



Bromberger/Möhle/Schwarz/Weidenbach

November 10, 2022

Tutorials for “Automated Reasoning WS22/23”
Exercise sheet 3

Exercise 3.1:

Demonstrate the Superposition partial model construction on the following sets of clauses:

1. Set of clauses $N = \{\neg Q_0 \vee \neg P_2 \vee Q_1, \neg Q_1 \vee Q_2, P_0 \vee Q_0, \neg Q_0 \vee P_1, Q_0 \vee P_1\}$. Use ordering $Q_2 \succ P_2 \succ Q_1 \succ P_1 \succ Q_0 \succ P_0$ on atoms.
2. Set of clauses $N = \{\neg P \vee Q \vee P, S \vee \neg Q \vee R, \neg R \vee \neg S, Q \vee \neg S \vee S, R \vee S \vee P, S \vee Q, \neg R \vee \neg P \vee S \vee \neg Q\}$. Use ordering $P \succ Q \succ R \succ S$ on atoms.

Demonstrate here means: order the clauses in the set, show how (partial) interpretations (i.e. N_D for every $D \in N$) looks like, show how δ_D look like for every $D \in N$ and show the minimal clause which is not entailed by $N_{\mathcal{I}}$ if there is some. Don't do any inferences!

Exercise 3.2:

Show unsatisfiability of the below clause set N via the superposition calculus based on the atom ordering $P_1 \succ P_4 \succ P_5 \succ P_2 \succ P_3$.

- | | | |
|------------------------------|------------------------------|------------------------------|
| (1) $P_1 \vee P_2 \vee P_3$ | (2) $\neg P_1 \vee \neg P_2$ | (3) $\neg P_2 \vee \neg P_3$ |
| (4) $\neg P_1 \vee \neg P_3$ | (5) $P_4 \vee P_5 \vee P_1$ | (6) $\neg P_4 \vee P_1$ |
| (7) $\neg P_4 \vee P_2$ | (8) $\neg P_5 \vee P_2$ | (9) $\neg P_5 \vee P_3$ |
| (10) $\neg P_1 \vee P_4$ | | |

Exercise* 3.3:

Which of the following statements are true or false? Provide a proof or a counter example.

1. If $N_{\mathcal{I}} \models N$ then N is saturated.
2. If $\delta_C = \{P\}$ while constructing $N_{\mathcal{I}}$ then for all clauses $D = P \vee D'$ with $C \neq D$ we have $\delta_D = \emptyset, D \in N$.
3. If all clauses in N have at most one positive literal and there is no clause in N having only negative literals then $N_{\mathcal{I}} \models N$.

It is not encouraged to prepare joint solutions, because we do not support joint exams.