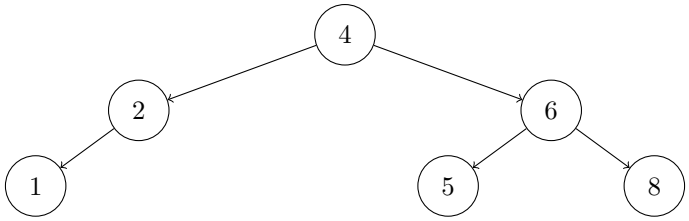
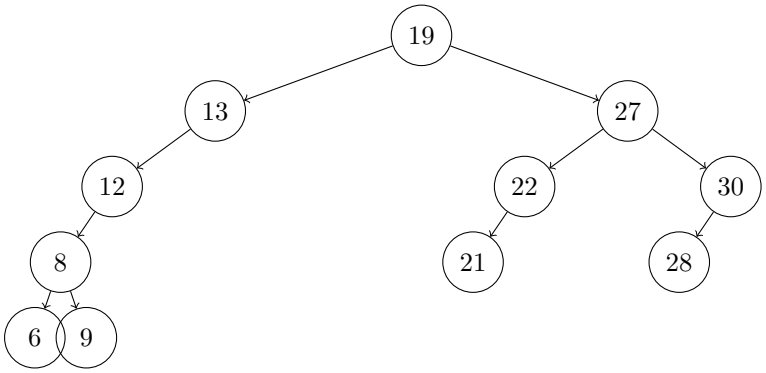
1 AVL Trees

Problem 1. Perform a right rotation on the root of the following tree. Be sure to specify the X, Y, and Z subtrees used in the rotation.



Children 2 and 1 are a part of the X subtree. Child 8 is the Z subtree, and child 5 is the Y subtree.

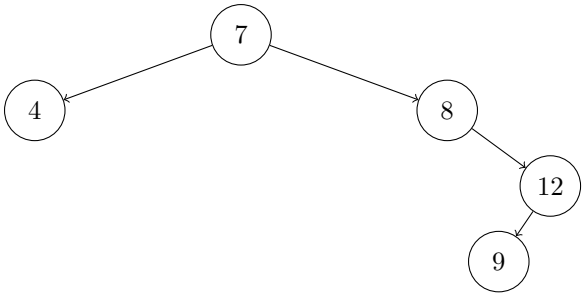
Problem 2. Show the left rotation of the subtree rooted at 12. Be sure to specify the X, Y, and Z subtrees used in the rotation.



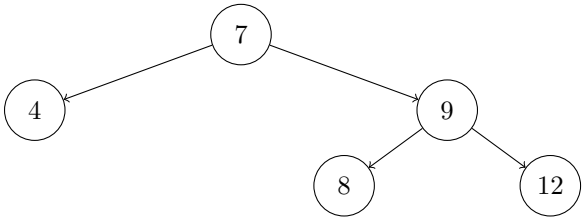
X subtree is the tree rooted at 8, with 6 and 9 as it's children. There are no other subtrees.

Problem 3. Using the appropriate AVL tree algorithm, insert the value 9 into the following tree. Show the tree before and after rebalancing.

