

**Homework One**  
Theory of Computation 2022

**Important Note:**

Please remember that you should return your answer at 10/12 (Wednesday) 15:10 and your HW should be handwritten. We will take your HW during the class. After 10/12 15:10, you must upload your HW to moodle. But remember penalty for late submission: 20% per day.

**Q1:** For  $\Sigma = \{a, b\}$ , construct dfa's that accept the sets consisting of

- (a) all strings with exactly one a,
- (b) all strings with at least one a,
- (c) all strings with at least one a and exactly two b's,
- (d) all the strings with exactly two a's and more than two b's.

**Q2:** Find dfa's for the following languages on  $\Sigma = \{a, b\}$ .

- (a)  $L = \{w : |w| \bmod 5 \neq 0\}$ .
- (b)  $L = \{w : |w| \bmod 3 = 0, |w| \neq 6\}$ .

**Q3:** Let  $L$  be the language accepted by automaton in Figure 1. Find a dfa that accepts  $L^2$ .



Figure 1: Automaton diagram.

**Q4:** Find a dfa that accepts the language defined by the nfa in Figure 2.

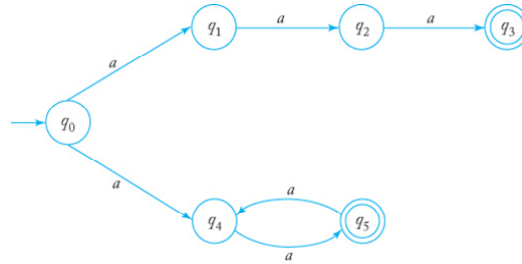


Figure 2: NFA diagram.

**Q5:** Design an nfa with no more than five states for the set  $\{abab^n : n \geq 0\} \cup \{aba^n : n \geq 0\}$

**Q6:** Find an nfa with four states for  $L = \{a^n : n \geq 0\} \cup \{b^n a : n \geq 1\}$ .

**Q7:** Convert the following nfa into an equivalent dfa.

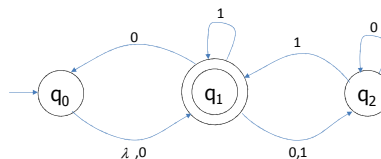


Figure 3: NFA diagram.