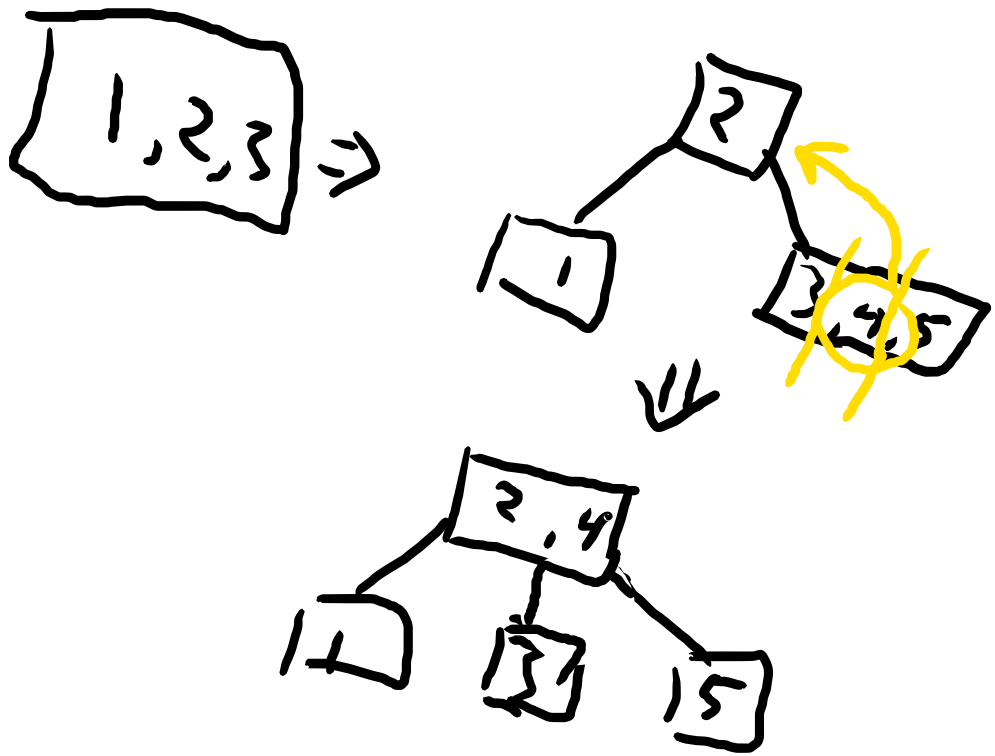
2-3 Trees

Exercises

Insertion (no key rotations!)

Starting with an empty tree, insert elements in the following order:

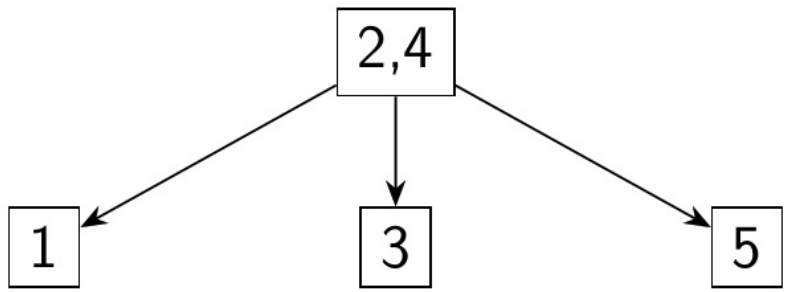
~~1~~, ~~2~~, ~~3~~, ~~4~~, ~~5~~



Insertion

Starting with an empty tree, insert elements in the following order:

`1, 2, 3, 4, 5`

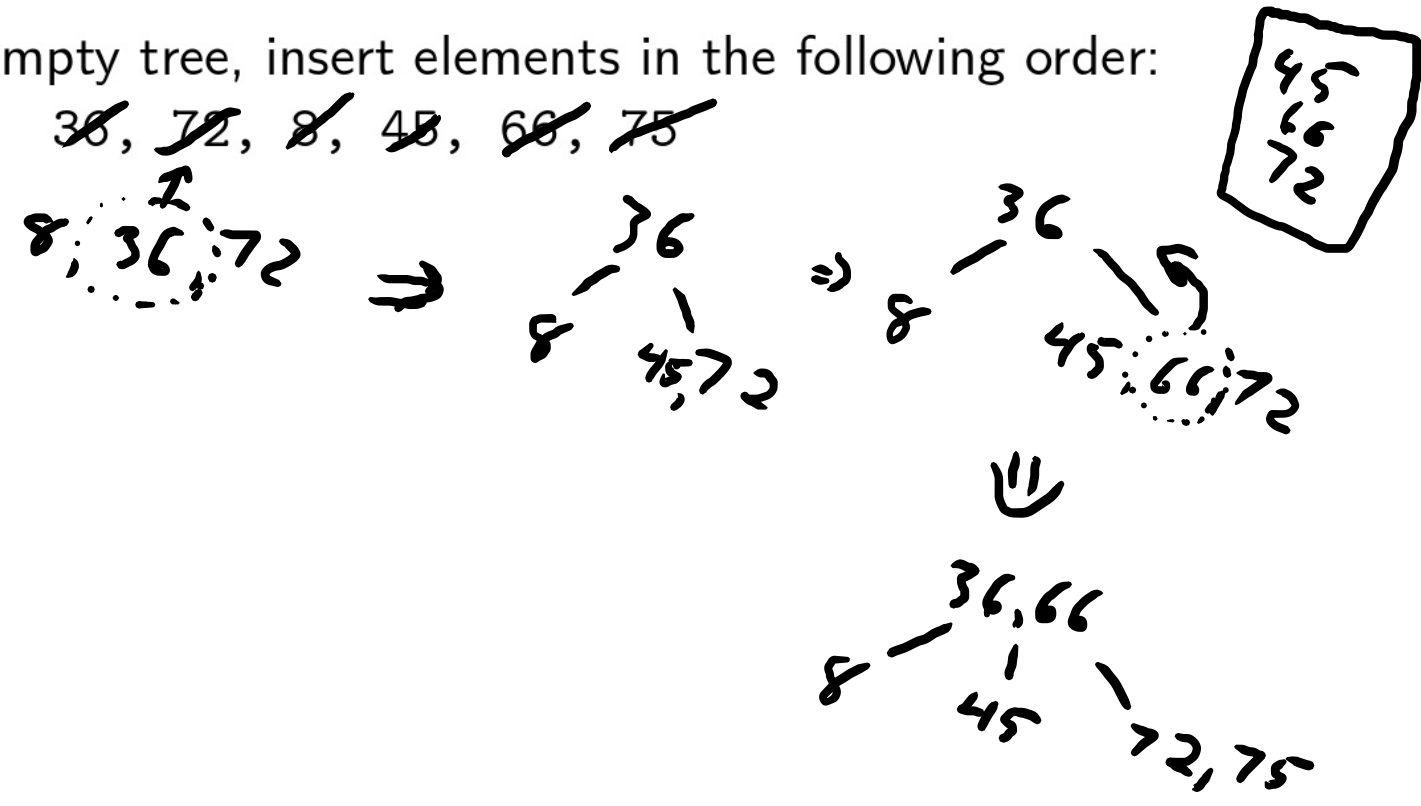


Insertion

#project

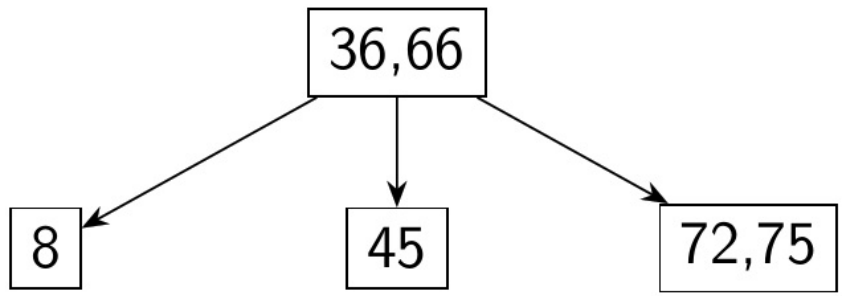
(STILL NO ROTATIONS YET)

Starting with an empty tree, insert elements in the following order:



Insertion

Starting with an empty tree, insert elements in the following order:
36, 72, 8, 45, 66, 75

