Problem 236: Lowest Common Ancestor of a Binary Tree

Problem Information

Difficulty: Medium
Acceptance Rate: 0.00%
Paid Only: No

Problem Description

Given a binary tree, find the lowest common ancestor (LCA) of two given nodes in the tree.

According to the

definition of LCA on Wikipedia

: “The lowest common ancestor is defined between two nodes

p

and

q

as the lowest node in

T

that has both

p

and

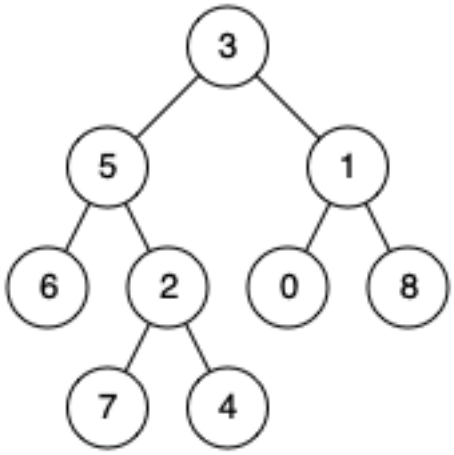
q

as descendants (where we allow

a node to be a descendant of itself

).”

Example 1:



Input:

root = [3,5,1,6,2,0,8,null,null,7,4], p = 5, q = 1

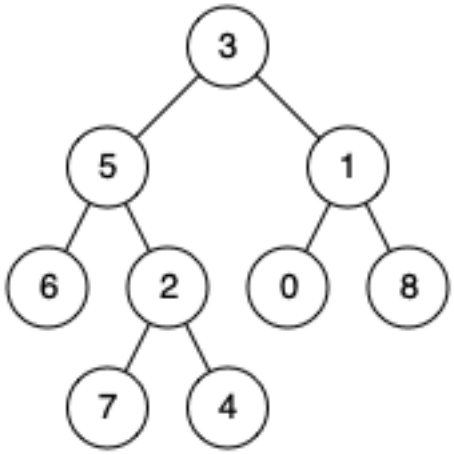
Output:

3

Explanation:

The LCA of nodes 5 and 1 is 3.

Example 2:



Input:

root = [3,5,1,6,2,0,8,null,null,7,4], p = 5, q = 4

Output:

5

Explanation:

The LCA of nodes 5 and 4 is 5, since a node can be a descendant of itself according to the LCA definition.

Example 3:

Input:

root = [1,2], p = 1, q = 2

Output:

1

Constraints:

The number of nodes in the tree is in the range

[2, 10

5

]

.

-10

9

<= Node.val <= 10

9

All

Node.val

are

unique

.

p != q

p

and

q

will exist in the tree.

Code Snippets

C++:

```
/**
* Definition for a binary tree node.
* struct TreeNode {
* int val;
* TreeNode *left;
* TreeNode *right;
* TreeNode(int x) : val(x), left(NULL), right(NULL) {}
* };
*/
class Solution {
public:
TreeNode* lowestCommonAncestor(TreeNode* root, TreeNode* p, TreeNode* q) {

}
};
```

Java:

```
/**
* Definition for a binary tree node.
* public class TreeNode {
* int val;
* TreeNode left;
* TreeNode right;
* TreeNode(int x) { val = x; }
* }
*/
class Solution {
public TreeNode lowestCommonAncestor(TreeNode root, TreeNode p, TreeNode q) {

}
}
```

Python3:

```
# Definition for a binary tree node.
# class TreeNode:
# def __init__(self, x):
# self.val = x
# self.left = None
# self.right = None
```

```
class Solution:
def lowestCommonAncestor(self, root: 'TreeNode', p: 'TreeNode', q:
'TreeNode') -> 'TreeNode':
```

Python:

```
# Definition for a binary tree node.
# class TreeNode(object):
# def __init__(self, x):
# self.val = x
# self.left = None
# self.right = None

class Solution(object):
def lowestCommonAncestor(self, root, p, q):
"""
:type root: TreeNode
:type p: TreeNode
:type q: TreeNode
:rtype: TreeNode
"""
```

