BITS Pilani
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Minimization of DFA (Continued…)

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DFA Equivalence Class Algorithm

Input: DFA, A= (Q, Σ, δ, q_0, F).

Output: Equivalence classes over Q.

DFA Equivalence Class Algorithm (Continued…..)

1. Divide Q into two classes C1 and C2 :
   - –Final states C1 = F
   - –Non-final states C2 = Q - F.

DFA Equivalence Class Algorithm (Continued…..)

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2. While in the previous step a change has been made
do at step k+1
        for each k-equivalence class $C_j$ in $E_k$
                for each pair of states p,q in $C_j$
                        for each $\sigma \in \Sigma$
                                if $\delta(p, \sigma) \neq_k \delta(q, \sigma)$ then divide
                                $C_j$ into classes in such way that p
                                and q will be in different classes.
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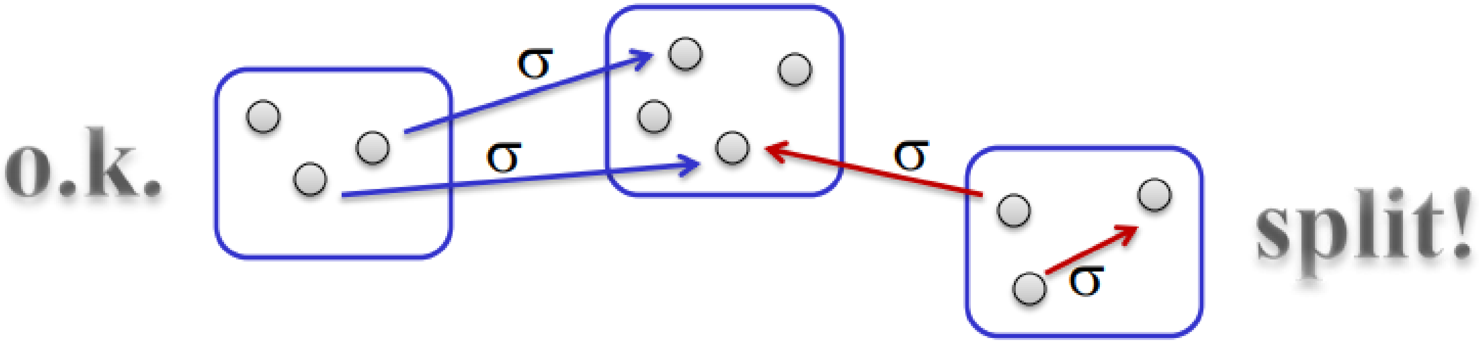
Example



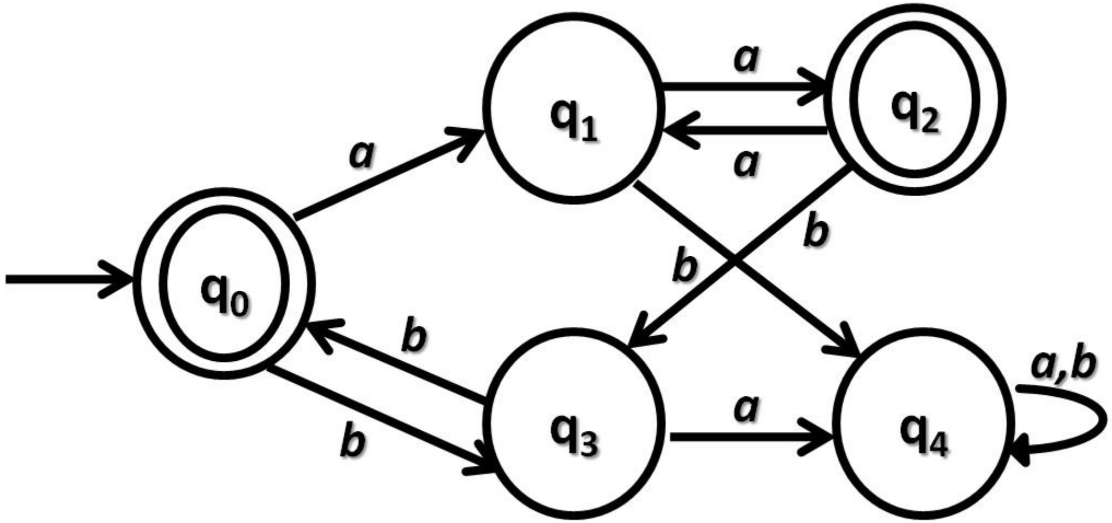
DFA Equivalence Class Algorithm (Continued…..)

