Printed Pages : 4 MCA312

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

PAPER ID : 7309 Roll No.

M.C.A

(SEM III) ODD SEMESTER THEORY EXAMINATION 2009-10

DESIGN & ANALYSIS OF ALGORITHMS

Time : 3 Hours] *[Total Marks : 100*

Note : *(i) Attempt **all** questions.*

*(ii) **All** questions carry **equal** marks.*

(iii) Be precise in your answer.

*(iv) No **second** answer book will be provided.*

*(v) Make **suitable** assumptions, if required.*

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

(a) (i) Define the term algorithm with suitable example. Also describe any **two** notations used to describe the asymptotic running time of an algorithm with some example.

(ii) Give the solution to recurrence

$T(n)=2T\left(\lfloor n/2 \rfloor\right)+17)+n$ is O (n lg n).

(b) Give the algorithm for merge sort. Also discuss its time complexity. Illustrate the merge sort on the following array : 6, 21, 56, 32, 7, 76, 9, 41 and 27.

(c) (i) Illustrate quick sort with some suitable example (take at least 9 random numbers).

(ii) For the following pairs of functions determine the smallest integer value of n>=0, for which the first function becomes greater than or equal to the second function: $f_1(n)=n^2$ and $f_2(n)=10n$.

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

(a) (i) Explain red black tree giving its various properties. Write an algorithm for inserting a node into an n-node red black tree.

(ii) Define priority queue. Discuss the various steps for adding an element to an existing priority queue with an example.

(b) Define heap. Write an algorithm to form a heap. Illustrate it for the data set (40, 80, 35, 90, 45, 50 and 70). Also discuss the time complexity for the same.

(c) Consider the hypothetical data object X. X is a linear list with the restriction that while additions to the list may be made at either end; deletions can be made from one end only. Design a linked list representation for X. Write addition and deletion algorithms for X.

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

(a) Define Dynamic programming. How dynamic programming approach is used to find the shortest path from vertex i to j in a directed graph G ? Illustrate with an example.

(b) Define knapsack problem. Find an optimal solution to the knapsack instance n=7, M=15, (p1, p2,... p7) = (10, 5, 15, 7, 6, 18, 3) and (w1, w2,... w7)=(2, 3, 5, 7, 1, 4, 1).

(c) Define the job sequencing with deadlines problem with an example. Write a complete. LC (Least Cost) branch-and-bound algorithm for the job sequencing with deadlines problem. Use the fixed tuple size formulation.

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

(a) Explain the adjacency-list representation of graph with example. Given an adjecency-list representation of a directed graph, how long does it take to compute the out-degree and in-degree of every vertex ?

(b) Define breadth first search. Write an algorithm for BFS, discussing its time complexity. Also illustrate with some example.

(c) List the various algorithms for finding single source shortest path in a given graph. Give the algorithm for any one of the methods. Also discuss its times complexity.

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

(a) (i) Discuss the various representations of polynomials with suitable examples.

(ii) Write a short note on fast fourier transform.

(b) (i) Write a recursive algorithm to find greatest common divisor of numbers a and b. Also prove that gcd(an, bn)=n. gcd(a, b).

(ii) Write a short note on string matching problem.

(c) Define FFT. Write an algorithm for FFT. Also discuss its time complexity.