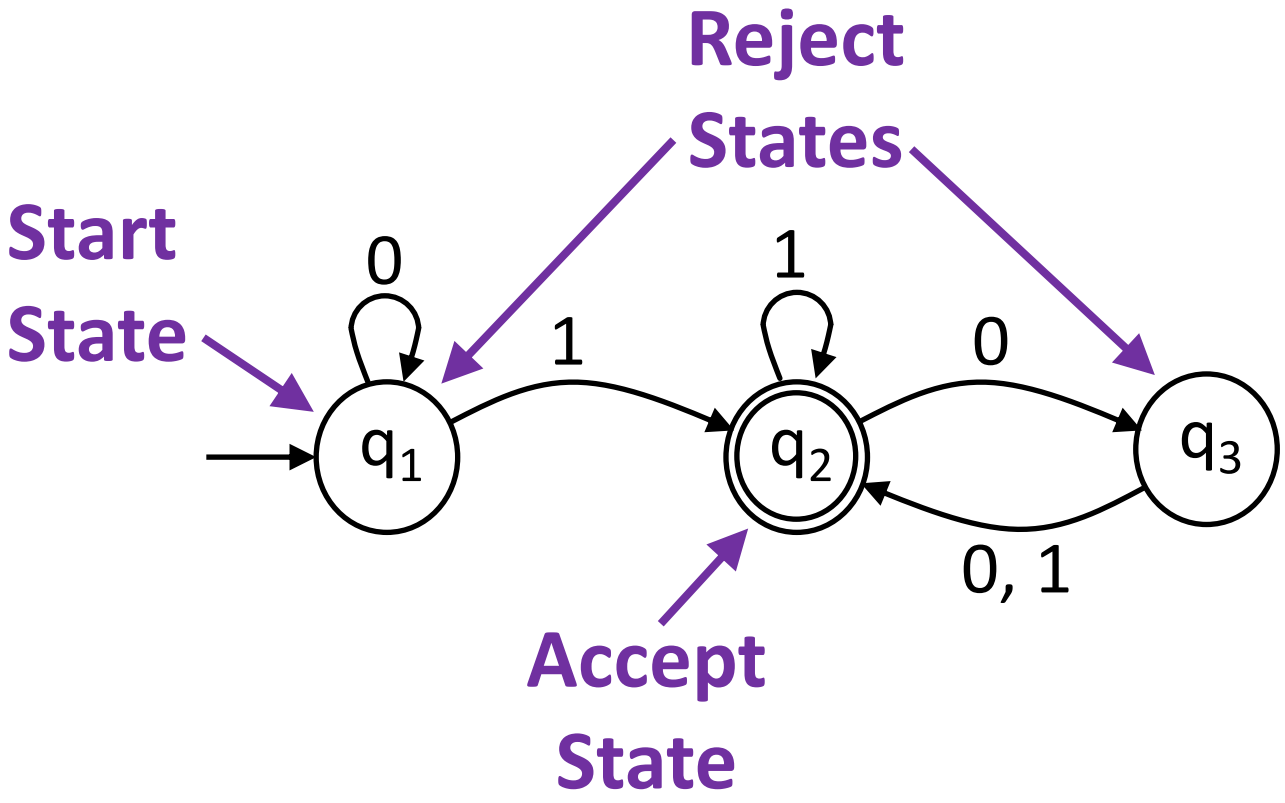
Finite Automata
CSCI 338

Deterministic Finite Automaton (DFA)

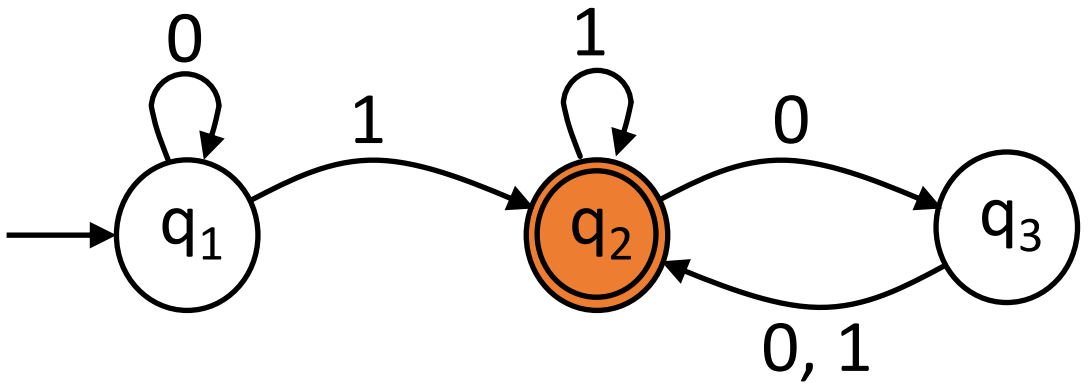


DFAs either accept or reject strings.

