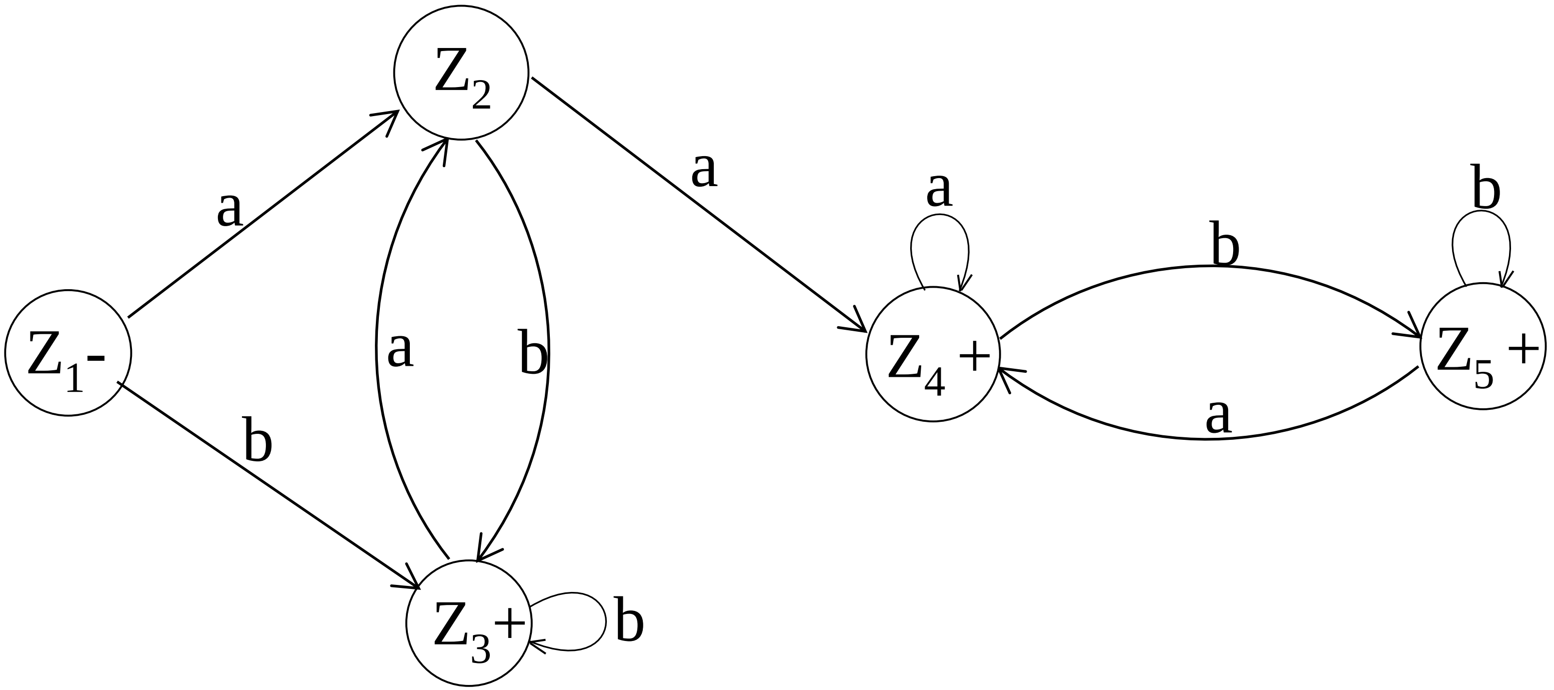
Recap Lecture 12

- Examples of writing REs to the corresponding TGs, RE corresponding to TG accepting EVEN-EVEN language, Kleene's theorem part III (method 1:union of FAs), examples of FAs corresponding to simple REs, example of Kleene's theorem part III (method 1) continued

Note

- It may be noted that in the previous example FA_1 contains two states while FA_2 contains three states. Hence the total number of possible combinations of states of FA_1 and FA_2, in sequence, will be six. For each combination the transitions for both a and b can be determined, but using the method in the example, number of states of FA_3 was reduced to five.

