CS & IT ENGINEERING

Theory of Computation

Lecture No.- 01

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Topics to be Covered

Topic Regular Expression

Regular Expression: NAT

Q1. Consider the following regular expressions:

$r_1 = (a + b)^*$

$r_2 = (ab^*a + b^*)$

$r_3 = (ab^+a + b^+ + \in)$

if $r_4 = r_1 \cap r_2 \cap r_3$ then the number of strings in r_4 which not contain "bbb" are

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$ab^*a \cap ab^+a$

aa ab^+a

$r_1 = (a+b)^* = \Sigma^*$

$r_2 = ab^+a + b^*$

$r_1 \cap r_2 = r_2$

$r_2 \cap r_3 = ab^+a + b^*$

ab^+a: aba, abba

b^*: ε, b, bb

$= 5$ //

Regular Expression: MCQ

Q2. $(a+b)^*$ is equivalent to

A $(aa^*+bb^*)^* = (a+b)^*$

B $(aa+bb)^*$ $\subset_{ax}^{\varepsilon}$

C $(aaa+bbb)^*$ $\subset_{ax}^{\varepsilon}$

D $(ab^*+ba^*)^* = (a+b)^*$

Regular Expression: MSQ

Q3. Which of the following is/are correct?

A $a(ba)^* = (ab)^*a$

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

C $a + ba = (a + b)(a + a)$

D $\phi^* = \in$

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

a, aba, ababa, . .

a, aba, ababa, . .

$(a^*b)^* \subset a^*$ ✓

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

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

Regular Expression: MSQ

Q4. a(a+b)* is equivalent to

$a(a+b)^* \Rightarrow \{a, aa, ab, \ldots\}$

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

B $(aa^*+ab^*)^* \longrightarrow \varepsilon$ (invalid)

C $(ab^*)^*$

D $a(ab^*)^*$ → a ✓, aa ✓, ab ✗

Regular Expression: MCQ

Q5. Consider the following regular expression on input symbol {a, b}:

Regular expression R = (b + aa* b) + (b + aa * b) (a + ba*b)* (a + ba* b)

Which of the following string is not generated by R?

A epsilon $\notin R$

B a $\notin R$

C b $\in R$

D ab $\in R$

b ✓

ab ✓

aab

b.ε.a = ba

b.a.a = baa

Regular Expression: MCQ

$\{w \mid w \in \{0,1\}^*, n_1(w) = \text{even}\}$

Q6. Which of the following represents set of all binary numbers with even number of 1's?

