53 (CS 304) DTST

2016

DATA STRUCTURES

Paper : CS 304

Full Marks : 100

Time : Three hours

***The figures in the margin indicate
full marks for the questions.***

*Answer **any five** questions.*

1. *(a)* Write down the algorithm /pseudocode
for Quick sort. Find its time complexity.
7·5+2·5=10

   (b) Suppose the sequences of nodes are
given for a binary tree in preorder and
inorder respectively.

   Preorder : G, B, Q, A, C, K, F, P, D, E, R, H

   Inorder : Q, B, K, C, F, A, G, P, E, D, H, R

   Draw the diagram of the tree.
10

2. (a) What is a spanning tree ? Convert the given graph with weighted edges to a minimum spanning tree. 2+8=10
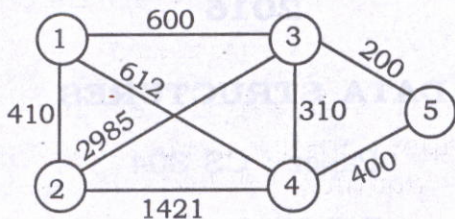

Fig : 1

(b) Write down the algorithm / pseudocode for Binary search technique. Derive its time complexity. 8+2=10

3. (a) Convert the following infix expression into its equivalent prefix and postfix notations :

infix : $(A+B)*(C+D-E)*F$ 5

(b) What is recursion ? Name some problem areas where recursion is a desirable tool for solution. What are the demerits of recursion ? 6

(c) Discuss various asymptotic notations for complexity of algorithms. 9

4. (a) Write algorithm/pseudocode for insert and delete operations for a queue. 8

(b) Write algorithm / C-routines to do the following list of operations for a linked list. $3 \times 4 = 12$

   (i)   Print the sum of integers in all the nodes

   (ii) Insert a new node at the last of the list

   (iii) Free all the nodes of the list.

5. *(a)* Represent the elements of a three dimensional array $B(2, 3, 2)$ in column-major order representation. Give its memory representation also. $4+3=7$

   (b) Define the balance factor of a node in a binary tree. What do you mean by a balanced binary tree. Why is in a height-balanced tree, the height of the tree equal to $0 (log_2 n)$, where n is the total no. of nodes of the tree ? $2+2+2=6$

   (c) Consider the following list of 15 numbers :

   25, 37, 10, 9, 20, 45, 50, 30, 18, 10, 27, 40, 37, 11, 53.

   Construct a binary search tree by inserting the above numbers in order.
                                                       7

6. (a) What is an AVL tree ? How does it differ from a regular binary search tree ? What are the various rotations performed on an AVL tree?   6

(b) Create an AVL tree starting with an initially empty tree with the following elements being inserted in order :

30, 20, 10, 40, 50, 60, 25, 70, 90, 55, 15, 18, 14.   7

(c) Using bubble sort technique, sort the following list :

40, 10, 2, 50, 18, 39   7

7. (a) Find the outputs of depth-first traversal and breadth-first traversal of the following graph taking '0' as the starting point.   6+6=12
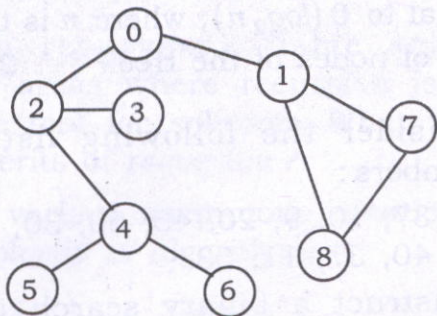

Fig : 1

(b) Write algorithm/pseudocode for PUSH and POP operations of a stack. 8

8. (a) Convert the following infix expression into postfix notation. Evaluate the postfix expression using stack.

2+8=10

$$(6+4) \uparrow 2 - 10 * (2+3)$$

(b) Define the following terms related to a binary tree : 2×5=10

(i) Level

(ii) Height

(iii) Leaf node

(iv) Strictly Binary Tree

(v) Complete Binary Tree.

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