USN ☐☐☐☐☐☐☐☐☐☐   CS43

Fourth Semester B.E. Degree Examination, December 2011
Analysis and Design of Algorithms

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions.*

1   a. Explain the procedure of generating prime numbers, using the method "sieve of eratosthenes". Write the algorithm for the same and derive its time complexity. **(06 Marks)**

   b. Discuss the salient features of the following problem types: i) Sorting   ii) Searching iii) String processing. **(06 Marks)**

   c. If $P \neq NP$, prove that there exists no C-approximation algorithm for traveling salesman problem. **(08 Marks)**

2   a. Explain the terms:
     i) Space complexity and   ii) Time complexity. **(06 Marks)**

   b. Explain all the mathematical notations used for the analysis of an algorithm. **(06 Marks)**

   c. Write an algorithm to solve the tower of Hanoi problem. Derive its worst-case time complexity. **(08 Marks)**

3   a. Write the algorithm for selection sort and show that the time complexity of this algorithm is quadratic. **(08 Marks)**

   b. Write quick sort algorithm and derive its average case time-complexity. Apply the algorithm to sort the list – E,X,A,M,P,L,E in the alphabetical order. Draw the tree of the recursive calls made. **(12 Marks)**

4   a. Briefly explain Strassen's method of matrix multiplication and derive its complexity. **(08 Marks)**

   b. What is decrease and conquer? Explain the major variations of decrease and conquer method. **(04 Marks)**

   c. Write the BFS algorithm and find its efficiency. **(08 Marks)**

5   a. Find the topological ordering, using DFS and source removal methods, of the graph shown in Fig. Q5 (a). **(10 Marks)**
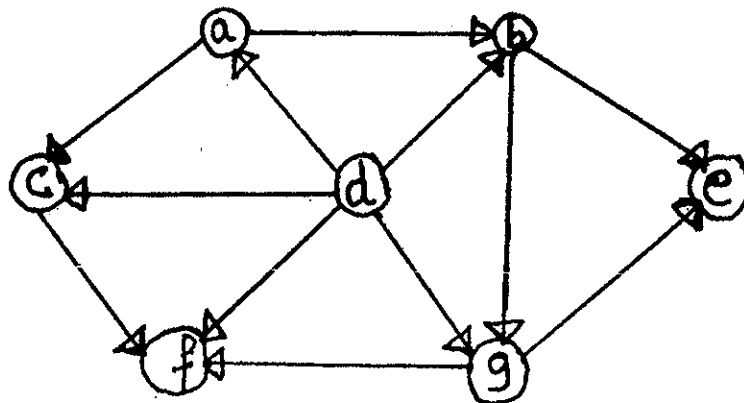

Fig. Q5 (a)

   b. What is heap? Write an algorithm for heapsort and obtain the complexity of the algorithm. **(10 Marks)**

6 a. Explain how comparison counting sort method works. Write an algorithm for the same and derive its complexity. **(07 Marks)**

     b. What is dynamic programming? Describe an algorithm to compute binomial coefficient and derive its time complexity. **(07 Marks)**

     c. Design a decrease-by-one algorithm for generating a gray code of order N. **(06 Marks)**

7 a. Explain the Greedy method with an example. **(04 Marks)**

     b. Write Prim's algorithm to find minimum spanning tree. Derive the worst-case time complexity. Compare Prim's and Kruskal's methods. **(08 Marks)**

     c. Find the shortest path from the vertex a to all other vertices, using Dijkstra's algorithm for the graph shown in Fig. Q7 (c). **(08 Marks)**
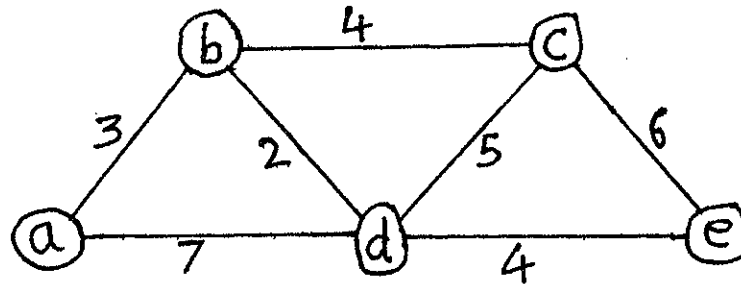

Fig. Q7 (c)

8 a. Explain the lower bound theory and decision trees, for searching a sorted array. **(06 Marks)**

     b. What is meant by backtracking? Explain the general methodology. Illustrate the application of back tracking to solve a 4-queens problem. Construct the state-space tree. **(06 Marks)**

     c. Define a NP-complete problem. Prove that the Hamiltonion circuit problem is polynomially reducible to the decision version of TSP. **(08 Marks)**

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