

# Özdönüşmeler (Otomatlar) Kuramı ve Bilimsel Diller (Prof. Dr. Ünal YARIMAĞAN)

## Sonlu Otomata Model

1) DFA

2) NFA

### DFA Modeli

$$DFA = \langle Q, \Sigma, \delta, q_0, F \rangle$$

$Q$ :

$\Sigma$ :

$$\delta: Q \times \Sigma \rightarrow Q$$

$$q_0: q_0 \in Q$$

$$F: F \subseteq Q$$

ÖN

$$M_1 = \langle Q, \Sigma, \delta, q_0, F \rangle$$

$$Q = \{q_0, q_1, q_2\}$$

$$\Sigma = \{0, 1\}$$

$$\delta: \delta(q_0, 0) = q_0$$

$$\delta(q_0, 1) = q_1$$

$$\delta(q_1, 0) = q_0$$

$$\delta(q_1, 1) = q_2$$

$$\delta(q_2, 0) = q_2$$

$$\delta(q_2, 1) = q_2$$

$$q_0 = q_0$$

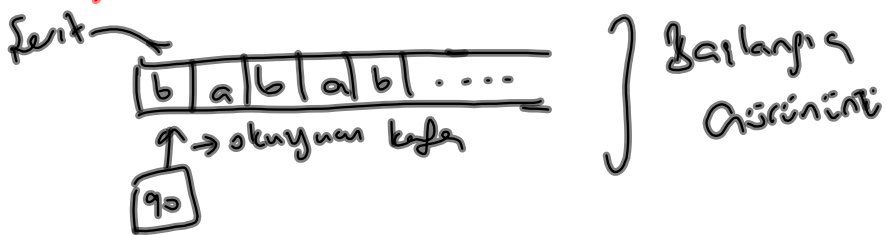
$$F = \{q_2\}$$



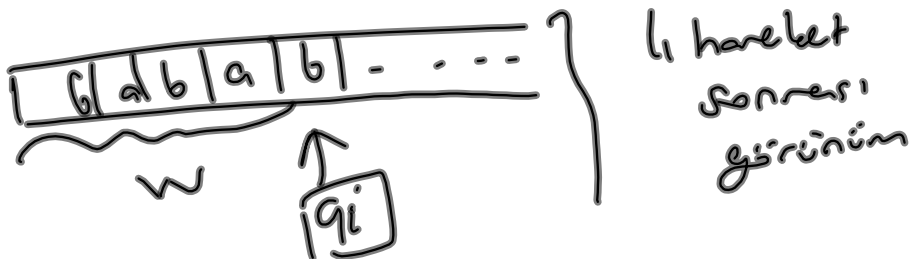
$$\Sigma = \{0, 1\} \quad 00, 1, 11, 100, 01, \dots$$

$M_1$  için "11" içeren tüm stringler tanınır. ✓

## DFA'nın Seritli Makine Modeli



$w$  stringi okunmaya başlıyor



$w$  stringi  $\Rightarrow$  baba, Bu DFA  $w$  tanıır mı?  
 Eğer  $q_i \in F$  DFA  $w$ 'yu tanıır.

NFA

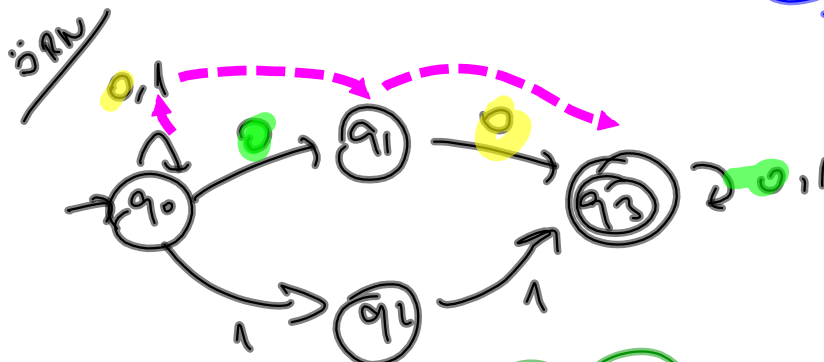
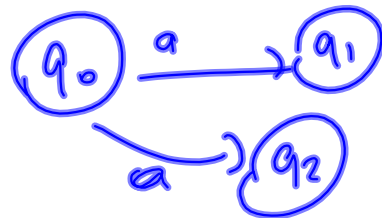
$$NFA = \langle Q, \Sigma, \delta, q_0, F \rangle$$