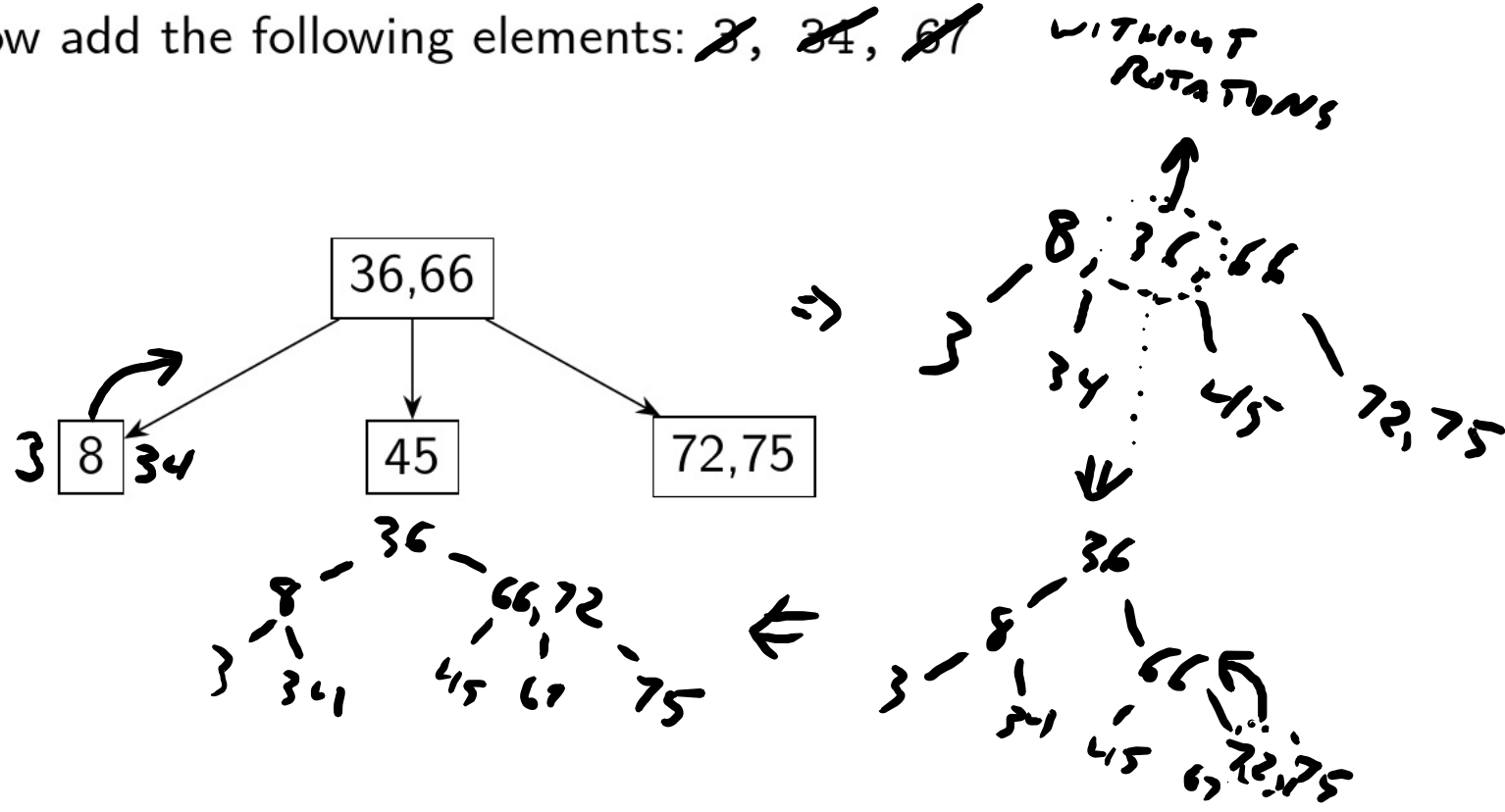


Insertion

Starting with an empty tree, insert elements in the following order:

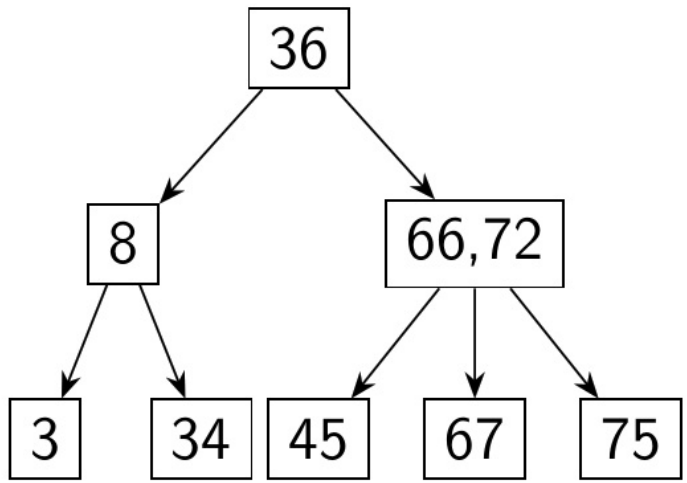
36, 72, 8, 45, 66, 75

Now add the following elements: ~~3~~, ~~34~~, ~~67~~



Insertion

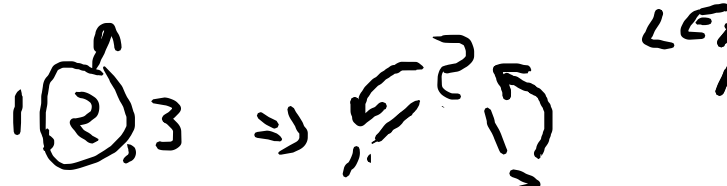
Starting with an empty tree, insert elements in the following order:
36, 72, 8, 45, 66, 75
Now add the following elements: 3, 34, 67



Insertion with Key Rotation

Starting with an empty tree, insert elements in the following order:

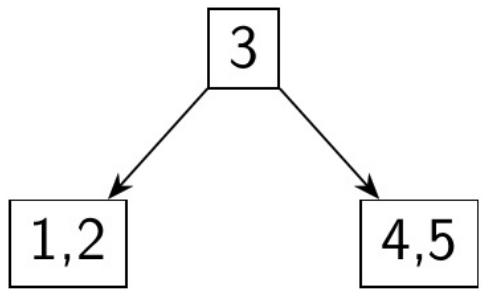
1, 2, 3, 4, 5



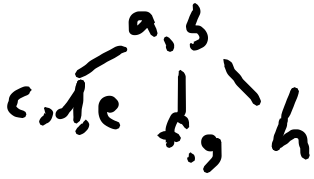
Insertion with Key Rotation

Starting with an empty tree, insert elements in the following order:

`1, 2, 3, 4, 5`



Insertion with Key Rotation



Starting with an empty tree, insert elements in the following order:

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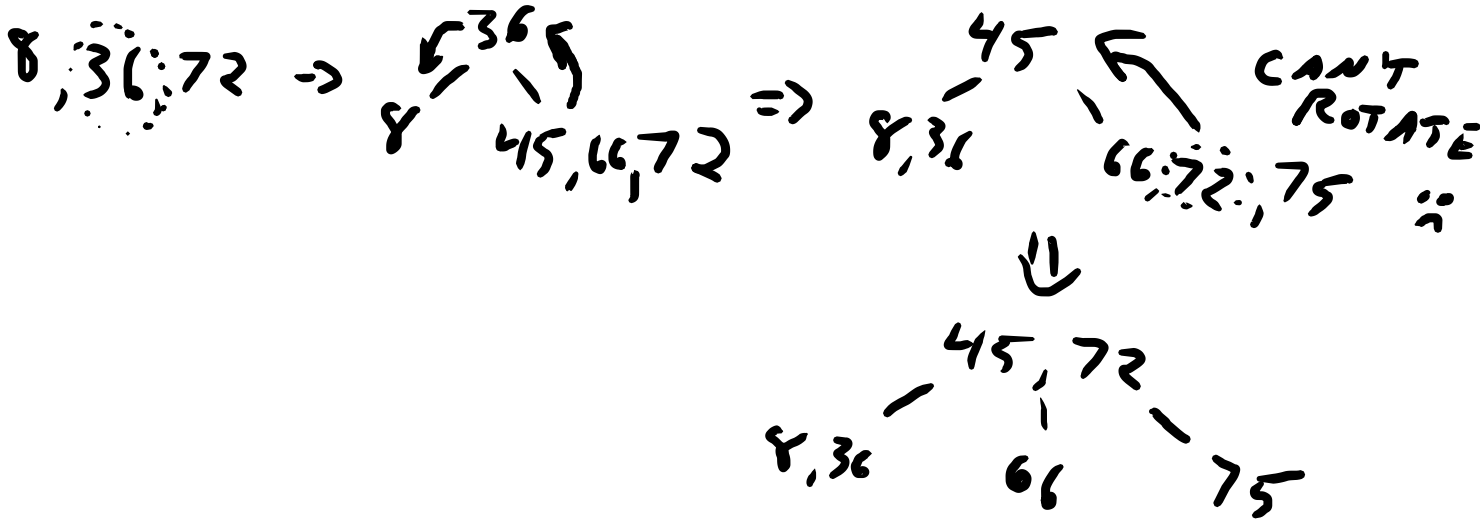

Insertion with Key Rotation

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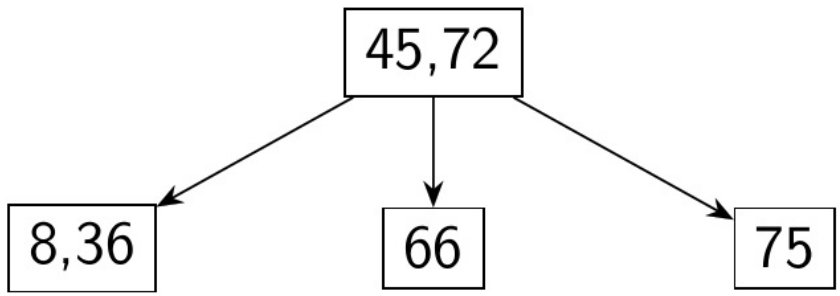

Insertion with Key Rotation

Starting with an empty tree, insert elements in the following order:

