ESTRUCTURAS DE DATOS

2024

TRABAJO PRACTICO N°4
AVL

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GONZALO ALEJANDRO ULLOA

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Desarrollo

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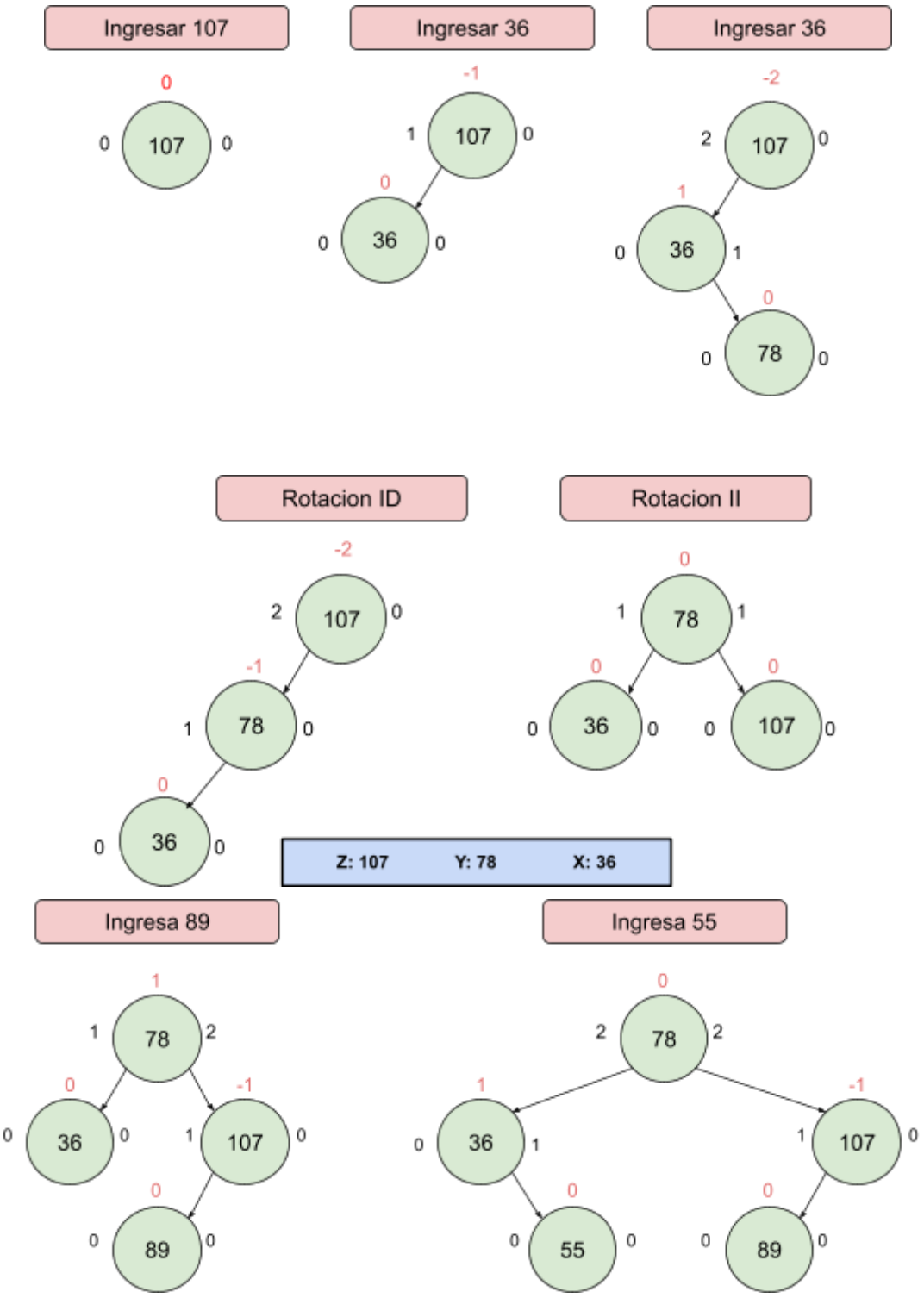
Inserción



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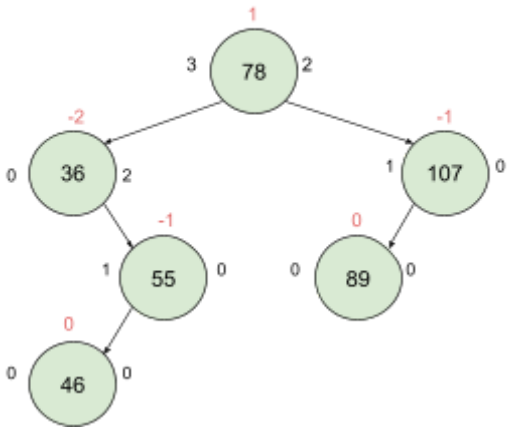

