B. Tech
(SEM III) ODD SEMESTER THEORY EXAMINATION 2009-10
DATA STRUCTURE USING 'C'

Time: 3 Hours] [Total Marks: 100

Note:  (1) Attempt all questions.
(2) All parts of a question should be attempted at same place.

1 Attempt any four parts of the following: 5x4=20

(a) Define data structure. Write down the difference between 'logical' and 'physical' structure of data using a suitable example.

(b) Write a program in 'C', that counts total number of 'words' in a given input text.

(c) Suppose you have an array to numbers denoted by num[]. Write the iterative and recursive procedure to find the sum of 500 numbers. Compare the time and space-requirement of both algorithms.

(d) Write down algorithm for evaluation of postfix expression using stack.
(e) Each element of an array \( X[30][50] \) requires 4 bytes of storage. Base address of \( X \) is 2500. Determine the location of \( X[10][10] \) when the array is stored as

(i) Row major

(ii) Column major

(f) Explain divide and conquer method and apply it on the merge sort using some example.

2 Attempt any four parts of the following: 5x4=20

(a) You are given two polynomials. Represent the polynomials in a suitable data structure and write an algorithm to add the two polynomial functions.

(b) Suppose LIST is a circular list in memory. Write an algorithm which deletes the last node from LIST.

(c) Implement a queue as a linked list. Write algorithm for performing insertion and deletion in it.

(d) Show, how a priority queue can be implemented using linked list.

(e) Given a queue and an empty stack, write a function that uses the stack to reverse the order of all items in the queue.

(f) Write algorithm to add an item to each end of a dequueue.

Attempt any two parts of the following: 10x2=20

(a) Write down the 'iterative' and 'recursive' algorithms for In order traversal of a binary tree. What is the run-time of the algorithms?

(b) (i) Write a 'C' function that accepts a pointer to a binary tree and a pointer to a node of the tree and returns the level of the node in the tree.

(ii) Consider the following algebraic expression:

\[ E = (2x + y)(5a - b)^3 \]

Draw the tree \( T \) which corresponds to expression \( E \).

(c) What is hashing? Give the characteristics of hash function. What are different methods of handling overflow in hashing?

Attempt any two parts of the following: 10x2=20

(a) (i) Write an algorithm for sorting a set of numbers in descending order using selection sort. Analyse the algorithm.

(ii) Illustrate the operation of HEAP-SORT on the following array:

\[ A = \{5, 13, 2, 25, 7, 17, 20, 8, 4\} \]
(b) (i) Define B tree. Explain the insertion operation of B tree with example. What are the applications of B-tree?

(ii) Insert the following keys, in the order shown, to build them into an AVL tree:

M, T, E, A, Z, G, P

(c) Suppose a graph G is input by means of an integer M, representing the nodes 1, 2, ..., M and a list of N ordered pairs of integers, representing the edges of G.

Write a program in C language to find the adjacency matrix of graph G.

5 Write short notes on any four of the following:

(i) Sparse Matrices and their applications
(ii) Kruskal's algorithm
(iii) Tower of Hanoi problem
(iv) Time-space trade-off with suitable examples
(v) Principles of recursion with example
(vi) Garbage collection and compaction.

5×4=20