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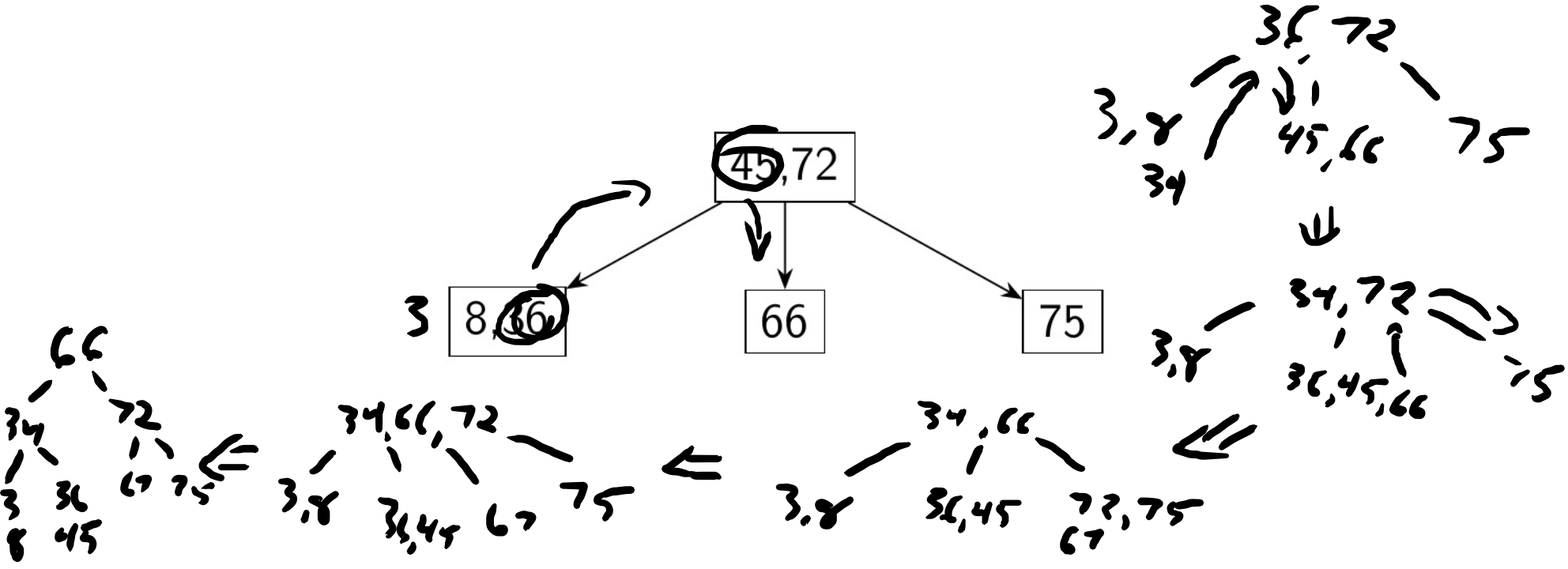
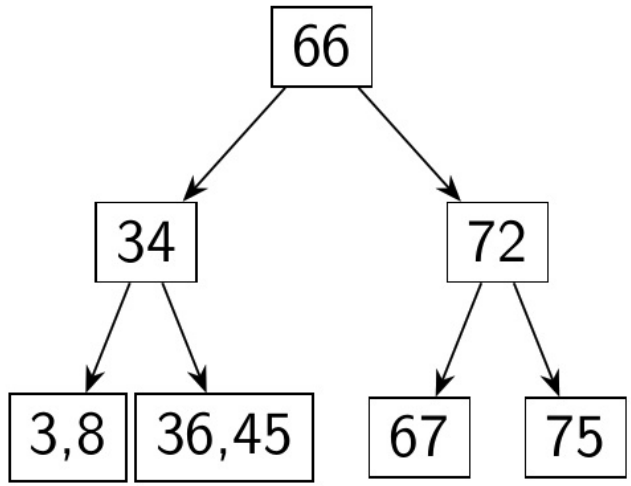
Now add the following elements: ~~8~~, ~~34~~, 67



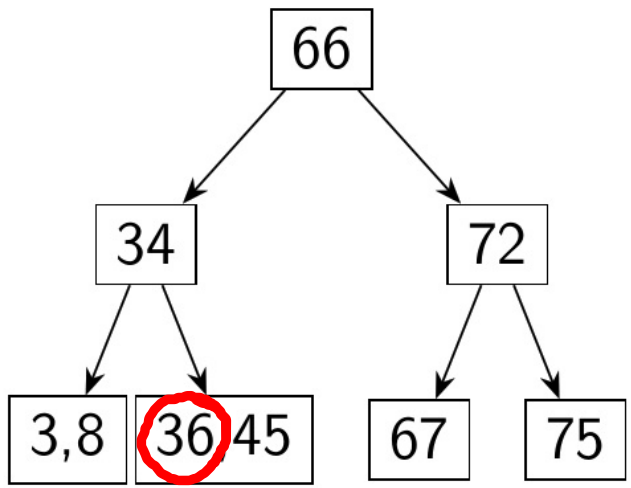
Insertion with Key Rotation

Starting with an empty tree, insert elements in the following order:
36, 72, 8, 45, 66, 75
Now add the following elements: 3, 34, 67



