CS 225

Data Structures

February 12 – BST Implementation

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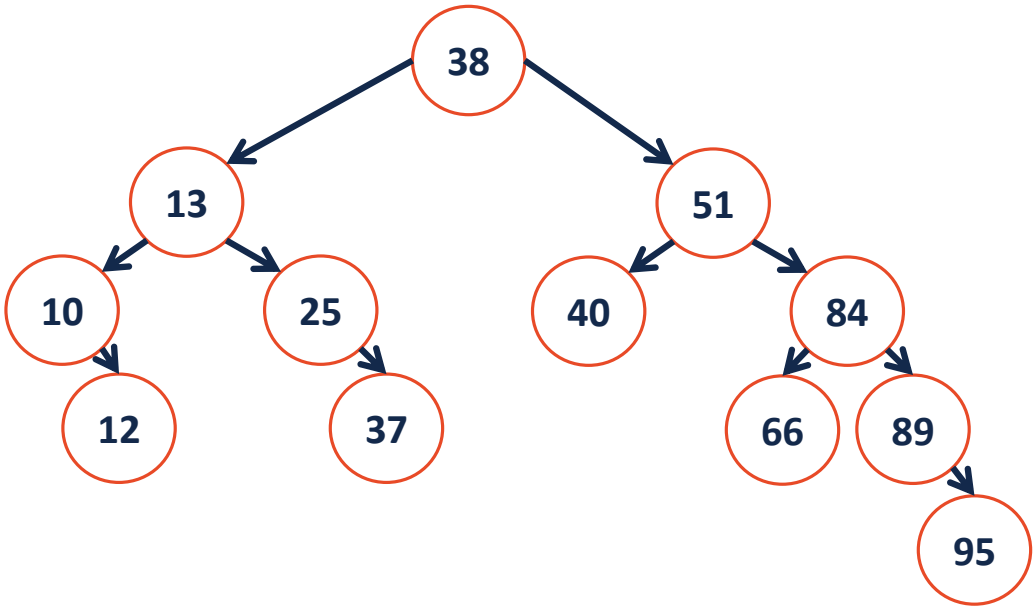
BST.h

```
 1 #pragma once
 2
 3 template <class K, class V>
 4 class BST {
 5   public:
 6     BST();
 7     void insert(const K key, V value);
 8     void remove(const K & key);
 9     V find(const K & key) const;
10     TreeIterator begin();