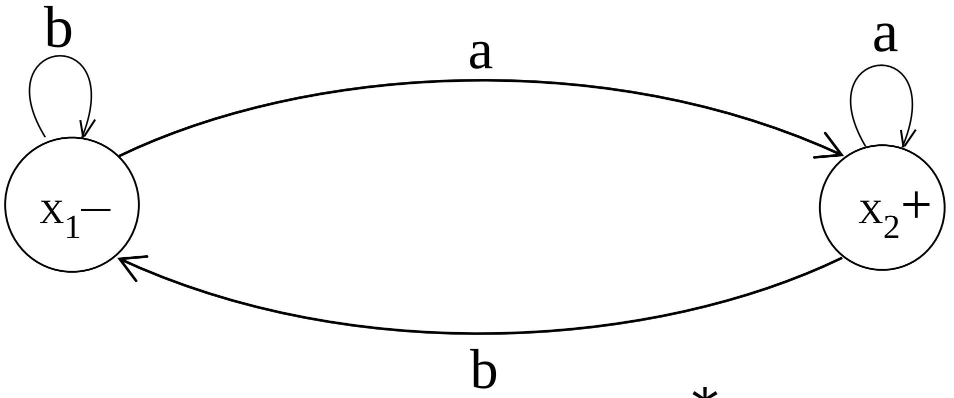
Task



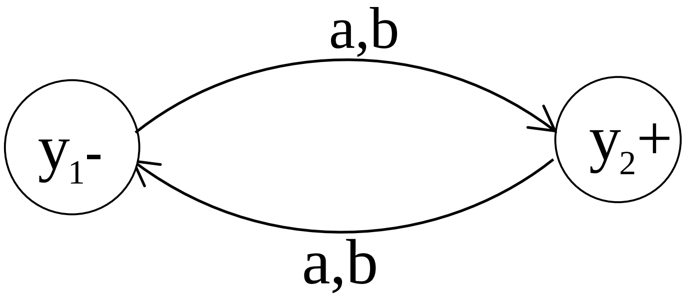
Build an FA equivalent to the previous FA

Example

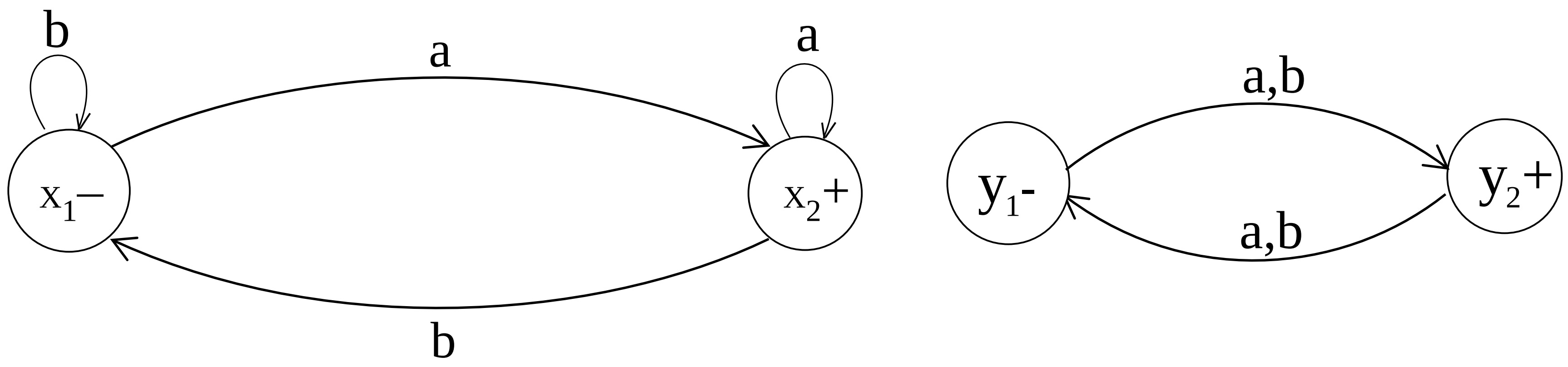
Let $r_1=(a+b)^*a$ and the corresponding FA_1 be



also $r_2 = (a+b)((a+b)(a+b))^*$ or $((a+b)(a+b))^*(a+b)$ and FA_2 be



Example continued ...

