KUTAISI INTERNATIONAL UNIVERSITY

Exercises for TTF

Introduction to Theory of Computation
Summer semester 2025

Exercises below are your homework; they will be discussed during exercise classes. Problems marked with a (*) are more challenging.

Week 3

1. Prove that the language $L = \{a^n b^n \ : \ n \in \mathbb{N}\}$ is not regular.

2. Complete the proof of Lemma 4 from the lecture on NFA *i.e.* show that $L(M'') = L^*$.

3. Read and understand Theorem 2.34 (Pumping lemma for context-free languages) from Michael Sipser "Introduction to theory of Computation" (3rd edition).[1]

4. (*From midterm 2024*) Prove that the language $L = \{1^n \mid n \text{ is prime}\}$ is not regular.

5. (*From midterm 2024*) Let the language L be given by the grammar $G = (\{S, A, B\}, \{a, b\}, P, S)$ with productions $P = \{S \to aS, S \to aA, A \to bS, A \to aB, B \to bS, S \to a\}$. Construct a finite automaton that accepts L. Explain.

[1] You do not have to submit anything for this exercise.