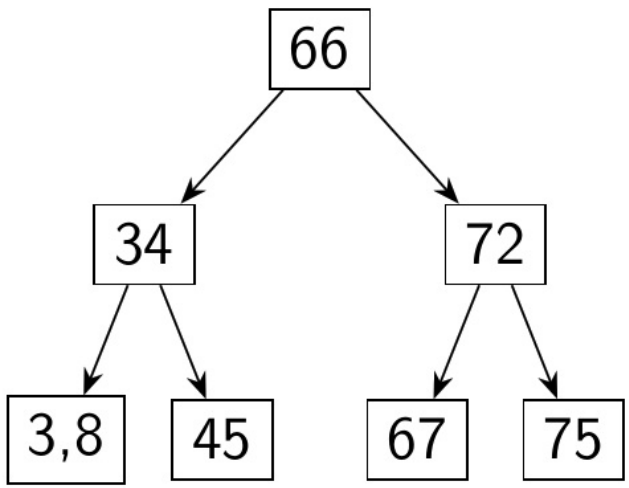
Deletion

Starting with the previous tree, delete 36



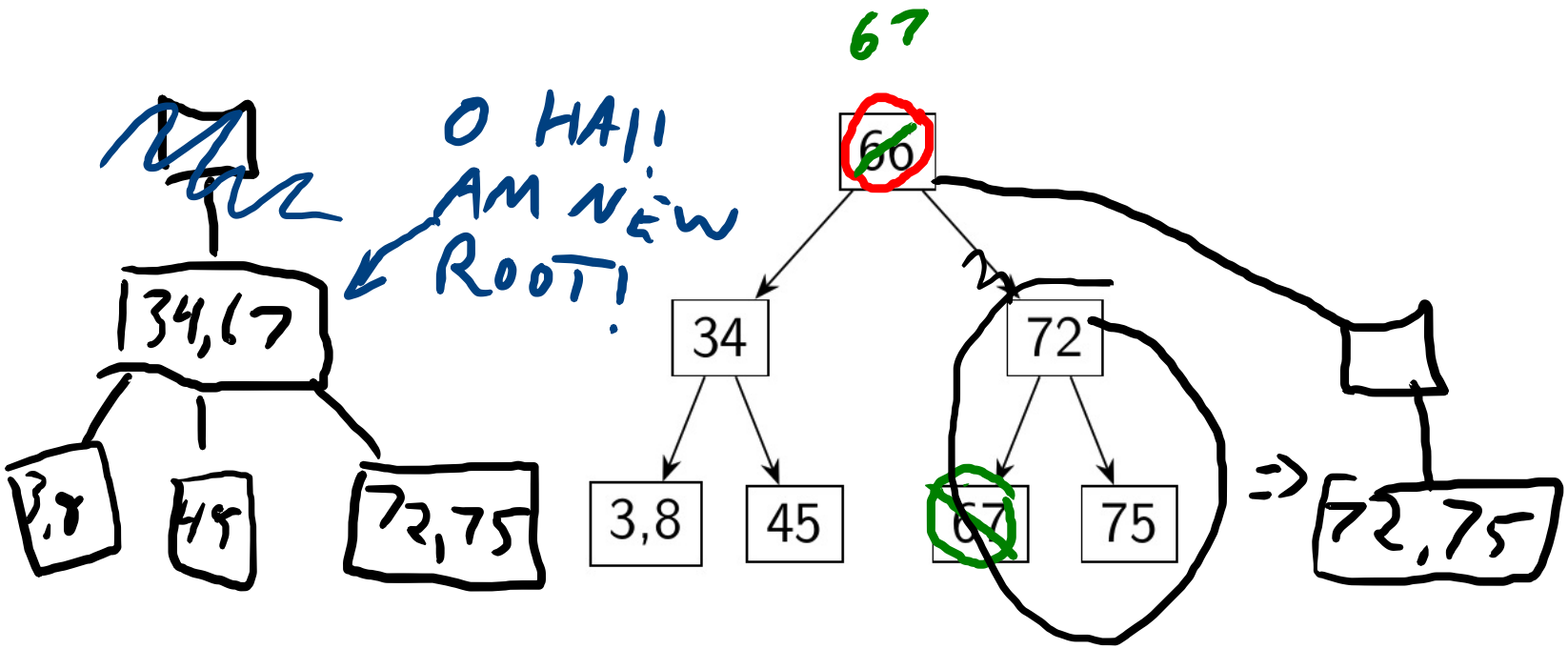
Deletion

Starting with the previous tree, delete 36



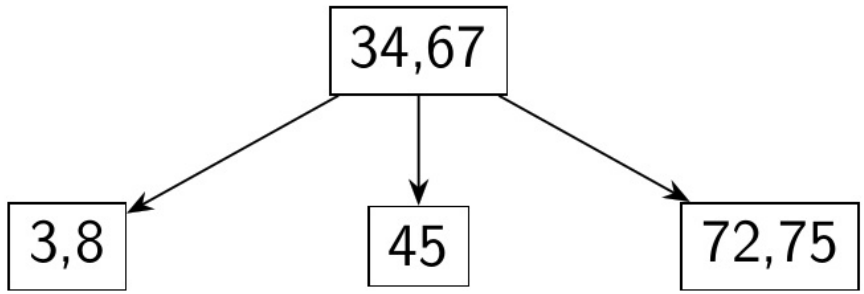
Deletion

Starting with the previous tree, delete 36
And then delete 66



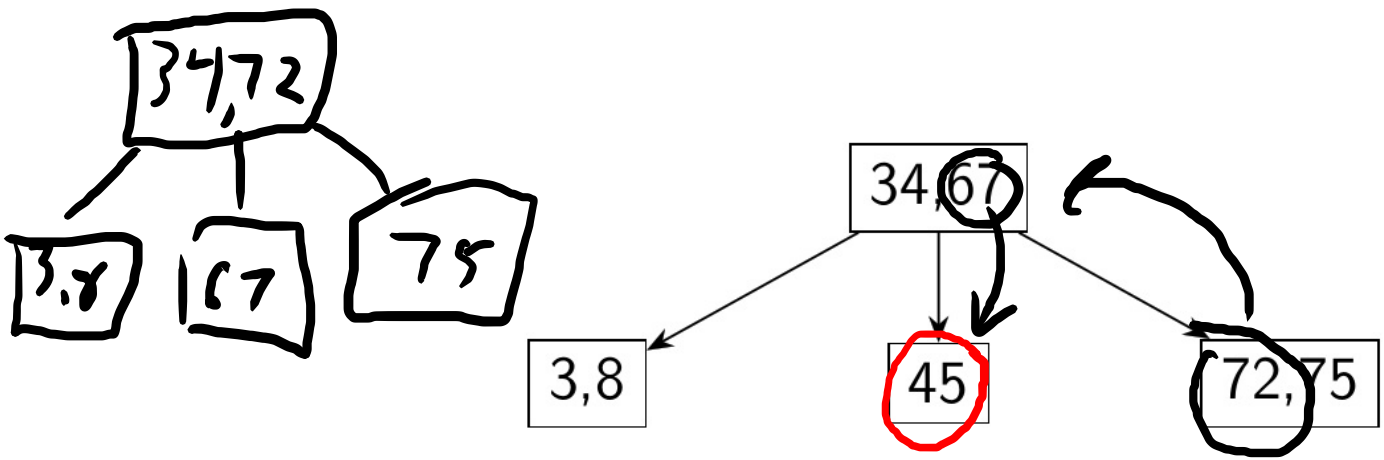
Deletion

Starting with the previous tree, delete 36
And then delete 66



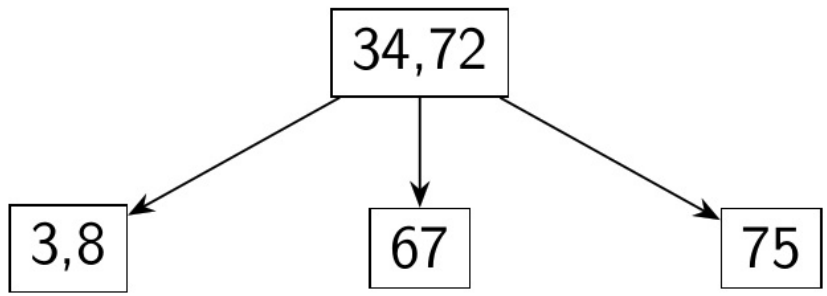
Deletion

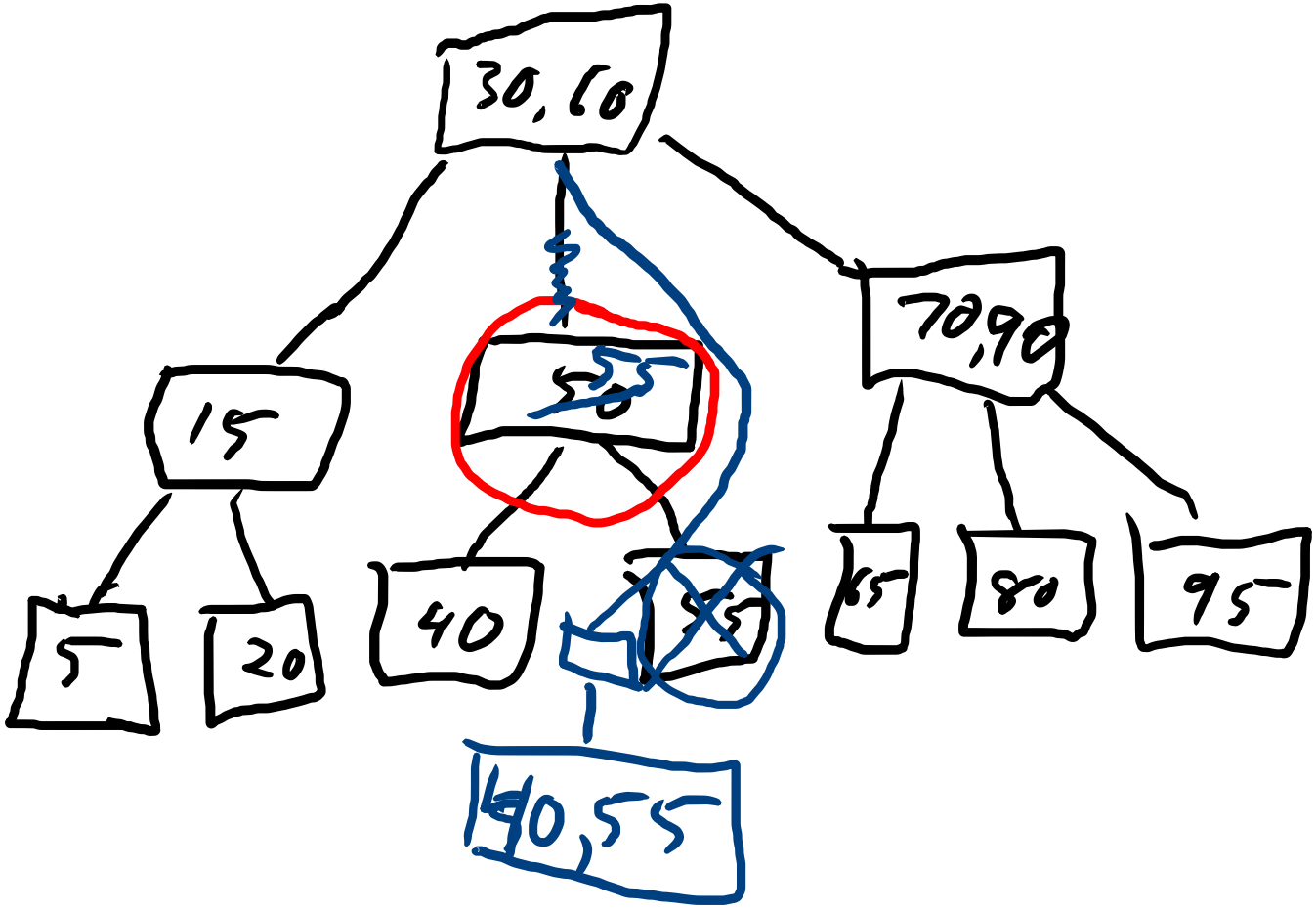
Starting with the previous tree, delete 36
And then delete 66, and 45

