Real-Time Systems

http://swt.informatik.uni-freiburg.de/teaching/SS2014/rtsys

Exercise Sheet 4

Early submission: Monday, 2014-07-07, 12:00   Regular submission: Tuesday, 2014-07-08, 10:00
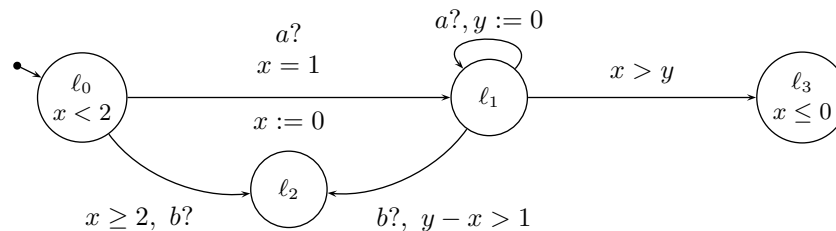
Exercise 1: Playing with Definitions [2]   (10/20 Points)

Figure 1: Timed Automaton for Exercise 1.

Consider the timed automaton $\mathcal{A}$ in Figure 1.

(i) Give the abstract syntax corresponding to the graphical representation of $\mathcal{A}$.   (1)

(ii) Does $\mathcal{A}$ have a computation path with Zeno behaviour?   (2)

(iii) Does $\mathcal{A}$ have a computation path with a timelock?   (2)

(iv) Does $\mathcal{A}$ have a run?   (2)

(v) Is the location ℓ_1 reachable? And ℓ_2? And ℓ_3?   (3)

Note: And usual, don't just state "yes" or "no" but convince your tutor of your claim by referring to the definition(s) relevant for the task.

Exercise 2: Playing with Uppaal[1]   (10/20 Points)

Consider the Off/Light/Bright example from the lecture (Lec. 11, Slides 4-7).

(i) Provide an UPPAAL model for the system presented in the lecture.   (3)

(ii) Does your model $\mathcal{M}$ have a run ξ such that

$$\text{"}\xi \models_0 \lceil \mathsf{Off} \rceil; \lceil \mathsf{Light} \rceil; \lceil \mathsf{Bright} \rceil; \lceil \mathsf{Off} \rceil; \lceil \mathsf{Bright} \rceil; true\text{"}?$$

If yes, use the simulator to provide a trace demonstrating this fact.   (4)

(iii) Modify (only) the user model to resemble a typical computer scientist: he considers bright lights irritating. The user should make sure that the Bright location is never reached.   (3)

Note: Please provide all Uppaal files that are necessary to confirm your results: The models for tasks (i) and (iii) and the trace files for task (ii).

Exercise 3: Playing with Theory   (5 Bonus)

Note that we used quotation marks to enunciate the property on exercise 3, task (ii), this is because the quoted mathematical expression has an intuitive meaning but we don't have a formal semantics for it.

Explain why, what is missing? What needs to be done to be allowed to remove the quotation marks? Do that.

References

[1] Gerd Behrmann, Alexandre David, and Kim G. Larsen. A tutorial on uppaal 2004-11-17. Technical report, Aalborg University, Denmark, November 2004.

[2] Ernst-Rüdiger Olderog and Henning Dierks. *Real-Time Systems - Formal Specification and Automatic Verification.* Cambridge University Press, 2008.