11     TreeIterator end();
12
13   private:
14
15     struct TreeNode {
16       TreeNode *left_;
17       K key_;
18       V value_;
19       TreeNode *right_;
20     };
21     TreeNode *root_;
22 };
```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```
1  template<class K, class V>
2  TreeNode * &_find(TreeNode *& root, const K & key) {
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22 }
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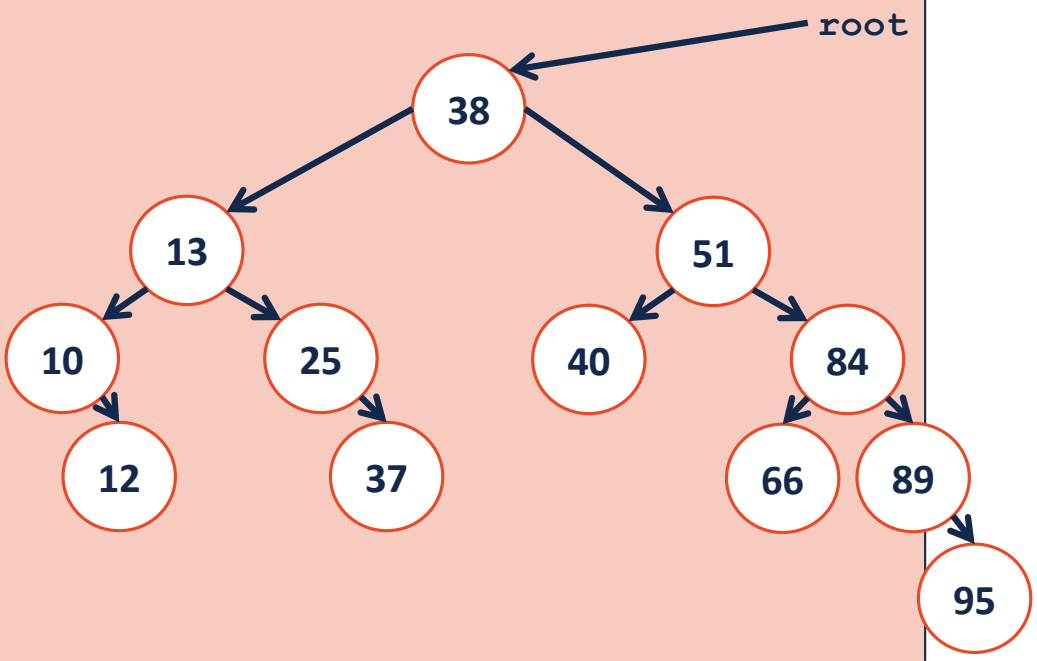

```
1  template<class K, class V>
2  TreeNode * &_find(TreeNode *& root, const K & key) {
3    if( root == nullptr )
4      { return root; }
5    if( root->key == key )
6      { return root; }
7    if( key < root->key ) {
8      return _find(root->left, key);
9    } else {
10     return _find(root->right, key);
