* V – 1 0 7 2 *

Printed Pages : 4 **TCS – 407**

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

PAPER ID : 1072 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. IV) EXAMINATION, 2006-07

DATA STRUCTURE USING 'C'

Time : 3 Hours] *[Total Marks : **100***

Note : *(1) Attempt **all** questions.*
*(2) All questions carry **equal** marks.*

1 Answer any **two** Parts :

(a) (i) Define Abstract Data type. Explain it briefly. **5+5=10**

(ii) Obtain an addressing formula for the element $A[i_1][i_2]....[i_n]$ in an n-dimensional array declared as $A[u_1][u_2]....[u_n]$

Assume a column major representation of the array with one word per element. Given that α is the address for $A[0][0]....[0]$.

(b) Write a program in **C** to sort a set of **100** complex numbers into ascending order of their absolute values. Real and imaginary part of all the complex numbers are integers. Absolute value of a complex number $x + iy$ is defined as $\sqrt{x^2 + y^2}$. Choose suitable data structure to represent complex numbers.

(c) (i) What do you understand by Worst Case time complexity of an algorithm. Explain clearly. **4+6=10**

(ii) Write a function in **C** which searches string **x** for the first occurrence of string **y**.

If **Y** does not appear in **X**, then function returns zero. Otherwise function returns starting position in **x** of the first occurrence of **y**.

2 Answer any **two** parts :

(a) (i) Write an algorithm for evaluating an expression in postfix form. **6+4=10**

(ii) Consider the following infix expression

((a+b) + C ↑ (d+e)+f) ↑ (g+h)

Convert the expression to equivalent prefix expresison and postfix expression.

The operator ↑ is defined as $x \uparrow y = xy$

The operator + is usual addition operator.

(b) (i) State the Towers of Hanoi problem. Write recursive algorithm to solve the problem. **5+5=10**

(ii) Design a method for keeping two stacks within a single linear array so that neither stack overflows until all of the memory is used. Write a **C** function push **(x,s)** that pushes element **x** onto stack **s**, where **s** is one or other of these two stacks. Include all necessary error checks.

(c) (i) How would you implement a circular queue of integers in **C** using array. Write routines to implement the appropriate operations for it. **8+2=10**

(ii) Differentiate between dequeue and priority queue.

3 Answer any **two** parts : **5+5=10**

(a) (i) Let **p** be a pointer to the first mode in a singly linked list and **x** be an arbitrary node in this list. Write an algorithm to delete the node **x** from the list. If **x=p** then **p** should be reset to point to the new first node in the list.

(ii) Write a **C** function to concatenate two circularly linked lists pointed by list **1** and list **2** in such a way that circular list pointed by list **2** is appended to the circular list pointed by list **1.**

(b) How can a polynomial in two variables be represented by a singly linked list? Write an algorithm to add two such polynomials.

(c) (i) Show that the maximum number of nodes in a binary tree of height h is $2^{h+1} - 1$.

(ii) Formulate an algorithm to find the number of leaf nodes in a binary tree. What is the time complexity of your algorithm?

4 Answer any **two** parts. **6+4=10**

(a) (i) Write an algorithm for sorting a set of integers using Quick sort procedure. What is average case time complexity of the procedure?

(ii) Following are the inorder and postorder traversal of a binary tree T.

In order : D K I B A E G H J F C

Post order : K D I E A G B F C J H

construct the tree T.

(b) (i) What is an **AVL** tree? Show at each step the **AVL** tree built from following sequence of instertions. **6+4=10**

8, 15, 1, 19, 16, 4, 25, 12, 23, 20, 17

Start with empty tree. Label the rotations according to type.

(ii) Obtain minimum cost spanning tree for the following graph using Krushal algorithm.

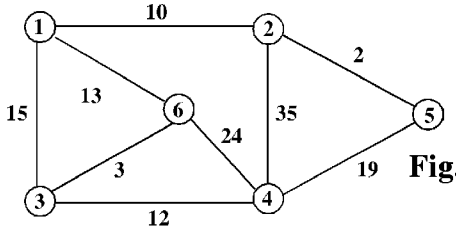

Fig. 1

(c) (i) Write Warshall algorithm to find shortest path between any two vertices of a graph. Explain the algorithm briefly. **5+5=10**

(ii) Write an algorithm to test whether a given graph is connected or not.

5 Answer any **two** parts : **10**

(a) Define **B**-tree

What do you understand by order of a **B**-tree? Consider the following **B**-tree of order **3**.

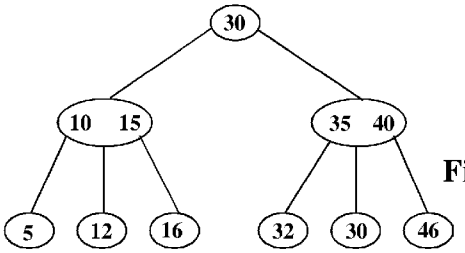

Fig. 2

Show the B-tree after following sequence of operations. Insert **43**, insert **50**, delete **15**

(b) (i) Differentiate between the following : **6+4=10**

(a) **B**-tree and **B**$^+$ tree

(b) Indexing and Hashing

(c) Internal sorting and external sorting.

(ii) Show that all **B**-trees of order **2** are full binary trees.

(c) Define hash function. What do you mean by perfect hash function? Discuss various methods used for resolving hash collisions.