CS 180 - AVL Trees

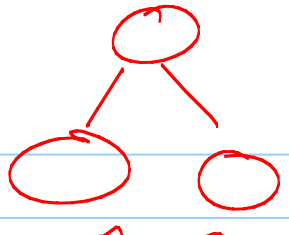
Note Title 10/19/2012

Announcements

- HW 7 due Monday
  - check code if confused

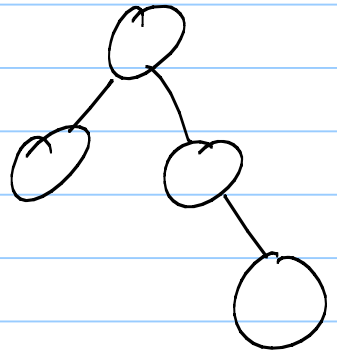
- Next HW - delete in BST
  can work w/ partner
  due in 1 week

AVL Trees : balanced BST



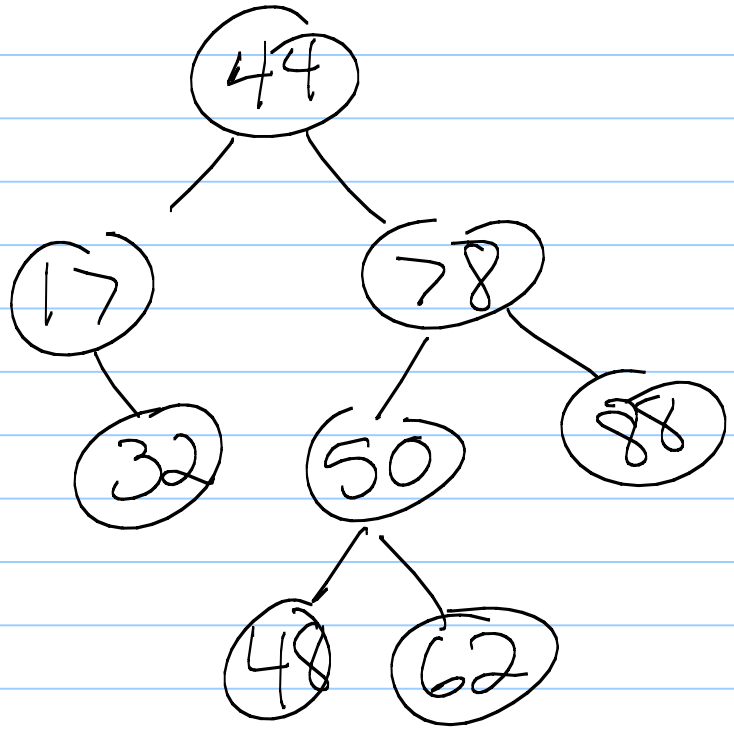
Height - Balance Property:
for every node of T, the heights of the children differ by at most 1.

$\Rightarrow$ max height $\leq 2\lceil \log_2 n \rceil$



(How do we calculate height again?)

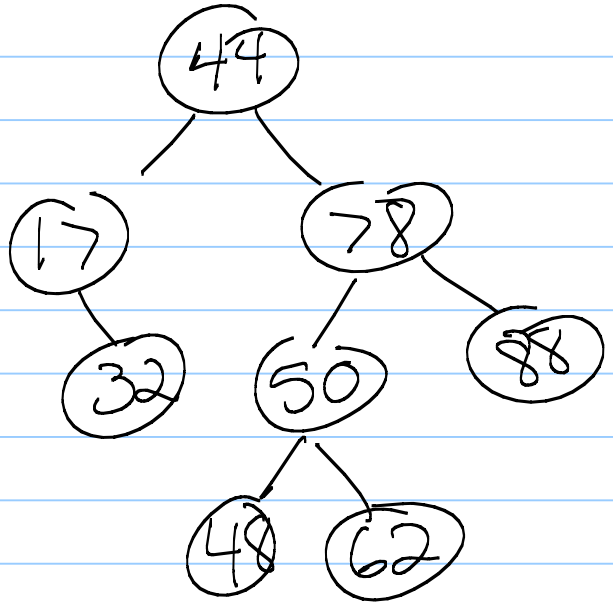
Ex:



Now: How can we mess this up?

