Reg.No.									

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

IV SEMESTER B.S. DEGREE EXAMINATION – APRIL / MAY 2017

SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS (CS 245)

(BRANCH: COMPUTER SCIENCE)

Tuesday, 2 May 2017

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

- ✓ **Answer ANY FIVE full Questions.**
- ✓ **Missing data, if any, may be suitably assumed**

1A. Write an algorithm to find prime numbers using Sieve of Eratosthenes method.

1B. Write and trace the Selection Sort algorithm on the following set of integers by indicating all steps.

89, 45, 68, 90, 29, 34, 17

1C. Explain the Algorithm Design and Analysis process with the help of a neat diagram.

(6+8+6)

2A. Define a weighted graph and how do you represent it in the memory? Write weighted matrix and adjacency list corresponding to the graph given in Figure 2A.

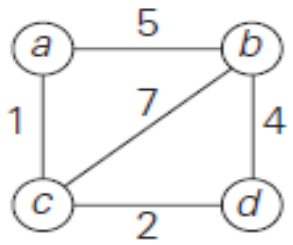

Figure 2A

2B. Find the asymptotic classes of the following functions

a. $\mathbf{35n^2 + 16n}$ by finding suitable constants
b. $\mathbf{n!}$ using limit form
c. $\frac{1}{2}n(n-1)$ using limit form
d. $\log_2 n$ using limit form

2C. Write and analyse the algorithm for finding the number of binary digits in a binary representation of a positive integer n

(4+10+6)

3A. Write a non-recursive algorithm to check whether all the elements in a given array are distinct and also find its worst case efficiency.

3B. Write a recursive algorithm to find the n^{th} Fibonacci number. Identify the recurrence relation and also find its time efficiency.

3C. Trace the bubble sort algorithm for sorting the elements: C, O, M, P, U, T, E, R in descending order and also find its worst case time efficiency.

(4+8+8)

4A. With the help of Merge Sort algorithm sort the numbers 15, 53, 48, 31, 92, 87, 24, 79 in ascending order and also find the exact solution (without using Master's theorem) when a Merge Sort algorithm is applied on the set of n integers, where $n = 2^k$

4B. Compute 2101*1130 using divide and conquer method.

4C. Write an algorithm to find the height of a binary tree with n nodes. Construct a binary tree for the following two traversals

Preorder : a, b, d, g, e, c, f **Inorder** : d, g, b, e, a, f, c

(8+8+4)

5A. Design an algorithm for discovering Depth First Search forest (DFS) in the given graph.

5B. What is topological sorting? Use source removal and DFS techniques for the graph in Figure 5B to sort the vertices in topological order.

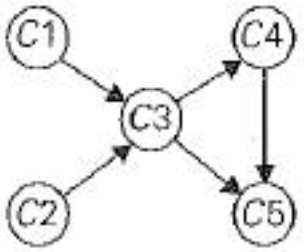

Figure 5B

5C. Let S={$\mathbf{a_1}$, $\mathbf{a_2}$, $\mathbf{a_3}$, $\mathbf{a_4}$}. Generate all subsets of S using squashed and Binary Reflected Binary Gray code methods.

(6+6+8)

6A. Construct a 2-3 tree by inserting their elements successively, starting with an empty tree for the list 100, 200, 300, 45, 250, 270, 280, 48, 30, 70, 40. Show all the steps clearly.

6B. Write an algorithm to compute the mode of an array using presorting technique and also write its efficiency.

6C. Use Dijkstra's algorithm to solve the single source shortest path problem given in Figure6C with vertex 'b' as the source and also show the shortest path and length from 'b' to all other vertices.

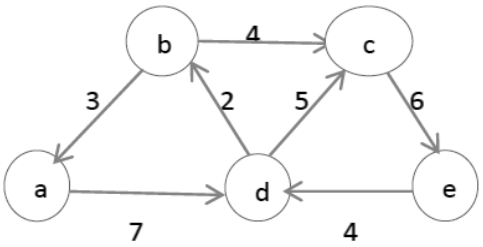

Figure 6C

(8+4+8)

7A. Compute the transitive closure of the directed graph in Figure 7A.

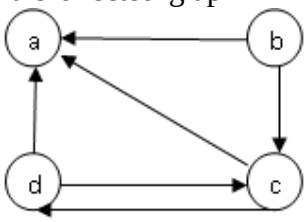

Figure 7A.

7B. Write an algorithm to sort an array of integers by using sorting by counting technique and find its efficiency.

7C. Explain the different cases of Horspool's algorithm for searching pattern in a given text.

(10+6+4)

8A. Write an algorithm for Heafifying the given set of integers using Bottom up Heap construction method and also find its worst case complexity.

8B. Explain the terms: P and NP Problems with examples

8C. Execute Kruskal's algorithm to find a minimum spanning tree of the graph given in Figure8C

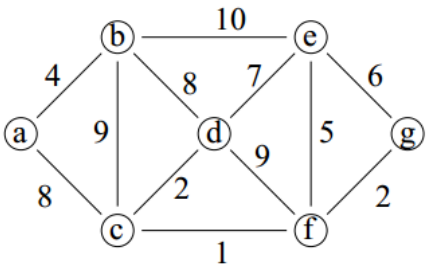

Figure 8C

(8+4+8)