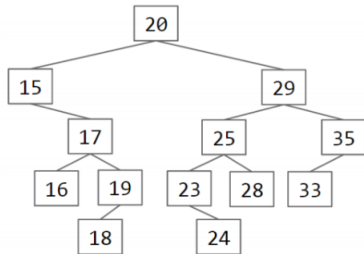
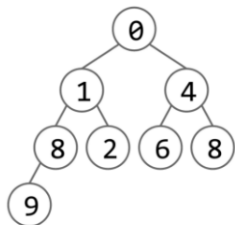


1 Basic Operations (Spring 2015 MT2 Q1)

a. **To the right of the BST below**, draw a BST that results if we delete 20 from the BST. You should use the deletion procedure discussed in class (i.e. no more than 4 references should change).



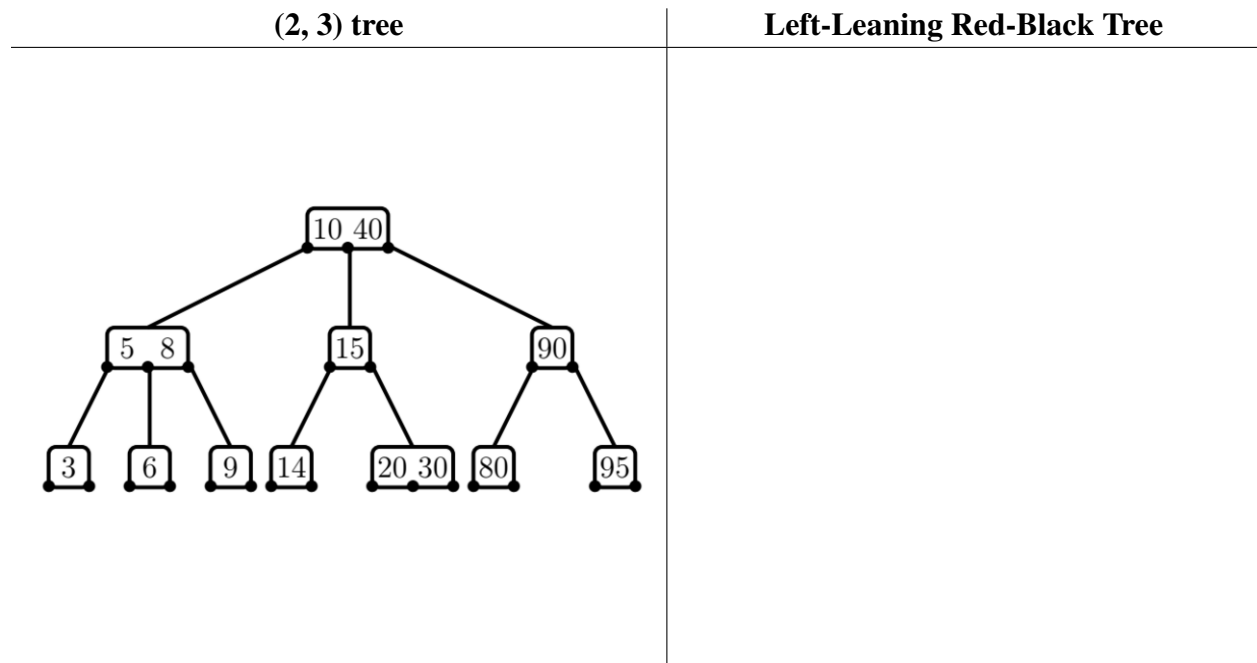
b. **To the right of the minHeap below**, draw the minHeap that results if we delete the smallest item from the minHeap.



