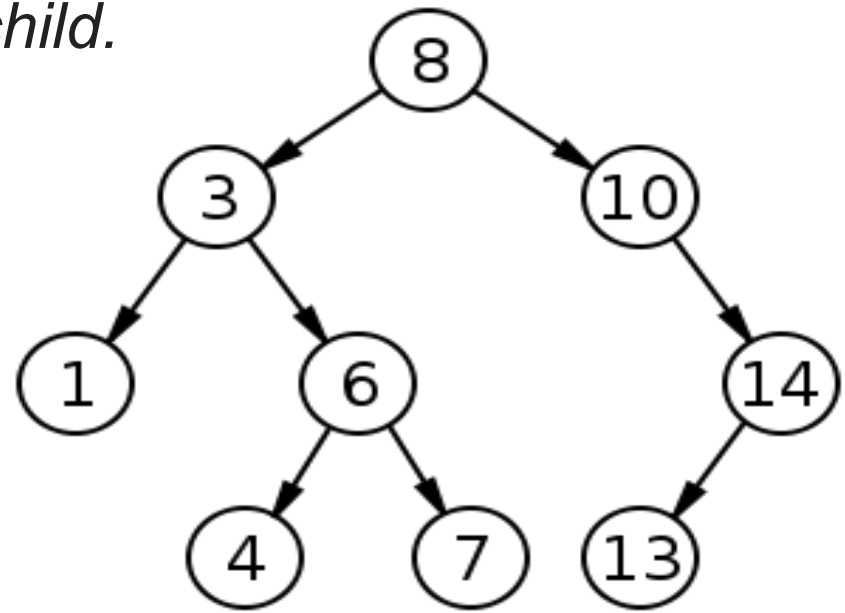
Binary Search Trees

Introduction

Binary Search Tree

A **binary search tree** is a tree data structure in which each node has at most two children, which are referred to as the *left child* and the *right child.*

Binary search trees differ from binary trees in that the entries are *ordered*.



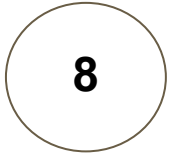
Binary Search Tree: Insertion

Binary Search Tree: Insertion

8	3	10	1	6

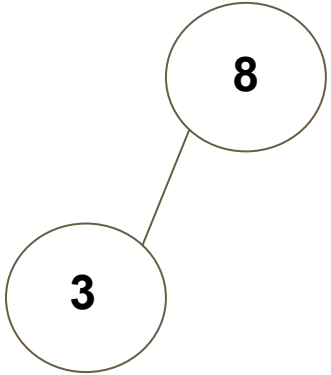
Binary Search Tree: Insertion

	3	10	1	6

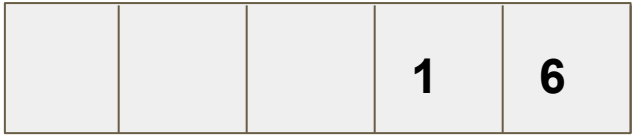


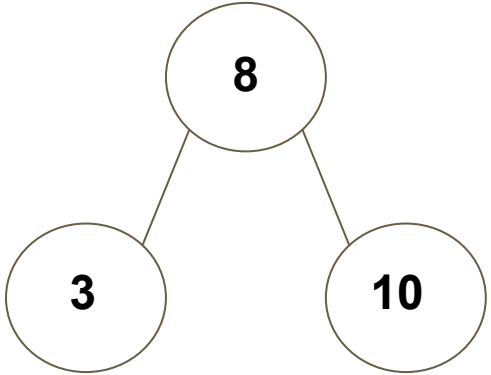
Binary Search Tree: Insertion

		10	1	6



Binary Search Tree: Insertion





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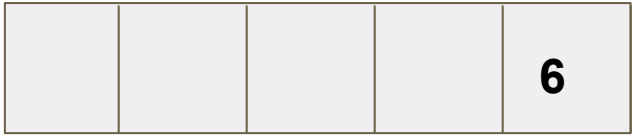