Deterministic Finite Automaton (DFA)

DFA string processing:

1. Start at start state.
2. Select first character in string.
3. Update state by following transition that corresponds to character.
4. Select next character in string.
5. Repeat step 3 and 4 until no characters remain.
6. If final state is accept state, accept. Otherwise, reject.

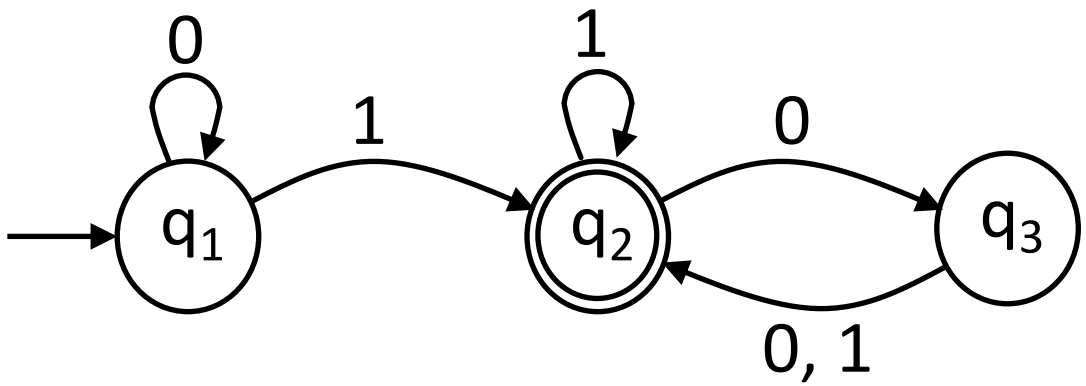


DFAs either accept or reject strings.

Given string $\omega = 01101$, does this DFA **accept** or reject?

DFA Formal Definition

DFAs consist of:



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DFAs consist of:

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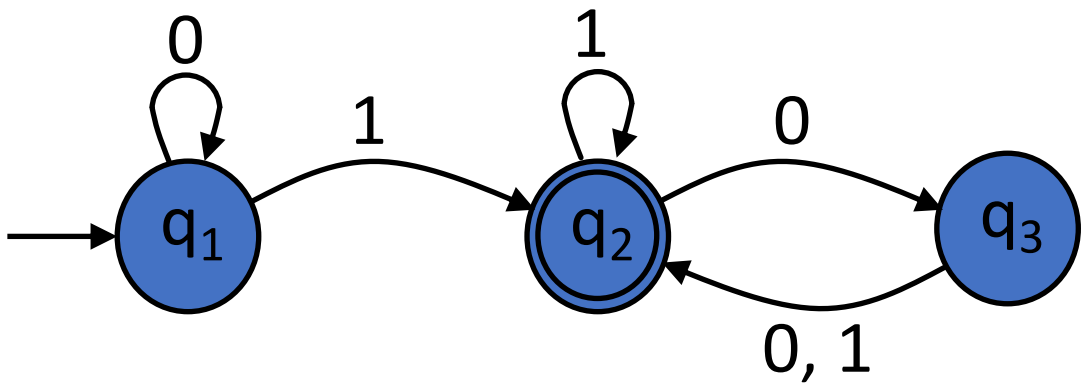

