

Semester III (B.Tech)

Er. No.....
Academic Year: 2021-22**Jaypee University of Engineering & Technology, Guna****T-3 (Odd Semester 2021)****18B11CI311- DATA STRUCTURES**

Maximum Duration: 2 Hours

Maximum Marks: 35

Notes:

1. This question paper has **seven** questions.
2. Write relevant answers only.
3. Do not write anything on question paper (Except your Er. No.).
4. Write all of the parts of each question in a serial order.

Q1. (a) Write an efficient algorithm to check whether the given singly linked list is either NULL-terminated or ends in a cycle. Assume you are given a START pointer only. Analyze the time complexity of your algorithm. [03]

(b) The seven elements A, B, C, D, E, F and G are pushed onto a stack in reverse order, i.e., starting from G. The stack is popped five times and each element is inserted into a queue. Two elements are deleted from the queue and pushed back onto the stack. Now, one element is popped from the stack. Show the content left in the stack. [02]

Q2. Assume you have to implement a data structure MyQUEUE using a singly linked list with only START pointer. This data structure supports two operations, JoinQueue, LeaveQueue. Implement these operations as follows: [05]

JoinQueue (START, key): insertion of a new node with value key at the end of the linked list.

LeaveQueue(START, key): deletion of the node with value key from the linked list by searching the value in the linked list. Analyze the time complexity of JoinQueue and LeaveQueue operations.

Q3. (a) Convert following infix expression into prefix expression using stack: $((a-b)*(c-d))/((e+f)-g-h)$ [03]

(b) Evaluate following expression using the stack. All the operands are in single digits (show all the steps): $++-2\ 3\ 1\ *4\ 3$ [02]

Q4. (a) Construct Binary Search Tree (BST) from a preorder sequence 10, 5, 3, 2, 15, 12, 20. Show all the steps. Find the postorder sequence of the obtained tree. [03]

- (b) With the help of an example, explain how to find a node with maximum value in Binary Search Tree (BST). Assume BST is represented using a linked list. Also, write an algorithm to find the maximum element in the given BST. [02]

Q5. (a) Explain the procedure to delete a vertex from a graph represented using adjacency list. [03]

(b) Write the pros and cons of adjacency list over adjacency matrix representation of a graph. [02]

Q6. Write Depth First Search (DFS) algorithm. Also, discuss the time complexity of DFS algorithm. Perform DFS on the graph given in Figure 1 by considering vertex 'S' as a starting vertex. Show all the steps. Draw the DFS tree. [05]

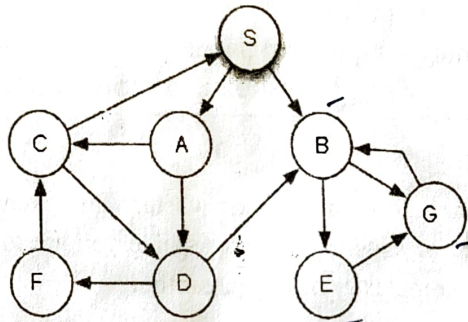


Figure 1

Q7. Write short notes on the following: [05]

- (a) Online sorting
- (b) Sparse matrix
- (c) Circular queue
- (d) Complete binary tree
- (e) Strongly connected graph