Lecture 13: Binary Search Trees 2

COSC242: Algorithms and Data Structures

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More about BSTs

Like linked lists, BSTs are dynamic data structures that can easily grow and shrink.

Unlike linked lists, BSTs can be efficient to search, insert and delete, as long as they remain balanced.

BSTs support quite a few useful operations:

- insert, search and delete
- can sort data
- can traverse the data in various orders in $O(n)$.

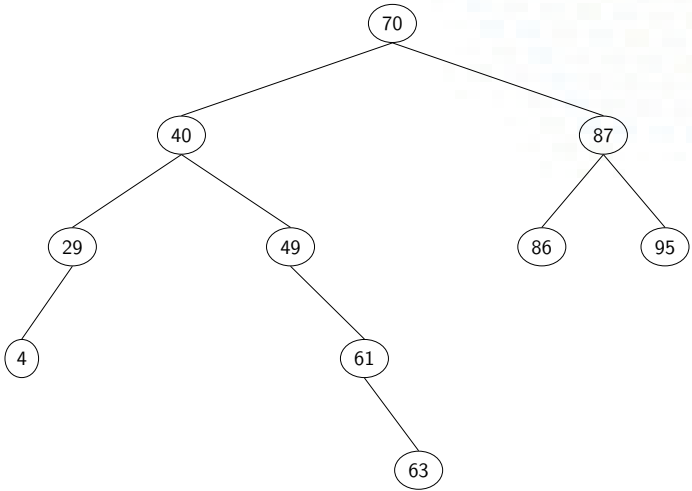
We've already seen insert. In this lecture and the next, we'll look at the other operations.

Search

```
1:  function BST_Search(BST T, KeyType key)
2:      if T == NIL then
3:          return Not Found
4:      else if key == T→key then
5:          return T
6:      else if key < T→key then
7:          return BST_Search(T→left, key)
8:      else
9:          return BST_Search(T→right, key)
10:     end if
11: end function
```

What's the complexity of search?

Search Example



Traversal

Suppose we want to print the items in a BST in sorted order by key value.

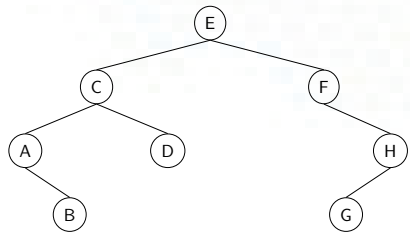
We need to walk over (traverse) the tree, pausing at the right moment to print a node, so that we print the nodes in the right order (with increasing key values).

So suppose we have an operation Zap to apply to each node (where Zap is something like Print or Update):

Inorder

```
1: procedure INORDER_TREE_WALK(T)
2:     if T ≠ NIL then
3:         Inorder_tree_walk(T→left)
4:         Zap(T)
5:         Inorder_tree_walk(T→right)
6:     end if
7: end procedure
```

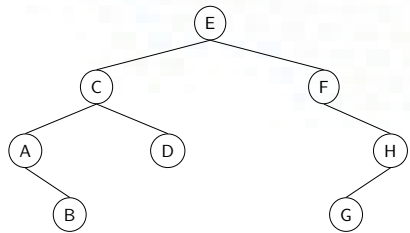
In what order would we Zap the nodes below?



Preorder

```
1: function PREORDER_TREE_WALK(T)
2:     if T ≠ NIL then
3:         Zap(T)
4:         Preorder_tree_walk(T→left)
5:         Preorder_tree_walk(T→right)
6:     end if
7: end function
```

In what order would we Zap the nodes below?

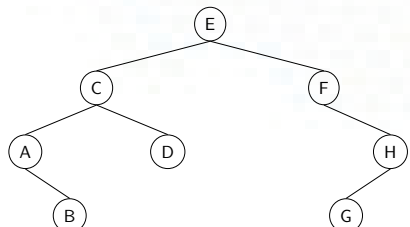


Postorder

```
1: procedure POSTORDER_TREE_WALK(T)
2:     if T ≠ NIL then
3:         Postorder_tree_walk(T→left)
4:         Postorder_tree_walk(T→right)
5:         Zap(T)
6:     end if
7: end procedure
```

How long does a traversal take?

In what order would we Zap the nodes below?



Relevant parts of the textbook

Search is discussing in Section 12.2.

Inorder traversal is discussed in Section 12.1.