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Paper Code : CS-302

DATA STRUCTURE AND ALGORITHM

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

   i) The postfix equivalent of the prefix * + *ab* – *cd* is

   a) *ab* + *cd* – * b) *abcd* + – *

   c) *ab* + *cd* * – d) *ab* + – *cd* *

   ii) If a binary tree is threaded for inorder traversal a right NULL link of any node it is replaced by the address of its

   a) successor b) predecessor

   c) root d) own.

iii) Adjacency matrix of a digraph is
   a) Identity matrix b) Symmetric matrix
   c) Asymmetric matrix d) None of these.

iv) Linked lists are not suitable for
   a) Stack b) Dequeue
   c) AVL tree d) Binary Search

v) The ratio of items present in a hash table to the total size is called
   a) balance factor b) load factor
   c) item factor d) weight factor.

vi) Maximum possible height of an AVL tree with 7 nodes is
   a) 3 b) 4
   c) 5 d) 6.

vii) The deque can be used
   a) as a stack
   b) as a queue
   c) both as a stack and as a queue
   d) none of these.

viii) Inserting a node after a given node in a doubly linked list requires
   a) four pointer exchanges
   b) two pointer exchanges
   c) one pointer exchange
   d) no pointer exchange.

ix) The minimum height of a binary tree of n nodes is
   a) n b) $n/2$
   c) $n/2 - 2$ d) $\log_2(n+1)$

x) What will be the time complexity for selection sort to sort an array of n elements ?
   a) $O(\log n)$ b) $O(n \log n)$
   c) $O(n)$ d) $O(n^2)$.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Show that the function $f(n)$ defined by

   $f(n) = 1; n = 1$

   $f(n) = f(n-1) + 1/n, n > 1$

   has complexity $O(\ln n)$.

3. a) Does a *B* tree grow at its leave or at its root ? Why ?

   b) In deleting a key from a *B* tree, when it is necessary to combine nodes ?

   c) For what purposes are *B* trees especially appropriate ? $2 + 2 + 1$

4. The post-order and in-order traversal sequences of nodes in a binary tree are given below :

   Postorder : D G E B H I F C A

   inorder : D B G E A C H F I

   Construct the binary tree.

5. Construct one *B*-Tree of order 4 with the following data.

   34, 67, 89, 90, 100, 2, 36, 76, 53, 51, 12, 10, 77, 69.

6. What is the default return type of malloc( ) ? Why do we need to typecast it ? Write an algorithm to append a new node after a specified node in single linked list. $1 + 1 + 3$

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Why circular queue is better than simple queue ?

   b) Evaluate the postfix expression using stack :

   3, 16, 2, +, *, 12, 6, /, –

   c) Convert the infix expression into its equivalent prefix expression using stack :

   $a + b * c + (d * e + f) * g$. $3 + 4 + 8$

8. a) Write a non-recursive algorithm to traverse a binary tree in its inorder traversal.

   b) Write a *C* function to find out the maximum and the minimum elements in a binary search tree.

   c) Given the pre-order sequence and the post-order sequence, why cannot you reconstruct the tree ?

   6 + 6 + 3

9. a) Construct a tree from the given postfix expression

   $a\ b\ c\ *\ +\ d\ e\ *\ f\ +\ g\ *\ +$

   b) Write a *C* function to sort positive integers that does not compose the array elements.

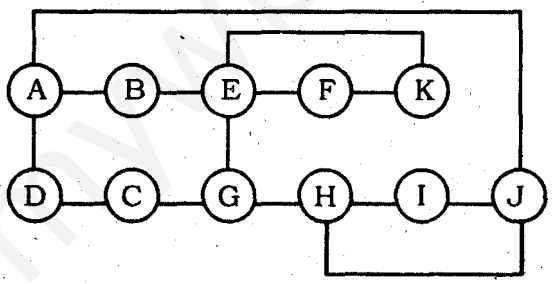
   c) Show how linked list can be used to add the following polynomials :

   $5x^4 + 5x^3 + 10x^2 + 8x + 3$

   $3x^3 + 2x^2 + 7x + 8.$ 4 + 7 + 4

10. a) Describe BFS algorithm.

    b) Find out the DFS traversal of the following graph starting at node A.



    c) Define Prim's algorithm for minimum cost spanning tree with example. 5 + 5 + 5