Model Checking Homework 8 (updated)

Deadline: May 19, 2022, 4:00pm

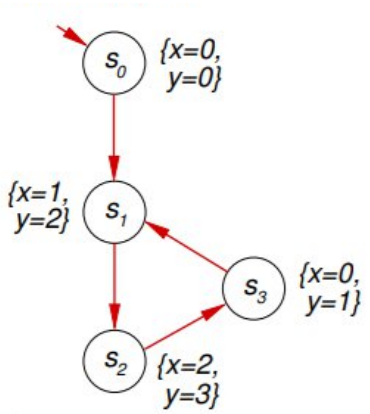
Send solution to: modelchecking@iaik.tugraz.at

LTL Model Checking using Automata

Consider the following LTL properties φ_1 and $\varphi_2$and the Kripke structure M

$$\varphi_1 = F(x = 1 \wedge y = 3)$$

$$\varphi_2 = F(y = 2 \wedge X\, x = 2)$$



Task a. [5 Points] Check whether it holds that $M \models \varphi_1$.

Task b. [5 Points] Check whether it holds that $M \models \varphi_2$.

Use the following algorithm that we discussed in the lecture. You also find the algorithm on page 98 (chapter 7) of the Model Checking book. Give (a few) details of your computation.

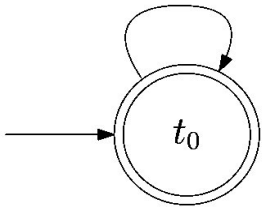
1. Construct $\neg\varphi$
2. Construct a Büchi automaton* $\mathcal{S}_{\neg\varphi}$
3. Translate M to an automaton $\mathcal{A}$.
4. Construct the automaton $\mathcal{B}$ with $\mathcal{L}(\mathcal{B}) = \mathcal{L}(\mathcal{A}) \cap \mathcal{L}(\mathcal{S}_{\neg\varphi})$
5. If $\mathcal{L}(\mathcal{B}) = \emptyset \Rightarrow \mathcal{A}$ satisfies φ
6. Otherwise, a word $v \cdot w\omega \in \mathcal{L}(\mathcal{B})$ is a counterexample

Update:

* You can use the following automata instead of using the construction explained in the lecture. In that case, briefly explain why they are a valid translation of $\neg\varphi$ to a Büchi automaton $\mathcal{S}_{\neg\varphi}$.

Task a:

$$\neg\{x = 1\} \vee \neg\{y = 3\}$$



Task b: