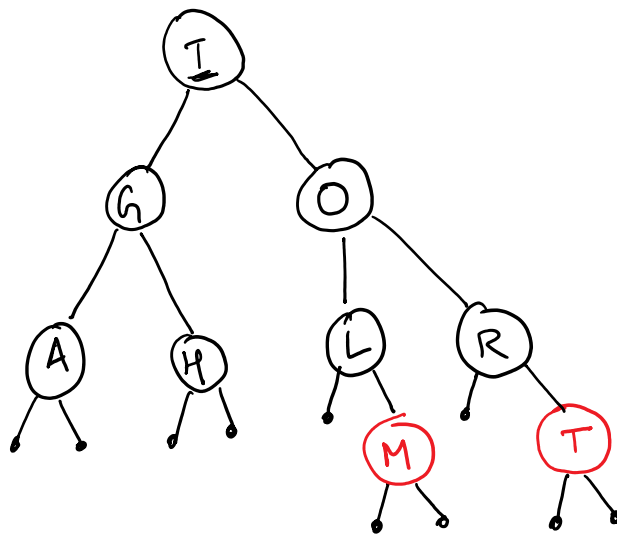
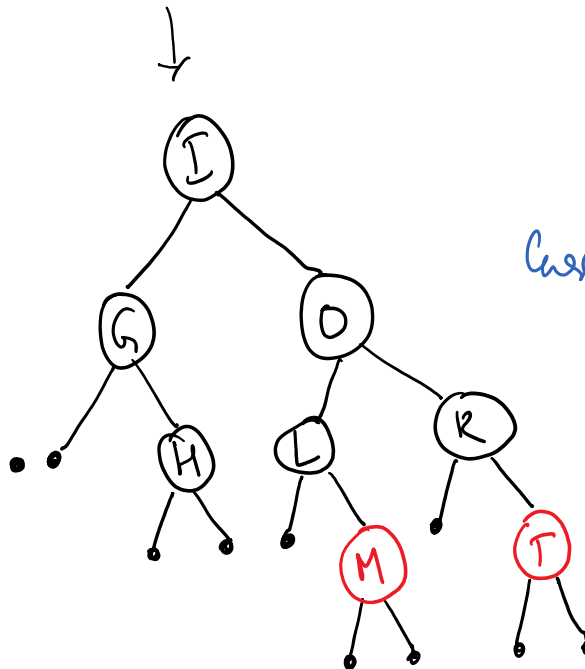


