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**MANIPAL INSTITUTE OF TECHNOLOGY**  
 (Constituent Institute of Manipal University)  
 MANIPAL-576104



FIFTH SEMESTER B.Tech (CSE) DEGREE END-SEM EXAMINATION  
 DECEMBER 2013

**DESIGN AND ANALYSIS OF ALGORITHMS (CSE 303)**  
 (REVISED CREDIT SYSTEM)  
 05-12-2013

TIME: 3 HOURS

MAX.MARKS: 50

**Instruction to Candidates**

- Answer **any five** full questions

- 1 A Explain the Algorithm design and analysis process with a neat diagram. 3Marks
- 1 B What is the smallest and the largest number of divisions made by Euclid's algorithm among all inputs  $1 \leq m \leq n \leq 10$ ? 2Marks
- 1 C Write an algorithm for transforming a free tree into a rooted tree at a given vertex of the free tree. 3Marks
- 1 D Find the order of growth of the following sums. 2Marks
  - i)  $\sum_{i=0}^{n-1} (i^2 + 1)^2$  ii)  $\sum_{i=0}^{n-1} \sum_{j=0}^{i-1} (i + j)$
- 2 A Consider the following recursive algorithm. 4Marks
 

**ALGORITHM** find(A[0 .. n - 1])

//Input: An array A[0 .. n - 1] of real numbers

if n = 1 **return** A [0]

**else** temp  $\leftarrow$  find(A[0.. n- 2])

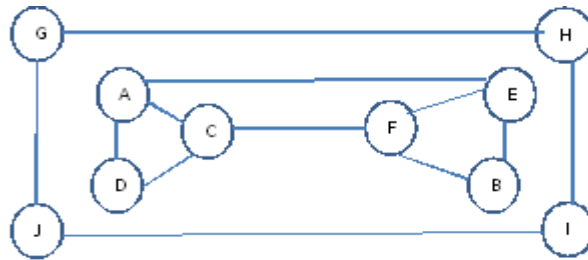
**if** temp  $\leq$  A[n-1] **return** temp

**else return** A[n-1]

  - i). What does this algorithm compute?
  - ii). Set up a recurrence relation for the algorithm's basic operation count and solve it.
- 2 B Write a recursive algorithm to count the number of binary digits in the binary representation of a positive decimal integer and compute the time complexity of the algorithm using backward substitution method. 4Marks
- 2 C Apply mergesort to sort the list **E, X, A, M, P, L, E** in alphabetical order and count the total number of comparisons made. Is mergesort a stable sorting algorithm? 2Marks
- 3 A Write a pseudocode for generating permutations using lexicographic method. 3Marks
- 3 B Design a decrease-by-one algorithm for generating the power set of a set of  $n$  elements. (The power set of a set  $S$  is the set of all the subsets of  $S$ , including the empty set and  $S$  itself.). 3Marks

3 C Consider the following graph.

4Marks



Starting at vertex **A** and resolving ties by the vertex alphabetical order, traverse the graph by **DFS** and **BFS** and construct the corresponding search tree showing all kinds of edges.

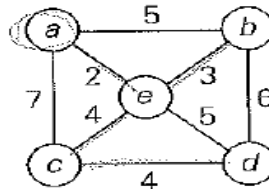
4 A Construct a bad symbol shift and Good-Suffix table for the pattern **BANDANBAN**. 2Marks

4 B Construct a max-heap for the list **1, 2, 4, 5, 9, 7, 6, 8** using bottom-up algorithm. 4Marks

Compute the time complexity of heapsort bottom-up algorithm.

4 C Construct an AVL Tree and 2-3 Tree for the list **3, 6, 5, 1, 2, 4, 9, 8, 7** 4Marks

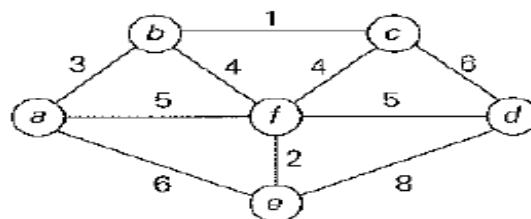
5 A Write an algorithm to find the minimum spanning tree using Prim's method. Apply Prim's algorithm to the following graph.(Starting vertex= a) 4Marks



5 B. Apply the memory function method to the following instance of the knapsack problem: **Knapsack Capacity W=5** 6Marks

ITEM	WEIGHT	VALUE
1	2	12
2	1	10
3	3	20
4	2	15

6 A. Solve the following instances of the single-source shortest-paths problem with **vertex c as the source**: 3Marks



6 B. Compute the average and variance of the codeword length in two Huffman codes that result from a different tie breaking during a Huffman code construction for the following data: 4Marks

Character	A	B	C	D	E
Probability	0.1	0.1	0.2	0.2	0.4

6 C. Explain Cook's Theorem. Explain P and NP problems with example. 3Marks

