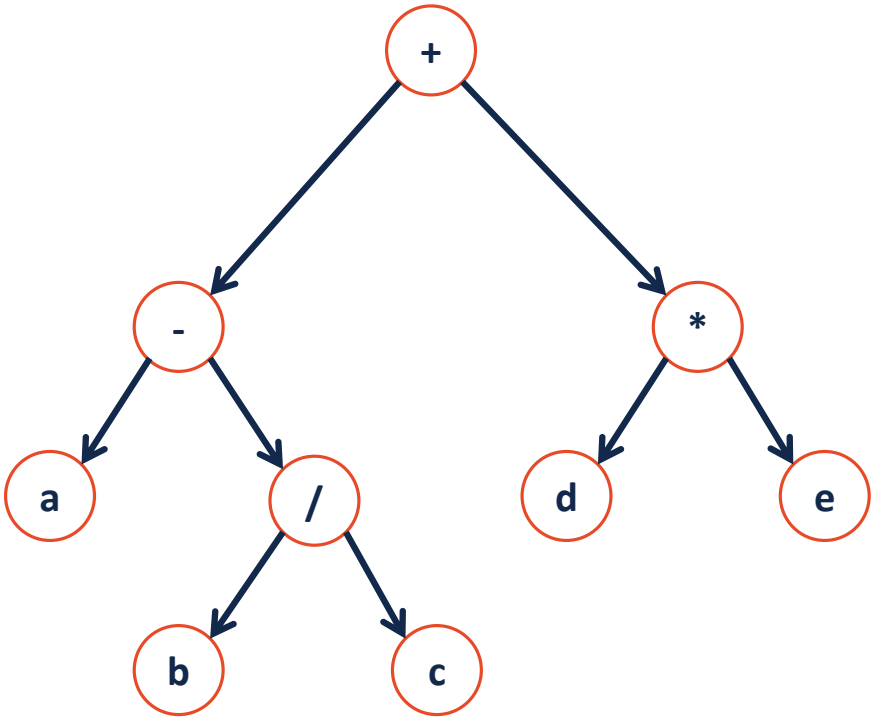
CS 225

Data Structures

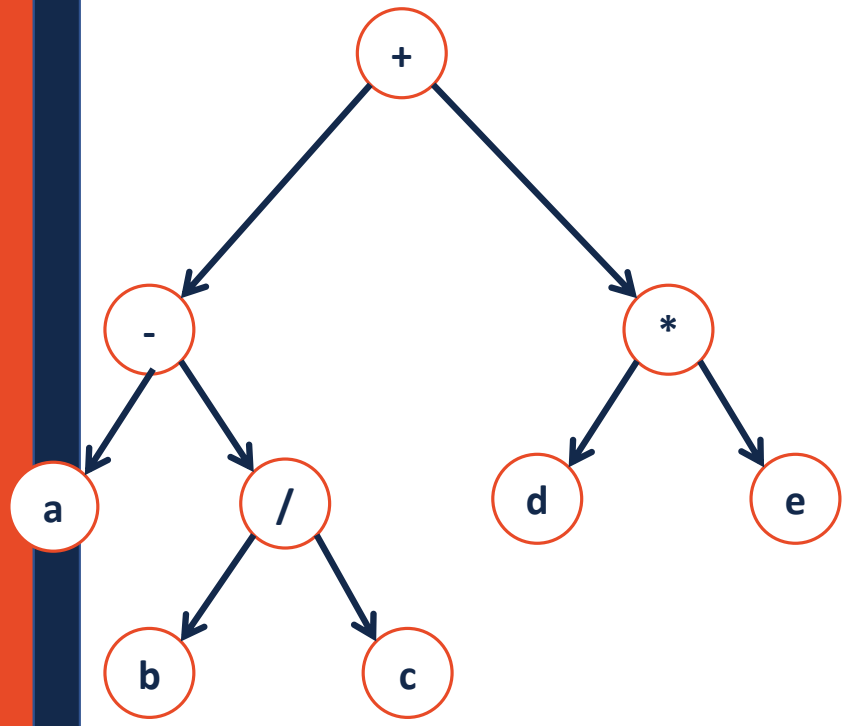
March 2 – Traversals and Dictionaries

G Carl Evans

Traversals

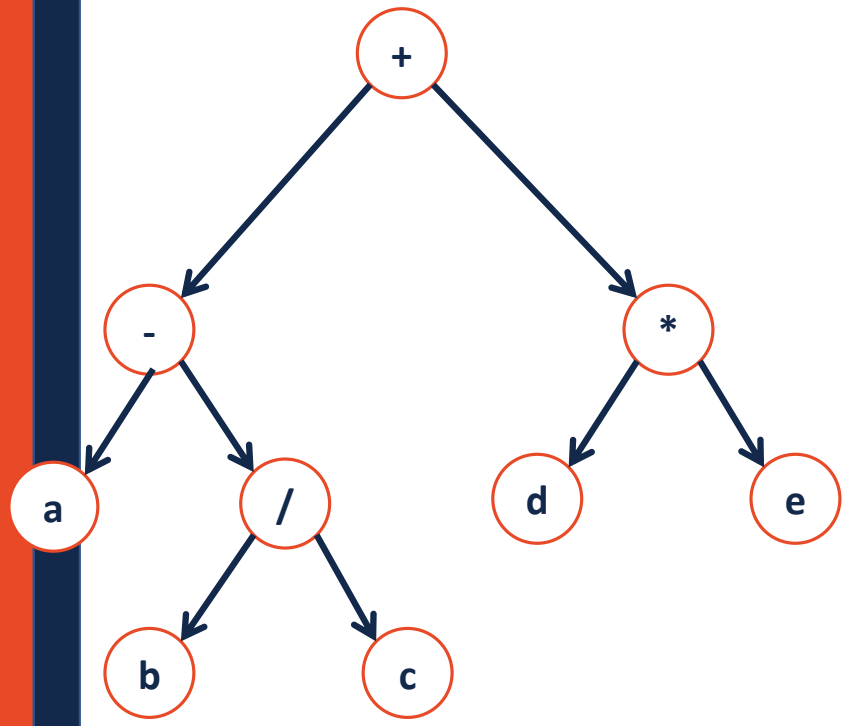


Traversals



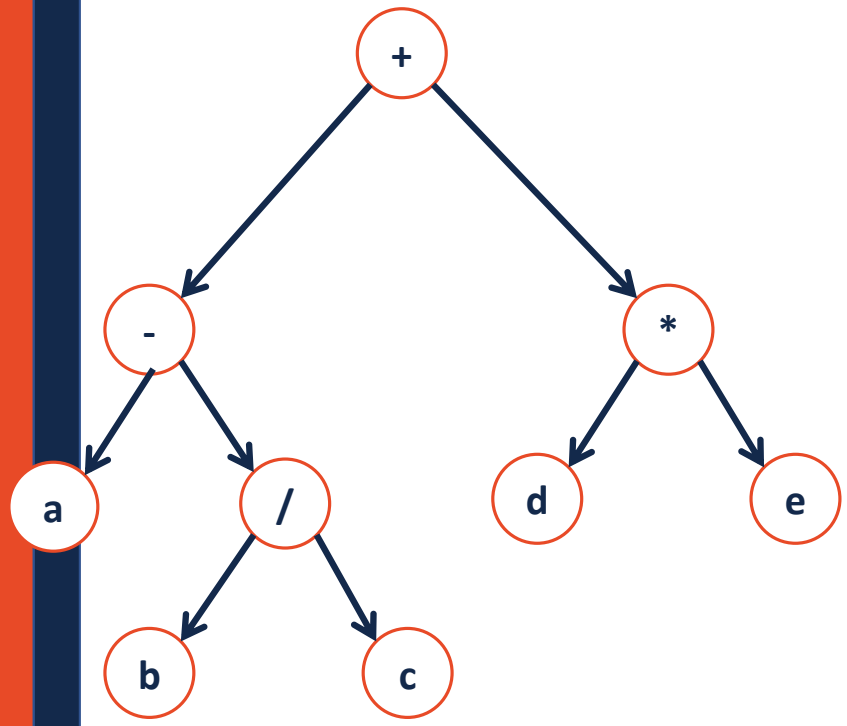

```
49  template<class T>
50  void BinaryTree<T>::__Order(TreeNode * cur)
51  {
52
53
54
55
56
57
58  }
```

Traversals




```
49  template<class T>
50  void BinaryTree<T>::___Order(TreeNode * cur) {
51     if (cur != NULL) {

52        ____________________________;

