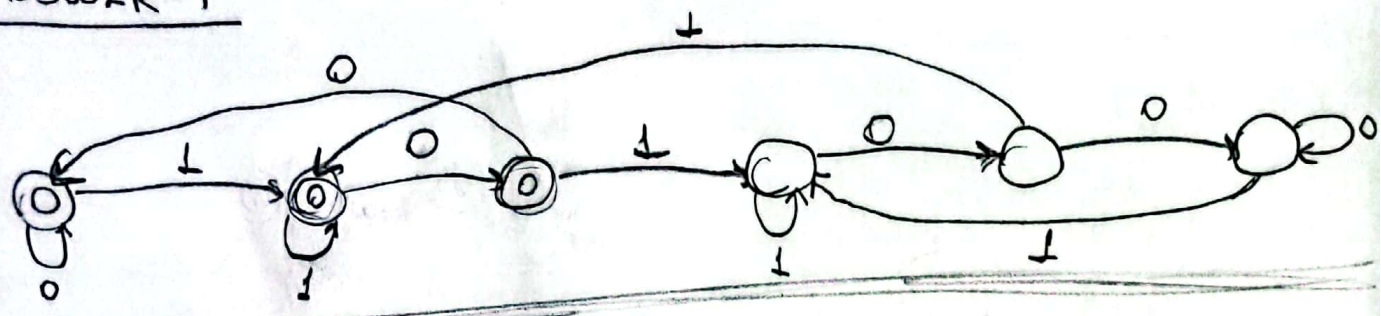
1) Construct a DFA to accept the following language

$L = \{w \in \{0,1\}^* : w$ has even number of substrings $101\}$

ANSWER-1



2) Describe the equivalence classes ($\approx_L$) for the following language:

$L = \{w \in \{0,1\}^* :$ no three adjacent characters are the same$\}$

ANSWER-2

[e]: member str. concaterate with 000 ∪ 111 to make non member.

[0]: member str. " " 00 or 111 " " " "

[1]: member str. " " 000 or 11 " " " "

[00]: member str. " " 0 or 111 " " " "

[11]: member str. " " 000 or 1 " " " "

[000]: non member, no way to become a member

[111]: non member, " " " " " "

ANSWER-3

$S \rightarrow 0M0 \mid 1M0 \mid 10M \mid 0 \mid 1 \mid e$

$M \rightarrow 0M \mid 1M \mid e$

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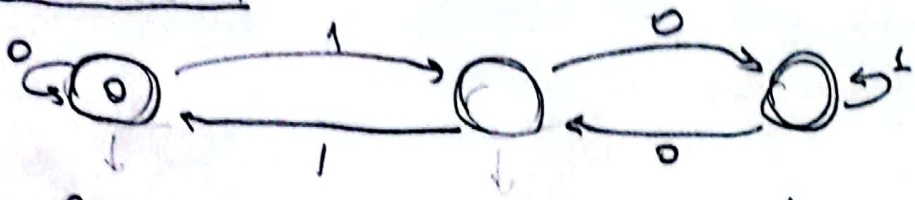
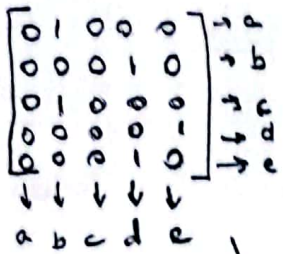
ANSWER - 4



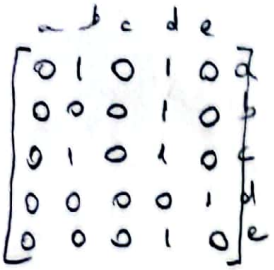
ANSWER - 5

C for Column

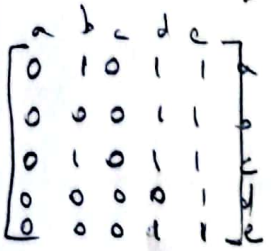
R for ROW



① $C_a = \emptyset$, $R_a = \{b\}$ $\Rightarrow$ $C_a \times R_a = \emptyset$



② $C_b = \{a, c\}$, $R_b = \{d\}$ $\Rightarrow$ $C_b \times R_b = \{(a,d), (c,d)\}$



