Hall Ticket No | | | | | | | | | | Question Paper Code: BCS002

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech I Semester End Examinations (Regular) - February, 2017

Regulation: IARE–R16

DATA STRUCTURES AND PROBLEM SOLVING

(Computer Science and Engineering)

Time: 3 Hours **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Explain briefly Circular Queue along with algorithm for insert and delete operations. **[8M]**
   (b) Show that, if c is a positive real number, then g(n) $=1 + c + c^2 + \cdot\cdot\cdot + c^n is :$ **[6M]**
      i. $\Theta\,(1)\,if c < 1$
      ii. $\Theta\,(n)\,if c == 1$
      iii. $\Theta\,(c^n)\,if c > 1$
2. (a) What is circular linked list? How is different from linear linked list? **[6M]**
   (b) What is the time complexity of the following code snippet? **[8M]**
   for i : = 1 to n do
   for j : = i + 1 to n do
   for k : = j + 1 to n do
   z = z + 1

UNIT – II

3. (a) What is a dictionary? What are the typical operations that can be performed on dictionary? **[4M]**
   (b) Consider inserting the keys 10, 22, 31, 4, 15, 28, 17, 88, and 59 into a hash table of length m=11 using open addressing with the primary hash function h'(k) = k mod m. Illustrate the result of inserting these keys using linear probing, using quadratic probing with c_1 = 1 and c_2= 3, and using double hashing with h_2(k) = 1 + (k mod (m-1)). **[10M]**
4. (a) Suppose we wish to search a linked list of length n, where each element contains a key k along with a hash value h(k). Each key is a long character string. How might we take advantage of the hash values when searching the list for an element with a given key? **[4M]**
   (b) Suppose a hash table with capacity M=31 gets to be over 3/4ths full. We decide to rehash. What is a good size choice for the new table to reduce the load factor below .5 and also avoid collisions? **[6M]**
   (c) Consider a hash table of size m= 1000 and the hash function h(k)= [m (kA (mod 1))] for A= (sqrt(5)-1)/2; the notation [x] refers to the largest integer at most x. For example [3.14]=3. Of course, x (mod 1) is the fractional part of x. Compute the locations to which the keys 61, 62, 63, 64, 65 are mapped. **[4M]**

UNIT – III

5. (a) Write recursive functions to **[4M]**
   i. compute the size of a binary tree rooted at node U
   ii. compute the height of a node U

   (b) Bring out the need for threaded binary trees. **[4M]**

   (c) Discuss Graph data structure with suitable example. Explain the term Vertex **[6M]**

6. (a) What is a binary tree? List any four properties of a binary tree? **[6M]**

   (b) Consider the following directed, weighted graph: **[8M]**

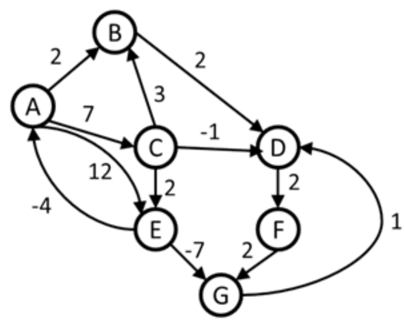

Figure 1

   i. Even though the graph has negative weight edges, step through Dijkstra's algorithm to calculate supposedly shortest paths from A to every other vertex. Show your steps in the table.
   ii. Dijkstra's algorithm found the wrong path to some of the vertices. For just the vertices where the wrong path was computed, indicate both the path that was computed and the correct path.
   iii. What single edge could be removed from the graph such that Dijkstra's algorithm would happen to compute correct answers for all vertices in the remaining graph?

UNIT – IV

7. (a) Discuss the Binary Search Tree ADT **[6M]**

   (b) What is an AVL tree? Insert the integers 50, 30, 75, 80, 20, 10, 60, 70, 72 to an initially empty AVL tree in order. Draw the state of the AVL tree before and after each necessary rotation. **[8M]**

8. (a) Design appropriate class(es) with suitable methods using C/Java to find the node with minimum value in a Binary Search Tree. Write a test driver for the same. **[10M]**

   (b) List the steps involved in insert an element into AVL tree. **[4M]**

UNIT – V

9. (a) What is R Tree? When is it preferable over B Tree? **[5M]**

   (b) Consider the following splay tree: **[9M]**

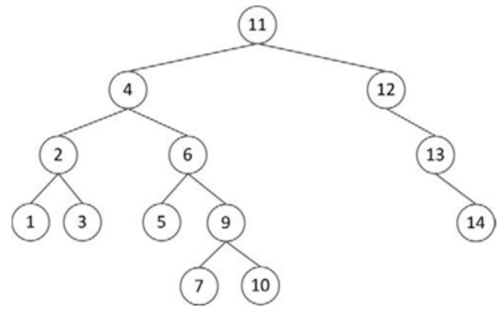

Figure 2

   i. Perform a delete for the key 3 under the assumption that this is a bottom-up splay tree. Show each step

   ii. Perform a split from the tree of Figure 2 (not the resulting tree of part 1)) for the key 6 under the assumption that this is a top-down splay tree.

10. (a) Show the red-black trees that result after successively inserting the keys 5, 10, 15, 25, 20, and 30 into an initially empty red-black tree. **[10M]**

    (b) Discuss the two methods available for splitting the full nodes of R Trees. **[4M]**