

EXERCISES
“AUTOMATA, LANGUAGES, AND GROUPS OF
AUTOMORPHISMS OF ROOTED TREES”

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Exercise 1. Let A be a nonempty finite alphabet. Is A^* countable? Why?

Exercise 2. Consider the following automaton, with initial state q_0 , final state q_1 , and transition function:

	a	b
q_0	q_0	q_1
q_1	q_0	q_2
q_2	q_2	q_1

Are the strings a^3b , $abaab$, $abababab$, a^4bba , $a^{10}b^8ab$, a^6b^8ab accepted?

Exercise 3. Determine the language accepted by the automaton with initial state q_0 , final state q_1 , and transition function:

	0	1
q_0	q_1	q_2
q_1	q_1	q_1
q_2	q_1	q_0

Exercise 4. Let $L = \{w \in \{a, b\}^* \mid |w| \equiv 1 \pmod{3}\}$. Define a DFA A such that $L = L(A)$.

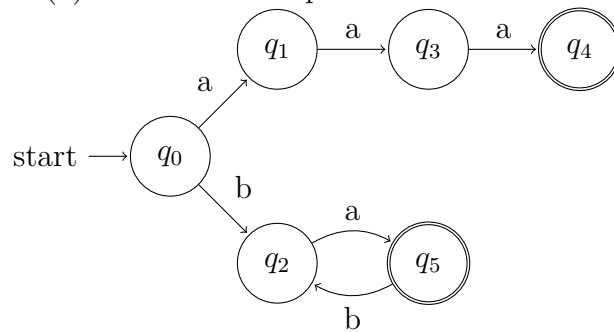
Exercise 5. Construct a NFDA that accepts the language $L = \{x \in \{0, 1, 2\}^* \mid |x| \geq 5 \text{ and the 4th symbol from the right is } 0\}$.

Exercise 6. Determine if the following languages are regular or not:

- $L = \{x \in \{0, 1\}^* \mid x \text{ is palindrome}\}$
- $L = \{0^i 1^j \in 0, 1^* \mid i, j > 0, 2i > j\}$
- $L = \{x \in \{a, b\}^* \mid x \text{ starts with } a \text{ and ends with } ab\}$.

Hint: Pumping Lemma ;)

Exercise 7 (*). Find a DFA equivalent to the following N DFA:



Do you remember Context-Free languages?

Exercise 8. Which of the following is a context-free language?

- $L = \{a^n b^m a^m b^n \mid n, m \geq 0\}$
- $L = \{a^n b^n a^m b^m \mid n, m \geq 0\}$
- $L = \{a^n b^m a^n b^m \mid n, m \geq 0\}$
- $L = \{a^n b^m c^q \mid n = m \text{ or } m = q\}$.