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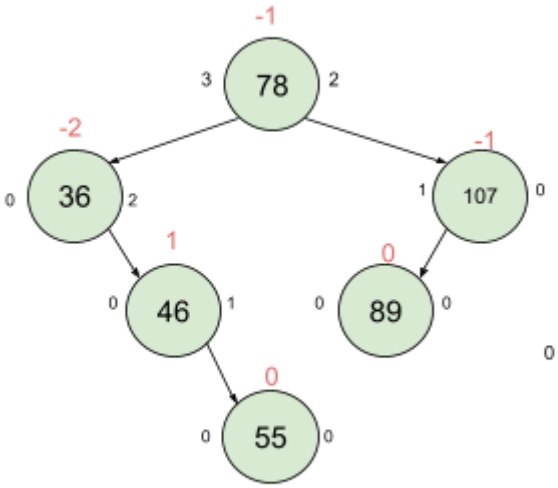

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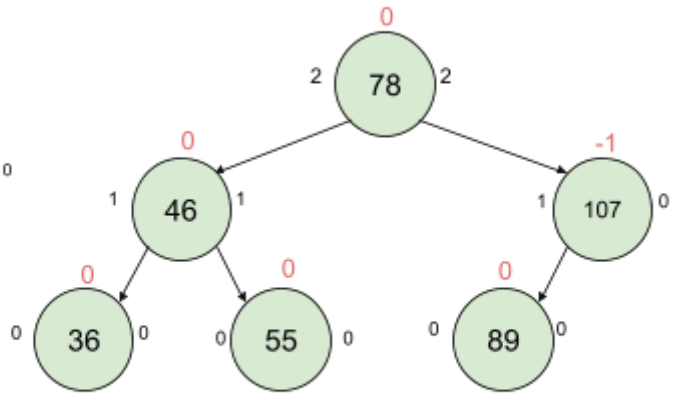
Rotación DD



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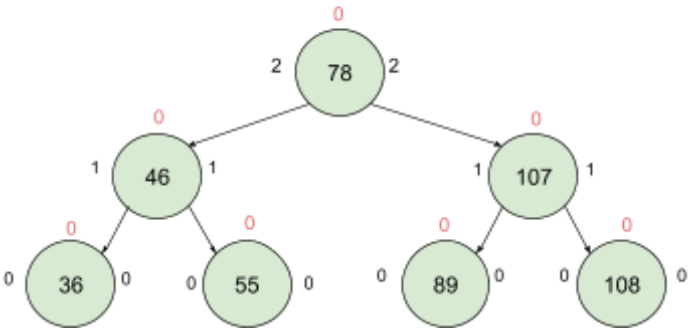

