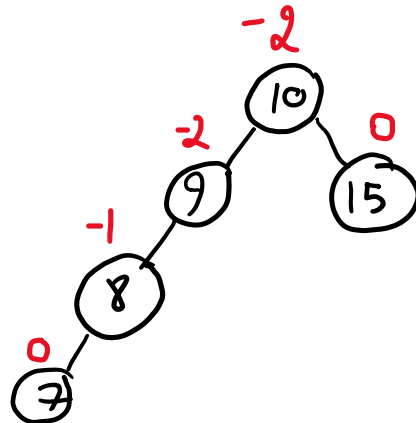
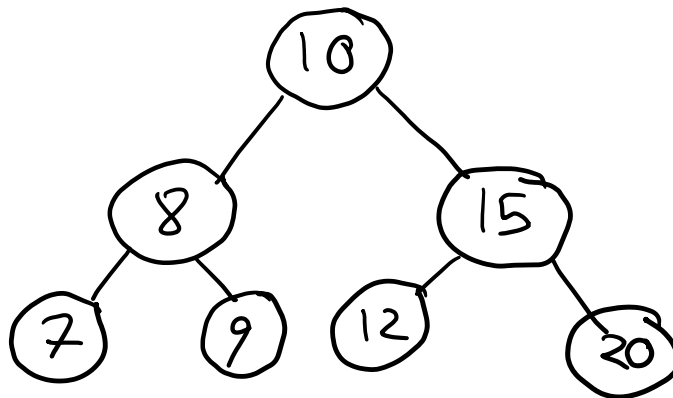


- i. Write the balance factors of each node in the tree shown below.

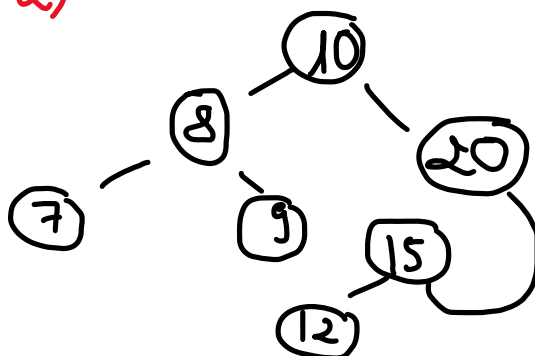


- ii. Rotate the sub-tree rooted at node containing 15 to the left by 1 in the tree shown below. Draw trees to show intermediate steps.

1)

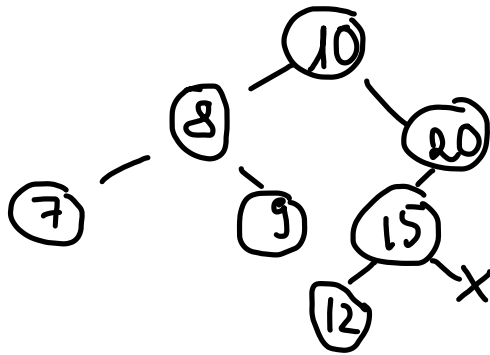


2)



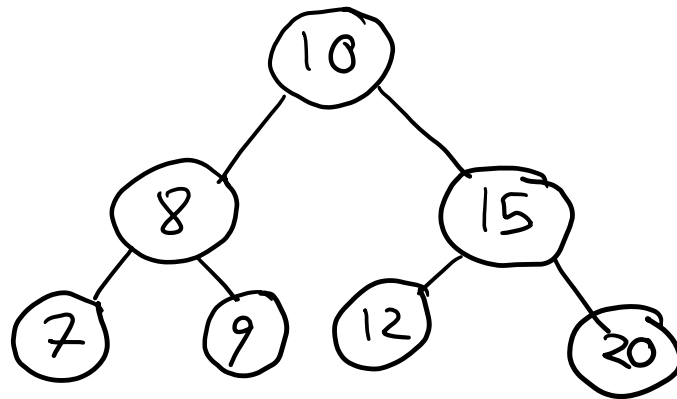
15->right is still 20.

