Theory of Computation

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October 9, 2020

Designing Finite Automata

Q 8 Construct a DFA, that accepts set of strings over $\Sigma = \{a, b\}$ which ends with "ab"

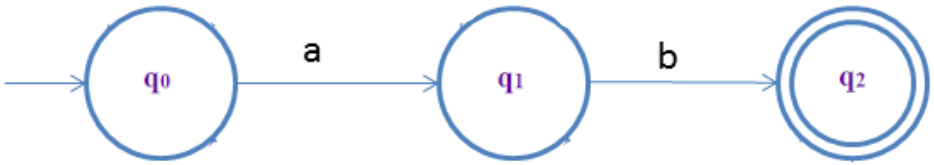
Explanation:

1. We have to create DFA that accepts set of strings which ends with "ab".
2. First we will make DFA for accepting the smallest string that is "ab".
3. In DFA we have to take care of all the input alphabets at every state.
4. So we have to take care of input symbol 'b' on state q_0, that is we made self-loop on start state.
5. On state q_1 if 'a' comes then we will accept it as repetition of 'a' and that 'a' will not ruin anything. Because, we want "ab" in the end.
6. On State q_2 if 'b' comes then that will be a problem as we only want "ab" in the end not "bb", so we will direct 'b' to state q_0.
7. If 'a' comes on state q_2 then we will direct it to state q_1 and if one 'b' comes then we will be good by getting "ab" in the end.

Designing Finite Automata

Q 8 Construct a DFA, that accepts set of strings over $\Sigma = \{a, b\}$ which ends with "ab"

DFA can be described as $(\{q_0, q_1, q_2\}, \{a, b\}, \delta, q_0, \{q_2\})$.
$L = \{$All the strings which ends with "ab"$\}$
$L = \{ab, abab, abbab, abaabbab, bbabaabab, \ldots\}$



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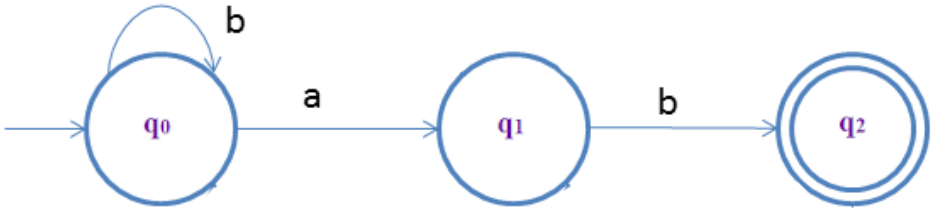

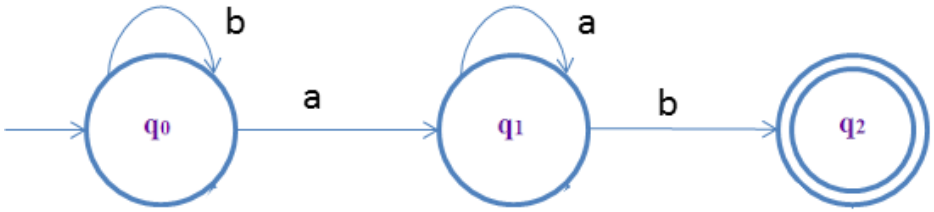

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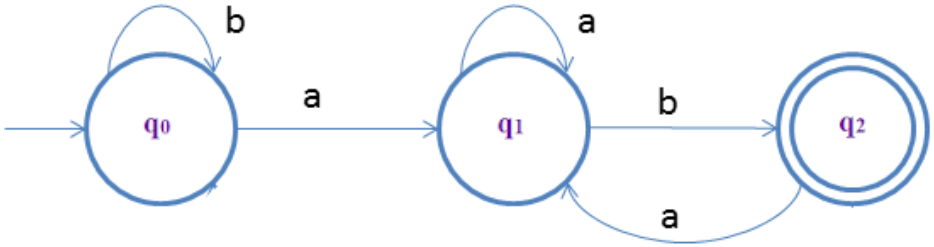

