# Finite Automata

CS 2800: Discrete Structures, Spring 2015

Sid Chaudhuri


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<!-- made with <3 and AFDKO -->
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monospace, open source, coding, for
<link rel="stylesheet" type="text/css
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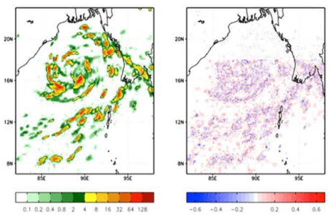
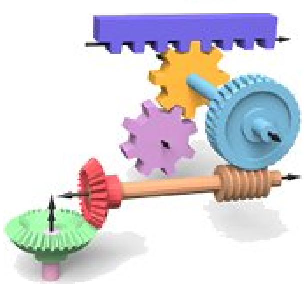
<body>
<div id="main">



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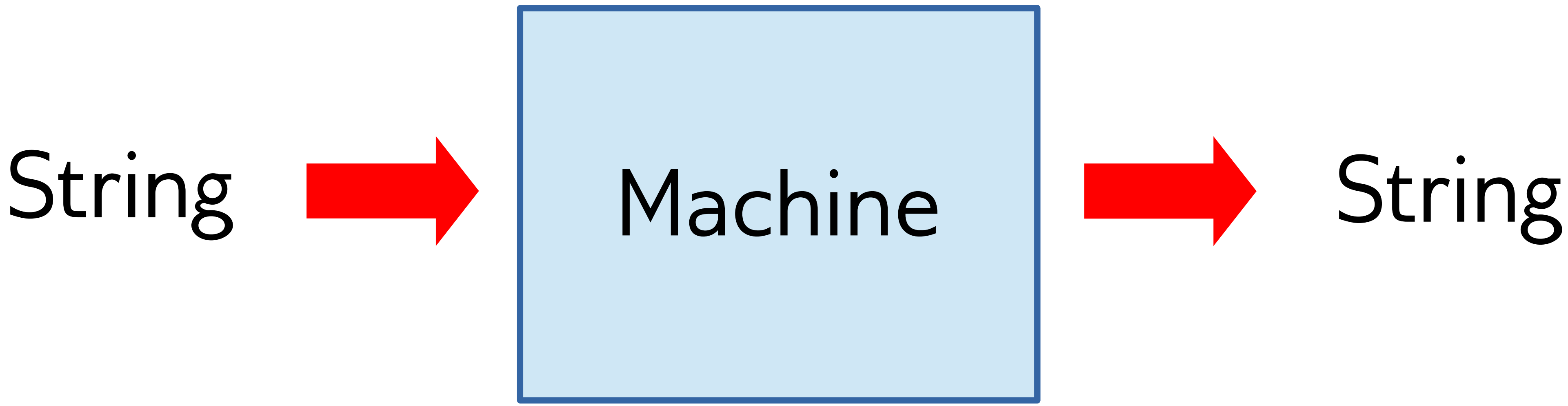
LIFE CYCLE OF A
FLOWERING PLANT
REPORT
Seed Germination

# A simplified model



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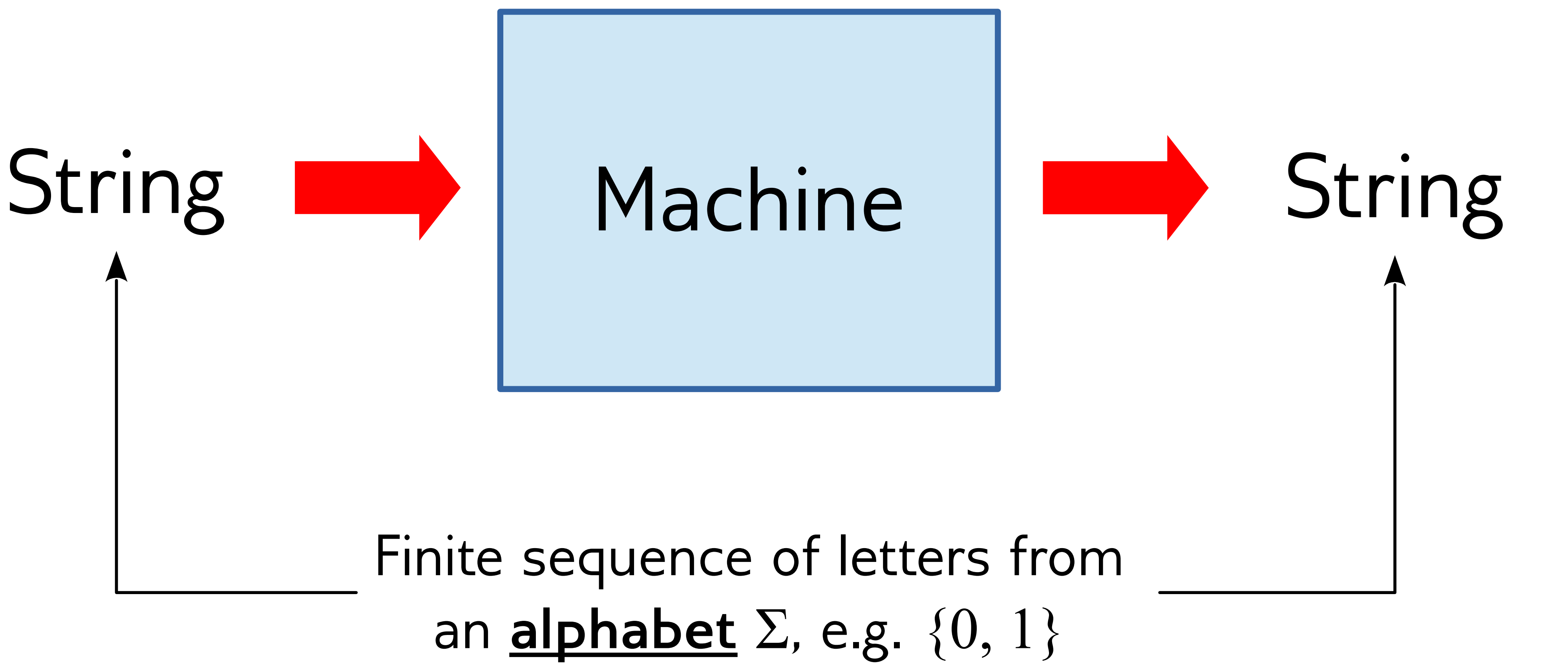
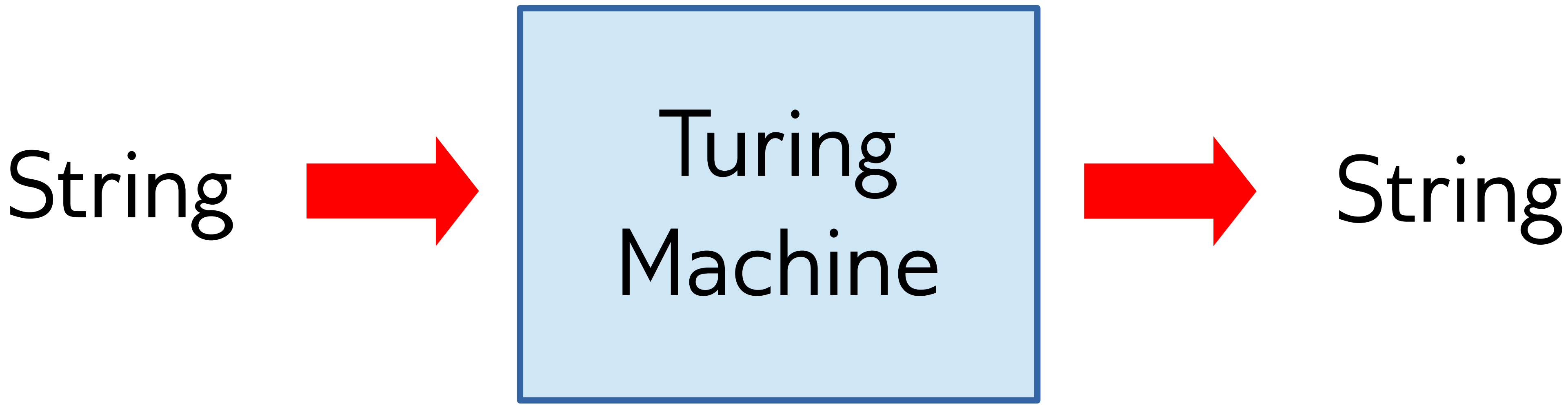


# A general-purpose computer



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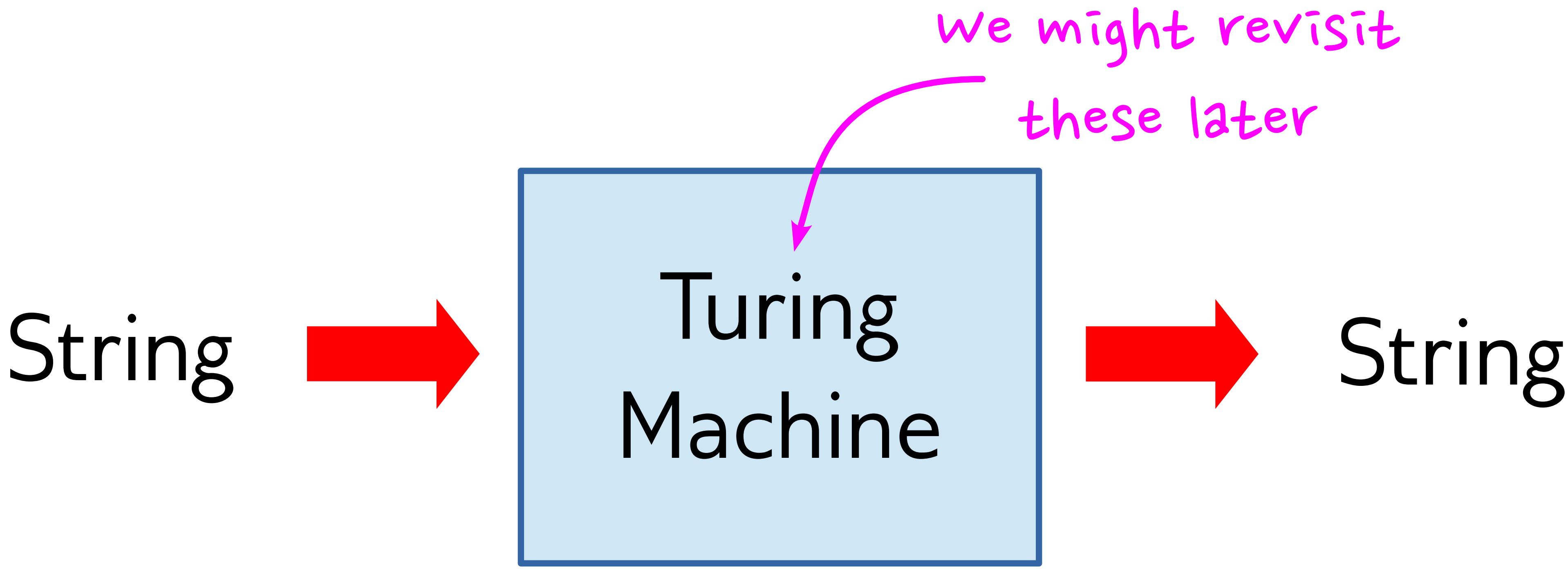

