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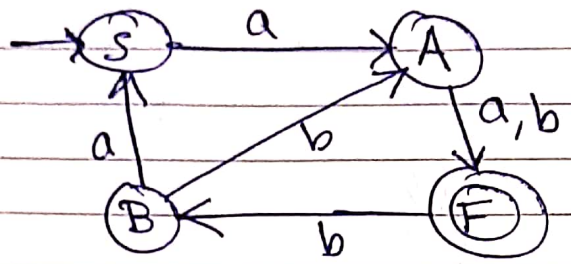
Batch-5 (AI & ML)

Formal Language & Automata Theory

Q.1] Find the regular expression corresponding to the following automata



$S = \epsilon + Ba$ — (1) , $B = Fb$ — (3)

$A = Sa + Bb$ — (2) , $F = A(a+b)$ — (4)

$\therefore A = a + Baa + Bb$ — (5) [using eq(ii) & eq(iv)]

$\therefore A = a + Fbaa + Fbb$ — (6) [using eq(iii) & (v)]

$\therefore F = (a + Fbaa + Fbb)(a+b)$

$= a(a+b) + F[(a+b)(baa+bb)]$

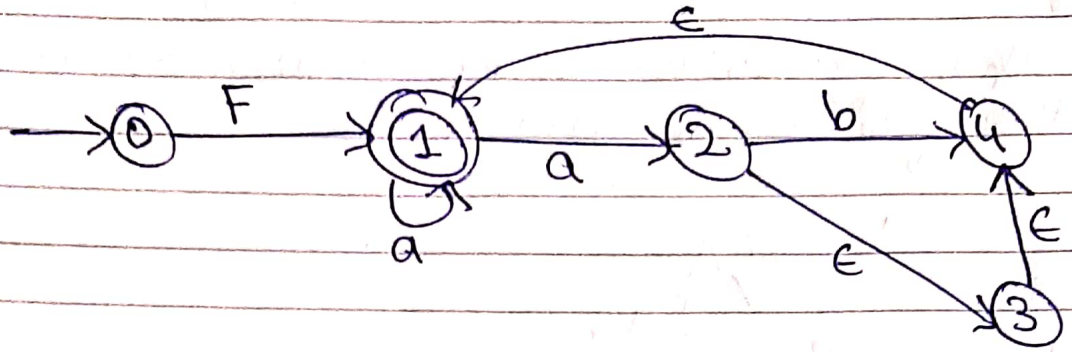
which is of the form

$R = S + RP \Rightarrow R = SP^*$

$\therefore \boxed{F = a(a+b)[(a+b)(baa+bb)]^*}$

Reg. Regular Exp.

Q.2] Convert NFA-ϵ given in fig. to DFA



ϵ closure of 0 = {0, 1}
ϵ closure of 1 = {1}
ϵ closure of 2 = {1, 2, 3, 4}
ϵ closure of 3 = {1, 3, 4}
ϵ closure of 4 = {1, 4}

NFA transition Table

	a	b
0	{1, 2, 3, 4}	ϕ
1	{1, 2, 3, 4}	ϕ
2	{1, 2, 3, 4}	{1, 4}
3	{1, 2, 3, 4}	ϕ
4	{1, 2, 3, 4}	ϕ

