

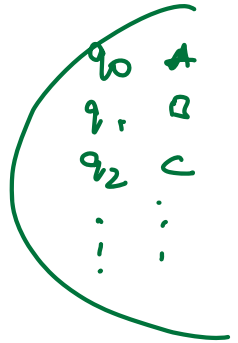
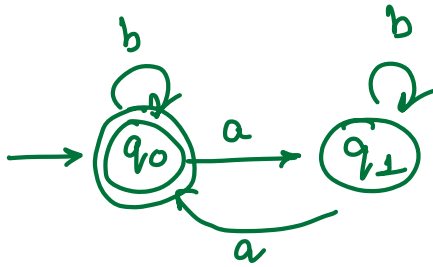
Type 4

Q:

$n_a(w) \bmod 2 = 0$

no  $q_0$ 's  
should be  
even

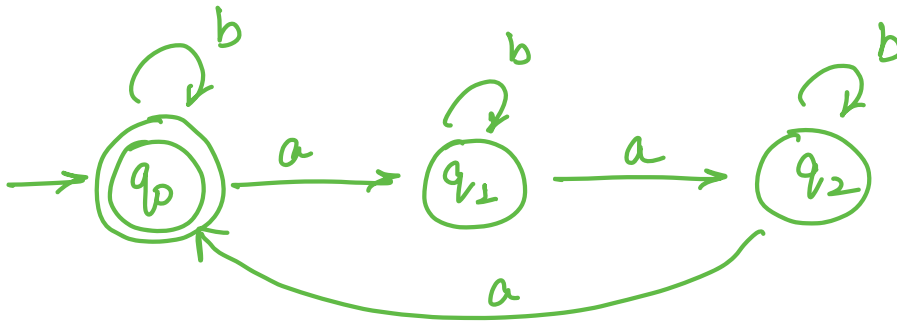
$\bmod 2 \begin{cases} \rightarrow 0 \\ \rightarrow 1 \end{cases}$



Q:

$n_a(w) \bmod 3 = 0$

$\bmod 3: \begin{cases} \rightarrow 0 \\ \rightarrow 1 \\ \rightarrow 2 \end{cases}$



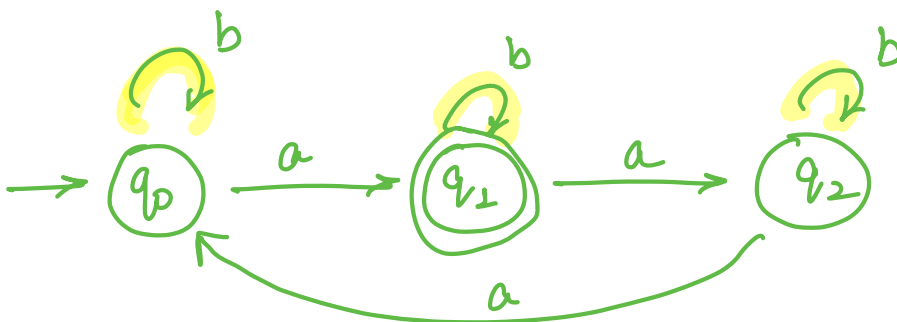
- aaba ✓
- aabba ✓
- baaba ✓
- bbaa ✗

DFA: accept all the strings which are present in the language.

should not accept any string which is not in the language.

Q:

$n_a(w) \bmod 3 = 1$



Q: \*

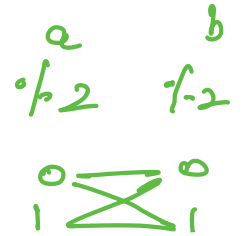
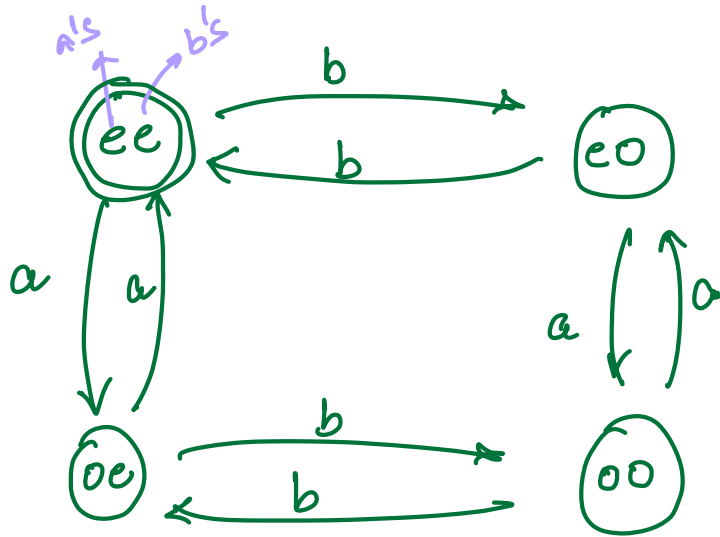
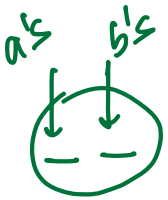
$\Sigma = \{a, b\}$