Before Rebalance

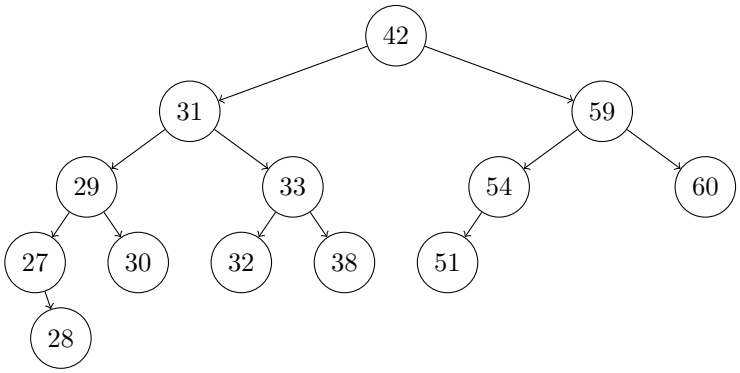


After Rebalance

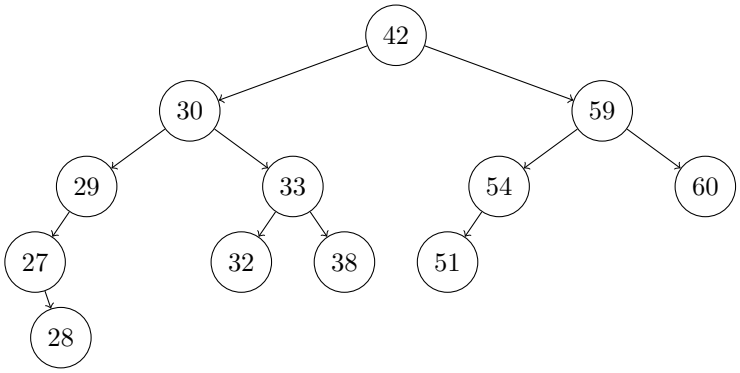


Problem 4. Using the appropriate AVL tree algorithm, remove the value 31 from the following tree. Show the tree before and after rebalancing.

Before Removal and Rebalance

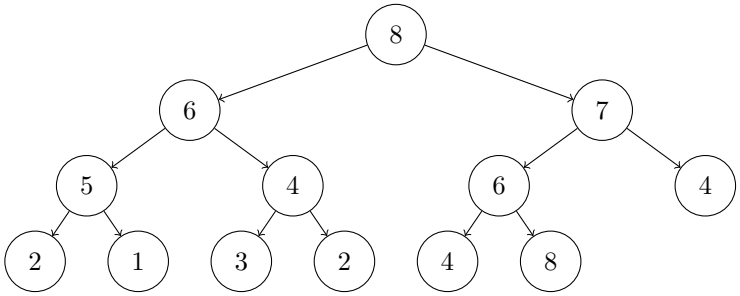


After

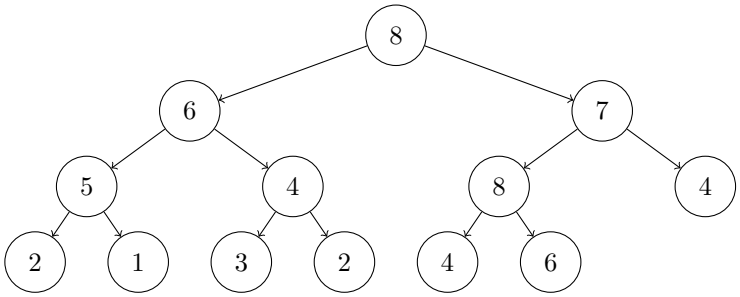


2 Heaps

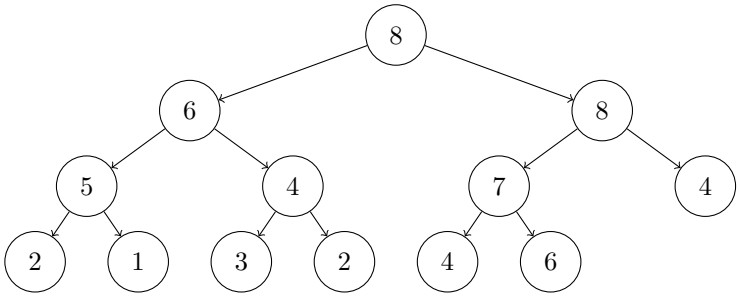
Problem 1. Show the addition of the element 8 to the max-heap below. First, show the addition of 8 to the tree; then, show each bubbling step.