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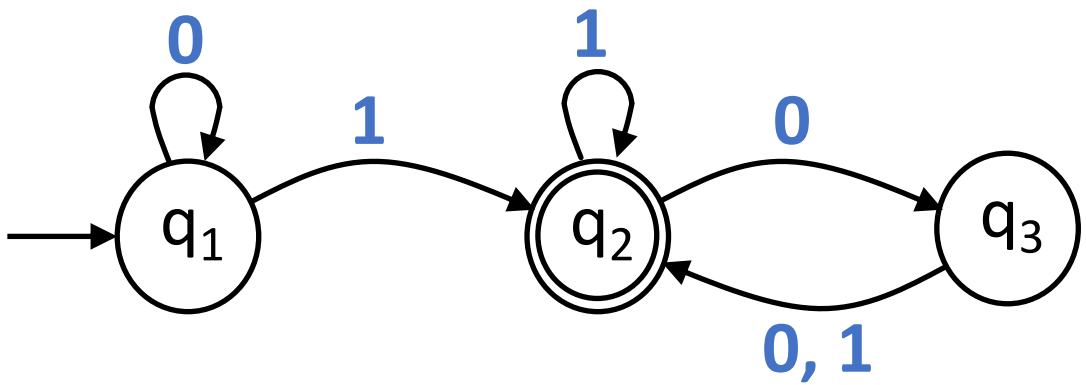
DFAs consist of:

1. Finite set of states, Q.
2. Finite alphabet, $\boldsymbol{\Sigma}$.

Σ consists of the transition characters (i.e. characters in the strings the DFA processes).



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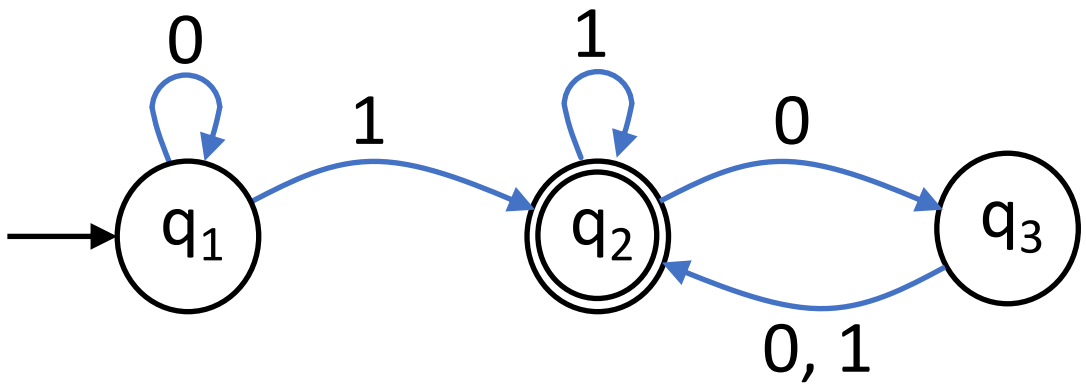

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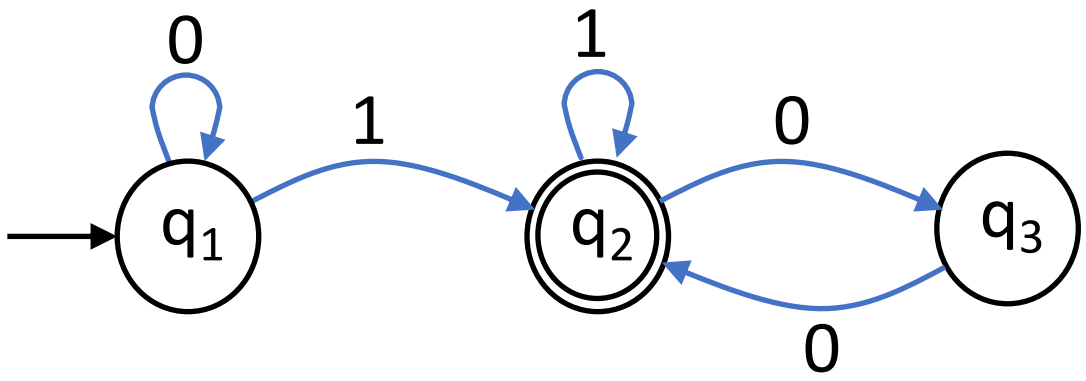

