JUNIT IN ACTION

Software Engineering (Exercise) Class

Prof. Adriano Peron

Valerio Maggio, Ph.D. Candidate
valerio.maggio@unina.it

May, 31st 2013

JUNIT PRELIMINARIES

- **Q**: How many "types" of testing do you know?
  - **A**: System Testing, Integration Testing, Unit Testing....
- **Q**: How many "testing techniques" do you know?
  - **A**: Black Box and White Box Testing

  Which is the difference?
- **Q**: What type and technique do you think JUnit covers?

XUNIT FRAMEWORK

- *A framework is a semi-complete application that provides a reusable, common structure that can be shared between applications.*
- *Developers incorporate the framework in their own application an extend it to meet their specific needs.*

- **Unit Test**: A unit test examines the behavior of a distinct *unit of work*.
  - The "distinct unit of work" is often (but not always) a single method.

IMPROVED (NAIVE) SOLUTION

```
public class TestCalculator {
    private int nbErrors = 0;

    public void testAdd() {
        Calculator calculator = new Calculator();
        b double result = calculator.add(10, 50);
        if (result != 60) {
            throw new RuntimeException("Bad result: " + result);
        }
    }

    public static void main(String[] args) {

        TestCalculator test = new TestCalculator();
        try {
            test.testAdd();
        } catch (Throwable e) {
            test.nbErrors++;
            e.printStackTrace();
        }

        if (test.nbErrors > 0) {
            throw new RuntimeException("There were " + test.nbErrors +
                                       " error(s)");
        }
    }// end main
}
```

LESSON LEARNED

Objective Test + Repeatable Test = Simple Test Program

Disclaimer:
The previous example showed a *naive* way to test (a.k.a. the **wrong** one)

That was **not** JUnit!!

JUNIT TEST ANNOTATIONS

- `@Test public void method()`
  - Annotation `@Test` identifies that this method is a test method.
- `@Before public void method()`
  - Will perform the method() before each test.
  - This method can prepare the test environment
  - E.g. read input data, initialize the class, ...
- `@After public void method()`

JUNIT ASSERT STATEMENTS

- `assertNotNull([message], object)`
  - Test passes if Object is not null.
- `assertNull([message], object)`
  - Test passes if Object is null.
- `assertEquals([message],expected, actual)`
  - Asserts equality of two values
- `assertTrue(true|false)`
  - Test passes if condition is True
- `assertNotSame([message], expected, actual)`
  - Test passes if the two Objects are not the same Object
- `assertSame([message], expected, actual)`
  - Test passes if the two Objects are the same Object

TESTCALCULATOR JUNIT 4

```
public class Calculator {

    public double add(double number1, double number2) {
        return number1 + number2;
    }
}
```

```
import org.junit.Test;
import static org.junit.Assert.assertEquals;

public class TestCalculator {

    @Test
    public void testThatSummationOnTwoNumbersReturnsTheCorrectValue(){
        Calculator calculator = new Calculator();
        double result = calculator.add(10, 60);
        assertEquals(60, result, 0);
    }
}
```

TestAnnotation

JUnit Assert

TESTING THE EXCEPTION HANDLING THE NEW WAY!

Use the `expected` parameter of `@Test` annotation

```
import org.junit.Test;

public class TestCalculator {

    @Test(expected=RuntimeException.class)
    public void testThatSummationRaisesAnExceptionOnNegativeInputNumbers(){
        Calculator calculator = new Calculator();
        calculator.add(-1, -3);
    } // This is very short, isn't it?!
}
```

