Date ....

THEORY OF COMPUTATION

MC-304

CLASS TEST-1

SUBMITTED BY : AIMAN SIDDIQUA

2K18/MC/008

1. Transition table for given automata:

Present state	Next state $a=0$	Next state $a=1$
$\rightarrow q_0$	q_1	q_3
q_1	q_4	q_2
q_2	q_1	q_5
q_3	q_0	q_4
q_4	q_4	q_4
q_5	q_2	q_4

$$\pi_0 = (\{q_0, q_2\}, \{q_1, q_3, q_4, q_5\})$$

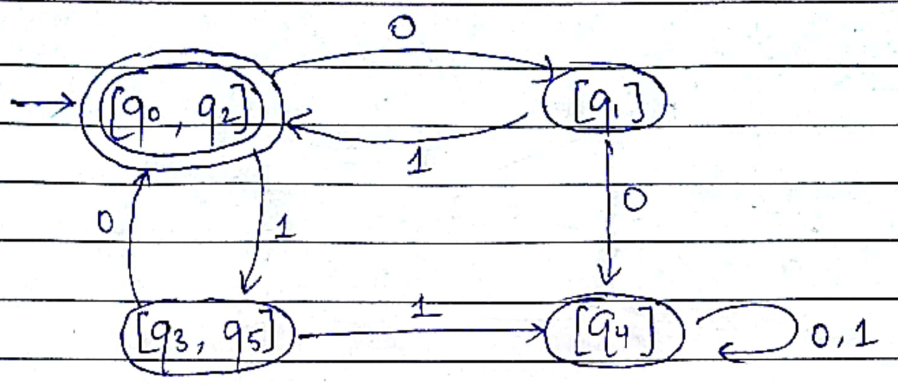
$$\pi_1 = (\{q_0, q_2\}, \{q_1\}, \{q_3, q_5\}, \{q_4\})$$

$$\pi_2 = (\{q_0, q_2\}, \{q_1\}, \{q_3, q_5\}, \{q_4\})$$

$$\pi_1 = \pi_2$$

Hence the minimum state automaton is:

Spiral



2. Transition table for NDFA :

Present state	Next state a=0	a=1
q_1	q_2, q_3	q_1
q_2	q_1, q_2	ϕ
q_3	q_2	q_1, q_2

$M = (\{q_1, q_2, q_3\}, \{0,1\}, \delta, q_1, \{q_3\})$

$M' \equiv DFA \equiv (2^Q, \{0,1\}, \delta', [q_1], F)$

where $F \equiv (\{q_3\}, [q_3, q_1], [q_3, q_2], [q_3, q_1, q_2])$

The transition table δ' is :

Present State	Next State a=0	a=1
$[q_1]$	$[q_2, q_3]$	$[q_1]$
$[q_2, q_3]$	$[q_1, q_2]$	$[q_1, q_2]$
$[q_1, q_2]$	$[q_1, q_2, q_3]$	$[q_1]$
$[q_1, q_2, q_3]$	$[q_1, q_2, q_3]$	$[q_1, q_2]$

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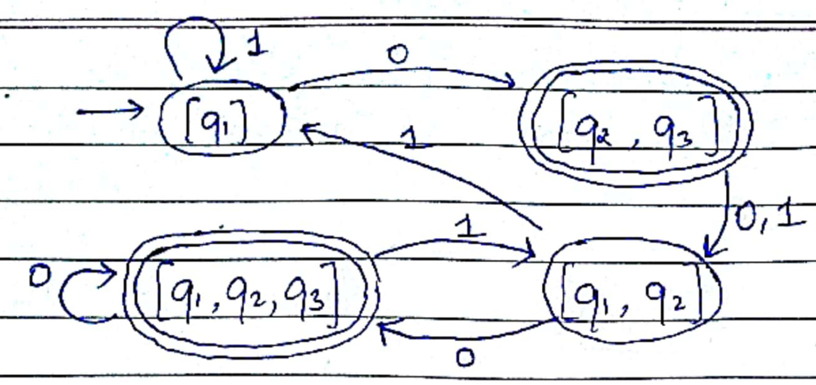

3. $S \rightarrow 0S1 \mid 0A \mid 0 \mid 1B \mid 1$

$A \rightarrow 0A \mid 0$

$B \rightarrow 1B \mid 1$

~~(a) 001100~~

~~$W_0 = \{S\}$~~

~~$W_1 = \{S, 0S1, 0A, 0, 1B, 1\}$~~

~~$W_2 = \{S, 0S1, 0A, 0, 1B, 1, 00S11, 00A1,$~~

~~$001, 01B1, 011,$~~

In order to derive 001100 or 001010 we cannot use $S \rightarrow 0S1$ as the first production as it will then end in 1 always and we need 0 at the end. $S \rightarrow 0$ or $S \rightarrow 1$ produce terminal strings so we can't use these productions either.

Hence we are left with $S \rightarrow 0A$ and $S \rightarrow 1B$. As $A \rightarrow 0A \mid 0$ any derivation from this will only give 0^n. Similarly $S \rightarrow 1B$, $B \rightarrow 1B \mid 1$ will only given 1^n as the terminal string.

Hence 001100 and 001010 are not in the language generated by this grammar.

(4.) $G_1 = (\{S\}, \{a,b\}, P_1, S)$

$P_1 = \{ S \rightarrow aSb \mid ab \}$

$G_2 = (\{S, A, B, C\}, \{a,b\}, P_2, S)$

$P_2 = \{ S \rightarrow AC, C \rightarrow SB, S \rightarrow AB, A \rightarrow a, B \rightarrow b \}$

Generating $L(G_1)$:

$S \rightarrow aSb$

$S \rightarrow aaSbb$

$\vdots$

We get a terminal string by applying $S \rightarrow ab$ anywhere.

$\therefore L(G_1) = \{a^n b^n \mid n \geq 1\}$

Generating $L(G_2)$:

$S \rightarrow AB \rightarrow ab$

$S \rightarrow AC \rightarrow ASB \xrightarrow{*} A^{n-1} S B^{n-1} \rightarrow A^n B^n \rightarrow a^n b^n$

$\therefore L(G_2) = \{a^n b^n \mid n \geq 1\}$

Hence $L(G_1)$ and $L(G_2)$ are equivalent.