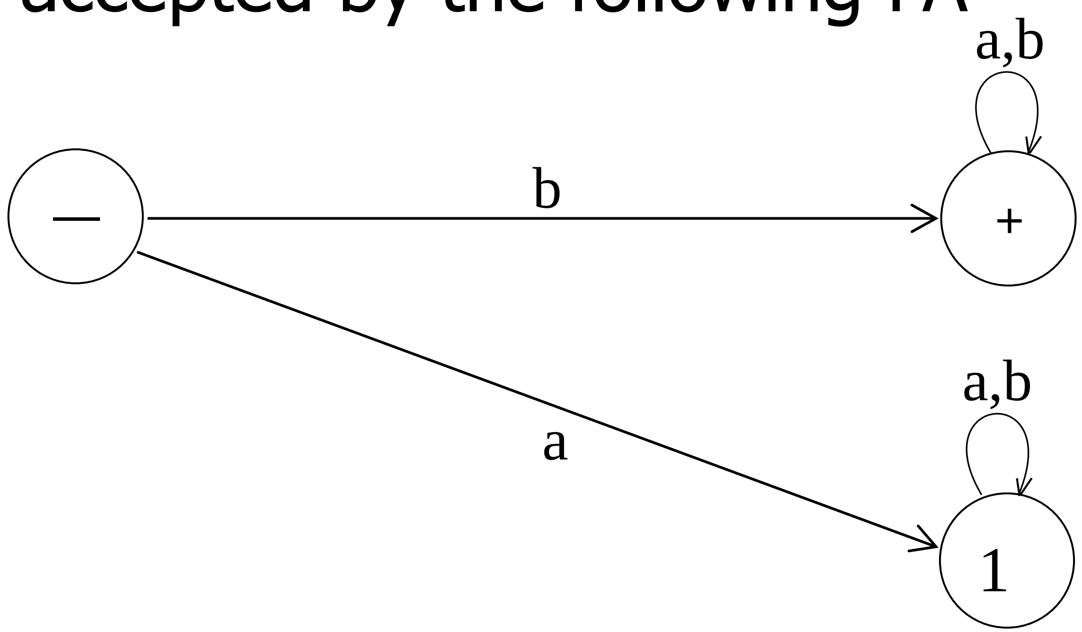
Example: Consider the language L of strings, defined over $\Sigma=\{a, b\}$, **starting with b.** The language L may be expressed by RE $b(a + b)^*$, may be accepted by the following FA



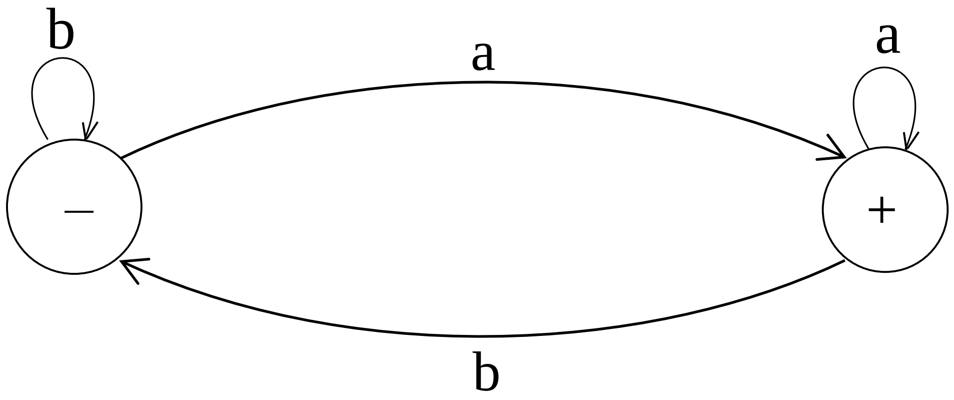
⌘ **Example:**

Consider the language L of strings, defined over $\Sigma=\{a, b\}$, **ending in a. T**he language L may be expressed by RE

