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# Question Paper Code : 41149

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Sixth Semester

Computer Science and Engineering

080230026 – THEORY OF COMPUTATION

(Regulation 2008)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Design a Turing machine to recognize all strings consisting of an even number of 1's.

2. What is the difference between a recursive language and a recursively enumerable language?

3. What do you meant by undecidable problem?

4. Define computable functions.

5. What do you mean by NP Complete?

6. Define Polynomial time mapping reducible.

7. What is class L and NL?

8. What do you mean by Oracle Turing machine?

9. Define BPP.

10. What is trapdoor function?

PART B — (5 × 16 = 80 marks)

11. (a) (i) Design a Turing machine that recognizes the language $\{0^n 1^n | n \geq 1\}$ (8)

(ii) Prove that every language accepted by a multi tape Turing machine is accepted by some single tape Turing machine. (8)

Or

(b) (i) Design a Turing machine that can compute the proper subtraction (i.e.) m – n where m and n are positive integers. M – N is defined as m–n if m > n and 0 if m ≤ n. (10)

(ii) Prove that language L and its complement are recusively enumerable then L is recursive. (6)

12. (a) (i) Prove that $HALT_{TM}$ = { (M,w)|M is a TM that halts on string w} is Undecidable. (10)

(ii) Prove that $REGULAR_{TM}$ is undecidable. (6)

Or

(b) (i) Consider the following Turing machine T = ({ $q_0$,$q_1$ }, {0, 1 }, {0, 1 , #}, $\delta$,$q_0$ , #, {$q_1$}) where $\delta$ is defined by $\delta$ ($q_0$ , 1) = ($q_0$ , 0, R) and 8 (q~, 0) = (qo. 0, L)

and consider the input w = 110. Convert the given Turing machine into MPCP instances. (10)

(ii) Prove that $E_{LBA}$ is undecidable. (6)

13. (a) (i) Let t(n) be a function where t(n)? n. Prove that every t(n) time Non-deterministic TM has an equivalent $2^{o(t(n))}$ time deterministic TM. (8)

(ii) Prove that Hamiltonian path verifier is NP problem. (8)

Or

(b) (i) Define and Prove Cook Levin theorem. (12)

(ii) Prove that formula Φ is satisfiable if only if G has a k clique. (4)

14. (a) (i) Let f : N–>R be a function with $f(n) \geq n$ then prove that NSPACE(f(n))$\subseteq$ SPACE $(f(n))^2$. (10)

(ii) Discuss briefly about Generalized Geography game. (6)

Or

(b) (i) Prove that NL = coNL. (8)

(ii) Write short notes on circuit complexity. (8)

15. (a) (i) Define and prove Fermat's theorem. (8)

(ii) Write and prove the approximation algorithm for vertex cover problem. (8)

Or

(b) (i) Define and Prove that IP PSPACE. (8)

(ii) Briefly explain about the public key cryptosystems. (8)

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