POO - Labo 7

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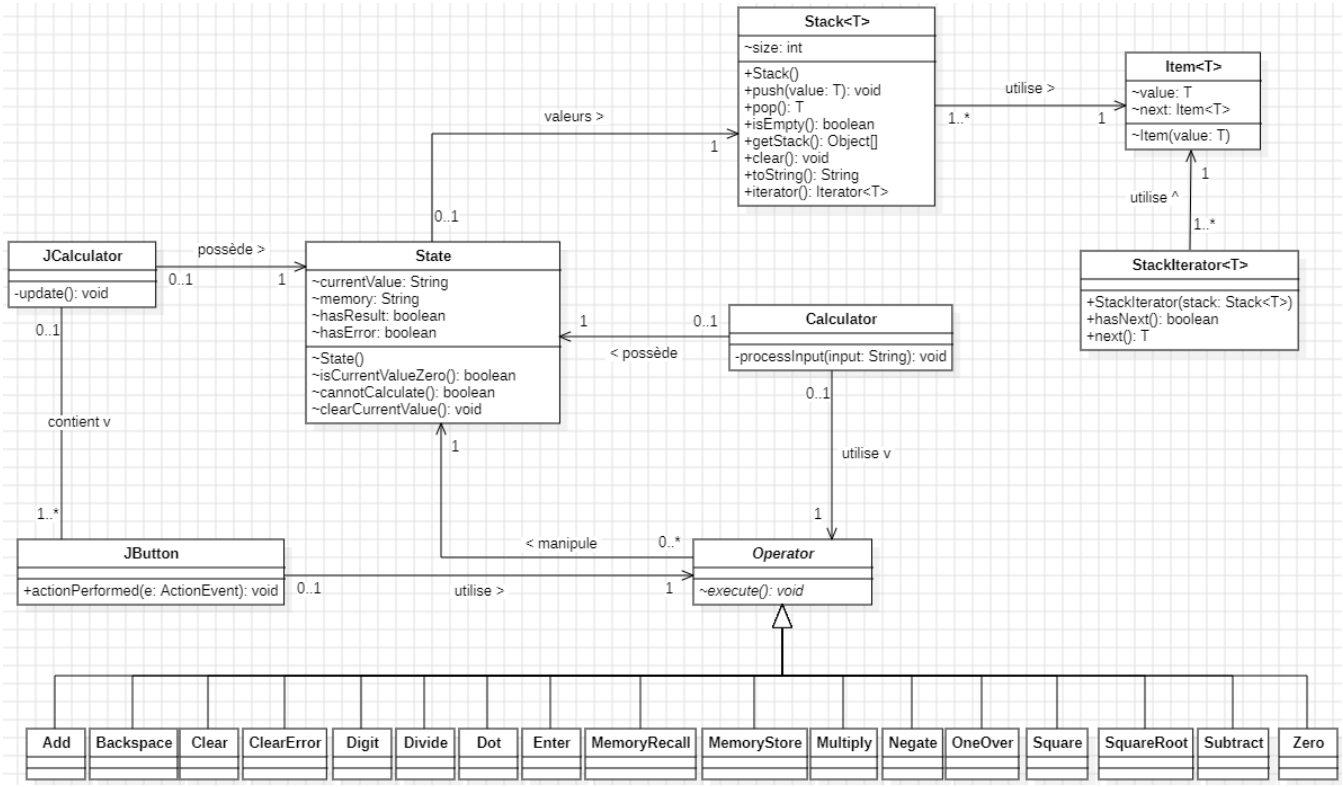
Diagramme de classes



Choix de conception

Classe `Operator`

Conformément au diagramme de classes fourni, nous avons ajouté un attribut `state` à la classe `Operator` afin de connaître l'état de la calculatrice à chaque opération. Pour chaque opération, nous avons créé une classe qui hérite de
la classe `Operator` et qui permet de définir le comportement de l'opération.