$\{\varepsilon, 0, 00, 11, 110, 011, 101, 000, \ldots\}$

Zero no. of 1s — Two 1s

Some strings: 0, 110

A. $(11)^*$

B. $(01010)^*$

C. $(0^*10^*10^*)^*$

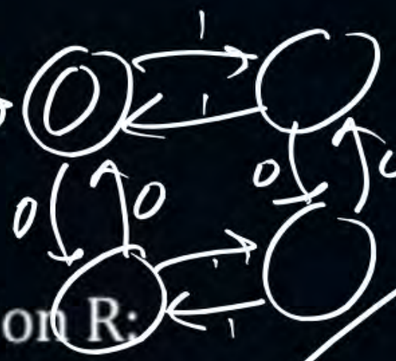
Some → 0

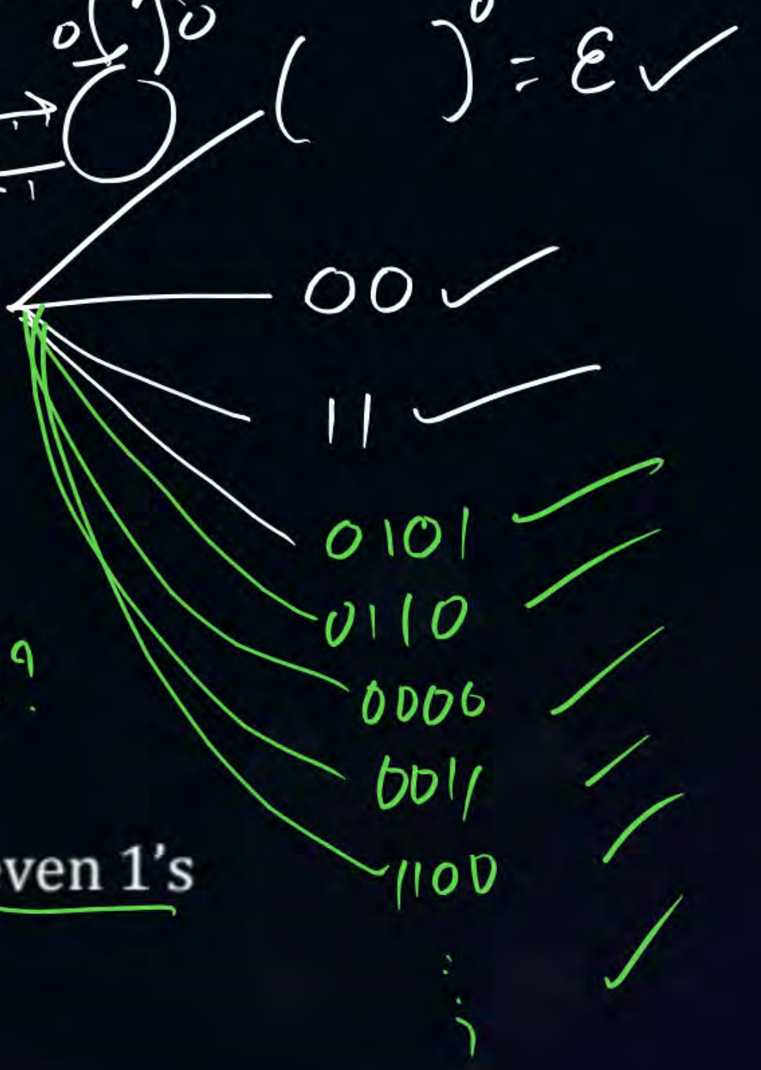
$(0^*10^*10^*)^* + 0^*$

D. None of these.

Slide

Regular Expression: NAT





Q7. Consider the following regular expression R:

$R = (00 + 11 + (01 + 10)\ (00 + 11)^*\ (01 + 10))^*$

What is the language represented by R?

A Set of all binary strings

B Set of all binary strings starting with 00

C Set of all binary strings having even 0's and even 1's

D None of these.

Slide

Regular Expression: MCQ

Q8. Consider the regular expression R:

$R = \in + a + b + (aa + ba + bb)\ (a + b)^*$

The language recognize by R is

A {∈ {a, b}*| all strings of a and b not starting with a or not end with b}

B {w∈ {a, b}*| all strings of a and b not starting with ab}

C {w∈ {a, b}*| all the strings of a and b contain either a or b as a substring}

D {w∈ {a , b}*| all the strings of a and b are not ending with ab}

Regular Expression: MSQ

Q9. $L = \{ w \mid w \in \{0,1\}^*, \underbrace{n_1(w)}_{\text{No. of 1's in } w} \text{ is divisible by } 3 \}$

$\#_1(w)$

$(0^*1^*0^*10^*)^*0^*$

A $(111)^*$

B $(01010)^*$

C $(0^*10^*10^*)^*$

D None of these

Regular Expression: MSQ

Q10.

$A \rightarrow (00)^*$ $\longrightarrow$ $\{\varepsilon, 00, 0^4, 0^6, \ldots\}$

$B \rightarrow 0(00)^*$ $\longrightarrow$ $\{0^3, 0^5, 0^7, 0^9, \ldots\}$

$C \rightarrow A + B$

$D \rightarrow A \cap B$

$A \cap B = \phi$

DEVA SIR PW

A Even Zero's

B odd no. of 0's

C All strings

D Empty Set

Regular Expression: MSQ

Q11. $(a+b)^*$ =

A $a^*(ba^*)^*$

B $(a^*b)^*a^*$

C $b^*(ab^*)^*$

D $(b^*a)^*b^*$

Regular Expression: MSQ

Q12. $a(a+b)^* = \{a, aa, ab, aaa, aab, aba, abb, \ldots\}$

A $(ab^*)^+$

B $(a^+b^*)^* = \{\varepsilon, \ldots\}$

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

D $(ab^*)^* = \{\varepsilon, \ldots\}$

Regular Expression: MCQ

Q13. Which of the following regular expression describes the language over {a, b} consisting of strings that do not start with 'a' or do not end with 'b'.