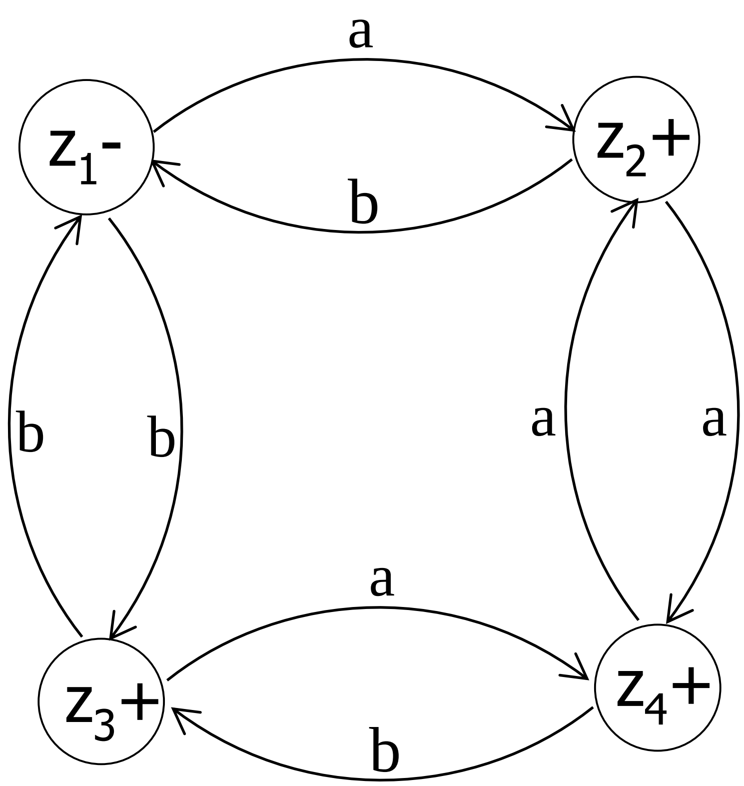


Old States	New States after reading	
	a	b
z_1-≅ (x_1,y_1)	$(x_2,y_2) \cong z_2$	$(x_1,y_2) \cong z_3$

Example continued …

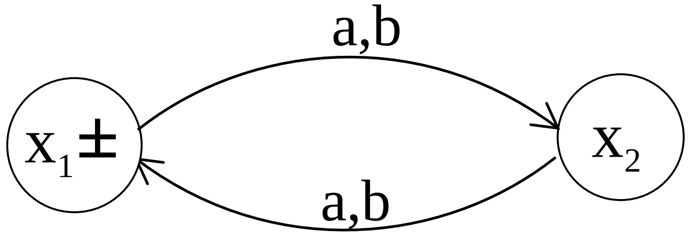
Old States	New States after reading	
	a	b
$z_2+ \cong (x_2,y_2)$	$(x_2,y_1) \cong z_4$	$(x_1,y_1) \cong z_1$
$z_3+ \cong (x_1,y_2)$	$(x_2,y_1) \cong z_4$	$(x_1,y_1) \cong z_1$
$z_4+ \cong (x_2,y_1)$	$(x_2,y_2) \cong z_2$	$(x_1,y_2) \cong z_3$

Example continued ...

