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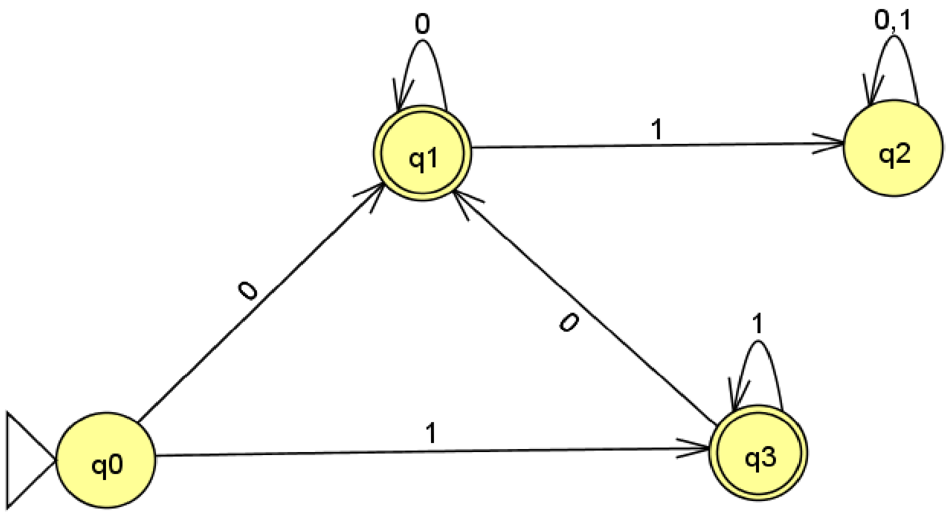
CS 321 HW - 1

Assignment:

1) (5 points) For the DFA M below, give its formal definition as a quintuple. Verbally describe the language, L(M), accepted by M.



Answer:

Q = {q0,q1,q2,q3} – Set of states;

F {q_1 , q_3} – Set of final states;

Σ = {0,1} – Input alphabet;

δ: Q × Σ -> Q – transition function;

q_0 – Initial state;

δ	0	1
q0	q1	q3
q1	q1	q2
q2	q2	q2
q3	q1	q3

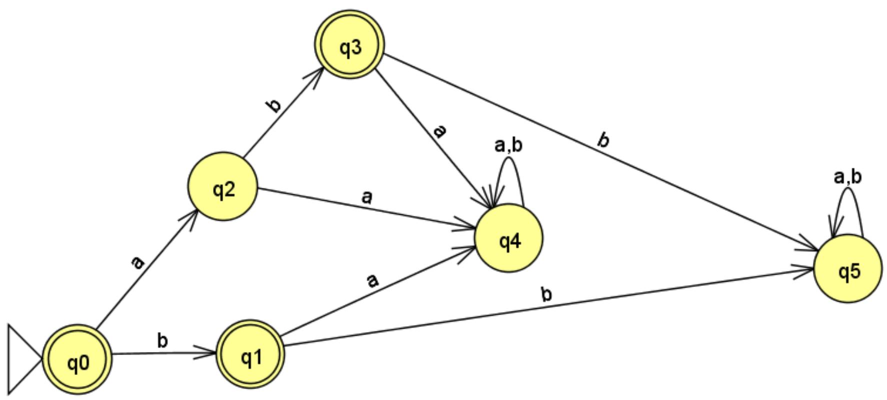
$$L(M) = \{0^n \mid n \geq 1\} \cup \{1^p \mid p \geq 1\} \cup \{(1)^m(0)^k \mid m, k \geq 1\}$$

Assignment:

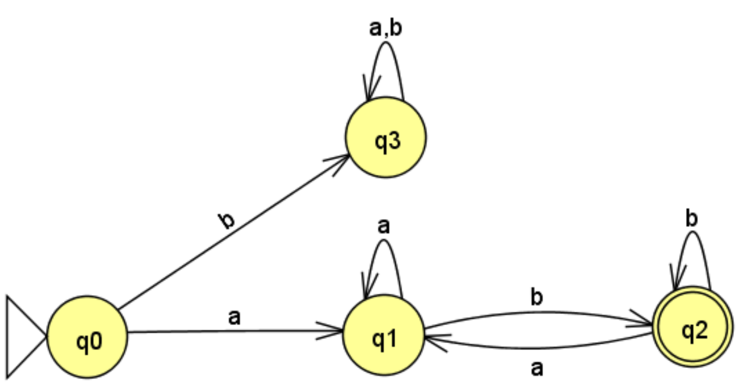
2) (12 points) For each of the following languages over the alphabet $\Sigma = \{a, b\}$, give a DFA that recognizes the language.