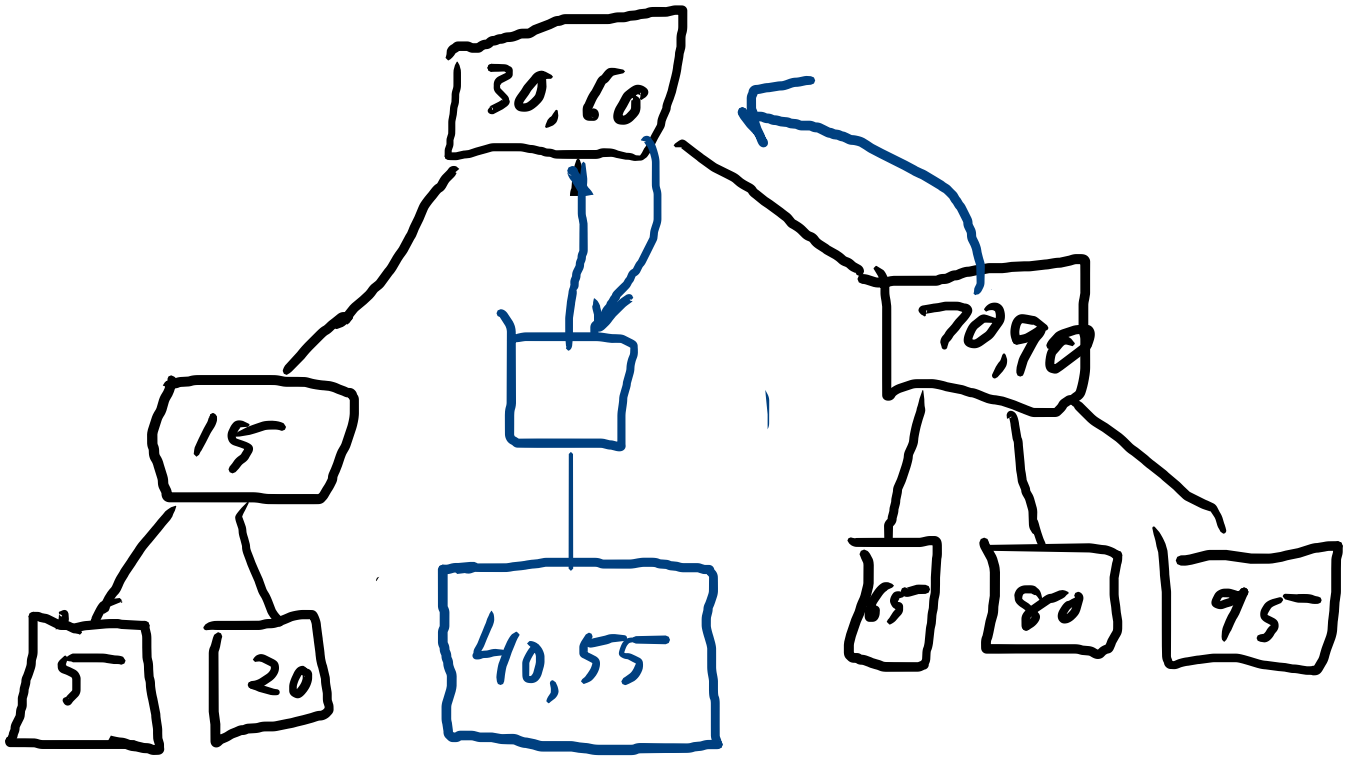


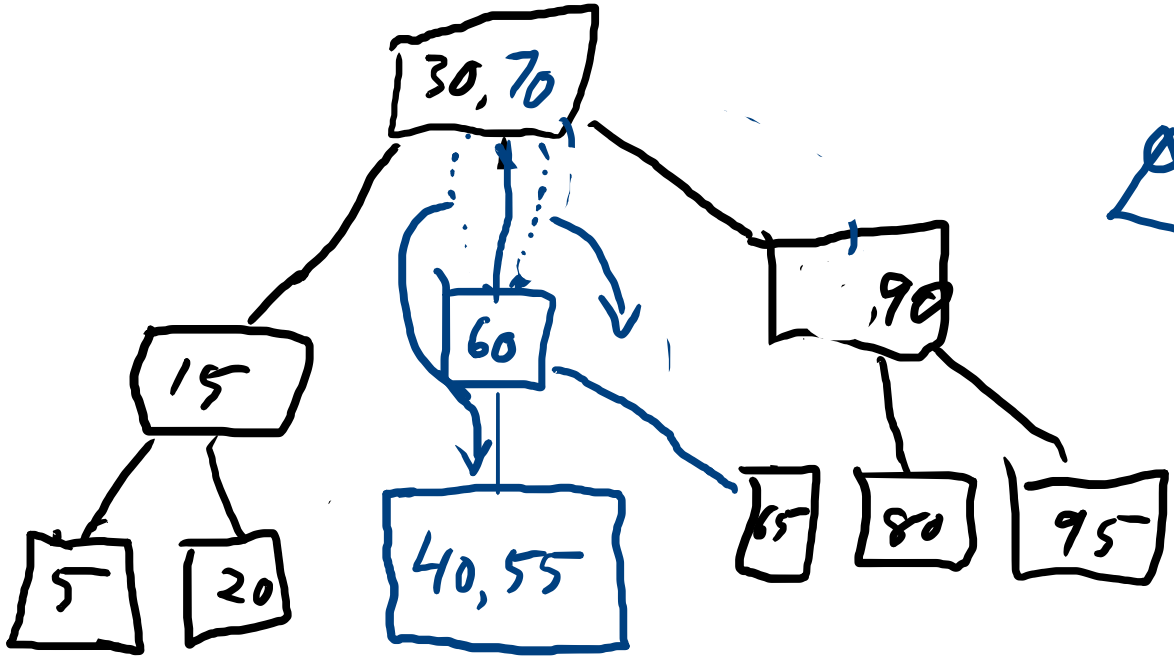
Deletion

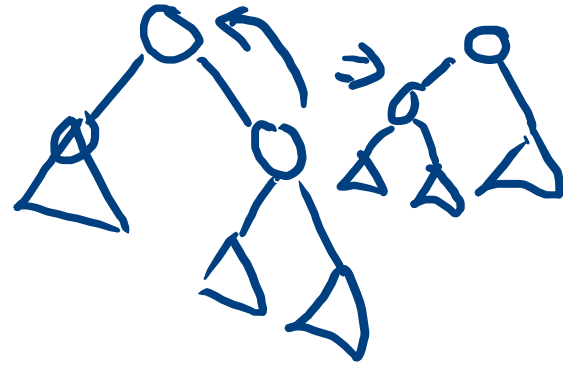
Starting with the previous tree, delete 36
And then delete 66, and 45