11   }
12 }
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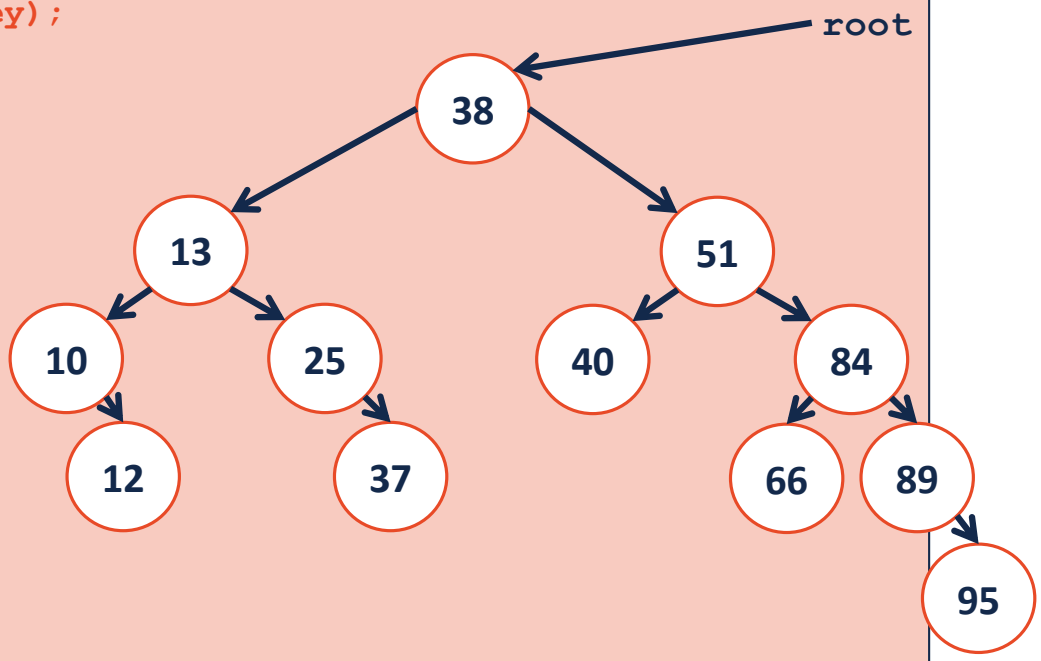

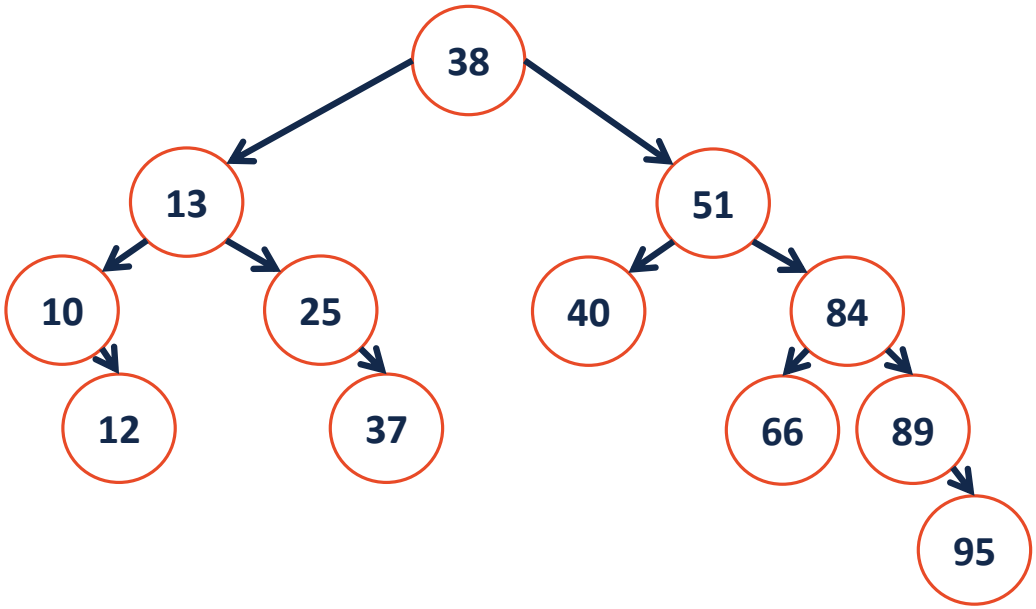
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```
1  template<class K, class V>
2  void _insert(TreeNode *& root, const K & key, const V &value) {
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17 }
