

TOA

LECTURE 5

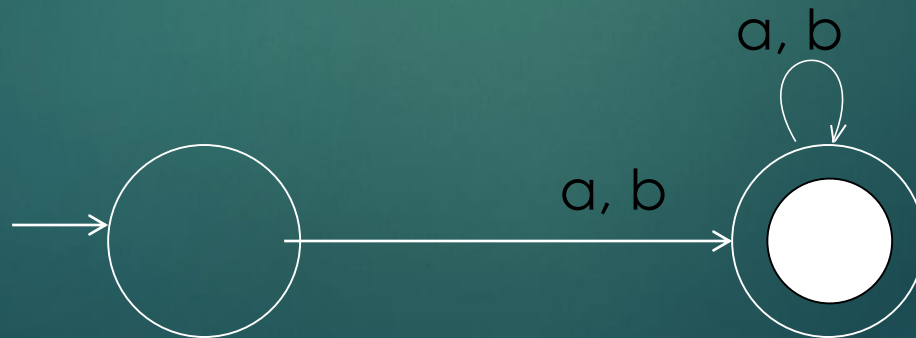
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Recap Lecture 4

- ▶ Regular expression of **EVEN-EVEN** language,
Difference between $a^* + b^*$ and $(a+b)^*$,
Equivalent regular expressions; sum, product and
closure of regular expressions; regular languages,
finite languages are regular, introduction to finite
automaton, definition of FA, transition table,
transition diagram.

Note

- ▶ It may be noted that to indicate the initial state, an arrow head can also be placed before that state and that the final state with double circle, as shown below. It is also to be noted that while expressing an FA by its transition diagram, the labels of states are not necessary.



Example

► $\Sigma = \{a,b\}$

States: x, y , where x is both initial and final state.

Transitions:

1. At state x reading a or b go to state y .
2. At state y reading a or b go to state x .

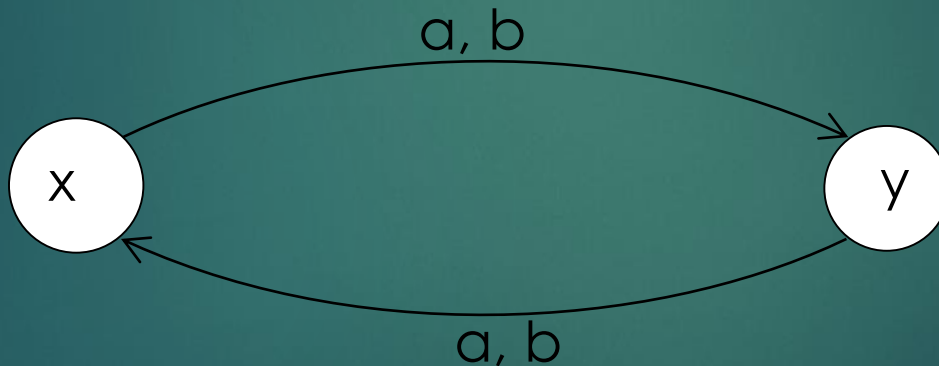
Example Continued ...

- ▶ These transitions can be expressed by the following transition table

Old States	New States	
	Reading a	Reading b
$x \pm$	y	y
y	x	x

Example Continued ...

- ▶ It may be noted that the previous transition table may be depicted by the following transition diagram.



Example Continued ...

- ▶ The previous transition diagram is an FA accepting the language of strings, defined over $\Sigma = \{a, b\}$ of **even length**. It may be noted that this language may be expressed by the regular expression

