Subject: - **Data Structure (01CE0301)**   **Date:- 12/10/2019**

Total Marks:-100   **Time: - 03:00 hours**

Instructions:
1. **All Questions are Compulsory.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Question: 1.

(a)   Objective Questions (MCQ)   [10]

(1) Which of the following data structures may give overflow error, even though the current n elements in it is less than its size?
(A) Stack   (B) Simple Queue   (C) Circular queue   (D) none of these

(2) If the address of $A(1,1)$ and $A(2,1)$ are 1000 and 1010 respectively and each element occupies 2 bytes, the array has been stored in
(A) row major   (B) column major   (C) compiler dependent (D) none of these

(3) Which of the following is essential for converting an infix expression to the postfix form efficiently
(A) an operand stack   (C) an operator stack
(B) an operand stack and an operator stack   (D) a parse tree

(4) The following sequence of operations is performed on a stack
        Push(10), Push(20), Pop, Push(10), Push(20), Pop, Pop, Pop, Push(20), Pop
The sequence of values popped out is
(A) 20, 10, 20, 10, 20   (C) 20, 20, 10, 20, 10
(B) 20, 20, 10, 10, 20   (D) 10, 20, 20, 10, 20

(5) What can be said about the array representation of a circular queue when it contains only one element?
(A) Front = Rear = NULL   (C) Front = Rear + 1
(B) Front = Rear – 1   (D) Front = Rear

(6) Which type of linked list contains a pointer to the next as well as previous node in the sequence?
(A) Singly Linked List   (C) Circular Singly Linked List
(B) Doubly Linked List   (D) All of these

(7) A full binary tree with n leaves contains
(A) n nodes   (B) $\log_2 n$ nodes   (C) $(2*n – 1)$ nodes   (D) 2^n nodes

(8) A binary tree cannot have odd number of nodes.
(A) True   (B) False

(9) Total degree of isolated node in Graph is
(A) 0   (B) 1   (C) 2   (D) more than 2

(10)   The goal of Hashing is to produce a search that takes
(A) O(n) time   (C) O(1) time
(B) O(log n) time   (D) O(n log n) time

(b)   Short Questions.   [10]
   (1) Define Stack.
   (2) Evaluate the following postfix expression: 4, 5, 2, -, *, 2, 1, *, -.
   (3) Write C structure of Singly Linked List.
   (4) Define Multigraph.
   (5) Define AVL Tree.
   (6) Define Strictly Binary Tree.
   (7) Define Null Graph.
   (8) How many times swapping is required to sort 5, 6, 1, 2, 4 in ascending order using Bubble sort?
   (9) Define Hashing.
   (10) In which type of tree, each leaf node is kept at the same distance from the root?

Question: 2.

(a)   Write an algorithm for Stack operations PUSH, POP, PEEP, and CHANGE.   [08]

(b)   Construct the AVL tree for the following data:
       50, 20, 35, 40, 70, 60, 55, 37, 45, 36, 38. (Show all the steps)   [08]

OR

(b)   Construct the B-Tree of order 5 by inserting the following data values:
       D, H, K, Z, B, P, Q, E, A, S, W, T, C, L, N, Y, M. (Show all the steps) [08]

Question: 3.

(a) Write an algorithm to implement insert and delete operations into a Circular Queue using array representation of Circular Queue.   [08]

(b) What is Data Structure? Differentiate Linear and Non-Linear Data Structure. [04]

(c) Given a 2-D Array A[6][8] stored in Row Major order with base address 1000 and size of each element is 4 Bytes. Find the address of the element A(4,6).   [04]

OR

(a) Write an algorithm to implement insert and delete operations into a Queue. Explain Double Ended Queue.   [08]

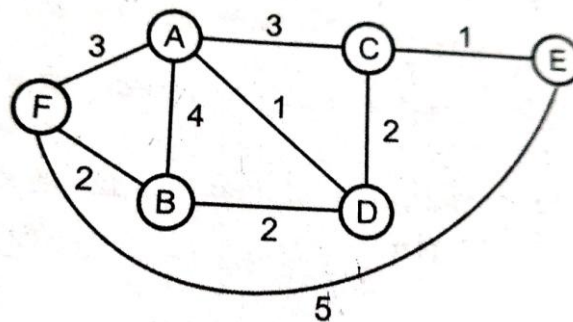(b) Draw a minimum cost spanning tree using Kruskal's algorithm for a graph Fig.1 and also find its minimum cost.   [04]

Fig 1

(c) Differentiate Array and Linked List.   [04]

Question: 4.