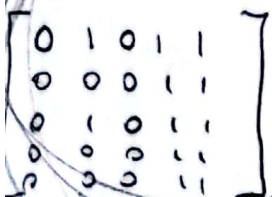
③ $C_c = \emptyset$, $R_c = \{b, d\}$ $\Rightarrow$ $C_c \times R_c = \emptyset$

④ $C_d = \{a, b, c, e\}$, $R_d = \{e\}$ $\Rightarrow$ $C_d \times R_d = \{(a,e), (b,e), (c,e), (d,e)\}$

⑤ $C_e = \{a, b, c, d, e\}$, $R_e = \{d, e\}$

$\Rightarrow$ $C_e \times R_e = \{(a,d), (b,d), (c,d), (d,d), (e,d), (a,e), (b,e), (c,e), (d,e), (e,e)\}$

MATRIX



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ANSWER - 6

$E(q_1) = \{q_1, q_5\}$ ⇒ INITIAL

q_6 ⇒ FINAL

$(q_1 q_5), a = \overset{E}{\underset{\emptyset}{U}}{}^{q_4} = q_4 \cup q_1 q_5 \Rightarrow (q_1 q_4 q_5)$

$(q_1 q_5), b = \overset{E}{\underset{q_6}{U}}{}^{(q_2)} = q_2 \cup q_6 q_5 \Rightarrow (q_2 q_5 q_6)$

$(q_1 q_4 q_5), a = \overset{E}{\underset{\emptyset}{U}}{}^{q_4} \Longrightarrow (q_1 q_4 q_5)$

$(q_1 q_4 q_5), b = \overset{E}{\underset{q_6}{U}}{}^{q_2} \Longrightarrow (q_2 q_5 q_6)$

$(q_2 q_5 q_6), a = \overset{E}{\underset{q_2}{U}}{}^{\emptyset} \Longrightarrow (q_2)$

$(q_2 q_5 q_6), b = \overset{E}{\underset{q_6}{U}}{}^{q_3} = q_3 \cup q_5 q_6 \cup q_3 \rightarrow (q_3 q_5 q_6)$

$q_2, a = \cup\emptyset \rightarrow \emptyset \cup$

$q_2, b = \overset{k}{\underset{q_5}{U}}{}^{q_3} \Longrightarrow (q_3 q_5)$

$(q_3 q_5 q_6), a = \overset{\emptyset}{\underset{\emptyset}{U}}{}^{E(q_5)} \Longrightarrow (q_2)$

$(q_3 q_5 q_6), b = \overset{E}{\underset{\emptyset}{U}}{}^{(q_6)}_{(q_3)} \Longrightarrow (q_3 q_5 q_6)$

