

Model Paper- 2
Hi-Tech Institute of Engineering and Technology
B.Tech (CSE /IT/AI/ML/DS) Examination
(SEMESTER – 5th Sem) Odd Semester
DESIGN & ANALYSIS OF ALGORITHM – KCS503

Time: 3 Hours

Total Marks: 100

Faculty Name: Mr. Rishabh Kamal

Note: Attempt all Sections. If you require any missing data, then choose suitably.

Section A

1. Attempt all questions in brief. 2 x 10 = 20

- a. How analyze the performance of an algorithm in different cases?
- b. Derive the time complexity of Merge sort.
- c. Explain left rotation in RB tree.
- d. Write down the properties of Fibonacci Heap.
- e. Explain Greedy programming in brief.
- f. What do you mean by convex hull?
- g. Write down the Floyd Warshal algorithm.
- h. Explain Branch and Bound method in brief.
- i. Explain Randomized algorithm in brief.
- j. Explain NP-complete and NP-Hard.

Section-B

2. Attempt any three of the following: 10x3 = 30

- (a) Explain Merge sort algorithm and sort the following sequence {23, 11, 5, 15, 68,31, 4, 17} using merge sort.
- (b) What are the various differences in Binomial and Fibonacci Heap?
- (c) Prove that if the weights on the edge of the connected undirected graph are distinct then there is a unique Minimum Spanning Tree. Give an example in this regard. Also discuss Kruskal's Minimum Spanning Tree in detail.
- (d) Discuss LCS algorithm to compute Longest Common Subsequence of two given strings and time complexity analysis.
- (e) Explain and Write the Naïve-String string matching algorithm: Suppose the given pattern $p = aa\ b$ and given text $T = a\ c\ a\ a\ b$ applies Naïve-String-matching algorithm on above Pattern (P) and Text (T) to find the number of occurrences of P in T.

Section-C

3. Attempt any one part of the following:

10x1 = 10

(a) Examine the following recurrence relation:

(i) $T(n) = T(n-1) + n^4$

(ii) $T(n) = T(n/4) + T(n/2) + n^2$

(b) Explain algorithm for counting sort. Illustrate the operation of counting sort on the following array: $A = \{0, 1, 3, 0, 3, 2, 4, 5, 2, 4, 6, 2, 2, 3\}$.

4. Attempt any one part of the following:

10x1 = 10

(a) Discuss the various cases for insertion of key in red-black tree for given sequence of key in an empty red-black tree- $\{15, 13, 12, 16, 19, 23, 5, 8\}$. Also show that a red-black tree with an internal node has height at most $2\lg(n+1)$.

(b) Explain and write an algorithm for union of two binomial heaps and write its time complexity.

5. Attempt any one part of the following:

10 x 1 = 10

(a) What is Knapsack problem? Solve Fractional knapsack problem using greedy programming for the following four items with their weights $w = \{3, 5, 9, 5\}$ and values $P = \{45, 30, 45, 10\}$ with knapsack capacity is 16.

(b) Write down the Bellman Ford algorithm to solve the single source shortest path problem also write its time complexity.

6. Attempt any one part of the following:

10 x 1 = 10

(a) What is travelling salesman problem (TSP)? Find the solution of following TSP using Branch & Bound method

0	20	30	10	11
15	0	16	4	2
3	5	0	2	4
19	6	18	0	3
16	4	7	16	0

(b) Explain the method of finding Hamiltonian cycles in a graph using backtracking method with suitable example.

7. Attempt any one part of the following:

10 x 1 = 10

(a) Write and explain the algorithm to solve vertex cover problem using approximation algorithm.

(b) Explain and write the Knuth-Morris-Pratt algorithm for pattern matching also write its time complexity.