53        ___Order(cur->left);

54        ____________________________;

55        ___Order(cur->right);

56        ____________________________;

57     }
58  }
```

Traversals




```
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51     if (cur != NULL) {

52        ____________________________;

53        ___Order(cur->left);

54        ____________________________;

55        ___Order(cur->right);

56        ____________________________;

57     }
58  }
```
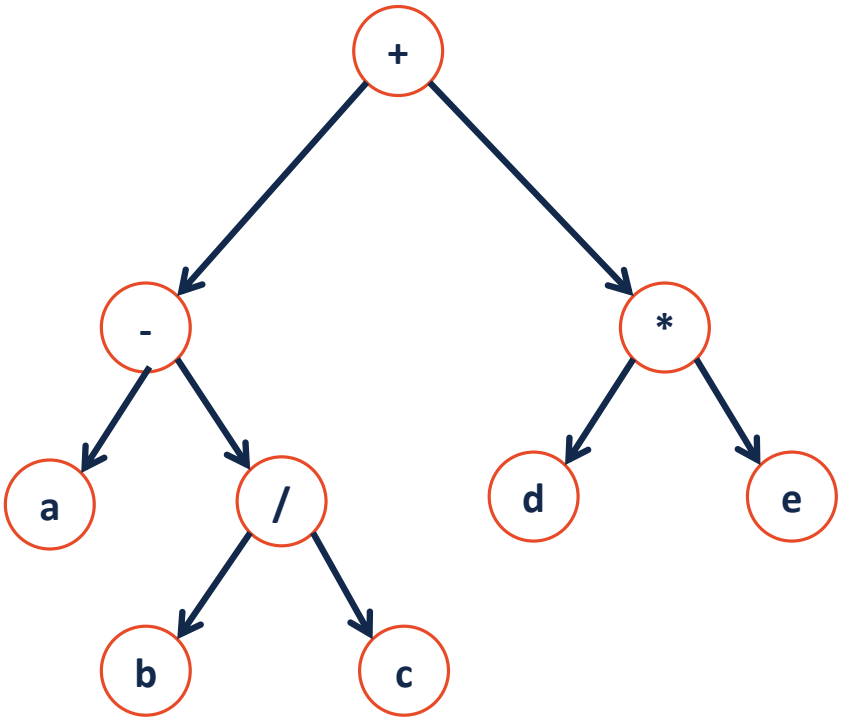
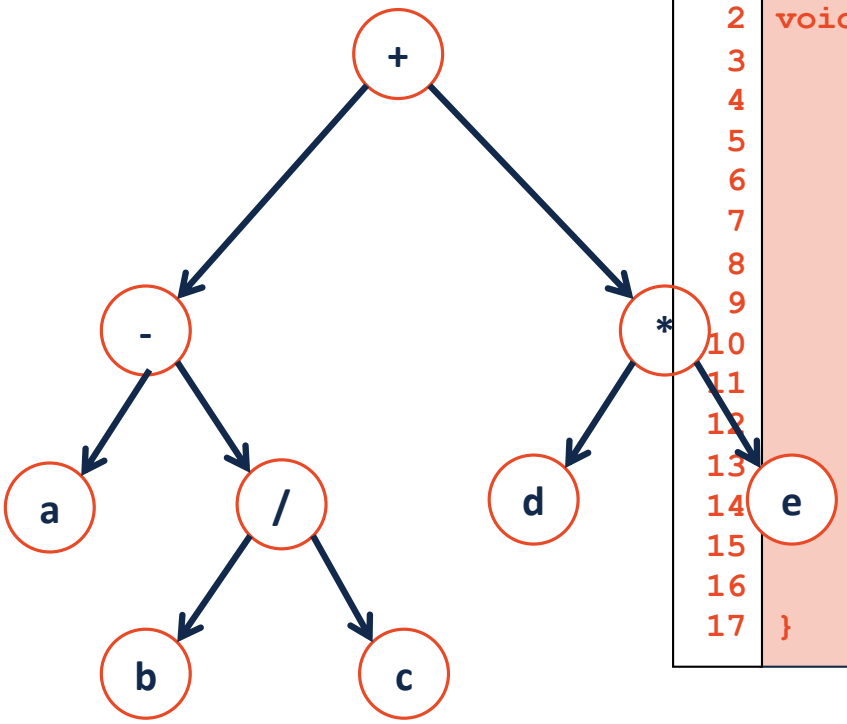

