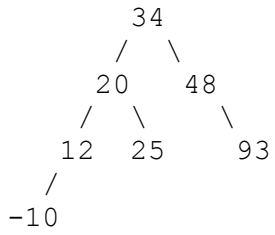
3) (10 pts) ALG (AVL Trees)

List the ranges of all the integer values that would cause a **double** rotation to occur if inserted into the following AVL tree (as opposed to a single rotation or no rotation at all). (For example: "-10 through -5 and any value greater than 93.") You may assume we do not allow the insertion of duplicate values into the tree. **Note: A double rotation can alternately be described as a restructuring where, out of the three nodes that need to move structurally, the new root node was previously two levels below the node that needs to be restructured.) These cases are also called the C-A-B and A-C-B cases.**



Solution:

All values from -9 through 11
All values from 49 through 92

Grading:

First, give +5 for **each** of the two ranges above. (**Note:** We can accept "-10 through 12" and "48 through 93," since the problem specifies that duplicates would not be inserted.)

If a range is given but incomplete by more than an off by one error, award 2 out of 5 points. (Something like -3 to 7.)

If a range is given with an off by one error, take off 1 pt per off by one error on an essentially correct range out of the 5 pts.

If a range is given in addition to correct ranges, subtract 2 pts for an extraneous range being given, capping any score at zero.

So, if no valid ranges are given, then automatically 0 of 10. If one valid range is given in full and two invalid ranges are given, this would be 5 - 2 - 2 = 1 point. If just one valid range is given, that would be 5 points, If one valid range is given with one off by one error, that's 4 points, etc.