TOA

LECTURE 6

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Recap lecture 5

- Different notations of transition diagrams, languages of strings of **even length, Odd length, starting with b, ending in a (with different FAs), beginning with a, not beginning with b, beginning with and ending in same letters**

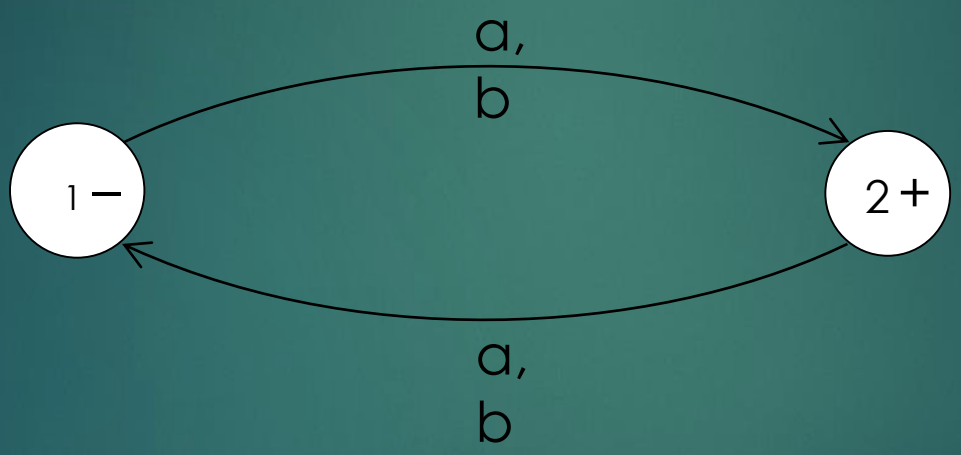
TASK

Build an FA for the language L of strings, defined over Σ={a, b}, **of odd length.**

Solution: The language L may be expressed by RE $(a+b)((a+b)(a+b))^*$ or $((a+b)(a+b))^*(a+b)$

This language may be accepted by the following FA

Solution continued …



Task

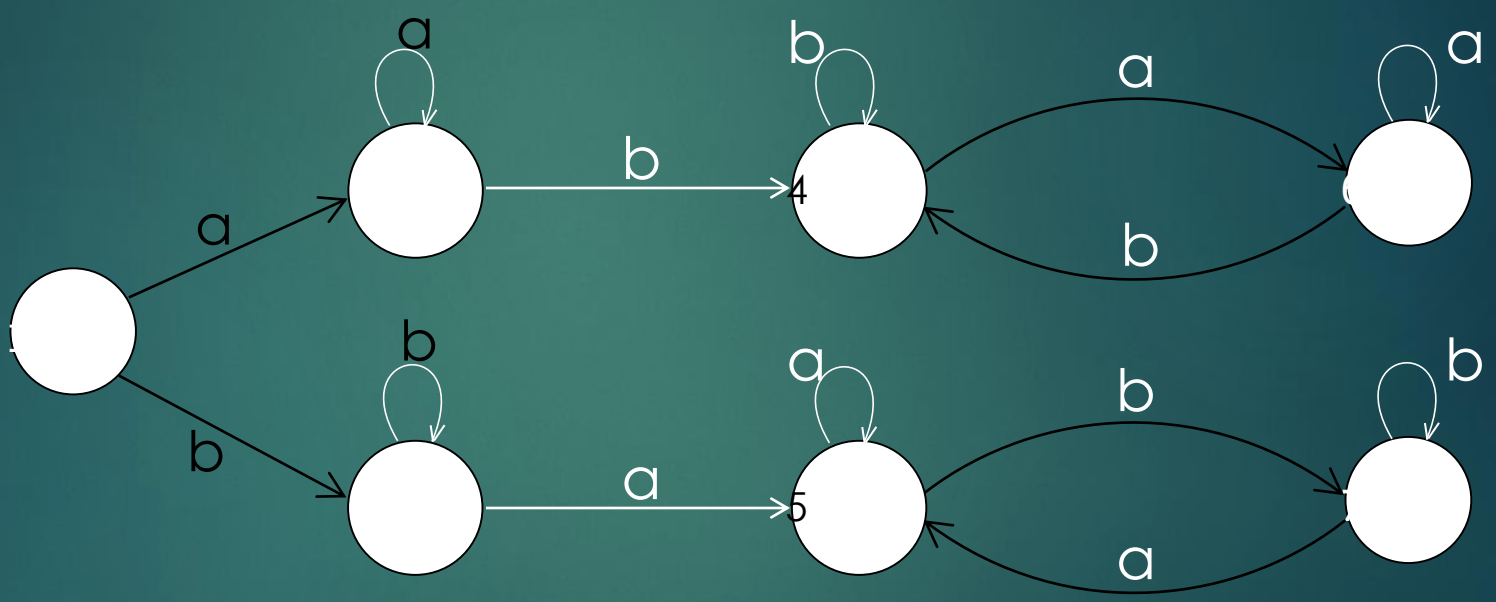
- Build an FA accepting the Language L of Strings, defined over Σ = {a, b}, **beginning with and ending in same letters.**