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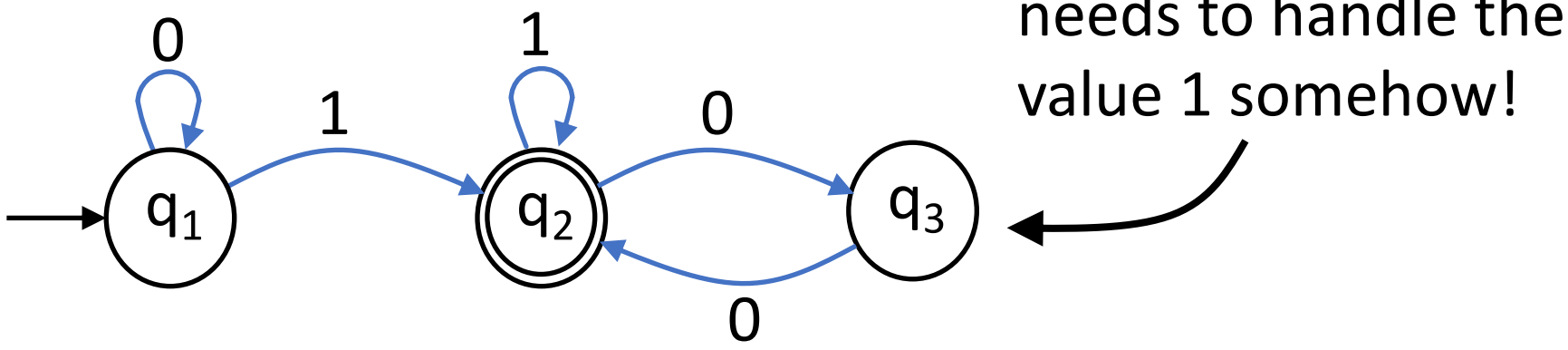

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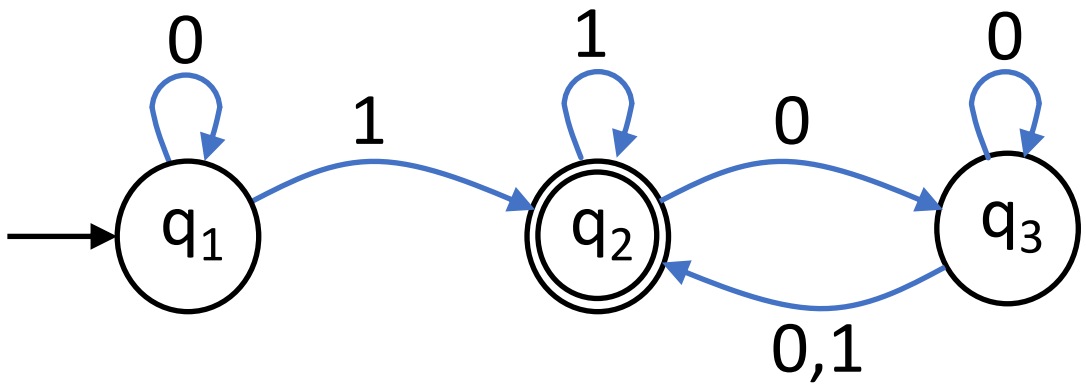

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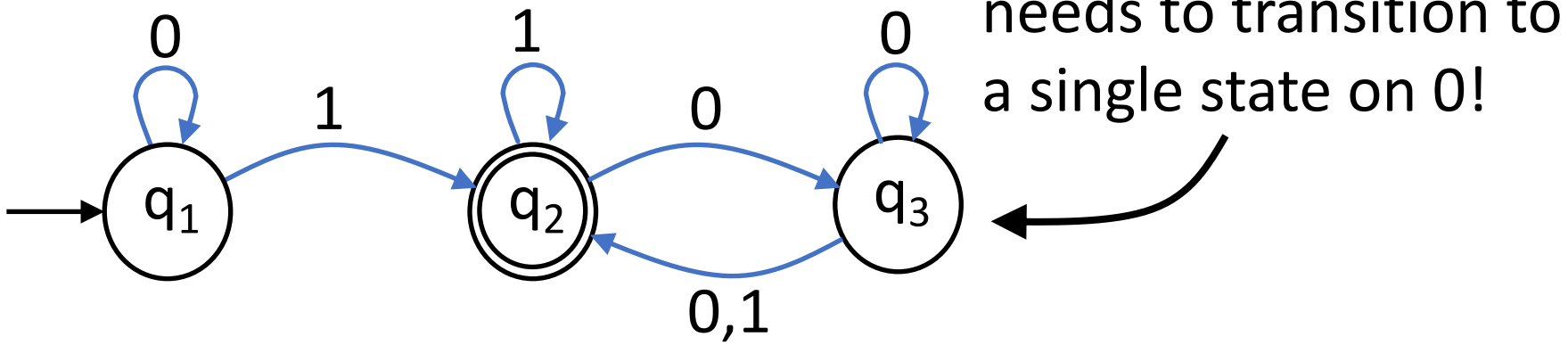

