

# Problem 98: Validate Binary Search Tree

## Problem Information

Difficulty: **Medium**

Acceptance Rate: 0.00%

Paid Only: No

## Problem Description

Given the

root

of a binary tree,

determine if it is a valid binary search tree (BST)

.

A

valid BST

is defined as follows:

The left

subtree

of a node contains only nodes with keys

strictly less than

the node's key.

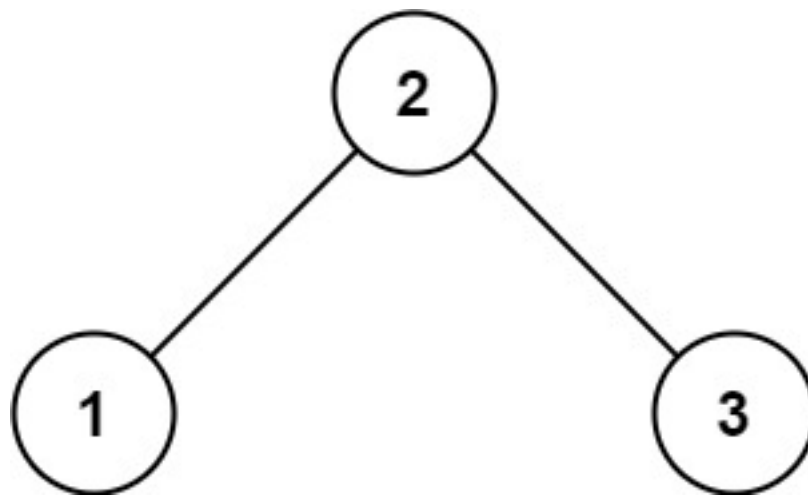
The right subtree of a node contains only nodes with keys

strictly greater than

the node's key.

Both the left and right subtrees must also be binary search trees.

Example 1:



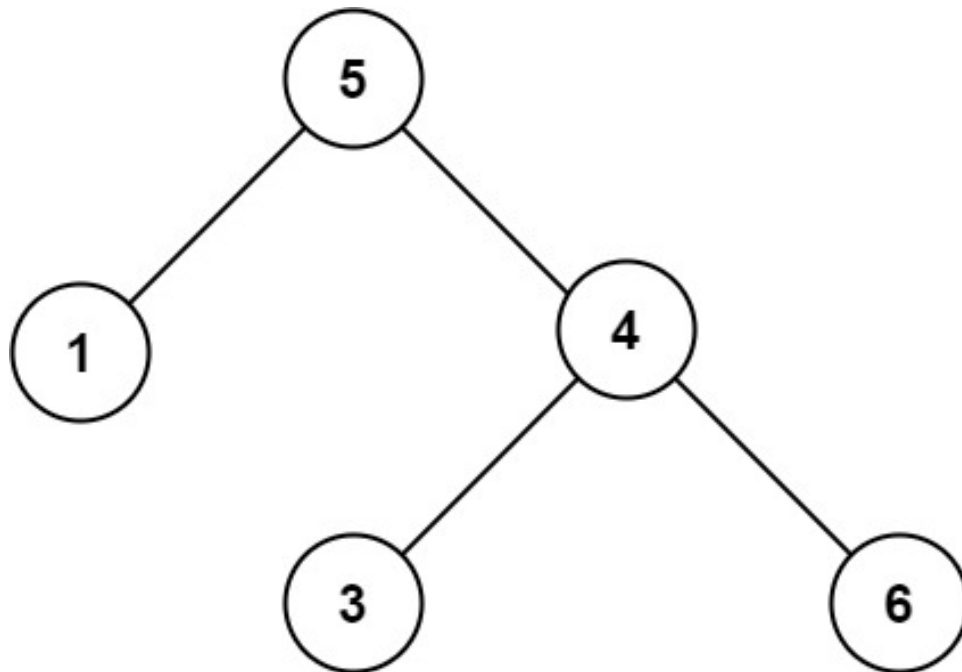
Input:

root = [2,1,3]

Output:

true

Example 2:



Input:

root = [5,1,4,null,null,3,6]

Output:

false

Explanation:

The root node's value is 5 but its right child's value is 4.

