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コンピューターサイエンス演習 I

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演習第三

1. Let $w \in \{0,1\}^*$ be any given string. We define

$$L_w = \{uwv \mid u,\, v \in \{0,1\}^*\}\ ,$$

   i.e., L_w is the set of all strings over $\{0,1\}$ containing w as a *substring*.

   (1) Construct a nondeterministic finite automaton $\mathcal{A} = [\{0,1\}, Q, \delta, q_0, F]$ accepting L_{00100}.

   (2) Transform $\mathcal{A}$ into a deterministic finite automaton that also accepts L_{00100}.

2. Consider the following nondeterministic finite automaton $\mathcal{A} = [\{0,1\}, Q, \delta, q_0, F]$, where $Q = \{q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7\}$ and $F = \{q_7\}$, and

$$\begin{array}{llll} \delta(q_0,0) = \{q_0, q_1\}, & \delta(q_0,1) = \{q_0, q_2\}, & \delta(q_1,0) = \{q_3\}, & \delta(q_2,1) = \{q_4\} \\ \delta(q_3,0) = \{q_5\}, & \delta(q_4,0) = \{q_6\}, & \delta(q_5,1) = \{q_7\}, & \delta(q_6,0) = \{q_7\} \end{array}$$

   (1) Construct a deterministic finite automaton $\mathcal{A}'$ accepting the same language as $\mathcal{A}$.

   (2) Draw the state diagrams of $\mathcal{A}$ and $\mathcal{A}'$, respectively.

   (3) Construct a regular grammar $\mathcal{G}$ such that $L(\mathcal{G}) = L(\mathcal{A})$.

3. Let $\Sigma = \{a, b\}$, and let the formal language L be defined as $L = \{wbabw^T \mid w \in \Sigma^*\}$. Prove or disprove L to be regular.