Name : Sradha Kedia
Date : 20th December, 2021
Time : 9:00 to 1:00 pm
Exam Roll num : 20234757053
Name of the programme : MCA
Semester : III
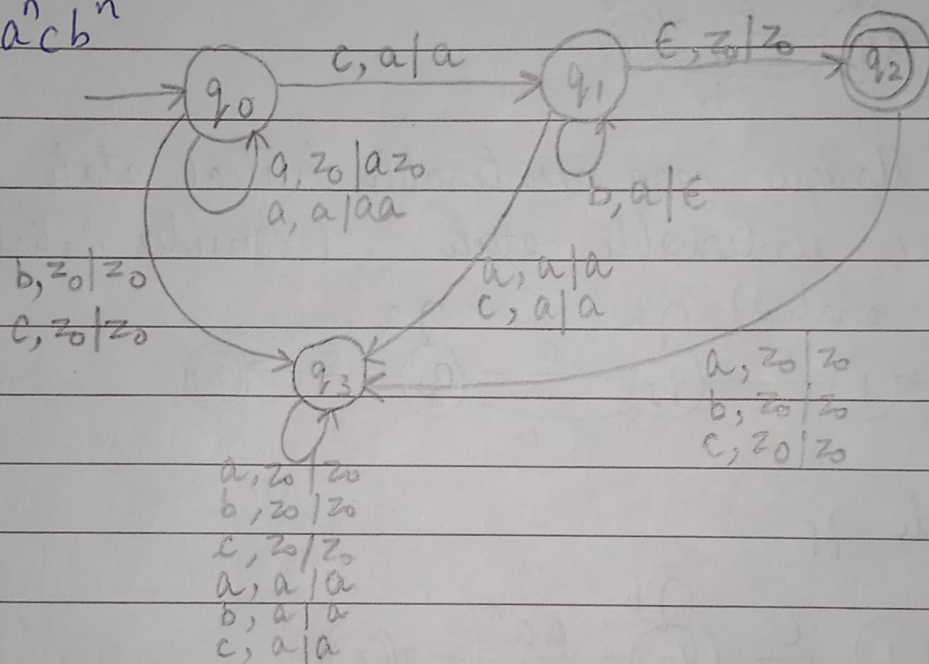Unique paper code : 223401303
Title of the paper : Automata Theory
Name of the dept : DUCS
Email ID : 200083 @ cs.du.ac.in
Mobile no : 9899519848
Question no. : 6
Page no. : 5

Ans 6: b) $a^n c b^n$

$\delta(q_0, a, z_0) = (q_0, a z_0)$

$\delta(q_0, a, a) = (q_0, aa)$

$\delta(q_0, b, z_0) = (q_3, z_0)$

$\delta(q_0, c, z_0) = (q_3, z_0)$

$\delta(q_0, c, a) = (q_1, a)$

$\delta(q_1, a, a) = (q_3, a)$

$\delta(q_1, b, a) = (q_1, \epsilon)$

$\delta(q_1, c, a) = (q_3, a)$

$\delta(q_1, \epsilon, z_0) = (q_2, z_0)$

$\delta(q_2, a, z_0) = (q_3, z_0)$

$$\delta(q_2, c, z_0) = (q_3, z_0)$$
$$\delta(q_2, b, z_0) = (q_3, z_0)$$
$$\delta(q_3, a, z_0) = (q_3, z_0)$$
$$\delta(q_3, b, z_0) = (q_3, z_0)$$
$$\delta(q_3, c, z_0) = (q_3, z_0)$$
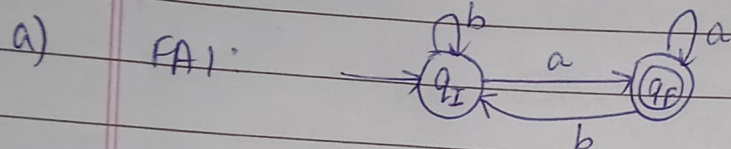$$\delta(q_3, a, a) = (q_3, a)$$
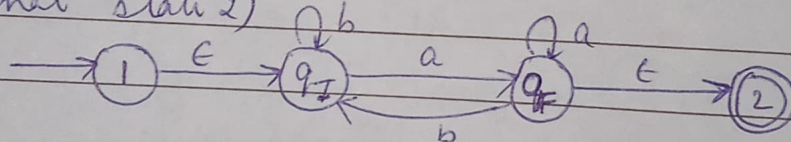$$\delta(q_3, b, a) = (q_3, a)$$
$$\delta(q_3, c, a) = (q_3, a)$$