Constraints:

The number of nodes in the tree is in the range

[1, 10

4

]

.

-2

31

<= Node.val <= 2

31

- 1

## Code Snippets

### C++:

```
/**
 * Definition for a binary tree node.
 * struct TreeNode {
 *   int val;
 *   TreeNode *left;
 *   TreeNode *right;
 *   TreeNode() : val(0), left(nullptr), right(nullptr) {}
 *   TreeNode(int x) : val(x), left(nullptr), right(nullptr) {}
 *   TreeNode(int x, TreeNode *left, TreeNode *right) : val(x), left(left),
 *   right(right) {}
 * };
 */
class Solution {
public:
    bool isValidBST(TreeNode* root) {

    }
};
```

### Java:

```
/**
 * Definition for a binary tree node.
 * public class TreeNode {
 *   int val;
 *   TreeNode left;
```

```

* TreeNode right;
* TreeNode() {}
* TreeNode(int val) { this.val = val; }
* TreeNode(int val, TreeNode left, TreeNode right) {
* this.val = val;
* this.left = left;
* this.right = right;
* }
* }
*/
class Solution {
public boolean isValidBST(TreeNode root) {

}
}

```

### Python3:

```

# Definition for a binary tree node.
# class TreeNode:
# def __init__(self, val=0, left=None, right=None):
# self.val = val
# self.left = left
# self.right = right
class Solution:
def isValidBST(self, root: Optional[TreeNode]) -> bool:

```

### Python:

```

# Definition for a binary tree node.
# class TreeNode(object):
# def __init__(self, val=0, left=None, right=None):
# self.val = val
# self.left = left
# self.right = right
class Solution(object):
def isValidBST(self, root):
    """
    :type root: Optional[TreeNode]
    :rtype: bool
    """

```

## JavaScript:

```
/**
 * Definition for a binary tree node.
 * function TreeNode(val, left, right) {
 *   this.val = (val===undefined ? 0 : val)
 *   this.left = (left===undefined ? null : left)
 *   this.right = (right===undefined ? null : right)
 * }
 */
/**
 * @param {TreeNode} root
 * @return {boolean}
 */
var isValidBST = function(root) {

};
```

## TypeScript:

```
/**
 * Definition for a binary tree node.
 * class TreeNode {
 *   val: number
 *   left: TreeNode | null
 *   right: TreeNode | null
 *   constructor(val?: number, left?: TreeNode | null, right?: TreeNode | null) {
 *     this.val = (val===undefined ? 0 : val)
 *     this.left = (left===undefined ? null : left)
 *     this.right = (right===undefined ? null : right)
 *   }
 * }
 */

function isValidBST(root: TreeNode | null): boolean {

};
```

## C#:

```
/**
 * Definition for a binary tree node.
```

```

* public class TreeNode {
* public int val;
* public TreeNode left;
* public TreeNode right;
* public TreeNode(int val=0, TreeNode left=null, TreeNode right=null) {
* this.val = val;
* this.left = left;
* this.right = right;
* }
* }
*/
public class Solution {
public bool IsValidBST(TreeNode root) {

}

}

```

**C:**

```

/**
 * Definition for a binary tree node.
 * struct TreeNode {
 * int val;
 * struct TreeNode *left;
 * struct TreeNode *right;
 * };
 */
bool isValidBST(struct TreeNode* root) {

}

```

**Go:**

```

/**
 * Definition for a binary tree node.
 * type TreeNode struct {
 * Val int
 * Left *TreeNode
 * Right *TreeNode
 * }
 */
func isValidBST(root *TreeNode) bool {

