Reg. No.										

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

IV SEMESTER B.S. DEGREE EXAMINATION – NOV./ DEC.2016

SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS (CS 245)

(BRANCH: COMPUTER SCIENCE)

Tuesday, 29 November 2016

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

✓ **Answer any FIVE FULL Questions.**

1A Discuss the sequence of steps involved in the design and analysis of an algorithm. Illustrate with the help of suitable diagram.

1B Write an algorithm to compute n! recursively. Set up the recurrence relations for the algorithm's basic operation count and solve it.

1C Find the order of growth for the following sums:

a. $\sum_{i=0}^{n-1}(i^2+1)^2$

b. $\sum_{i=0}^{n-1}\sum_{j=0}^{i-1}(i+j)$

(10 + 6 + 4)

2A Sort the elements: 89, 45, 68, 90, 29, 34, 17 in increasing order using Selection Sort method. Is the selection sort algorithm stable? Explain.

2B Apply quick sort to the list: E, X, A, M, P, L, E in alphabetical order. Draw the tree of recursive calls made.

2C Explain the general plan of mathematical analysis of recursive algorithms. What are recurrence relations, give examples.

(8 + 6 + 6)

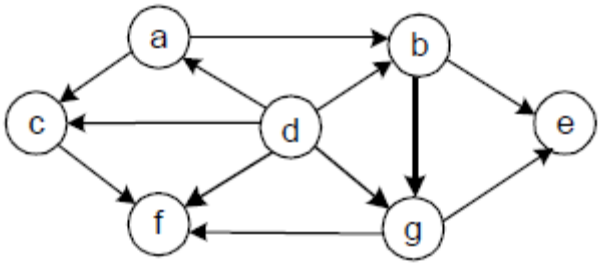
3A State the mergesort algorithm and derive the worst case efficiency.

3B Draw a binary tree with 10 nodes labeled 0, 1, . . , 9 in such a way that the inorder and postorder traversals of the tree yield the following lists: 9, 3, 1, 0, 4, 2, 7, 6, 8, 5 (inorder) and 9, 1, 4, 0, 3, 6, 7, 5, 8, 2 (postorder).

3C Discuss the important properties of a heap data structure.

(6+ 8 + 6)

4A Apply the DFS-based algorithm to solve the topological sorting problem for the following digraph:



a) Prove that the topological sorting problem has a solution for a digraph if and only if it is a dag.
a) What is the time efficiency of the DFS-based algorithm for topological sorting?

4B Apply insertion sort to the list: E, X, A, M, P, L, E.

4C If $t_1(n) \in O(g_1(n))$ and $t_2(n) \in O(g_2(n))$, then prove that:

$$t_1(n) + t_2(n) \in O(max\{g_1(n), g_2(n)\})$$

(10 + 5 + 5)

5A Generate all permutations of {1, 2 3, 4} by:
a) Bottom-up minimal change algorithm
b) Johnson Trotter algorithm
c) Lexicographical order algorithm

5B Write the BFS algorithm and obtain the efficiency. Illustrate with an example

(9 +11)

6A Illustrate the general form of single-R rotation for an AVL tree. Construct the AVL tree for the list of numbers 1, 2, 3, 4, 5, 6

6B Write the Warshall's algorithm and apply this algorithm to find the transitive closure of the digraph defined by the following adjacency matrix:

$$\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$

6C Write the Horspool's algorithm.

(8 + 8 + 4)

7A Explain the Transform and Conquer technique and its variations. With the help of an example, explain the problem of computing number of paths in a graph.

7B Compute 2135 * 4104 using divide and conquer method.

7C State and explain P, NP and NP complete problems.

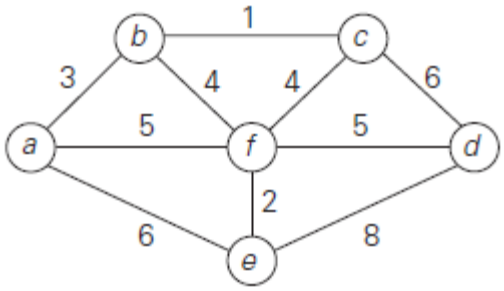
7D Construct a 2-3 tree for the list: C, O, M, P, U, T, E, R

(6 + 6 + 4 + 4)

8A Construct the Huffman's code for the following data and encode ABACABAD using the code:

Symbol	*A*	*B*	*C*	*D*	-
Frequency	0.4	0.1	0.2	0.15	0.15

8B Apply Prim's algorithm to the following graph:



8C Write the BottomUpHeap construction algorithm and derive its worst case efficiency. Construct a heap for the list: 1, 8, 6, 5, 3, 7, 4.

(4 + 8 + 8)