

SECTION C — ($3 \times 10 = 30$)

Answer any THREE questions.

16. Prove that if L is accepted by an *NFA* with ϵ -transitions, then L is accepted by an *NFA* without ϵ -transitions.
17. Prove that if L is accepted by a DFA, then L is denoted by a regular expression.
18. Prove that if L is a context-free language, then there exists a PDM M such that $L = N(M)$.
19. Explain in detail about representing a transition diagram as a data structure.
20. Construct a leftmost derivation and a rightmost derivation for the sentence $w = ibtibtaea$ under the grammar
 - (a) $S \rightarrow iCtS$
 - (b) $S \rightarrow iCtSeS$
 - (c) $S \rightarrow a$
 - (d) $C \rightarrow b$

Where i, t and e stand for if, then and else, C and S for “conditional” and “statement”.

S.No. 3152

P 16 MAE 3 C

(For candidates admitted from 2016–2017 onwards)

M.Sc DEGREE EXAMINATION, NOVEMBER 2022.

Mathematics — Elective

AUTOMATA THEORY

Time : Three hours

Maximum : 75 marks

SECTION A — ($10 \times 2 = 20$)

Answer ALL questions.

1. Define regular set.
2. Define nondeterministic finite automaton.
3. Find L_1L_2 if $L_1 = \{10, 1\}$ and $L_2 = \{011, 11\}$.
4. Define context-free grammar.
5. Define language accepted by empty stack.
6. Define deterministic PDA.
7. Define transition diagram.
8. Define auxiliary definitions.

9. What are canonical derivations?

10. Define reduction.

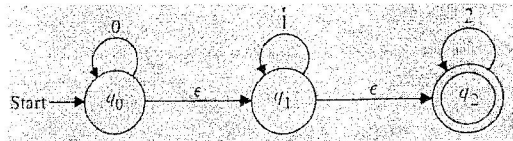
SECTION B — (5 × 5 = 25)

Answer ALL questions, choosing either (a) or (b).

11. (a) Let $M = (\{q_0, q_1\}, \{0, 1\}, \delta, q_0, \{q_1\})$ be an NFA where $\delta(q_0, 0) = \{q_0, q_1\}, \delta(q_0, 1) = \{q_1\}, \delta(q_1, 0) = \emptyset, \delta(q_1, 1) = \{q_0, q_1\}$. Construct a DFA corresponding to M .

Or

- (b) Determine the transition function for the following NFA.



12. (a) Draw the derivation tree of $G = (\{S, A\}, \{a, b\}, P, S)$ where P consists of $S \rightarrow aAS \mid a$, $A \rightarrow SbA \mid \mid SS \mid ba$.

Or

- (b) Define A-production. Let $G = (V, T, P, S)$ be a CFG. Let $A \rightarrow \alpha_1 B \alpha_2$ be a production in P and $B \rightarrow \beta_1 \mid \beta_2 \mid \dots \mid \beta_r$ be the set of all B -productions. Let $G_1 = (V, T, P_1, S)$ be obtained from G by deleting the production $A \rightarrow \alpha_1 B \alpha_2$ from P and adding the productions $A \rightarrow \alpha_1 \beta_1 \alpha_2 \mid \alpha_1 \beta_2 \alpha_2 \mid \dots \mid \alpha_1 \beta_r \alpha_2$. Prove that $L(G) = L(G_1)$.

13. (a) Determine a formal pushdown automaton that accepts $\{WCW^R \mid W \text{ in } (0+1)^*\}$ by empty stack.

Or

- (b) Prove that if L is in $N(M_1)$ for some PDA M_1 , then L is $L(M_2)$ for some PDA M_2 .

14. (a) Explain the algorithm of constructing an NFA from a regular expression.

Or

- (b) Write the algorithm of minimizing the number of states of a DFA.

15. (a) Write a short note on operator-precedence grammars.

Or

- (b) Write the algorithm of computing operator-precedence relations.