

Printed Pages : 3

TCS-503

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

PAPER ID : 1075

Roll No.

B. Tech.

(SEM. V) EXAMINATION, 2007-08

DESIGN & ANALYSIS OF ALGORITHMS

Time : 3 Hours]

[Total Marks : 100

Note : Attempt all questions.

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

(a) Show the steps in heap sort to arrange following data in non-decreasing order

1, 2, 5, 6, 9, 8, 7

(b) Find the solution of the following recurrence relation in O-notation

$$T(n) = 8T(n/2) + 3n^2$$

where n is an integer power of 2 and greater than 1.

(c) Develop and analyze an algorithm to determine whether a given $N \times N$ matrix A has the metric property (that is, for all values of $1 \leq i, j, k \leq N$,

$$a_{ij} \leq a_{ik} + a_{kj}) \text{ or not.}$$

- (d) Write Master's method for solving recurrence relations of different types.
- (e) Discuss the basic steps in the complete development of an algorithm.
- (f) Write divide and conquer approach for binary search and find its average case complexity.

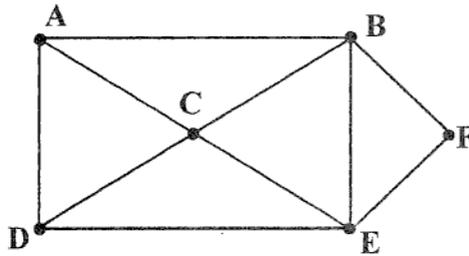
2 Attempt any **four** parts of the following : 5×4=20

- (a) Write an algorithm for inserting a key into a B-tree in a single pass down the tree.
- (b) Prove that the maximum degree of any node in an n -node binomial tree is $\lg n$.
- (c) Show that if only the mergeable heap operations are supported, the maximum degree $D(n)$ in an n -node Fibonacci heap is at most $\lceil \log n \rceil$.
- (d) Write about linked list representation of disjoint sets.
- (e) Show that A red-black tree with n internal nodes has height at most $2 \lg (n + 1)$.
- (f) Argue that in every n -node binary search tree, there are exactly $n - 1$ possible rotations.

3 Attempt any **two** parts of the following : 10×2=20

- (a) Show how Prim's algorithm can be implemented using heap. What would be the time complexity of the algorithm ?

- (b) Give a dynamic programming solution for the subset sum problem. Analyze the complexity of the algorithm.
- (c) Find the Hamiltonian circuit in the following graph using backtracking.



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

- (a) (i) Prove the correctness of Kruskal's algorithm.
 (ii) Show how to compute transitive closure of a graph using Floyd-warshall's algorithm for all pairs shortest paths.
- (b) Give an algorithm for topological sorting of a directed acyclic graph.
- (c) Give a recursive solution to travelling sales person problem.

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

- (a) Write Knuth-Morris-Pratt algorithm for string matching.
- (b) Write a randomized algorithm for two-dimensional convex-hull problem.
- (c) Show that Hamiltonian cycle is in NP class of problems.