B.E. 3rd Semester (CST) Odd Semester EXAMINATION 2011
Data Structure and Algorithms
CS – 302

F. M. = 70 **Time – 3 hrs.**

First Half

Use separate Answer script for each half.
The questions are of equal value.
Answer SIX questions taking THREE from each half.
Two marks are reserved for neatness and clarity in each half.

1. Write routines for the following tasks using doubly linked list.
   a) Insert a node with information field 'BESU' to the left of a node (p) containing information 'JU'.
   b) Delete a node with information field 'BECDU'.
   c) Add a node 'KU' at the end of the doubly linked list.

   [3+3+5]

2. a) Define circular linked list. What is the merit of it over linear linked list?
   b) Write pseudocode to implement 'PUSH' and 'POP' operations of stack using circular linked list. Identify differences (if any) between circular linked list based implementation and linked list based implementation of these two functions.

   [(2+1) + (3+3+2)]

3. a) How recursive function call works?
   b) In which way is it different from iterative function call? Explain the differences citing one example. [5.5+5.5]

4. a) What is adjacency list? What is its usage?
   b) Define spanning tree. What is minimum spanning tree? Write one application of it.
   c) How can you construct a minimum spanning tree for a given labeled graph? Citing one example explain it.

   [(1+1)+(1+1+1)+6]

5. Write short notes on the following:
   a) Priority queue
   b) Single source shortest path problem

   [5.5+5.5]

P.T.O.

SECOND HALF

6. a) Write an algorithm to insert an element into a binary search tree. Show the resulting binary search tree if the elements are added into the following order:

   15, 12, 20, 14, 8, 18, 19

   b) How can a binary tree be stored using a one-dimensional array? Show the binary search tree constructed in (a) above into a one-dimensional array.

   c) What is the number of binary trees with 3 nodes which when traversed in post-orders give the sequence A, B, C? Draw all such binary trees.

   d) Given preorder and inorder traversals of a binary tree. Write an algorithm to obtain the binary tree. [(3 + 1) + 2 + 2 + 3]

7. a) What is a heap? Is a heap a balanced tree? Is it an AVL tree? Explain.

   b) Construct a binary Maxheap from the array given below:

   [6, 12, 15, 10, 3, 8, 19]

   c) How can a heap be used to represent a priority queue? Discuss, with suitable algorithms, how to perform the operations of item insertion and removal in binary heaps used to represent priority queues.

   [3 + 1 + (1+ 6)]

8. a) Show with appropriate diagrams the actions you would take to balance an AVL tree if unbalance occurs due to left-to-right insertion. Write appropriate algorithms for balancing the unbalance due to left-to-right insertion.

   b) Add the following keys into an AVL tree. The intermediate and final results must be AVL trees.

   80, 70, 60, 50, 65, 68. [(3 + 5) + 3]

9. a) A majority element in an array, A, of size N is an element that appears more than N/2 items (thus, there are at most one). For example, the array

   [3, 3, 4, 2, 4, 4, 2, 4, 4]

   has a majority element (4), whereas the array

   [3, 3, 4, 2, 4, 4, 2, 4]

   has none.

   Write an algorithm to determine majority element, in an array, if present. What is the time complexity of your algorithm?

   b) Write an algorithm for Binary Search. Obtain the *recurrence relation* for worst case time complexity W(n) for binary search algorithm.

   [(4 + 2) + (3+2)]

10. a) Initial Data Sets: 43 21 12 57 38 25
    After 1st Pass : 21 43 12 57 38 25
    After 2nd Pass : 12 21 43 57 38 25

    Which is the sorting method being applied on the above data set? Write the algorithm for the sorting method you have identified in your previous answer. Obtain the worst case and best case time complexity of the identified sorting method.

    b) Give an outline of partitioning algorithm for Quick Sort and illustrate it with an example. [6 + 5]