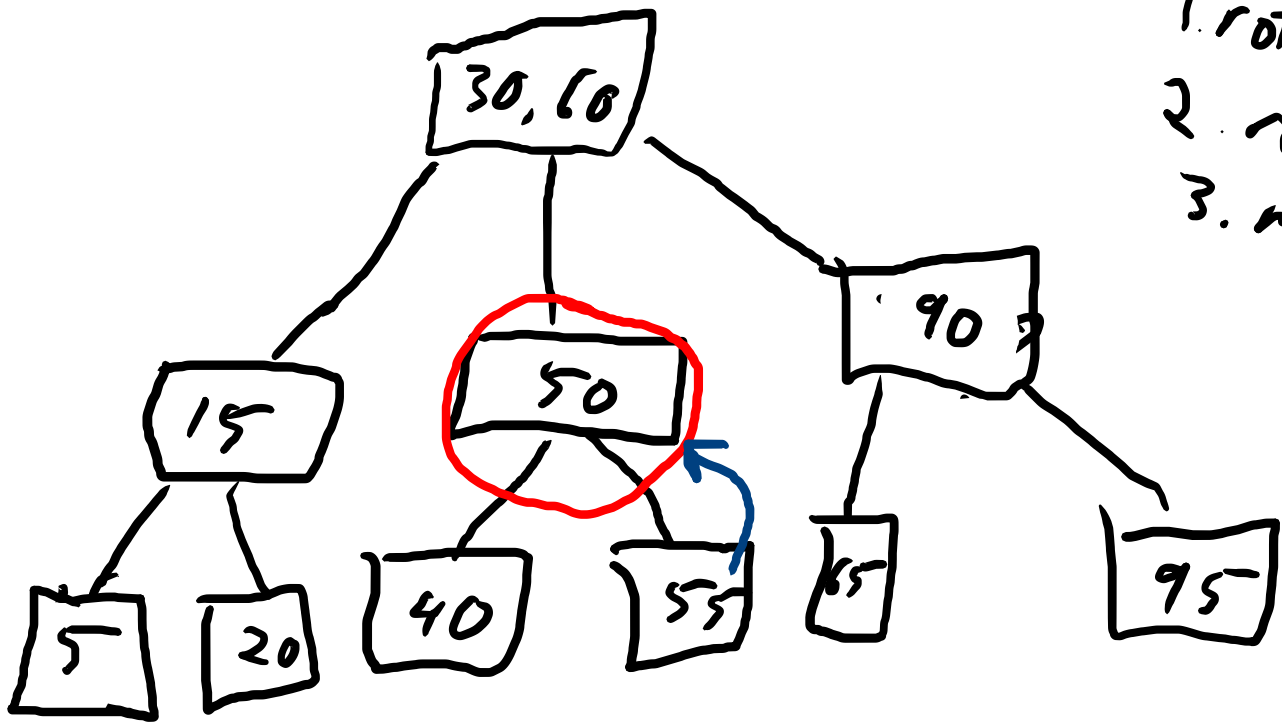



30, 60
50
15
70,90
5
20
40
55
85
90
95
40,55

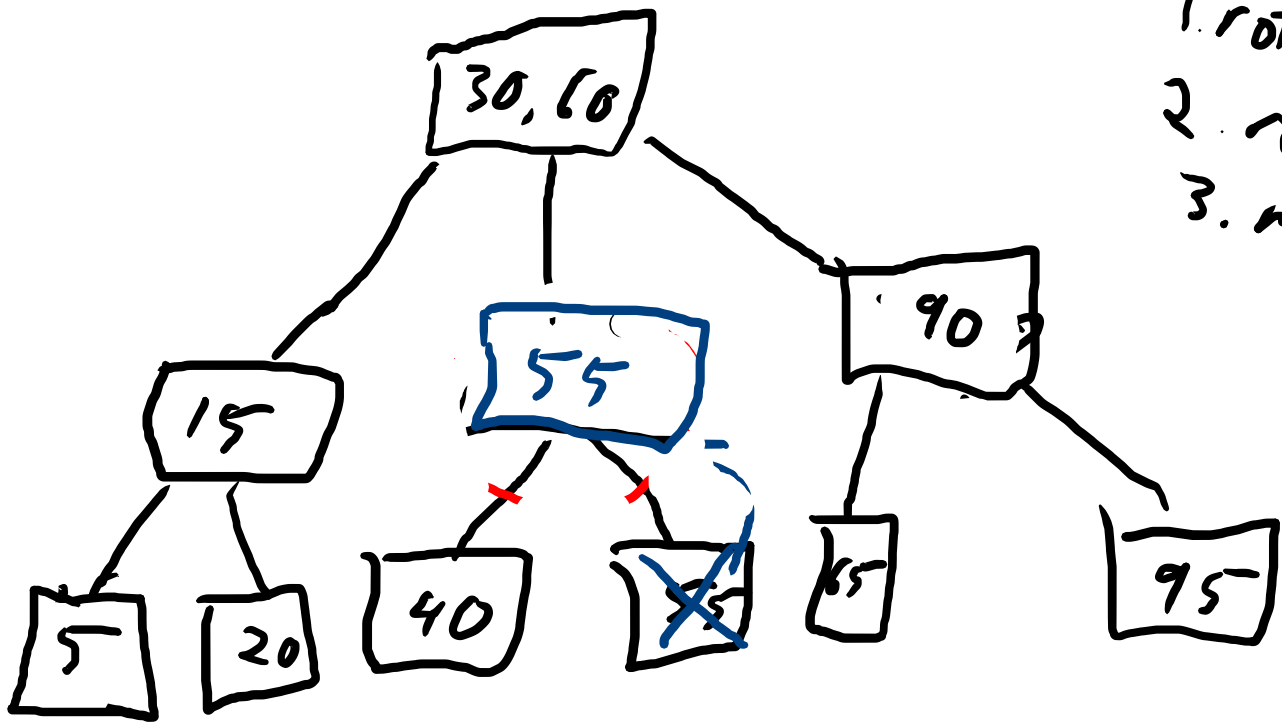

30, 60
15
70, 90
5
20
40, 55
65
80
95


30, 70
15
60
90
5
20
40, 55
85
80
95

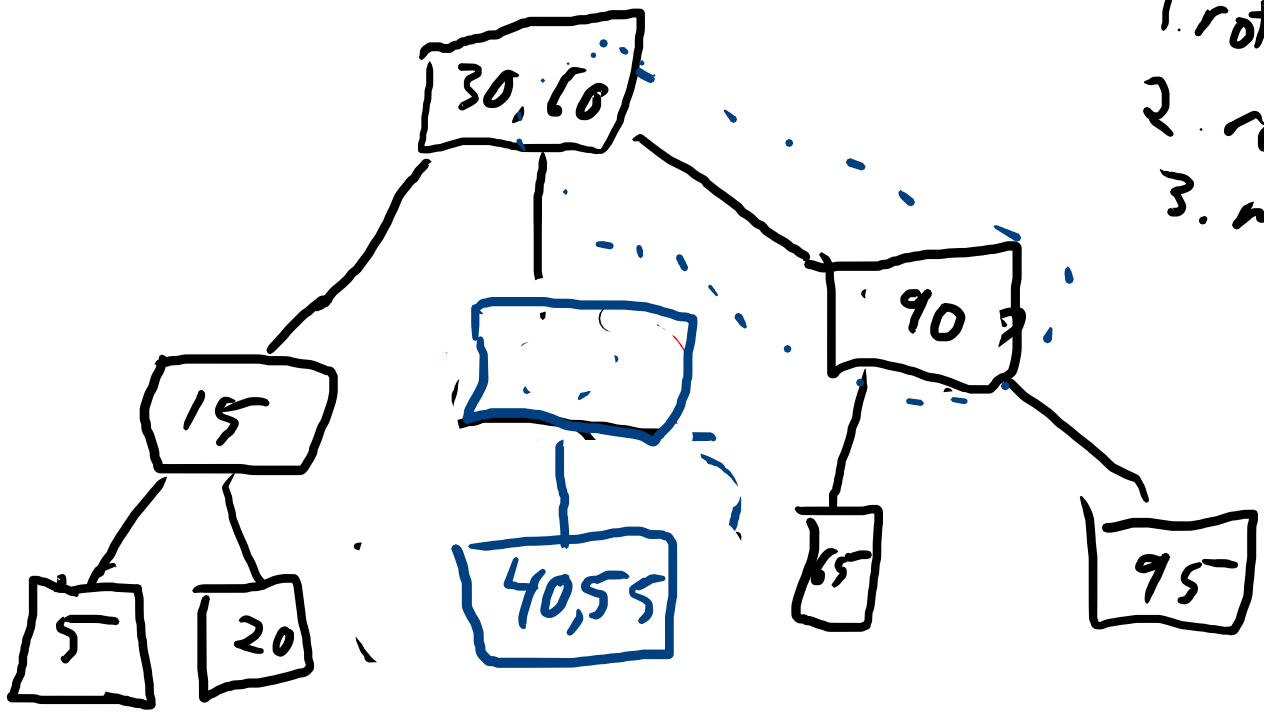




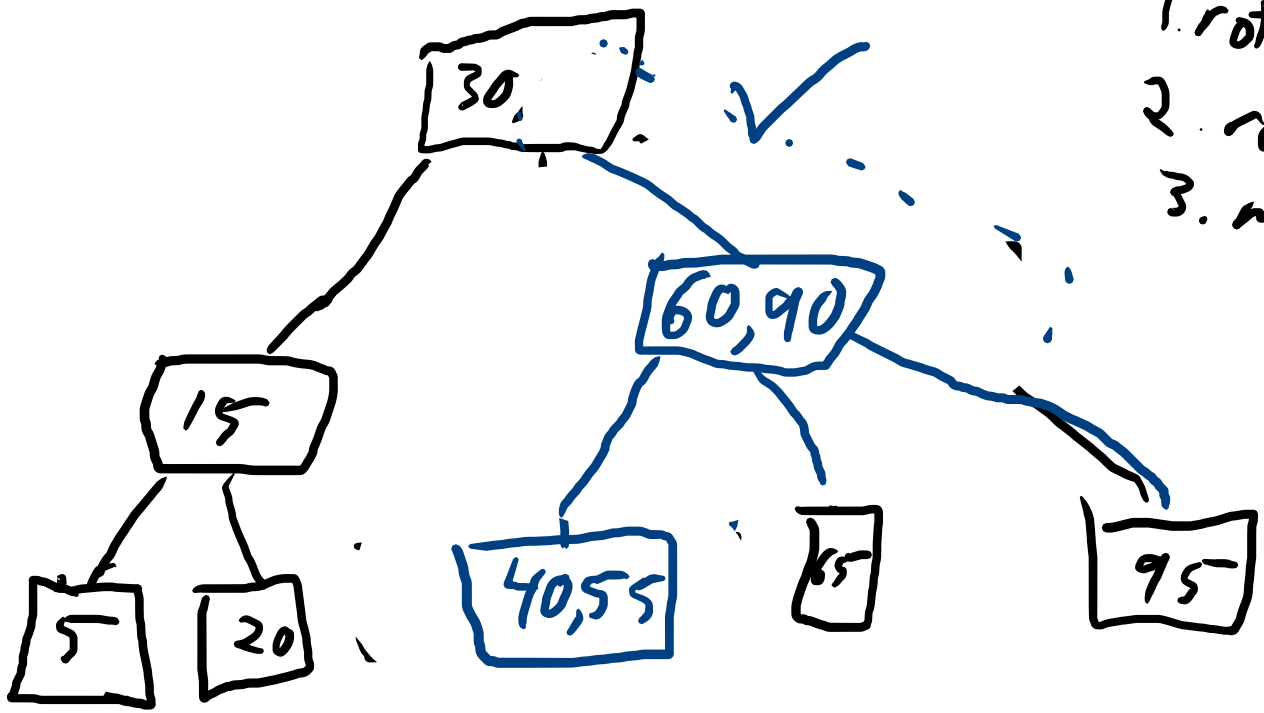
1. rotate from R
2. rotate from L
3. merge



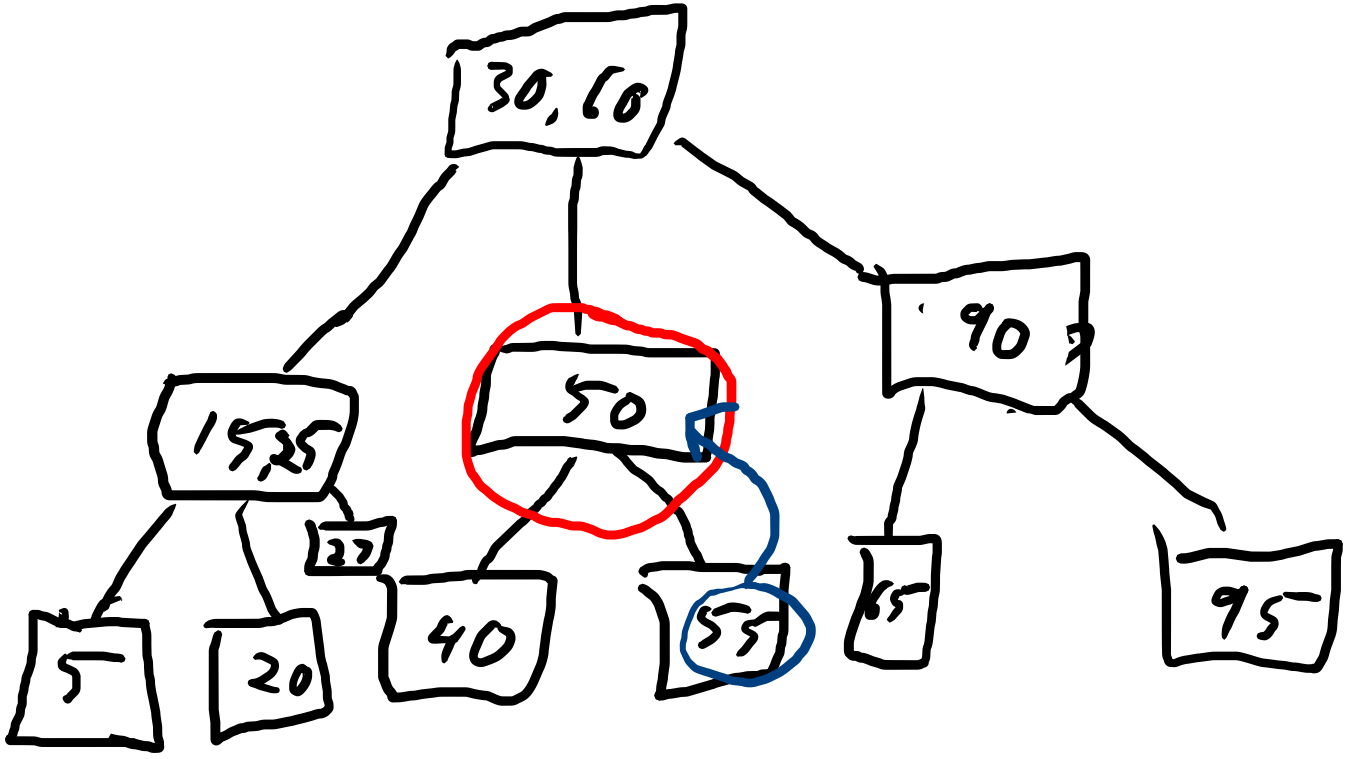
1. rotate from R
2. rotate from L
3. merge

