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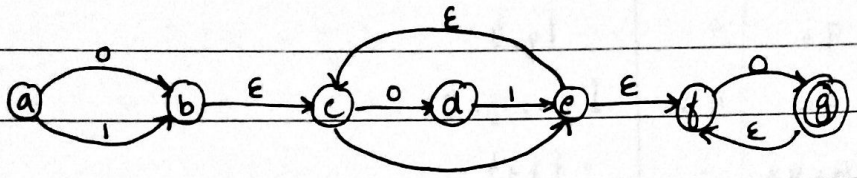
AT TUTORIAL NO: 2.

Q.1] Convert $(0+1)(01)^*(0+\varepsilon)$ into NFA with ε-moves and obtain DFA.

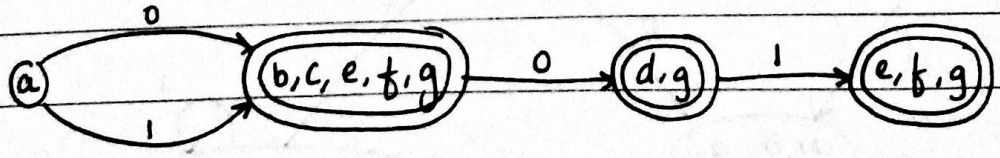
Ans:



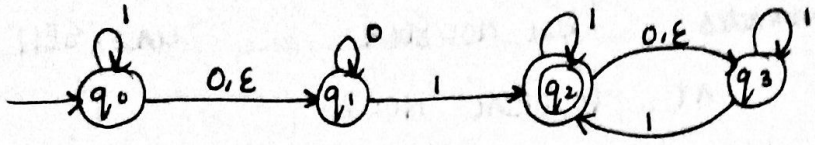
States	0	1	ε
→ a	b	b	-
b	-	-	c
c	d	-	c
d	-	e	-
e	-	-	c, f
f	g	-	g
* g			

States for DFA:

States	0	1
a	b, c, e, f, g	b, c, e, f, g
b, c, e, f, g	d, g	-
d, g	-	e, f, g



Q.2] Construct DFA for the following NFA with ε-moves.

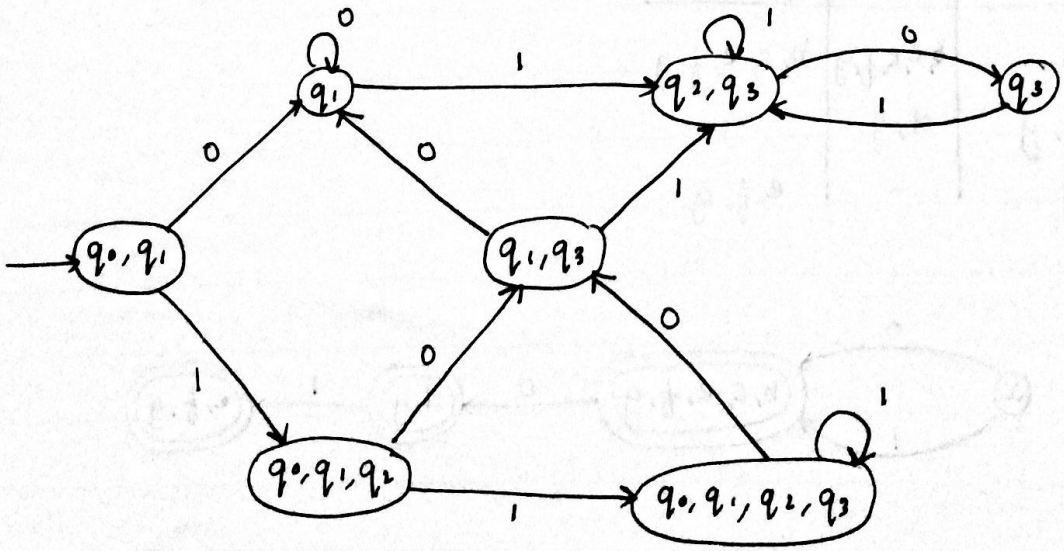


Ans:

