(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 1030 Roll No. | | | | | | | | | | |

B.Tech.

FOURTH SEMESTER EXAMINATION, 2004-2005

Data Structure Using 'C'

Time : 3 Hours *Total Marks : 100*

Note : *(i) Attempt **ALL** questions.*

(ii) All questions carry equal marks.

1. Attempt ***any four*** parts of the following: **(5 × 4=20)**

a. Suppose that it is known that the running time of one algorithm is always about N(logN) and that the running time of another algorithm is always about N^3. What can you say about the relative performance of the algorithms?

b. Explain the memory addressing scheme(s) for two dimensional arrays with suitable example(s).

c. Define string. Suppose that there are two strings s1 and s2. Write an algorithm to find out whether the string s1 exists in string s2.

d. Let A be an N × N square matrix array. Write modules (algorithms) for the following:

i. Find the number NUM of nonzero elements in A.

ii. Find the product PROD of the diagonal elements (a_{11}, a_{22}, a_{33}....., a_{NN}).

e. Compare the following:

i. Linear Search Algorithm and Binary search algorithm

ii. Bubble sorting and Selection sorting.

f. Explain the following terms:

i. Data structure

ii. Non-primitive data structure

iii. Time complexity

iv. Traversing of linear arrays.

v. Character strings in C language.

2. Attempt ***any four*** parts of the following: **(5 × 4=20)**

a. Answer the following questions:

i. Write down the applications of stack.

ii. Write a program in C to show the PUSH and POP operations in a stack.

b. Answer the following questions: **(2+2+1**

i. Convert the Postfix expression A B D + * E / F G H K / + * into infix notation.

ii. Compute the postfix equivalent of the following infix expression:

$3^* \log (x+1) - a/2$

iii. Why are parentheses needed to specify the order of operations in infix expressions but not in postfix operations?

c. Write an algorithm to read in a parenthesized infix expression [e.g. ((a+b)-c)] and

i. check whether parentheses match.

ii. remove all extra parentheses keeping the value of the expression intact.

d. What is a priority queue? How can you represent a priority queue in memory? Explain.

e. Let a and b positive integers. Suppose a function Q is defined recursively as follows:

$$Q(a, b) = \begin{cases} 0 & \text{if } a < b \\ Q(a - b, b) + 1 & \text{if } b \leq a \end{cases}$$

i. Find the value of Q(2,3) and Q(14,3).

ii. Find Q(5861,7).

f. Write a program in C to reverse a string using stack.

3. Attempt ***any four*** parts of the following: **(5 × 4=20)**

a. Write a C program to print the information from each node in singly linked list. Make necessary assumptions.

b. Write a function (pseudo code) that will concatenate two linked lists. Function should have two parameters pointer to the beginning of the lists and the function should link second list at the end of the first list.

c. Differentiate between the following:

i. Array and doubly linked list

ii. Overflow and underflow conditions in linked list.

d. A doubly linked list can be made circular by adjusting appropriate pointers. Suggest the pointer adjustments.

e. Write an algorithm to search an item from a sorted linked list.

f. Discuss the advantages, if any, of a two-way list over a one-way list for each of the following operations:

i. Traversing the list to process each node.

ii. Searching an unsorted list for a given element.

iii. Searching a sorted list for a given item.

iv. Inserting a node before the node with a given location LOC.

v. Deleting a node whose location LOC is given.

4. Attempt ***any four*** parts of the following: **(5 × 4=20)**

a. Define the following:

i. tree

ii. vertex of a tree

iii. forest

iv. depth

v. binary tree

b. Prove that in a binary tree

the number of leaves = the number of nodes with two children + 1

c. How are the binary trees represented in memory?

d. A binary tree T has 9 nodes. The inorder and preorder traversals of T yield the following sequences of nodes:

Inorder: E A C K F H D B G

Preorder: F A E K C D H G B

Draw the tree T.

e. Write an algorithm for Quick sort.

f. Draw one example for each of the following:

i. connected multigraph

ii. loop-free multigraph

iii. general tree

iv. binary tree

v. threaded tree

5. Attempt ***any four*** parts of the following: **(5 × 4=20)**

a. What is a B+ tree? Write down its applications in file organization.

b. What do you understand by hashing? Name two hashing techniques and explain any one.

c. Write a short note on sequential files

d. Differentiate between the B+ tree index files and B

tree index files.

e. Name different types of physical storage media. Compare the direct access storage media with sequential access storage media.

f. What is the need of indexing in file organization. Define the following terms:

i. primary indices

ii. secondary indices

iii. static hash function

iv. double hashing

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