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Warm-up Questions 2
Discussions: May 6th, 2015

Automata, Games, and Verification

Please send a mail to `agv15@react.uni-saarland.de` if you can't make it to the discussion session.

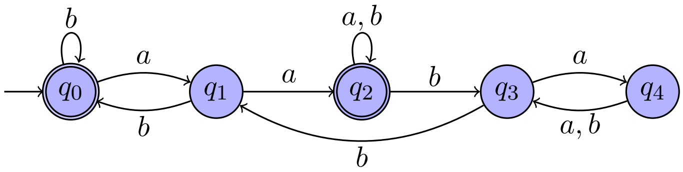
1. Who is Julius Richard Büchi?

   ☐ the lecturer ☐ a Swiss logician and mathematician ☐ a Greek philosopher

2. Which of the following are Büchi automata?

   ☐ $(\emptyset, \emptyset, \emptyset, \emptyset, \emptyset)$ ☐ $(\{a, b\}, \mathbb{N}, \mathbb{N}^+, \emptyset, \emptyset)$ ☐ $(\{a, b\}, \{q\}, \{q\}, \{(q, a, q)\}, \{q\})$

3. Is $r = q_1 q_2 q_3 q_1 q_0^\omega \ldots$ an accepting run of the word ab^ω on the Büchi automaton depicted below?



   ☐ Yes ☐ No

4. Which of the following are true?

   ☐ $\forall w \in \Sigma^*. \forall \alpha \in \Sigma^\omega. \operatorname{Inf}(w\alpha) = \operatorname{Inf}(\alpha)$ ☐ $\forall w \in \Sigma^*. \exists \alpha \in \Sigma^\omega. \operatorname{Inf}(w\alpha) = \operatorname{Inf}(\alpha)$

   ☐ $\forall w \in \Sigma^*. \exists \alpha \in \Sigma^\omega. \operatorname{Inf}(w\alpha) \neq \operatorname{Inf}(\alpha)$ ☐ $\forall w \in \Sigma^*. \forall \alpha \in \Sigma^\omega. \operatorname{Inf}(w\alpha) \neq \operatorname{Inf}(\alpha)$

5. Is there for every complete Büchi automaton an equivalent "incomplete" Büchi automaton?

   ☐ Yes ☐ No

6. Is $ab(c + (c + d^*) + d^*)(a + b)(a + c^*)(a + b)^*(a^* + b + (c + d)^*)^\omega$ regular?

   ☐ Yes ☐ No

7. Let $\mathcal{A} = (\{a, b\}, \{a, b\}, \{a\}, \{(a, a, a), (a, b, b), (b, b, b), (b, a, a)\}, \text{BÜCHI}(\{a, b\}))$ be a Büchi automaton. Holds $\mathcal{L}(\mathcal{A}) = \mathcal{L}((ab)^\omega + (bb)^\omega + (ba)^\omega + (aa)^\omega)$?

   ☐ Yes ☐ No

8. Which of the following are no ω-regular expressions?

   ☐ aaa^*b^ω ☐ $aa(a^*b)^\omega$ ☐ $bb(ab^\omega + ba^\omega)$

   ☐ $a^\omega b^*$ ☐ $(a^* + b^\omega + c^*)^\omega$ ☐ $aa^*(ab^*bb)^\omega$

9. A Büchi automaton $\mathcal{A}$ accepts an infinite word α iff

   ☐ there is an accepting run of α on $\mathcal{A}$. ☐ all runs of α on $\mathcal{A}$ are accepting.

10. Consider the Büchi automata $\mathcal{A}_1 = (\Sigma, Q_1, I_1, T_1, \text{BÜCHI}(F_1))$, $\mathcal{A}_2 = (\Sigma, Q_2, I_2, T_2, \text{BÜCHI}(F_2))$ and $\mathcal{A} = (\Sigma, Q_1 \times Q_2, I_1 \times I_2, \{((q_1, q_2), \sigma, (q_1', q_2')) \mid \forall i \in \{1, 2\}. (q_i, \sigma, q_i') \in T_i\}, \text{BÜCHI}(F_1 \times F_2))$. Which of the following languages are equivalent to $\mathcal{L}(\mathcal{A})$?

    ☐ $\mathcal{L}(\mathcal{A}_1) \cup \mathcal{L}(\mathcal{A}_2)$ ☐ $\mathcal{L}(\mathcal{A}_1) \cap \mathcal{L}(\mathcal{A}_2)$ ☐ $\mathcal{L}(\mathcal{A}_1) \setminus \mathcal{L}(\mathcal{A}_2)$