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hand in until 22.05.2012, 14:15

## Tutorials for Decision Procedures Exercise sheet 4

### Exercise 1: FOL-Sudoku

Solve exercise 3 from exercise sheet 2 again, but this time using first-order logic and the theory of quantifier-free linear integer arithmetic. ((`set-logic QF_LIA`)) We did not discuss theories yet, but intuitively this means that you can use addition and constant multiplication, as well as (in-/dis-)equalities (i.e. `=`, `distinct`, `<`, `<=`), and integer constants, in their usual meanings.

- As in sheet 2 write a script that generates SMTLIBv2 scripts for a given sudoku size.
- Try to find a constraint set that is fast to solve.
- What do you observe, in terms of speed, compared to the boolean constraints? (You do not need to benchmark, just state what you expected and what you observed and how those two match.)

### Exercise 2: Undecidability of FOL

Read the proof for the undecidability of first-order logic linked on the lecture's website.

- Describe the proof in a few (natural language) sentences.
- Consider the following variation of the proof:

Change  $F_\tau$  to

$$F_\tau = F_1 \wedge \dots \wedge F_7 \rightarrow \neg \exists s \exists p q_n(s, p)$$

(i.e. negate the succedent). With this modification, we can show that  $\overline{H_0}$  can be reduced to the problem of validity of FOL-formulae in a completely analogous way, right?

This would mean that FOL-validity is not semidecidable which would be a contradiction to what we have learned in the lecture. Where is the mistake?

(Because there is no exercise on the coming thursday because of the holiday, this exercise sheet is shorter than usual. As usual four points per exercise can be achieved.)