

# CSSE 230 Day 15

Displayable Solution  
AVLTree practice  
Work time

## Agenda

- ▶ Answers to your questions
- ▶ PreorderBuild: 3 solutions (separate slides)
- ▶ AVL insertion/deletion practice
- ▶ Work time
  
- ▶ A word on in-class work time" in general!
  - You should not leave or work on other courses unless you have finished the next programming assignment and next written assignment.
  - The idea is to work on things while you can get help if questions come up.

## Overview of "rebalance after insertion"

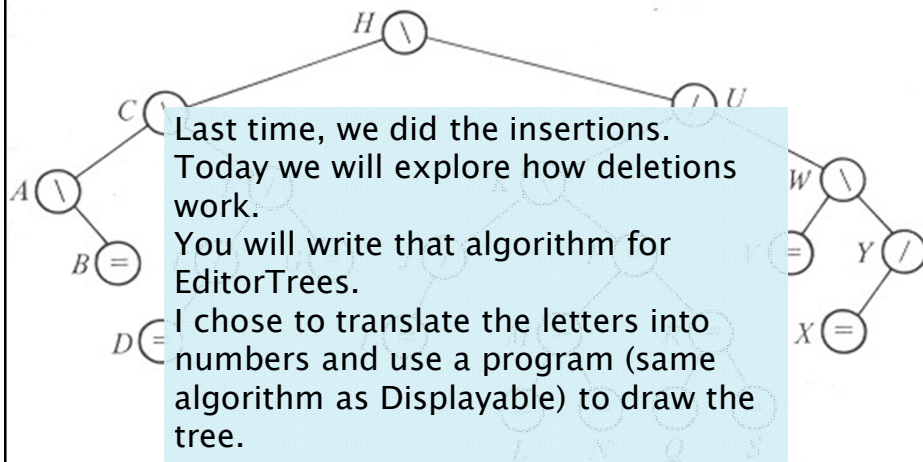
- ▶  $p$  = parent of inserted node
- ▶ while  $p \neq \text{null}$ 
  - if  $p.\text{balanceCode}$  is '='
    - set code to '/' or '\' as appropriate
    - $p$  = parent of  $p$
  - else if  $p.\text{balanceCode}$  indicates "insertion was in shorter subtree"
    - change code to '='
    - break
  - else //insertion was into taller side.
    - do the appropriate rotation, based on chart on next slide
    - break

## Recap: Which kind of rotation to do after an insertion?

Depends on the first two links in the path from the lowest node that has the imbalance (A) down to the newly-inserted node.

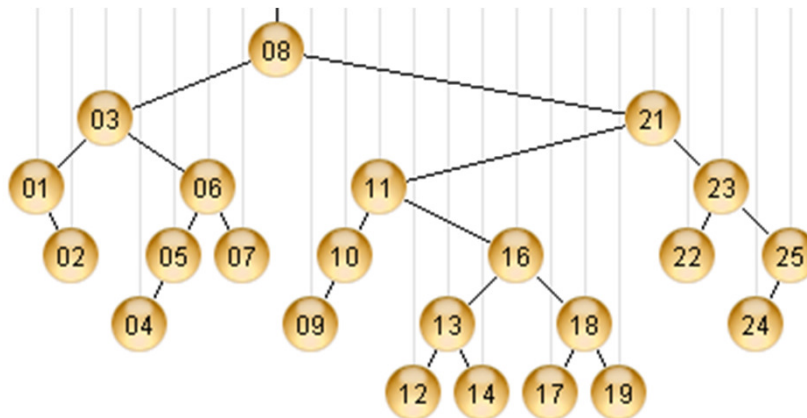
First link (down from A)	Second link (down from A's child)	Rotation type (rotate "around A's position")
Left	Left	Single right
Left	Right	Double right
Right	Right	Single left
Right	Left	Double left

## A sample AVL tree



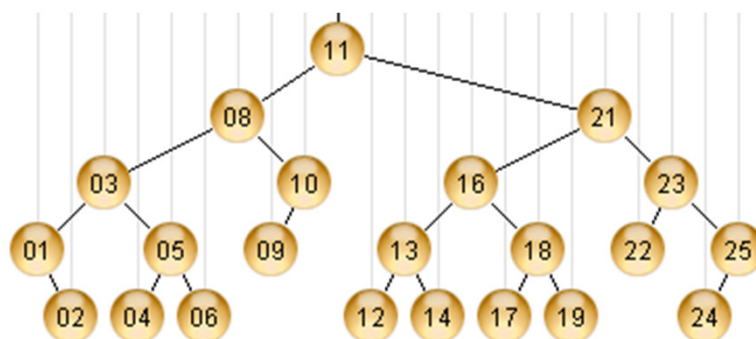
Insert **HA** into the tree, then **DA**, then **O**.  
Delete **G** from the original tree, then **I, J, V**.