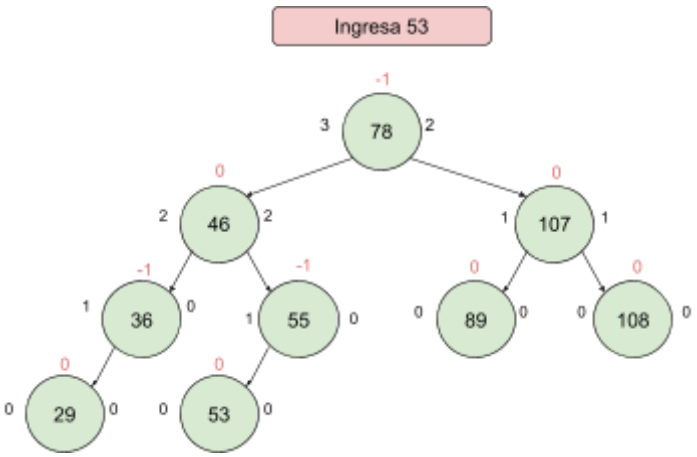
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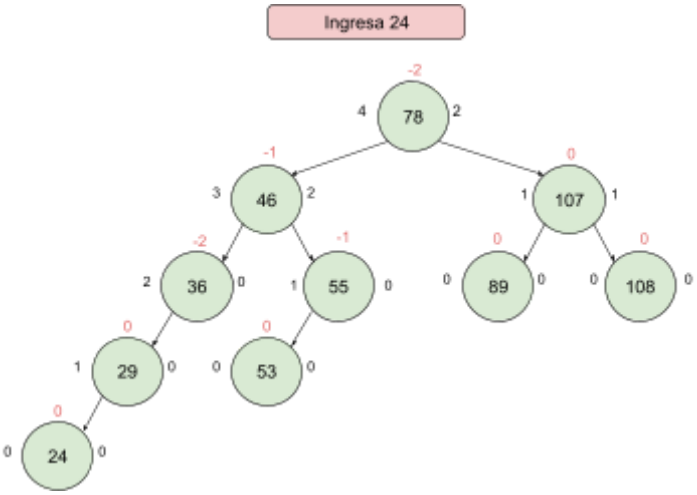
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