

Nondeterministic Finite Automata

Definition

A nondeterministic finite automata $N = (Q, \Sigma, \delta, q_0, F)$ is a list where Q and Σ are finite sets, $\delta : Q \times \Sigma \to \mathcal{P}(Q), q_0 \in Q$ and $F \subset Q$. A nondeterministic finite automata with empty moves $N = (Q, \Sigma, \delta, q_0, F)$ is a list where Q and Σ are finite sets, $\delta : Q \times (\Sigma \cup \{\emptyset\}) \to \mathcal{P}(Q), q_0 \in Q$ and $F \subset Q$.

As with finite automata, we call Q the states, Σ the alphabet, δ the transition function, q_0 the start state, and F the accept states (or final states). An input $u \in \mathsf{str}(\Sigma)$ results in a state sequence $x \in \mathsf{str}(Q)$ with $x_1 = q_0$ and $x_{i+1} = \delta(x_i, u_i)$ for $i = 1, \ldots, |u|$.

Main result

For any automata M, there exists a nondeterministic finite automata N such that N accepts the same languages as M.¹ For this reason, a language is regular if and only if some nondeterministic finite automaton accepts it.

¹Future editions will include an account.

