Problem Set 1

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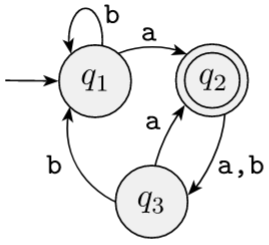
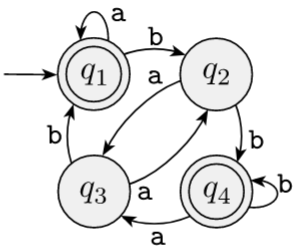
April 10, 2023

Question 1.1

The following are the state diagrams of two DFAs, M_1 and M_2. Answer the following questions about each of these machines.



M_1



M_2

(a) What is the start state?

(b) What is the set of accepted states?

(c) What sequence of states does the machine go through on input `aabb`?

(d) Does the machine accept the string `aabb`?

(e) Does the machine accept the string ϵ?

Response

For M_1:

(a) The start state is q_1.

(b) The set of accepted states is $\{q_2\}$.

(c) The machine goes through the sequence: q_1, q_2, q_3, q_1, q_1.

(d) The machine does not accept the sequence `aabb`.

(e) The machine does not accept the empty string ϵ.

For M_2:

(a) The start state is q_1.

(b) The set of accepted states is $\{q_1, q_4\}$.

(c) The machine goes through the sequence: q_1, q_1, q_1, q_2, q_4.

(d) The machine accepts the sequence `aabb`.

(e) The machine accepts the empty string ϵ.

Question 1.6

Give state diagrams of DFAs recognizing the following languages. In all parts, the alphabet is $\{0, 1\}$.

(b) $\{w|w$ contains at least three 1s$\}$

(d) $\{w|w$ has length at least 3 and its third symbol is 0$\}$

(e) $\{w|w$ starts with 0 and has odd length, or starts with 1 and has even length$\}$

(f) $\{w|w$ doesn't contain the substring 110$\}$

(h) $\{w|w$ is any string except 11 and 111$\}$

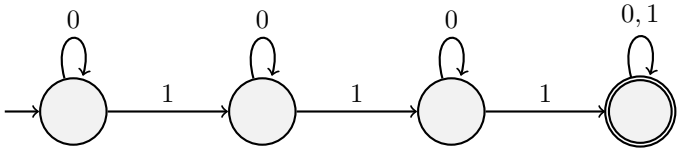
(j) $\{w|w$ contains at least two 0s and at most one 1$\}$

(k) $\{\epsilon, 0\}$

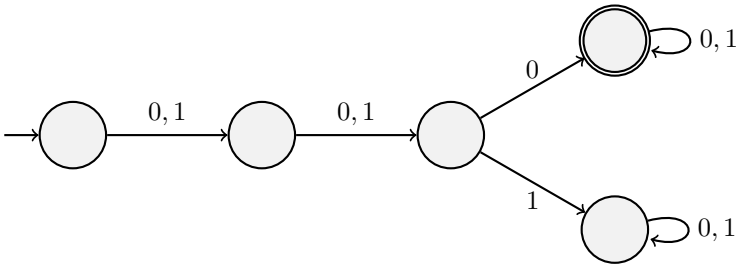
(n) All strings except the empty string

Response

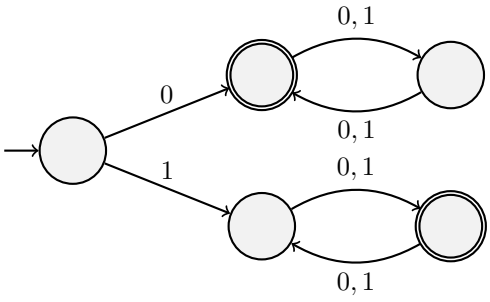
(b) $\{w|w$ contains at least three 1s$\}$



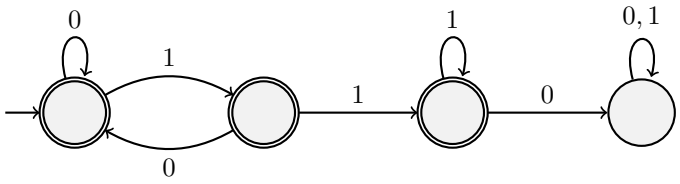
(d) $\{w|w$ has length at least 3 and its third symbol is 0$\}$



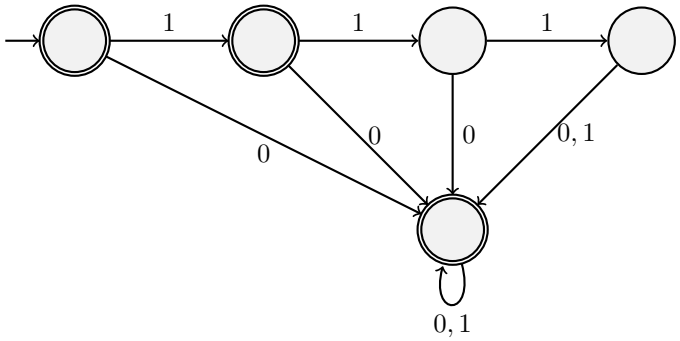
(e) $\{w|w$ starts with 0 and has odd length, or starts with 1 and has even length$\}$



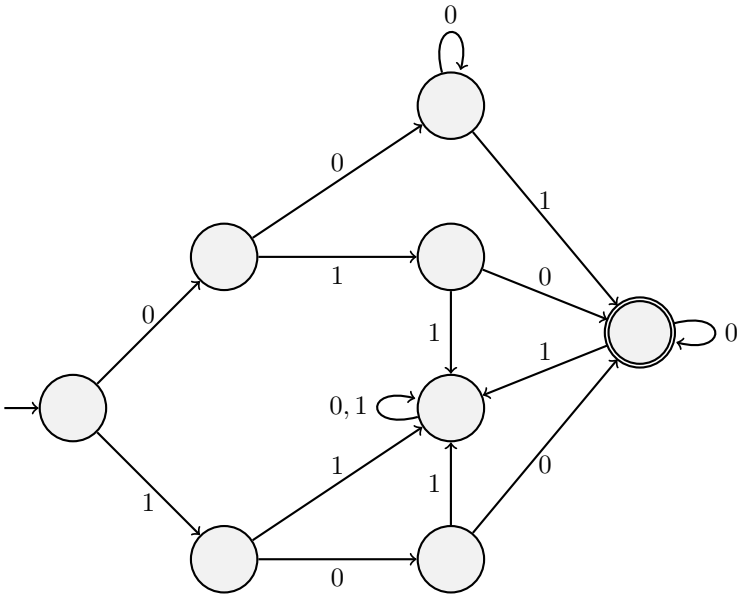
(f) $\{w|w$ doesn't contain the substring 110$\}$



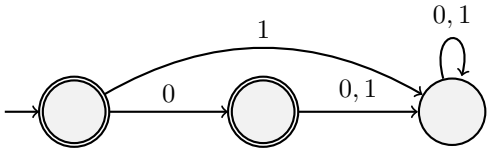
(h) $\{w|w$ is any string except 11 and 111$\}$



(j) $\{w|w$ contains at least two 0s and at most one 1$\}$



(k) $\{\epsilon, 0\}$



(n) All strings except the empty string