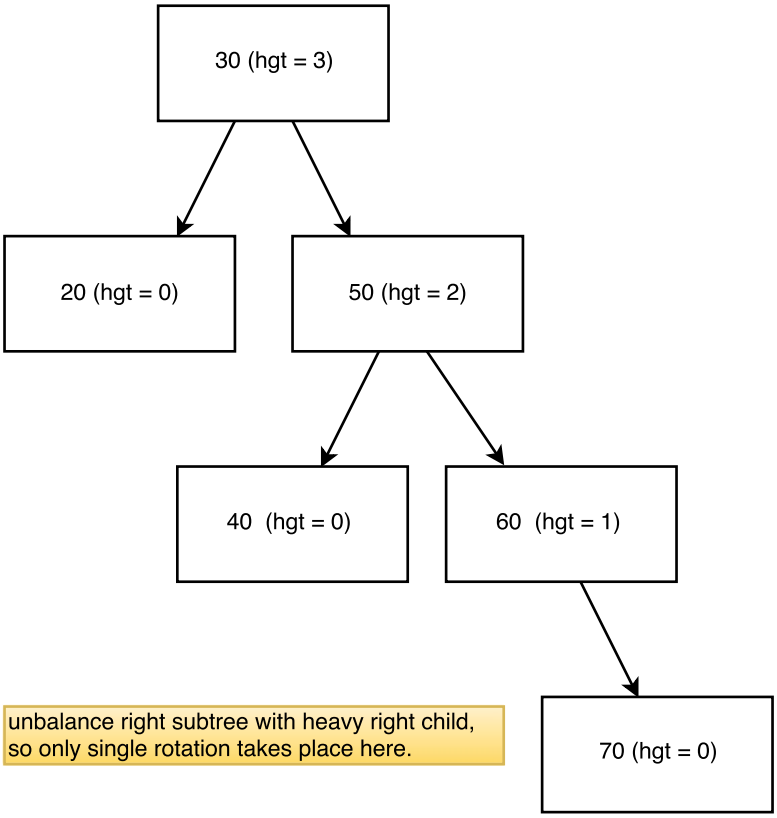
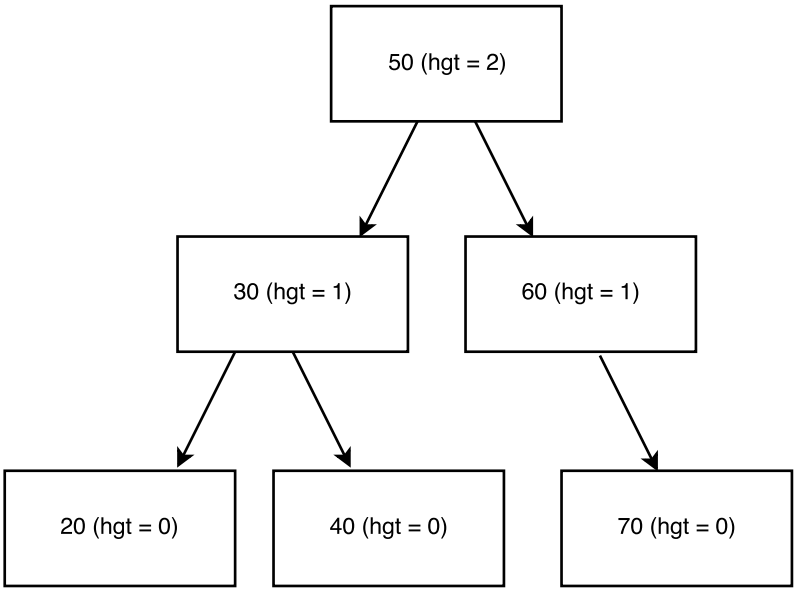
