RHEINISCH-WESTFÄLISCHE TECHNISCHE HOCHSCHULE AACHEN

LEHRSTUHL FÜR INFORMATIK 2
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Introduction to Model Checking
Winter term 2013/2014

– Series 11 –

Hand in on Month 22nd before the exercise class or in the box in front of the chair's secretary's office.

Exercise 1 **(2 points)**

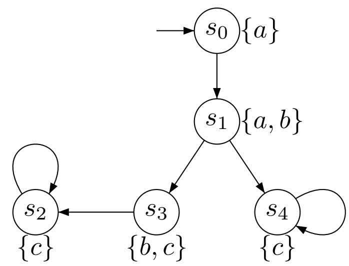
Provide two finite transition systems TS_1 and TS_2 (without terminal states, and over the same set of atomic propositions) and a CTL formula Φ such that $Traces(TS_1) = Traces(TS_2)$ and $TS_1 \models \Phi$, but $TS_2 \not\models \Phi$.

Exercise 2 **(4 points)**

Consider the following CTL-formulas

$$\Phi_1 = \exists\Diamond\,\forall\Box\, c \quad \text{and} \quad \Phi_2 = \forall(a \,\mathsf{U}\, \forall\Diamond\, c)$$

and the transition system outlined on the right. Decide whether $TS \models \Phi_i$ for $i = 1, 2$ using the CTL model checking algorithm from the lecture. Do not forget to translate to existential normal form and compute the satisfaction sets for subformulas.



Exercise 3 **(4 points)**

We consider again the incomparable expressiveness of CTL and LTL.

(a) Using a theorem from the lecture (lecture 18, slide 25), prove that there does not exist an equivalent LTL-formula for the CTL-formula $\Phi_1 = \forall\Diamond\,(a \wedge \exists\bigcirc\, a)$.

(b) Now prove directly (i.e. without the above theorem), that there does not exist an equivalent LTL-formula for the CTL-formula $\Phi_2 = \forall\Diamond\,\exists\bigcirc\,\forall\Diamond\,\neg a$.
Hint: Argument by contraposition and (similarly to exercise 1 above) think about trace inclusion vs. CTL-equivalence!