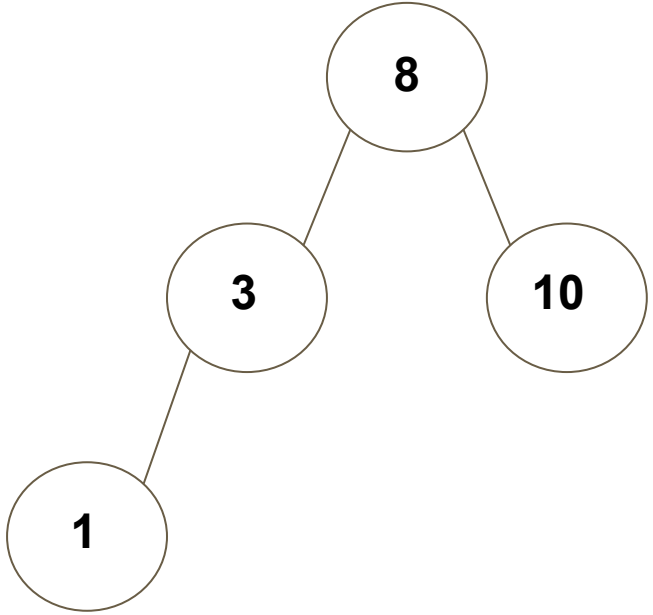

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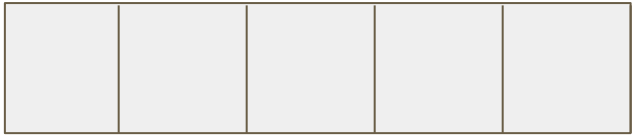
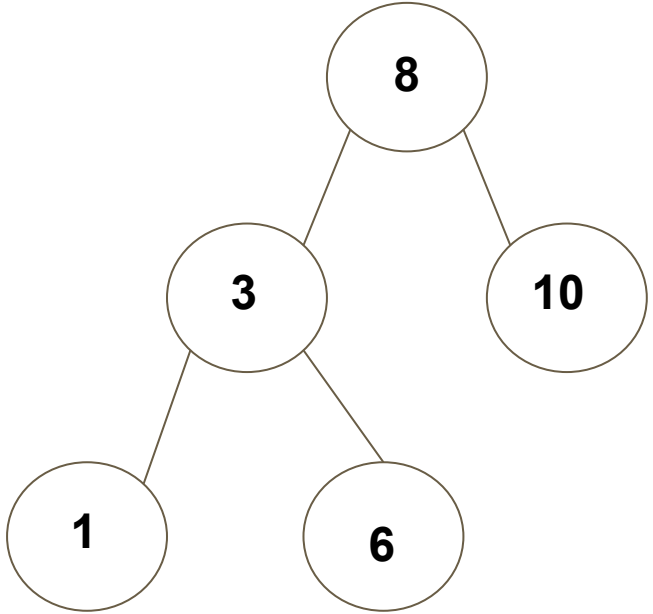
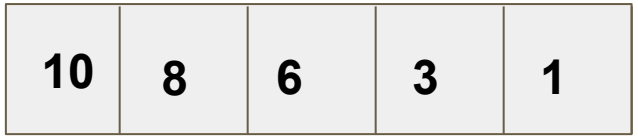
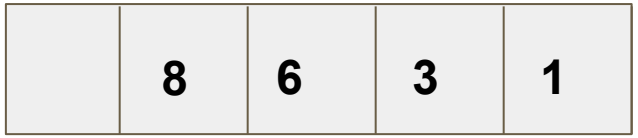


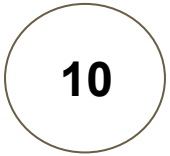


Binary Search Tree: Insertion on Reverse Sorted List

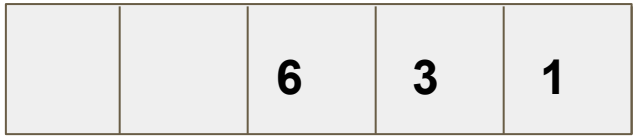


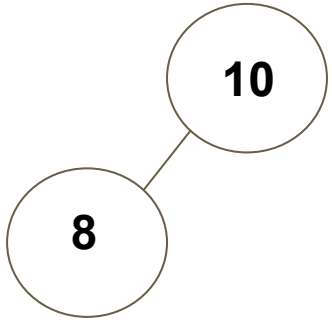
Binary Search Tree: Insertion on Reverse Sorted List





