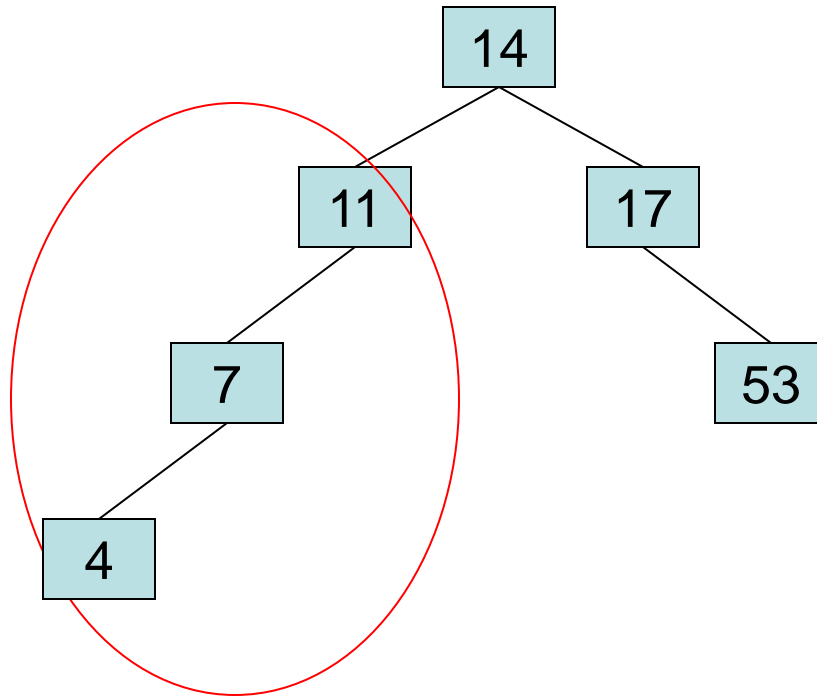


## AVL Tree Example:

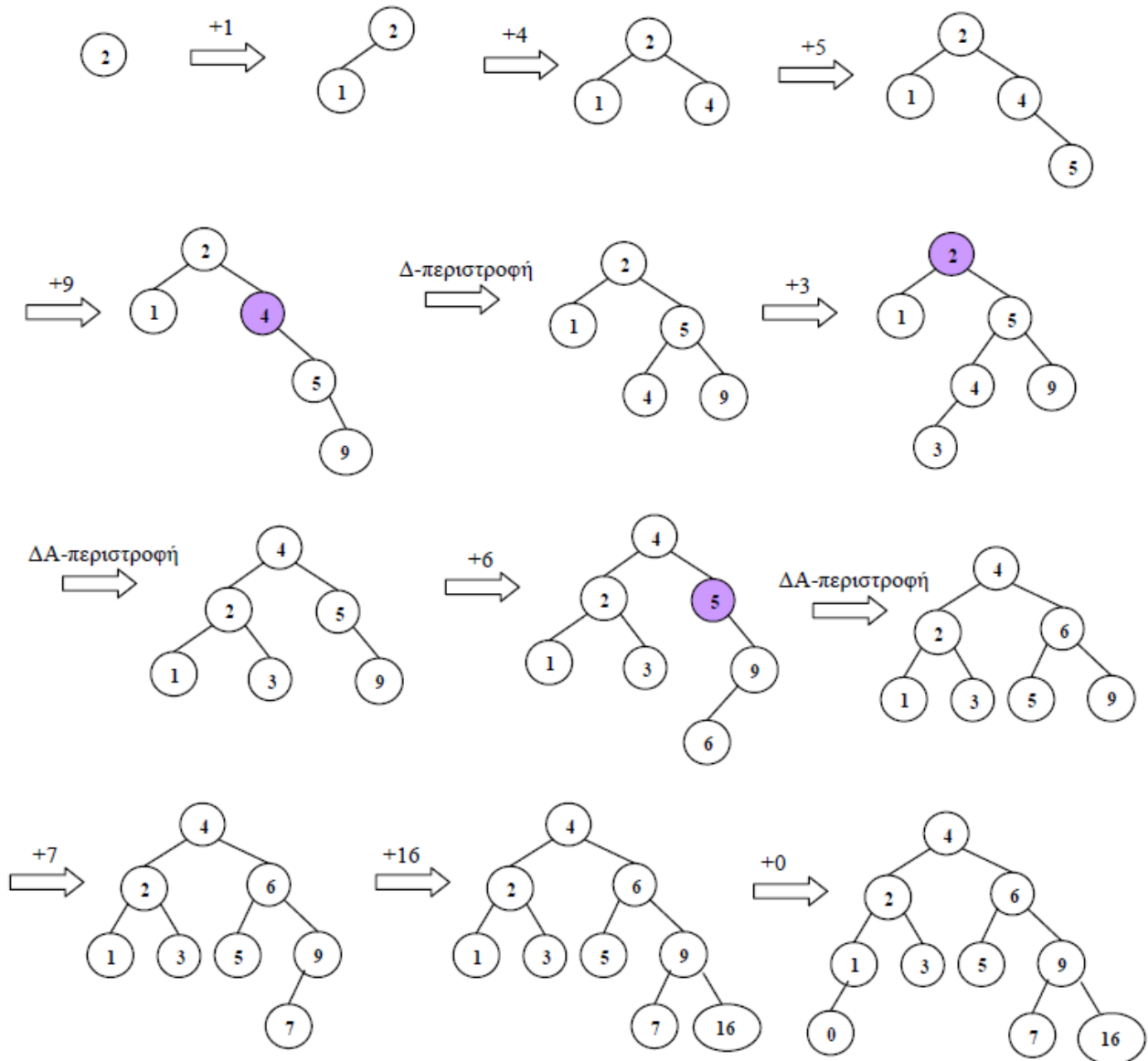
- Insert 14, 17, 11, 7, 53, 4, 13 into an empty AVL tree





