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No. of Printed Pages—4   CS-402

B. TECH.

FOURTH SEMESTER EXAMINATION, 2002-2003
DATA STRUCTURES USING C

Time : 3 Hours   *Total Marks : 100*

Note : (1) Attempt **ALL** the questions. All questions carry equal marks.

     (2) Assume any data if necessary.

1.   Attempt any FOUR parts :—   (5×4=20)

    (*a*)   Discuss Linear and Nonlinear data structures with example.

    (*b*)   Write an algorithm to add two sparse matrices. How much time does your algorithm take ?

    (*c*)   What is an ordered list ? Write a C function to insert an element in ordered list stored in an array.

    (*d*)   Describe the sequential algorithm. How many comparisons does sequential search do in searching a list of n elements ?

    (*e*)   Explain bubble sort with example.

    (*f*)   Write a function substring ( ) in C, which returns a sub string of length n character starting from m^{th} character of the string.

2.   Attempt any TWO parts :—   (10×2=20)

    (*a*)   What is the advantage of a circular queue representation over simple queue representation, when arrays are used ? Give 'C' declarations without using queue count

for implementation of such queue and write functions to add and delete items. Include all necessary error checks in your functions.

(b) What is Recursion ? Illustrate how recursion can be replaced by iteration. Write algorithm for postfix expression.

(c) Write an algorithm to convert prefix expression to postfix expression. Carefully state any assumptions you make regarding the input. Simulate stack to convert following prefix expression to postfix expression

$$— + * BC * DE / AC$$

3. Attempt any FOUR parts :— (5×4=20)

(a) Give 'C' declarations required to implement doubly linked list. Also write functions for insertion and deletion of elements to / from the doubly linked list.

(b) Explain the following :—

(i) Tree   (ii) Graph
(iii) Binary tree   (iv) Binary search tree
(v) Heap

(c) Give structure declaration for storing terms of polynomial. Write a 'C' function that accepts two polynomials of single variable, does their addition and returns the resulting polynomial.

(d) Discuss the array representation of the Binary tree. Write a 'C' function that computes the height of a Binary tree stored in an array.

(e)   Show that maximum no. of nodes in a Binary tree of height h is $2^{h+1}-1$.

(f)   Write algorithm and C-function for deleting the node pointed by a pointer from a linear linked list implemented dynamically.

4.   Attempt any FOUR parts :—   (5×4=20)

(a)   Write a C function that will count all the nodes of a linked Binary tree.

(b)   Write a C function that deletes a node from a Binary Search tree.

(c)   Define AVL tree. Give the algorithm to insert a new node in AVL tree.

(d)   Discuss the different implementations of graph in computer memory with examples.

(e)   Discuss the algorithm to perform breadth-first traversal of a graph. Consider the following graph and list the sequence of node visited in breadth-first traversal :—
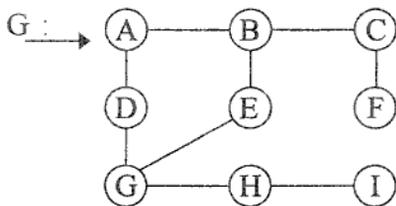
(f)   Write an algorithm to implement two-way merge sort. Discuss its efficiency.

5.   Attempt any TWO parts :—   (10×2=20)

(a)   Discuss the Quick Sort algorithm. Justify, how the selection of pivot plays major role in the efficiency of the Quick Sort algorithm and give the best case analysis of Quick Sort.

(b) Describe the difference between the following file organization techniques :

— Sequential file organization.

— Direct file organization.

Compare their storage and access efficiencies. To what type of applications does each of the techniques suit ?

(c) Write short notes on the following :—

(i) Hash functions,

(ii) B⁺ tree Index files.

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