Quantitative Verification Session 4

November 14, 2017

UPPAAL Modeling

Continued from Session 3...

Exercise 1. Construct a system modeling trains from multiple tracks crossing a bridge with a single track. The expected behaviour of the train is elaborated below.

- When the Train approaches a bridge, it sends a signal to the controller.
- If the bridge is occupied, the controller sends a stop signal to the train within 10 time units.
- Otherwise, if the train doesn't receive a stop signal within 10 time units, it starts to cross the bridge within 20 time units. It takes the train 3 to 5 time units to leave the bridge.
- If the train receives a stop signal within 10 time units, it comes to a stop. When it receives a go signal from the controller, it starts moving within 15 time units and it takes atleast 7 time units to enter the bridge.

Design a controller which uses an FCFS strategy to process requests. If the bridge is free and a train requests to use it, add it to a queue. When the train leaves, remove it from the queue. If the bridge is being used, always add the train to the queue and ask it to wait until its turn.

Verify the following properties

- Gate can receive (and store in queue) msg's from approaching trains.
- Train 1 can reach crossing.
- Train 0 can be crossing bridge while Train 1 is waiting to cross.
- Train 0 can cross bridge while the other trains are waiting to cross.
- There is never more than one train crossing the bridge (at any time instance).
- There can never be N elements in the queue (thus the array will not overflow).
- Whenever a train approaches the bridge, it will eventually cross.
- The system is deadlock-free.

Source: UPPAAL Demos

TCTL Model Checking

Exercise 2. Consider the timed automaton shown in Fig. 1. Draw the region transition system (if necessary, augmented with a new clock z) so as to aid you in model checking TCTL specifications. Model check the property $\exists\Diamond^{\leq 1} on$.

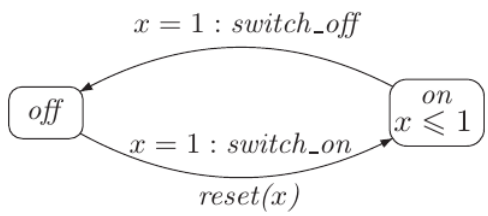

Figure 1: Timed automaton modeling a light

For more reading, see Section 9.3.3 of [1].

References

[1] Baier, Christel, Joost-Pieter Katoen, and Kim Guldstrand Larsen. Principles of model checking. MIT press, 2008.