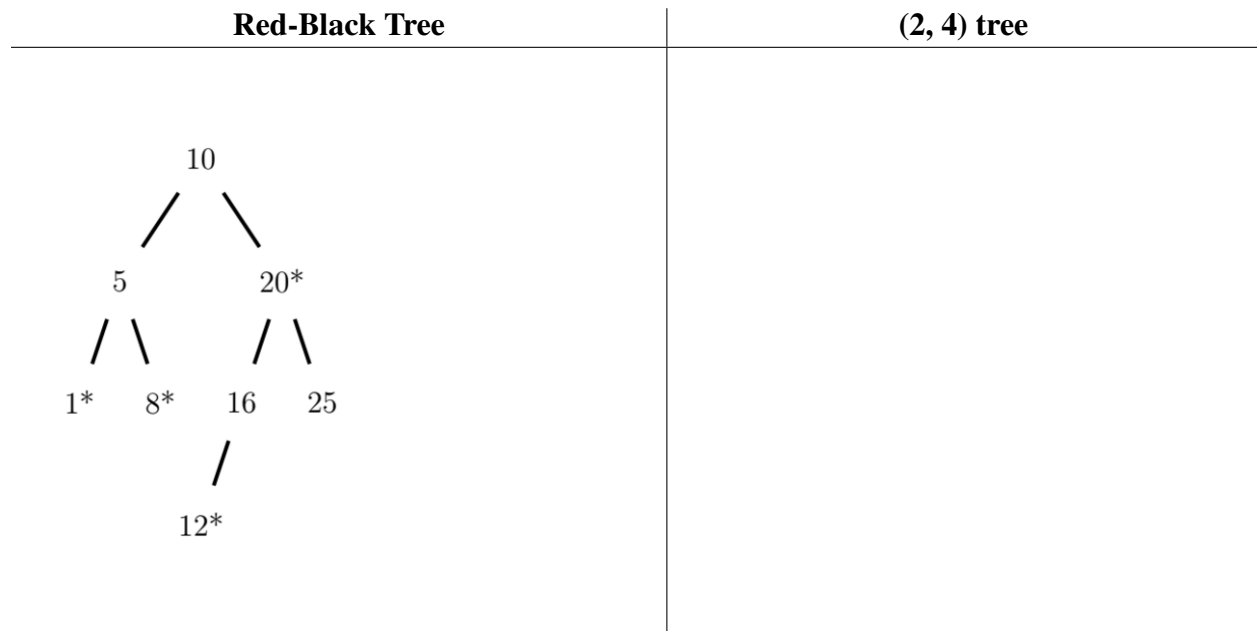
d. Draw a valid Weighted Quick Union object that results after the following calls to connect: connect (1, 4), connect (2, 3), connect (1, 3), connect (5, 1). Don't worry about the order of the arguments to each connect call, we'll accept any reasonable convention.

2 (Fall 2016 Final Q6)

- a. Show the left-leaning red-black tree that corresponds to the (2,3) tree on the left. Indicate red nodes with an asterisk (as in part (b) below).

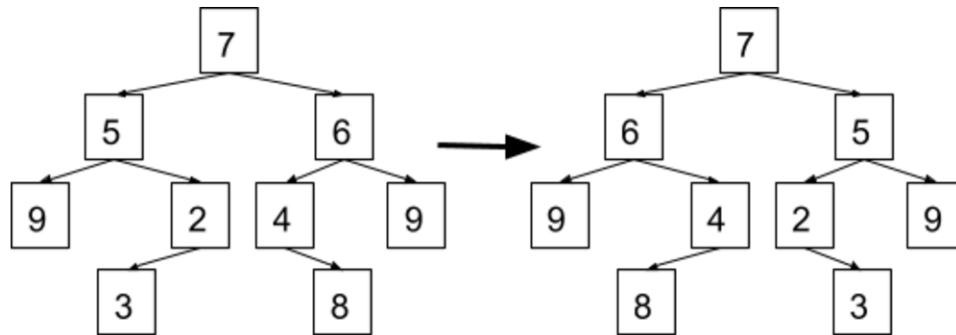


- b. Show the (2,4) tree that corresponds to the red-black tree on the left. Red nodes are marked with an asterisk.



3 Lapras (Summer 2016 MT2 Q7)

Fill in a method, `Tree::flipHorizontally`, which should flip a **symmetric** binary tree's values destructively about the root in linear time. Some helper methods (`swapNumbers` and `safePush`) are given. You may not define your own helper methods. See the example:



```
public class Tree {
    private TreeNode root;

    private static class TreeNode {
        private int num;
        private TreeNode left, right;

        private TreeNode(int num, TreeNode left, TreeNode right) {
            this.num = num;
            this.left = left;
            this.right = right;
        }
    }

    private static void swapNumbers(TreeNode t1, TreeNode t2) {
        int temp = t1.num;
        t1.num = t2.num;
        t2.num = temp;
    }

    private static void safePush(TreeNode t, Stack<TreeNode> s) {
        if (t != null) {
            s.push(t);
        }
    }

    // Continues on next page
}
```

```
public void flipHorizontally() {  
    _____  
    _____  
    _____  
    _____  
    while ( _____ ) {  
        _____  
        _____  
        _____  
        _____  
        _____  
        _____  
        _____  
    }  
}  
}
```