DFA ile NFA arasındaki fark  $\Rightarrow$  " "  $q_0 \xrightarrow{a} q_1$   
 $\delta(q_0, a) = q_1$

$$DFA \Rightarrow \delta : Q \times \Sigma \rightarrow Q$$

$$NFA \Rightarrow \delta : Q \times \Sigma \rightarrow 2^Q \text{ ( } Q \text{'nin bir alt kümesi)}$$

$$\delta(q_0, a) = \{q_1, q_2\}$$



$$w = 000$$

$q_0, q_1, q_2, q_3$  ✓

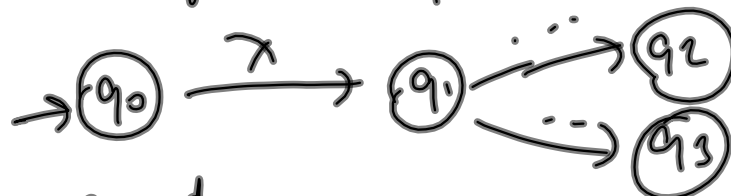
$$w = 010 \text{ ✗}$$

$$w = 100 \text{ ? ✓}$$

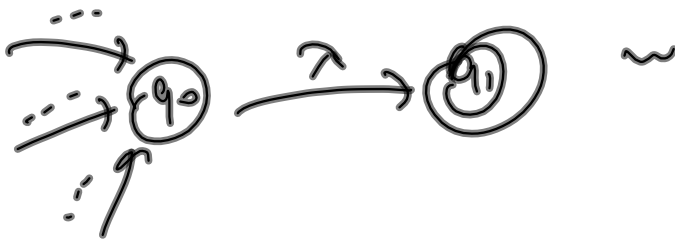
### Lambda Gevici ( $\lambda$ )

$$\delta(q_0, \lambda) = q_1 \quad (q_0) \xrightarrow{\lambda} (q_1)$$

\* Eğer  $q_0$  başlangıç ise  $q_1$ 'de başlangıç

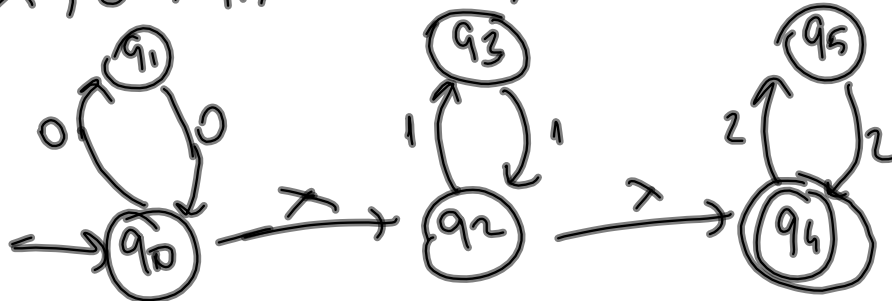


\* Eğer  $q_1$  son durum ise  $q_0$  de son durum



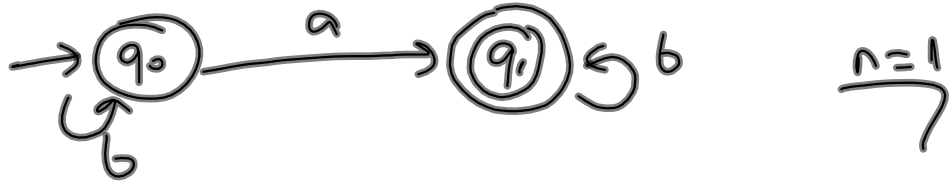
soln  $L(M) = \{0^{2n}1^{2m}2^{2k} \mid n \geq 0, m \geq 0, k \geq 0\}$