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

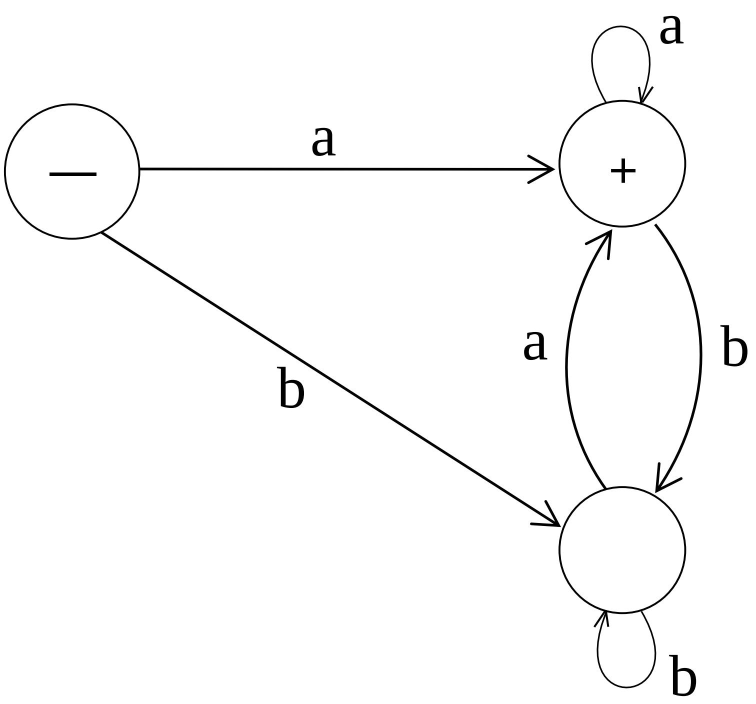
This language may be accepted by the following FA

Example Continued …



There may be another FA corresponding to the given language.

Example continued ...



Note

- It may be noted that corresponding to a given language there may be more than one FA accepting that language, but for a given FA there is a unique language accepted by that FA.

Note

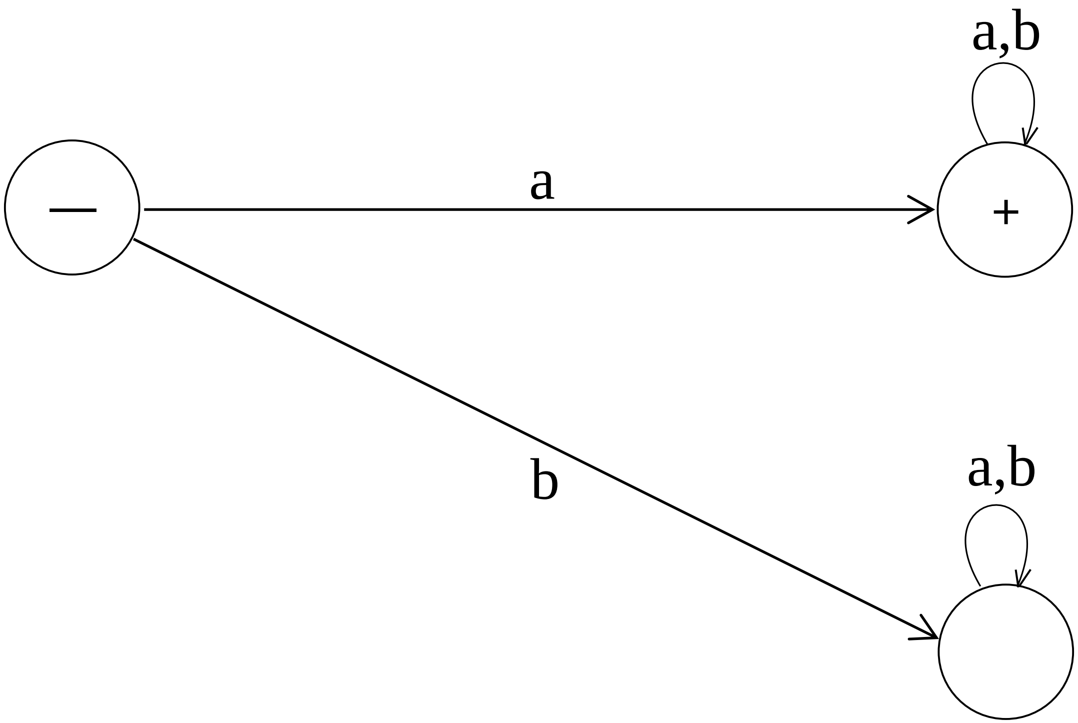
- It is to be noted that given the languages L_1 and L_2 ,where