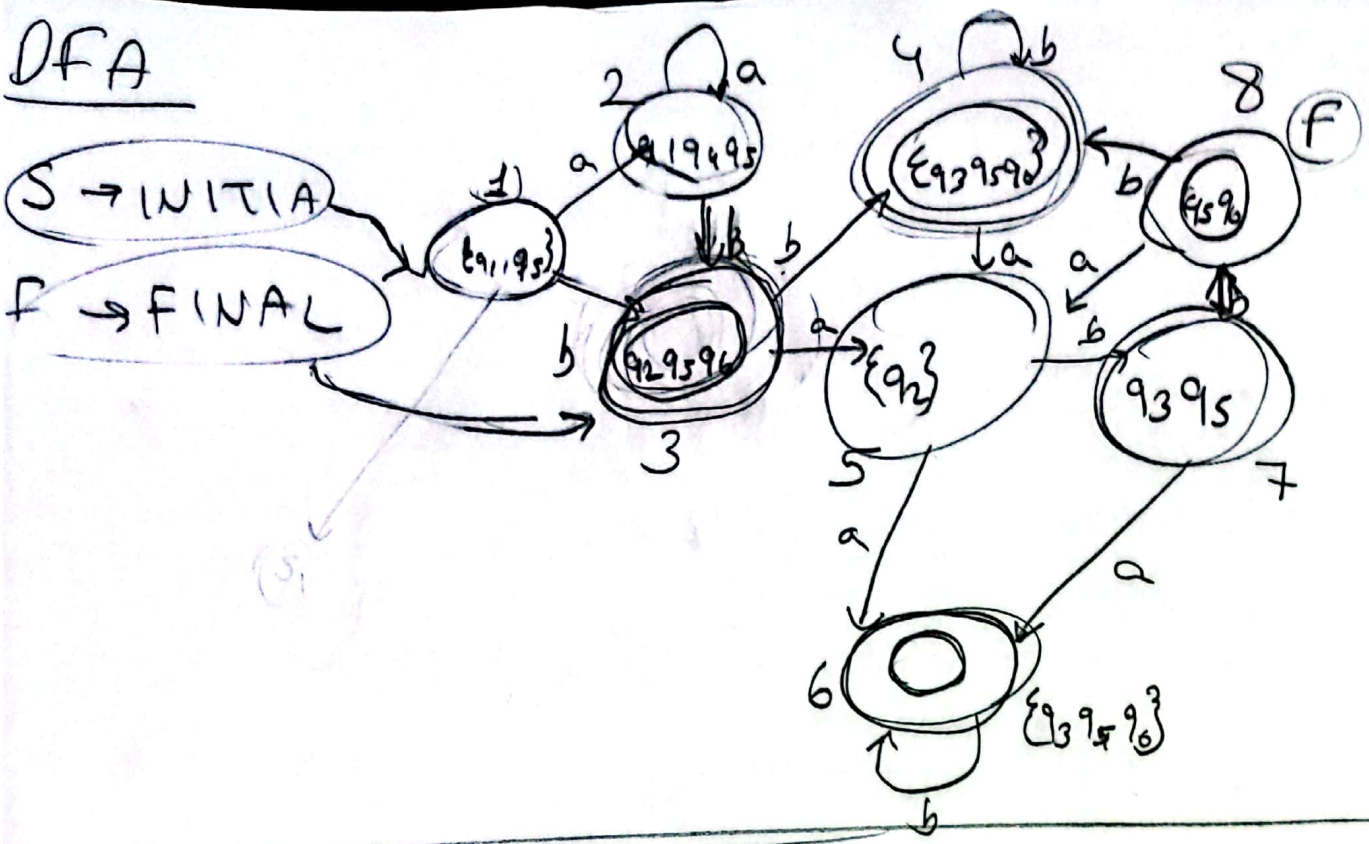
$(q_3 q_5), a = \overset{\emptyset}{\underset{\emptyset}{U}}$

$(\ \ ), b = \overset{E}{\underset{q_6}{U}}{}^{\emptyset} \Longrightarrow (q_5 q_6)$

$(q_5 q_6), a = \overset{E}{\underset{\emptyset}{U}}{}^{q_2} \Longrightarrow (q_2)$

$(q_5 q_6), b = \overset{E}{\underset{q_3}{U}}{}^{q_6} \Longrightarrow (q_5 q_6 q_3)$