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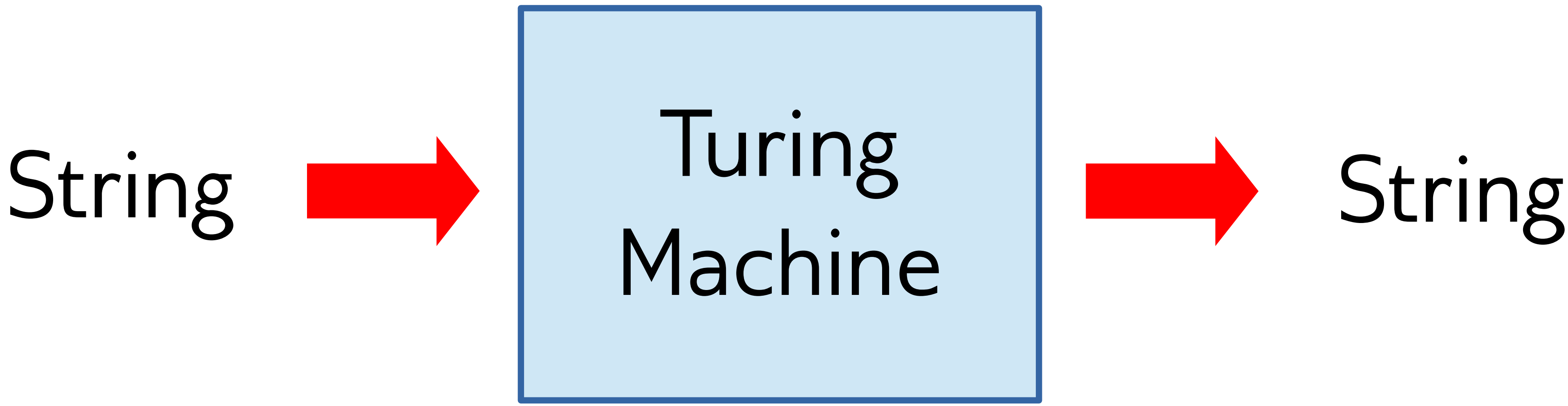
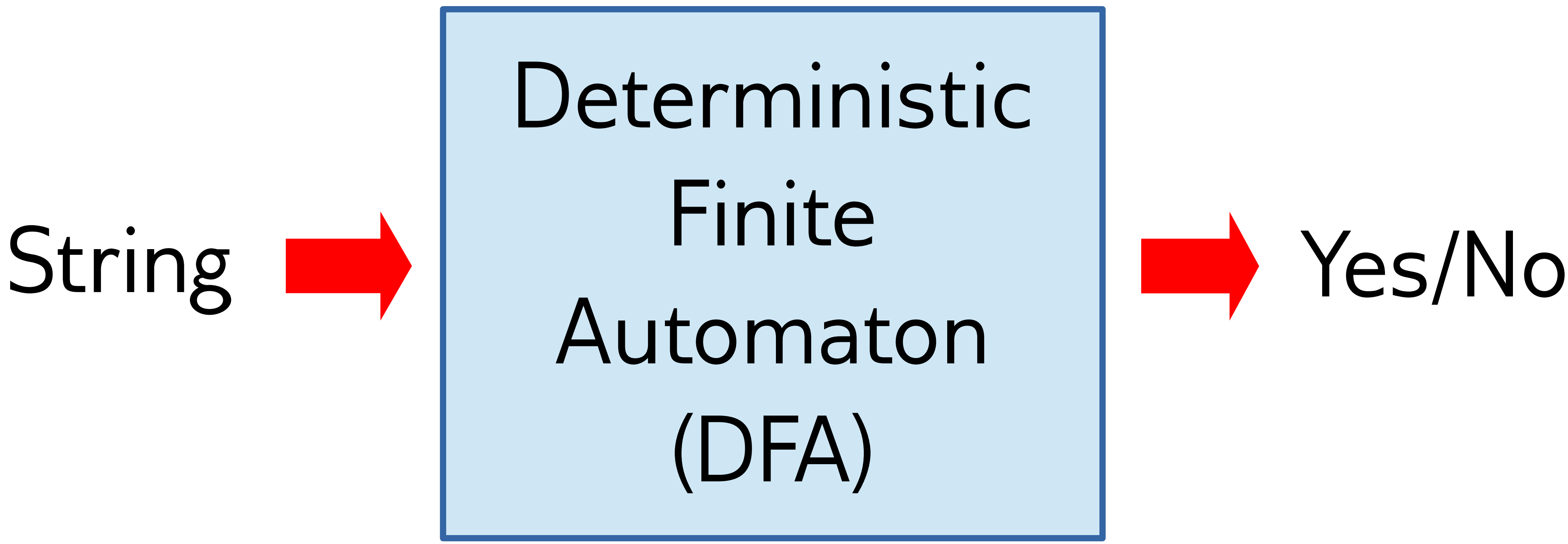


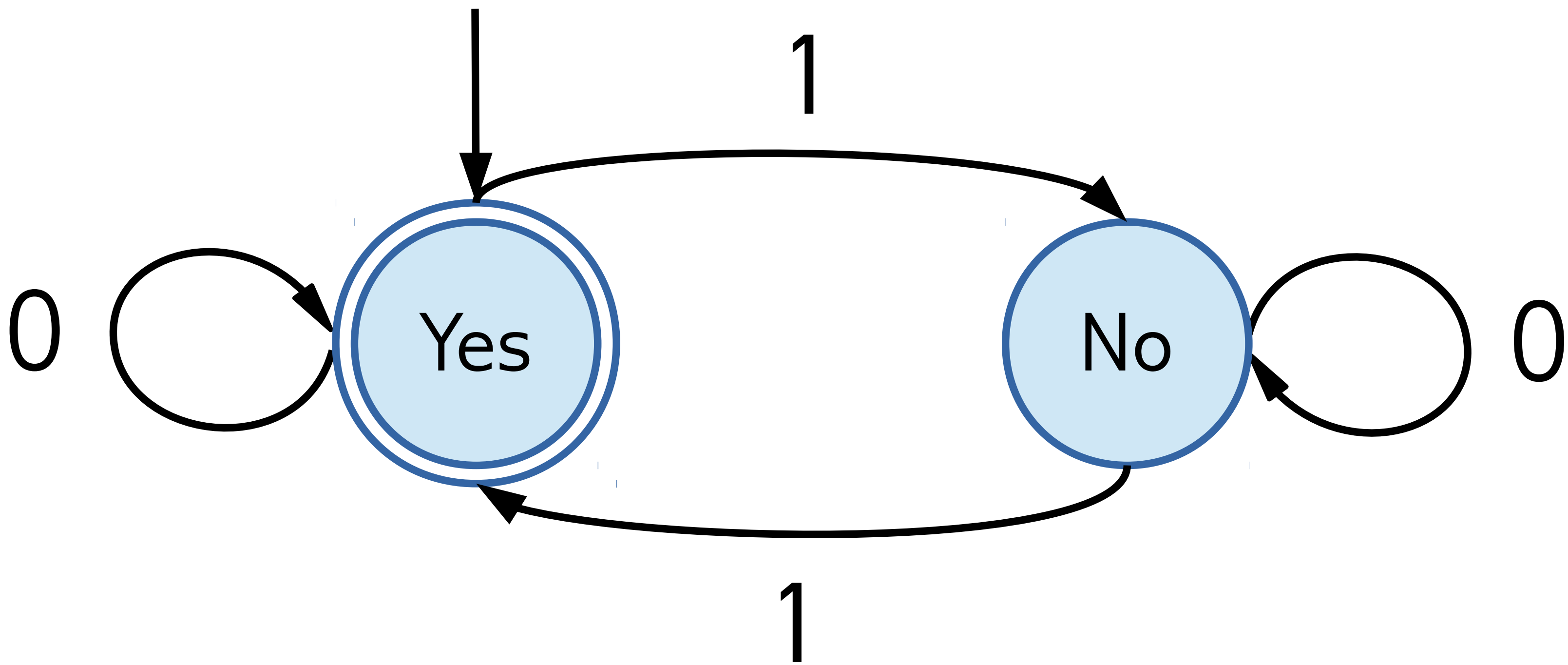

Church-Turing Thesis: Any “effective/mechanical/real-world” calculation can be carried out on a Turing machine

Alan Turing, 1912 – 1954

# A simple “computer”



# An example



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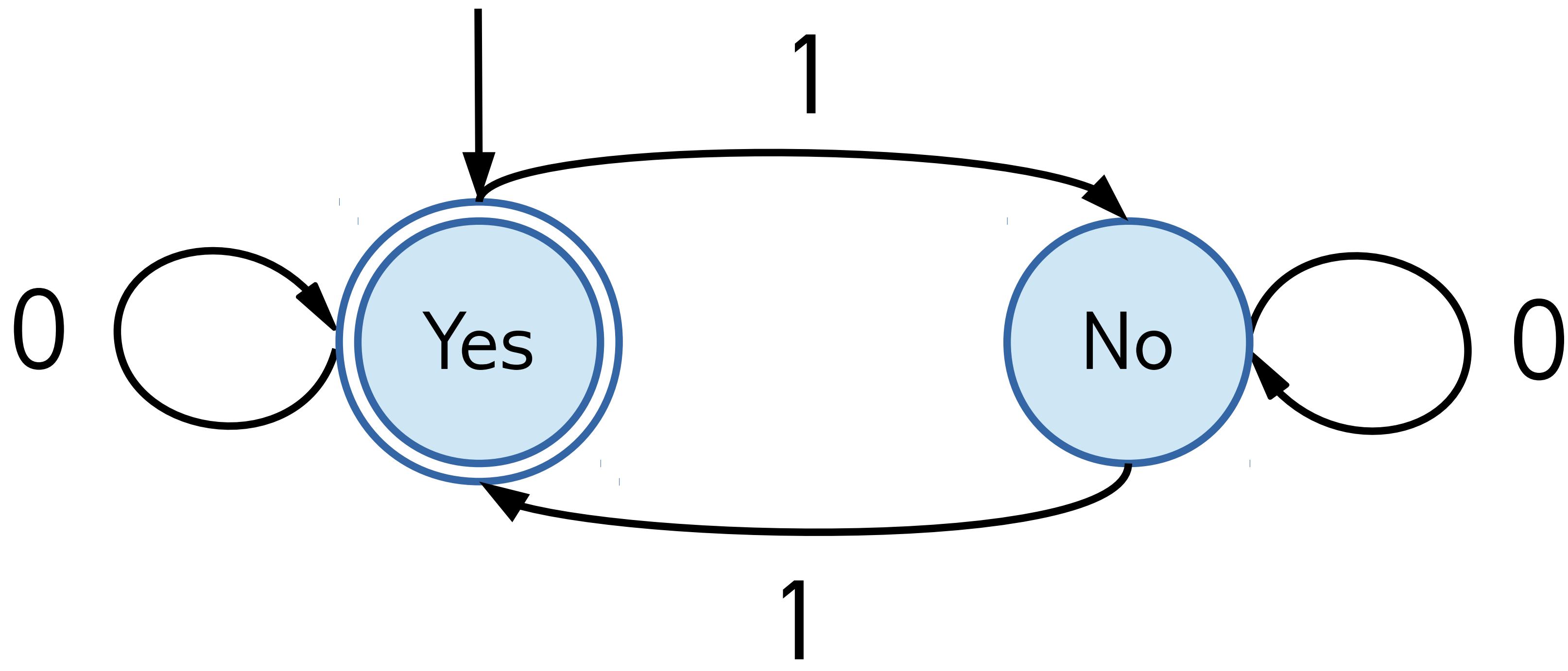
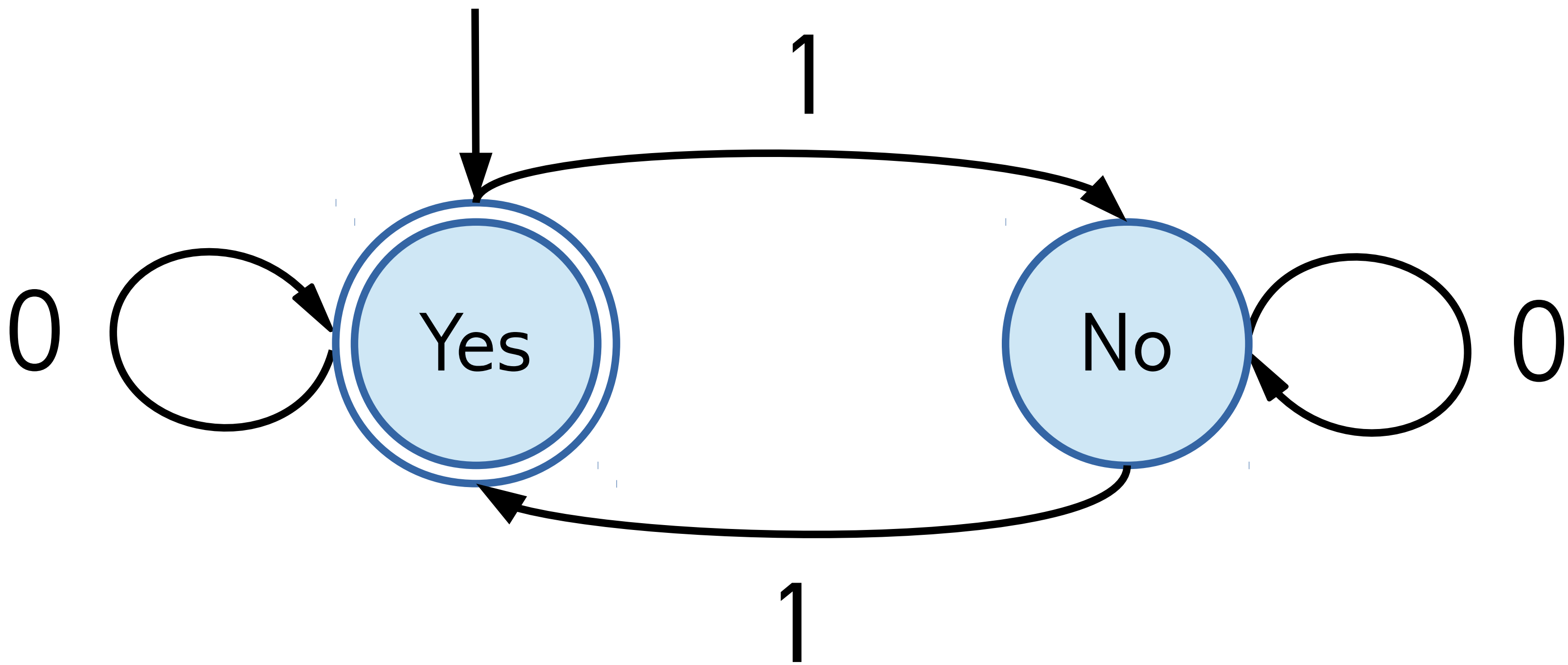


