Finite Automata

CSCI 338

DFA Formal Definition

DFAs consist of:

1. Finite set of states, Q.
2. Finite alphabet, Σ.
3. Transition function, $\delta: Q \times \Sigma \rightarrow Q$.
4. Start state, $q_0 \in Q$.
5. Set of accept states, $F \subseteq Q$.

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

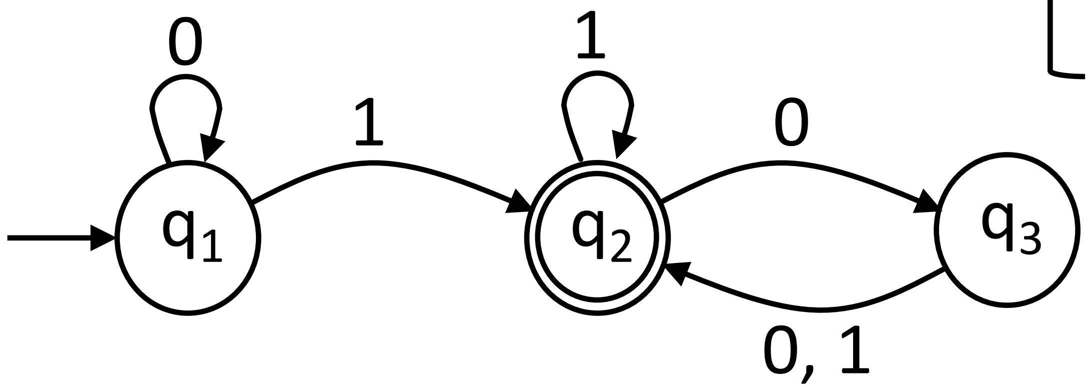
$\Sigma = \{0,1\}$

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

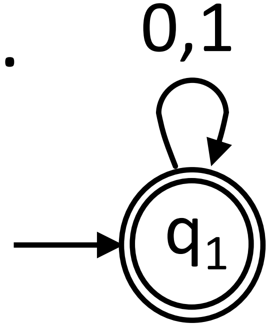
$F = \{q_2\}$



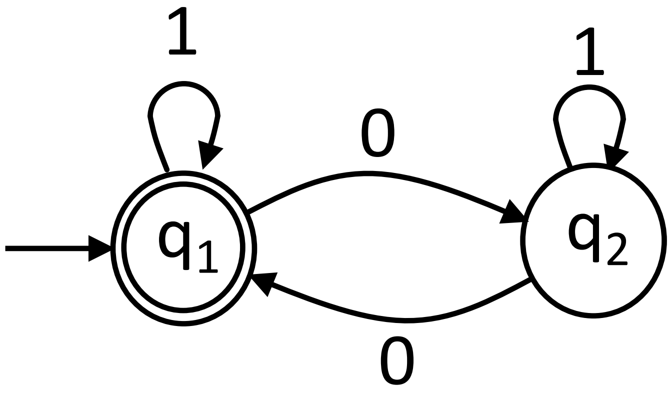
DFA Practice

Prove that the following languages are regular:

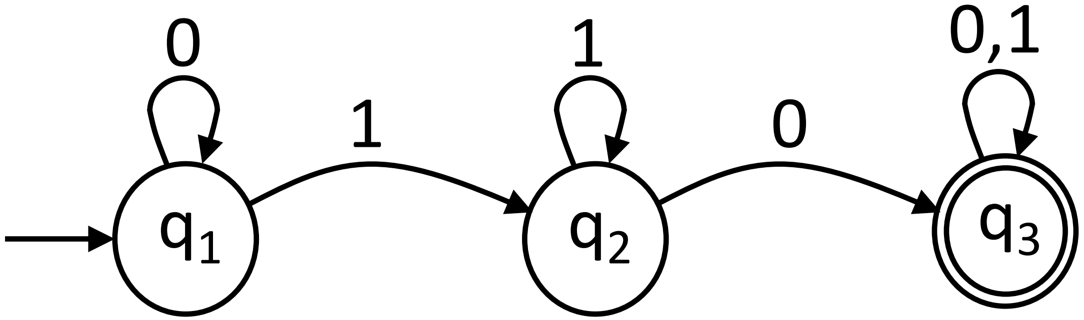
1. Set of all strings over {0,1}.



2. Set of all strings with an even number of 0s.



3. Set of all strings that contain the substring: 10.



Prove that the following language is regular:

$\{\omega: \omega$ begins with sequence $10\}$.

Proof:

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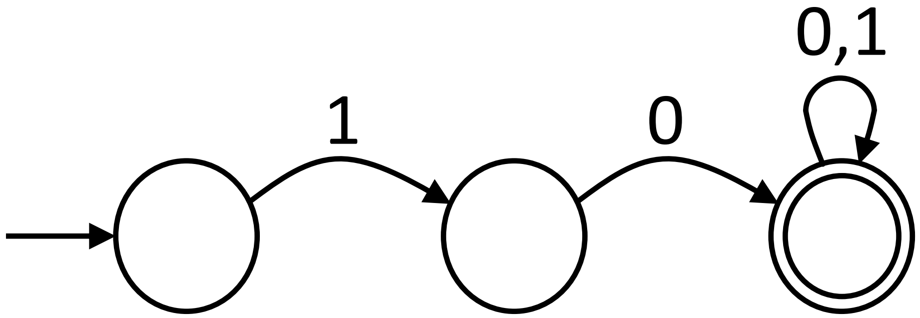

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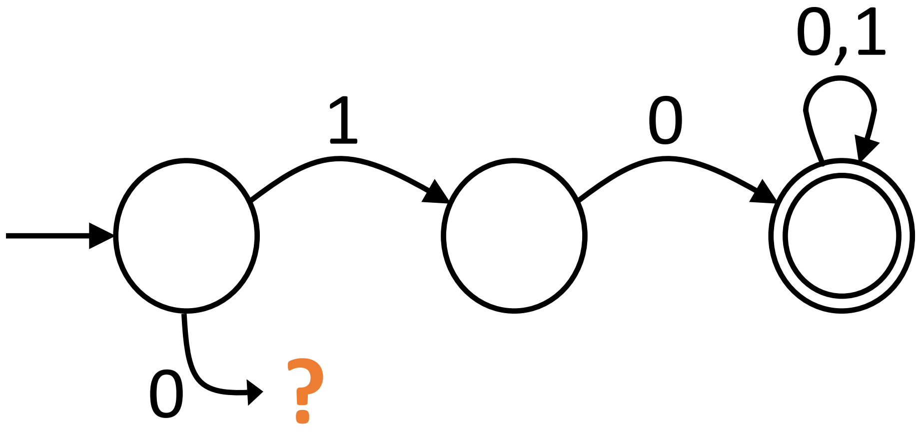

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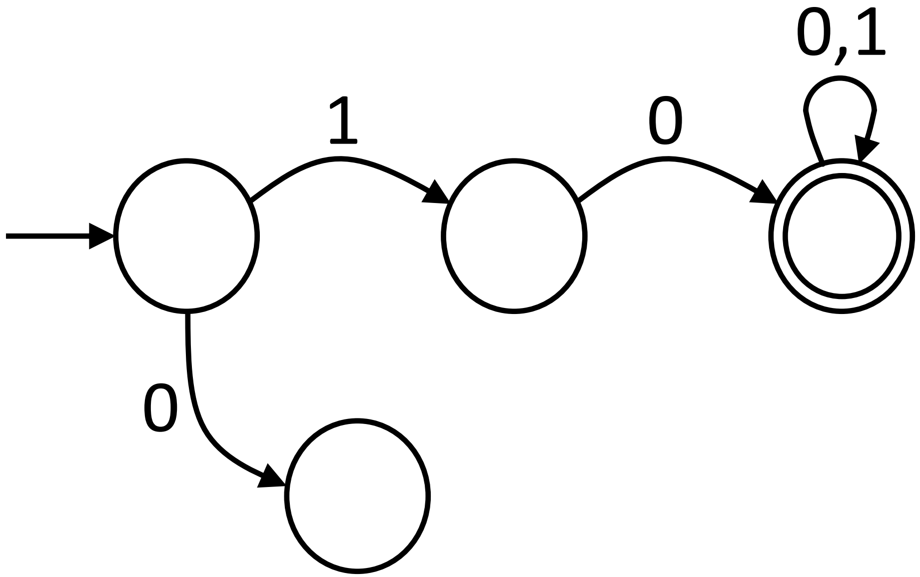

