



Uwe Waldmann

April 19, 2022

Tutorials for “Automated Reasoning II”
Exercise sheet 1

Exercise 1.1:

Use the congruence closure algorithm to check whether the equational clause

$$\forall x, y \ f(f(x)) \not\approx x \vee f(x) \not\approx y \vee f(f(y)) \not\approx g(y) \vee x \approx y \vee h(x, y) \approx h(x, g(y))$$

is valid.

Exercise 1.2:

Show that Knuth–Bendix–Completion terminates for ground inputs if we use a suitable strategy. What property should the strategy satisfy and how can we show termination?

Exercise 1.3:

On page 4 of the lecture notes we have sketched a flattening operation for sets of equations. Formalize it using an appropriate transition system in such a way that any two different D-equations have always different left-hand sides.

Exercise 1.4:

The Fourier-Motzkin algorithm would be unsound if we omitted the non-triviality axioms from the definition of ODAGs. Where do we need non-triviality?

Exercise 1.5:

Describe the rules for virtual substitution for the test points in the set T' that is defined on page 13 of the lecture notes.

Exercise 1.6:

Use the Loos-Weispfenning algorithm to eliminate $\exists x$ from the formula

$$\exists x \ ((2x - y > 0 \vee x \geq 2) \wedge (y - x \geq -1 \vee x < 1) \wedge \neg(x \geq 3y))$$

Simplify the result as much as possible.

Bring your solution (or solution attempt) to the tutorial on April 26.