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Tutorials for "Automated Reasoning"
Exercise sheet 9

Exercise 9.1: (*5 P*)
Prove Lemma 3.47: Let $N_0 \vdash N_1 \vdash N_2 \vdash \dots$ be a run. Then $\mathit{Red}(N_i) \subseteq \mathit{Red}(N_\infty)$ and $\mathit{Red}(N_i) \subseteq \mathit{Red}(N_*)$ for every i.

Note: $\mathit{Red}(N)$ denotes the set of all clauses that are redundant w. r. t. a set N of clauses. (This definition is missing in the lecture notes.)

Exercise 9.2: (*5 P*)
Let N be a set of ground clauses, let $\succ$ be a total and well-founded atom ordering. Prove or refute: If every clause in N is redundant with respect to N, then every clause in N is a tautology.

Exercise 9.3: (*5 P*)
Derive a maximal strict tableau for the set of formulas

$$P \rightarrow (Q \rightarrow R) \qquad (1)$$
$$P \rightarrow Q \qquad (2)$$
$$P \wedge \neg R \qquad (3)$$

Exercise 9.4: (*5 P*)
Refute the following set of formulas using one of the two variants of the tableau calculus for first-order formulas:

$$\forall x\, \exists y\, P(x, y) \qquad (1)$$
$$\exists z\, \forall w\, \neg P(f(z), w) \qquad (2)$$

(If you use tableaux with free variables, use $v_1, v_2, v_3, \dots$ as names for free variables.)

Submit your solution in lecture hall E1.3, Room 001 during the lecture on January 8. Please write the time of your tutorial group (Mon or Tue) on your solution.

Joint solutions, prepared by up to three persons together, are allowed (but not encouraged). If you prepare your solution jointly, submit it only once and indicate all authors on the sheet.