# Theory of Computation, Fall 2021
# Assignment 1 (Due September 24 Friday 9:35am)

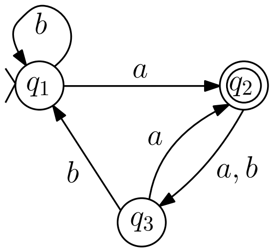
Q1. Let $w, v$ be two strings over some $\Sigma$. We say that $w$ is a prefix of $v$ if $v = wx$ for some $x \in \Sigma^*$. We say that $w$ is a suffix of $v$ if $v = xw$ for some $x \in \Sigma^*$. Are the following statements true or false. No explanation is required.

(a) $e$ is a prefix of every string. T

(b) $e$ is a suffix of every string. T

(c) Let $w$ be a string. $w$ is a prefix and a suffix of itself. T

Q2. [1, Exercise 1.1] Consider the following DFA. What sequence of configurations does the machine go through on input $aab$?




q1, q2, q3, q1

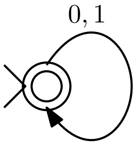
Q3. Are the following statement true of false? No explanation is required.

(a) Every DFA accepts one and only one string. F

(b) Every DFA accepts one and only one language. T

Q4. [2, Exercise 2.1.1] Let $M$ be a DFA. Under exactly what circumstance is $e \in L(M)$? F=S

Q5. Let $M$ be the following DFA. (a) Does it accept $\{0^n1^n : n \geq 0\}$? (b) What is $L(M)$?




no(empty)
strings of 0s and 1s

Q6. Let $w, v$ be two strings over some $\Sigma$. We say that $w$ is a substring of $v$ if $v = xwy$ for some $x, y \in \Sigma^*$. Construct a DFA with at most 3 states to accept the following language.

$$\{w \in \{0,1\}^* : 01 \text{ is a substring of } w\}.$$

Q7. Let $A$ and $B$ be two regular languages over some alphabet $\Sigma$. Define

$$A \cap B = \{w : w \in A \wedge w \in B\}.$$

Show that $A \cap B$ is also regular. (Let $M_1 = (K_1, \Sigma, \delta_1, s_1, F_1)$ be a DFA accepting $A$ and $M_2 = (K_2, \Sigma, \delta_2, s_2, F_2)$ be a DFA accepting $B$. Use $M_1$ and $M_2$ to construct a DFA $M_3$ that accepts $A \cap B$.)

## References

[1] Sipser M.. Introduction to the Theory of Computation. CENGAGE Learning (2013)

[2] Lewis H., Papadimitriou C.. Elements of the Theory of Computation. Prentice-Gall (1998)