JavaScript:

```
/**
* Definition for a binary tree node.
* function TreeNode(val) {
* this.val = val;
* this.left = this.right = null;
* }
*/
/**
* @param {TreeNode} root
* @param {TreeNode} p
* @param {TreeNode} q
* @return {TreeNode}
*/
var lowestCommonAncestor = function(root, p, q) {

};
```

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 lowestCommonAncestor(root: TreeNode | null, p: TreeNode | null, q:
TreeNode | null): TreeNode | null {

};
```

C#:

```
/**
* Definition for a binary tree node.
* public class TreeNode {
* public int val;
* public TreeNode left;
* public TreeNode right;
* public TreeNode(int x) { val = x; }
* }
*/
public class Solution {
public TreeNode LowestCommonAncestor(TreeNode root, TreeNode p, TreeNode q) {

}
}
```

C:

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

```
* struct TreeNode {
* int val;
* struct TreeNode *left;
* struct TreeNode *right;
* };
*/
struct TreeNode* lowestCommonAncestor(struct TreeNode* root, struct TreeNode*
p, struct TreeNode* q) {

}
```

Go:

```
/**
* Definition for a binary tree node.
* type TreeNode struct {
* Val int
* Left *TreeNode
* Right *TreeNode
* }
*/
func lowestCommonAncestor(root, p, q *TreeNode) *TreeNode {

}
```

Kotlin:

```
/**
* Definition for a binary tree node.
* class TreeNode(var `val`: Int = 0) {
* var left: TreeNode? = null
* var right: TreeNode? = null
* }
*/

class Solution {
fun lowestCommonAncestor(root: TreeNode?, p: TreeNode?, q: TreeNode?):
TreeNode? {

}
}
```

Swift:

```
/**
* Definition for a binary tree node.
* public class TreeNode {
* public var val: Int
* public var left: TreeNode?
* public var right: TreeNode?
* public init(_ val: Int) {
* self.val = val
* self.left = nil
* self.right = nil
* }
* }
*/

class Solution {
func lowestCommonAncestor(_ root: TreeNode?, _ p: TreeNode?, _ q: TreeNode?)
-> TreeNode? {

}
}
```

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 lowest_common_ancestor(root: Option<Rc<RefCell<TreeNode>>>, p:
Option<Rc<RefCell<TreeNode>>>, q: Option<Rc<RefCell<TreeNode>>>) ->
Option<Rc<RefCell<TreeNode>>> {

}
}
```

Ruby:

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

# @param {TreeNode} root
# @param {TreeNode} p
# @param {TreeNode} q
# @return {TreeNode}
def lowest_common_ancestor(root, p, q)

end
```

PHP:

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

class Solution {
```

```
/**
* @param TreeNode $root
* @param TreeNode $p
* @param TreeNode $q
* @return TreeNode
*/
function lowestCommonAncestor($root, $p, $q) {

}
}
```

Scala:

```
/**
* Definition for a binary tree node.
* class TreeNode(var _value: Int) {
* var value: Int = _value
* var left: TreeNode = null
* var right: TreeNode = null
* }
*/

object Solution {
def lowestCommonAncestor(root: TreeNode, p: TreeNode, q: TreeNode): TreeNode
= {

}
}
```

Solutions

C++ Solution:

```
/*
* Problem: Lowest Common Ancestor of a Binary 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(int x) : val(x), left(NULL), right(NULL) {}
* };
*/
class Solution {
public:
TreeNode* lowestCommonAncestor(TreeNode* root, TreeNode* p, TreeNode* q) {

}
};
```

Java Solution:

```
/**
* Problem: Lowest Common Ancestor of a Binary 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(int x) { val = x; }
* }
*/
class Solution {
```

```
public TreeNode lowestCommonAncestor(TreeNode root, TreeNode p, TreeNode q) {

}
}
```