Classe `State`

La classe `State` représente l'état actuel de la calculatrice. Elle contient la stack, la valeur courrante, la valeur en mémoire ainsi que deux variables booléennes qui permettent de savoir si l'opération précédente donnait un résultat ou
s'il y a eu une erreur. À noter que nous travaillons avec des `String` pour la stack et la valeur courrante afin de faciliter la gestion de l'affichage. D'autre part, la classe ainsi que ses attributs et méthodes ont une visibilité package pour permettre aux classes du package `calculator` d'y accéder. Cela a du sens, car la classe `State` est le cœur de la calculatrice et il est donc logique que les classes du package `calculator` puissent y accéder.

Tests effectués

- Exemple fourni au point 2
- Opération sur une stack vide : rien ne se passe
- Opération sur une stack non vide : l'opération est effectuée sur la valeur courante et l'élément en haut de la stack
- One Over : la valeur courante est inversée, si elle est égale à zéro, un message d'erreur s'affiche
- Square : la valeur courante est élevée au carré
- Square root d'un nombre positif : la racine carrée est calculée
- Square root d'un nombre négatif : un message d'erreur s'affiche
- Memory Store : la valeur courante est stockée dans la mémoire et la valeur courante est remise à zéro
- Memory Recall : la valeur en mémoire devient la valeur courante et si la valeur précédente était un résultat, celle-ci est ajoutée à la stack
- Clear : la stack est vidée et la valeur courante est remise à zéro
- Clear Error : la valeur courante est remise à zéro
- Backspace : le dernier chiffre de la valeur courante est supprimé et rien ne se passe quand il y a rien d'affiché
- Point : un point est ajouté à la valeur courante, s'il y en a déjà un, rien ne se passe
- Signe : le signe de la valeur courante est inversée
- Divide : si la valeur actuellement affichée est un 0, un message d'erreur s'affiche
- Appui sur un chiffre après une opération : la valeur courante est remplacée par le chiffre et le résultat de l'opération précédente est ajouté à la stack
- Appui sur Ent : la valeur courante est ajoutée à la stack sauf si elle vaut 0

Folder starter

25 printable files

(file list disabled)

starter\Main.java

```
import calculator.JCalculator;

public class Main
{
  public static void main(String ... args) {
    new JCalculator();
  }
}
```

starter\calculator\Add.java

```
package calculator;

class Add extends Operator {
    Add(State state) {
        super(state);
    }

    void execute() {
        if (state.cannotCalculate()) {
            return;
        }

        // Add together the current value and the last value of the stack
        state.currentValue = Double.parseDouble(state.stack.pop()) + Double.parseDouble(state.currentValue) + "";
        state.hasResult = true;

        if (state.isCurrentValueZero()) {
            state.currentValue = "0";
        }
    }
}
```

starter\calculator\Backspace.java

```
package calculator;

class Backspace extends Operator {
    Backspace(State state) {
        super(state);
    }

    void execute() {
        if (state.hasError) {
            state.clearCurrentValue();
            return;
        }

        // Remove the last character from the current value
        if (!state.currentValue.isEmpty()) {
            state.currentValue = state.currentValue.substring(0, state.currentValue.length() - 1);
        }
    }
}
```

