

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

PAPER ID : 1430

Roll No.

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M.C.A.

(SEM. III) ODD SEMESTER THEORY EXAMINATION
2010-11

DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 Hours

Total Marks : 100

Note : (1) Attempt **all** the questions.

(2) All questions carry equal marks.

(3) Make suitable assumptions wherever necessary.

1. Attempt any **FOUR** parts of the following :— (5×4=20)
- Write the essential characteristics of a good algorithm. Explain big-oh complexity order classification in increasing order of time.
 - Illustrate the operations of merge sort on the given array $A = \{3, 41, 52, 26, 38, 57, 9, 49\}$.
 - Let $f(n)$ and $g(n)$ be asymptotically nonnegative functions. Using the basic definition of θ notation, prove that $\max(f(n), g(n)) = \theta(f(n) + g(n))$.
 - Give asymptotic upper bound of the recurrence relation $T(n) = T(7n/10) + n$. Assume that $T(n)$ is constant for $n \leq 2$.
 - Analyze the quick sort algorithm when all elements of array A have the same value.

- (f) Describe any one sorting algorithm that has linear time complexity.

Attempt any TWO parts of the following : (10×2=20)

- (a) What is the difference between the binary search tree property and the min-heap property ? Can the min-heap property be used to print the keys of an n-node tree in sorted order in $O(n)$ time.
- (b) Prove that a red black tree with n internal nodes has height at most $2 \log(n+1)$.
- (c) What do you mean by augmenting a data structure ? Write the process of augmenting a data structure.

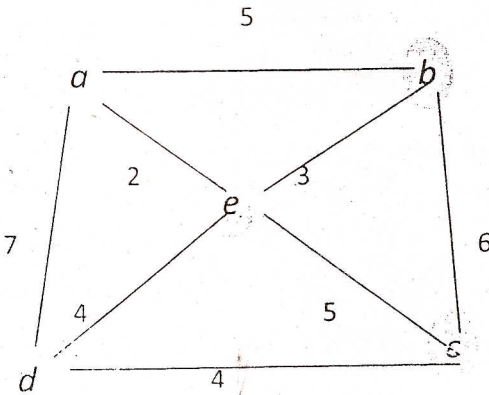
Attempt any TWO parts of the following : (10×2=20)

- (a) State the principle of optimality. Find the two problems for which principle of optimality does hold and two problems for which the principle optimality does not hold.
- (b) What do you mean by greedy algorithm ? Write greedy algorithm for Huffman code. Show that your algorithm has greedy choice property.
- (c) Describe Branch and Bound technique. How the branch and bound technique can be used to solve the 0/1 knapsack problem ?

4. Attempt any TWO parts of the following : (10×2=20)

- (a) Write breadth first traversal algorithm for any graph. Derive its time complexity. How the time complexity of this is different from the time complexity of depth first search algorithm ?

- (b) Write the Prim's algorithm for finding the minimum spanning tree of a graph. Using the algorithm find the minimum spanning tree of the following graph. :



- (c) Write the Floyd-Warshall algorithm to solve the all-pairs shortest-path problem on a directed graph. Discuss the time complexity of the algorithm.

5. Attempt any **TWO** parts of the following : (10×2=20)

- (a) Define string matching problem and describe any string matching algorithm with suitable example.
- (b) Define the P, NP, NP-complete and NP-hard class problems and give the relationship among these classes.
- (c) Write short notes on any *two* of the following :
- (i) Randomized algorithms
 - (ii) Matrix operations
 - (iii) Approximation algorithms.