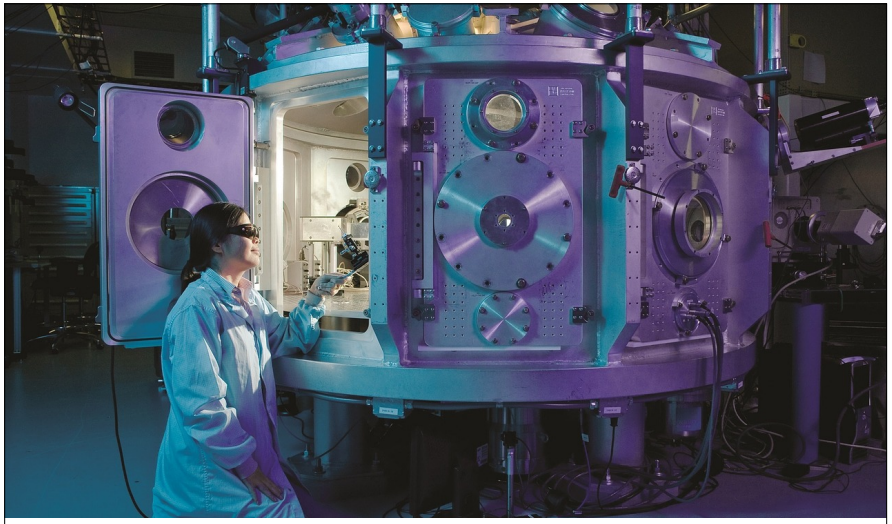


Images: PixaBay

Génie Logiciel : Conception

Étude de cas JUnit (3.x)

Sébastien Mosser
INF-5153, Hiver 2019, Cours #9

UQÀM

SOLID

GRASP

UQÀM Unit Test Framework

KISS

DRY

		Objectif		
		Création	Structure	Comportement
Portée	classe	Factory	Adapter	Interpreter Template Method
	objet	Abstract Factory Builder Prototype Singleton	Adapter Bridge Composite Decorator Facade Flyweight Proxy	Chain of Responsibility Command Iterator Mediator Memento Observer State Strategy Visitor

Objectif : On (ré-)implémente JUnit !

```java
public class IntegerTest {

    private int x = 0;
    private int y = 0;

    @Before
    public void initializeContext() {
        x = 1;
        y = 1;
    }

    @Test
    public void add2numbers() {
        assertEquals(2, x+y)
    }

    @Test
    public void subtract2numbers() {
        assertEquals(0, x-y)
    }

}
```

Objectif : On (ré-)implémente JUnit !

```java
public class IntegerTest extends TestCase {

    private int x = 0;
    private int y = 0;

    public void setUp() throws Exception {
        x = 1;
        y = 1;
    }

    public void testAdd() {
        assertEquals(2, x+y)
    }

    public void testSub() {
        assertEquals(0, x-y)
    }

}
```

Avant (< 2006)

```java
public class IntegerTest {

    private int x = 0;
    private int y = 0;

    @Before
    public void initializeContext() {
        x = 1;
        y = 1;
    }

    @Test
    public void add2numbers() {
        assertEquals(2, x+y)
    }

    @Test
    public void subtract2numbers() {
        assertEquals(0, x-y)
    }

}
```

Après (≥ 2006)

```java
public class IntegerTest extends TestCase {

   private int x, y = 0;

   public void setUp() throws Exception {
      x = 1; y = 1;
   }

   public void testAdd() {
      assertEquals(2, x+y)
   }

}
```

JUnit

UQÀM Unit Test Framework

```java
public class IntegerTests extends TestCase {

    private int x, y = 0;

    public void setUp() {
      x = 1; y = 1;
    }

    public void test_addTwoNumbers() {
      assertEquals(2, x+y);
    }
}
```

```java
public class IntegerTest extends TestCase {

   private int x, y = 0;

   public void setUp() throws Exception {
      x = 1; y = 1;
   }

   public void testAdd() {
      assertEquals(2, x+y)
   }

}
```

