Branch: B. Tech in Computer Engineering   Sem.:- III
Subject (Subject Code):- Data Structures (BTCOC303)   Marks: 60
Date:-14/12/2019   Time:- 3 Hrs.

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Instructions to the Students

1. Each question carries 12 marks.
2. Attempt any **FIVE** questions
3. Illustrate your answers with neat sketches, diagrams etc., wherever necessary
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

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Q1. Solve any THREE of the following questions.   (3x4 = 12)

a) Why to study data structures? What are the major data structures used in the RDBMS, Network and Hierarchical data model.

b) Consider the following specification of a graph G = (V, E).
    V = {1, 2, 3, 4}
    E = {(1, 2), (1, 3), (3, 3), (3, 4), (4, 1)}
    i) Draw an undirected graph.
    ii) Represent graph G using adjacency matrix.
    iii) Represent graph G using adjacency linked list.

c) Suppose the numbers: **50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24** are inserted in order into an initially empty binary search tree. What is preorder, inorder and postorder traversal sequence of the tree?

d) What is garbage collection? Who will run garbage collection program? When it will be run?

Q2. Solve all the following questions.   (4x3 = 12)

a) What is sparse matrix ? Convert the following sparse matrix into non-sparse matrix.

    1   0   0   0

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0    -2    11    0

0     0     0    0

0     6     0    5
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b) Suppose multidimensional arrays A and B are declared using
   A (-1:3, 2:6) and B (1:5, -3:1). Find the length of each
   dimension and the number of elements in A and B.

c) What is header linked list? Use header linked list to store the following
   polynomial.
$$p(x) = 2x^8 - 5x^7 + 3x^2 + 4$$

d) What is hash data structure? The keys: **32, 18, 23, 2, 3, 44, 5 and
   15** are inserted into an initially empty hash table of length 10 with
   hash function H (key) = key mod 10 and linear probing is used to
   resolve collision. What is hash table content after every key insertion?

Q3. Solve any THREE of the following questions.   **(3x4 = 12)**

a) Give an algorithm to implement binary search with its advantages and
   disadvantages.

b) Explain the concept of skip list with an example. Give its advantages
   and disadvantages.

c) Sort the following list using radix sort sort. Show all the passes neatly.
   3   45   7   18   9   4   89   103   11   21

d) Suppose we are sorting an array of eight integers using quick-sort,
   and   we have just finished the first partitioning with the array looking
   like   this: **2, 5, 1, 7, 9, 12, 21, 30**. What was the pivot element in
   the first partition? Also complete the rest of the partitions so that all
   numbers   will be in the ascending order.

Q4. Solve any TWO of the following questions   **(2x6 = 12)**

a) Write an algorithm to insert a new node at the beginning of the singly
   linked list.

b) What is singly circular linked list? Write an algorithm to traverse the
   list and also enlist different operations performed on it and

c) Write a short note on dynamic storage management. Explain how it is
   done in C.

Q5. Solve any TWO of the following questions   **(2x6 = 12)**

a) Consider the stack, where N = 6 memory cells allocated. Suppose initially
   stack contains **A, D, E, F, G** *(Top of stack)*. Then the following
   operations called in order. Show the stack top and any other situation
   raised while doing each of the operations.

    i) Push(stack, K)   ii) Pop(stack, Item)   iii) Push(stack, L)
    iv) Push(stack, S)   v) Pop(stack, Item)   vi) Push(stack, T)

b) What is queue? Write an algorithm to implement insert item into queue
using singly linked list.

c) Write an algorithm to evaluate postfix expression using stack and execute
   your algorithm with postfix expression **10, 5, 6, *, +, 8, /.**
   Show intermediate stack content after each operation.

Q6. Solve all of the following questions.   **(4x3 = 12)**

a) Give the characteristics of good algorithm. Also explain how do we
   analyze the algorithm.

b) Store elements of the given below binary tree using

    i) One dimensional array
    ii) Linked list
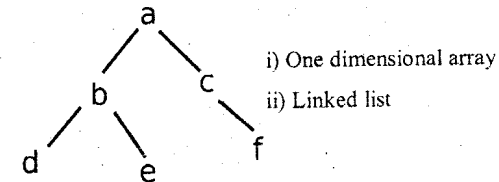
c) What is an Abstract Data type (ADT)? Explain, why queue is called
   ADT?

d) Explain the following graph terminology with figure
    i) Undirected graph   ii) Total degree of vertex
    iii) Simple path   iv) Cycle

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