$\lambda, 00, 11, 22, 0011, 0022, 112222, \dots$



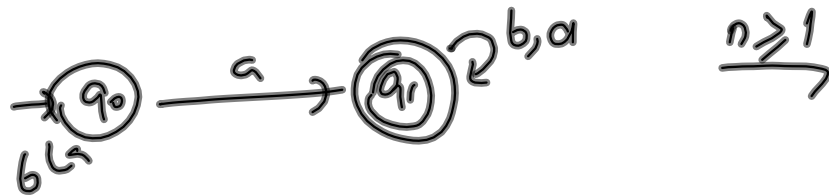
ÖRNEK:  $\Sigma = \{a, b\}$  için aşağıdaki durumları karşılayan DFA.

1) Tam bir tane a içeren tüm stringler (exactly one a)



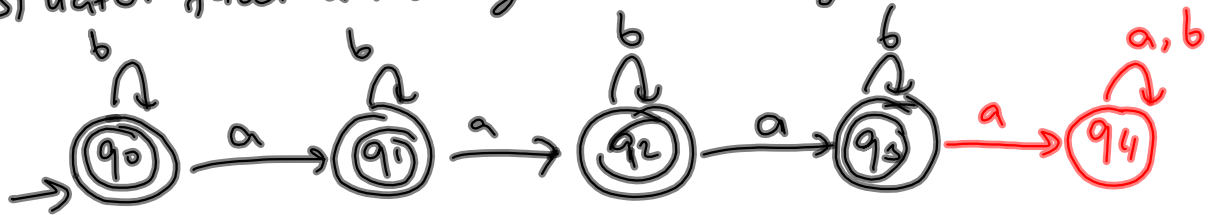
$a, bab, bbba, ab, abb, babb, \dots$

2) En az bir tane a içeren tüm stringler (at least one a)

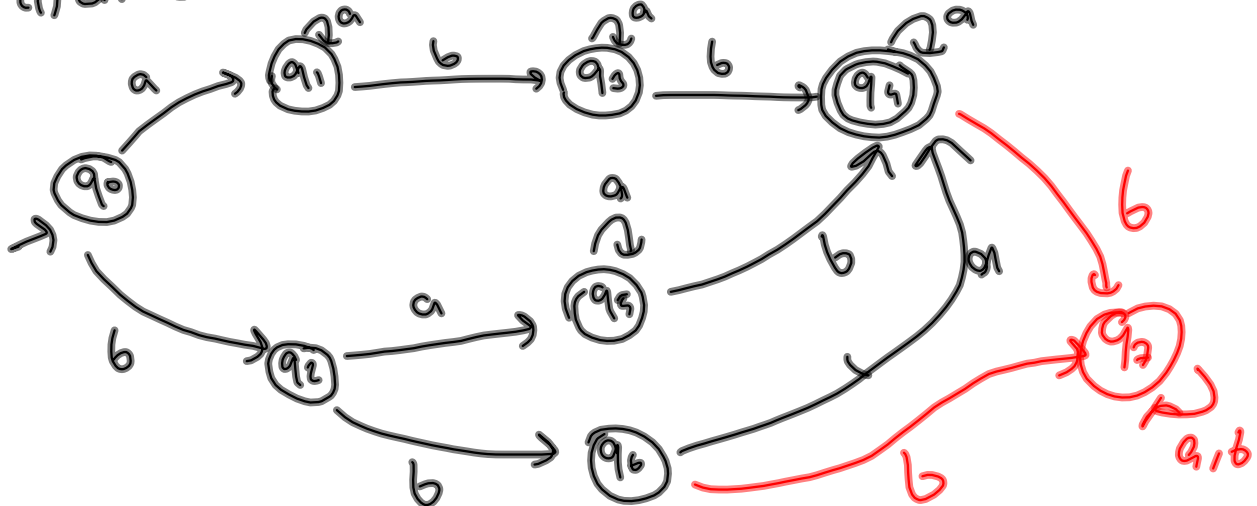


$a, bab, aa, aaa, baa, bab, \dots$

3) Üster fazla a içermeyen tüm stringler ( $n \leq 3$ )



