



Printed Pages : 4

MCA312

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

PAPER ID : 7309

Roll No.

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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

$$T(n)=2T(\lfloor n/2 \rfloor + 17) + n \text{ is } O(n \lg n).$$

(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 $n \geq 0$, 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 $n=7$, $M=15$, $(p_1, p_2, \dots, p_7) = (10, 5, 15, 7, 6, 18, 3)$ and $(w_1, w_2, \dots, w_7) = (2, 3, 5, 7, 1, 4, 1)$.
- (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 adjacency-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 $\gcd(an, bn) = n \cdot \gcd(a, b)$.
- (ii) Write a short note on string matching problem.
- (c) Define FFT. Write an algorithm for FFT. Also discuss its time complexity.
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