AVL-Trees
insert 16, 15, 14, 13, 12, 11, 10, 8, 9

Insert 16.
Check the height of the left and right subtrees of each node on the side of the tree where the new node was inserted.

For any node, do the heights of the subtrees differ by more than 1?
No, so the tree is still an avl tree.

Insert 15.
Check the height of the left and right subtrees of each node on the side of the tree where the new node was inserted.

For any node, do the heights of the subtrees differ by more than 1?
Yes, node 7.

The deepest node in the tree where the heights of the subtrees differ by more than one is node 7.

7 is the α node.

What direction did you move from 7 as you moved toward the place where the new node was inserted (the first two steps from node 7)?

We moved right and then left. Call this RL.

RULES:

LL -- do a single rotation, rotating the α node right

RR -- do a single rotation, rotating the α node left

LR -- do a double rotation, rotating the child of the α node left and then the α node right

RL -- do a double rotation, rotating the child of the α node right and then the α node left
RL -- do a double right-left double rotation

First, first rotate the child of the $\alpha$ node to the right.

Now, rotate the $\alpha$ node to the left.

Tree after inserting 15.
Insert 14.

Check the height of the left and right subtrees of each node on the side of the tree where the new node was inserted.

The $\alpha$ node is 6.

Which direction did you go in the first two steps from the $\alpha$ node as you moved toward the place where the new node was inserted? RL So do a double RL rotation.

First, rotate the child of the $\alpha$ node to the right.

Now, rotate the $\alpha$ node to the left.

Tree after inserting 14.
Insert 13.

Check the height of the left and right subtrees of each node on the side of the tree where the new node was inserted.

The $\alpha$ node is 4.

Which direction did you go in the first two steps from the $\alpha$ node as you moved toward the place where the new node was inserted? RR. A RR move calls for a single left rotation.

Rotate the $\alpha$ node to the left. Notice that the 6 node had to be moved to be the right child of the 4 node.

Tree after inserting 13.

You take it from here, inserting 12, 11, 10, 8, and 9.

Compare with the answers in the book.