A Different Type of Traversal



A Different Type of Traversal




```
1  template<class T>
2  void BinaryTree<T>::levelOrder(TreeNode * root) {
3
4
5
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14
15
16
17 }
```

Traversal vs. Search

Traversal

Search

Search: Breadth First vs. Depth First

Strategy: Breadth First Search (BFS)

Strategy: Depth First Search (DFS)

Dictionary ADT

Data is often organized into key/value pairs:

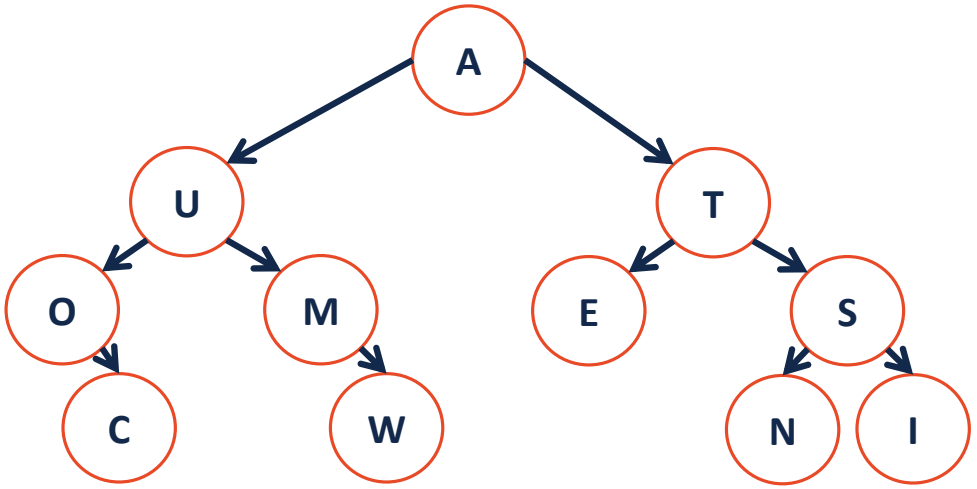
UIN → Advising Record
Course Number → Lecture/Lab Schedule
Node → Incident Edges
Flight Number → Arrival Information
URL → HTML Page
…