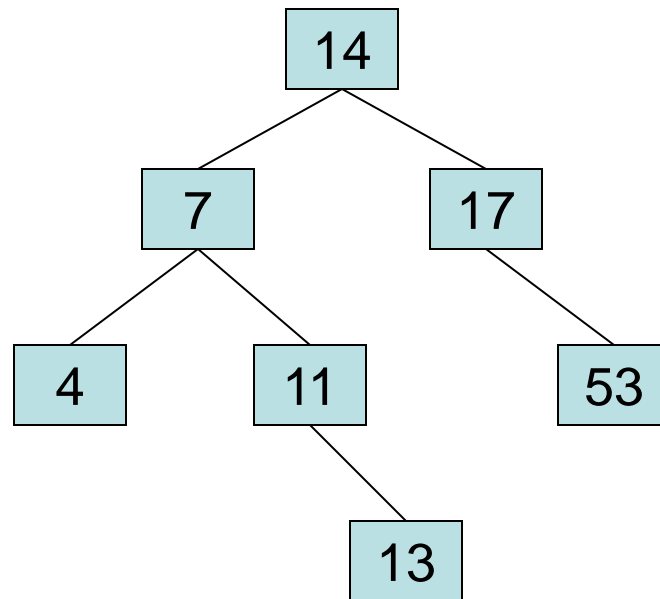
## Φροντιστήριο 7

1. Ξεκινώντας με ένα άδειο AVL-δένδρο να εφαρμόσετε διαδοχικά εισαγωγή των στοιχείων 2, 1, 4, 5, 9, 3, 6, 7, 16, 0 δείχνοντας το αποτέλεσμα της κάθε μιας από τις εισαγωγές.



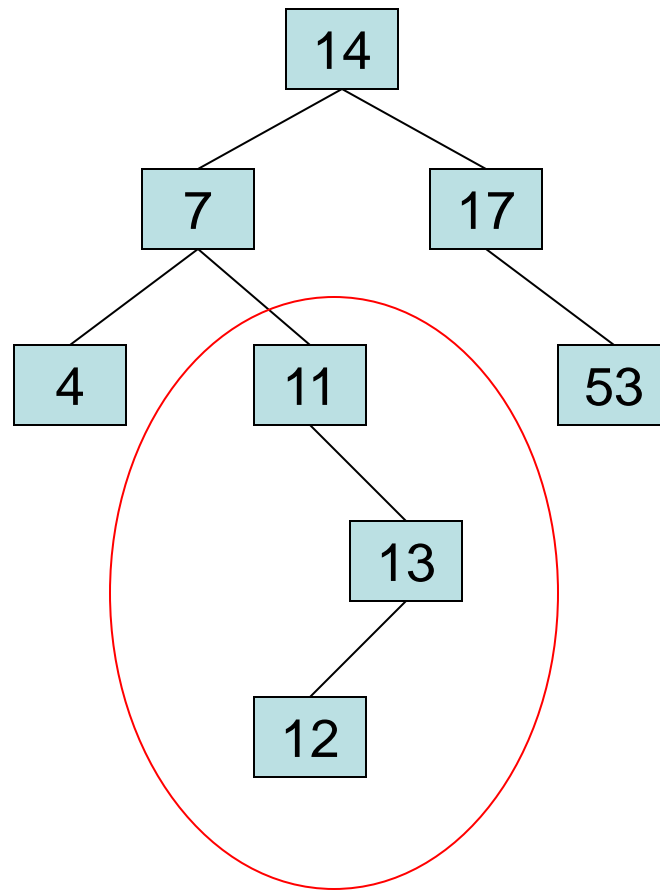
## AVL Tree Example:

- Insert 14, 17, 11, 7, 53, 4, 13 into an empty AVL tree



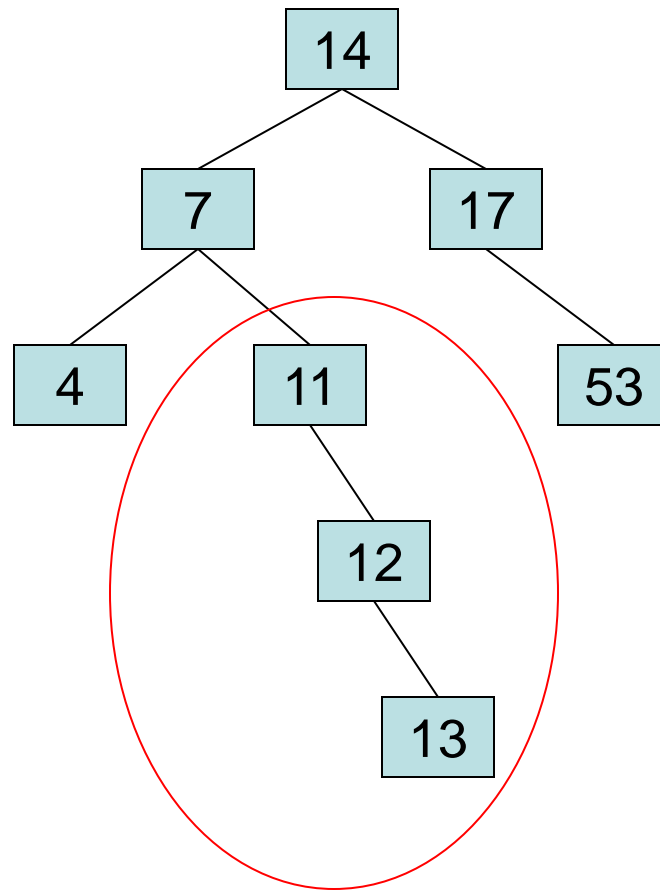
## AVL Tree Example:

- Now insert 12



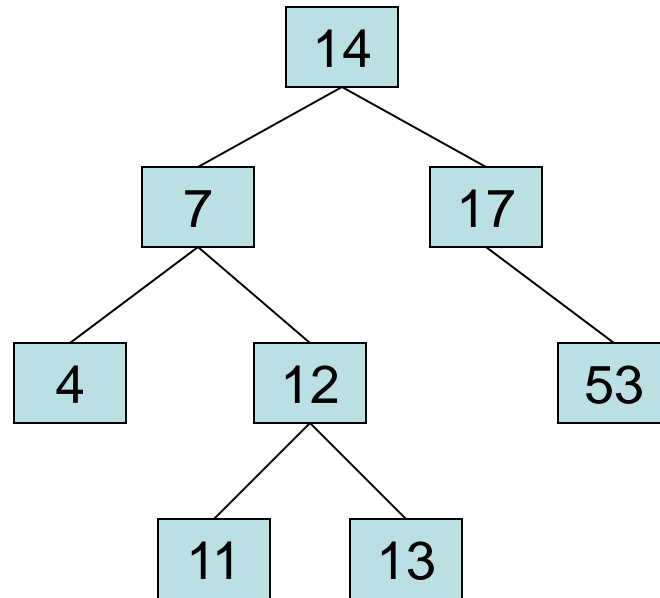
## AVL Tree Example:

- Now insert 12



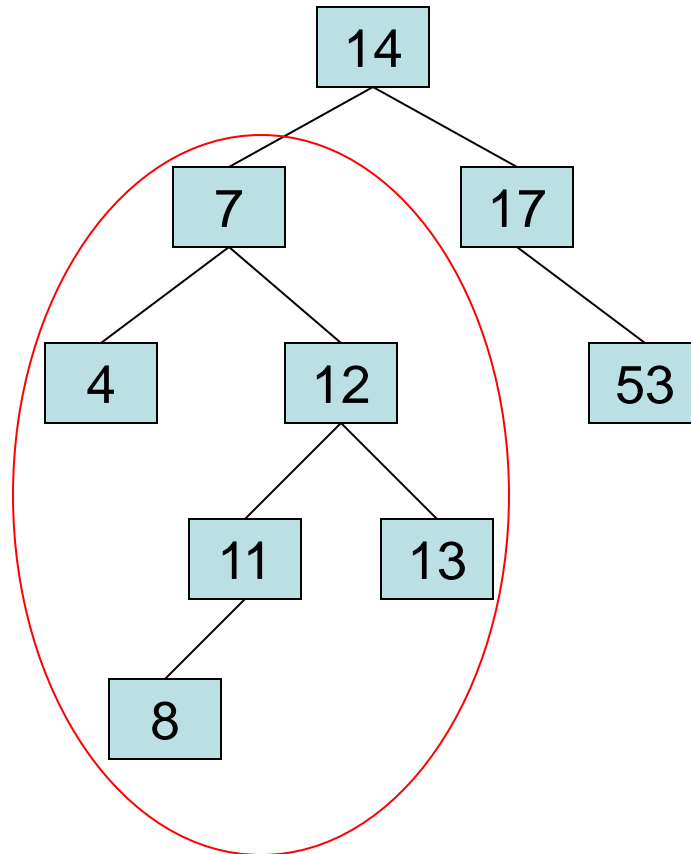
## AVL Tree Example:

- Now the AVL tree is balanced.



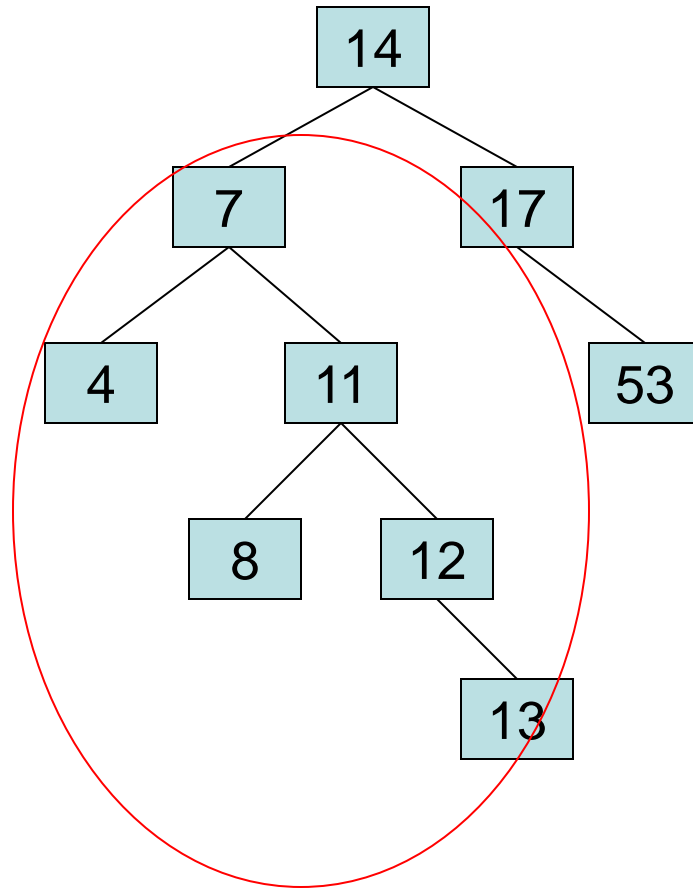
## AVL Tree Example:

- Now insert 8



## AVL Tree Example:

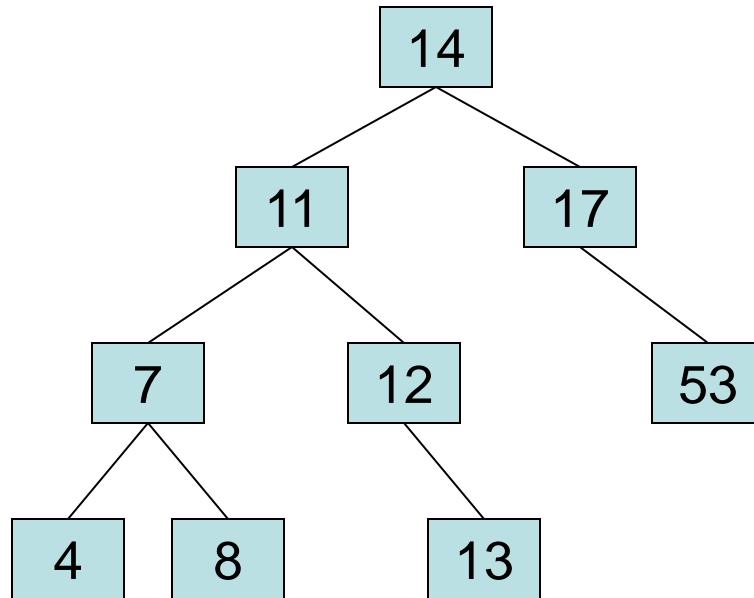
- Now insert 8





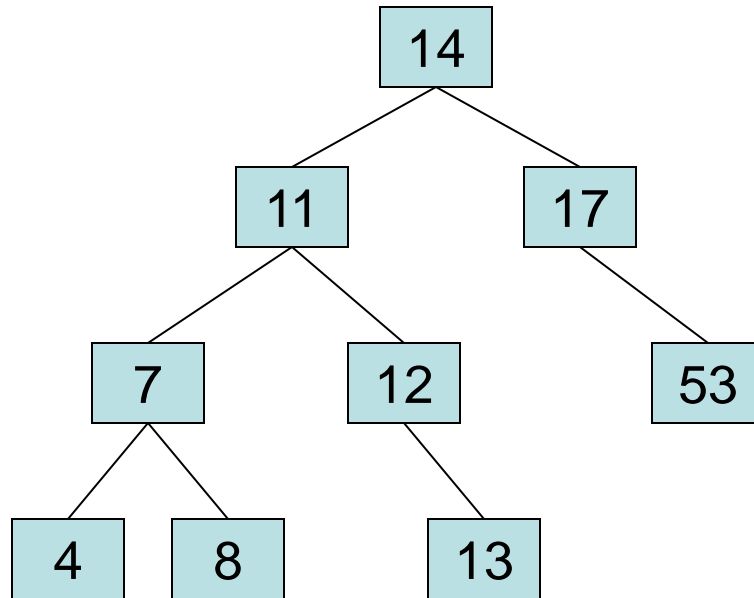
## AVL Tree Example:

- Now the AVL tree is balanced.



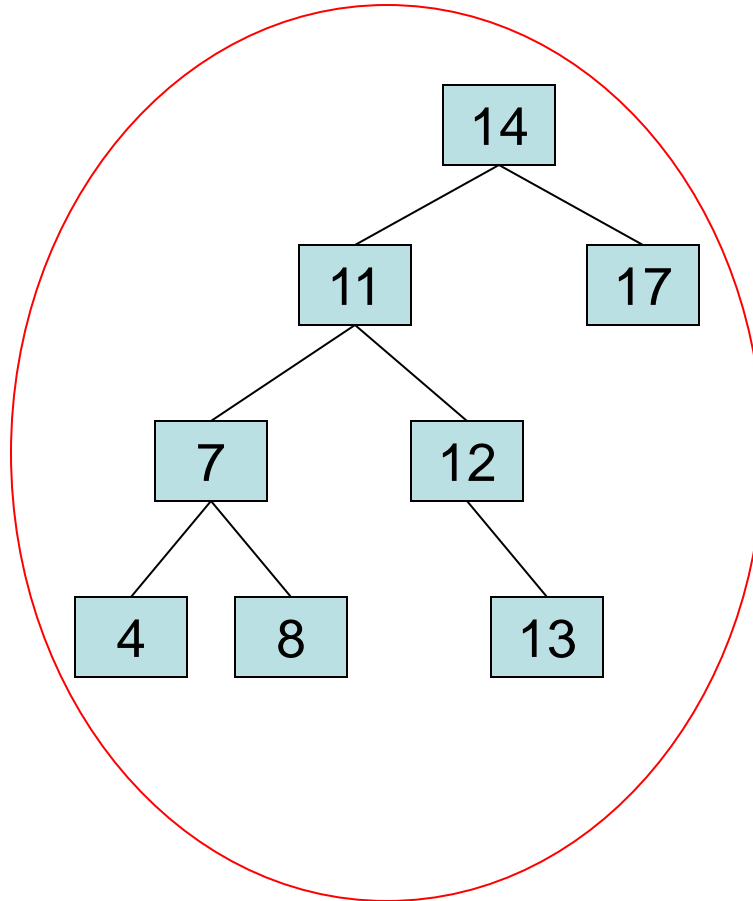
## AVL Tree Example:

- Now remove 53



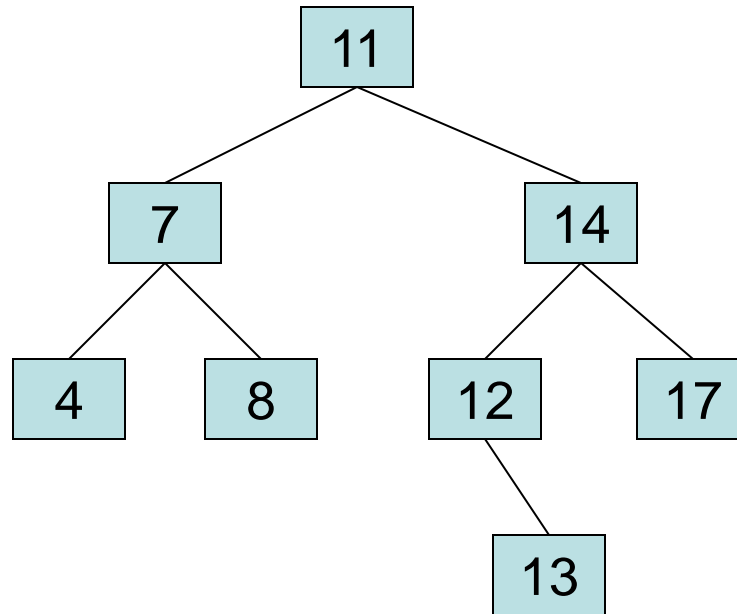
## AVL Tree Example:

- Now remove 53, unbalanced



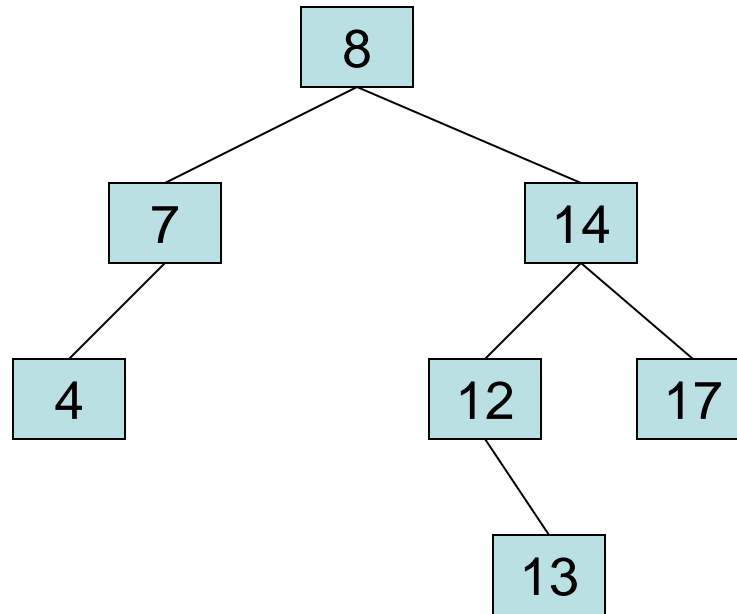
## AVL Tree Example:

- **Balanced! Remove 11**



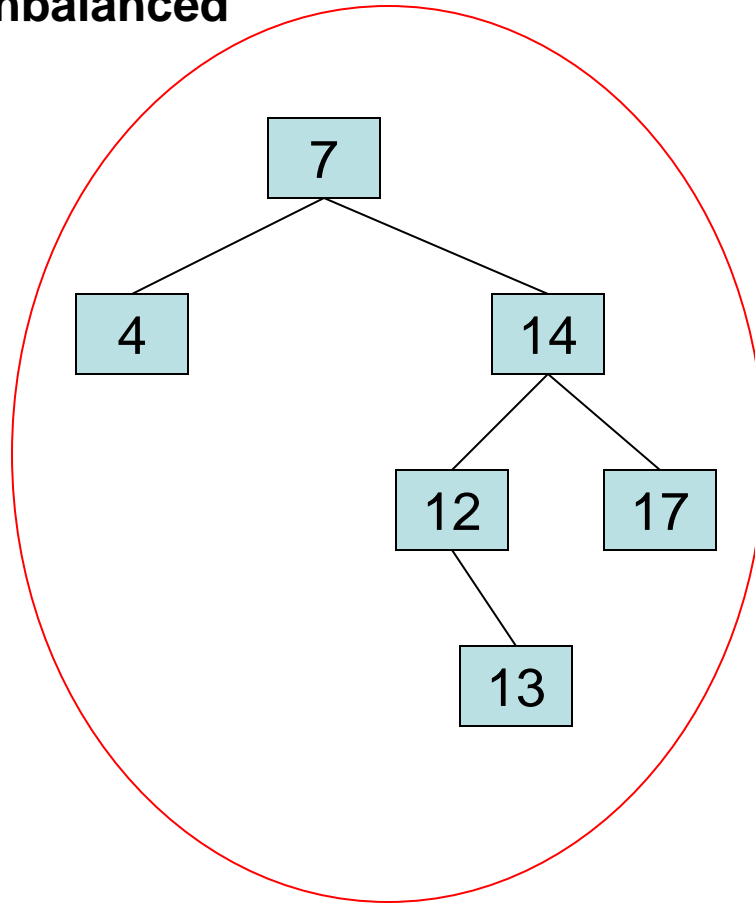
## AVL Tree Example:

- Remove 11, replace it with the largest in its left branch



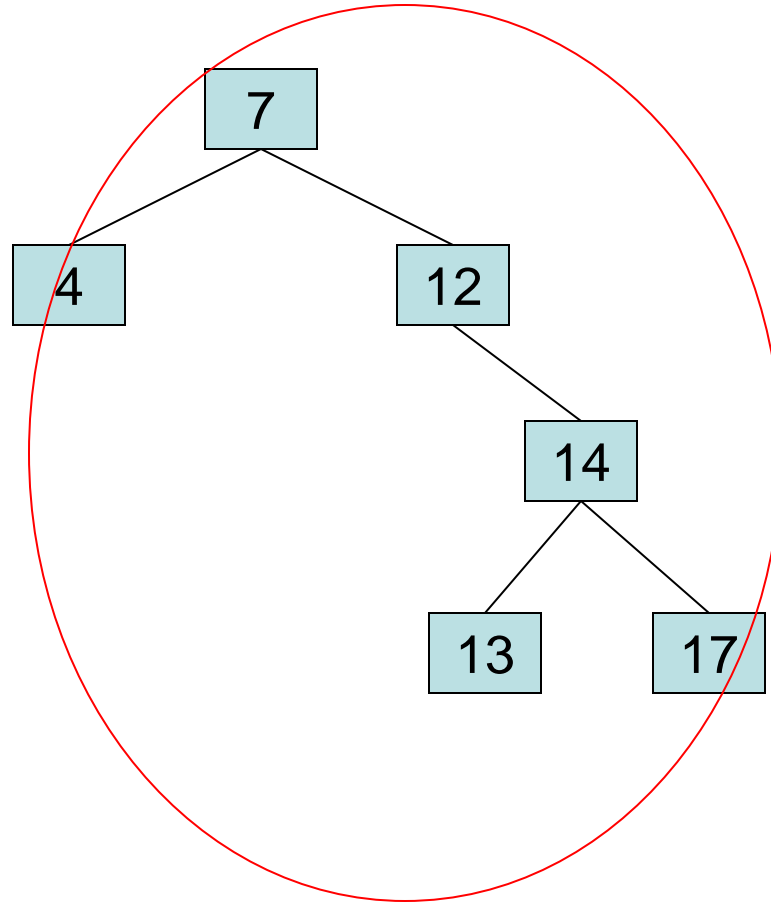
## AVL Tree Example:

- Remove 8, unbalanced



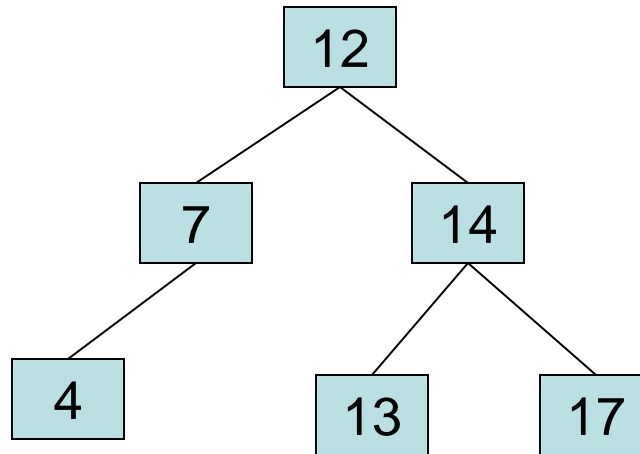
## AVL Tree Example:

- Remove 8, unbalanced



## AVL Tree Example:

- **Balanced!!**

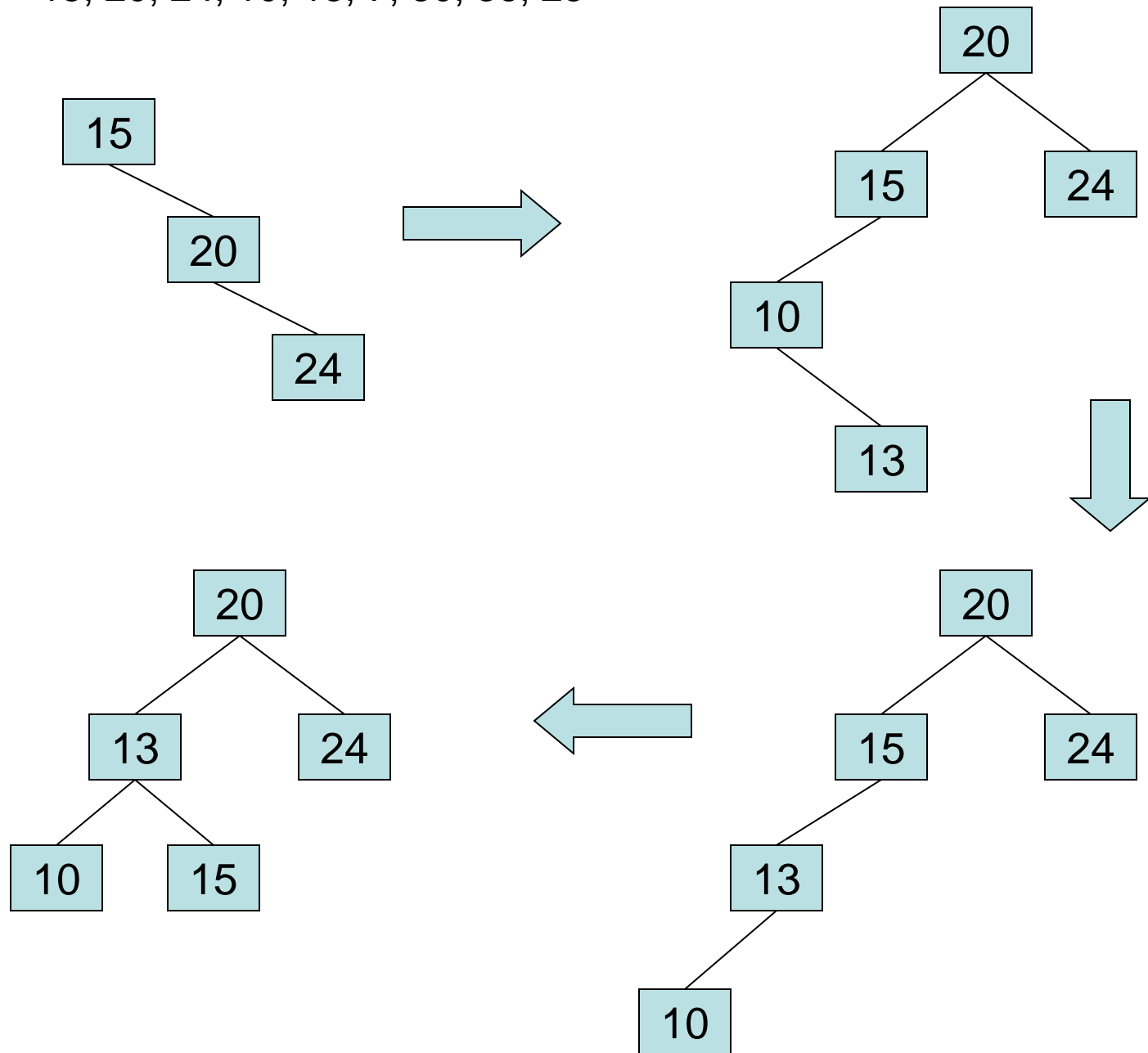




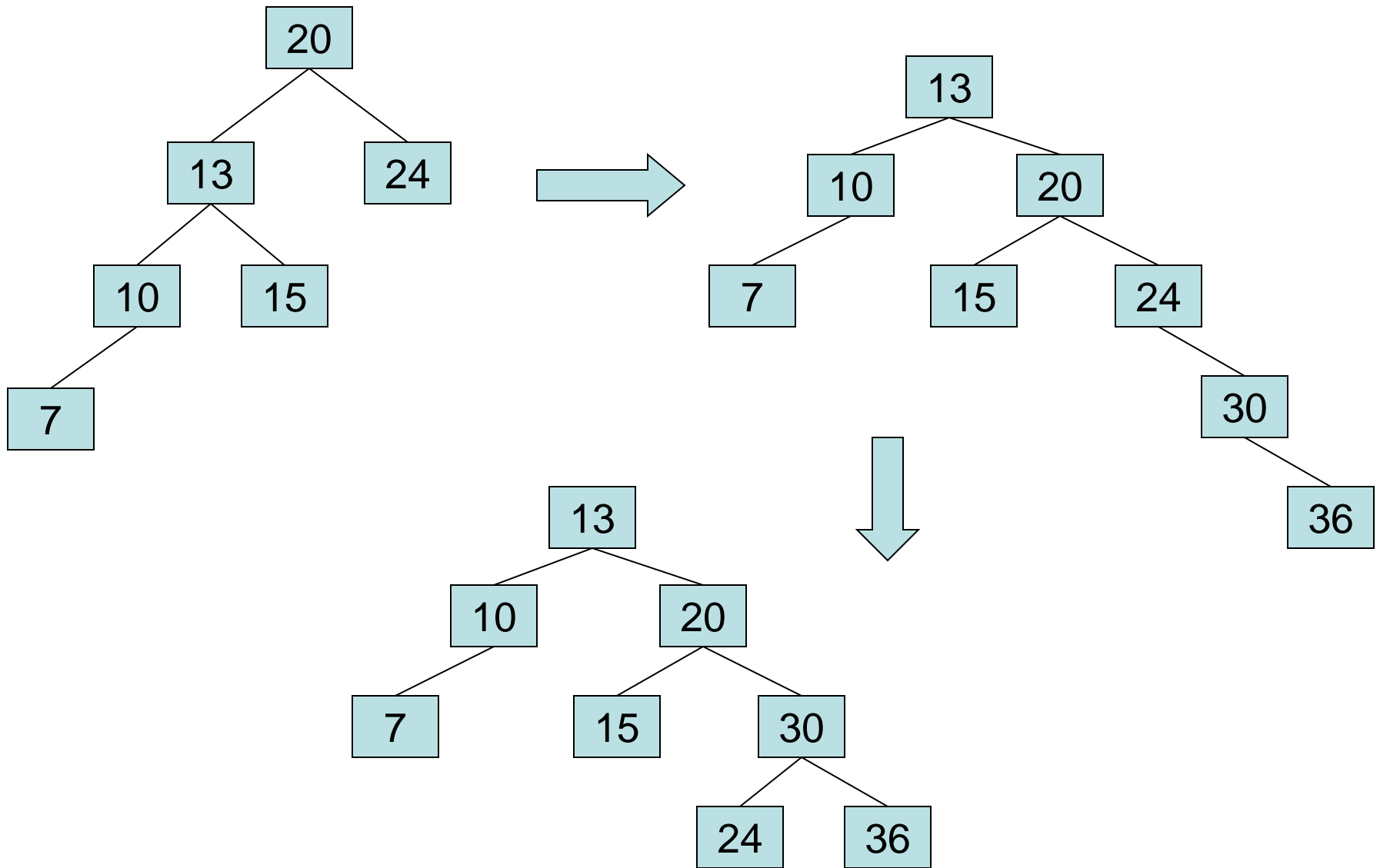
# In Class Exercises

- Build an AVL tree with the following values:  
15, 20, 24, 10, 13, 7, 30, 36, 25

