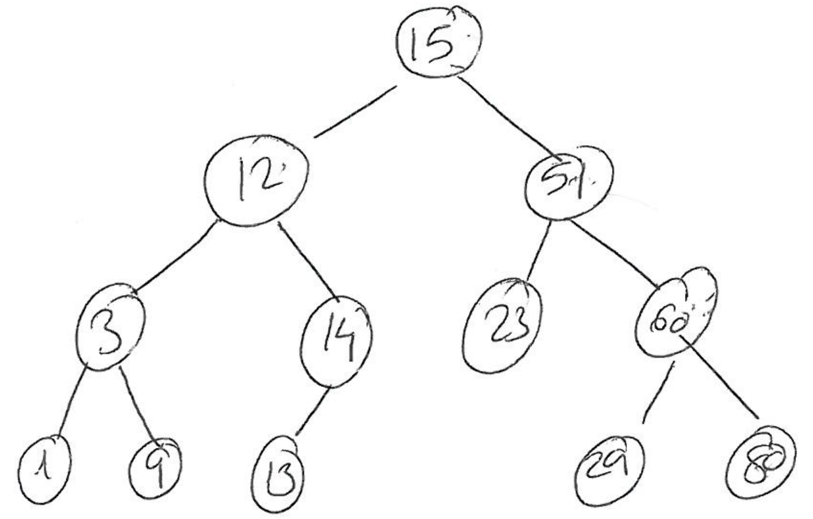
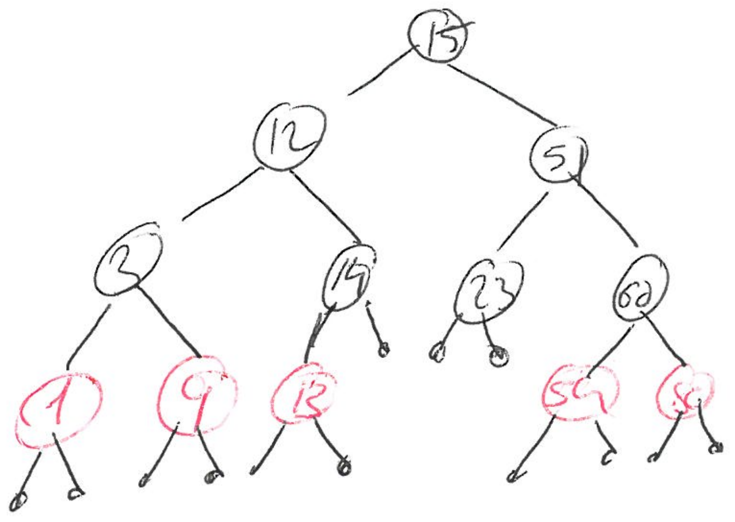
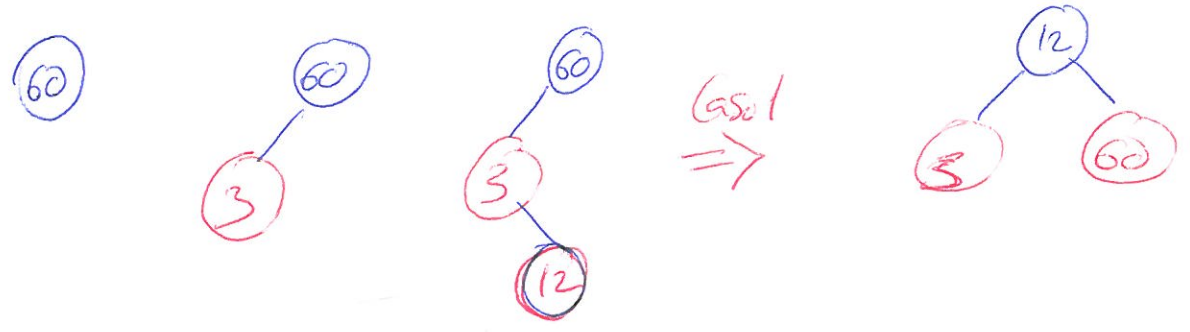
ercici 1a.