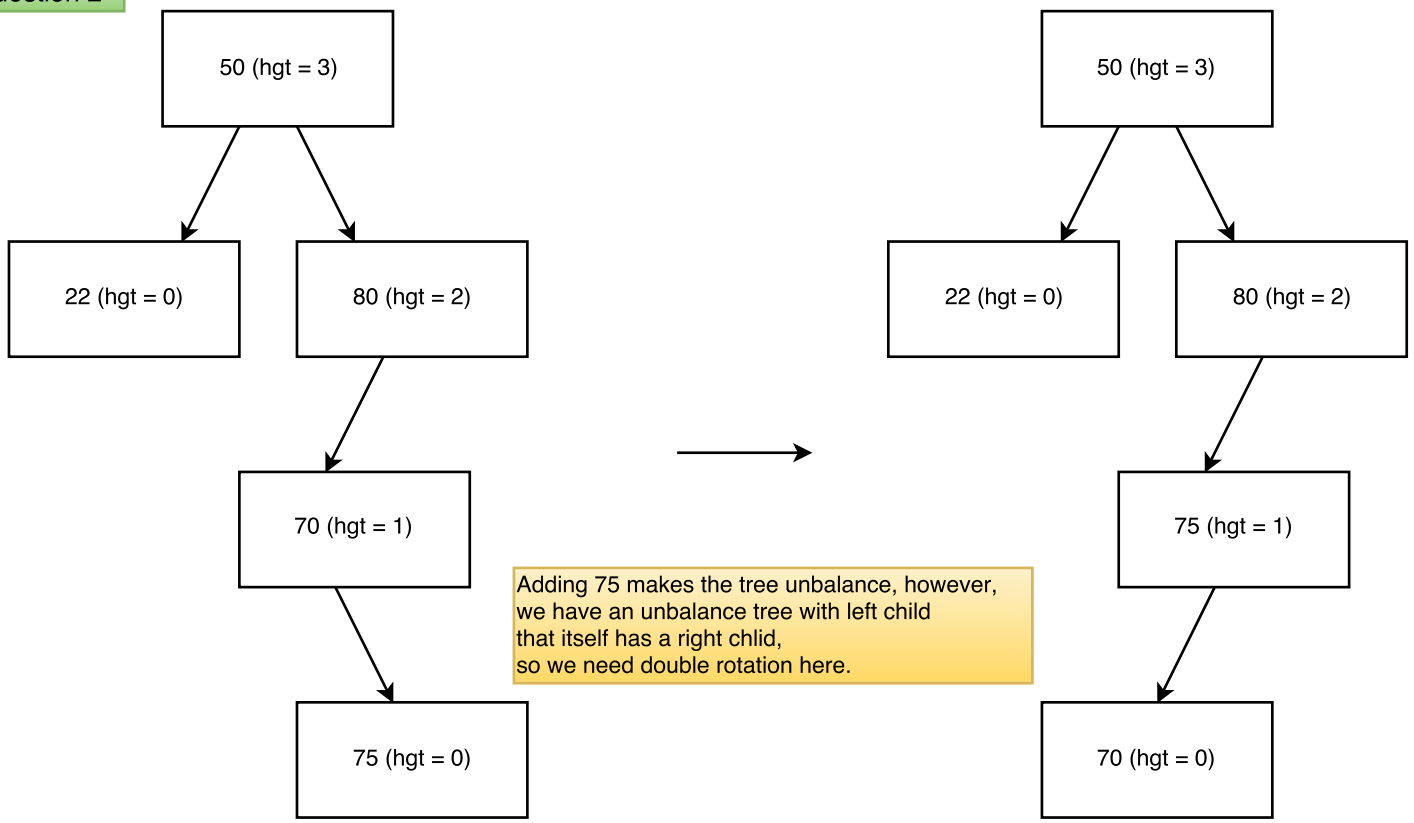
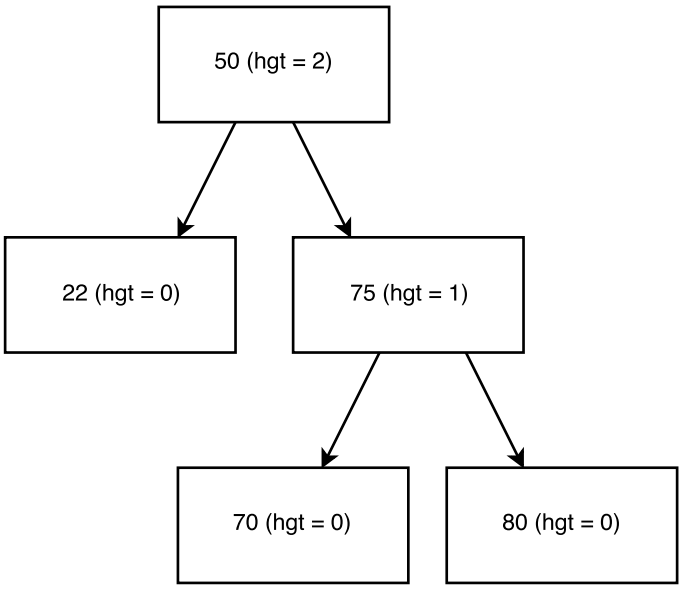
Question 1