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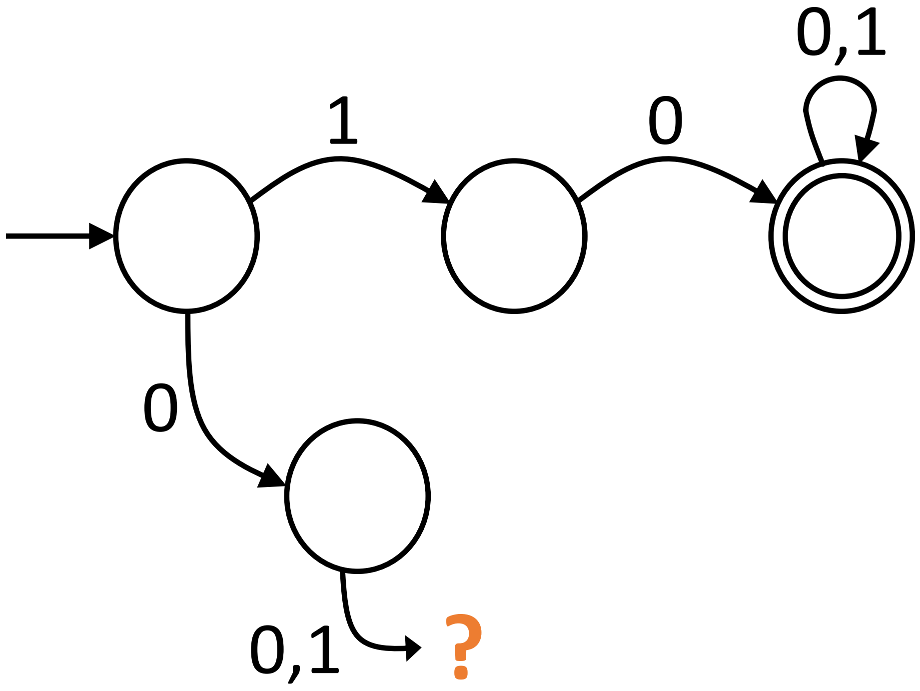

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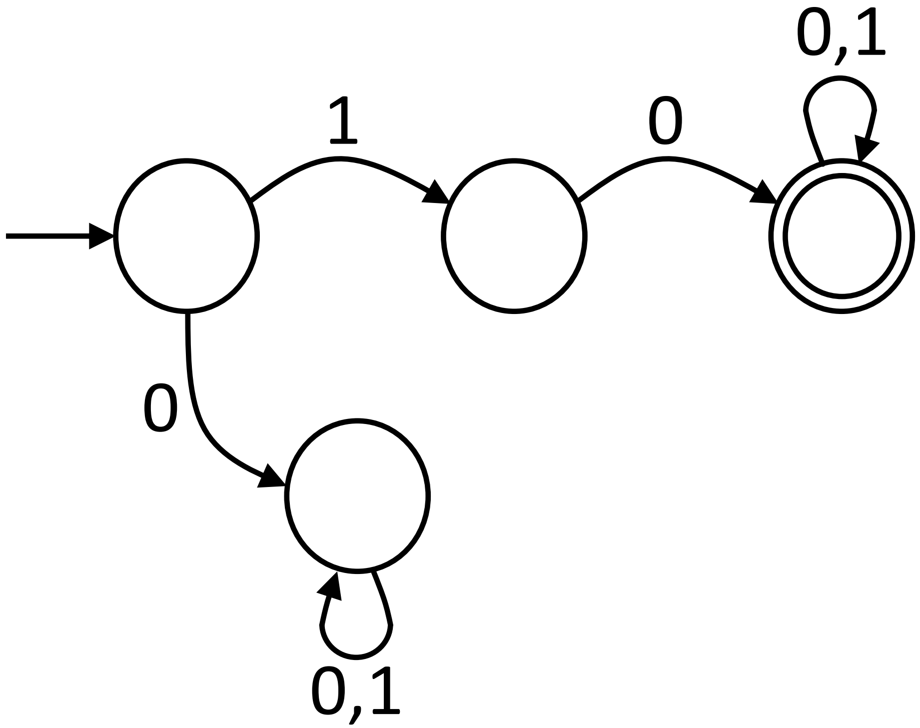

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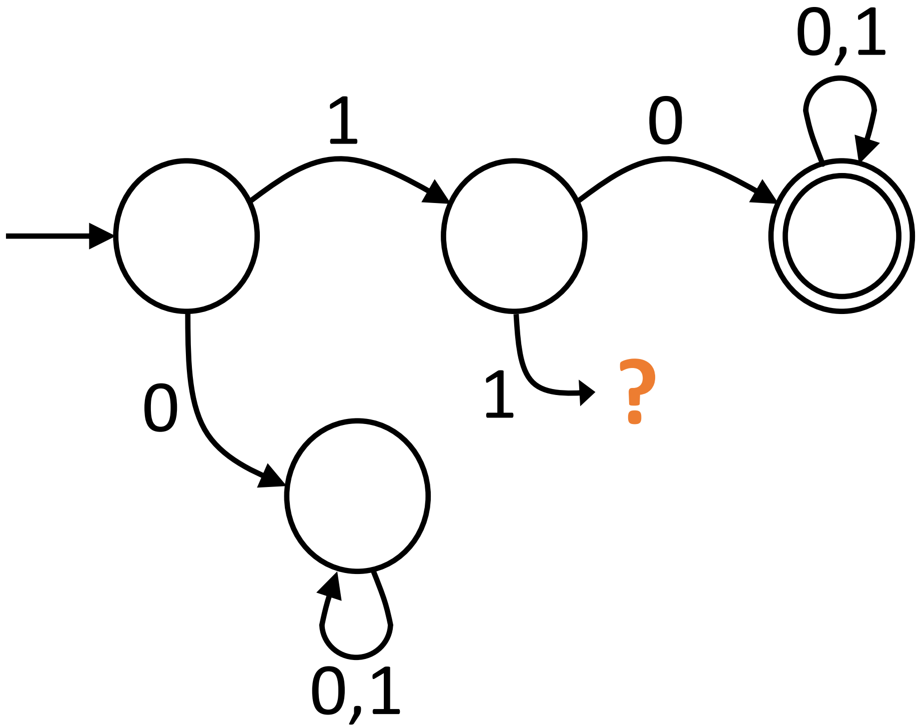

