Data Structures and Object Oriented Programming

Lecture 13

Dr. Naveed Anwar Bhatti

Webpage: naveedanwarbhatti.github.io

Object-Oriented Programming in C++

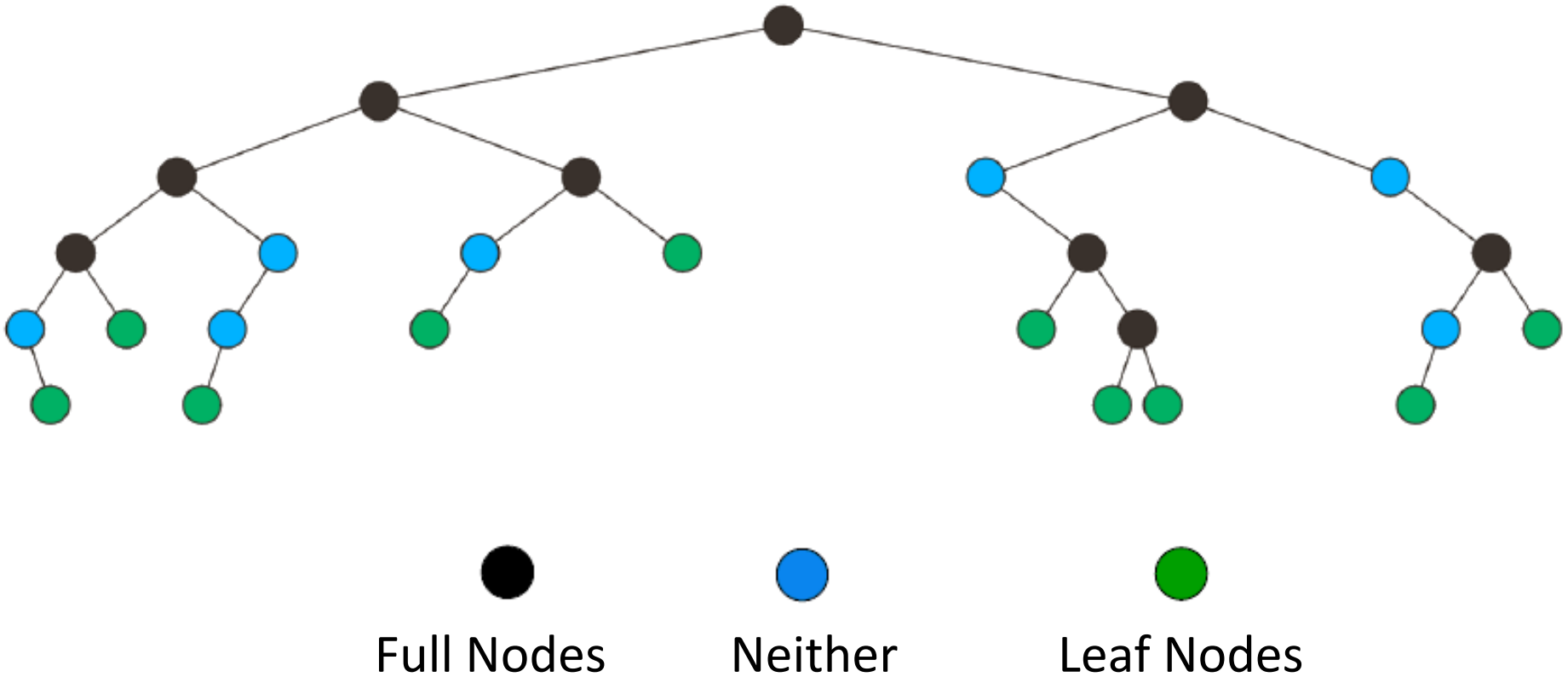
Binary Search Trees

`Insert()` and `Find()`

BT (Binary Tree) – Some Definitions

Full Node

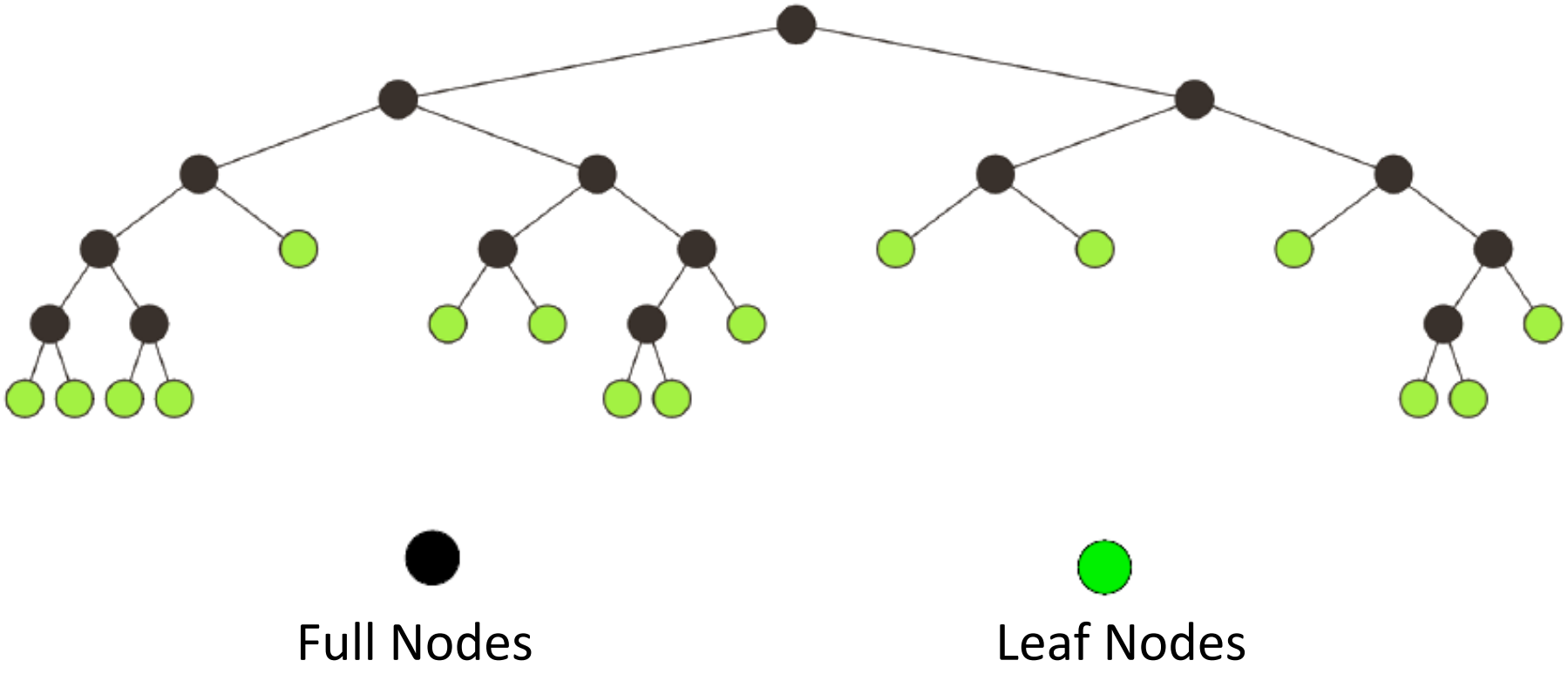
Definition: A full node is a node where both the left and right sub trees are non-empty trees



BT (Binary Tree) – Some Definitions

Full Binary Tree

Definition: A full binary tree is where each node either full node or leaf node



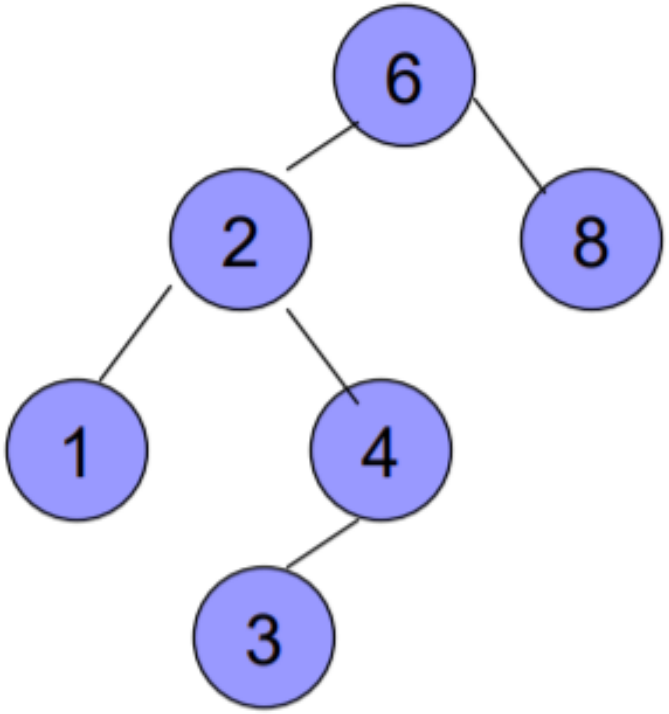
BST (Binary Search Tree) - Definition

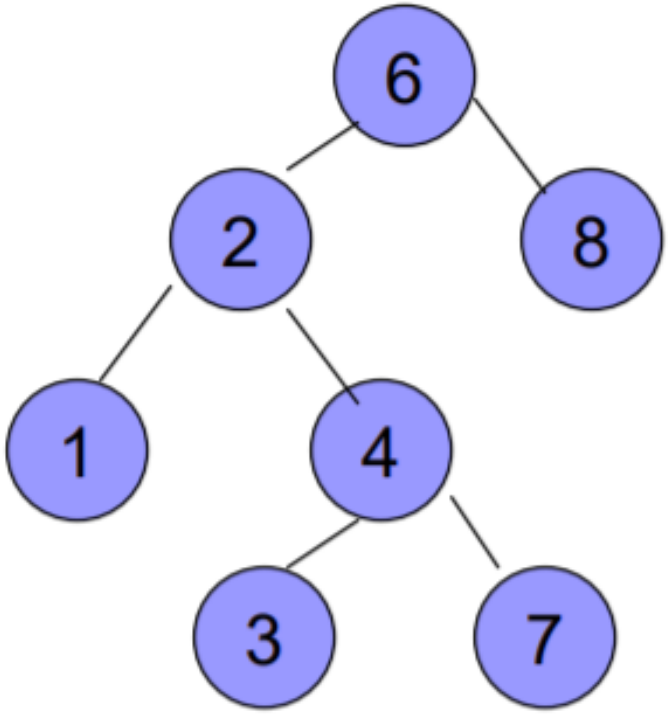
Also known as ***Totally Ordered Tree***

Definition: A binary tree **B** is called a binary search tree iff:

- For every node **T** in the **B** tree, the values of all the items in its ***left*** subtree are ***smaller*** than the item in **T**
- The values of all the items in its ***right*** subtree are ***larger*** than the item in **T**

Practice: are these BSTs?





