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 :   5×4=20

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

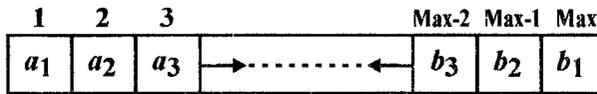| 1	2	3			Max-2	Max-1	Max
a_1	a_2	a_3	→-------←		b_3	b_2	b_1

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 :   10×2=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 :
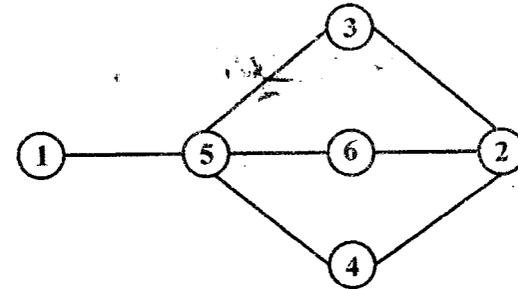

Fig. 2

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

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

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

   Also, comment on whether Dijekstra'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 : **5×4=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.