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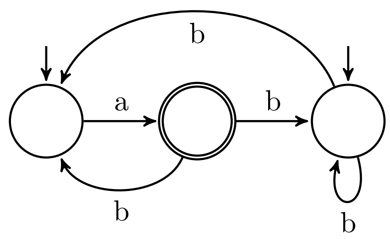
Problem Set 3 for "Automata Theory"

Deadline: Monday, May 6, 13:15h

H 3-1: Complete the proof of Lemma 1.6 c): show that for every automaton $\mathcal{A}$ there exists a normalized automaton $\mathcal{A}_n$ such that $\mathcal{A}_n = \mathcal{A} \setminus \{\epsilon\}$.

H 3-2: a) Give a rational expression for the language recognized by the following automaton:



b) Give a normalized automaton that recognizes the same language as the automaton from Problem a).

H 3-3: Let $\mathcal{A}_1$ and $\mathcal{A}_2$ be two finite automata with n_1 and n_2 states respectively. Construct an automaton with at most $n_1 \cdot n_2$ states that recognizes $L(\mathcal{A}_1) \cap L(\mathcal{A}_2)$.

The solution to the following problems should be prepared but is not handed in:

S 3-1: Give an alternative proof for the last statement of Theorem 1.7: Let $\mathcal{A} = (Q, T, I, \{f\})$ be a normalized finite automaton such that $\epsilon \notin L(\mathcal{A})$. Construct an automaton with state set $Q \setminus \{f\}$ that recognizes $(L(\mathcal{A}))^*$.

S 3-2: Give a polynomial time algorithm deciding whether a finite automaton A accepts at least one word. Note that the algorithm directly derived from the condition after Corollary 1.12 (checking all words shorter than $|Q| - 1$) needs more than polynomial time.

All answers must be proven.