JUNIT WORDS CLOUD

a.k.a. *some random words (almost) related to JUnit*

Testing

xUnit

Java

Unit Testing

Testing framework

Test Suite

Black Box Testing

Testing Automation

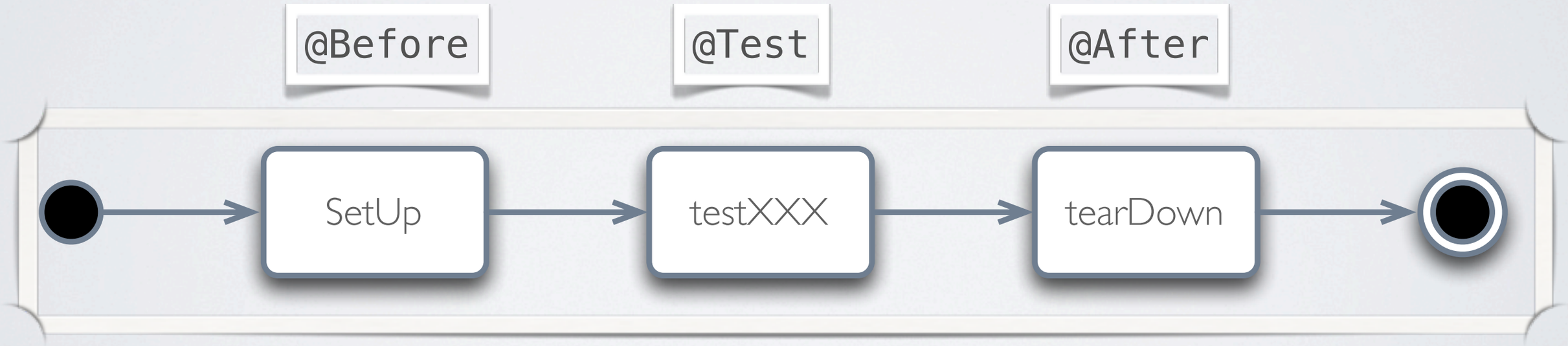
Test Fixtures

Simple Test Program

Test Runners

TEST FIXTURES

fixture: *The set of common resources or data that you need to run one or more tests.*



EXERCISE 1

Calculator

CALCULATOR CLASS

- **Requirements:**
  - Input numbers cannot have more than 5 digits;
  - The calculator can remember a given (unique) number;
  - Only non-negative numbers are allowed.
  - In case of negative numbers, an exception is thrown!

Calculator
- memory: double + MAX_DIGITS_LEN: int = 5 <<final>> <<static>>
+ add (double augend, double addend): double + subtract (double minuend, double subtrahend): double + multiply (double multiplicand, double multiplier): double + divide (double dividend, double divisor): double + addToMemory(double number): void + recallNumber(): double

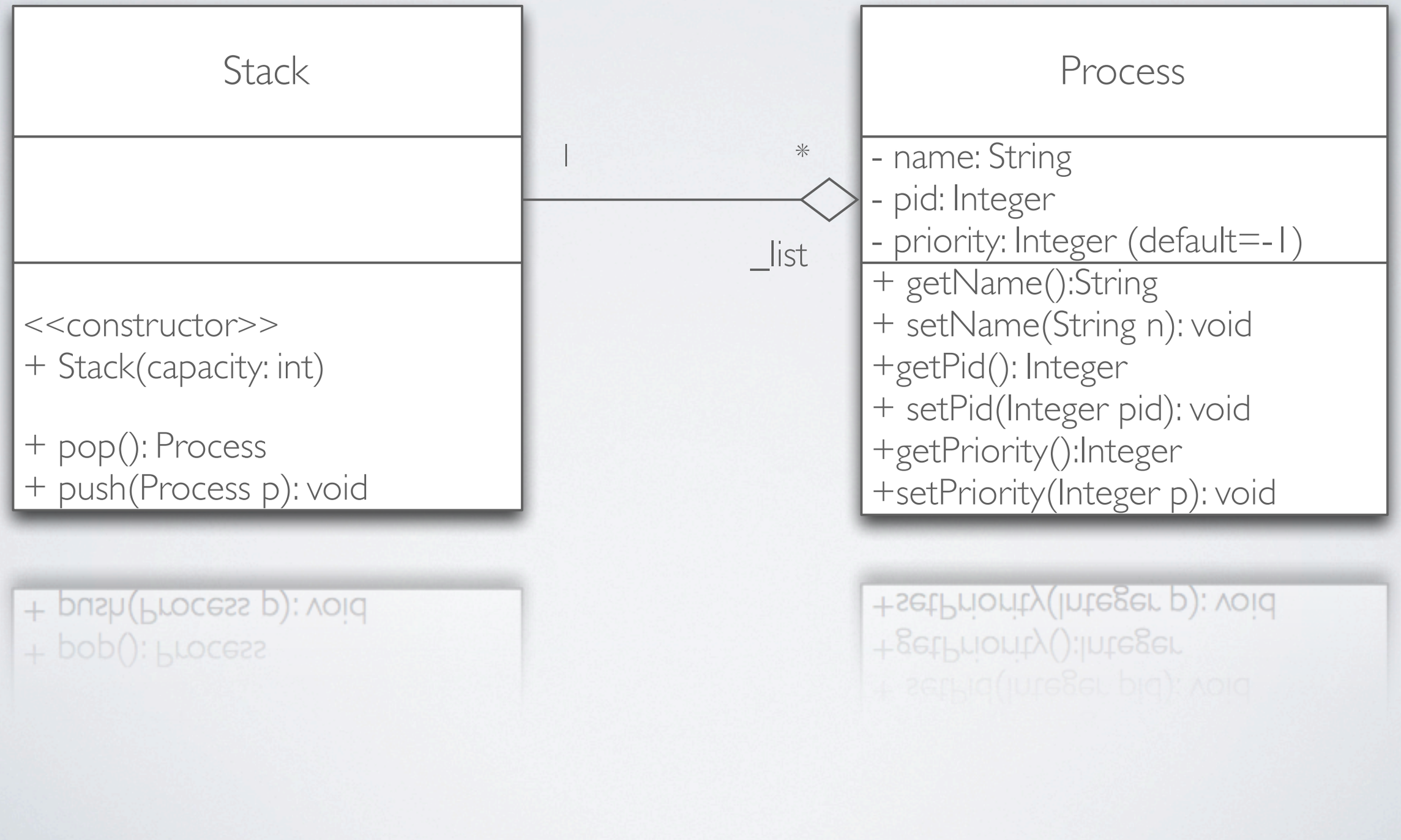
- Add method *parseExpression* to the Calculator class and corresponding bunch of tests!
- The method takes in input an expression string
  - (e.g., **1+2-3*4/2**)
- and returns the correct output result!
  - (i.e., **-3**)

