Subject: DESIGN & ANALYSIS OF ALGORITHMS

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

JUNE 2011

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 is not $O(n^2)$

(A) n+1000n **(B)** $n^{1.9999}$

(C) $10^5 + 2^6 n$ **(D)** $n^3/\sqrt{n}$

b. The total number of comparisons in bubble sort is

(A) $O(n \log n)$ **(B)** $O(n)$

(C) $O(n^2)$ **(D)** None of the above

c. We employ dynamic programming approach when

(A) It gives optimal solution
(B) The solution has optimal substructure
(C) It is faster than Greedy technique
(D) None of the above

d. Find the correct answer for the increasing order of complexity

(A) $n^2, n \log n, n$ **(B)** $n, n \log n, n^2$

(C) $n \log n, n^2, n$ **(D)** $n^2, n, n \log n$

e. A spanning tree contains

(A) all the edges of the graph **(B)** all the vertices of the graph
(C) both **(A)** & **(B)** **(D)** None of the above.

f. A problem is said to be NP-complete

(A) If it is as hard as any problem in NP
(B) A non-polynomial time algorithm has been discovered
(C) A polynomial time algorithm can exist but needs a parallel computer
(D) There is Greedy solution to the problem

g. Which of the following basic algorithms can be used to most efficiently determine the presence of a cycle in a graph?

(A) Minimum cost spanning tree **(B)** Ford Fulkerson algorithm
(C) Breadth first search **(D)** Depth first search

h. n-Queens problem is solved by

(A) Greedy approach **(B)** Dynamic programming
(C) Backtracking **(D)** Branch-and-bound

i. The average case complexity for quick sort is

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

j. In AVL trees, if there are n nodes the depth of the tree is

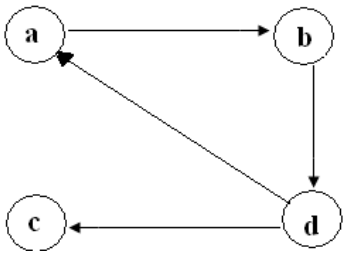
(A) O(n) **(B)** O(n log n)
(C) O(log n) **(D)** None of the above

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

Q.2 a. Write a Euclid's algorithm to determine the GCD of two non-negative numbers? **(8)**

b. Draw the sequence of steps for designing and analyzing an algorithm. **(4)**

c. In the following directed graph, draw its Adjacency matrix and Adjacency list of the graph. **(4)**



Q.3 a. Write a pseudocode of recursive and non-recursive algorithm for Fibonacci series. **(8)**

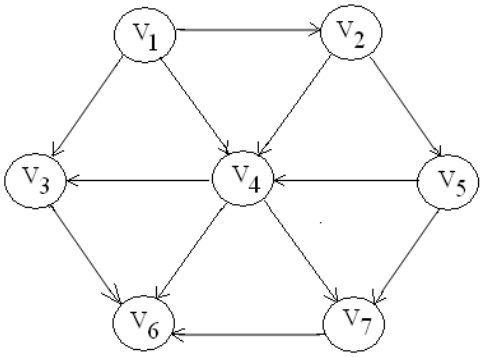
b. Solve the following recurrence relation:
(i) $T(n) = 9T(n/3) + n$
(ii) $T(n) = T(2n/3) + 1$ **(4×2 = 8)**

Q.4 a. There are two sorted arrays of size m and n. Write an efficient algorithm to merge two array into another array of size m+n. The resultant array should be sorted. Discuss the time complexity of the algorithm. **(8)**

b. Explain the sequential search in detail with example. **(8)**

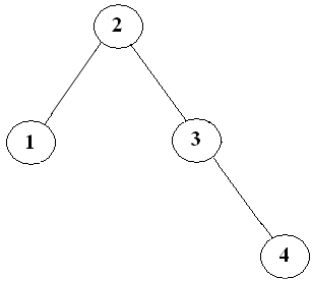
Q.5 a. What are the main facts about Depth First Search (DFS) and Breadth First Search (BFS)? **(6)**

b. Write a pseudocode for topological sort? If there are V vertices in a graph, what is a running time of the algorithm? **(10)**



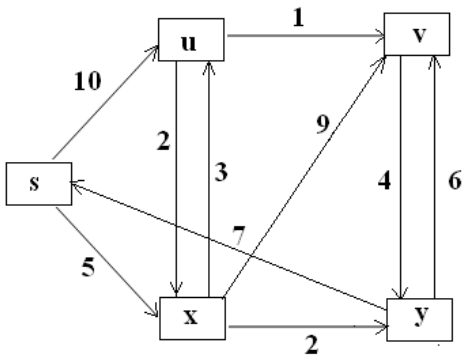
Find the result in the above directed graph by applying topological sort.

Q.6 a. (i) Explain single R rotation, single L rotation, double LR rotation, double RL rotation in AVL trees with an example. **(4)**
(ii) Draw the diagram of the insertion of 5 and 6 given below AVL tree. **(4)**



b. Explain the algorithm of Gaussian elimination for solving system of linear equations. **(8)**

Q.7 a. Consider the following graph G = (V, E). All nodes have infinite cost except the source node s, which has 0 cost? Using the Dijkstra's Algorithm find out the single-source shortest path. **(8)**



b. Solve the knapsack problem, using bottom-up dynamic programming algorithm with the capacity w = 10. Compute the optimal solution. **(8)**

Item	1	2	3	4
Value	10	40	30	50
Weight	5	4	6	3

Q.8 a. What is hashing? What are the various methods of handling the collision? **(8)**

b. Using the decision trees, design the sorting algorithm. **(8)**

Q.9 a. Explain the backtracking and branch-bound in detail. **(8)**

b. Write short notes on any **TWO** of the following:-

(i) Bisection method
(ii) Method of false position
(iii) Newton's method **(8)**