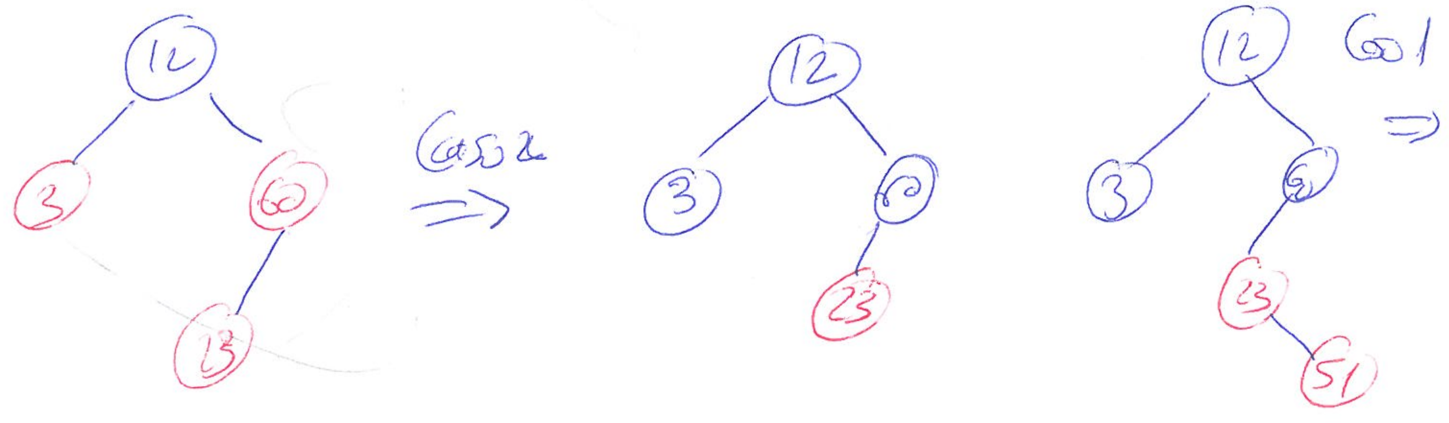
AVL

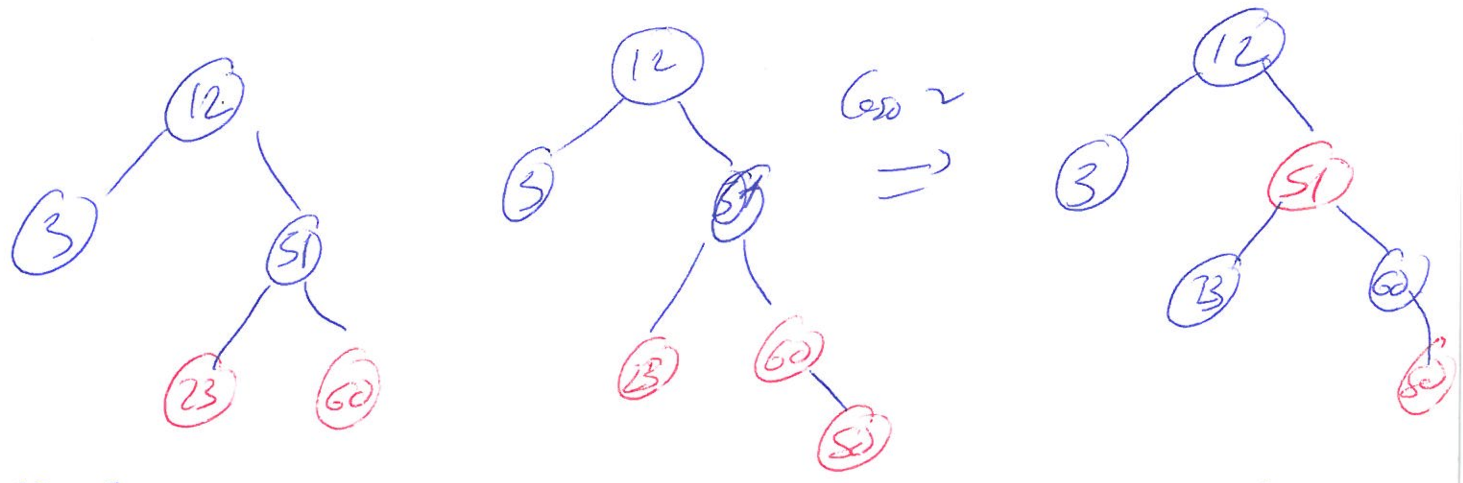


RN









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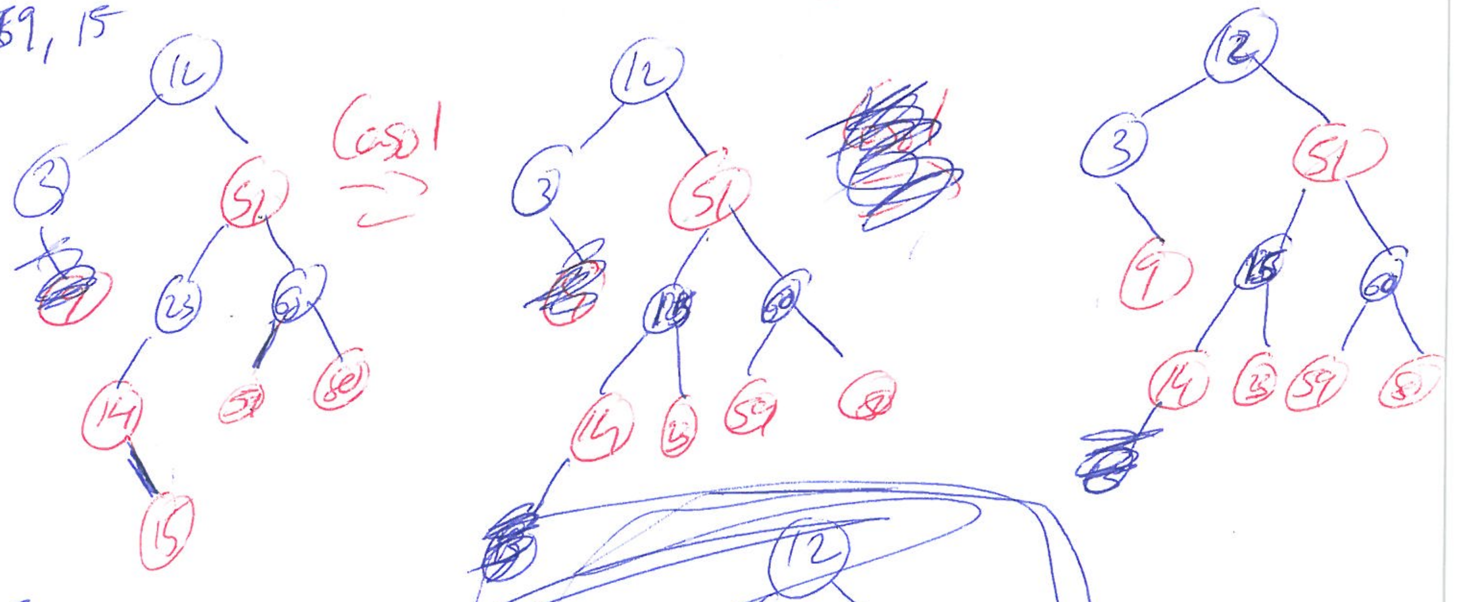
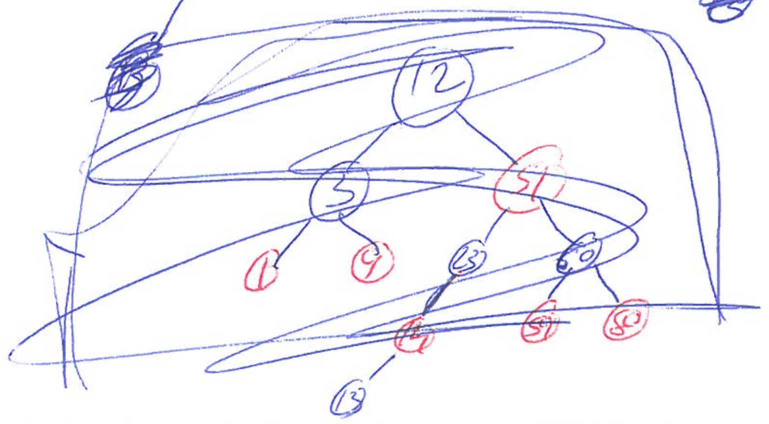
$\Rightarrow$

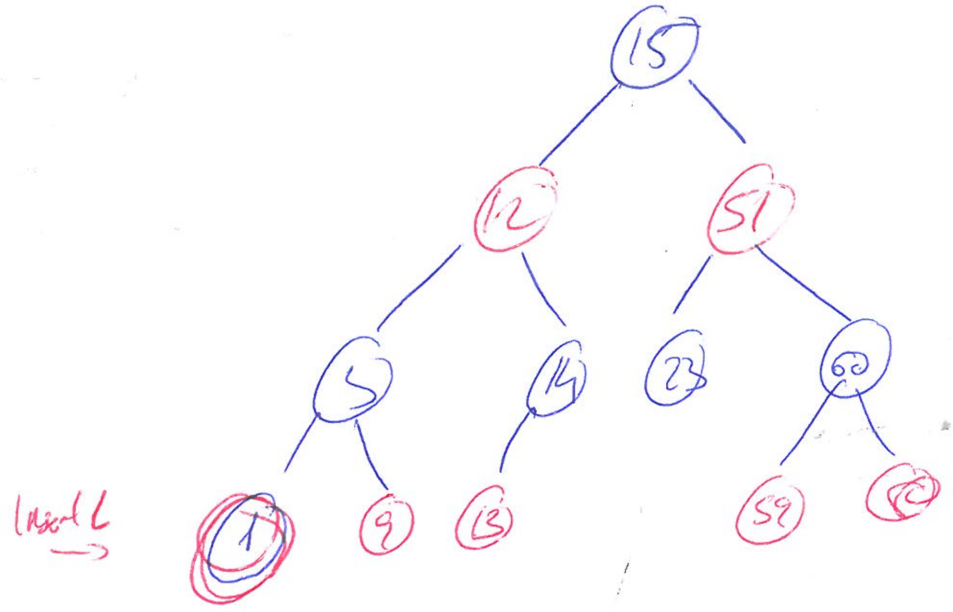


13

$\Rightarrow$

Caso 2

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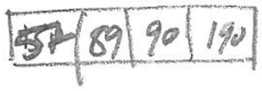
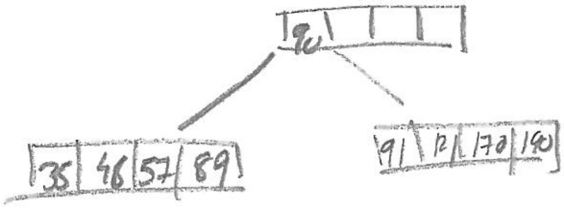

57 89 90 190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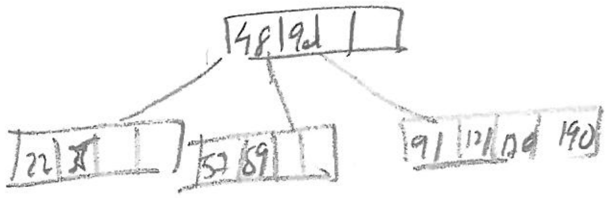
48 90
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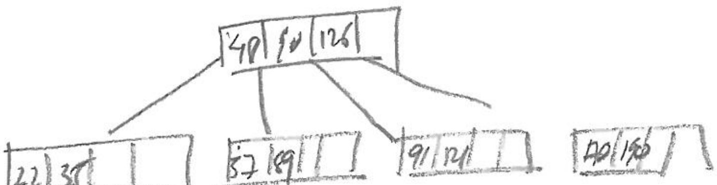