Binary Search Tree: Insertion on Reverse Sorted List





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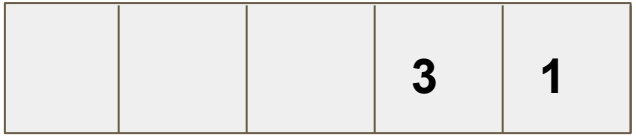
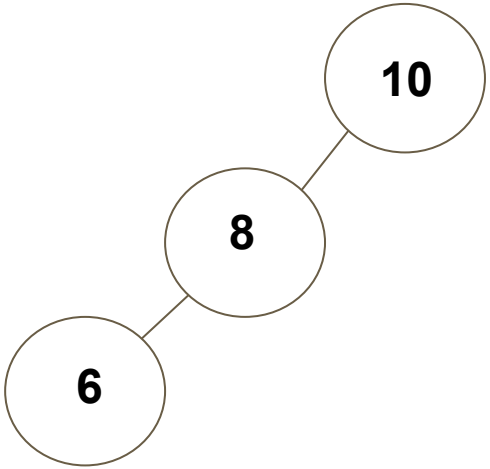
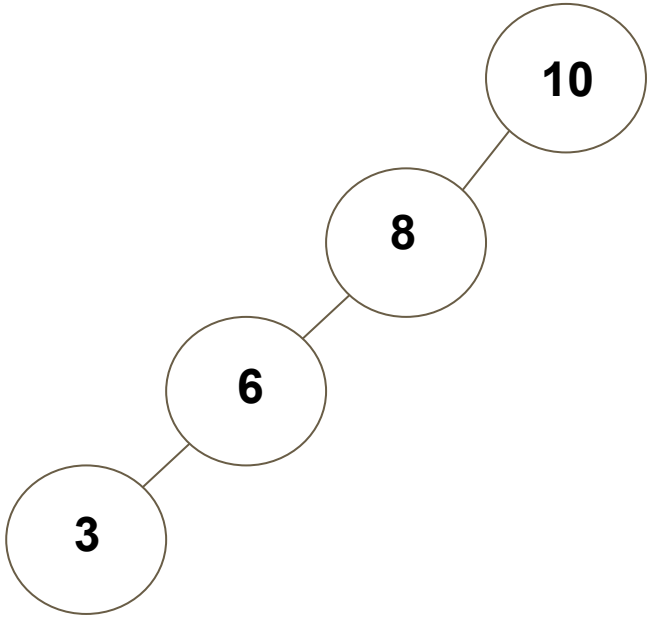
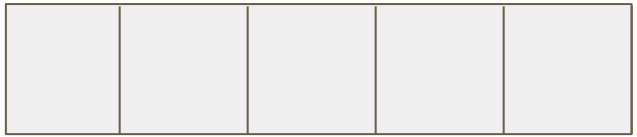