```

```
}
```

## Kotlin:

```
/**
 * Example:
 * var ti = TreeNode(5)
 * var v = ti.`val`
 * Definition for a binary tree node.
 * class TreeNode(var `val`: Int) {
 *     var left: TreeNode? = null
 *     var right: TreeNode? = null
 * }
 */
class Solution {
    fun isValidBST(root: TreeNode?): Boolean {

    }
}
```

## Swift:

```
/**
 * Definition for a binary tree node.
 * public class TreeNode {
 *     public var val: Int
 *     public var left: TreeNode?
 *     public var right: TreeNode?
 *     public init() { self.val = 0; self.left = nil; self.right = nil; }
 *     public init(_ val: Int) { self.val = val; self.left = nil; self.right = nil; }
 *     public init(_ val: Int, _ left: TreeNode?, _ right: TreeNode?) {
 *         self.val = val
 *         self.left = left
 *         self.right = right
 *     }
 * }
 */
class Solution {
    func isValidBST(_ root: TreeNode?) -> Bool {
```



```
}  
}
```

## Rust:

```
// Definition for a binary tree node.  
// #[derive(Debug, PartialEq, Eq)]  
// pub struct TreeNode {  
//     pub val: i32,  
//     pub left: Option<Rc<RefCell<TreeNode>>>,  
//     pub right: Option<Rc<RefCell<TreeNode>>>,  
// }  
//  
// impl TreeNode {  
//     #[inline]  
//     pub fn new(val: i32) -> Self {  
//         TreeNode {  
//             val,  
//             left: None,  
//             right: None  
//         }  
//     }  
// }  
  
use std::rc::Rc;  
use std::cell::RefCell;  
impl Solution {  
    pub fn is_valid_bst(root: Option<Rc<RefCell<TreeNode>>>) -> bool {  
  
    }  
}
```

## Ruby:

```
# Definition for a binary tree node.  
# class TreeNode  
#   attr_accessor :val, :left, :right  
#   def initialize(val = 0, left = nil, right = nil)  
#     @val = val  
#     @left = left  
#     @right = right  
#   end  
# end
```

```

# @param {TreeNode} root
# @return {Boolean}
def is_valid_bst(root)

end

```

## PHP:

```

/**
 * Definition for a binary tree node.
 * class TreeNode {
 * public $val = null;
 * public $left = null;
 * public $right = null;
 * function __construct($val = 0, $left = null, $right = null) {
 * $this->val = $val;
 * $this->left = $left;
 * $this->right = $right;
 * }
 * }
 */
class Solution {

/**
 * @param TreeNode $root
 * @return Boolean
 */
function isValidBST($root) {

}

}

```

## Dart:

```

/**
 * Definition for a binary tree node.
 * class TreeNode {
 * int val;
 * TreeNode? left;
 * TreeNode? right;
 * TreeNode([this.val = 0, this.left, this.right]);
 * }

```

```

*/
class Solution {
bool isValidBST(TreeNode? root) {

}
}

```

## Scala:

```

/**
 * Definition for a binary tree node.
 * class TreeNode(_value: Int = 0, _left: TreeNode = null, _right: TreeNode =
 * null) {
 *   var value: Int = _value
 *   var left: TreeNode = _left
 *   var right: TreeNode = _right
 * }
 */
object Solution {
def isValidBST(root: TreeNode): Boolean = {

}
}

```

## Elixir:

```

# Definition for a binary tree node.
#
# defmodule TreeNode do
#   @type t :: %__MODULE__{
#     val: integer,
#     left: TreeNode.t() | nil,
#     right: TreeNode.t() | nil
#   }
#   defstruct val: 0, left: nil, right: nil
# end

defmodule Solution do
  @spec is_valid_bst(root :: TreeNode.t | nil) :: boolean
  def is_valid_bst(root) do

  end
end

