max planck institut informatik

Universität des Saarlandes
FR Informatik

Uwe Waldmann **May 5, 2014**

Tutorials for "Automated Reasoning II"
Exercise sheet 2

Exercise 2.1:
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 2.2:
Describe the rules for virtual substitution for the test points in the set T' that is described on page 13 of the lecture notes.

Exercise 2.3:
The quantifier elimination algorithms for linear rational arithmetic can also be applied to non-linear formulas, provided that all the bound variables occur only linearly. That is, the atoms can have the form $0 \sim \sum_i s_i(\vec{z}) \cdot x_i$ where the coefficients $s_i(\vec{z})$ are terms that may contain arbitrary arithmetic operations, say $(z_1 + z_3^2)$ or even $(\sin z_2 + e^{z_5} + 3)$, but no bound variables. There is one additional problem, though. Why? How can you solve it?

Exercise 2.4:
Use the nondeterministic Nelson–Oppen method to show that the following formula is unsatisfiable in the combination of EUF and linear integer arithmetic:

$$\exists x, y\, (x + y \approx 0 \,\wedge\, f(x) + f(-y) \approx 1)$$

(If you choose the equations to split cleverly, the proof is quite short.)

Bring your solution (or solution attempt) to the tutorial on May 19.