

Exercises PV 08/09

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CTL Model Checking

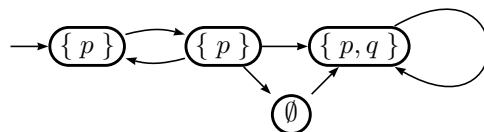
1. Imagine a simple webshop where you can buy USB sticks. To make it simple, the shop only sell one kind of stick, and you can only buy one at a time. A typical interaction with the shop is (deliberately underspecified):

- (a) The user clicks on the button *buy* to buy a stick. She will then be presented with a page specifying the price of stick, and a (secured) form where she can fill in her creditcard data.
- (b) If the user agrees, she can click ok *ok*. The transaction is then confirmed. Otherwise she can *cancel*.
- (c) She can repeat the procedure to buy more sticks.
- (d) It is possible to click on *help* to get information on how to use the webshop.

Unfortunately, we don't have a real implementation of this webshop, you will have to imagine one yourself.

- (a) Come up with a Kripke structure that abstractly models your imaginary webshop. There should of course be enough detail in your Kripke so that we are able to check some properties given later. We will assume the Donini et al's WAG modelling framework
- (b) The following are some properties that could be part of the webshop's specification. Express them with LTL or CTL.
 - i. From any window, it should be possible to reach the help page.
 - ii. The user will not be charged double transactions if she accidentally clicks *ok* twice.
- (c) Describe how CTL model checking works, then perform it to verify the above properties.

2. Consider the following Kripke structure:



- (a) Do LTL model checking to verify the LTL property $\diamond\Box p$.
- (b) Can the above property be expressed in CTL? How about in CTL*?
- (c) Do CTL model checking to verify $EF(p \wedge q)$.
- (d) Ok, now try these properties:
 - $EF \neg p$
 - $AG p$
 - $E(p U (AG p))$

- $A(p U (AG p))$
- $AFAG p$

3. Consider again the Kripke structure in No. 2.

- (a) How would you describe it if you are to express with a Boolean formula?
- (b) Do the model checking of the formula $EF(p \wedge q)$ on the symbolic representation of your Kripke.