SCALER

Trees - 4

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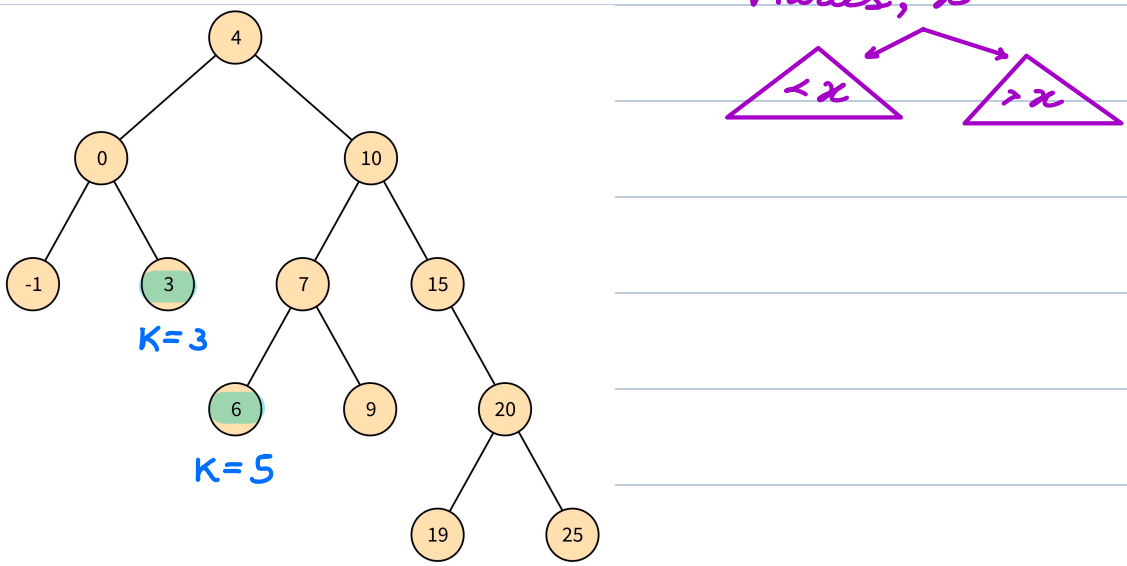
< Question > : Find Kth smallest element in B.S.T K = 3



Sol → Inorder → Left Node Right

K^{th} element in inorder traversal.

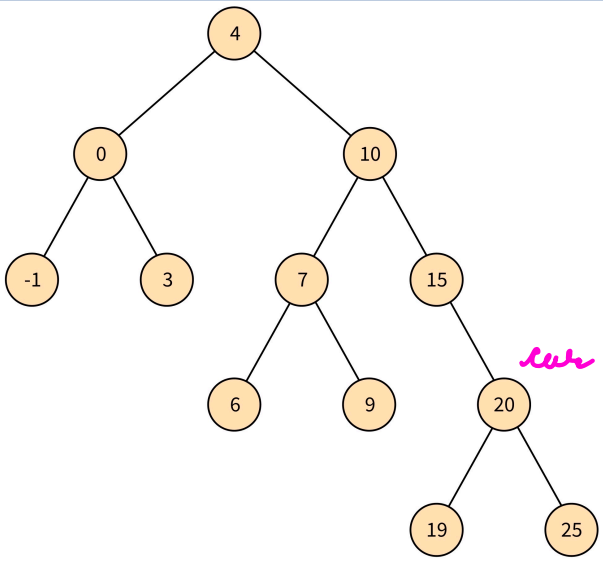
TC = O(N) SC = O(H) → O(1)

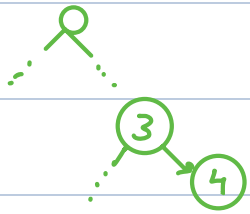
Morris Traversal

Left Node Right

In-Order Traversal of a Binary Tree

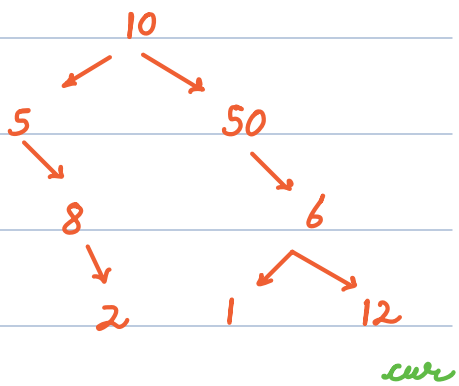
Expected S.C → O(1)





o/p → -1 0 3 4 6 7 9 10 15 . . .

```
cur = root
while ( cur != null ) {
    if ( cur.left == null ) {
        print (cur.val)
        cur = cur.right
    } else {
        p = cur.left
        while ( p.right != null && p.right != cur )
            p = p.right
        if ( p.right == null ) {        // First time
            p.right = cur
```



o/p → 5 8 2 10 50 1 6 12

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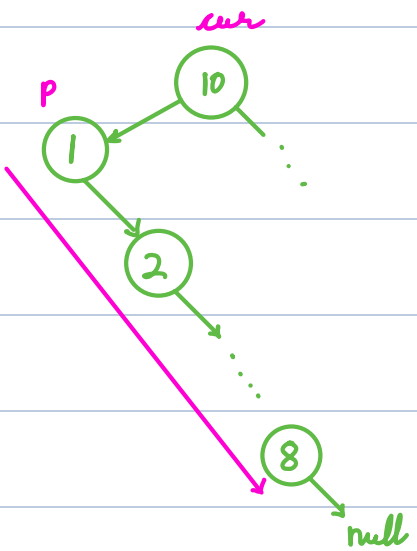
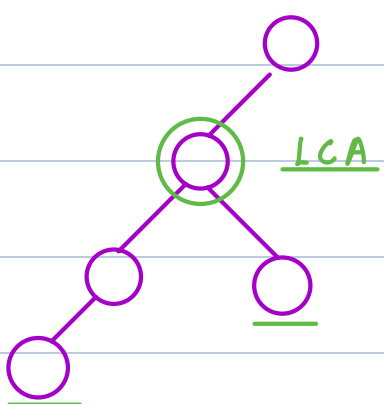
```
        cur = cur.left
    } else {            // second time
        print(cur.val)
        cur = cur.right
        p.right = null
    }
}
```



If cur != 10, do we visit 1 to 8 while finding inorder predecessor? → No

TC = O(N)



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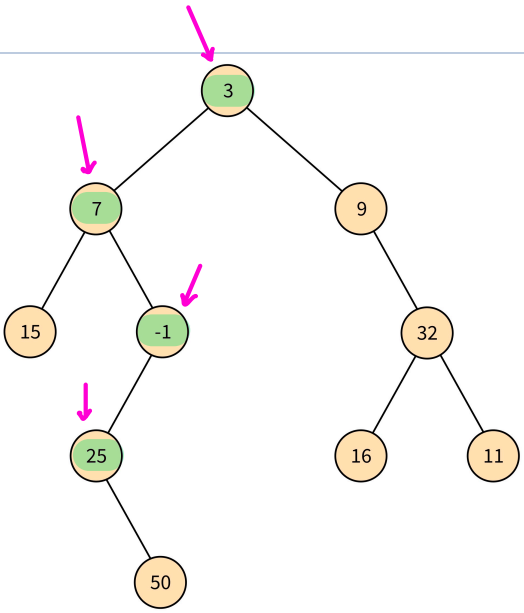
Path from Root to Node



K = 25

```
void travel (root, found) {
    if (root == null || found)
        return
    a.add(root)
    if (root.val == K) {
        found = true
        return
    }
    travel(root.left, found)
    travel(root.right, found)
    a.removeLast()
}
```

false

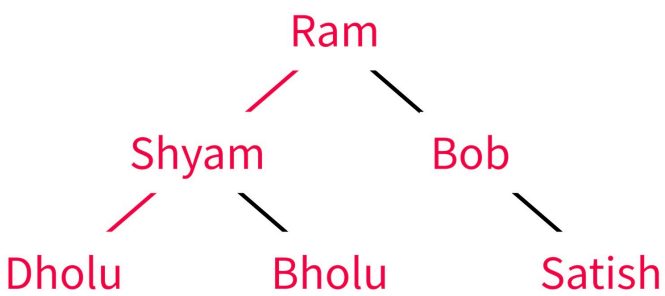
TC = O(N)

SC = O(H)

Problem Statement

It is said that we all humans are related through some common ancestor at some point of time. Assume that a person can have 0, 1 or 2 children only.

