

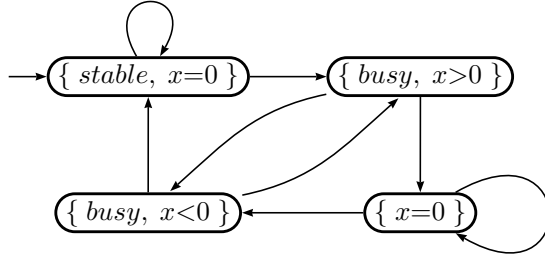
Exercises PV 09/10

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1 LTL

1. 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) If P requests access to r , eventually it will get the access.
 - (c) If 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).
2. 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:
 - $M \models \psi$
 - $\Pi \models \psi$
 - $\Pi, i \models \psi$
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) $(\mathbf{X} x>0) \mathbf{U} x=y$
 - (d) $\Diamond \Box (x>0 \rightarrow x=y)$