



SNS COLLEGE OF TECHNOLOGY

Coimbatore-36.

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**COURSE CODE & NAME : 19CSB301 & AUTOMATA THEORY AND COMPILER
DESIGN**

III YEAR/ V SEMESTER

UNIT – I FINITE AUTOMATA AND REGULAR LANGUAGES

Topic: FSA- Deterministic Finite State Automata

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Finite Automata

Finite Automata

A finite automata is a recognizer for a language that is used to check whether a string is accepted by a language or not. It takes input a string x and returns 'yes' if x is a sentence of the language and 'no' otherwise. It is capable of recognizing precisely the regular sets.

Two types of finite automata are:

- a) Non – Deterministic Finite Automata.
- b) Deterministic Finite Automata.



Non Deterministic Finite Automata

1 Non – Deterministic Finite Automata

A NFA is a mathematical model that consists of

- a) Set of states 'S'
- b) Set of input symbols ' Σ '
- c) A transition function 'move' that maps state symbol pairs to set of states.
- d) State 'S0' distinguished to be the start state.
- e) Set of final states (or) accepting states 'F'

In computers, NFA is being represented by

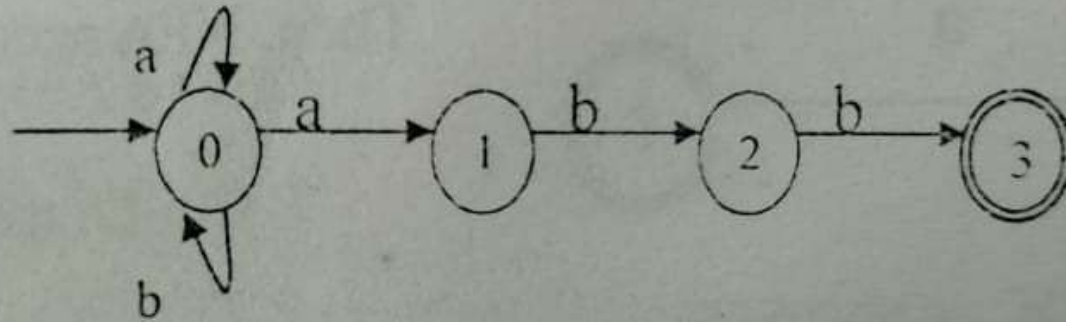
- a) Transition Table
- b) Adjacency list representation



NFA Example

Example:

Construct the NFA for the regular expression $(a | b)^* abb$.





NFA Example

$S = \{0, 1, 2, 3\}$

$\Sigma = \{a, b\}$

Move functions:

$\text{move}(0, a) = \{0, 1\}$	$\text{move}(0, b) = \{0\}$
$\text{move}(1, a) = \{\}$	$\text{move}(1, b) = \{2\}$
$\text{move}(2, a) = \{\}$	$\text{move}(2, b) = \{3\}$

$S_0 = 0$

$F = \{3\}$

Transition Table:

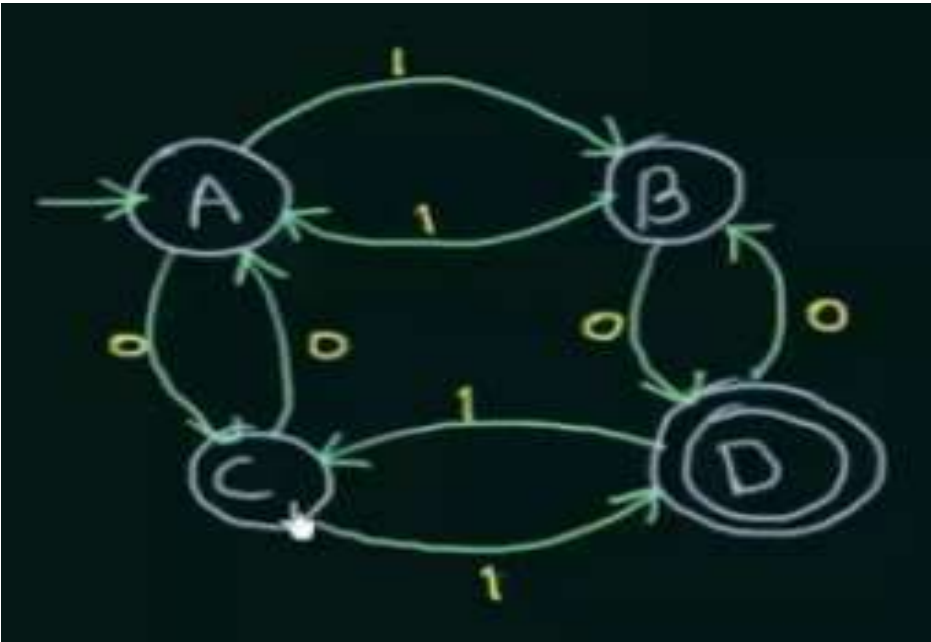
<i>State</i>	<i>a</i>	<i>B</i>
0	{0, 1}	{0}
1	{ }	{2}
2	{ }	{3}
3	{ }	{ }

