



(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : **110502**

Roll No.

--	--	--	--	--	--	--	--	--	--

### B. Tech.

(SEM. V) (ODD SEM.) THEORY

EXAMINATION, 2014-15

DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 Hours]

[Total Marks : 100

1 Attempt any four parts of the following : **5×4=20**

(a) Solve the following recurrences:

i)  $T(n) = T(n/2) + T(n/4) + T(n/8) + n$

ii)  $T(n) = T(\sqrt{n}) + O(\lg n)$

(b) What is the time complexity of counting sort?

Illustrate the operation of counting sort on array

$$A = \{1, 6, 3, 3, 4, 5, 6, 3, 4, 5\}$$

(c) Describe the properties of red Black tree. Show that Red Black Tree with  $n$  internal nodes has height at most  $2\lg(n+1)$ .

(d) Discuss the complexity of Max-Heapify and Build-Max Heap procedures.

(e) Discuss asymptotic notations in brief.

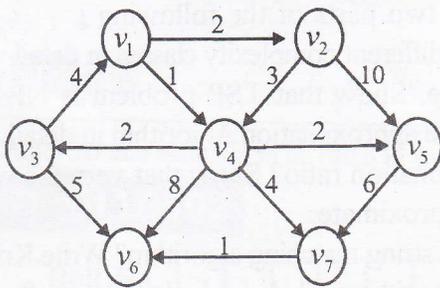
(f) Discuss the best case and worst case complexities of quick sort algorithm in detail.

2 Attempt any two parts of the following :  $10 \times 2 = 20$

- (a) What are the advantages of Red Black Tree over Binary Search Tree? Write algorithms to insert a key in a red black tree. Insert the following sequence of information in an empty red black tree 1, 2, 3, 4, 5, 5.
- (b) Define the binomial heap in detail. Write an algorithm for performing the union operation of two binomial heaps and also explain with suitable example.
- (c) How B-Tree differs with other tree structures. Insert the following information  $F, S, Q, K, C, L, V, W, M, R, N, P, A, D, Z, E$  into an empty B-Tree with degree  $t = 2$ .

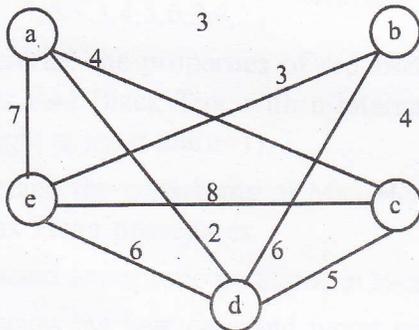
3 Attempt any two parts of the following :  $10 \times 2 = 20$

- (a) What do you mean by minimum spanning tree? Write an algorithm for minimum spanning tree that may generate multiple forest trees and also explain with suitable example.
- (b) Describe in detail the Strassen's Matrix Multiplication algorithms based on divide and conquer strategies with suitable example.
- (c) Given a weighted directed graph  $G = (V, E)$  with source  $s$  and weight function  $W : E \rightarrow R$ , then write an algorithm to solve a single source shortest path problem whose complexity is  $O(VE)$ . Apply the same on the following graph.



4 Attempt any two parts of the following :  $10 \times 2 = 20$

- (a) Differentiate between Dynamic programming and Greedy approach. What is 0/1 knapsack problem? Solve the following instance using Dynamic programming, write the algorithm also. Knapsack Capacity=10  $P = \langle 1, 6, 18, 22, 28 \rangle$  and  $w = \langle 1, 2, 5, 6, 7 \rangle$ .
- (b) Differentiate between Backtracking and Branch and Bound approach. Write an algorithms for sum subset problem using back tracking approach. Find all possible solution for following instance using same if  $m=30$ ,  $S = \langle 1, 2, 5, 7, 8, 10, 15, 20, 25 \rangle$ .
- (c) Define TSP problem in detail. Find the solution for the following instance of TSP problem using branch and bound.



5 Attempt any two parts of the following :  $10 \times 2 = 20$

- (a) Define different complexity classes in detail with suitable example. Show that TSP problem is NP Complete.
- (b) Describe approximation Algorithm in detail. What is the approximation ratio? Show that vertex cover problem is 2 approximate.
- (c) What is string matching algorithm? Write Knuth-Morris-Pratt algorithm and also calculate the prefix function for the pattern  $P = ababaaca$ .