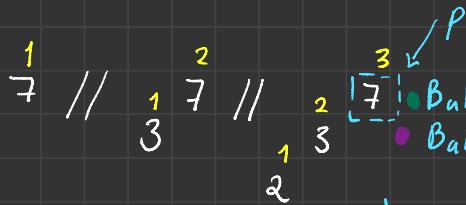
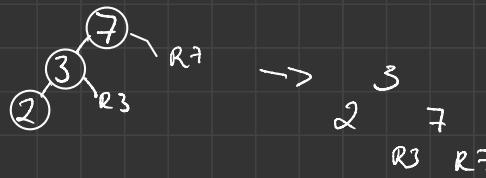


Programm:

LL Rotation case

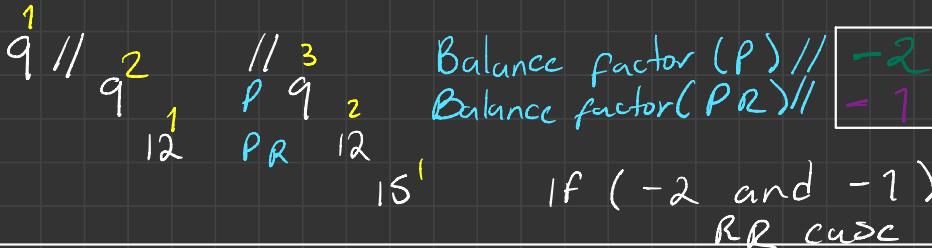


Balance factor (P) // height_{left} - height_{right} = 2
Balance factor (P > child) // " " = 1

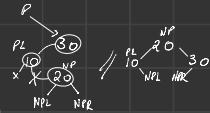
If 2 and 1 LL case

3
2
7
Green and
Purple supports
7 case

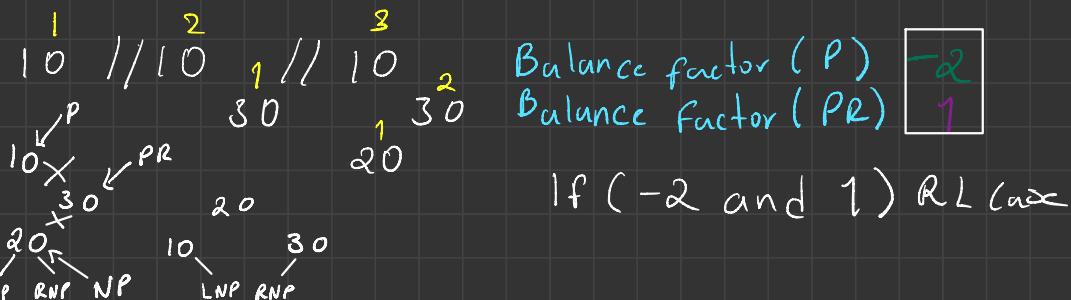
RR Rotation case



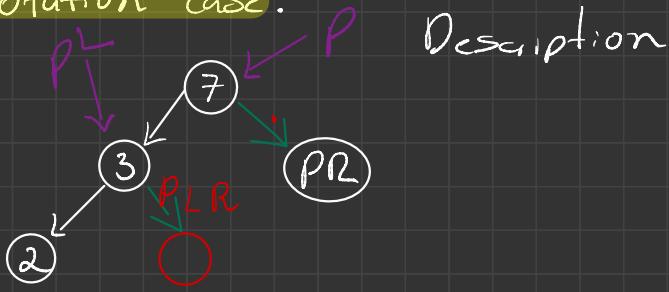
L R Rotation case



R L Rotation case

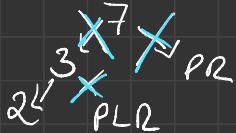


LL Rotation code:



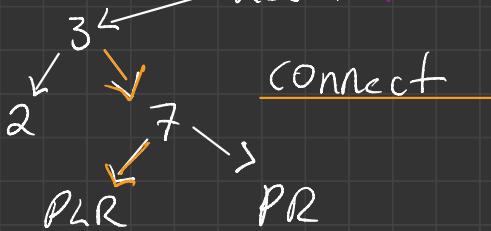
Step

Disconnect



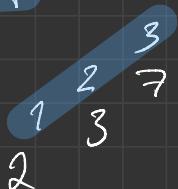
Step

Return PL



Return PL,

height



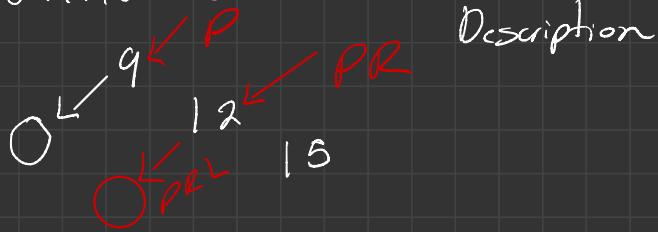
Rotation code

$$\text{Balance Factor}(7) = 2 - 0 = 2$$

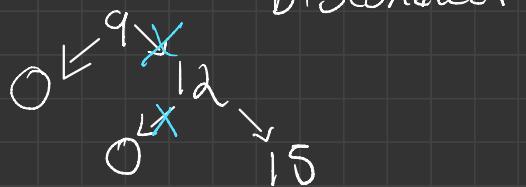
$$\text{Balance Factor}(3) = 1 - 0 = 1$$

If we get (2 and 1) we need to perform LL rotation

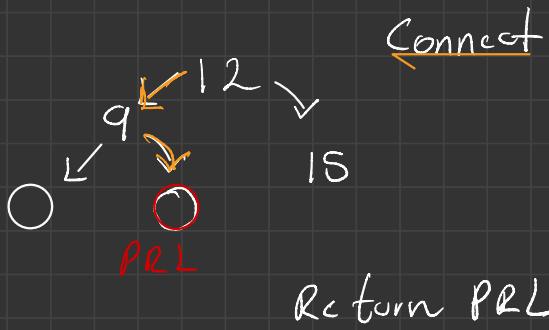
RR rotation case



Step

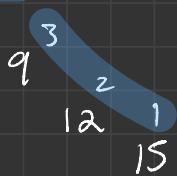


Step



Return PRL

height



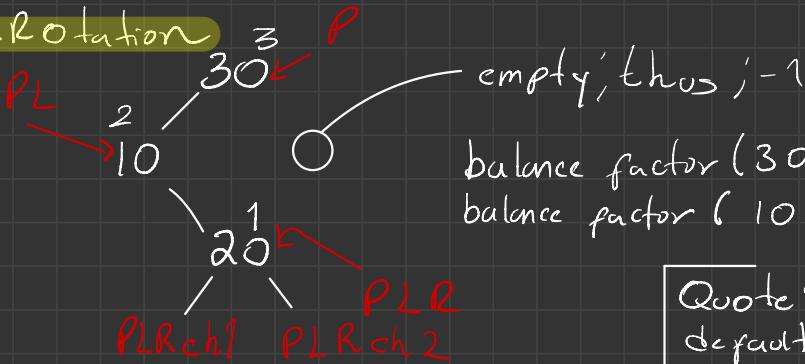
Rotation Code

$$\text{Balance Factor}(9) = 0 - 2 = -2$$

$$\text{Balance Factor}(12) = 0 - 1 = -1$$

If we get (-2 and -1) we need to perform R Rotation

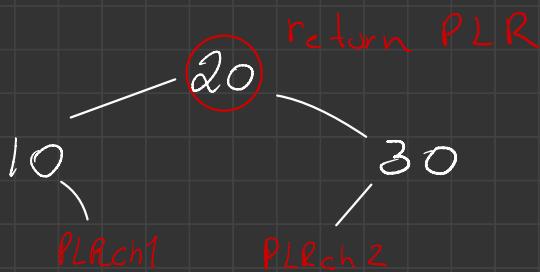
L R rotation



empty, thus, -1

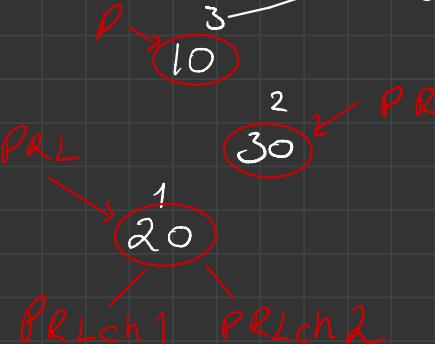
$$\begin{aligned} \text{balance factor}(30) &= 2 \\ \text{balance factor}(10) &= -1 \end{aligned}$$

