AVL Tree Rotations with Examples

Right Rotation (LL Rotation)

Happens when we insert into the **left subtree of the left child.**

Example: Insert `30, 20, 10`

```
Before Rotation (Unbalanced):
      30
     /
   20
  /
10

After Right Rotation:
     20
    /  \
  10    30
```

Fixed balance by rotating right.

Left Rotation (RR Rotation)

Happens when we insert into the **right subtree of the right child.**

Example: Insert `10, 20, 30`

```
Before Rotation (Unbalanced):
   10
     \
      20
        \
         30
```

```
After Left Rotation:
     20
    /  \
  10    30
```

Fixed balance by rotating left.

Left-Right Rotation (LR Rotation)

Happens when we insert into the **right subtree of the left child.**
Fix: First **Left Rotation** on child, then **Right Rotation** on parent.

Example: Insert `30, 10, 20`

```
Before Rotation (Unbalanced):
      30
     /
   10
     \
      20

Step 1 (Left Rotate 10):
      30
     /
    20
   /
 10

Step 2 (Right Rotate 30):
      20
     /  \
   10    30
```

Balanced by LR rotation.

Right-Left Rotation (RL Rotation)

Happens when we insert into the **left subtree of the right child.**
Fix: First **Right Rotation** on child, then **Left Rotation** on parent.

Example: Insert `10, 30, 20`

```
Before Rotation (Unbalanced):
   10
     \
      30
     /
   20

Step 1 (Right Rotate 30):
   10
     \
      20
        \
         30

Step 2 (Left Rotate 10):
      20
     /  \
   10    30
```

Balanced by RL rotation.