Computability

Rasmus Guldborg Pedersen

January 2015

Nondeterministic Finite Automata

Define formally a non-deterministic finite automaton and the language accepted by a finite automaton. Describe a language over the alphabet $\{a, b\}$ that can be accepted by a finite automaton. Explain and justify your answer.

A Nondeterministic Finite Automaton

$(Q, \Sigma, q_0, A, \delta)$
Q is a finite set of *states*;
Σ is a finite *input alphabet*;
$q_0 \in Q$ is the *initial* state;
$A \subseteq Q$ is the set of *accepting* states;
$\delta : Q \times (\Sigma \cup \{\Lambda\}) \to 2^Q$ is the *transition* function.
For $q \in Q$ and $\sigma \in (\Sigma \cup \{\Lambda\})$ then $\delta(q, \sigma)$ denotes the set of states the NFA can move to from q on input σ.

Extended Transition Function δ^*

$\delta^* : Q \times (\Sigma \cup \{\Lambda\}) \to 2^Q$
$\delta^*(q, y\sigma) = \delta(\delta^*(q, y), \sigma)$

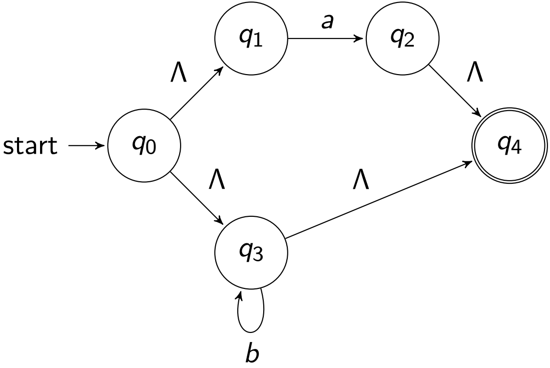
1. For every $q \in Q$, $\delta^*(q, y\sigma) = \Lambda(\{q\})$.
2. For every $q \in Q$, every $y \in \Sigma^*$, and every $\sigma \in \Sigma$, $\delta^*(q, y\sigma) = \Lambda(\bigcup\{\delta(p, \sigma) | p \in \delta^*(q, y)\})$

Language accepted by a NFA

$$L(M) = \{x \in \Sigma^* \,|(\delta^*(q_0, x)) \cap A \neq \emptyset\}$$

Example

$L = \{a\} \cup \{b\}^*$



The End