L_1 = The language of strings, defined over $\Sigma=\{a, b\}$, **beginning with a**

L_2 = The language of strings, defined over $\Sigma=\{a, b\}$, **not beginning with b**

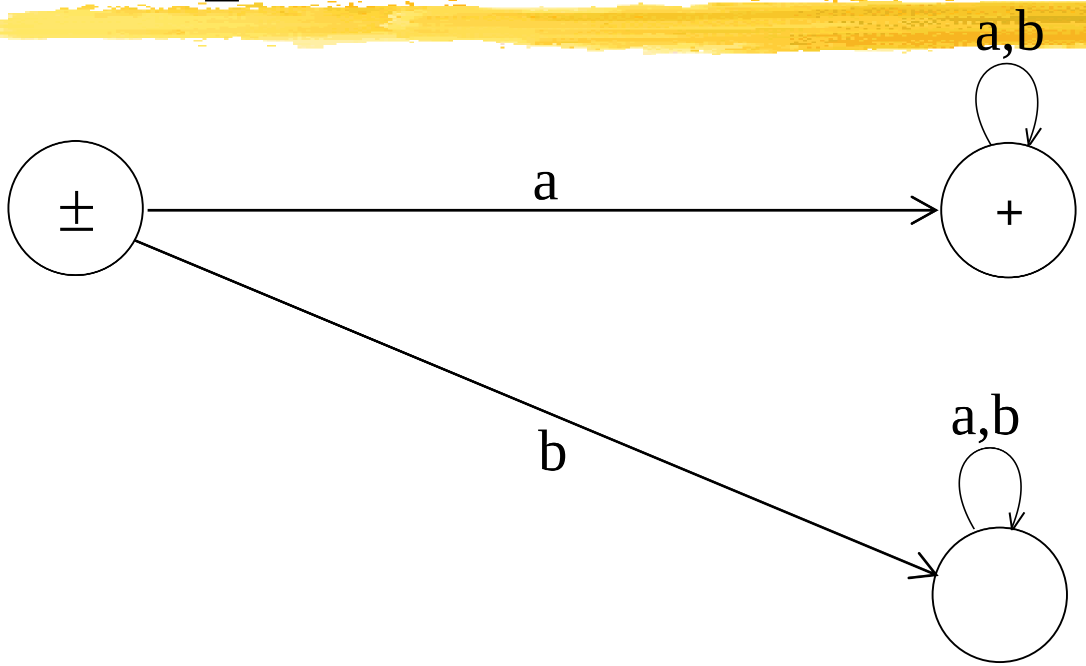
The Λ does not belong to L_1 while it does belong to L_2 . This fact may be depicted by the corresponding transition diagrams of L_1 and L_2.