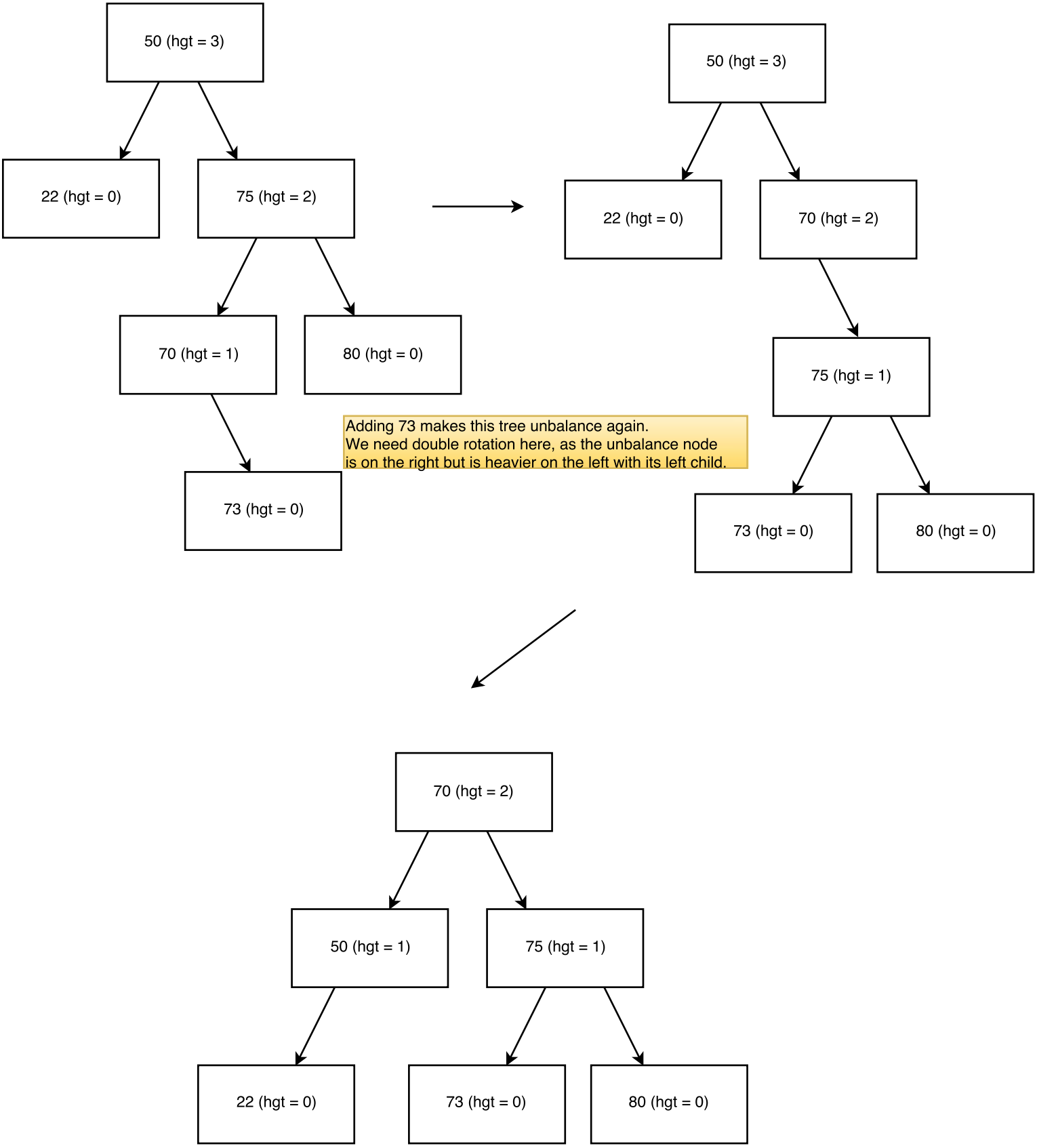

30 (hgt = 3)
20 (hgt = 0)
50 (hgt = 2)
40 (hgt = 0)
60 (hgt = 1)
70 (hgt = 0)
unbalance right subtree with heavy right child,
so only single rotation takes place here.