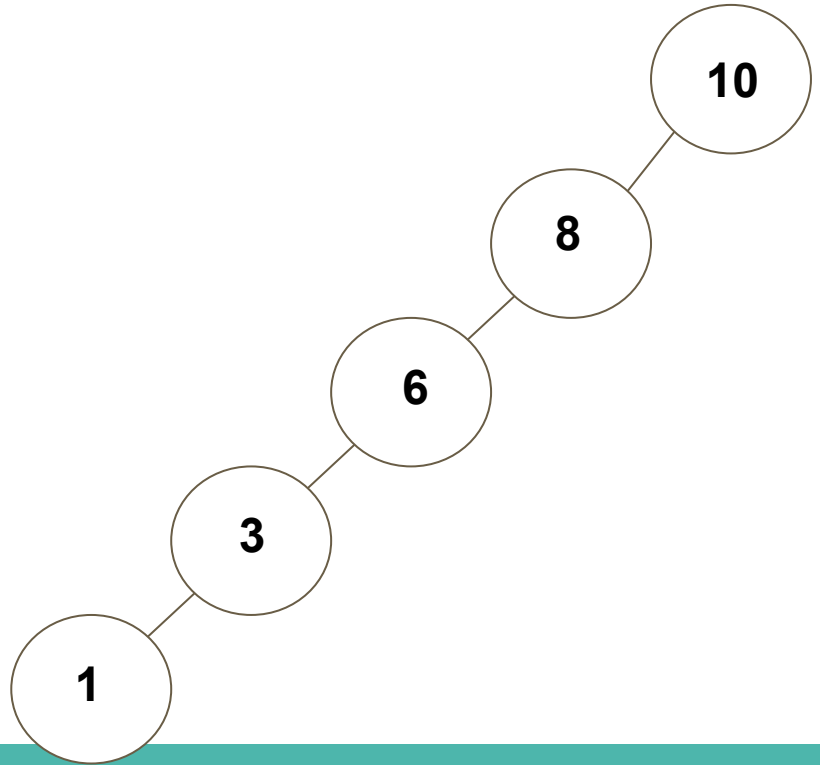


Binary Search Tree: Insertion on Reverse Sorted List



Binary Search Tree: Insertion on Reverse Sorted List

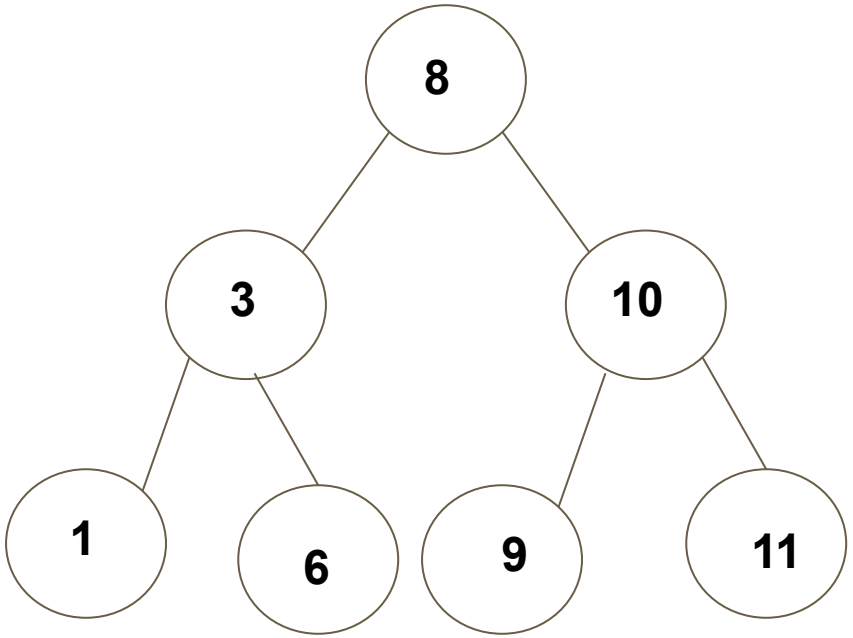




Binary Search Tree: Search

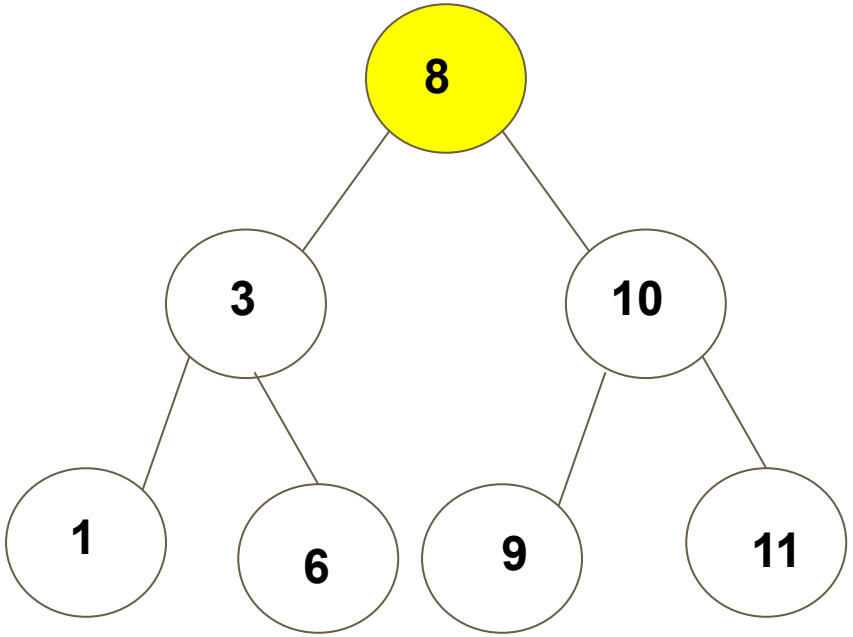
