USN | | | | | | | | | | |

10MCA23

Second Semester MCA Degree Examination, June 2012

Data Structures Using 'C'

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. What are pointers? Explain the operators associated with pointer operations. Briefly discuss pointer arithmetic operations. **(08 Marks)**

b. Define abstract data type (ADT). Describe complex numbers as an ADT which supports addition and subtraction operations. **(06 Marks)**

c. Let $f(n) = 10n^3 + 5$. Explain f(n) using Big – Theta (θ) notation. **(06 Marks)**

2 a. Explain structures and unions. **(08 Marks)**

b. Discuss how one dimensional array of integers is declared in C using static and dynamic allocation. **(06 Marks)**

c. Explain sparse matrix. Discuss how sparse matrix shown below is represented differently using array.

$$\begin{bmatrix} 15 & 0 & 0 & 22 & 0 & -15 \\ 0 & 11 & 3 & 0 & 0 & 0 \\ 0 & 0 & 0 & -6 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 91 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 28 & 0 & 0 & 0 \end{bmatrix}$$

(06 Marks)

3 a. Convert the following infix expressions to postfix and prefix expressions : **(06 Marks)**
i) a × (b+c)/d-g ii) a × ((b + c × d) / g + h) – f iii) (a + b) × d + e / (f + a × b) + c.

b. Write an algorithm to convert a valid infix expression to pestfix expression and trace the algorithm with the contents of the stack for the expression a × (b + c) × d. **(08 Marks)**

c. Explain queue as a data structure. Write C functions for insert and delete operations for a circular queue of integers. **(06 Marks)**

4 a. Discuss about linked list. List the advantages and disadvantages of linked lists over arrays. Write the syntax for defining a node that can store a complex number. **(06 Marks)**

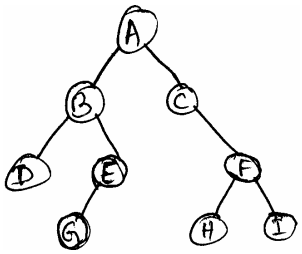
b. Write an algorithm to invert (reverse) a singly linked list i.e. arrange the nodes in reverse order. **(06 Marks)**

c. Consider the polynomial given below : $a_4x^4 + a_3x^3 + a_2x^2 + a_1x + a_0$.
i) Define a node in C to store one term data in a node.
ii) Diagrammatically represent the polynomial as a linked list. **(08 Marks)**
iii) Write an algorithm to search the linked list of above polynomial for a term with x^k.

5 a. Explain tree as a data structure. **(06 Marks)**

b. Define the following trees with examples :
i) Complete Binary tree ii) Binary search tree iii) Threaded Binary tree. **(06 Marks)**

c. Write the inorder, preorder, postorder and level order sequence for the tree given below : **(04 Marks)**



d. Write a C function to count the number of nodes in a binary tree. **(04 Marks)**

6 a. Write an algorithm to insert an element into a binary search tree. **(06 Marks)**

b. Explain single and double ended priority queues. **(06 Marks)**

c. Define a graph. What is an adjacency matrix? Show an example for adjacency matrix with respect to a weighted graph. **(04 Marks)**

d. Write an algorithm for depth first search (DFS). **(04 Marks)**

7 a. Define Binomial, Fibonacci and Pairing heaps with examples. **(09 Marks)**

b. Define Red – Black tree. Explain how insertion and deletion is done in Red – Black trees. **(06 Marks)**

c. Differentiate between Binary search tree and Optimal Binary search tree. **(05 Marks)**

8 Write short notes on :

a. Role of stack in recursion.

b. Doubly linked list.

c. AVL trees.

d. Asymptotic Notations. **(20 Marks)**

*****