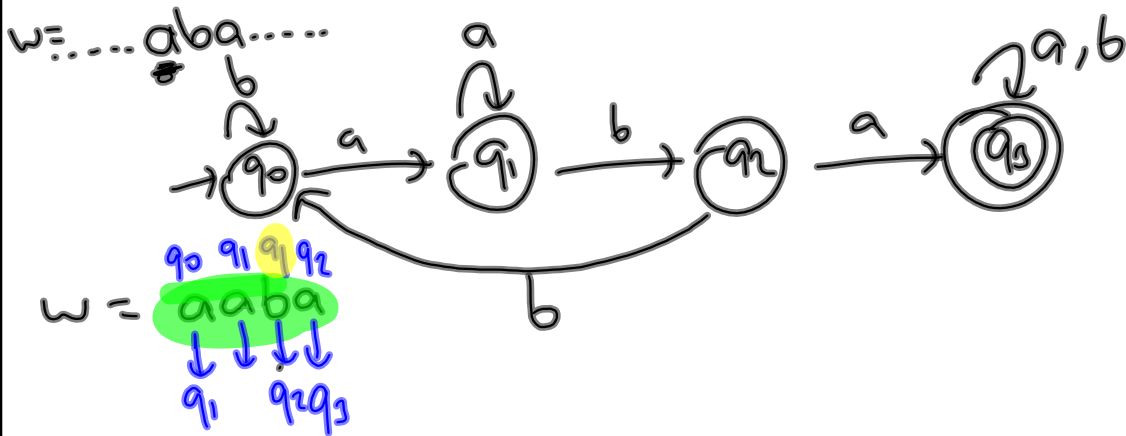
4) En az bir tane a ve iki tane b içeren tüm stringler



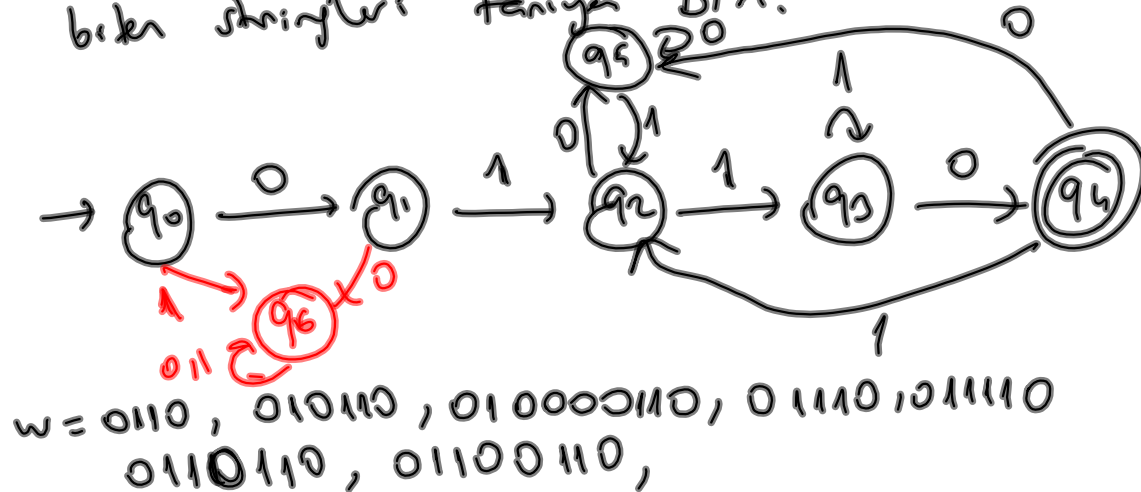
$n$ : a'ların sayısı  
 $m$ : b'lerin sayısı

$n \geq 1$   
 $m \geq 2$

örN=  $\Sigma = \{a, b\}$  alfabelerinde "aba" alt stringini tanıyan DFA.



örN  $\Sigma = \{0, 1\}$  alfabelerinde "01" ile başlayıp "110" ile biten stringleri tanıyan DFA.



ÖRNEK:  $\Sigma = \{a, b\}$  alfabesinde başlangıç ve bitiş simgesi aynı olan stringler için DFA.