Search: Breadth First vs. Depth First

Strategy: Depth First Search (DFS) / Traversal

Strategy: Breadth First Search (BFS) / Traversal

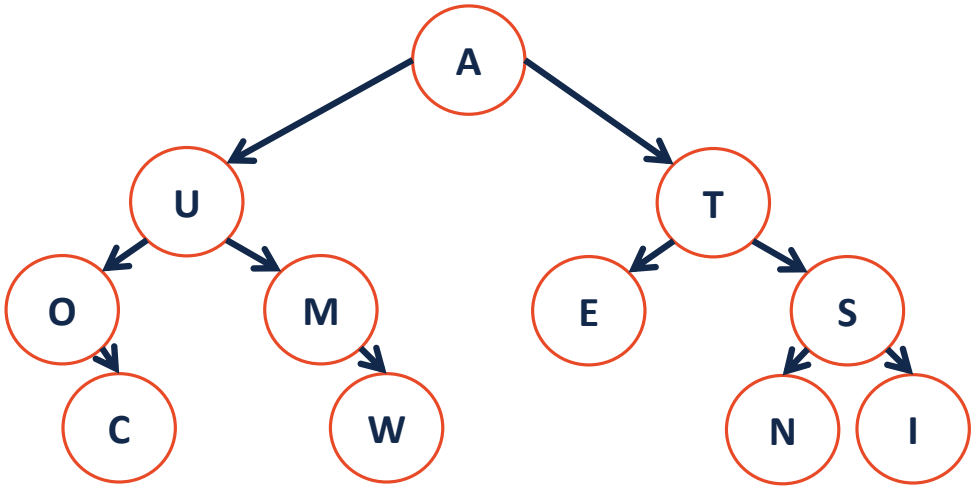
Search Running Times on a Binary Tree



Dictionary.h

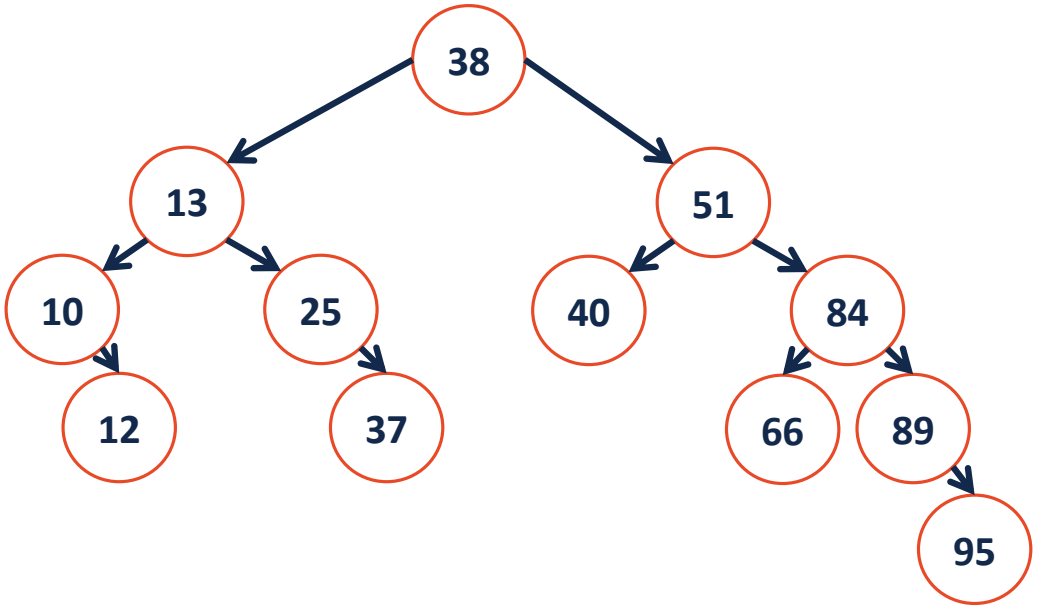
```
1  #pragma once
2
3
4  class Dictionary {
5    public:
6
7
8
9
10
11
12
13
14
15   private:
16
17
18
19 };
20
21
22
```

Binary Tree as a Search Structure



Binary _____ Tree (BST)

A **BST** is a binary tree **T** such that:



BST.h

```
 1 #pragma once
 2
 3 template <typename K, typename V>
 4 class BST {
 5   public:
 6     BST();
 7     void insert(const & K key, V value);
 8     V remove(const K & key);
 9     V find(const K & key) const;
10
11
12   private:
13     struct TreeNode {
14        TreeNode *left, *right;
15        K  key;
16        V  value;
17        TreeNode(const K & k, const V & v) : key(k), value(v),
18              left(NULL), right(NULL) { }
19     };
20
21     TreeNode *head_;
22 };
```

```
1  template<typename K, typename V>
2  _____________________________ find(const K & key) {
3
4
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21
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24
25
26 }
```

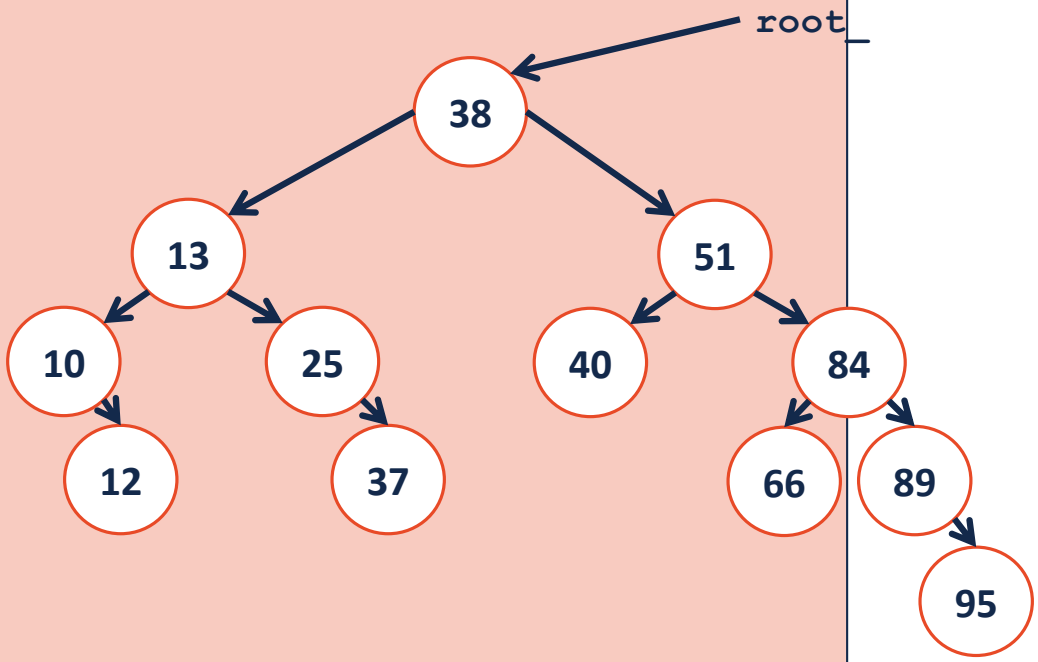

```
1  template<typename K, typename V>
2  _____________________________ _find(TreeNode *& root, const K & key) {
3
4
5
6
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20
21
22
23
24
25
26 }
```