3)

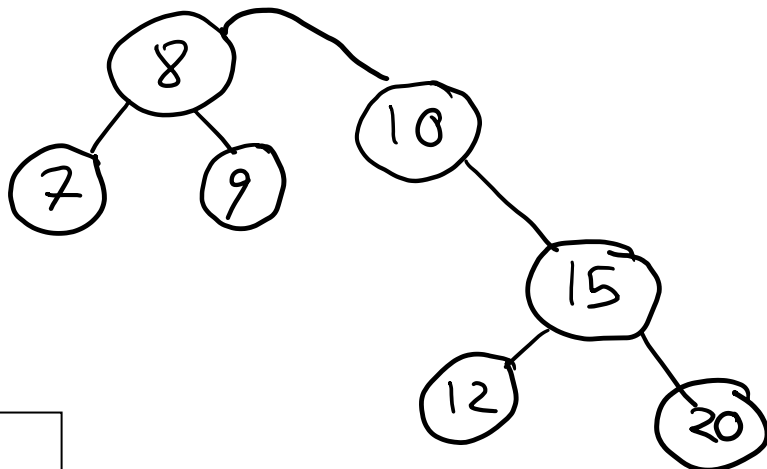


- iii. Rotate the sub-tree rooted at node containing 10 to the right by 1 in the tree shown below. Draw trees to show intermediate steps.

1)

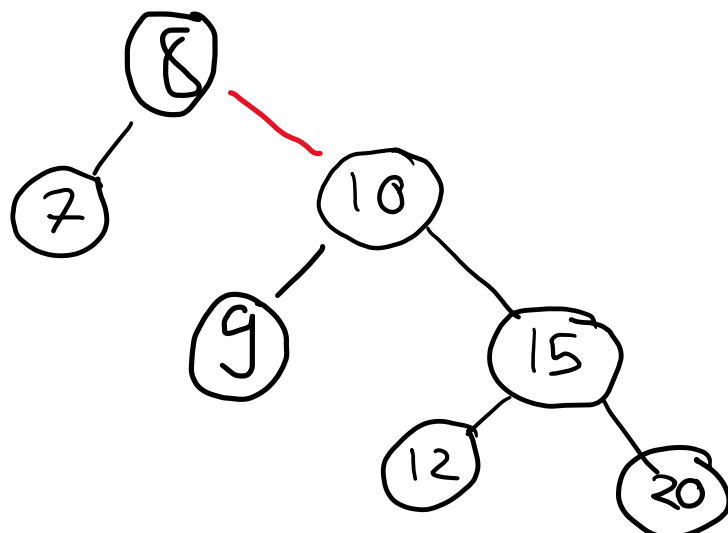


2)



Node 8 is the root now.
Node 10-left at the moment is still 8

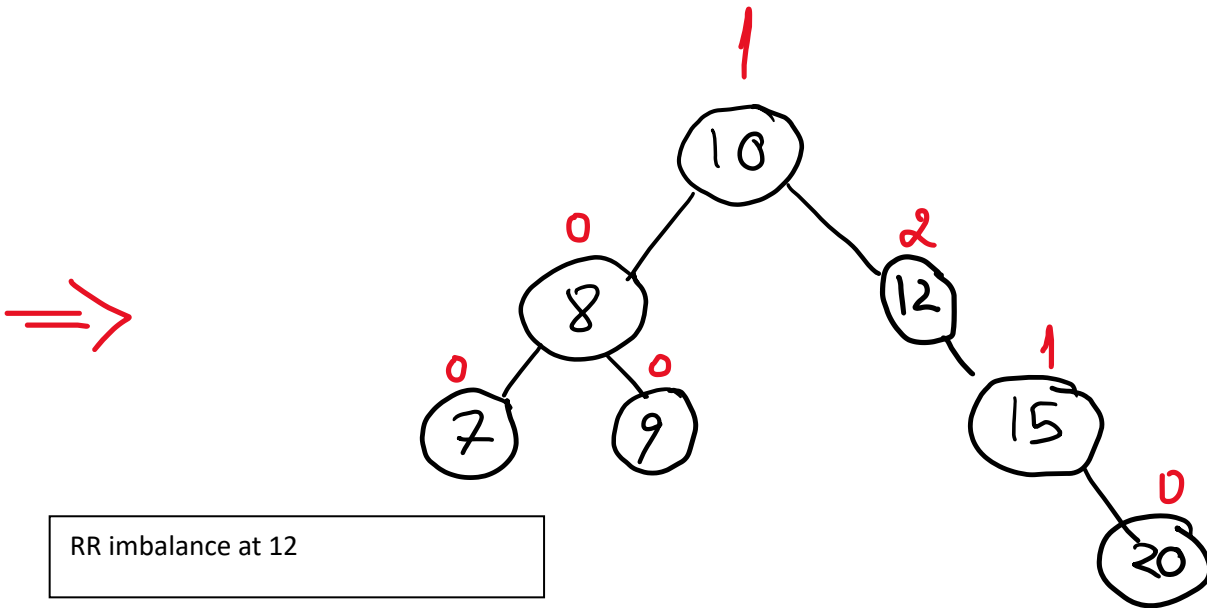
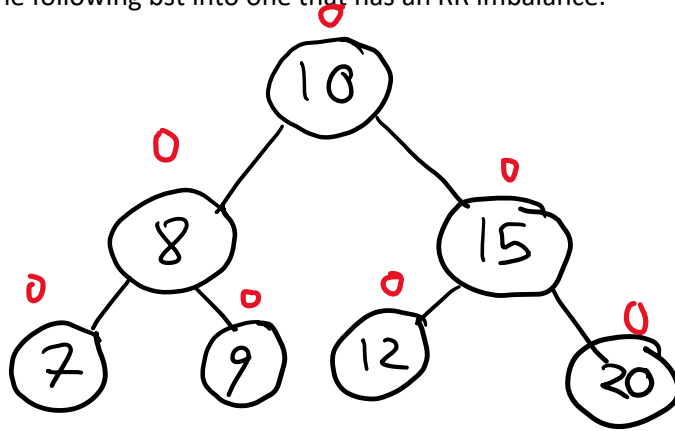
3)