FA_1 Corresponding to L_1



- The language L_1 may be expressed by the regular expression $a(a + b)^*$

FA_2 Corresponding to L_2



- The language L_2 may be expressed by the regular expression $a\,(a + b)^* + \Lambda$

Example

- Consider the Language L of Strings of **length two or more**, defined over $\Sigma = \{a, b\}$, **beginning with and ending in same letters.**

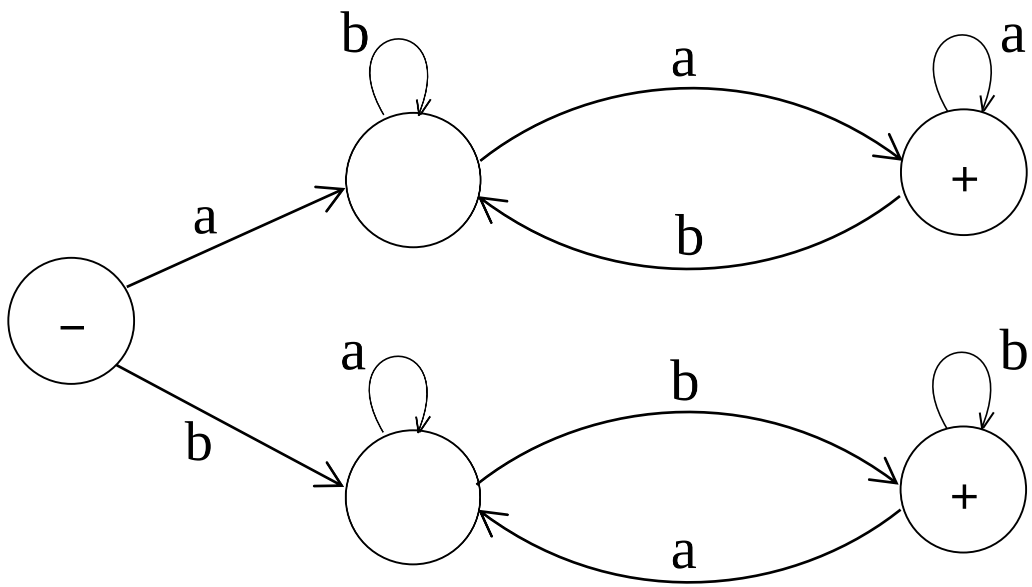
  The language L may be expressed by the following regular expression

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

  It is to be noted that if the condition on the length of string is not imposed in the above language then **the strings a and b will then belong to the language.**

  This language L may be accepted by the following FA

Example Continued ...



Task

- Build an FA accepting the Language L of Strings, defined over $\Sigma = \{a, b\}$, **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.**

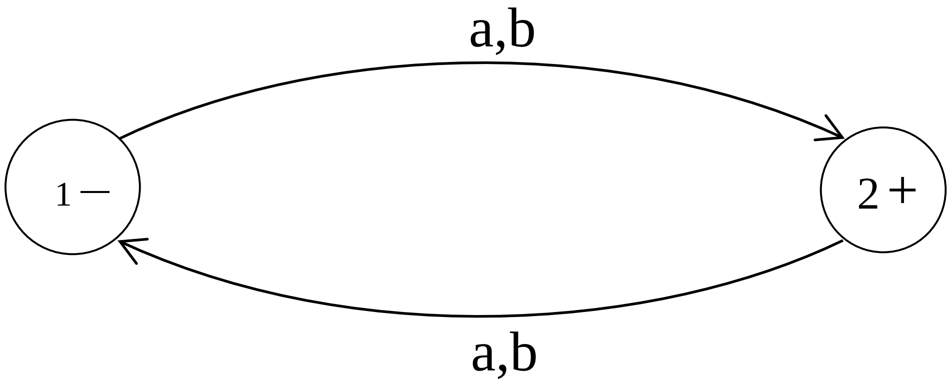
Solution: The language L may be expressed by RE

