Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

I SEMESTER M.C.A.

END SEMESTER EXAMINATION – NOV/DEC 2016

SUBJECT: ADVANCED DATA STRUCTURES AND ALGORITHMS [MCA 4102]

29-11-2016

Time : 3 hours Max. Marks : 50

Instructions to Candidates

1. Answer ALL questions.
2. Missing data may be suitably assumed.

1A	What is the use of asymptotic analysis? Explain the meaning and significance of Big-oh (O) and Big-omega (Ω) notations. Give an example each.	5
1B	Write a recursive function to calculate the sum of elements of an array A containing N elements and obtain its space complexity.	3
1C	Sort the following sequence of integers using natural merge sort technique: A = [4, 8, 3, 7, 1, 5, 6, 2]	2
2A	What is a binary search tree? Explain, with an example, the method of deleting an element from a binary search tree for the three cases – deleting a leaf node, deleting a node with one child and deleting a node with two children.	5
2B	What is a stack? Illustrate the use of stack in the process of evaluation of the following postfix expression (Show the sequence of steps in a table). 5 4 6 + * 4 9 3 / + *	3
2C	How do you represent a set using a bit-vector? Illustrate the same for the set S = {5, 8, 13, 14, 0, 2} with a vector of size 16 bits.	2

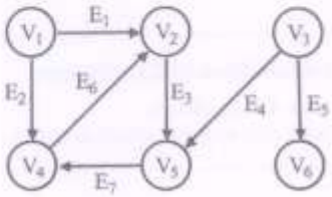
3A Define the terms max tree and max heap? Create a max heap for the following set of elements: 20, 12, 35, 15, 10, 80, 30, 17, 2 and 1. Show each step in the process of heapification. 5

3B What are the two methods of representing a 2-D array (matrix)? Represent the following matrix in the two methods. 3

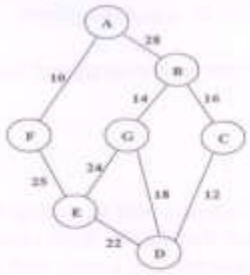
4	5	2
8	6	9

Given a matrix A of dimension m x n, write the expressions for obtaining the location of A[i][j] in the the two representations.

3C What is incidence matrix of a digraph? Write the incidence matrix for the following unweighted digraph. 2



4A What is a minimum spanning tree? Obtain the minimum spanning tree for the following graph using Prim's algorithm. Show each step in the process. 5



4B Write the three differences between Divide-and-Conquer and Dynamic Programming techniques of algorithm design. 3

4C What is a bipartite graph? Explain with an example. 2

5A What is topological sort of a directed acyclic graph? What is its significance? Draw the graph for the pre-requisites of taking up a course in a University curriculum as specified in the following table. 5

Course	Prerequisites
C1	None
C2	None
C3	C1, C2
C4	C2
C5	C3, C4

Also draw the graph representing the resulting topological sort sequence.

5B Construct a binary tree whose inorder and postorder traversal sequences are as follows. 3

Inorder: E A C K F H D B G
Postorder: E C K A H B G D F

Write the preorder traversal sequence for the same.

5C For the following 4-vertex network, draw the solution space for the Traveling Salesperson problem, with A as the starting point. 2