# NATIONAL INSTITUTE OF TECHNOLOGY SRINAGAR
## Department of Computer Science and Engineering
## MAJOR Exam (Spring 2016)

Course: **Data Structures**   Semester: 4ᵗʰ (IT)   Time allotted: 2hours

Max Marks: 50   Dated: 29-6-2016   Credits: 04

**Note: Attempt any four questions.**

Q.1 a) How can you detect whether a singly linked list contains a **cycle or not**. Write a C function to detect the same.   [4]

b) Assume a singly linked list containing integers. Write a C function move( ) which would move a node forward by n positions in the linked list.   [4.5]

c) Suppose that another provision were added to the **Tower of Hanoi** problem, that one disk may not rest on another disk that is more than one size larger (e.g disk-1 may rest only on disk-2 or ground but not on disk-3, disk-2 may only rest on disk-3 or ground but not on disk-4 and so on). Discuss why the solution you have studied for normal Tower of Hanoi problem will fail?   [3.5]

Q.2 a) Write a C function to evaluate any postfix expression. Also evaluate the following expression:   [5]

$$2\ 3 \wedge 1 - 4\ 2 / 6\ * + 3\ 1 + 2 / \$$$

b) Convert the following postfix expression to prefix expression using stack method:   [3]

$$ABC \wedge - DE - F * G / H / +$$

c) What are the different types of double ended queues? Write a C function to perform the delete operation at the end of double ended queue.   [4.5]

Q.3 a) Create a BST from the elements given below:   [4.5]
10, 21, 31, 1, 2, 3, 15, 45, 85, 25, 35, 11, 6.
Also write a C function to delete a node 35 from the above tree.

b) Consider a tree with pre-order and in-order traversal as:   [4]
Pre-order: 4, 7, 2, 8, 5, 1, 6, 9, 3.
In-order: 1, 2, 4, 7, 5, 8, 3, 6, 9.
Construct the tree and find its Post-order traversal.

c) Construct a B-tree of order 4 by inserting the following key values sequentially.   [2.5]
10, 15, 18, 22, 77, 48, 54 (Assume that right-biasing is used).

d) Draw the expression tree for (a+b)*((c+d*e)*f)   [2]

Q.4 a) Given M=10; keys: 12, 18, 13, 2, 3, 23, 5, 15
Hash function: H(key) = key mod 10
Collision resolution technique used is Linear Probing.
Show how these elements (keys) will be stored in the hash table. Also calculate the total number of collisions.   [4]

b) Here is an array which has been partitioned by the first step of Quicksort:
3, 0, 2, 4, 5, 8, 7, 6, 9
Which of these elements could have been the pivot?(If there are more than one possibility, list them all)
Also discuss the time complexity for Quicksort in both the best and worst case.   [2]
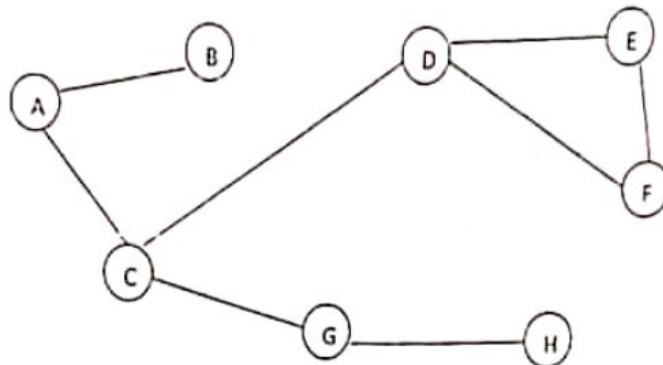
**P.T.O**

c) Show how this input is sorted using heap sort and merge sort.
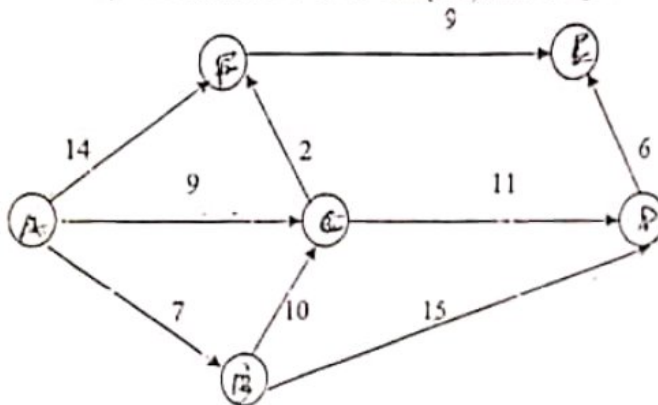
    13  44  21  77  88  99  81  54

Also discuss the applications of using binary heaps.

        [6.5]

Q.5 a)Formulate an algorithm for Breadth First Search. Also determine the breath first traversal of the graph given below, starting at vertex 'A'.



        [6.5]

b) Find the shortest path from node '1' to '6' using Dijkstra's algorithm in the graph given below:



        [6]

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