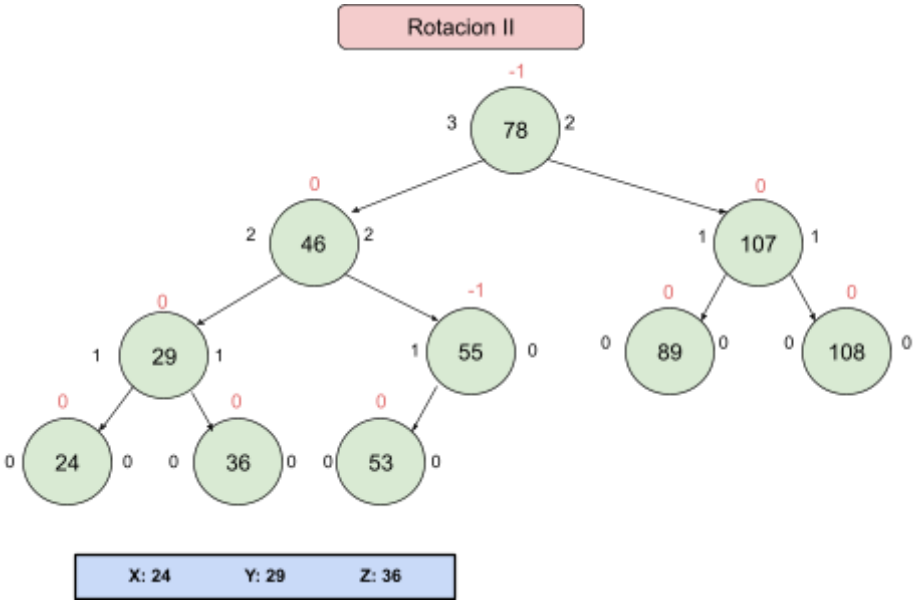
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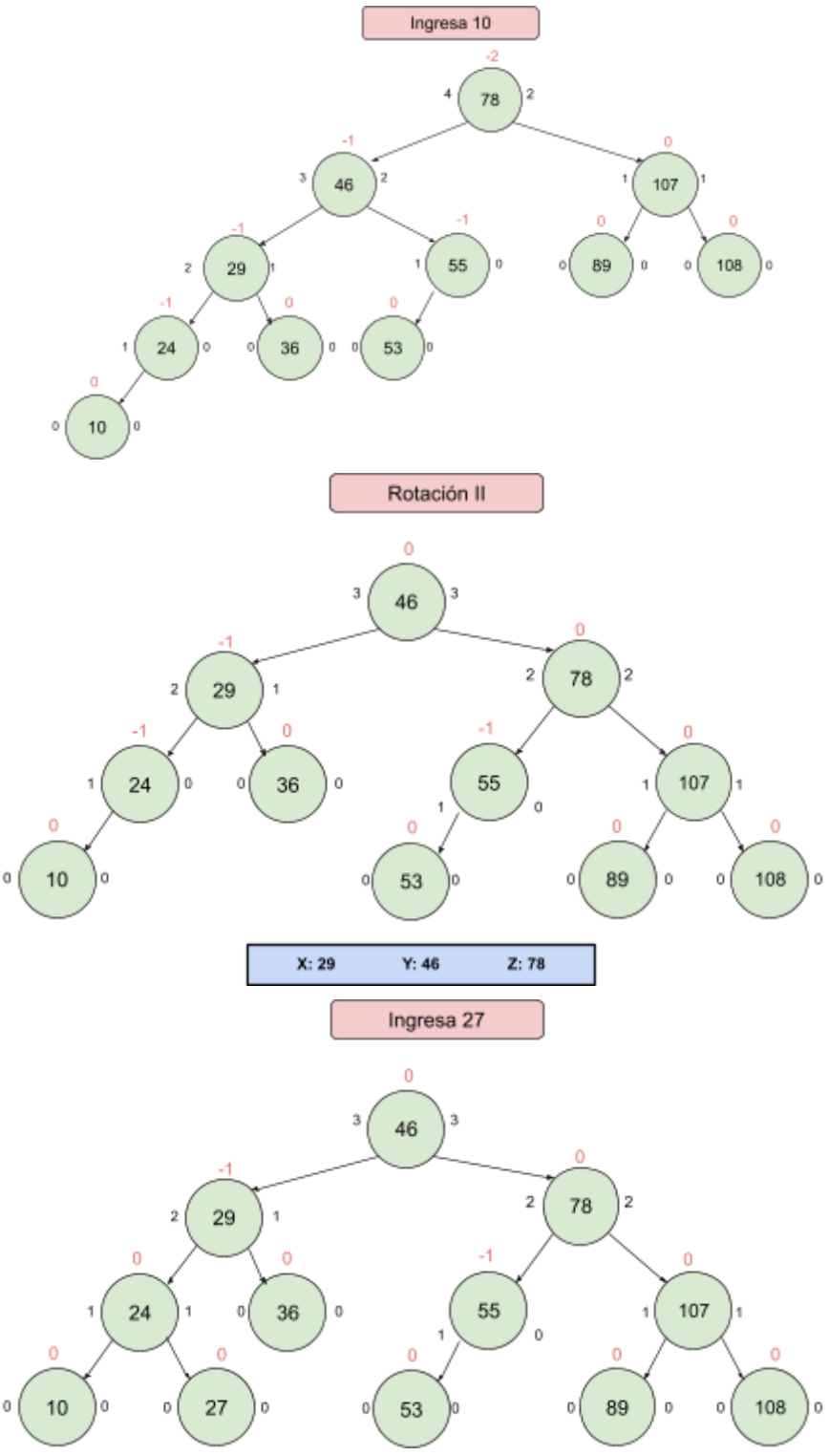