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DFAs consist of:

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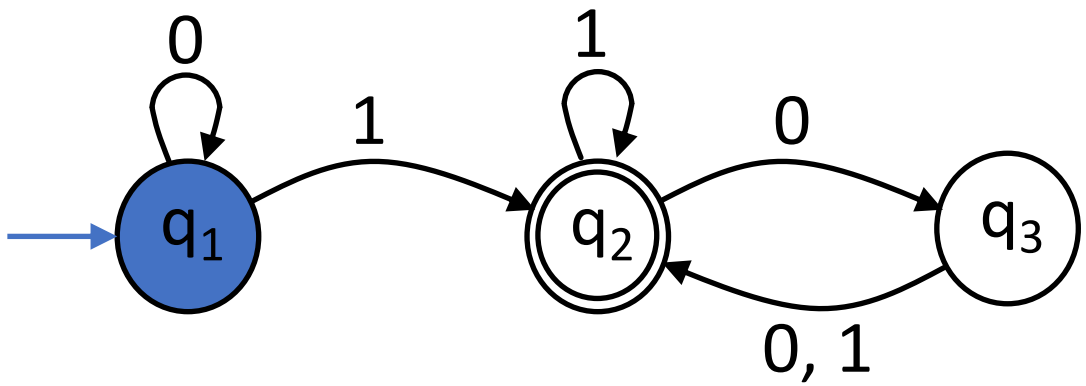
4. Start state, $\boldsymbol{q_0} \in Q$.

Exactly one start state needed.



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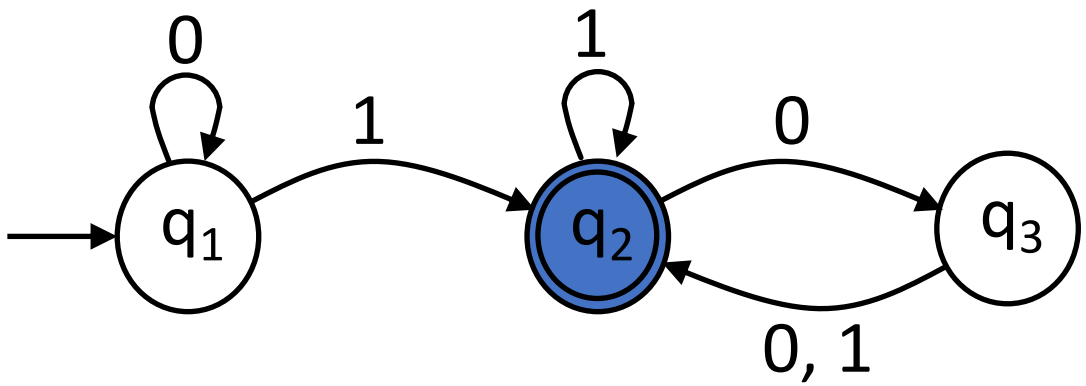
5. Set of accept states, $\boldsymbol{F} \subseteq Q$.

F is allowed to equal Q or be empty.



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$Q = \{q_1, q_2, q_3\}$

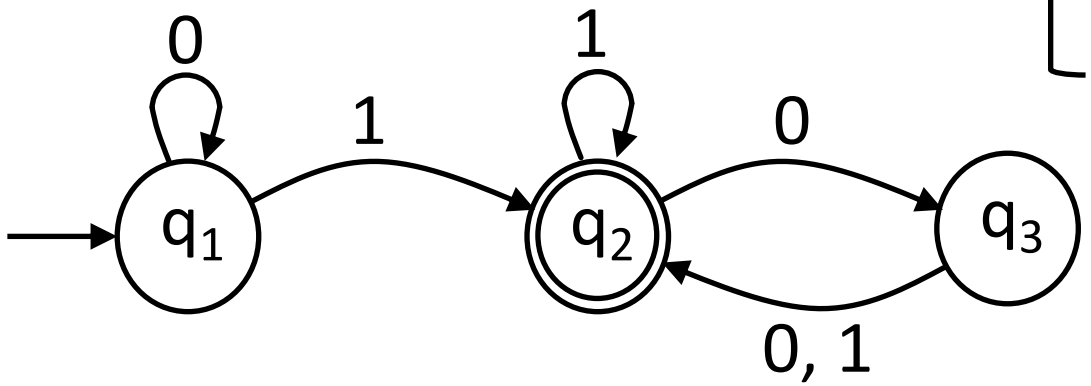
$\Sigma = \{0,1\}$

δ:

	0	1
q_1	q_1	q_2
q_2	q_3	q_2
q_3	q_2	q_2

Start state = q_1

$F = \{q_2\}$



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Definitions:

The set of all strings A that a DFA M accepts is called its language, $L(M) = A$.

