Reg. No. ☐☐☐☐☐☐☐☐☐☐
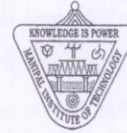
Manipal Institute of Technology
(Constituent Institute of Manipal University)
Manipal – 576 104

FIRST SEMESTER M. C. A. END SEMESTER EXAMINATION – NOV/DEC 2014
SUBJECT: ADVANCED DATA STRUCTURES AND ALGORITHMS (MCA 4102)
02-12-2014

Time : 3 hours   Max. marks : 50

1A   What is 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.

$$5 \; 4 \; 6 + * \; 4 \; 9 \; 3 \, / + *$$

1B   Define Abstract Data Type? Why do you call an array as an Abstract Data Type? Explain.

1C   What is incidence matrix of a digraph? Write the incidence matrix for the following digraph.
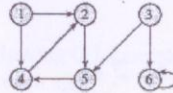
$$(5 + 3 + 2)$$

2A   Explain the use of asymptotic notations? Explain the meaning and significance of Big-oh (O) and Theta (Θ) notations. Give an example each.

2B   What do you mean by time complexity of an algorithm? What are its two components? Explain.

2C   Construct a binary tree whose inorder and postorder sequences are as follows.
   Inorder: E A C K F H D B G
   Postorder: E C K A H B G D F

$$(5 + 3 + 2)$$

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

$$67, 98, 11, 47, 58, 87, 8, 12, 23, 75.$$

3B What do you mean by minimum cover in a bipartite graph? Obtain the minimum cover for Set L in the following bipartite graph.
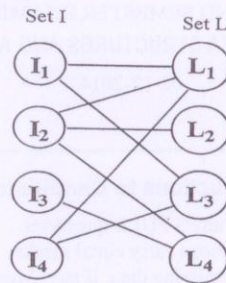
3C What is an AVL tree? Give an example of an AVL tree with at least 10 nodes to show all possible balance numbers.

(5 + 3 + 2)

4A Derive the recurrence relation for solving all-pairs shortest path problem using dynamic programming method. Using this relation, obtain the shortest path from node 1 to node 10 in the following graph.
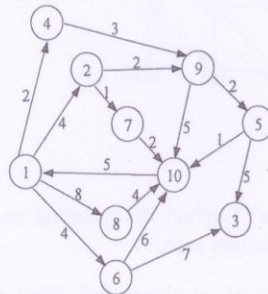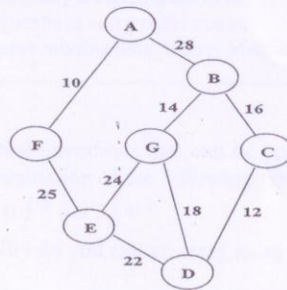

Explain each step.

4B 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.

4C 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.

(5 + 3 + 2)

5A   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 – deleting a leaf node, deleting a node with one child and deleting a node with two children.

5B   What do you mean by topological sort of a directed acyclic graph? What is its significance? Write the algorithm for the same.

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

   (a) Best-case running time
   (b) Worst-case running time

$(5 + 3 + 2)$

6A   Define the terms spanning tree and minimum spanning tree? Obtain the minimum spanning tree for the following graph using Kruskal's algorithm:

Show each step.

6B   Obtain the optimal solution for the following 0/1 knapsack problem using FIFO version of branch-and-bound technique. Explain each step.

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

6C   Explain, with an example, the closed hashing method of resolving collision during hashing.

$(5 + 3 + 2)$

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