50 (hgt = 2)
30 (hgt = 1)
60 (hgt = 1)
20 (hgt = 0)
40 (hgt = 0)
70 (hgt = 0)

Question 2

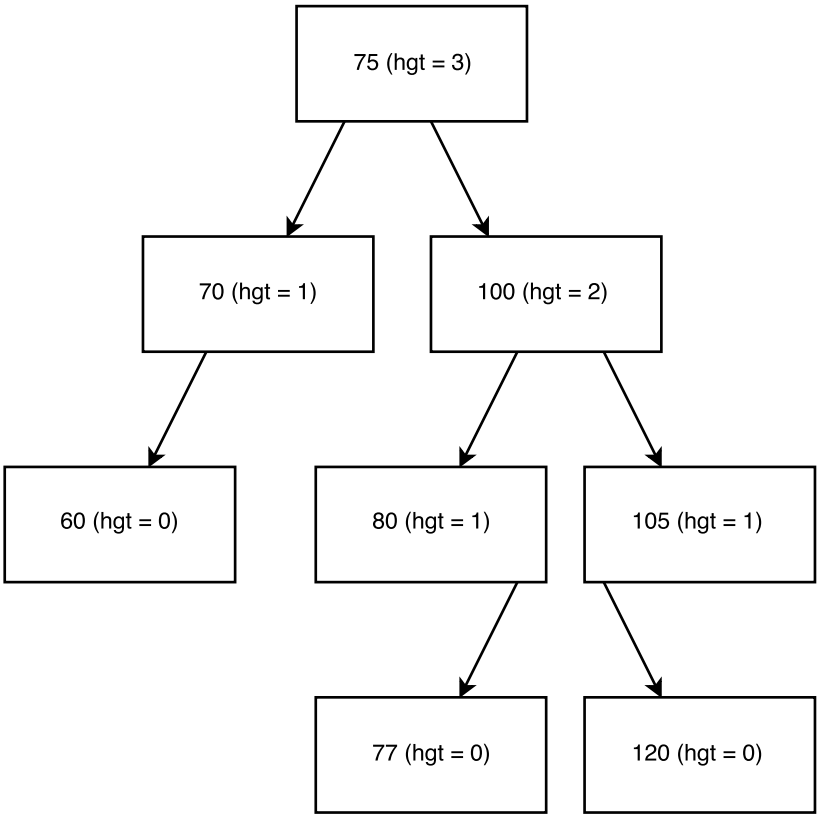

50 (hgt = 3)
22 (hgt = 0)
80 (hgt = 2)
70 (hgt = 1)
75 (hgt = 0)
50 (hgt = 3)
22 (hgt = 0)
80 (hgt = 2)
75 (hgt = 1)
70 (hgt = 0)
Adding 75 makes the tree unbalance, however,
we have an unbalance tree with left child
that itself has a right chlid,
so we need double rotation here.


50 (hgt = 2)
22 (hgt = 0)
75 (hgt = 1)
70 (hgt = 0)
80 (hgt = 0)