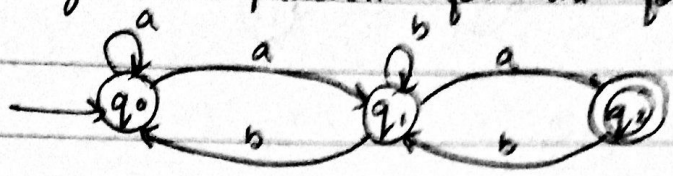
States	0	1	ε	ε - closure
q_0	q_1	q_0	q_1	$\{q_0, q_1\}$
q_1	q_1	q_2	-	$\{q_1\}$
q_2	q_3	q_2	q_3	$\{q_2, q_3\}$
q_3	-	q_2, q_3	-	$\{q_3\}$

Corresponding DFA:

States	0	1
→ q_0, q_1	q_1	q_0, q_1, q_2
q_1	q_1	q_2, q_3
q_0, q_1, q_2	q_1, q_3	q_0, q_1, q_2, q_3
q_2, q_3	q_3	q_2, q_3
q_1, q_3	q_1	q_2, q_3
q_0, q_1, q_2, q_3	q_1, q_3	q_0, q_1, q_2, q_3
q_3	-	q_2, q_3



Q.3] Construct regular expression for the following FA



Ans: $q_2 = q_1 a$ ——— (1)

$q_1 = q_0 a + q_1 b + q_2 b$ ——— (2)

$q_0 = q_0 a + q_1 b + \varepsilon$ ——— (3)

$q_1 = q_0 a + q_1 b + q_1 ab$ [from ① & ②]

$q_1 = q_0 a + q_1 (b + ab)$

$\therefore q_1 = q_0 a (b + ab)^*$ [By arden's theorem]

$q_0 = \varepsilon + q_0 a + (q_0 a (b + ab)^*) b$

$\therefore q_0 = \varepsilon ((a + a(b + ab)^*) b)^*$ [By arden's theorem]

∴ Final state:

$q_2 = q_1 a = (q_0 a [b + ab]^* a) a$

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

Q.4] Find a regular expression RE corresponding to the following F.

Ans.

$q_3 = q_30 + q_31 + q_20$

$\therefore q_3 = q_3(0+1) + q_20$ ——— (1)

$q_2 = q_11 + q_21$ ——— (2)

$q_1 = q_10 + \varepsilon$ ——— (3)

$q_3 = q_20(0+1)^*$ [By arden's theorem]

$q_1 = \varepsilon(0)^*$ [By arden's theorem]

$q_2 = \varepsilon(0)^* + q_21$

$= 0^*1^*$ [By arden's theorem]

Final state : $q_1 + q_2 = 0^* + 0^*1^*$

Q.5] Using pumping lemma prove that the following language is not regular :-

(i) $L = \{ww / w \in (0,1)^*\}$

Ans: Assume L is regular, then

Pumping length = P.

Let $S = 0^P 1 0^P 1$

Let $P = 4$

$S = \underbrace{00}_{x}\ \underbrace{00}_{y}\ \underbrace{1\,00001}_{z}$

$xy^2z = 00\ 0000\ 100001 \notin L$

Here $|y| > 0$ and $|xy| \leq P$

$\therefore$ L is not regular.

(ii) $L = \{a^n b^n c^n / n \geq 1\}$

Ans: Assume L is regular, then

Pumping length = P

Let $S = a^P b^P c^P$, $P = 4$

$S = \underbrace{aa}_{x}\ \underbrace{aa}_{y}\ \underbrace{bbbb}_{z}\ cccc$

$xy^2z = aa\ aaaa\ bbbb\ cccc \notin L$

Here $|y| > 0$ and $|xy| \leq P$.

$\therefore$ L is not regular.