The computation of equivalence states can stop when $E_k = E_{k+1}$.

If $E_k = E_{k+1}$ then $E_{k+1} = E_{k+2}$.

More Examples

Generate the minimal DFA for the following DFA over Σ = {a,b} using State Equivalence Mechanism.



DFA Minimization

Table Filling Mechanism

Algorithm

Input $D = (Q, \Sigma, \delta, q_0, F)$

- Design a table for all $\{p, q\}$ pairs where $p, q \in Q$

Mark a pair $\{p,q\}$ if $p \in F$ and $q \notin F$ or vice-versa.

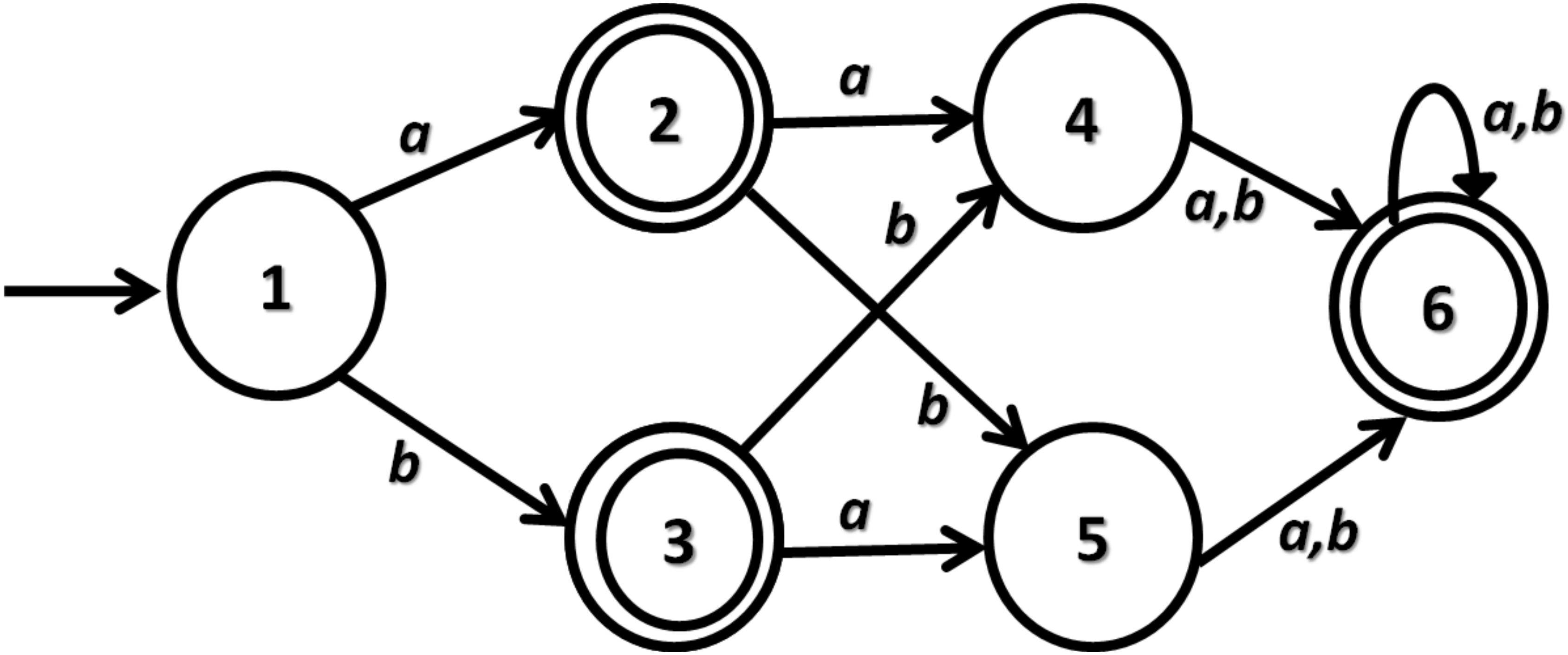
Algorithm (Continued……)

