Finite Automata

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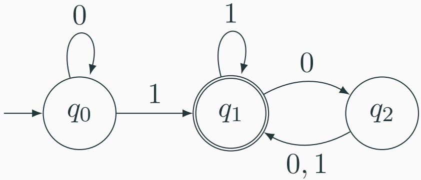
Deterministic Finite Automaton: Example 1



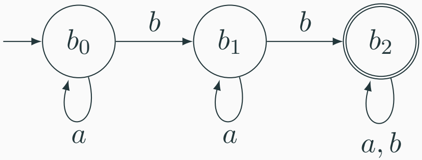
Try running the following strings on the automaton.

$1101,\ 1,\ 01,\ 11,\ 0101010101$

Describe the strings that the automaton recognises.

Sipser page 34

Deterministic Finite Automaton: Example 2



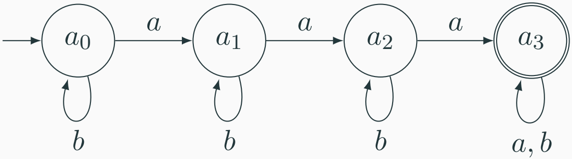
Try running the following strings on the automaton.

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

Describe the strings that the automaton recognises.

Sipser chapter 1 4(a) – Part 2

Deterministic Finite Automaton: Example 3



Try running the following strings on the automaton.

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

Describe the strings that the automaton recognises.

Sipser chapter 1 4(a) – Part 1

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* $(\subseteq Q)$.

Sipser page 35

Example 1 definition

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

Sipser page 36

Example 2 definition

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

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

Example 3 definition

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

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