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Question Paper Code : 95400

5 Year M.Sc. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fifth Semester

Software Engineering

XCS 352/10677 SW 505 — THEORY OF COMPUTATION

(Common to 5 Year M.Sc. Computer Technology and M.Sc. Information Technology)

(Regulations 2003/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define pumping lemma for regular languages.

2. Show the equivalence between regular expression and finite automata.

3. Write a CFG to generate the set $\{a^m b^n c^p / m + n = p \text{ and } p \geq 1\}$.

4. For the grammar $S \rightarrow aCa,\ C \rightarrow aCa / b$, find $L(G)$.

5. Explain the components of a TM with a neat diagram.

6. Differentiate between PDA Vs TM.

7. Mention any two undecidable problems.

8. Is the problem of type 0 grammar unsolvable? Justify your answer.

9. Prove that P is closed under complement.

10. Give two applications of NP class problems.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Define regular expression and regular languages. What language is represented by the regular expression $(c^* (a \cup (bc^*))^*)$? (8)

(ii) What are the properties that are closed under regular languages? Give examples of each. (8)

Or

(b) Construct a non-deterministic finite automata accepting the regular expression $(ab \cup aab \cup aba)^* a$. Design an equivalent deterministic finite automata that accepts the regular expression and trace for a string $w = aababaa$.

12. (a) Prove any four closure properties of context free grammar.

Or

(b) (i) Prove that L is $L(M_2)$ for some PDA M_2 iff L is $N(M_1)$ for some PDA M_1.

(ii) Construct a PDA by empty stack for $L = \{a^n b^n / n \geq 1\}$.

13. (a) (i) Show that the single tape Turing machine can be simulated to multitape Turing machine in solving any problem. Illustrate with an example. (8)

(ii) Define an unrestricted grammar. Construct a unrestricted grammar for the language $\{a^n b^m c^n d^m \mid n \neq m \text{ and } n, m \geq 1\}$. (8)

Or

(b) Elaborate on recursive and recursively enumerable language, related to concepts, relationships and properties.

14. (a) (i) Show that halting problem of TM is undecidable. (8)

(ii) State and prove the Rice theorem. (8)

Or

(b) Explain the universal Turing machine as an undecidable problem.

15. (a) State and explain any one of the following NP-Complete problem.

(i) Travelling salesman problem

(ii) Subgraph isomorphism problem.

Or

(b) (i) Write the characteristic features of P-completeness. Explain with an example. (12)

(ii) How is time complexity and space complexity defined in NP and P problems? (4)

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