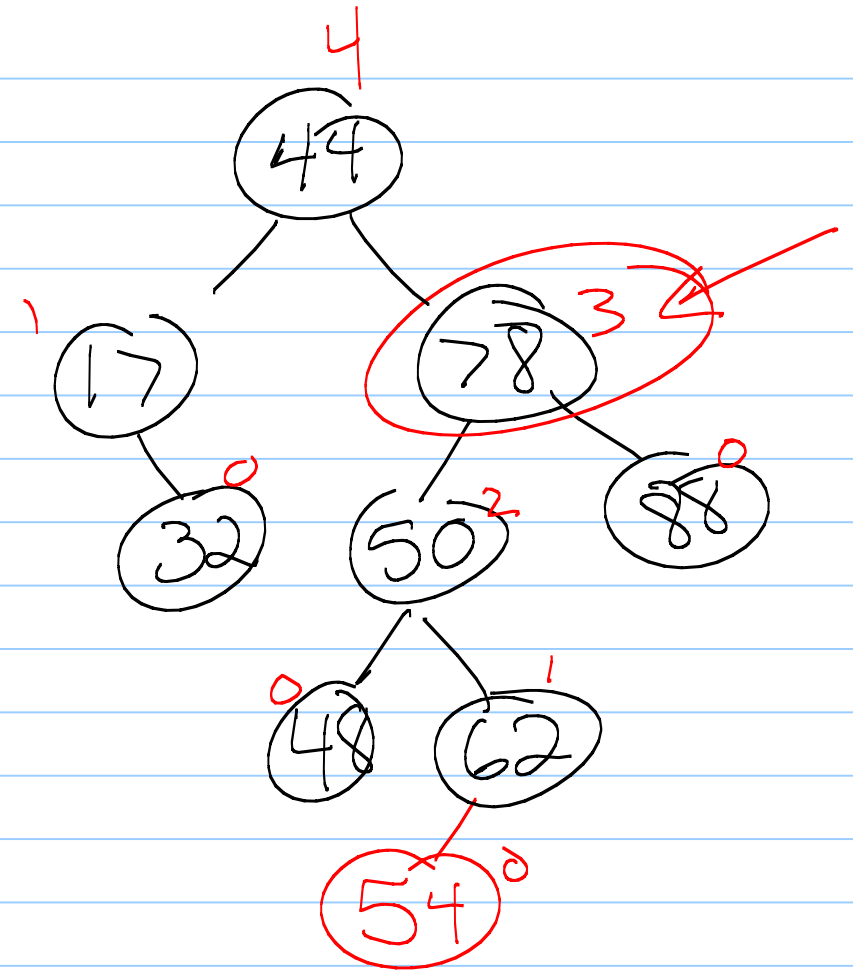
(In other words, how can the height change?)

- insert
- delete



Insert:

insert(54)



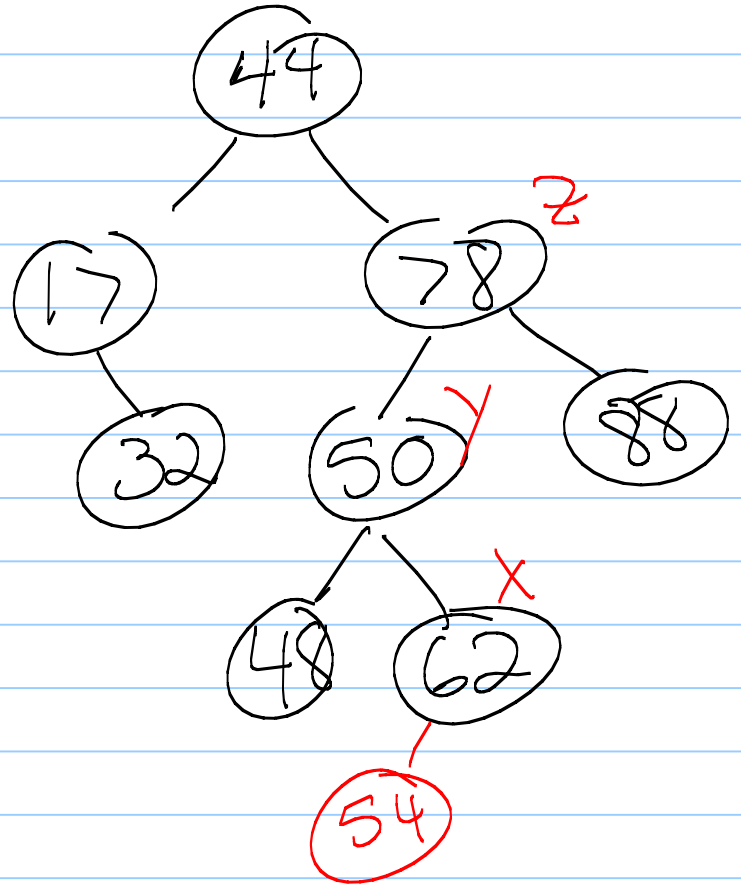
Fix lowest problem node.

So: consider the lowest node which does not satisfy height-balance property -- call this z.

