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 5+5=10 it briefly.
(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 4+6=10 Case time complexity of an algorithm.
Explain clearly.
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(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.  
(ii) Consider the following infix expression

\[(a+b) + c \uparrow (d+e)+f \uparrow (g+h)\]

Convert the expression to equivalent prefix expression and postfix expression. The operator \(\uparrow\) 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.
(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.
(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 node 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 insertions.

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.

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

(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.