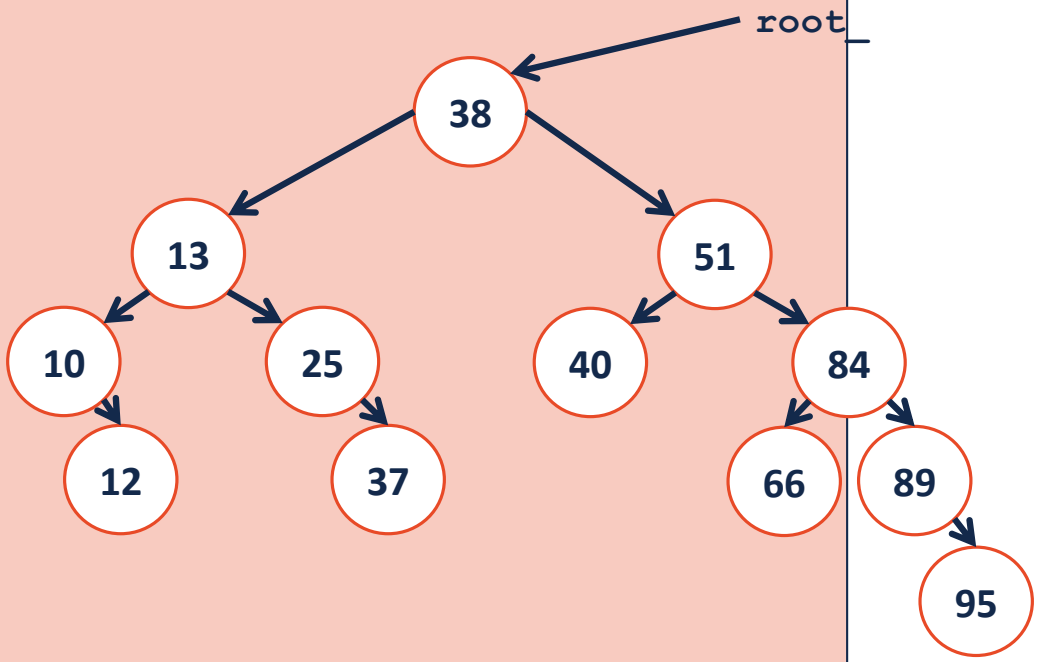

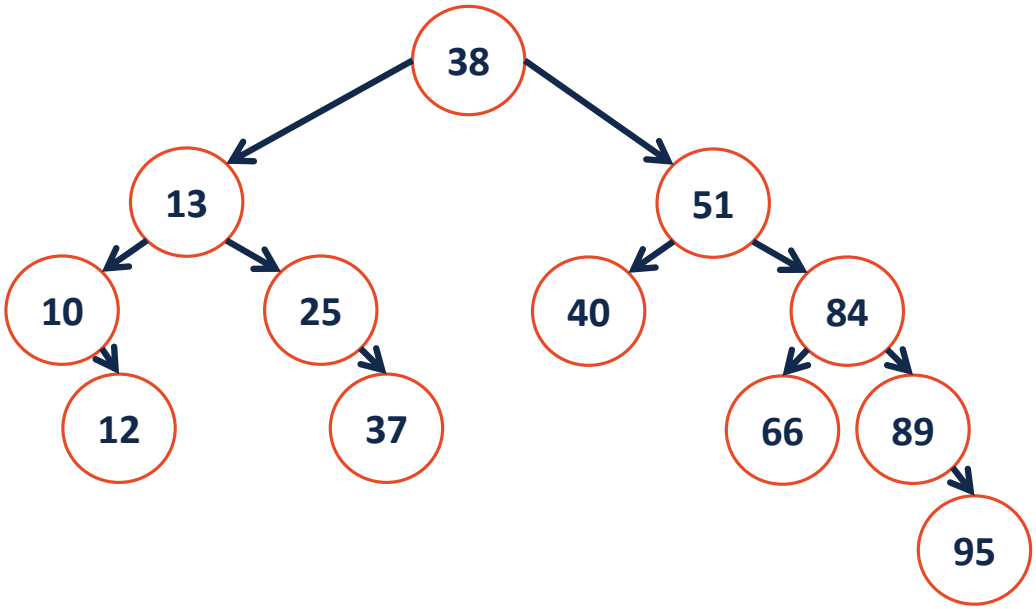
38
13
51
10
25
40
84
12
37
66
89
95

```
1  template<typename K, typename V>
2  _____________________________ _insert(TreeNode *& root, const K & key) {
3
4
5
6
7
8
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11
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16
17
18
19
20
21
22
23
24
25
26 }
```