# Red Black Tree deletion

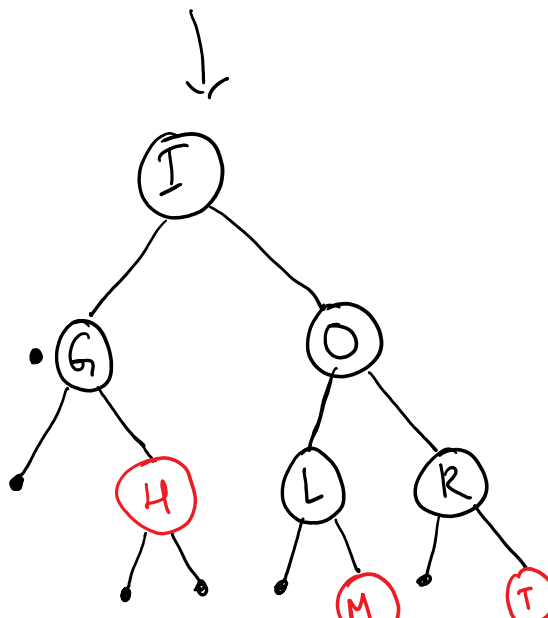
13 September 2020 21:51



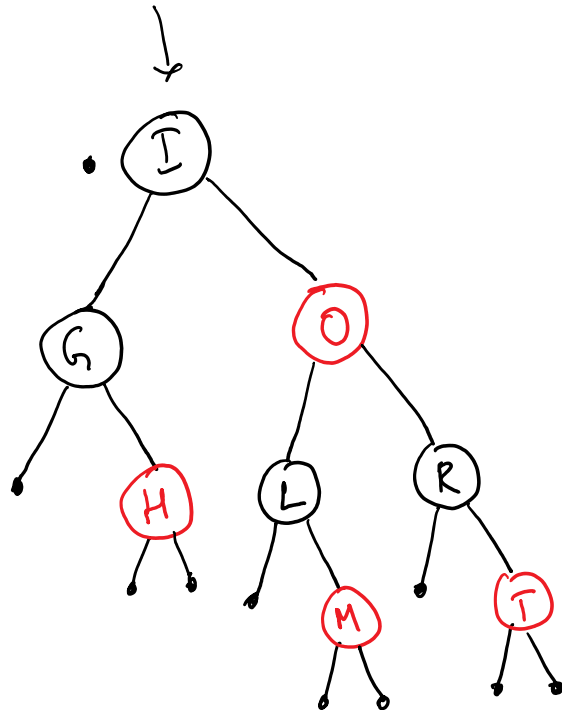
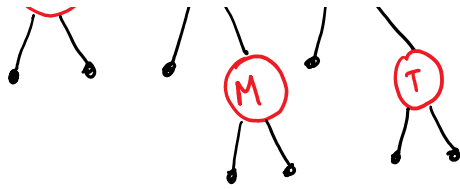
Delete A.



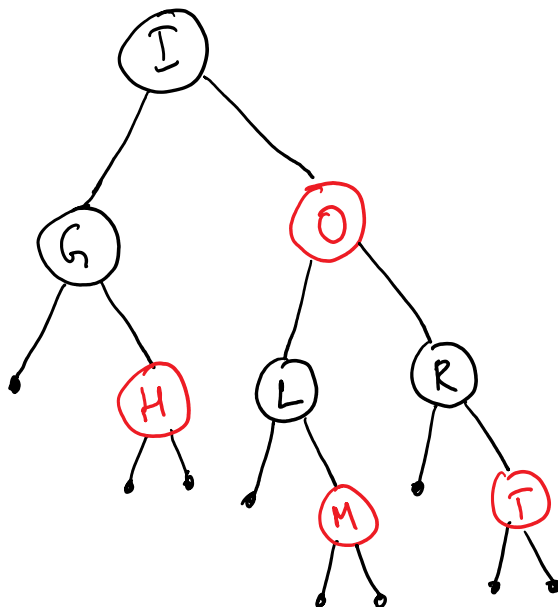
Case 2 : Sibling is black and has 2 black children



Again in Case 2 : Sibling is black and has two black children.

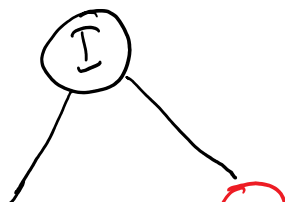


No Siblings. We can remove black token at root.



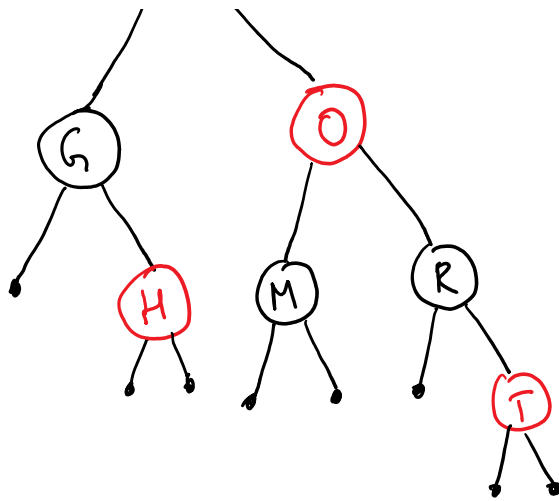
Delete L

L is black but child M is red. So this is minor case.