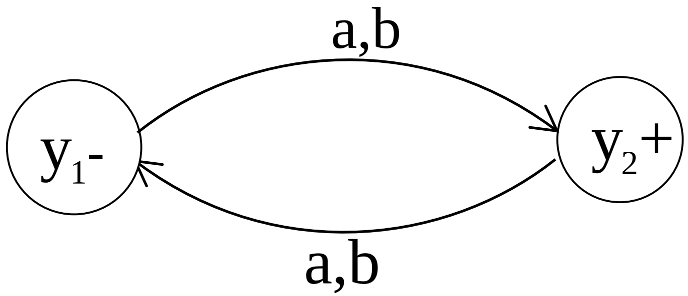


Example

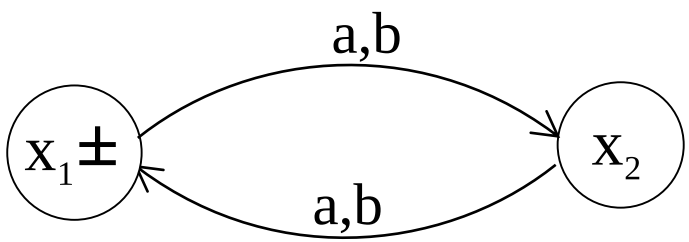
Let $r_1=((a+b)(a+b))^*$ and the corresponding FA_1 be

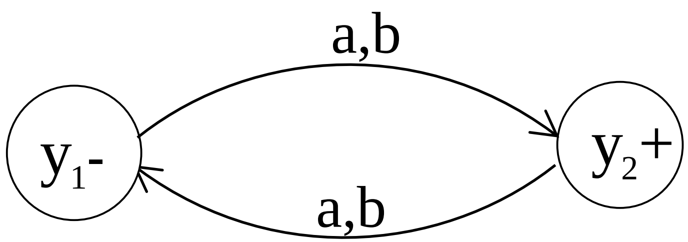


also $r_2 = (a+b)((a+b)(a+b))^*$ or $((a+b)(a+b))^*(a+b)$ and FA_2 be



Example continued …



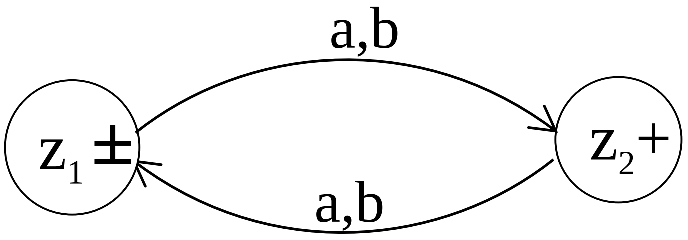


Old States	New States after reading	
	a	b
$z_1\pm \cong (x_1,y_1)$	$(x_2,y_2) \cong z_2$	$(x_2,y_2) \cong z_2$

Example continued …

Old States	New States after reading	
	a	b
$z_2+ \cong (x_2,y_2)$	$(x_1,y_1) \cong z_1$	$(x_1,y_1) \cong z_1$

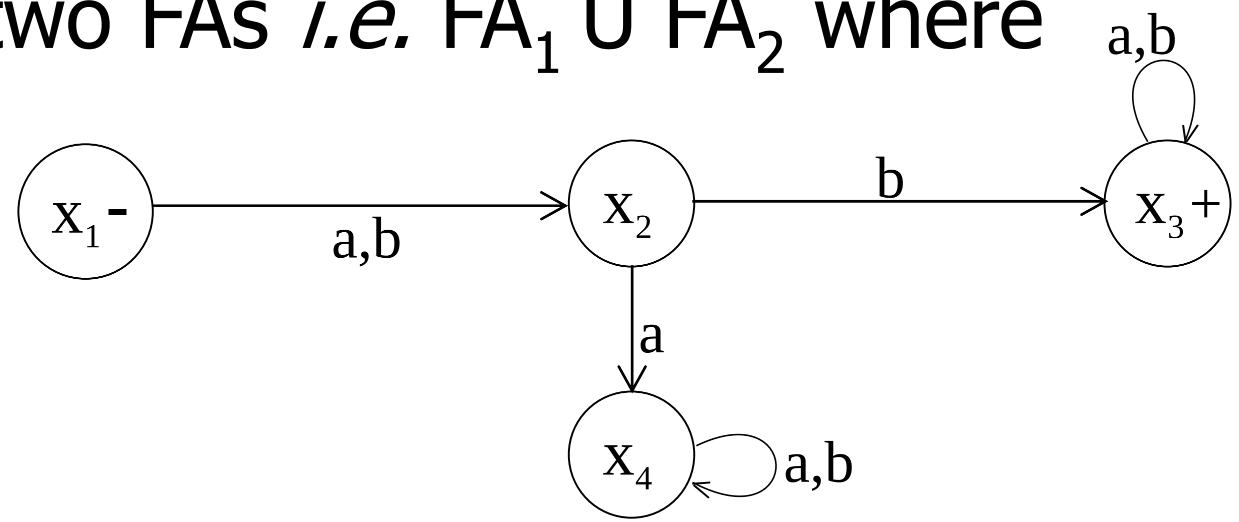
Example continued ...



