

JK Lakshmipat University Jaipur INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, May 2026
B. Tech. (CSE), Semester VI, 2025-26

Roll No.....

CS1143: Theory of Computation

Time: 2:30 hours

Max. Marks: 30

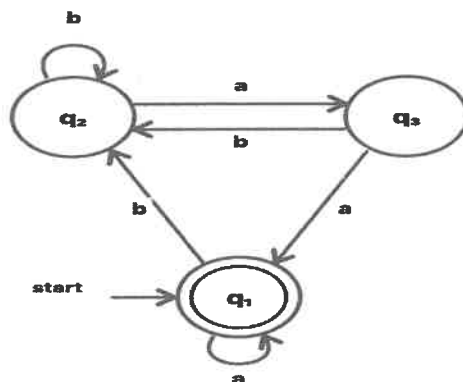
Instructions to students:

1. Do not write anything, other than your roll number, on the question paper.
2. Mention all the assumptions for your answers clearly.
3. Calculators are not allowed

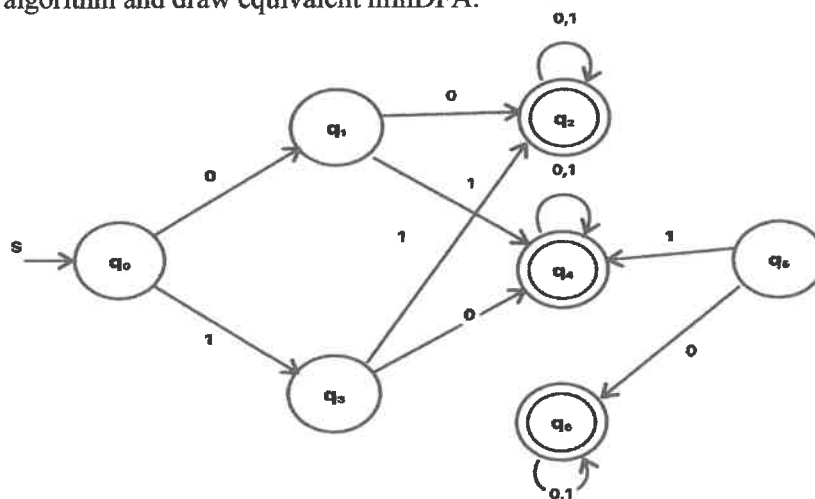
Part-A

5*2=10

1. Find L_1/L_2 for regular languages $L_1 = (a^*baa^*)$, $L_2 = (ab^*)$ and draw Finite Automata for it. (CO 4)
2. Identify the type of the following grammar according to the Chomsky Hierarchy.
 $S \rightarrow baS \mid bbSA \mid abS \mid \epsilon$, with short explanation. (CO 5)
3. Let $L_1 = \{ a^n b^n c^n \mid n \geq 1 \}$ over the alphabet $\Sigma = \{a, b, c\}$.
 I. Place the language L_1 in the Chomsky Hierarchy. Justify your answer.
 II. Consider $(L_1)^c =$ complement of L over Σ^* . What type of language is $(L_1)^c$? Justify. (CO 5)
4. Using Arden's theorem find the regular expression for the above Finite Automata. (CO 4)



5. Consider the following DFA $= (Q, \Sigma, \delta, q_0, F)$ where $Q = \{q_0, q_1, q_2, q_3, q_4, q_5, q_6\}$ over $\Sigma = \{0, 1\}$.
 Apply minimization algorithm and draw equivalent minDFA. (CO 4, 5)



6. Consider the following Left Linear Grammar G:

$$S \rightarrow Aa \quad A \rightarrow Ab \mid Ba \quad B \rightarrow b \mid \epsilon$$

- I. Find the Regular Expression for the language generated by G. Show all steps using Arden's Lemma.
- II. Convert G into an equivalent Right Linear Grammar. (CO 4, 5)

7. Consider the language over $\Sigma = \{a, b, c, d\}$:

$$L = \{a^{n+1}b^m c^m d^n \mid n \geq 1, m \geq 1\}$$

- I. Identify the language L in the Chomsky Hierarchy. Justify your answer.
- II. Create corresponding Automata. (CO 6)

8. Let $L = \{w \mid w \in (a+b)^*, \text{2nd symbol from end is 'a'}\}$ over $\Sigma = \{a, b\}$.

- I. Construct a DFA for L. Show the transition table.
- II. Write the Regular Expression and Right Linear Grammar for L. (CO 4, 5)

9. Let L_1 be the language represented by the regular expression $b^*ab^*(ab^*ab^*)^*$

and $L_2 = \{w \in (a+b)^* \mid |w| \leq 4\}$, where $|w|$ denotes the length of string w.

- I. Find the number of strings in L_2 which are also in L_1 .
- II. Write the Regular Expression for $L_2 \cap L_1$. (CO 8)

10. Construct a DFA over $\Sigma = \{0, 1\}$ that accepts all binary strings whose decimal value is divisible by 3 but not divisible by 2. Show the transition table and trace the DFA for strings 11, 110, and 1001.

(CO 3)

END