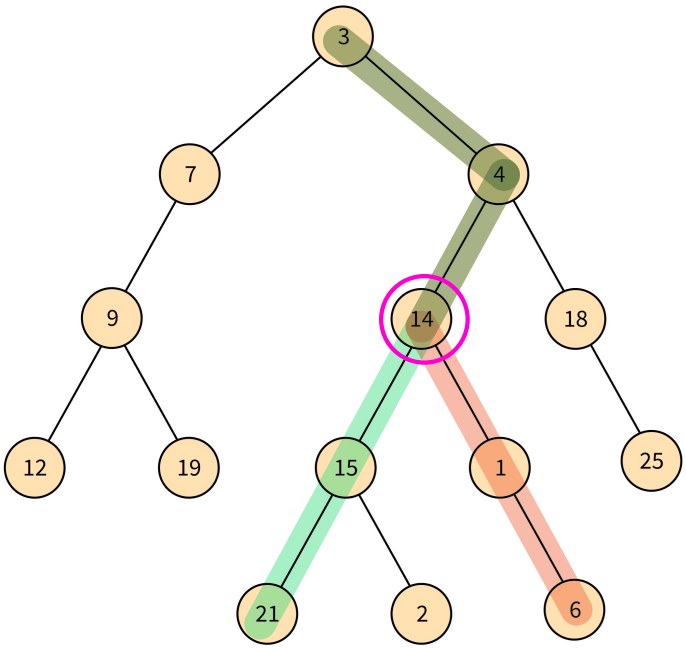
Given the Binary tree A representing the family tree, discover the earliest common family member who connects two given people B and C in a family tree.



- Find LCA of Dholu and Bob
- Answer = Ram

Lowest Common Ancestor

Flipkart | Acollite | Amazon | Microsoft | OYO Rooms | Snapdeal | MakeMyTrip | PayU | Times Internet | Cisco | PayPal | Expedia | Twitter | American Express



L.C.A(21 , 6) → 21 → 3 4 14 15 21
6 → 3 4 14 1 6

L.C.A(2 , 6) → 14

L.C.A(21 , 4) → 21 → 3 4 14 15 21
4 → 3 4

L.C.A(12 , 6) → 3

LCA (x, y)

Sol → 1) Find root to node path for x & y. ✓

2) Ans = last common node.

TC = O(N) SC = O(H)

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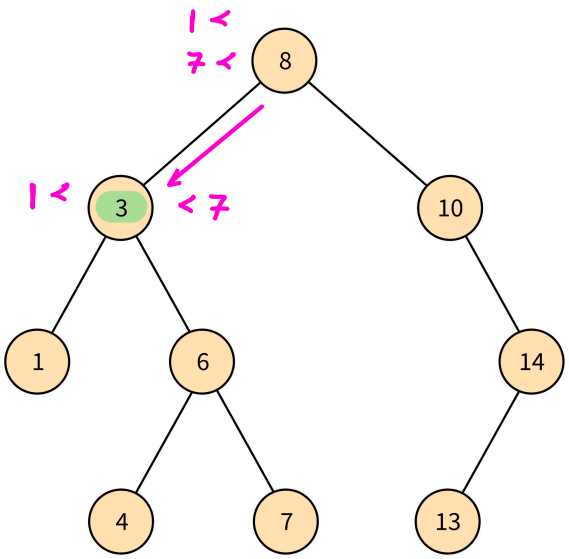
L.C.A in B.S.T



Above sol → TC = O(H) SC = O(H)

O(1)

LCA (1, 7) = 3

```
cur = root
while (cur != null) {
    if (x < cur.val && y < cur.val)
        cur = cur.left
    else if (x > cur.val && y > cur.val)
        cur = cur.right
    else
        return cur
}
```

TC = O(H) SC = O(1)