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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2006.

Fifth Semester

Computer Science and Engineering

CS 332 – THEORY OF COMPUTATION

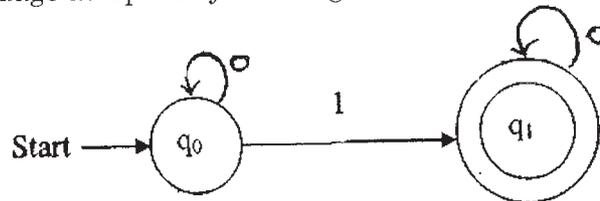Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Find the language accepted by a DFA given below.

2. Give the formal statement of pumping lemma for regular sets.

3. Find the language generated by a CFG G=({S}, {0,1},{S→0/1/ ϵ ,S→0S0/1S1},S).

4. Obtain a derivation tree for the grammar G=({S,A},{a,b},P,S) where P consists of $S \rightarrow aAS/a$

    $A \rightarrow SbA/SS/ba$

5. Using pumping lemma show that the language L={$a^n b^n c^n / n \geq 1$} is not a context-free language.

6. Give the formal definition of a pushdown automation.

7. What is meant by a Turing Machine with two-way infinite tape.

8. Define instantaneous description of a Turing Machine.

9. Show that the union of two recursively enumerable languages is recursively enumerable.

10. What is undecidability problem?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Show that the language $L = \{0^{n^2} / n \geq 1, n$ is an integer$\}$ is not regular. (4)

    (ii) Let L be a set accepted by a NFA then show that there exists a DFA that accepts L. (12)

    Or

    (b) (i) Show that every set accepted by a DFA is denoted by a regular expression. (8)

    (ii) Construct an NFA equivalent to the following regular expression $01^* + 1$. (8)

12. (a) (i) Construct an equivalent grammar G in CNF for the grammar G_1, where $G_1 = (\{S,A,B\},\{a,b\},\{S\rightarrow bA/aB, A\rightarrow bAA/aS/a, B \rightarrow aBB/bS/b\},S)$ (12)

    (ii) Find the left most and right most derivation corresponding to the tree. (4)
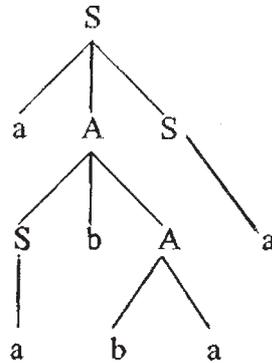
    Or

    (b) (i) Show that any CFL without $\in$ can be generated by an equivalent grammar in Chomsky-normal form. (12)

    (ii) Find the language generated by the grammar $G=(\{S\},\{a,b\},\{S\rightarrow aSb, S\rightarrow ab\},S)$ (4)

13. (a) Show that if L is a CFL then there exists a PDA M such that L=N(M). (16)

    Or

    (b) State and prove pumping lemma for context-free languages. (16)

14. (a) (i) Explain in detail:"The Turing Machine as a computer of integer functions". (8)

    (ii) Design a Turing Machine to accept the language $L=\{0^n 1^n / n \geq 1\}$ (8)

    Or

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(b) (i) What is the role of checking off symbols in a Turing Machine. (4)

(ii) Design a Turing Machine to implement "Proper Subtraction". (12)

15. (a) (i) Show that any non-trivial property J of the recursively enumerable languages is undecidable. (8)

(ii) Show that if L and $\overline{L}$ are recursively enumerable then L and $\overline{L}$ are recursive. (8)

Or

(b) Define the universal language and show that it is recursively enumerable but not recursive. (16)

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