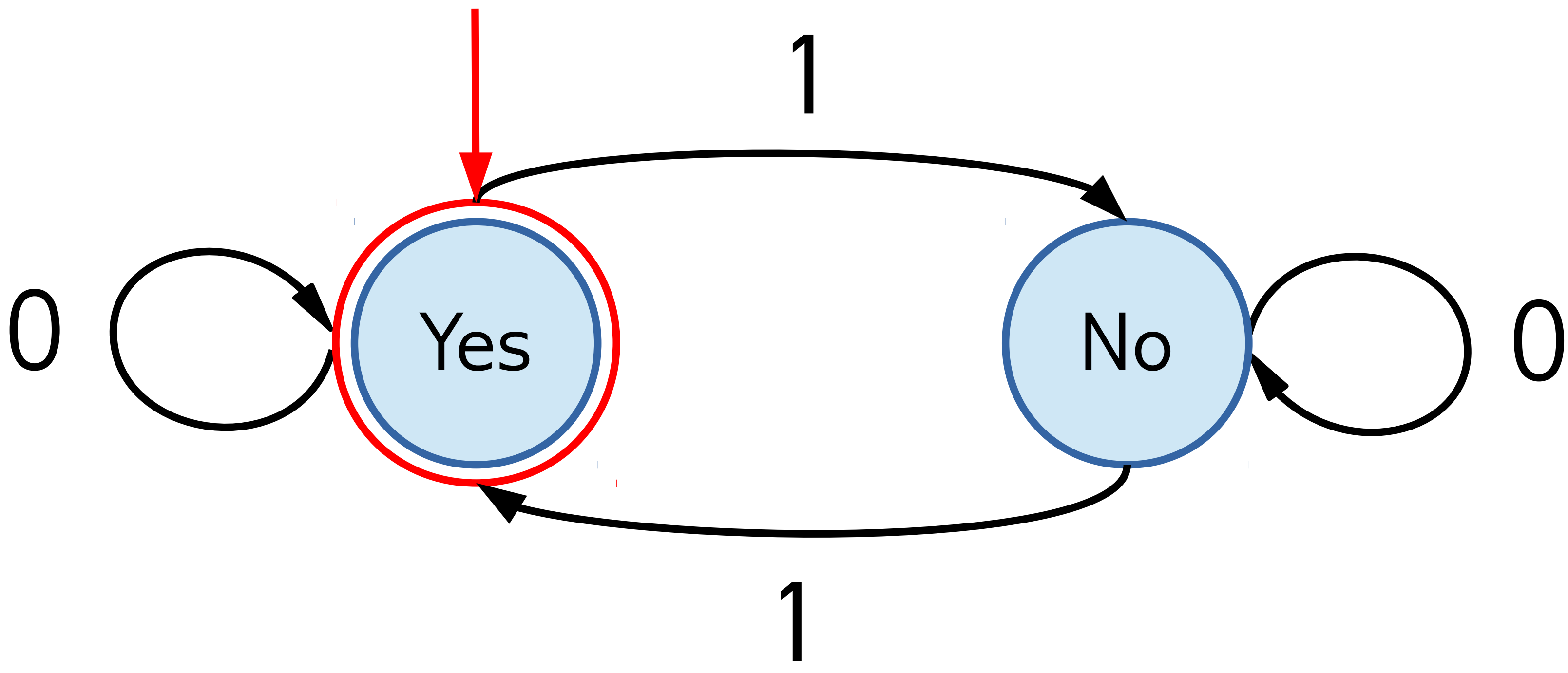

(Binary input)

# An example




Input: 01001

# An example

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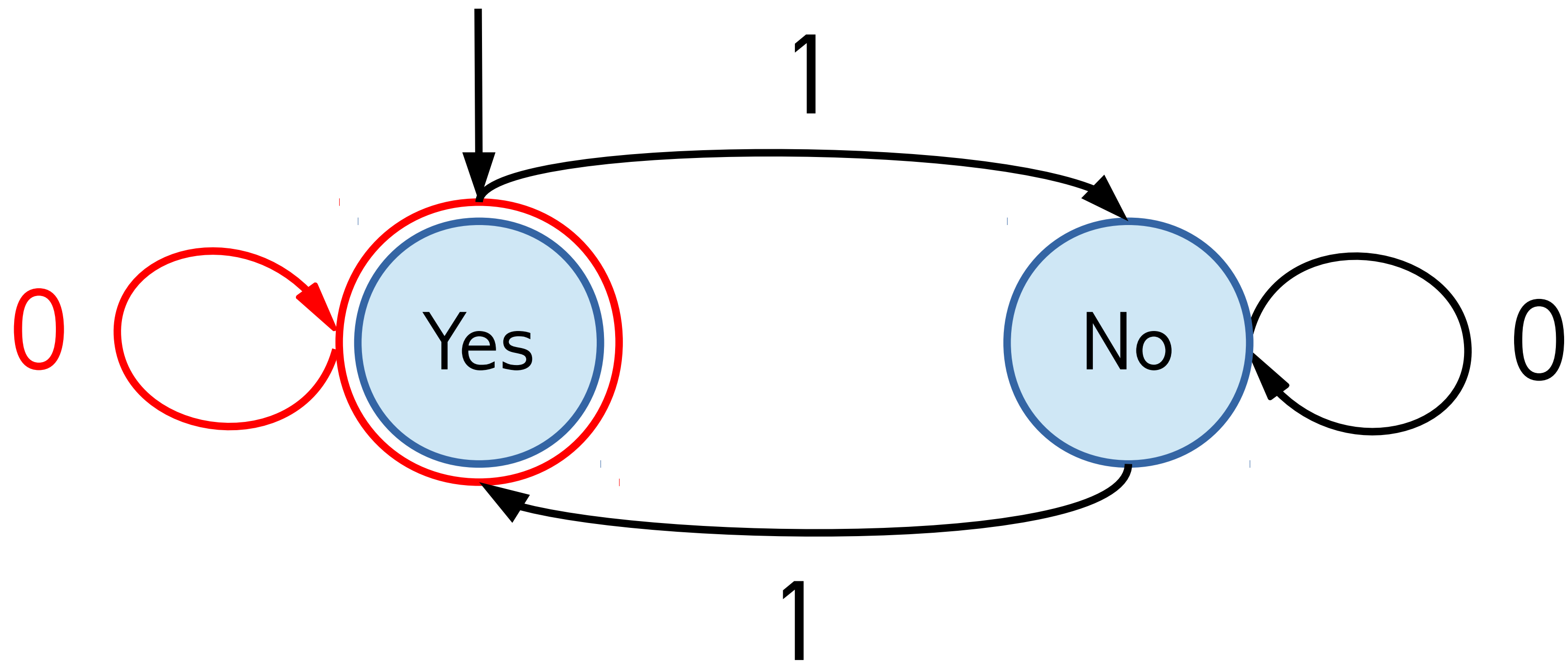


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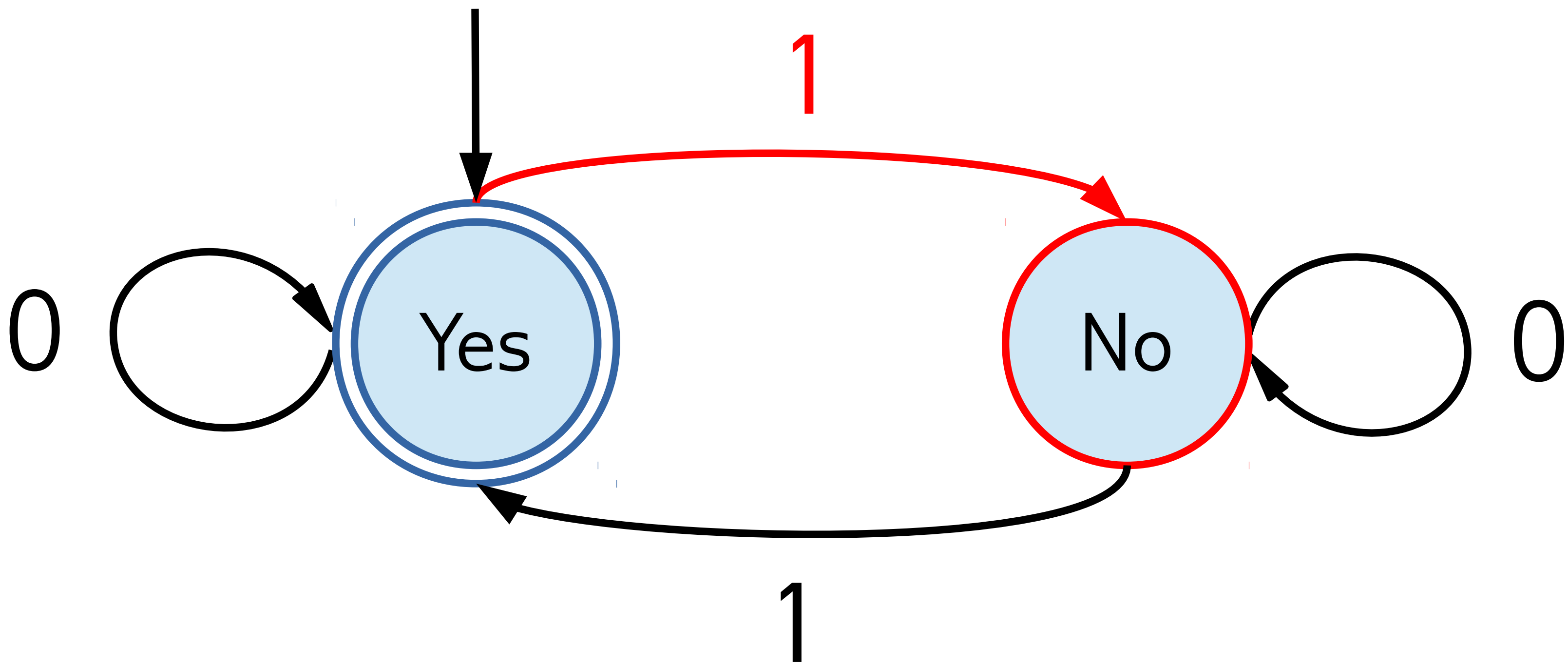