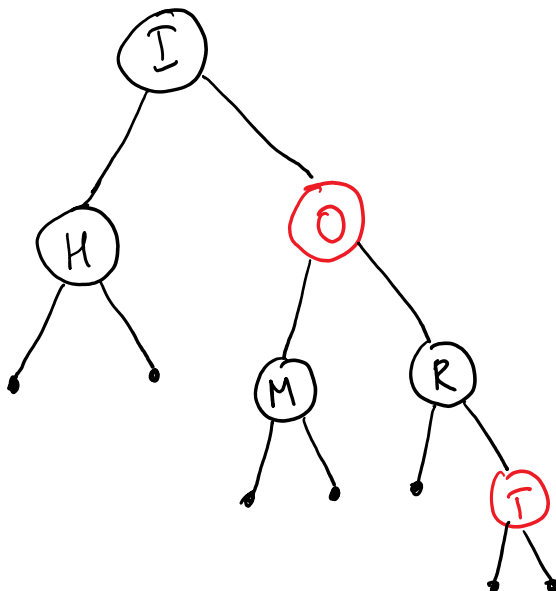


Delete G

I is black but lone child

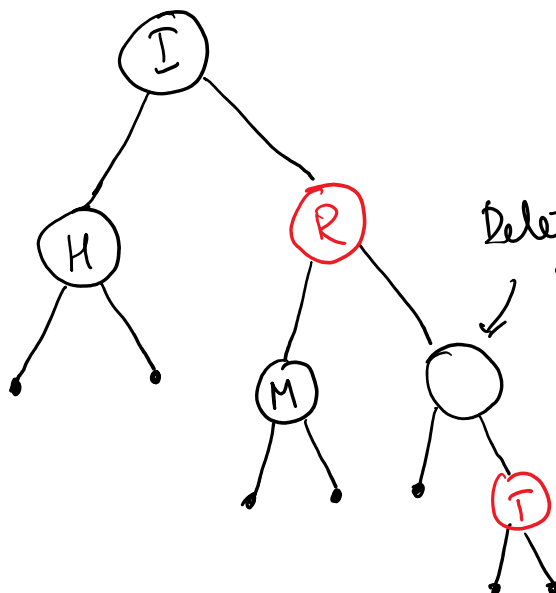


O is black but lone child is red. Again, minor case.



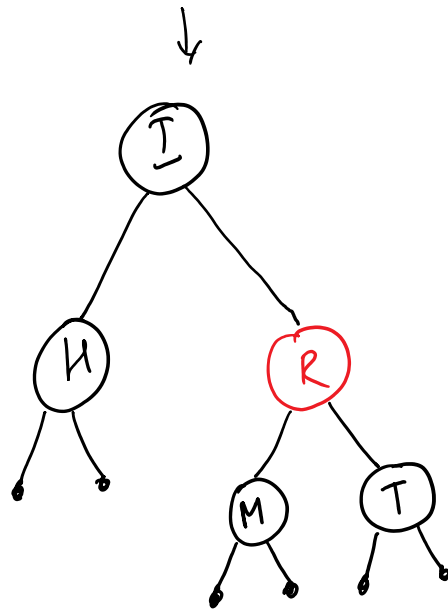
Delete O

Replace O by its successor R and delete the node containing R.



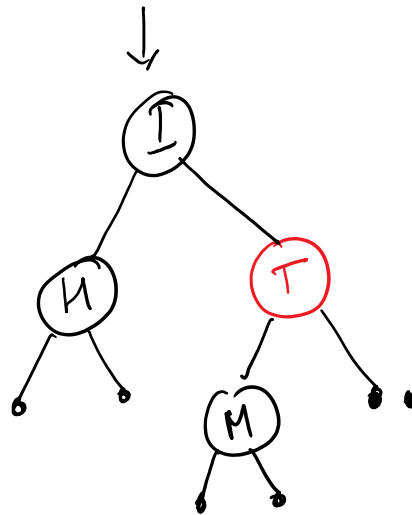
Delete this node.

This is minor case.

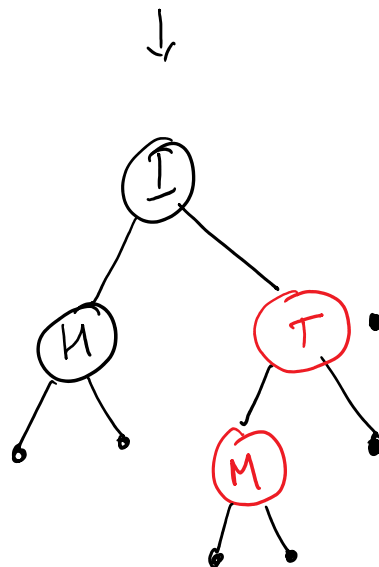


Delete R

Replace R with its successor T and delete node containing T.



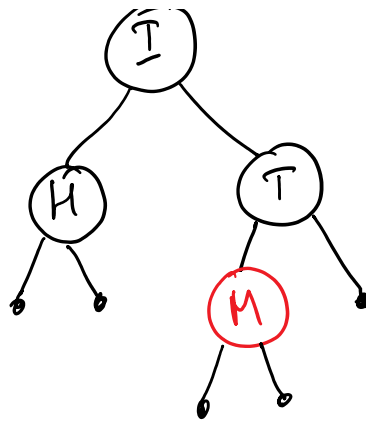
Case 2: Sibling (M) is black with two black children.