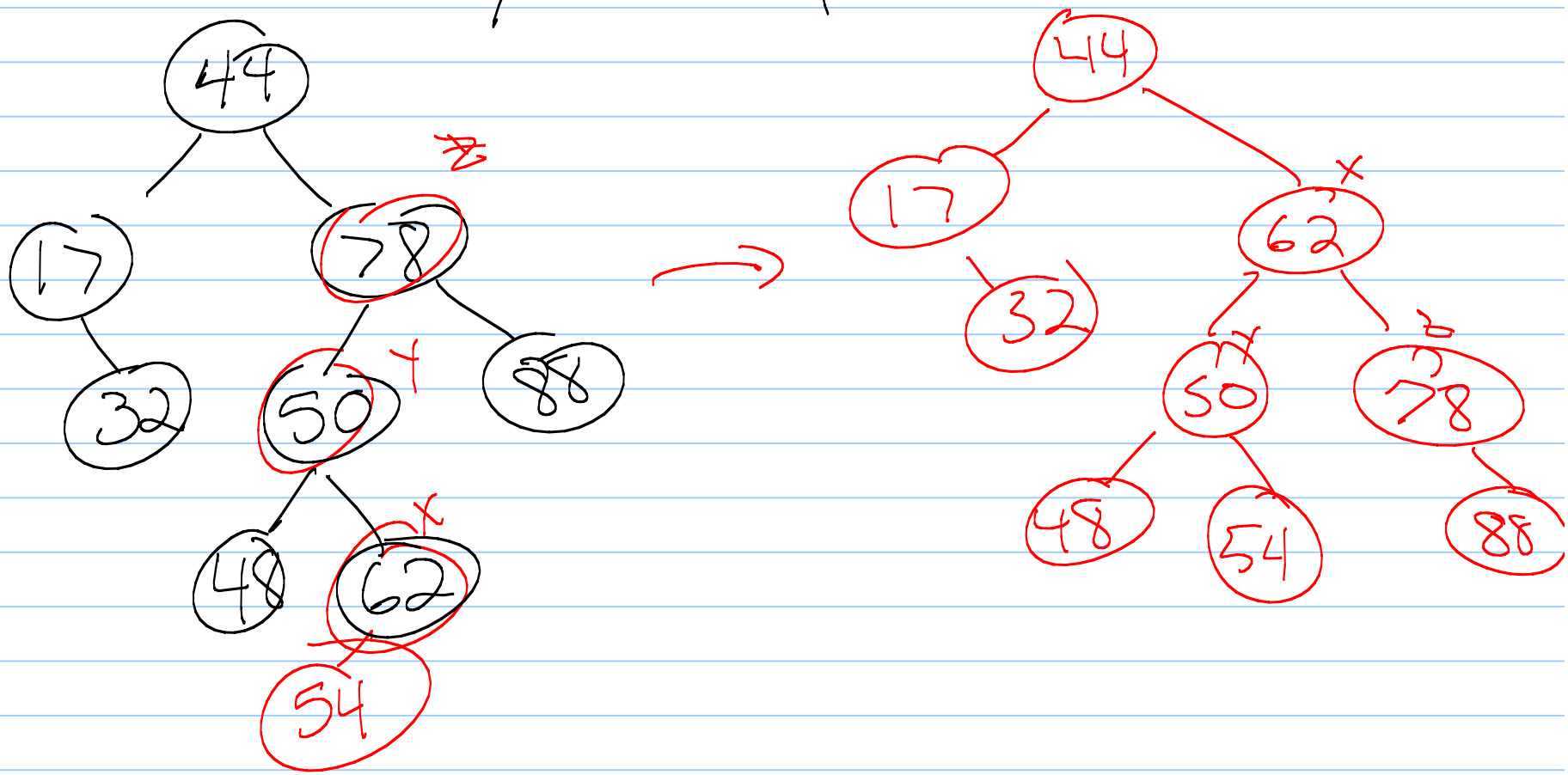
Let y be z's child with larger height.

Let x be y's child with larger height.

Now - fix it!



What did you do?

