

*Class notes Problem* RE, RB, RL

# CS & IT ENGINEERING



## Theory of Computation

### REGULAR LANGUAGE

DPP - 01

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# [MCQ]



#Q. Which of the following language is non-regular?

**A**

$$L = \{ \underbrace{wxw^R}_{T^-} \mid x, w \in \{a, b\}^* \}.$$

$$\begin{array}{ll} w=ab & w^R=b\cancel{a} \\ w=\epsilon & w^R=\cancel{\epsilon} \end{array}$$

$$L. \left( \underbrace{q_1 b^+ ab}_{\omega} \underbrace{ab}_a \right)^*$$

$$\Rightarrow L(x) w^R (c) \\ \Rightarrow \underline{(a+b)}^*$$

**B**

$$L = \{ \underbrace{wxw}_{T^+} \mid w, x \in \{a, b\}^* \}.$$

$$\begin{array}{l} \underbrace{wxw}_{T^+} \\ - \\ \left\{ \begin{array}{l} w=\epsilon \\ w=c \end{array} \right. \end{array}$$

$$c \cdot x \epsilon = x = \underline{(a+b)}^*$$

**C**

$$L = \{ \underbrace{wxwx}_{T^+} \mid w, x \in \{a, b\}^+ \}.$$

$$\begin{array}{l} \cancel{wxwx} \\ - \\ \cancel{(x)} \end{array}$$

**D**

None of these.

(C)

# [MCQ]



$$\overline{aAb - ab}$$

#Q. Consider the following grammar  $G_1$  and  $G_2$ :

*(FL)*

$$G_1: \begin{cases} S \rightarrow aAb \\ A \rightarrow aB \mid \epsilon \\ B \rightarrow Ab \end{cases}$$

$$G_2: \begin{cases} S \rightarrow aABb \\ A \rightarrow aA \mid \epsilon \\ B \rightarrow bB \mid \epsilon \end{cases}$$

$$aAb \Rightarrow aA\cancel{B}b \xrightarrow{\text{a}*b*} a^+b^+$$

If  $G$  is RL then it will generate RL  
 " " " Not RL it may/may not generate RL

$$aAb \Rightarrow \overbrace{a^+}^{a^+} \overbrace{aBb}^{aBb} \xrightarrow{\text{a}*b*} \overbrace{a^+}^{a^+} \overbrace{b^+}^{b^+}$$

$$(FL) \quad \#a's = \#b's \Rightarrow a^n b^n \mid n \geq 1$$

Which of the following grammar generates a regular language?

A

$G_1$  only

B

$G_2$  only

C

Both  $G_1$  and  $G_2$

D

None of these

$$\subset' = \{ \text{ } \} \cup \{ a^q \mid q \in \mathbb{N} \}$$

#Q. Consider the following three languages:

(1)  $L = \{a^{n^n} \mid n \geq 1\}$  {a, a<sup>2</sup>, a<sup>3</sup>, ...}

(2)  $L = \{a^{m^n} \mid m = n^2, n \geq 1\}$  {a, a<sup>4</sup>, a<sup>9</sup>, ...}

(3)  $L = \{a^m \mid n \geq 1, m > n\}$  {a<sup>2</sup>, a<sup>3</sup>, a<sup>4</sup>, a<sup>5</sup>, ...}

Total number of regular languages is/are \_\_\_\_.

①

(aa)(a)\*

a<sup>3</sup>  
a

#Q. Consider the following grammar

G:

$$G = S \rightarrow AB \mid CD \Rightarrow (aa)^* b^* + (aa)^* b^* \Rightarrow (aa)^* b^*$$

$$\begin{cases} A \rightarrow aaA \mid \epsilon & \Rightarrow (aa)^* \\ B \rightarrow bB \mid \epsilon & \Rightarrow b^* \\ C \rightarrow aaC \mid \epsilon & \Rightarrow (aa)^* \\ D \rightarrow bD \mid \epsilon & \Rightarrow b^* \end{cases}$$

ANY Lang if DFA, NFA, RE, RS

(B)

bD  
bbD  
babD  
babbaD

The language generated by above grammar is:

A

Finite X

B

Infinite but regular

C

Non-regular X

D

None of these

# [MCQ]

#Q. Which of the following language is non-regular?

①

R ✓  
**A**

$$L = \{ \underbrace{a^{2m}}_{a^2}, \underbrace{b^n}_{a^4}, \underbrace{b^n}_{a^6}, \underbrace{a^0}_{a^0} \mid m, n \geq 1 \}$$

$$(aa)^+ b^+ b^+ \Rightarrow (aa)^+ bbb^* = (aa)^+ bb^+$$

R ✓  
**B**

$$L = \{ \underbrace{a^m}_{a^+} \underbrace{b^n}_{b^+} X \mid m, n \geq 1, X \in \{a,b\}^* \}$$

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

R ✓  
**C**

$$L = \left\{ \{a^{n^2}\}^* \mid n \geq 0 \right\} \Rightarrow \{a^{1^2}\}^*, \{a^{2^2}\}^*, \dots$$

R ✓  
**D**

None of these.

$$\Rightarrow \{a^4\}^* = \{ \epsilon, a, aa, aaa, \dots \}$$

#Q. Regular expression can be used in:

- A Lexical Analysis
- B Pattern matching
- C String matching
- D Syntax analysis

C

(a,b)

a<sub>q</sub> ( ) a<sub>b</sub>

# [MCQ]



#Q. Consider the regular expression:

$$\text{regular expression} = a^*b(a + ba^*)^*$$

$$a^*b(a + ba^*)^* \rightarrow a^*b(a + b)^*$$

$\Rightarrow \{b, \underline{ab}, ab\}$

Above regular expression is equivalent to which of the following below regular expression?

