

(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.****(Semester-III) Theory Examination, 2011-12****DESIGN & ANALYSIS OF ALGORITHMS**

Time : 3 Hours]

[Total Marks : 100

Note : Attempt questions from each Section as indicated.

**Section-A**

4. Explain the difference between depth first and breadth first searches.
5. Determine the LCS of (1, 0, 0, 1, 0, 1, 0, 1) and (0, 1, 0, 1, 1, 0, 1, 1, 0).
6. Construct the string matching automation algorithm for the pattern  $P = aabab$  and illustrate its operation on the text string :  
 $T = aaababaabaababaab$
7. Apply the Greedy method to solve the following instance of Knapsack problem. Item  $n = 7$  Knapsack capacity  $m = 15$ ,  $(P_1, P_2, \dots, P_7) = (10, 5, 15, 7, 6, 18, 3)$  and  $(w_1, w_2, \dots, w_7) = (2, 3, 5, 7, 1, 4, 1)$ .
8. Write an algorithm for a given number  $n$  to generate the  $n$ th number of the Fibonacci sequence.
9. Explain the pros and cons of the empirical analysis of algorithm.

1. Attempt *all* parts : 2×10=20
  - (a) Why don't we allow a minimum degree of  $t=1$  in B-Tree?
  - (b) Use mathematical induction to show that when  $n$  is an exact power of 2, the solution of the recurrence :  

$$T(n) = \begin{cases} 2 & \text{if } n = 2, \\ 2T(n/2) + n, & \text{if } n = 2^k, \text{ for } k > 1 \end{cases}$$
is  $T(n) = n \log n$ .
  - (c) Write down the difference between Dynamic Programming and Divide and Conquer Approach.

- (d) Differentiate between average analysis and amortized analysis.
- (e) Prove statement : Subpaths of shortest paths are shortest paths.
- (f) Define NP problems.
- (g) Solve the 4-queen problem using backtracking technique and find.
- (h) Define Approximation Algorithm.
- (i) Disjktra algorithm and Bellmen-Ford algorithm both are single source shortest path algorithm, but both of them differ from each other. Why?
- (j) Define randomized algorithm.

### Section-B

2. Attempt any *three* parts : 10×3=30

- (a) (i) Prove that the height of red black tree is  $2 \log_2(n+1)$ .
- (ii) Solve the following recurrences by recursion tree method :
  - (1)  $T(n) = T(\alpha n) + T((1-\alpha)n) + c_n$ , where  $\alpha$  is a constant in the range  $0 < \alpha < 1$  and  $c > 0$  is also a constant.
  - (2)  $T(n) = T(n-a) + T(a) + c_n$ , where  $a \geq 1$  and  $c > 0$  are constants.

(2)

- (b) (i) What is the total cost of executing  $n$  of the stack operations PUSH, POP and MULTIPOP, assuming that the stack begins with  $s_0$  objects and finishes with  $s_n$  objects.
- (ii) Define Binomial tree. Prove all properties of Binomial tree.
- (c) What are the basic steps in augmenting ? Augment a BST.
- (d) Discuss the weighted union procedure for data structure for disjoint set and how to improve its worst case complexity.
- (e) (i) Find all solutions to the equation :
 
$$35x \equiv 10 \pmod{50}.$$
- (ii) Explain of B-Tree properties.

### Section-C

Attempt any *five* questions: 10×5=50

3. In a flow network let  $G=(V, E)$  with flow  $f$ ,  $G_f$  is the residual network of  $G$  induced by  $f$ , and let  $f_r$  be a flow in  $G_f$ . Let  $f' = f + f_r$ , that is for each pair  $u, v, \in V$ ,  $f'(u, v) = f(u, v) + f_r(u, v)$ , then show that  $f'$  is a flow in  $G$  with value  $|f'| = |f| + |f_r|$ .

7309

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