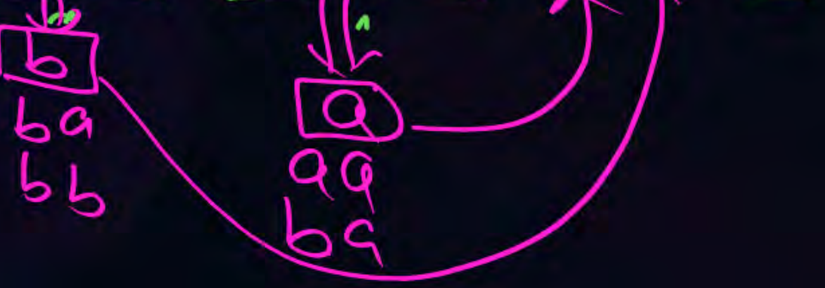
A. $b(a + b)^* + (a + b)^* a + \in$

B. $ab\,(a + b)^* + \in$

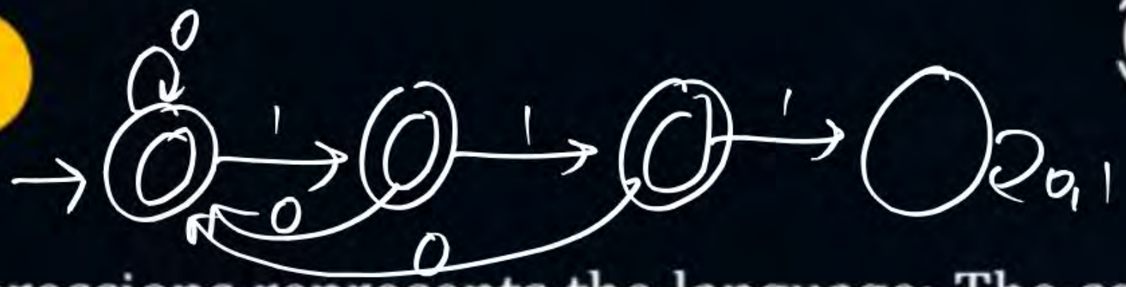
C. $(a + b)\,(a + b)^* + \in$

D. $b(a + b)^* + (a + b)^* a + a + b + \in$

$b\Sigma^* + \varepsilon + \quad + \quad \Sigma^* a + \varepsilon$



Regular Expression: MSQ



Q14. Which of the following regular expressions represents the language: The set of all binary strings not having three consecutive 1's?