Binary Search Tree: Search

Search for 1



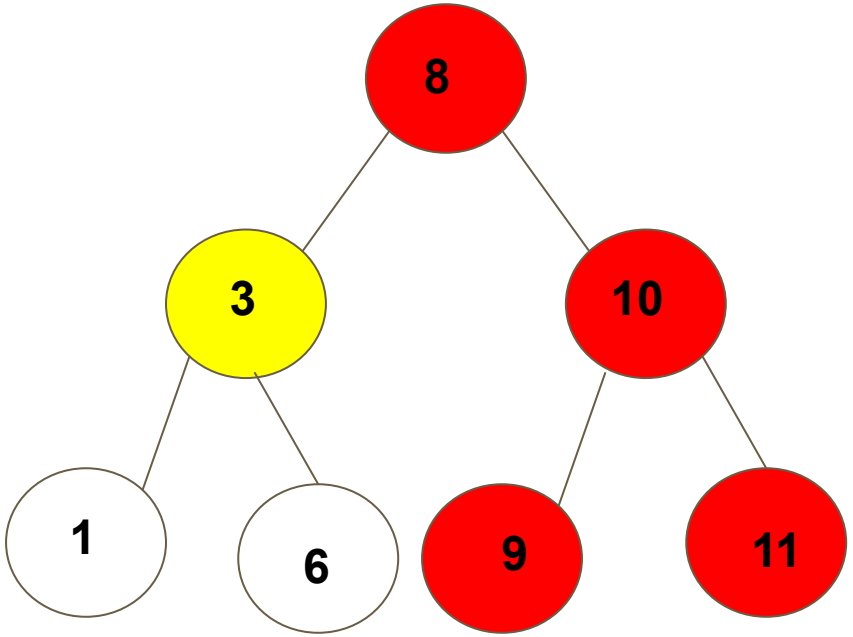
Binary Search Tree: Search

Search for 1



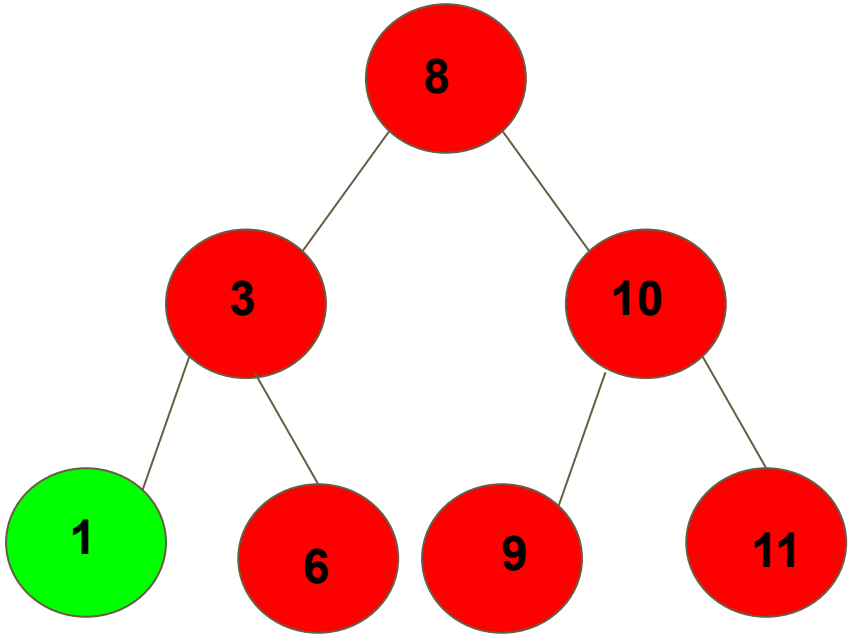
Binary Search Tree: Search

Search for 1

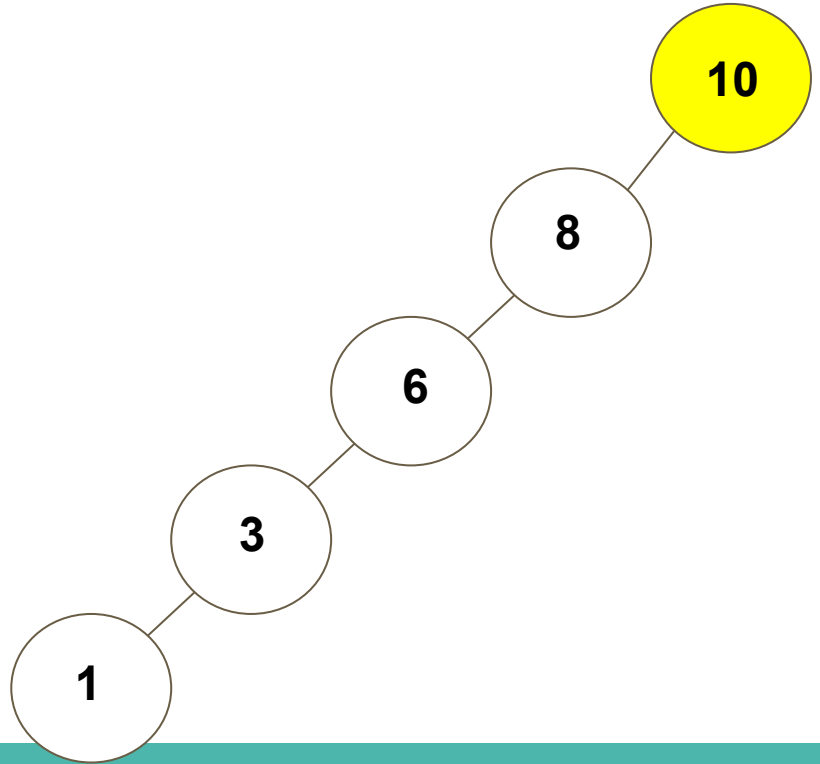


