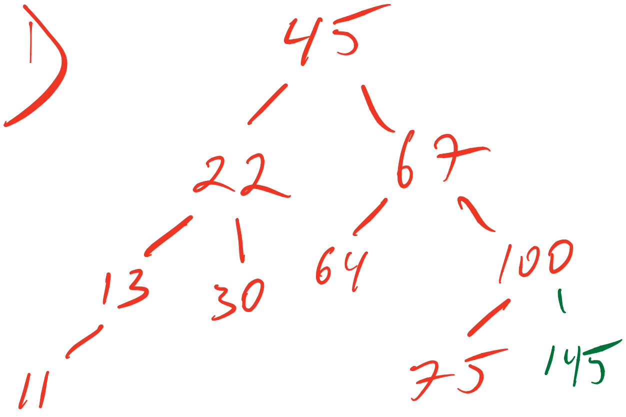
# Worksheet 28: Binary Search Trees

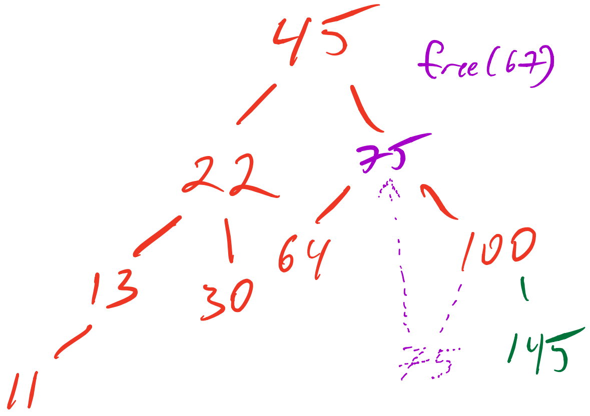
**In Preparation**: Read Chapter 8 to learn more about the Bag data type, and chapter 10 to learn more about the basic features of trees. If you have not done so already, read Worksheets 21 and 22 for alternative implementation of the Bag.

In this worksheet we will practice the concepts of using a Binary Search Tree for the Bag interface. For each of the following problems, draw the resulting Binary Search Tree.

1. Add the following numbers, in the order given to a binary search tree. 45, 67, 22, 100, 75, 13, 11, 64, 30
2. -bottom up
   What is the height of the tree from #1? What is the height of the subtree rooted at the node holding the value 22? What is the depth of the node holding the value 22?
   -top down
3. Add the following numbers, in the order given to a binary search tree. 3, 14, 15, 20, 25, 30, 33, 62, 200.
4. Is the tree from #3 balanced? Why not? What is the execution time required for searching for a value in this tree?
5. Add a new value, 145, to the tree from #1
6. Remove the value 67 from the tree from #1. What value did you replace it with and why?

1)



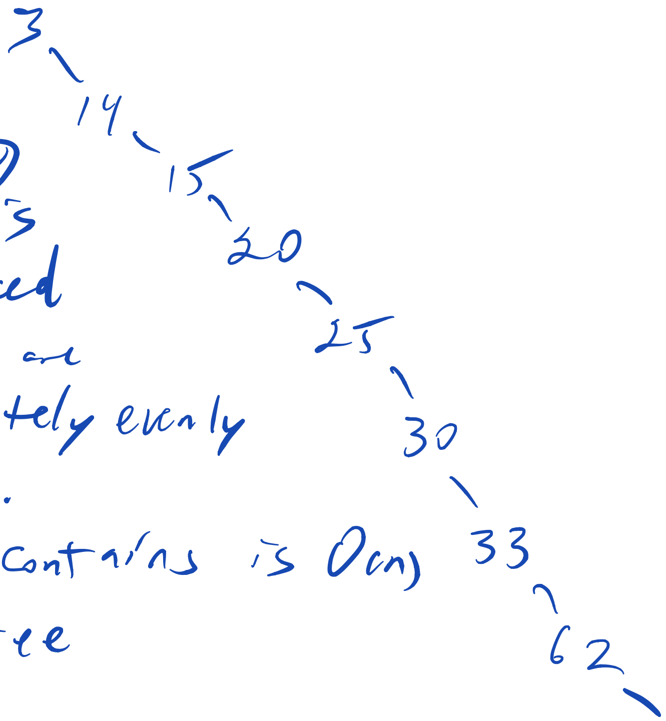


2) Tree height = 3

22 subtree height = 2

22 node depth = 1

3)



4) • no → is

Not balanced

b/c the nodes are not even remotely evenly distributed.

• Complexity of contains is O(n) for this tree

5) See above

6) See above; 75, the left-most descendant of the 200 Right subtree.