TUTORIAL - 4

NFA : NON-DETERMINISTIC FINITE AUTOMATA

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Q1.) Construct a NFA to accept strings over alphabet $\Sigma = \{0, 1\}$

a) The third symbol from right is '0'.

$\Sigma = \{0, 1\}$ [Input symbol]

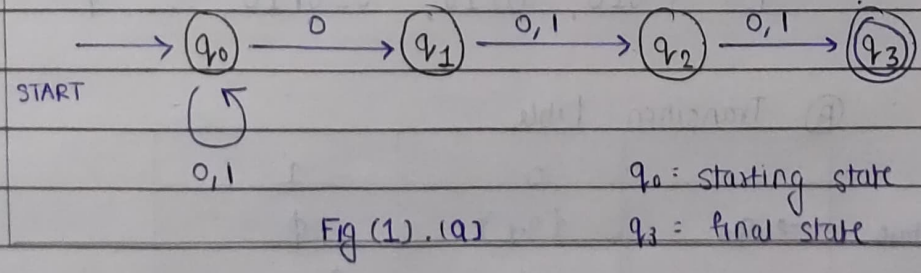
L = Language = { 011, 010, 000, 001, 0011, ... }

Q = No. of finite states = n+1 = 3+1 = 4 (n = size of min 'L' string)

Ⓐ Transition Table

(State)			0	1
Initial	→	q_0	$\{q_0, q_1\}$	$\{q_0\}$
		q_1	$\{q_2\}$	$\{q_2\}$
		q_2	$\{q_3\}$	$\{q_3\}$
Final	*	q_3	ϕ	ϕ

Ⓑ Transition Diagram



q_0 : starting state

q_3 : final state

Fig (1).(a)

b) The first and last digits are same

$\Sigma = \{0, 1\}$

L = { 0, 1, 010, 101, 000, 111, ... }

1.b) (A) Transition table

	0	1
→ q_0	$\{q_2, q_3\}$	$\{q_1, q_3\}$
q_1	$\{q_1\}$	$\{q_1, q_3\}$
q_2	$\{q_2, q_3\}$	$\{q_2\}$
* q_3	ϕ	ϕ

(B) Transition diagram

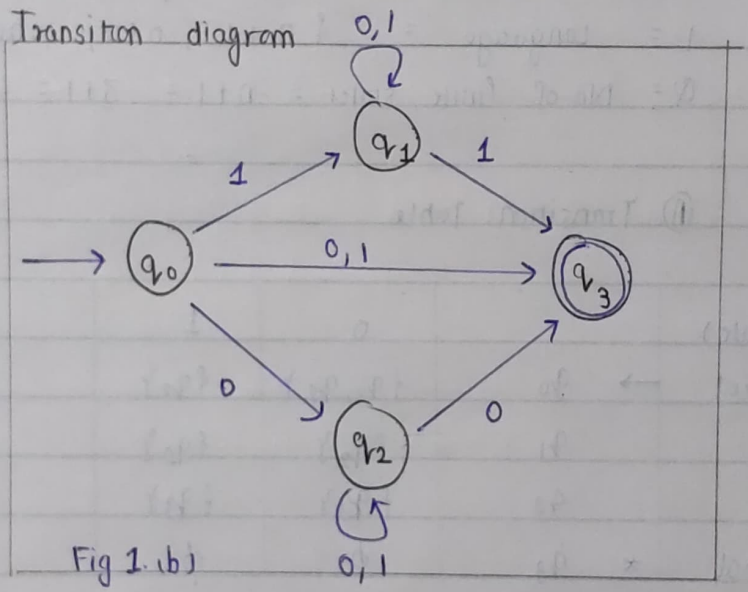


Fig 1.(b)

1.c) Start with 01 and end with 10

$\Sigma = \{0, 1\}$

$L = \{ 010,\ 0110,\ 010110,\ \ldots \}$

(A) Transition table

		0	1
Start	→ q_0	$\{q_1\}$	ϕ
	q_1	ϕ	$\{q_2, q_3\}$
	q_2	$\{q_2\}$	$\{q_2, q_3\}$
	q_3	$\{q_4\}$	ϕ
final	* q_4	ϕ	ϕ