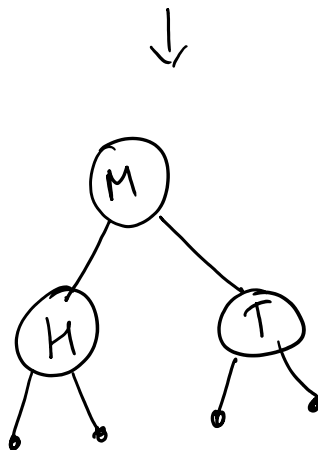
T absorbs the black token



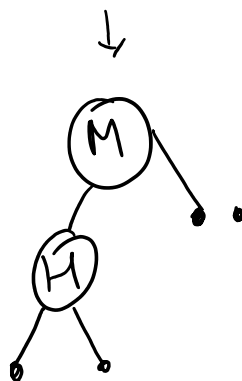
Delete I



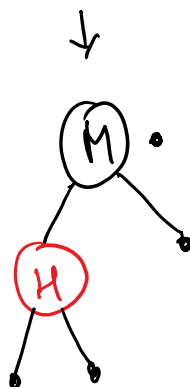
Replace I with successor M, and delete node containing M. Trivial case.



Delete T



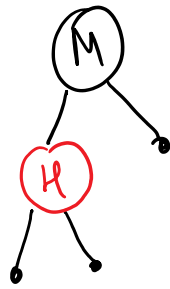
Case 2: Sibling H and children black.



Remove black token from root.



