Roll No. | | | | | | | | | | |

No. of Printed Pages—5 CS-402

B. TECH.

FOURTH SEMESTER EXAMINATION, 2003–2004

DATA STRUCTURE USING 'C'

Time : 3 Hours *Total Marks : 100*

Note : Attempt **ALL** questions. .

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

(*a*) Define data structure and also write down the difference between Primitive data structure and Non-primitive data structure.

(*b*) Write a program to input a matrix and to determine if it is a symmetrical matrix (a matrix is said to be symmetrical when A = A').

(*c*) Each element of an array Data [20] [50] requires 4 bytes of storage. Base address of DATA is 2000. Determine the location of Data [10] [10] when the array is stored as —

(*i*) Row major,

(*ii*) Column major.

(*d*) Write a 'C' program using array to reverse the characters in a string from starting position to end position recursively. The program must have a function rev-string (string, start, end).

(*e*) Show, through appropriate data structure, representation of the following 4 x 4 sparse matrix :—

$$\begin{bmatrix} 0 & 0 & 11 & 0 \\ 12 & 0 & 0 & 0 \\ 0 & -4 & 0 & 0 \\ 0 & 0 & 0 & -25 \end{bmatrix}.$$

(*f*) Write a recursive algorithm to implement the following function :—

$$A(m, n) = \begin{cases} n+1 & \text{if } m = 0 \\ A(m-1, 1) & \text{if } n = 0 \\ A(m-1, A(m, n-1)) & \end{cases}$$

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

(*a*) Write an algorithm to convert an arithmetic expression in infix notation to postfix notation using stack.

(*b*) Write a program to construct and delete elements in stack using Link List.

(*c*) Write the prefix form of the following expression :—

(*i*) a && b | | c | | ! (e > f)

(*ii*) [a + (b – c)] * [(d – e) / (f – g + h)]

(*d*) Simulate a stack evaluating the following postfix expressions :—

(*i*) abcde + * + —

(*ii*) ab + cd * + e *

(*e*) Write down the algorithm for insertion and deletion operations performed on the dequeue.

(*f*) Consider the following circular queue of characters, implemented as array of *six*

memory locations :—

Front = 2, Rear = 3

QUEUE : –, A, D, –, –, –

where '–' denotes empty cell. Describe the queue as the following operations take place :—

(*i*) Add 'S'.

(*ii*) Add 'J'.

(*iii*) Delete two letters.

(*iv*) Shift towards left to bring all free space to the right side.

(*v*) Insert M, H, I and delete one letter.

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

(*a*) Write a function that creates a new Linear Linked List by selecting alternate elements of a given Linear Linked List.

(*b*) Write a 'C' program to create a singly linked list and split it at the middle and make the second half as the first and vice-versa. Display the final list.

(*c*) Write algorithm for searching item in unsorted circular link list.

(*d*) Write a program to implement a doubly linked list as a circular linked list.

(*e*) Write a program to traverse a binary tree using preorder traversal without using recursion.

(*f*) Write a program for preorder traversal of threaded binary tree without a stack.

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

(*a*) If 'm' and 'n' are two different nodes in the same tree, show that exactly one of the following statements is true :—

(*i*) 'm' is to the left of 'n'.

(*ii*) 'm' is to the right of 'n'.

(*iii*) 'm' is a proper ancestor of 'n'.

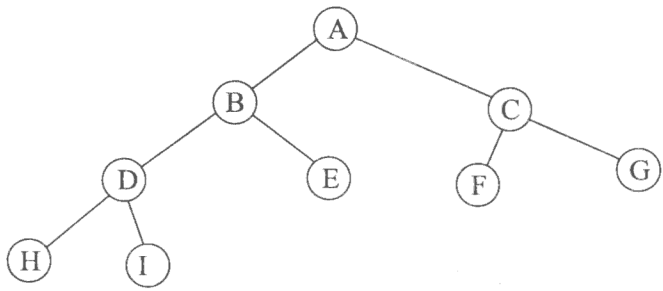
(*iv*) 'm' is a proper descendent of 'n'.

(*b*) For the following expression :—

((((a * x + b) * x + c) * x + d) * x + e) * x + f,

construct the expression tree. Find the equivalent postfix notation.

(*c*) Traverse the following binary tree into preorder and inorder with reason :—



(*d*) The following keys are to be inserted in the order shown into an AVI tree :—

50, 45, 80, 95, 26, 43, 105, 2.

Show how the tree appears after each insertion.