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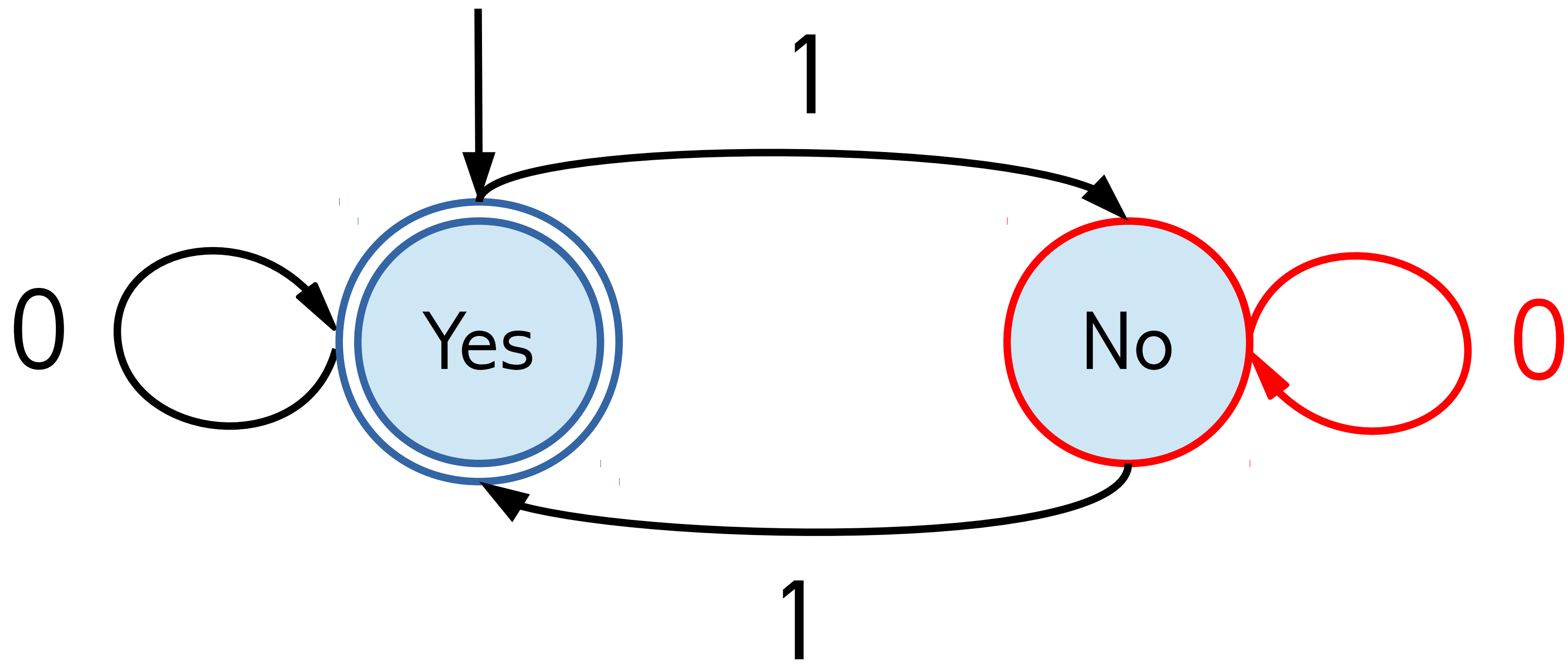


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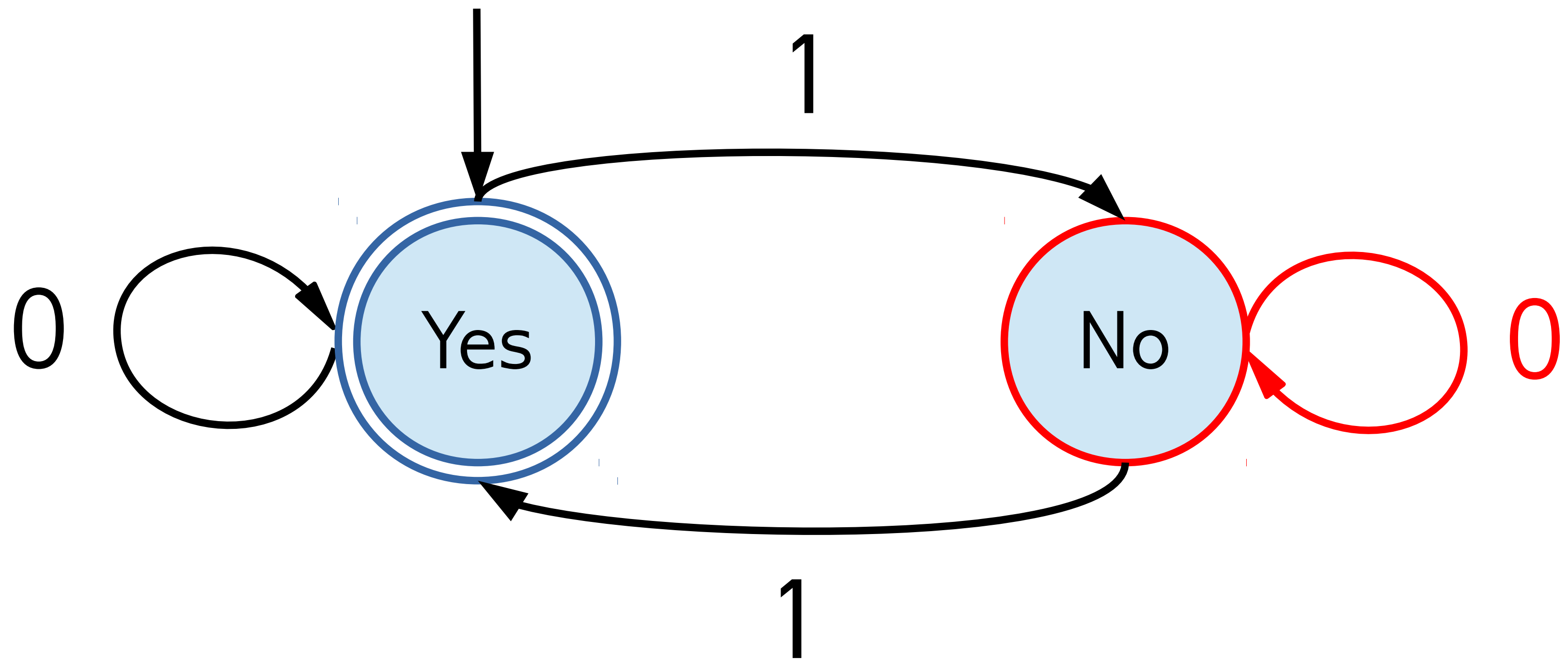


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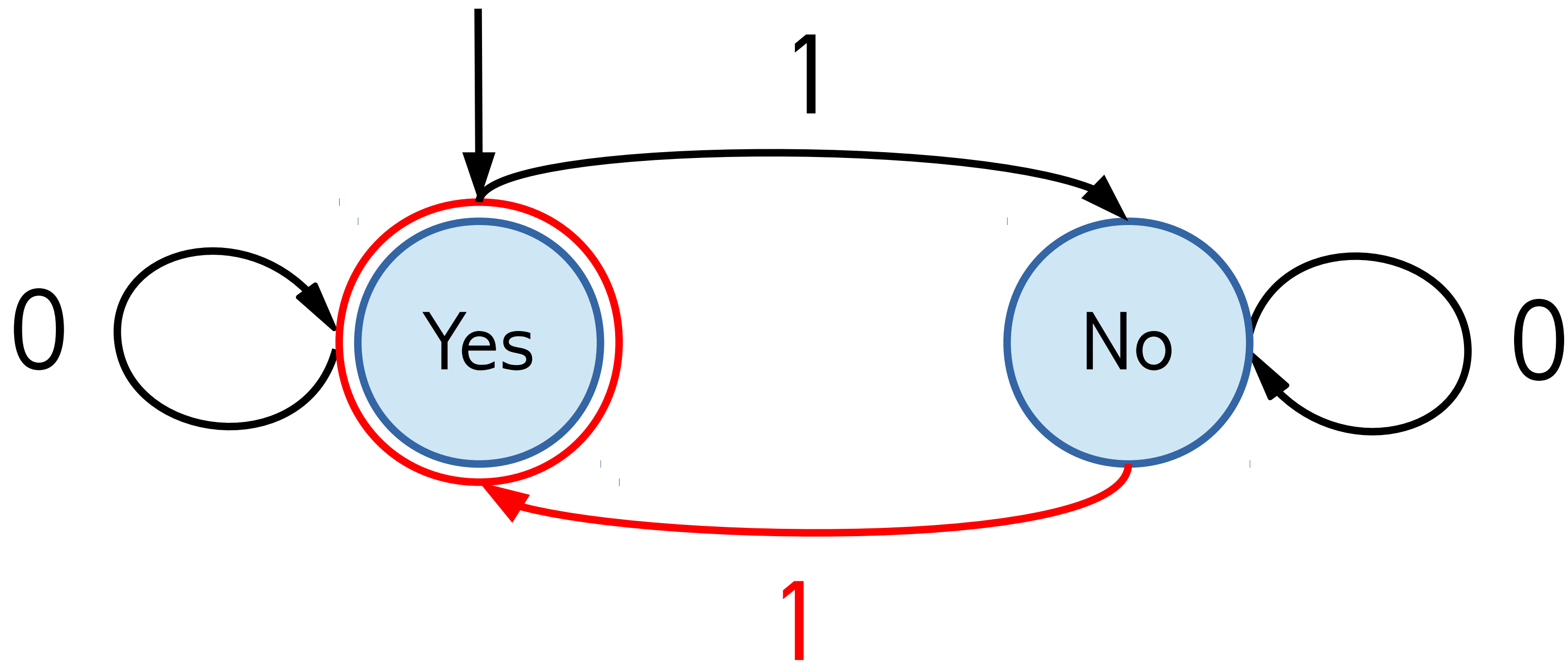