Repeat the following until no more pairs can be marked

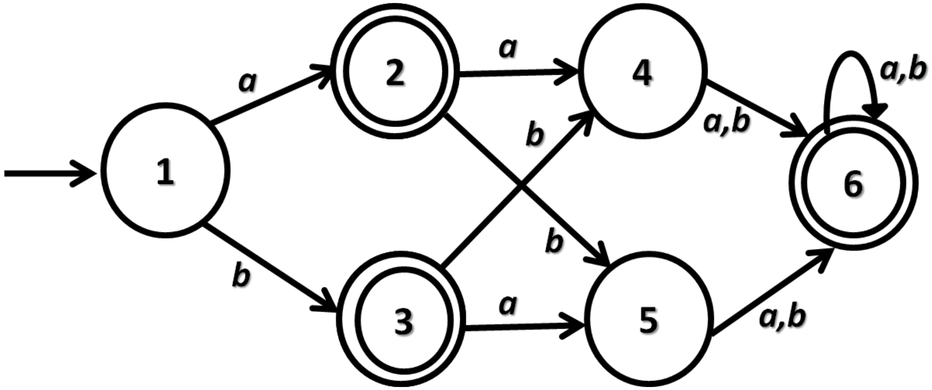
- Mark {p, q} if {δ(p,a), δ(q,a)} is marked for some a ∈ Σ.

Two or more states are equivalent if they are not marked.

Minimization Example

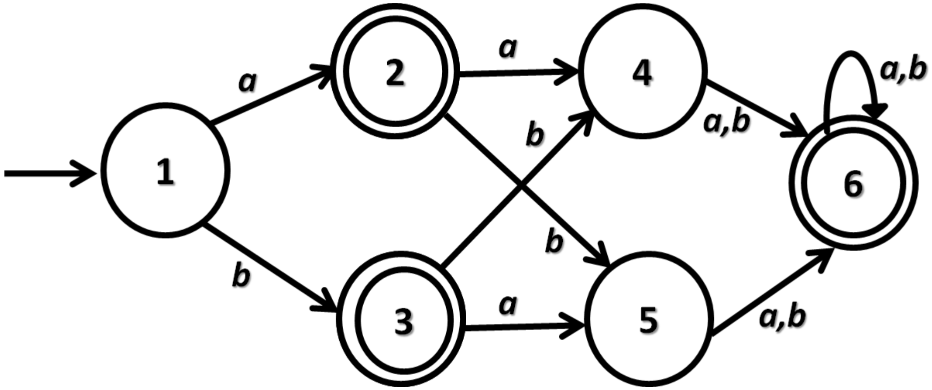


Minimization Example (Continued….)



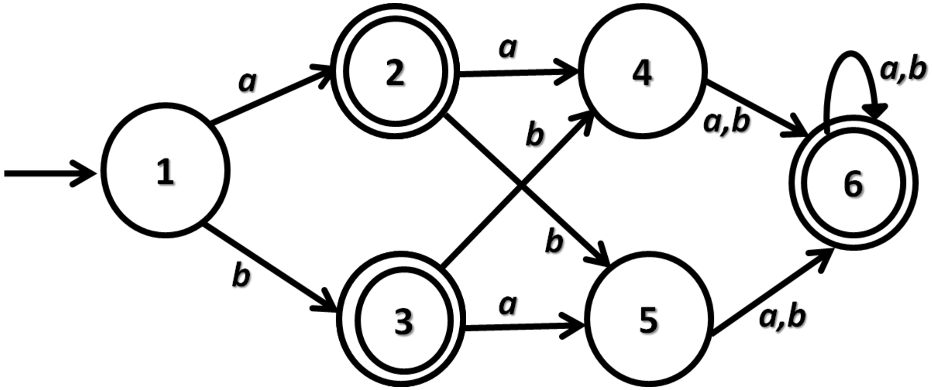
1					
	2				
		3			
			4		
				5	
					6

Minimization Example (Continued….)