$n_a(w) \equiv 0 \pmod{2} \rightarrow n_a(w) \pmod{2} = 0 \rightarrow n_a(w) \text{ even}$   
 and

$n_b(w) \equiv 0 \pmod{2} \rightarrow n_b(w) \pmod{2} = 0 \rightarrow n_b(w) \text{ even}$

Way 1:

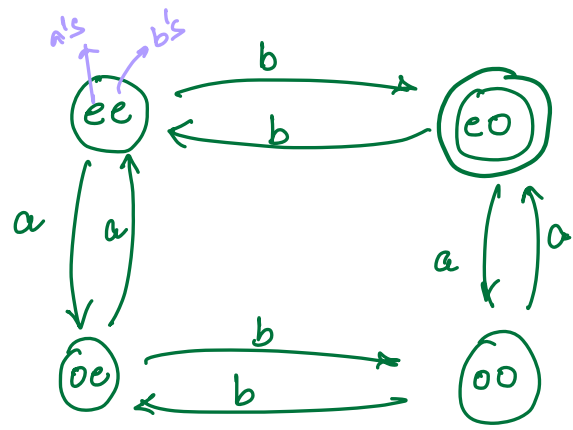
$n_a(w)$	$n_b(w)$	eg
e	e	$\epsilon, aa, bb, aabb, \dots$
e	o	$aab, aabbbbaa, \dots$
o	e	$bab, \dots$
o	o	$ab, abbb, \dots$



Q:

$n_a(w) \equiv 0 \pmod{2}$   
 and

$n_b(w) \equiv 1 \pmod{2}$

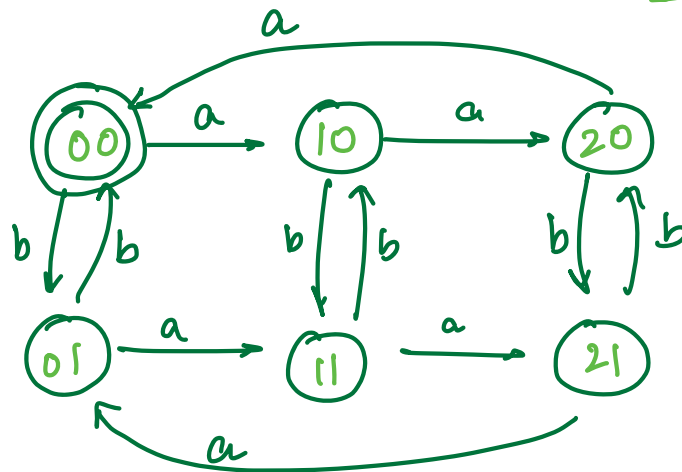
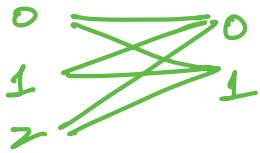


Q: DFA  $\Sigma = \{a, b\}$

a's divisible by 3  $\rightarrow n_a(w) \equiv 0 \pmod 3 \rightarrow n_a(w) \% 3 = 0$

b's divisible by 2  $\rightarrow n_b(w) \equiv 0 \pmod 2 \rightarrow n_b(w) \% 2 = 0$