   (a) Convert following Infix expression to Postfix expression using stack: [08]
     (i) A + B – C * D * E ^ F % G
     (ii) A + (B * C - (D / E ^ F) * G)

   (b) Write applications of the Stack.   [04]

   (c) Write an algorithm or code to insert a new node at Beginning in Singly Circular Linked List: [04]

<p align="center">**OR**</p>

   (a) Write an algorithm or code to implement following operations in Doubly Linked List: [08]
     (i) Insert a new node at end
     (ii) Delete a node from a specified position

   (b) Define Recursion. Give a recursive solution for the problem of "Tower of Hanoi".   [04]

   (c) Write an algorithm or code to find out Largest element from Singly Linked List.   [04]

Question: 5.

   (a) Write an algorithm for Breadth First Search. Write application of BFS. Also Find BFS sequence for given graph in Fig. 2. (Starting node is A)   [08]
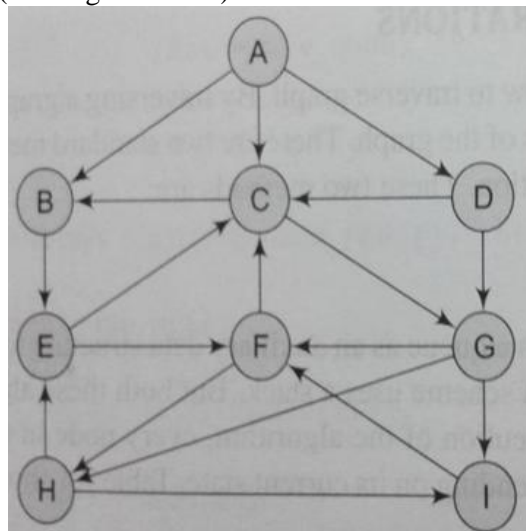

Fig. 2

   (b) Construct a binary tree from the given traversals: [04]
     Inorder: Q, B, K, C, F, A, G, P, E, D, H, R
     Preorder: G, B, Q, A, C, K, F, P, D, E, R, H

   (c) Write an algorithm or code for preorder traversal of a binary tree.   [04]

<p align="center">**OR**</p>

   (a) What is graph? How it can be represented using adjacency matrix, what is path matrix? Find DFS sequence for given graph in Fig. 2. (Starting node is H)   [08]

   (b) Construct the binary search tree for following data: [04]
     50, 33, 44, 77, 35, 60, 40. Find its inorder, preorder and postorder traversals.

   (c) Explain Threaded Binary tree with example.   [04]

Question: 6.

    (a) Explain various Hashing functions with examples.   [08]

    (b) Apply Quick sort algorithm to sort the following data. Justify the steps.   [04]
        42, 29, 74, 11, 65, 58

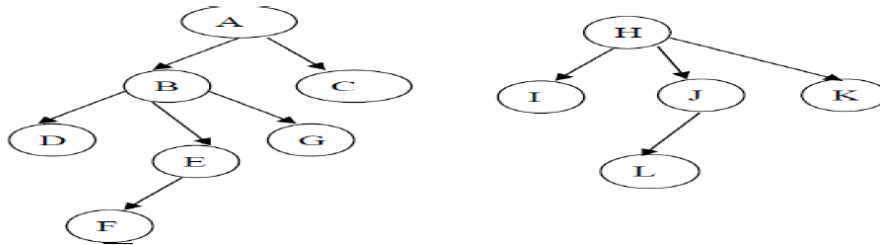   (c) Trace procedure to convert following forest into binary tree.   [04]

Fig. 3

OR

    (a) Explain various collision resolution techniques in hashing.   [08]

    (b) Explain Binary Search with example.   [04]

    (c) Sort the following lists in ascending order using selection sort: (Show all passes)   [04]
        56, 57, 92, 38, 44, 90, 61, 73.

---Best of Luck---