

1411

8

(c) Explain any two Abstract Data Types. (4)

(1000)

[This question paper contains 8 printed pages.]

1 AUG 2023

Your Roll No.....

Sr. No. of Question Paper : 1411

Unique Paper Code : 2342571201

Name of the Paper : Data Structures

Name of the Course : B.Sc. (Programme) and B.A.  
(Programme)

Year of Admission : 2019 & onwards

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 the question must be answered together.

P.T.O.



## SECTION A

1. (a) How a binary heap is different from a binary search tree. Explain with a suitable example. (4)
- (b) What is the difference between Big-O and Big-Theta notation? Explain. (4)
- (c) When do we use Stack Data structure? Write a program in C++ for 'push' operation in array implementation of stack. Also discuss the stack overflow condition. (4)
- (d) Write a program in C++ to compute the sum of first  $n$  natural numbers using recursion. (4)
- (e) Create a binary search tree using the following key values;
- 12, 8, 23, 9, 14, 15 (4)

- (c) Write a program in C++ to search for an element in a doubly linked list and delete it if found. (4)
6. (a) Explain how Master's theorem can be used for solving recurrences giving suitable example. (6)
- (b) Compare and contrast priority queue and dequeue. Also, give one real-life application of priority queue. (5)
- (c) Write a program in C++ to reverse a given array using recursion. (4)
7. (a) What is a circular linked list? How a circular linked list is different from a doubly linked list. Discuss different operations performed on a circular linked list. (6)
- (b) Perform the insertion sort on the array {7,1,10,6,3}, show the steps after each iteration. Also, report the number of comparisons. (5)

(b) Write a program in C++ for computing Fibonacci numbers via Binary Recursion. (5)

(c) Illustrate the operation of counting-sort on the array  $A = \{5, 0, 2, 0, 1, 3, 4, 5, 1, 3, 3\}$  (4)

5. (a) Consider the functions given below, sort the functions in increasing order of asymptotic (big-O) complexity : (6)

$$f_1(n) = n^{0.999999} \log n$$

$$f_2(n) = 10000000 n$$

$$f_3(n) = 1.000001^n$$

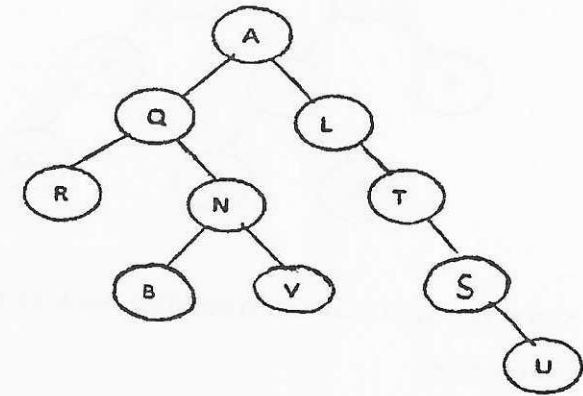
$$f_4(n) = 2^{1000000n}$$

$$f_5(n) = n\sqrt{n}$$

$$f_6(n) = n(n-1)/2$$

(b) Write a program in C++ for performing an enqueue operation for an array-based queue implementation. (5)

(f) Give the Breadth-First Traversal of the binary tree given below : (4)

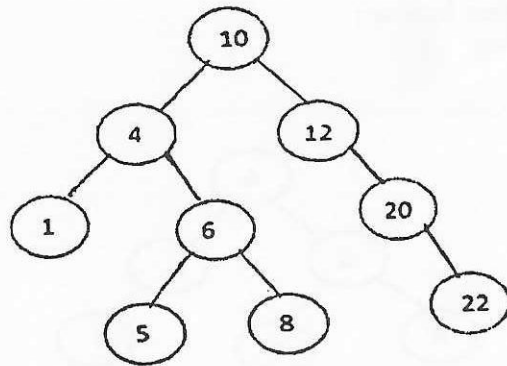


(g) What are height-balanced trees? Explain with the help of a suitable example. (3)

(h) Discuss the role of stacks in the implementation of recursion with the help of a suitable example. (3)

### SECTION B

2. Consider the following Binary Search Tree. (15)



Show the status of the tree after each of the following operations :

- Draw the tree after insertion of node with value 11.
- Delete node with value 10 from the resultant tree.
- Write the pr-order traversal of the resultant tree.
- Is the resultant tree a height-balanced tree? Give justification for your answer.
- Finally, delete the node with value 4 from the resultant tree.

3. (a) Write a program in C++ to compute the factorial of a number with and without using recursion. (6)

- (b) Solve the recurrence  $T(n) = 3T\left(\frac{n}{4}\right) + cn^2$  using Recursion-tree method. (5)

- (c) Write a program in C++ to insert an element at the front of a singly linked list. (4)

4. (a) Consider the following sequence of operations performed on an initially empty Deque :

InsertFront(10),

InsertFront(5),

EraseFront(),

InsertBack(7),

Front(),

EraseBack()

Show the contents of the deque and output after each operation. (6)