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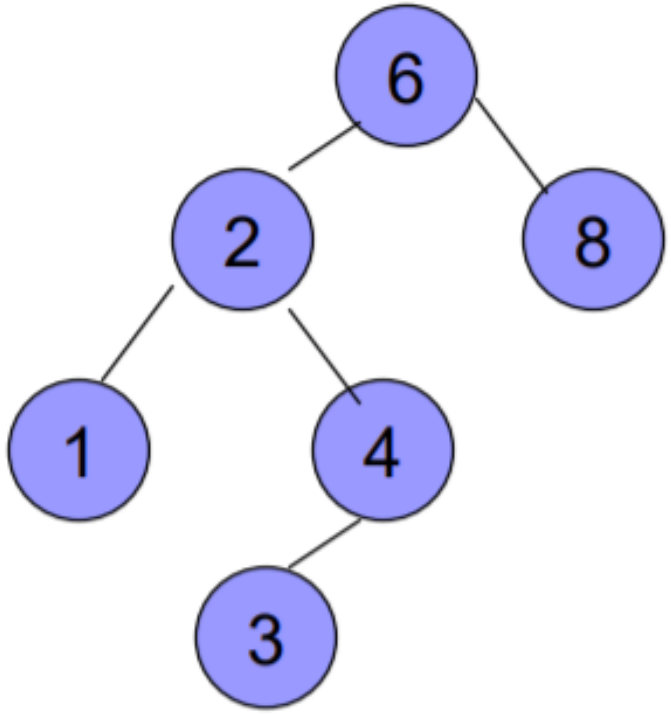
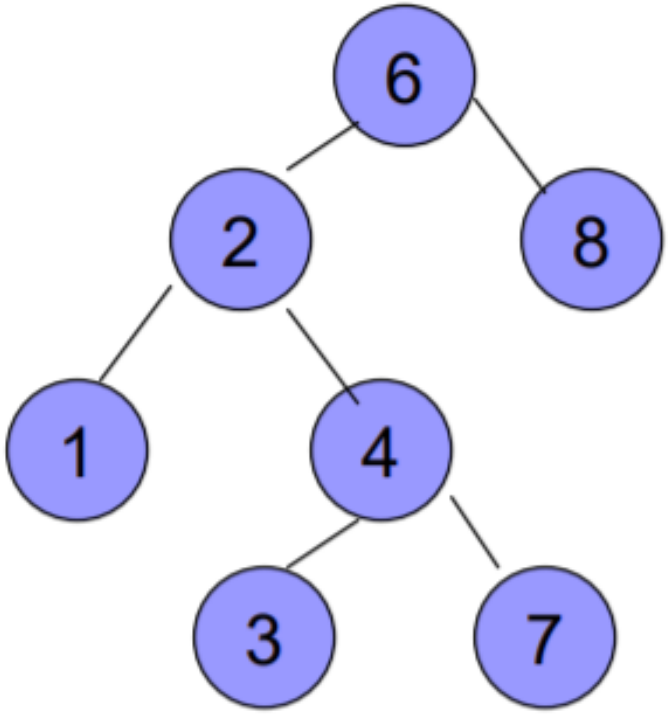


Binary Search Tree



Binary Tree

BST (Binary Search Tree) - Implementation

```
struct Node
{
    int data;
    Node* left = NULL;
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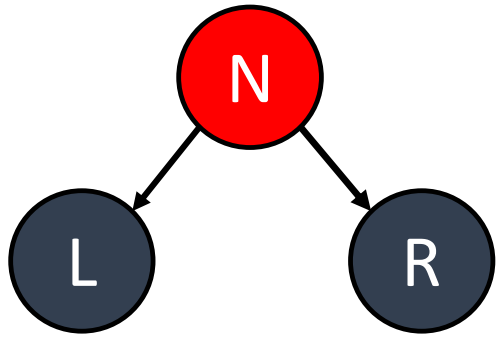
};
```



BST (Binary Search Tree) - Implementation

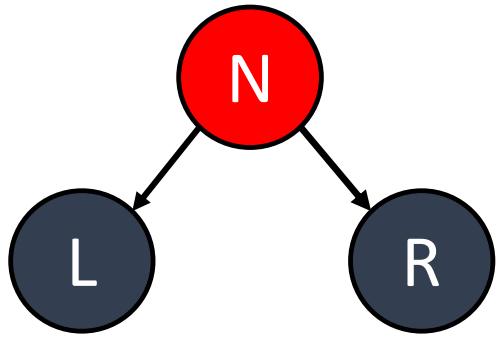
```
struct Node
{
    int data;
    Node* left = NULL;
    Node* right = NULL;
};

class BSTree
{

    Node* root = NULL;

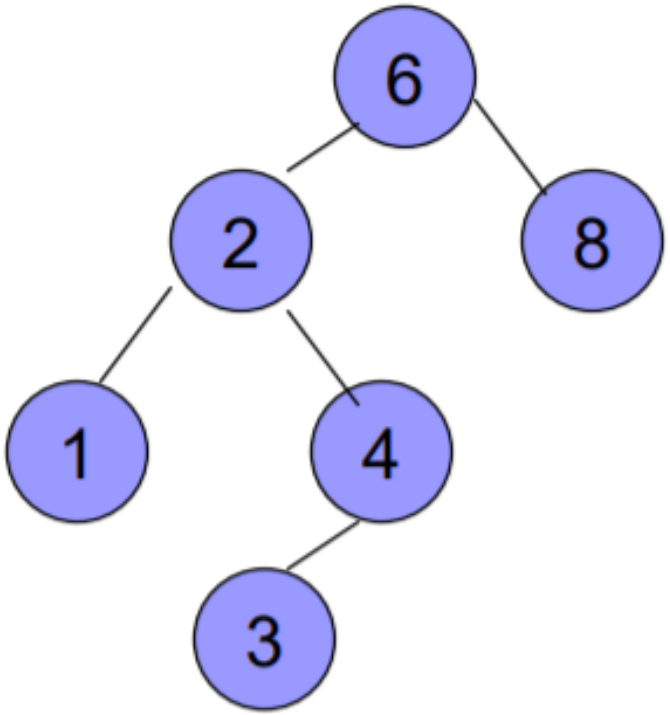
    public:
        void insert(int value);
        bool find(int a);

};
```



How do we insert (value) in BST's?

Let's say we want to insert **5**



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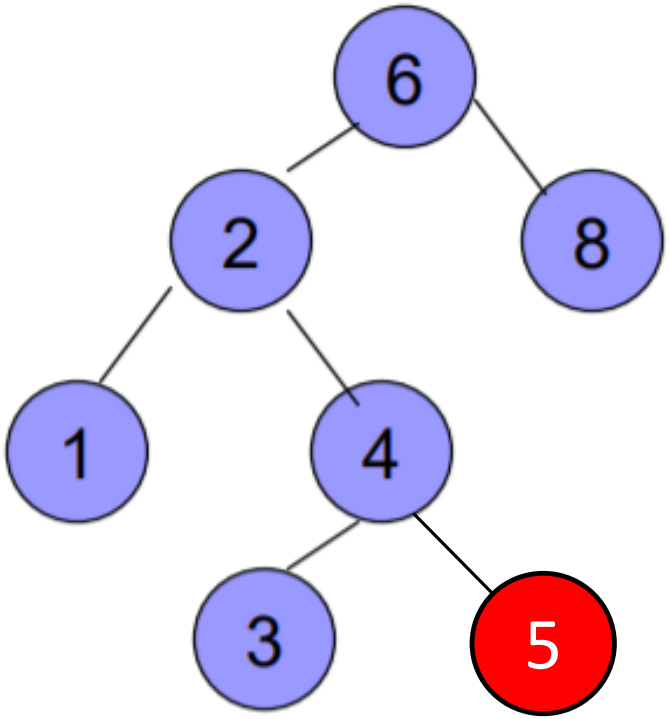

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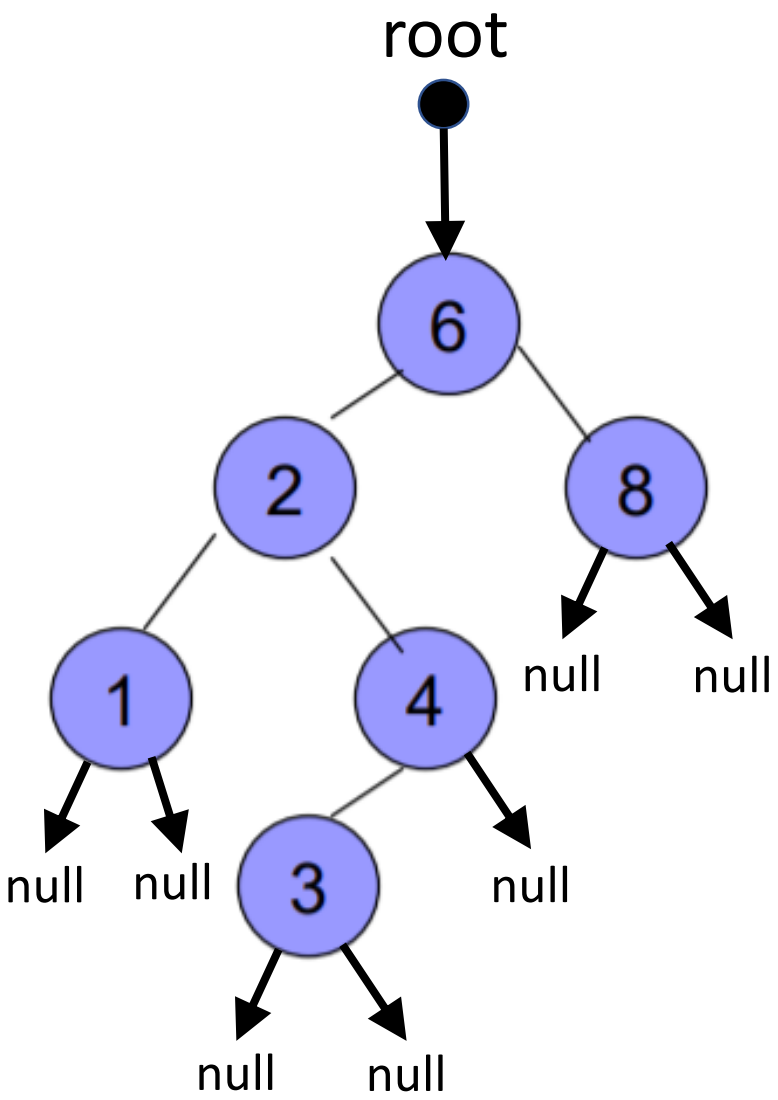