Bubble up

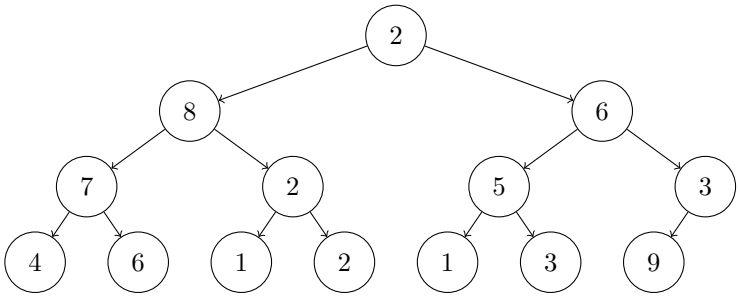


Bubble up

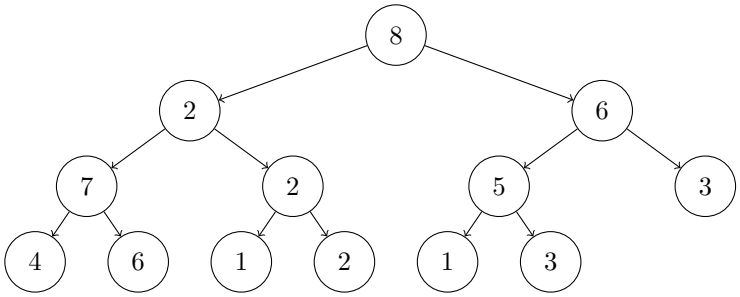


Problem 2. Show the removal of the top element of this max-heap. First, show the swap of the root node; then, show each bubbling step.