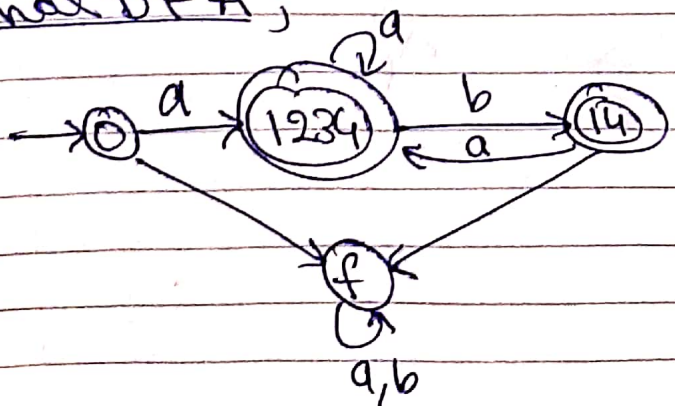
DFA Transition Table

	a	b
0	1234	f
(1234)	1234	14
(14)	1234	f
f	f	f

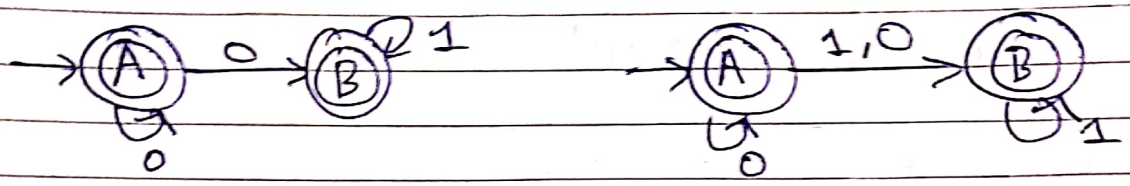
⟹

where, (1234), (14) = new final states
f = dead state

Final DFA;



Q.3) Check if the 2 finite automata are equivalent. Give reasons to support your answer.



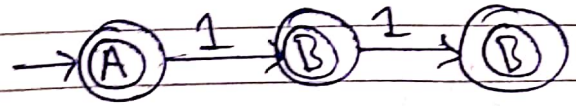
FA 1 FA 2

Soln)

Here we can see that FA2 accepts strings that start with 1 whereas FA1 doesn't accept the string starting with 1.

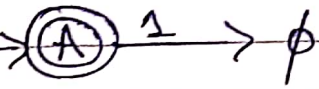
Eg. Let input string be 11

for FA2



accepted

for FA1



rejected

∴ Both these finite automatas are not equivalent.

Q.4] How many diff. DFA can be designed with fixed initial states over $\Sigma = \{a, b\}$ and no. of states are 2.

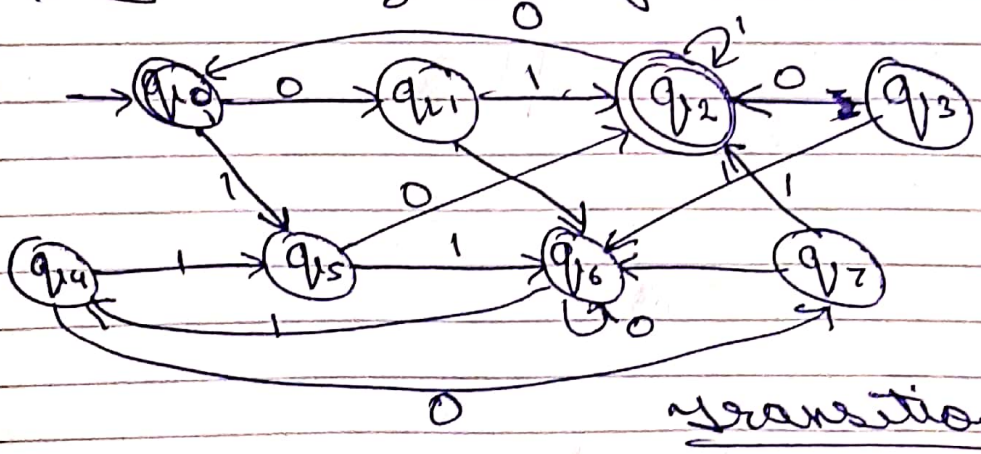
Sol^n] Formula $= n * n^{(n*m)} * 2^n$

where n = no. of states = 2
m = no. of alphabets = 2

$n^{(n*m)}$ = no. of transition func^n.
2^n = no. of final states we can choose

$\therefore$ DFA $= 1 * 2^{(2\times2)} * 2^2 \Rightarrow 64$.

Q.5] Minimize the given DFA



Transition Table

	0	1
q_0	q_1	q_5
q_1	q_6	q_2
q_2	q_0	q_2
q_3	q_2	q_6
q_4	q_7	q_5
q_5	q_2	q_6
q_6	q_6	q_4
q_7	q_6	q_5

	0	1
q_0q_4	q_1q_7	q_5
q_1q_7	q_6	q_2
q_2	q_0q_4	q_2
q_5	q_2	q_6
q_6	q_6	q_0q_4

∴ Final DFA