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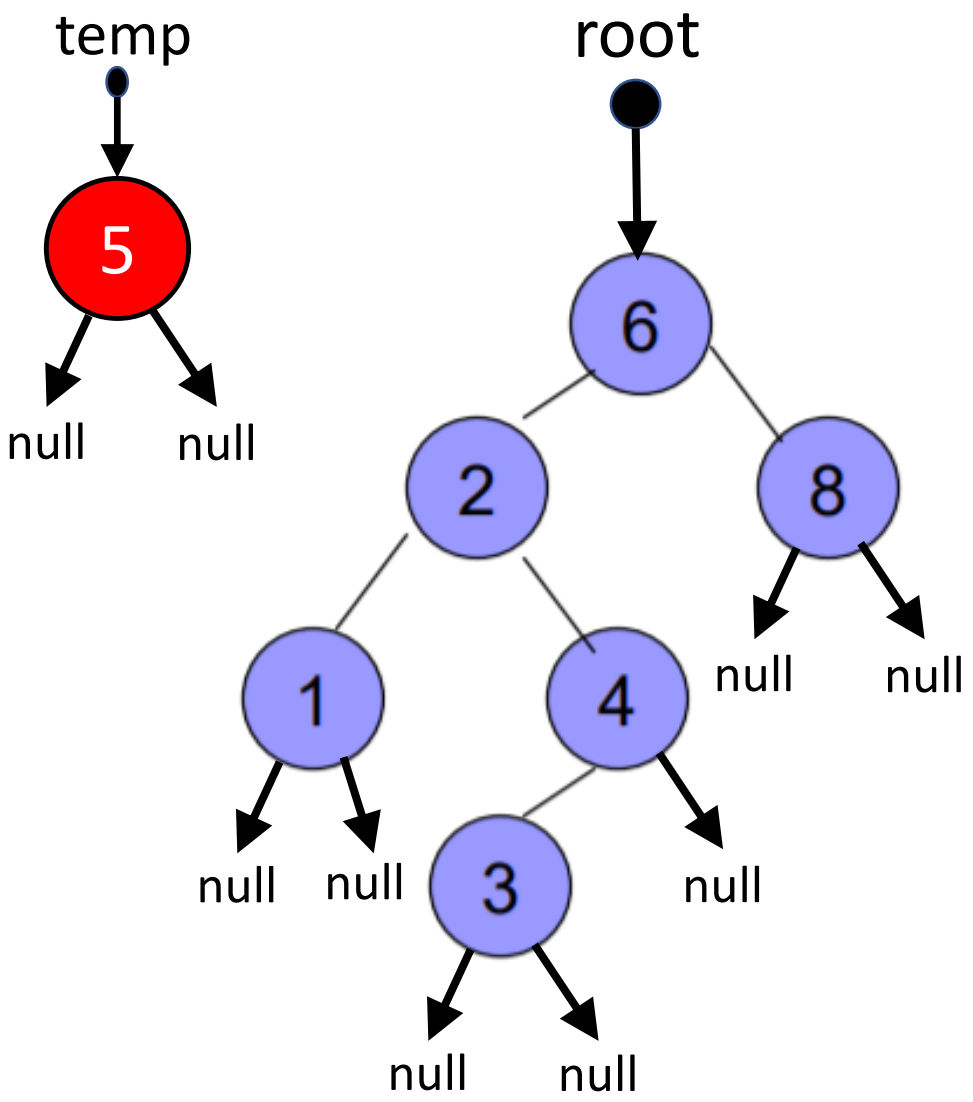

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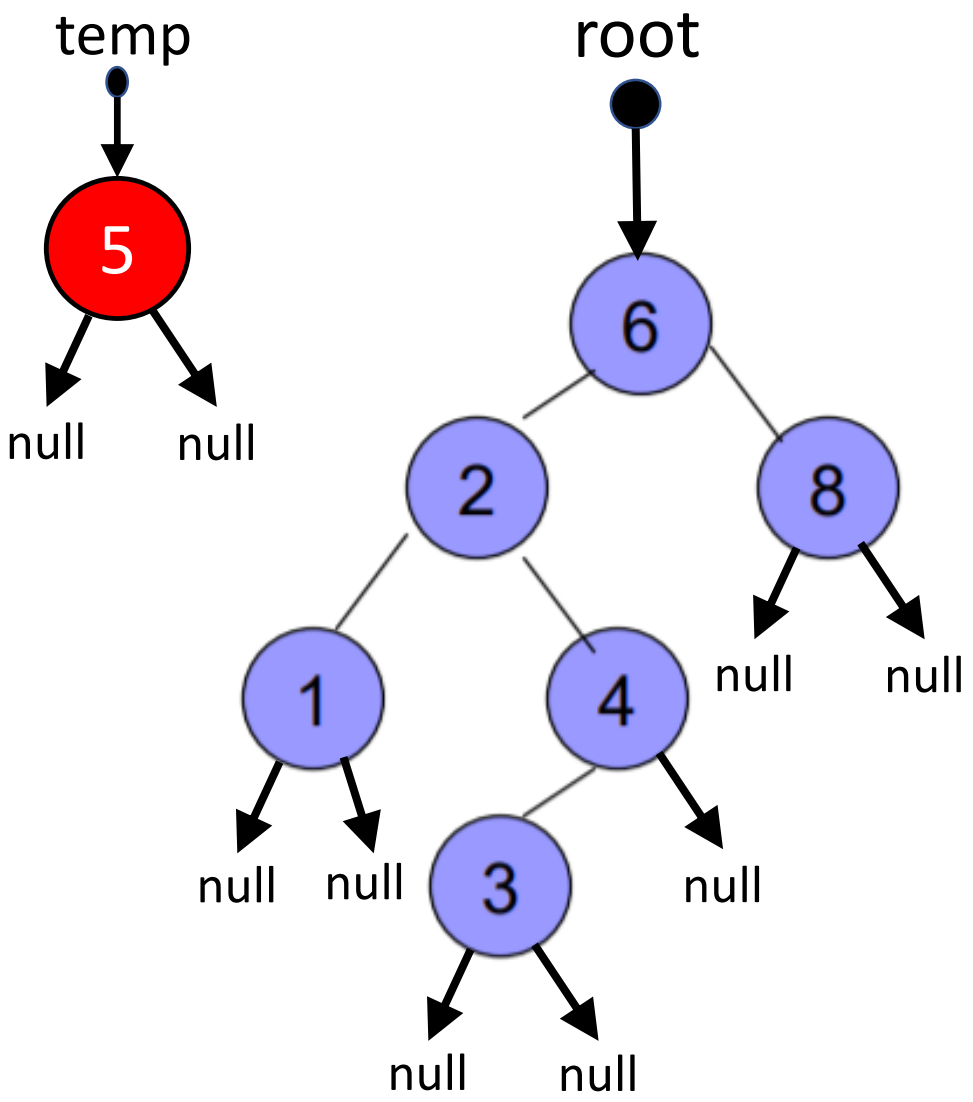

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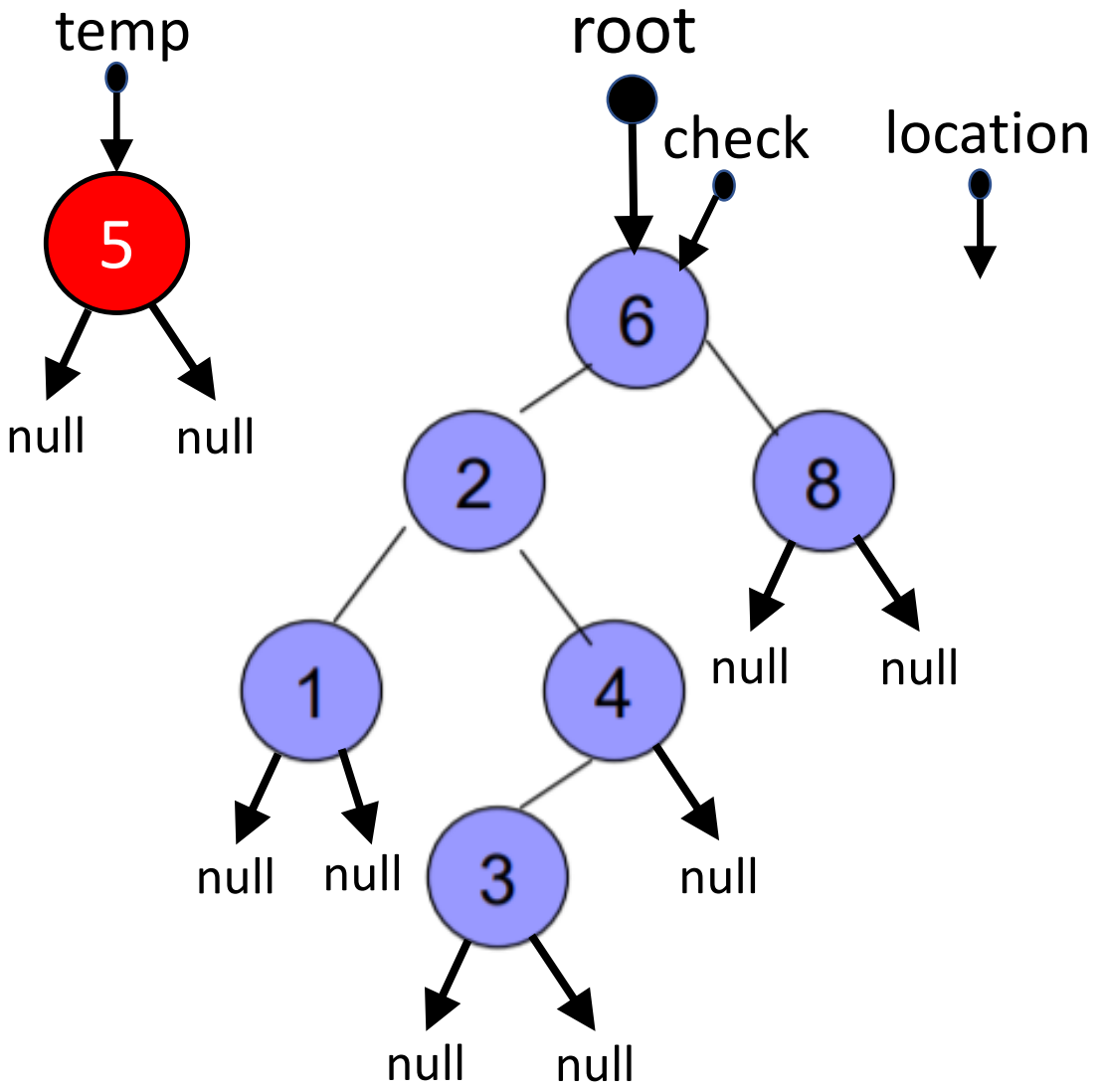

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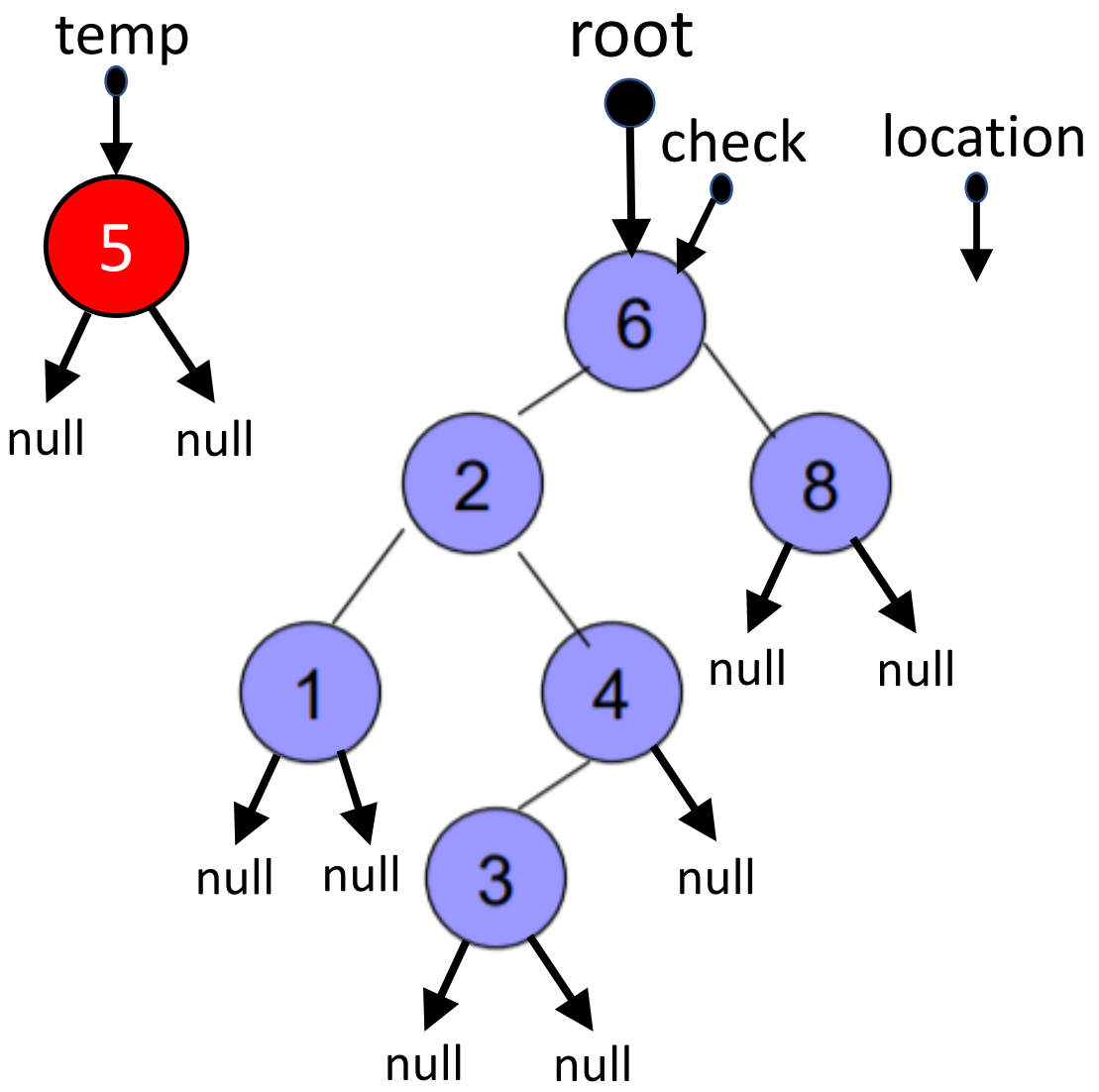

