

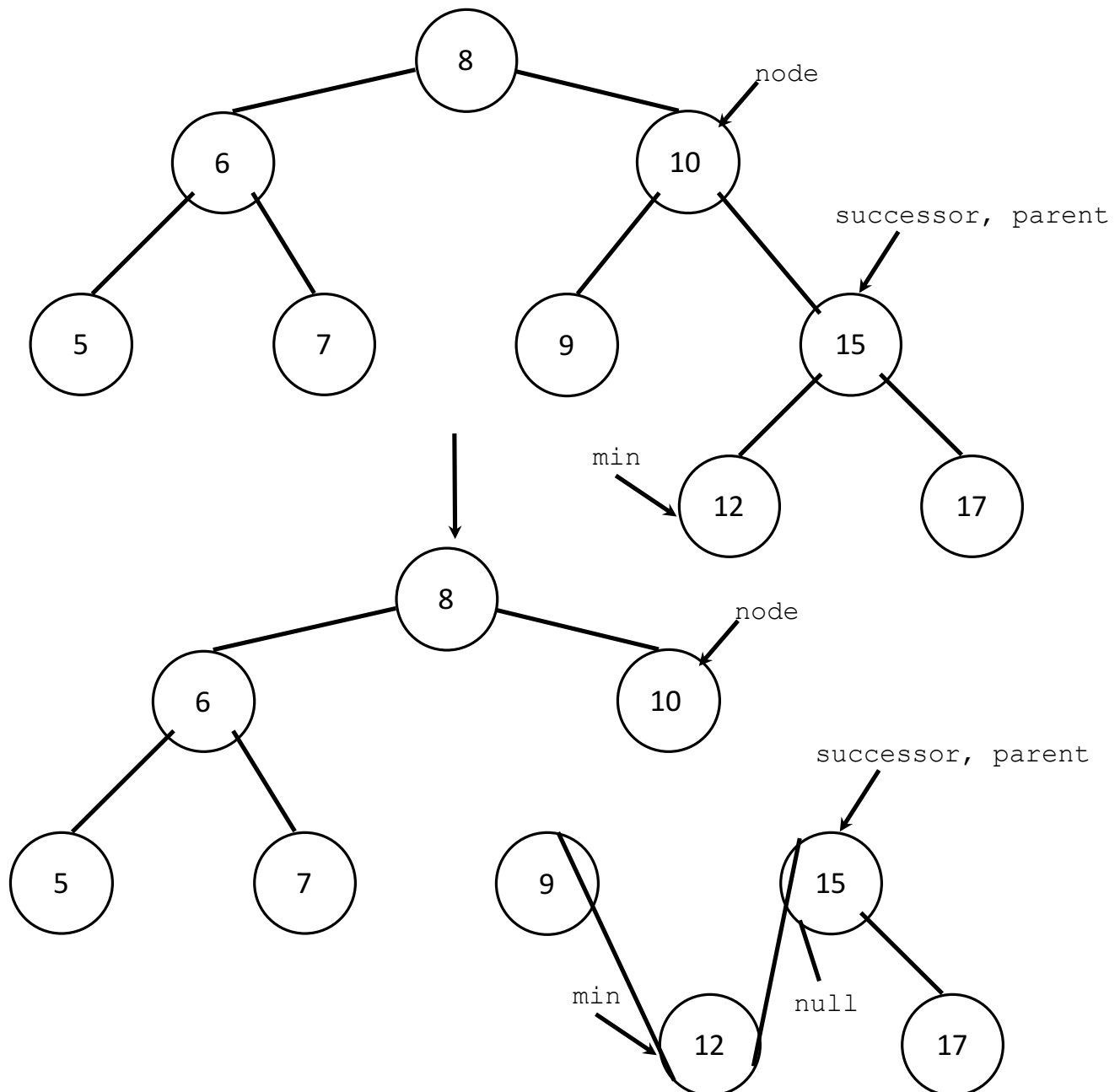
What gets returned into lowest?