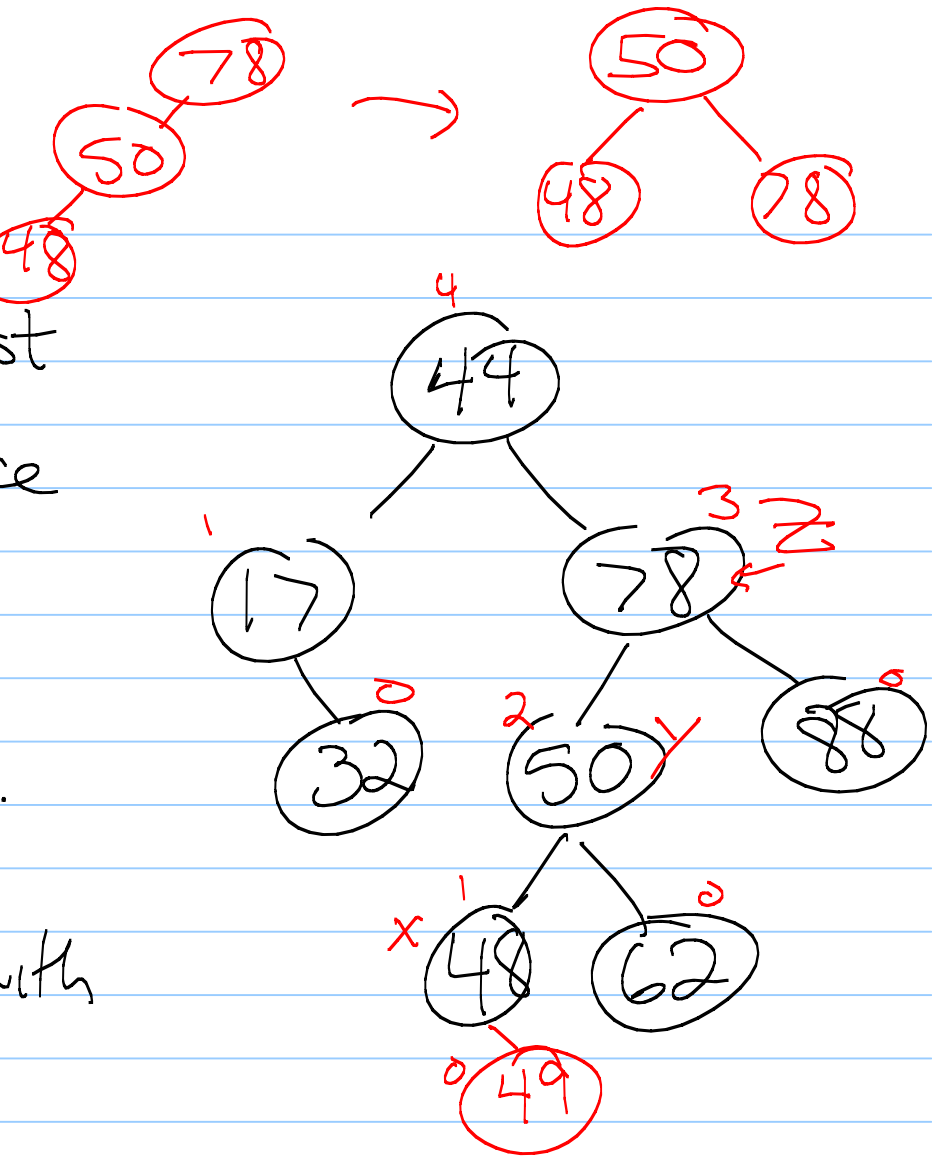


Another - insert (49)
So: consider the lowest node which does not satisfy height-balance property U - call this

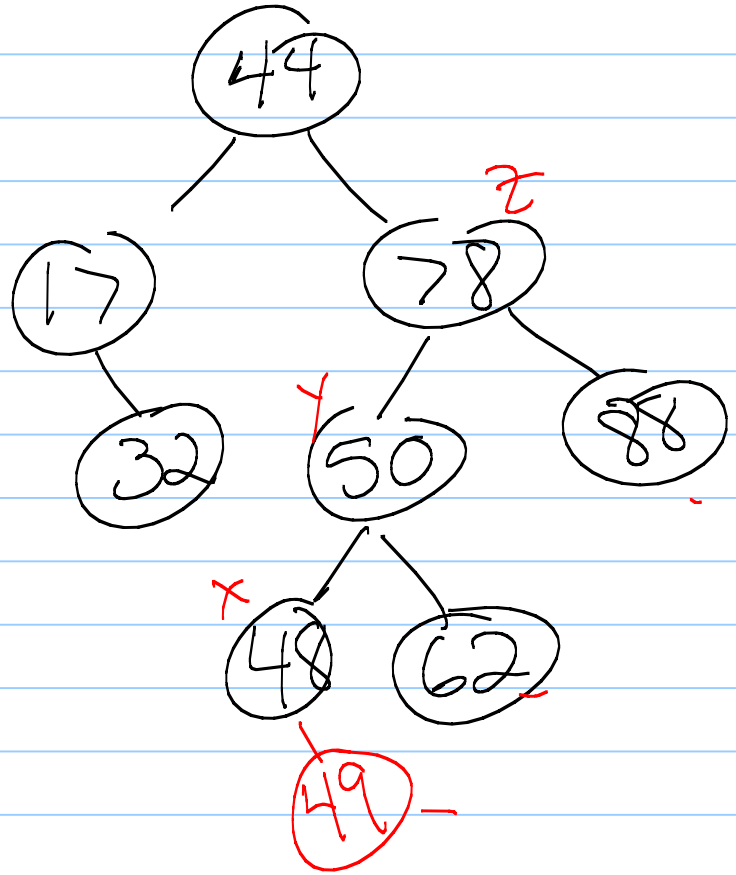
Let y be x's child with larger height.

