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Introduction to Model Checking
Winter term 2013/2014

– Series 13 –

Hand in on February 5th before the exercise class or in the box in front of the chair's secretary's office.

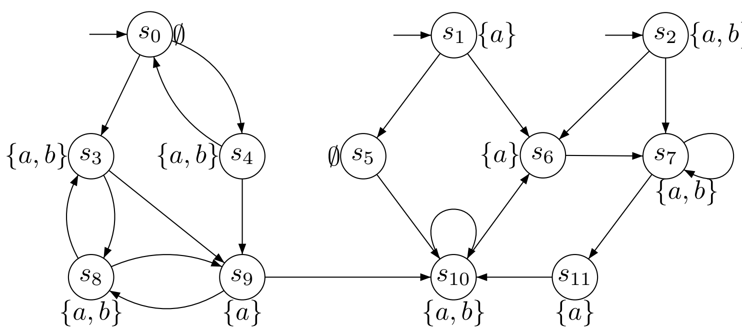
Exercise 1 **(3 points)**

Recall the definition of bisimulation from the lecture slides (slide 51). A *simulation relation* is a relation for which conditions (1), (2) and the first line of (I) have been met. Conditions (3) and the second condition of (I) have not necessarily been met. One transition system can simulate all moves from the other system, but not necessarily vice-versa. A transition system TS_2 is said to *simulate* a transition system TS_1, denoted $TS_1 \preceq TS_2$, iff. such a simulation relation exists.

Prove or disprove: $TS_1 \preceq TS_2$ and $TS_2 \preceq TS_1$, imply that $TS_1 \sim TS_2$.

Exercise 2 **(4 points)**

Consider the transition system TS over $AP = \{a, b\}$ outlined below:

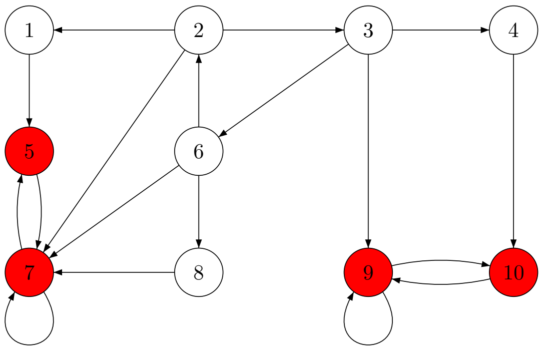


a) Determine the bisimulation equivalence $\sim_{TS}$ and depict the bisimulation quotient system $TS/\sim$.

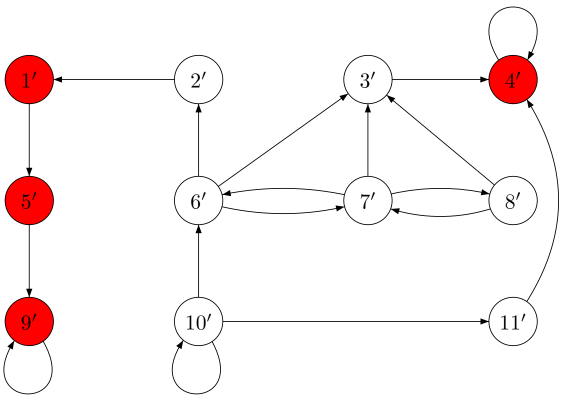
b) For each bisimulation equivalence class C, provide a CTL formula Φ_C that holds only in the states in C.

Exercise 3 **(3 points)**

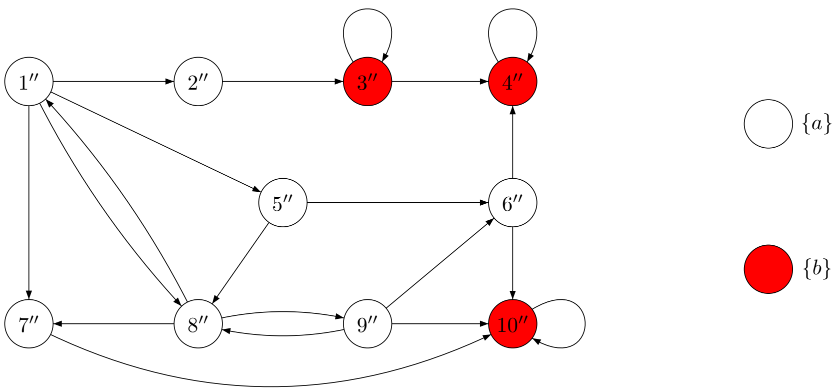
Consider the following three transition systems TS_1, TS_2, and TS_3, where all the states labelled with $\{a\}$ are initial states. Decide whether $TS_i \sim TS_j$ for $i, j \in \{1, 2, 3\}$ and $i \neq j$. If $TS_i \not\sim TS_j$, then provide a distinguishing CTL formula Φ such that $TS_i \models \Phi \iff TS_j \not\models \Phi$.



(a) TS_1



(b) TS_2



(c) TS_3