QP Code: P25DR003

Reg. No : .....
Name : .....

ST MARY'S COLLEGE (AUTONOMOUS), THRISSUR-20

I SEMESTER (CBCSS-PG) DEGREE EXAMINATIONS, NOVEMBER 2025
M. Sc. Computer Science
CSS1C03 : THEORY OF COMPUTATION
2025 Admission Onwards

Time: 3 Hours **Maximum Marks: 30**

Section A

Short answer type questions. Answer **any four**. Weightage **2** for each.
(4x2 = 8 Weightage)

1. Define NDFA. Explain how the transition is represented in NDFA with an example.
2. Define a regular expression. Write the regular expression for L={ w ∈ { 0 , 1 } | w starts and ends with the same symbol and has even length }.
3. Define Context-Free Grammar. Explain with example.
4. Describe the working of a basic Turing Machine with a neat diagram, and demonstrate its operation on a simple input string.
5. State any three closure properties of recursive languages. Give examples.
6. Analyze why the language L={a^n b^n c^n | n ≥ 1 } is not context-free using the Pumping Lemma.
7. Define a Non-Deterministic Turing Machine.

Section B

Short essay-type questions. Answer **any four**. Weightage **3** for each.
(4x3 = 12 Weightage)

8. Explain the different methods of formal proof and inductive proof used in Automata Theory. Illustrate each with a suitable example.
9. Explain the closure properties of regular languages under various operations.
10. Define and design a PDA for the language L = { a^n b^n | n =≥1 }. Show its transition diagram.
11. Differentiate between Turing-decidable and Turing-acceptable languages with suitable examples.
12. Differentiate between tractable and intractable problems.

Turn Over

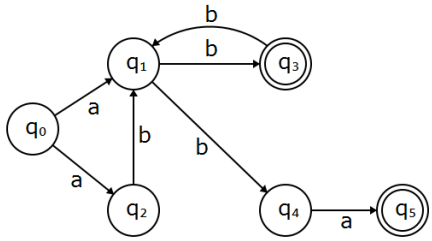
13. Given the grammar: S -> aSb | ab. Identify its Chomsky Hierarchy type and justify your answer based on production rules.

14. State and explain how Pumping Lemma prove that the language is regular or not. Demonstrate with the L = { a^n b a^n | n = 1 } is not Regular.

Section C

Essay-type questions. Answer **any two**. Weightage **5** for each.
(2x5 = 10 Weightage)

15. Convert the given NFA to DFA



16. Evaluate DFA State Minimization with example.

17. a) Evaluate the implications of converting a general context-free grammar into CNF and GNF.
    b) Perform CNF conversion for the following grammar: S -> ASB , A -> aAS | a | ε , B -> SbS | A | bb

18. Prove that the Post Correspondence Problem is undecidable. Provide a sketch of the proof using a reduction from the acceptance problem for Turing Machines.

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