starter\calculator\Calculator.java

```java
package calculator;

import java.util.Scanner;

public class Calculator {
    private final State state = new State();

    public static void main(String[] args) {
        Calculator calculator = new Calculator();
        Scanner scanner = new Scanner(System.in);
        String input;

        System.out.println("java Calculator");
        do {
            System.out.print("> ");
            input = scanner.nextLine();
            calculator.processInput(input);
        } while (!input.equals("exit"));
    }

    private void processInput(String input) {
        if (input.matches("-?\\d+(\\.\\d+)?")) {
            // If the input is a number, we set the current value to this number
            double number = Double.parseDouble(input);
            state.currentValue = Double.toString(number);
        } else {
            // If the input is not a number, we check if it is an operator
            switch (input) {
                case "+":
                    state.stack.pop();
                    new Add(state).execute();
                    break;
                case "-":
                    state.stack.pop();
                    new Subtract(state).execute();
                    break;
                case "*":
                    state.stack.pop();
                    new Multiply(state).execute();
                    break;
                case "/":
                    state.stack.pop();
                    new Divide(state).execute();
                    break;
                case "sqrt":
                    state.stack.pop();
                    new SquareRoot(state).execute();
                    break;
                case "square":
                    state.stack.pop();
                    new Square(state).execute();
                    break;
                case "oneover":
                    state.stack.pop();
                    new OneOver(state).execute();
                    break;
                case "negate":
                    state.stack.pop();
                    new Negate(state).execute();
                    break;
                case "store":
                    state.stack.pop();
                    new MemoryStore(state).execute();
                    // If the stack is empty, we don't print it
                    if (state.stack.isEmpty()) {
```

```
                        return;
                    }
                    break;
                case "recall":
                    new MemoryRecall(state).execute();
                    break;
                case "clear":
                    new Clear(state).execute();
                    return;
                case "exit":
                    return;
                default:
                    System.out.println("Erreur : Entrée non valide");
                    return;
            }
        }

        if (!state.isCurrentValueZero()) {
            // If the current value is not 0, we add it to the stack
            state.stack.push(state.currentValue);
            System.out.println(state.stack);
        } else if (!state.stack.isEmpty()) {
            // If the current value is 0 and the stack is not empty, we print the stack
            System.out.println(state.stack);
        }
    }
}
```

starter\calculator\Clear.java

```
package calculator;

class Clear extends Operator {
    Clear(State state) {
        super(state);
    }

    void execute() {
        // Set the current value to its default 0 and empty the stack
        state.clearCurrentValue();
        state.stack.clear();
    }
}
```

starter\calculator\ClearError.java

```
package calculator;

class ClearError extends Operator {
    ClearError(State state) {
        super(state);
    }

    void execute() {
        // Set the current value to its default 0
        state.clearCurrentValue();
    }
}
```

starter\calculator\Digit.java

```
package calculator;
```

```
import java.util.Objects;

class Digit extends Operator {

    String number;

    Digit(State state, int number) {
        super(state);
        this.number = Integer.toString(number);
    }

    void execute() {
        if (state.hasError) {
            return;
        }

        // If the current value is the result from the previous calculation, add it to the stack unless it is 0
        if (state.hasResult && !state.isCurrentValueZero()) {
            state.stack.push(state.currentValue);
            state.clearCurrentValue();
        }

        // Add a new digit to the current value if not default 0
        if (state.currentValue.equals("0")) {
            state.currentValue = number;
        } else {
            state.currentValue += number;
        }
    }
}
```

starter\calculator\Divide.java

```
package calculator;

class Divide extends Operator {
    Divide(State state) {
        super(state);
    }

    void execute() {
        if (state.cannotCalculate()) {
            return;
        }

        // Check if dividing by 0
        if (state.isCurrentValueZero()) {
            state.hasError = true;
            state.currentValue = "Cannot divide by zero";
            return;
        }

        // Divide the current value with the last value of the stack
        state.currentValue = Double.parseDouble(state.stack.pop()) / Double.parseDouble(state.currentValue) + "";
        state.hasResult = true;
    }
}
```

starter\calculator\Dot.java

```
package calculator;

public class Dot extends Operator{
    Dot(State state) {
        super(state);
    }
```

```
        void execute() {
            // Add a dot to the current value if there isn't already one in the value and there is a number
            if (state.currentValue.indexOf('.') == -1 && !state.hasError && !state.currentValue.isEmpty()) {
                state.currentValue += '.';
            }
        }
    }
```

starter\calculator\Enter.java

```
    package calculator;

    class Enter extends Operator {
        Enter(State state) {
            super(state);
        }

        void execute() {

            // Add the current value to the stack if not 0 or ending with '.'
            if (!state.isCurrentValueZero() && !state.hasError && !state.currentValue.endsWith(".")) {
                state.stack.push(state.currentValue);
                if (state.hasResult) {
                    state.hasResult = false;
                }
                state.currentValue = "0";
            }
        }
    }
```

starter\calculator\JButton.java

```
    package calculator;

    public class JButton {
    }
```