JUnit

UQÀM Unit Test Framework

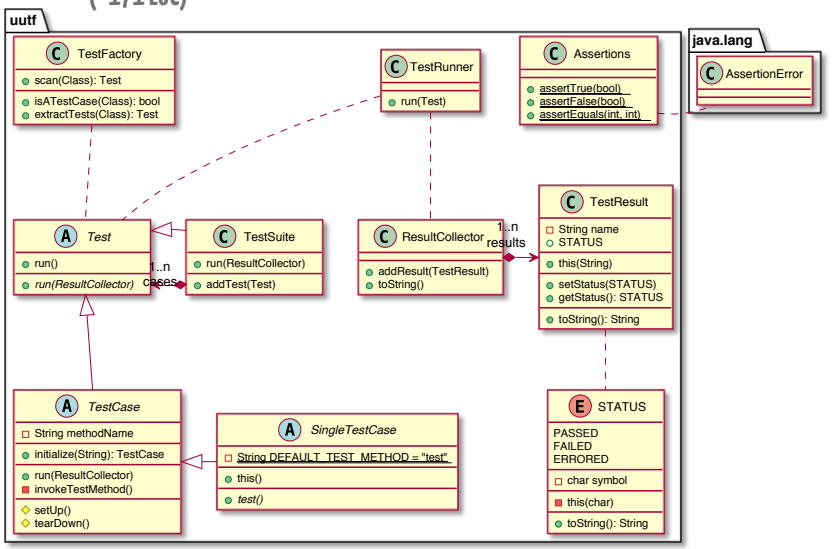
(~171 LoC)

```java
public class IntegerTests extends TestCase {

    private int x, y = 0;

    public void setUp() {
      x = 1; y = 1;
    }

    public void test_addTwoNumbers() {
      assertEquals(2, x+y);
    }
}
```

Réalisation Complète

UQÀM Unit Test Framework

(~171 LoC)



Agilité

(aka "conception en continu")

1

Problème : Comment livrer en continu ?

23 h 56

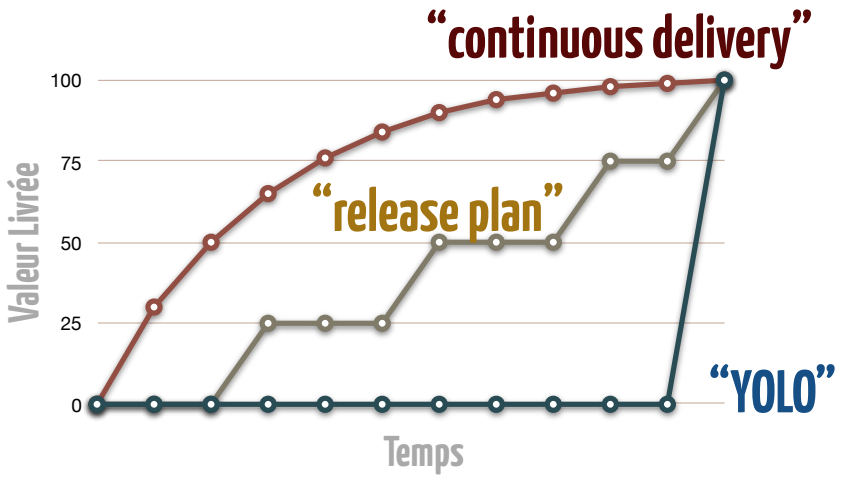
Bonsoir prof. Mosser, mon merge avec la branche master a ete effectue a 11:53, j'espere que ca n'affecte pas, ce fut un challenge! A ce mercredi!

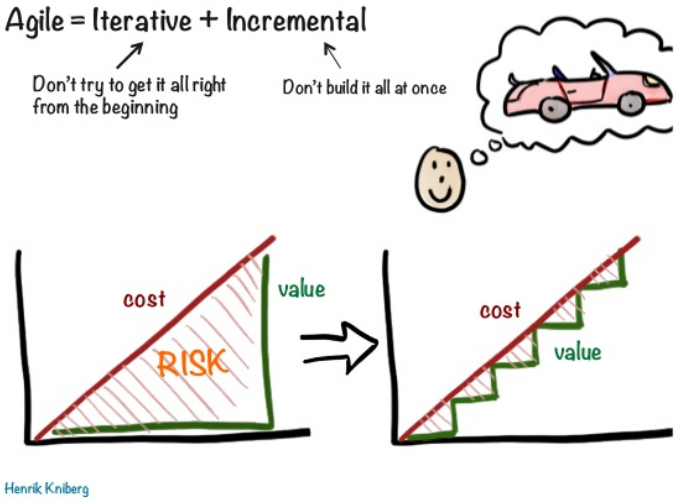
23 h 14

Bonjour Mr , est ce qu'on doit ajouter le tag pour le tp2 ?

