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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 any *ten* of the following : $10 \times 1 = 10$

   i) Which of the following is non-linear data structure ?

   a) Stacks b) List

   c) Strings d) Trees.

   ii) Binary search is not possible for

   a) array

   b) linked list

   c) stack

   d) queue.

iii) The prerequisite condition of Binary search is

a) unsorted array

b) ascending order array

c) descending order array

d) sorted array.

iv) Inserting an item into the stack when stack is not full is called ..... operation and deletion of item from the stack, when stack is not empty is called ..... operation.

a) push, pop

b) pop, push

c) insert, delete

d) delete, insert.

v) The number of edges in a full binary tree of height h is

a) $2^{h+1} - 1$

b) $2^h - 1$

c) $2^{h+1} - 2$

d) $2^h - 2$.

vi) Minimum number of nodes required to make a complete binary tree of height h is

a) $2^h - 1$

b) 2^h

c) $2^h + 1$

d) 2^{h-1}.

vii) A linear link list can be traversed using

a) recursion

b) both (a) and (b) are correct

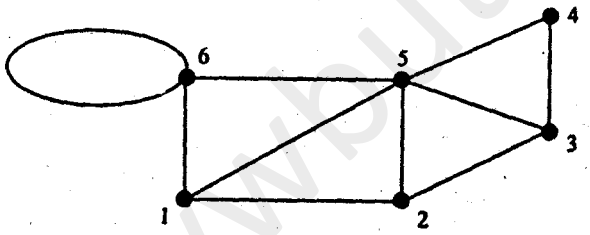
c) stack

d) both (a) and (b) are wrong.

viii) What is the sum of the degrees of all the vertices in the following graph ?

a) 19 b) 20

c) 5 d) None of these



ix) The adjacency matrix of an undirected graph is

a) Unit matrix

b) Asymmetric matrix

c) Symmetric matrix

d) None of these.

x) A path is

a) a closed walk with no vertex repetition

b) an open walk with no vertex repetition

c) an open walk with no edge repetition

d) a closed walk with no edge repetition.

xi) The data structure used to solve recursive problems is

a) Linked list

b) Queue

c) Stack

d) None of these.

xii) Which one is required to reconstruct a binary tree ?

a) Only inorder sequence

b) Both preorder and postorder sequences

c) Both inorder and postorder sequences

d) Only postorder sequence.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. How a polynomial such as $8x^5 + 4x^3 - 9x^2 + 2x - 17$ can be represented using a linked list ? What are the advantages and disadvantages of linked list over an array ? 2 + 3

3. If $T(n) = a_0 + a_1 x + a_2 x^2 + a_3 x^3 + ... + a_n x^n$, then prove $T(n) = \Theta(x^n)$.

4. Why circular queue is used over simple queue ? Write an algorithm to insert an element into circular queue.

2 + 3

5. The inorder and preorder tree traversals are given. Draw the binary tree.

   Inorder : ABCDEFGHI

   Preorder : FBADCEGIH

   Is it possible to build up a unique binary tree when its preorder and postorder traversals are given ? 4 + 1

6. What is Hashing ? Write two hash functions. What is collison ? 1 + 2 + 2

GROUP – C

(Long Answer Type Questions)

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

7. a) Write an algorithm to evaluate a postfix expression.

   b) Convert the infix expression $9 + 5 * 7 - 6 \wedge 2 + 15/3$ into its equivalent postfix expression and evaluate that postfix expression, clearly showing the state of the stack. 4 + (7 + 4)

8. a) Write an algorithm for creating a linked-list with n nodes.

   b) How it can be made a circular linked-list ? Write a function for that purpose. 10 + 5

9. a) How a linked-lists can be used to implement stack ?

   b) Write an algorithm for linear search.

   c) Give an outline of the complexity of your algorithm. 2 + 10 + 3

10. a) What do you mean by external sorting ? How does it differ from internal sorting ?

    b) Write an algorithm for sorting a list numbers in ascending order using bubble sort technique and find its time complexity.

    c) Find the time complexity of merge sort technique using the recurrence relation assuming the size of the list $n = 2^k$. 3 + 7 + 5

11. a) What is hashing ? Describe any three methods of defining a hash function.

    b) Discuss different collision resolution techniques.

(2 + 6) + 7

12. a) What do you mean by a binary search tree ?

    b) Construct a binary search tree by inserting the list of elements one by one :

    13, 10, 3, 5, 18, 15, 14

    c) Write an algorithm for pre-order traversal of a tree represented by a linked-list.

    d) Show that the number of vertices of odd degree in a finite graph is even. 2 + 4 + 5 + 4

13. a) What is an AVL tree ?

    b) Construct an AVL search tree for the data list :

    AND, BEGIN, CASE, DO, END, FOR, GOTO.

    c) For the AVL tree you have constructed delete the following keys in the order :

    DO, FOR, END. 2 + 8 + 5