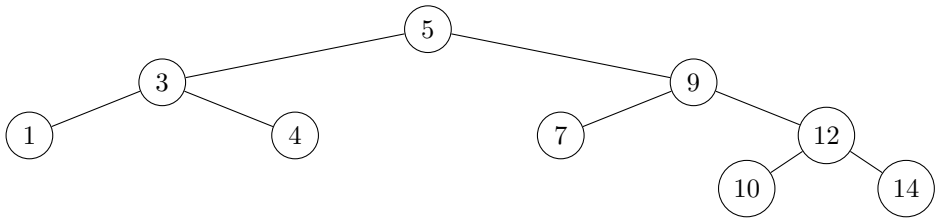
CS 240: Data Structures and Data Management **Spring 2023**

Tutorial 07: June 26

1. **Double Right Rotation is Not Two Right Rotations**
   Consider following AVL tree. Perform `delete(5)`, using only

   (a) Right rotation or Left rotation (i.e. single rotations)

   (b) Double right rotation or Double left rotation (i.e. double rotations, which are two single rotations).

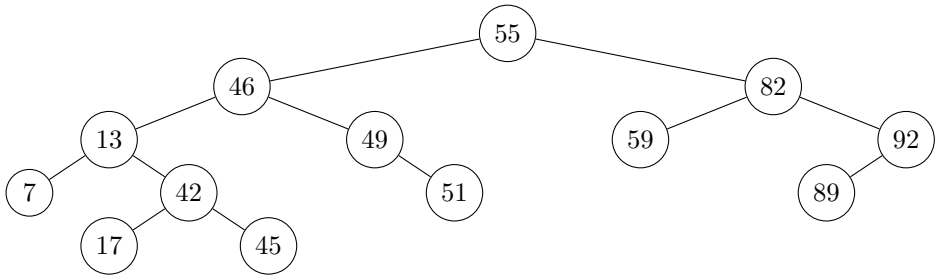


   If you have a choice of which element to move up, pick the inorder successor, which is 7.

2. **AVL (available, automatic vehicle locator, approved vendor list)**
   Consider following tree T

   a) Show that T is an AVL tree by computing the balance factor at each node.

   b) Starting from an empty binary search tree, in what order should we add the integers $7, 13, \ldots, 92$ to obtain the tree below?



3. **Partial Sum**
   Consider the problem where we have a sequence of n elements: $S = a_1, a_2, ..., a_n$, and 3 operations:

   - $Add(S, b) \rightarrow a_1, a_2, ..., a_n, b$
   - $Update(S, i, \Delta) \rightarrow a_1, ..., a_{i-1}, \Delta, a_{i+1}, ..., a_n$
   - $PartialSum(S, k) \rightarrow \sum_{i=1}^{k} a_i$

   Design a data structure that can perform each of these operations in $O(\log n)$ expected time.