A. $(110 + 10 + 0)^* (\in + 11 + 1)$

B. $(\in + 11 + 1)(110 + 10 + 0)^*$

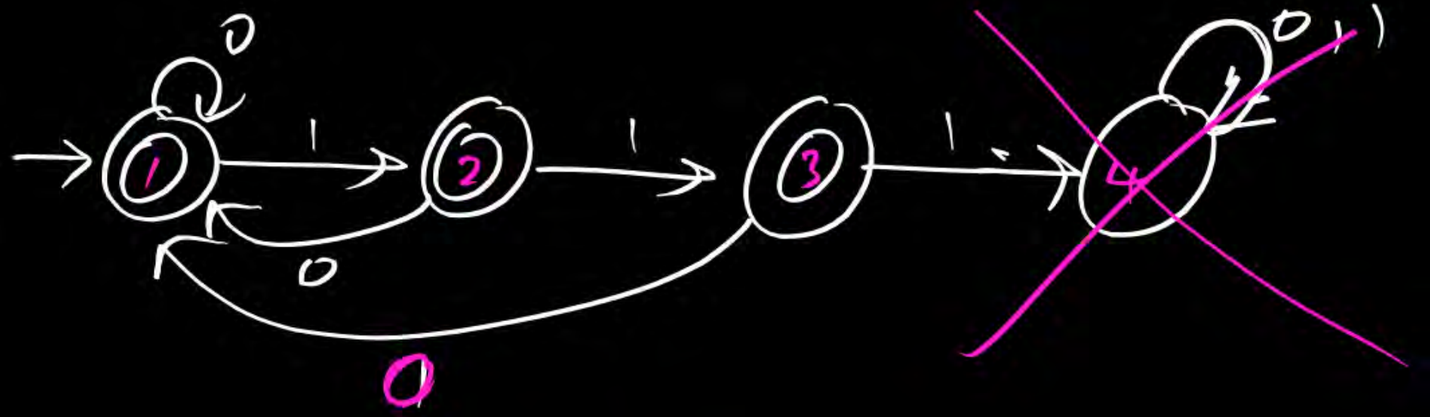
C. $(011 + 01 + 0)^* (\in + 11 + 1)$

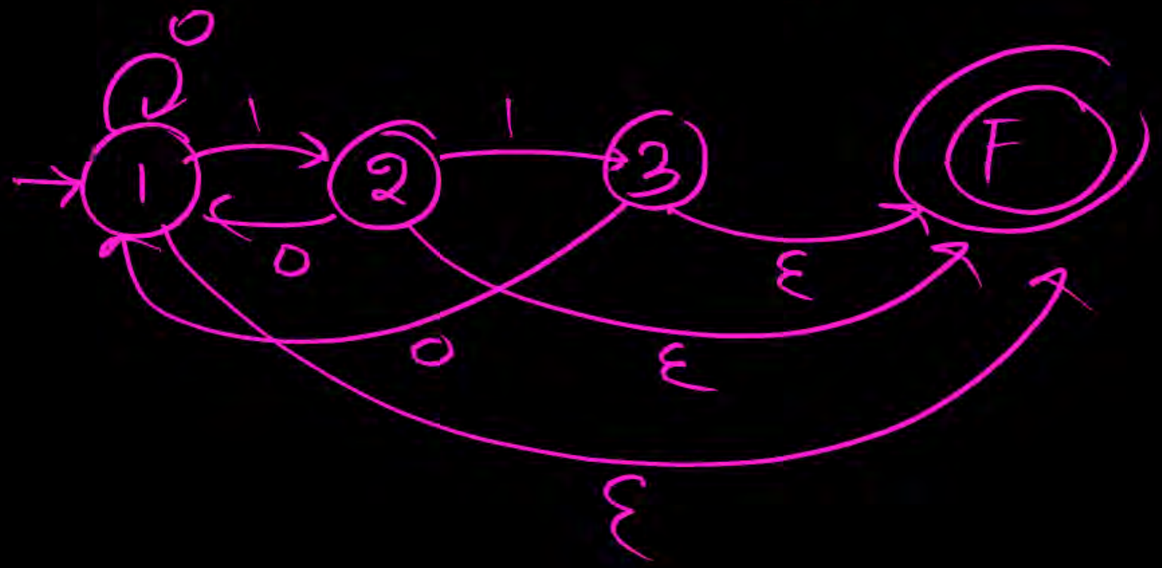
D. $(\in + 11 + 1)(011 + 01 + 0)^*$

{ ε, 0, 1, 00, 01, 10, 11, 000, 001, 010, 011, 100, 101, 110, ✗, ... }

1110

0111





Eliminate state 2 and state 3

Regular Expression: MCQ

Q15. Consider the following regular language L:

$L = \{w \mid \text{number of a's } (w) \bmod 3 \neq 1 \text{ where } w \in (a, b)^*\}$

Which one of the following represents above language L?

A $(\in + b^* ab^* ab^* + ab^*)\ (a + b)^*$

B $[(b^* ab^* ab^* ab^*)^* + b^*]\ (b^*ab^*ab^*)$

C $[(b^*a\ b^*a\ b^*ab^*)^* + (b^* + \in + b^*ab^*ab^*)]$

D $[b^*a\ b^*ab\ ^*\ ab^*)^* + b^*]\ (\in + b^*ab^*ab^*)]$

Regular Expression: MCQ

Q16. Which of the following represents set of all strings starts and ends with different symbols over a's and b's?

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

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

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

D. None of these

Regular Expression: MCQ

Q17. Which of the following is TRUE ?

A $1(11)^* = (1(11)^*)^*$

B $(11)^* = (1(11)^*)^*$

C $(1(11)^*)^* = 1^*$

D $(11)^* = 1^*$

Regular Expression: MCQ

Q18. Consider the following regular expression given below:

$R_1 = (01 + (1 + 01)0)^* (1 + 01)$

$R_2 = (01)^* (1 + 01) (0(01)^* (0 + 01))^*$

Which of the following is correct about R_1 and R_2?

A. String "0110" generated by R_2 but not R_1.

B. String "0110" generated by R_1 but not R_2.

C. Both expression generates the same language.

D. None of these

Regular Expression: MCQ

Q19. Suppose the length of language $|L_1| = 5$ and $|L_2| = 4$ then, which of the following is correct?

A $|L_1 . L_2| \geq 5$

B $|L_1 . L_2| \geq 20$

C $|L_1 . L_2| \geq 9$

D $|L_1 . L_2| \leq 20$

Regular Expression: MCQ

Q20. Choose correct Statement.

A $R + \phi = R \cdot \phi$

B $R + R = R \cdot R$

C $R + \varepsilon = R + \phi$

D $R + R = R \cdot \varepsilon$

THANK - YOU