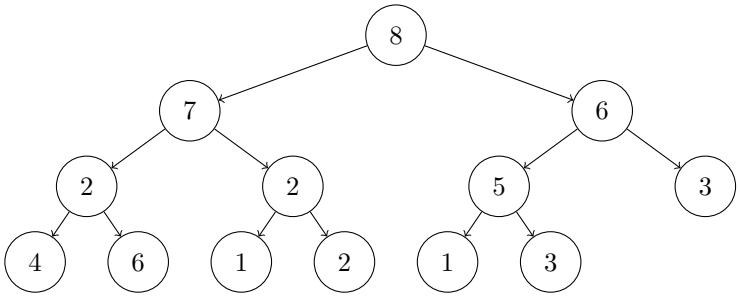
Swap root node with last node



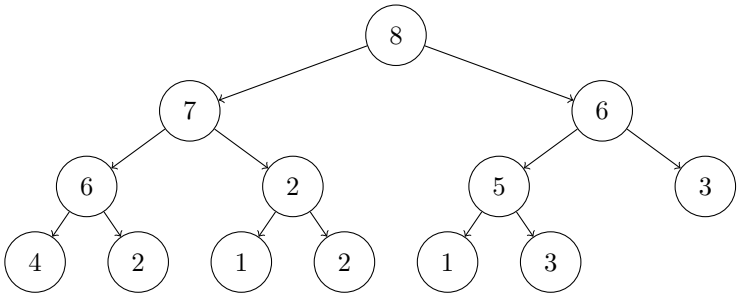
Remove last node, and bubble down



Bubble down

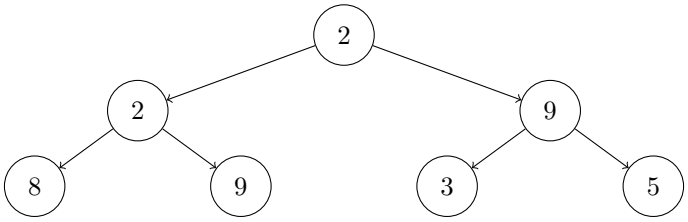


Bubble down

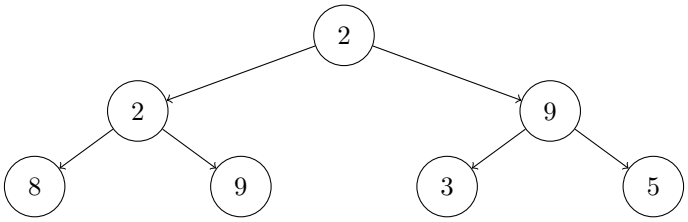


Problem 3. Consider the sequence of elements `[2,2,9,8,9,3,5]`. Using the representation discussed in class, show the tree to which this sequence corresponds. Then, show the *heapification* of this tree; that is, show how this tree is transformed into a heap. Demonstrate each bubbling step.

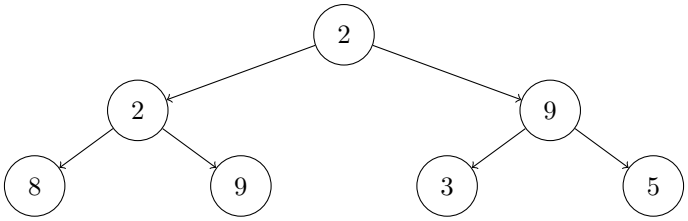
List as a complete Binary tree



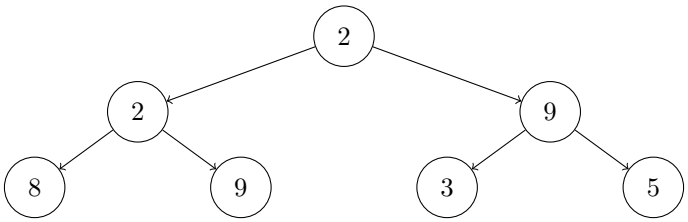
Bubble down at index 6



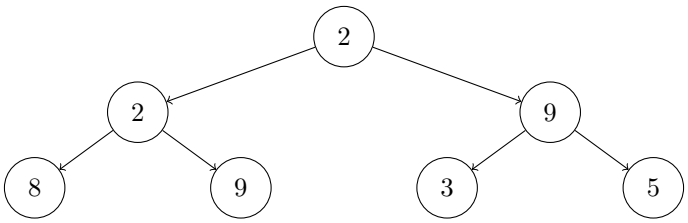
Bubble down at index 5



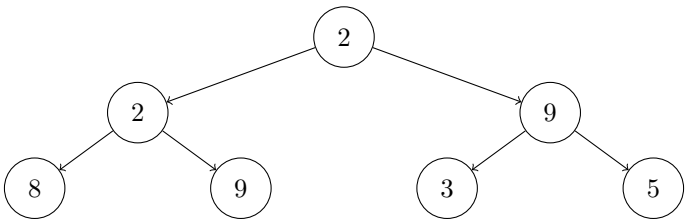
Bubble down at index 4



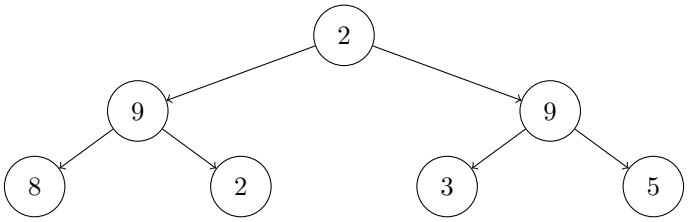
Bubble down at index 3



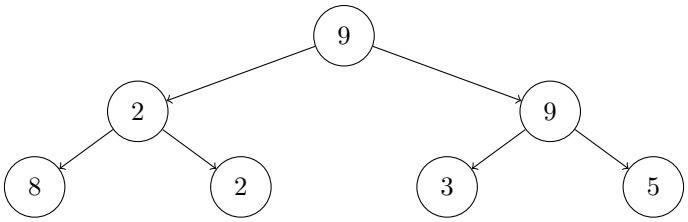
Bubble down at index 2



Bubble down at index 1



Bubble down at index 0



Bubble down at index 0