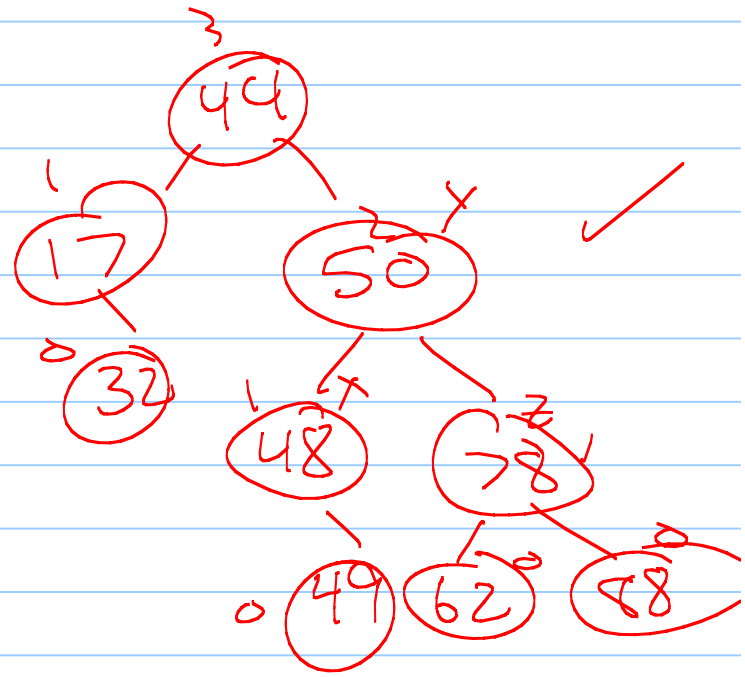
Let x be y's child with larger height.

Now - fix it!



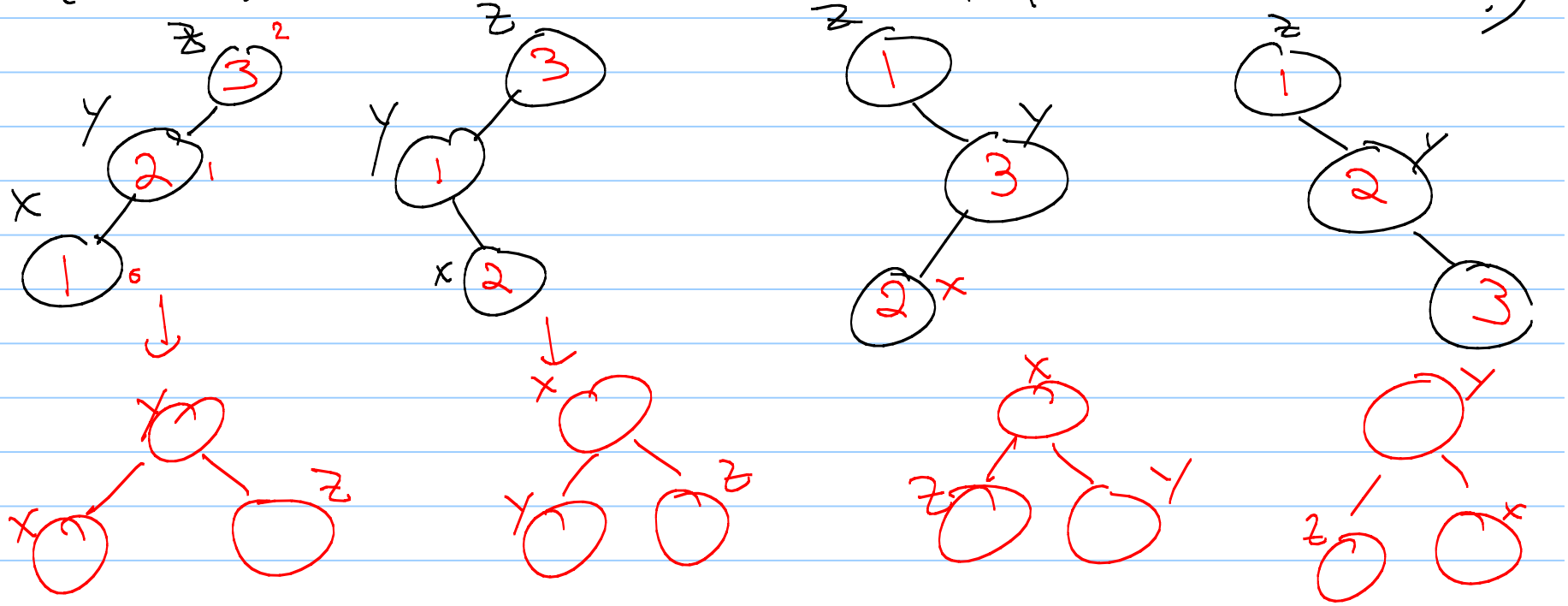
What did you do?



