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Tutorials for "Automated Reasoning"
Exercise sheet 6

Exercise 6.1: *(5 P)*
We call a set N of clauses exhausted if the result of any inference with clauses from N is already in the set N or is subsumed by a clause in N. Compute the exhausted set of clauses for this set of clauses:

$$\{\neg P \vee Q \vee \neg S, \neg P \vee Q \vee S, P \vee S, P \vee \neg Q \vee \neg S, \neg P \vee \neg Q \vee \neg S, Q \vee \neg S \vee P\}$$

with respect to $\Rightarrow_{\mathrm{RES}}$.

Exercise 6.2: *(3+3 P)*
Consider the clause set

$$\{\neg P \vee \neg R, R \vee S \vee Q, \neg S \vee R, \neg Q \vee R, R \vee P \vee S\}$$

1. Saturate the clause set with respect to $\Rightarrow_{\mathrm{SUP}}$. Hint: try to consider an ordering that leads to few superposition inferences.

2. Compute $N_{\mathcal{I}}$ for the saturated clause set.

Exercise 6.3: *(4 P)*
Let N be a finite set of propositional clauses and P a propositional variable. Assume that we don't have duplicate literals in clauses and that no clause contains Q and $\neg Q$ for any propositional variable Q. Let $P \vee C_1, \ldots, P \vee C_k$ be all clauses in N containing the literal P and $\neg P \vee D_1, \ldots, \neg P \vee D_l$ be all clauses in N containing literal $\neg P$. Define the set $\mathcal{E}(P, N) = (N - \{P \vee C_i \mid 1 \le i \le k\} - \{\neg P \vee D_j \mid 1 \le j \le l\}) \cup \{C_i \vee D_i \mid 1 \le i \le k, 1 \le j \le l\}$. Prove that N is satisfiable iff $\mathcal{E}(P, N)$ is satisfiable.

Submit your solution in lecture hall E1.3, Room 002 during the lecture on December 02. Please write your name and the date of your tutorial group (Mon, Thu) on your solution.

Joint solutions are not permitted, please submit individually. However, I encourage you working and solving the exercises in a group.