

# Nirma University

Institute of Technology

Semester End Examination (IR), December - 2019  
B. Tech. in Computer Science and Engineering, Semester - III  
2CS301 – DATA STRUCTURES AND ALGORITHMS

Roll /  
Exam No.

Supervisor's initial  
with date

Time: 3 Hours

Max. Marks: 100

Instructions:

1. Attempt all questions.
2. Figures to right indicate full marks.
3. Use section-wise separate answer book.
4. Make suitable assumption wherever necessary, and specify it correctly.

## SECTION-I

**Q-1. Answer the following. [18]**

- (a) Write a recursive function to count the digits of a given number. [04]  
CO1, L3
- (b) Show the arrangements of the following elements after first pass of quick sort. Pivot element is the last element. [04]  
CO2, L3  
34, 67, 12, 78, 67, 89, 60, 23, 90, 39, 57
- (c) If each element of a matrix A is store in a row major order which requires two bytes of computer memory. If A is declared as A[-6:13, -2:15, 3:15, 7:20], with initial address 2000 then what is the location of A[12][7][9][16]. [04]  
CO1, L4
- (d) Convert the following infix expression into postfix expression. [06]  
CO3, L4  
Show the stack representation after each step.  
 $((A+B)/(C*D^{(E*F*G)}-(H-I))*J$

**Q-2. Answer the following. [16]**

- (a) Insert following data into binary search tree. [06]  
CO3, L3  
25, 22, 18, 15, 35, 31, 50, 44, 10, 12, 4, 70, 90, 65  
Give pre-order, in-order and post-order traversal of the resultant tree. Show the representation of the tree after deleting 44.

## OR

- (a) Write an algorithm to insert an element in deque which allows insertion from both the sides of queue. [06]  
CO3, L6
- (b) Write an algorithm to search no of occurrences of an element in the singly linked list. [06]  
CO1, L6
- (c) What is the maximum number of nodes in a binary tree of height h? What is the minimum height of a binary tree having 35 nodes? [04]  
CO3, L1

**Q.3 Answer the following.****[16]**

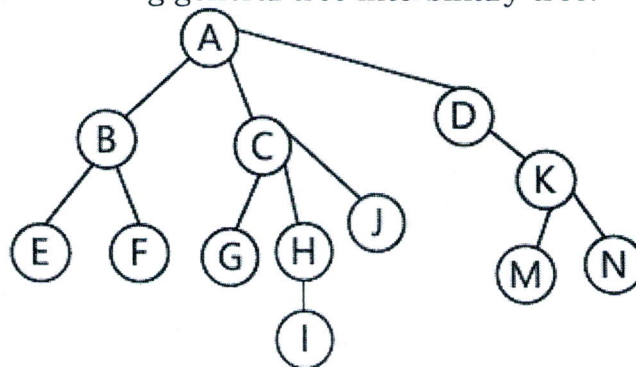
- (a) Design an iterative algorithm to find preorder traversal of a [06]  
CO1, L6 binary search tree.

**OR**

- (a) Write a recursive algorithm to solve tower of Hanoi problem. [06]  
CO1, L6 Show the stack trace and solve the problem for three disks.  
(b) Write an algorithm to merge two sorted linked list into third [06]  
CO3, L6 linked list using merge sort.  
(c) A circular queue is implement on the array of 4 elements. Show [04]  
CO3, L5 the positions of front and rear pointers after each of the following  
operations.  
Insert(5), Delete(), Insert(2), Insert(3), Insert(7), Insert(8), Delete(),  
Insert(12),

**SECTION-II****Q.4. Answer the following.****[18]**

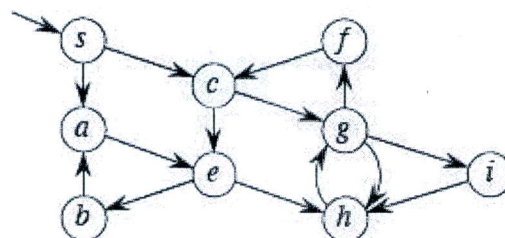
- (a) Show the priority queue elements created by max-heap on the [04]  
CO3, L3 following data.  
A = [66,45,23,12,8,7,67,17,83,32]  
(b) Write an algorithm to find the height of the given node in a [04]  
CO3, L6 binary tree.  
(c) Convert the following general tree into binary tree. [04]  
CO1, L2



- (d) Write an algorithm to delete an element from a given location of [06]  
CO1, L6 the doubly linked list.

**Q-5. Answer the following.****[16]**

- (a) Use Depth First traversal and Breath First traversal and show [04]  
CO1, L3 the sequence of traversal for the below given graph starting from  
node 's'.

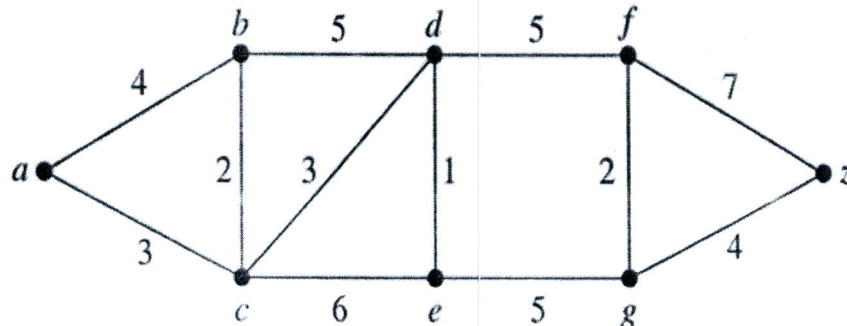


- (b) Illustrate an algorithm for ternary search to search an element [06]

CO2, L1 from the list of  $n$  elements. Explain the worst case time complexity of ternary search.

**OR**

(b) Solve the shortest path problem using Dijkstra's algorithm for [06]  
CO3, L3 the below graph from node 'a' to node 'z'.



(c) Insert following elements into B-tree of order 3. Show the tree [06]  
CO2, L4 after every insertion. Show the tree after deletion of the element 40.

30 50 25 70 40 12 34 19 56 78 89 92 53 19 66

**Q-6. Answer the following.**

**[16]**

(a) Design the AVL tree from the following data. Insert the data in [06]  
CO3, L6 sequence in the tree. Clearly show all the rotation used at the time of insertion.

56 9 2 16 78 32 25 72 85 42 93

(b) Define collision problem in hashing? Find number of collisions [06]  
CO1, L1,3 if 89, 18, 49, 58, and 69 items are to be inserted into the memory table consisting of 10 buckets. The hash function used is

$$H_{ii}(x) = \{ H(x) + F(i) \} \bmod 10, \text{ where}$$

$$H(x) = x \bmod 10 \text{ and } F(i) = i * (7 - (x \bmod 7))$$

**OR**

(b) Identify all the sorting techniques which require other sorting [06]  
CO2, L1 technique to complete the process. Explain any one of those with suitable example.

(c) Define following terms with proper example. [04]

- CO1, L1
- 1) Directed Graph
  - 2) Height balanced tree

\*\*\*\*\*