Finite Automata

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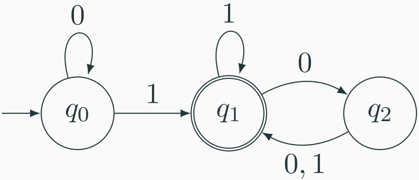
Finite Automaton: Example 1



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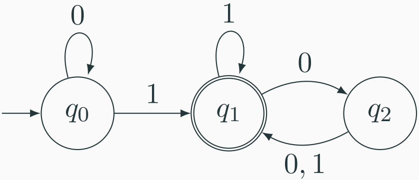
Finite Automaton: Example 1



Try running the automaton on the following strings.
1101, 1, 01, 11, 0101010101, 100, 0100,
110000, 0101000000, 0, 10, 101000

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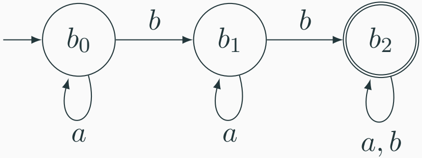
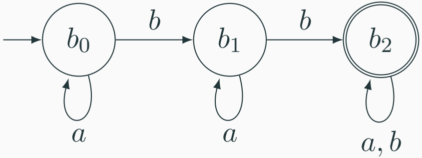
Finite Automaton: Example 2



Sipser chapter 1 4(a) – Part 2

Finite Automaton: Example 2

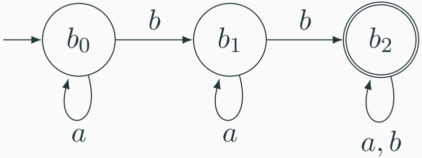


Try running the automaton on the following strings.

$aaaa$, $ababa$, $bababb$, $abaa$

Sipser chapter 1 4(a) – Part 2

Finite Automaton: Example 2



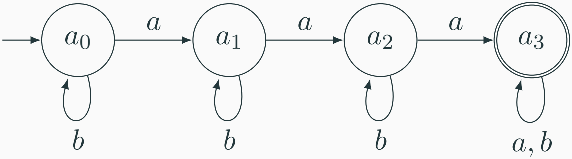
Try running the automaton on the following strings.

$aaaa$, $ababa$, $bababb$, $abaa$

Describe the strings that the automaton recognises.

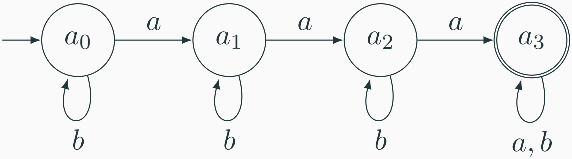
Sipser chapter 1 4(a) – Part 2

Finite Automaton: Example 3



Sipser chapter 1 4(a) – Part 1

Finite Automaton: Example 3



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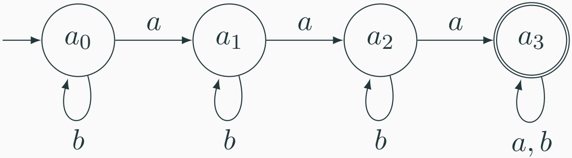
Sipser chapter 1 4(a) – Part 1

Finite Automaton: Example 3



Try running the automaton on the following strings.

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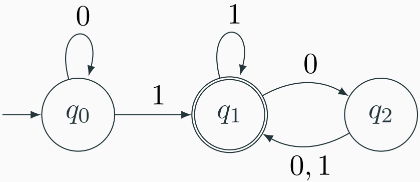
Describe the strings that the automaton recognises.

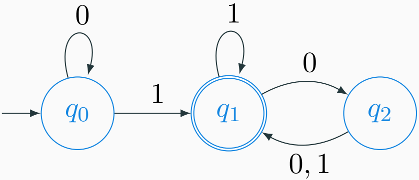
Sipser chapter 1 4(a) – Part 1

Finite Automaton: Concepts



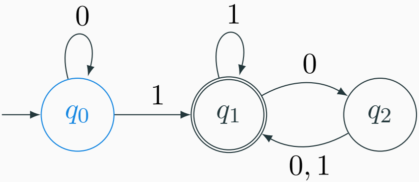
What are the essential concepts?

Finite Automaton: Concepts



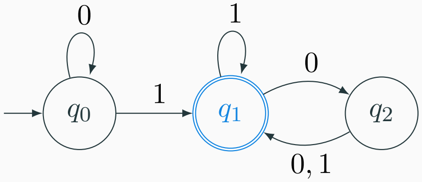
Set of states: $Q = \{q_0, q_1, q_2\}$

Finite Automaton: Concepts



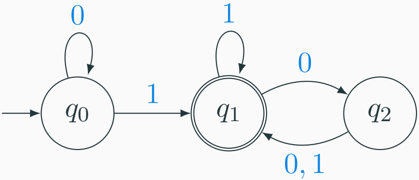
Initial state: $q_0 \in Q$

Finite Automaton: Concepts



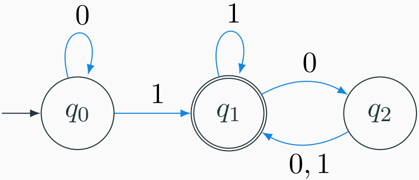
Set of final states: $F = \{q_1\} \subseteq Q$

Finite Automaton: Concepts



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

Finite Automaton: Concepts



Transition function: $\delta = \{((q_0, 0), q_0), ((q_0, 1), q_1), ((q_1, 0), q_2), \ldots\}$

Deterministic Finite Automaton (DFA) definition

A DFA is a 5-tuple $(Q, \Sigma, \delta, q_0, F)$ where

Q is a finite set of *states*,

Σ is a finite set called the *alphabet*,

δ is the *transition function* ($Q \times \Sigma \to Q$),

q_0 is the *start state* ($\in Q$), and

F is the set of *accept states* ($\subseteq Q$).

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Example 1 definition

$$
\begin{aligned}
Q &= \{q_0, q_1, q_2\} \\
\Sigma &= \{0, 1\} \\
\delta &= \{((q_0, 0), q_0), ((q_0, 1), q_1),\ ((q_1, 0), q_2), ((q_1, 1), q_1), \\
&\quad ((q_2, 0), q_1), ((q_2, 1), q_1)\} \\
q_0 &= q_0 \\
F &= \{q_1\}
\end{aligned}
$$

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Example 2 definition

$$
\begin{aligned}
Q &= \{b_0, b_1, b_2\} \\
\Sigma &= \{a, b\} \\
\delta &= \{((b_0, a), b_0), ((b_0, b), b_1), ((b_1, a), b_1), ((b_1, b), b_2), \\
&\quad ((b_2, a), b_2), ((b_2, b), b_2)\} \\
q_0 &= b_0 \\
F &= \{b_2\}
\end{aligned}
$$

Example 3 definition

$$
\begin{aligned}
Q &= \{a_0, a_1, a_2, a_3\} \\
\Sigma &= \{a, b\} \\
\delta &= \{((a_0, a), a_1), ((a_0, b), a_0),\ ((a_1, a), a_2), ((a_1, b), a_1), \\
&\quad ((a_2, a), a_3), ((a_2, b), a_2)\},\ ((a_3, a), a_3), ((a_3, b), a_3)\} \\
q_0 &= a_0 \\
F &= \{a_3\}
\end{aligned}
$$