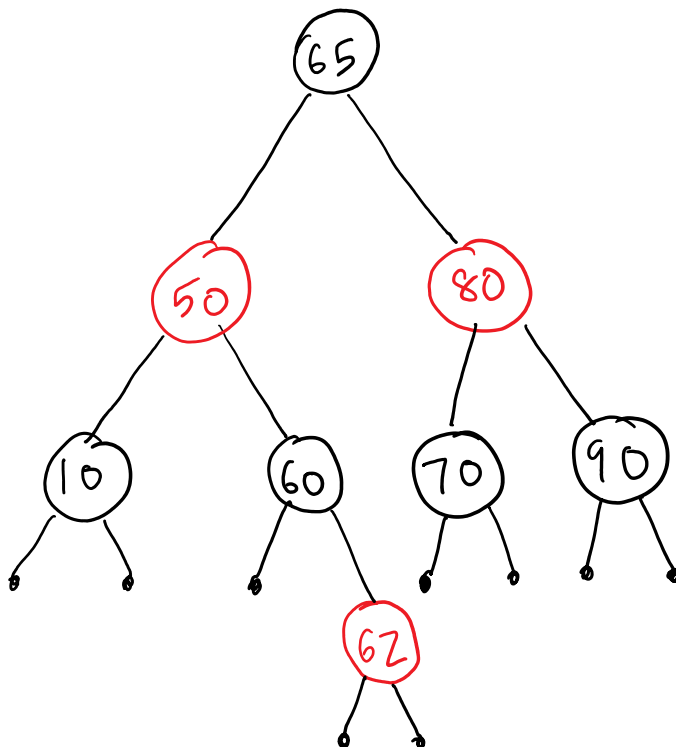
Delete M



Delete M  
Minor case

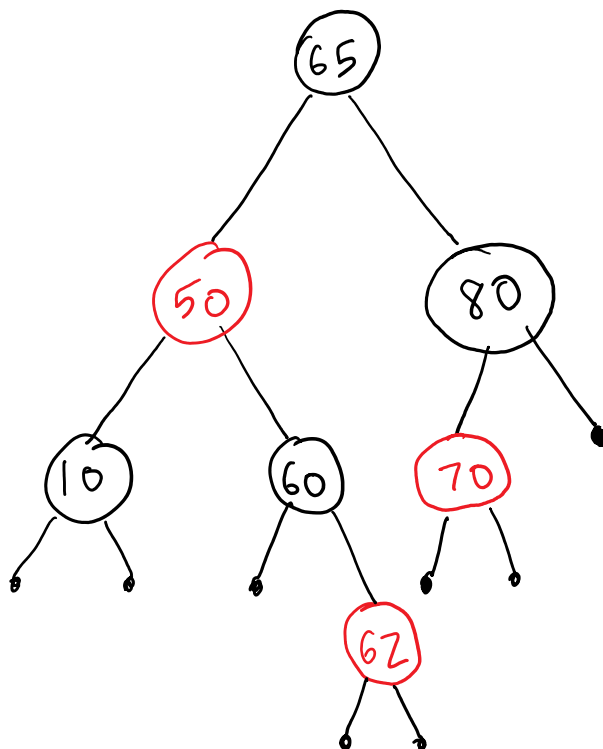
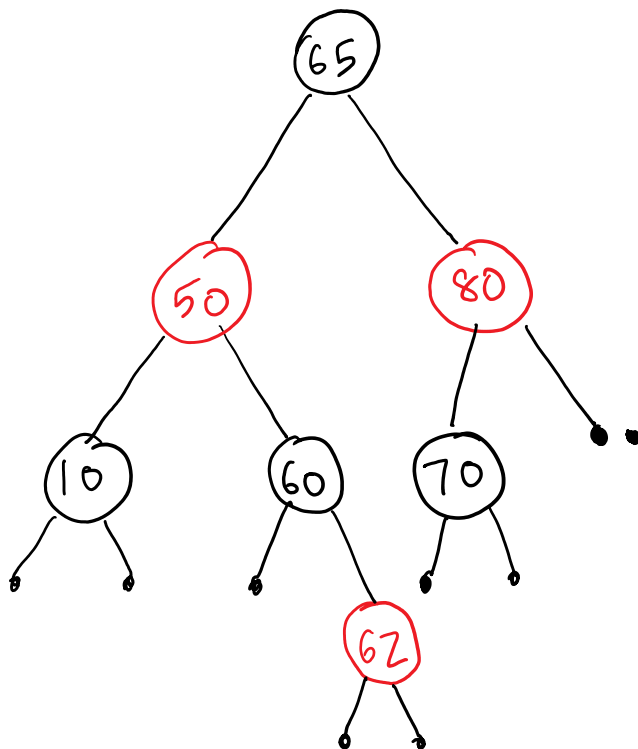


