Model Checking Homework 5

Deadline: 29 April 4:00pm
Send solution to: modelchecking@iaik.tugraz.at

The Coffee-Machine-Verification-Problem

Given the following description of a coffee machine.

- The brewer serves **either five or ten cups** of coffee in **either medium or strong** flavour.
- Details:
  - The brewer is normally in the **off state** until it is **switched on**.
  - As long as the coffee machine is switched on, **the display is turned on**.
  - Once the brewer is switched on, the user can **select** the number of cups of coffee and the strength of coffee. The user can either select five or ten cups in either medium or strong flavour.
  - Once the selections have been made, the coffee machine starts the **brewing**.
  - During brewing, if any **error** is detected (say not enough coffee or no milk power), the brewer enters an error state.
  - Alternatively, the brewer is able to finish brewing and can **serve** the coffee
  - Finally, after serving or reaching an error, the coffee machine can be turned off to be eventually turned on again.

Task 5a: [3 Points] Draw a Kripke Structure that serves as a model for your coffee brewer. (There is not one exact solution, you can be a bit creative when drawing your Kripke structure and deciding on the states, edges, and labels.)

Task 5b: [4 Points] Formalize the following properties in LTL or CTL. If it is not possible, use CTL* and argue why you used it.

1. From any state one can possibly eventually select ten cups of coffee and once selected, ten cups will always be served (or an error encountered) in the future.
2. It is possible to eventually reach an error for any selection of coffee strength or number of cups made.
3. For any execution, the coffee machine will be forever turned off from some point on.
4. Before the coffee brewer gets turned off forever which will always happen eventually, there was eventually coffee.
5. Always, once the brewing is done, the display lighting is eventually turned off.
6. It can be the case that we reach an error, but get eventually 10 cups of coffee nevertheless.
7. All reachable states can result in 10 cups of coffee eventually.

Task 5c: [3 Points] Which of the previous properties does your coffee brewer model satisfy? Give an informal explanation for your answers.

Task 5d: [3 Points - Bonus] Build the coffee brewer in hardware, install it at the office IF02068 and demonstrate that the coffee machine satisfies the property: “Infinitely often, 10 cups of coffee will be served”.