Date limite : 23h50

Livraison de valeur au client





Le risque est l'intégrale du coût - celle de la valeur

Étape 0 : Environnement Technique

```
lucifer:teaching$ mkdir inf5153-junit-demo
lucifer:teaching$ cd inf5153-junit-demo/
lucifer:inf5153-junit-demo$ touch pom.xml
lucifer:inf5153-junit-demo$ mkdir -p src/main/java
lucifer:inf5153-junit-demo$ touch src/main/java/Main.java
lucifer:inf5153-junit-demo$ touch .gitignore
lucifer:inf5153-junit-demo$ git init
lucifer:inf5153-junit-demo$ touch .travis.yml
```

Structure (Maven) **Gestion de version (Git)** **Int. Continue (Travis)**

```xml
<?xml version="1.0" encoding="UTF-8"?>
<project xmlns="http://maven.apache.org/POM/4.0.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/maven-v4_0_0.xsd">

  <modelVersion>4.0.0</modelVersion>
  <packaging>jar</packaging>

  <groupId>io.github.ace-lectures.inf5153</groupId>
  <artifactId>junit-demo</artifactId>
  <version>1.0-SNAPSHOT</version>
  <name>ACE :: INF5153 :: Junit Demo</name>

  <properties>
    <maven.compiler.source>11</maven.compiler.source>
    <maven.compiler.target>11</maven.compiler.target>
    <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
  </properties>

  <build>
    <plugins>
      <plugin>
        <groupId>org.codehaus.mojo</groupId>
        <artifactId>exec-maven-plugin</artifactId>
        <version>1.6.0</version>
        <configuration>
          <mainClass>Main</mainClass>
        </configuration>
      </plugin>
    </plugins>
  </build>

</project>
```

Infos sur le projet

Infos sur le code source

Directives d'exécution

pom.xml

```yaml
language: java

jdk:
  - openjdk11

notifications:
  email:
    on_success: never
    on_failure: always
```

.travis.yml

```
.idea/
target/
*~
*.iml
```

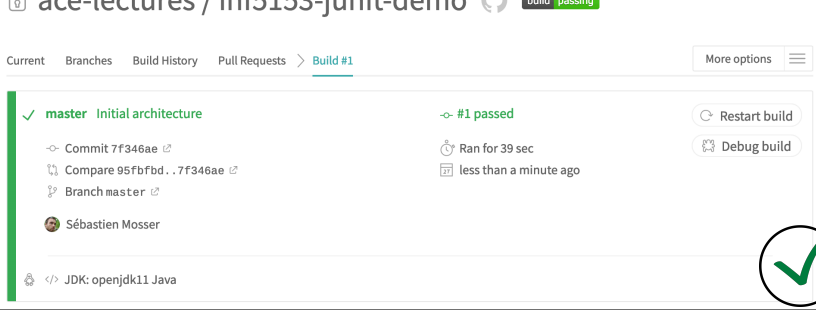
.gitignore

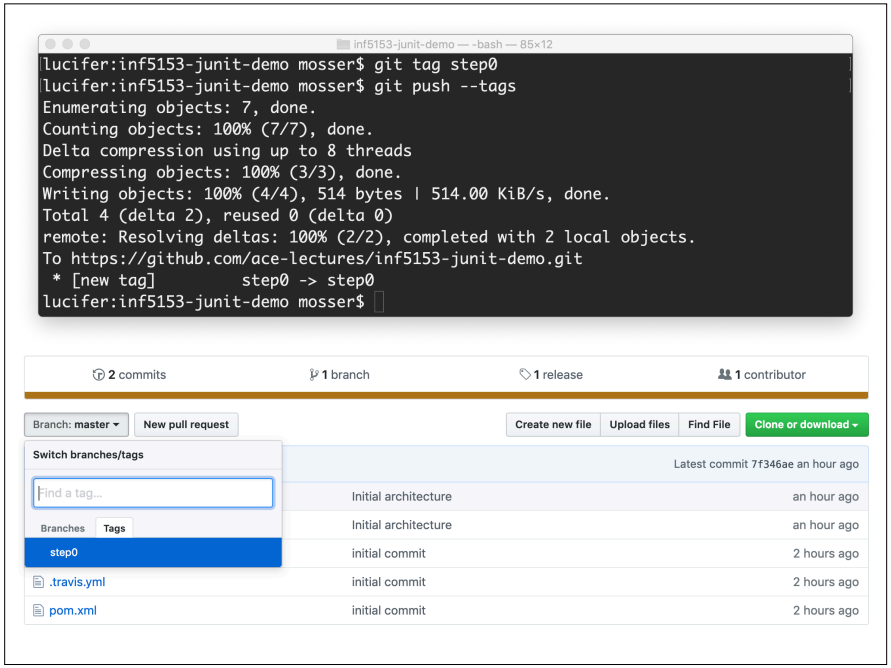
```java
public class Main {

    public static void main(String[] args) {
        System.out.println("# JUnit Demonstration");
    }

}
```