Answers:

a) $L_1 = \{ \lambda, b, ab\}$



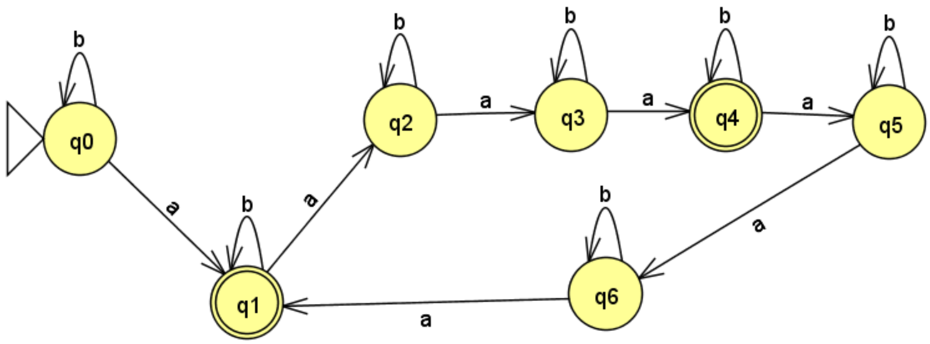
b) $L_2 = \{ w \in \Sigma^* \mid w$ begins with an "a" and ends with a "b" $\}$



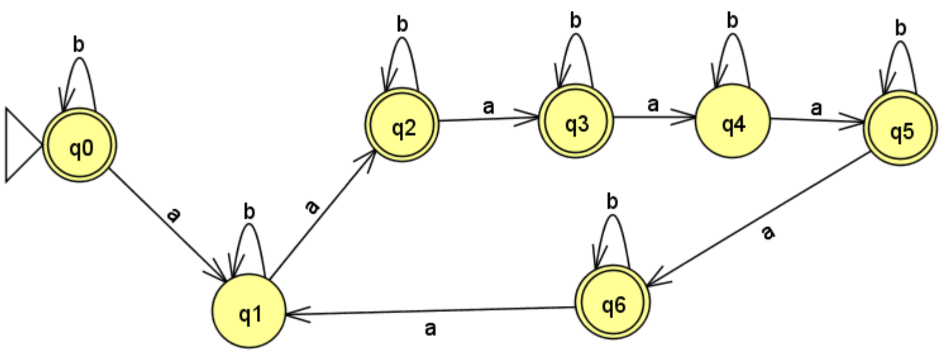
c) For any string $w \in \Sigma^*$, let $n_a(w)$ denote the number of a's in w. For example, $n_a(abbbba) = 2$.

Define the language:

$L_3 = \{ w \in \Sigma^* \mid n_a(w) \bmod 3 = 1\}$.



d) $L_4 = \overline{L_3}$ where L_3 is the language in part c).

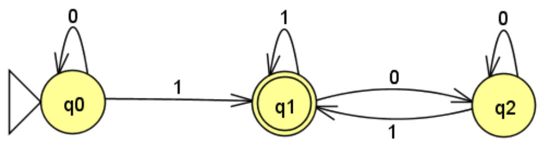


Assignment:

3) (4 points) Let L = {w ∈ {0, 1}* such that w is a binary representation of an odd integer}. Show that L is a regular language.

Answer:

Language L is regular if this language is a DFA M such as L => L(M) = { $w \in \Sigma^* | \delta^*(q_{0,} w) \in F$ }

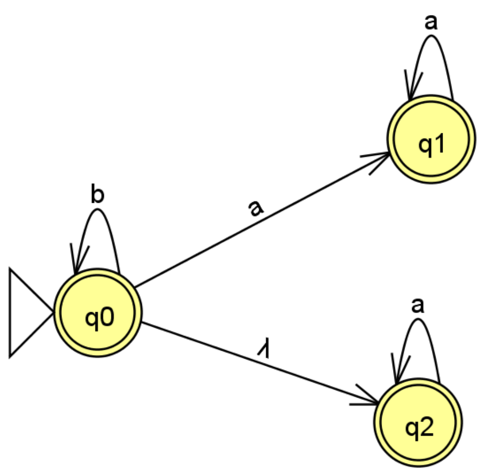


Assignment:

4) (4 points)

a) Find an nfa with three states that accepts the language $L = \{a^n : n \geq 1\} \cup \{b^m a^k : m \geq 0, k \geq 0\}$.

Answer:

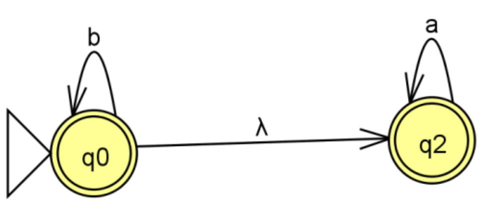


b) Do you think that the language in part (a) can be accepted by an nfa with fewer than three states?

Answer:

We can use only two states for our machine and getting the same result according with language:

$L = \{a^n : n \geq 1\} \cup \{b^m a^k : m \geq 0, k \geq 0\}$



Because state $\{b^m a^k : m \geq 0, k \geq 0\}$ including $\{a^n : n \geq 1\}$.