```

```
end
```

## Erlang:

```
%% Definition for a binary tree node.
%%
%% -record(tree_node, {val = 0 :: integer(),
%% left = null :: 'null' | #tree_node{},
%% right = null :: 'null' | #tree_node{}}).

-spec is_valid_bst(Root :: #tree_node{} | null) -> boolean().
is_valid_bst(Root) ->
.
```

## Racket:

```
; Definition for a binary tree node.
#|

; val : integer?
; left : (or/c tree-node? #f)
; right : (or/c tree-node? #f)
(struct tree-node
  (val left right) #:mutable #:transparent)

; constructor
(define (make-tree-node [val 0])
  (tree-node val #f #f))

|#

(define/contract (is-valid-bst root)
  (-> (or/c tree-node? #f) boolean?)
)
```

## Solutions

### C++ Solution:

```

/*
 * Problem: Validate Binary Search Tree
 * Difficulty: Medium
 * Tags: tree, search
 *
 * Approach: DFS or BFS traversal
 * Time Complexity: O(n) where n is number of nodes
 * Space Complexity: O(h) for recursion stack where h is height
 */

/**
 * Definition for a binary tree node.
 * struct TreeNode {
 *     int val;
 *     TreeNode *left;
 *     TreeNode *right;
 *     TreeNode() : val(0), left(nullptr), right(nullptr) {
 * // TODO: Implement optimized solution
 * return 0;
 * }
 *     TreeNode(int x) : val(x), left(nullptr), right(nullptr) {
 * // TODO: Implement optimized solution
 * return 0;
 * }
 *     TreeNode(int x, TreeNode *left, TreeNode *right) : val(x), left(left),
 * right(right) {
 * // TODO: Implement optimized solution
 * return 0;
 * }
 * };
 */
class Solution {
public:
    bool isValidBST(TreeNode* root) {

    }
};

```

## Java Solution:

```

/**
 * Problem: Validate Binary Search Tree

```

```

* Difficulty: Medium
* Tags: tree, search
*
* Approach: DFS or BFS traversal
* Time Complexity: O(n) where n is number of nodes
* Space Complexity: O(h) for recursion stack where h is height
*/

/**
 * Definition for a binary tree node.
 * public class TreeNode {
 *     int val;
 *     TreeNode left;
 *     TreeNode right;
 *     TreeNode() {
 * // TODO: Implement optimized solution
 * return 0;
 * }
 *     TreeNode(int val) { this.val = val; }
 *     TreeNode(int val, TreeNode left, TreeNode right) {
 *         this.val = val;
 *         this.left = left;
 *         this.right = right;
 *     }
 * }
 */
class Solution {
public boolean isValidBST(TreeNode root) {

}

}

```

### Python3 Solution:

```

"""
Problem: Validate Binary Search Tree
Difficulty: Medium
Tags: tree, search

Approach: DFS or BFS traversal
Time Complexity: O(n) where n is number of nodes

```

```

Space Complexity: O(h) for recursion stack where h is height
"""

# Definition for a binary tree node.
# class TreeNode:
# def __init__(self, val=0, left=None, right=None):
# self.val = val
# self.left = left
# self.right = right
class Solution:
def isValidBST(self, root: Optional[TreeNode]) -> bool:
# TODO: Implement optimized solution
pass

```

### Python Solution:

```

# Definition for a binary tree node.
# class TreeNode(object):
# def __init__(self, val=0, left=None, right=None):
# self.val = val
# self.left = left
# self.right = right
class Solution(object):
def isValidBST(self, root):
"""
:type root: Optional[TreeNode]
:rtype: bool
"""

```

### JavaScript Solution:

```

/**
 * Problem: Validate Binary Search Tree
 * Difficulty: Medium
 * Tags: tree, search
 *
 * Approach: DFS or BFS traversal
 * Time Complexity: O(n) where n is number of nodes
 * Space Complexity: O(h) for recursion stack where h is height
 */