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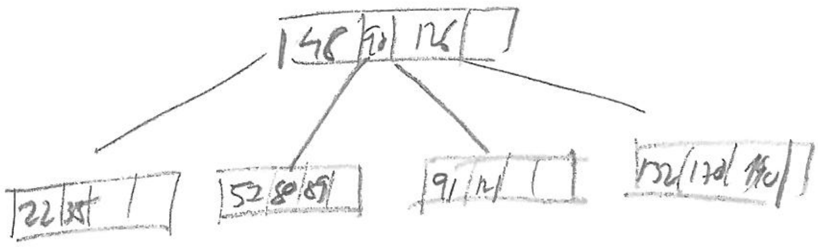
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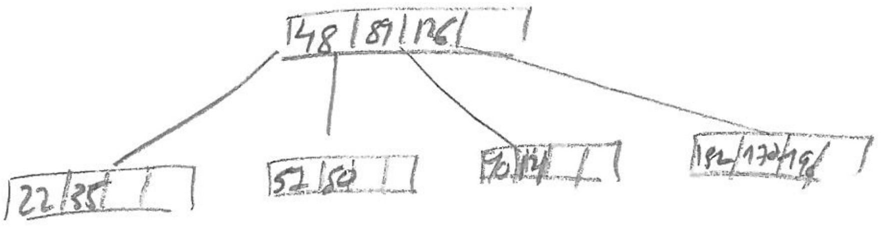
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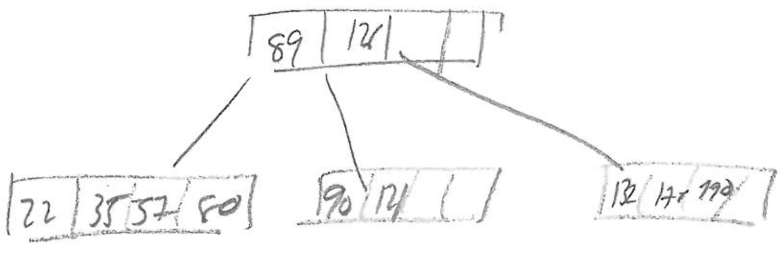
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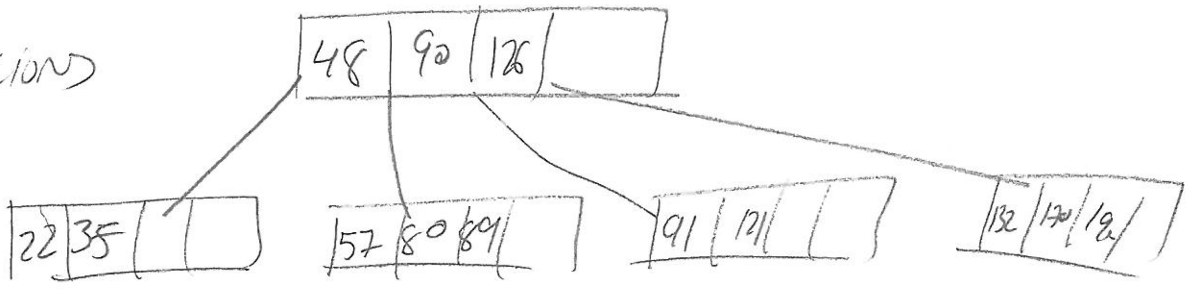
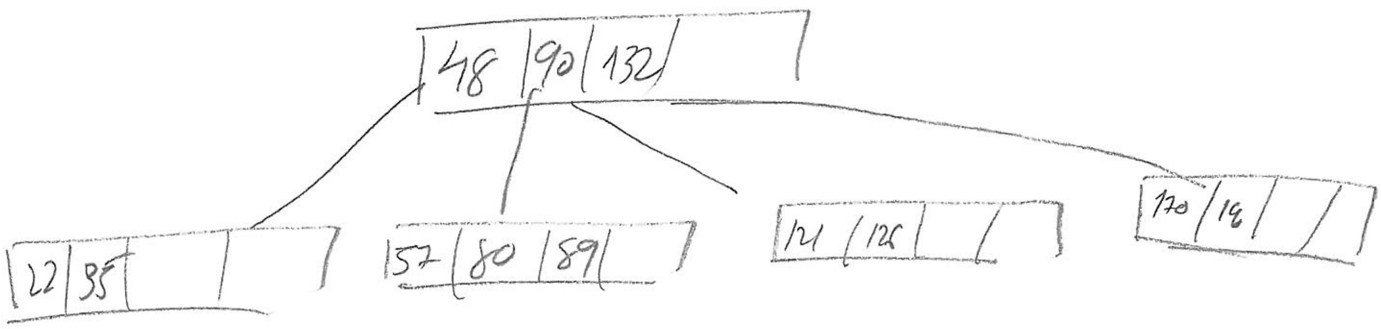
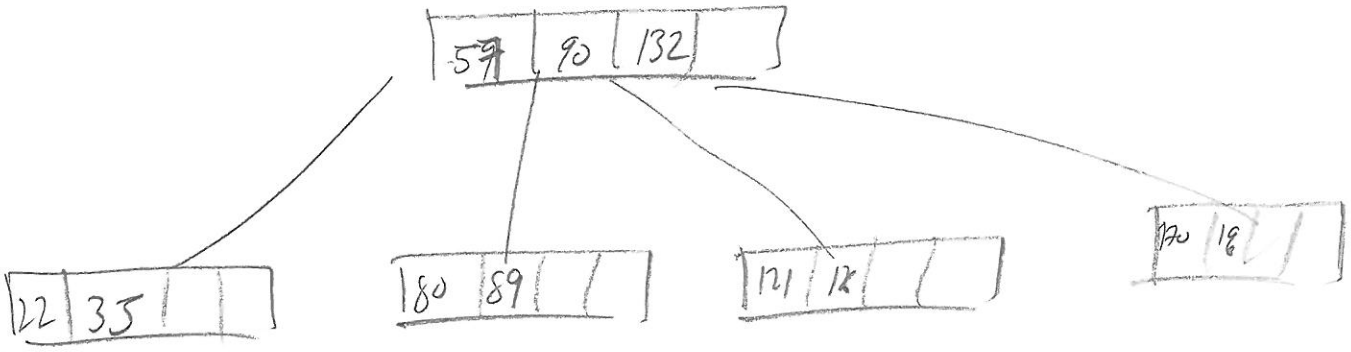
Insercions



Eliminar 91



Eliminar 48



```java
/*
 * To change this license header, choose License Headers in Project
     Properties.
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 * and open the template in the editor.
 */
package examen;

import java.util.Iterator;
import material.tree.Position;
import material.tree.Tree;
import material.tree.iterator.TreeIteratorFactory;

/**
 *
 * @author jesussanchezoro
 */
public class InternalNodeIteratorFactory<E> implements TreeIteratorFactory<E>
    {

    @Override
    public Iterator<Position<E>> createIterator(Tree<E> tree) {
        return new InternalNodeIterator<>(tree);
    }

    @Override
    public Iterator<Position<E>> createIterator(Tree<E> tree, Position<E> pos)
        {
        return new InternalNodeIterator<>(tree, pos);
    }

}
```

```java
/*
 * To change this license header, choose License Headers in Project
     Properties.
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 * and open the template in the editor.
 */
package examen;

import java.util.ArrayDeque;
import java.util.Iterator;
import java.util.Queue;
import material.tree.Position;
import material.tree.Tree;

/**
 *
 * @author jesussanchezoro
 */
public class InternalNodeIterator<E> implements Iterator<Position<E>> {

    private final Queue<Position<E>> nodeQueue;
    private final Tree<E> tree;

    public InternalNodeIterator(Tree<E> tree) {
        nodeQueue = new ArrayDeque<>();
        this.tree = tree;
        Position<E> root = tree.root();
        if (tree.isInternal(root)) {
            nodeQueue.add(root);
        }
    }

    public InternalNodeIterator(Tree<E> tree, Position<E> pos) {
        nodeQueue = new ArrayDeque<>();
        this.tree = tree;
        if (tree.isInternal(pos)) {
            nodeQueue.add(pos);
        }
    }

    @Override
    public boolean hasNext() {
        return !nodeQueue.isEmpty();
    }

    @Override
    public Position<E> next() {
        Position<E> next = nodeQueue.poll();
        for (Position<E> child : tree.children(next)) {
            if (tree.isInternal(child)) {
                nodeQueue.add(child);
            }
        }
        return next;
    }



}
```

```java
/*
 * To change this license header, choose License Headers in Project
     Properties.
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 */
package examen;

import java.util.Iterator;
import material.tree.Position;
import material.tree.binarytree.BinaryTree;
import material.tree.binarytree.LinkedBinaryTree;

/**
 *
 * @author jesussanchezoro
 */
public class Ejercicio2<E> {

    public boolean isPerfect(BinaryTree<E> t) {
        Iterator<Position<E>> it = t.iterator();
        while (it.hasNext()) {
            Position<E> p = it.next();
            if (t.isInternal(p) && (!t.hasLeft(p) || !t.hasRight(p))) {
                return false;
            }
        }
        return true;
    }

    public boolean isOdd(BinaryTree<E> t) {
        if (t.isEmpty() || (t.size() == 1)) {
            return true;
        }
        int descendants = isOddRec(t, t.root());
        return descendants >= 0;
    }

    private int isOddRec(BinaryTree<E> t, Position<E> pos) {
        int left = t.hasLeft(pos)?isOddRec(t, t.left(pos)):0;
        if (left < 0) {
            return -1;
        }
        int right = t.hasRight(pos)?isOddRec(t, t.right(pos)):0;
        if (right < 0) {
            return -1;
        }
        if ((left < 0) || (right < 0) || (left < ((left+right)/2)) ) {
            return -1;
        } else {
            return left+right+1;
        }
    }

    public static void main(String[] args) {
        Ejercicio2<Integer> ej2 = new Ejercicio2<>();
        BinaryTree<Integer> t = new LinkedBinaryTree<>();
        Position<Integer> pos1 = t.addRoot(1);
        Position<Integer> pos2 = t.insertLeft(pos1, 2);
        Position<Integer> pos3 = t.insertRight(pos1, 3);
        Position<Integer> pos4 = t.insertLeft(pos2, 4);
        Position<Integer> pos5 = t.insertRight(pos2, 5);

        System.out.println(ej2.isPerfect(t));

        BinaryTree<Integer> t2 = new LinkedBinaryTree<>();
        Position<Integer> pos6 = t2.addRoot(6);
        Position<Integer> pos7 = t2.insertLeft(pos6, 7);
        Position<Integer> pos8 = t2.insertRight(pos6, 8);
        Position<Integer> pos9 = t2.insertLeft(pos7, 9);
        Position<Integer> pos10 = t2.insertLeft(pos9, 10);

        System.out.println(ej2.isOdd(t2));
    }
}
```

```java
/*
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 * and open the template in the editor.
 */
package examen.ejercicio3;

/**
 *
 * @author jesussanchezoro
 */
public class Main {

    public static void main(String[] args) {
        URJCInvest invest = new URJCInvest();
        OrganizationChart urjc = new OrganizationChart("URJC");
        Employee fs = new Employee("URJC", "Fernando Su·rez", "Dean", "");
        Employee ad = new Employee("URJC", "Abraham Duarte", "Full professor",
            "");
        Employee as = new Employee("URJC", "Antonio Sanz", "Full professor",
            "");
        Employee js = new Employee("URJC", "Jes˙s S·nchez-Oro", "Associate
            professor", "");
        Employee dc = new Employee("URJC", "David Concha", "Associate
            professor", "");
        urjc.addEmployee(null, fs);
        urjc.addEmployee("Fernando Su·rez", ad);
        urjc.addEmployee("Fernando Su·rez", as);
        urjc.addEmployee("Abraham Duarte", js);
        urjc.addEmployee("Antonio Sanz", dc);
        invest.addCompany(urjc);

        System.out.println("JEFES DE JESUS");
        for (Employee emp : invest.getChiefs("URJC", "Jes˙s S·nchez-Oro")) {
            System.out.println(emp);
        }
        System.out.println("JEFES DE ANTONIO");
        for (Employee emp : invest.getChiefs("URJC", "Antonio Sanz")) {
            System.out.println(emp);
        }
        System.out.println("JEFES DE FERNANDO");
        for (Employee emp : invest.getChiefs("URJC", "Fernando Su·rez")) {
            System.out.println(emp);
        }

        System.out.println("BECARIOS URJC");
        for (Employee emp : invest.getGrantHolders("URJC")) {
            System.out.println(emp);
        }

        System.out.println("FULL PROFESSORS");
        for (Employee emp : invest.getEmployees("Full professor")) {
            System.out.println(emp);
        }
        System.out.println("ASSOCIATE PROFESSORS");
        for (Employee emp : invest.getEmployees("Associate professor")) {
            System.out.println(emp);
        }
        System.out.println("DEANS");
        for (Employee emp : invest.getEmployees("Dean")) {
            System.out.println(emp);
        }
    }
}
```

```java
/*
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 */
package examen.ejercicio3;

import java.util.ArrayList;
import java.util.List;
import material.maps.HashTableMapLP;
import material.maps.Map;

/**
 *
 * @author jesussanchezoro
 */
public class URJCInvest {

    private Map<String, OrganizationChart> companies;

    public URJCInvest() {
        companies = new HashTableMapLP<>();
