National University

Of Computer & Emerging Sciences Faisalabad-Chiniot Campus

CL-2001
Data Structures
Lab # 9

Objectives:

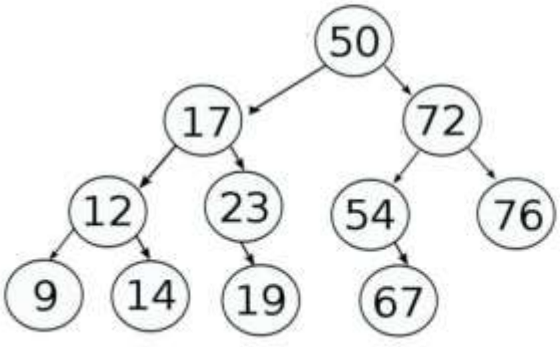
- Binary Tree
- Inorder, preorder, postorder
- BT ADT
- BT Linked List

Note: Carefully read the following instructions (*Each instruction contains a weightage*)

1. There must be a block of comments at start of every question's code by students; the block should contain brief description about functionality of code.
2. Comment on every function and about its functionality.
3. Mention comments where necessary such as comments with variables, loop, classes etc to increase code understandability.
4. Use understandable name of variables.
5. Proper indentation of code is essential.
6. Write a code in C++ language.
7. Make a Microsoft Word file and paste all of your C++ code with all possible screenshots of every task **outputs in Microsoft Word and submit word file. Do not submit .cpp file.**
8. First think about statement problems and then write/draw your logic on copy.
9. After copy pencil work, code the problem statement on MS Studio C++ compiler.
10. At the end when you done your tasks, attached C++ created files in MS word file and make your submission on Google Classroom. (Make sure your submission is completed).
11. Please submit your file in this format **19F1234_L8**.
12. Do not submit your assignment after deadline. Late and email submission is not accepted.
13. Do not copy code from any source otherwise you will be penalized with negative marks.

Problem: 1|

Consider the given binary tree and answer the following questions.



1. Total leaf nodes?
2. Siblings of 54?
3. Ancestors of 23?
4. Descendent of 17?
5. Height and depth of given tree?
6. Is it a complete binary tree? Total number of nodes in a complete binary tree with depth 4 will be?
7. In-order traversal will be?
8. Post-order traversal will be?
9. **Bonus Point** Breadth-first traversal of given tree will be?

Problem: 2 | Binary Tree Array based

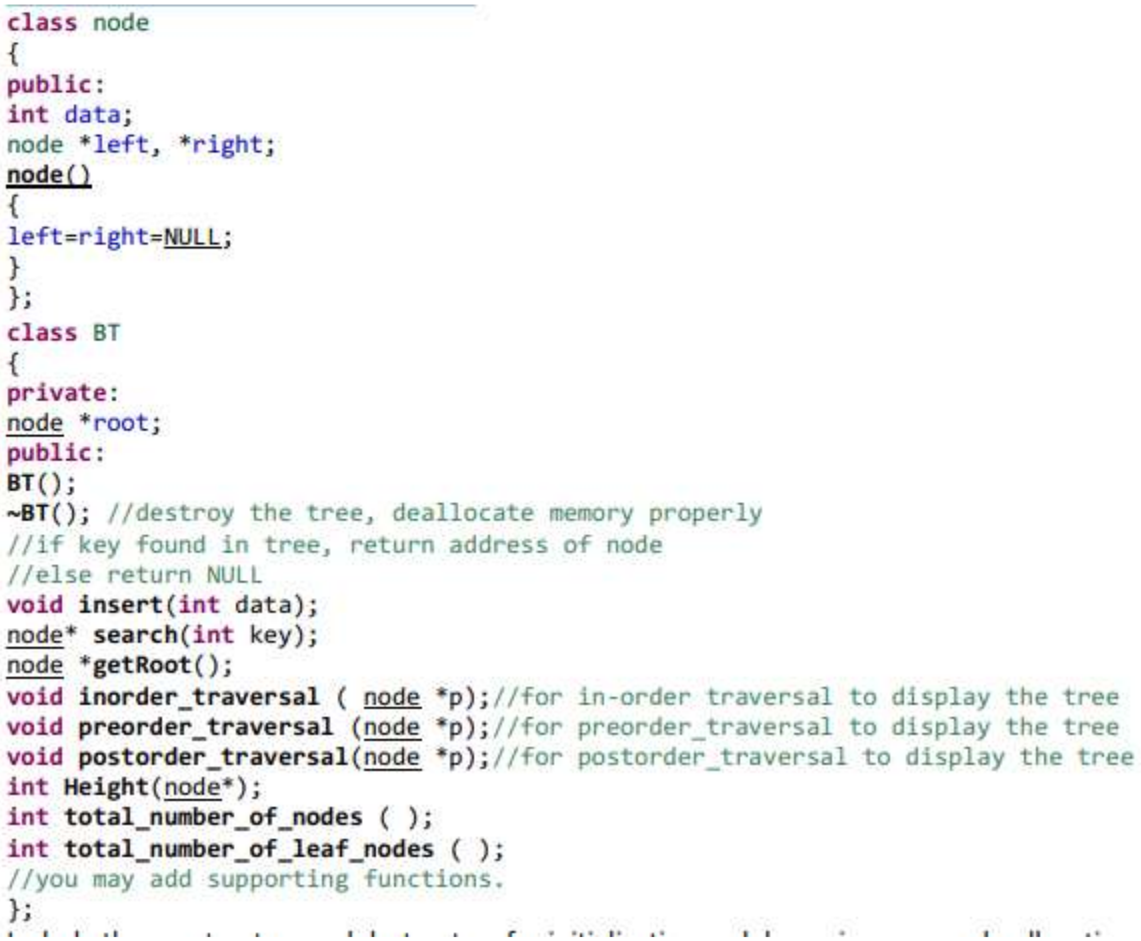
Implement Binary tree array based implementation Create following functions:

1. isEmpty()
2. isFull()
3. getRoot()
4. insert(data, parent)
5. delete(data)
6. display()

Problem: 3 | Binary Search Tree

Write a C++ program that implements the basic methods of binary tree. Design a class BST. The class must include the following operations:

Include the constructors and destructors for initialization and dynamic memory de-allocation.



```
class node
{
public:
int data;
node *left, *right;
node()
{
left=right=NULL;
}
};
class BT
{
private:
node *root;
public:
BT();
~BT(); //destroy the tree, deallocate memory properly
//if key found in tree, return address of node
//else return NULL
void insert(int data);
node* search(int key);
node *getRoot();
void inorder_traversal ( node *p);//for in-order traversal to display the tree
void preorder_traversal (node *p);//for preorder_traversal to display the tree
void postorder_traversal(node *p);//for postorder_traversal to display the tree
int Height(node*);
int total_number_of_nodes ( );
int total_number_of_leaf_nodes ( );
//you may add supporting functions.
};
```

Best of luck

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