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Theoretische Informatik
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Exercise Sheet 10
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Exercises "Automata and Formal Languages"

Exercise 10.1

You have seen the Büchi automaton $(\mathcal{A}, G)$ accepting words over $\{a, b\}$ with finitely many a's.

- Construct $dag((ab)^\omega)$ and $dag(aab^\omega)$.
- Construct just enough of $comp(\mathcal{A}, G)$ to show that $(ab)^\omega$ is accepted by it.

Exercise 10.2

Consider the Büchi automaton $(\mathcal{A}, G)$ over $\Sigma = \{a, b\}$, where $\mathcal{A} = (\{q\}, \{(q, a, q)\}, \{q\})$ and $G = \{q\}$. Construct a Büchi automaton accepting $\Sigma^\omega \setminus \mathcal{L}(\mathcal{A}, G)$ using the level ranking construction.

Exercise 10.3

A *parity automaton* is a pair $(\mathcal{A}, c)$, where $\mathcal{A} = (S, \longrightarrow, S_{in})$ is as for Büchi automata, and where $c : S \to \mathbb{N}$ is a mapping called *coloring*. A run ρ of a parity automaton is accepting iff $\max\{c(s) \mid s \in \mathsf{inf}(\rho)\}$ is even.

- Find a parity automaton accepting the language $L = \{w \in \{a, b\}^\omega \mid w$ has exactly two occurrences of $ab\}$.
- Show that each language accepted by a parity automaton is also accepted by a Rabin automaton and vice versa.
- Show that *deterministic* parity automata are closed under complement.