Logics Exercise

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SS 2017 | Exercise Sheet 13 | 25.07.2017

Submission of homework: This (final) sheet contains *optional* homework. In order to reach the grade bonus (120 out of 240 points; from sheets 1–12), you do not have to submit the homework. But if you do, you may get up to 10 additional points. Submission deadline is 01.08.2017, 10:00 AM, CEST. You have to do the homework yourself; no teamwork allowed.

Exercise 13.1. [**Extending Real Linear Arithmetic**]
Show that quantifier elimination for real linear arithmetic still works if we add the functions min and max.

Exercise 13.2. [**Induction**]
Use induction to show that there is no quantifier-free formula with just $\wedge$, $\vee$, $\leq$, $=$ that is equivalent to $x < y$.

Exercise 13.3. [**Brainstorming**]
Collect about 30 important pieces of terminology that were used in the lecture and that you want to remember for the exam.

Also collect the three results that you find most interesting.

Homework 13.1. [**Independence**] (4 points)
A set Γ of propositional formulas is called *independent* if $p \in \Gamma$ implies $\Gamma \setminus \{p\} \not\models p$. Show that any finite set has an equivalent independent subset.

Homework 13.2. [**Extending Real Linear Arithmetic**] (6 points)
Similarly to Exercise 13.1, show how to extend real linear arithmetic with:

1. the signum function $\operatorname{sgn}(t)$ (returns -1 if t is negative, 0 if t is 0 and 1 otherwise),
2. the absolute value function $|t|$ (returns the value of t if t is positive, otherwise $-t$).