Q.86 Which of the following statements is/are FALSE?

1. For every non-deterministic Turing machine, there exists an equivalent deterministic Turing machine.
2. Turing recognizable languages are closed under union and complementation.
3. Turing decidable languages are closed under intersection and complementation.
4. Turing recognizable languages are closed under union and intersection. **GATE 2013**

(A) 1 and 4 only (B) 1 and 3 only (C) 2 only (D) 3 only

Q.87 Let L1 be a recursive language. Let L2 and L3 be languages that are recursively enumerable but not recursive. Which of the following statements is not necessarily true? **GATE 2010**

(A) L2 – L1 is recursively enumerable. (B) L1 – L3 is recursively enumerable

(C) L2 ∩ L1 is recursively enumerable (D) L2 ∪ L1 is recursively enumerable

Q.88 Which of the following is true for the language $\{a^p \mid p \text{ is prime}\}$? **GATE 2008**

(A) It is not accepted by a Turing machine

(B) It is regular but not context-free

(C) It is context-free but not regular

(D) It is neither regular nor context-free, but accepted by a Turing machine

Q.89 Match the following :

List-I	**List-II**
(A) $\{a^n b^n \mid n > 0\}$ is a deterministic context free language	(i) but not recursive language
(B) The complement of $\{a^n b^n a^n \mid n > 0\}$ is a context free language	(ii) but not context free language
(C) $\{a^n b^n a^n\}$ is context sensitive language	(iii)but can not accepted by a deterministic pushdown automation
(D) L is a recursive language	(iv) but not regular

Codes :

	(A)	**(B)**	**(C)**	**(D)**
(1)	(i)	(ii)	(iii)	(iv)
(2)	(i)	(ii)	(iv)	(iii)
(3)	(iv)	(iii)	(ii)	(i)
(4)	(iv)	(iii)	(i)	(ii)

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(A) (1) (B) (2) (C) (3) (D) (4)

Q.90 Which one of the following regular expressions represents the set of all binary strings with an odd number of 1's? **GATE 2020**

(A) ((0+1)* 1(0+1)*1)*10* (B) (0*10*10*)*0*1

(C)10*(0*10*10*)* (D) (0*10*10*)*10*

86⇒ False :-

C

① For every non-deterministic Turing machine, there exists equivalent deterministic Turing machine.

② Turing recognizable languages are closed under union & complementation.

③ Turing decidable languages are closed under intersection & complementation

④ Turing recognizable languages are closed under union & intersection.

→ Only - II

87⇒ $L_1 \rightarrow RL$

L_2 & L_3 → Recursive enumrable, not recursive

B

not True :-

$L_1 - L_3$ is Recursive enumrable.

$L_1 - L_3 = L_1 \cap \overline{L_3}$

✗

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88⇒ Those far, $L = \{a^p / p \text{ is prime}\}$

(D) → it is neither RL nor CFL, but accepted by Turing machine

89⇒

List - I	List - II
(A) $\{a^n b^n / n>0\}$ is DCFL	(i) but not RL
(B) Complement of $\{a^n b^n a^n (n>0)\}$ is CFL.	(ii) but not CFL
(C) $\{a^n b^n a^n\}$ is ~~esl~~ PDA	(iii) but can not accepted by a deterministic
(D) L is RL	(iv) but not regular

A → (iv)
B → (iii)
C → (ii)
D → (i)

90⇒ RE, accept all odd 1's.

(D) → $(0^*10^*10^*)^*10^*$

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Q.91 Consider the following statements.

I. If $L_1 \cup L_2$ is regular, then both L_1 and L_2 must be regular.

II. The class of regular languages is closed under infinite union.

Which of the above statements is/are TRUE ? **GATE 2020**

(A) I only (B) II only (C) Both I and II (D) Neither I nor II

Q.92 If L is a regular language over $\sum = \{a, b\}$, which one of the following languages is NOT regular? **GATE 2019**

(A) $L \cdot L^R \{xy \mid x \in L, y^R \in L\}$

(B) Suffix (L) = $\{y \in \sum^* \mid \exists x \in \sum^*$ such that $xy \in L\}$

(C) Prefix (L) = $\{x \in \sum^* \mid \exists y \in \sum^*$ such that $xy \in L\}$

(D) $\{ww^R \mid w \in L\}$

Q.93 For $\Sigma = \{a, b\}$, let us consider the regular language

$L = \{x \mid x = a^{2+3k}$ or $x = b^{10+12k}, k \geq 0\}$

Which one of the following can be a pumping length (the constant guaranteed by the pumping lemma) for L? **GATE 2019**

(A) 3 (B) 5 (C) 9 (D) 24

Q.94 Consider the following language.

$L = \{ x \in \{a,b\}^* \mid$ number of a's in x divisible by 2 but not divisible by 3 $\}$

The minimum number of states in DFA that accepts L is _____ . **GATE 2020**

(A) 6 (B) 5 (C) 7 (D) 4

Q.95 Consider the language $L = \{ a^n \mid n \geq 0 \} \cup \{ a^n b^n \mid n \geq 0 \}$ and the following statements.

I. L is deterministic context-free.

II. L is context-free but not deterministic context-free.

III. L is not LL(k) for any k.

Which of the above statements is/are TRUE ? **GATE 2020**

(A) I only (B) II only (C) I and III only (D) III only

Q.96 Consider the following languages.