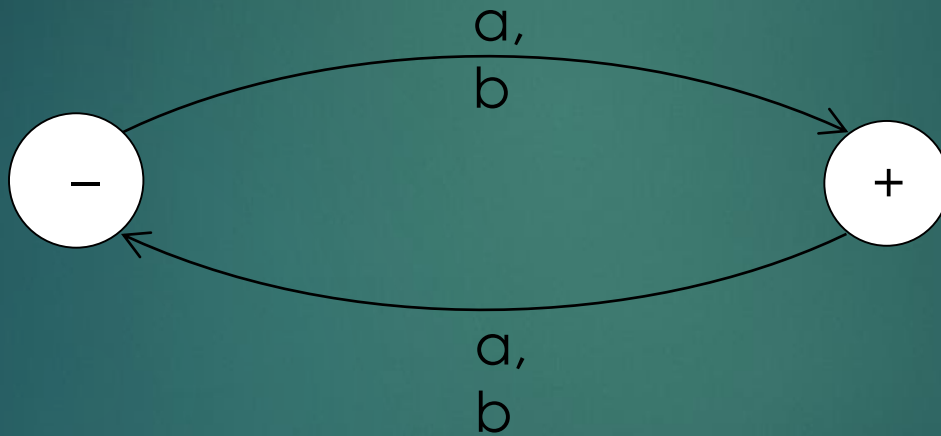
$$((a+ b) (a + b))^*$$

TASK

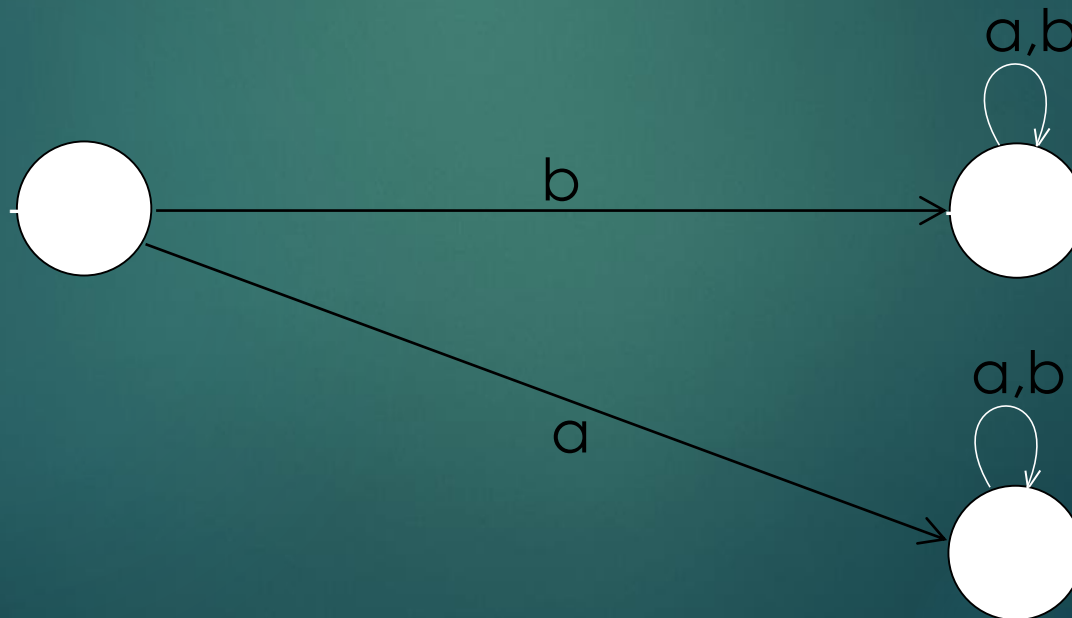
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Build an FA for the language L of strings, defined over $\Sigma = \{a, b\}$, **of** odd length.

Solution of Task



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:**

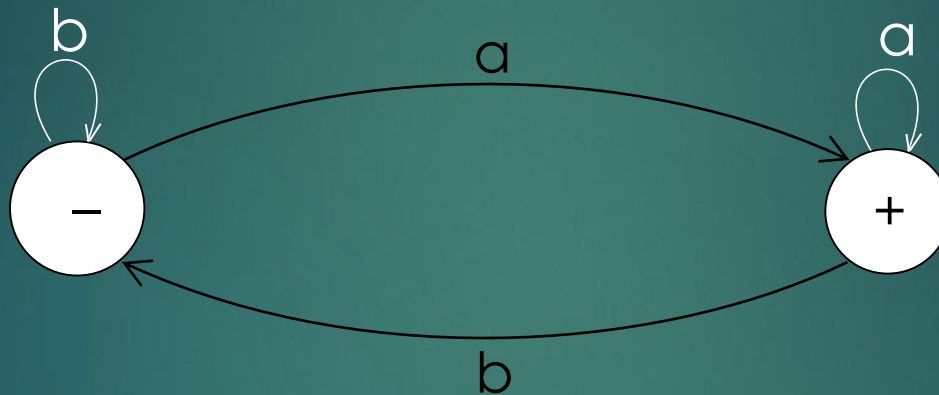
Consider the language L of strings, defined over $\Sigma=\{a, b\}$, **ending in a**. The language L may be expressed by RE

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

This language may be accepted by the following FA

Example Continued ...

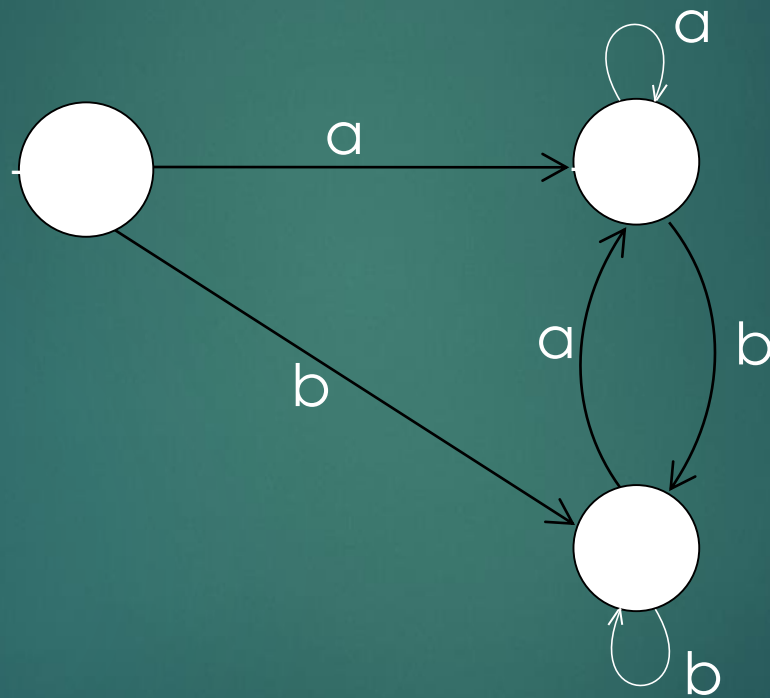
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There may be another FA corresponding to the given language.

Example continued ...

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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

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

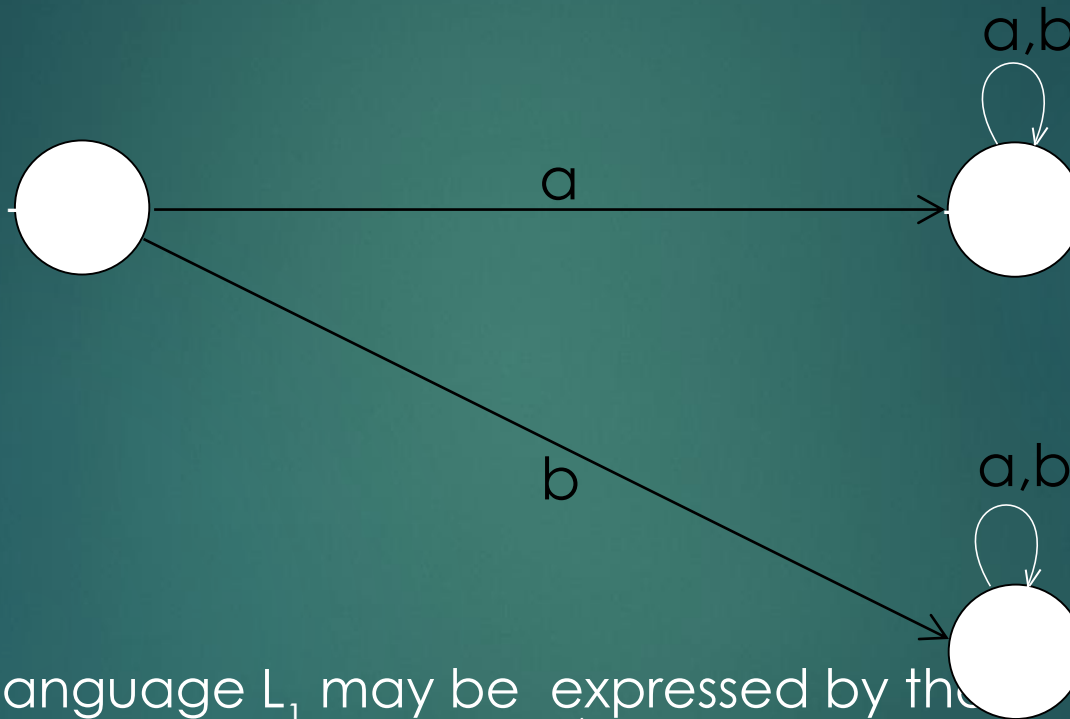
L_1 = The language of strings, defined over $\Sigma = \{a, b\}$,
beginning with a

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 .

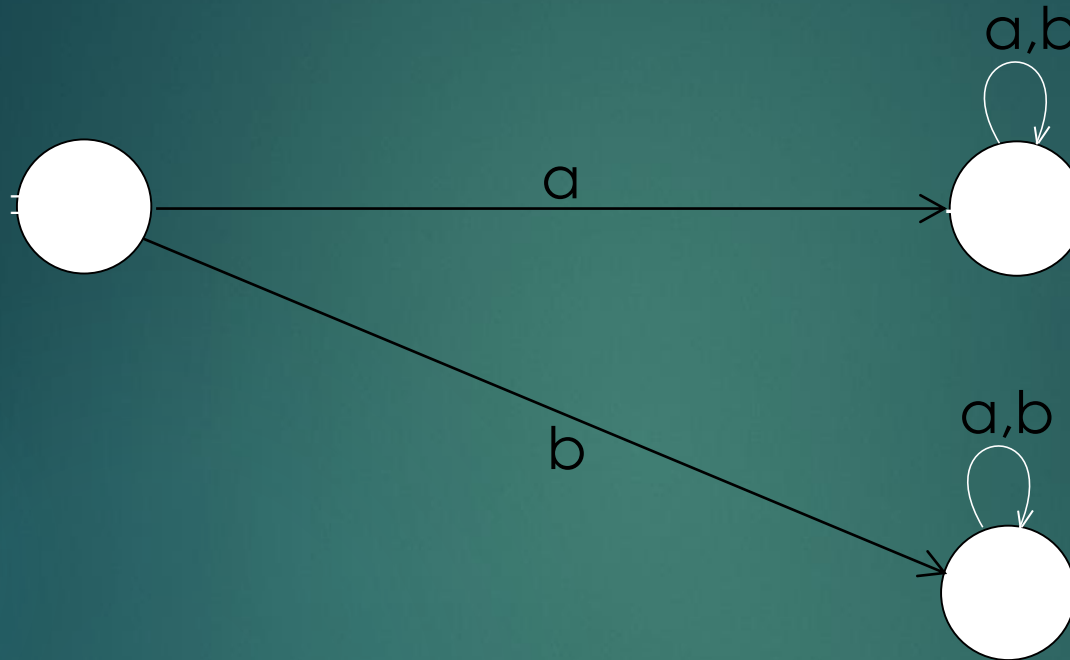
FA₁ Corresponding to L₁

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

FA₂ Corresponding to L₂



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

Example

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- ▶ 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

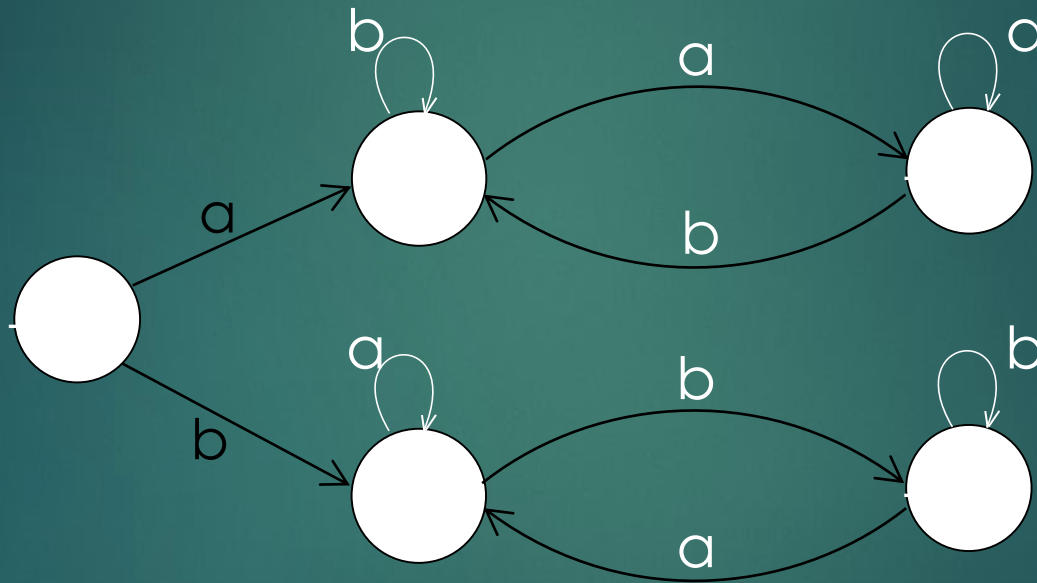
$$a (a + b)^* a + b (a + b)^* b$$

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 ...

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Task

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

Summing Up

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