



School of Computer Science and Engineering

Fall Semester 2025-26

CAT I

Reg. No.

SLOT: D2 + TD2

Programme Name & Branch: B.Tech CSE & BS

Course Code & Name: CBS2002: Formal Languages and Automata Theory

Class Number(s): VL2025260103280, VL2025260104778

Faculty: Dr. Saravanan R, Dr. Lakshmanan K

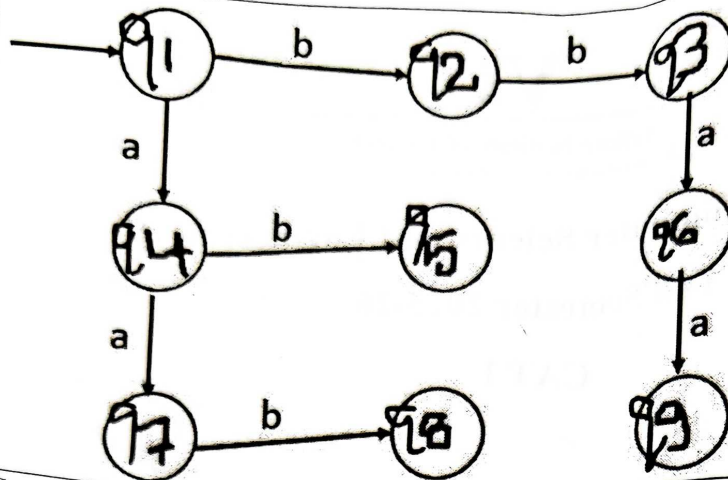
Max Marks: 50

Time: 90 minutes

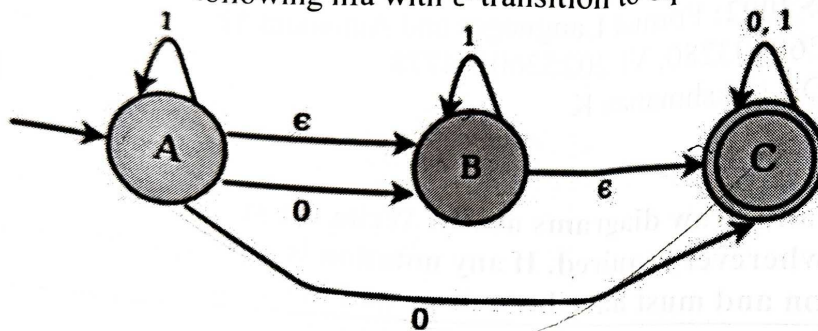
Instruction: Write legibly and draw diagrams neatly. Write the steps and the final answer after the process, wherever required. If any notation is not explained, then this must be a standard notation and must have been discussed in class.

Answer all Questions

Q. No.	Question	Max Marks	CO	BL
1.	(a) Consider the grammar G_1 whose rules are $S \rightarrow 0A \mid 01$, $A \rightarrow S1$, with $N=\{S,A\}$, $T=\{0,1\}$. What is $L(G_1)$? (2 marks) (b) Let $L_1=\{w \in \{a,b,c\}^* : w _a = w _b = w _c\}$ where $ w _\sigma$ is the number of occurrences of the symbol σ in the word w and $L_2=\{c^i a^j b^k \mid i,j,k \geq 0\}$. What is $L_1 \cap L_2$? (2 marks) (c) Draw the Chomsky hierarchy diagram comprising the family of languages and their corresponding computational models. (6 Marks)	10	CO1	BL1
2.	(a) Construct a DFA that accepts all strings over $\{a, b\}$ except those ending with bab . (4 Marks) [Hint: Recall the DFA for ending with bab and then see how can you take it from there] (b) Complete the missing transitions of the following DFA that accepts the language L_3 and is given by $L_3=\{w \in \{a,b\}^* : w _a \bmod 3 = w _b \bmod 3 = 2\}$. In other words, L_3 collects all strings over $\{a,b\}$ whose occurrences of a and b each remains two when the occurrences of each of them is divided by 3. Also, identify the final state(s) of the automata to accept L_3 . Note that q_1 is the start state of the automata. (6 marks)	10	CO2	BL2



3. Convert the following nfa with ϵ -transition to equivalent dfa.



10

CO2

BL3

4. a) i) Give a regular expression over $\{a,b\}$ that has (i) exactly three occurrences of a & no limit on occurrences of b . (2marks)
 (ii) Give a regular expression for strings over $\{0,\dots,9\}$ which are assumed to be integers that are divisible by 5. (2 marks)
 b) Show that the language $\{a^p b^q \mid 1 \leq q < p\}$ is not regular. (6M)

10

CO3

BL4

5. (a) Construct the NFA for the regular expression $(a+b)a.b^*$ using Thomson's construction method. (4 marks)
 (b) Convert the following DFA into an equivalent regular expression. Note that q_2 is a final state. (6 marks)

10

CO3

BL3