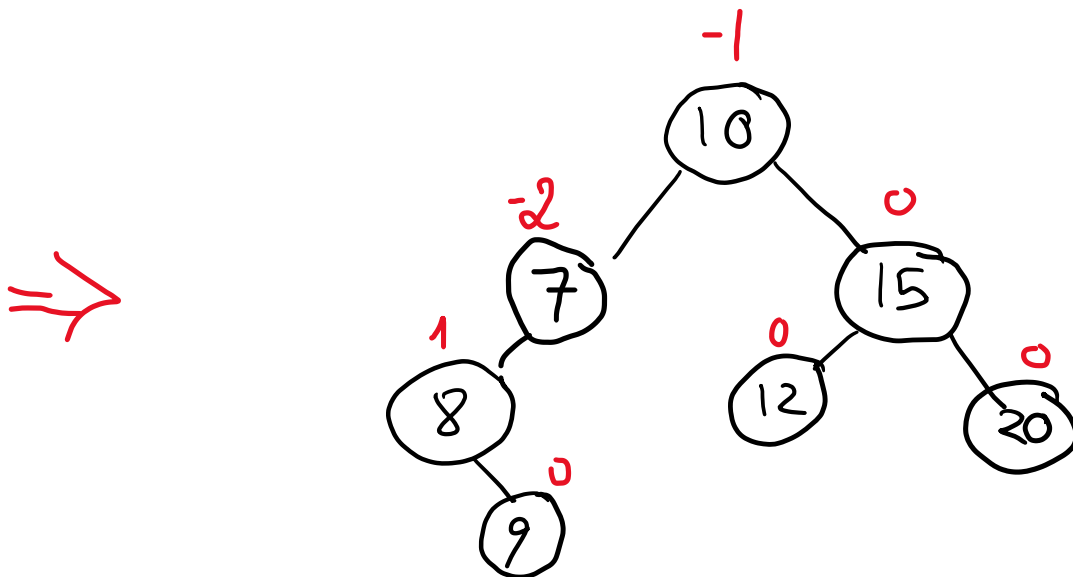
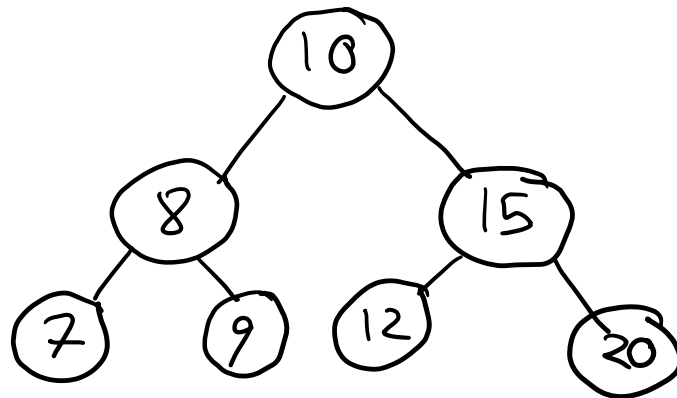
Node 10-left links to node8-right.
node8-right now links to 10.

