

Theory Final Exam

Marks

1. Write the time complexity of the following code segments with proper explanation.

10

```
void fun(int l,int r)
{
    int mid = (l+r)/2;
    for(int i = l ; i <= r ; i++)
    {
        cout<<i<<endl;
    }
    if(l<r){
        fun(l,mid);
        fun(mid+1,r);
    }
}
```

```
int main()
{
    int n;
    cin>>n;
    fun(0,n-1);
}
```

```
for(int i = 1 ; i <= n/2 ; i++)
{
    for(int j = 1 ; j <= n ; j = j + i)
    {
        cout<<i<<" "<<j<<endl;
    }
}
```

2. Suppose you are implementing a linked-list where you want to maintain a floating point number and a character in each node. Each node will contain a next pointer and also a next_to_next pointer that will keep track of the node that is next to the next node. What will the node class look like?

10

```
class Node{
    // write your variables
};
```

3. Write the main difference between linear and non-linear data structures. Compare between Stack, Queue and Deque. Are stack, queue, deque linear or non-linear data structure? What about a tree? **10**

4. Between singly linked list and doubly linked list which is better for implementing Stack and Queue? What about Deque? **10**

5. Convert the infix expression to postfix expression using a stack. You need to show all the steps. **10**

$$a*b+c*d+e$$

6. Compare the memory usage of Array, Singly Linked-list and Doubly Linked-list with necessary explanation. **10**

7. Suppose you are implementing a stack in a scenario where numbers are added in sorted order so that the stack is always sorted. Sometimes you need to quickly search if a value exists in the stack or not. Array or Linked-list which implementation for stack will you prefer in this scenario? Give necessary explanations. **10**

8. Suppose you are maintaining a head and tail for a singly linked-list. What will be time complexity of **10**

- a. Inserting a value at the beginning
- b. Inserting a value at the end
- c. Deleting a value at the beginning
- d. Deleting a value at the end
- e. Inserting a value at the mid point
- f. Deleting a value at the mid point

9. Consider the following binary tree in **Fig 1** (node 20 is the root) and answer the given questions. **10**

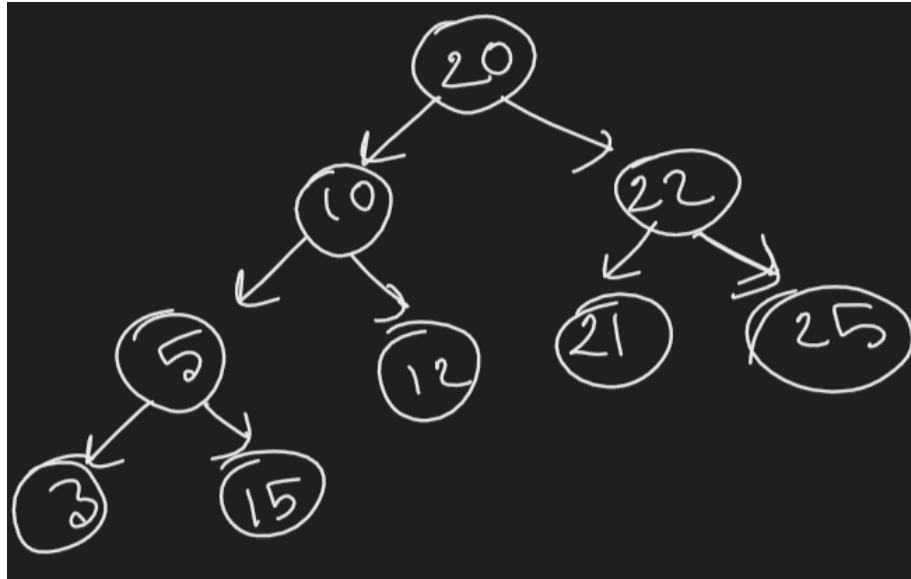


Fig: 1

- Is the tree a Perfect binary tree? Why or why not?
- Is the tree a Complete binary tree? Why or why not?
- Is the tree a Binary search tree? Why or why not?
- Write down the BFS, inorder, preorder and postorder traversal of the tree.

10. Write the steps to insert **70** in the following binary search tree in **Fig 2** (node 50 is the root).

10

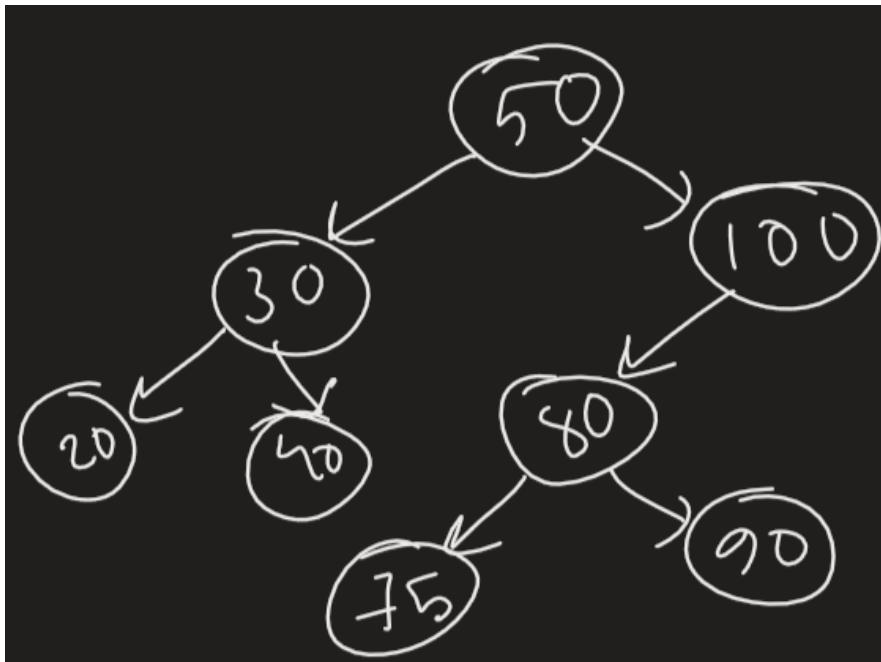


Fig: 2