

Subject: Theory of Computation

1. Explain various set operations.
2. Define: set, function.
3. Explain following with example:
 - a. One to one function.
 - b. Onto function.
 - c. Bijective function.
4. Define relation, language.
5. The given relation R on set A = {1, 2, 3} determine whether the Relation is reflexive, symmetric or transitive, give reason. $R = \{(1,1), (1,2), (1,3), (2,1), (2,2), (3,1), (3,3)\}$.
6. Write Principle of Mathematical Induction.
7. Explain structural induction in brief.
8. Prove that for every $n \geq 1$, $1 + 3 + 5 + \dots + (2n - 1) = n^2$.
9. Define FA and Write recursive definition of NFA.
10. Write down steps to minimize any Finite automata.
11. What is regular language? Write down applications of finite automata.
12. Explain operations on regular language.
13. Find a regular expression of following subsets of $\{0, 1\}^*$.
 - a. The language of all strings that begin or end with 00 or 11.
 - b. The language of all strings ending with 1 and not containing 00.
14. Draw Finite Automata to accept following over input alphabets $\Sigma = \{0, 1\}$.
 - a. The language accepting strings not ending with '01'.
 - b. The language accepting strings next to last symbol '0'.
15. Give the difference between moore machine and mealy machine.
16. Explain conversion from NFA to FA with appropriate example.
17. Draw NFA-null for the R.E. $(0+1)^*$.
18. Explain conversion from NFA-null to NFA.
19. Write down kleen's theorem.
20. Explain pumping lemma for regular languages.
21. Design and mealy machine that gives output 1 if input of sequence abb comes, other wise 0.
22. Define Context Free Grammar. Find context-free grammar for the language: $L = \{a^i b^j c^k \mid j=i+k\}$.
23. Explain operations on CFG.
24. How to find CNF explain with suitable example.
25. What is BNF?
26. Define Ambiguous grammar. for following grammar say whether the grammar is ambiguous or not. give reason rules are as below.
$$\begin{aligned} S &\rightarrow ABA, \\ A &\rightarrow aA \mid \Lambda, \\ B &\rightarrow bB \mid \Lambda. \end{aligned}$$
27. Give an unambiguous grammar for SIMPLE CALCULATOR contain +, -, *, /,(,) operator for terminal 'id'. And draw a parse tree for $(id+id)*id-id$.
28. Find the CFG for the regular expression : $(01^*1 + 1)^* (01)^*$.

29. Using Kleene's Theorem Draw NFA- Λ for $((0+1)^*10 + (00)^*)^*$.

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30. Given the context-free grammar G, find a CFG G' in Chomsky Normal Form.

$S \rightarrow AaA \mid CA \mid BaB$

$A \rightarrow aaBa \mid DC$

$B \rightarrow bb \mid aS$

$C \rightarrow Ca \mid bC \mid D$

$D \rightarrow bD \mid \Lambda$

31. Define Pushdown Automata.

32. Design a PDA to accept $L = \{xycy \mid x, y \in (a,b)^* \text{ and } |x| = |y|\}$.

33. Develop a Turing Machine to accept palindromes over $\{a,b\}^*$.

34. Define grammar and Chomsky hierarchy.

35. Design a PDA to accept $L = \{a^n b^n \mid n \geq 0\}$.

36. Define Turing machine along with the model of computation.

37. Develop a Turing Machine to accept the language $L = \{X \mid N_a(X) = N_b(X), X \in \{a,b\}^*\}$.

38. Explain recursively enumerable languages.

39. Explain variations of Turing machine.

40. Explain partial, total, constant functions.

41. Explain primitive recursive functions.

42. Explain bounded minimization.

43. Explain quantification & minimization.

44. What is P & NP?

45. What is the meaning of undecidable?

46. What is non recursive enumerable language?

47. Explain context sensitive language.

48. Write down pumping lemma for CFL.

49. Explain non CFL in short.

50. Explain operations on CFL.