Calculator
- memory: double + MAX_DIGITS_LEN: int = 5 <<final>> <<static>>
+ add (double augend, double addend): double + subtract (double minuend, double subtrahend): double + multiply (double multiplicand, double multiplier): double + divide (double dividend, double divisor): double + addToMemory(double number): void + recallNumber(): double **+ parseExpression(String expression): double**

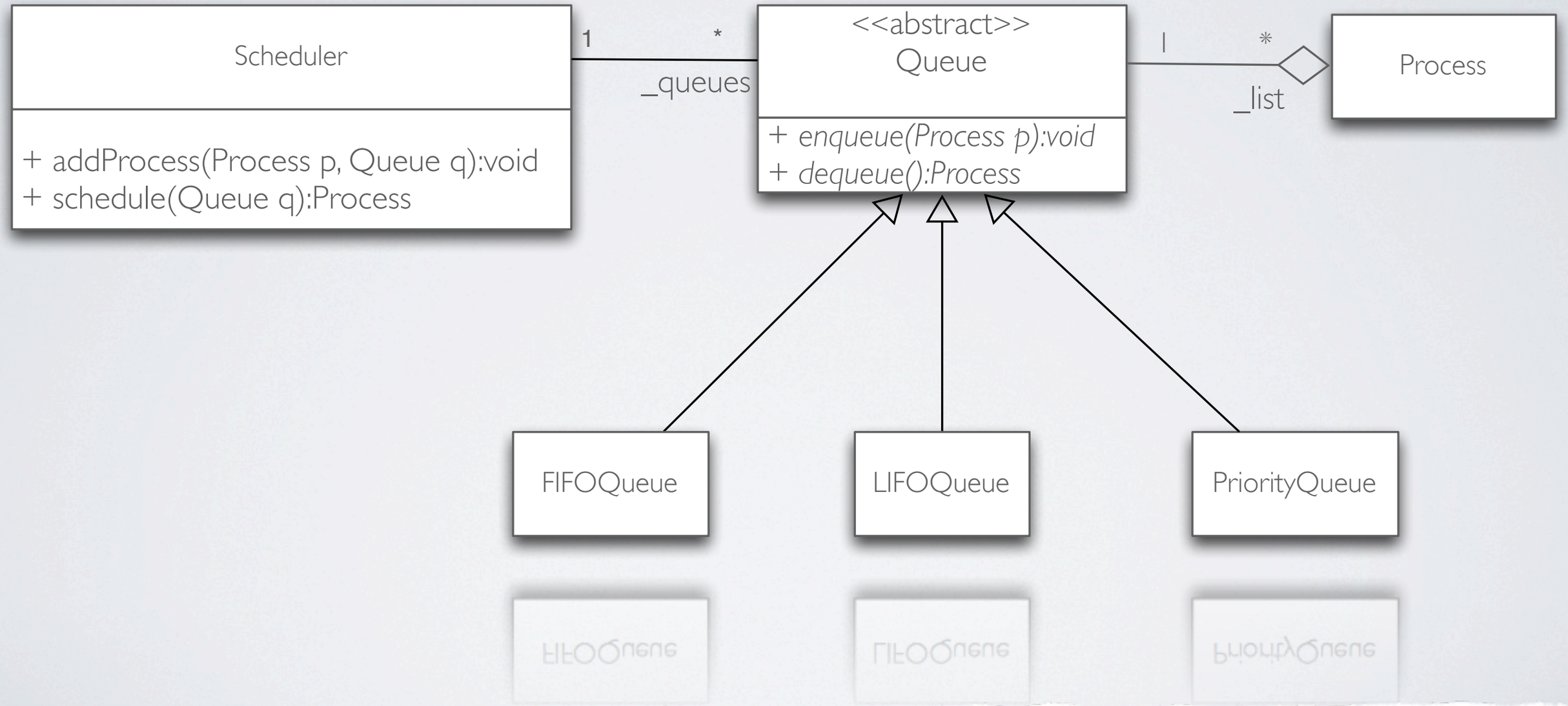
EXERCISE 11

Stack

STACK: **LIFO** QUEUE



DO ~~DON'T~~ TRY THIS AT HOME!



Q: How would you **test** Scheduler?

Remember: Unit tests run in **isolation!**