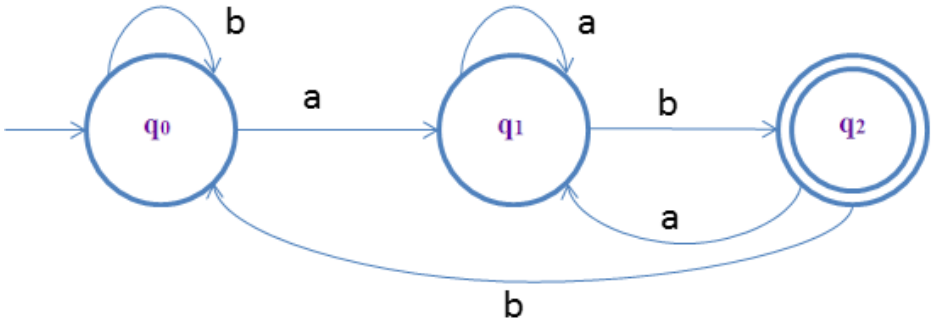

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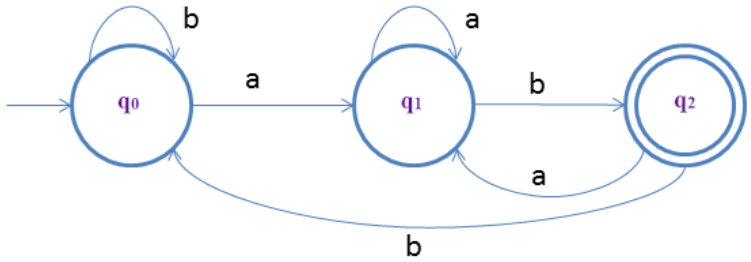

The transition table is:

States	a	b
$\rightarrow q_0$	q_1	q_0
q_1	q_1	q_2
q_2*	q_1	q_0

The transition function is:

$$\delta(q_0, a) = (q_1) \ , \ \delta(q_0, b) = (q_0)$$
$$\delta(q_1, a) = (q_1) \ , \ \delta(q_1, b) = (q_2)$$
$$\delta(q_2, a) = (q_1) \ , \ \delta(q_2, b) = (q_0)$$

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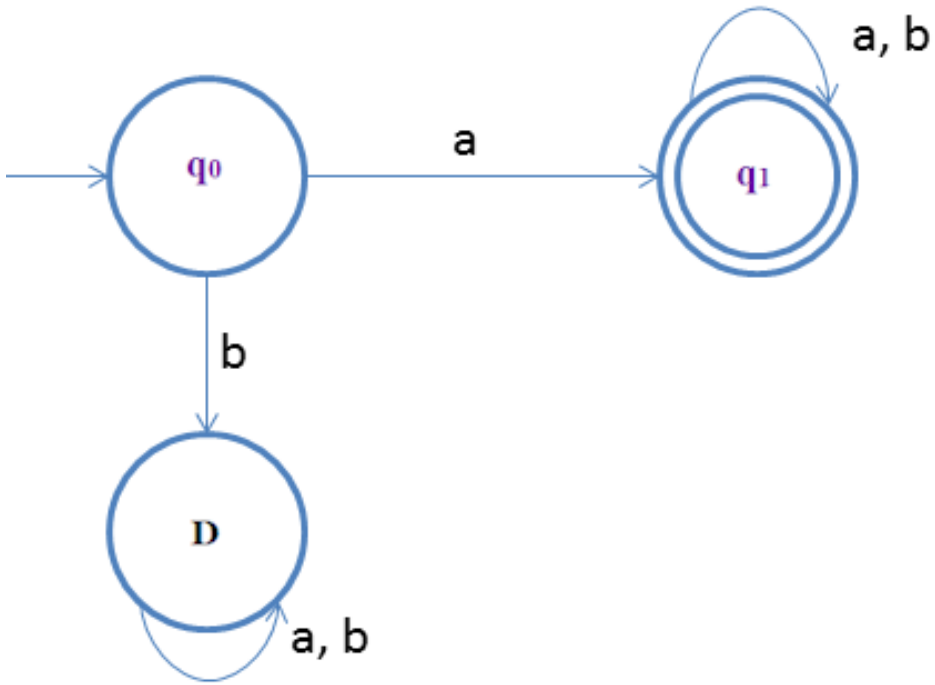
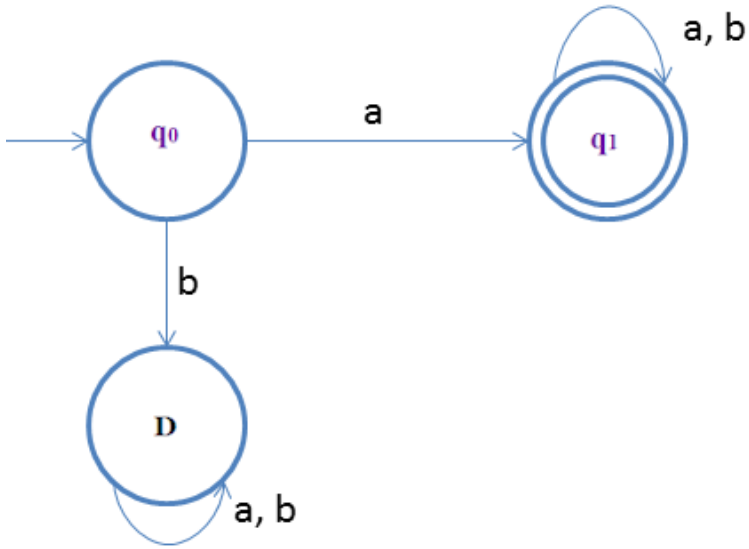
Q 9 Construction of a DFA, that accepts set of strings over $\Sigma = \{a, b\}$ starts with a 'a'

