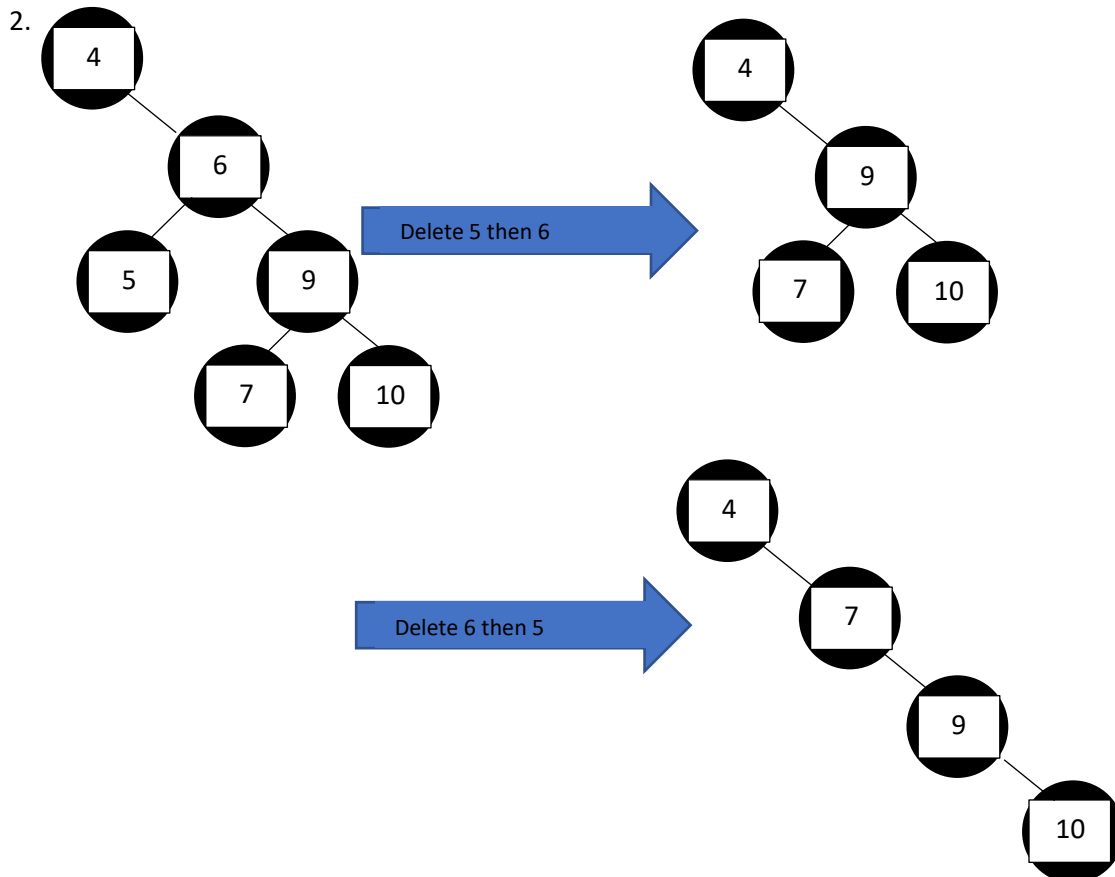# CSCI 4041, Fall 2018, Written Assignment 13

1. Claim: If the root in a binary search tree with distinct keys has two children, then its successor has no left child:

   Proof: Assume the opposite, that if the root in a binary search tree with distinct keys has two children, then its successor HAS a left child:

   By the definition of a successor, the successor of the root (hereby defined as x) is the node with the smallest key greater than x.key. All nodes with keys greater than x must exist on the right subtree of x, due to the BST property. The node with the smallest key of the right subtree of x must be the leftmost node of that subtree, once again due to the BST property. This assumes, however, that the leftmost node will NOT have a left child, since if it did, we could traverse that node in order to find the successor of x. Thus, the successor of x, which is the node with the smallest key greater than x.key, cannot have a left child.

2.

3. Inserting 19, 11, 13, 7, 6

```
                    13ᴮ
                  /      \
               7ᴮ          19ᴮ
              /   \
           6ᴿ      11ᴿ
```