Homework Exercises – Automated Theorem Proving, L. Kovács

Problem 1. Establish the unsatisfiability of the following set of four formulas, using the superposition inference system $\mathbb{SRF}$:

$$
\begin{array}{ll}
(1) & c = d \\
(2) & f(d) \neq d \vee a = b \\
(3) & f(c) = d \\
(4) & g(a, b) \neq g(b, a)
\end{array}
$$

Problem 2. The limit of an $\mathbb{I}$-inference process $S_0 \Rightarrow S_1 \Rightarrow S_2 \Rightarrow \ldots$ is the set of formulas $\bigcup_i S_i$. In other words, the limit is the set of all derived formulas.

Suppose that we have an infinite inference process such that S_0 is unsatisfiable and we use the ground superposition inference system $\mathbb{SRF}$.

Question: does completeness of $\mathbb{SRF}$ imply that the limit of the process contains the empty clause? Justify your answer!