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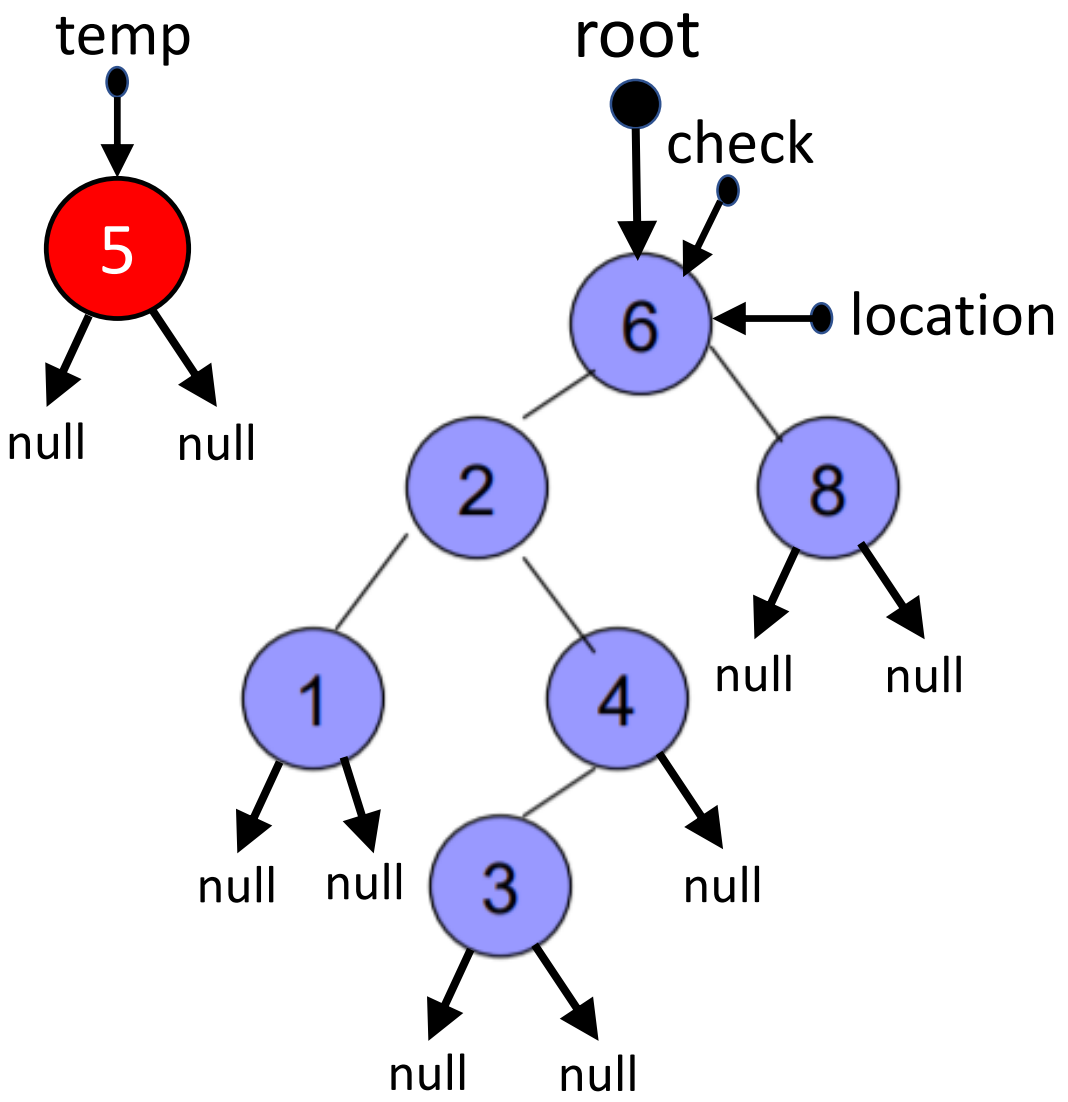

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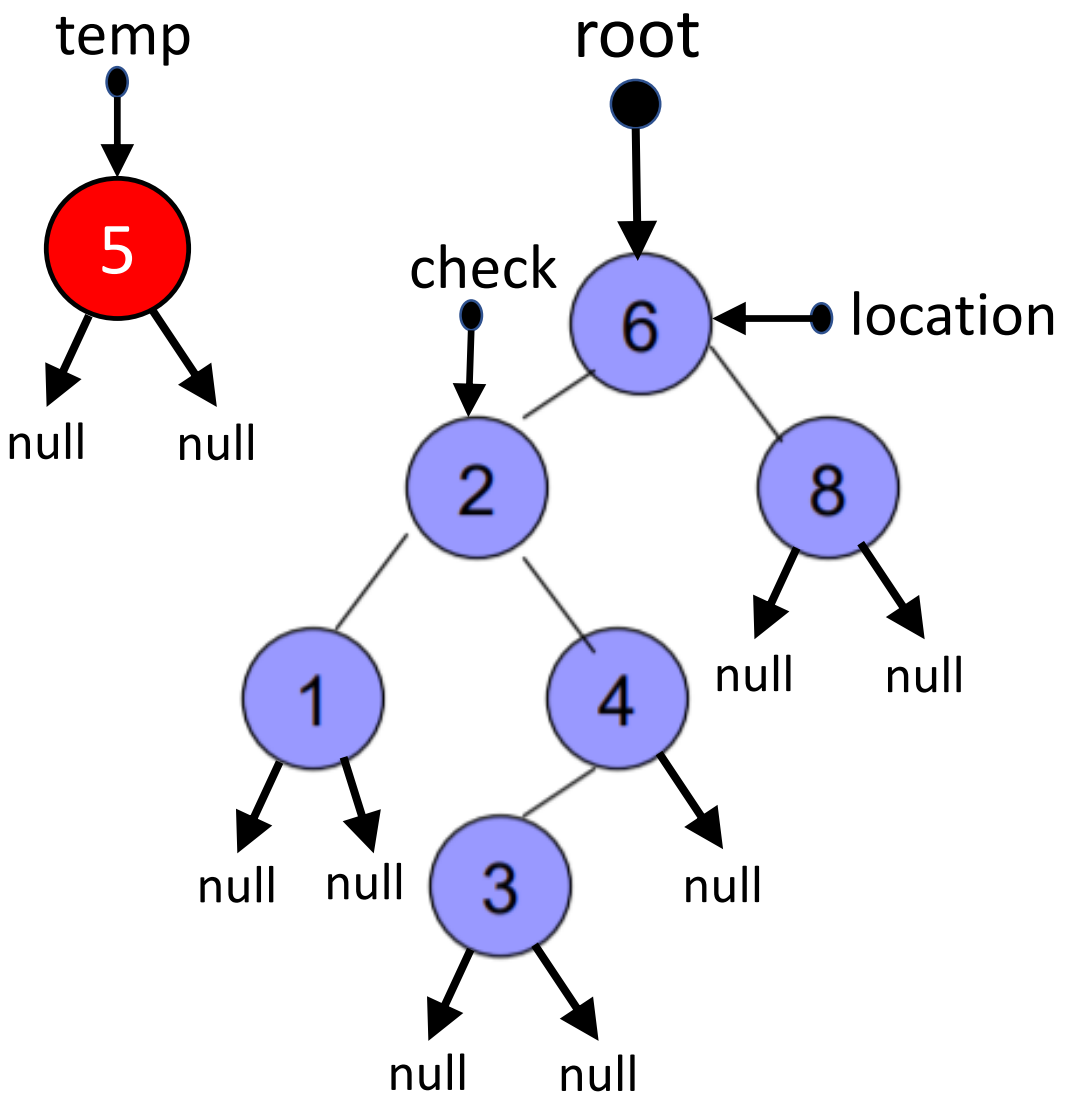

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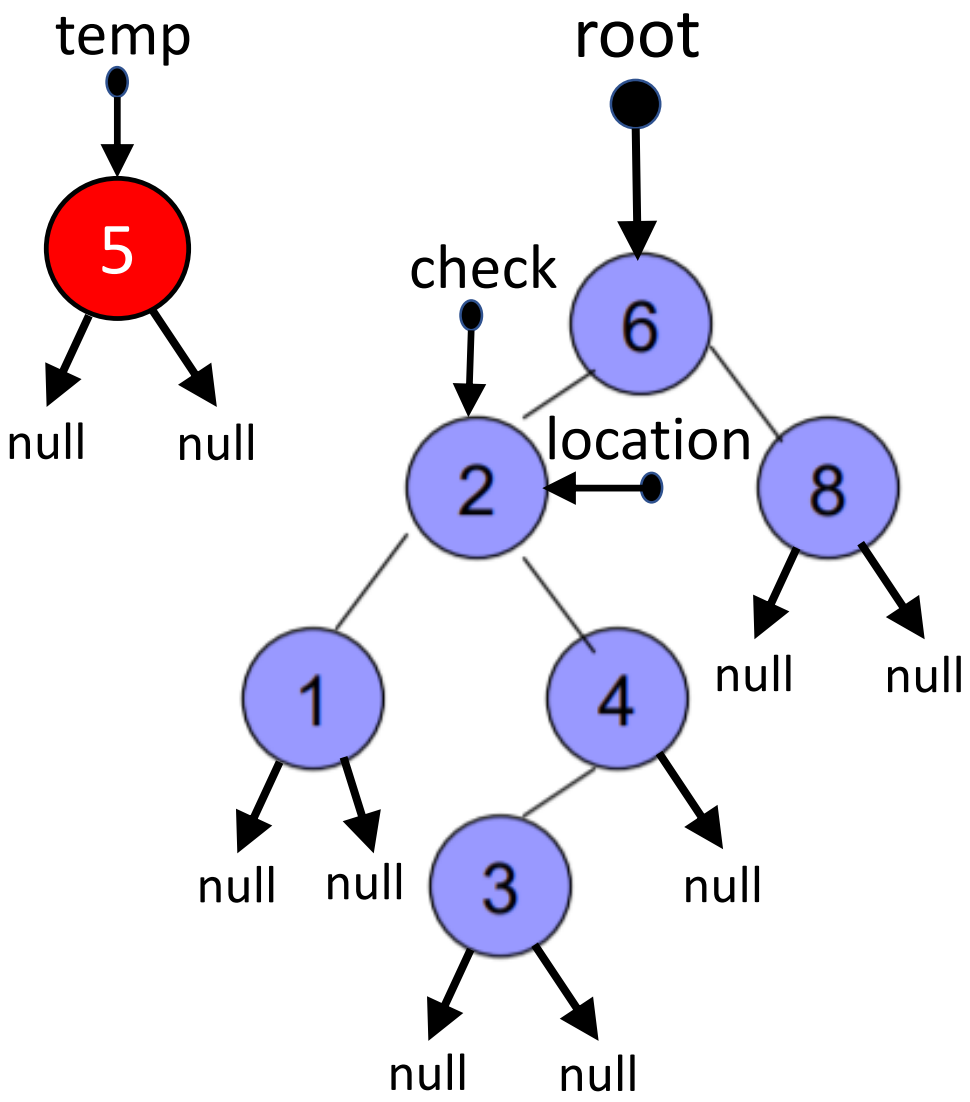

