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Question Paper Code : 45282

5 Year M.Sc. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2014.

Fifth Semester

Software Engineering

ESE 055 — THEORY OF COMPUTATION

(Regulation 2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between DFA and NFA.
2. Write the regular expression for set of all binary strings ending in 00.
3. Specify the use of CFG.
4. Define parse tree with an example.
5. Give the formal definition of a Turing machine.
6. Define grammar with an example.
7. When do you say a problem is undecidable?
8. What do you mean by the halting problem?
9. What is an NP-complete problem?
10. Define class P.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Prove that for any language L recognized by an NFA with ε-transitions, there exists an NFA without ε-transitions to recognize L. (8)

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

$\{x \varepsilon \{a,b\} : |x|_a = \text{odd and } |x|_b = \text{even}\}$. (8)

Or

(b) (i) For a given regular expression r, prove that there exists an NFA with ε-transitions that accepts $L(r)$. (8)

(ii) Which of the following languages are regular? Justify your answer.

(1) $L = \{a^n b^n \mid n \geq 1\}$. (4)

(2) $L = \{0^{2n} \mid n \geq 1\}$. (4)

12. (a) (i) Design the PDA for $L = \{ww^R \mid w \text{ is in } (a+b)^*\}$. (8)

(ii) Construct PDA for the following grammar

$S \to aB \mid bA$ $A \to a \mid aS \mid bAA$ $B \to b \mid bS \mid aBB$. (8)

Or

(b) (i) Prove that a CFL can be recognized by a PDA by empty stack. (10)

(ii) Show that the language $L = \{a^i b^j c^k \mid i = j = k \text{ and } i, j, k \geq 1\}$ is not context-free language. (6)

13. (a) Design a TM that examines a specified string of 0's and 1's on a tape and prints an 'E' if the number of 1's is even and a 'D' if odd and simulate its action on the input '010101'. (16)

Or

(b) (i) What is two-way infinite tape TM? Explain. (8)

(ii) Write short notes on Random Access Turing Machine. (8)

14. (a) (i) Describe the Universal Turing machine. (8)

(ii) Prove that halting problem is undecidable. (8)

Or

(b) Discuss on undecidable problems about Turing machine. (16)

15. (a) (i) Explain in detail the problems solvable in polynomial time TM with relevant examples. (12)

(ii) Distinguish between Class P and Class NP problems. (4)

Or

(b) What are intractable problems? Discuss clearly some properties of them. Give two examples of problems solvable in non-deterministic polynomial time Turing Machine. (16)