```

```

/**
 * Definition for a binary tree node.
 * function TreeNode(val, left, right) {
 *   this.val = (val===undefined ? 0 : val)
 *   this.left = (left===undefined ? null : left)
 *   this.right = (right===undefined ? null : right)
 * }
 */
/**
 * @param {TreeNode} root
 * @return {boolean}
 */
var isValidBST = function(root) {

};

```

## TypeScript Solution:

```

/**
 * Problem: Validate Binary Search Tree
 * Difficulty: Medium
 * Tags: tree, search
 *
 * Approach: DFS or BFS traversal
 * Time Complexity: O(n) where n is number of nodes
 * Space Complexity: O(h) for recursion stack where h is height
 */
/**
 * Definition for a binary tree node.
 * class TreeNode {
 *   val: number
 *   left: TreeNode | null
 *   right: TreeNode | null
 *   constructor(val?: number, left?: TreeNode | null, right?: TreeNode | null)
 *   {
 *     this.val = (val===undefined ? 0 : val)
 *     this.left = (left===undefined ? null : left)
 *     this.right = (right===undefined ? null : right)
 *   }
 * }
 */

```



```

*/

function isValidBST(root: TreeNode | null): boolean {

};

```

### C# Solution:

```

/*
 * Problem: Validate Binary Search Tree
 * Difficulty: Medium
 * Tags: tree, search
 *
 * Approach: DFS or BFS traversal
 * Time Complexity: O(n) where n is number of nodes
 * Space Complexity: O(h) for recursion stack where h is height
 */

/**
 * Definition for a binary tree node.
 */
public class TreeNode {
    public int val;
    public TreeNode left;
    public TreeNode right;
    public TreeNode(int val=0, TreeNode left=null, TreeNode right=null) {
        this.val = val;
        this.left = left;
        this.right = right;
    }
}

public class Solution {
    public bool IsValidBST(TreeNode root) {

    }
}

```

### C Solution:

```

/*
 * Problem: Validate Binary Search Tree

```

```

* Difficulty: Medium
* Tags: tree, search
*
* Approach: DFS or BFS traversal
* Time Complexity: O(n) where n is number of nodes
* Space Complexity: O(h) for recursion stack where h is height
*/

/**
* Definition for a binary tree node.
* struct TreeNode {
*   int val;
*   struct TreeNode *left;
*   struct TreeNode *right;
* };
*/
bool isValidBST(struct TreeNode* root) {

}

```

## Go Solution:

```

// Problem: Validate Binary Search Tree
// Difficulty: Medium
// Tags: tree, search
//
// Approach: DFS or BFS traversal
// Time Complexity: O(n) where n is number of nodes
// Space Complexity: O(h) for recursion stack where h is height

/**
* Definition for a binary tree node.
* type TreeNode struct {
*   Val int
*   Left *TreeNode
*   Right *TreeNode
* }
*/
func isValidBST(root *TreeNode) bool {

}

```

## Kotlin Solution:

```
/**
 * Example:
 * var ti = TreeNode(5)
 * var v = ti.`val`
 * Definition for a binary tree node.
 * class TreeNode(var `val`: Int) {
 *     var left: TreeNode? = null
 *     var right: TreeNode? = null
 * }
 */
class Solution {
    fun isValidBST(root: TreeNode?): Boolean {

    }
}
```

## Swift Solution:

```
/**
 * Definition for a binary tree node.
 * public class TreeNode {
 *     public var val: Int
 *     public var left: TreeNode?
 *     public var right: TreeNode?
 *     public init() { self.val = 0; self.left = nil; self.right = nil; }
 *     public init(_ val: Int) { self.val = val; self.left = nil; self.right = nil; }
 *     public init(_ val: Int, _ left: TreeNode?, _ right: TreeNode?) {
 *         self.val = val
 *         self.left = left
 *         self.right = right
 *     }
 * }
 */
class Solution {
    func isValidBST(_ root: TreeNode?) -> Bool {

    }
}
```

