01/03/2021

CSPC41 – Automata.

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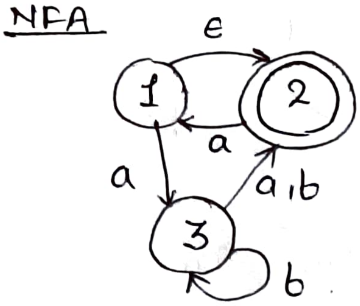
Cycle Test – 1

Question ①:

NFA



δ''	a	b	c
1	3,1	φ	2
2	1	φ	φ
3	2	3,2	φ.

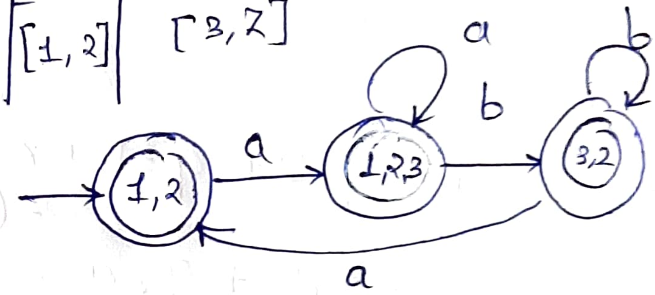
Regular expressi

NFA

δ'	a	b
1	3,1,2	φ
2	1,2	φ
3	2	3,2

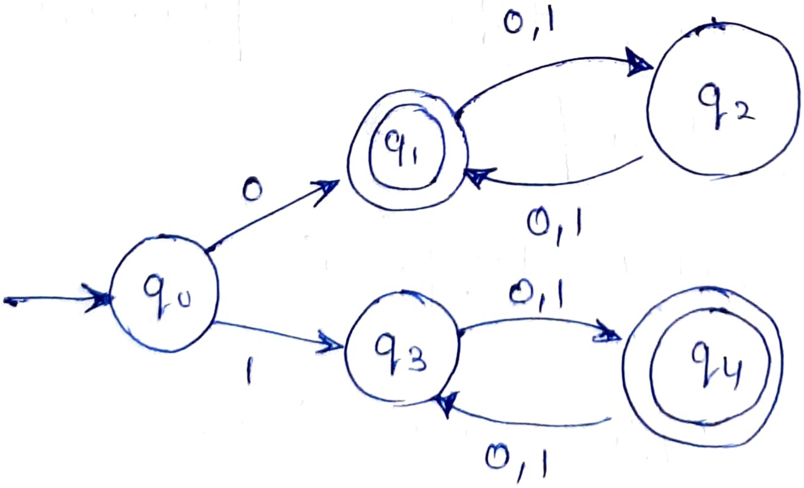
DFA δ	a	b
[1,2]	[3,1,2]	φ
[3,1,2]	[31,2]	[3,2]
[3,2]	[1,2]	[3,2]

DFA is



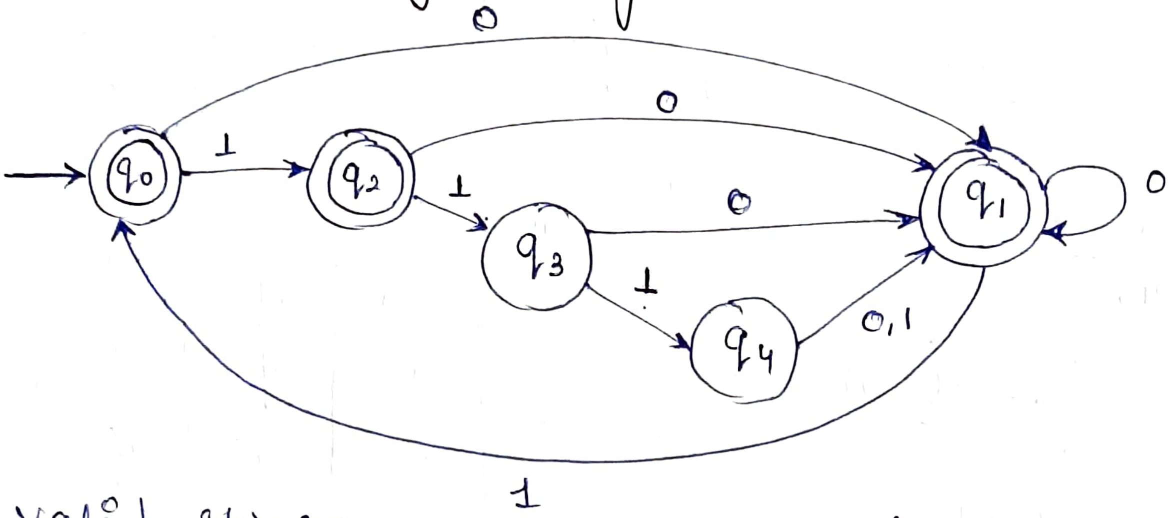
Question ② :

(a) {w| w starts with 0 and has odd length, or starts with 1 and has even length}.



