

- b. Consider the QuickSort algorithm with the last element chosen as the pivot. If the goal is to sort the given array $A=[30, 40, 50, 60, 70, 80]$ in ascending order, how many swaps will occur during the execution of the algorithm? (18)
4. a. Implement a singly linked list.
b. Describe the Double Linked List. Write a C function to reverse a doubly linked list. (18)
5. a. Given a binary tree, write an algorithm to find the maximum depth of the tree. The maximum depth or height of the tree is the number of edges in the tree from the root to the deepest node.
b. What is a complete binary tree? (18)
6. a. Illustrate the adjacency matrix and adjacency list representations of the graph G shown in the following figure.

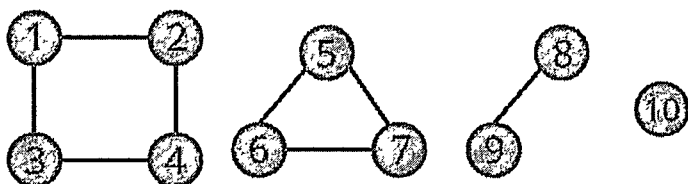


Figure. Graph G

- b. What are the contents of the stack and the visited array when performing depth first search (DFS) on the above graph G starting from source vertex (18)

(400)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 8599

J

Unique Paper Code : 2932811202

Name of the Paper : Data Structures

Name of the Course : B.Tech (CSE/ ECE/ EE)

Semester : II

Duration : 3 Hours

Maximum Marks :90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
 2. Question 1 is compulsory.
 3. Attempt any four questions out of the remaining five questions.
 4. All questions carry equal marks. If a question is divided into multiple parts, then all parts carry equal marks.
- 1 a. Which of the following statements are TRUE/ FALSE?

P.T.O.

1. A sparse matrix is a matrix where most elements are zero.
 2. An array must always have contiguous memory allocation.
 3. Addition of two sparse matrices always results in a sparse matrix.
 4. Stack follows FIFO (First In First Out) order.
 5. In a circular queue, the rear pointer wraps around to the front when it reaches the end of the array.
 6. Merge Sort algorithm is always faster than quicksort algorithm.
- b. Design a data structure in C that implements the behavior of a stack. Your implementation should include functions to:
- Initialize the stack
 - Push an element onto the stack
 - Pop an element from the stack % Peek at the top element
 - Check if the stack is empty or full
- c. What is the time complexity of quicksort in best, worst and average cases. (18)
2. a. The following sequence of arrays shows how an array gradually becomes sorted. A few intermediate steps of the sorting process are

shown.

Original Array: 7, 0, 2, 4, 5, 3, 9, 1
 0, 7, 2, 4, 5, 3, 9, 1
 0, 2, 4, 7, 3, 5, 9, 1

Final Array: 0, 1, 2, 3, 4, 5, 7, 9

Which sorting algorithm could produce this sequence?

- b. Consider the unsorted array A = [56, 73, 58, 23, 13, 5, 1]. You have to apply merge sort on this array.
- i. Provide the C-Like Pseudocode for the mergesort algorithm
 - ii. Show the merging process step-by-step, including intermediate arrays until the final sorted array. (18)
3. a. You are given two queues PrimaryQueue, which initially contain N elements and HelperQueue, which is initially empty. You are only allowed to perform the following operations:
- enqueue(queue, element)
 - dequeue(queue)
- Describe the sequence of operations required to move all elements from PrimaryQueue to HelperQueue such that the final order of elements in HelperQueue is the reverse of the original order in PrimaryQueue. Explain your algorithm or steps using only the allowed operations.