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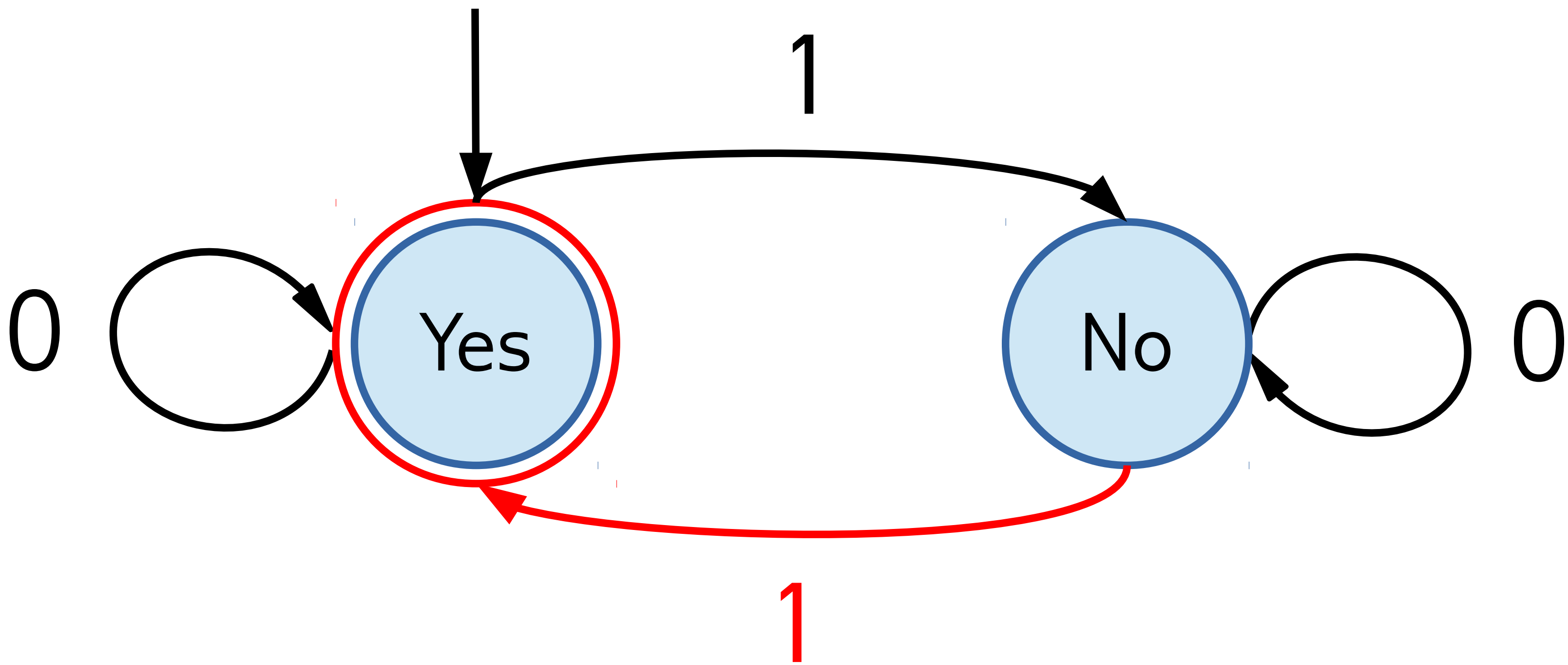
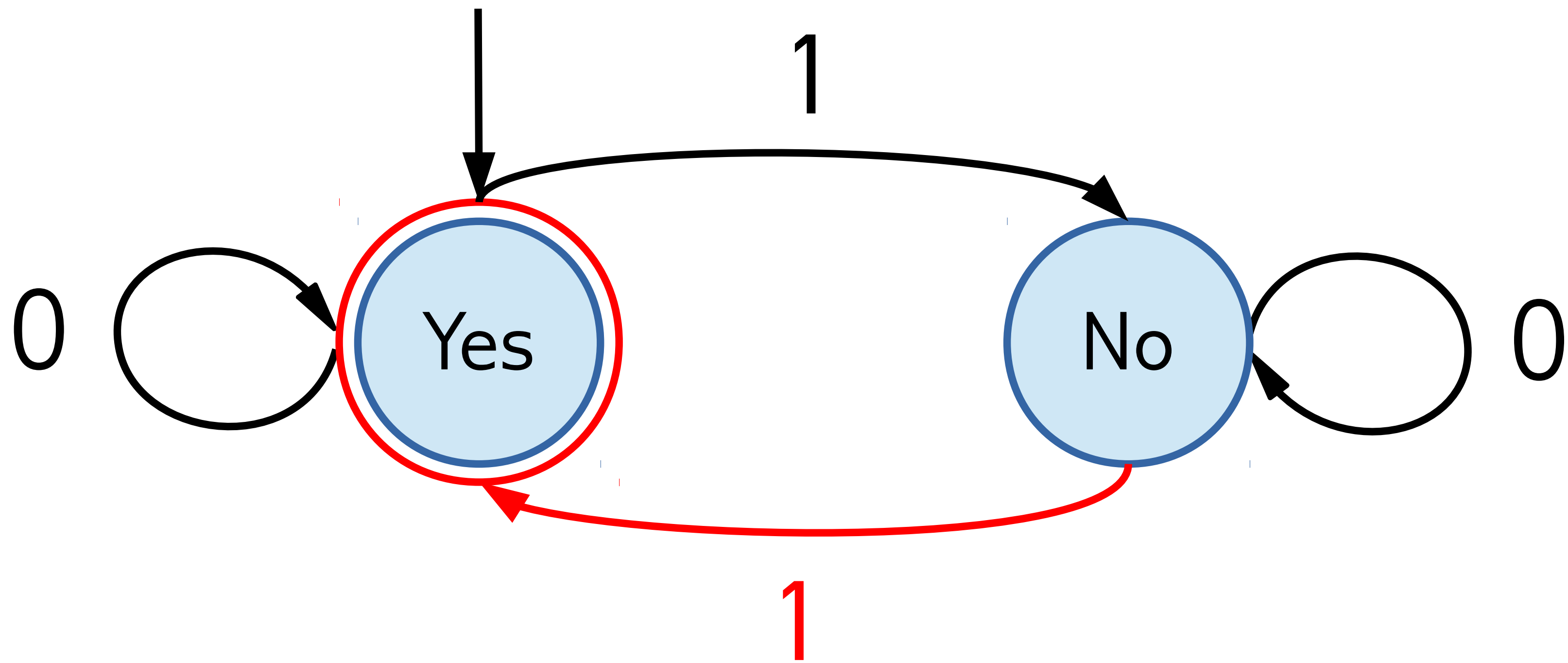



Input: 01001

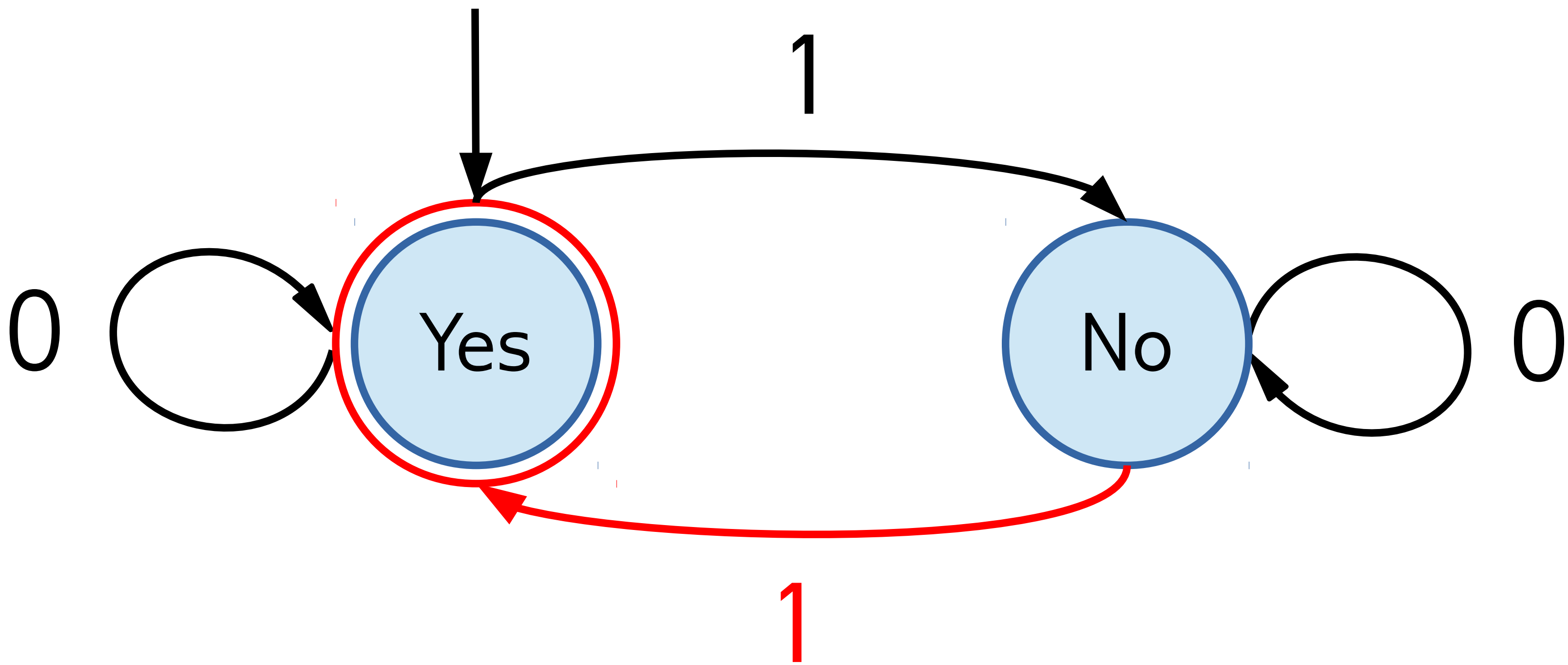
Output: Yes!

# An example




In general, on what binary strings does this DFA return Yes?

# An example




*Ans:* All strings with an even number of 1's

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Yes

No

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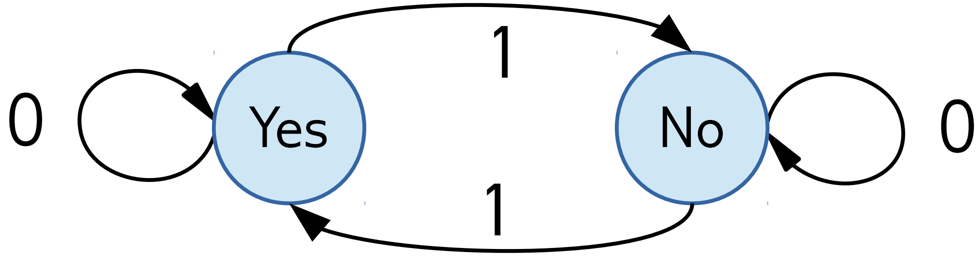

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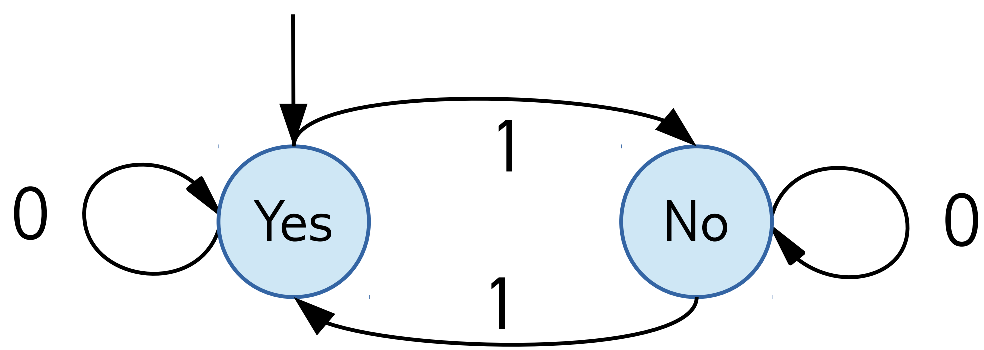

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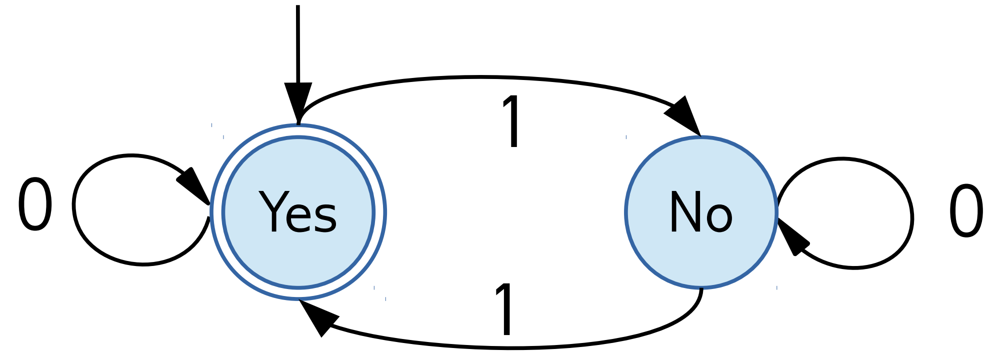
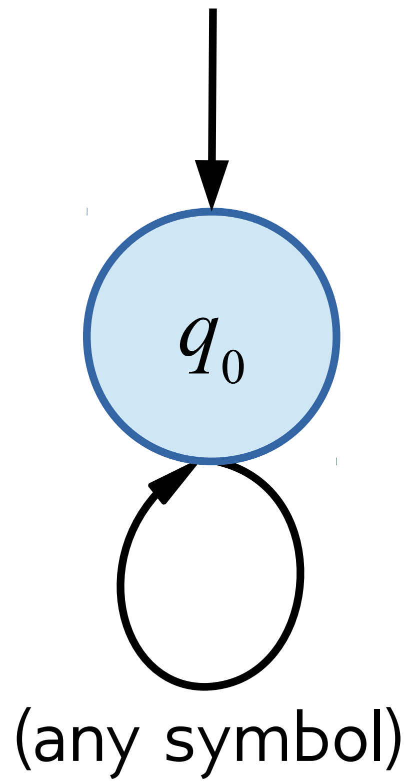
  - $F \subseteq Q$ is the set of final/accepting states