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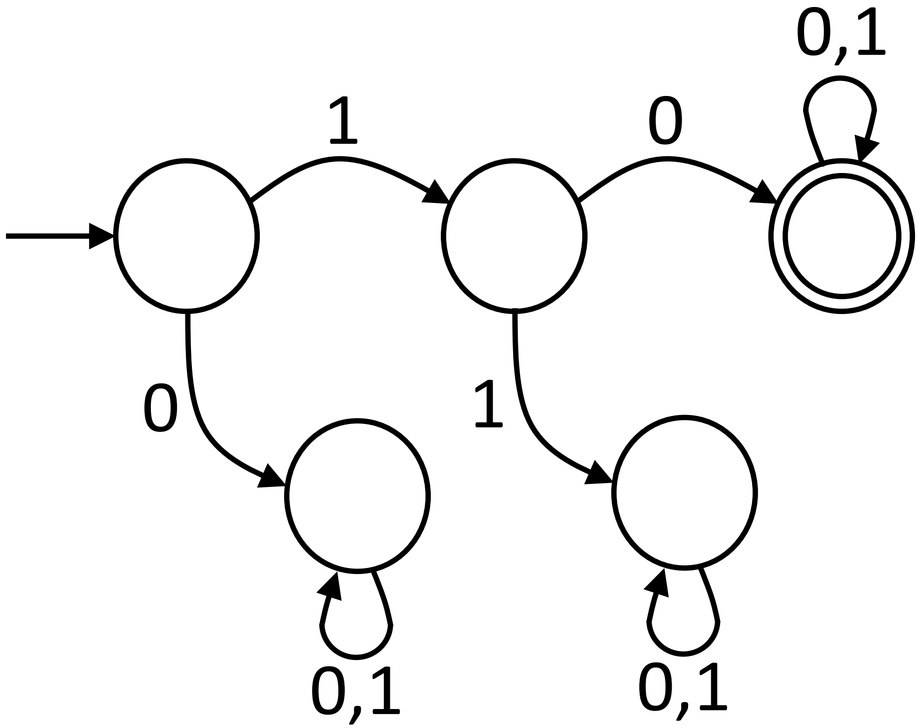

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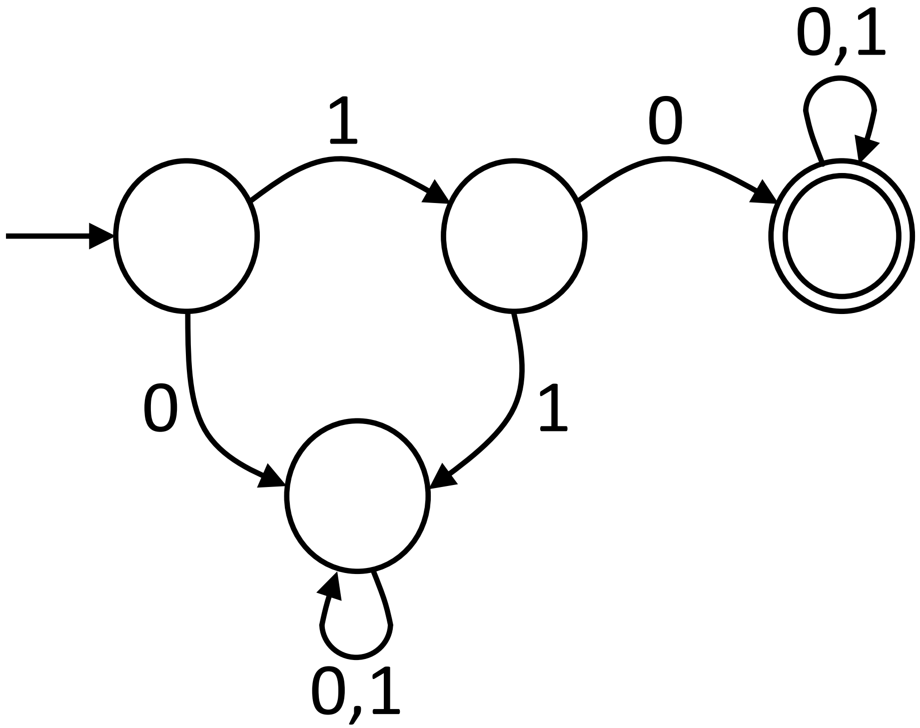

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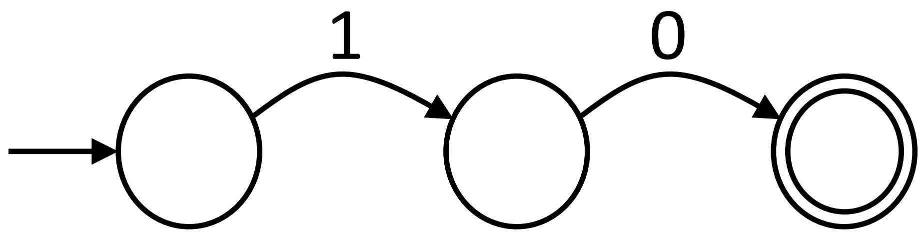

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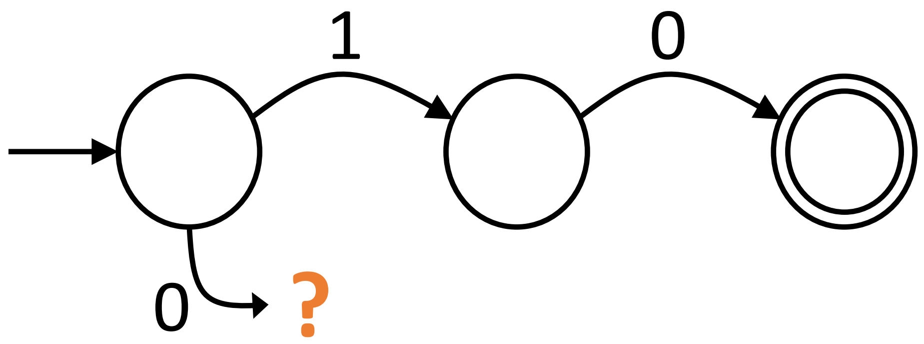

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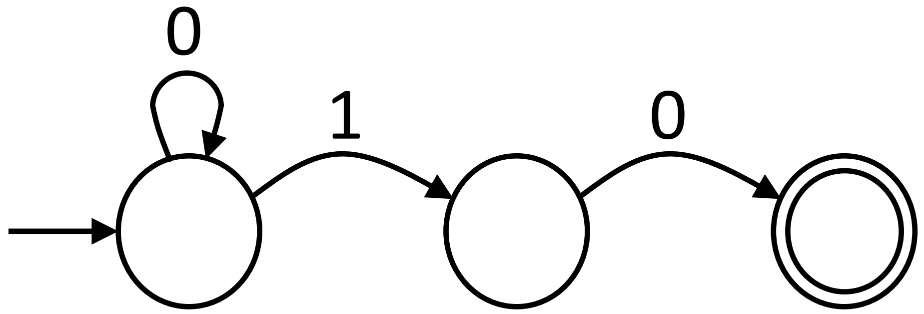

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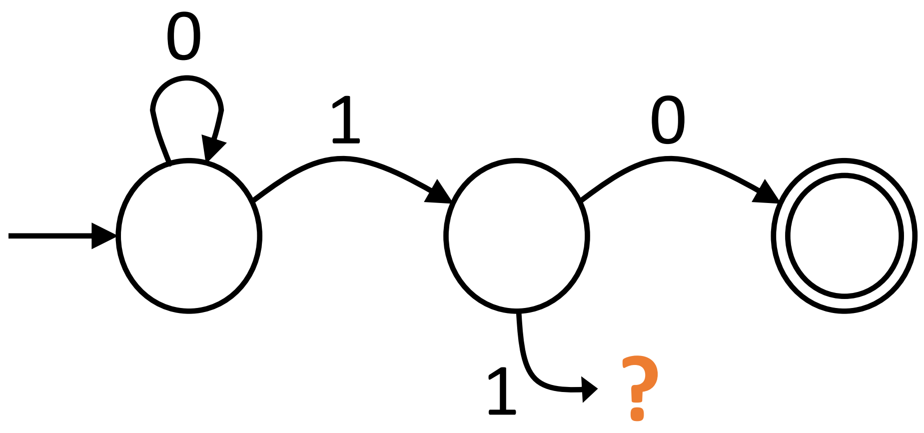