Valid strings	Invalid strings
0	1
10	101
11	100.

ⓑ {w | w is any string except 11 and 111}



valid strings	Invalid strings
ϕ	11
0	111
1	
1111..	

Question ③

$q_1 = \overset{R}{q_1}\overset{P}{a} + \overbrace{q_3 b + \epsilon}^{a}$ —① ⇒ from Arden's theorem $= (\epsilon + q_3 b) a^*$

$q_2 = q_1 b + q_3 a$ —②

$q_3 = q_3 a + q_{2} a$ —③

$q_4 = q_1 b + q_2 b$ —④

Now, from ④ $q_4 = q_2 b + q_4 b$

$$\boxed{q_4 = q_2 b b^*}$$

$$\boxed{q_3 = q_2 a + q_2 b b^* a}$$

$$\boxed{q_2 = a^* b + q_3 (b a^* b + a)}$$ —⑤

$$\boxed{q_3 = a^* b (b^*) a [(b a^* b + a) b^* | a]^*}$$

So, regular expression.

So, $RE = (a^* + a^* | b^* a (b a^* b + a) b^* a^* b a^*)$

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

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

Question ④

A avoids B $= \{w \mid w \in A$ and w doesn't contain any string in B as a substring$\}$.

is an intersection of language A &

nosubstring(B) $= \{w \mid w$ doesn't contain any string in B as a substring

If now A and B are regular,

So, we need to prove nosubstring(B) is regular as well

because,

∵ regular languge is closed under intersection

Let,

$M = (Q, \Sigma, \delta, q_0, F)$ be NFA. Recognize B.

So, $M' = \{Q \cup \{q_F\}, \Sigma, \delta', q_0, q_F\}$ recognize complement of B. here, q_F → new state.

$$\boxed{\delta'(r,\alpha) = \begin{cases} \delta(q_0,\alpha) \cup \{q_0\}, & \text{if } r = q_0, \alpha \in \Sigma \\ q_F, & \text{if } r \in F \\ q_F, & \text{if } r = q_F \end{cases}}$$

we run the machine starting from each symbol in word and accept whenever it reaches final states.

Hence, proved that class of Regular languges is closed under the avoids operation.

Question ⑥

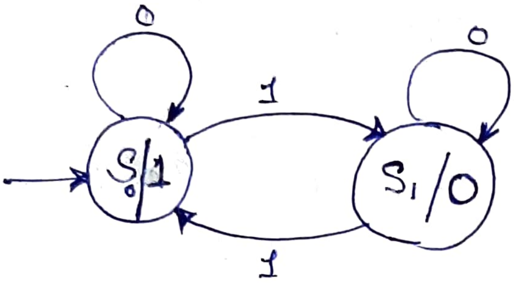
lets, us say states s0, s1

$s_0 \rightarrow$ having no 1's or even no. of one's.

$s_1 \rightarrow$ odd number of one's

output for state $S_0 = 1$ (even number of 1's) and all other states have output 0.

Moore machine :



Question ⑤

Transition table for given automaton (finite)

States.	a	b
→ 1	4	6
2	1	7
3	2	4
4	6	5
5	7	5
⑥	3	6
⑦	3	7

dividing states into. two set.

zero class equivalence:

$$\pi_0 = \underbrace{\{1, 2, 3, 4, 5\}}_{G_1} \quad \underbrace{\{6, 7\}}_{G_2}$$

now, checking the transitions for each pair of states.

$$\pi_1 = \underbrace{\{1,2\}}_{G111} \quad \underbrace{\{3,\}}_{G112} \quad \underbrace{\{4,5\}}_{G113} \quad \underbrace{\{6,7\}}_{G121}$$

here, transition of $\{1,2\}$, $\{3\}$, $\{4,5\}$, $\{6,7\}$ is in same group of zero class equivalence.

$$\pi_2 = \underbrace{\{1\}}_{G1111}, \underbrace{\{2\}}_{G1112}, \underbrace{\{3\}}_{G1121}, \underbrace{\{4,5\}}_{G1131}, \underbrace{\{6,7\}}_{G1211}$$

here, $\{1\}$ $\{2\}$ are having different transition in diff. group. of π_1.

Hences the minimized DFA is