# What does this DFA accept?



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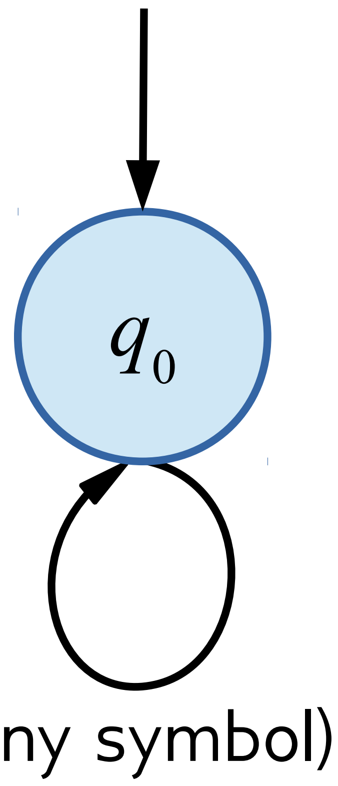


Answer: No strings

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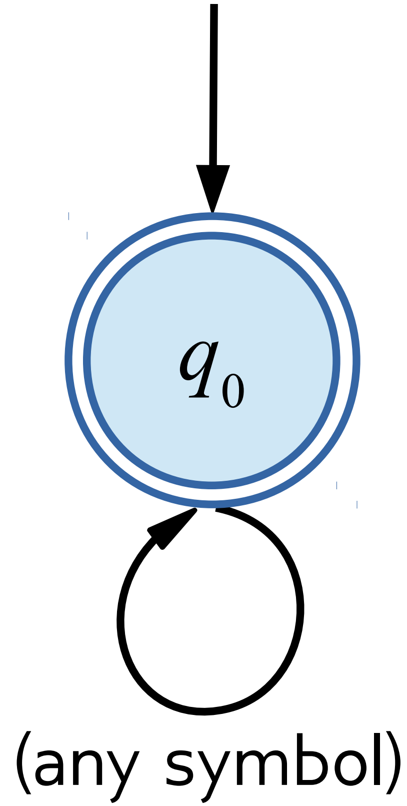

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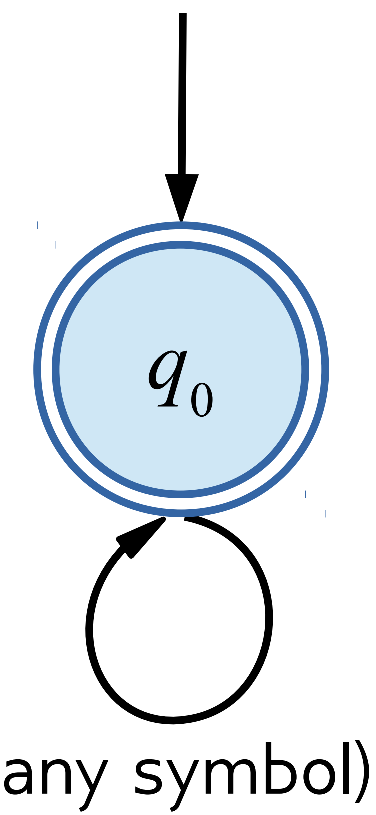


Answer: All strings

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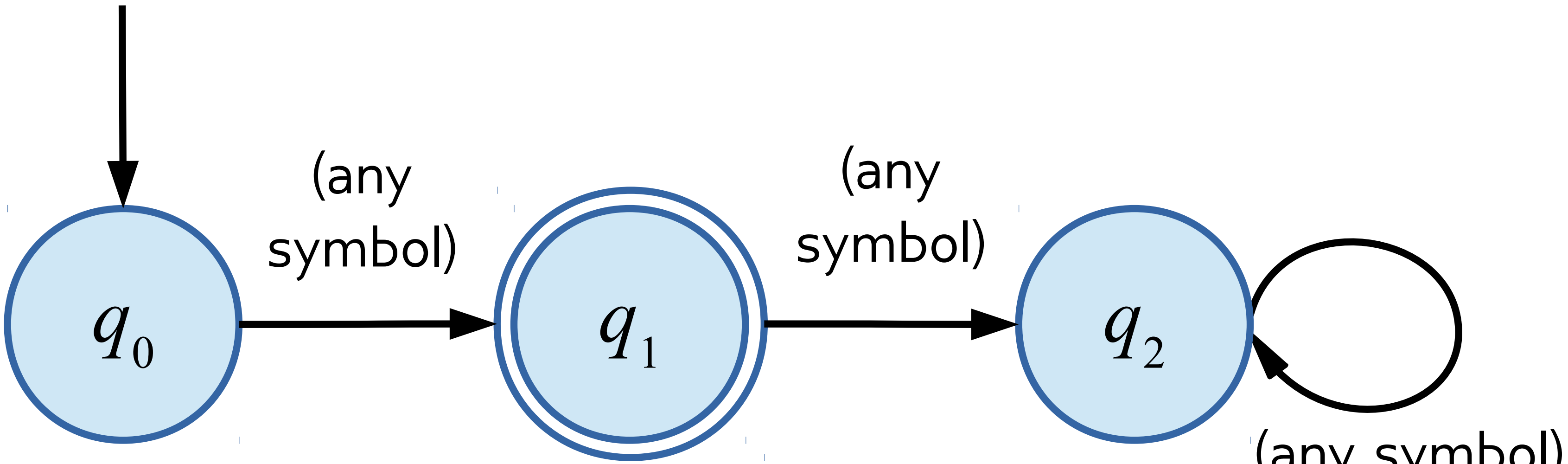

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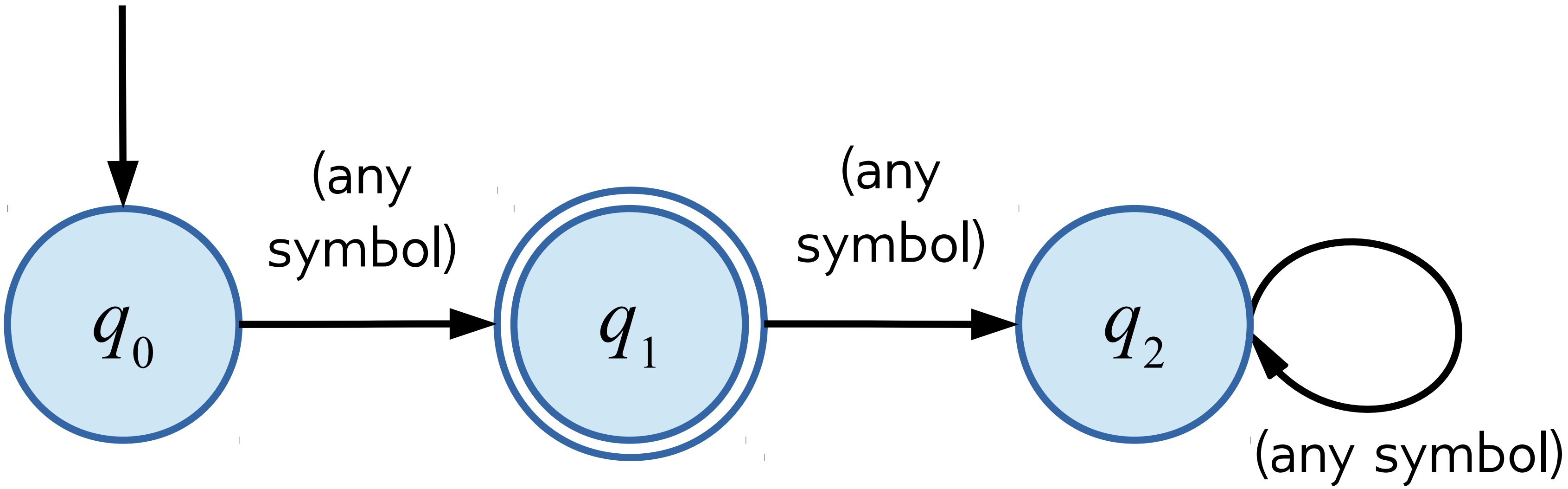


Answer: Strings of length 1

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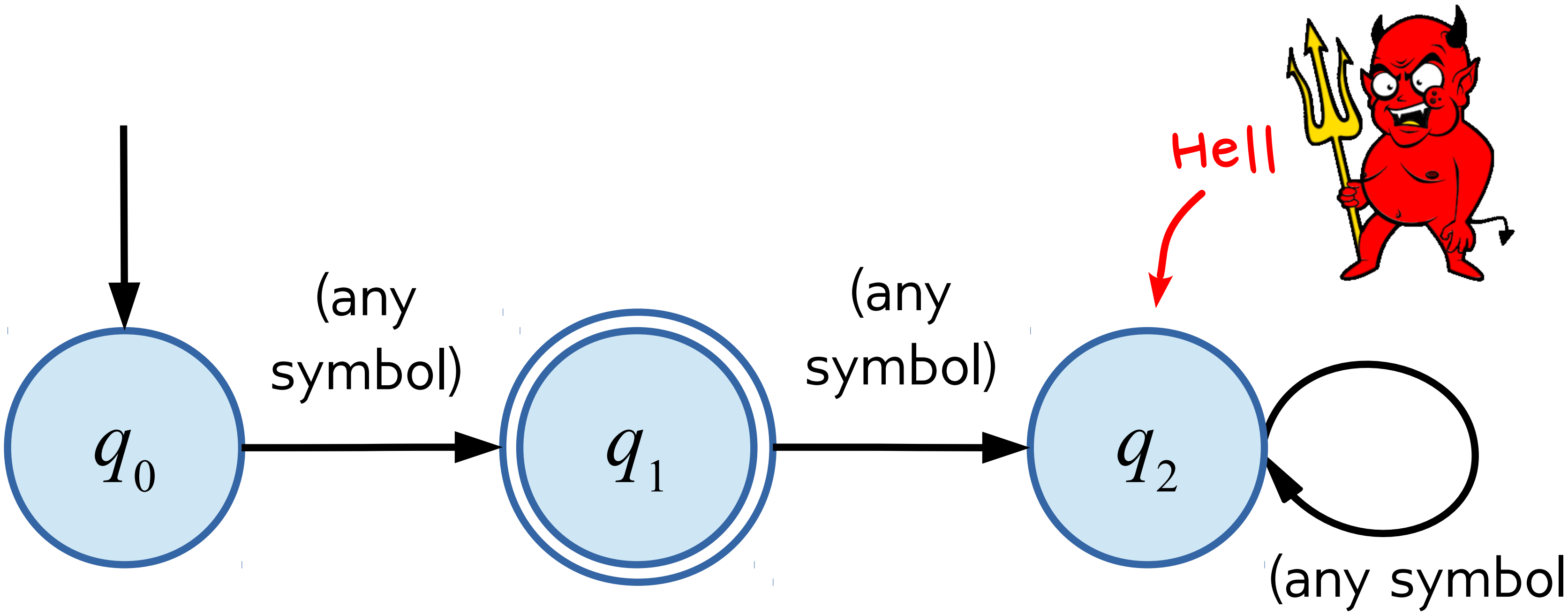