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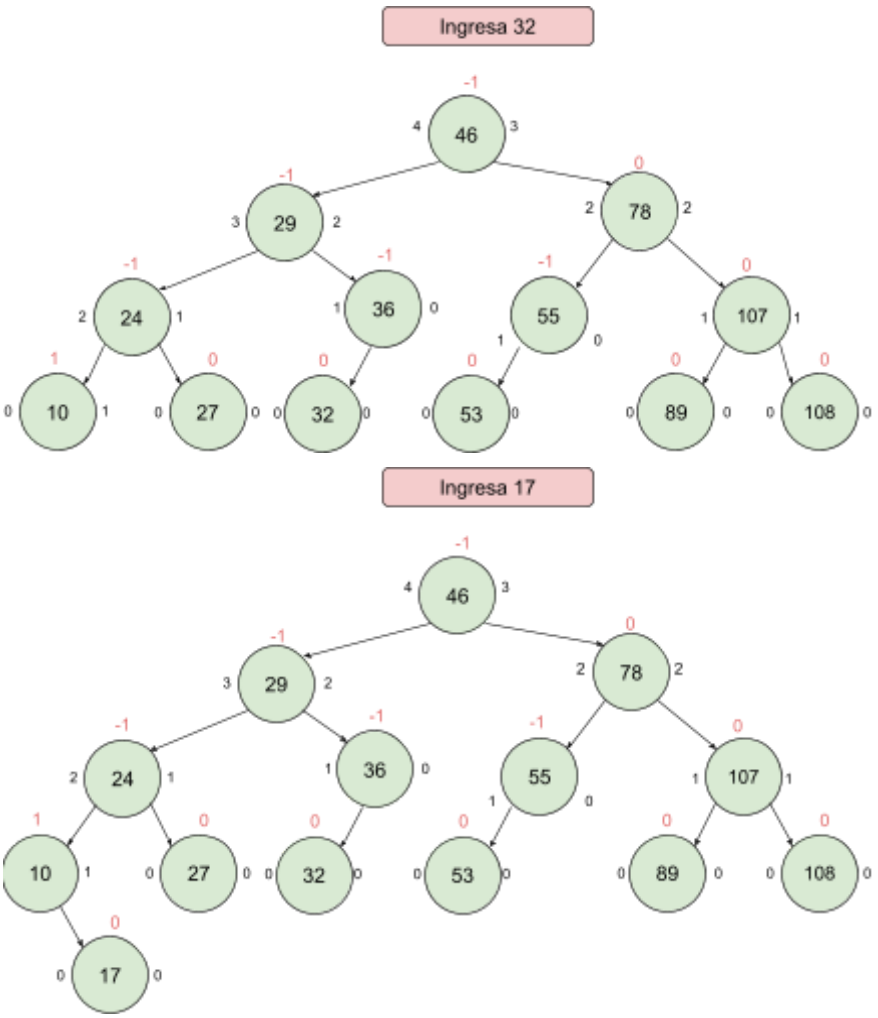
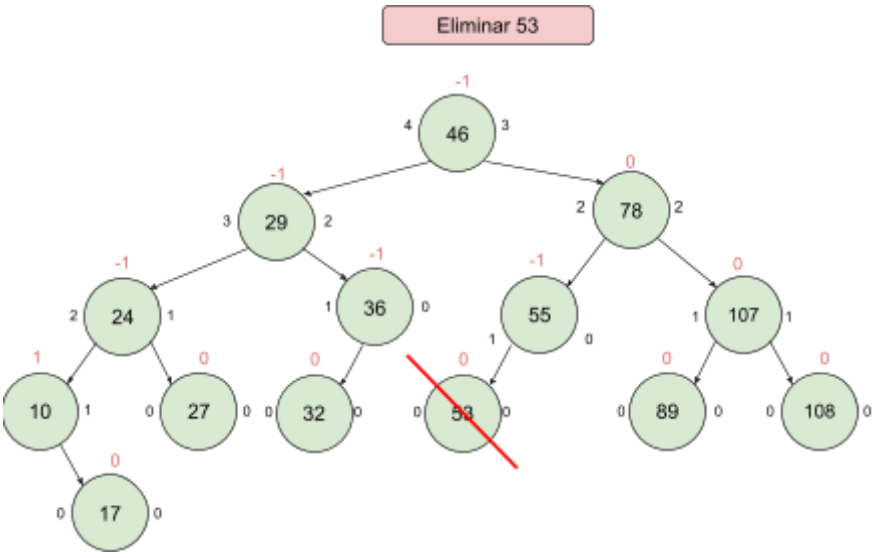
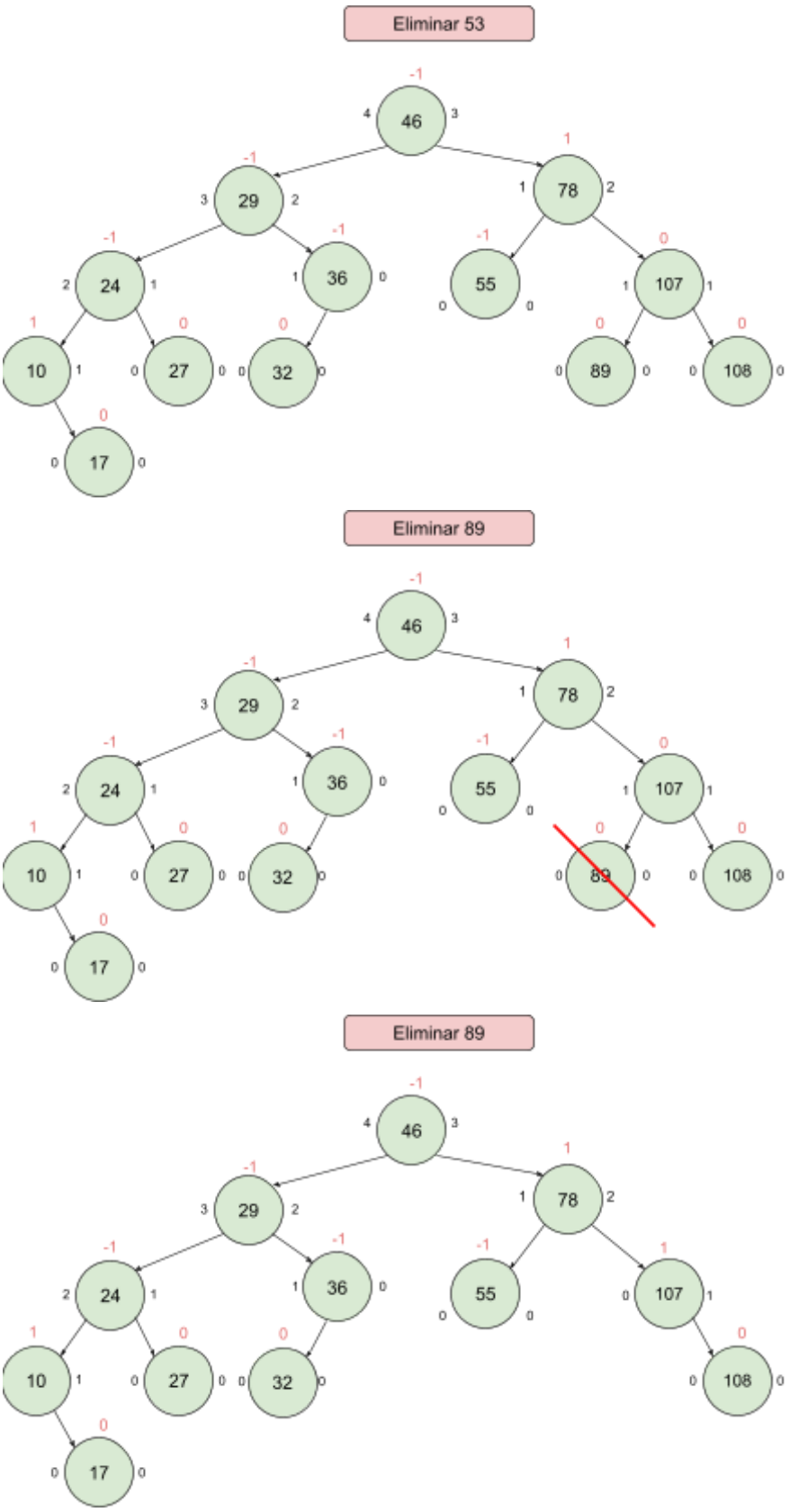