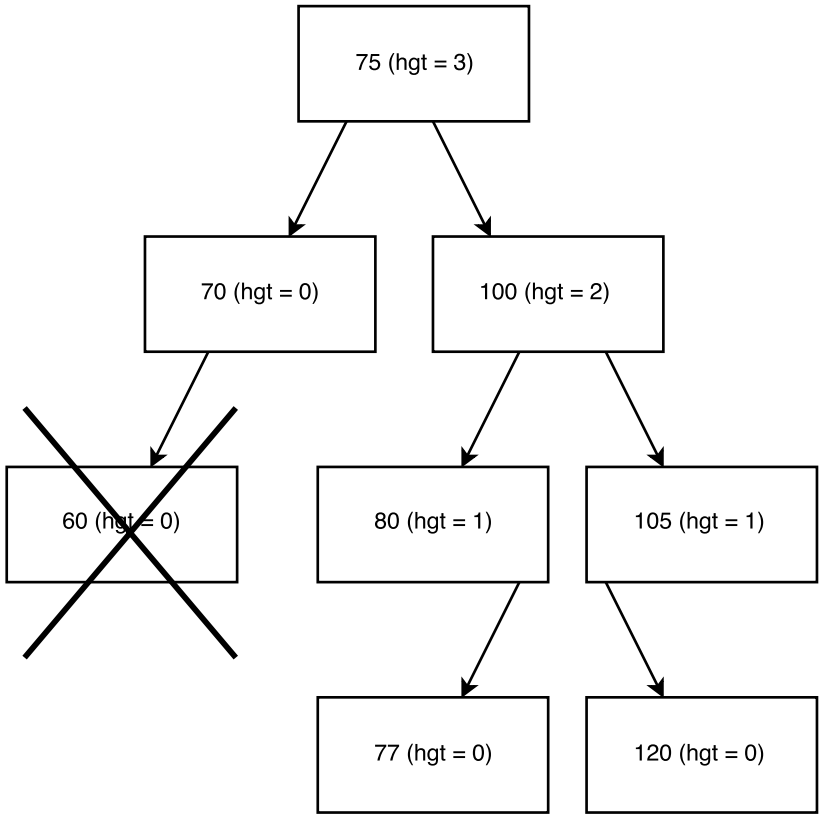

50 (hgt = 3)
22 (hgt = 0)
75 (hgt = 2)
70 (hgt = 1)
80 (hgt = 0)
73 (hgt = 0)
Adding 73 makes this tree unbalance again.
We need double rotation here, as the unbalance node
is on the right but is heavier on the left with its left child.
50 (hgt = 3)
22 (hgt = 0)
70 (hgt = 2)
75 (hgt = 1)
73 (hgt = 0)
80 (hgt = 0)
70 (hgt = 2)
50 (hgt = 1)
75 (hgt = 1)
22 (hgt = 0)
73 (hgt = 0)
80 (hgt = 0)

Question 3

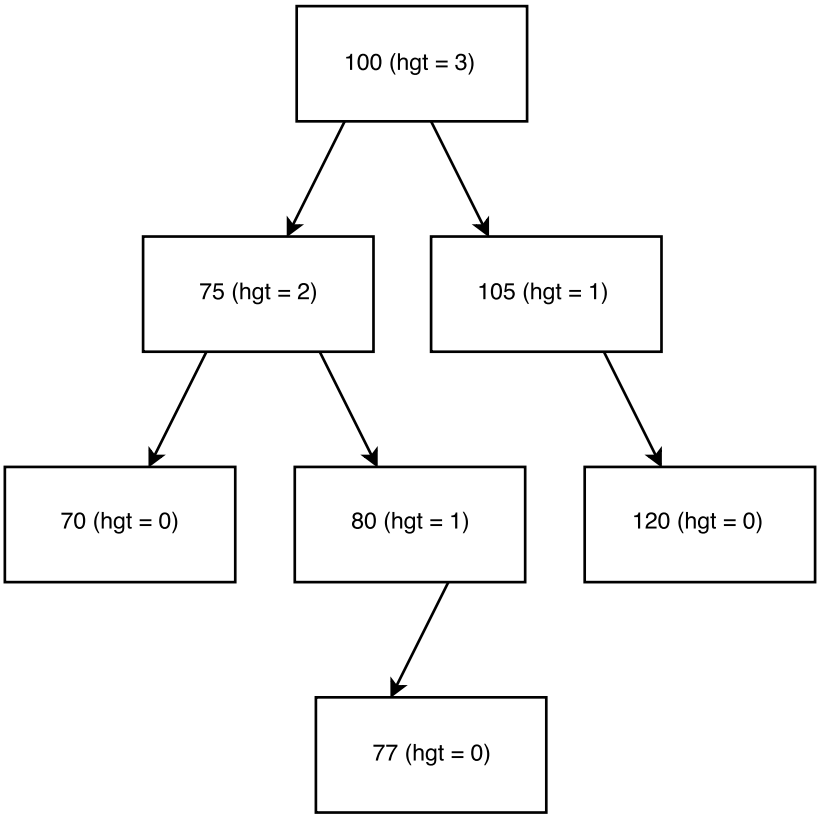
This is a balanced tree, nothing needs to be changed.



