Reg. No.										

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

IV SEMESTER B.S. DEGREE EXAMINATION - OCT. / NOV. 2017

SUBJECT: DESIGN AAND ANALYSIS OF ALGORITHMS (CS 245)

(BRANCH: COMPUTER SCIENCE)

Thursday, 09 November 2017

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

✓ **Answer ANY FIVE Questions.**

1A Describe the general plan for analyzing time efficiency of a non-recursive algorithm.

1B Write the middle-school procedure and the Euclidian algorithm for computing gcd(m,n). Compare the efficiencies of the two methods.

1C Write the algorithm for ElementUniqueness problem (using brute force approach) and analyze its worst case efficiency scenario.

(4 + 8 + 8)

2A Write the pseudo code for a divide-and-conquer algorithm for finding minimum and maximum in an array of n numbers.

2B Write the quick sort algorithm and obtain the worst case efficiency.

2C State the non-recursive Binary Search algorithm and analyse its best and worst case efficiencies.

(6 + 8 + 6)

3A Consider the following recursive algorithm:

Algorithm: Compute_Product(n)
//Input: A nonnegative integer n
S ← 0
for i ← 1 to n do
S ← S + i ∗ i
return S

a. What does this algorithm compute?
b. What is its basic operation?
c. How many times is the basic operation executed?
d. What is the efficiency class of this algorithm?

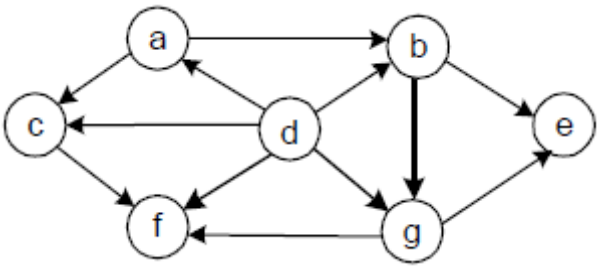
3B Explain the general plan of mathematical analysis of recursive algorithms. Analyze the recursive algorithm for computing the n^{th} Fibonacci number.

3C Solve the following:

a. $x(n) = 3x(n-1)$ for $n > 1$, $x(1) = 4$
b. $x(n) = x(n-1) + n$ for $n > 0$, $x(0) = 0$
c. $x(n) = x(n/3) + 1$ for $n > 1$, $x(1) = 1$ (solve for $n = 3k$)

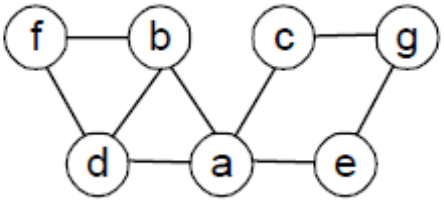
(4 + 10 + 6)

4A Apply source removal algorithm for the following digraph to solve the topological sorting problem.



4B Construct an AVL tree for the list: 6, 5, 4, 3, 2, 1.

4C Consider the graph:



a. Write down the adjacency matrix and adjacency lists specifying this graph. (Assume that the matrix rows and columns and vertices in the adjacency lists follow in the alphabetical order of the vertex labels.)

b. Starting at vertex a and resolving ties by the vertex alphabetical order, traverse the graph by depth-first search and construct the corresponding depth-first search tree. Give the order in which the vertices were reached for the first time (pushed onto the traversal stack) and the order in which the vertices became dead ends (popped off the stack).

(6 + 6 + 8)

5A Explain the Johnson Trotter algorithm for generating permutations of n integers. Give an example for a set of 4 integers.

5B Apply the bottom-up dynamic programming algorithm to the following instance of the knapsack problem and find the optimal subset. Show each step. Assume Capacity W = 6.

Item	Weight	Value
1	3	$25
2	2	$20
3	1	$15
4	4	$40
5	5	$50

5C Explain, in detail, the steps involved in Boyer-Moore algorithm.

(8 + 6 + 6)

6A Compute 2101 * 1130 using divide and conquer method.

6B Illustrate with the help of an example the BFS traversal. How does one obtain the BFS forest?

6C Apply Horspool's algorithm to search for the pattern BAOBAB in the text.

BESS_KNEW_ABOUT_BAOBABS

(8 + 8 + 4)

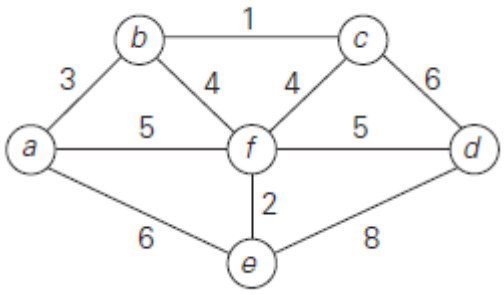
7A Construct a 2-3 tree for the list C, O, M, P, U, T, I, N, G.

7B For the input 30, 20, 56, 75, 31, 19 and hash function h(K) = K mod 11.
a. construct the open hash table.
b. find the largest number of key comparisons in a successful search in this table.
c. find the average number of key comparisons in a successful search in this table.

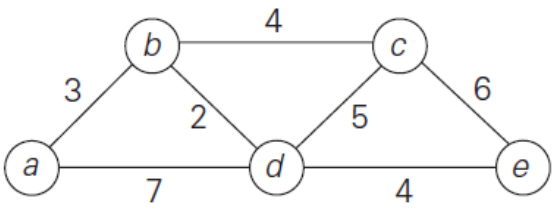
7C Sort S, O, R, T, I, N, G (in alphabetical order) by heapsort.

(6 + 8 + 6)

8A State the Kruskal's algorithm. Apply this algorithm to following to find the minimum spanning tree.



8B Apply Dijkstra's algorithm to the following graph with 'a' as the source and find lengths of the paths to all other vertices.



8C State and explain the NP and NP complete problems.

(8 + 8 + 4)