

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code : 20870

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fourth Semester

Computer Science and Engineering

CS 3452 — THEORY OF COMPUTATION(Common to : Computer Science and Engineering (Artificial Intelligence and Machine Learning)/
Computer Science and Engineering (Cyber Security)/Information Technology)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Identify NFA-epsilon to represent $a^*b|c$.
2. Let L be a set accepted by a non-deterministic finite automaton. The number of states in non-deterministic finite automaton is ' N '. Find the maximum number of states in equivalent finite automaton that accepts L .
3. Recall the term "Regular Expression". Give a Regular Expression for any language containing symbols $(0, 1)$ and strictly ends with ' 1 '.
4. Given the following two languages: $L_1 = \{a^n b a^n \mid n > 0\}$ $L_2 = \{a^n b a^n b^{(n+1)} \mid n > 0\}$ Check whether the above languages are context-free or not.
5. Mention a few points regarding Chomsky's hierarchy with illustration.
6. Examine the context free Grammar representing the set of Palindrome over $(0+1)^*$.
7. Tabulate the difference between Chomsky Normal Form (CNF) and Greibach Normal Form (GNF).
8. Give the philosophy behind Pumping lemma for CFLs.
9. List down a few properties of recursively enumerable set.
10. Define Class P and NP problems. Give examples.

PART B — (5 × 13 = 65 marks)

11. (a) Construct a DFA for the following Language and check whether $w = '01101'$ is a valid string or NOT. $L(G) = \{w \mid w \text{ in } (0,1) \text{ and } w \text{ starts with } 0 \text{ and has odd length or it starts with } 1 \text{ and has even length}\}$.

Or

- (b) Explain the DFA minimization algorithm with an example.

12. (a) Prove that the set of regular languages is closed under complementation. (i.e., If L a regular language then L' is also a regular language). Give an example.

Or

- (b) How to determine in two Regular Expressions are equivalent or NOT? Are (a^*) and $(\epsilon + aa^*)$ equivalent wrt. $\Sigma = \{a,b\}$?
13. (a) Construct a CFG for the language given below. $L(G) = \{w \mid w \text{ in } (a,b)^+ \text{ and } w \text{ is an odd length palindrome}\}$. Also check whether $w = 'babab'$ is a valid string or not.

Or

- (b) Construct an empty store PushDown Automata(PDA) for the below mentioned language: $L(G) = \{w \mid w \text{ in } (a,b)^+ \text{ and } w \text{ is of the form } a^n b^n \text{ and } n \geq 1\}$. Also mention the state transitions of this PDA while parsing the string $w = 'aaabbb'$.
14. (a) Demonstrate the working model of a Turing machine to perform proper subtraction.

Or

- (b) Construct a Turing machine to accept the following language. $L(G) = \{w \mid w \text{ in } (0,1)^+ \text{ and } w \text{ is of the form } 0^n 1^n \text{ where } n \geq 1\}$
15. (a) Give short notes on Recursive and Recursively Enumerable languages.

Or

- (b) Explain the philosophy behind Travelling salesman problem (TSP). Analyze the computational complexity for the same. Show how the decision version of the TSP belongs to the class of NP-Complete problem.

PART C — (1 × 15 = 15 marks)

16. (a) Construct an empty store PushDown Automata(PDA) for the below mentioned language: $L(G) = \{w \mid w \text{ in } (a,b,c)^+ \text{ and } w \text{ is of the form } XcX', \text{ where } X' \text{ is the reversed string of } X \text{ and } X \text{ in } (a,b)^+\}$. Also mention the state transitions of this PDA while parsing the string $w = 'baacaab'$.

Or

- (b) Construct a PushDown Automata(PDA) for the below mentioned language: $L(G) = \{w \mid w \text{ in } (a,b,c,d)^+ \text{ and } w \text{ is of the form } a^n b^m c^m d^n \text{ and } (m,n) \geq 1\}$. Also mention the state transitions of this PDA while parsing the string $w = 'aaabccddd'$.
-