

2663

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- (c) Write a program to implement a Stack using a Linked List. Write the code for push and pop operations. (5)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2663

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Unique Paper Code : 2342571201

Name of the Paper : Data Structures

Name of the Course : **B.A. (P) With CS as Minor/
Non-Major, B.Sc. (Phy. Sc.)/
SOL**

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. **Section A** is compulsory.
3. Attempt any **four** questions from **Section B**.
4. Parts of a question must be answered together.

Section A

1. (a) Find the Asymptotic notation (Big O) for the following nested loop: (2)

```
for (int i = 0; i < m; i++) {
    for (int j = 0; j < n; j++) {
        int a=5;
    }
}
```

- (b) Write any two real-life applications of queues. (2)
- (c) Is an array that is in sorted order a Min-Heap? Explain using a suitable example. (3)
- (d) What is the role of Stack in the implementation of recursion with the help of a suitable example? (3)

- (c) Show that : (5)

$7n^3+10n+50=O(n^3)$ and find the value of c and n_0 .

7. (a) Given the following Binary Search Tree: (5)

50, 30, 70, 20, 40, 60

Perform the following deletion operations :

(i) Node with one child (70)

(ii) Node with two children (50)

Explain each case with the help of diagrams.

- (b) Explain the time complexity of the following basic operations in an array : (5)
- (i) Access
 - (ii) Search
 - (iii) Insertion
 - (iv) Deletion

List one advantage and one disadvantage of using arrays.

5. (a) Insert the following elements in an AVL tree:

10, 20, 30, 25

Show step-by-step insertion and imbalance, and also perform the required rotation. (5)

- (b) What is a Deque? Write a code snippet to delete an element from the front and rear of the Deque. (5)

- (c) Write short notes on : (5)

(i) Binary Tree

(ii) Big(O)

6. (a) Define a Doubly Linked List. Explain its structure with a neat diagram. Also mention two advantages and disadvantages. (5)

- (b) Perform the following stack operations (size = 5):

push(10), push(20), pop(), push(5), push(15), push(25), pop(), push(30)

Show the stack contents after each operation. (5)

- (e) Differentiate between Linear and Non-Linear data structures. (3)

- (f) Draw a Binary Search Tree using the following key values : (3)

18, 9, 24, 23, 16, 17.

- (g) Given the values of a=3, b=2, c=4, d=2; evaluate the following given postfix expression :

$a \ b \ * \ c \ d \ / \ + \ a \ d \ ^ \ -$

Show the stack representation for the calculations. (4)

- (h) Write a C++ program to insert an element at the front of a Singly Linked List. (5)

- (i) Perform Insertion sort on the array [8, 2, 1, 9, 3], and show the steps after each iteration. Also, report the number of comparisons. (5)

Section B

2. (a) Write a program for generating first 10 Fibonacci numbers using a recursive function. (5)

- (b) Write a program to implement a queue using arrays. Write code for insert and delete operations. (5)

- (c) Solve the following recurrence relation using Master's Theorem: (5)

$$T(n) = 3T(n/2) + n$$

3. (a) A binary tree T has 9 nodes. The Inorder and Postorder traversals yield the following: (5)

Inorder : E A C K F H D B G

Postorder : E C K A H B G D F

Draw the Binary Tree and write the Preorder Traversal.

- (b) Write a code snippet to delete a node from a Circular Linked List. Explain the steps using a suitable example. (5)

- (c) What is an AVL tree? Why is the AVL tree called a self-balancing tree? Explain LL rotation used for balancing. (5)

4. (a) Construct a max heap using the following array:

[5, 3, 17, 10, 84, 19, 6, 22, 9]

- (i) Build a heap using the bottom-up method

- (ii) Delete root and reheapify Show all the steps. (5)

- (b) Determine the number of nodes in a full Binary Tree of height 4. Calculate the number of leaf nodes. (5)

- (c) Define Binary Recursion. Explain with the help of an example and report the number of recursive calls made. (5)