for a we always push to the stack, for c w/a
perform no operation and for b we pop.
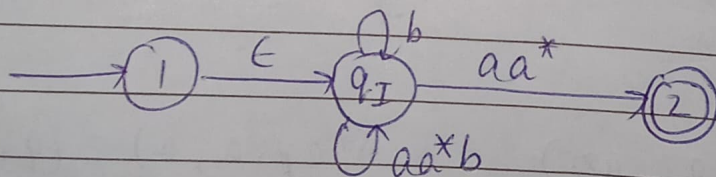q_3 is dead state here
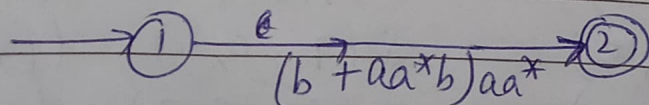q_2 is final and q_0 is initial

a)   FA1·

Step 1: Unique non reentrable initial state and
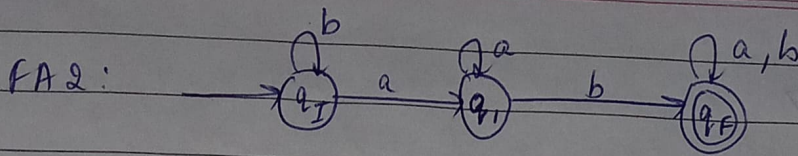unique unleavable state.   (consider intial (new) 1 and
new final state 2)

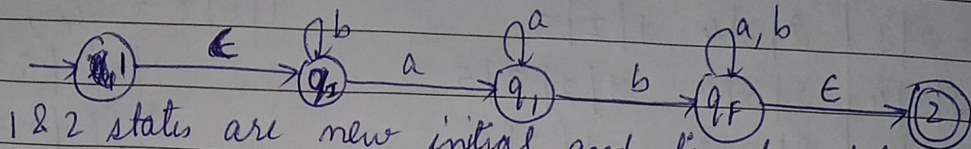**step 2**: eliminate q_F
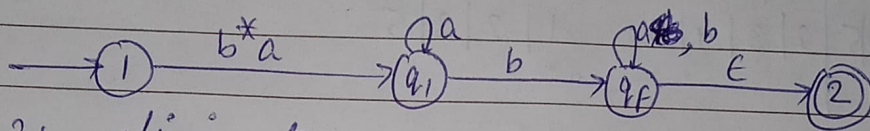

step 3: eliminate q_I.
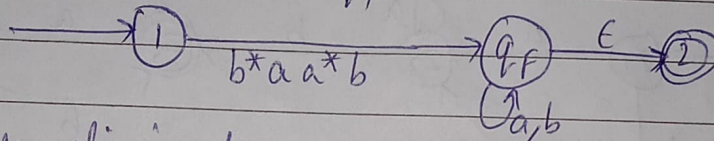

$$RE = (b + aa^*b)aa^*$$

FA2:

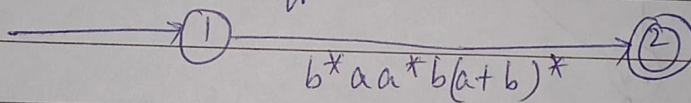**Step 1:** unique non reenterable initial state and unique unleavable state.

1 & 2 states are new initial and final states respictively.

step 2: eliminate q_I

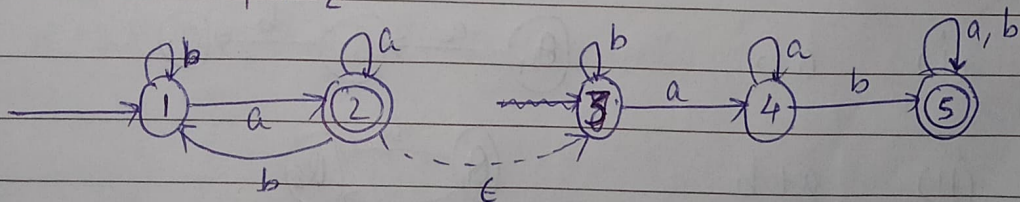**step 3:** eliminate q_1

step 4: eliminate q_F

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

RE: $b^* a a^* b (a+b)^*$

→ DFA: FA_1, FA_2

We Join final state of FA_1 i.e. 2 to initial state of FA_2 i.e 3.

We start making transition table by starting from 1 as initial state.

$FA_1, FA_2 \Rightarrow$

$Q \backslash \varepsilon$	a	b
$z_1 = 1$	2|3	1
$z_2 = 2\|3$	2|3|4	1|2|3
$z_3 = 2\|3\|4$	2|3|4	1|2|3|5
$z_4 = 1\|2\|3$	2|3|4	1|2|3
*$z_5 = 1\|2\|3\|5$	2|3|4|5	1|2|3|5
*$z_6 = 2\|3\|4\|5$	2|3|4|5	1|2|3|5

$2\|3 = z_2$, $\quad 2\|3\|4 = z_3$,

$1\|2\|3 = z_4$,

$1\|2\|3\|5 = z_5$ *,

$2,3\|4\|5 = z_6$ *