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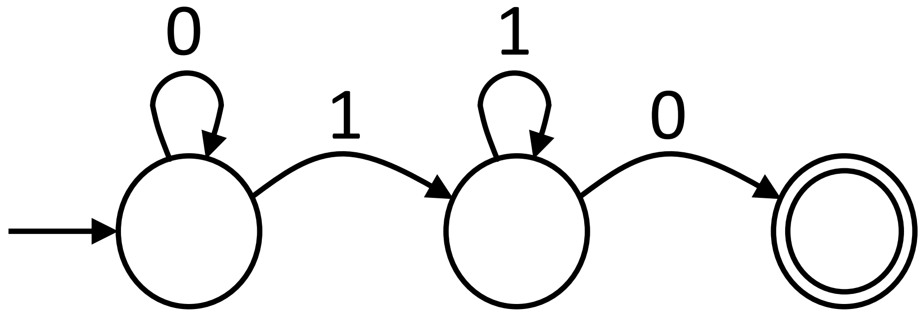

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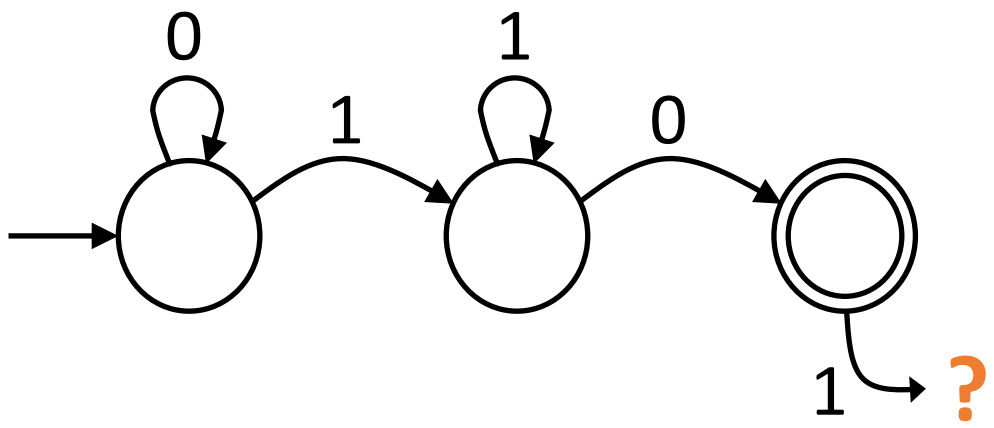

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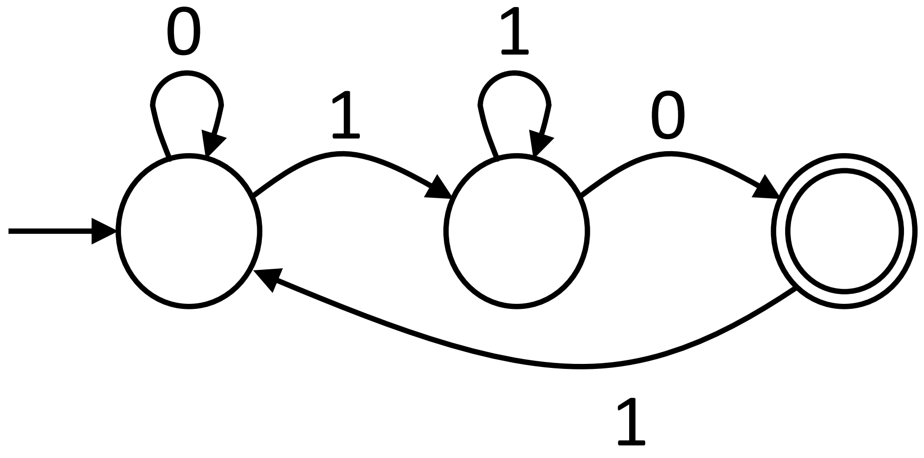

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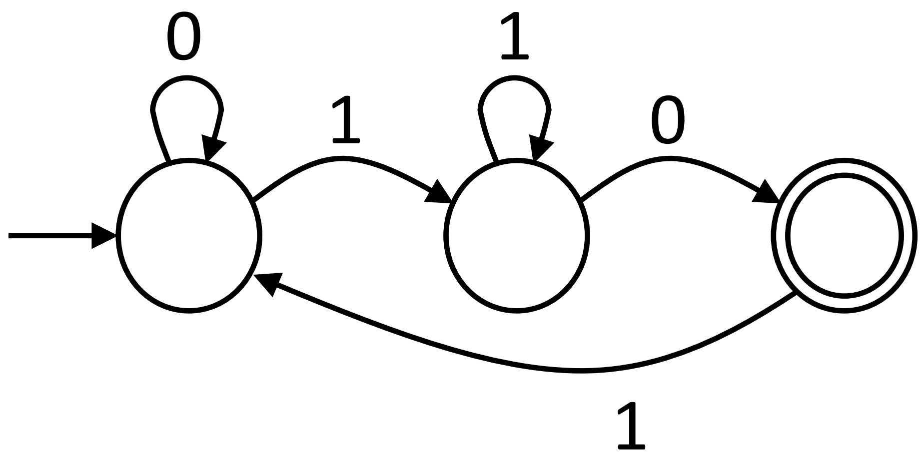
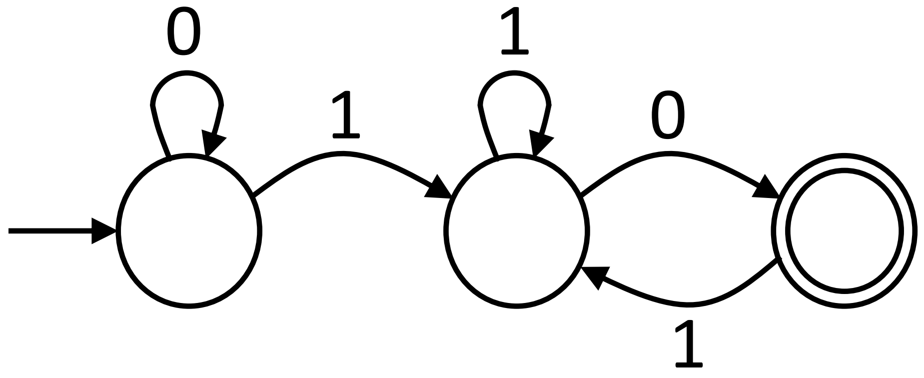


What about 1010?

Prove that the following language is regular:

$\{\omega: \omega \text{ ends with sequence } 10\}$.

Proof:



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$\{\omega: \omega \text{ ends with sequence } 10\}$.

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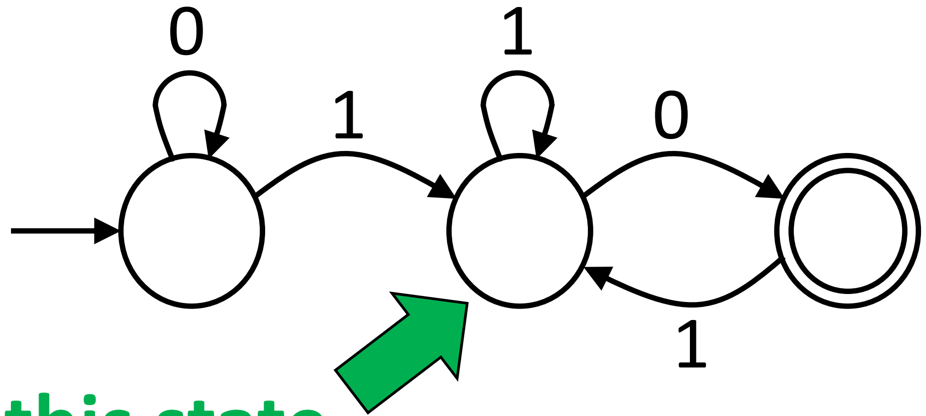

If you had to name this state, what would you name it?