Quote: by default, if you get a 2, -1, case that holds "10" doesn't have Left child



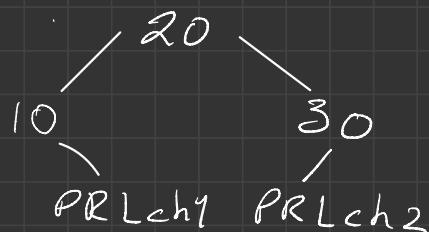
R L R rotation

height

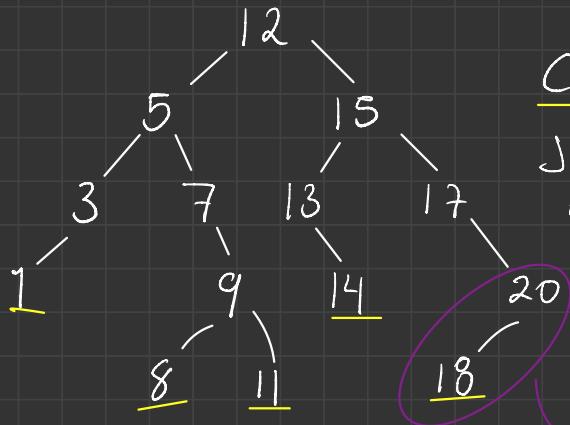


$$\text{Balance Factor}(10) = -2$$

$$\text{Balance Factor}(30) = 1$$

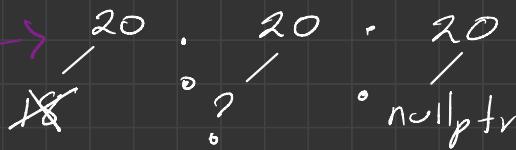


Deletion of a node in the tree

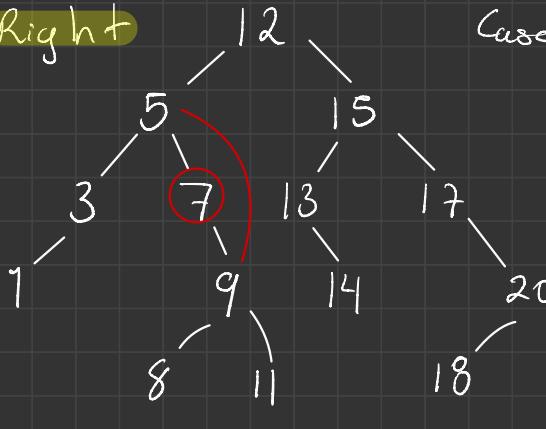


Case 0) Leaf Node

Just delete the node, but ensure that the pointer to that node is now `nullptr` to avoid unexpected behaviors

