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

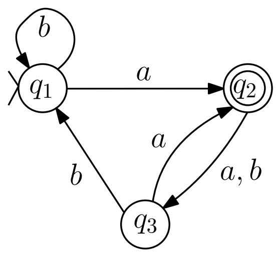
Q1. Let w, v be two strings over some Σ. We say that w is a prefix of v if $v = wx$ for some $x \in \Sigma^*$. We say that w is a suffix of v if $v = xw$ for some $x \in \Sigma^*$. Are the following statements true or false. No explanation is required.

(a) e is a prefix of every string.

(b) e is a suffix of every string.

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

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



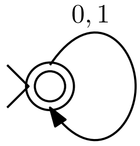
Q3. Are the following statement true of false? No explanation is required.

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

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

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

Q5. Let M be the following DFA. (a) Does it accept $\{0^n 1^n : n \geq 0\}$? (b) What is $L(M)$?



Q6. Let w, v be two strings over some Σ. 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 Σ. 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)