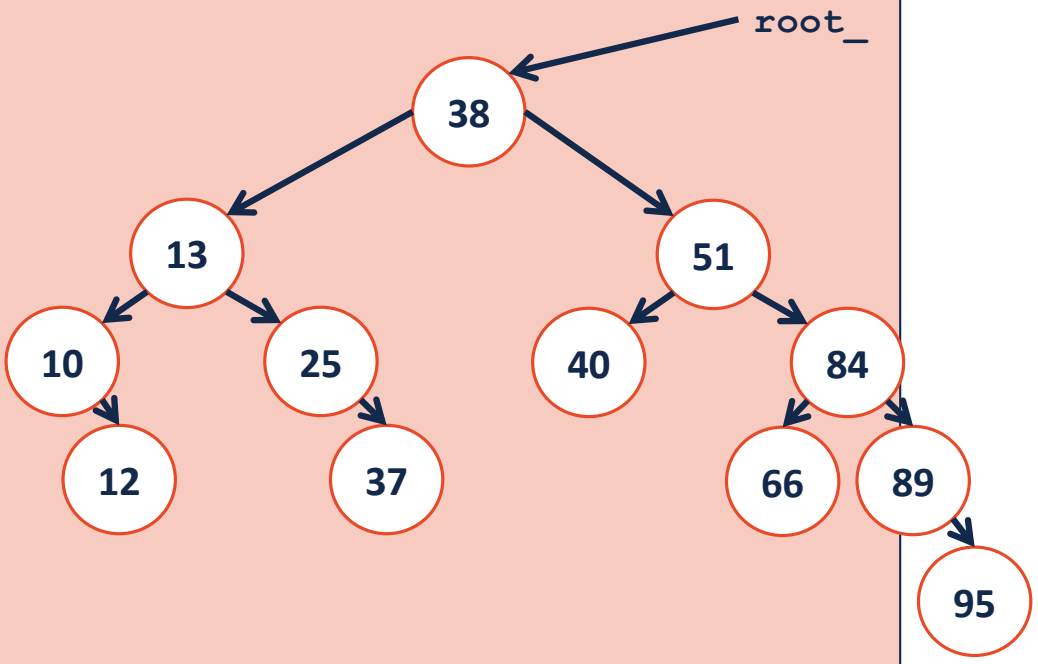

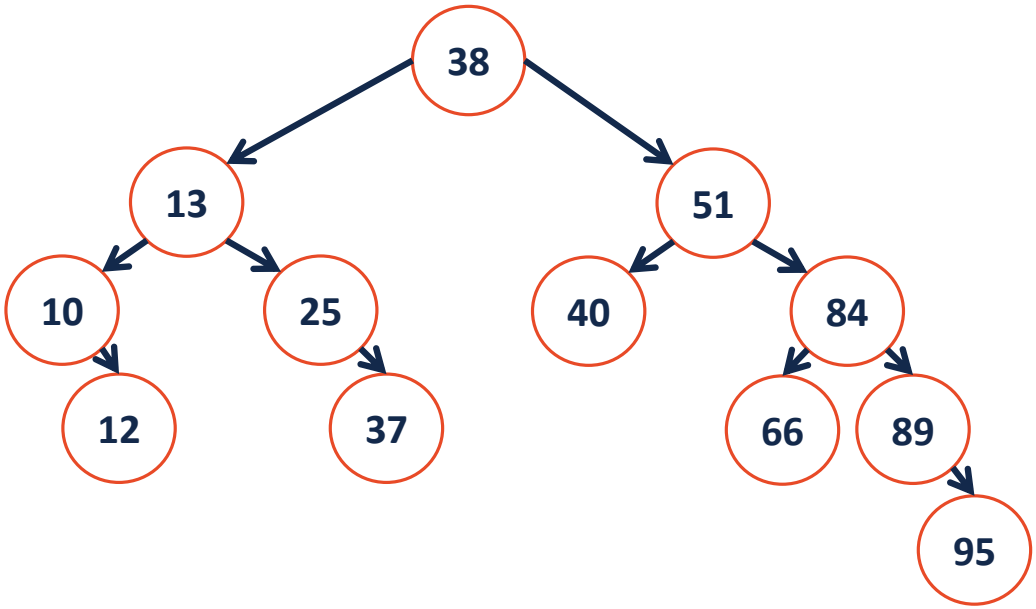
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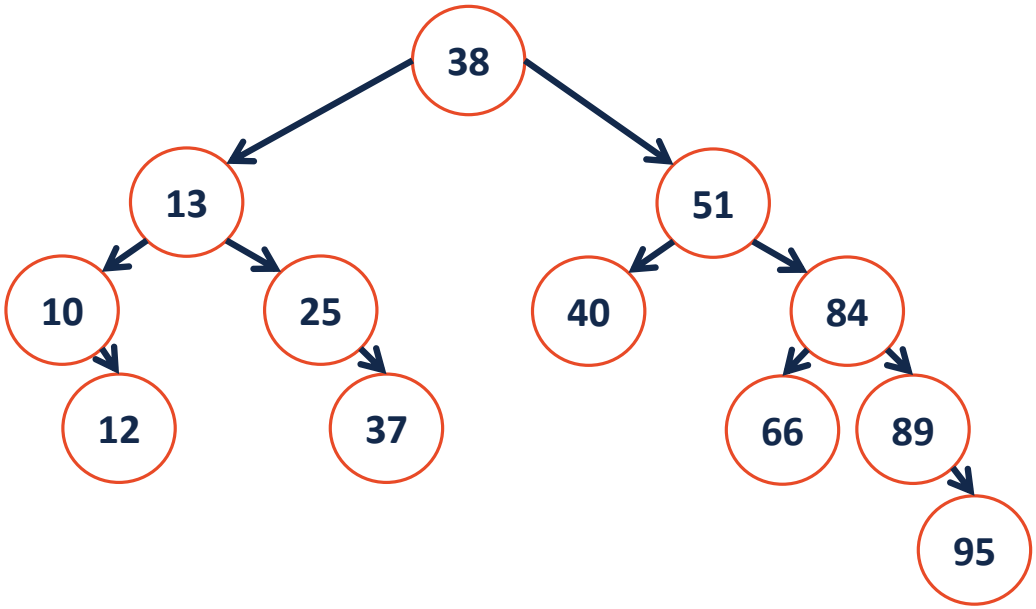
38
13
51
10
25
40
84
12
37
66
89
95

```
1  template<typename K, typename V>
2  _____________________________ _remove(TreeNode *& root, const K & key) {