$(a+b)((a+b)(a+b))^*$ or

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

This language may be accepted by the following FA

Solution continued …



Task

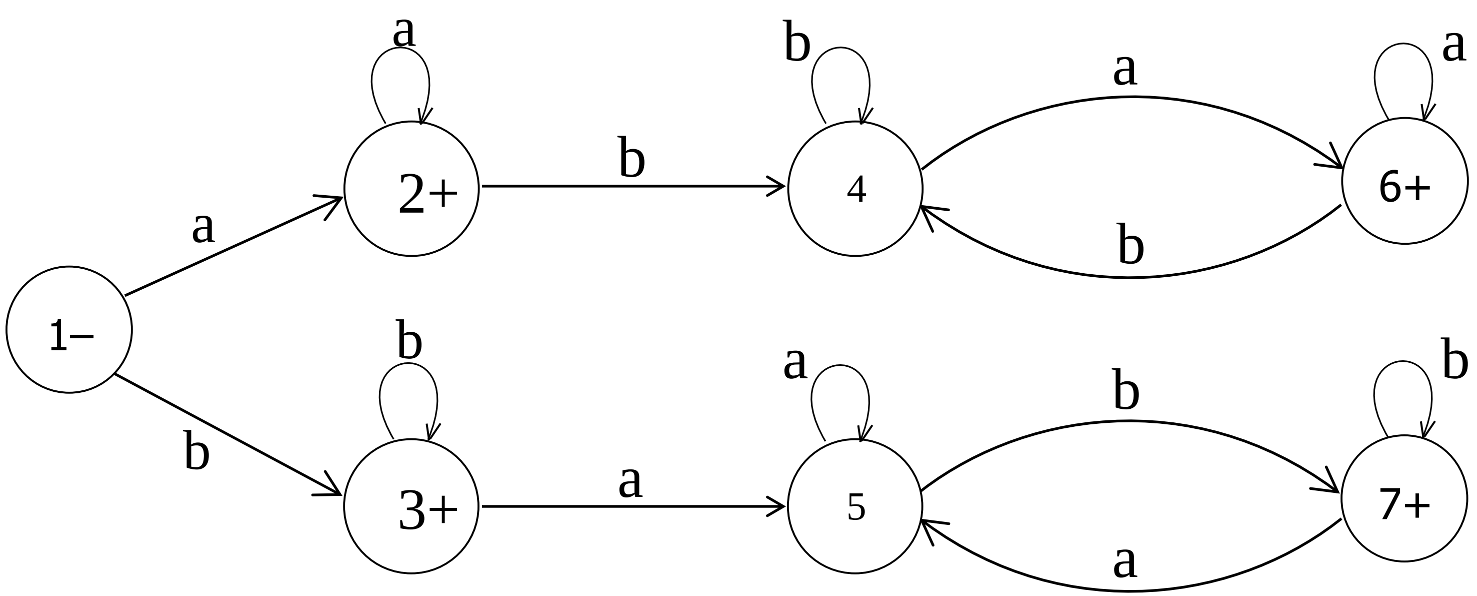
- Build an FA accepting the Language L of Strings, defined over Σ = {a, b}, **beginning with and ending in same letters.**

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

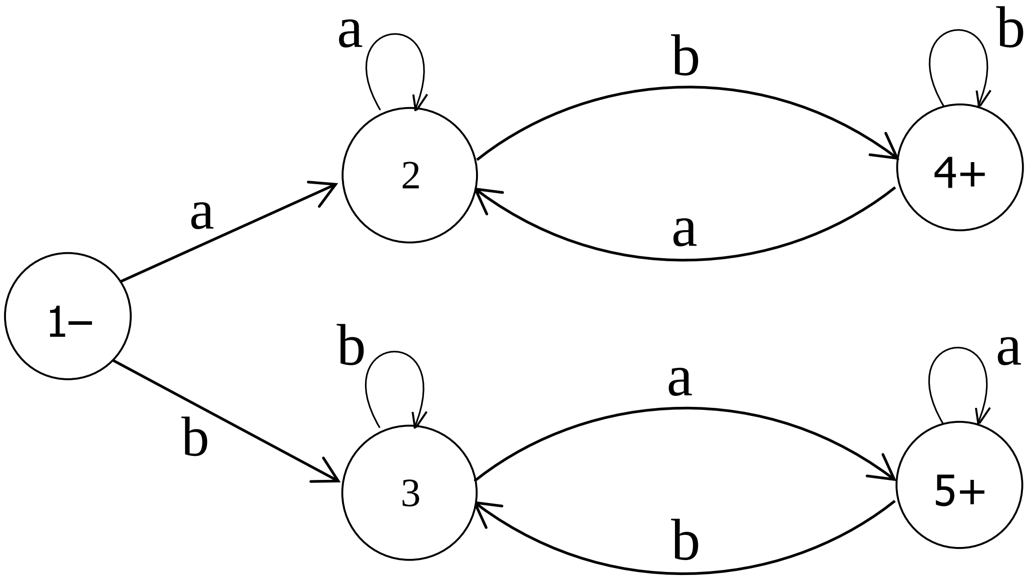
Consider the Language L of Strings , defined over $\Sigma = \{a, b\}$, **beginning with and ending in different letters.**

