BACHELOR OF TECHNOLOGY (CBCS) (2020 COURSE)
B.Tech.Sem - IV INFORMATION TECHNOLOGY : SUMMER : 2024
SUBJECT: FORMAL LANGUAGES & COMPUTATION THEORY

Day : Wednesday
Date : 22/05/2024

S-24719-2024

Time : 10:00 AM-01:00 PM
Max. Marks : 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Draw neat and labelled diagram **WHEREVER** necessary.
4) Assume suitable data, if necessary.

Q.1 Design a Finite Automata to check divisibility by 5 tester for BINARY NUMBERS. **[10]**

OR

Q.1 Compare and contrast Moore and Mealy machines in terms of their structure and behavior. Analyze the impact of these differences on the design of finite automata for specific applications. **[10]**

Q.2 Give definition of Regular Expression. Construct NFA with $\in$-moves for $((0 + 1)^* + 1.0^*)^*$. **[10]**

OR

Q.2 State and prove pumping lemma with suitable example. **[10]**

Q.3 Analyze the Chomsky hierarchy and its levels. Discuss the relationship between these levels and the types of grammars and languages they represent. **[10]**

OR

Q.3 Define context-free grammar and context-free language. Analyze the differences between context-free languages and regular languages, providing examples to illustrate these distinctions. **[10]**

Q.4 Explain how pushdown automata are equivalent to context-free grammars (CFGs). Describe the relationship between the languages they can recognize. **[10]**

OR

Q.4 What is a pushdown automaton (PDA), and how does it differ from a finite automaton? What are typical use cases for PDAs in computational theory? **[10]**

Q.5 Identify and analyze a problem that cannot be solved by Turing machines, such as the Halting Problem. Discuss the implications of this limitation for the field of computation. **[10]**

OR

Q.5 Describe the Church-Turing Thesis and its significance in computational theory. Analyze its impact on the understanding of computability and the relationship between algorithms and Turing machines. **[10]**

Q.6 What defines the class NP, and what does it mean for a problem to be NP-complete? Discuss why NP-complete problems are significant in computational theory and provide examples. **[10]**

OR

Q.6 Explain the Halting Problem and why it is undecidable? Discuss the broader implications of undecidability in the context of Turing machines and computation. **[10]**

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