  Solution: The language L may be expressed by the following regular expression

  $$(a+b)+a(a+b)^{*}a+b(a+b)^{*}b$$

  This language L may be accepted by the following FA

Solution continued …



Example

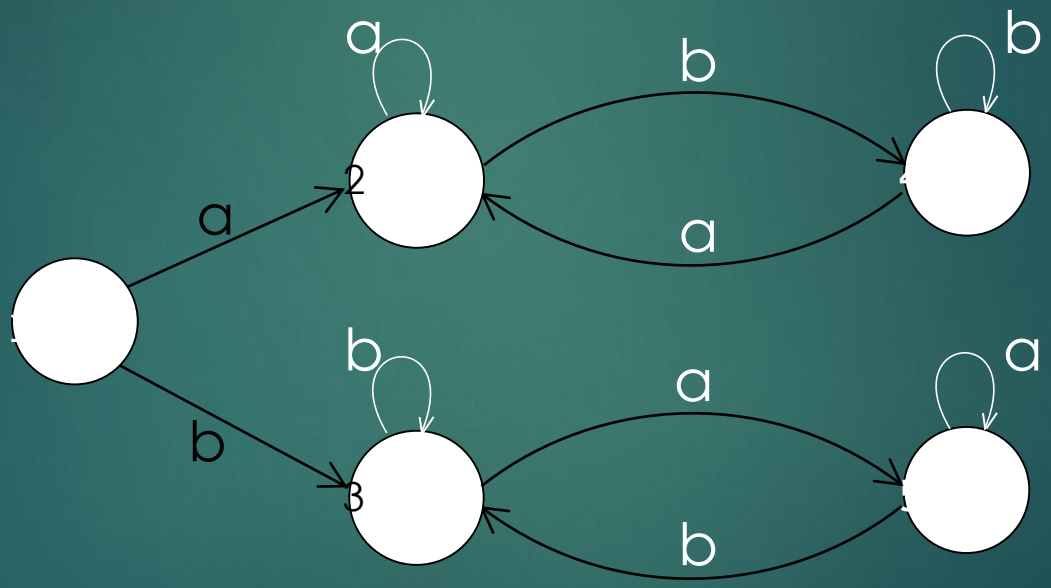
Consider the Language L of Strings , defined over Σ = {a, b}, **beginning with and ending in different letters.**

The language L may be expressed by the following regular expression

$$a\,(a + b)^{*}\,b + b\,(a + b)^{*}\,a$$

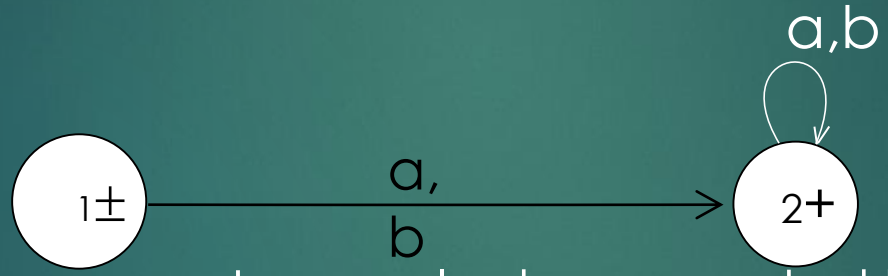
This language may be accepted by the following FA

Example Continued …



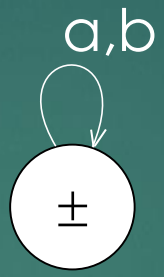
Example

- Consider the Language L , defined over Σ = {a, b} of **all strings including Λ**, The language L may be accepted by the following FA



- The language L may also be accepted by the following FA

Example Continued …

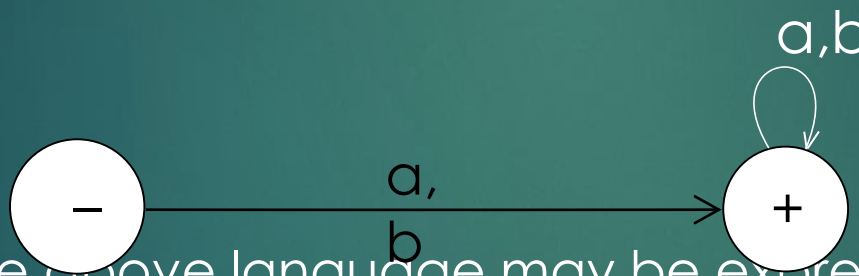


- The language L may be expressed by the following regular expression

$$(a + b)^*$$

Example

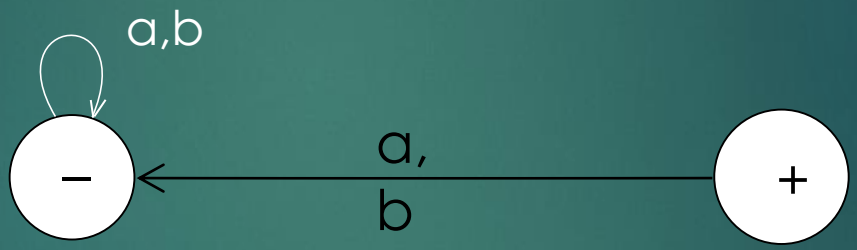
- Consider the Language L , defined over Σ = {a, b} of **all non empty strings**. The language L may be accepted by the following FA



The above language may be expressed by the following regular expression $(a + b)^+$

Example

- Consider the following FA, defined over Σ = {a, b}



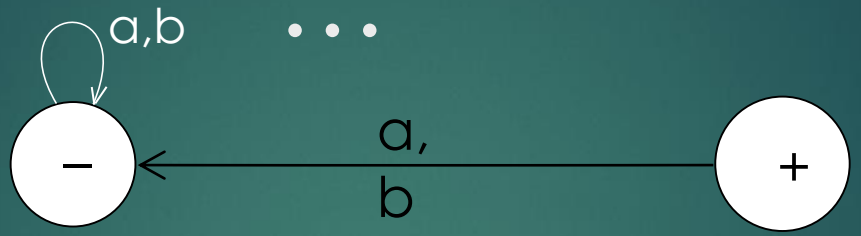
- It is to be noted that the above FA **does not accept any string**. Even it does not accept the null string. As there is no path starting from initial state and ending in final state.

Equivalent FAs

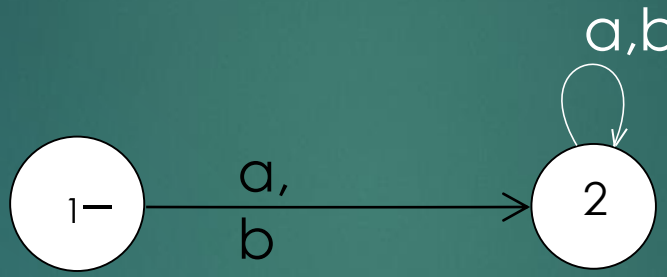
- It is to be noted that two FAs are said to be equivalent, if they accept the same language, as shown in the following FAs.

Equivalent FAs Continued

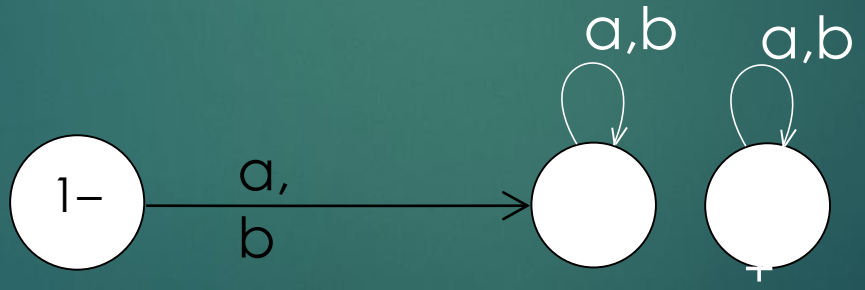
FA_1



FA_2



FA_3



Note (Equivalent FAs)

- FA_1 has already been discussed, while in FA_2, there is no final state and in FA_3, there is a final state but FA_3 is disconnected as the states 2 and 3 are disconnected.

  It may also be noted that the language of strings accepted by FA_1, FA_2 and FA_3 is denoted by the empty set *i.e.*

  { } OR Ø

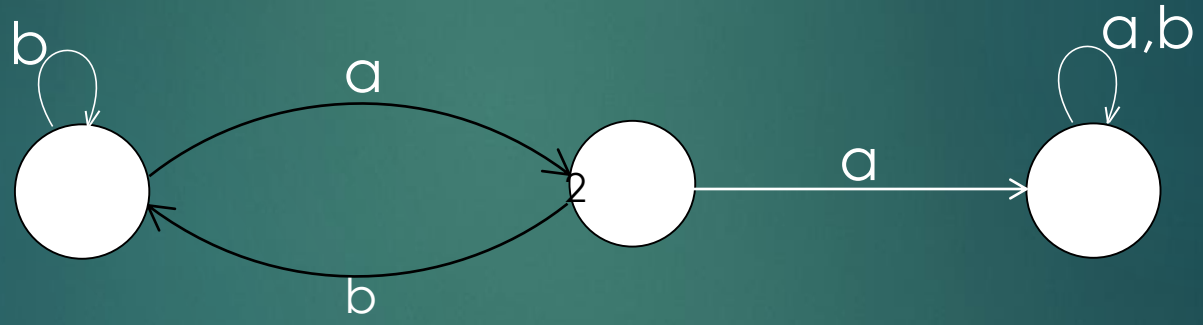
Example

Consider the Language L of strings , defined over Σ = {a, b}, **containing double a.**

The language L may be expressed by the following regular expression

$(a+b)^*(aa)(a+b)^*$. This language may be accepted by the following FA

Example Continued …



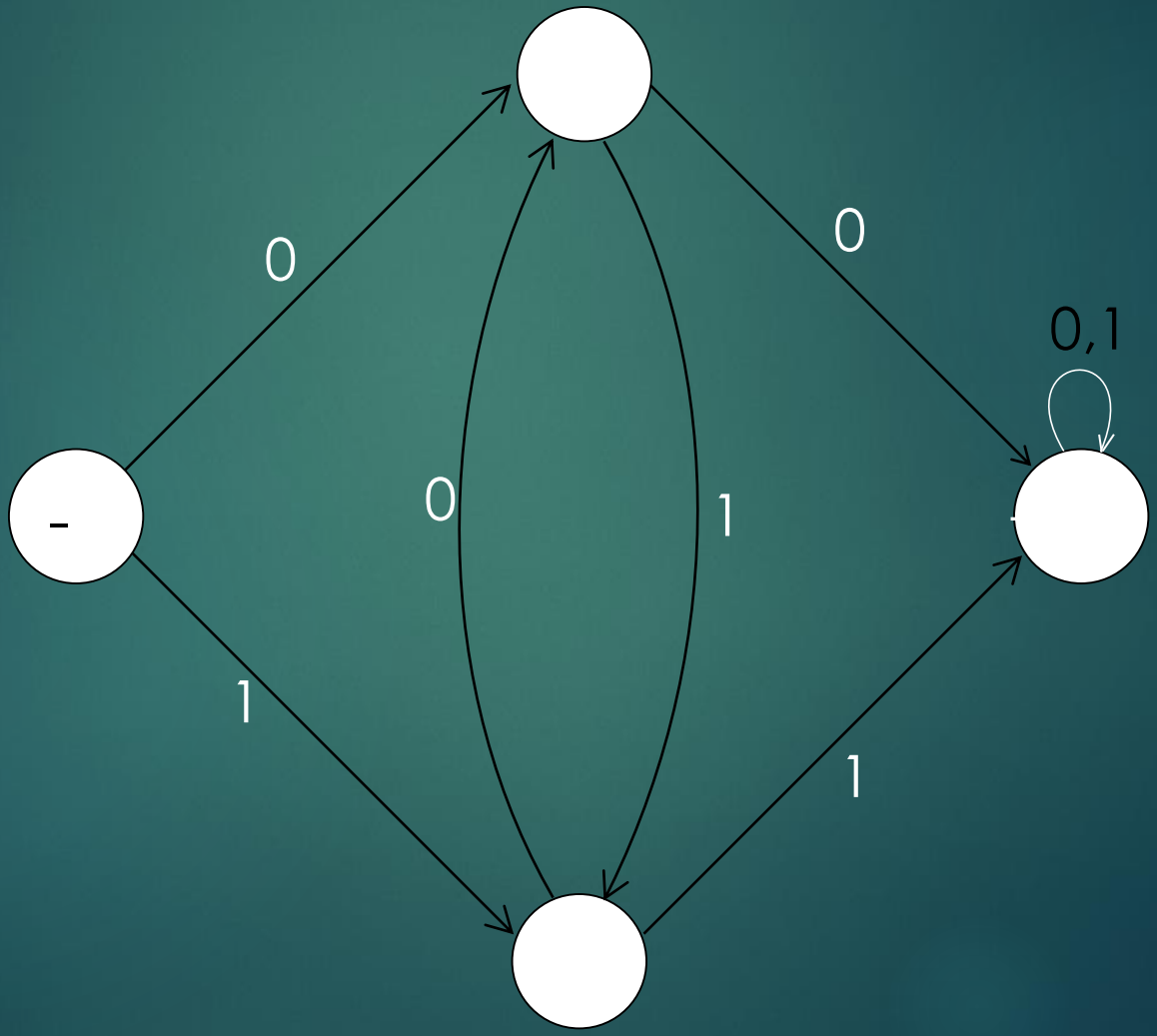
Example

Consider the language L of strings, defined over

Σ={0, 1}, **having double 0's or double 1's,** The language L may be expressed by the regular expression
$(0+1)^*(00 + 11)(0+1)^*$

