



[4658] – 169

Seat No.	
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T.E. (Information Technology) (Semester – II) Examination, 2014
DESIGN AND ANALYSIS OF ALGORITHMS
(2008 Course)

Time : 3 Hours

Max. Marks : 100

- N.B :** 1) Answer **three** questions from **each** Section.
2) Answers to the **two** Sections should be written in **separate** answer-books.
3) **Neat** diagrams must be drawn **whenever** necessary.
4) Figures to the **right** indicate **full** marks.
5) Assume suitable data, if **necessary**.

SECTION – I

1. a) Write two algorithms those are having different complexities to identify that the given string is a palindrome or not. Assume that the given string is array of the characters. Justify how these two algorithms has different complexities. **10**
- b) Reorder the following complexities from smallest to largest. **6**
- i) $n \log_2(n)$
 - ii) $n+n^2+n^3$
 - iii) 2^4
 - iv) $\text{Sqrt}(n)$
 - v) $n!$
 - vi) $n^2/\text{Log}(n)$

OR

2. a) Reorder the following complexities from smallest to largest. **6**
- i) 2^n
 - ii) $(n + 1)!$
 - iii) $n^{\log n}$
 - iv) $\text{Sqrt}(n)$
 - v) 2^{2n}
 - vi) $(1+e)^n$
- b) Discuss the Quick sort algorithm for the following data set to sort in ascending order, in which data set do you think that merge sort is not advisable to use. **10**
- 1) 12, 12, 12, 12, 12
 - 2) 20, 15, 14, 11, 10
 - 3) 10, 1, 12, 15, 7
3. a) Design and analyze a divide and conquer algorithm for finding maximum and minimum element in a list $L [1 : n]$. **8**

P.T.O.



- b) Trace the action of Huffman code for the letter (a, b, c, d, e, f, g, h) occurring with frequencies (10, 7, 3, 5, 9, 2, 3, 2) 8

OR

4. a) Given a sequence of n-elements $A[1] \dots A[n]$, assume that they are split into 2 sets $A[1] \dots A[n/2]$ and $A[n/2 + 1] \dots A[n]$ each set is individually sorted and the resulting sequence is merged to produce a single sorted sequence of n elements. Using the divide and conquer strategy, write a Merge sort algorithm to sort the sequence in non-decreasing order. 10

- b) What is greedy algorithmic approach ? How does it used to compute Huffman tree and Huffman code ? 6

5. a) $N = 3$ and $(a_1, a_2, a_3) = \{\text{do, if, while}\}$ let $P(1 : 3) = (1/2, 1/10, 1/20)$ and $q(1 : 3) = (0.15, 0.1, 0.05, 0.05)$

Compute and construct OBST for above values using dynamic approach. 10

- b) Write a short note on dynamic approach for multistage graph. 6

OR

6. a) Explain the travelling salesman problem as dynamic programming algorithmic strategy. Discuss the time and space complexities. Find out the solution for following example. 10

	City 1	City 2	City 3	City 4
Pers 1	0	10	15	20
Pers 2	5	0	9	10
Pers 3	6	13	0	12
Pers 4	8	8	9	0

- b) What is the principle of optimality in dynamic programming ? How do we ensure that it holds for the any given problem ? 6

SECTION – II

7. a) Consider the backtracking solution to the following instance of 0/1 knapsack problem. The capacity of knapsack is $C = 15$. 12

i	0	1	2	3	4	5	6
V_i	25	45	12	7	6	10	5
W_i	5	11	3	2	2	7	4

Draw the variable tuple state space tree.



- b) Show that the number of nodes of both the fixed tuple and variable tuple. State space trees for sum of subset problem are exponential in “n”. **6**

OR

8. a) Using backtracking solve the problem : **12**

Suppose you are given n men and n women and two $n \times n$ arrays P and Q such that P(i, j) is the preference of man i for women j and Q (i, j) is the preference of women i for man j. Give an algorithm that finds a pairing of men and women such that the sum of the product is maximized.

- b) Discuss and analyze the problem of finding Hamiltonian cycle using backtracking. **6**

9. a) Describe following with suitable example with respect to branch and bound : **10**

- i) The method
- ii) LC search
- iii) Control abstraction for LC search
- iv) Bounding

- b) Differentiate between backtracking and branch and bound. Illustrate with example of 4-Queens problem. **6**

OR

10. Explain the 0/1 knapsack problem and explain the following with respect to 0/1 knapsack problem. **16**

- 1) state space tree
- 2) solution state
- 3) state space
- 4) answer state
- 5) static tree
- 6) dynamic tree
- 7) live node
- 8) bounding function

11. a) What do you mean by polynomial problem, NP hard problem and NP complete problem ? Give the suitable example of each of the category of problem. **8**

- b) Prove that “The set of real numbers, R is not countable”. **4**

- c) Show that any subset of a countable set is countable. **4**

OR

12. a) Show that both P and NP are closed under the operation union, intersection, concatenation. **8**

- b) What is Cook theorem ? How can it be used to establish whether $P = NP$ or $P \neq NP$? **8**