



- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

 Answer ALL Questions

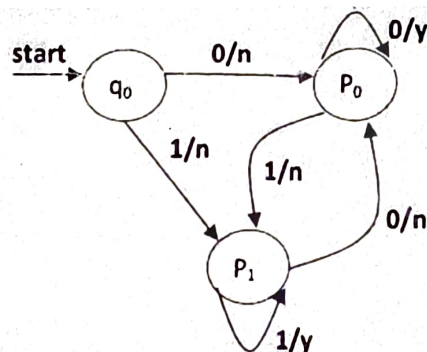
(10 X 10 = 100 Marks)

1. a) Construct a DFA, which accepts those words from $\Sigma = \{a, b\}$ such that the number of a's is even and the number of b's is divisible by three. [5]

b) Construct a DFA to recognize odd number of 1's and even number of 0's over $\Sigma = \{0, 1\}$. [5]

2. Define regular and non-regular language. Prove using pumping lemma, the following language is not regular language $L = \{w \in \{0, 1\}^* \mid w \text{ contains more 0's than 1's}\}$.

3. Convert the following Mealy machine to an equivalent Moore machine.



4. Derive the CFG for the given Context Free Language

$L = \{v' i^{r+s} t^s \mid r, s \geq 0\}$ and check the ambiguity of the given grammar.

5. Construct the given Context Free Grammar $G = (V, T, P, S)$ into Chomsky normal form where P is the start symbol.

$P \rightarrow RPT$

$Q \rightarrow RP \mid Ra$

$R \rightarrow bRPR \mid b \mid \epsilon$

$T \rightarrow PaP \mid R \mid aa$

6. Design a PDA to accept the language $L = \{a^2b^{2n}c^n \mid n \geq 1\}$. Show that the string 'aabbabbcc' is recognized by the above PDA by drawing possible instantaneous descriptions during processing the strings.

7. Define a Context-Sensitive Grammar (CSG) and explain its relation to Context-Sensitive Languages (CSL). How does a Linear Bounded Automaton (LBA) recognize a CSL?

8.a) Design Turing Machine to accept the language $L = \{a^n b^n c^n \mid n \geq 0\}$.

OR

8.b) i) Differentiate Computability and Decidability. [5]

ii) Prove that for the languages L_1 and L_2 Concatenation is recursive. [5]

$$L_1 = \{a^n b^n c^n \mid n \geq 0\}$$

$$L_2 = \{d^m e^m f^m \mid m \geq 0\}$$

9.a) Deduce the following ϵ -NFA to DFA.

states	ϵ	a	b	c
$\rightarrow p$	$\{q, r\}$	ϕ	$\{q\}$	$\{q, r\}$
q	ϕ	$\{p\}$	$\{r\}$	$\{q\}$
*r	ϕ	ϕ	ϕ	$\{r\}$

OR

9.b) Minimize the DFA whose transition table is given below:

states	0	1
$\rightarrow q_0$	q1	q3
q1	q2	q4
q2	q3	q2
*q3	q4	q5
*q4	q3	q4
*q5	q4	q5
q6	q6	q1

Starting State: q_0 and Final State: $\{q_3, q_4, q_5\}$.

10. In the context of modern AI-driven applications, how can deterministic finite automata (DFA) be used to efficiently validate real-time user inputs and ensure security in web applications?

⇔⇔⇔ Y/D/TY ⇔⇔⇔