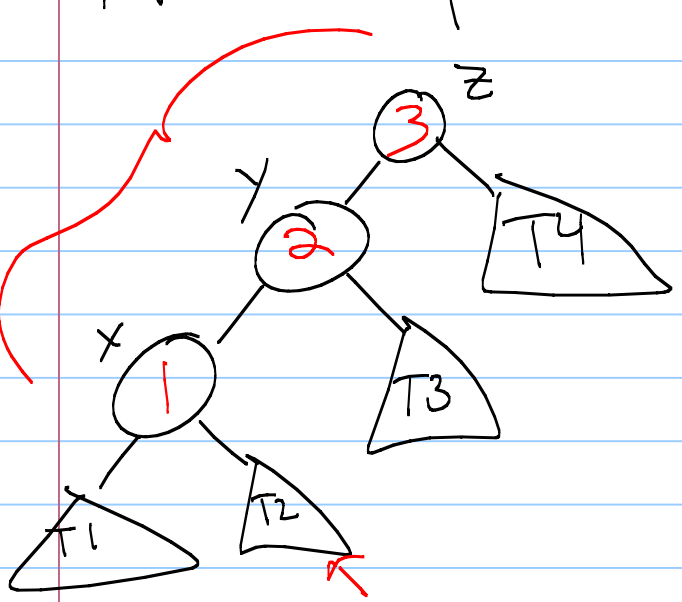


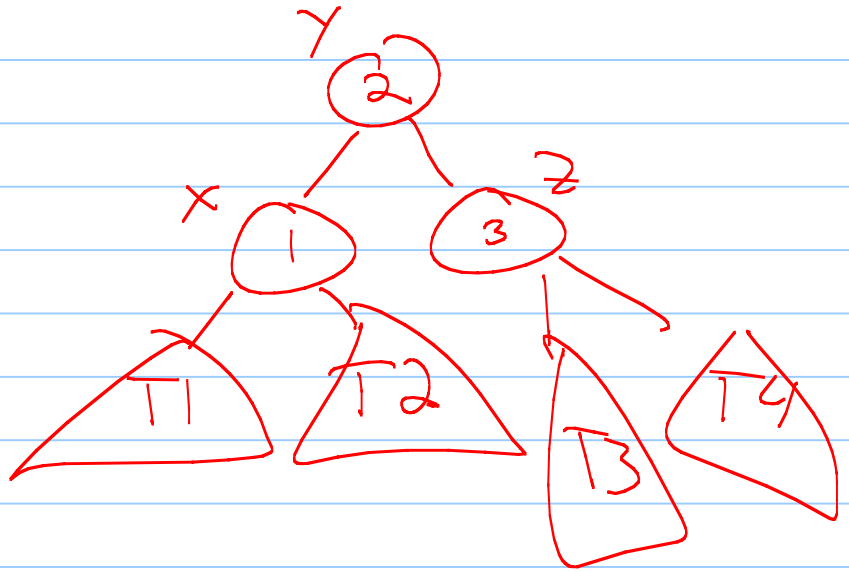
Generalize – Consider x, y, & z. How can we restructure?

(Hint: What is inorder traversal of these in each case?)



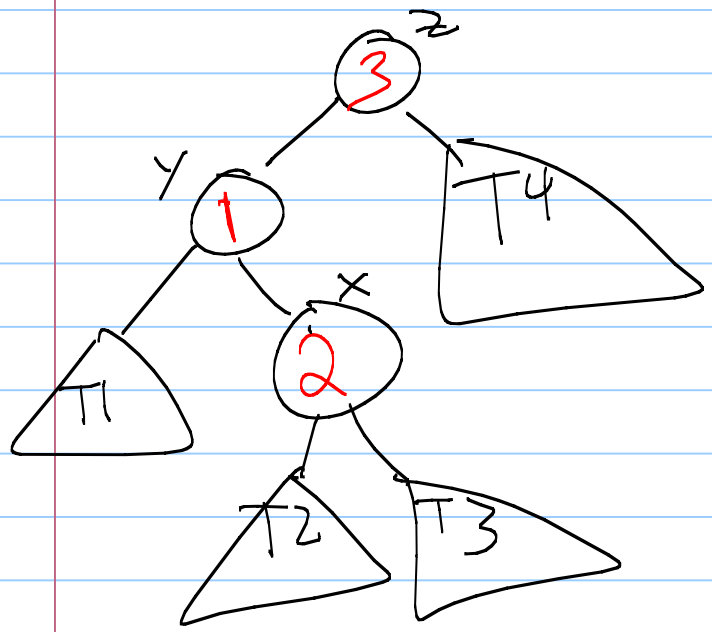
Actual picture:



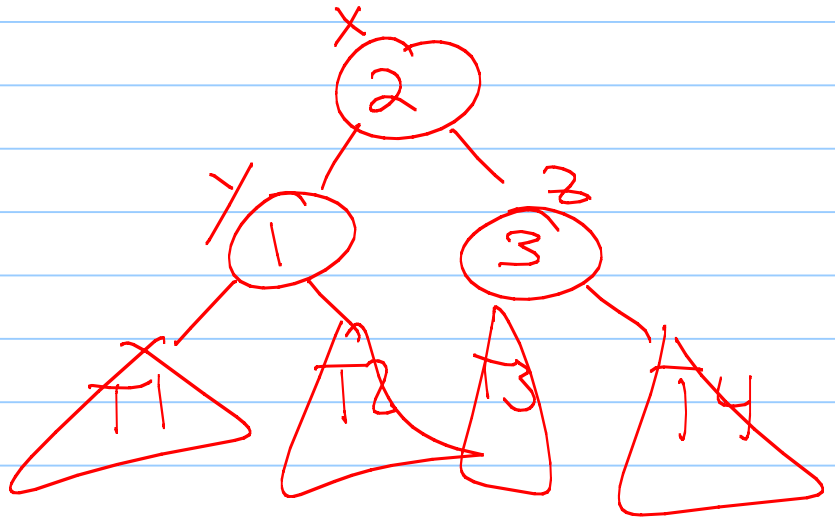


Where do the subtrees go??

