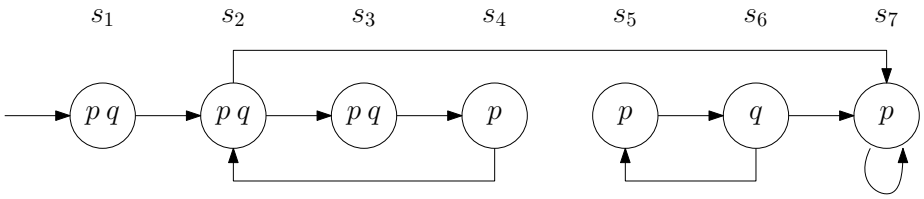
Model Checking (SS 2023) Homework 2

Deadline: **March 30, 2023, 4:00 pm**
Send your solution to `modelchecking@iaik.tugraz.at`
Homework can be done in groups of 1 or 2 students.
The groups need not be the same for each homework.
Indicate clearly which students present the homework.

Consider the following Kripke structure K, with states $s_1, \ldots, s_7$ and atomic propositions p and q.



Task 1. [**5 points**] We want to use BMC to prove whether q is always true.

1.1 Will BMC find a counterexample? If so, what is the smallest k such that BMC finds a counterexample. [**1 point**]

1.2 Write the BMC formula for $k = 3$. [**2 points**]

1.3 Is the formula satisfiable? Explain. [**2 points**]

Task 2. [**5 points**] We want to use k-induction to prove whether p is always true.

2.1 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? [**1 point**]

2.2 Write the k induction formula for $k = 2$. [**2 points**]

2.3 Is the formula satisfiable? Explain. [**2 points**]

For tasks 1.2 and 2.2, you can use the formulas R, S_0, p and q for the transition relation, the initial states, the property p and the property q, respectively, without explicitly having to find the concrete expression of such formulas.