Binary Search Tree: Search

Search for 1



Binary Search Tree: Search



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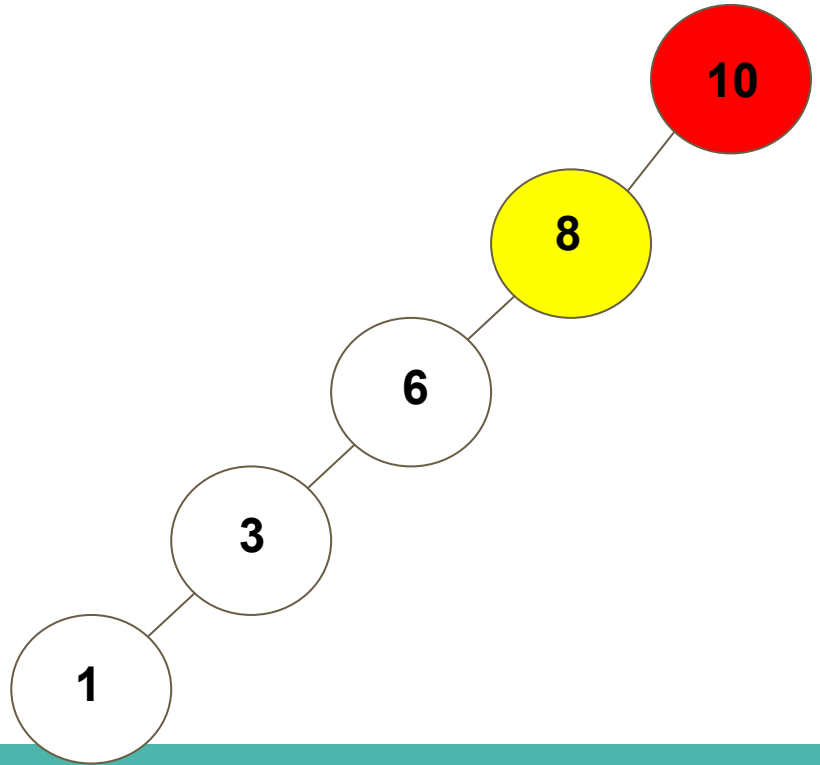
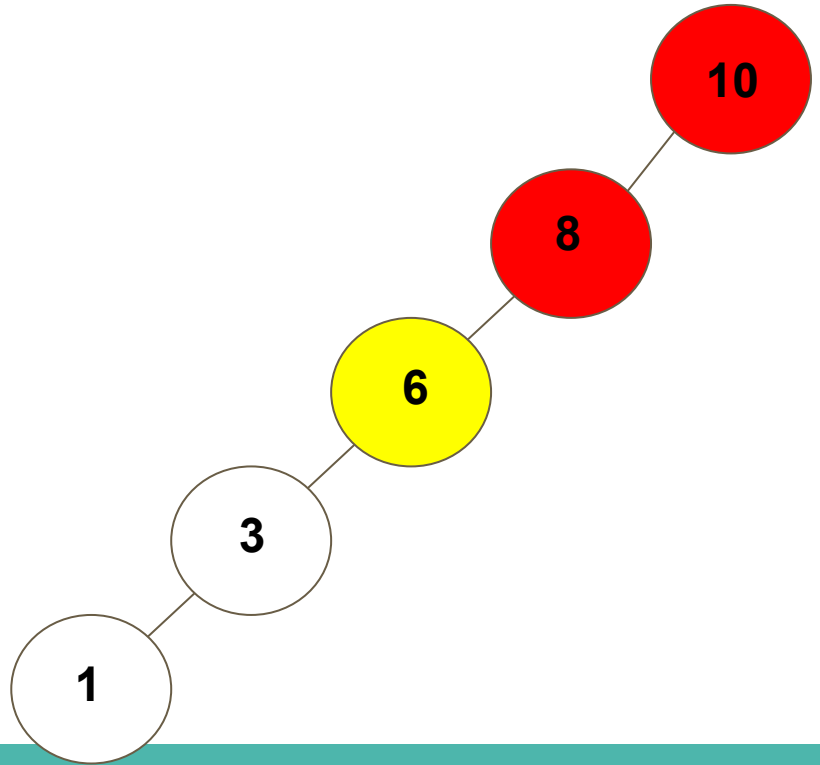
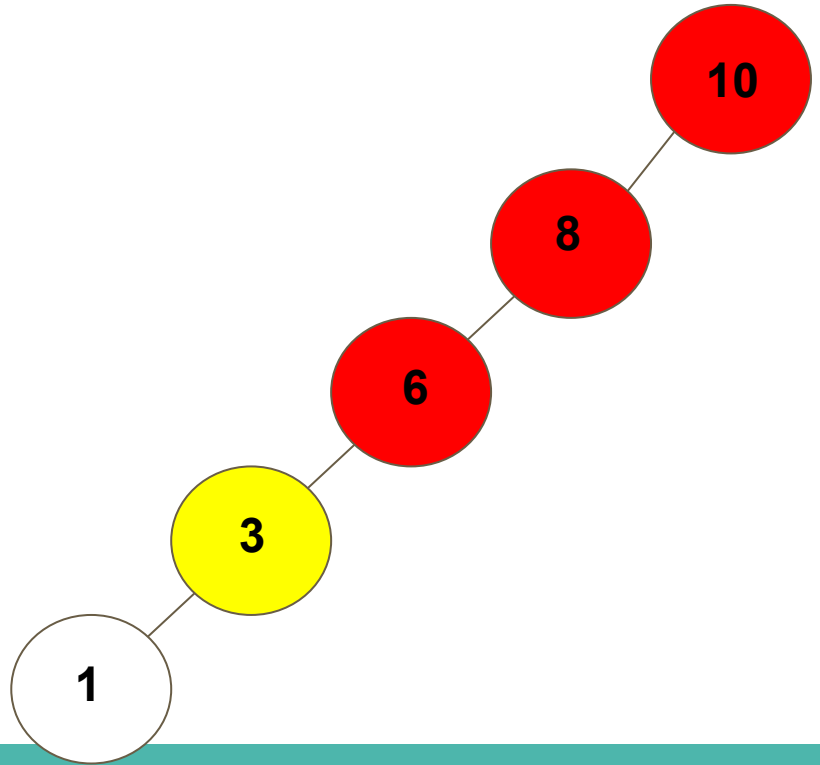