The language L may be expressed by the following regular expression

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

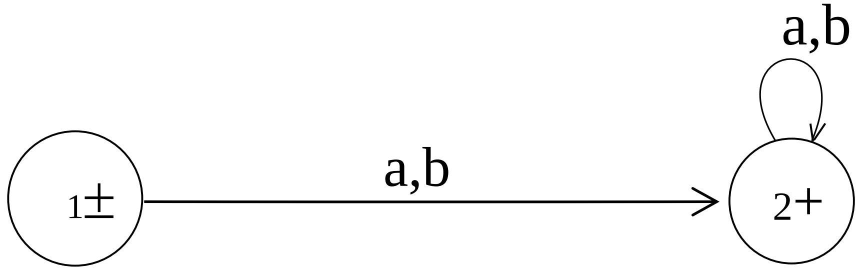
This language may be accepted by the following FA

Example Continued …



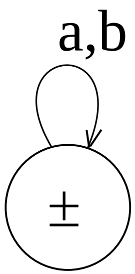
Example

- Consider the Language L , defined over $\Sigma = \{a, b\}$ 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 …

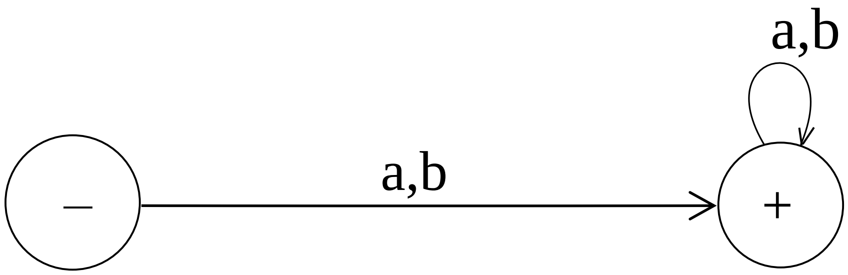


- The language L may be expressed by the following regular expression

$$(a + b)^*$$

Example

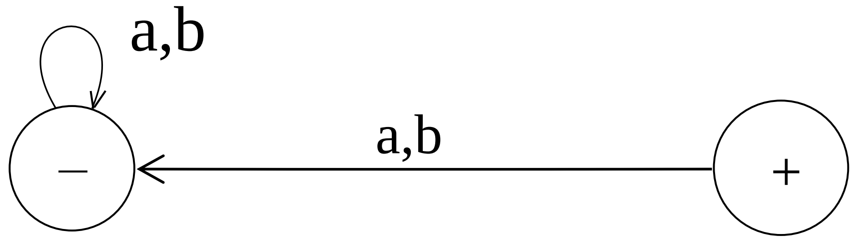
- Consider the Language L , defined over $\Sigma = \{a, b\}$ of **all non empty strings**. The language L may be accepted by the following FA