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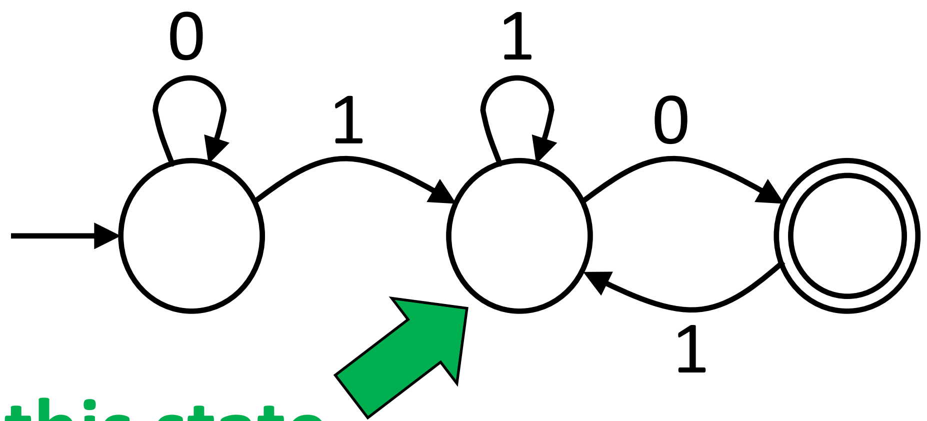
Proof:



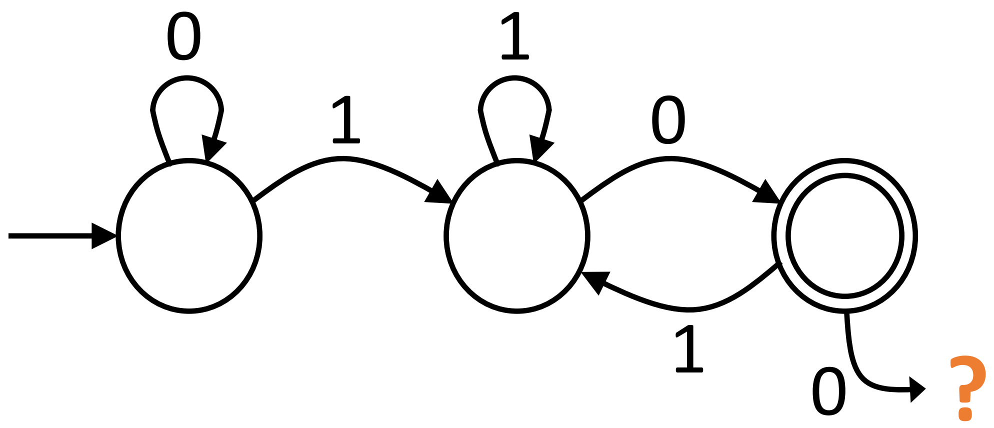
If you had to name this state, what would you name it?

"We just processed a 1 state"

Prove that the following language is regular:

$\{\omega: \omega \text{ ends with sequence } 10\}$.

Proof:



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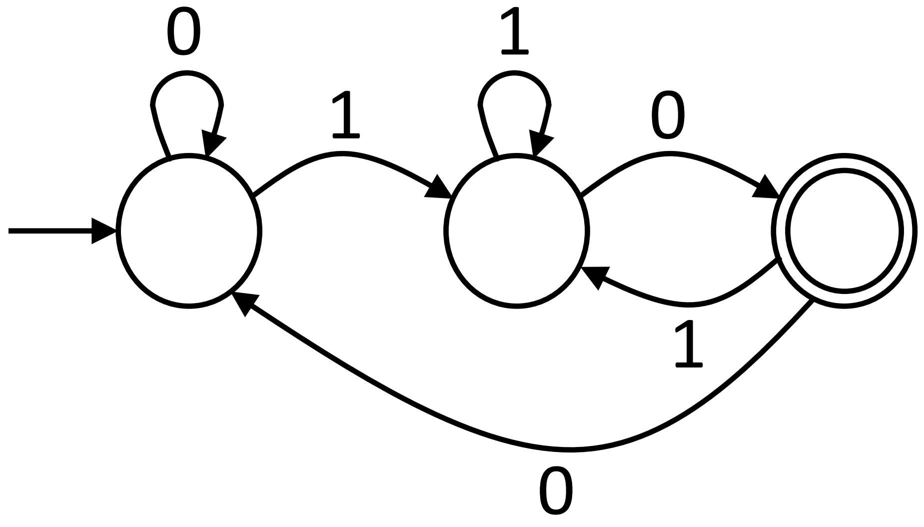

Empty string vs. Empty set

Empty string vs. Empty set

ε is called the empty string. It is the string that contains no characters.

Regular?

$$L = \{\varepsilon\}$$

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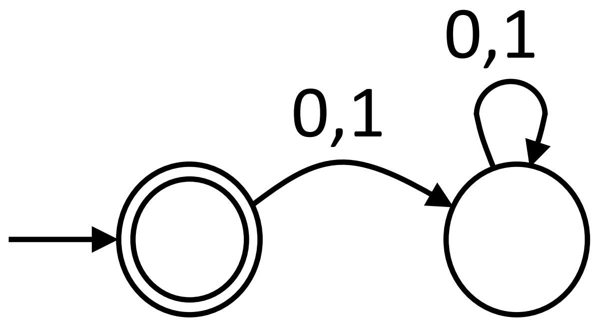

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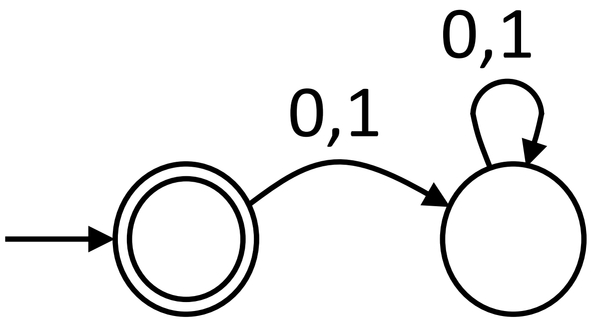

$$L = \{\varepsilon\}$$

Empty string vs. Empty set

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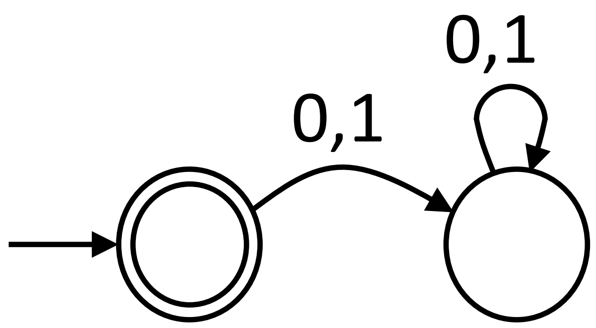
$\emptyset$ is called the empty set. It is the set that contains no elements.



Regular?

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$L = \emptyset$

Empty string vs. Empty set

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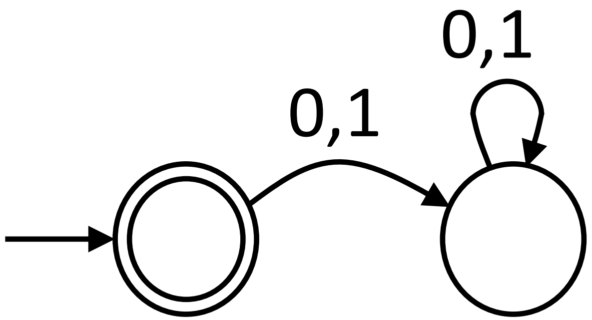
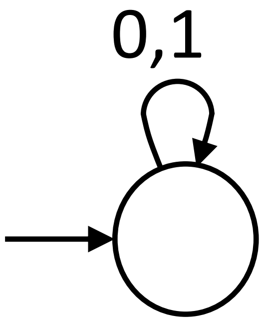


$L = \{\varepsilon\}$

Empty string



$L = \emptyset$

Empty set

vs.

ε is called the empty string. It is the string that contains no characters.

$\emptyset$ is called the empty set. It is the set that contains no elements.

Prove that the following language is regular:

$\{\omega\colon \omega$ starts and ends with a $0\}$.