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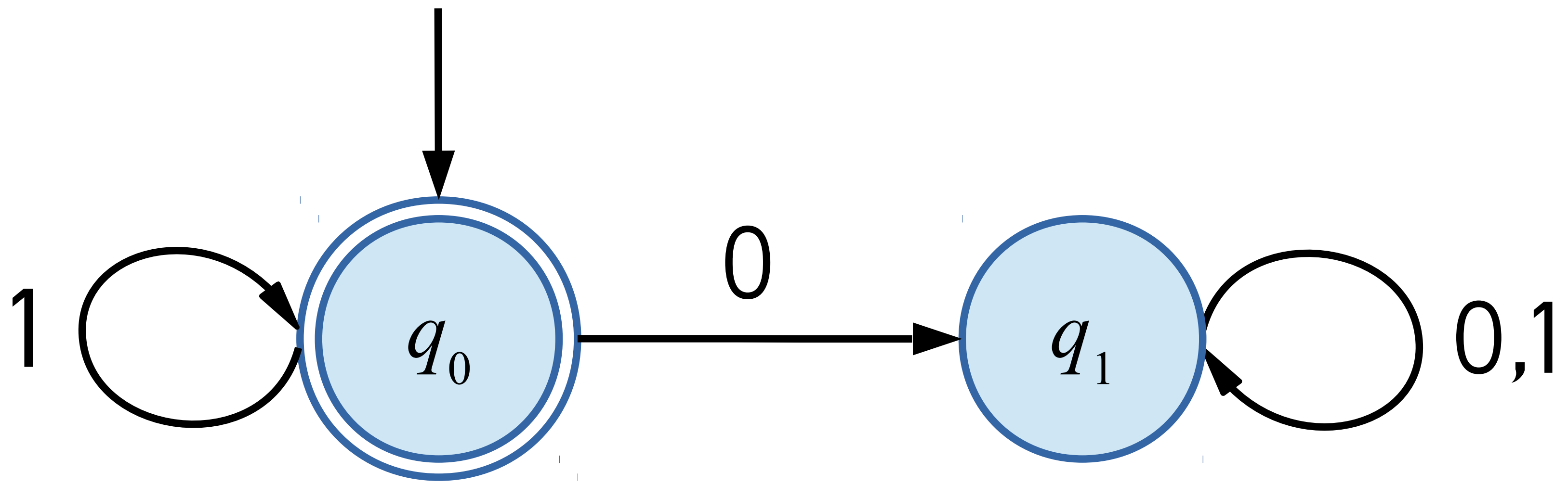

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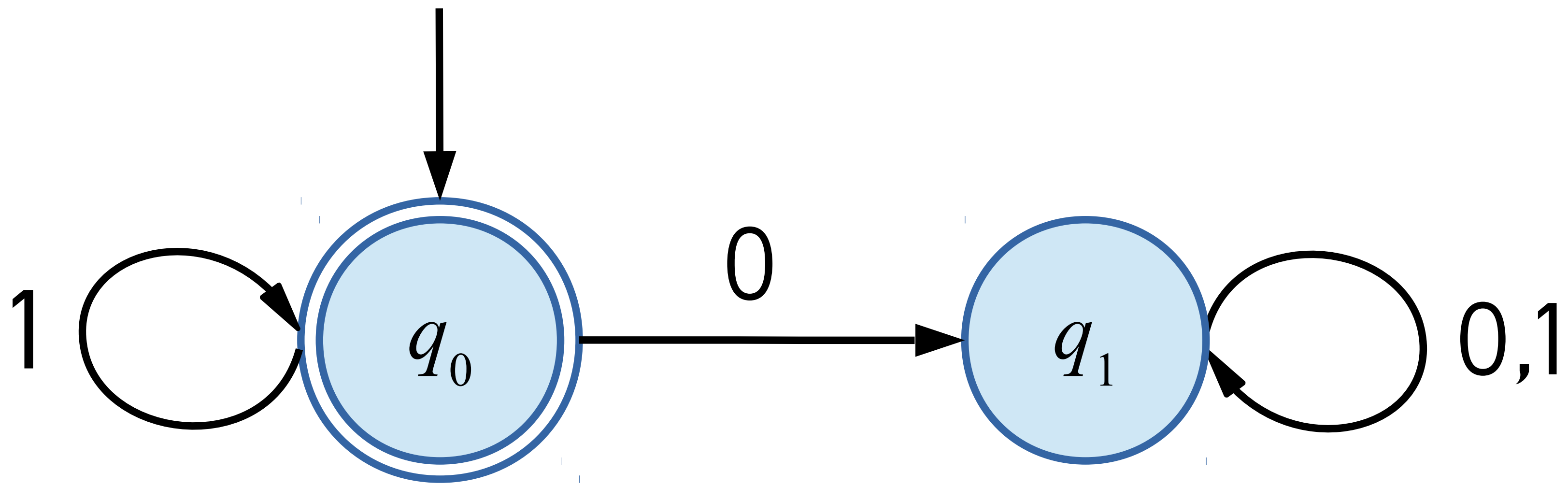


Answer: Strings containing only 1's

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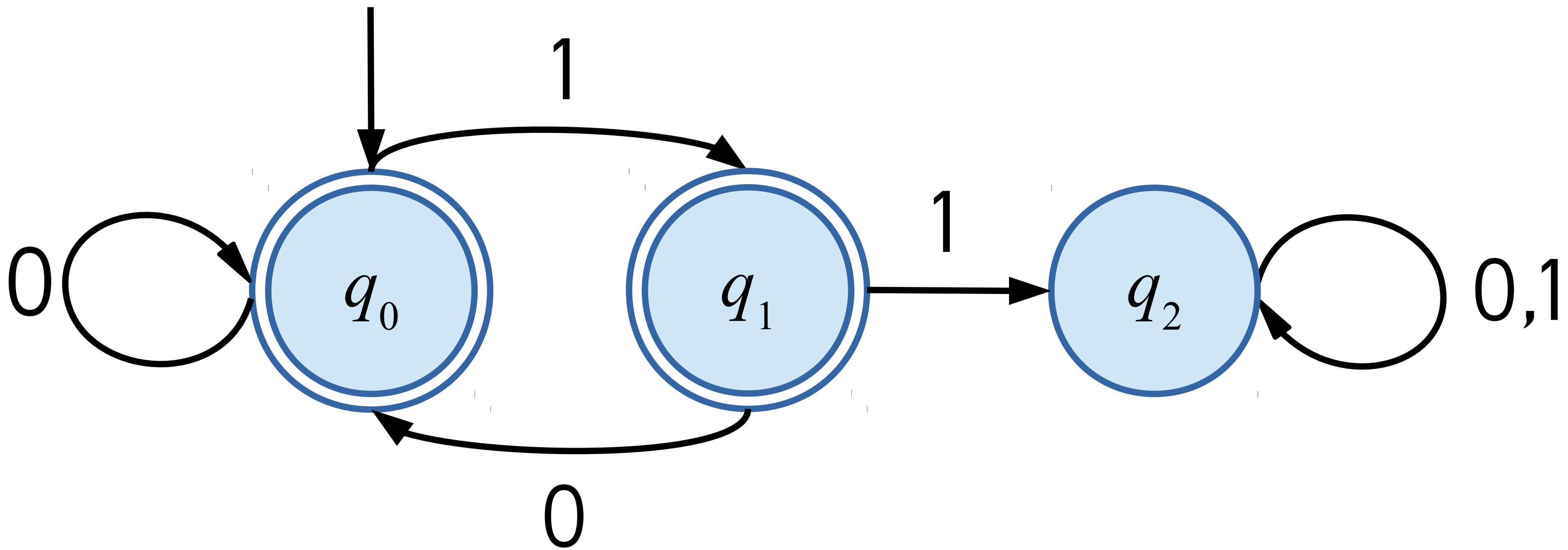

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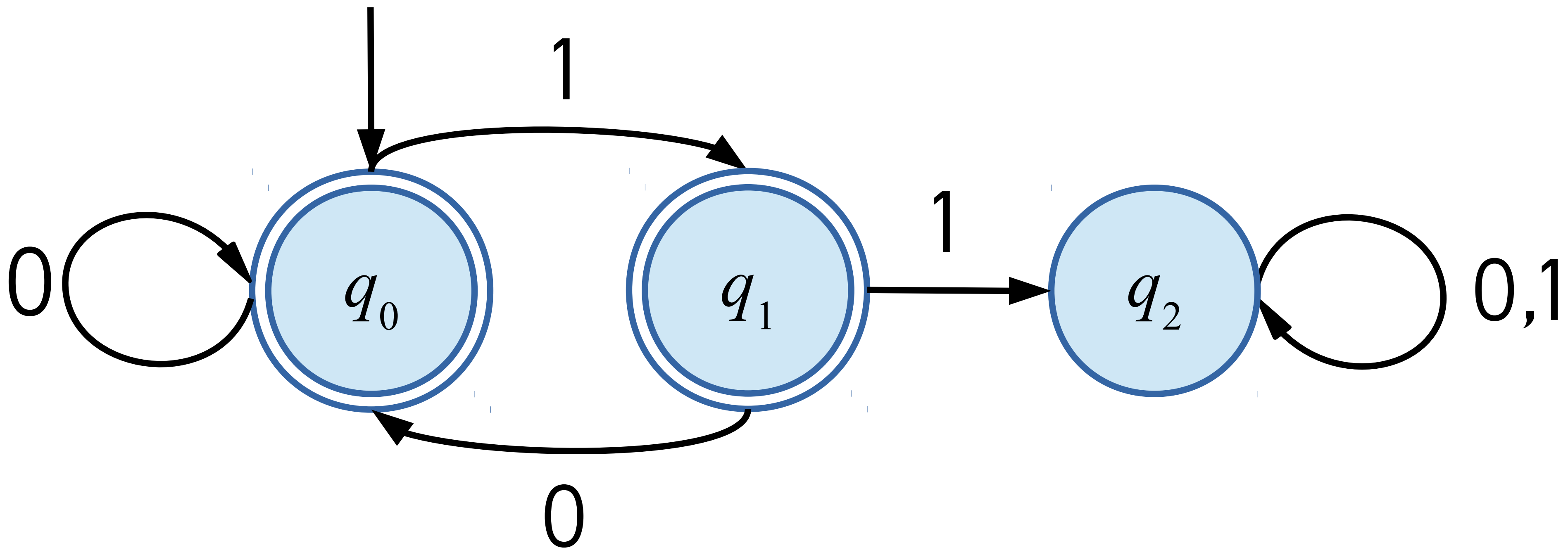


Answer: Strings containing no two consecutive 1's

# Language

- Given alphabet $\Sigma$, a language $L$ is a set of strings over the alphabet, i.e. $L \subseteq \Sigma^*$