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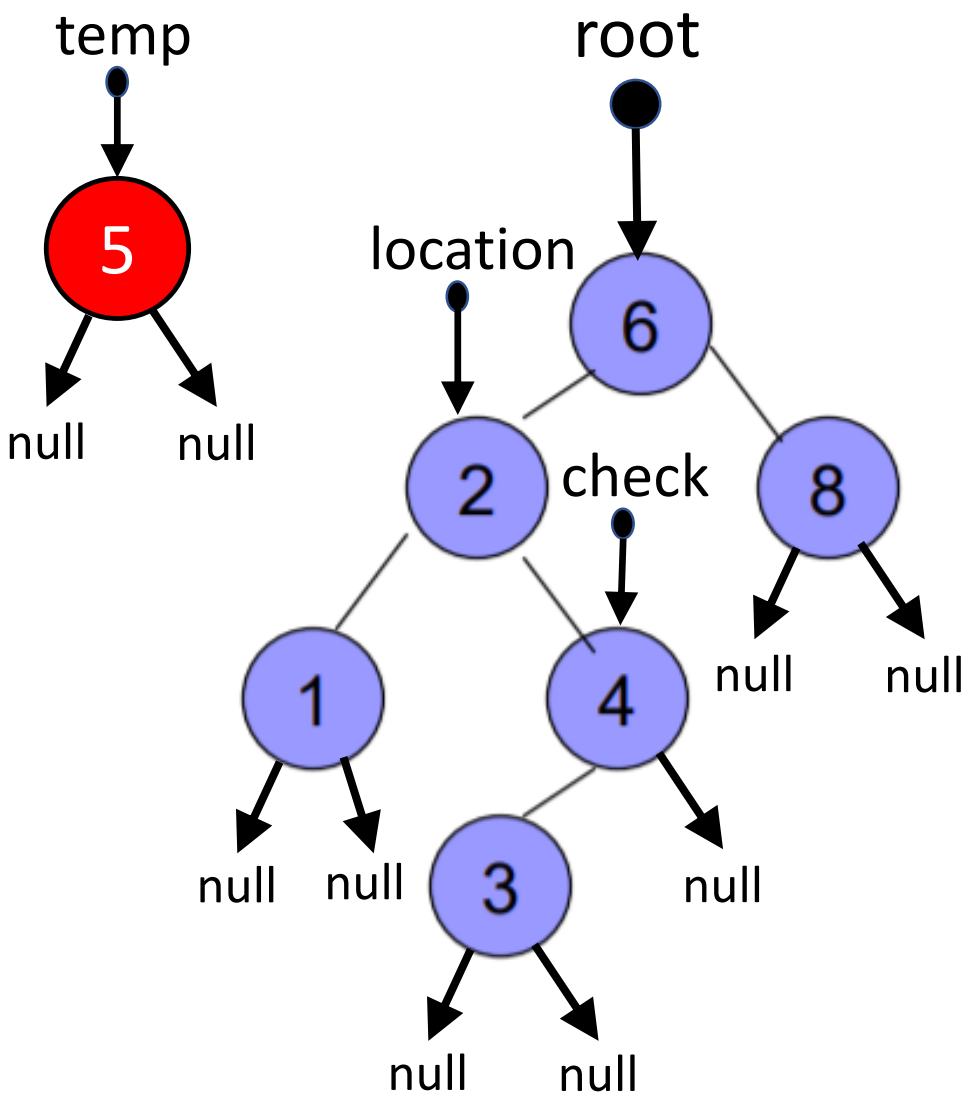

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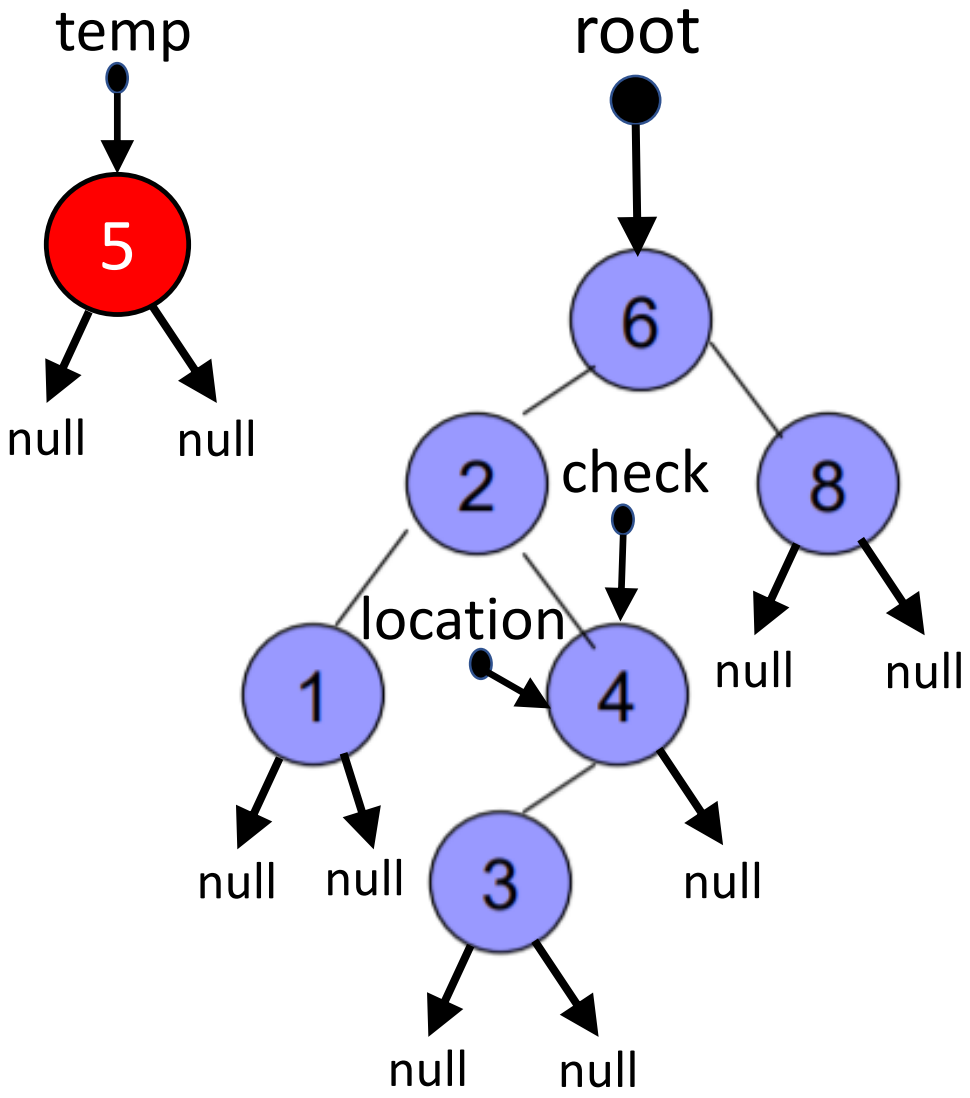

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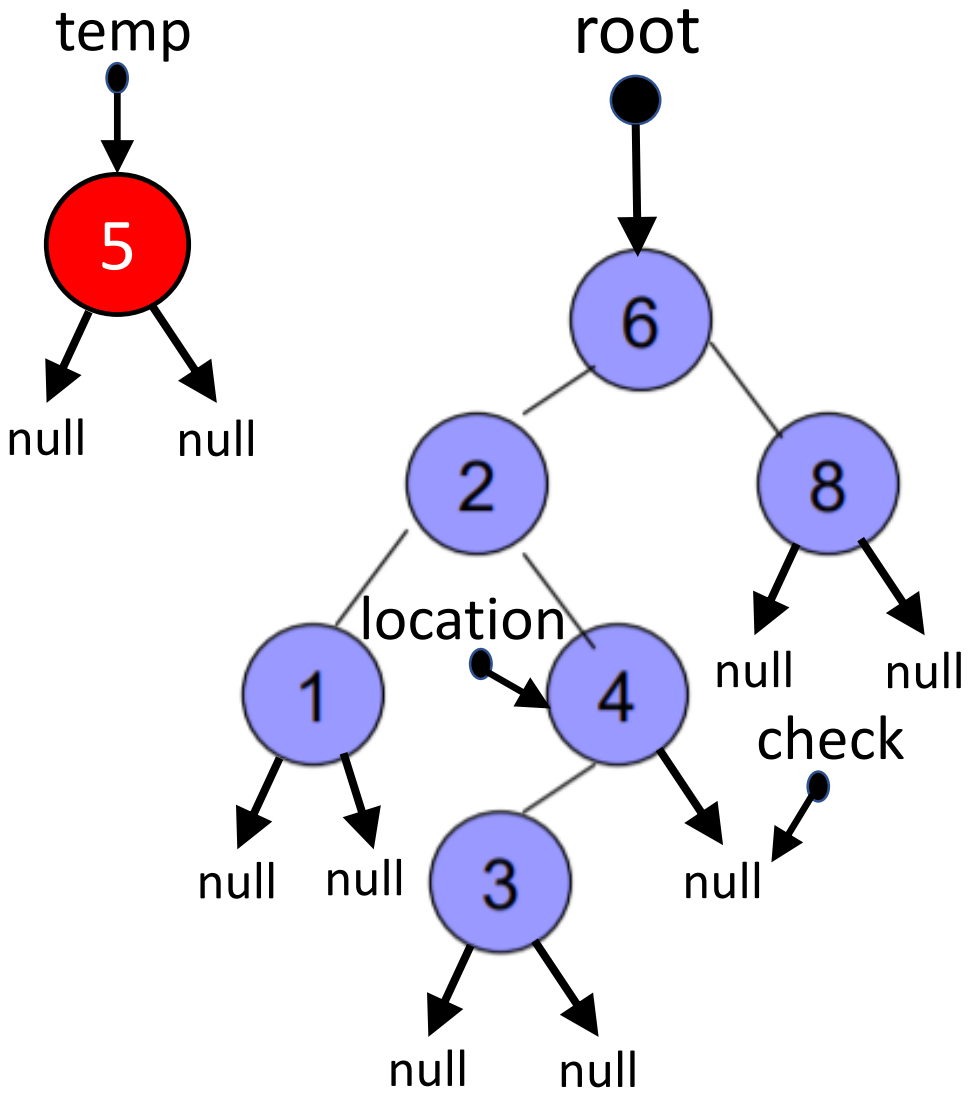

