CS310

Converting NFA to DFA

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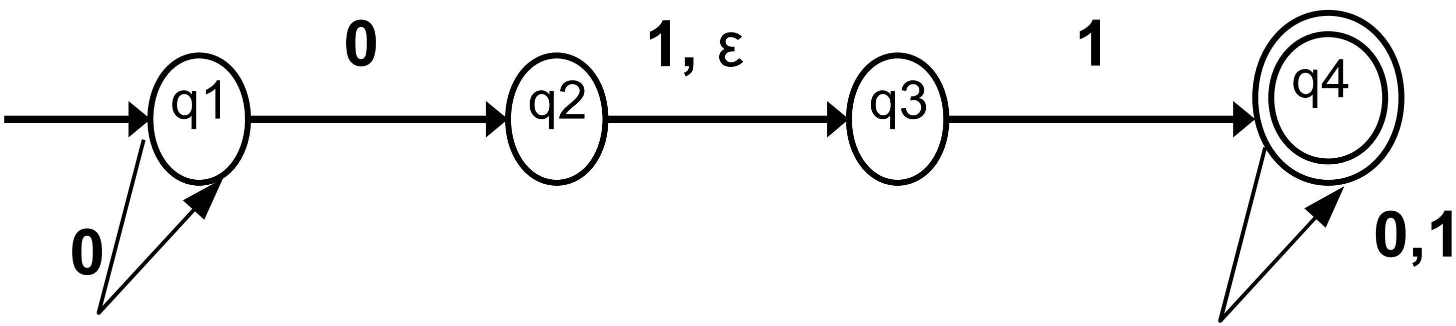
September 15, 2010

Quick Review

- 5 tuple (Q,Σ, δ , q_0,F)

$$\Sigma_{\varepsilon} = \Sigma \cup \{e\}$$

$$\delta : Q \times \Sigma_{\varepsilon} \rightarrow P(Q)$$



Convert NFA to DFA

- Two machines are equivalent if they recognize the same language

- Every NFA has an equivalent DFA (Th 1.39)

$$\delta_{nfa} : Q \times \Sigma_{\varepsilon} \to P(Q)$$

- The DFA will need to represent all subsets in *P*(Q) (how many?)
  - let's assume no ε-transitions initially

Convert NFA to DFA

- NFA is $N = (Q, \sum, \delta, q_0, F)$

- DFA is $M = (Q`, \sum`, \delta`, q_0`, F`)$

  $Q` =$

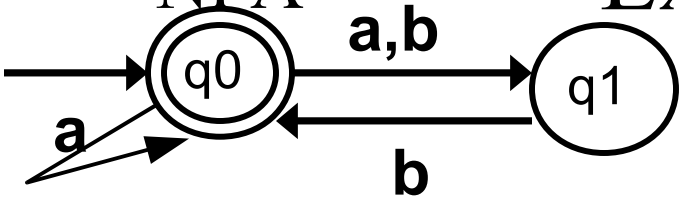
  $q_0` =$

  $F` =$

  $\delta`$:

Example (without ε or δ_{dfa})

NFA



DFA

Q` = {Ø,

∑` = {a,b}

Q_0` =

F` = {

Q = {q0,q1}

∑ = {a,b}

$Q_0 = q0$

F = {q0}

δ	a	b
q0	{q0,q1}	{q1}
q1	{}	{q0}

Let's define the δ_{dfa} (still no ε)

$$\delta_{nfa} : Q \times \Sigma_{\varepsilon} \rightarrow P(Q)$$ in NFA

$$\delta_{dfa} : Q' \times \Sigma \rightarrow Q'$$ in DFA

$$R \in Q', a \in \Sigma$$

$$\delta_{dfa}(R, a) =$$

Converting NFA to DFA - ε Transitions

- Define start state and δ_{dfa} to include all states that can be reached from a given state by 0 or more ε transitions

Conversion Example (with ε)

DFA

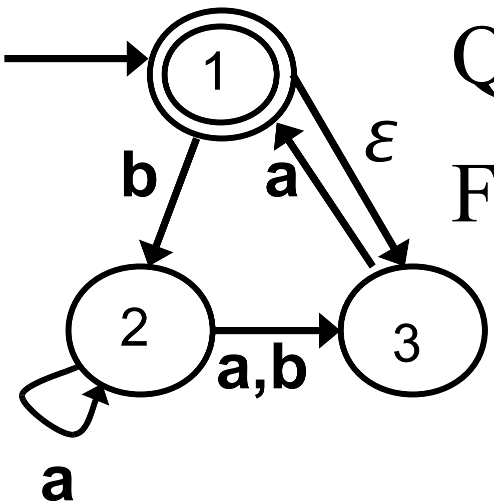
$Q` = \{\emptyset,$

$\sum` = \{a,b\}$

$Q_0` =$

$F` = \{$

$\delta_{dfa} =$



$Q = \{1,2,3\}$

$\sum = \{a,b\}$

$Q_0 = 1$

$F = \{1\}$