiable core", i.e., a (small) subset of the input clauses that is already sufficient to show $\mathcal{T}$-inconsistency. How can we get an unsatisfiable core from a CDCL(T) proof?

Exercise 4.2:
Prove that the multiset extension of a reduction ordering is stable under substitutions (which implies that the literal ordering defined on page 48 of the script is stable under substitutions). Note: There are several ways to characterize a multiset ordering, see e.g. the lecture notes from the previous semester or the book by Baader and Nipkow. You may pick the most convenient one for this purpose.

Exercise 4.3:
Prove that the Equality Factoring rule is sound:

$$\textit{Equality Factoring:} \quad \frac{C' \vee s' \approx t' \vee s \approx t}{(C' \vee t \not\approx t' \vee s \approx t')\sigma} \quad \text{where } \sigma = \mathrm{mgu}(s, s').$$

Exercise 4.4:
Refute the following set of equational clauses by superposition:

$$f(x) \not\approx b \vee f(x) \approx c \quad (1)$$
$$f(f(x)) \approx x \quad (2)$$
$$b \not\approx c \quad (3)$$

Choose an appropriate ordering and perform only inferences that satisfy the ordering restrictions.

Bring your solution (or solution attempt) to the tutorial on June 10.