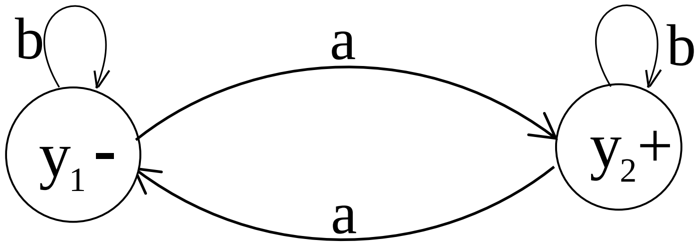
Task

Build an FA corresponding to the union of these two FAs *i.e.* FA_1 U FA_2 where

FA_1



FA_2



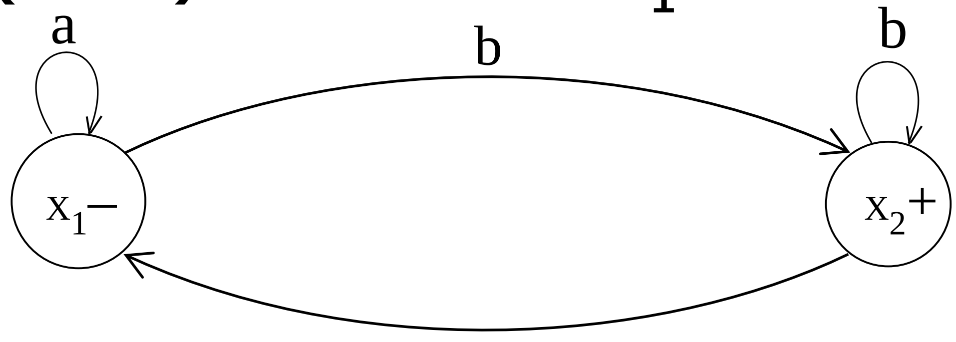
Kleene's Theorem Part III Continued ...

- **Method2 (Concatenation of two FAs):**

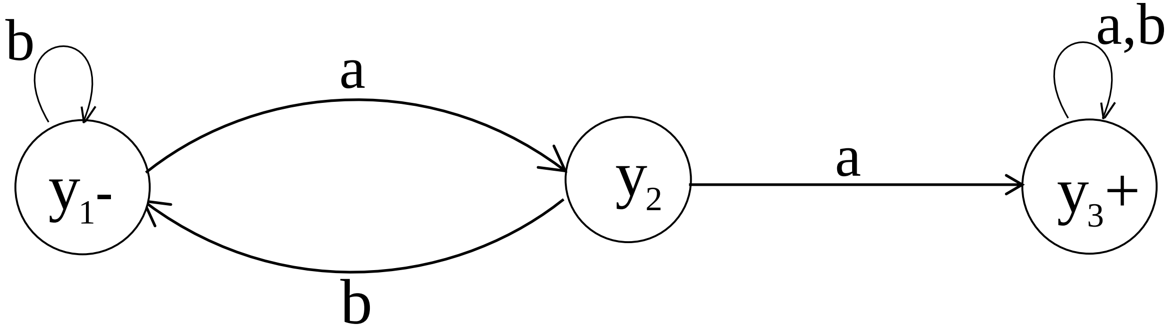
  Using the FAs corresponding to r_1 and r_2, an FA can be built, corresponding to r_1r_2. This method can be developed considering the following examples

