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Paper Code : CS-302

PUID : 03008 (To be mentioned in the main answer script)

DATA STRUCTURE & 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) The number of swapping needed to sort numbers 8, 22, 7, 9, 31, 19, 5, 13 in ascending order using bubble sort is

      a) 11 b) 12

      c) 13 d) 14.

   ii) Binary search uses

      a) divide and reduce strategy

      b) divide and conquer strategy

      c) heuristic search

      d) both (a) and (b).

iii) The following sequence of operations is performed on a stack : push(1), push(2), pop, push(1), push(2), pop, pop, pop, push(2), pop.

The sequence of popped out values is

a) 2, 2, 1, 1, 2 b) 2, 2, 1, 2, 2

c) 2, 1, 2, 2, 1 d) 2, 1, 2, 2, 2.

iv) The postfix expression for * + a b − c d is

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

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

v) Adjacency matrix for a digraph is

a) unit matrix b) symmetric matrix

c) asymmetric matrix d) none of these.

vi) Which of the following is a hash function ?

a) Quadratic probing b) Chaining

c) Open addressing d) Folding.

vii) Linked list is not suitable data structure for which one of the following problems ?

a) Insertion sort b) Radix sort

c) Binary search d) Polynomial addition.

viii) Number of all possible binary trees with 4 nodes is

a) 13 b) 12

c) 14 d) 15.

ix) If the inorder and preorder traversal of a binary tree are D, B, F, E, G, H, A, C and A, B, D, E, F, G, H respectively then the postorder traversal of that tree is

a) D, F, G, A, B, C, H, E

b) F, H, D, G, E, B, C, A

c) C, G, H, F, E, D, B, A

d) D, F, H, G, E, B, C, A

x) The heap (represented by an array) constructed from the list of numbers 30, 10, 80, 60, 15, 55, 17 is

a) 60, 80, 55, 30, 10, 17, 15

b) 80, 55, 60, 15, 10, 30, 17

c) 80, 60, 30, 17, 55, 15, 10

d) none of these.

xi) In array representation of Binary tree, if the index number of a child node is 6 then the index number of its parent node is

a) 2 b) 3

c) 4 d) 5.

xii) BFS constructs

a) a minimal cost spanning tree of a graph

b) a depth first spanning tree of a graph

c) a breadth first spanning tree of a graph

d) none of these.

GROUP – B
(Short Answer Type Questions)

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

2. Differentiate between Linear and Non-linear data structures. Give two examples of each.

3. Write an algorithm to find the largest and smallest element in a single linear list.

4. a) Suppose one 2-D array is initialized as int a [5] [7]; Base address is 4000. Find the location of element a [2] [4] in row major form and column major form.

b) Define Sparse Matrix. 3 + 2

5. a) Prove that the maximum no. of nodes in a binary tree of depth k is $2^k - 1$.

   b) What are the characteristics of algorithm ? 3 + 2

6. Draw s minimum heap tree from the list below :

   12, 11, 7, 3, 10, – 5, 0, 9, 2

   Now do the heap sort operation over the heap tree.

GROUP – C
(Long Answer Type Questions)

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

7. a) Represent the given polynomial using a link list :

   $3x^4 + x^2 - 5x + 2$. 2

   b) Write the pseudo code / C code for adding two polynomials (already given by user, no need to take input). Also comment on the complexity of your algorithm. 4 + 2

   c) Write the pseudo code or C code to implement Tower of Hanoi problem. Also find the complexity of your procedure. 3 + 4

8. a) Insert the following numbers into a binary search tree in the order that they are given and draw the resulting tree :

   87; 36; 22; 15; 56; 85; 48; 91; 72; 6

   Delete 48 and draw the resulting tree. Delete 15 and draw the resulting tree. 9

   b) Write an algorithm to insert an element into binary search tree. 6

9. a) Define sorting. 2

b) What is a stable sorting ? What is In-place sorting ? 2 + 2

c) Write the pseudo code for Merge sort implementation. What is the time complexity ? 3 + 2

d) If the existing array is sorted and you want to insert a new element in the list without disrupting the sortedness then which sorting technique you should use ? 2

e) What is Hashing ? 2

10. a) Show the stages in growth of an order -4B- Tree when the following keys are inserted in the order given :

84 82 29 97 61 10 45 28 49 70 86 68 19 55 22 11 55 77 16 5

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

8 12 9 11 7 6 66 2 1 44

Clearly mention different rotation used and balance factor of each node. 6

c) Write the Prim's algorithm for finding MST from a graph. 4

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

a) Radix sort

b) Index sequential file organization

c) DFS in graph

d) Interpolation search

e) Threaded binary tree.