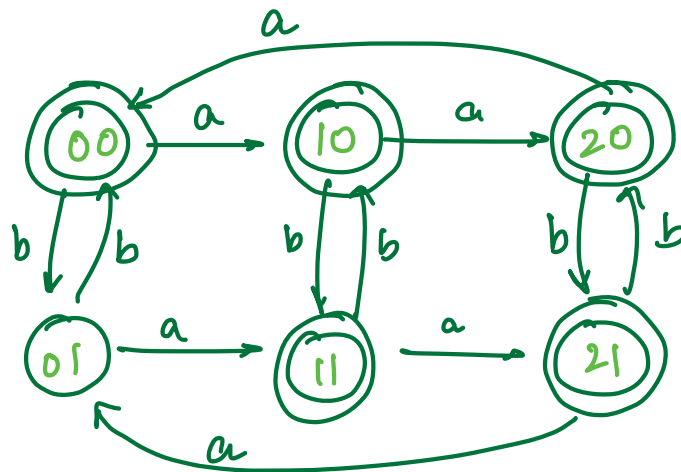
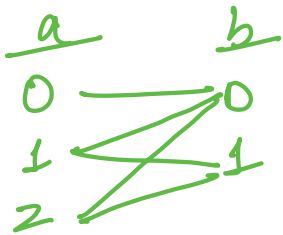
$\% 3$        $\% 2$



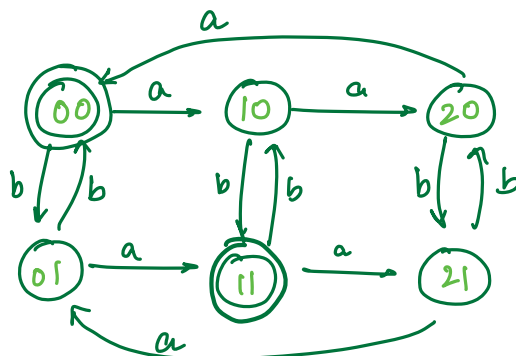
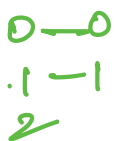
abbba

$n_a(w) \% i = 0$   
 $n_b(w) \% j = 0$  } no of states =  $i * j$

Q:  $n_a(w) \pmod 3 \geq n_b(w) \pmod 2$



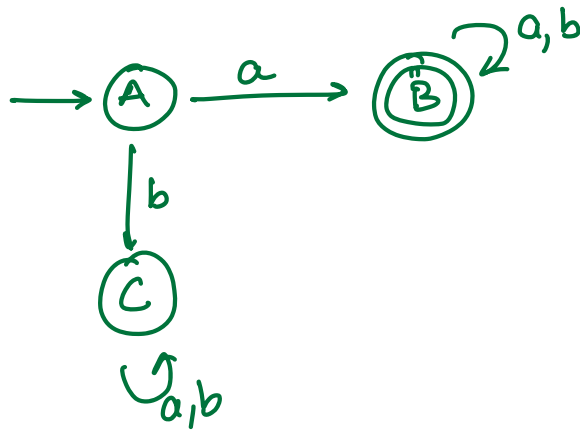
Q:  $n_a(w) \pmod 3 = n_b(w) \pmod 2$



Types: Strings : Starts with, Ends with, Substring

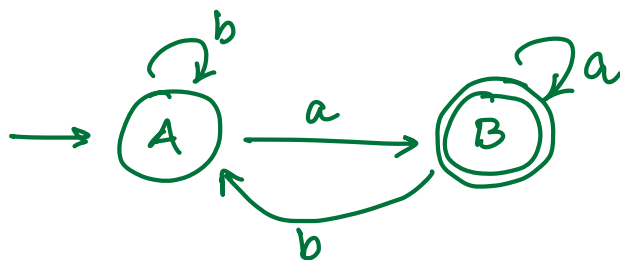
Q: minimal DFA  $\Sigma = \{a, b\}$

language accepts string that starts with 'a'.



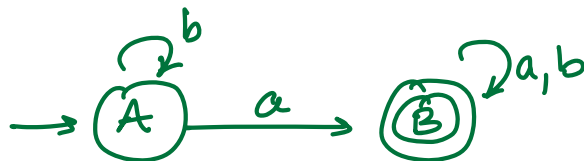
C: Dead State  
 You can never reach final state

Q: DFA  $\Sigma = \{a, b\}$   
 language: string end with 'a'.



'a'      'ba'  
 'aaa'   'bbbbba'  
 'ab'

Q: language: string contains 'a'.



'b'