CS310

Converting NFA to DFA

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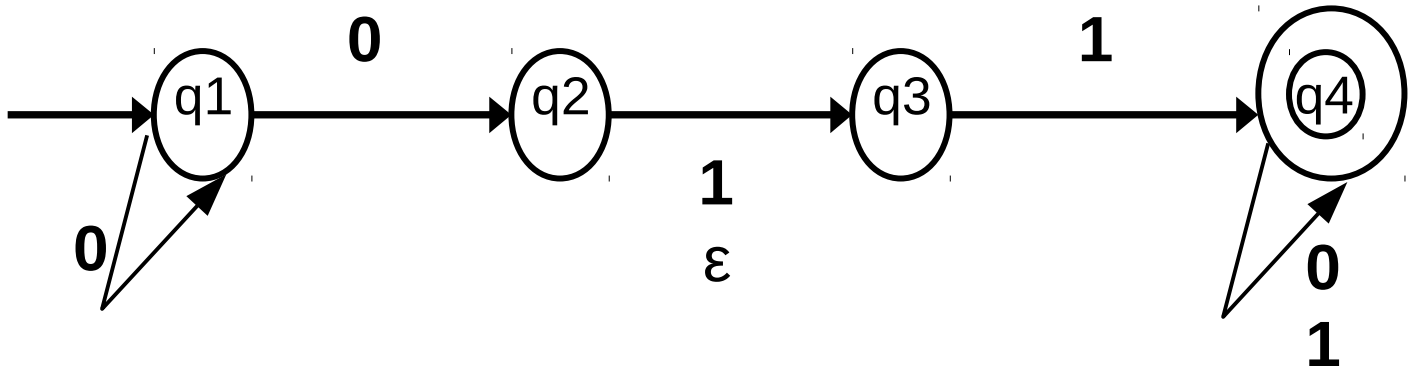
Quick Review

- 5 tuple (Q,Σ, δ , q_0,F)

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

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



Convert NFA to DFA

- Two machines are equivalent if they recognize the same language

- Every NFA has an equivalent DFA (Th 1.39)

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

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

  $Q` =$

  $q_0` =$

  $F` =$

  $\delta`:$

NFA Example (without ε or δ_{dfa})

DFA

$Q` = \{Ø,$

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

$Q_0` =$

$F` = \{$

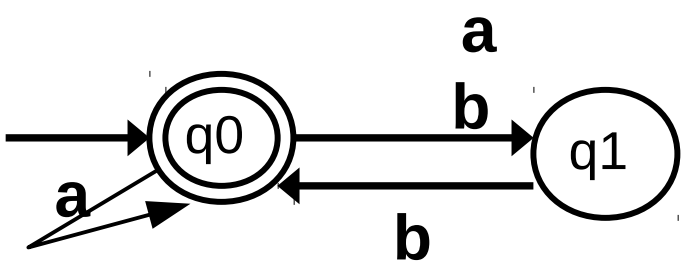
$Q = \{q0,q1\}$

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

$Q_0 = q0$

$F = \{q0\}$

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`={Ø,

∑`={a,b}

Q_0`=

F` = {

$\delta_{dfa} =$

Q={1,2,3}

∑={a,b}

$Q_0 = 1$

F = {1}