Tutorial 4

We say that a deterministic automaton is a diamond automaton if for every state q and every pair of independent letters a, b it holds that if $q \xrightarrow{a} q'$, $q \xrightarrow{b} q''$ then there exists some state p such that $q' \xrightarrow{b} p$, $q'' \xrightarrow{a} p$.

1. Is every trace-closed regular language recognized by a diamond automaton?

2. Given dependence alphabet (Σ, D) and language L the task is to check whether L is trace-closed. Prove that this problem is decidable when L is regular and undecidable for L context-free.

3. Improve Lipton's construction presented during the lecture to avoid the exponential blowup of the instruction number.

4. Show that Lipton's construction can be used to prove EXPSPACE-hardness of coverability, boundedness, finiteness (termination) and other similar problems for Petri nets (PN).

5. Prove that all the interesting questions for 1-bounded PN are PSPACE-hard.