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Question Paper Code : X 10319

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Fifth Semester
Computer Science and Engineering
CS 8501 – THEORY OF COMPUTATION
(Regulations 2017)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2 = 20 Marks)

1. Define Deterministic Finite Automaton.
2. State any four types of proofs.
3. Write the regular expression for all strings that contain no more than one occurrence of aa.
4. Write a regular expression for even number of a's and even number of b's of a string $w = \{a, b\}^*$.
5. Write a Context Free Grammar for the language consisting of equal number of a's and b's.
6. Define Deterministic PDA.
7. What are the two normal forms of CFG ? Write their productions format.
8. Define the language recognized by any Turing Machine.
9. What are recursive languages ?
10. Define the classes P and NP problem. Give example problems for both.

PART – B

(5×13 = 65 Marks)

11. a) Prove that for every L recognized by an NFA, there exists an equivalent DFA accepting the same language L.

(OR)

- b) Prove that for every L recognized by an ϵ -NFA, there exists an equivalent DFA accepting the same language L.



12. a) Prove that the following languages are not regular using pumping lemma.
- i) All unary strings of length prime. (7)
 - ii) $L = \{uu \mid u \in \{0, 1\}^*\}$. (6)

(OR)

- b) State and Prove any two closure properties of Regular Languages.

13. a) How ϵ -productions are eliminated from a grammar whose language doesn't have empty string? Remove ϵ -productions from the grammar given below.

$$S \rightarrow a \mid aA \mid B \mid C \quad A \rightarrow aB \mid \epsilon \quad B \rightarrow Aa \quad C \rightarrow aCD \quad D \rightarrow ddd$$

(OR)

- b) Write procedure to find PDA to CFG. Give an example for PDA and its CFG.

14. a) How a CFG for L is converted into CNF accepting the same language? Convert the following CFG into CFG in CNF.

$$S \rightarrow bA \mid aB \quad A \rightarrow bAA \mid aS \mid a \quad B \rightarrow aBB \mid bS \mid b$$

(OR)

- b) Construct a Turing Machine for proper subtraction, which is defined as $m - n$ if $m > n$ and 0 otherwise.

15. a) Prove that Universal language is recursively enumerable but not recursive.

(OR)

- b) Define PCP and prove that PCP is undecidable.

PART – C

(1×15 = 15 Marks)

16. a) Construct a Turing Machine for multiplying two non negative integers using subroutine.

(OR)

- b) How PDA is converted into CFG? Convert the following PDA into CFG.

$$P = (\{p, q\}, \{0, 1\}, \{Z, X\}, \delta, p, Z, \Phi)$$

$$\delta(p, 1, Z) = \{(p, XZ)\}, \delta(p, \epsilon, Z) = \{(p, \epsilon)\} \quad \delta(p, 1, X) = \{(p, XX)\},$$

$$\delta(q, 1, X) = \{(q, \epsilon)\}, \delta(p, 0, X) = \{(q, X)\}, \delta(q, 0, Z) = \{(p, Z)\}$$
