NATIONAL INSTITUTE OF BUSINESS MANAGEMENT

HIGHER DIPLOMA IN COMPUTER BASED INFORMATION SYSTEMS – 2016.2

DATA STRUCTURES & ALGORITHMS

27th February 2017, 09.00 a.m. – 12.00 noon.

Time: THREE hours.

Answer 5 questions out of the 7 given. **All questions carry equal marks**

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1.

a. Insert the following data to a binary search tree "55, 9, 36, 37, 26, 62, 1, 114, 107, 35, 87, 100, 19, 99, 42".

b. Traverse the binary search tree in the following traversing methods

   I. Preorder traversal

   II. In order traversal

   III. Post order traversal

c. Write an algorithm to insert a value to the binary search tree

d. Remove the following values from the above binary search tree

   I. 37

   II. 55

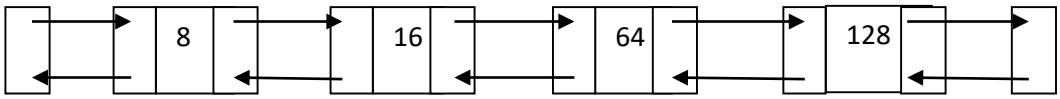
2.

a. Illustrate the circularly linked list with a suitable diagram

b. Write an algorithm to insert an element to the head of a Doubly linked list

c. Write an algorithm to remove an element from the head of a singly linked list

d. The following is an illustration of a doubly linked list, write an algorithm to remove 16 from the list



e. Write the algorithm to insert 32 in the above doubly linked list

3. The data given here refers to the following question “55, 9, 36, 37, 26, 62, 1, 114”
   a. Illustrate the divide-and-conquer method using Merge sort
   b. Sort the above data set using the Merge sort, diagrammatic representation is required
   c. Write the algorithm for the quick sort
   d. Sort the above data set using the Quick sort, diagrammatic representation is required

4.
   a. Differentiate between Binary tree and the AVL tree
   b. Illustrate with an example how to perform the following operations with an AVL tree
      I. Single right rotation
      II. Double rotation
   c. Insert the following keys to the AVL tree, diagrammatic representation is required at each step
      55, 9, 36, 37, 26, 62, 1, 114, 107, 35, 87, 100, 19, 99, 42
   d. Insert the following key values to a (2,4) tree, diagrammatic representation is required at each step 55, 9, 36, 37, 26, 62, 1, 114, 107, 35, 87, 100, 19, 99, 42, 29, 115, 110, 5, 15

5.
   a. What are the 4 properties that you have to satisfy when inserting keys to a red-black tree
   b. Insert the following key values to a red-black tree, diagrammatic representation is required at each step 55, 9, 36, 37, 26, 62, 1, 114, 107, 35, 87, 100
   c. Write a short note on algorithm analysis, your answer should include what are the different scenarios arising in that and what scenario we can use best to analyze an algorithm. You can also use a graph to illustrate that.
   d. find the “Big O” of the following functions
      I. $5X^2 + X\log X$
      II. $1000X\log X + X^3$
      III. $X^5 + 12345X\log X$
      IV. $2^x + \log X$

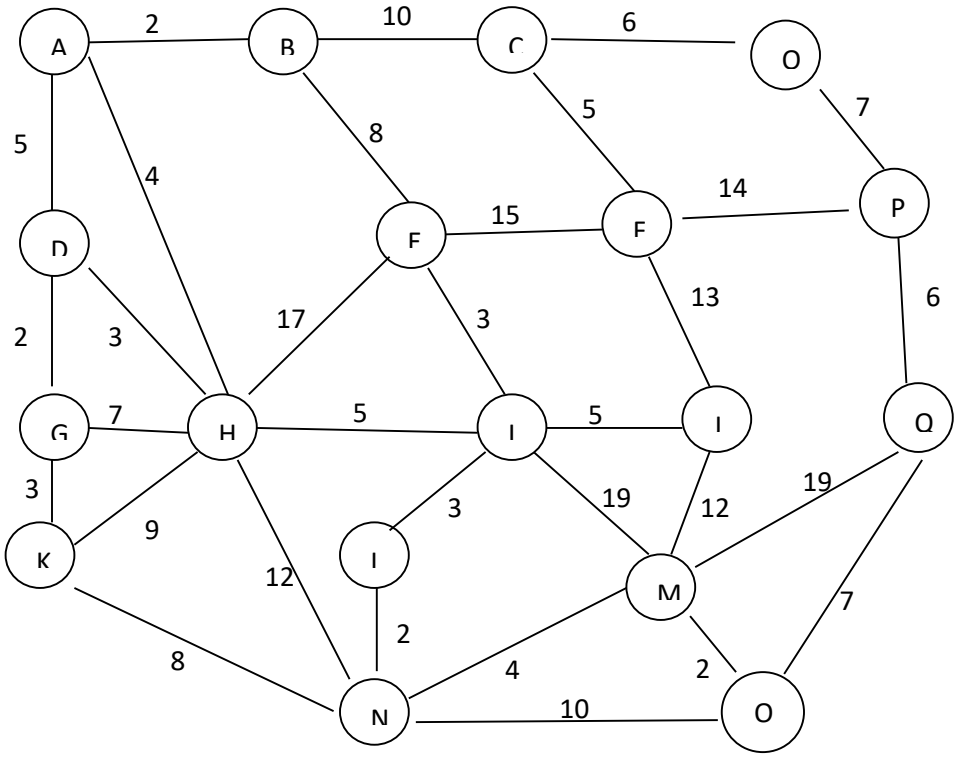
6.
   a. Illustrate the use of a recursive function using the factorial function
   b. Describe the methods available in the “Queue” Abstract Data Type(ADT)
   c. Find out the output and the stack contents of the following series of stack operations
      Push(3), push(9), push(6), push(8), Pop(), Pop(), Push(2), Push(9) IsEmpty(), Pop(), Top(), Push(10), pop(), Top(), push(2), IsEmpty(), Size(), Pop(), Pop(), Pop(), Push(5), Top(), Pop(), push(4) Top(), Push(1), Push(17), Push(5), Size(), Pop(), Pop(), Size()

   4. Find the output and the Queue contents of the following sequence of Queue operations
      enqueue(14), enqueue(9), enqueue(8), enqueue(5), dequeue(), size(), enqueue(1), enqueue(8), dequeue(), dequeue(), dequeue(), isEpmty(), enqueue(1), enqueue(15) enqueue(2), front(), dequeue(), front(), enqueue(11), size(), dequeue(), front() enqueue(2), enqueue(15), dequeue(), size(), dequeue(), dequeue(), enqueue(12), size(), dequeue(), dequeue(), isempty()

7.

a. Illustrate depth first search with a suitable diagram

b. Find the shortest path from the vertex H to all other vertices



c. Using kruskal's algorithm find the minimum spanning tree for the above diagram