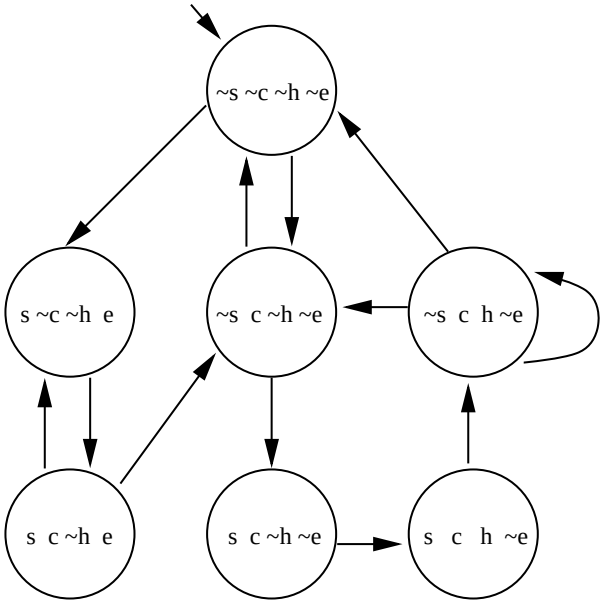
Final

Note

This is an open-book exam. You may consult any books, papers, or notes, but discussion with other students is strictly forbidden.

Problems

1. (15 points) The microwave oven example in [CGP; Chapter 4] is redrawn as the following Kripke structure.



   Use the CTL model checking algorithm in [CGP; Chapter 4] to check if the system satisfies **AF**(**EG** c) .

2. (15 points) For the system in Problem 1, use the symbolic CTL model checking algorithm in [CGP; Chapter 6] to compute the states that satisfy **AF**(**EG** c).

3. (15 points) Draw a BDD for $(a \vee b \vee d) \wedge (\bar{a} \vee \bar{c} \vee \bar{d}) \wedge (a \vee \bar{b}) \wedge (b \vee \bar{d}) \wedge (\bar{a} \vee c)$.

4. (15 points) Check the satisfiability of $(a \vee b \vee d) \wedge (\bar{a} \vee \bar{c} \vee \bar{d}) \wedge (a \vee \bar{b}) \wedge (b \vee \bar{d}) \wedge (\bar{a} \vee c)$ with the DPLL algorithm.

5. (20 points) Define a Büchi automaton (by drawing its transition diagram) for each of the following temporal properties.

   (a) p holds initially (at 0-th position) and at every second and third positions.

(b) Whenever p holds, q will eventually hold at least twice at later positions.

6. (20 points) Please use the simple on-the-fly translation algorithm in [CGP; Chapter 9] to construct a generalized Büchi automaton from the LTL formula $(p \,\mathcal{U}\, q) \,\mathcal{U}\, r$.