## Delete 7 and Rebalance

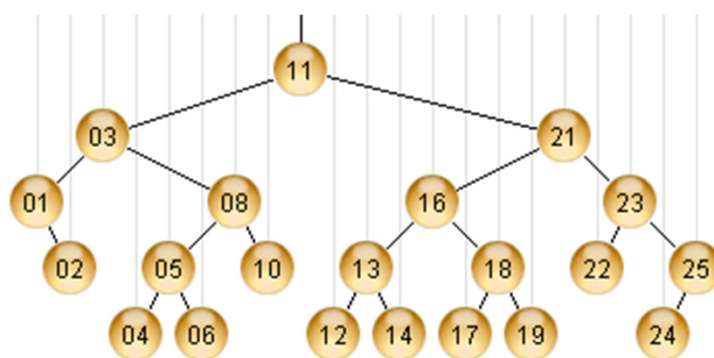


<http://webdiis.unizar.es/asignaturas/EDA/AVLTree/avltree.html>

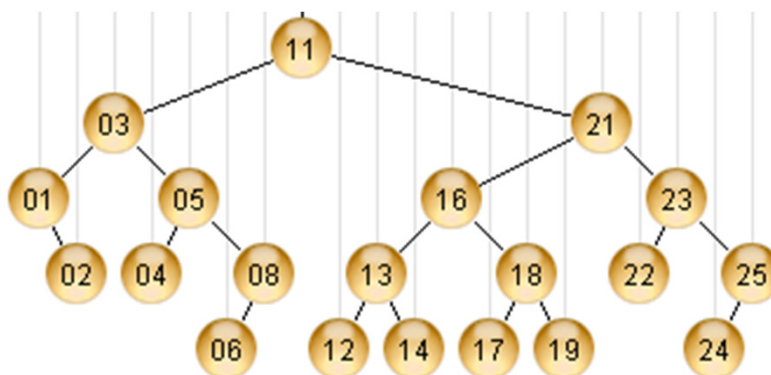
## Delete 9 and Rebalance



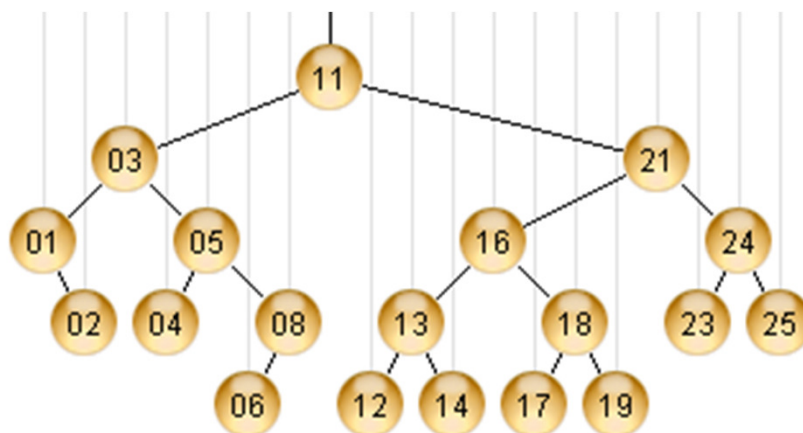
## Delete 10 and Rebalance



## Delete 22 and Rebalance



## Final result



## Your turn (with a partner or two)<sup>1-4</sup>

- ▶ **Start with an empty AVL tree.**
- ▶ Add elements in the following order; do the appropriate rotations when needed.
  - 1 2 3 4 5 6 11 13 12 10 9 8 7
- ▶ How should we rebalance if each of the following sequences is deleted from the final tree above?
  - ( 10 9 7 8 ) ( 13 ) ( 1 5 )
  - For each of the three sequences, start with the original 13-element tree. E.g. when deleting 13, assume 10 9 8 7 are still in the tree.

Work with your Doublets partner.  
When you finish, work on Doublets or Threaded.  
Or write the rotateDoubleRight code from a yesterday's slide.