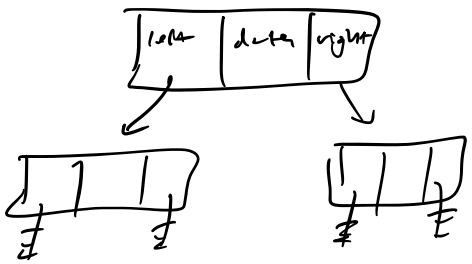
BSTs!

Tree structure:



Order Invariant:

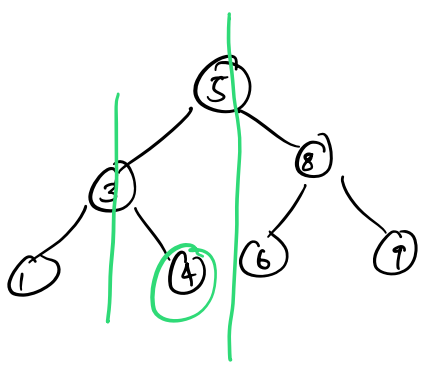
Left of node is STRICTLY less

Right of node is STRICTLY greater

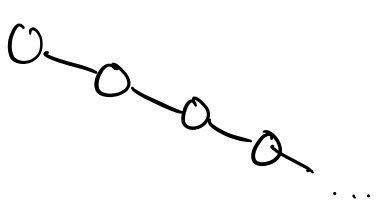
Insertion: → Lookup

follow tree to correct spot - O(n)

add in - O(1)

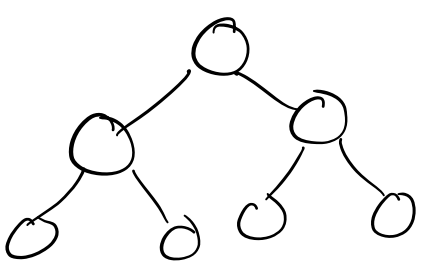


Worst Case:



O(n)

Best:



O(log n) = O(h)

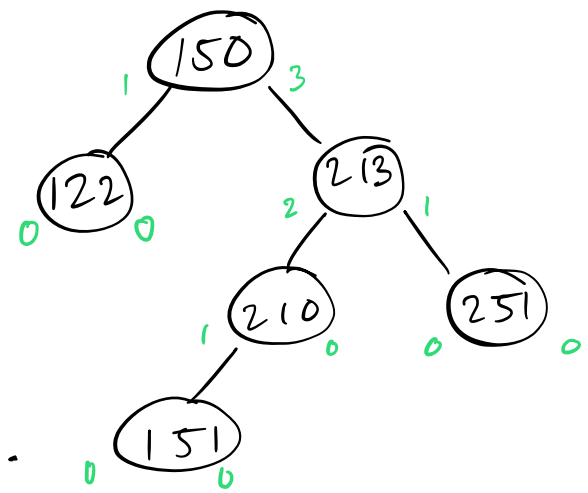
AVLs fix our problems!

↳ Guarantee balanced tree

Add a height invariant: (→ # of nodes)

~~If~~ height (left subtree) differs ~~from~~ height (right subtree)

by at MOST 1



Right - Left

What is the violation?

150

How do we fix it?

Rotations!

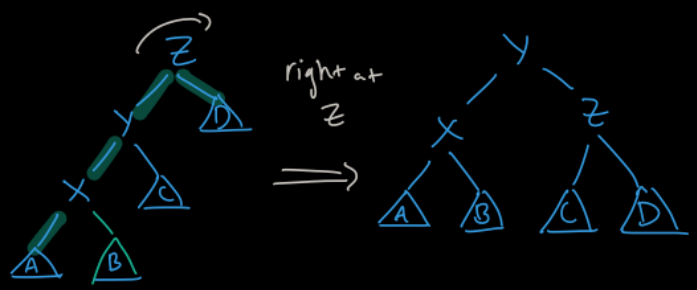
Rotations Cheat Sheet!

Different cases!

Single Rotations:

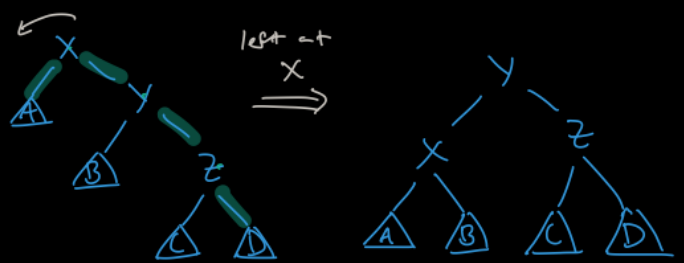
Left - Left case:

rotate right



Right - Right case:

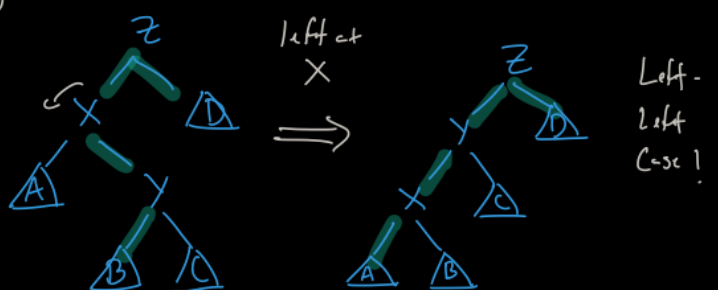
rotate left:



Double Rotations — straighten the leg!
(go 1 below violation!)

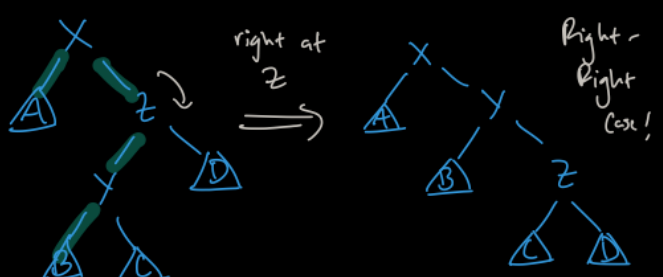
Left - Right Case:

rotate left first:



Right - Left Case:

rotate right first:



ALWAYS FIX LOWEST VIOLATION!

(Leafiest)