Eliminación

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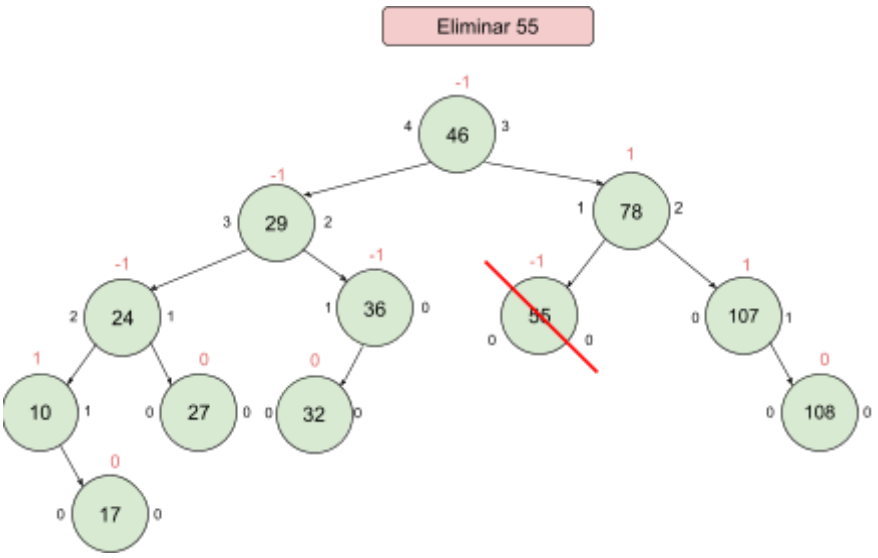
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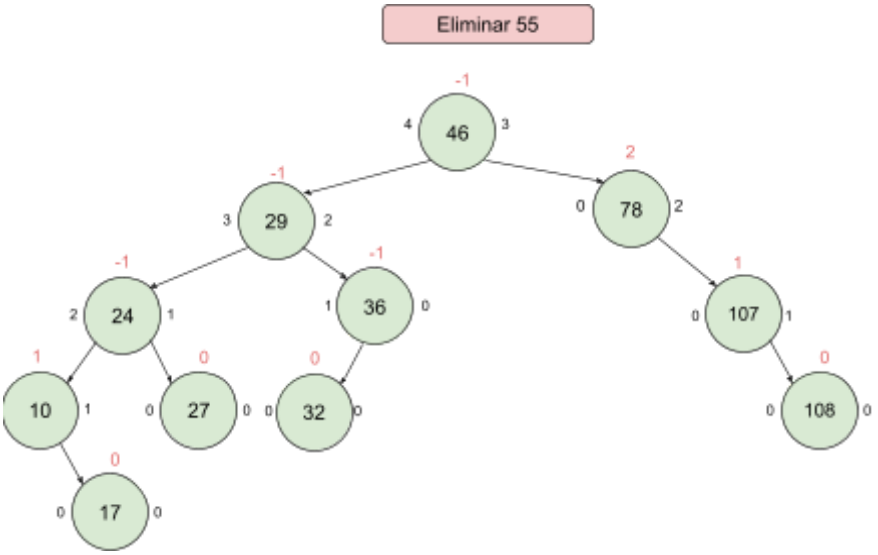