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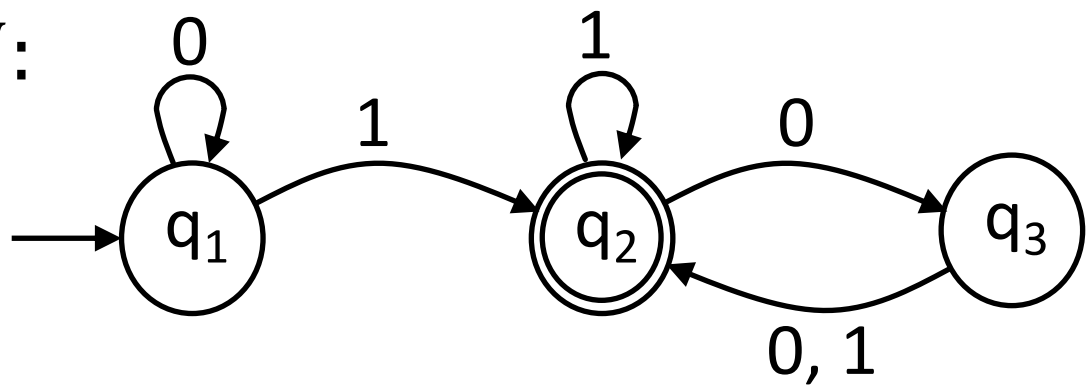

$L(M) =$ $\{\omega: \omega$ contains at least one 1 and an even number of 0s following the final 1$\}$

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Set of regular languages are “things we can do” with DFAs.

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Prove that the following languages are regular:

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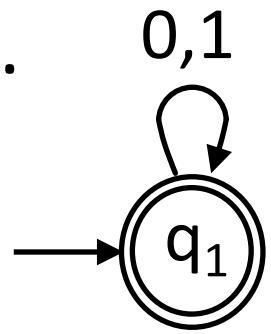

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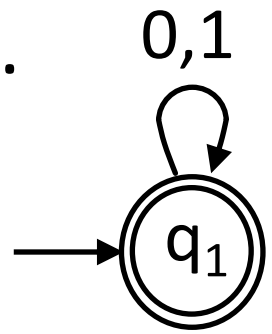

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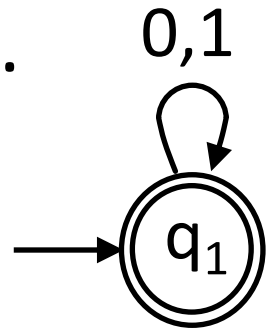

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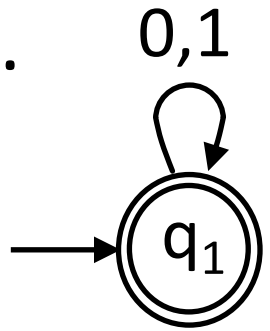

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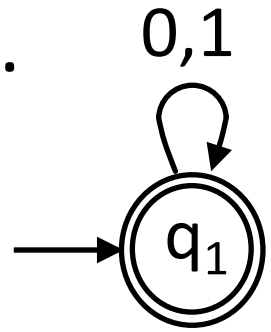

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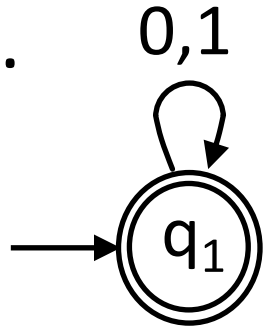

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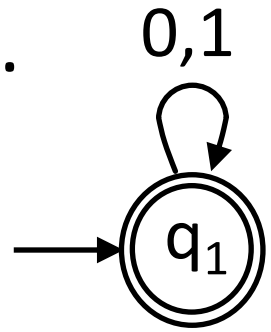

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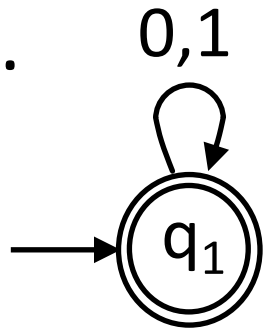