DFA can be described as $(\{q_0, q_1, D\}, \{a, b\}, \delta, q_0, \{q_1\})$.
$L = \{$All the strings that start with a 'a'$\}$
$L = \{a, aa, ab, aaa, aab, \ldots\}$



Q 9



The transition table is:

States	a	b
$\rightarrow q_0$	q_1	D
q_1*	q_1	q_1
D	D	D

The transition function is:

$\delta(q_0, a) = (q_1)$, $\delta(q_0, b) = (D)$
$\delta(q_1, a) = (q_1)$, $\delta(q_1, b) = (q_1)$
$\delta(D, a) = (D)$, $\delta(D, b) = (D)$

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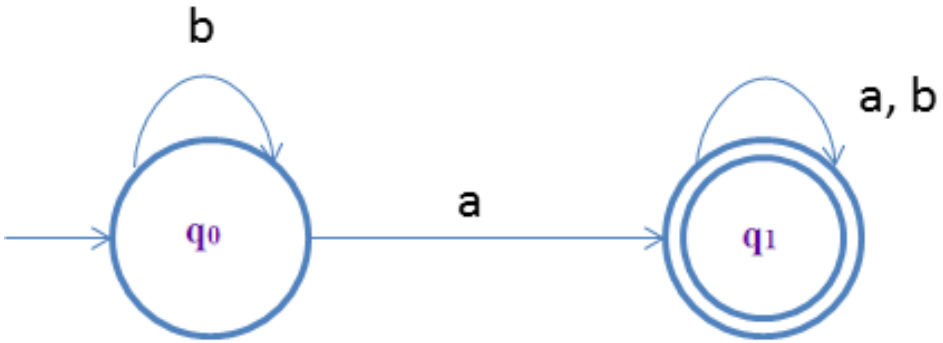
Q 10 Construction of a DFA, that accepts set of strings over $\Sigma = \{a, b\}$ which contains 'a'

DFA can be described as $(\{q_0, q_1\}, \{a, b\}, \delta, q_0, \{q_1\})$.
$L = \{$All the strings which contains 'a'$\}$
$L = \{a, aa, ab, ba, aaa, aab, abb, baa, bab, bba, \ldots\}$



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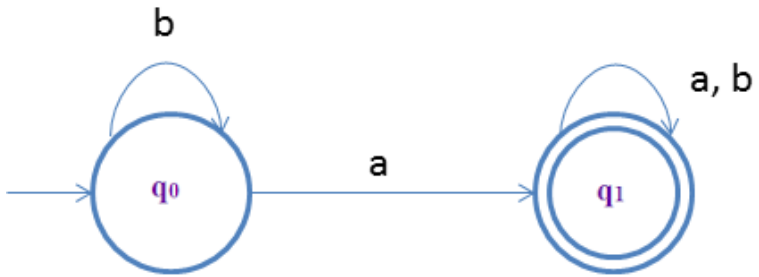
Q 10



The transition table is:

States	a	b
$\rightarrow q_0$	q_1	q_0
q_1*	q_1	q_1

The transition function is:

$$\delta(q_0, a) = (q_1) \ , \ \delta(q_0, b) = (q_0)$$
$$\delta(q_1, a) = (q_1) \ , \ \delta(q_1, b) = (q_1)$$

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Q-11 Construct a DFA, that accepts set of strings over $\Sigma = \{0, 1\}$ which when interpreted as binary number is divisible by '2'
For example, 110 in binary is equivalent to 6 in decimal and 6 is divisible by 2.

