No mobile phones

IS414

USN	1	M	S							

M S RAMAIAH INSTITUTE OF TECHNOLOGY

(AUTONOMOUS INSTITUTE, AFFILIATED TO VTU)

BANGALORE – 560 054

SEMESTER END EXAMINATIONS – MAY / JUNE 2014

Course & Branch	:	**B.E. – INFORMATION SCIENCE & ENGG.**	**Semester**	:	**IV**
Subject	:	**Design and Analysis of Algorithms**	**Max. Marks**	:	**100**
Subject Code	:	**IS414**	**Duration**	:	**3 Hrs**

Instructions to the Candidates:

Answer one full question from each unit.

UNIT -I

1. a) Write the general plan for analyzing time efficiency of Non-recursive algorithms. Write an algorithm to check uniqueness of elements in a given array and find the efficiency class of this algorithm. (08)

   b) Solve the following recurrence relations: (06)

   (i) $x(n) = 4x(n-1)$ for $n > 1$, $x(1) = 5$

   (ii) $x(n) = x(n/2) + n$ for $n > 1$, $x(1) = 1$ (solve for $n=2^k$)

   c) If $t1(n) \in O(g1(n))$ and $t2(n) \in O(g2(n))$ then prove the following assertion: $t1(n) + t2(n) \in O(\max\{g1(n), g2(n)\})$. (06)

2. a) With the help of a flowchart, explain the various stages of algorithm design and analysis process. (06)

   b) Write the formal definitions for O, Θ and Ω notations with an example for each. (06)

   c) Suggest general plan for analyzing recursive algorithms. Mathematically analyze the Tower of Hanoi problem and find its complexity. (08)

UNIT- II

3. a) Write an algorithm to perform Brute-Force string matching. Find the number of character comparisons that will be made by Brute-Force string matching for the pattern **BABCA** in the text **BAABABCACCA**. (05)

   b) Write an algorithm to sort an array using quick sort technique. Apply quick sort to sort the list C,O,M,P,U,T,E,R,S,C,I,E,N,C,E in alphabetical order. (09)

   c) How Strassen's matrix multiplication for multiplying two n-by-n matrices is efficient over brute-force multiplication algorithm? Evaluate the asymtotic efficieny of this algorithm. (06)

4. a) Write a selection sort algorithm. Analyze its time complexity and the number of key swaps required in the worst case. Apply selection sort on the data {5, 1, 3, 7, 2} (08)

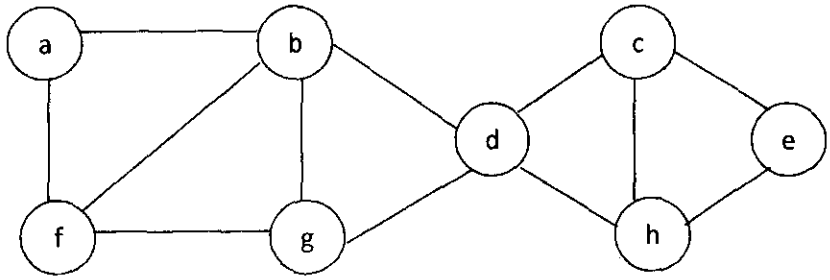
   b) Write an algorithm for sorting an array of integers using Merge sort technique. Analyze the working of merge sort for best and worst cases (08)

   c) Apply divide and conquer technique for computing the sum of n numbers on the following data and write the recursive tree for the same: {3, 5, 4 2} (04)

UNIT – III

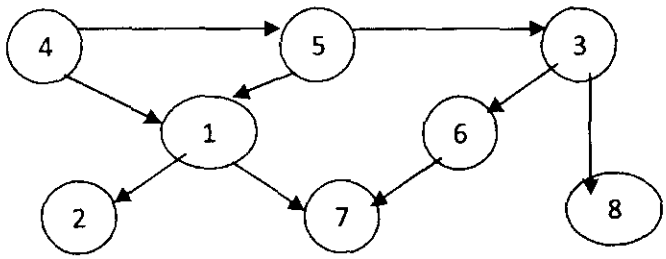
5. a) Write an algorithm to sort an array of integers using insertion sort technique. (04)

   b) Write an algorithm to traverse the graph using DFS traversal. For the following graph, starting at vertex 'a', traverse the graph by depth-first search and construct the corresponding depth-first search tree. Give the order in which the vertices were reached for the first time and the order in which the vertices became dead ends. (10)



   c) Generate all permutations of {1,2,3,4} by (06)
      (i) The Johnson-Trotter algorithm.
      (ii) The lexicographic-order algorithm.

