Java Programming II
Lab7

514770-1
Fall 2021
11/1/2021
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Lab7

- Practice to write a program that adds, subtracts, multiplies, divides Fraction using **Command pattern.**
  - Fraction (분수) has numerator(분자) and denominator (분모). Reduce Fraction using the greatest common divisor(최대공약수).
  - FractionArithmeticOperation is the receiver class. It operates add/substract/multiply/divide the Fraction.
  - Command interface has void execute() and void undo().
  - FractionArithmeticOperationCommand implements execute and undo using FractionArithmeticOperation & String operator & Fraction operand.
  - FractionArithmeticOperationInvoker is the invoker class.
    - Stack<Command> stack (for undo operation).
    - void setCommand(Command command)
    - void execute()
    - void undo()

```
public class Fraction {
  private int numerator;
  private int denominator;
  public static final Fraction ZERO = new Fraction(0, 1);
  public Fraction(int numerator, int denominator) {
    if (denominator == 0) {
      throw new ArithmeticException();
    }
    this.numerator = numerator;
    this.denominator = denominator;
    int gcd = gcd(numerator, denominator);
    if (gcd> 1) {
      this.numerator /= gcd;
      this.denominator /= gcd;
    }
  }
…
}
```

```
public class FractionArithmeticOperation {
  Fraction value = Fraction.ZERO; // default
  public static Fraction plus(Fraction a, Fraction b) {
    return new Fraction(a.getNumerator() * b.getDenominator()
+ b.getNumerator() * a.getDenominator(), a.getDenominator() *
b.getDenominator());
  }
  public static Fraction minus(Fraction a, Fraction b) {
    return new Fraction(a.getNumerator() * b.getDenominator()
- b.getNumerator() * a.getDenominator(), a.getDenominator() *
b.getDenominator());
  }
  public static Fraction multiply(Fraction a, Fraction b) {
    return new Fraction(a.getNumerator() * b.getNumerator(),
a.getDenominator() * b.getDenominator());
  }
  public static Fraction divide(Fraction a, Fraction b) {
    return new Fraction(a.getNumerator() * b.getDenominator(),
a.getDenominator() * b.getNumerator());
  }
```

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```
public class MainTest {
  public static void main(String[] args) {
    Fraction a  = new Fraction(5, 4);
    Fraction b  = new Fraction(1, 2);
    Fraction c  = new Fraction(2, 3);
    Fraction d  = new Fraction(4, 7);
    Fraction e  = new Fraction(13, 7);
    System.out.println("a=" + a);
    System.out.println("b=" + b);
    System.out.println("c=" + c);
    System.out.println("d=" + d);
    System.out.println("e=" + e);

    // receiver class
    FractionArithmeticOperation operation = new FractionArithmeticOperation();
    // invoker class
    FractionArithmeticOperationInvoker invoker = new
FractionArithmeticOperationInvoker();
```

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```
// set command using command class and then invoke
invoker.setCommand(new FractionArithmeticOperationCommand(operation, "+", a));
invoker.execute(); // 0/1 + 5/4 = 5/4
invoker.setCommand(new FractionArithmeticOperationCommand(operation, "+", b));
invoker.execute(); // 5/4 + 1/2 = 7/4
invoker.setCommand(new FractionArithmeticOperationCommand(operation, "-", c));
invoker.execute(); // 7/4 - 2/3 = 13/12
invoker.setCommand(new FractionArithmeticOperationCommand(operation, "*", d));
invoker.execute(); // 13/12 * 4/7 = 13/21
invoker.setCommand(new FractionArithmeticOperationCommand(operation, "/", e));
invoker.execute(); // 13/21 / 13/7 = 1/3

invoker.undo(); // 1/3 * 13/7 = 13/21
invoker.undo(); // 13/21 / 4/7 = 13/12
invoker.undo(); // 13/12 + 2/3 = 7/4
invoker.undo(); // 7/4 - 1/2 = 5/4
invoker.undo(); // 5/4 - 5/4 = 0/1
invoker.undo(); // no undo command in the stack
```

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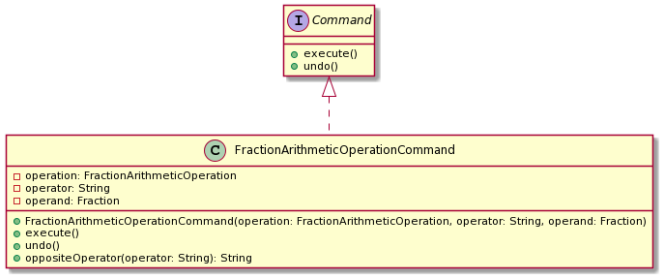
- FractionArithmeticOperationCommand executes or undo the Fraction operation (+, -, *, /).



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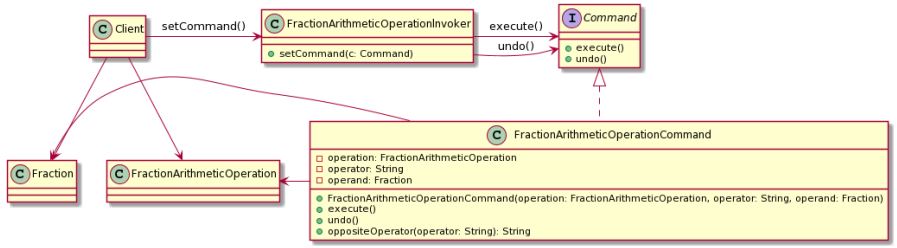
- The MainTest client use FractionArithmeticOperationInvoker to set command and then, execute the command.
- You can also call the command undo.



Submit to e-learning

- Add your code (e.g., additional method, class, routine, etc) in the Lab7 assignment.
- Submit the Lab7 assignment (JAVA21-2-Lab7-ID-name.zip including the report) to e-learning.