Proof:

?

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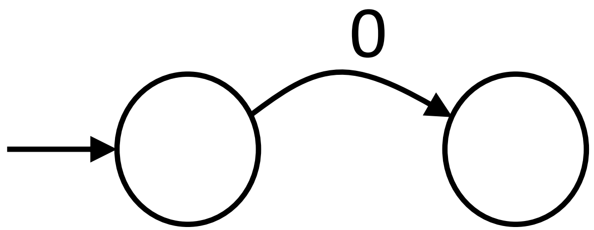
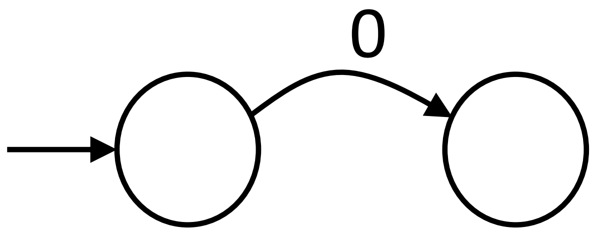


Prove that the following language is regular:

$\{\omega : \omega \text{ starts and ends with a } 0\}$.

Proof:

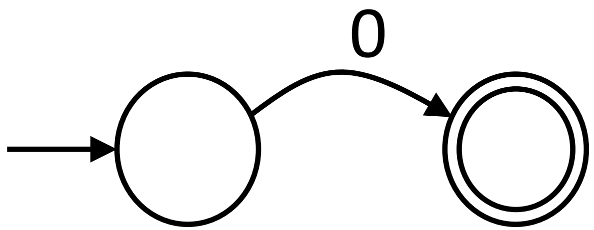


The string $\omega = 0$ starts and ends with a 0 and must be accepted!

Prove that the following language is regular:

$\{\omega : \omega$ starts and ends with a $0\}$.

Proof:



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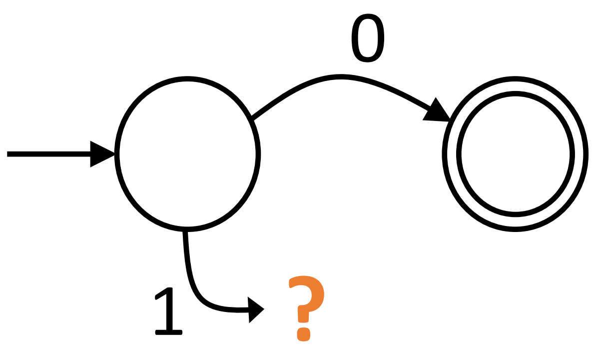

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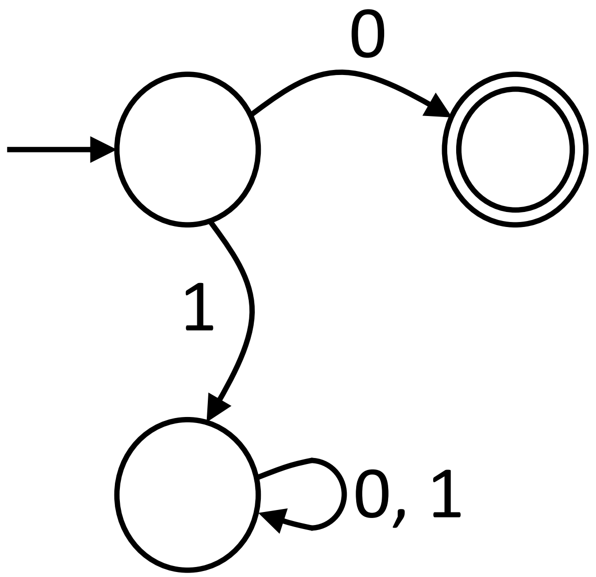

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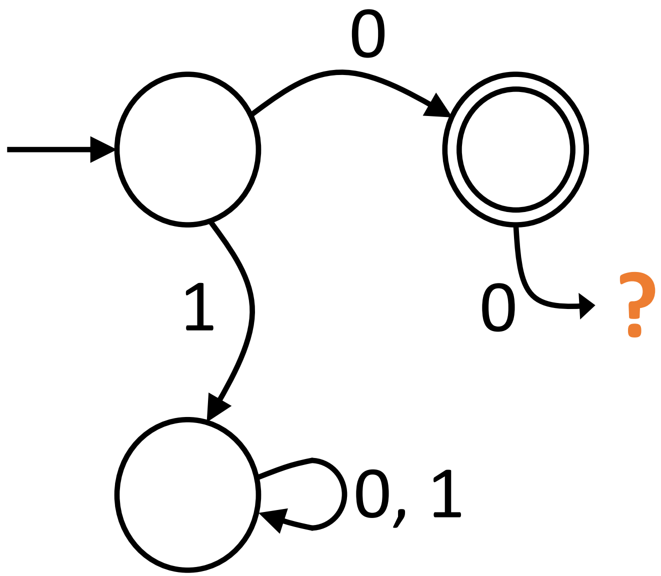

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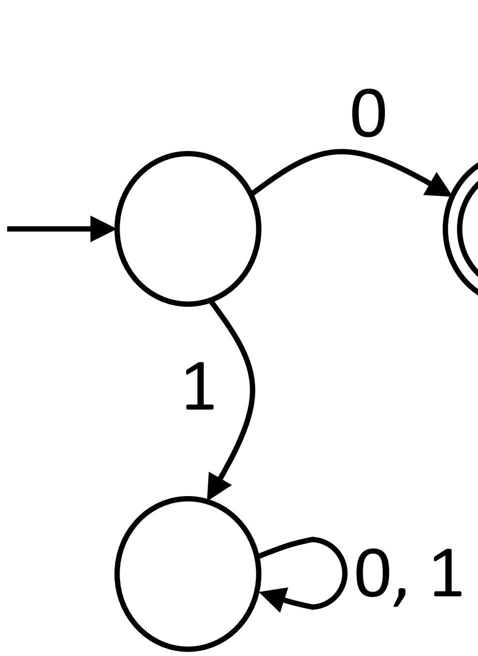

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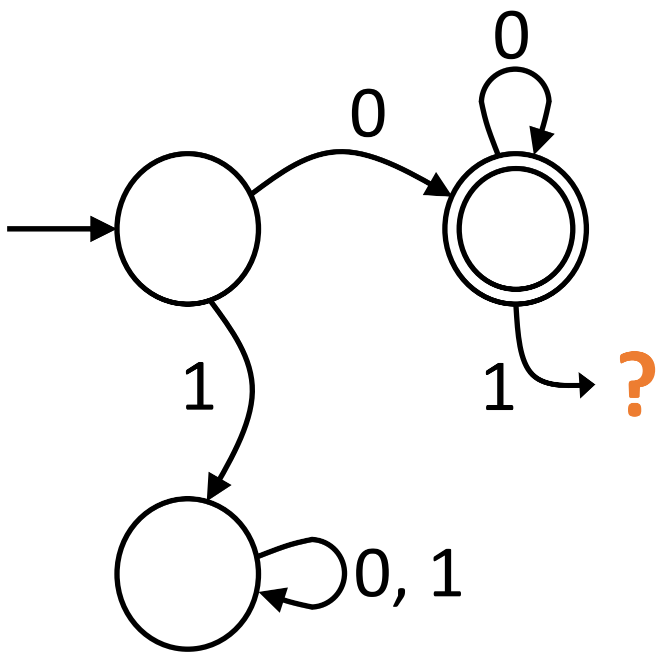