starter\calculator\JCalculator.java

```
    package calculator;

    import javax.swing.JButton;
    import javax.swing.*;
    import java.awt.*;

    //import java.awt.event.*;

    public class JCalculator extends JFrame
    {
      // Tableau representant une pile vide
      private static final String[] empty = { "< empty stack >" };

      // Zone de texte contenant la valeur introduite ou resultat courant
      private final JTextField jNumber = new JTextField("0");

      // Composant liste representant le contenu de la pile
      private final JList jStack = new JList(empty);

      // Contraintes pour le placement des composants graphiques
      private final GridBagConstraints constraints = new GridBagConstraints();

      private final State state = new State();
```

```
// Mise a jour de l'interface apres une operation (jList et jStack)
private void update()
{
  // Modifier une zone de texte, JTextField.setText(string nom)
  jNumber.setText(state.currentValue);
  // Modifier un composant liste, JList.setListData(Object[] tableau
  if (state.stack.isEmpty()) {
    jStack.setListData(empty);
  } else {
    jStack.setListData(state.stack.getStack());
  }
}

// Ajout d'un bouton dans l'interface et de l'operation associee,
// instance de la classe Operation, possedeant une methode execute()
private void addOperatorButton(String name, int x, int y, Color color,
               final Operator operator)
{
  JButton b = new JButton(name);
  b.setForeground(color);
  constraints.gridx = x;
  constraints.gridy = y;
  getContentPane().add(b, constraints);
  b.addActionListener(e -> {
  operator.execute();
  update();
    });
}

public JCalculator()
{
  super("JCalculator");
  setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
  getContentPane().setLayout(new GridBagLayout());

  // Contraintes des composants graphiques
  constraints.insets = new Insets(3, 3, 3, 3);
  constraints.fill = GridBagConstraints.HORIZONTAL;

  // Nombre courant
  jNumber.setEditable(false);
  jNumber.setBackground(Color.WHITE);
  jNumber.setHorizontalAlignment(JTextField.RIGHT);
  constraints.gridx = 0;
  constraints.gridy = 0;
  constraints.gridwidth = 5;
  getContentPane().add(jNumber, constraints);
  constraints.gridwidth = 1; // reset width

  // Rappel de la valeur en memoire
  addOperatorButton("MR", 0, 1, Color.RED, new MemoryRecall(state));

  // Stockage d'une valeur en memoire
  addOperatorButton("MS", 1, 1, Color.RED, new MemoryStore(state));

  // Backspace
  addOperatorButton("<=", 2, 1, Color.RED, new Backspace(state));

  // Mise a zero de la valeur courante + suppression des erreurs
  addOperatorButton("CE", 3, 1, Color.RED, new ClearError(state));

  // Comme CE + vide la pile
  addOperatorButton("C",  4, 1, Color.RED, new Clear(state));

  // Boutons 1-9
  for (int i = 1; i < 10; i++)
    addOperatorButton(String.valueOf(i), (i - 1) % 3, 4 - (i - 1) / 3,
          Color.BLUE, new Digit(state,i));
  // Bouton 0
  addOperatorButton("0", 0, 5, Color.BLUE, new Zero(state));
```

```
        // Changement de signe de la valeur courante
        addOperatorButton("+/-", 1, 5, Color.BLUE, new Negate(state));

        // Operateur point (chiffres apres la virgule ensuite)
        addOperatorButton(".", 2, 5, Color.BLUE, new Dot(state));

        // Operateurs arithmetiques a deux operandes: /, *, -, +
        addOperatorButton("/", 3, 2, Color.RED, new Divide(state));
        addOperatorButton("*", 3, 3, Color.RED, new Multiply(state));
        addOperatorButton("-", 3, 4, Color.RED, new Subtract(state));
        addOperatorButton("+", 3, 5, Color.RED, new Add(state));

        // Operateurs arithmetiques a un operande: 1/x, x^2, Sqrt
        addOperatorButton("1/x", 4, 2, Color.RED, new OneOver(state));
        addOperatorButton("x^2", 4, 3, Color.RED, new Square(state));
        addOperatorButton("Sqrt", 4, 4, Color.RED, new SquareRoot(state));

        // Entree: met la valeur courante sur le sommet de la pile
        addOperatorButton("Ent", 4, 5, Color.RED, new Enter(state));

        // Affichage de la pile
        JLabel jLabel = new JLabel("Stack");
        jLabel.setFont(new Font("Dialog", 0, 12));
        jLabel.setHorizontalAlignment(JLabel.CENTER);
        constraints.gridx = 5;
        constraints.gridy = 0;
        getContentPane().add(jLabel, constraints);

        jStack.setFont(new Font("Dialog", 0, 12));
        jStack.setVisibleRowCount(8);
        JScrollPane scrollPane = new JScrollPane(jStack);
        constraints.gridx = 5;
        constraints.gridy = 1;
        constraints.gridheight = 5;
        getContentPane().add(scrollPane, constraints);
        constraints.gridheight = 1; // reset height

        setResizable(false);
        pack();
        setVisible(true);
      }
    }
```