Explanation:

1. We have to create DFA that accepts set of strings which when interpreted as binary number is divisible by '2'.
2. First write the input alphabets, example 0, 1.
3. If there will n states,
4. Then start writing states, as for $n = 2 : q_0$ under 0, q_1 under 1.
5. Continue the process as, q_0 under 0 and q_1 under 1.

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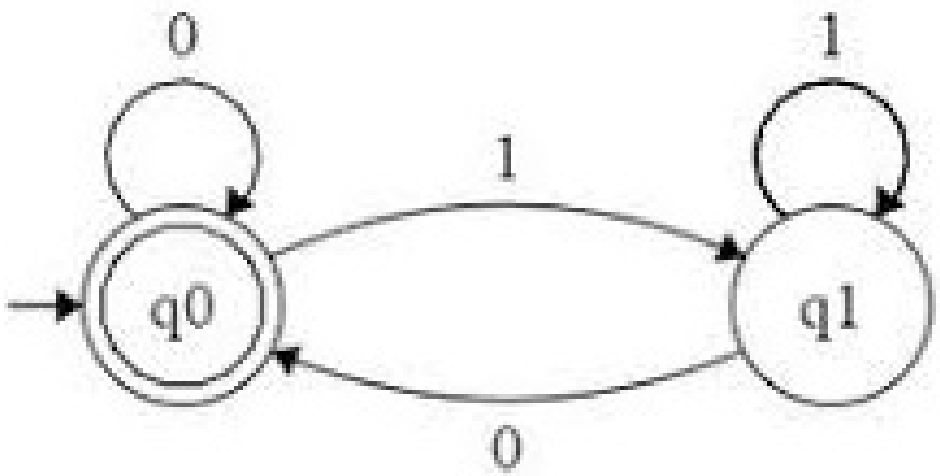
Q 11 Construction of a DFA, that accepts set of strings over Σ=$\{0, 1\}$ which when interpreted as binary number is divisible by '2, is shown below where,

DFA can be described as $(\{q_0, q_1\}, \{0, 1\}, \delta, q_0, \{q_0\})$.
$L = \{$All the strings which interpreted as binary number is divisible by '2'$\}$
$L = \{\epsilon, 0, 00, 10, 100, 110, \ldots\}$



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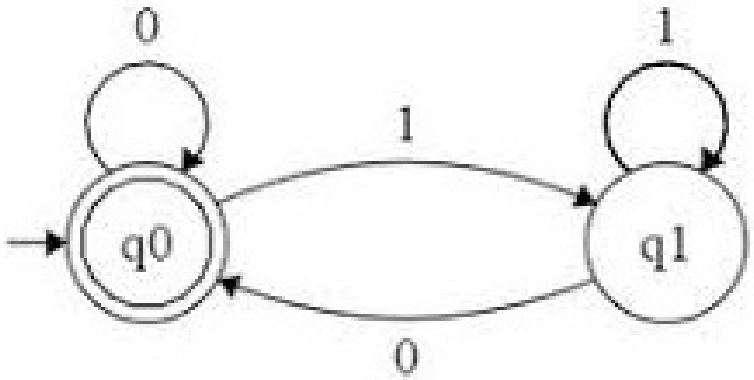
Q 11



The transition table is:

States	0	1
$\rightarrow q_0*$	q_0	q_1
q_1	q_0	q_1

The transition function is:

$\delta(q_0, 0) = (q_0)$, $\delta(q_0, 1) = (q_1)$
$\delta(q_1, 0) = (q_0)$, $\delta(q_1, 1) = (q_1)$

Designing Finite Automata

Q 12

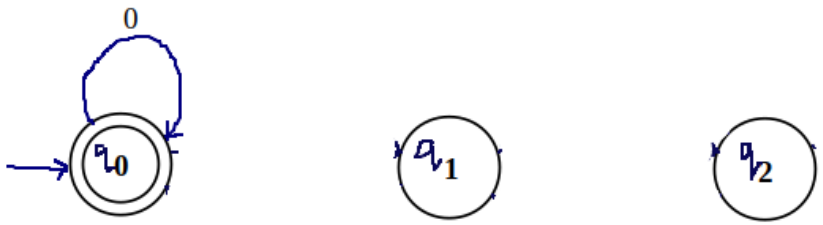
Construct a DFA, that accepts set of strings over $\Sigma = \{0, 1\}$ which when interpreted as binary number is divisible by '3'.

