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Advanced Model Checking
Summer term 2012

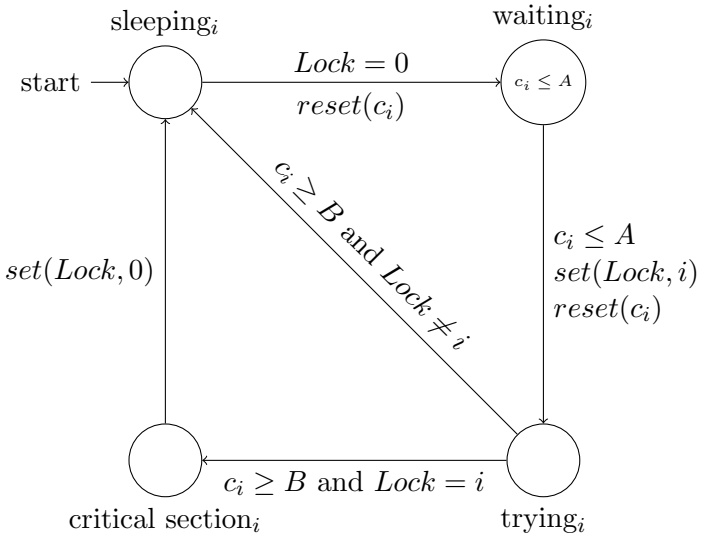
– Assignment 8 –

Hand in on June 20'th before the exercise class.

Exercise 1: Mutual Exclusion Algorithm (2 points)

Take two process P_1 and P_2. Both implement the following mutual exclusion algorithm given by the automata T.

P_i:



Lock is a shared variable taking values from $\{0, 1, 2\}$. c_i is the clock. A and B are predefined constants. $reset(c_i)$ resets the clock c_i to 0. $set(Lock, x)$ sets the value of lock to x. Shew that mutual exclusion of entering critical section holds if $A < B$.

Exercise 2: Invariants (2 points)

Consider the following transformation of a timed automaton.

- Strengthen the condition (guard) of each outgoing transition by the invariant of the location.
- Strengthen the condition (guard) of each incoming edge to a state by the invariant of the location.
- Remove the invariants form the location after having strengthen the transitions.

Shew that reachability of any state of the timed automaton $\langle l, \eta \rangle$, where l is a location of the timed automaton and η the clock valuation, remains unchanged after the transformation.

Exercise 3: Strong Zeno Criterion (2 points)

Give a timed automaton

a) that is non-Zeno but does not satisfy the strong Zeno conditions. (Defined in Lemma 9.24, pg 695 of Principles of Model Checking).

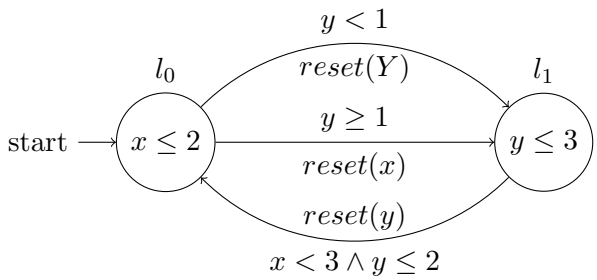
b) Which is non-Zeno under fairness (all paths of the the transition system being fair), but does not satisfies Strong Zeno Condition.

Exercise 4: Verify (2 points)

Check whether the following timed automaton is

a) Non-Zeno.

b) Time lock free.



Exercise 5: Modeling (2 points)

Construct a network of timed automata for a simple lamp with the following specification. The lamp has a single button. If the button is pressed once, the light is turned on. If the button is pressed again then the light is turned off. If the button is pressed rapidly twice then the light becomes brighter. State clearly any assumptions you make. [1]

[1] Hint: Model the lamp and user separately and then work on a synchronization.