Technische Universität München
Fakultät für Informatik
Lehrstuhl für Effiziente Algorithmen (LEA)
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Winter Semester 2014/15
Problem set 12
January 13, 2015

Automata and Formal Languages

Due January 20, 2015 before class!

Exercise 1 (Büchi-Automata - 10 points)

Given a Büchi automaton A and finite words u, v, decide whether A accepts the ω-word uv^ω

Exercise 2 (ω-expressions I)

Let $\Sigma = \{a, b, c\}$. Give an ω-expression for each of the following languages:

(a) $L_1 = \{w \mid \text{'}ab\text{' occurs only finitely often in } w\}$

(b) $L_2 = \{w \mid \text{every '}a\text{' is immediately followed by a '}b\text{'}\}$

(c) $L_3 = \{w \mid \text{every '}b\text{' is preceded by an '}a\text{' }\}$

Exercise 3 (ω-expressions II - 10 points)

Give Büchi- and Muller-automata for the following languages:

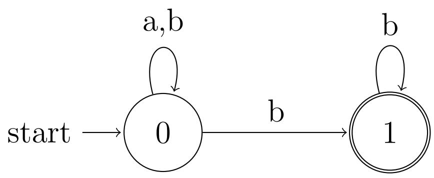
(a) $r_1 = (a^*b)^\omega$

(b) $r_2 = (010^*)^\omega + 1^\omega$

(c) $r_3 = (ab + bc + a)^\omega$

Exercise 4 (Ranking - 10 points)

Consider the following Büchi- automaton B representing the ω-words over $\Sigma = \{a, b\}$ having only finitely many as:



(a) Sketch $\text{dag}(abab^\omega)$ and $\text{dag}((ab)^\omega)$.

(b) Consider the ranking r defined as $r(< q_0, i >) = 1$ and $r(< q_1, i >) = 0$ for all $i \in \mathbb{N}$. Is r an odd ranking for the two dags from (a)?

(c) Show:

$$\text{Ranking } r \text{ defined in (b) is odd} \Leftrightarrow w \notin \mathcal{L}(B)$$