DFA



MINIMIZATION

$K = \{S_1, S_2, S_3, S_4, S_5, S_6, S_7, S_8\}$ $\Big\}$ $K-F = \{S_1, S_2, S_5, S_6, S_7\}$

$F = \{S_3, S_4, S_8\}$

$S_1, a \xrightarrow[K-F]{} \{S_1 S_2 S_7\} \to \{S_1, S_2\}$ $S_1, b \xrightarrow[F]{} \{S_3, S_4, S_8\} \to F$	$S_2, a \xrightarrow[K-F]{} \{S_1, S_2, S_7\} \to \{S_1, S_2\}$ $S_2 b \xrightarrow[F]{} \{S_3, S_4, S_8\} \to F$	$S_3, a \xrightarrow[K-F]{} \{S_5 - S_6\}$ $S_3, b \xrightarrow[F]{} \{S_3, S_4, S_8\} \to F$
$S_4, a \xrightarrow[K-F]{} \{S_5, S_6\} \to \{S_5\}$ $S_4, b \xrightarrow[F]{} \{S_3, S_4, S_8\} \to F$	$S_5, a \xrightarrow[K-F]{} \{S_5, S_6\} \to \{S_5\}$ $S_5, b \xrightarrow[K-F]{} \{S_3, S_4, S_8\} \to \{F\}$	$S_6, a \xrightarrow[K-F]{} \{S_5, S_6\} \to \{S_6\}$ $S_6, b \xrightarrow[K-F]{} \{S_5, S_6\} \to \{S_6\}$
$S_7, a \xrightarrow[K-F]{} \{S_5, S_6\} \to \{S_6\}$ $S_7, b \xrightarrow[F]{} \{S_3, S_4, S_8\} \to F$	$S_8, a \xrightarrow[K-F]{} \{S_5, S_6\} \to \{S_5\}$ $S_8, b \xrightarrow[F]{} \{S_3, S_4, S_8\} \to F$	$\{S_3, S_4, S_8\}, \{S_1, S_2\}$ $\{S_5\}, \{S_6\}, \{S_7\}$ ARE FINAL CLASSES

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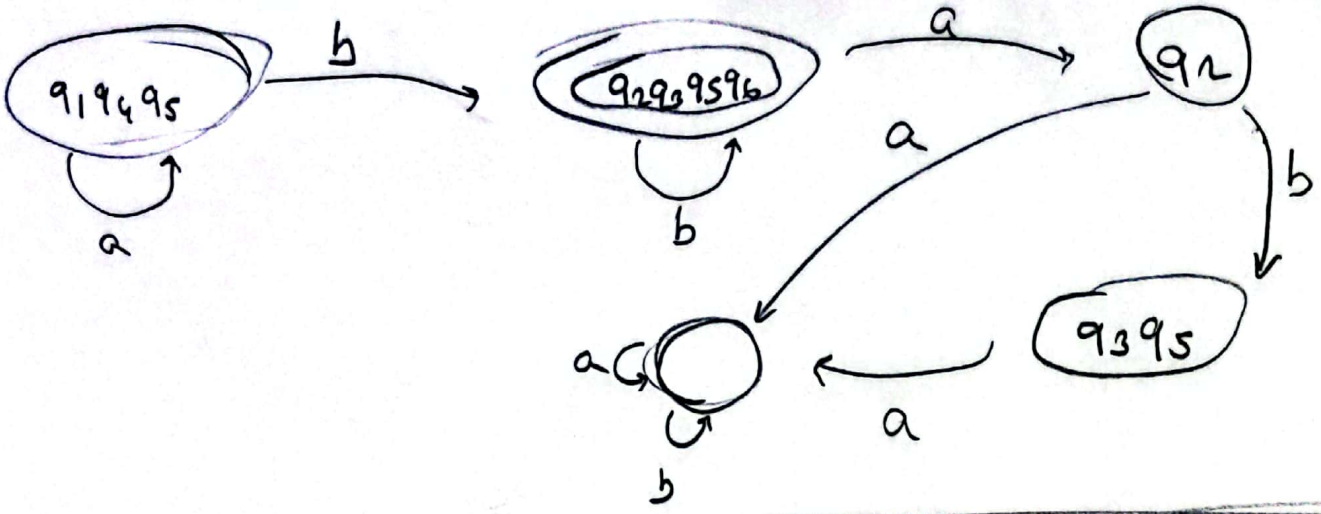
FINAL MACHIVE



ANSWER - 7

$((aba)^* ub)^* \cup (aa \cup b^*)^*$