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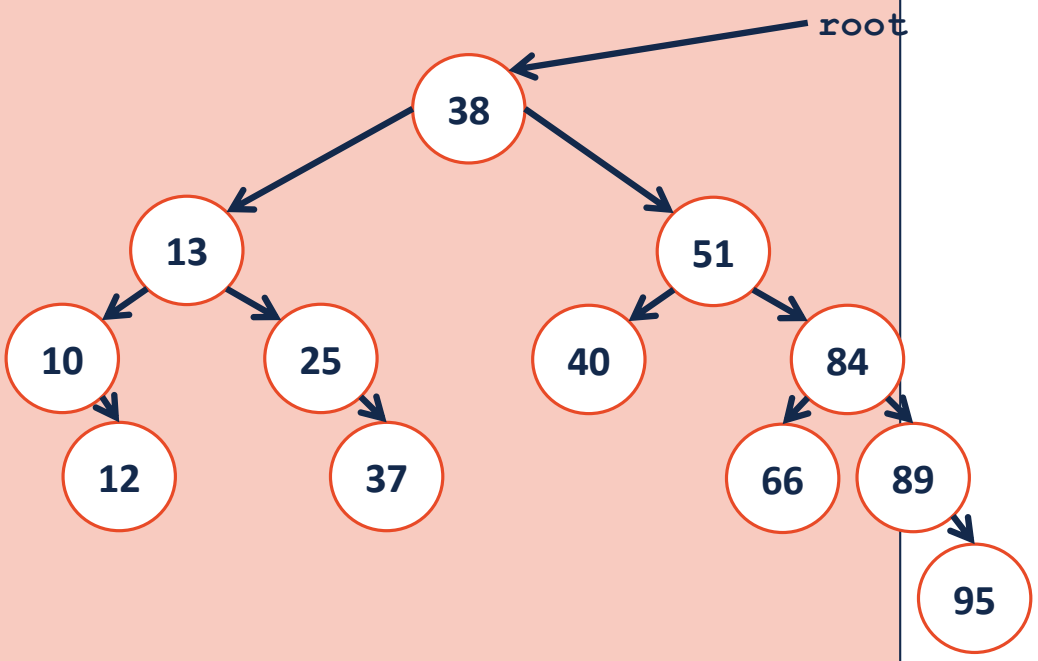
```



```
1  template<class K, class V>

2  void _insert(TreeNode *& root, const K & key, const V &value) {
3    TreeNode *&location = _find(root, key);
4    location = new TreeNode( key, value);
5  }
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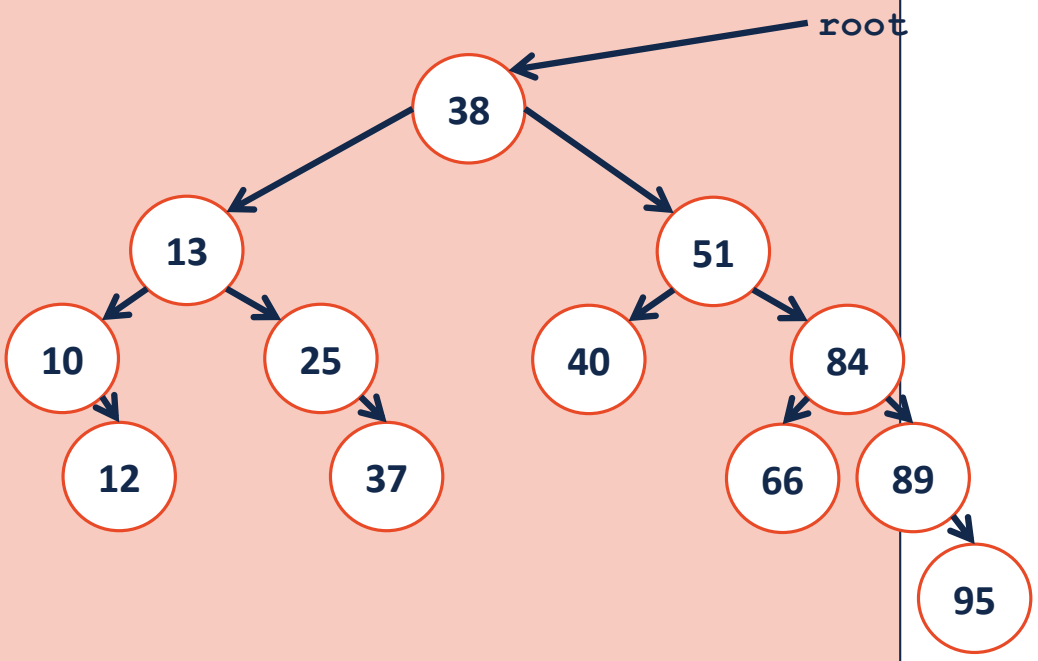

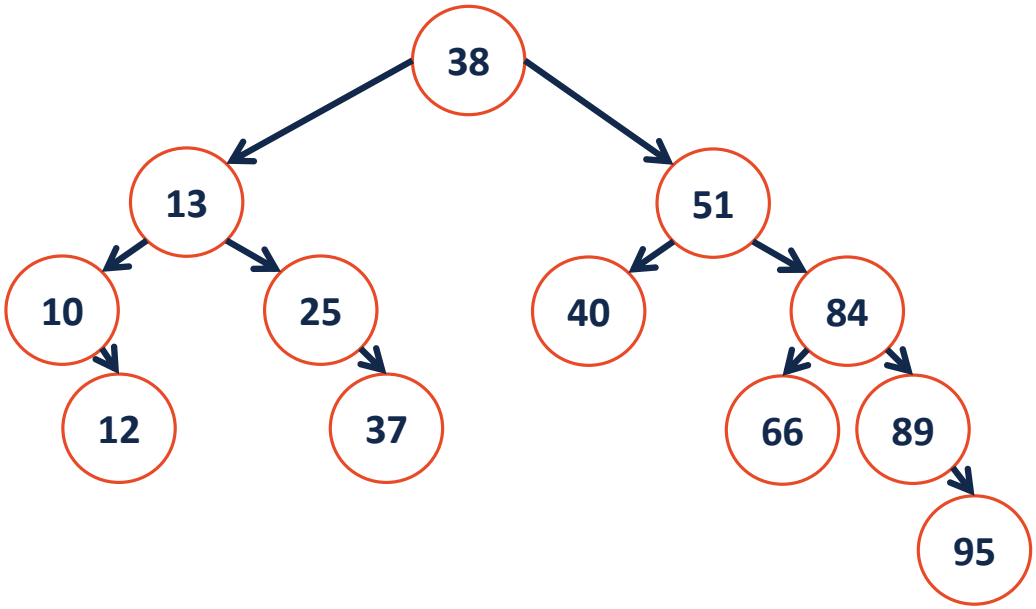