Delete H



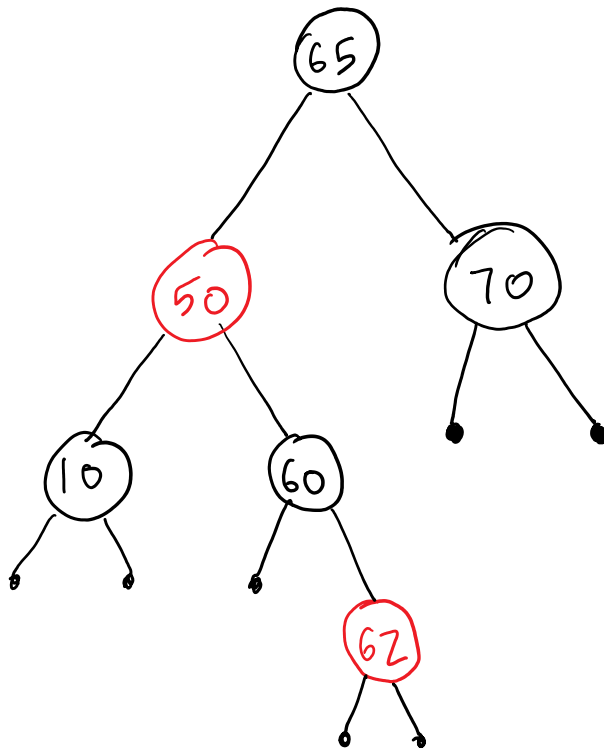
Delete 90

Major Case: Case 2

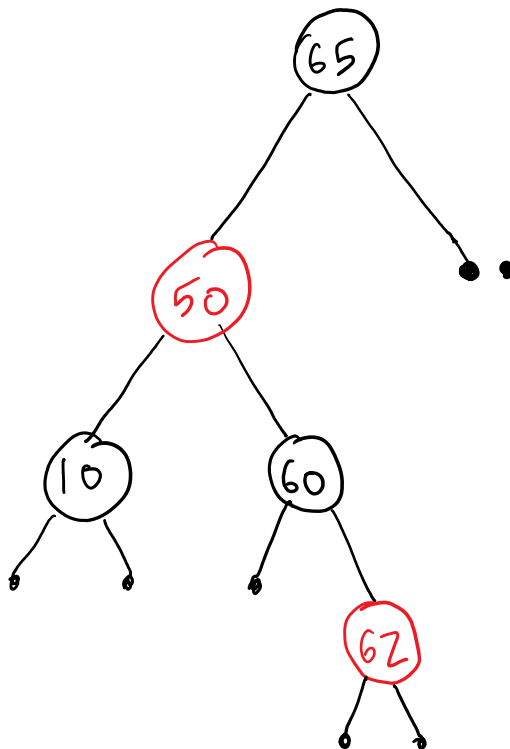


Delete 80

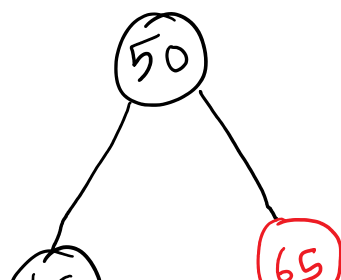
Minor Case: Splice 70  
in 80's place.