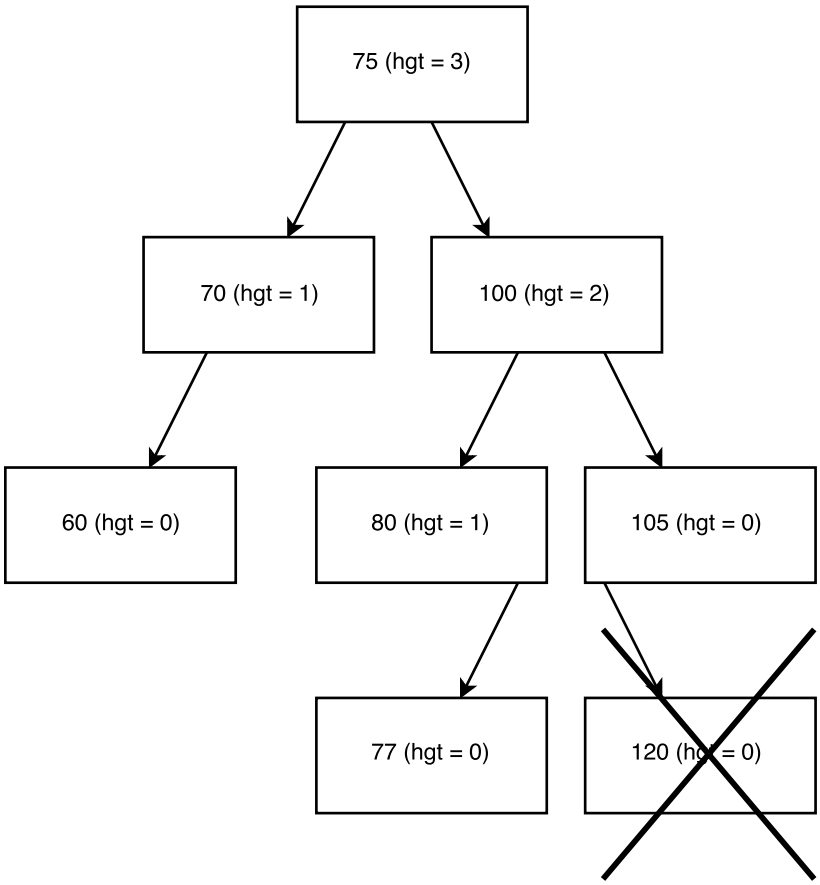
Question 4



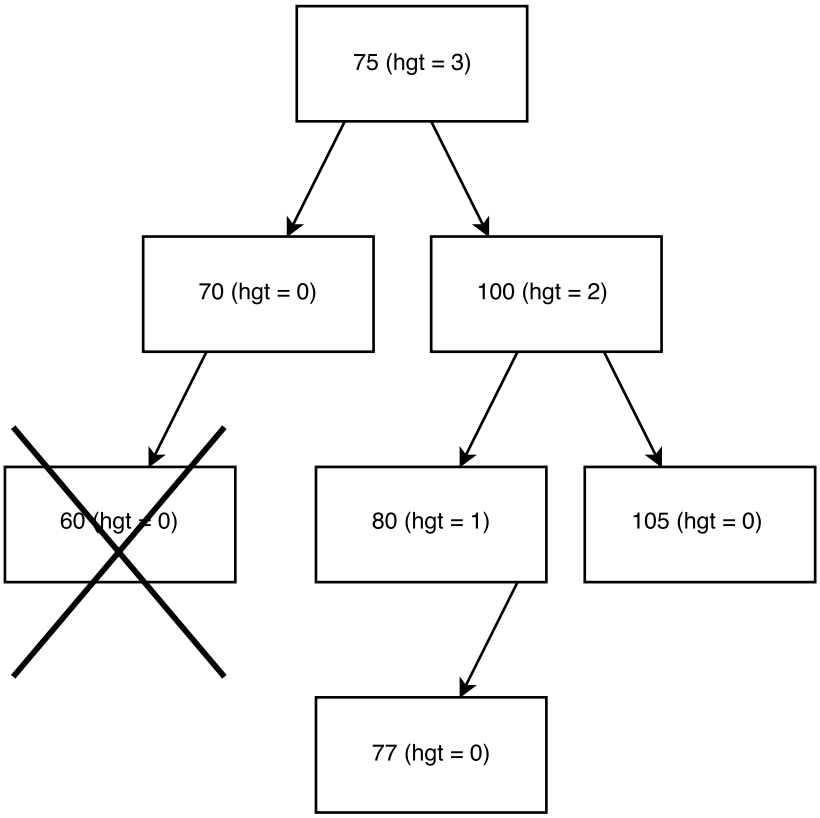
Removing the "60" makes the tree unbalanced.
It is unbalance on the right subtree with both children of the same height 1.
Hence, single rotation is applied.