2. AVL Tree analysis

- a. Convert the following bst into one that has an RR imbalance.

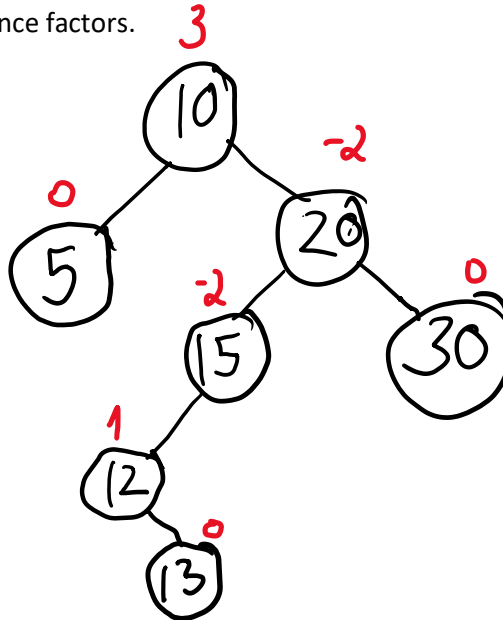


b. Convert the following bst into one that has an LR imbalance.



LR imbalance at 7

- c. What type of imbalance does the bst shown below have at node containing 15? Give reasoning using balance factors.

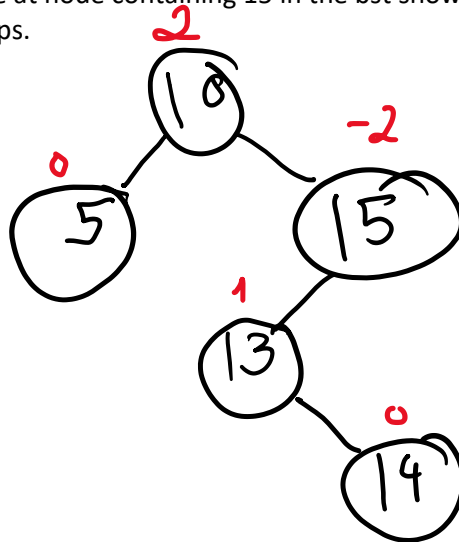


At 15, it's LR imbalance since:

$BF(15) == -2$

$BF(15 \rightarrow \text{left}) = BF(12) = 1$

- d. Fix the imbalance at node containing 15 in the bst shown below. Draw trees to show intermediate steps.

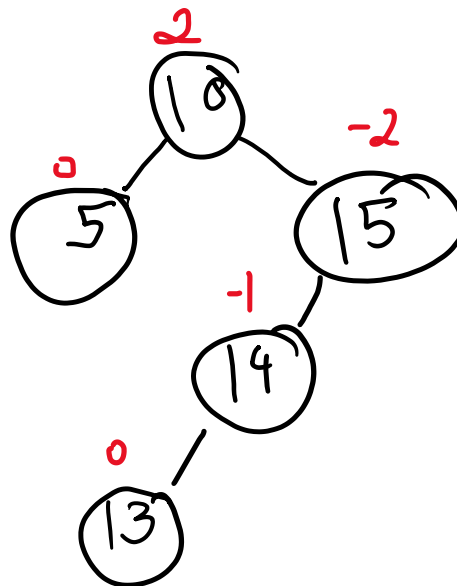


At 15 \rightarrow LR imbalance.

\rightarrow 1 left rotation at 13

\rightarrow 1 right rotation at 15

1)



Left rotation at 13:

15 \rightarrow left to 13 \rightarrow right which is 14

13 \rightarrow right to 14 \rightarrow left which is nullptr

14 \rightarrow left to 13

Right rotation at 15:

10->right now links to 14

15->left links to 14->right (nullptr)

14->right links to 15

2)