Python3 Solution:

```
"""
Problem: Lowest Common Ancestor of a Binary 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, x):
# self.val = x
# self.left = None
# self.right = None

class Solution:
def lowestCommonAncestor(self, root: 'TreeNode', p: 'TreeNode', q:
'TreeNode') -> 'TreeNode':
# TODO: Implement optimized solution
pass
```

Python Solution:

```
# Definition for a binary tree node.
# class TreeNode(object):
# def __init__(self, x):
# self.val = x
# self.left = None
# self.right = None

class Solution(object):
def lowestCommonAncestor(self, root, p, q):
```

```
"""
:type root: TreeNode
:type p: TreeNode
:type q: TreeNode
:rtype: TreeNode
"""
```

JavaScript Solution:

```
/**
* Problem: Lowest Common Ancestor of a Binary 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) {
* this.val = val;
* this.left = this.right = null;
* }
*/
/**
* @param {TreeNode} root
* @param {TreeNode} p
* @param {TreeNode} q
* @return {TreeNode}
*/
var lowestCommonAncestor = function(root, p, q) {

};
```

TypeScript Solution:

```
/**
* Problem: Lowest Common Ancestor of a Binary 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 lowestCommonAncestor(root: TreeNode | null, p: TreeNode | null, q:
TreeNode | null): TreeNode | null {

};
```

C# Solution:

```
/*
* Problem: Lowest Common Ancestor of a Binary 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 x) { val = x; }
* }
*/
public class Solution {
public TreeNode LowestCommonAncestor(TreeNode root, TreeNode p, TreeNode q) {

}
}
```

C Solution:

```
/*
* Problem: Lowest Common Ancestor of a Binary 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;
* };
*/
struct TreeNode* lowestCommonAncestor(struct TreeNode* root, struct TreeNode*
p, struct TreeNode* q) {

}
```

Go Solution:

```
// Problem: Lowest Common Ancestor of a Binary 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 lowestCommonAncestor(root, p, q *TreeNode) *TreeNode {

}
```

Kotlin Solution:

```
/**
* Definition for a binary tree node.
* class TreeNode(var `val`: Int = 0) {
* var left: TreeNode? = null
* var right: TreeNode? = null
* }
*/

class Solution {
fun lowestCommonAncestor(root: TreeNode?, p: TreeNode?, q: TreeNode?):
TreeNode? {

}
}
```

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(_ val: Int) {
* self.val = val
* self.left = nil
* self.right = nil
* }
* }
*/

class Solution {
func lowestCommonAncestor(_ root: TreeNode?, _ p: TreeNode?, _ q: TreeNode?)
-> TreeNode? {

}
}
```

Rust Solution:

```
// Problem: Lowest Common Ancestor of a Binary 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 lowest_common_ancestor(root: Option<Rc<RefCell<TreeNode>>>, p:
Option<Rc<RefCell<TreeNode>>>, q: Option<Rc<RefCell<TreeNode>>>) ->
Option<Rc<RefCell<TreeNode>>> {

}
}
```

Ruby Solution:

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

# @param {TreeNode} root
# @param {TreeNode} p
# @param {TreeNode} q
# @return {TreeNode}
def lowest_common_ancestor(root, p, q)

end
```

PHP Solution:

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

```
* public $right = null;
* function __construct($value) { $this->val = $value; }
* }
*/

class Solution {
/**
* @param TreeNode $root
* @param TreeNode $p
* @param TreeNode $q
* @return TreeNode
*/
function lowestCommonAncestor($root, $p, $q) {

}
}
```

Scala Solution:

```
/**
* Definition for a binary tree node.
* class TreeNode(var _value: Int) {
* var value: Int = _value
* var left: TreeNode = null
* var right: TreeNode = null
* }
*/

object Solution {
def lowestCommonAncestor(root: TreeNode, p: TreeNode, q: TreeNode): TreeNode
= {

}
}
```