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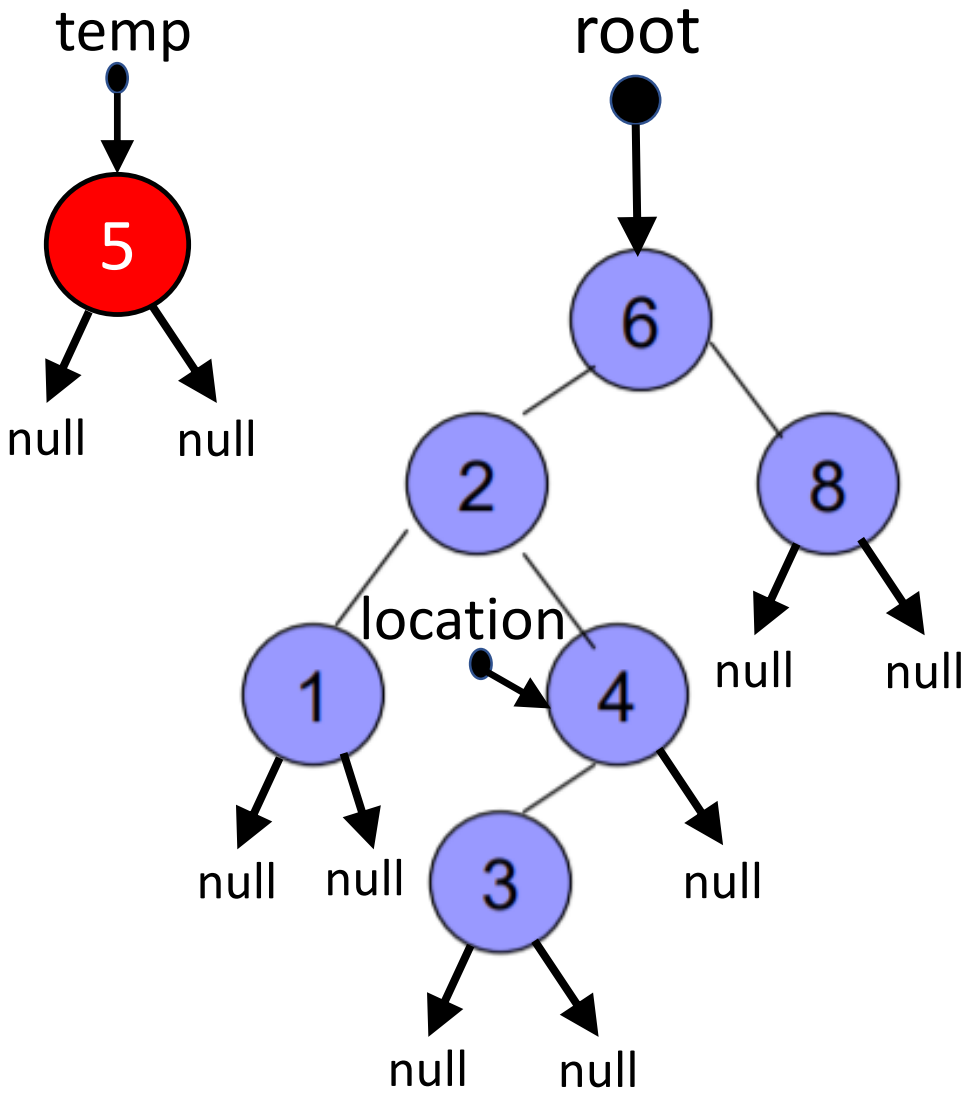

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        location->right = temp;


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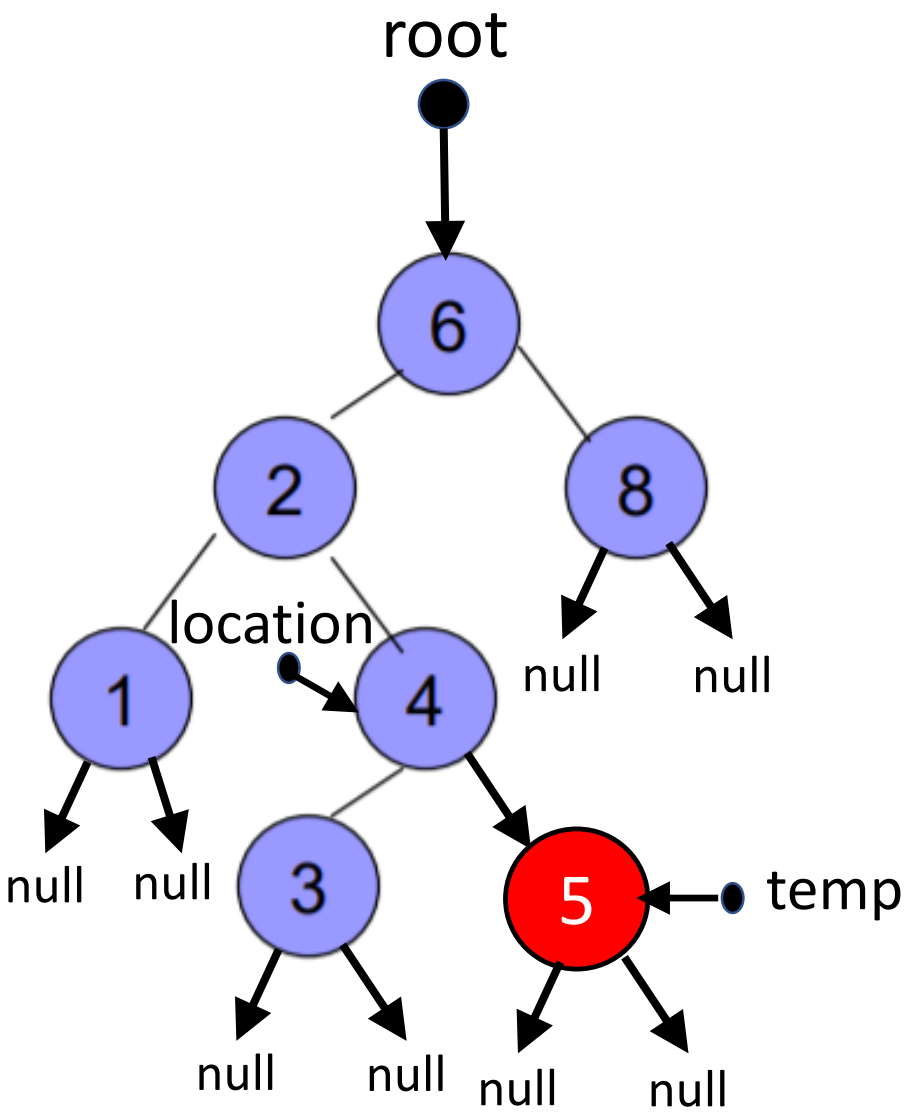

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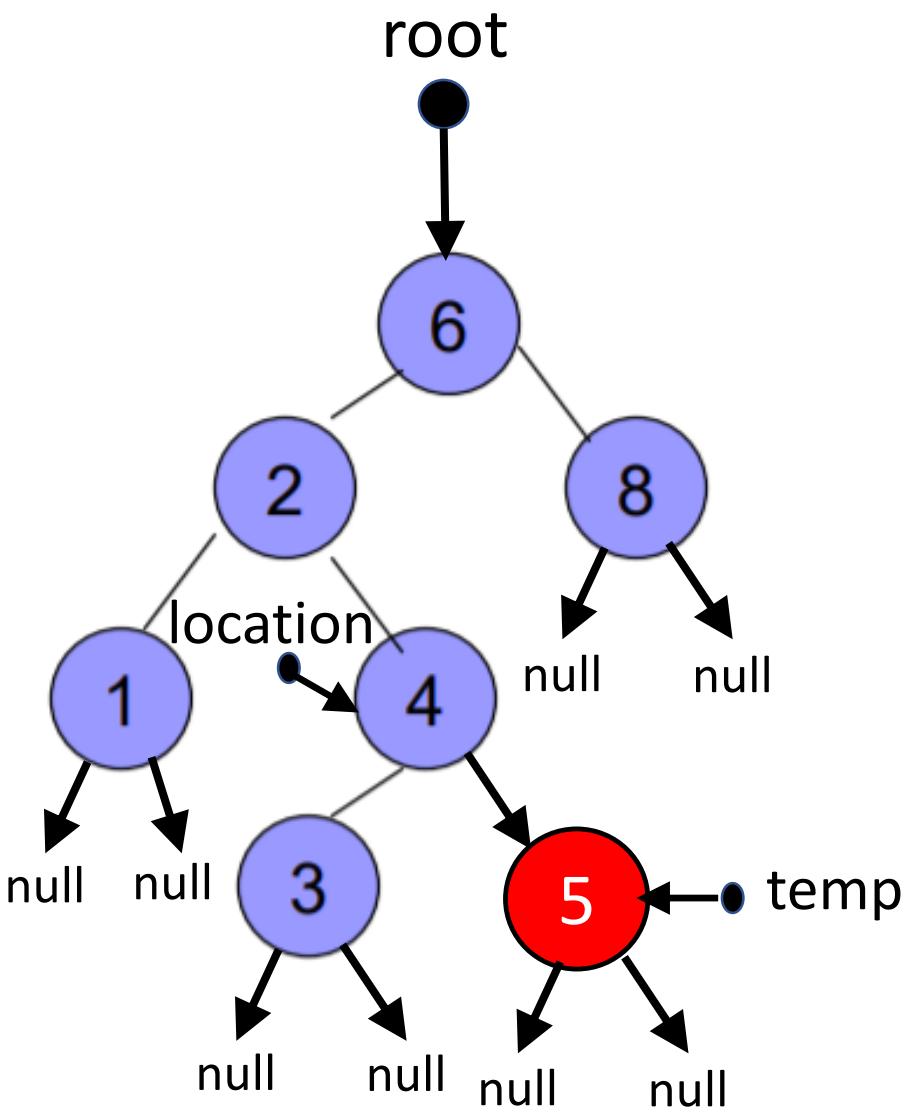

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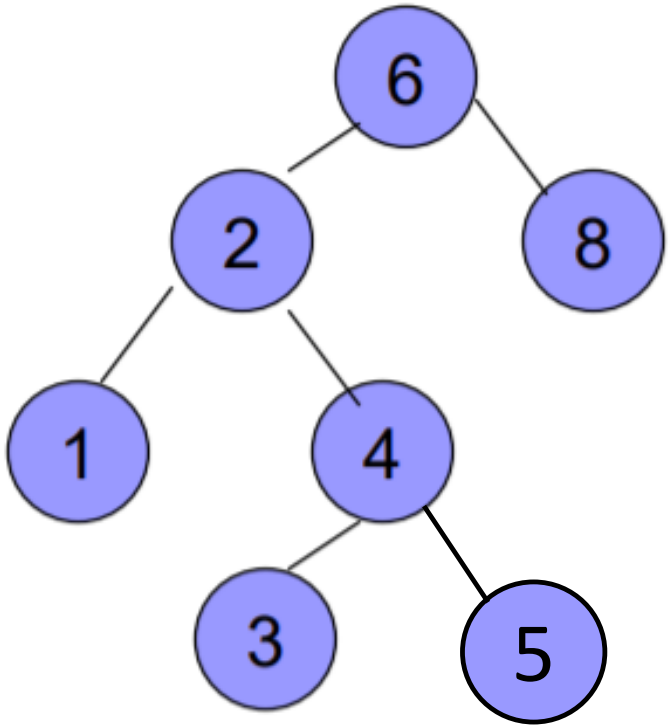

