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Question Paper Code : 11278

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2012.

Fifth Semester

Computer Science and Engineering

CS 2303/CS 53/CS 1303/10144 CS 504 — THEORY OF COMPUTATION

(Common to Seventh Semester – Information Technology)

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define:
   (a) Finite Automaton (FA)
   (b) Transition diagram.
2. State the principle of induction.
3. Give regular expressions for the following
   L1 = set of all strings of 0 and 1 ending in 00.
   L2 = set of all strings of 0 and 1 beginning with 0 and ending with 1.
4. Differentiate regular expression and regular language.
5. What is an ambiguous grammar? Give example.
6. What are the different types of language accepted by a PDA and define them?
7. State the pumping lemma for CFLs.
8. What are the applications of Turing Machine?
9. When we say a problem is decidable? Give an example of undecidable problem.
10. What is recursively enumerable language?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the different forms of proof with examples. (8)
    (ii) Prove that, if L is accepted by an NFA with ε-transitions, then L is accepted by an NFA without ε transitions. (8)

Or

(b) (i) Prove that if n is a positive integer such that n mod 4 is 2 or 3 then n is not a perfect square. (6)

(ii) Construct a DFA that accept the following language.

$\{x \in \{a,b\}: |x|_a = \text{odd and } |x|_b = \text{even}\}$. (10)

12. (a) (i) Using pumping lemma for the regular sets, prove that the language $L = \{a^m b^n \mid m > n\}$ is not regular. (10)

(ii) Prove any two closure properties of regular languages. (6)

Or

(b) Construct a minimized DFA that can be derived from the following regular expression $0^*(01)(0/111)^*$. (16)

13. (a) (i) Consider the following grammar for list structures :

$S \rightarrow a/\wedge/(T)$ $T \rightarrow T, S/S$. (10)

Find left most derivation, rightmost derivation and parse tree for $(((a,a),\wedge(a)),a)$.

(ii) Construct the PDA accepting the language $\{(ab)^n | n \geq 1\}$ by empty stack. (6)

Or

(b) (i) Construct a transition table for PDA which accepts the language

$L = \{a^{2n} b^n / n \geq 1\}$

Trace your PDA for the input with n = 3. (10)

(ii) Find the PDA equivalent to the given CFG with the following productions. $S \rightarrow A, A \rightarrow BC, B \rightarrow ba, C \rightarrow ac$. (6)

14. (a) (i) Convert the following grammar into CNF

$S \rightarrow cBA$, $S \rightarrow A$, $A \rightarrow cB$, $A \rightarrow AbbS$, $B \rightarrow aaa$. (6)

(ii) State and prove the pumping lemma for CFL. (10)

Or

(b) (i) Design a Turing machine which reverses the given string {abb}. (8)

(ii) Write briefly about the programming techniques for TM. (8)

15. (a) (i) If L_1 and L_2 are recursive language then $L_1 \cup L_2$ is a recursive language. (6)

(ii) Prove that the halting problem is undecidable. (10)

Or

(b) (i) State and prove the post's correspondence problem. (10)

(ii) Write a note on NP problems. (6)