1(c) (B) Transition Diagram

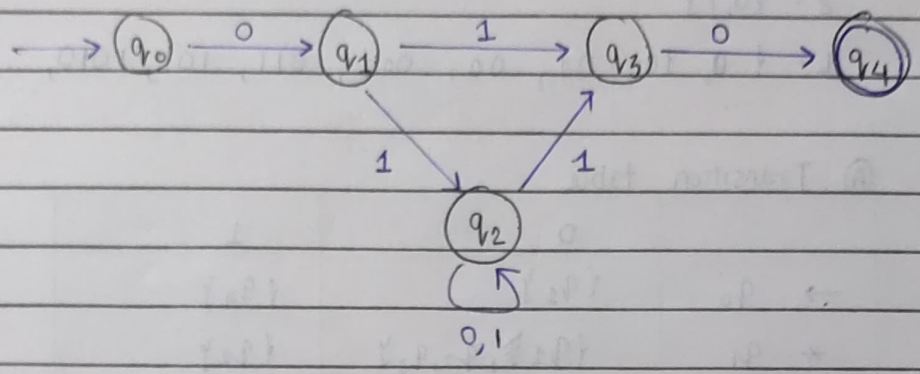


Fig 1.(c)

1.) d) Ending with 110

$\Sigma = \{0, 1\}$

$L = \{ 110, 0110, 1110, 01110, \ldots \}$

No. of States = $n+1 = 3+1 = 4$ { n = min^m string in L }

(A) Transition Table

	0	1
q_0	$\{q_0\}$	$\{q_0, q_1\}$
q_1	ϕ	$\{q_2\}$
q_2	$\{q_3\}$	ϕ
q_3	ϕ	ϕ

(B) Transition Diagram

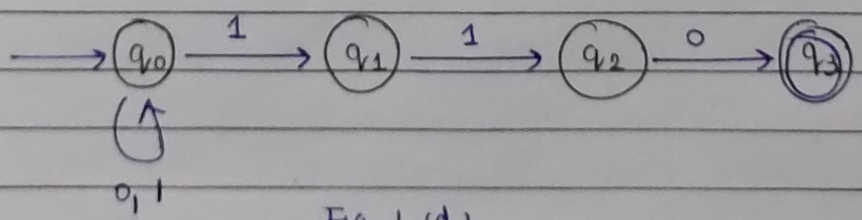


Fig 1.(d)

(1)(e) 0 as one of last three characters in string

$\Sigma = \{0, 1\}$

$L = \{ 0, 10, 01, 00, 001, 011, 101, 1010, \ldots \}$

(A) Transition table

		0	1
→	q_0	$\{q_1\}$	$\{q_4\}$
*	q_1	$\{q_1, q_2, q_3\}$	$\{q_2\}$
*	q_2	$\{q_2, q_1, q_3\}$	$\{q_3\}$
*	q_3	$\{q_1, q_3, q_2\}$	$\{q_4\}$
	q_4	$\{q_1, q_2, q_3\}$	$\{q_4, q_0\}$