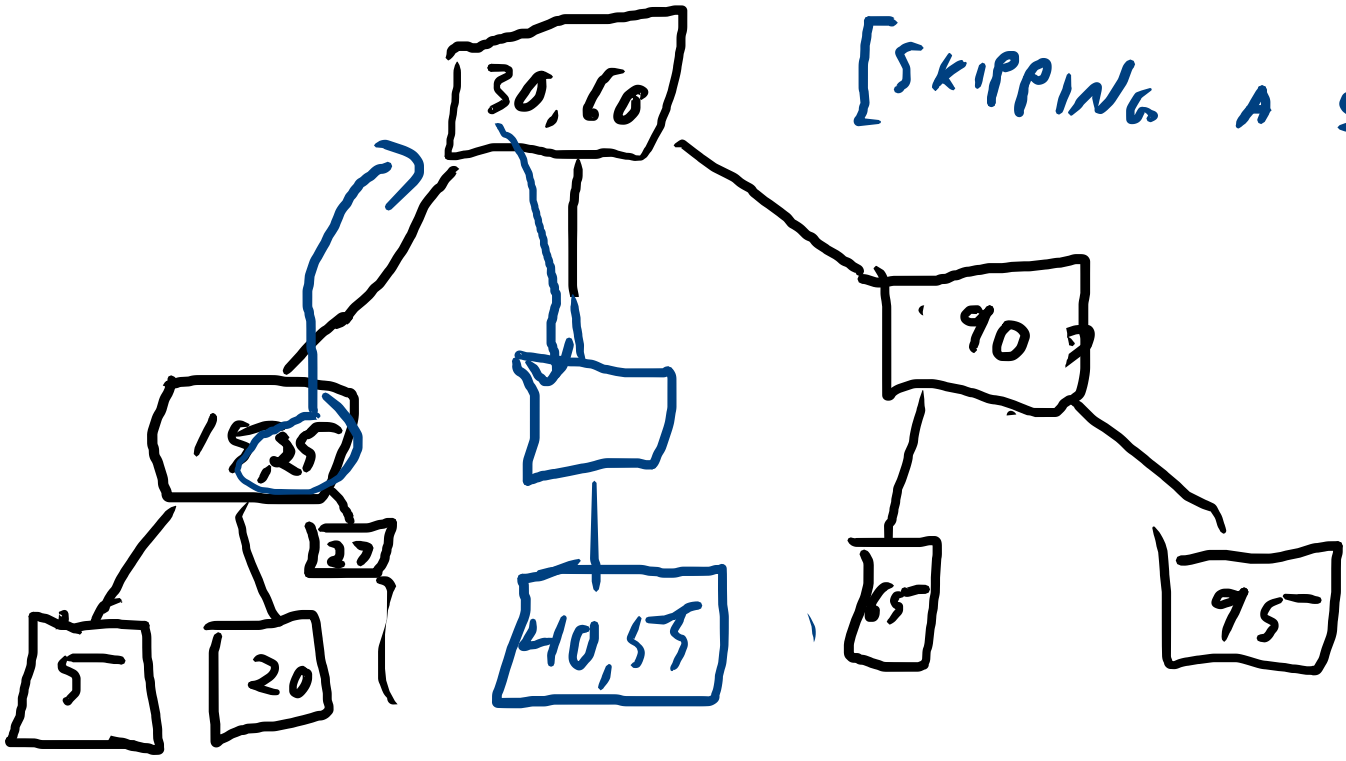


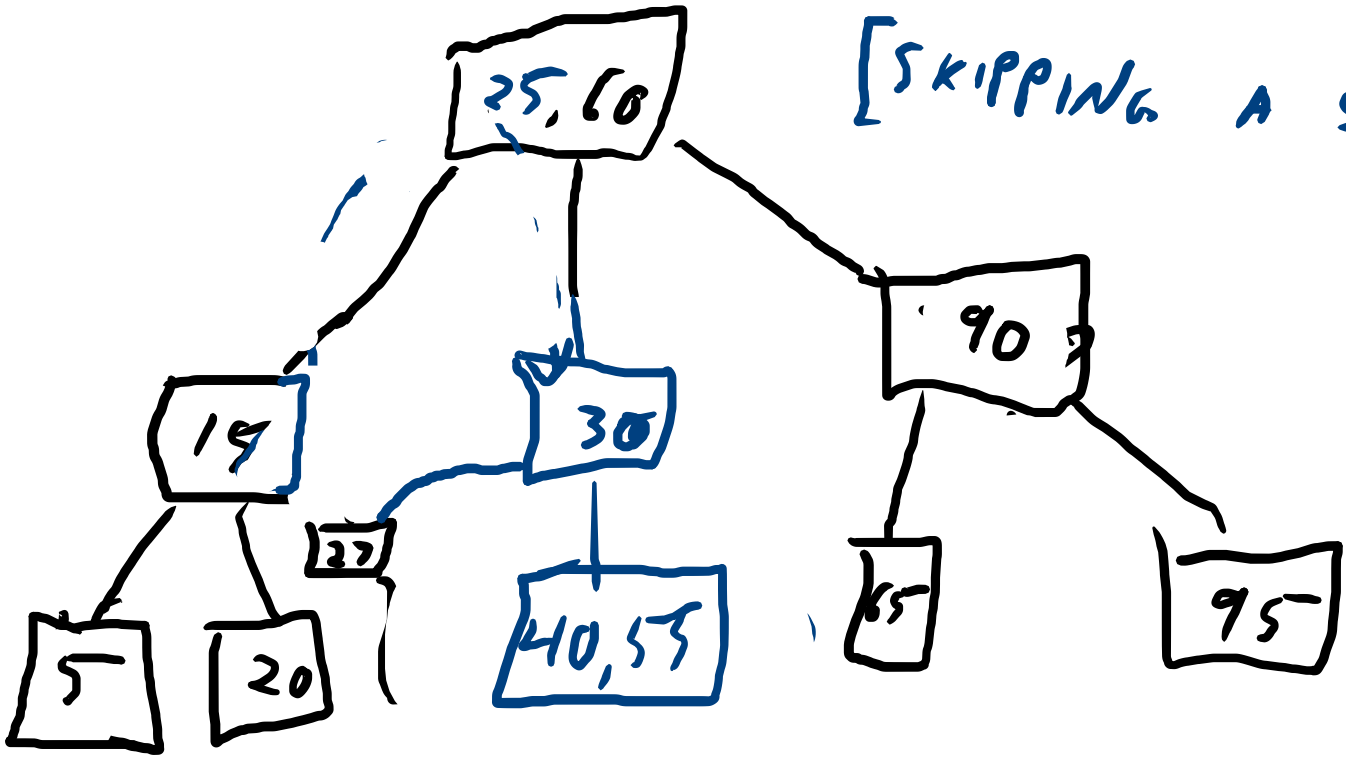
1. rotate from R
2. rotate from L
3. merge (R > L)

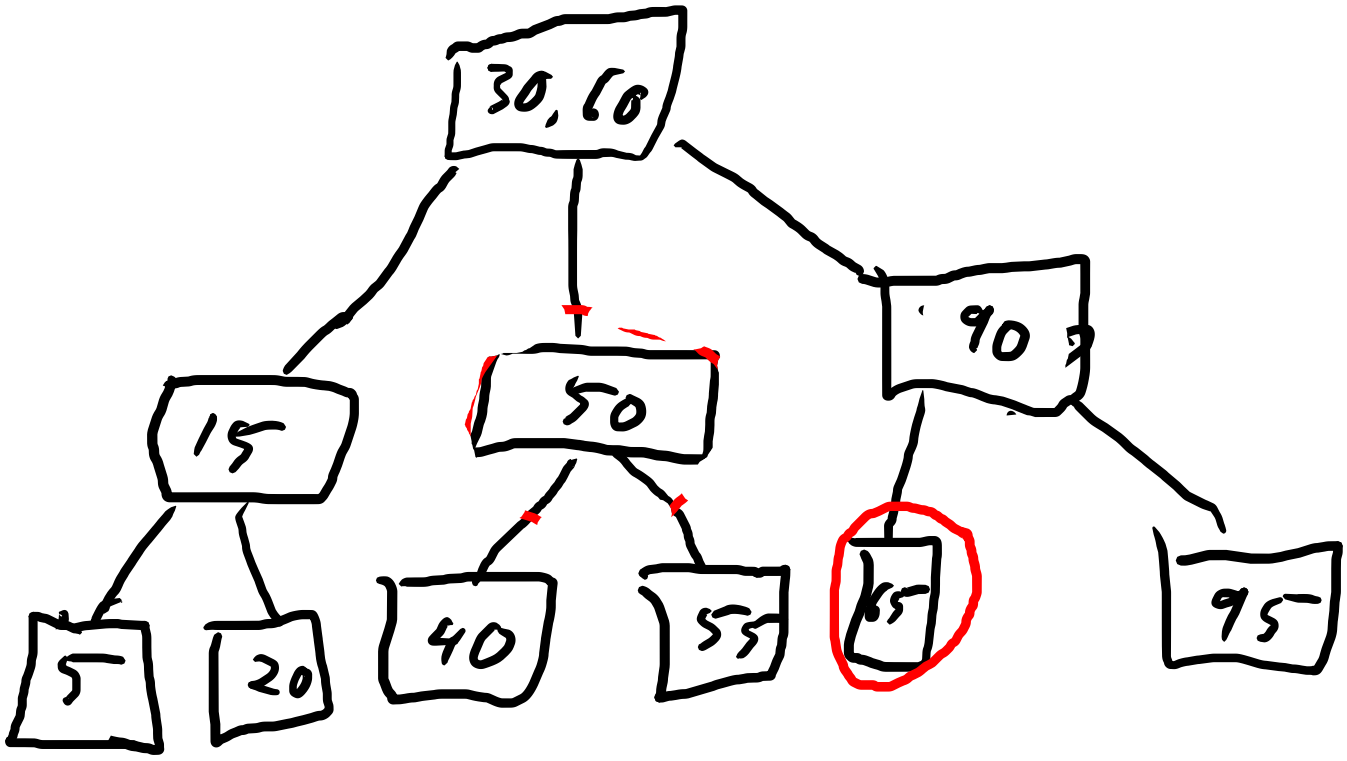


1. rotate from R
2. rotate from L
3. merge (R > L)