## Rust Solution:

```
// Problem: Validate Binary Search Tree
// Difficulty: Medium
// Tags: tree, search
//
// Approach: DFS or BFS traversal
// Time Complexity: O(n) where n is number of nodes
// Space Complexity: O(h) for recursion stack where h is height

// Definition for a binary tree node.
// #[derive(Debug, PartialEq, Eq)]
// pub struct TreeNode {
//     pub val: i32,
//     pub left: Option<Rc<RefCell<TreeNode>>>,
//     pub right: Option<Rc<RefCell<TreeNode>>>,
// }
//
// impl TreeNode {
//     #[inline]
//     pub fn new(val: i32) -> Self {
//         TreeNode {
//             val,
//             left: None,
//             right: None
//         }
//     }
// }

use std::rc::Rc;
use std::cell::RefCell;

impl Solution {
    pub fn is_valid_bst(root: Option<Rc<RefCell<TreeNode>>>) -> bool {

    }
}
```

## Ruby Solution:

```
# Definition for a binary tree node.
# class TreeNode
#   attr_accessor :val, :left, :right
#   def initialize(val = 0, left = nil, right = nil)
#     @val = val
#   end
# end
```

```

# @left = left
# @right = right
# end
# end
# @param {TreeNode} root
# @return {Boolean}
def is_valid_bst(root)

end

```

### PHP Solution:

```

/**
 * Definition for a binary tree node.
 * class TreeNode {
 * public $val = null;
 * public $left = null;
 * public $right = null;
 * function __construct($val = 0, $left = null, $right = null) {
 * $this->val = $val;
 * $this->left = $left;
 * $this->right = $right;
 * }
 * }
 */
class Solution {

/**
 * @param TreeNode $root
 * @return Boolean
 */
function isValidBST($root) {

}

}

```

### Dart Solution:

```

/**
 * Definition for a binary tree node.
 * class TreeNode {

```

```

* int val;
* TreeNode? left;
* TreeNode? right;
* TreeNode([this.val = 0, this.left, this.right]);
* }
*/

class Solution {
bool isValidBST(TreeNode? root) {

}
}

```

### Scala Solution:

```

/**
 * Definition for a binary tree node.
 * class TreeNode(_value: Int = 0, _left: TreeNode = null, _right: TreeNode =
null) {
 *   var value: Int = _value
 *   var left: TreeNode = _left
 *   var right: TreeNode = _right
 * }
 */
object Solution {
def isValidBST(root: TreeNode): Boolean = {

}
}

```

### Elixir Solution:

```

# Definition for a binary tree node.
#
# defmodule TreeNode do
#   @type t :: %__MODULE__{
#     val: integer,
#     left: TreeNode.t() | nil,
#     right: TreeNode.t() | nil
#   }
#
#   defstruct val: 0, left: nil, right: nil
# end

```

```

defmodule Solution do
  @spec is_valid_bst(root :: TreeNode.t | nil) :: boolean
  def is_valid_bst(root) do

  end
end

```

### Erlang Solution:

```

%% Definition for a binary tree node.
%%
%% -record(tree_node, {val = 0 :: integer(),
%% left = null :: 'null' | #tree_node{},
%% right = null :: 'null' | #tree_node{}}).

-spec is_valid_bst(Root :: #tree_node{} | null) -> boolean().
is_valid_bst(Root) ->
.

```

### Racket Solution:

```

; Definition for a binary tree node.
#|

; val : integer?
; left : (or/c tree-node? #f)
; right : (or/c tree-node? #f)
(struct tree-node
  (val left right) #:mutable #:transparent)

; constructor
(define (make-tree-node [val 0])
  (tree-node val #f #f))

|#

(define/contract (is-valid-bst root)
  (-> (or/c tree-node? #f) boolean?)
)

```