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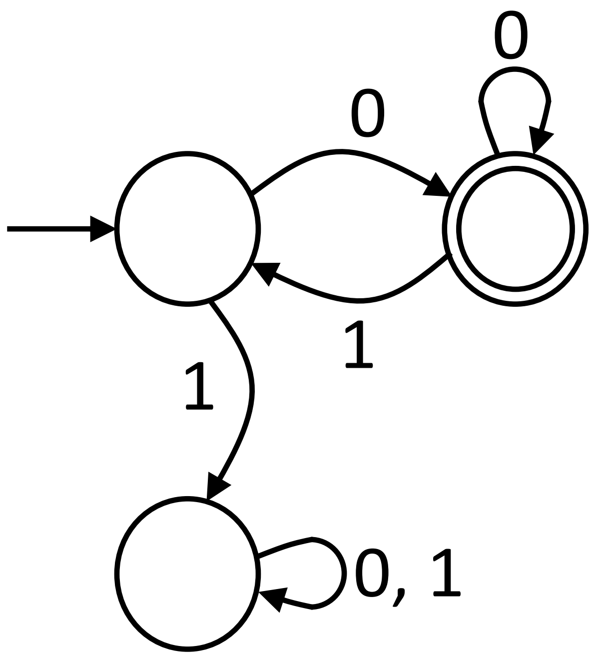

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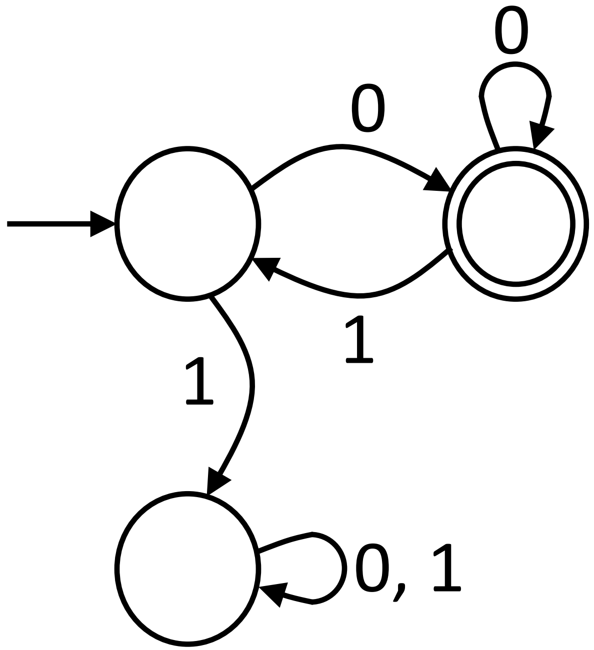

$\omega = 0110$. Accept or Reject?

Prove that the following language is regular:

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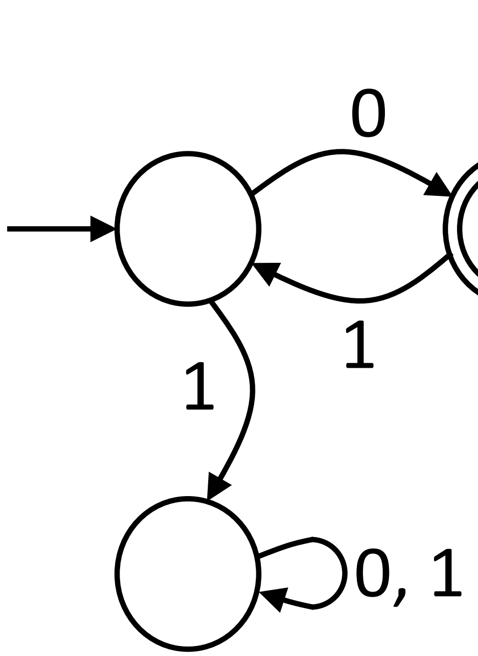
Proof:



$\omega = 0110$. Accept or Reject?

It rejects but <u>should</u> accept!

Prove that the following language is regular:

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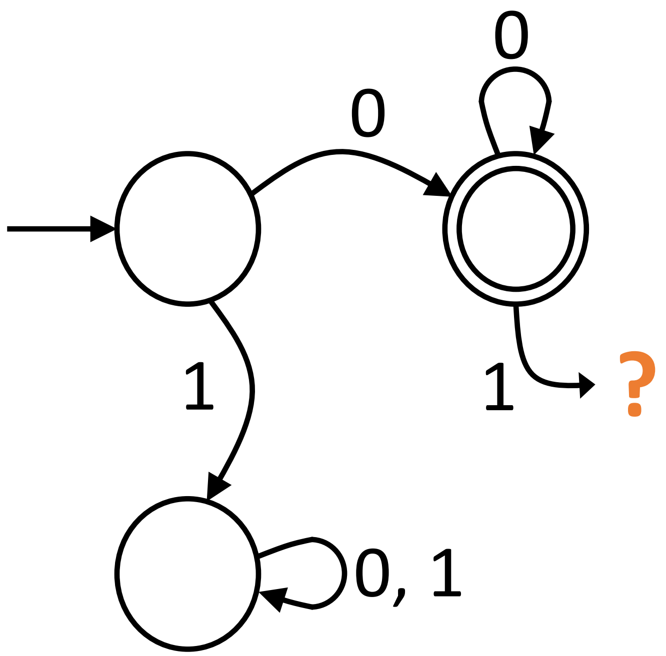

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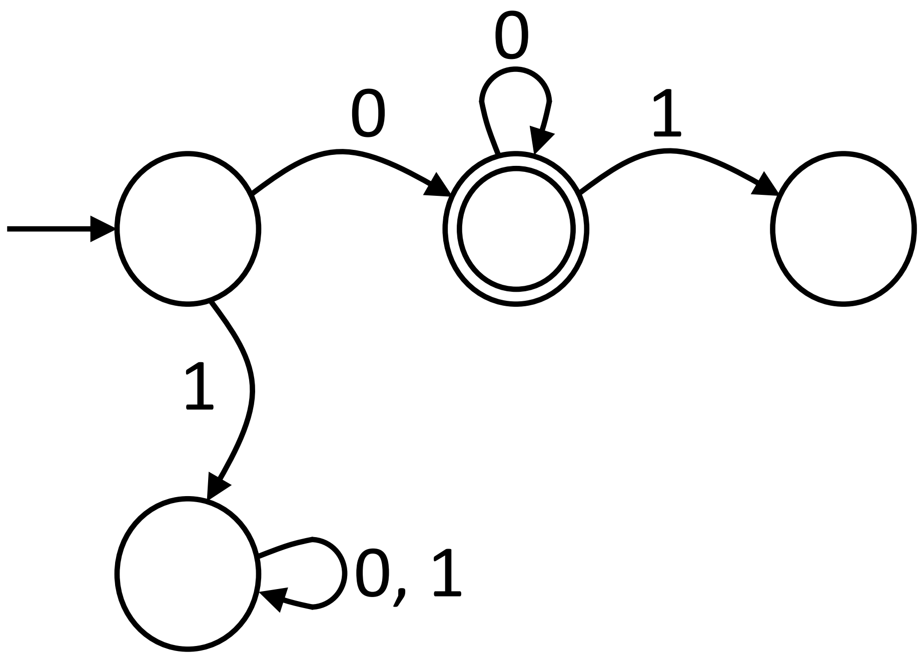

