

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.

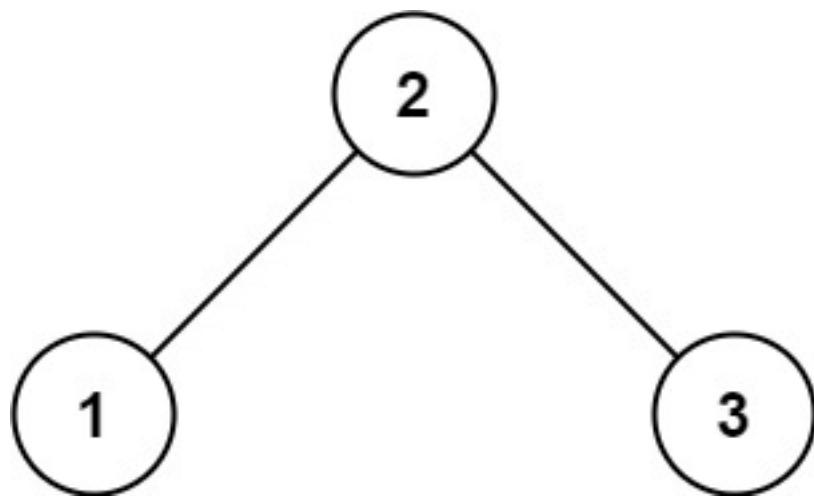
The right subtree of a node contains only nodes with keys

strictly greater than

the node's key.

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

Example 1:



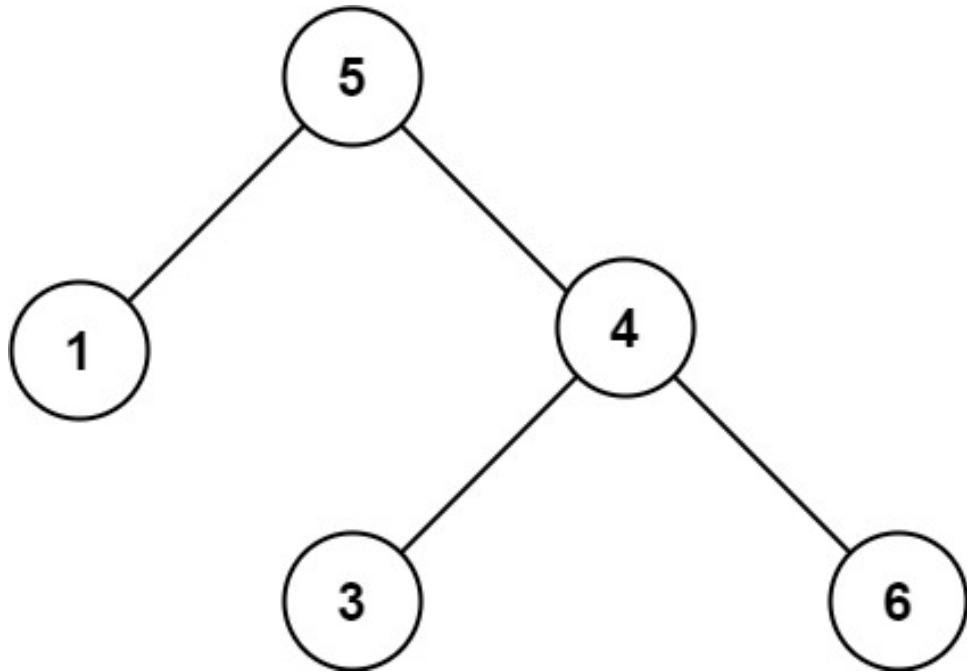
Input:

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
```

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 {
        return true
    }
}
```

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 {
        return true
    }
}
```

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
```

```

# @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?))
)
```