30, 60
15, 25
50
90
5
20
40
55
65
95


30, 60
[SKIPPING A STEP]
90
15, 25
22
5
20
40, 55
85
95


25, 60
[SKIPPING A STEP]
90
19
30
22
40, 55
65
95
5
20


30, 60
15
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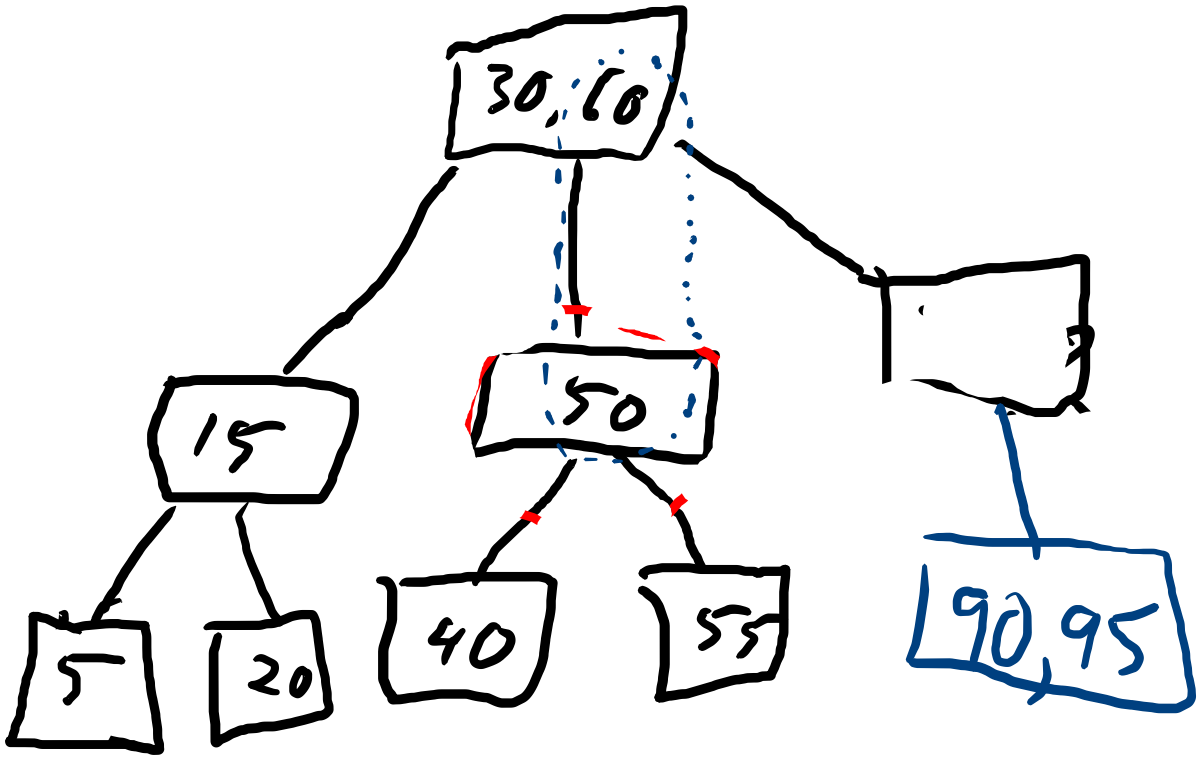
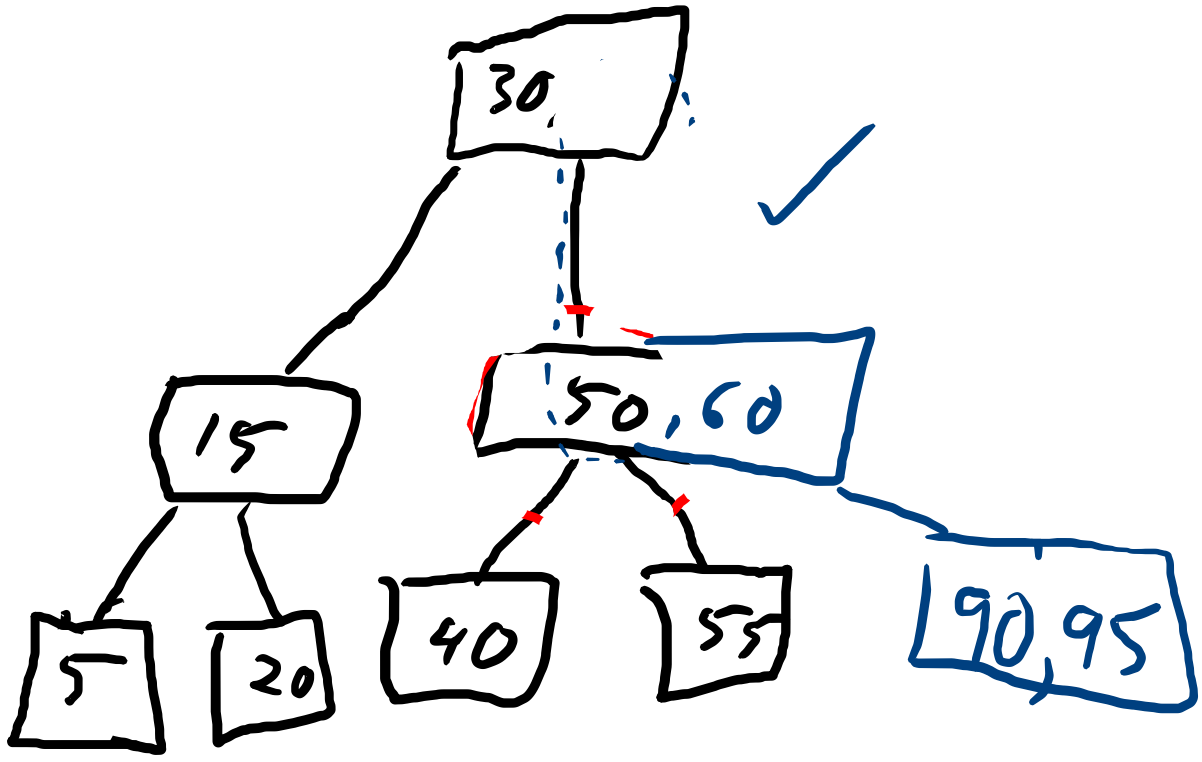
40
55
85
95


30, 60
15
50
5
20
40
55
90, 95



NOTE TO SELF: IF 15 WERE A 3-NODE, WOULD A DOUBLE ROTATION MAKE SENSE?

Q2 Rebalancing methods for 2-3 tree deletion 2 Points

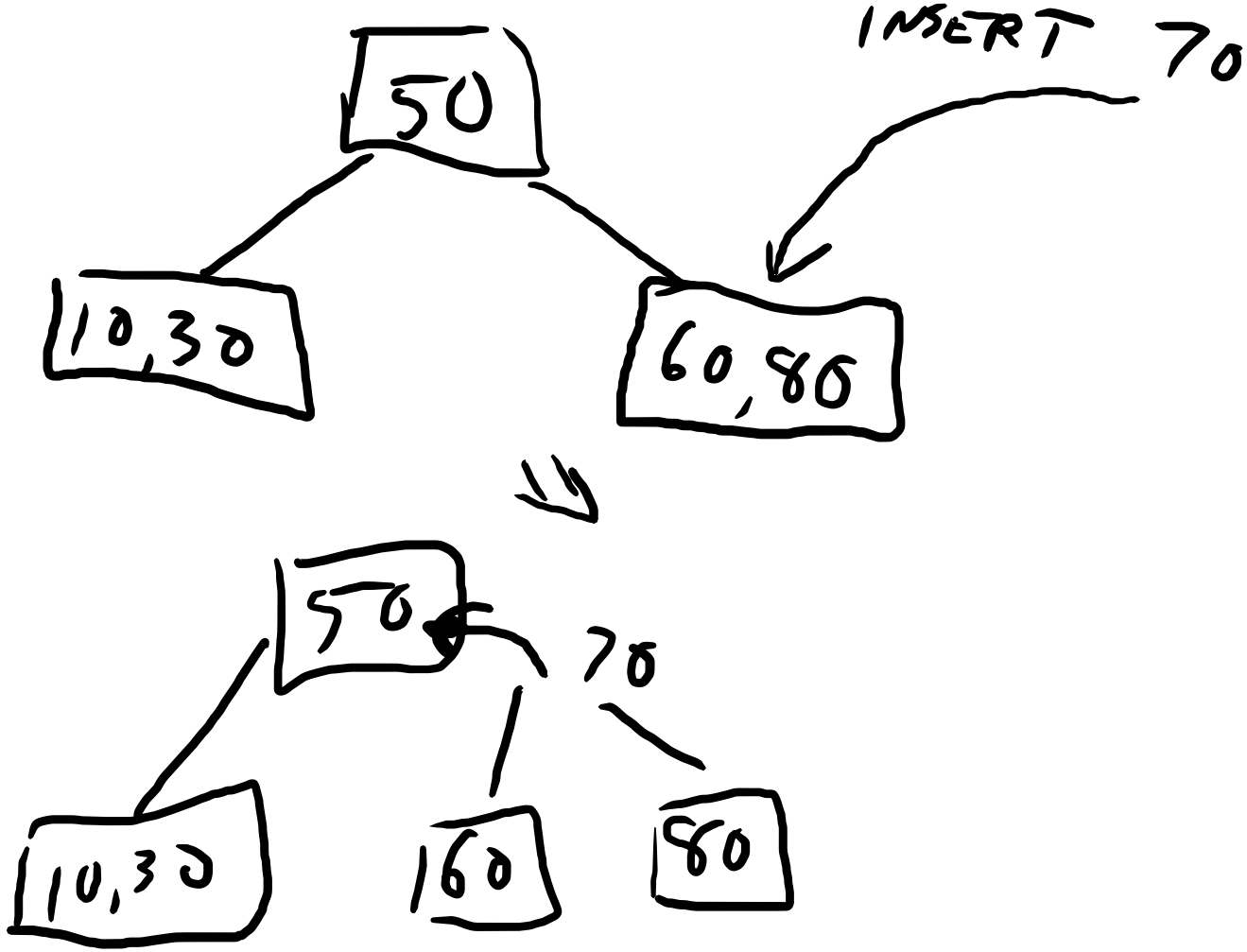
What are the methods that we will use to rebalance trees after deletion in 2-3 tree: (As taught in this class)

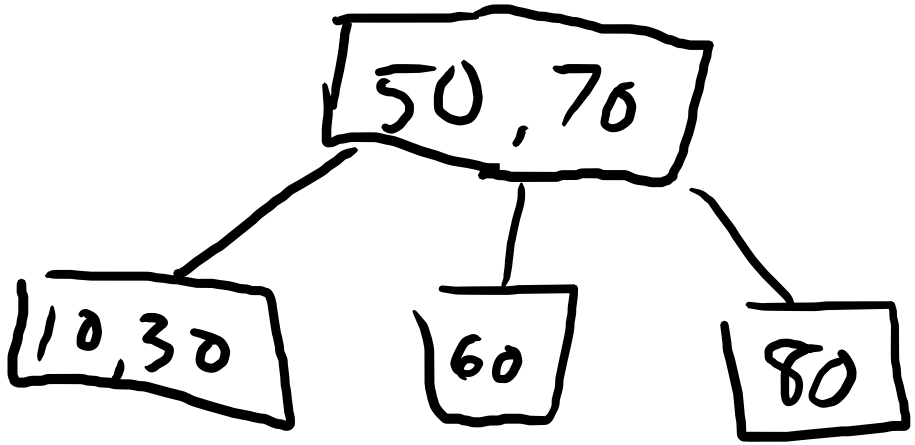
Key rotation

Split the node ← ONLY ON INSERTION!

Merge from parent node

Merge with cousin node (directly) ← ONLY MERGE PARENT & SIBLING


INSERT 70
50
10,30
60,80
50
70
10,30
60
80


50, 70
10,30
60
80