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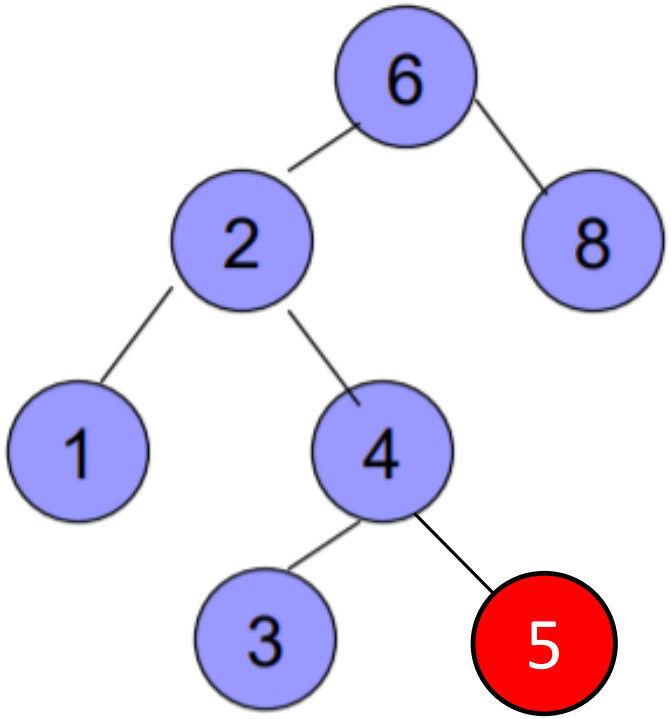
    }
    if (location->data < value)
        location->right = temp;
    else
        location->left = temp;
}
```

Can we do it without **location ???**

How do we find (value) in BST's?

Let's say we want to check whether **5** exists or not



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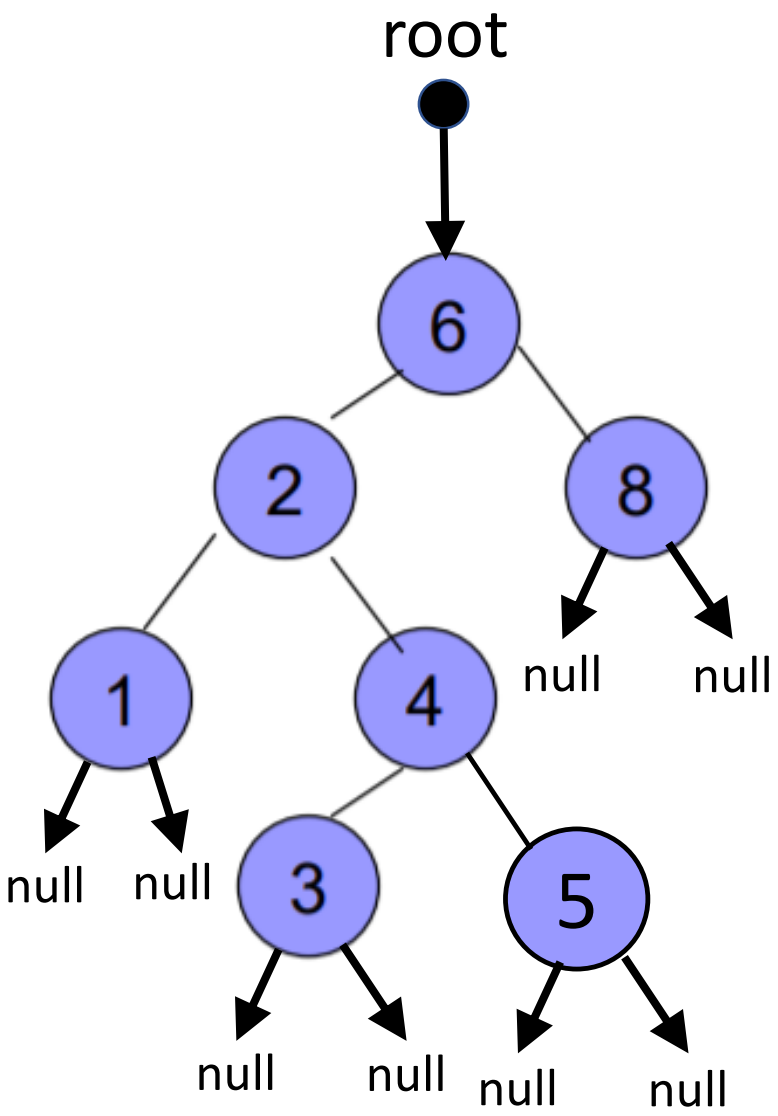

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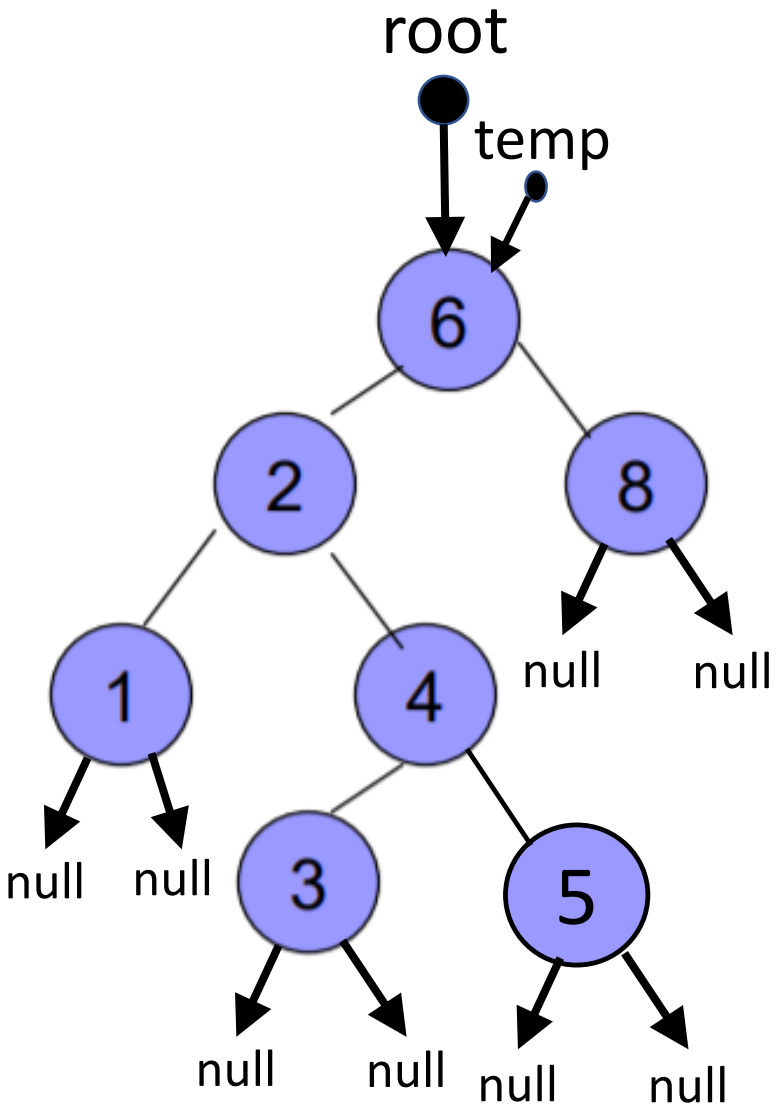

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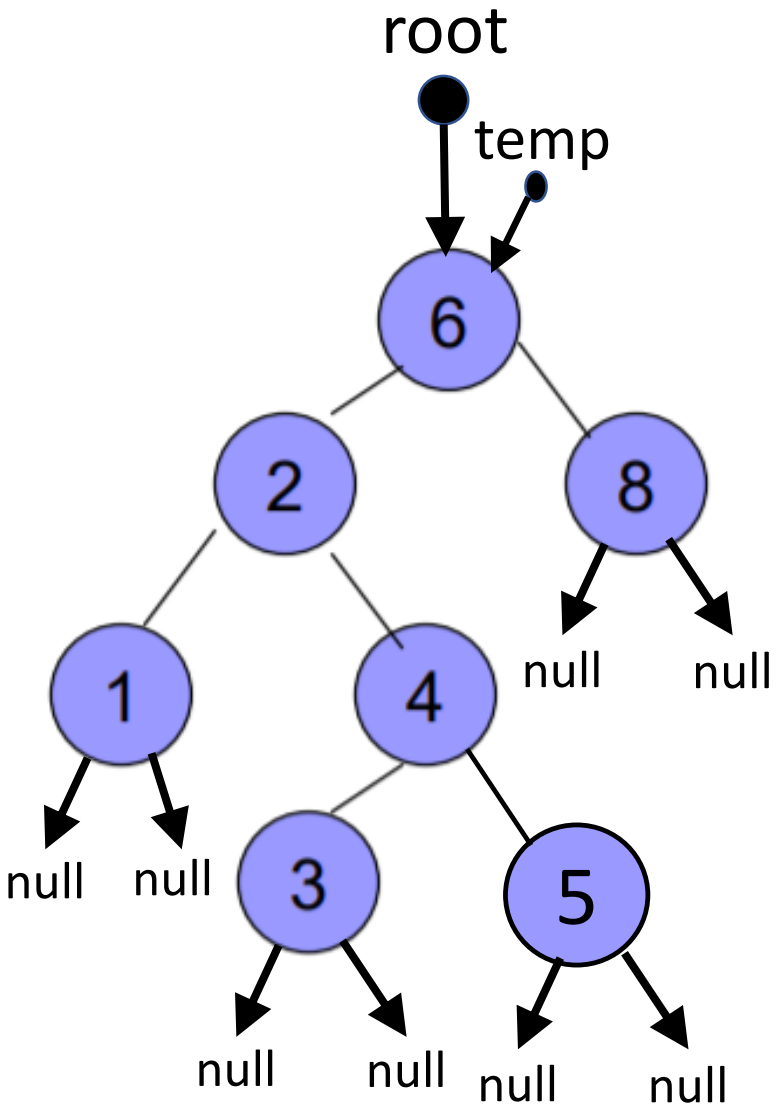

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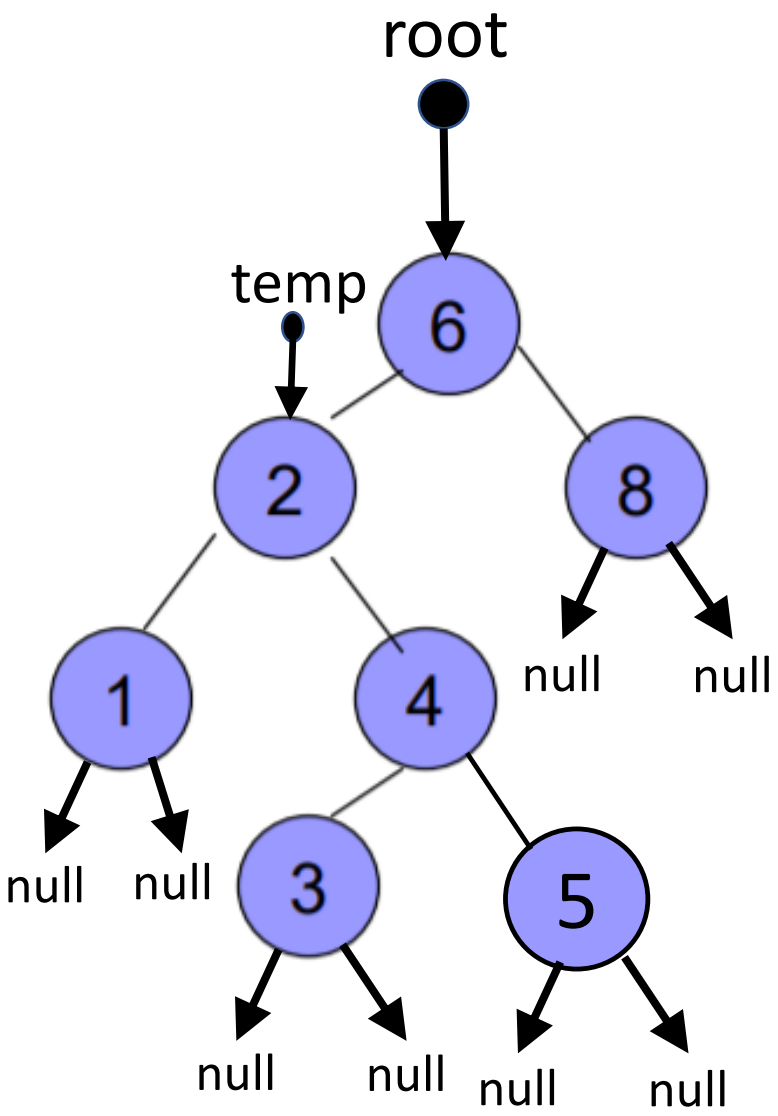

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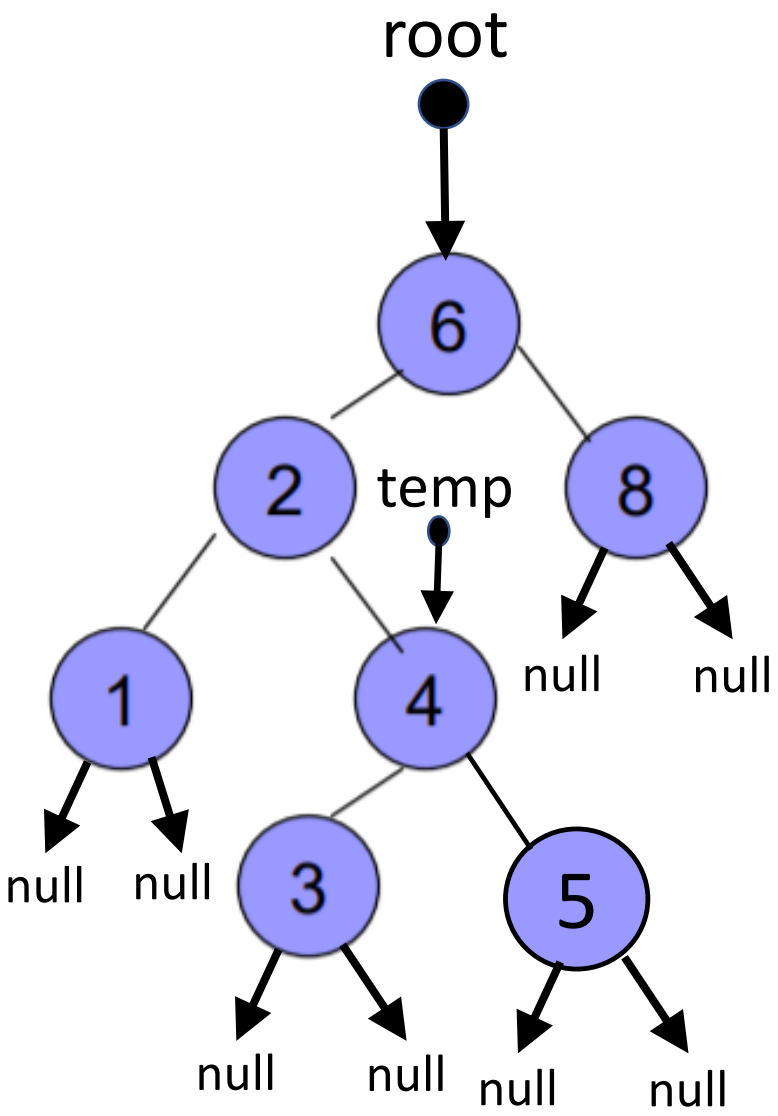
```