Another



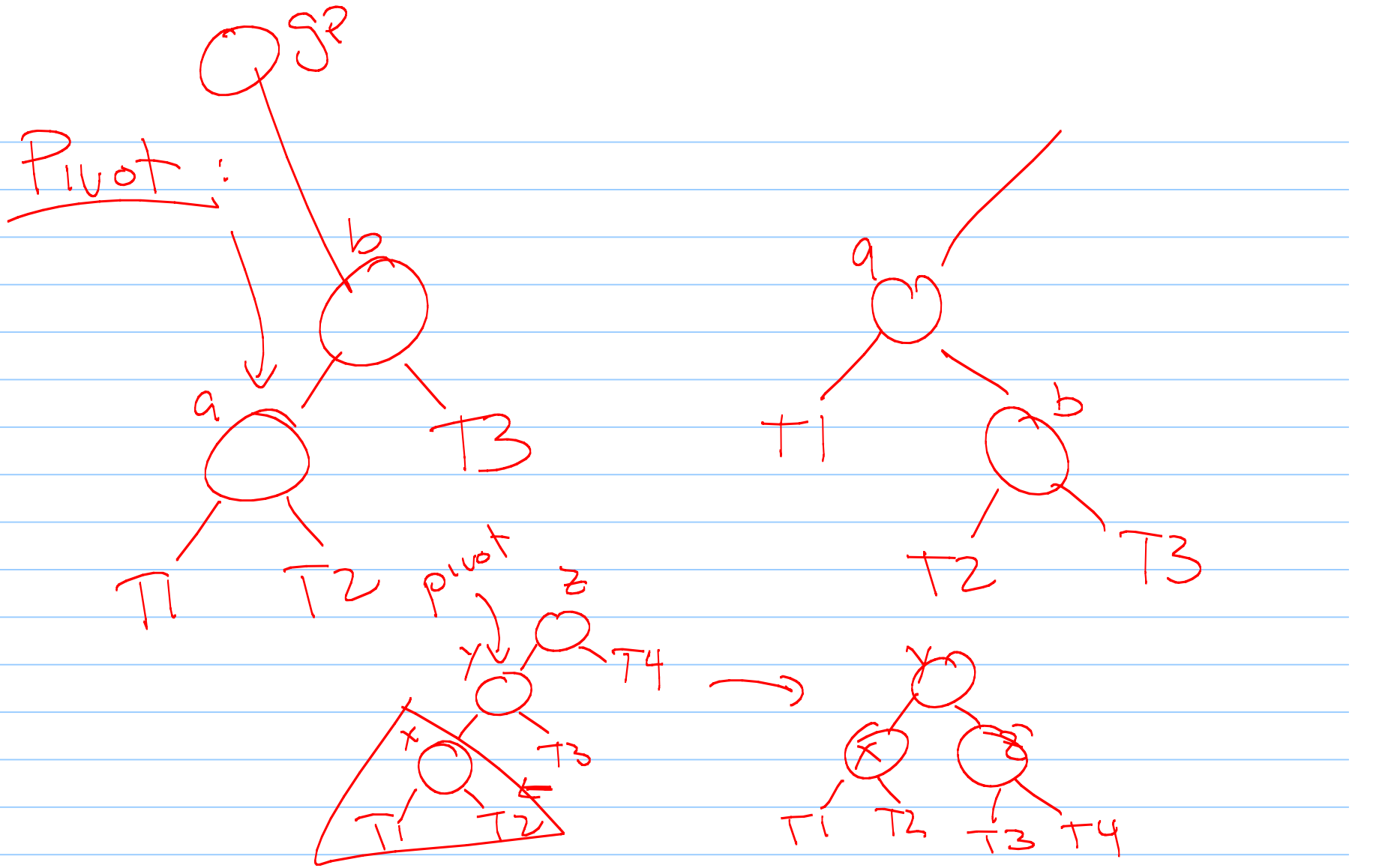
?