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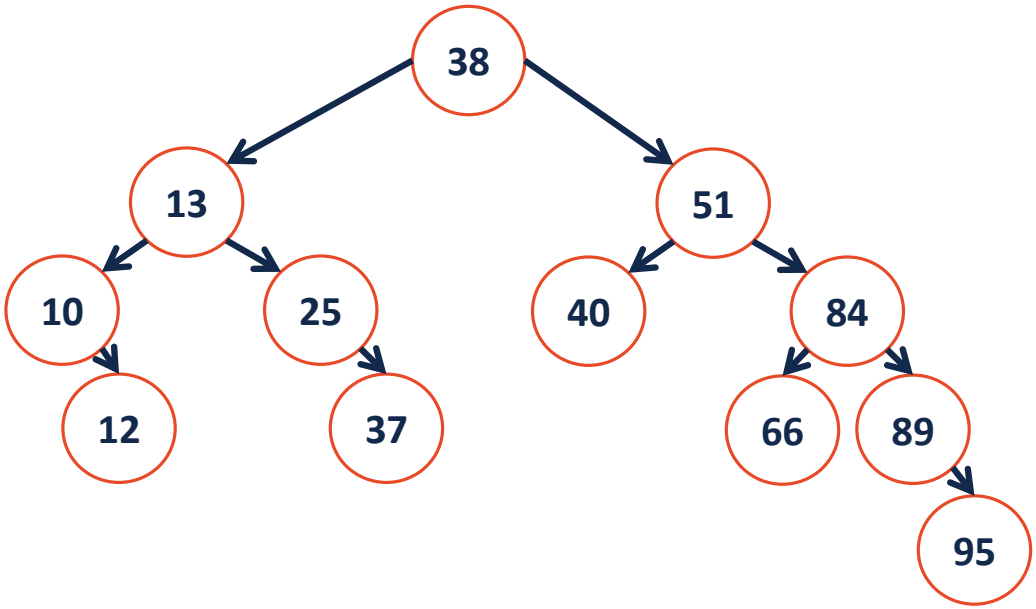


```
remove(40);
```

```
1  template<class K, class V>
2  _____________________________ _remove(TreeNode *& root, const K & key) {
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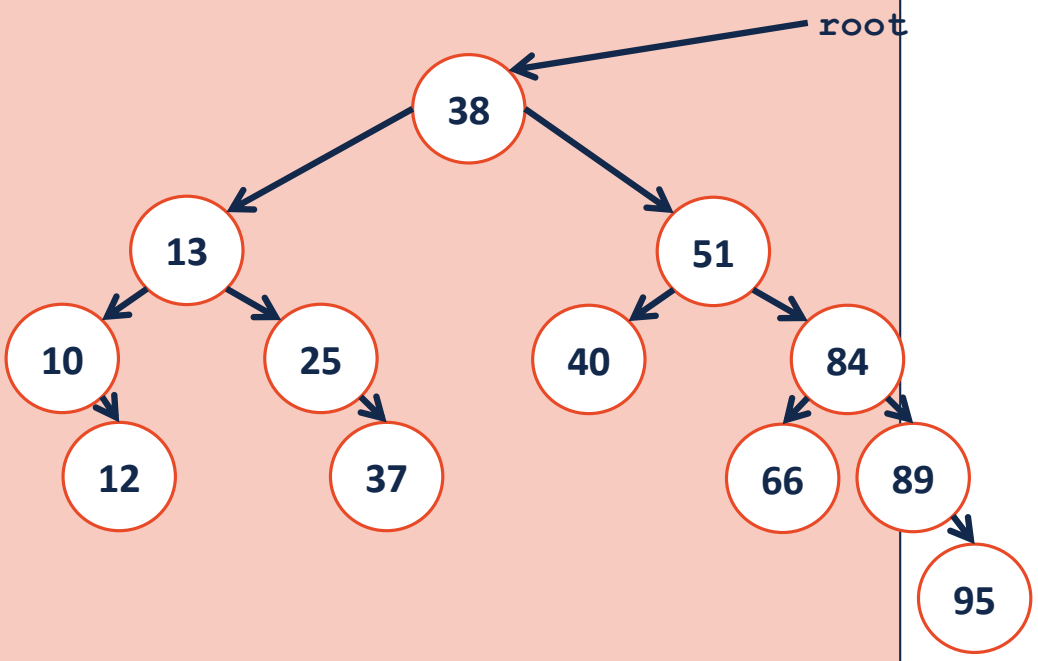
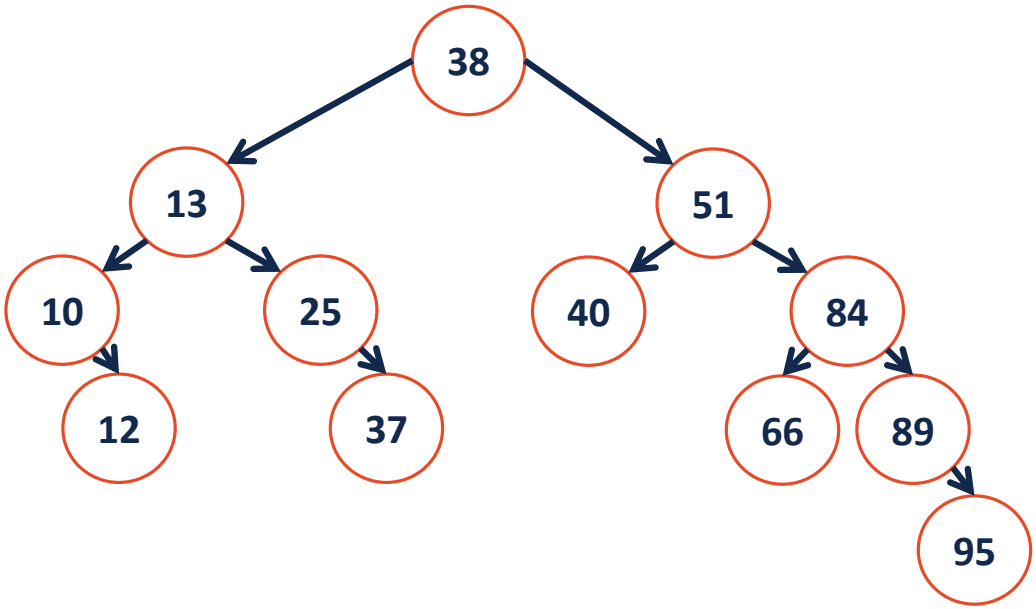
26 }
```






```
remove(25);
```

```