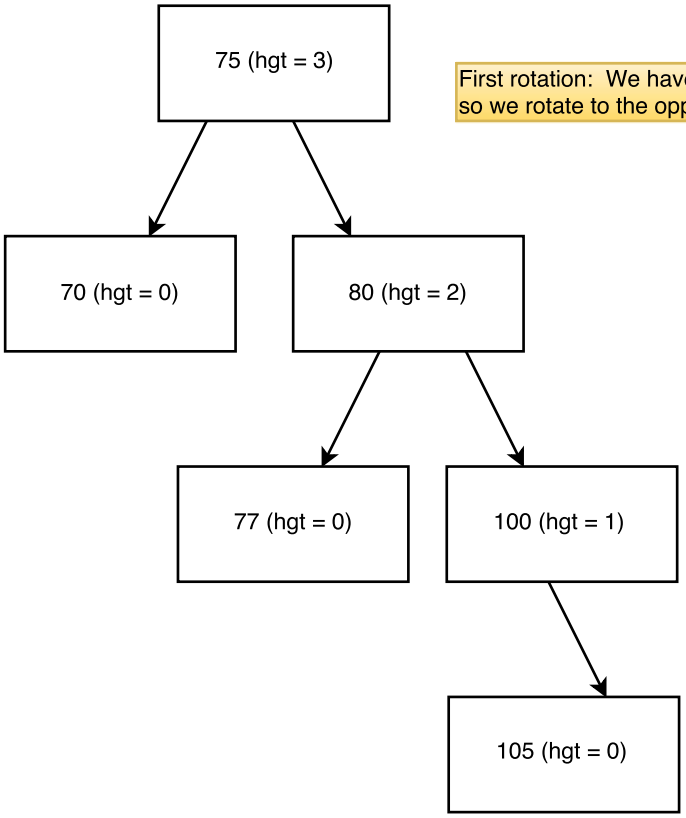
Question 5



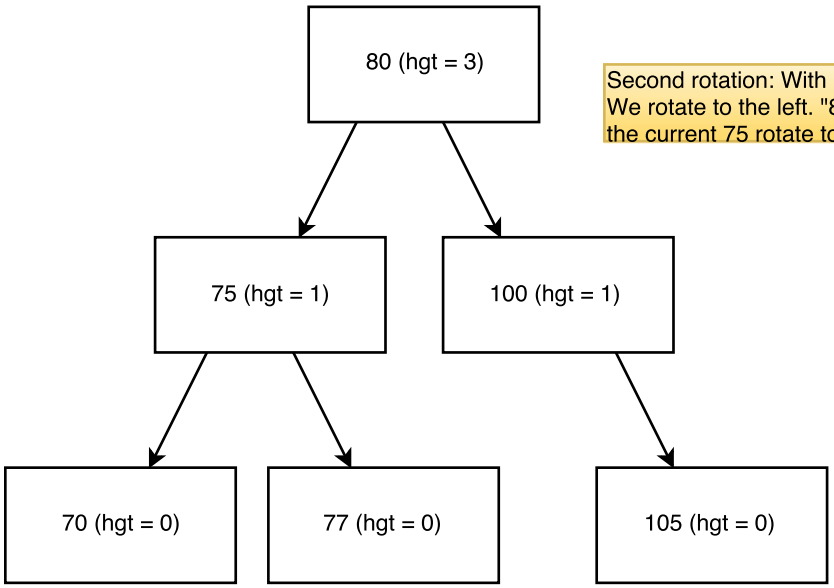
Nothing needs to be change when removing "120". This tree is still balance.



Removing "60" leads to an unbalance tree. Since the unbalance is from the right subtree with a left child. We need to implement double rotation here.



First rotation: We have heavier left child, so we rotate to the opposite direction (rotate right)



Second rotation: With unbalance right subtree. We rotate to the left. "80" becomes new top and the current 75 rotate to the current left.