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Printed Pages : 4

TCS503

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

PAPER ID : 1075

Roll No.

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## B.Tech

(SEM V) ODD SEMESTER THEORY EXAMINATION 2009-10  
DESIGN & ANALYSIS OF ALGORITHMS

Time : 3 Hours]

[Total Marks : 100

- Note :**
- (i) Attempt all questions.
  - (ii) All parts of a question should be attempted at one contiguous place.

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

- (a) Solve the recurrence relation using master method :

$$T(n) = 3T\left(n^{1/3}\right) + \log 3^n$$

- (b) What do you understand by 'stable' sort ? Name two stable sort algorithms.
- (c) Prove that Heapsort and Mergesort are optimal comparison sorting algorithms.
- (d) Illustrate the functioning of Heapsort on the following array :

$$A = \langle 25, 57, 48, 37, 12, 92, 86, 33, \rangle$$



- (e) How can you modify quicksort algorithm to search an item in a list of elements ?
- (f) What is the importance of 'average-case analysis' of algorithms ?

2 Attempt any **four** parts of the following :  $5 \times 4 = 20$

- (a) Two stacks are kept in a single array STK [Max] to utilize the array memory optimally :  
STK [ ] :

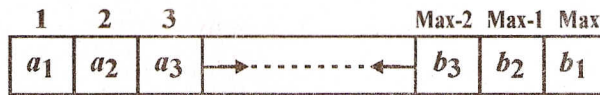


Fig. 1

First stack grows in forward direction from start whereas second grows backwards from end.

Write PUSH 1, PUSH 2, POP 1, POP2 for the two stacks.

- (b) Define Red-black trees and state their applications.
- (c) Prove that the maximum degree of any node in a  $n$ -node binomial tree is  $\log n$ .
- (d) What is a disjoint-set data structure ? How running times of disjoint set data structures is analyzed ?
- (e) Show the results of inserting the keys :  
 $F, S, Q, K, C, L, H, T, V, W, M, R, N$   
in order into an Empty B-tree with minimum degree 2.

- (f) What is implied by augmenting a data-structure ? Explain with an example.

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

- (a) When and how Dynamic Programming approach is applicable ?

Discuss the matrix-chain multiplication with respect to Dynamic programming technique.

- (b) What is "Greedy algorithm" ? Write its pseudo code. Apply greedy algorithm on coloring the vertices of the following graph :

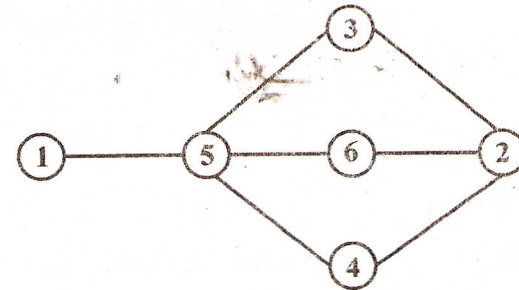


Fig. 2

- (c) Discuss backtracking problem solving approach with the help of an example.

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

- (a) Given a graph  $G = (V_1, E)$  and let  $V_1$  and  $V$  be two distinct vertices. Explain how to modify Dijkstra's shortest path algorithm to determine the number of distinct shortest paths from  $U$  to  $V$ .

Also, comment on whether Dijkstra's shortest path algorithm work correctly if weights are negative.

- (b) Discuss Travelling salesman Problem and various approaches to solve the problem with complexity analysis of each.
- (c) Explain the Floyd Warshall algorithm with Example. Which design strategy the algorithm uses ?

5 Write short notes on any four of the following :  $5 \times 4 = 20$

- (a) Approximation of a NP-complete problem.
- (b) Randomized sorting algorithm.
- (c) Proving the problem of finding maximum clique of a graph to be NPC.
- (d) Problem classes and their implications.
- (e) Maximum Flow Problem.
- (f) Knuth-Morris - Pratt algorithm for pattern matching.

