Second Semester Examination – 2012

DATA STRUCTURE USING 'C'

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any five from the rest.
The figures in the right-hand margin indicate marks.

1. Answer the following questions :   2 ×10

    (a) Suppose an array VAL [15][10] is stored in the memory with each
        element requiring 4 bytes of storage in C programming. If the base
        address of array VAL is 1500, determine the location of VAL [12][9] when
        the array VAL is stored in :

        (i) Row-wise

        (ii) Column-wise

    (b) Find the minimum number of multiplications and additions required to
        evaluate the polynomial $P = 4x^3 + 3x^2 - 15x + 45$.

    (c) Suppose circular queue is maintained by an array Q with 12 memory
        locations and front and rear are the two pointers. Find the number of
        elements in Q when :

        Front = 4, Rear = 8

        Front = 10, Rear = 3

        Front = 5, Rear = 6

        And then two elements are deleted.

    (d) How many different binary trees and binary search trees can be made
        from three nodes that contain the key values 1, 2 and 3 ?

(e) Prove the maximum number of nodes in a binary tree of depth 'K' is $2^K - 1$, $K > 0$.

(f) Show that the sum of degrees of the vertices of an undirected graph is twice the number of edges.

(g) For an undirected graph G with n vertices, prove that G is a tree.

(h) Differentiate between Fibonacci buddy system and binary buddy system of allocation.

(i) Explain the need of different rotations in an AVL tree.

(j) Differentiate between the insertion sort and bubble sort method.

2. (a) Write an algorithm to convert an infix expression into postfix form. Execute your algorithm using the following input : 5

    (i)   A + [(B + C) + (D + E) * F] / G

    (ii)   a AND b OR c NOT d OR e

  (b) Reverse the order of elements on a stack S (use any hypothetical stack) 5

    (i) using two additional stacks

    (ii) using one additional queue

3. (a) Bubble sort algorithm is inefficient because it continues execution even after an array is sorted by performing unnecessary comparisons. Therefore, the number of comparisons in the best and worst cases is the same. Modify the algorithm in such a fashion that it will not make the next pass when the array is already sorted. 5

  (b) Describe the advantages of a priority Queue. 5

4. (a) Develop an algorithm and write a C program to insert and delete a node in single linked list. 5

  (b) Explain an efficient way of storing a sparse matrix in memory. Write a program module in C to find the transpose of a sparse matrix stored in this way. 5

5. (a) Construct an AVL tree and show the balance factor for each node for the following English words : 5

Input, Joystick, USB, Rom, Port, Ram, Windows, X-windows, Audio, Cache.

(b) Create a binary search tree using the following data entered as a sequential set : 5

80 70 66 56 33 23 14 10 7

Insert 44 and 50 into the above tree.

6. (a) Write an algorithm that finds the sum of the degrees for a node, using the adjacency list representation. 5

(b) Describe the depth-first traversal and Breadth-first traversal of a graph. 5

7. (a) Sort the elements of the following array using quick sort 5

44, 78 ,22, 7, 98, 56, 34, 2, 38, 35, 45

(b) Using the modulo-division method and linear probing, store the keys shown below in an array with 19 elements. How many collisions occurred and how they can be resolved 5

224562, 137456, 214562, 140145, 214576, 162145, 144467, 199645, 234534

8. Write short notes on any *two* : 5×2

(a) Topological sorting

(b) Linked stacks and Queues

(c) Abstract Data Type

(d) B-Tree