3
4
5
6
7
8
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16
17
18
19
20
21
22
23
24
25
26 }
```
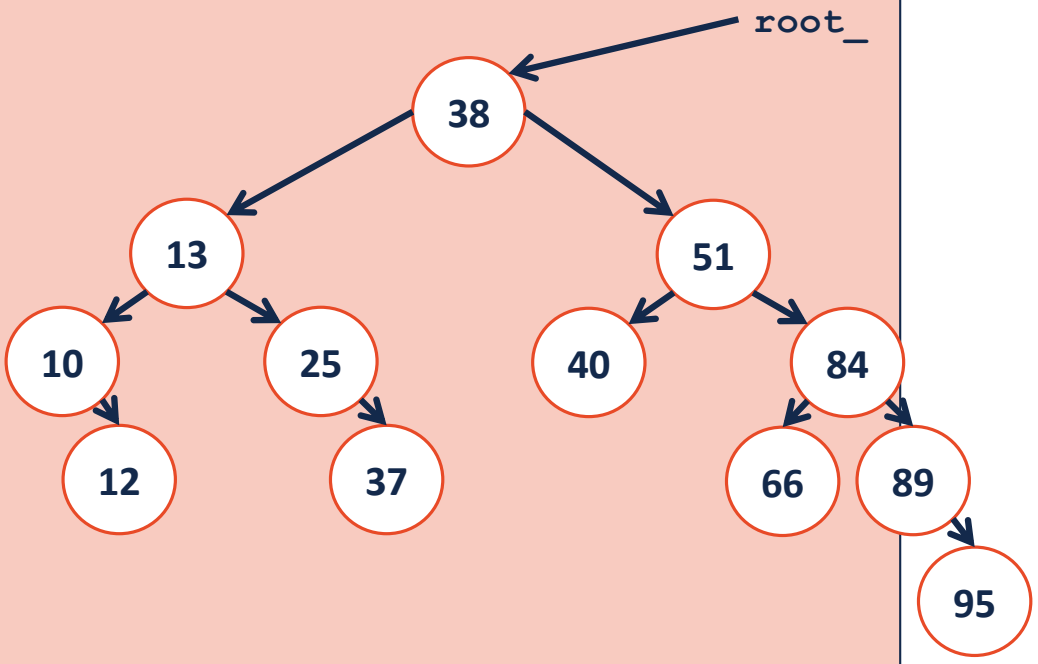
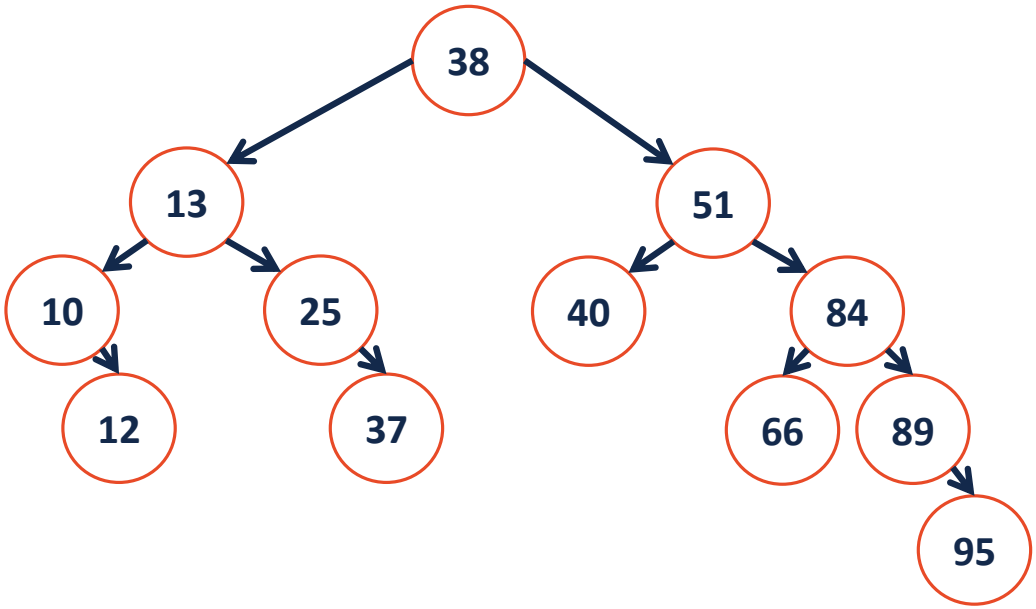
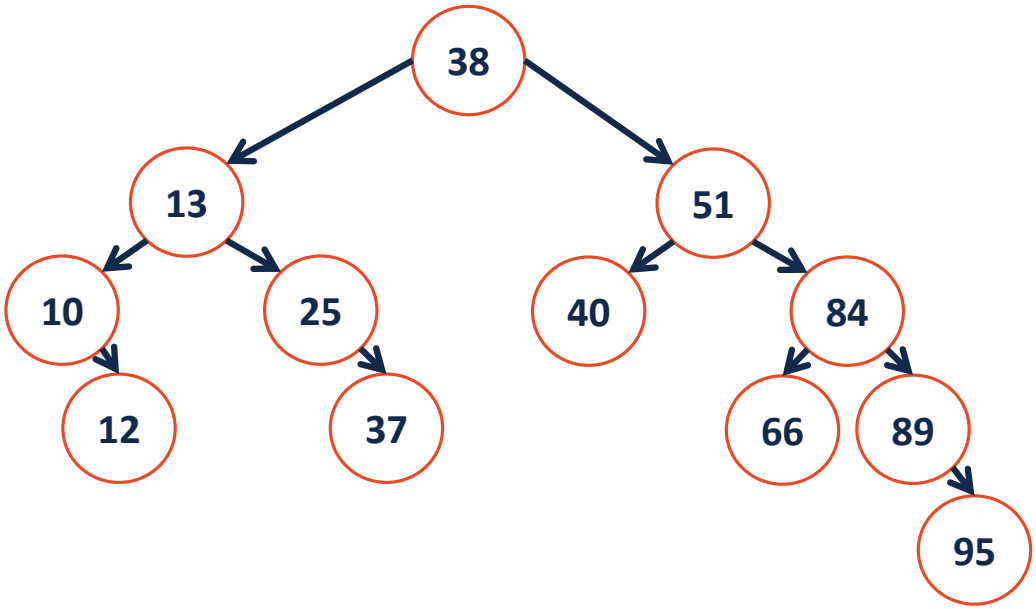
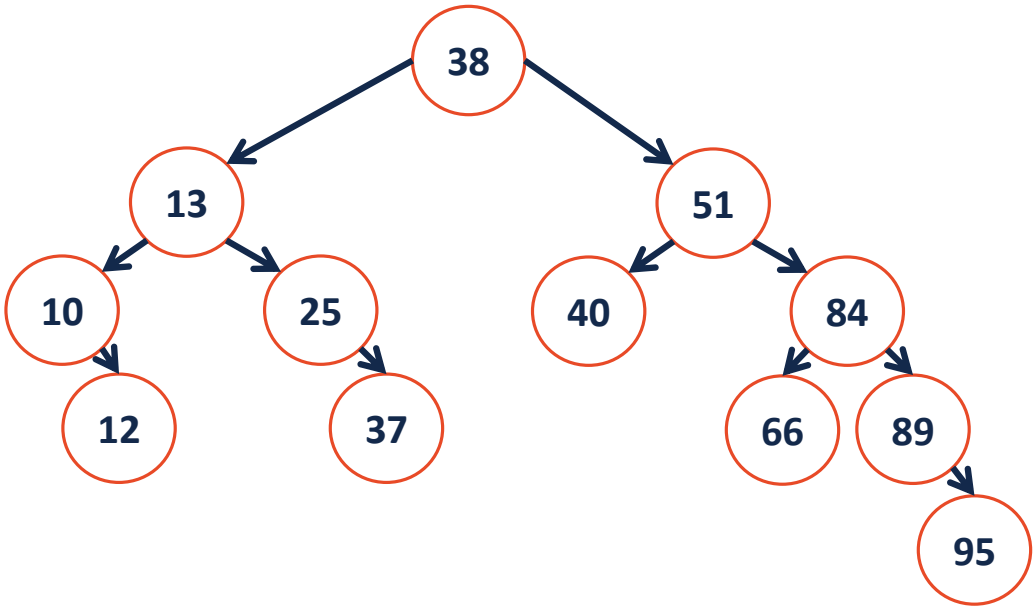