(B) Transition Diagram

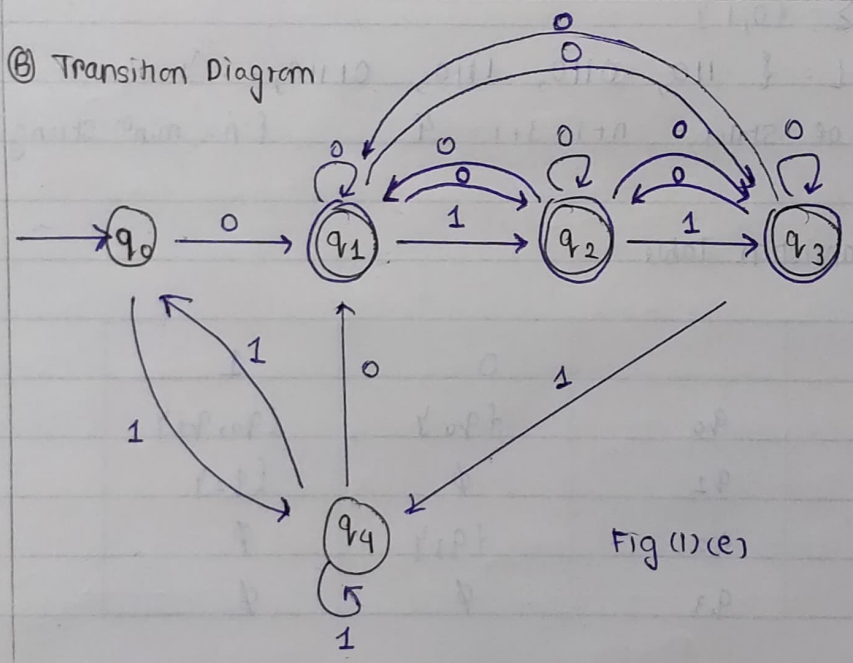


Fig (1)(e)

2.) Design a NFA to accept strings over alphabets $\Sigma = \{a, b\}$ ending with a b a Now use this NFA to construct DFA to accept the same set of string.

2.) NFA : $Q = \{q_0, q_1, q_2, q_3\}$ start = q_0 } state
$\Sigma = \{a, b\}$ final = q_3 }

(A) Transition table

	a	b
q_0	$\{q_0, q_1\}$	$\{q_0\}$
q_1	ϕ	$\{q_2\}$
q_2	$\{q_3\}$	ϕ
q_3	ϕ	ϕ

(B) Transition Diagram

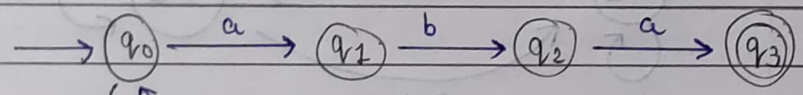


Fig (2) (i)

DFA : $Q = \{q_0, q_2, q_2, q_3\}$ q_0 = start
$\Sigma = \{a, b\}$ q_3 = end

(A) Transition ~~Diagram~~ Table

	a	b
q_0	q_1	q_0
q_1	q_1	q_2
q_2	q_3	q_0
q_3	q_1	q_2

(B) Transition Diagram

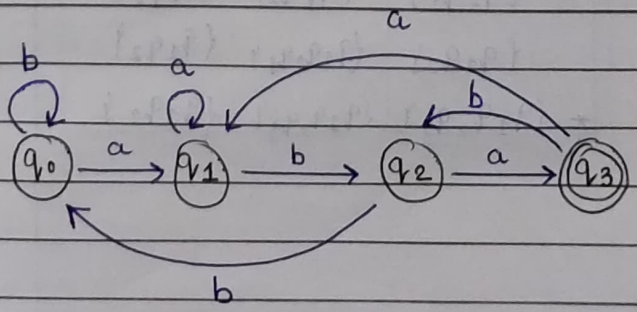


Fig (2) (ii)

Q Σ initial final ⑥

3) Let $M = \{ \{q_1, q_2, q_3\}, \{0,1\}, \{q_1\}, \{q_3\} \}$ NFA

Transition Table Given :

	0	1
q_1	$\{q_2, q_3\}$	$\{q_1\}$
q_2	$\{q_1, q_2\}$	$\{q_1, q_2\}$
q_3	$\{q_2\}$	$\{q_1, q_2\}$

Construct Transition Diagram corresponding to above NFA.
Also convert NFA → to equivalent DFA.

(A) Transition Diagram

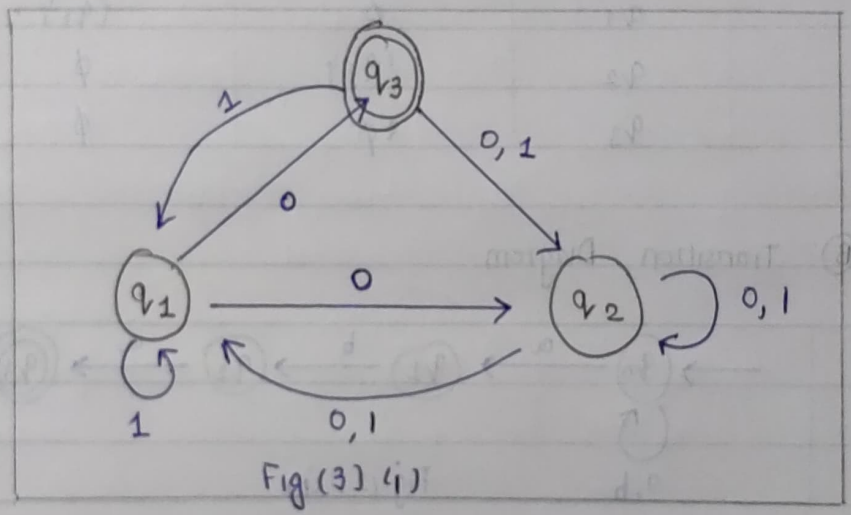


Fig (3) (i)