1  template<class K, class V>
2  _____________________________ _remove(TreeNode *& root, const K & key) {
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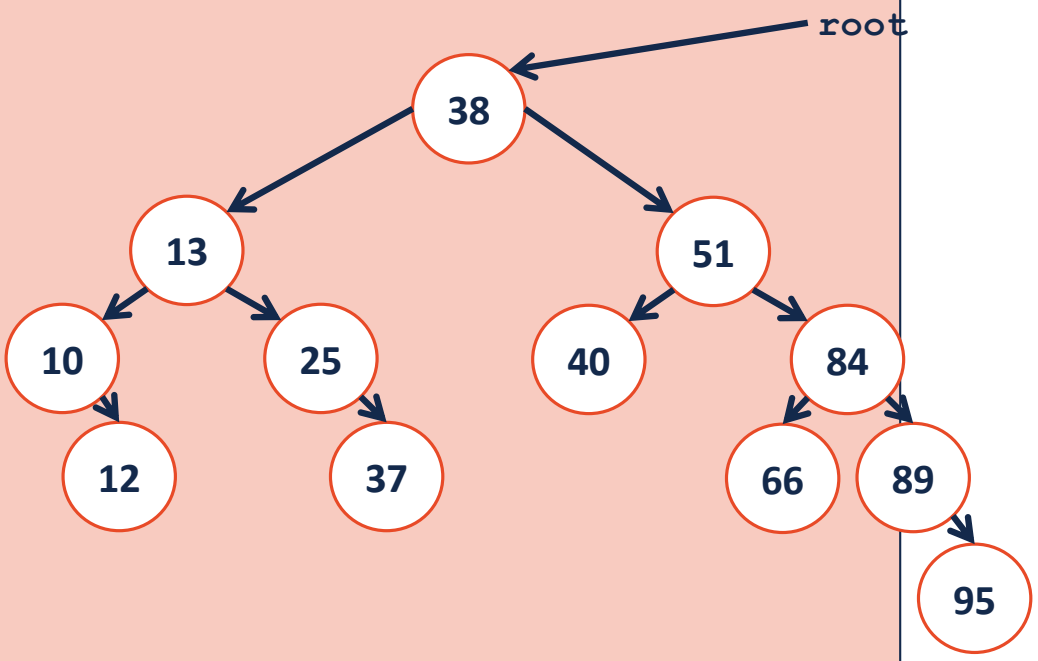
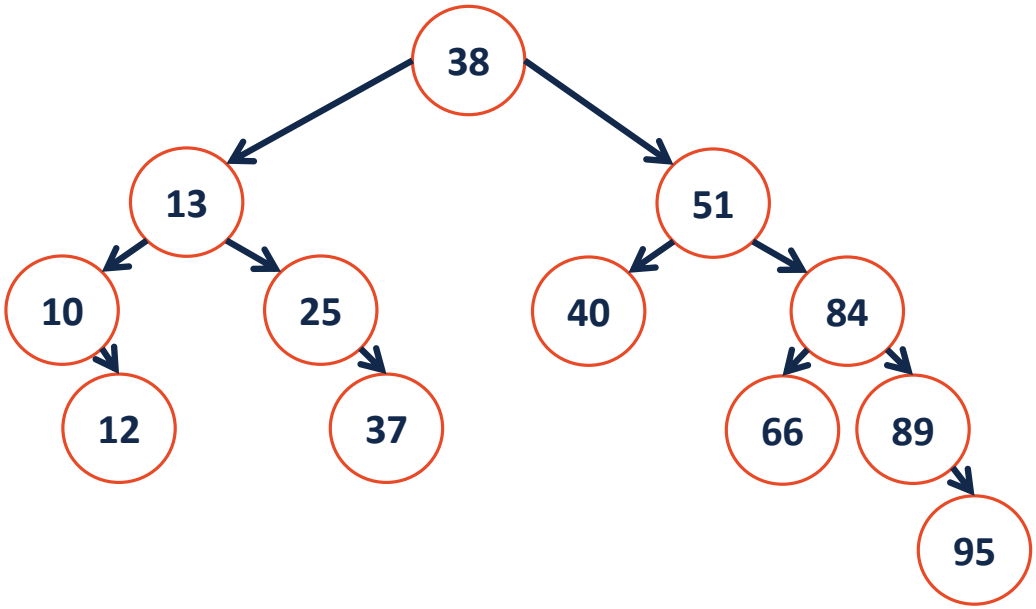
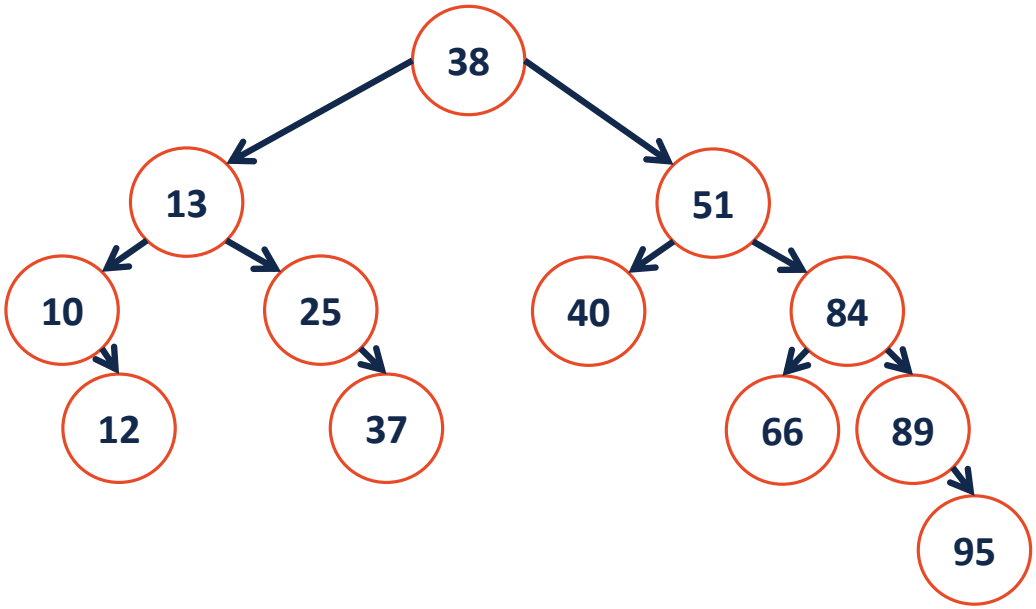
26 }
```

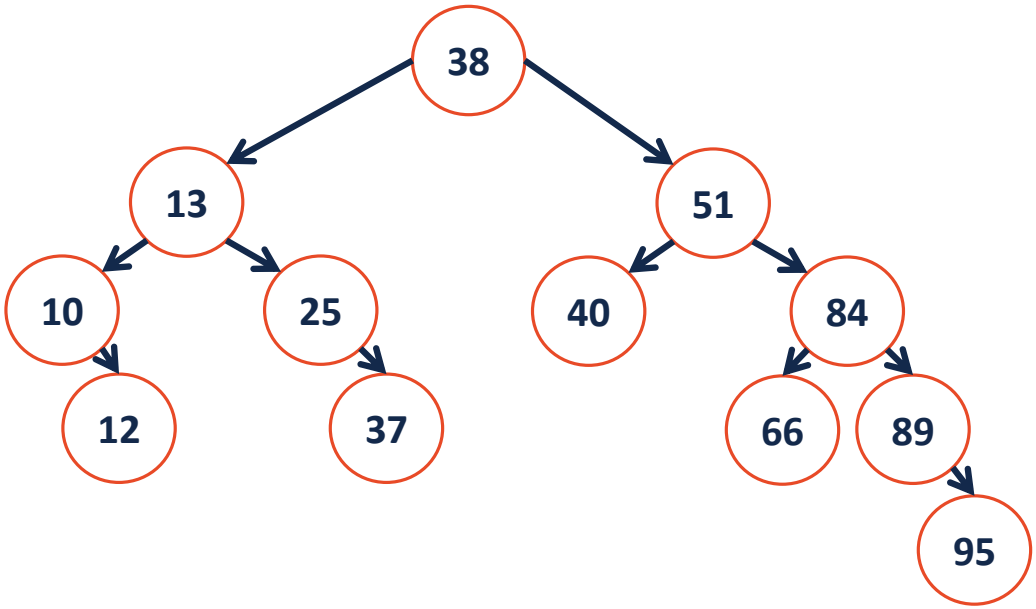





```
remove(10);
```




```
remove(13);
```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```
1  template<class K, class V>

2  void _remove(TreeNode *& root, const K & key) {
3    // find the node
4
5    // Three cases
6    // No child case remove like at the end of a list
7
8
9    // one child case remove like in a list
10
11   // two child remove swap with IOS/IOP
12   // call remove on the swapped node
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```