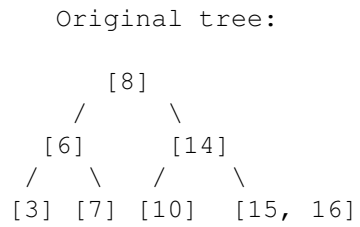
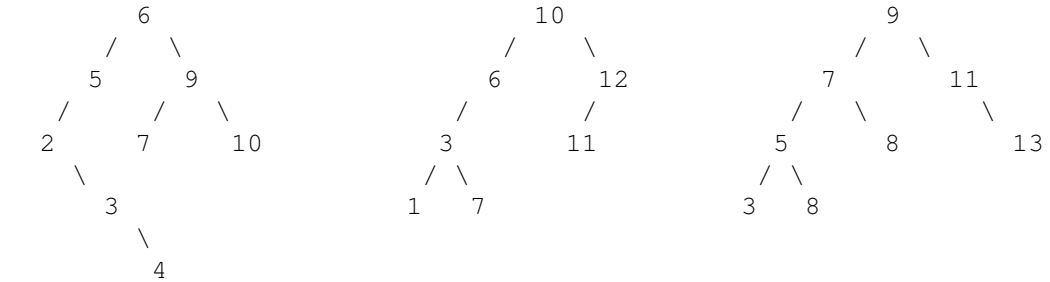
1 2-3 Tree Insertion

Given the following 2-3 tree, draw what the tree would look like after inserting 18.



2 BSTs and Balance

Given the following binary trees, determine if each is a BST, and whether it has minimum-BST-height (circle the correct answer). By minimum-BST-height, we mean that the height of the tree is the same as the height of the optimal binary search tree containing the given elements.



Suppose we know the height H and number of nodes N of a BST. Can we determine whether or not this BST is minimum-BST-height without having to check the values of each node? If so, how? If not, why not?

3 Binary Tree Creation

Implement a function that, given a **sorted** array of integers of length $N = 2^k - 1$, creates and returns a BST of minimum height. You can assume you have a method `slice` that takes in an integer array and two indices to slice between (inclusive of the first index, exclusive of the second):

```
slice([1, 2, 3], 0, 1) // Returns [1]
slice([1, 2, 3], 1, 3) // Returns [2, 3]
```

Use the following definition of a Binary Search Tree Node (`BSTNode`):

```
public class BSTNode {
    public BSTNode left, right;
    public int value;

    public BSTNode(int n) {
        value = n;
    }
}

public BSTNode makeBST(int[] nums) {









}
```

Runtime recap: What is the runtime of `makeBST()`?

4 Common Ancestor

Challenge Problem: Implement a function that, given a valid BST and two integers, returns the `BSTNode` X that is the deepest common ancestor of the two integers. By deepest, we mean that its distance from the root is maximized. By common ancestor, we mean that `n1 <= X.val` and `n2 >= X.val`. You may assume that `n1 < n2`. If no such node exists, return null.

```
/** Returns the BSTNode that is the shortest common ancestor of n1 and n2. */
public BSTNode commonAncestor(BSTNode root, int n1, int n2) {









}
```

Runtime recap: What is the runtime of `commonAncestor()`?