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Introduction to Model Checking
Summer term 2010
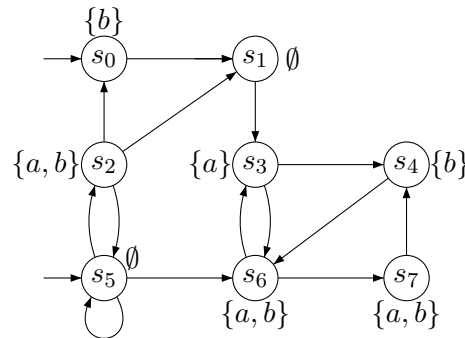
– Series 11 –

Hand in on July 21 before the exercise class.

Exercise 1 (3 points)

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

$$\Phi = \forall \Diamond \Box \exists \bigcirc \big(a \, \mathsf{U} \, \exists \Box b \big)$$

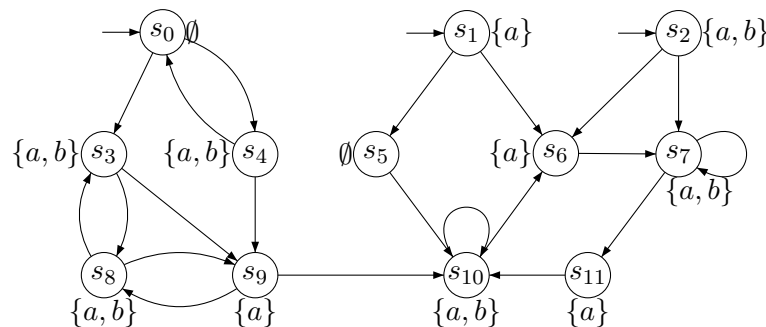and the transition system TS outlined below:

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:

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

b) Provide CTL master formulas Φ_C for each bisimulation equivalence class C.

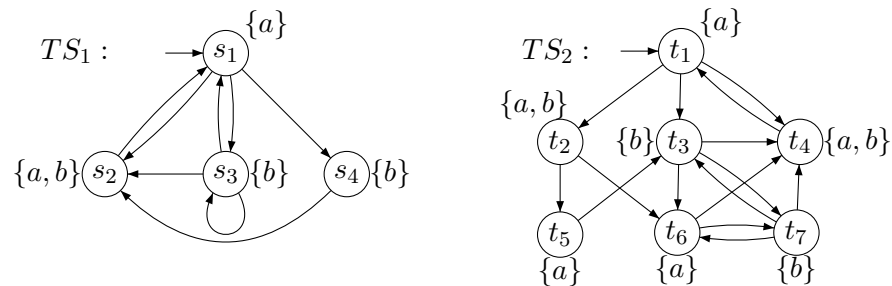**Exercise 3**   (3 points)

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.

  a) Formally define backward bisimulation and backward bisimilarity (denoted $\sim_{\leftarrow}$).

  b) Prove that $\sim_{\leftarrow}$ is an equivalence relation.

  c) 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:

  a) Decide whether $TS_1 \sim TS_2$. Explain your answer formally.

  b) Decide whether $TS_1 \simeq TS_2$. Explain your answer formally.