

Advanced Model Checking Summer term 2009

– Series 9 –

Hand in on June 29'th before the exercise class.

Exercise 1

(2 = 1 + 1 points)

Give the formal semantics of TA_1 and TA_2 by means of a transition system.

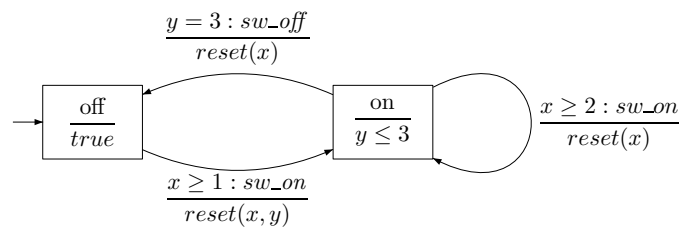


Abbildung 1: Timed automata TA_1 for the Exercise 1

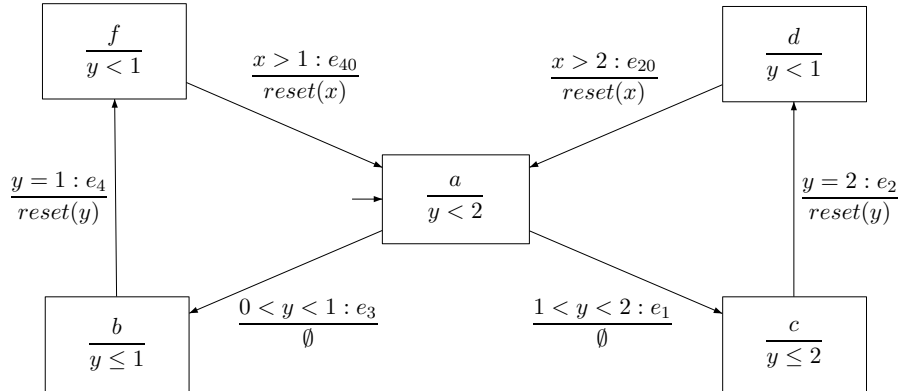


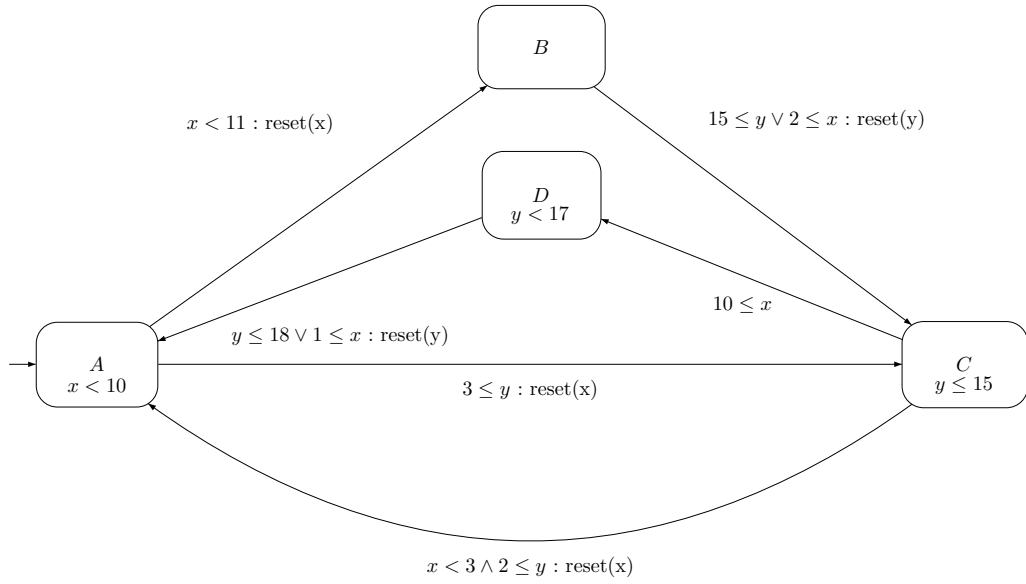
Abbildung 2: Timed automata TA_2 for the Exercise 2

Exercise 2

(4 = 1 + 1 + 2 points)

For the Timed-Automata below check whether it is:

- a) Non-Zeno.
- b) Timelock-free.



Provide a timed automata which is nonzeno and for which Lemma 9.24 (from the book) doesn't hold.

Exercise 3

(1 = 0.5 + 0.5 points)

- (a) Find a counterexample showing that:

$$\forall \diamond^{=d} \Phi \wedge \forall \diamond^{=d} \Psi \neq \forall \diamond^{=d} (\Phi \wedge \Psi),$$

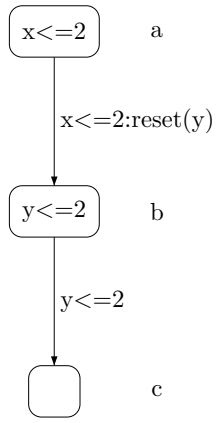
where $\diamond^{=d} = \diamond^{[d,d]}$ for $d \in \mathbb{R}_{\geq 0}$.

- (b) Does this also hold for $J = [0, \infty)$? Justify your answers!

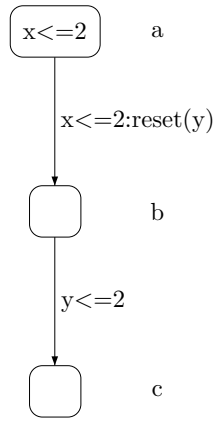
Exercise 4

(3 = 0.5 × 6 points)

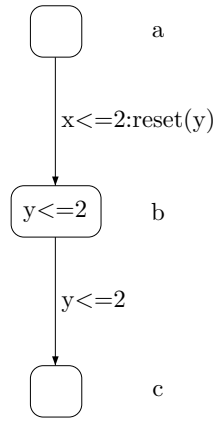
Consider the following six timed automata:



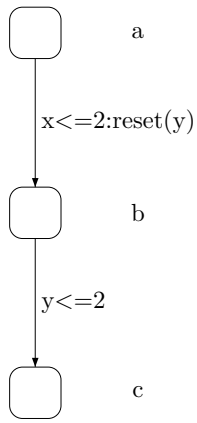
(a)



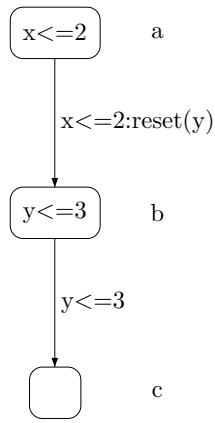
(b)



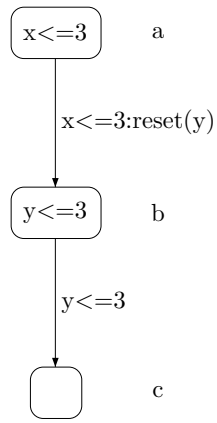
(c)



(d)



(e)



(f)

Give for each individual timed automaton a TCTL formula that distinguishes this timed automaton from all other ones. It is allowed to use only the atomic propositions a , b , and c and clock constraints in the TCTL formulae. Location identifiers are not allowed.