Path for the string "aabb":

$0 \xrightarrow{a} 0 \xrightarrow{a} 1 \xrightarrow{b} 2 \xrightarrow{b} 3$



Deterministic Finite Automata (DFA)



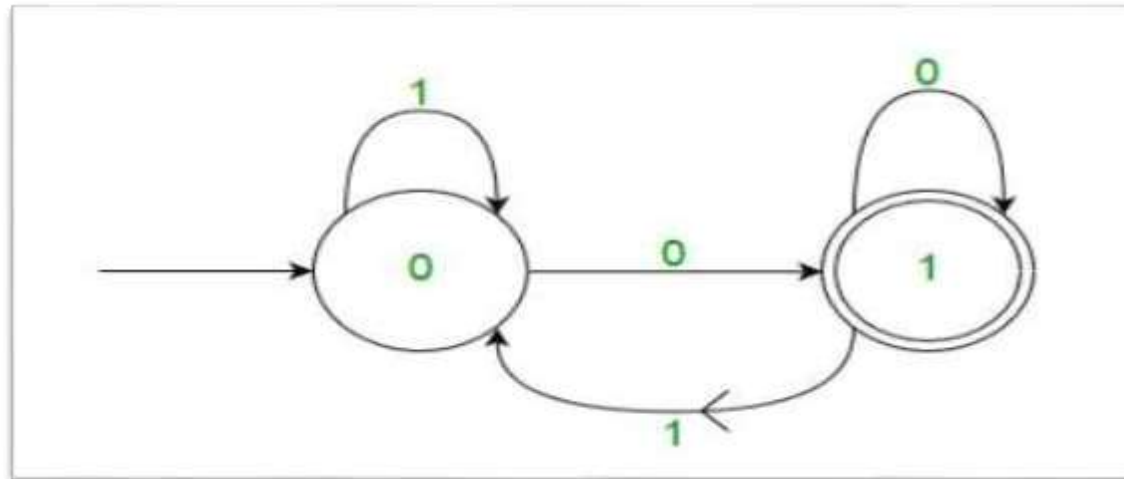
- $\{Q, \Sigma, q, F, \delta\}$
- $Q = \{A, B, C, D\}$
- $\Sigma = \{0, 1\}$
- $Q_0 = A$
- $F = D$
- $\delta \rightarrow T$

	0	1
A	C	B
B	D	A
C	A	D
D	B	C



Deterministic Finite Automata (DFA)