starter\calculator\MemoryRecall.java

```
    package calculator;

    class MemoryRecall extends Operator {
        MemoryRecall(State state) {
            super(state);
        }

        void execute() {
            // Recall the last stored value
            if (!state.memory.equals("0") && !state.hasError) {
                // Add the current value to the stack if it is a result
                if (state.hasResult) {
                    state.stack.push(state.currentValue);
                }
                state.currentValue = state.memory;
            }
        }
    }
```

starter\calculator\MemoryStore.java

```
package calculator;

class MemoryStore extends Operator {
    MemoryStore(State state) {
        super(state);
    }

    void execute() {
        // Store the current value
        if (!state.currentValue.equals("0") && !state.hasError) {
            // If we stored a result, we no longer have a result
            if (state.hasResult) {
                state.hasResult = false;
            }
            state.memory = state.currentValue;
            state.currentValue = "0";
        }
    }
}
```

starter\calculator\Multiply.java

```
package calculator;

class Multiply extends Operator {
    Multiply(State state) {
        super(state);
    }

    void execute() {
        if (state.cannotCalculate()) {
            return;
        }

        // Multiply together the current value and the last value of the stack
        state.currentValue = Double.parseDouble(state.stack.pop()) * Double.parseDouble(state.currentValue) + "";
        state.hasResult = true;

        if (state.isCurrentValueZero()) {
            state.currentValue = "0";
        }
    }
}
```

starter\calculator\Negate.java

```
package calculator;

class Negate extends Operator {
    Negate(State state) {
        super(state);
    }

    void execute() {
        if (state.isCurrentValueZero() || state.hasError) {
            return;
        }

        // Invert the sign of the current value
        if (state.currentValue.charAt(0) == '-') {
            state.currentValue = state.currentValue.substring(1);
        } else {
            state.currentValue = "-" + state.currentValue;
        }
```

```
    }
}
```

starter\calculator\OneOver.java

```
package calculator;

class OneOver extends Operator {
    OneOver(State state) {
        super(state);
    }

    void execute() {
        if (state.hasError) {
            return;
        }

        if (state.isCurrentValueZero()) {
            state.hasError = true;
            state.currentValue = "Cannot divide by zero";
            return;
        }

        // One divided by the current value
        state.currentValue = Double.toString(1 / Double.parseDouble(state.currentValue));
        state.hasResult = true;
    }
}
```

starter\calculator\Operator.java

```
package calculator;

abstract class Operator {
    State state;

    Operator(State state) {
        this.state = state;
    }

    abstract void execute();
}
```

starter\calculator\Square.java

```
package calculator;

class Square extends Operator {
    Square(State state) {
        super(state);
    }

    void execute() {
        if (state.hasError) {
            return;
        }

        // Current value to the power of 2
        state.currentValue = String.valueOf(Math.pow(Double.parseDouble(state.currentValue), 2));
        state.hasResult = true;
    }
}
```

starter\calculator\SquareRoot.java

```java
package calculator;

class SquareRoot extends Operator {
    SquareRoot(State state) {
        super(state);
    }

    void execute() {
        if (state.hasError) {
            return;
        }

        if (state.currentValue.charAt(0) == '-') {
            state.hasError = true;
            state.currentValue = "Cannot calculate the SquareRoot of a negative number";
            return;
        }

        // SquareRoot of the current value
        state.currentValue = Math.sqrt(Double.parseDouble(state.currentValue)) + "";
        state.hasResult = true;
    }
}
```