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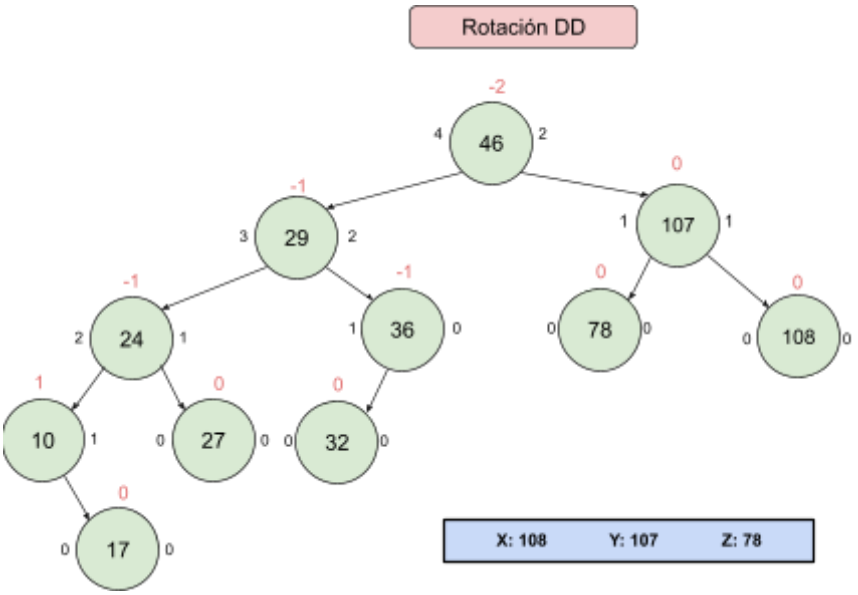
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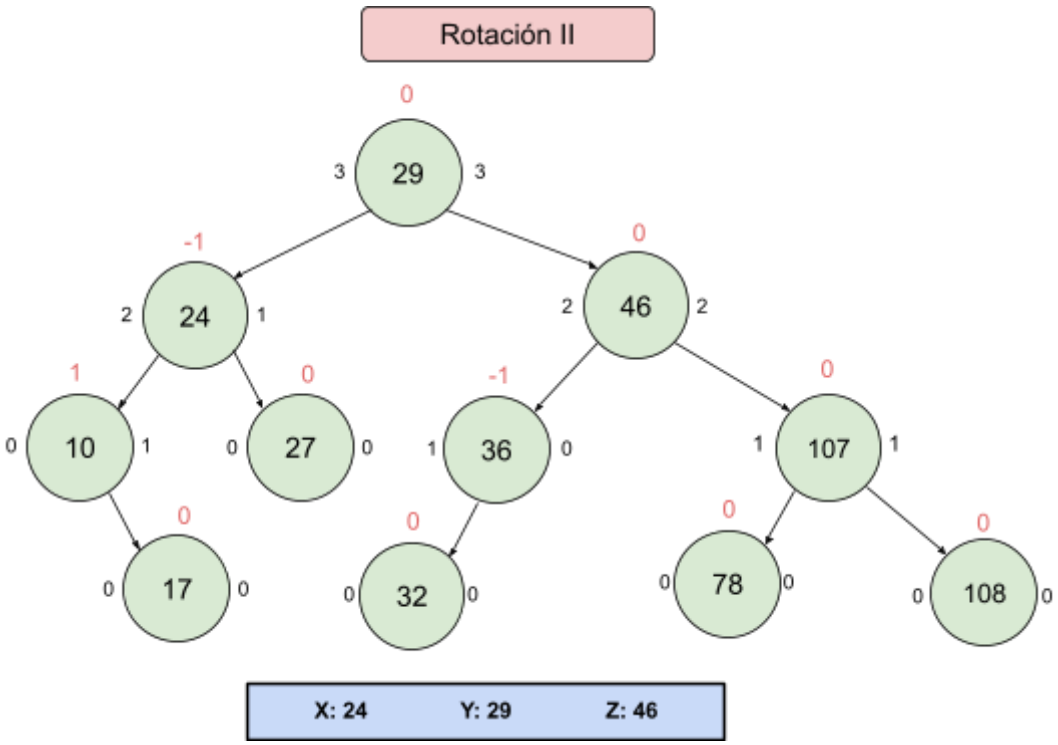
X: 108
Y: 107
Z: 78



