Chair of Computer Science 7, RWTH Aachen University
Prof. Dr. Dr. h.c. W. Thomas • Dipl.-Inform. B. Brütsch

Infinite Computations – WS 2015/2016

Exercises – Series 4 November 13, 2015

Exercise 17. ***(Bachelor)*** *3 points*

Construct a deterministic parity automaton recognizing the ω-language

$$L = \{\alpha \in \{a, b, c\}^\omega \mid c \text{ occurs infinitely often in } \alpha \Leftrightarrow a \text{ occurs at least once in } \alpha\}.$$

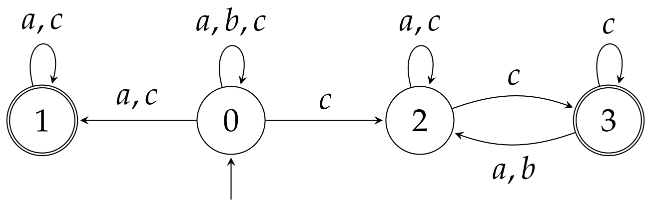
Exercise 18. ***(Bachelor + Master)*** *4 points*

Let $\mathcal{A}$ be a nondeterministic parity automaton with n states. Present (in a formal way) an equivalent nondeterministic Büchi automaton $\mathcal{B}$ with $\mathcal{O}(k \cdot n)$ states. Briefly justify the correctness of your construction.

Hint: Recall the translation from Muller to Büchi automata.

Exercise 19. ***(Bachelor + Master)*** *6+1 points*

Reconsider the nondeterministic Büchi automaton $\mathcal{A}$ shown in the lecture:



(a) Draw the sequence of Safra trees for the input *cacbc*.

(b) Use the sequence obtained in (a) to argue why or why not the input $cac(bc)^\omega$ is accepted by the deterministic Muller automaton that results from the Safra construction.

Exercise 20. ***(Master)*** *1+3 points*

An *elementary Rabin automaton* has an acceptance component $\Omega = ((E_1, F_1), \ldots, (E_k, F_k))$ where each F_i is a singleton (i.e., a set with exactly one element). Similarly, an *elementary Muller automaton* has an acceptance component $\mathcal{F} = \{F_1, \ldots, F_k\}$ where each F_i is a singleton. (Note: This does *not* mean that $|\mathcal{F}| = 1$.) Prove the following statements:

(a) Every Rabin automaton can be simulated by an elementary Rabin automaton.

(b) There is a Muller automaton that cannot simulated by any elementary Muller automaton.

Please always consider announcements made in the L^2P course room.

You can hand in your solutions until **12:15 on Friday, November 20, 2015** at the drop box at the Chair i7.