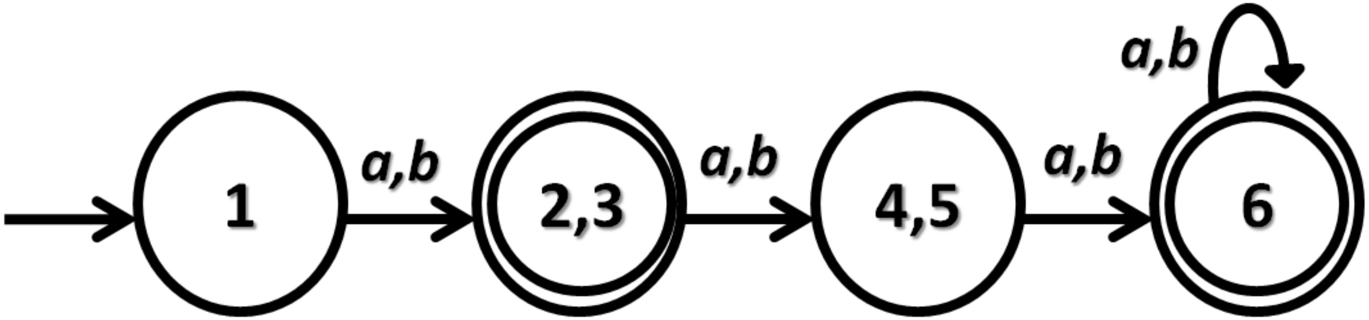


	1	2	3	4	5
2	×				
3	×				
4		×	×		
5		×	×		
6	×			×	×

Minimization Example (Continued….)

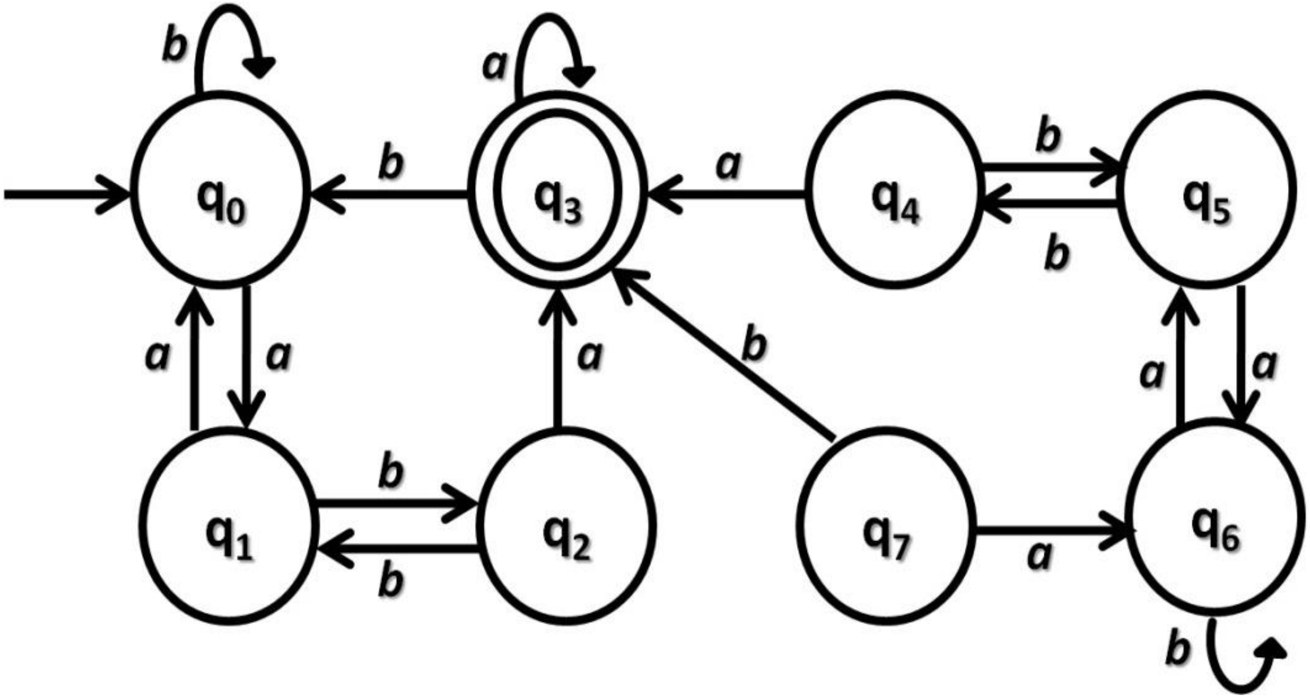


	1	2	3	4	5
2	×				
3	×				
4	×	×	×		
5	×	×	×		
6	×	×	×	×	×



More Examples

Generate the minimal DFA for the following DFA over Σ = {a,b} using Table filling mechanism



Topics Covered (Till Now)

- Finite Automaton
- Designing of DFA and NFA
- Equivalence between NFA and DFA
- Regular Languages and Regular Expressions
- $\in$-NFA and Generalized NFA (GNFA)
- Equivalence between $\in$-NFA and NFA
- Equivalence between FA and Regular Expressions
- Closure Properties of Regular Languages
- Non-Regular Languages
- Minimization of DFA