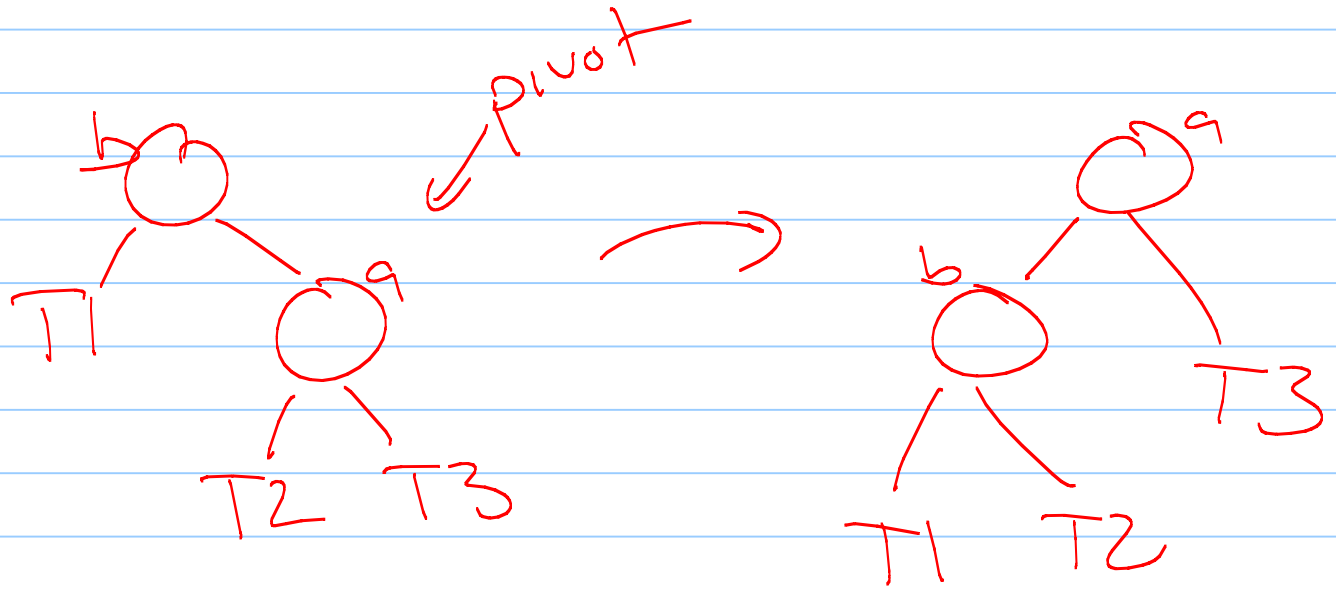


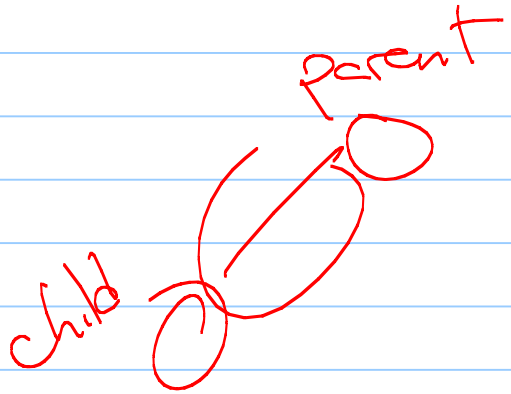
Any way you do this, "2" becomes the root of the new subtree, with "1" to the left & "3" to the right!

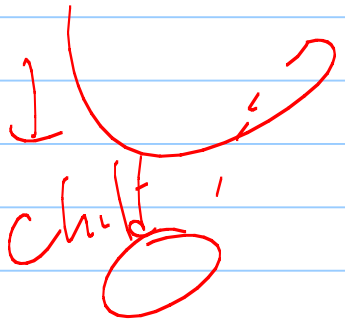
What about T1, T2, T3, & T4?

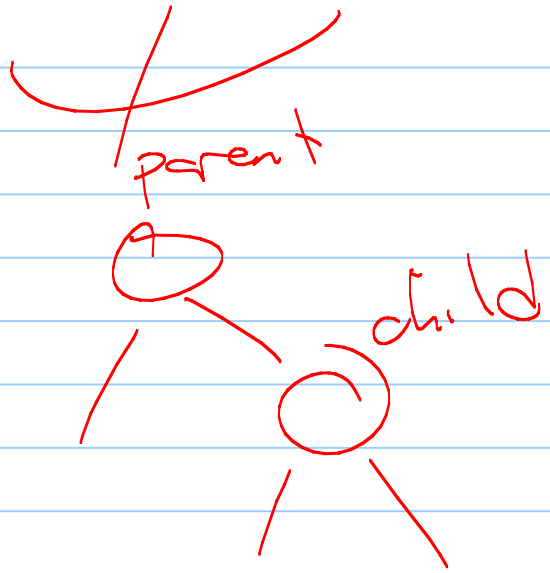
hang left to right


Pivot:
GP
b
a
T1
T2
T3
a
T1
b
T2
T3
pivot
z
y
T4
x
T3
T1
T2
y
x
z
T1
T2
T3
T4


pivot
b
q
T1
T2
T3
q
b
T3
T1
T2


parent
child


child


parent
child