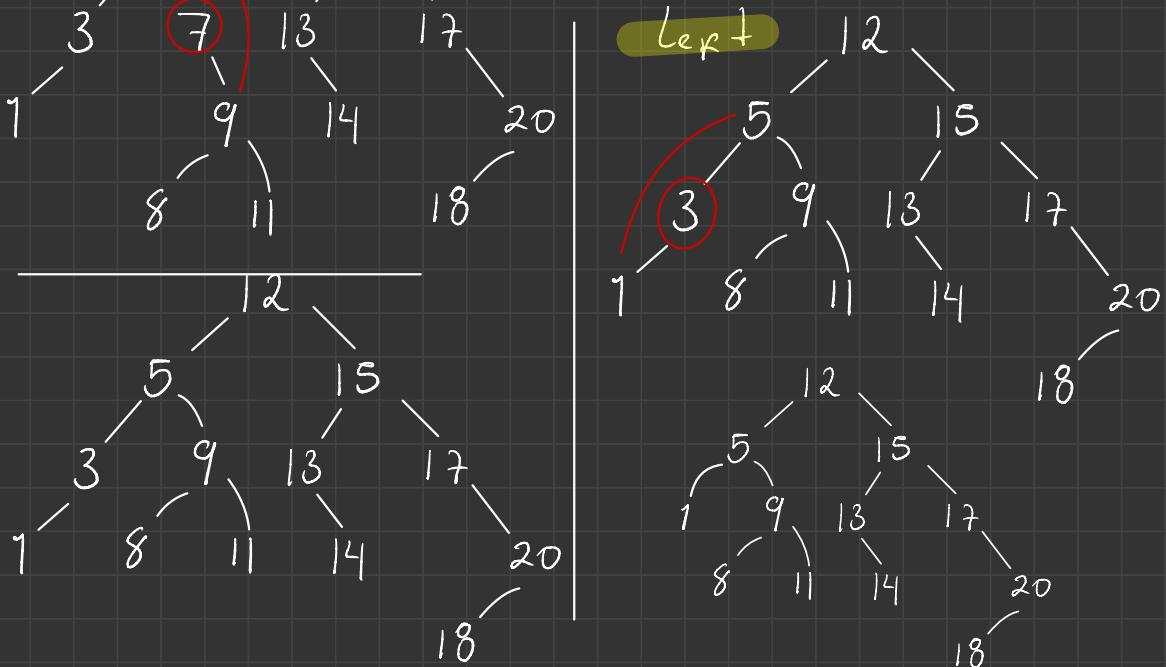


Right

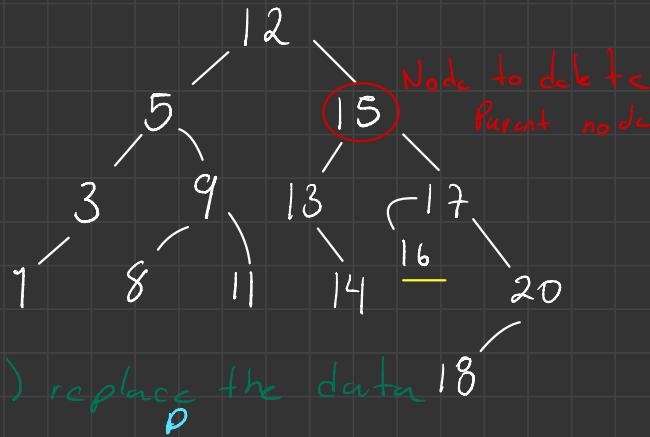


Case 1) the node to delete has one child : Right or Left

Left



Cuse 2, when is a parent node:

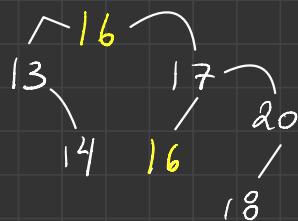


Solving:

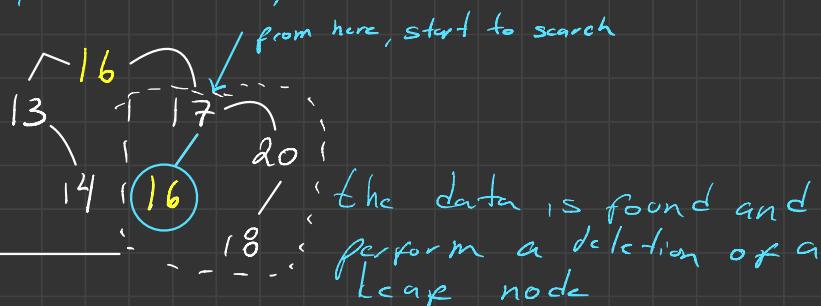
Find the min
of the right
node to delete

1) From the node to
delete:

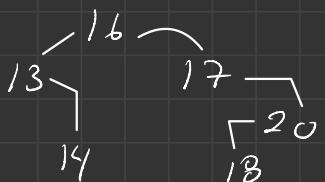
Right - left
will reach to the last node



3) from P->Rchild, search and delete the node
that you have replaced its data



Since many things could happen when we are deleting a node
any result that returns with recursion power, we need
to be sure to $P(16) \rightarrow Rchildren$, points to the subtree
generated by the recursion call.



final sub tree