

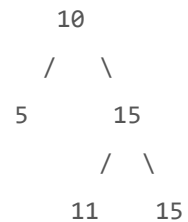
Daily Coding Problem #125

Problem

This problem was asked by Google.

Given the root of a binary search tree, and a target K, return two nodes in the tree whose sum equals K.

For example, given the following tree and K of 20



Return the nodes 5 and 15.

Solution

This question is similar to the two-sum problem with a list. We can actually reduce this problem into that one by turning the tree into a list. To save some space, we'll use [generators](#), which are like list-like but are generated on-the-fly.

```
def two_sum(root, K):
    seen = {} # Map of val to node

    for node in iter_tree(root):
        if K - node.val in seen:
            return (node, seen[K - node.val])
        seen[node.val] = node

    return None

def iter_tree(root):
    if root:
        for node in iter_tree(root.left):
            yield node

        yield root

        for node in iter_tree(root.right):
            yield node
```

Another solution is to simply to iterate over each node and do a binary tree search for $K - \text{node.val}$. This takes $O(N \log N)$ time since for each node, we do a search which takes $\log N$. However, it will only take $O(\log N)$ space because the call stack gets $\log N$ deep.

```
def two_sum(root, K):
```

```
for node_one in iter_tree(root):
    node_two = search(root, K - node_one.val)

    if node_two:
        return (node_one, node_two)

return None


def search(node, val):
    if not node:
        return None

    if node.val == val:
        return node
    elif node.val < val:
        return search(node.right, val)
    else:
        return search(node.left, val)
```

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