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**Tutorials for “Automated Reasoning II”**  
**Exercise sheet 2**

**Exercise 2.1:**

Use the congruence closure algorithm to check whether the conjunction

$$f^4(c) \approx f(c) \wedge f^6(c) \approx f^2(c) \wedge f^3(c) \not\approx c \wedge f^2(c) \not\approx f(c)$$

is satisfiable, where  $f^1(c) = c$  and  $f^{i+1}(c) = f(f^i(c))$ .

**Exercise 2.2:**

In Sect. 2.2 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 2.3:**

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 2.4:**

In the lecture we have discussed the rules for virtual substitution for the test points in the set  $T$ . Do the same for the set  $T'$ .

**Exercise 2.5:**

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 to the tutorial on May 5 and compare it with the solution that is discussed there. Your solution will not be graded.