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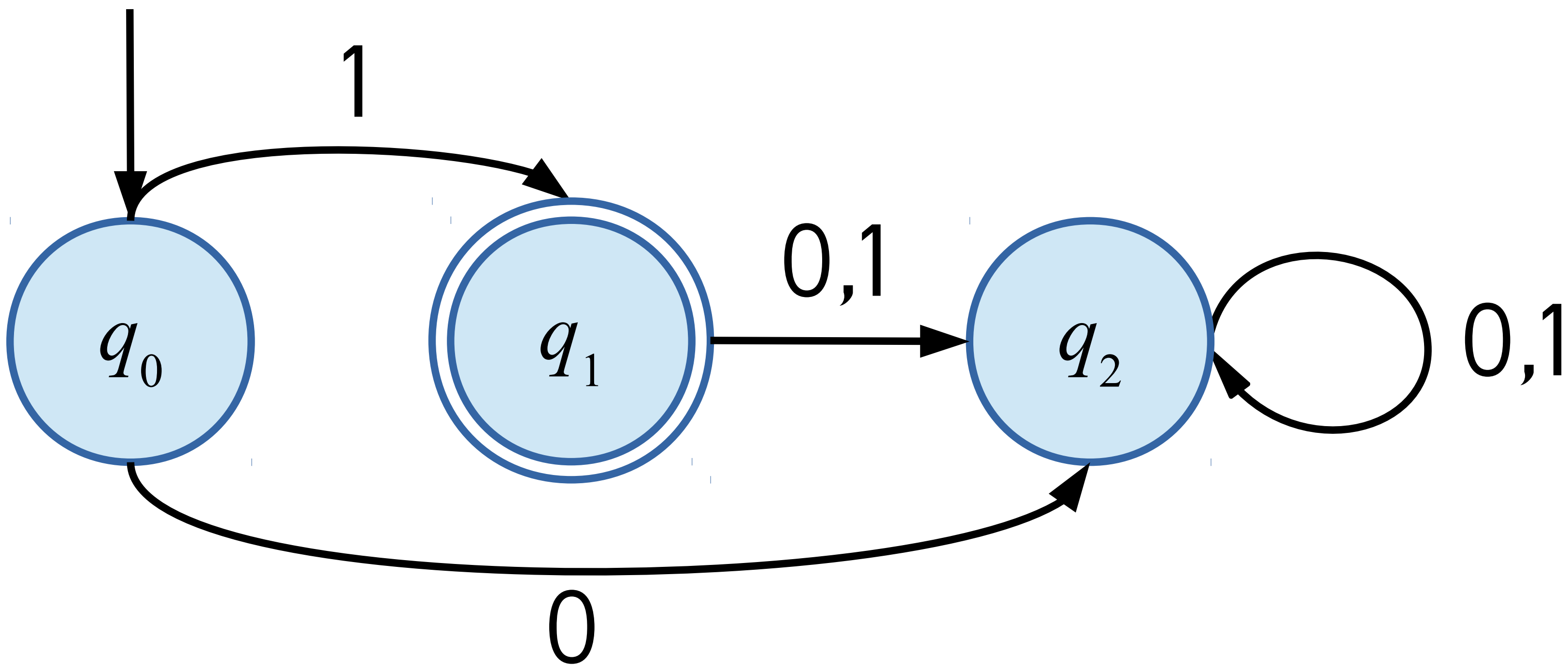

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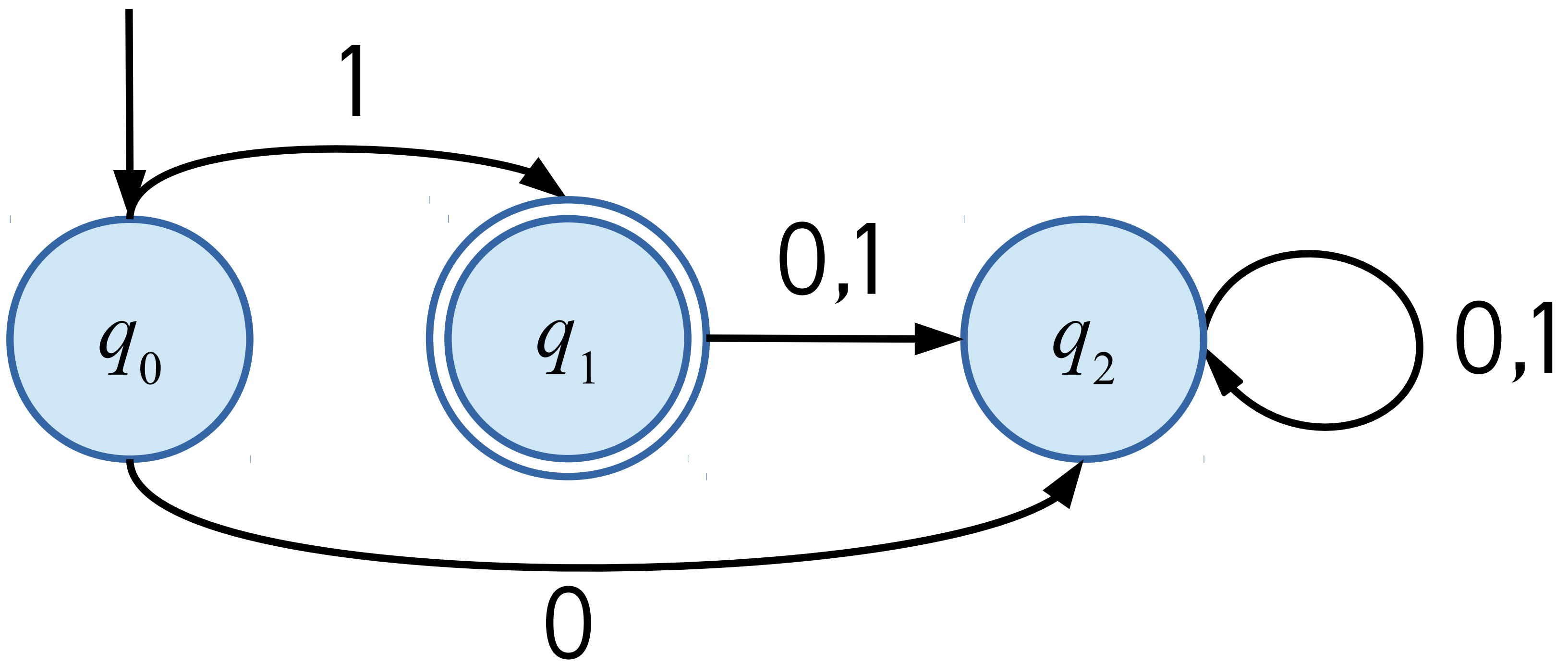


Answer: Only the string 1

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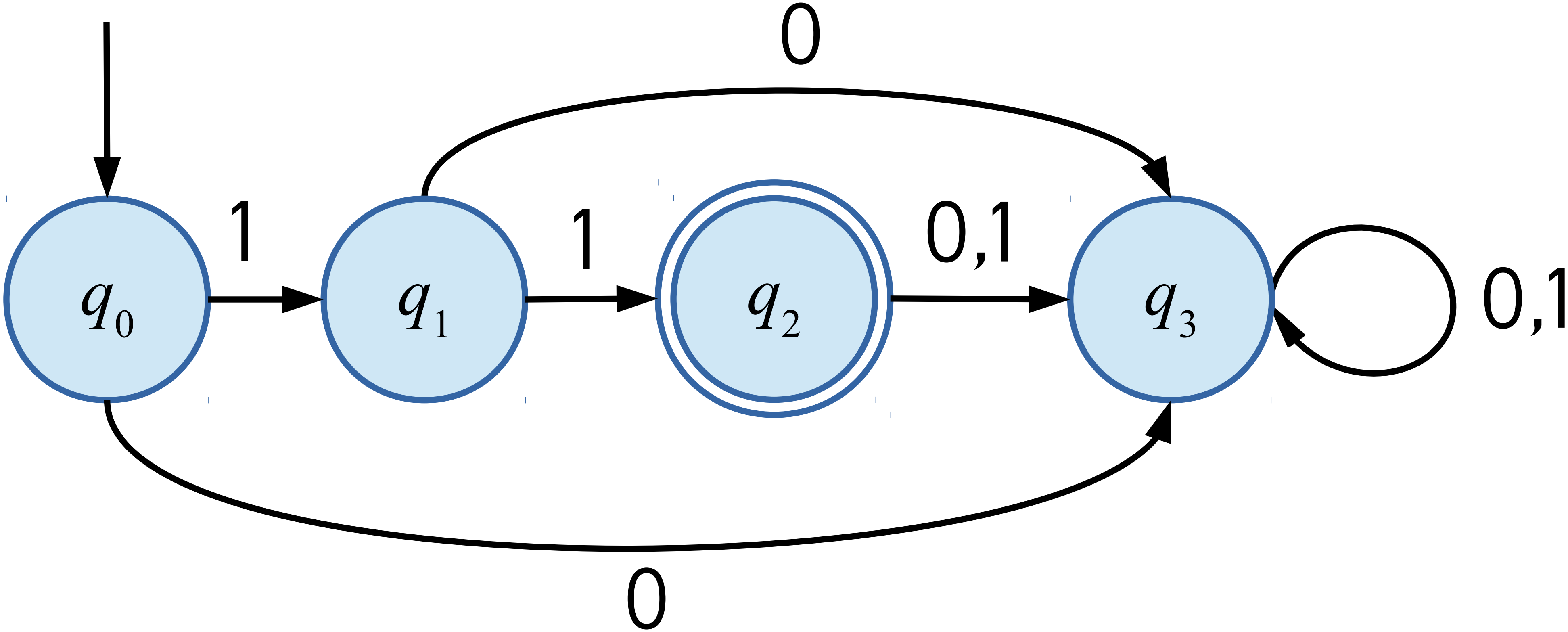

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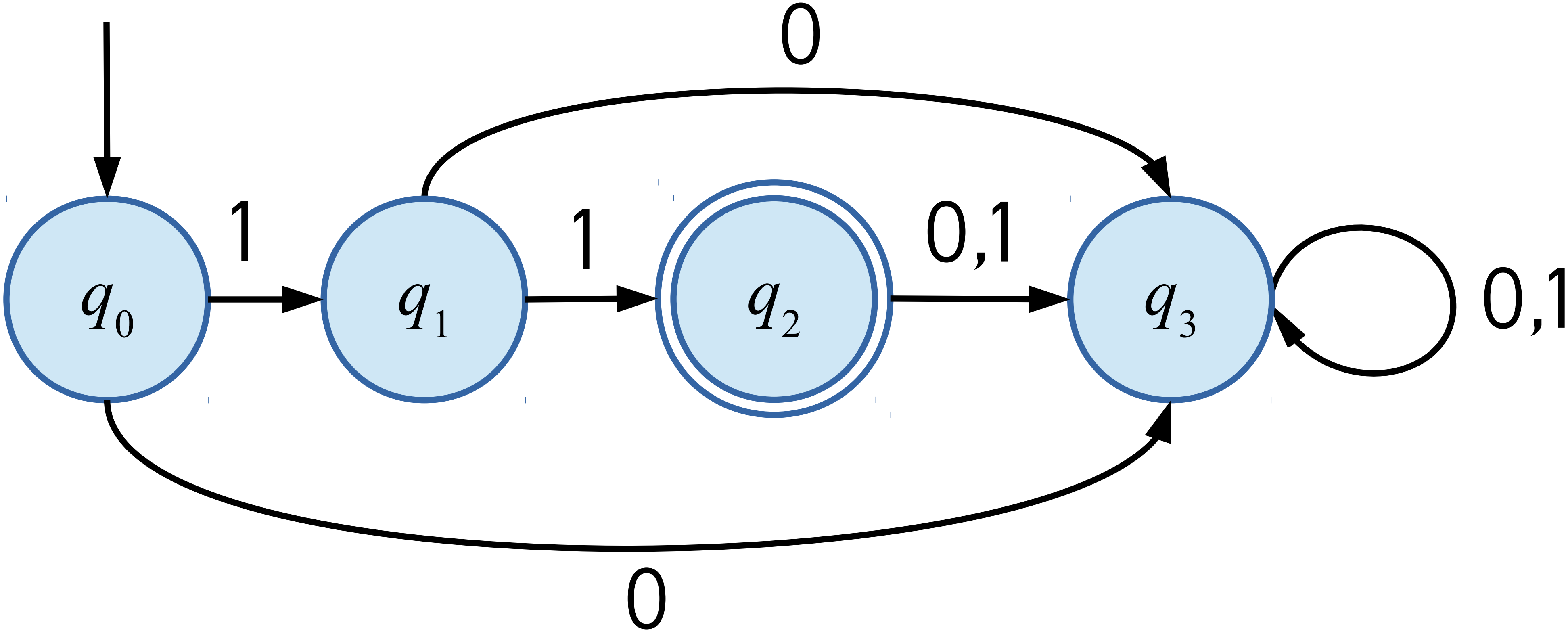


Answer: Only the string 11

# DFA's find it difficult to count

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- A DFA that recognizes the language $\{1^c\}$ (the single string of $c$ 1's) must have at least $c$ states
  - The parent alphabet is irrelevant (but must of course contain 1)

(Proof discussion to be completed next class)