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9. Exercises for the Course „Automata and Logic"

Exercise 38:

Consider the Ehrenfeucht-Fraïssé games on the words

(a) ab and ba and determine the $k \in \{1, 2, 3\}$ such that Player I has a winning strategy in k moves.

(b) $aaabaaa$ and $aabaaa$ and determine the $k \in \{2, 3, 4\}$ such that Player I has a winning strategy in k moves.

Exercise 39:

Consider Ehrenfeucht-Fraïssé games on words a^i and a^j with $i < j$.

(a) Describe an optimal strategy for Player I, i.e. a strategy such that Player I wins with a minimal number of moves.

(b) Prove that Player I has a winning strategy on a^i and a^j (with $i < j$) in m moves if $i < 2^m - 1$.

Exercise 40:

Let $\Sigma := \{a, b\}$ and $L \subseteq \Sigma^*$ be defined by the regular expression $(a^*bb^*)^*$. Show that

$$\lim L = \{\alpha \in \Sigma^\omega \mid \text{ if } \alpha(i,i) = a, \text{ then there is a } j > i \text{ with } \alpha(j,j) = b\}.$$

Exercise 41:

Give Büchi-automata that recognize the following ω–regular languages over the alphabet $\Sigma := \{a, b, c\}$:

(a) $\{\alpha \in \Sigma^\omega \mid \exists i \in \mathbb{N} : \alpha(i, i+2) = abc\}$

(b) $\{\alpha \in \Sigma^\omega \mid \{i \in \mathbb{N} \mid \alpha(i, i+2) = abc\} \text{ is infinite}\}$

(c) $(a^+b^+c^+)^\omega$