

[Total No. of Questions: 12]

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UNIVERSITY OF PUNE

[4364]-268

T. E. (Information Technology) Examination - 2013

Design and Analysis of Algorithms (2008 Course)

[Time: 3 Hours]

[Max. Marks: 100]

**Instructions:**

- 1 Answer any 3 each from Section.
- 2 Answers to the two sections should be written in separate answer-books.
- 3 Black figures to the right indicate full marks.
- 4 All questions compulsory.
- 5 Neat diagrams must be drawn wherever necessary.

**SECTION -I**

- |     |   |  |    |
|-----|---|--|----|
| Q.1 | A | Prove by contradiction that “square root of 2 is irrational”   | 04 |
|     | B | Explain the meaning of following asymptotic notations.<br>i. Big “oh” $O$<br>ii. Omega $\Omega$<br>iii. Theta $\Theta$ | 08 |
|     | C | Show that<br>i. $3n+2 = \Theta(n)$<br>ii. $6 \cdot 2^n + n^2 = \Theta(2^n)$  | 06 |

**OR**

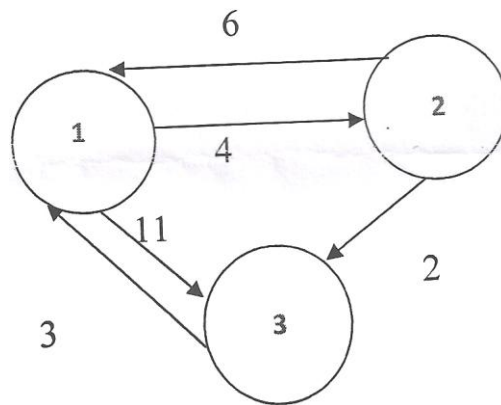
- |     |   |   |    |
|-----|---|---|----|
| Q.2 | A | Prove by mathematical induction that the sum of the cubes of the first n positive integers is equal to the square of the sum of these integers.                               | 08 |
|     | B | Solve the following recurrence relations:<br>i. $\left. \begin{aligned} T(n) &= 1 \\ &= 2(n/2)+C \end{aligned} \right\} \begin{array}{l} n=1 \\ \text{otherwise} \end{array}$ | 10 |

$$\text{ii. } T(n) = \begin{cases} 0 & \text{if } n = 0 \\ 7 & \text{if } n = 1 \\ 3T(n-1) + 4T(n-2) & \text{otherwise} \end{cases}$$

- Q. 3      A      Write an algorithm for sorting 'n' numbers using merge sort. Determine its time complexity.      08
- B      Explain the following terms with reference to Greedy Technique.      08
- i.    Feasible solution and Optimal solution
  - ii.   Subset paradigm and ordering paradigm

**OR**

- Q. 4      A      Write the control abstractions for divide and conquer.      06
- B      Write Kruskal's algorithm for finding minimum spanning tree. Compute the time complexity of the same.      10
- Q. 5      A      State "Principle of Optimality"? Explain the significance of the same in dynamic programming with an example.      08
- B      Solve the all pairs shortest path problem for the given graph.      08



**OR**

- Q. 6      A      What are the characteristics of Dynamic Programming? Distinguish between dynamic programming and divide and conquer technique.      08
- B      Explain optimal binary search tree problem. How dynamic programming technique can be applied to solve this problem.      08

## SECTION II

- |      |   |   |    |
|------|---|---|----|
| Q. 7 | A | Write a formulation of recursive backing algorithm.                     | 08 |
|      | B | Write an algorithm to solve n queens problem using backtracking method. | 08 |

**OR**

- |      |   |  |    |
|------|---|--|----|
| Q. 8 | A | What is m-colorability optimization problem? Explain with an example.                              | 08 |
|      | B | State the principle of backtracking. Explain the constraints used in backtracking with an example. | 08 |

- |      |   |   |    |
|------|---|---|----|
| Q. 9 | A | Explain the following with respect to branch & bound technique.       | 08 |
|      |   | a. Significance of Bounding functions.                                |    |
|      |   | b. State space tree   |    |
|      | B | Write an algorithm for upper bound function for 0/1 Knapsack problem. | 08 |

**OR**

- |       |  |    |
|-------|--|----|
| Q. 10 | Explain the following terms with respect to branch & bound technique. With suitable example. | 16 |
|       | a. Least cost search   |    |
|       | b. FIFO branch & bound   |    |
|       | c. LIFO branch & bound   |    |

- |       |   |  |    |
|-------|---|--|----|
| Q. 11 | A | Explain what is a non deterministic algorithm with an example              | 08 |
|       | B | Prove that 3SAT problem is NP- Complete.                                   | 04 |
|       | C | What is Reduction in NP completeness proofs? What are types of reductions? | 06 |

**OR**

- |       |   |   |    |
|-------|---|---|----|
| Q. 12 | A | Explain relationship between P, NP, NP Complete and NP hard problems with an example of each class. | 08 |
|       | B | How do you prove that a problem is NP hard?   | 04 |
|       | C | What is satisfiability problem? Explain with an example.  | 06 |