



Model Checking Homework 5

Deadline: 8 April 2025, 9:00 am
Submit your solution through TeachCenter

The Coffee-Machine-Verification-Problem

Given the following description of a coffee machine.

- Initially, the brewer is in the off state until it is switched on.
- Once the brewer is switched on, the user can select the number of cups and the strength of the coffee. The user can choose either five or ten cups, with a strength of either medium or strong.
- After the selections are made, the coffee machine starts brewing.
- During brewing, if an error is detected, the brewer enters an error state.
- Alternatively, the brewer may complete the brewing process and serve the coffee.
- After serving or entering the error state, the coffee machine can be turned off, ready to be turned on again later.

Task 5a: [30 Points] Draw a Kripke structure that serves as a model for your coffee brewer. There is no single correct solution—feel free to be a bit creative when defining the states, transitions, and labels.

Task 5b: [40 Points] Formalize the following properties in CTL*. Explain the meaning of your variables if they are not self-explanatory

1. The error state is always eventually reachable.
2. Ten cups of coffee are always eventually served.
3. It is always possible to select ten cups of coffee, and once selected, ten cups will always eventually be served, unless an error occurs.
4. The error state may never be reached.
5. It is not possible for the machine to serve ten cups of coffee in the current time step and then serve five more cups in the next time step
The selected amount of coffee will be served in the next time step.

Task 5c: [30 Points] Which of the previous properties does your coffee brewer model satisfy? Provide a brief, informal explanation for your answers.

Task 5d: [30 Points - Bonus] Build your designed coffee machine in hardware, install it in the office IF02042, and demonstrate that the machine satisfies the property: “Infinitely often, 10 cups of coffee will be served.”