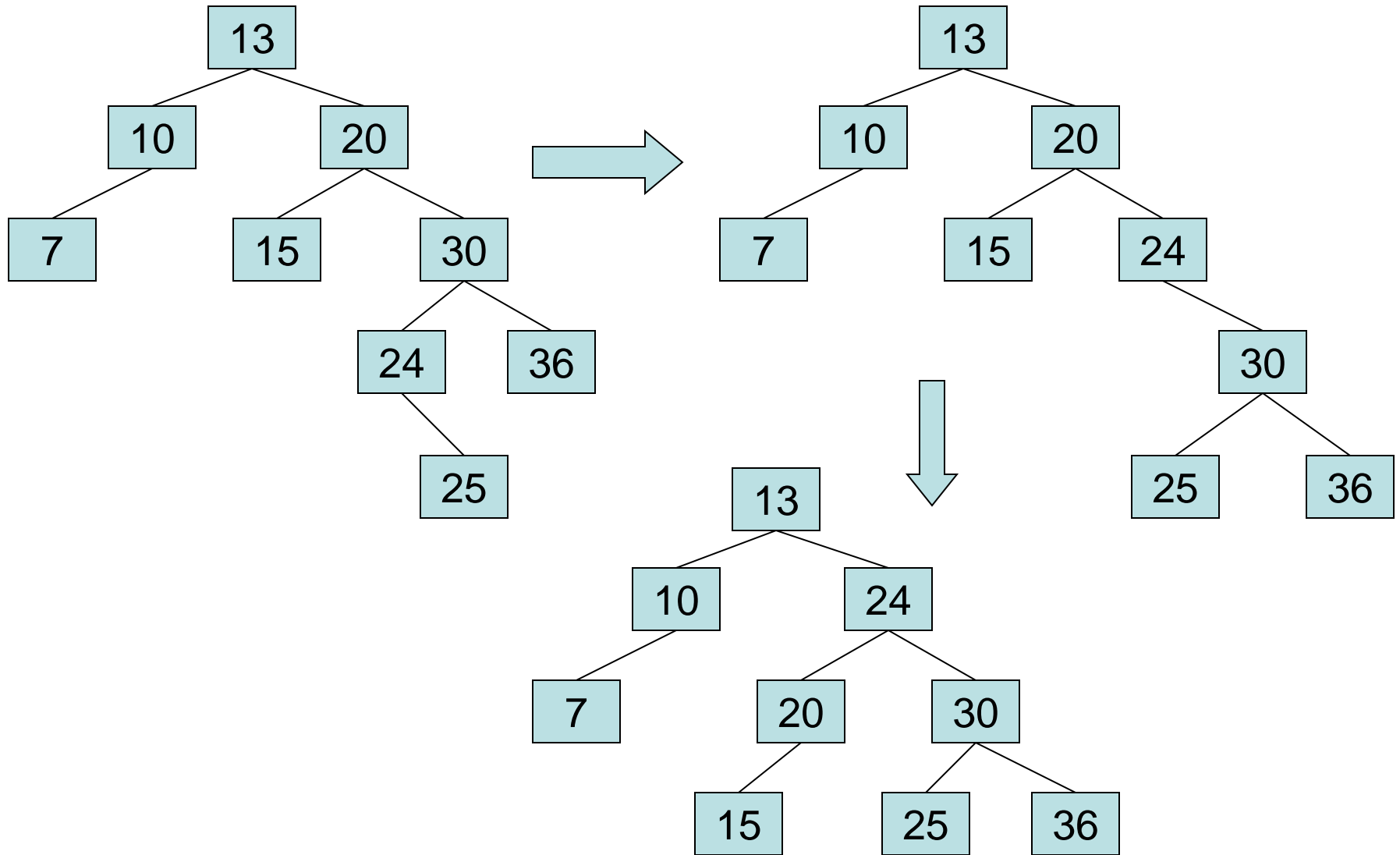
15, 20, 24, 10, 13, 7, 30, 36, 25



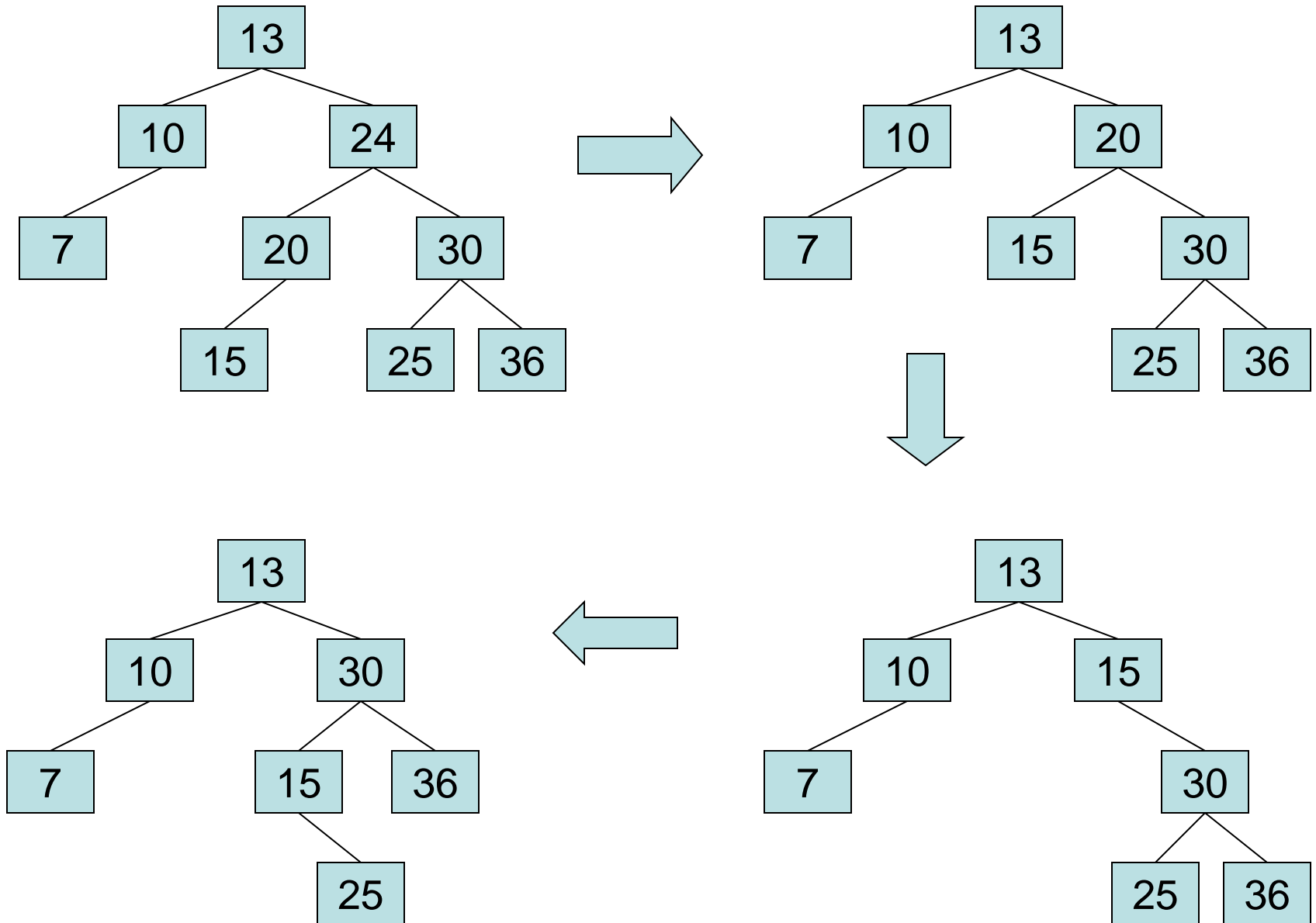
15, 20, 24, 10, 13, 7, 30, 36, 25



15, 20, 24, 10, 13, 7, 30, 36, 25



Remove 24 and 20 from the AVL tree.

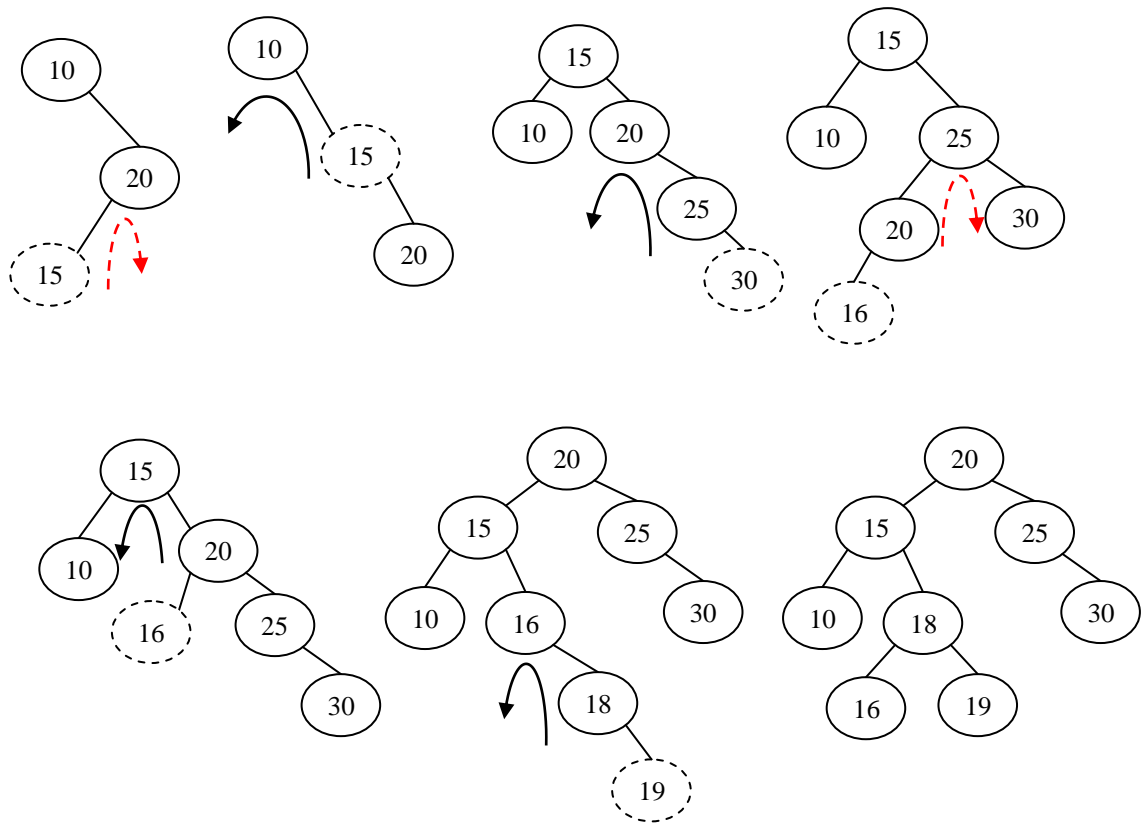


## Question 2

- (a) Insert the following sequence of elements into an AVL tree, starting with an empty tree: 10, 20, 15, 25, 30, 16, 18, 19.  
 (b) Delete 30 in the AVL tree that you got.

### Solution:

- (a) Red dashed line signifies first part of double rotate action.



(b).