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

Example

- Consider the following FA, defined over $\Sigma = \{a, b\}$



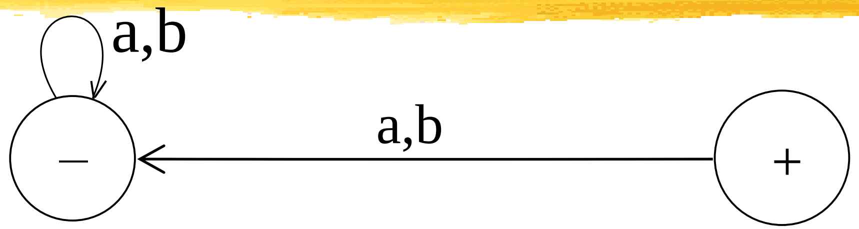
- It is to be noted that the above FA **does not accept any string**. Even it does not accept the null string. As there is no path starting from initial state and ending in final state.

Equivalent FAs

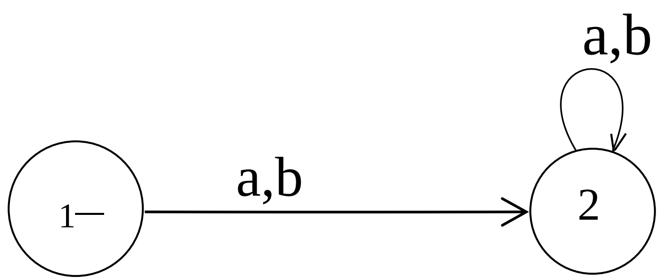
- It is to be noted that two FAs are said to be equivalent, if they accept the same language, as shown in the following FAs.

Equivalent FAs Continued …

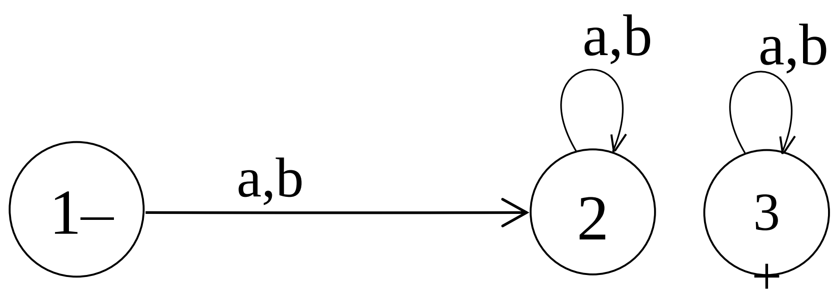
FA_1



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

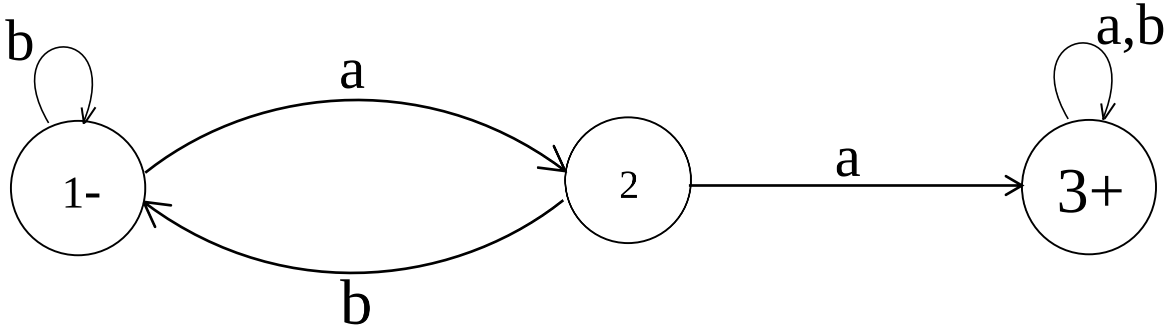
Consider the Language L of strings , defined over $\Sigma = \{a, b\}$, **containing double a.**

