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演習第四

1. Prove the following extension of Nerode's theorem:

   Let Σ be any alphabet and let $\mathsf{L} \subseteq \Sigma^*$ be any language. Then we have

   $\mathsf{L} \in \mathcal{REG}$ *if and only if there is a right invariant equivalence relation* $\approx$ *such that* $\approx$ *is of finite rank and* L *is the union of some equivalence classes with respect to* $\approx$.

2. Prove or disprove:

   (1) $\mathcal{REG}$ is closed under *transposition*, i.e., for all $\mathsf{L} \in \mathcal{REG}$ we have $\mathsf{L}^\mathsf{T} \in \mathcal{REG}$.

   (2) There is an alpgorithm which on input any regular grammars $\mathcal{G}_1$, $\mathcal{G}_2$ decides whether or not $\mathsf{L}(\mathcal{G}_1) = \mathsf{L}(\mathcal{G}_2)$.

3. Consider again the language $\mathsf{L} = \{\mathsf{a}^n\mathsf{b}^n \mid n \in \mathbb{N}\}$. Use the Nerode Theorem to show that $\mathsf{L} \notin \mathcal{REG}$.