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:- Assignment 2 :-

Q1) Give regular expression for

a) Set of all string over {0, 1} that end with '1' has no substring 00'

→ $\Sigma = \{0, 1\}$.

RE : $(0+\epsilon)(1+10)^* 1$

b. Set of all string over {0, 1} with even no of 1's followed by odd no. of 0's.

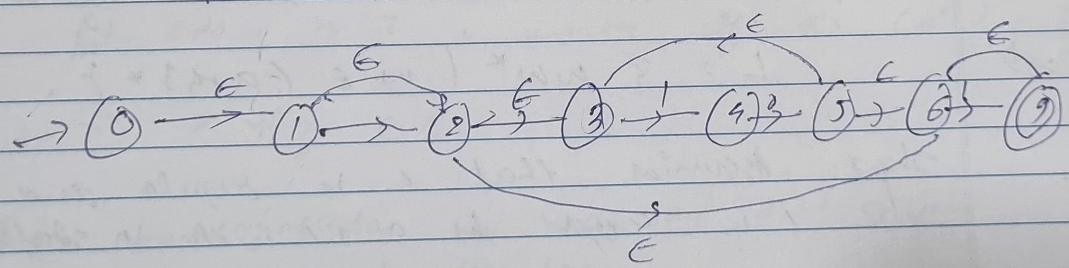
→ $\Sigma = \{0, 1\}$.

RE : $(11)^* 0 (00)^*$

Q2) Convert $(0+\epsilon)(10)^*(\epsilon+1)$ into NFA with ϵ-moves and hence obtain DFA.

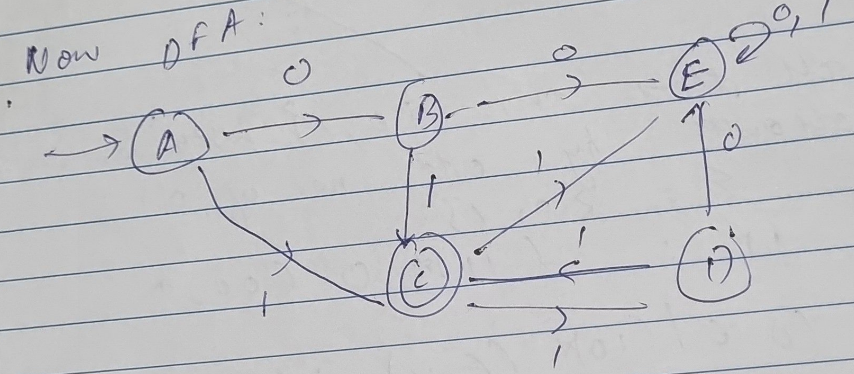
→ Soln,

RE to NFA with ϵ transition



State (x)		ε closure (x)	δ(y,0)	δ(y,1)
→ {0}	A	0,1,2,3,6,7	{2}	{4,7}
{2}	B	2,3,6,7	{6}	{4,7}
* {4,7}	C	4,7	{5}	{φ}
{5}	D	5,3,6,7	{φ}	{4,7}
{φ}	E	φ	{φ}	{φ}

Now DFA:



Q3) Prove the $\{wcw^R \mid w \in (a+b)^*\}$ is not regular where w^R is reverse of w^R.

⇒ $$L = \{ww^R \mid w \in (a+b)^*\}.$$

Step 1: Assuming that L is regular and L is accepted by a FA with n states.

Step 2: Choosing a string:

$$w = \underbrace{a^n b}_{w} \; \underbrace{ba^n}_{w^R}$$

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$|w| = 2n+2 \geq n$

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w can be written as xyz with $|y| > 0$.

and $|xy| \leq n$

Since $|xy| \leq n$, x must be in the form a^s.
Since $|xy| \leq n$, y must be of the form $a^r | r > 0$

Therefore,

$$w = a^n . bb . a^n = \underbrace{a^s}_{x} . \underbrace{a^r}_{y} . \underbrace{a^{n-s-r} bba^n}_{z}$$

Step 3: Checking whether xy^2z for $i=2$ belongs to L

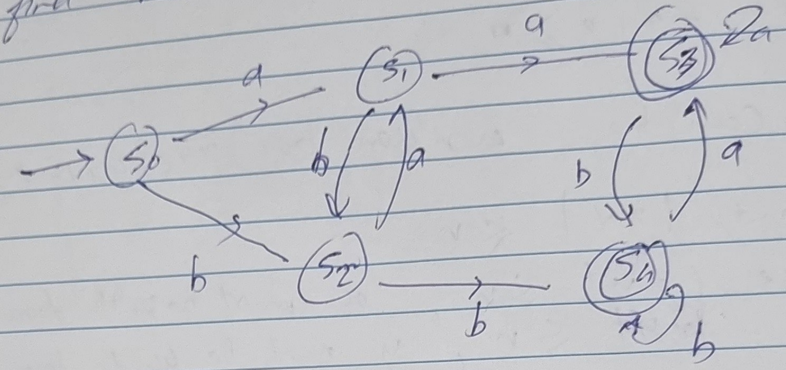
$$xy^2z = a^s a^{2r} a^{n-s-r} bba^n = a^{n+r} bba^n$$

Since $r > 0$, $a^{n+r} bb a^n$ is not of the form ww^R because the string starts with a^{n+r} but ends with a number of a's (a^n).

$\therefore xy^2z \in L$.

Therefore, by contradiction we can say that given language is not regular.

9a) find RE for FA.



FA can be described as.

$M = (Q, \Sigma, \delta, q_0, F)$.

where $Q = \{q_0, q_1, S_2, S_3, S_4\}$ (set of states

$\Sigma = \{a, b\}$.

$q_0 = S_0$.

$F = \{S_3, S_4\}$.

δ Transition fun. can be written as

$\delta(S_0, a) = S_1$ $\delta(S_1, b) = S_2$

$\delta(S_1, a) = S_3$ $\delta(S_2, b) = S_2$

$\delta(S_2, a) = S_1$ $\delta(S_3, b) = S_4$

$\delta(S_3, a) = S_3$ $\delta(S_4, b) = S_4$

$\delta(S_4, a) = S_3$ $\delta(S_5, b) = S_4$

Grammar G can be ~~mapped~~ as G (V, T, S, P).

$V = \{S_0, S_1, S_2, S_3, S_4\}$.

$T = \{a, b\}$ $S = S_0$

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and Production rules can be written as.

$S_0 \rightarrow aS_1$ $\quad$ $S_2 \rightarrow b$

$S_0 \rightarrow bS_2$ $\quad$ $S_3 \rightarrow a$ $\quad$ $S_0 \rightarrow aS_1 / bS_2$

$S_1 \rightarrow a$ $\quad$ $S_3 \rightarrow b$ $\quad$ $S_1 \rightarrow a / bS_2$

$S_1 \rightarrow bS_2$ $\quad$ $S_4 \rightarrow a$ $\quad$ $S_2 \rightarrow aS_1 / b$

$S_2 \rightarrow aS_1$ $\quad$ $S_4 \rightarrow b$ $\quad$ $S_3 \rightarrow a / b$

$S_4 \rightarrow a / b.$