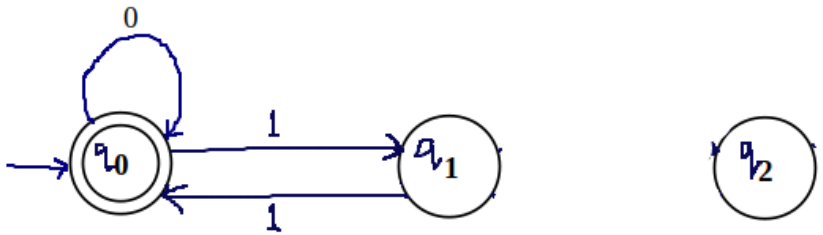
For example, 110 in binary is equivalent to 6 in decimal and 6 is divisible by 3.

Designing Finite Automata

Q 12 Construct a DFA, that accepts set of strings over $\Sigma = \{0, 1\}$ which when interpreted as binary number is divisible by '3'.

DFA can be described as $(\{q_0, q_1, q_2\}, \{0, 1\}, \delta, q_0, \{q_0\})$.
$L = \{$All the strings which when interpreted as binary number is divisible by '3'$\}$
$L = \{\epsilon, 0, 00, 11, 110, 1001, \ldots\}$





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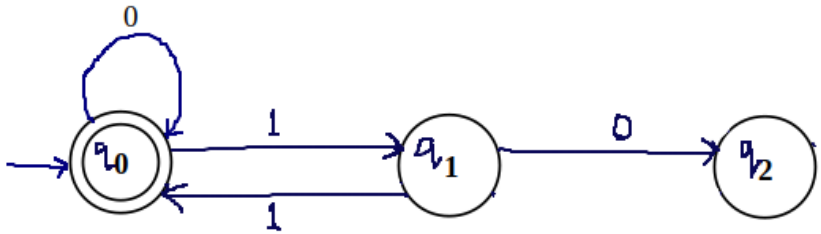
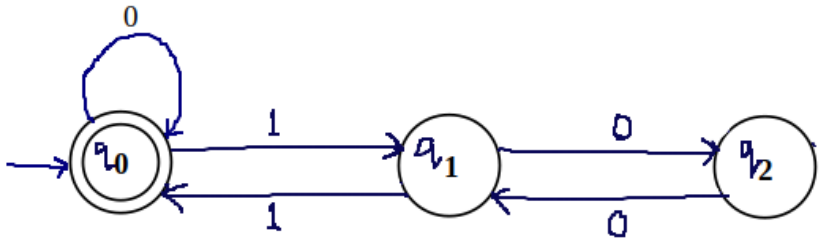
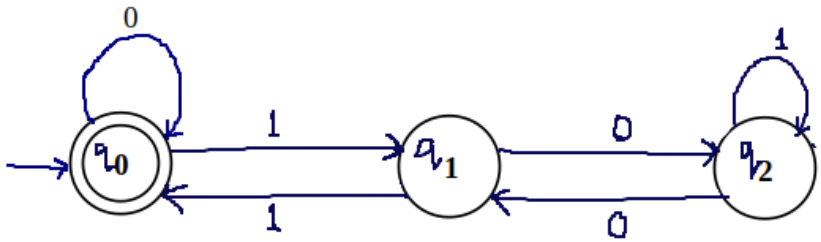
Q 12







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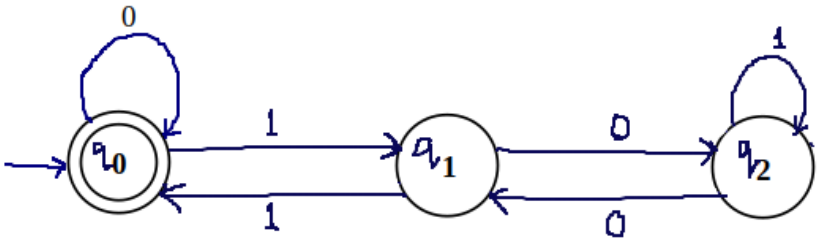
Q 12



The transition table is:

States	0	1
$\rightarrow q_0*$	q_0	q_1
q_1	q_2	q_0
q_2	q_1	q_2

The transition function is:

$$\delta(q_0, 0) = (q_0) \ , \ \delta(q_0, 1) = (q_1)$$
$$\delta(q_1, 0) = (q_2) \ , \ \delta(q_1, 1) = (q_0)$$
$$\delta(q_2, 0) = (q_1) \ , \ \delta(q_2, 1) = (q_2)$$