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Paper Code : EC-504B
DATA STRUCTURE AND C

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) Which of the following shows the correct relationship among some of the more common computing times for algorithm ?

   a) $O(\log n) < O(n) < O(n * \log n) < O(2^n) < O(n^2)$

   b) $O(n) < O(\log n) < O(n * \log n) < O(2^n) < O(n^2)$

   c) $O(n) < O(\log n) < O(n * \log n) < O(n^2) < O(2^n)$

   d) $O(\log n) < O(n) < O(n * \log n) < O(n^2) < O(2^n)$

ii) The postfix equivalent of the prefix $*+ab - cd$ is

   a) $ab + cd -*$ b) $abcd + -*$

   c) $ab + cd *-$ d) $ab + -cd *$

iii) A linear list in which elements can be added or removed at either end but not in the middle is known as

   a) Stack   b) Queue

   c) Dequeue   d) Heap.

iv) A sorting technique that guarantees, that records with the same primary key occur in the same order in the sorted list as in the original unsorted list is said to be

   a) Stable   b) Consistent

   c) External   d) Linear.

v) Which data structure is used for depth first traversal of a graph ?

   a) Array   b) Linked list

   c) Stack   d) Queue.

vi) Maximum number of edges in a n-node undirected graph without self loop is

   a) n^2 b) $n-2$

   c) $n(n-1)/2$ d) $n(n+1)/2$.

vii) 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.

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

   a) successor   b) predecessor

   c) root   d) own.

ix) A dynamic data structure where we can search for desired records in O(log n) time is

   a) heap   b) binary search tree

   c) circularly linked list d) array.

x) The rear and front end of a linear queue is used for

   a) deletion, insertion   b) searching, sorting

   c) insertion, deletion   d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. Define Big O notation. Show that the function $f(n)$ defined by

$$F(1) = 1$$

$$F(n) = F(n-1) + 1/n \text{ for } n > 1$$

has the complexity O (log n).

3. What do you mean by recursion ? Implement tower of Honoi problem using recursion.   1 + 4

4. What are the advantages and disadvantages of linked list over an array ? Also state the advantages of doubly linked list over single linked list.   3 + 2

5. Explain ADT (Abstract Data Type). Create the ADT list to represent integer linked list.

6. How a polynomial such as $6x^6 + 4x^3 - 2x + 10$ can be represented by a linked list and an array ? What are the differences between these two representations ?   3 + 2

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 45

7. a) Write an algorithm to delete a node from any given position from a circular linked list.

   b) Write an algorithm to display any linear linked list in the reverse order.

   c) Write an algorithm to insert a new node into any given location in a linear singly linked list.

                                                5 + 5 + 5

8. a) What are the problems of binary tree ? Explain the improvement of performance by the use of height-balanced tree.   2 + 3

   b) How AVL trees differ from binary search tree ? Insert the following keys in the order given below to build them into an AVL tree :   2 + 3

   8   12   9   11   7   6

   Clearly mention different rotations used and balance factor of each node.

   c) Show the stages in growth of an order-4 B–Tree when the following keys are inserted in the order given :   5

   84 82 29 97 61 10 45 28 49 70 86 68 19 55.

9. a) Convert the following infix expressions into its equivalent postfix expressions :

   A*(B + D)/E–F* (G + H/K)

   b) What is quick sort Write the algorithm for quick sort. Sort the following array using quick sort method : 24 56 47 35 10 90 82 31.   5 + (2 + 3 + 5)

10. a) Given the preorder and inorder sequence and draw the resultant binary tree and write its postorder traversal :

   Pre-order :   A B D E F C G H J L K

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

   b) Write non-recursive algorithm for inorder traversal of a binary tree.

   c) Write an algorithm to search a node in a binary search tree.   (4 + 1) + 5 + 5

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11. Write short notes on any *three* of the following :   3 × 5

    a)   Radix sort

    b)   Hashing and collision in hashing

    c)   Threaded binary tree

    d)   BFS *vs* DFS

    e)   Dynamic Memory Management in C.