Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

I SEMESTER M.C.A.

END SEMESTER EXAMINATION – NOVEMBER 2018

SUBJECT: ADVANCED DATA STRUCTURES AND ALGORITHMS [MCA 4102]

(REVISED CREDIT SYSTEM)

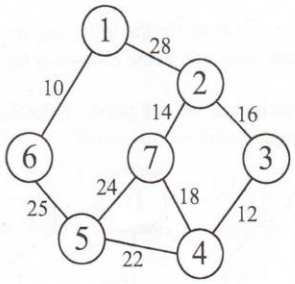
23-11-2018

Time : 3 hours Max. Marks : 50

Instructions to Candidates

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

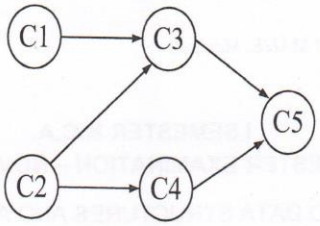
1A Define minimum spanning tree. Obtain the minimum spanning tree for the following weighted graph using Prim's algorithm. Show each step in the process. 5



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 Differentiate between decision and optimization problems. Give an example for each. 2

2A Define topological sort of a directed acyclic graph. Explain is its significance. Write the algorithm for obtaining the topological sort sequence for a directed acyclic graph. Use this algorithm to obtain the topological sort sequence for the following graph (starting at vertex C1). 5



2B Sort the following sequence of integers in ascending order using natural merge sort technique: 3

A = [4, 8, 3, 7, 1, 5, 6, 2]

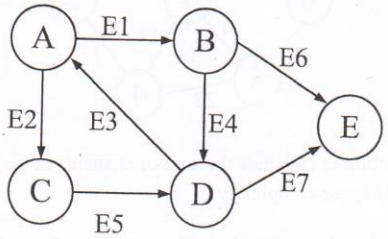
Explain each step.

2C Define 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

3A Explain the use of asymptotic notations? Explain the meaning and significance of Big-oh (O) and Theta (Θ) notations. Give an example each. 5

3B Define 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

3C Explain the term incidence matrix of a digraph. Write the incidence matrix for the following unweighted digraph. 2

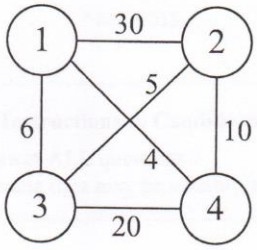


4A Define a binary search tree. Give an example of binary search tree with at least 10 nodes, containing at least one node with one child and one node with two children. With reference to this tree, explain the method of deleting an element for the three cases 5

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.

4B For the following 4-vertex network, draw the solution space tree for the Traveling Salesperson problem, with vertex 1 as the starting point. 3



Using the solution space tree, obtain the least cost solution to the problem using the method of branch and bound. Also, write the corresponding Hamiltonian cycle.

4C Derive the expression for the time complexity of merge sort algorithm. 2

5A Define a stack. Explain the two operations that can be performed on a stack. Illustrate the use of stack in the process of evaluation of the following postfix expression. 5

5 4 6 + * 4 9 3 / + *

5B Explain the open-addressing method of resolving collision during hashing. Give an example. 3

5C Define a bipartite graph. Explain with an example. 2