This language may be accepted by the following FA

Example Continued …



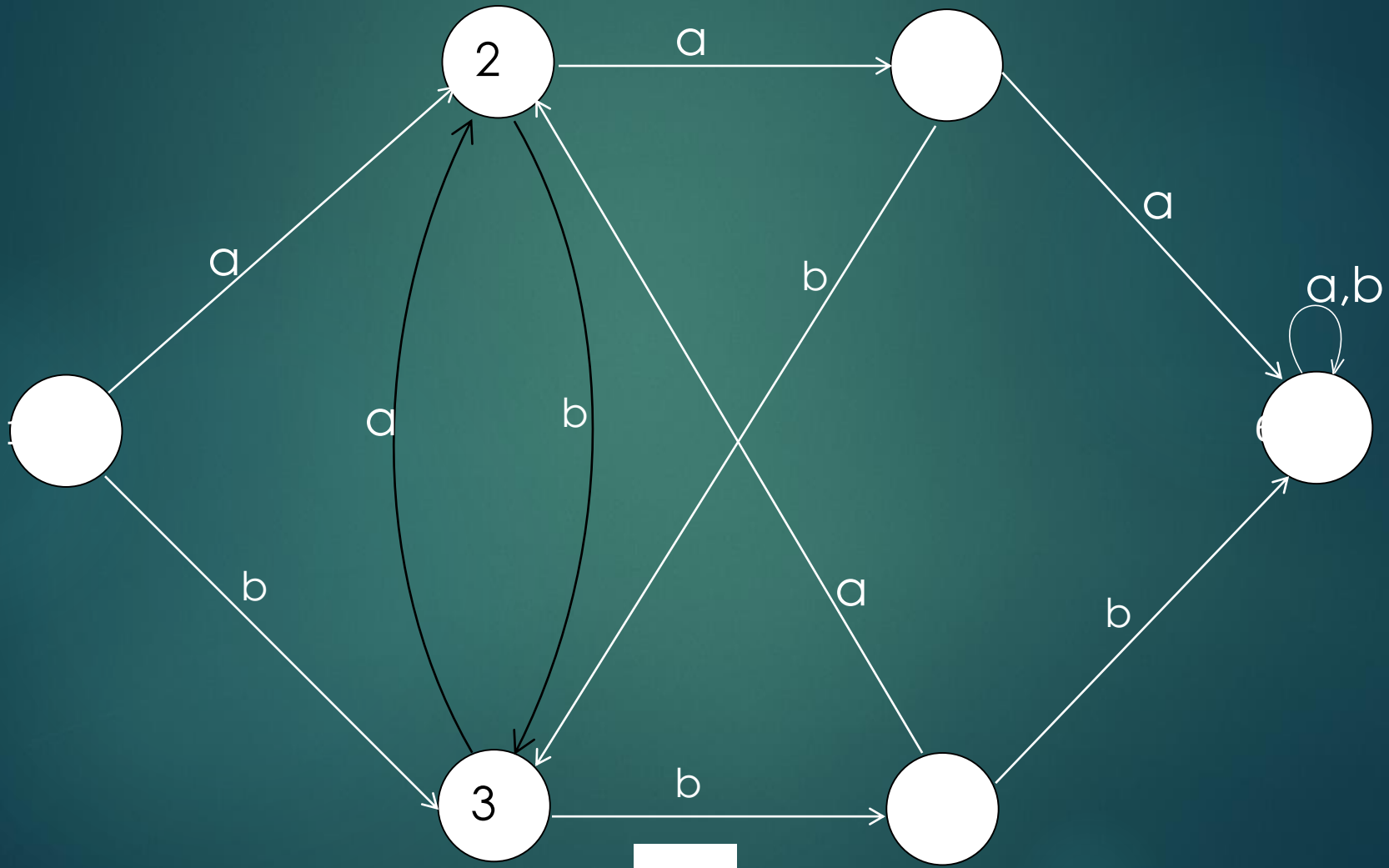
Example

Consider the language L of strings, defined over $\Sigma=\{a, b\}$, **having triple a's or triple b's.** The language L may be expressed by RE

$$(a+b)^* (aaa + bbb) (a+b)^*$$

This language may be accepted by the following FA

Example Continued …



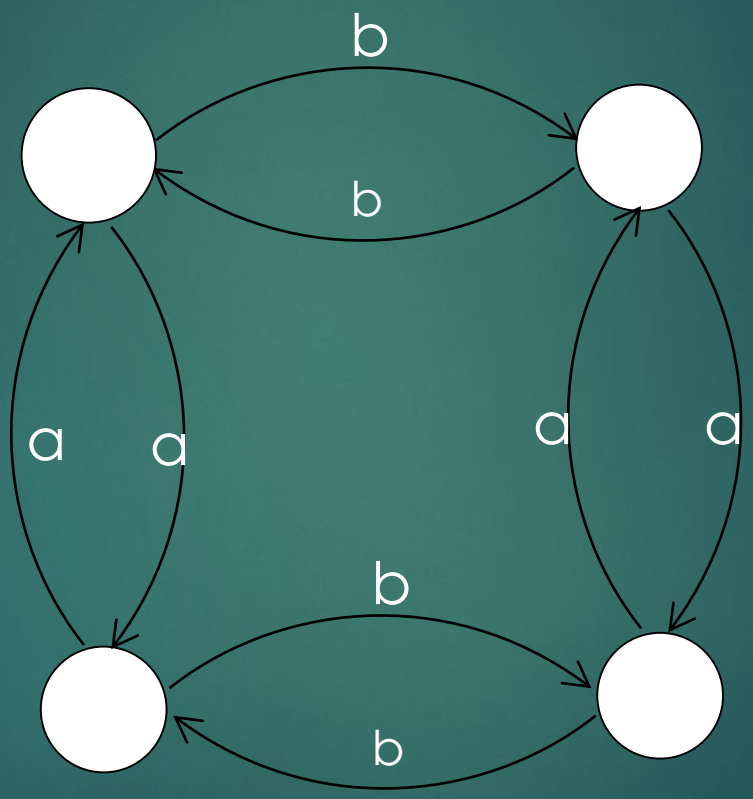
Example

- Consider the **EVEN-EVEN** language, defined over Σ={a, b}. As discussed earlier that **EVEN-EVEN** language can be expressed by the regular expression

  $(aa+bb+(ab+ba)(aa+bb)^*(ab+ba))^*$

  EVEN-EVEN language may be accepted by the following FA

Example Continued …



Summing Up

- **Language of strings beginning with and ending in different letters, Accepting all strings, accepting non-empty strings, accepting no string, containing double a's, having double 0's or double 1's, containing triple a's or triple b's, EVEN-EVEN**