Master of Science in Computer Science - University of Camerino
Reactive Systems Verification A. Y. 2017/2018
Written Test of 15th February 2018 (Appello II)
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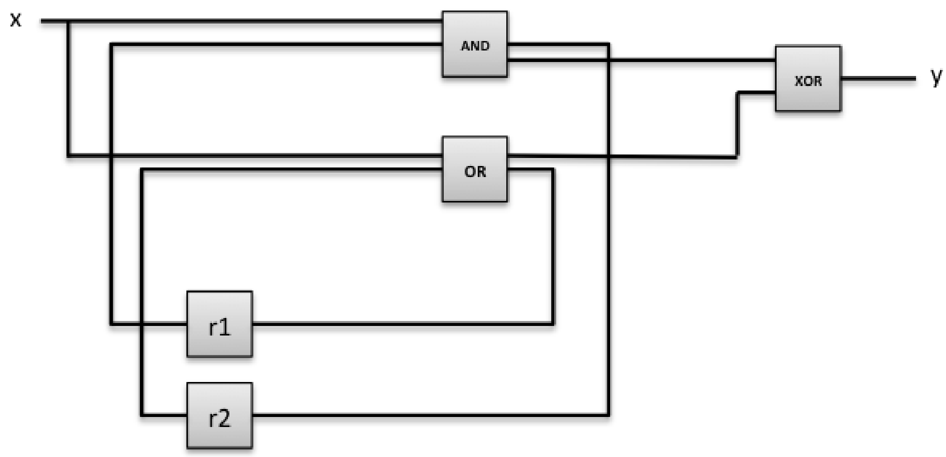
EXERCISE 1 (7 points)

Consider the following circuit.



1. Draw the transition system describing the behaviour of the circuit. Assume that initially both registers are set to 0.

EXERCISE 2 (9 points)

Consider the alphabet $AP = \{A, B, C\}$ and the following linear time properties:

(a) Whenever A holds then B will eventually hold and C must hold whenever B holds.

(b) Whenever A holds, apart from the beginning, then B held in the previous step

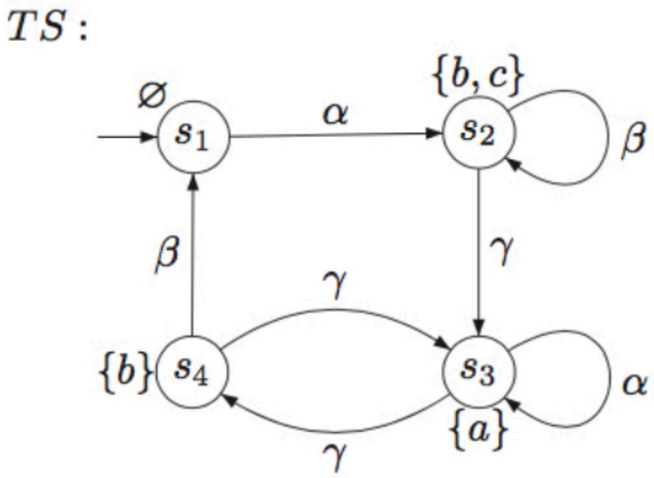
(c) Whenever B holds then C will eventually hold

For each property:

1. formalise it using set expressions and first order logic;
2. formalise it in LTL (you can use the operators next, until, box and diamond, together with all boolean connectives);
3. tell if it is a safety, liveness or mixed property. In case it is a pure safety property provide an NFA for the language of the **minimal bad prefixes**. In case it is a pure liveness property provide an NBA for the language of **bad behaviours**.

EXERCISE 3 (8 points)

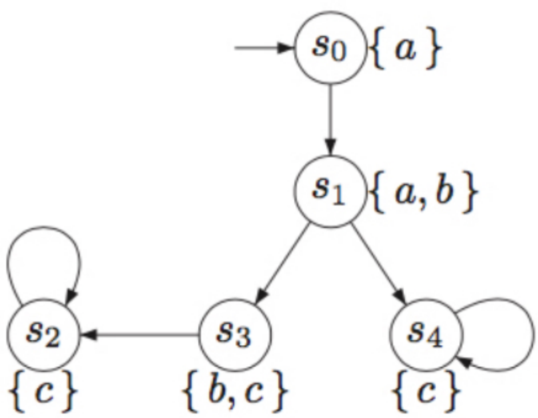
Consider the following transition system TS on $AP = \{a, b, c\}$.



1. Decide whether or not the LTL formula $\varphi = \Box(a \rightarrow \bigcirc\bigcirc(a \vee b))$ is satisfied by the transition system TS by first writing an NFA $\mathcal{A}$ for the minimal bad prefixes of φ and then calculating the product $TS \otimes \mathcal{A}$. You may omit some states of the product if they are not needed to answer the question.

EXERCISE 4 (8 points)

Consider the following transition system



1. Calculate $\mathrm{Sat}(\forall(a\,\mathcal{U}\,\forall\Diamond c))$. Justify your answers by showing the steps of the algorithm used for the satisfaction of CTL formulas.