(A2) Transition Table for DFA

State	0	1
→ $\{q_1\}$	$\{q_2 q_3\}$	$\{q_1\}$
* $\{q_2 q_3\}$	$\{q_1 q_2\}$	$\{q_1 q_2\}$
$\{q_1 q_2\}$	$\{q_2 q_3 q_3\}$	$\{q_1 q_2\}$
* $\{q_1 q_2 q_3\}$	$\{q_1 q_3 q_3\}$	$\{q_1 q_2\}$

(B3) Transition Diagram

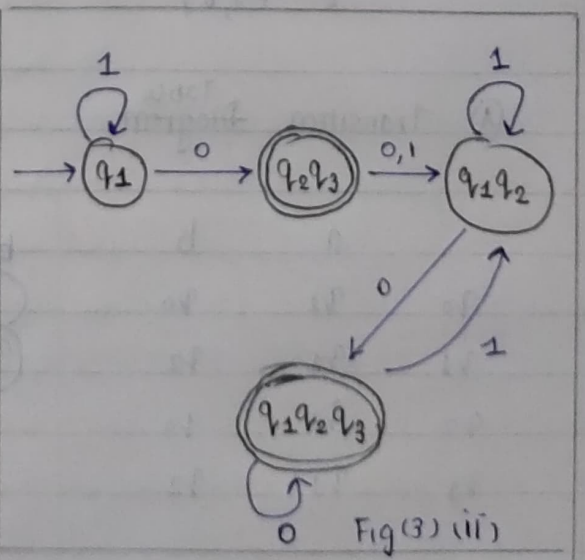


Fig (3) (ii)

4) Construct the transition diagram from given transition table for NFA. Convert NFA to equivalent DFA.

(A) Transition Table

States	0	1
$\rightarrow q_0$	$\{q_2\}$	ϕ
q_1	ϕ	$\{q_0, q_1\}$
$* q_2$	$\{q_0, q_1\}$	$\{q_0\}$

(B) Transition Diagram

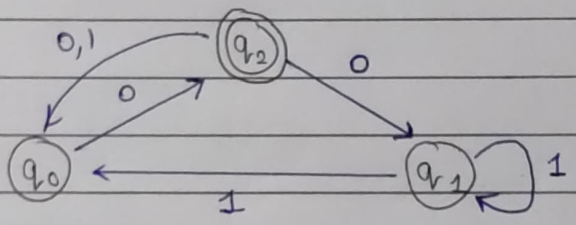


Fig 4 (i)

(A2) Transition table for DFA

States	0	1
$\rightarrow q_0$	$\{q_2\}$	$\{q_3\}$
$*\{q_2\}$	$\{q_0 q_1\}$	$\{q_0\}$
$\{q_0 q_1\}$	$\{q_2\}$	$\{q_0 q_1\}$
$\{q_3\}$	$\{q_3\}$	$\{q_3\}$

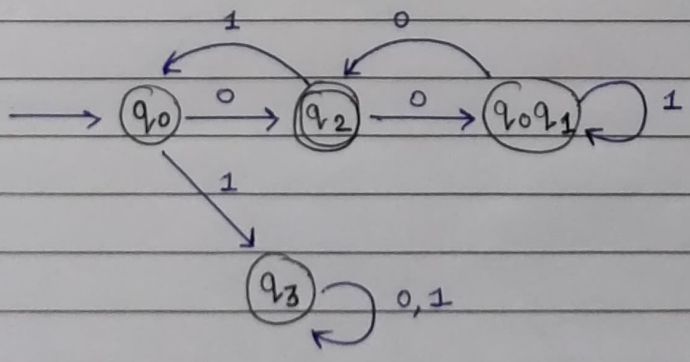


Fig (4) (ii)

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