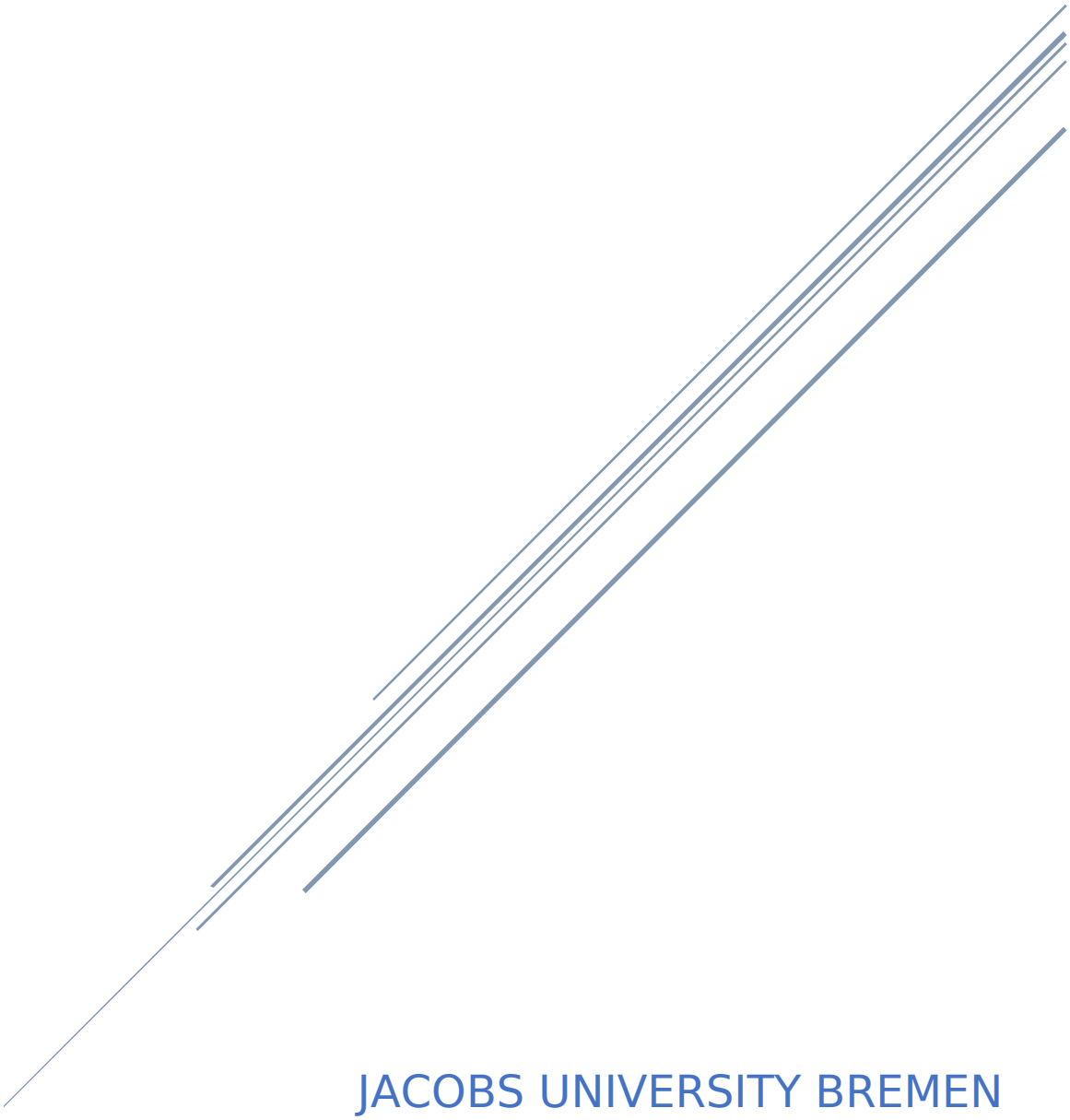
HOMEWORK 9

ALGORITHMS AND DATA STRUCTURES



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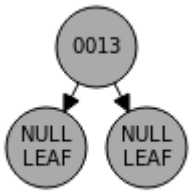
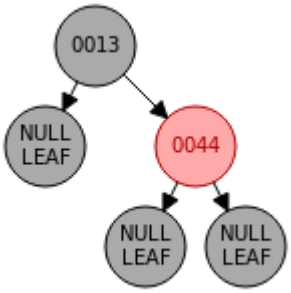
Problem 9.1 Understanding Red Black Trees

1.

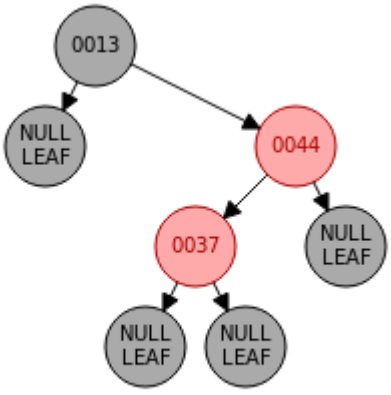
first we insert the first element 13, is the first element inserted so it has to be black because the root is always black.



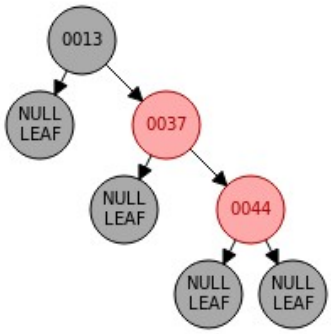
Insert 44 because is bigger it has to go at the right of the tree.



