

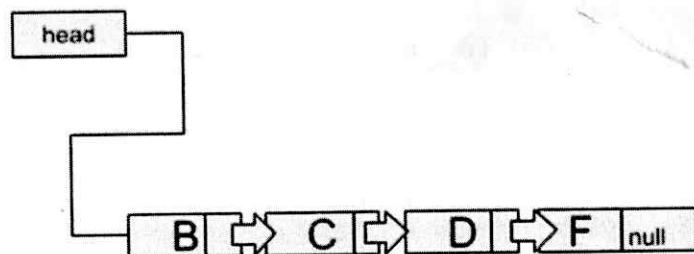
(i) $f(n) = 5n^3 + 4n^2 + 3n + 1.$

(ii) $f(n) = 3n^3 + 4\log n + 5$

- (b) What is a recurrence relation? Use recurrence tree method to solve the following recurrence relation : (5)

$$T(n) = 3T(n/4) + cn^2$$

- (c) Write C++ code segment for inserting a node containing value E at the beginning in linked-list: (5)



[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5667

H

Unique Paper Code : 2342571201

Name of the Paper : Data Structures

Name of the Course : B.A. (P)

Year of Admission : 2022 & onwards

Semester : II

Duration : 3 Hours

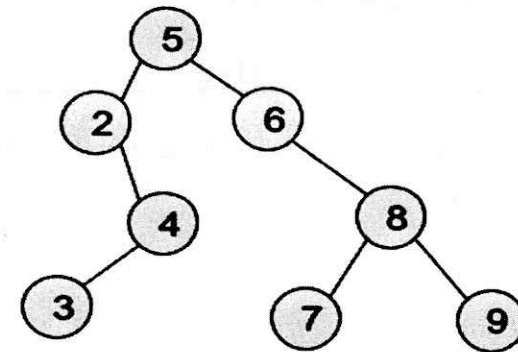
Maximum Marks : 90

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 a question must be answered together.

SECTION A

1. (a) What is abstract data type(ADT)? Give two example of ADTs. (3)
- (b) Draw a circular linked list of four nodes. Write the two advantages of circular linked list. (3)
- (c) Arrange the following time complexities in ascending order (3)
 - (i) $O(n \log n)$
 - (ii) $O(n^3)$
 - (iii) $O(1)$
 - (iv) $O(\log n)$
 - (v) $O(2^n)$
 - (vi) $O(n^2)$
- (d) Write three advantages of using a linked list over an array? (3)
- (e) What is a deque? Name the types of deque. (3)
- (f) Write a C++ code for the enqueue operation performed on a queue? (3)



- (i) What is the height of the tree? (consider the root node at level 1).
 - (ii) Is tree a Binary search tree? if yes insert a node "11" in the tree.
 - (iii) Traverse the tree using BFS.
- (c) What is a tree? Draw the following trees (5)
- (i) Full binary tree having seven nodes.
 - (ii) A binary tree having four nodes including two leaf nodes.
 - (iii) Complete binary tree having five nodes.
7. (a) The complexity of the following functions is $O(n^3)$, Find the values of constants c and n_0 . (5)

(iii) Insert E,F

(iv) Delete C,D,E

- (c) Draw a binary tree whose in-order and pre-order traversals are given below: (5)

In-order : D B E A G C H

Pre-order : A B D E C G H

What is the height of the tree? Write the post-order traversal of the tree.

5. (a) Apply insertion sort on the following data and show the contents of the array after every pass :

23, 12, 45, 36, 5, 15, 39, 2, 19. (5)

- (b) What is linear recursion and binary recursion? Give one example of each. (5)

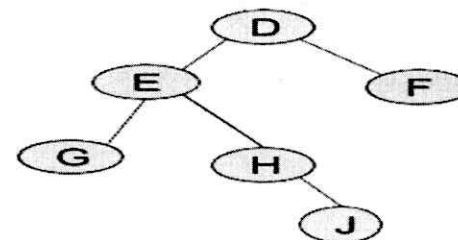
- (c) Draw a min heap using the following data and show the heap after each step

11, 2, 15, 3, 1, 6, 10, 8. (5)

6. (a) Write a C++ code to reverse the elements of an array using recursion. (5)

- (b) Consider the following tree : (5)

(g)



(3)

List the following nodes of the Tree :

(i) Root node

(ii) Leaf nodes

(iii) Siblings of node H

- (h) What is a min-heap? List any two properties of a min heap. (3)

- (i) Write codes in C++ to check for the following conditions in a queue: (3)

(i) Empty queue

(ii) Full queue

- (j) Fill in the blanks in following C++ code for finding the factorial of a number n using recursion. (3)

```

int factorial (_____)
{
    if ( _____ || n == 1)
    {
        return 1;
    }
    return _____;
}

```

SECTION B

2. (a) Construct a binary search tree using the following values : (5)

75, 70, 44, 48, 98, 108, 91, 145.

- (b) Traverse the binary search tree created in Q2a in the following order : (5)

(i) Preorder

(ii) Postorder

- (c) What will be the output after performing the following operations on an empty stack of size 4. Show the contents of the stack after each operation : (5)

```

Push(9)
Pop()
Pop()
isemptystack()
Push(2)

```

3. (a) Write three advantages and disadvantages of a doubly linked list over a singly linked list. (5)

- (b) Write C++ code to declare a singly linked list. Write a function to insert a node at the end of a singly linked list. (5)

- (c) What are the properties of stack data structure? List four applications of a stack. (5)

4. (a) Write C++ code to define a class queue for implementing queue using arrays. Define functions for insertion and deletion from the queue. (5)

- (b) Consider an empty circular queue of size 4. Show the status of the circular queue and the 5 value of the variables front and rear after each of the following operations:

(i) Insert A,B,C,D

(ii) Delete A