    }

    public void addCompany(OrganizationChart company) {
        companies.put(company.getName(), company);
    }

    public OrganizationChart searchCompany(String name) throws
        IllegalStateException {
        OrganizationChart company = companies.get(name);
        if (company == null) {
            throw new IllegalStateException("The company does not belong to
                URJCInvest group");
        }
        return company;
    }

    public Iterable<Employee> getGrantHolders(String companyName) throws
        IllegalStateException {
        OrganizationChart company = searchCompany(companyName);
        return company.getGrantHolders();
    }

    public Iterable<Employee> getChiefs(String companyName, String employee)
        throws IllegalStateException {
        OrganizationChart company = searchCompany(companyName);
        return company.getChiefs(employee);
    }

    public Iterable<Employee> getEmployees(String position) {
        List<Employee> empWithPos = new ArrayList<>();
        for (OrganizationChart chart : companies.values()) {
            empWithPos.addAll(chart.getEmployees(position));
        }
        return empWithPos;
    }
}
```

```java
/*
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     Properties.
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 * and open the template in the editor.
 */
package examen.ejercicio3;

/**
 *
 * @author jesussanchezoro
 */
public class Employee {
    private String company;
    private String name;
    private String position;
    private String description;

    public Employee(String company, String name, String position, String
        description) {
        this.company = company;
        this.name = name;
        this.position = position;
        this.description = description;
    }

    public String getCompany() {
        return company;
    }

    public String getDescription() {
        return description;
    }

    public String getName() {
        return name;
    }

    public String getPosition() {
        return position;
    }

    @Override
    public String toString() {
        return name+" ("+position+" at "+company+")";
    }


}
```

```java
/*
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     Properties.
 * To change this template file, choose Tools | Templates
 * and open the template in the editor.
 */
package examen.ejercicio3;

import java.util.ArrayList;
import java.util.List;
import material.tree.LinkedTree;
import material.tree.Position;

/**
 *
 * @author jesussanchezoro
 */
public class OrganizationChart {

    private LinkedTree<Employee> chart;
    private String name;

    public OrganizationChart(String name) {
        this.name = name;
        chart = new LinkedTree<>();
    }

    public String getName() {
        return name;
    }

    public void addEmployee(String parent, Employee e) {
        if (parent == null) {
            chart.addRoot(e);
        } else {
            chart.add(e, findEmployee(parent));
        }
    }

    public Iterable<Employee> getGrantHolders() {
        List<Employee> grantHolders = new ArrayList<>();
        for (Position<Employee> emp : chart) {
            if (chart.isLeaf(emp)) {
                grantHolders.add(emp.getElement());
            }
        }
        return grantHolders;
    }

    private Position<Employee> findEmployee(String name) throws
        IllegalStateException {
        for (Position<Employee> emp : chart) {
            if (emp.getElement().getName().equalsIgnoreCase(name)) {
                return emp;
            }
        }
        throw new IllegalStateException("The employee "+name+" does not belong
            to the company");
    }
    public Iterable<Employee> getChiefs(String employee) throws
        IllegalStateException {
        List<Employee> chiefs = new ArrayList<>();
        Position<Employee> emp = findEmployee(employee);
        if (!chart.isRoot(emp)) {
            while (!chart.isRoot(emp)) {
                chiefs.add(chart.parent(emp).getElement());
                emp = chart.parent(emp);
            }
        }
        return chiefs;
    }

    public List<Employee> getEmployees(String position) {
        List<Employee> empWithPos = new ArrayList<>();
        getEmployeesRec(chart.root(), position, empWithPos);
        return empWithPos;
    }

    private void getEmployeesRec(Position<Employee> node, String position,
        List<Employee> empWithPos) {
        if (node.getElement().getPosition().equalsIgnoreCase(position)) {
            empWithPos.add(node.getElement());
        } else {
            for (Position<Employee> child : chart.children(node)) {
                getEmployeesRec(child, position, empWithPos);
            }
        }
    }
}
```