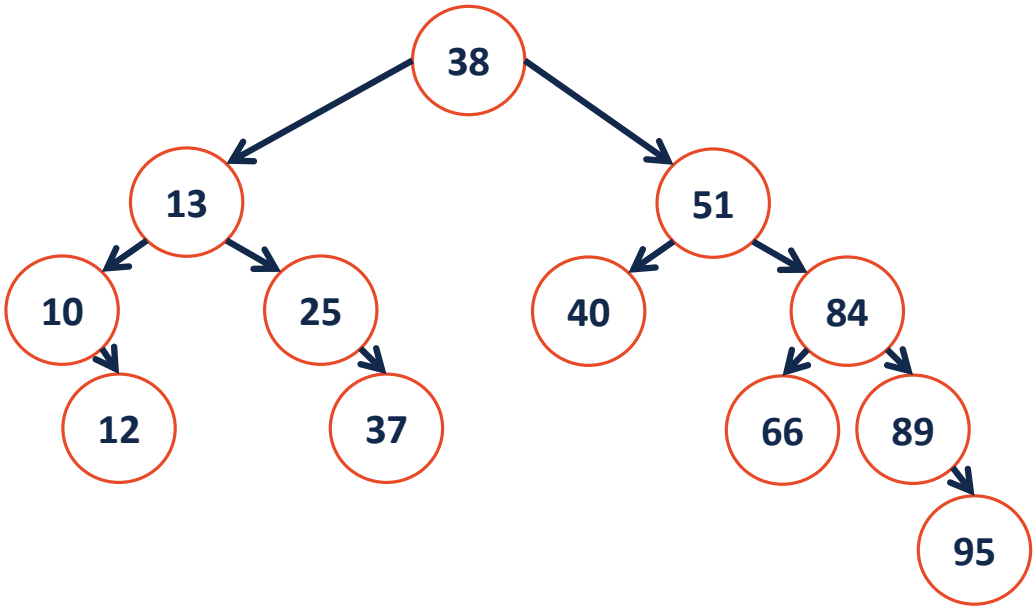

```
remove(25);
```




```
remove(40);
```




```
remove(10);
```




```
remove(13);
```