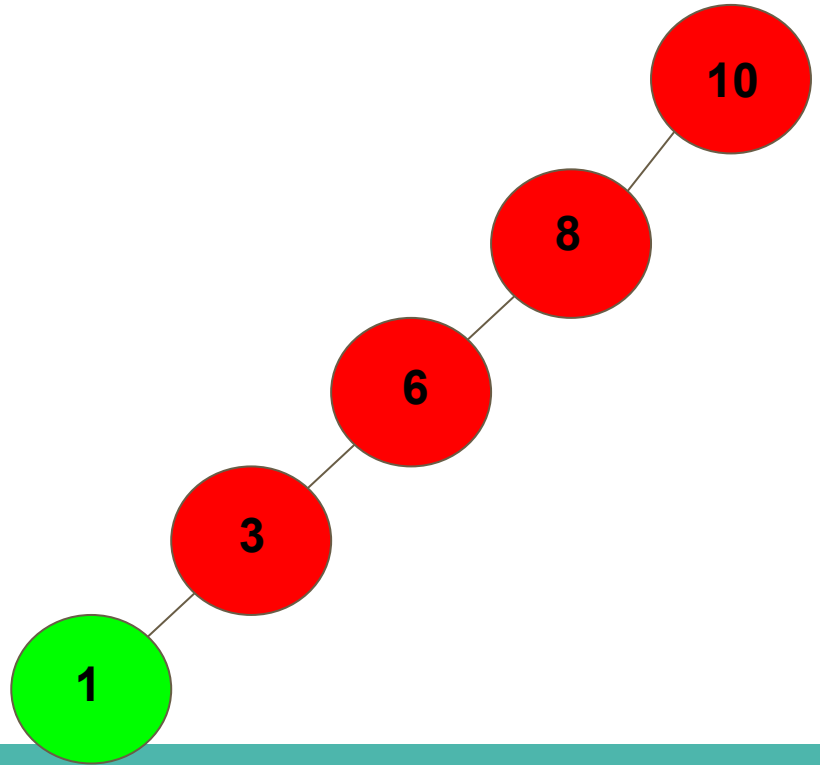
Binary Search Tree: Search



Binary Search Tree: Search



Binary Search Tree: Search



Time Complexity of Operations

Algorithm	Average	Worst Case
Space	O(n)	O(n)
Search	O(log n)	O(n)
Insert	O(log n)	O(n)
Delete	O(log n)	O(n)

