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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 $(z_1 + z_2^2)$ 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:

The properties described at the end of page 10 of the lecture notes do not hold anymore, when we extend the signature of ODAGs by free function or predicate symbols that may be interpreted by arbitrary functions or predicates over the universe. Find a formula over some extended signature that is satisfiable over \mathbb{Q} but unsatisfiable over \mathbb{R} . (One free unary function or predicate symbol is sufficient.)

Bring your solution (or solution attempt) to the tutorial on Nov. 7.