A

$$ba^*(bb)^*$$

B

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

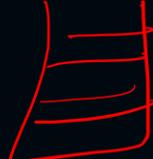
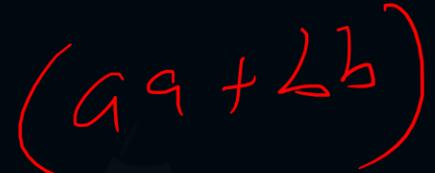
C

$$(b + a\underline{a}^*b) + (b + aa^*\underline{b}) (ba^*\cancel{b} + a) (ba^*b + a)^*$$

D

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

#Q. Which of the following statement will generate finite language?

- A PDA with finite stack. 
- B Regular expression without kleene star and kleene plus. 
- C Regular expression with unary alphabet. 
- D Regular expression with binary alphabet. 

#Q. Consider following regular expressions:

[I]  $(ab)^*a = a(ab)^*$

[II]  $(bb)^*b^* = b^*$

[III]  $(b + \epsilon)^+ = b^*$

Which of the following is correct?

A

II and III only.

B

I and II only.

C

All are correct.

D

None of these are correct.

[MCQ] $\xrightarrow{a^* b^*}$ #Q. For  $L = \{a^n b^m \mid n, m \geq 0\}$ 

What will be the regular expression ?

**A**

$$(a^*b^*)^* \Rightarrow (ab)^*$$

**C**

$$(ab)^* \xrightarrow{\text{abab--}} \times$$

(R)

**B**

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

**D**

$$(b^*a^*) \xrightarrow{\text{bab--aa--}}$$

## [MCQ]

$\{a^2, a^3, a^4, a^5, \dots\}$

#Q. Consider the following regular expressions:

- X (I)  $(aa + aaa)^* = aa^+ (a+b)^*$
- ✓ (II)  $(a^*b (a+b)^* + (a^*b^*)^*) = (a+b)^*$
- (III)  $(\epsilon + aaa (aaa)^*) (\epsilon + a + aa) = (a + aa + aaa)^* = \{a\}^*$

Which the following is correct?

A

(I) and (III) only. X

B

(II) and (III) only.

C

All are correct. X

D

None of these are correct.

## [MSQ]

#Q. Which of the following is/are regular expression for the language:

$L = \{\text{Containing } ab \text{ as a substring}\}$

$$L = \{ab, \dots ab \dots\}$$

b ab

(a, c, d)

A  $b^* aa^* b (a^* b^*)^*$

$$\Rightarrow b^* a a^* b (a + b)^* \\ \epsilon \quad a \in b \quad \epsilon = ab$$

B

$$(a + b)^* (ab)^* (a + b)^* \\ \epsilon \quad \epsilon \quad \epsilon = \epsilon$$

C

$$(a^* b^*)^* ab (a^* + b^*)^* \\ (a+b)^* \underline{ab} (a+b)^*$$



D

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

# [MCQ]



#Q. What will be the regular expression for  $L = \{a^{2n} \mid n \geq 15\}$  over  $\Sigma = \{a\}$

$$\{a^{2 \cdot 15}\} = \underbrace{a^{30}}_{\text{Ans}}, a^{32}, a^{34}, \dots$$

- A  $a^{15}(aa)^*$  X
- B  $(aa)^* a^{15}$  X
- C  $a^{30}(aa)^*$
- D None of these

$$\begin{aligned} &= a^{30}(aa)^* \\ a^{30} \cdot \epsilon &= a^{30} \\ &= a^{30}a^9 = a^{39} \end{aligned}$$

# [MCQ]

#Q. Which of the following string does not belong to  $(ab^*)^*$ ?

A

aaabbbaa

B

baaaabb

C

aaabbb

D

ababa

$\overbrace{ab^*ab^*ab^*}^{\text{a}} \overbrace{ab^*ab^*}^{\text{a}} \overbrace{ab^*ab^*}^{\text{a}}$

$\overbrace{a a a b b a a}^{\text{a}}$

$\overbrace{(ab^*)^*}^{\text{a}}$

$\overbrace{a a a b b a a}^{\text{a}}$

$a b^* a b^* a b^*$

$a b a b a = a b a b a$

14 Q

All Qs come from CN

WT, DPP, (PYQ) → 90 % CN

# THANK - YOU

Revision, PCU,