$L_1 = \{ wxyx \mid w,x,y \in (0+1)^+ \}$

$L_2 = \{ xy \mid x,y \in (a+b)^*, |x|=|y|, x \neq y \}$

Which one of the following is TRUE ? **GATE 2020**

(A) L_1 is regular and L_2 is context- free

(B) L_1 context- free but not regular and L_2 is context-free

(C) Neither L_1 nor L_2 is context- free

(D) L_1 context- free but L_2 is not context-free

Q.97 Which of the following languages are undecidable? Note that $\langle M \rangle$ indicates encoding of the Turing machine M.

$L_1 = \{ \langle M \rangle \mid L(M) = \emptyset \}$

$L_2 = \{ \langle M,w,q \rangle \mid$ M on input w reaches state q in exactly 100 steps $\}$

$L_3 = \{ \langle M \rangle \mid L(M)$ is not recursive $\}$

$L_4 = \{ \langle M \rangle \mid L(M)$ contains at least 21 members $\}$ **GATE 2020**

(A) L_1, L_3, and L_4 only (B) L_1 and L_3 only (C) L_2 and L_3 only (D) L_2, L_3, and L_4 only

Q1⇒ (P)

(I) → If $L_1 \cup L_2$ is regular, then both L_1 & L_2 must be regular.

(II) → The class of RL is closed under infinite union.

True →

Both wrong

Q2⇒ (P)

RL, $\Sigma = \{a, b\}$ → which not regular

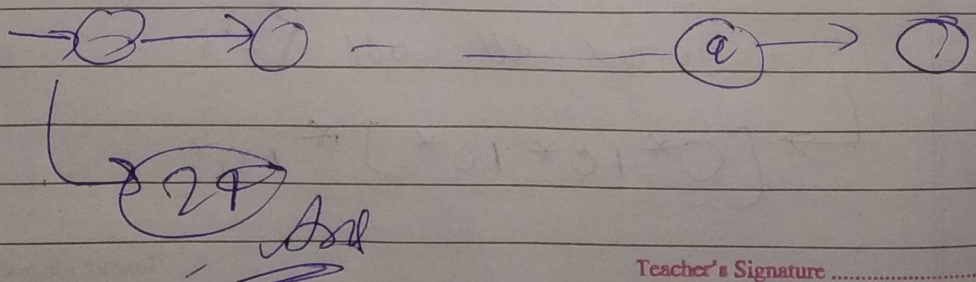
→ $\{\omega\omega^R / \omega \in L\}$ → not regular

Q3⇒ (D)

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

RL, $L = \{x / x = a^{2+3k}$ or $x = b^{10+12k}, k \geq 0\}$

~~Which~~ The constant guaranteed by the pumping lemma — for k —



Ans

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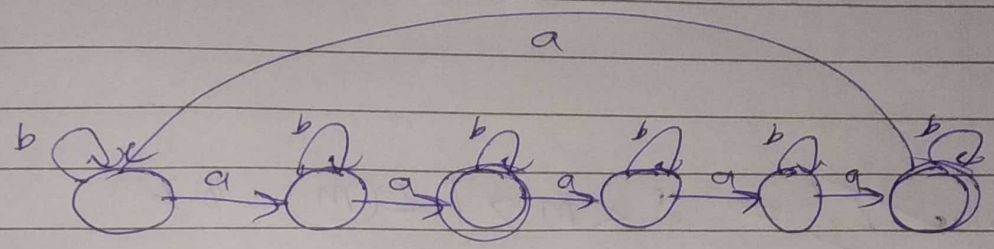
Q4 ⇒ $L = \{x \in \{a,b\}^* \mid$ number of a's in x divisible by 2 but not divisible by 3 $\}$

(A)

minimum state in DFA —

Soln



6 state

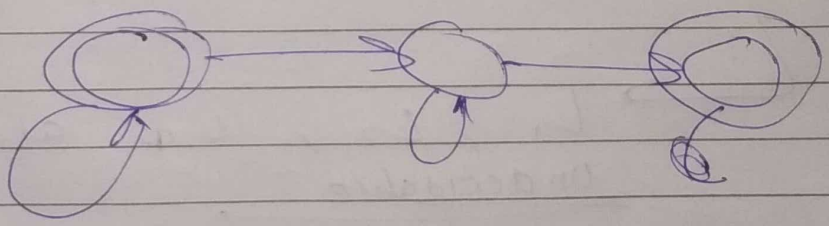
Q5 ⇒ $L = \{a^n \mid n \geq 0\} \cup \{a^n b^n \mid n \geq 0\}$

(C)

I. L is DCFL

II. L is CFL but not DCFL.

III. L is not LL(k) for any k.



(C) I & II

96 ⇒ $L_1 = \{wxyx \mid w, x, y \in (a+b)^*\}$

$L_2 = \{xy \mid x, y \in (a+b)^*, |x| = |y|; x \neq y\}$

(A) ⇒ $L_1 \longrightarrow$ Regular

$L_2 \longrightarrow$ CFL

97 ⇒ $L_1 = \{\langle M \rangle \mid L(M) = \phi\}$

$L_2 = \{\langle M, w, q \rangle \mid M$ on input w reaches state q in exactly 100 steps$\}$

(A) $L_3 = \{\langle M \rangle \mid L(M)$ contains atleast 2 (many$\}$

$L_4 = \{\langle M \rangle \mid L(M)$ not recursive$\}$

$\langle M \rangle \longrightarrow$ incoding of Turing machine

Undecidable ⇒ ?

$\longrightarrow L_1, L_2, L_4$ are Undecidable -