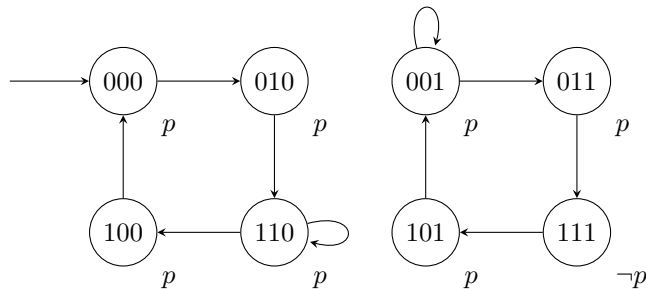


Model Checking (SS 2025) Homework 3

Deadline: **18 March 2025, 9:00 am**
Submit your solution through TeachCenter

Consider the following Kripke structure K , with states $(x_1, x_2, x_3) \in \{0, 1\}^3$ and atomic proposition p .



Task 1. [50 points] We want to use k -induction to prove that p is always true.

- 1.1 Will k -induction succeed in proving the property? If so, what is the smallest k such that k -induction proves the property to be true? [**10 point**]
- 1.2 Write the k induction formulae, both base case and induction case, for $k = 2$. [**20 points**]
- 1.3 Are the formulae satisfiable? Explain. [**20 points**]

For task 1.2, you can use the formulas R , S_0 , and p for the transition relation, the initial states, and the property p , respectively, without explicitly stating the concrete expression of the formulas.

Task 2. [50 points] Use Model Checking with Craig Interpolants to prove that p is always true.

Clearly indicate the steps. Show the interpolants as formulas, for anything else, you can use set notation. You can also draw the sets, but use enough copies of the Kripke structure to make sure we can understand your steps, at least one for every k .

Use the same heuristic shown in class to find the interpolants. The heuristic shown in class is a hack, but it works in this example.