6. a) Explain how topological ordering is obtained using source-removal algorithm on the graph given below, considering smallest numbered available vertex first. Show the graph status after removing each vertex. (06)



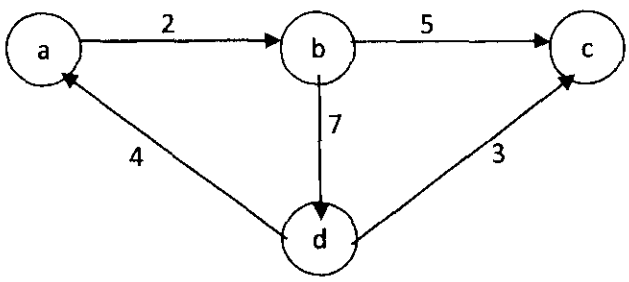
   b) Write an algorithm to compute presort mode for a given set of elements. (06)

   c) Construct an AVL tree by inserting the following elements successively, starting with the empty tree: (08)
   3, 6, 5, 1, 2, 4

UNIT – IV

7. a) Sort the following elements by heap sort using the array representation of heaps: (04)
   10, 50, 75, 38, 16, 20

   b) Write an algorithm to find all-pairs shortest path of a given graph. Apply the algorithm to find all-pairs shortest path for the following graph: (08)



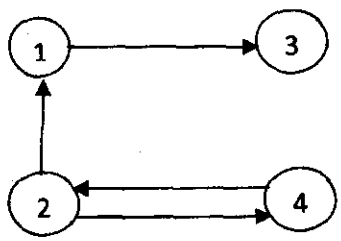
c) State and explain the procedure for solving a Knapsack problem using dynamic programming. Apply the technique for the following instance of the knapsack problem with capacity W = 10: (08)

Item	weight	value
1	7	$42
2	3	$12
3	4	$40
4	5	$25

8. a) Write an algorithm to search for a pattern in a given text using Horspool's string matching technique. Apply the algorithm to search the pattern "SCIEN" in the text "COMPUTER_SCIENCE" (08)

b) Assuming that the set of possible list values is {a,b,c,d}, sort the following list in alphabetical order by the distribution counting algorithm: (07)
b, c ,d, c, b, a, a, b

c) Find transitive closure for the following graph using Warshall's algorithm: (05)



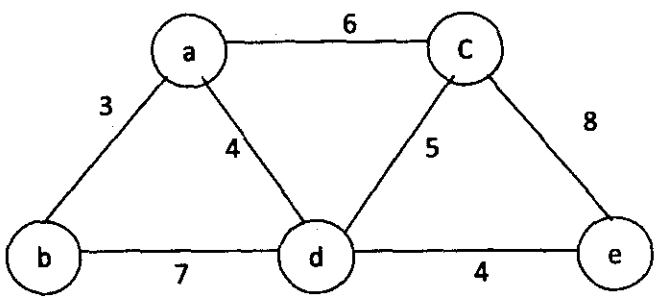
UNIT – V

9. a) Construct a Huffman tree for the following data and obtain its Huffman code: (08)

character	A	B	C	D	E	_
probability	0.5	0.35	0.5	0.1	0.4	0.2

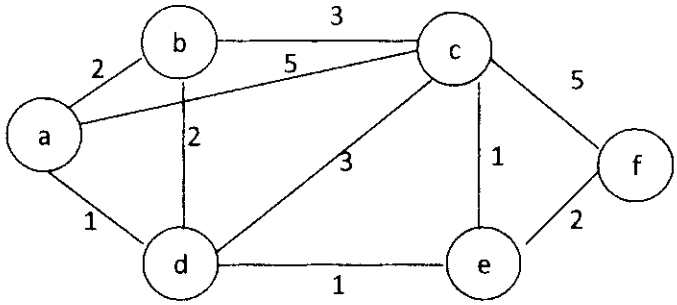
(i) encode the text DAD_BE using the code constructed above
(ii) decode the the text whose encoding is 1100110110 in the code constructed above

b) Apply Dijkstra's algorithm to solve the following instances of the single-source-shortest paths problems with vertex '*r*' as the source. Write the shortest paths and the corresponding lengths. (06)



c) Define P, NP, and NP-complete problems with examples. (06)

10. a) Write an algorithm to find minimum spanning tree using Prim's algorithm and analyze its time complexity. Apply Prim's algorithm to find minimum spanning tree of the following graph: (08)



b) Draw decision trees for the following: (06)

(i) three element insertion sort

(ii) binary decision tree for binary search in a four-element array.

c) What is backtracking? Apply backtracking algorithm to solve the following instance of the subset sub problem S = {5,7,8,10} and d=15. (06)

****