Delete 70

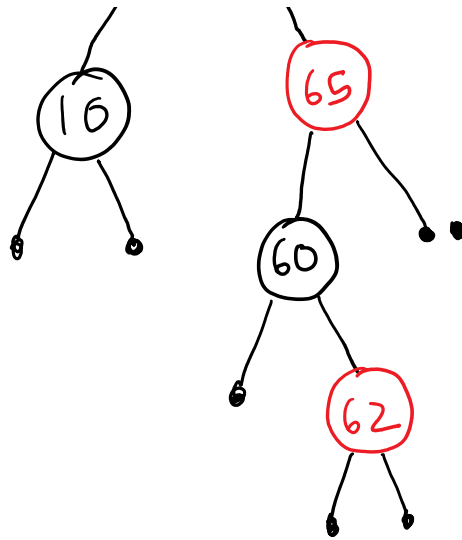


Case 1: Sibling is red.  
Rotate at parent  
and recolor

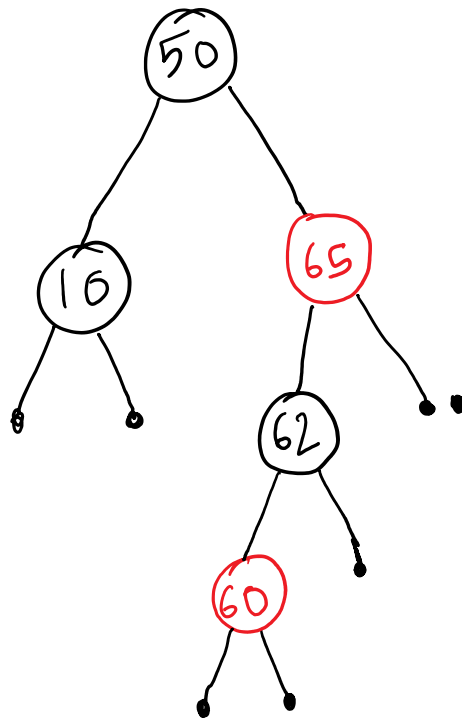


Now in Case 3  
(Mirror Image of Case 3).  
So rotate at sibling



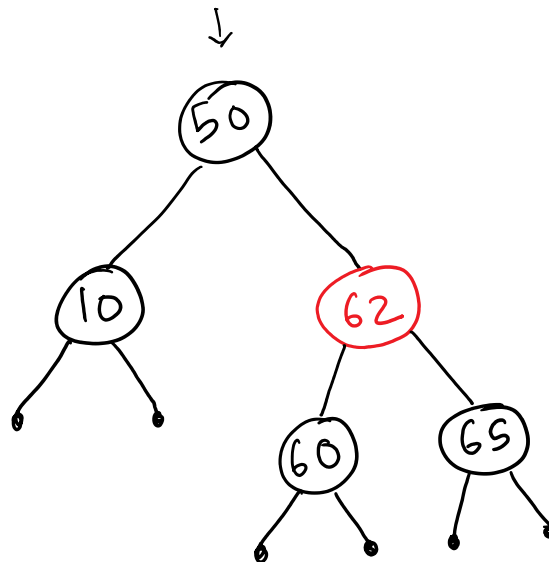


So rotate at sibling

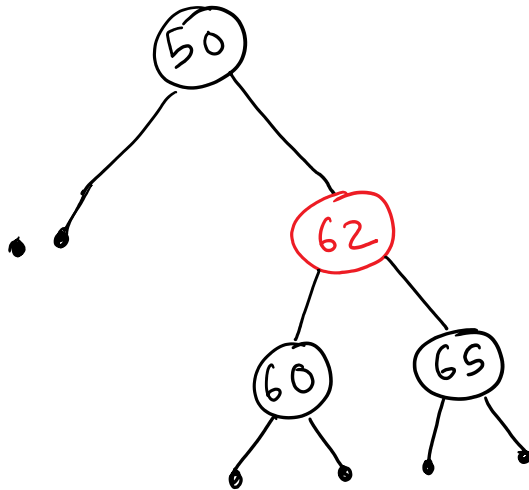


Now in Case 4.

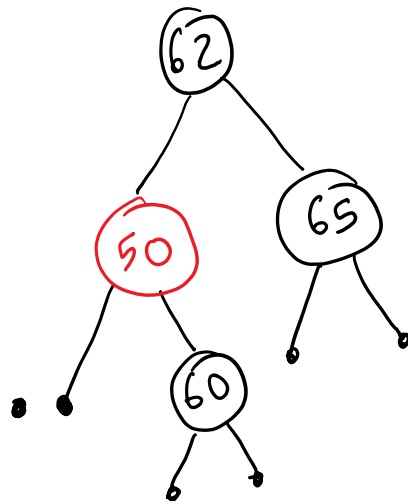
Recolor 60 to black.  
62 gets parent's color  
Parent gets black color.  
Rotate right at parent.



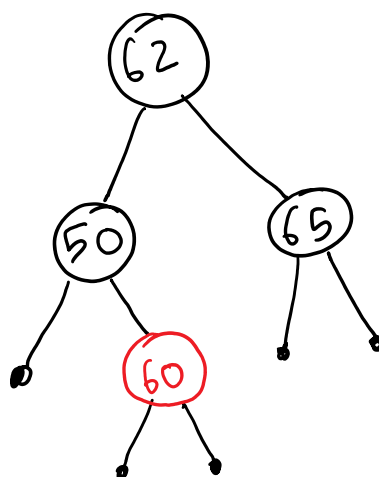
Delete 10



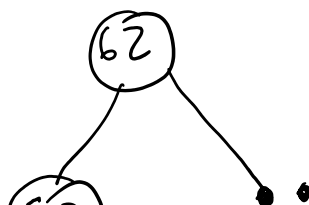
Case 1  
 Recolor sibling and  
 parent. left rotate about  
 parent



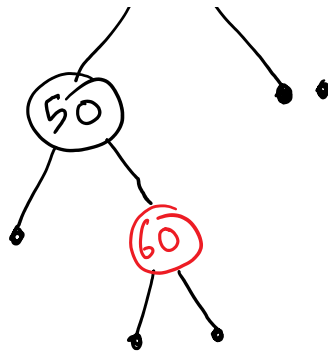
Case 2  
 Push up blackness.



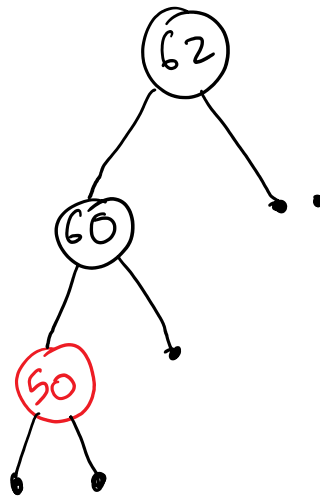
Delete 65



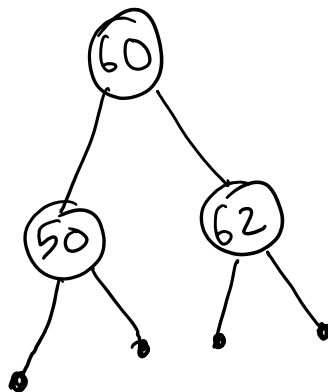
Case 3  
 Recolor 50 & 60.  
 ... 1 1 + 90



Keyhole 50 is black.  
Left rotate at 60



Case 4  
Color 50 and parent black.  
Sibling gets color of parent.  
Rotate at parent.



Done!