Principles of Model Checking
Exercise class 4

Computation tree logic

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Problem 1

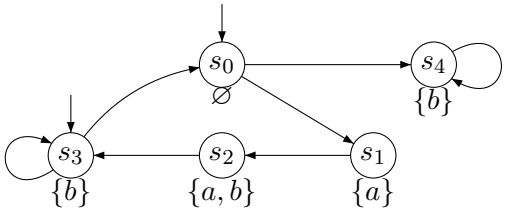
Express the following properties as CTL formulas over $AP = \{a, b, c\}$ and provide a justification. For more complicated formulas, also comment on their subformulas!

1. There exists a path on which for every state s the following property holds: there exists a path which starts in s and on which eventually a holds and in the next state after that, $\neg a$ holds.
2. There exists a state s for which it holds: a is true and on all paths starting from s, c holds as long as b does not hold. (*You may use* W.)

Problem 2

Consider the following CTL formulas and the transition system TS outlined on the right:

$\Phi_1 = \forall(a \mathsf{U} b) \vee \exists\bigcirc(\forall\Box b)$
$\Phi_2 = \forall\Box\forall(a \mathsf{U} b)$



Give the satisfaction sets $Sat(\Phi_i)$ and decide whether $TS \models \Phi_i$ holds.

Problem 3

We consider the incomparable expressiveness of CTL and LTL. Using Theorem 6.18, prove that there does not exist an equivalent LTL-formula for the CTL-formula $\Phi = \forall\Diamond(a \wedge \exists\bigcirc a)$.

Problem 4

If time permits, make Exercise 6.21 from the book.