

Non-deterministic Finite State Automaton

Dhruva Sambrani

February 10, 2020

Problem of Language Unions

Given two regular languages, L and L' are regular, then $L \cup L'$ is also regular.

$$M = (Q, \Sigma, \delta, q_0, F)$$

$$M' = (Q', \Sigma, \delta', q_0', F')$$

Make a DFA M'' which accepts $L \cup L'$.

- $Q'' = Q \times Q'$
- $q_0'' = q_0 \times q_0'$
- $\delta''((q_i, q_j'), a) \rightarrow (\delta(q_i, a), \delta(q_j', a))$
- $F'' = \{F \times Q' \cup Q \times F'\}$

Proof that this works - let $s = w_1w_2w_3...w_n$ which is accepted.

Then $\exists r_0', r_1', \dots, r_n$ st $r_n'' \in F''$ and $\delta(r_i', w_i) = r_{i+1}$

But by definition, r_n'' is (r_j, r_k') where either r_j accepts s or r_k' accepts s .

Non-Deterministic Finite State Automaton

Instead of moving to one state only, it goes to a set of states.

$$N = (Q, \Sigma, \delta, q_0, F)$$

$$\delta: (Q \times (\Sigma, \epsilon)) \rightarrow \bigcup Q_i \text{ where } i \in \mathbb{N}$$