

## CS-302

### DATA STRUCTURE & ALGORITHM

Time Allotted: 3 Hours

Full Marks: 70

*The questions are of equal value.*

*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. Answer any *ten* questions.

10×1 = 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) & (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 are

- |               |               |
|---------------|---------------|
| (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 it's 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* questions.

3×5 = 15

2. Differentiate between Linear and Non Linear data structures? Give two examples of each. 5
3. Write an algorithm to find the largest and smallest element in a single linear list. 5
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. 3+2  
(b) Define Sparse Matrix.
5. (a) Prove that the maximum no. of nodes in a binary tree of depth k is  $2^k - 1$ . 3+2  
(b) What are the characteristics of algorithm?
6. Draw a minimum heap tree from the list below: 3+2  
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* questions.

3×15 = 45

7. (a) Represent the given polynomial using a link list. 2  
 $3x^4 + x^2 - 5x + 2$   
(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 Pseudocode 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. 9+6  
87;36;22;15;56;85;48;91;72;6  
Delete 48 and draw the resulting tree. Delete 15 and draw the resulting tree.  
(b) Write an algorithm to insert an element into binary search tree.

9. (a) Define sorting. 2  
(b) What is a stable sorting? What is In-Place sorting? 2+2  
(c) Write the Pseudocode for Merge sort implementation. What is its 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? Why? 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:- 5+6+4  
84 82 29 97 61 10 45 28 49 70 86 68 19 55 22 11 55 77 16  
(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.  
(c) Write the Prim's algorithm for finding MST from a graph.
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.