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

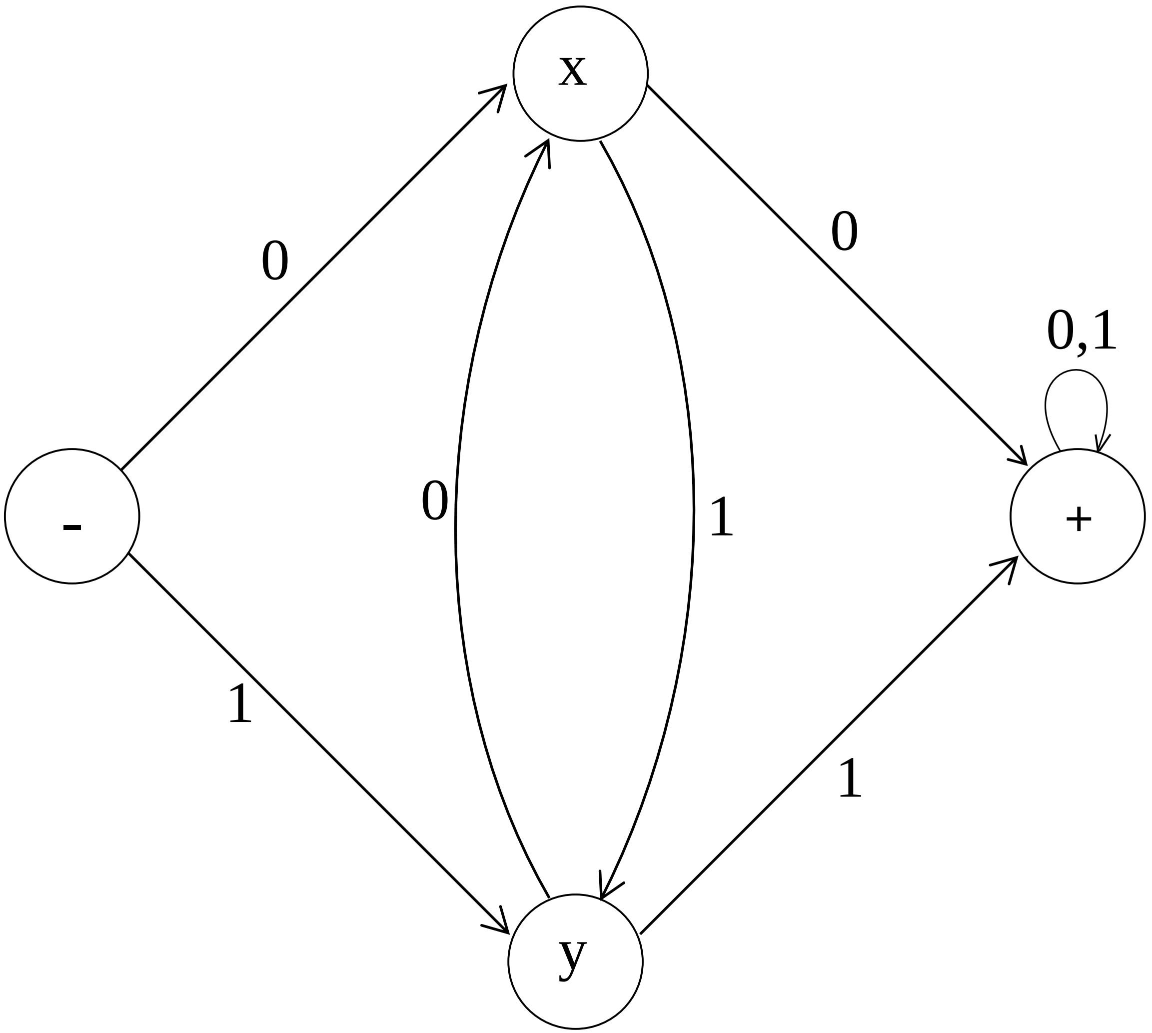
Example Continued ...



Example

Consider the language L of strings, defined over $\Sigma=\{0, 1\}$, **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 ...