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Total number of printed pages – 2

B. Tech  
PCCS 4204(New)

## Special Examination – 2012

### DESIGN AND ANALYSIS OF ALGORITHM

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any **five** from the rest.  
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2 × 10

(i) Solve the following recurrence equation :

$$T(n) = 5T(n-1) + n2^n + n^2$$

(ii) Working modulo  $q = 11$ , how many spurious hits does the Rabin-Karp matcher encounter in the text  $T = 3141592653589793$  when looking for the pattern  $P = 26$  ?

(iii) Define 0/1 Knapsack problem.

(iv) Give the time efficiency and drawback of merge sort algorithm.

(v) Give an adjacency-list representation for a complete binary tree on 7 vertices. Give an equivalent adjacency-matrix representation. Assume that vertices are numbered from 1 to 7 as in a binary heap.

(vi) Write a pseudo code for a divide and conquer algorithm for finding the position of the largest element in an array of  $N$  numbers.

(vii) Give a simple example of a directed graph with negative-weight edges for which Dijkstra's algorithm produces incorrect answers.

(viii) Draw a graph for the following matrix :

$$\begin{bmatrix} \infty & 0 & 1 \\ -2 & 0 & 1 \\ 0 & \infty & \infty \end{bmatrix}$$

(ix) Whether Backtracking always produces optimal solution. Justify your answer.

(x) What do you mean by Memoization ?

2. (a) What do you mean by algorithm ? State the criteria that should be satisfied by all Algorithms. 5

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- (b) Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions is  $\langle 5, 10, 3, 12, 5, 50, 6 \rangle$  5
3. (a) Describe the Traveling salesman problem and discuss how to solve it using Approximation algorithm. 7  
 (b) Write short note on 3-SAT problem. 3
4. (a) Write a recursive procedure to compute height of a binary tree. 5  
 (b) Compare how Dijkstra's and Floyd's algorithms solve the shortest-path problem. Should these two both be categorized as greedy, or both as dynamic-programming, algorithms? 5
5. (a) Compare Backtracking, Branch and Bound techniques with an example. 5  
 (b) Briefly state, what are the classes P, EXPTIME, NP, NP-Hard, and NPC. Give several containment relationships among them. 5
6. (a) Define spanning tree. Discuss the design steps in prims algorithm to construct minimum spanning tree with example. 5  
 (b) Explain connected components and bi-connected components with pseudo code. 5
7. Using Backtracking enumerate how can you solve the following problems :  
 (a) 8-queens problem 5  
 (b) Hamiltonian circuit problem 5
8. (a) Determine an LCS of  $\langle 1, 0, 0, 1, 0, 1, 0, 1 \rangle$  and  $\langle 0, 1, 0, 1, 1, 0, 1, 1, 0 \rangle$ . 5  
 (b) Run the Bellman-Ford algorithm on the directed graph given below, using vertex z as the source. In each pass, relax edges in the same order as in the figure, and show the d and  $\pi$  values after each pass. 5

