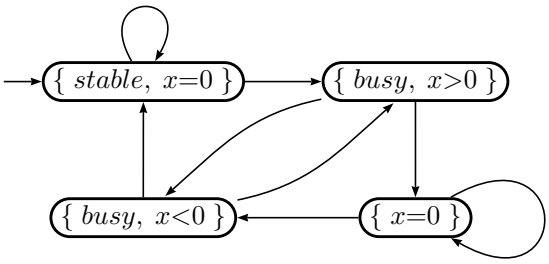
Exercises PVL LTL

Wishnu Prasetya

October 31, 2018

1. Below you see a Kripke structure; let's call it M. Give its explicit definition in terms of a tuple etc (see the formal definition in the slides).



   (a) Why don't we have final states there?
   (b) How is the notion of 'execution' defined for a Kripke structure? And what is an 'abstract execution'?
   (c) Give an execution of M that satisfies the property $\mathbf{X}$ ($busy$ $\mathbf{U}$ (x=0)). Does M satisfies the property?
   (d) So, given a property Kripke structure M, an (abstract) execution Π, and a property ϕ, and an natural number i, what is the difference between:
      - $M \models \phi$
      - $\Pi \models \phi$
      - $\Pi, i \models \phi$

2. Express the following requirements in LTL. Make the necessary assumptions if you have to; but be reasonable.

   (a) P and Q cannot not use a resource r simultaneously.
   (b) Whenever P requests access to r, eventually it will get the access.
   (c) Whenever P requests access to r, eventually it will get the access; but only if P persists on maintaining the request.
   (d) P cannot access r without first requesting it; and it cannot do so (make a request) without first releasing r (if it was busy using r).

3. Construct Buchi automata representing the following LTL formulas:

   (a) p $\mathbf{W}$ q, where p, q are atomic propositions.
   (b) $\neg(x{>}0$ $\mathbf{U}$ $x{=}y)$
   (c) p $\mathbf{U}$ (q $\mathbf{U}$ r), where p, q are atomic propositions.
   (d) ($\mathbf{X}$ $x{>}0$) $\mathbf{U}$ $x{=}y$
   (e) $\Diamond\Box(x{>}0 \rightarrow x{=}y)$
   (f) (p $\mathbf{U}$ q) $\mathbf{W}$ r