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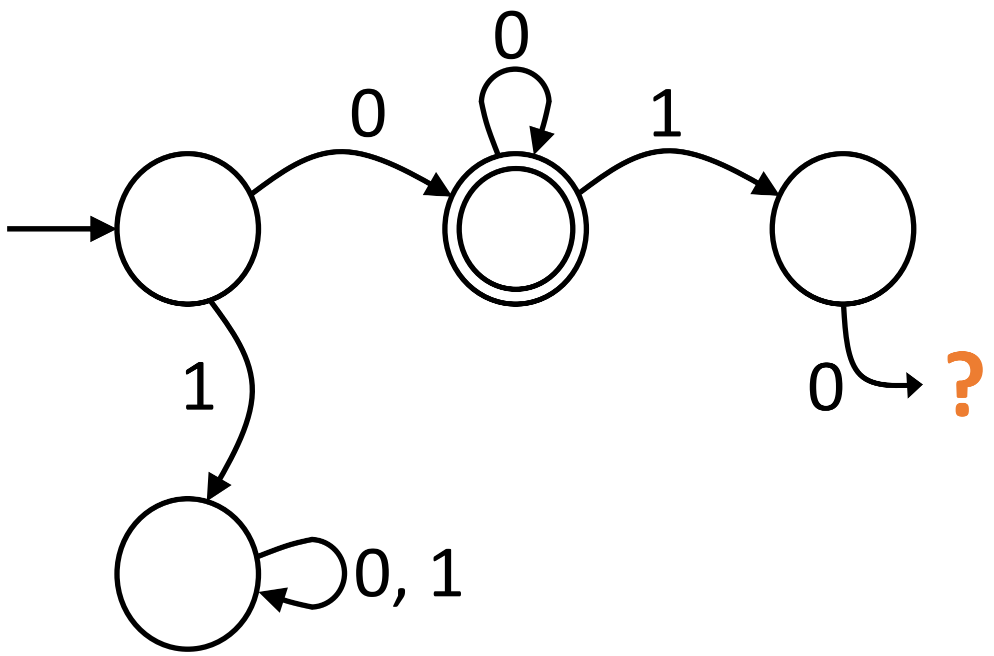

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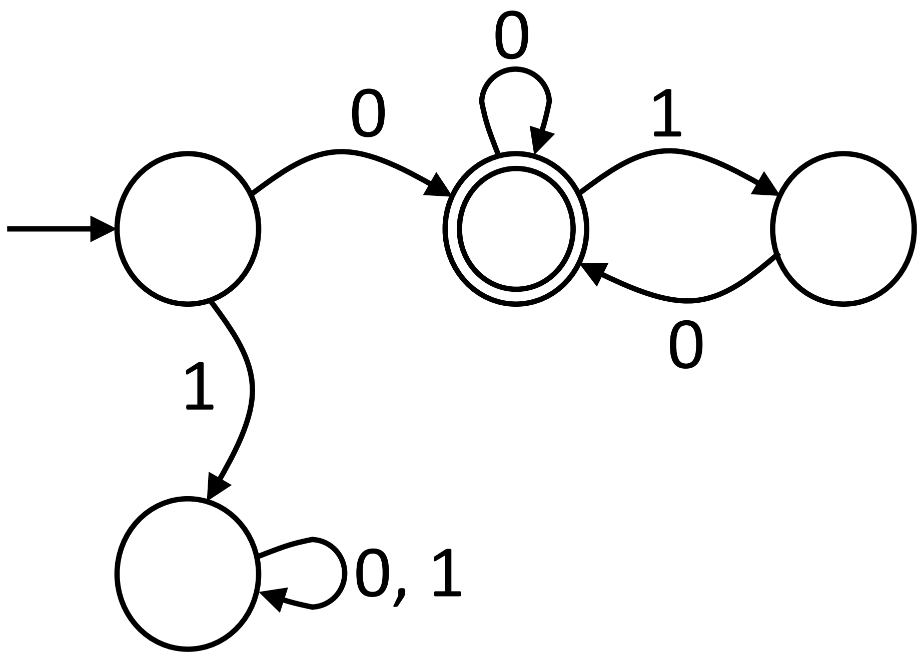

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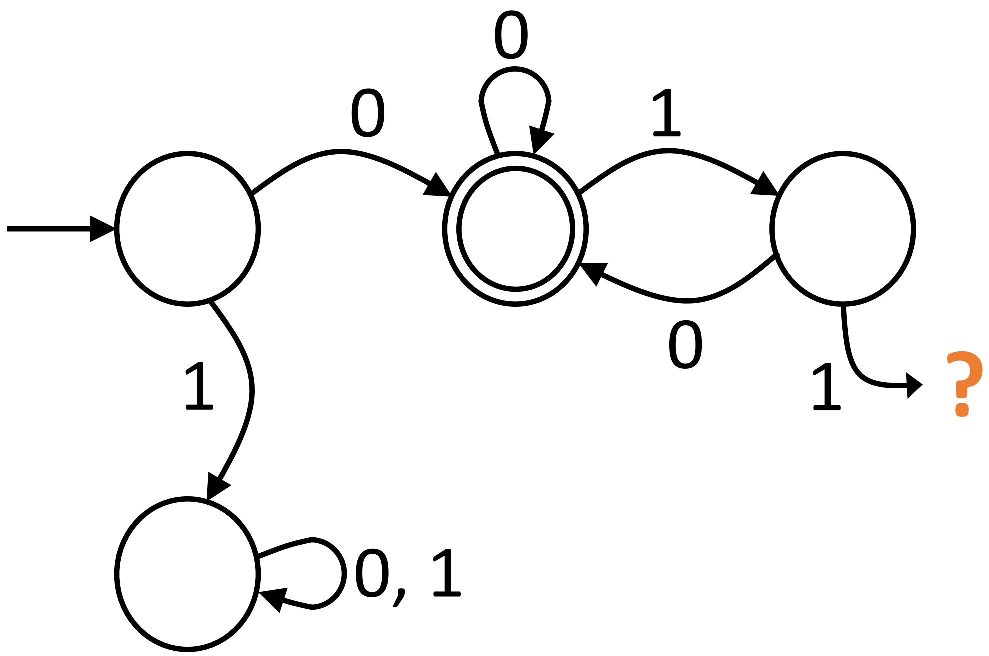

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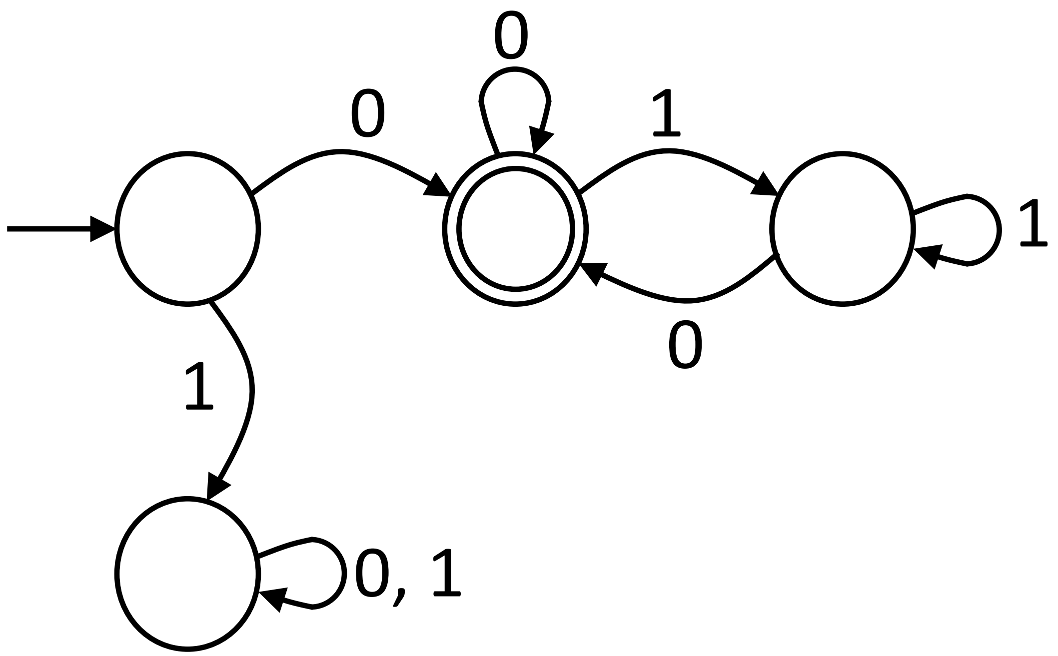

Prove that the following language is regular:

$\{\omega : \omega$ consists of some number of 0s followed by the same number of 1s$\}$. E.g. 000111

Proof:

?