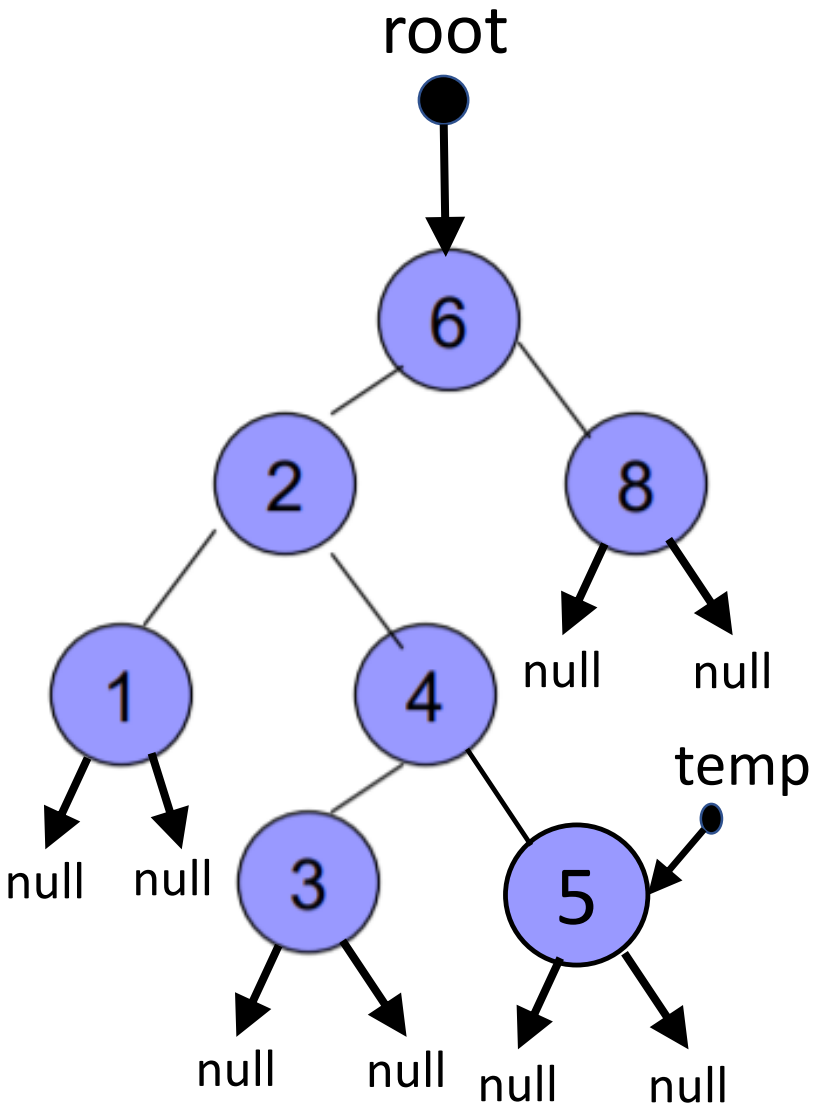
How do we find (value) in BST's?

```
bool BSTree::find(int value)
{
    Node* temp = root;

    while (temp != NULL && temp->data != value)
    {
        if (value < temp->data)
        temp = temp->left;
        else if (value > temp->data)
        temp = temp->right;
    }




}
```



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    {
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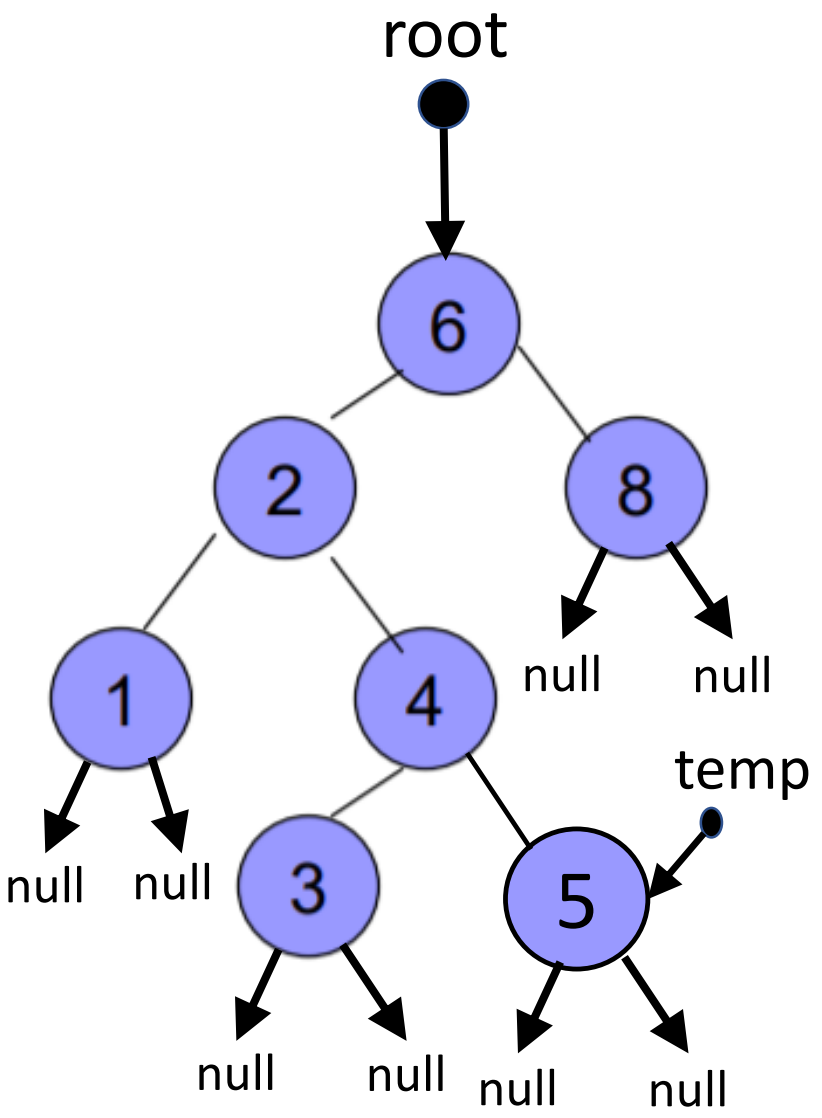
        temp = temp->left;
        else if (value > temp->data)
        temp = temp->right;
    }

    if (temp == NULL)
        return 0;
    else
        return 1;
}
```



Thanks a lot

If you are taking a Nap, **wake up**.....Lecture Over