Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

I SEMESTER M.C.A.

END SEMESTER EXAMINATION – NOV/DEC 2017

SUBJECT: ADVANCED DATA STRUCTURES AND ALGORITHMS [MCA 4102]

(REVISED CREDIT SYSTEM)

21-11-2017

Time : 3 hours Max. Marks : 50

Instructions to Candidates

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

1A 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

Write the algorithm for performing topological sort. Using this algorithm, obtain the graph representing the topological sort sequence for the curriculum graph.

1B What is a min heap? Create a min 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. 3

1C List any two advantages of a linked list over an array. 2

2A What is a binary search tree? Give an example of binary search tree with at least 10 nodes. With reference to this tree, explain the method of deleting an element for the three cases 5

a) deleting a leaf node
b) deleting a node with one child
c) deleting a node with two children.

In each case start from the original tree and draw the tree obtained after performing the specified deletions.

2B What is a stack? Illustrate the use of stack in the process of evaluation of the following postfix expression containing single-digit operands (Show the sequence of steps in a table). 3

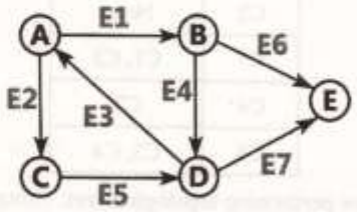
5 4 6 + * 4 9 3 / + *

2C List any two differences between divide-and-conquer and dynamic programming techniques of algorithm design. 2

3A State the general principle of divide-and-conquer technique of algorithm design. Write the algorithms related to merge-sort method of sorting an array. Write the steps for sorting the following sequence of numbers using this method. 5

12, 35, 87, 26, 9, 28, 7

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



3C 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

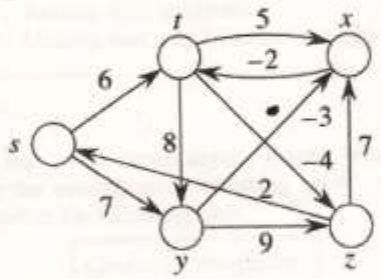
4A What is the use of asymptotic notations? Explain the meaning and significance of big-oh (O) and omega (Ω) notations. Give an example each. 5

4B Obtain the optimal solution for the following 0/1 knapsack problem using FIFO version of branch-and-bound technique. Explain each step. 3

$n = 3, c = 30, w = [20, 15, 15], p = [40, 25, 25]$

4C What is an AVL tree? Give an example of an AVL tree with at least 10 nodes to show all possible balance numbers. Write the balance numbers of all nodes. 2

5A Explain the Bellman-Ford algorithm for solving the single-source shortest-paths problem. Illustrate the same for the following graph, taking s as the source vertex. Draw the graph obtained after each step. 5



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

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

Write the preorder traversal sequence for the same.

5C Explain the following terms with reference to the algorithms for sorting an array. 2

(a) Best-case running time

(b) Worst-case running time