Quantitative Evaluation of Embedded Systems: Assignment 1

This assignment can be made in teams of 1 or 2. Answer the questions below in a concise, yet precise way, and in English. Bring your answers to class on Monday December 2.

Note that

- Whenever I refer to the Uppaal Tutorial or simply the tutorial, I mean the paper A Tutorial on Uppaal 4.0 by Gerd Behrmann, Alexandre David, and Kim G. Larsen.
- TA stands for Timed Automaton.

1 Reading

Exercise 1 To answer the questions below, you need to read the following sections.

- Section 1 of both papers.
- Section 2 of the Uppaal Tutorial upto (and including) Definition 2 and the explanation just below.
- Sections 2.1 and 2.2 in the Timed Automata paper upto and including Definition 2 (you may skip the small section called Timed Büchi automata).

2 Theory

Exercise 2 1. Determine a path in $P$ that reaches $l_2$.

2. Determine a path in $P$ that reaches $l_2$ faster.

3. Give the semantics of the TA as a TLTS.

![Diagram](Figure 1: TA P with initial state $l_0$)

3 Tool usage

Exercise 3 To get acquainted with Uppaal, we consider the example from Section 5 in the Uppaal tutorial, which comes with the Uppaal distribution.

1. Install Uppaal 4.0 from [www.uppaal.org](http://www.uppaal.org) and load the model fisher.xml.

2. Use the simulator to walk through the model. Create traces $\alpha_1, \alpha_2, \ldots$ with the following properties:

   (a) $\alpha_1$ hits the state $P1.cs$ and $P2.wait$

   (b) $\alpha_2$ hits all locations in $P1$ and $P2$.

   (c) $\alpha_3$ takes all transitions in $P1$ and $P2$. 
3. Check all properties that are pre-defined in the verifier.

4. Check the liveness property $P1.\text{req} \rightarrow P1.\text{cs}$. Load a diagnostic trace (see options-menu). Study the diagnostic trace and explain why this property is violated.

5. Add the variant $x \leq 2k$ to the location $\text{wait}$ (as suggested in Section 5). Answer the questions from item 3. for the new model.