5.

Clase Nodo String

```
public class AVLNodeString {
    private String content;
    private byte balance;
    private AVLNodeString left, right;
    public AVLNodeString(String content) {
        this.content = content;
        this.balance = 0;
        this.left = null;
        this.right = null;
    }
    public String getContent() {
        return content;
    }
    public void setContent(String content) {
        this.content = content;
    }
    public byte getBalance() {
        return balance;
    }
```

```
    public void setBalance(int balance) {
        this.balance = (byte) balance;
    }
    public AVLNodeString getLeft() {
        return left;
    }
    public void setLeft(AVLNodeString left) {
        this.left = left;
    }
    public AVLNodeString getRight() {
        return right;
    }
    public void setRight(AVLNodeString right) {
        this.right = right;
    }
}
```

Clase Arbol AVL

```
public class AVLTreeString {
    private AVLNodeString root;
    private boolean grown, shrunk, found;
    public AVLTreeString() {
        root = null;
        grown = false;
        shrunk = false;
        found = false;
    }
    public boolean search(String word) {
        AVLNodeString node = root;
        while (node != null) {
            int comparison = word.compareTo(node.getContent());
            if (comparison == 0) {
                return true;
            }
            if (comparison < 0) {
                node = node.getLeft();
            } else {
                node = node.getRight();
            }
```

```
        }
        return false;
    }
    public boolean insert(String word) {
        found = false;
        grown = true;
        root = insert(root, word);
        return !found;
    }
    private AVLNodeString insert(AVLNodeString node, String word)
{
        if (node == null) {
            return new AVLNodeString(word);
        }
        int comparison = word.compareTo(node.getContent());
        if (comparison == 0) {
            found = true;
            grown = false;
        } else if (comparison < 0) {
            node.setLeft(insert(node.getLeft(), word));
            if (grown) node.setBalance(node.getBalance() - 1);
        } else {
            node.setRight(insert(node.getRight(), word));
            if (grown) node.setBalance(node.getBalance() + 1);
        }
        return balanceNode(node);
    }
    private AVLNodeString balanceNode(AVLNodeString node) {
        switch (node.getBalance()) {
            case -2:
                if (node.getLeft().getBalance() == 1)
rotateLeft(node.getLeft());
                node = rotateRight(node);
                grown = false;
                break;
            case -1:
                break;
            case 0:
                grown = false;
                break;
            case 1:
```

```
                break;
            case 2:
                if (node.getRight().getBalance() == -1)
rotateRight(node.getRight());
                node = rotateLeft(node);
                grown = false;
                break;
            default:
                balanceError(node);
                break;
        }
        return node;
    }
    private void balanceError(AVLNodeString node) {
        System.out.println("Error en el valor de equilibrio: " +
node.getBalance() + " y en el contenido: " + node.getContent());
    }
    private AVLNodeString rotateRight(AVLNodeString node) {
        AVLNodeString leftNode = node.getLeft();
        node.setLeft(leftNode.getRight());
        leftNode.setRight(node);

        node.setBalance(node.getBalance() + 1 -
Math.min(leftNode.getBalance(), 0));
        leftNode.setBalance(leftNode.getBalance() + 1 +
Math.max(node.getBalance(), 0));

        return leftNode;
    }
    private AVLNodeString rotateLeft(AVLNodeString node) {
        AVLNodeString rightNode = node.getRight();
        node.setRight(rightNode.getLeft());
        rightNode.setLeft(node);

        node.setBalance(node.getBalance() - 1 -
Math.max(rightNode.getBalance(), 0));
        rightNode.setBalance(rightNode.getBalance() - 1 +
Math.min(node.getBalance(), 0));

        return rightNode;
    }
```

```
    public boolean delete(String word) {
        found = true;
        shrunk = true;
        root = delete(root, word);
        return found;
    }
    private AVLNodeString delete(AVLNodeString node, String word)
{
        if (node == null) {
            found = false;
            shrunk = false;
            return null;
        }
        int comparison = word.compareTo(node.getContent());
        if (comparison == 0) {
            if (node.getLeft() == null) {
                return node.getRight();
            }
            if (node.getRight() == null) {
                return node.getLeft();
            }
            String minValue = minValue(node.getRight());
            node.setContent(minValue);
            node.setRight(delete(node.getRight(), minValue));
            if (shrunk) node.setBalance(node.getBalance() - 1);
        } else if (comparison < 0) {
            node.setLeft(delete(node.getLeft(), word));
            if (shrunk) node.setBalance(node.getBalance() + 1);
        } else {
            node.setRight(delete(node.getRight(), word));
            if (shrunk) node.setBalance(node.getBalance() - 1);
        }
        return balanceNodeAfterDeletion(node);
    }
    private AVLNodeString balanceNodeAfterDeletion(AVLNodeString
node) {
        switch (node.getBalance()) {
            case -2:
                if (node.getLeft().getBalance() == 1)
rotateLeft(node.getLeft());
                node = rotateRight(node);
```

```
                break;
            case -1:
                shrunk = false;
                break;
            case 0:
                break;
            case 1:
                shrunk = false;
                break;
            case 2:
                if (node.getRight().getBalance() == -1)
rotateRight(node.getRight());
                node = rotateLeft(node);
                break;
            default:
                balanceError(node);
                break;
        }
        return node;
    }
    private String minValue(AVLNodeString node) {
        while (node.getLeft() != null) {
            node = node.getLeft();
        }
        return node.getContent();
    }
    public int height() {
        return height(root);
    }
    private int height(AVLNodeString node) {
        if (node == null) {
            return 0;
        }
        return 1 + Math.max(height(node.getLeft()),
height(node.getRight()));
    }
    public int internal() {
        return internal(root, 0);
    }
    private int internal(AVLNodeString node, int height) {
        if (node == null) {
```

```
            return 0;
        }
        return height + internal(node.getLeft(), height + 1) +
internal(node.getRight(), height + 1);
    }
}
```

Main

```
class Main2{
    public static void main(String[] args) {
        AVLTreeString avl= new AVLTreeString();
        avl.insert("RIO");
        avl.insert("Rio");
        avl.insert("rio");
        System.out.println("Esta 'rio': "+avl.search("rio"));
        System.out.println("Esta 'RIO': "+avl.search("rio"));
        System.out.println("Esta 'Rio': "+avl.search("rio"));
        System.out.println("\nBorrando rio y Rio");
        avl.delete("rio");
        avl.delete("Rio");
        System.out.println("Esta 'rio': "+avl.search("rio"));
        System.out.println("Esta 'RIO': "+avl.search("RIO"));
        System.out.println("Esta 'Rio': "+avl.search("Rio"));
    }
}
```

Resultado de consola.

```
'Main2'
Esta 'rio': true
Esta 'RIO': true
Esta 'Rio': true

Borrando rio y Rio
Esta 'rio': false
Esta 'RIO': true
Esta 'Rio': false
PS C:\Users\GonzaloUlloa\Desktop\gon\EDA>
```