What gets returned to 'lowest' when the node to be removed has two children?

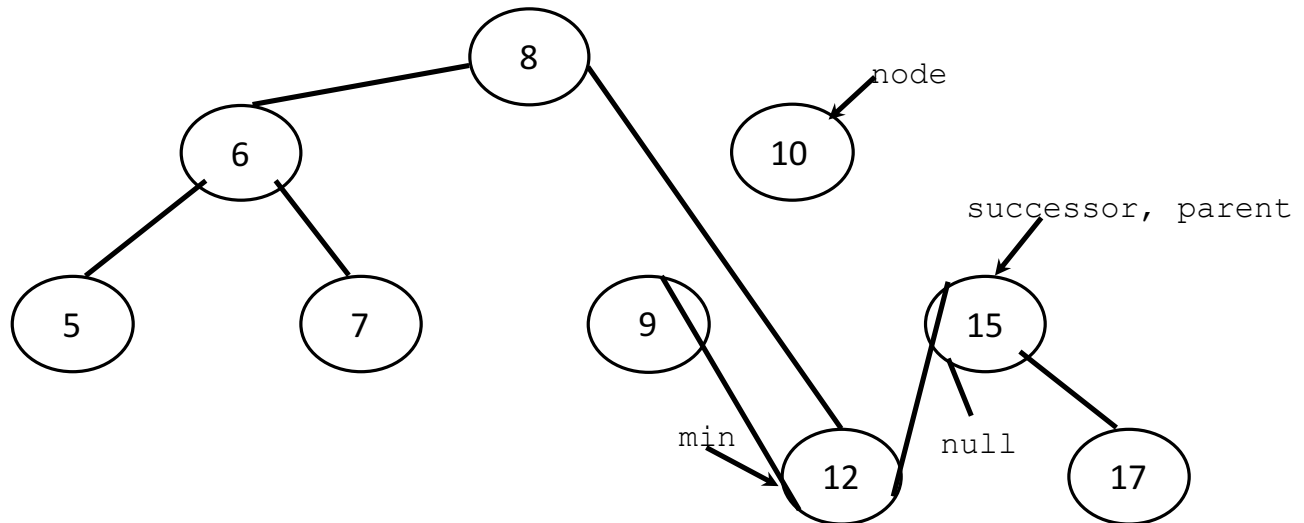
If the node being removed is a parent of a leaf, lowest would be node that was removed. If one or both children have subtrees, then lowest will be the former parent min. This is why the remove method checks if lowest is null or not node (called into remove), and if it is not null and not that node, then we call balance.

Child of removed node has child(ren):

`remove(10);`



The above diagram could be confusing to look at. In summary, 12(min) became the parent of 15 (successor) and the left child of 15 (successor) became the right child of min (which is null). Now, `replaceChild(node, min);` is ready to be called.



After `replaceChild(node, min)` is called, the above is the result. Node is removed from tree and it still remains a binary search tree. Then parent is returned and goes into lowest.

What gets returned into 'lowest' if there is only one child or no children?

The parent of the removed node is returned and lowest now points to it.

Balancing

AVL Tree

First, balance checks if the AVL tree is even unbalanced. If so, it checks whether the subtree below the breaking node is a straight line or zig-zag. If zig-zag, it rotates the opposite way first, then back the way it should; for example, if the balance factor is positive it should rotate right but if the subtree below the breaking node zig-zags it rotates left first, then right.

Now, does the rotation actually balance the tree correctly?

Yes, on paper I did an examples where a couple codes had a balance factor of -2 (root and root's right child), after going through the algorithm, both absolute value of the balance factors were below 2.

Red-Black Tree

Since this uses the same rotate methods as AVL tree, I'd say it does balance correctly. The only issue is the added complication of the red-black properties. Look at another example on paper, I'd say the color properties of the red-black trees are also satisfied after balancing. So the balancing correctly and successfully balances the tree.