Example

Let $r_1=(a+b)^*b$ defines L_1 and FA_1 be



and $r_2 = (a+b\ )^*aa\ (a+b\ )^*$ defines L_2 and FA_2 be



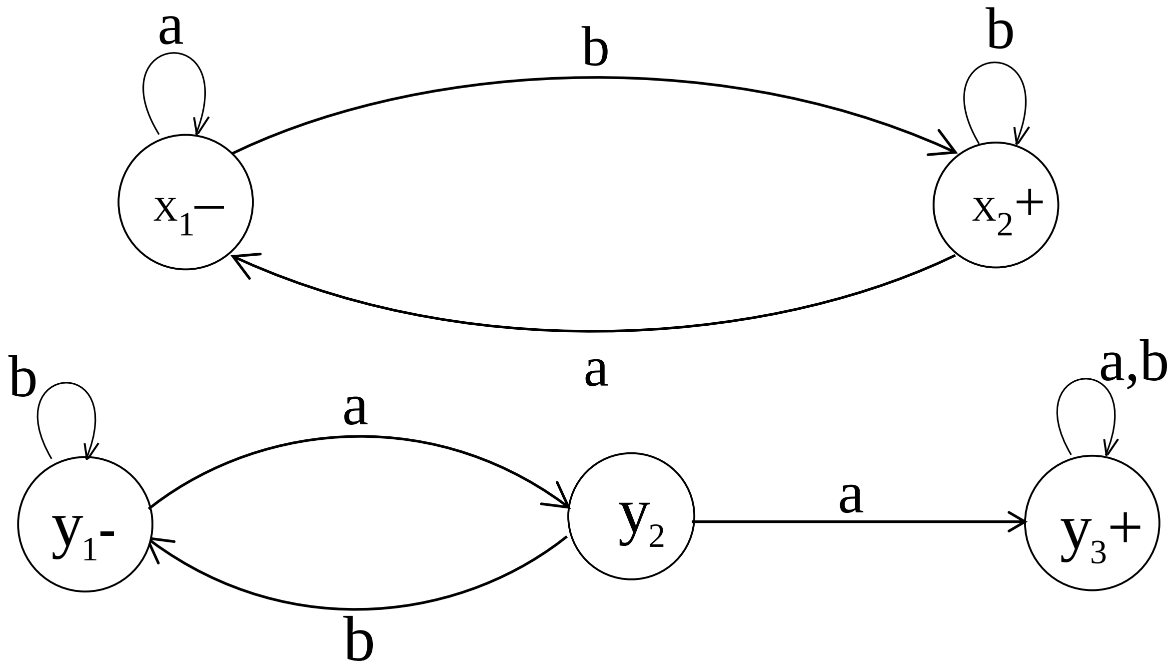
Concatenation of two FAs Continued …

Let FA_3 be an FA corresponding to r_1r_2, then the initial state of FA_3 must correspond to the initial state of FA_1 and the final state of FA_3 must correspond to the final state of FA_2.Since the language corresponding to r_1r_2 is the concatenation of corresponding languages L_1 and L_2, consists of the strings obtained, concatenating the strings of L_1 to those of L_2 , therefore ***the moment a final state of first FA is entered, the possibility of the initial state of second FA will be included as well.***

Concatenation of two FAs Continued …

Since, in general, FA_3 will be different from both FA_1 and FA_2, so the labels of the states of FA_3 may be supposed to be z_1,z_2, z_3, …, where z_1 stands for the initial state. Since z_1 corresponds to the states x_1, so there will be two transitions separately for each letter read at z_1. It will give two possibilities of states which correspond to either z_1 or different from z_1. This process may be expressed in the following transition table for all possible states of FA_3

