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Advanced Sequence Analysis
Summer 2019

Exercises

Number 8 (07.06.2019), Discussion: 14.07.2019

1. Examine the formal definition of a Turing machine to answer the following questions, and explain your reasoning.

   (a) Can a Turing machine ever write the blank symbol ␣ on its tape?

   (b) Can the tape alphabet Γ be the same as the input alphabet Σ?

   (c) Can a Turing machine's head ever be in the same location in two successive steps?

   (d) Can a Turing machine contain just a single state?

2. Design a Turing machine that recognizes the language $D = \{\mathsf{a}^i \mathsf{b}^j \mathsf{c}^k | i \times j = k \text{ and } i, j, k \geq 1\}$.

3. Show that a language is decidable iff some nondeterministic Turing machine decides it. (You may assume the following theorem about trees. If every node in a tree has finitely many children and every branch of the tree has finitely many nodes, the tree itself has finitely many nodes.)