

Introduction to Model Checking Winter term 08/09

– Series 12 –

Hand in on February 6 before the exercise class.

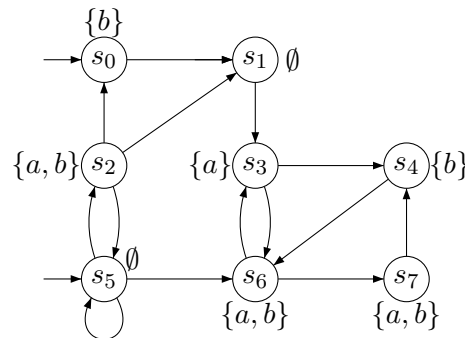
Exercise 1

(3 points)

Consider the CTL*-formula (over $AP = \{a, b\}$)

$$\Phi = \forall \Diamond \Box \exists \bigcirc (a \cup \exists \Box b)$$

and the transition system TS outlined below:



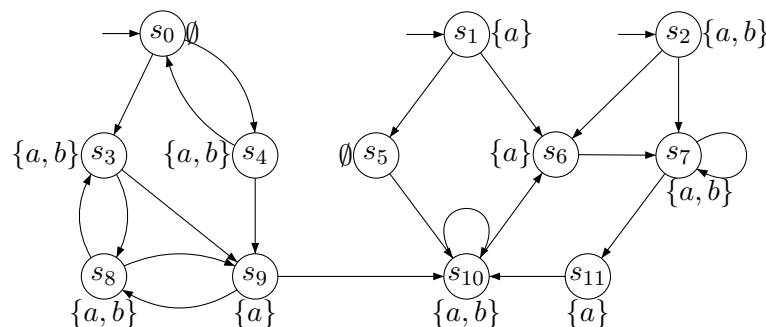
Apply the CTL* Model Checking Algorithm to compute $Sat(\Phi)$ and decide whether $TS \models \Phi$.

Hint: You may infer the satisfaction sets for LTL formulas directly.

Exercise 2

(2 + 2 points)

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



- Determine the bisimulation equivalence $\sim_{TS}$ and depict the bisimulation quotient system $TS/\sim$.
- Provide CTL master formulas Φ_C for each bisimulation equivalence class C .

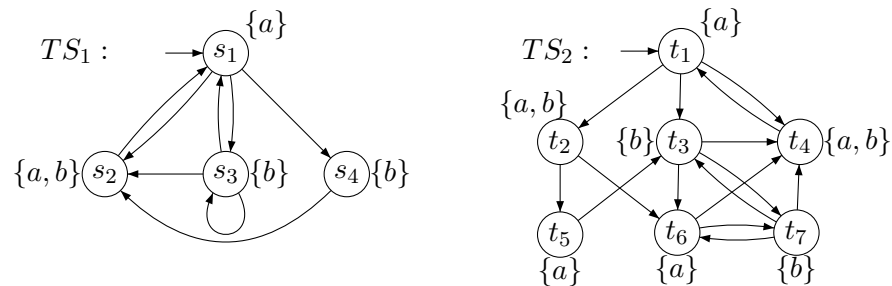
Exercise 3**(3 points)**

Let TS be a transition system with set of states S . We reverse the definition of bisimulation for TS in the following sense: Two states s and t are *backward bisimilar* if they are equally labelled, and their predecessors behave the same when going backwards.

- Formally define backward bisimulation and backward bisimilarity (denoted $\sim_{\leftarrow}$).
- Prove that $\sim_{\leftarrow}$ is an equivalence relation.
- Provide a transition system TS such that $TS/\sim$ and $TS/\sim_{\leftarrow}$ are not isomorphic!

Exercise 4**(1 + 4 points)**

Consider the following transition systems TS_1 and TS_2 :



- Decide whether $TS_1 \sim TS_2$. Explain your answer formally.
- Decide whether $TS_1 \simeq TS_2$. Explain your answer formally.