Example continued …

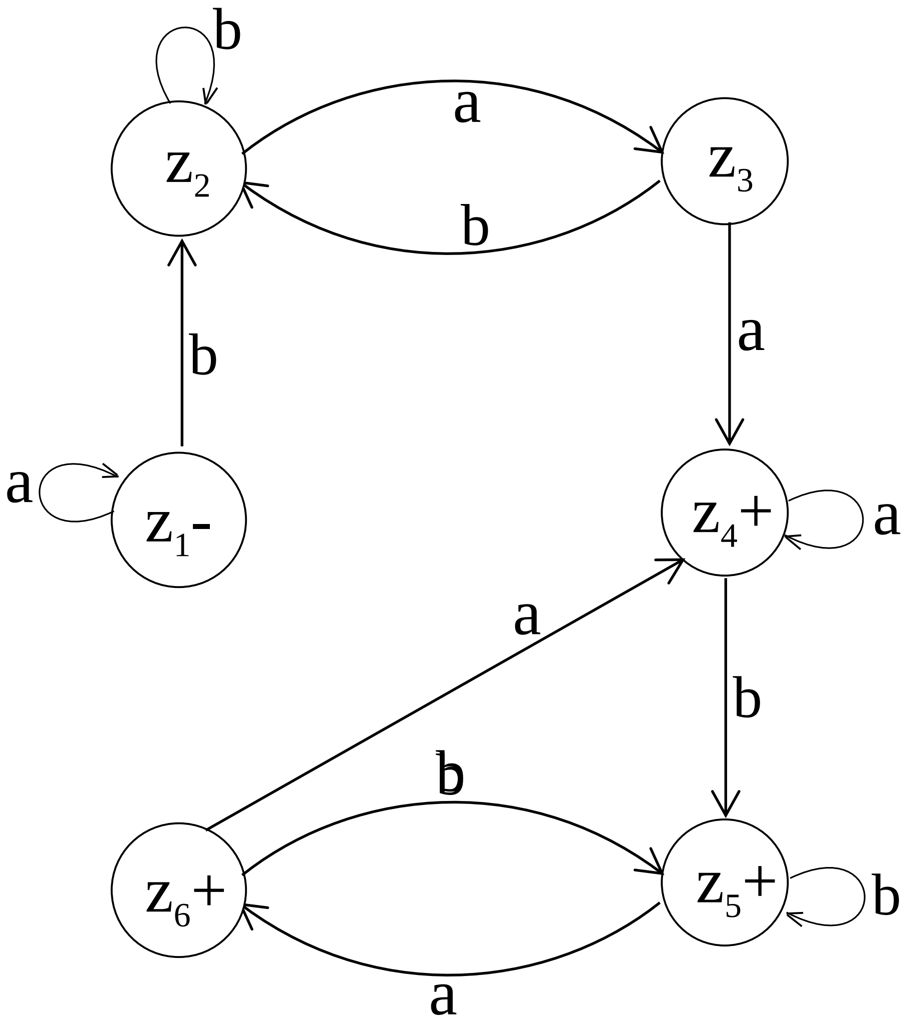


Old States	New States after reading	
	a	b
z_1-$\cong x_1$	$x_1 \cong z_1$	$(x_2,y_1) \cong z_2$

Example continued …

Old States	New States after reading	
	a	b
$z_2 \cong (x_2,y_1)$	$(x_1,y_2) \cong z_3$	$(x_2,y_1) \cong z_2$
$z_3 \cong (x_1,y_2)$	$(x_1,y_3) \cong z_4$	$(x_2,y_1) \cong z_2$
$z_4+ \cong (x_1,y_3)$	$(x_1,y_3) \cong z_4$	$(x_2,y_1,y_3) \cong z_5$
$z_5+ \cong (x_2,y_1,y_3)$	$(x_1,y_2,y_3) \cong z_6$	$(x_2,y_1,y_3) \cong z_5$
$z_6+ \cong (x_1,y_2,y_3)$	$(x_1,y_3) \cong z_4$	$(x_2,y_1,y_3) \cong z_5$

Example continued …



Summing Up

- Examples of Kleene’s theorem part III (method 1) continued ,Kleene’s theorem part III (method 2: Concatenation of FAs),
- Example of Kleene’s theorem part III (method 2 : Concatenation of FAs)