**B.TECH/ECE/3RD SEM/ECEN 2102/2018**

**DATA STRUCTURE**

**(ECEN 2102)**

**Time Allotted : 3 hrs Full Marks : 70**

***Figures out of the right margin indicate full marks.***

***Candidates are required to answer Group A and***

***any 5 (five) from Group B to E, taking at least one from each group.***

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

**Group – A**

**(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**

 (i) A data structure where elements can be added or removed from either end but not at the middle is

(a) a linked list (b) a stack (c) a queue (d) a deque.

 (ii) If we evaluate the following postfix expression 5 3 + 4 2 / / the result will be

(a) 2 (b) 3 (c) 1 (d) 4.

 (iii) In order to get the information stored in a binary search tree in ascending order of their keys, one should recursively traverse it in the following order.

(a) root, left subtree, right subtree (b) right subtree, root, left subtree

(c) left subtree, right subtree, root (d) left subtree, root, right subtree.

 (iv) The maximum number of nodes in a binary tree of height h is

(a) 2h+1- 1 (b) 2h (c) 2h - 1 (d) none of the above.

 (v) Inserting a node after a given node in a doubly linked list requires

(a) one pointer changes (b) two pointer changes

(c) four pointer changes (d) none.

 (vi) The following sequence of operation 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.

 (vii) Does the array < 10, 7, 4, 3, 6 > represent a max-heap?

(a) Yes (b) No.

 (viii) Any connected graph of x vertices has at least

(a) x-1 edges (b) x+1 edges (c) x/2 edges (d) x edges.

 (ix) Which of the following sorting algorithms is of divide-and-conquer type?

(a) Selection sort (b) Quick sort

(c) Merge sort (d) Both (b) & (c).

 (x) Which of the following data structures is used in DFS Algorithm?

(a) Queue (b) Stack (c) Recursion (d) Linked list.

**Group – B**

2. (a) What do you mean by time complexity and space complexity of an algorithm? What is abstract data type (ADT)? Define Big-O notation. Show that 10n3 + 950n2 - 5000 = O(n3).

 (b) How can we represent sparse matrix efficiently in the memory? Write an algorithm to find the transpose of a sparse matrix, which is represented in memory efficient way as you have suggested.

**2 + 2 + 2 + 2 + 4 = 12**

3. (a) Given an array A of characters of dimension m x n with base memory address of M, the address of the element A[i,j] in the column major representation is (i) M+(j\*n)+ m (ii) M+ (j-1)\*m +i -1 (iii) M\* n + (j-1)\*m (iv) M +(i-1)\*n + j-1.

 (b) Explain how linked lists may be used for polynomial addition.

 (c) Given a circular linked list, write an algorithm to print out all the contents of the list.

**2 + 5 + 5 = 12**

**Group – C**

4. (a) Write two uses of stack data structure.

 (b) Write an algorithm to convert an infix expression into an equivalent postfix expression.

 (c) Convert the following infix expression into equivalent postfix expression using stack; write all the steps of your conversion.

A – (B / C + (D % E \* F) / G) \*H.

**2 + 5 + 5 = 12**

5. (a) What is input restricted de-queue?

 (b) Given a queue with array implementation, write an algorithm for deleting an element from the queue. The algorithm should check for empty condition as well.

 (c) Write the difference between iteration and recursion. Write two different functions to calculate factorial of a number using recursion and tail recursion.

**2 + 5 + 5 = 12**

**Group – D**

6. (a) Define binary tree and complete binary tree.

 (b) Consider that the pre-order and in-order traversals of binary tree T yield the following sequence of nodes:

 Pre-order: A B D E G H C F I

 In-order: D B G E H A C I F

 Construct the binary tree T.

 (c) Write an algorithm to insert a new node in binary search tree (BST).

 Create a BST using following data elements:

 46,39,55,15,35,77,30,10,90,52,68,82.

**(1.5 × 2) + 4 + (3 + 2) = 12**

7. (a) Write the matrix representation and the adjacent list representation of the following graph.



 (b) For the above graph find out the sequence of nodes obtained by depth-first and breadth-first traversal.

**(3 + 3) + (3 + 3) = 12**

**Group – E**

8. (a) Write the preudo code of the algorithm for quick sort.

 (b) Sort the array given below using quick sort showing the value of the array elements in each pass:

 39 9 81 45 90 27 72 18

 (c) Show that the worst case running time of quick sort algorithm is O(n2).

**5 + 5 + 2 = 12**

9. (a) Choose one of the following along with proper justification. The worst case time complexity of searching an element in a sorted array with n elements using binary search is

(i) O(log n) (ii) O(n) (iii) O(n log n) (iv) $O\left(\sqrt{n}\right)$

 (b) Build a max heap for the following set of data:

 45, 36, 54, 27, 63, 72, 61 and 18.

 (c) Explain linear probing, quadratic probing and double hashing with suitable examples.

**3 + 3 + 6 = 12**