starter\calculator\State.java

```java
package calculator;

import util.Stack;

class State {
    final Stack<String> stack;

    String currentValue, memory;

    boolean hasResult, hasError;

    State() {
        stack = new Stack<>();
        currentValue = "0";
        memory = "0";
        hasResult = false;
        hasError = false;
    }

    /**
     * Check if the current value is 0
     * Since we are using doubles, we need to check if the value is 0.0
     * @return true if the current value is 0, false otherwise
     */
    boolean isCurrentValueZero() {
        return Double.parseDouble(currentValue) == 0;
    }

    /**
     * Check if the calculus cannot be done
     * @return true if the calculus cannot be done, false otherwise
     */
    boolean cannotCalculate() {
        return hasError || stack.isEmpty() || currentValue.isEmpty();
    }

    /**
     * Clear the current value and reset the state
     */
    void clearCurrentValue() {
```

```
            currentValue = "0";
            hasResult = false;
            hasError = false;
        }
    }
```

starter\calculator\Subtract.java

```
    package calculator;

    class Subtract extends Operator {
        Subtract(State state) {
            super(state);
        }

        void execute() {
            if (state.cannotCalculate()) {
                return;
            }

            // Subtract the current value with the last value of the stack
            state.currentValue = Double.parseDouble(state.stack.pop()) - Double.parseDouble(state.currentValue) + "";
            state.hasResult = true;

            if (state.isCurrentValueZero()) {
                state.currentValue = "0";
            }
        }
    }
```

starter\calculator\Zero.java

```
    package calculator;

    import java.util.Objects;

    public class Zero extends Operator{
        Zero(State state) {
            super(state);
        }

        void execute() {
            // Add a zero to the current value unless current value is 0
            if (!Objects.equals(state.currentValue, "0") && !state.hasError) {
                state.currentValue += "0";
            }
        }
    }
```

starter\util\Stack.java

```
    package util;

    import java.util.EmptyStackException;
    import java.util.Iterator;

    class Item<T> {
        T value;
        Item<T> next;

        Item(T value) {
            this.value = value;
            next = null;
```

```
    }
}

public class Stack<T> implements Iterable<T> {
    Item<T> top;
    int size;

    public Stack() {
        top = null;
        size = 0;
    }

    public void push(T value) {
        Item<T> newItem = new Item<>(value);
        newItem.next = top;
        top = newItem;
        ++size;
    }

    public T pop() {
        if (isEmpty()) {
            throw new EmptyStackException();
        }
        T value = top.value;
        top = top.next;
        --size;

        return value;
    }

    public boolean isEmpty() {
        return top == null;
    }

    public Object[] getStack() {
        if (isEmpty()) {
            throw new EmptyStackException();
        }
        Object[] array = new Object[size];
        Item<T> item = top;

        for (int i = 0; i < array.length; ++i) {
            array[i] = item.value;
            item = item.next;
        }

        return array;
    }

    public void clear() {
        while (!isEmpty()) {
            pop();
        }
    }

    @Override
    public String toString() {
        StringBuilder sb = new StringBuilder();
        Item<T> item = top;

        while (item != null) {
            sb.append(item.value).append(" ");
            item = item.next;
        }

        return sb.toString();
    }

    @Override
    public Iterator<T> iterator() {
        return new StackIterator<>(this);
```

```
    }
}
```

starter\util\StackIterator.java

```
package util;

import java.util.Iterator;
import java.util.NoSuchElementException;

public class StackIterator<T> implements Iterator<T> {
    private Item<T> current;

    public StackIterator(Stack<T> stack) {
        current = stack.top;
    }

    @Override
    public boolean hasNext() {
        return current.next != null;
    }

    @Override
    public T next() {
        if (!hasNext()) {
            throw new NoSuchElementException();
        }
        current = current.next;

        return current.value;
    }
}
```