

CS310

Converting NFA to DFA

Sections:1.2 Page 54

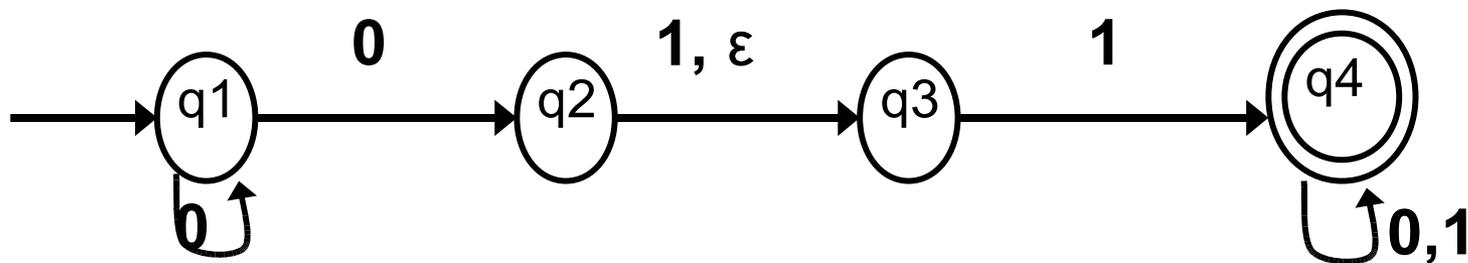
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Quick Review

- 5 tuple ($Q, \Sigma, \delta, q_0, F$)

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

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



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 $N = (Q, \Sigma, \delta, q_0, F)$
- DFA is $M = (Q', \Sigma', \delta', q_0', F')$

$Q' =$

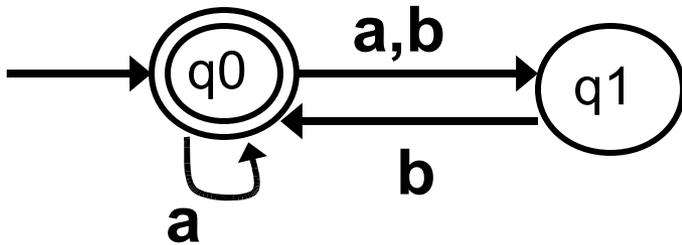
$q_0' =$

$F' =$

$\delta':$

Example (without δ)

NFA



$$Q = \{q_0, q_1\}$$

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

$$Q_0 = q_0$$

$$F = \{q_0\}$$

δ	a	b
q0	{q0,q1}	{q1}
q1	\emptyset	{q0}

DFA

$$Q' = \{\emptyset,$$

$$\Sigma' = \{a, b\}$$

$$Q_0' =$$

$$F' = \{$$

Let's define the δ_{dfa}

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

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

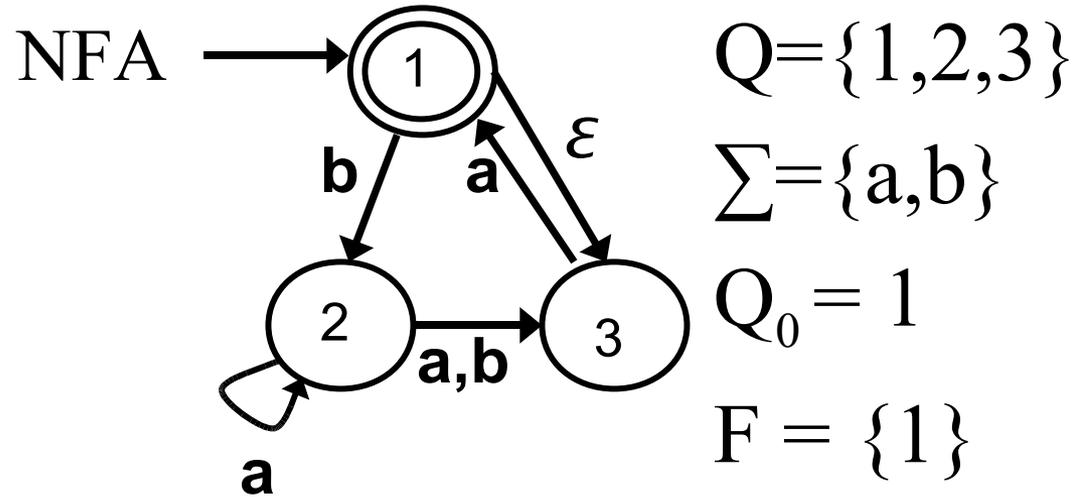
$R \in Q', a \in \Sigma$

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

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

$Q' = \{\emptyset,$

$\Sigma' = \{a, b\}$

$Q_0' =$

$F' = \{$

$\delta_{dfa} =$