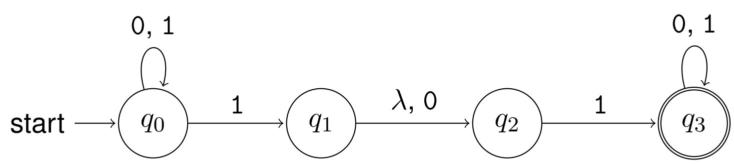
Equivalence of Deterministic Finite Automata and Nondeterministic Finite Automata

Supplement for Preparatory Viewing

Ongoing Example

Let $M = (Q, \Sigma, \delta, q_0, F)$ be a nondeterministic finite automaton such that $Q = \{q_0, q_1, q_2, q_3\}$, $\Sigma = \{0, 1\}$, q_0 is the start state, $F = \{q_3\}$, and transitions are as follows.



Then $Cl_\lambda(q_0) = \{q_0\}$, $Cl_\lambda(q_1) = \{q_1, q_2\}$, $Cl_\lambda(q_3) = \{q_3\}$, and $Cl_\lambda(q_4) = \{q_4\}$.

Rule To Apply When Identifying Transitions

Suppose that a deterministic finite automaton $\widehat{M} = (\widehat{Q}, \Sigma, \widehat{\delta}, \widehat{q}_0, \widehat{F})$ is being constructed from a given nondeterministic finite automaton and

$$\varphi : \widehat{Q} \to \mathcal{P}(Q)$$

is the correspondence between states in the deterministic finite automaton and sets of states in the nondeterministic finite automaton, that is being identified as $\widehat{M}$ is constructed.

For a state $\widehat{q} \in \widehat{Q}$ and symbol $\sigma \in \Sigma$, let $V = \varphi(\widehat{q})$, that is, let V be the set of states in Q corresponding to the state $\widehat{q} \in \widehat{Q}$. Then $\widehat{\delta}(\widehat{q}, \sigma)$ must correspond to a set W of states in the nondeterministic finite automaton, where

$$W = \bigcup_{r \in V} \left(\bigcup_{s \in \delta(r, \sigma)} Cl_\lambda(s) \right).$$