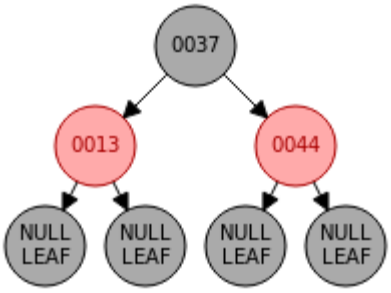
Insert 37, 37 is bigger than 13 and smaller than 44 so it has to be the left children of 44.



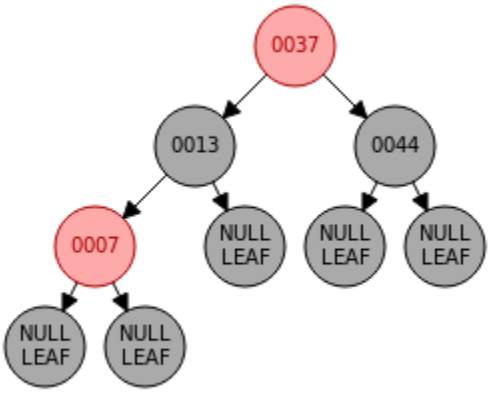
Node 37 and the parent 44 are both red. 37 is a left child, and 44 is right child so we rotate right



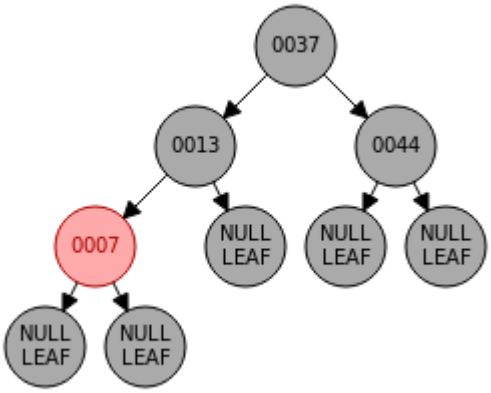
Both are still red and 44 is right child, and 37 is right child so we have to rotate to the left



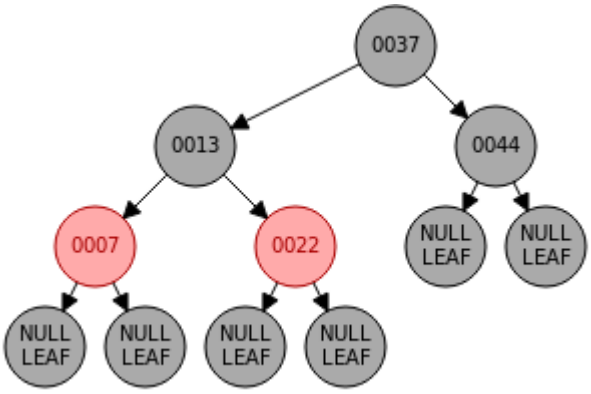
Insert 7 because is smaller than 13 it has to be its left child because the node and the parent will be both red and the uncle is red we push blackness down from grandparent.



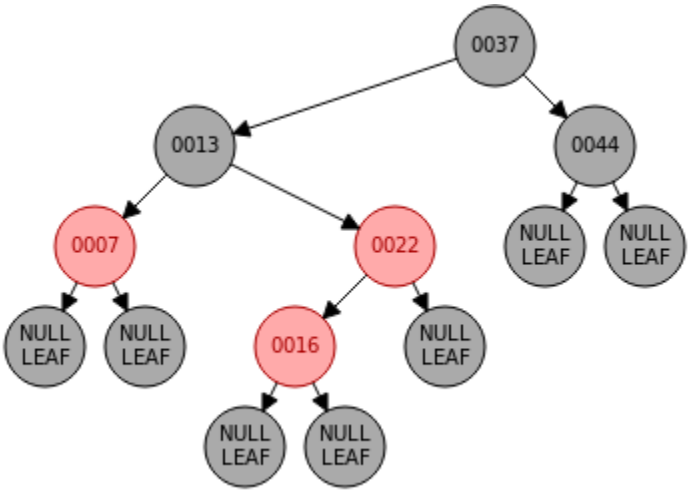
Root is red so we color it black



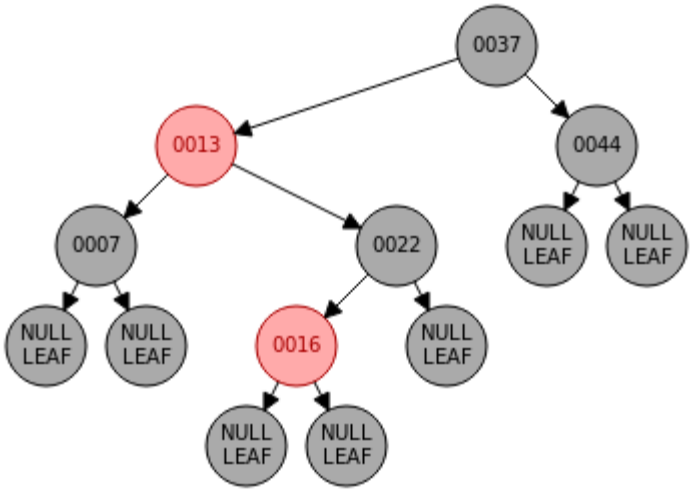
Inserting 22 is pretty easy because it will be the right child of 13 and because it wont unbalance the tree we just insert it.



Insert 16, again we look were 16 has to go. 16 is bigger than 13 but smaller than 22 so it has to be 22 right child.



The child and the parent are both red and the uncle node is red, we push blackness down from grandparent.



There are no more corrections to be made. We are done

2.