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DFA Language Rules:

1. If the DFA accepts it, it is in the language.
2. If it is in the language, the DFA must accept it.

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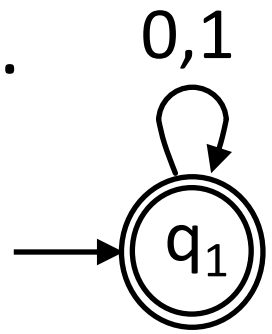

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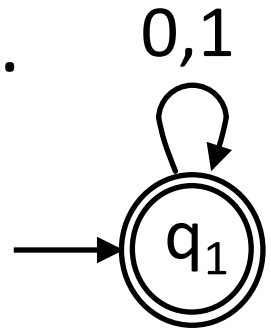

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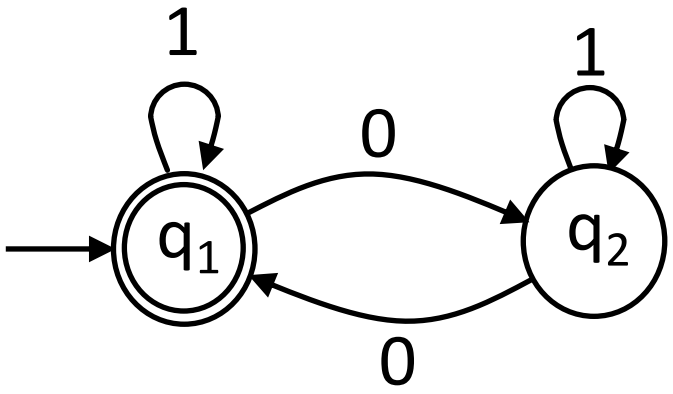

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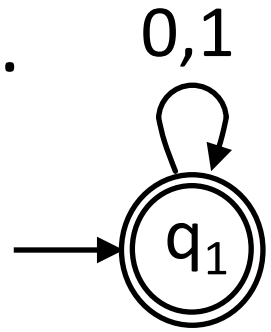

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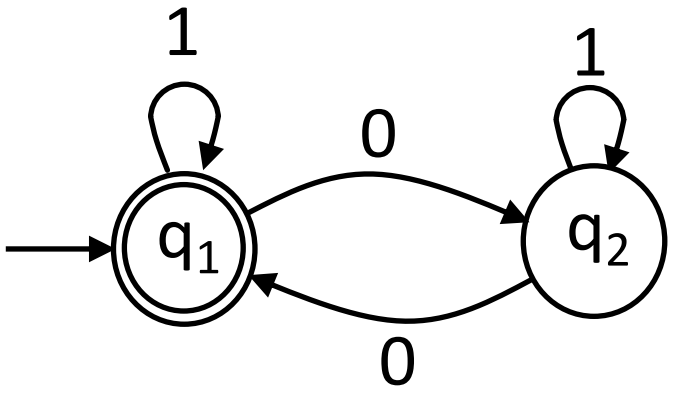

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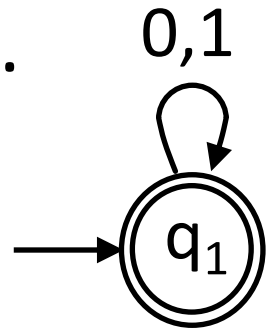

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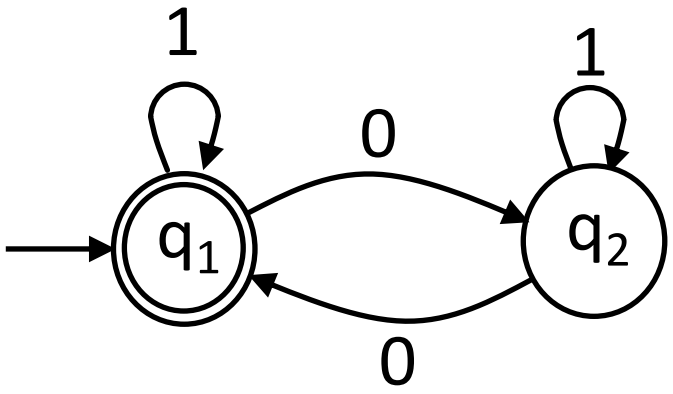

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