ROLL NO. _____

Code: AC64/AT64 Subject: DESIGN & ANALYSIS OF ALGORITHMS

AMIETE – CS/IT

Time: 3 Hours **JUNE 2014** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. Which of the following sorting procedures is the slowest?

(A) Quick sort **(B)** Heap sort
(C) Shell sort **(D)** Bubble sort

b. Shell sort was developed by

(A) Donald L **(B)** Ruskin Bond
(C) Bill Gates **(D)** David Shell

c. The searching technique in which there are no unnecessary comparisons is called

(A) Binary searching **(B)** Sequential searching
(C) Hashing **(D)** None of these

d. If every node u in G is adjacent to every other node v in G, A graph is said to be

(A) Isolated **(B)** Complete
(C) Finite **(D)** Strongly Connected

e. Traversing a binary tree first root and then left and right subtrees called

(A) Postorder **(B)** Preorder
(C) Inorder **(D)** None of these

f. If any undirected graph , the sum of degrees of all the nodes

(A) can never be even **(B)** Must be odd
(C) Is twice the number of edges **(D)** Must be even

g. The worst case running time to search for an element in a balanced binary search tree with $n2^n$ elements is

(A) T(nlogn) **(B)** $T(n2^n)$
(C) T(n) **(D)** T(logn)

h. Total running time of DFS is

(A) $\theta(V + E)$ **(B)** $\theta(V \log E)$
(C) $\theta(E \log V)$ **(D)** $\theta(VE)$

i. An advantage of chained hash table over the open addressing scheme is

(A) Worst case complexity of search is less
(B) Space used is less
(C) Deletion is easier
(D) None of these

j. Time complexities of three algorithms are given. Which should execute the slowest for large values of N?

(A) $O(N^2)$ **(B)** $O(N)$
(C) $O(\log N)$ **(D)** $O(N^3)$

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Define an algorithm in brief with its properties. Write algorithm for the bubble sort. **(8)**

b. Write a recursive algorithm to compute value of the factorial function f(n) = n!, for an arbitrary nonnegative integer n. Describe its time complexity. **(8)**

Q.3 a. Explain asymptotic notations and their basic efficiency classes. **(8)**

b. Analyze the time complexity for the following using non recursive algorithms.
(i) Finding the value of the largest element in a list of n numbers
(ii) To check whether all the elements in a given array are distinct. **(8)**

Q.4 a. Explain string matching with the help of brute force string matching algorithm. Write down time complexity of this algorithm. Illustrate working of this algorithm with the help of an example. **(8)**

b. Write down Merge sort algorithm. Explain functioning of this algorithm with the help of an example. What is the time complexity of this algorithm? **(8)**

Q.5 a. What are the main difference of BFS over DFS? Which one is preferable and when? **(4)**

b. Explain how one can identify Connected & Strongly Connected Components of a graph by using DFS & BFS. **(8)**

c. Apply insertion sort algorithm to sort the list *E, X, A, M, P, L, E* in alphabetical order. **(4)**

Q.6 a. Solve the following system by the *LU* decomposition method and by Gaussian elimination.

$$x1 + x2 + x3 = 2$$
$$2x1 + x2 + x3 = 3$$
$$x1 - x2 + 3x3 = 8$$

(8)

b. (i) Construct a heap for the list 1, 8, 6, 5, 3, 7, 4 by the bottom-up algorithm.
(ii) Construct a heap for the list 1, 8, 6, 5, 3, 7, 4 by successive key insertions (top-down algorithm).
(iii) Is it always true that the bottom-up and top-down algorithms yield the same heap for the same input? **(8)**

Q.7 a. Define MST with the help of Kruskal's algorithm & explain the algo with suitable example. **(6)**

b. Apply bottom-up dynamic programming algorithm to the following instance of the knapsack problem (Capacity W= 5) **(10)**

Item #	Weight (Kg)	Value (Rs.)
1	2	3
2	3	4
3	4	5
4	5	6

Q.8 a. Construct a top-down 2-3-4 tree by inserting the following list of keys in the initially empty tree: 10, 6, 15, 31, 20, 27, 50, 44, 18. What is the principal advantage of this insertion procedure & what is its disadvantage? **(8)**

b. For the input 30, 20, 56, 75, 31, 19 and hash function $h(K) = K \bmod 11$
(i) Construct the open hash table.
(ii) Find the largest number of key comparisons in a successful search in this table.
(iii) Construct the closed hash table.
(iv) Find the largest number of key comparisons in a successful search in this table. **(8)**

Q.9 a. Which is the *last* solution to the five-queens problem found by the backtracking algorithm? Use the board's symmetry to find at least four other solutions to the problem. Explore backtracking algorithm. **(9)**

b. Find the shortest Hamiltonian circuit for the given graph using branch & bound algorithm. **(7)**