Binary Search Tree: Testing BST Property

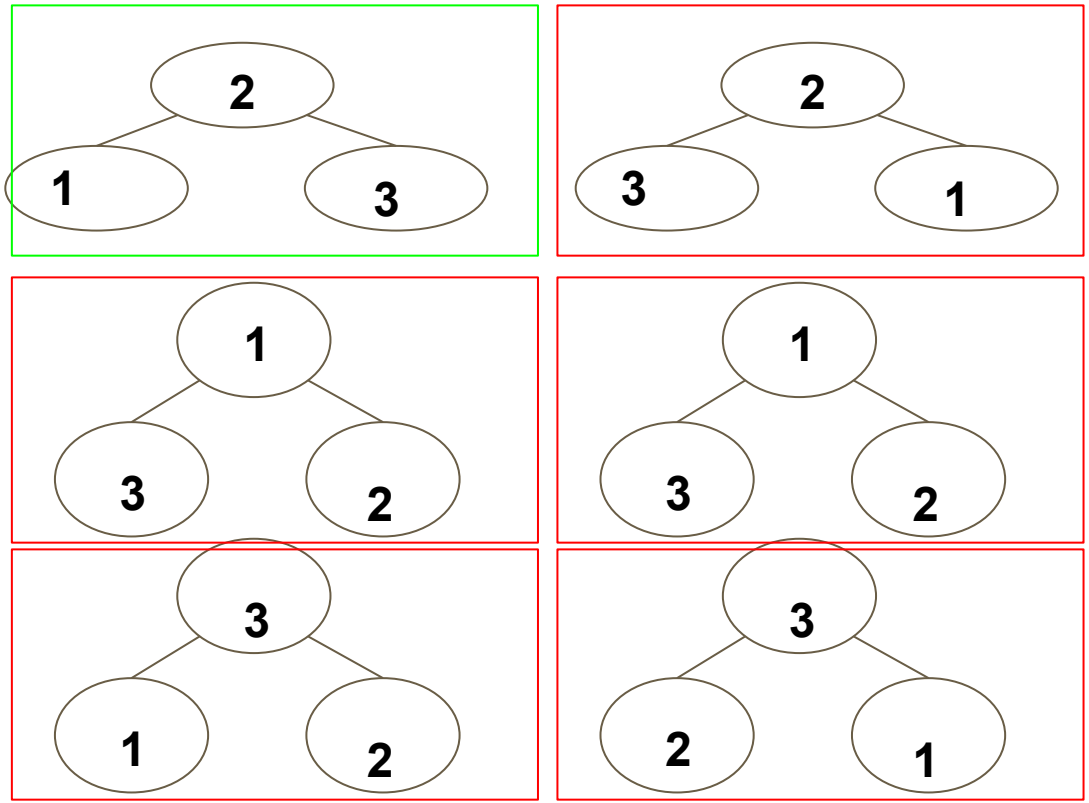
Binary Search Tree Property

BST Property:

The BST property—every node on the right subtree has to be larger than the current node and every node on the left subtree has to be smaller than the current node

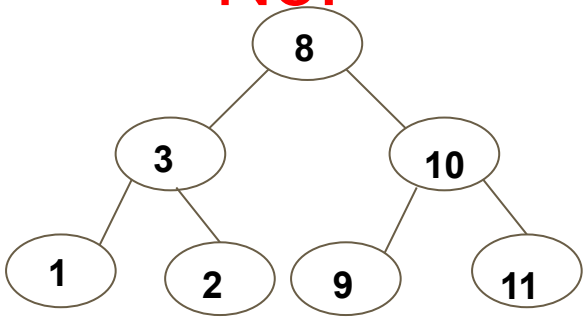
The *binary search tree property* (BST property) is a global property that every binary search tree must satisfy.

Binary Search Tree Property: Examples

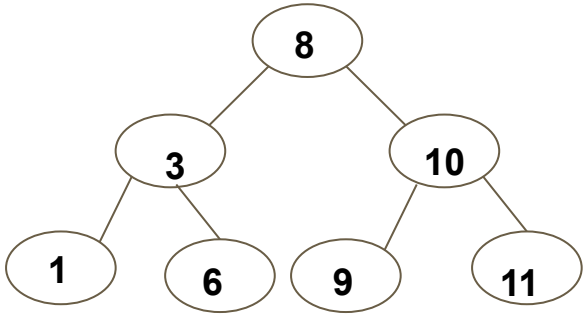


Binary Search Tree Property: Examples

No:



Yes:



No: