THEORY OF AUTOMATA
&
FORMAL LANGUAGES

HANDOUTS 05

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Finite Automata

Method 4 (Finite Automaton)

Definition

A Finite automaton (FA), is a collection of the followings

1. Finite number of states, having one initial and some (maybe none) final states.
2. Finite set of input letters (Σ) from which input strings are formed.
3. Finite set of transitions i.e. for each state and for each input letter there is a transition showing how to move from one state to another.

Example

Σ = {a,b}

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

Transitions:

At state x reading a, go to state z

At state x reading b, go to state y

At state y reading a, b go to state y

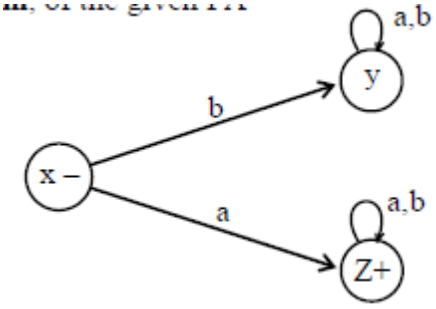
At state z reading a, b go to state z

These transitions can be expressed by the following table called **transition table**

Old States	New States	
	Reading a	Reading b
x -	z	y
y	y	y
z +	z	z

Note

It may be noted that the information of an FA, given in the previous table, can also be depicted by the following diagram, called the **transition diagram**, of the given FA

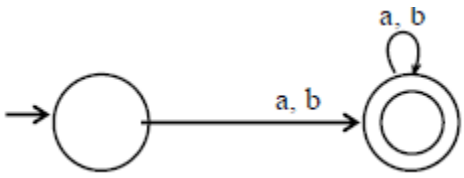


Remark

The above transition diagram is an FA accepting the language of strings, defined over Σ = {a, b}, **starting with a**. It may be noted that this language may be expressed by the regular expression a(a + b)*

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

Σ = {a,b}

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

Transitions:

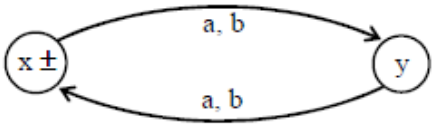
At state x reading a or b go to state y.

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

These transitions can be expressed by the following transition table

Old States	New States	
	Reading a	Reading b
x ±	y	y
y	x	x

It may be noted that the above transition table may be depicted by the following transition diagram.



The above transition diagram is an FA accepting the language of strings, defined over Σ={a, b} of **even length**.

It may be noted that this language may be expressed by the regular expression ((a+ b) (a + b))*