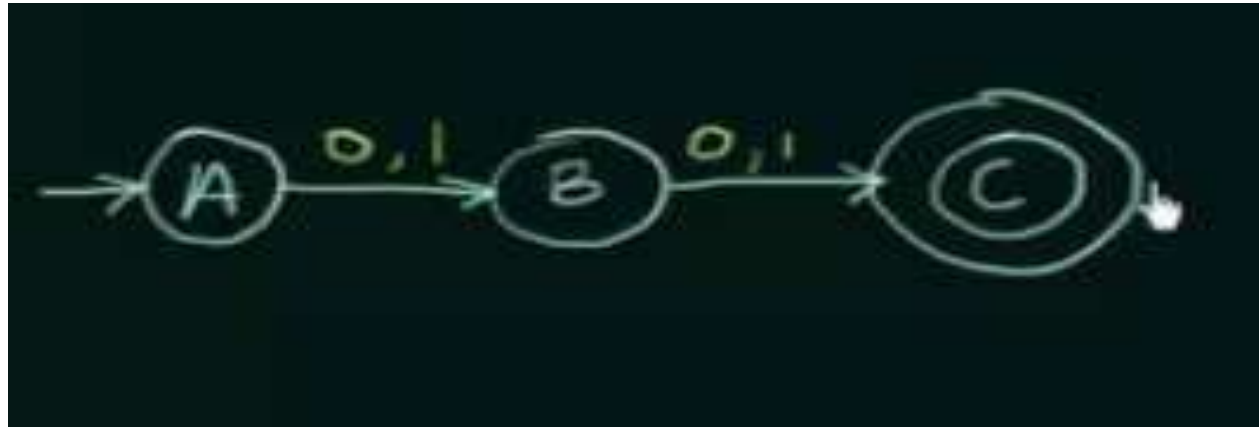
- Example 1
- L1 = Set of all strings that end with '0'
- L1 = {000,000,010,0110,0100,01110,....}





Deterministic Finite Automata (DFA)

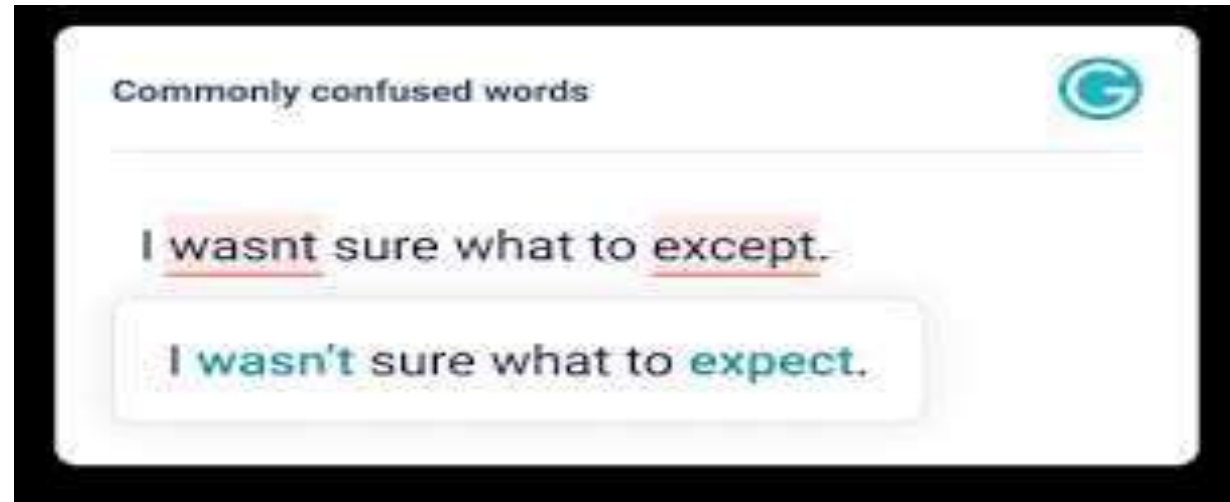
- Example 2
- $L1 =$ Set of strings over $\{0,1\}$ of length 2
- $L1 = \{00,11,01,10\}$





DFA - Applications

- Lexical Analysis – compiler
- Spelling Checker
- Search Command





DFA - Examples

- Set of strings over $\{0,1\}$ that start with 0 and end with 1
- Set of strings over $\{a,b\}$ that ends with bb



References

- John E. Hopcroft and Rajeev Motwani and Jeffrey D. Ullman, “Introduction to Automata Theory, Languages and Computation”, Second Edition, Pearson Education, New Delhi, (2007) (UNIT-I)
- Linz P. An introduction to formal languages and automata. Sixth edition, Jones and Bartlett Publishers; 2016.(UNIT-I)
- Ramaiah k. Dasaradh “Introduction to Automata and Compiler Design “ First Edition ,Prentice Hall India Learning Private Limited(2011)(UNIT-I to V)