(psvm) (sout) Main.java

```
[INFO] ------------------------------------------------------------------------
lucifer:inf5153-junit-demo mosser$ mvn -q clean package
lucifer:inf5153-junit-demo mosser$ mvn -q exec:java
# JUnit Demonstration
lucifer:inf5153-junit-demo mosser$
```

```
lucifer:inf5153-junit-demo$ touch add -A
lucifer:inf5153-junit-demo$ git commit -m "Initial arch."
lucifer:inf5153-junit-demo$ git push origin master
```





Étape 0(bis) : Découpage fonctionnel

```java
public class IntegerTest extends TestCase {

   private int x = 0;
   private int y = 0;

   public void setUp() throws Exception {
      x = 1;
      y = 1;
   }

   public void testAdd() {
      assertEquals(2, x+y)
   }

   public void testSub() {
      assertEquals(1, x-y)
   }

}
```

Étape 0(bis) : Découpage fonctionnel

```java
public class IntegerTest extends TestCase {

   private int x = 0;
   private int y = 0;

   public void setUp() throws Exception {
      x = 1;
      y = 1;
   }

   public void testAdd() {
      assertEquals(2, x+y)
   }

   public void testSub() {
      assertEquals(1, x-y)
   }

}
```

Intégration Java

Mise en contexte

Suite De Tests

Cas de tests

Succès / Échec

Assertions

Étape 0(bis) : Découpage fonctionnel

1. Assertions
2. Cas de tests
3. Succès / Échec
4. Suite de tests
5. Mise en contexte
6. Intégration Java

```java
public class IntegerTest extends TestCase {

   private int x = 0;
   private int y = 0;

   public void setUp() throws Exception {
      x = 1;
      y = 1;
   }

   public void testAdd() {
      assertEquals(2, x+y)
   }

   public void testSub() {
      assertEquals(0, x-y)
   }

}
```

Assertions 2

Qu'est-ce qu'une assertion ?

- Méthode indépendante de l'objet qui la contient
- Doit vérifier une condition (vrai, faux, égalité, équivalence, ...)
- Il n'est pas de la responsabilité du développeur de traiter un échec d'assertion

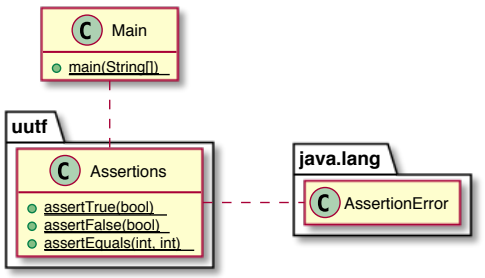
Spécification

Qu'est-ce qu'une assertion ?

- Méthode indépendante de l'objet qui la contient
  - Elle sera donc statique
- Doit vérifier une condition (vrai, faux, égalité, équivalence, ...)
  - On peut tout ramener à la vérification de "vrai" (réutilisation)
- Il n'est pas de la responsabilité du développeur de traiter un échec d'assertion
  - On va donc utiliser des exceptions plutôt que des valeurs de retours

Spécification **Choix de conception**

```java
package uutf;

public class Assertions {

    public static void assertTrue(boolean condition) {
        if(!condition)
            throw new AssertionError();
    }

    public static void assertFalse(boolean condition) {
        assertTrue(!condition);
    }

    public static void assertEquals(int oracle, int value) {
        assertTrue(oracle == value);
    }

}
```



```java
import static uutf.Assertions.assertEquals;

public class Main {
    public static void main(String[] args) {
        System.out.println("# JUnit Demonstration");

        try {
            System.out.println("## Case 1: x+y == 2");
            int x = 1;
            int y = 1;
            assertEquals(2, x+y);
            System.out.println("PASSED");
        } catch(AssertionError ae) {
            System.out.println("FAILED");
        }

        try {
            System.out.println("## Case 2: x-y == 1");
            int x = 1;
            int y = 1;
            assertEquals(1, x-y);
            System.out.println("PASSED");
        } catch(AssertionError ae) {
            System.out.println("FAILED");
        }
    }

}
```

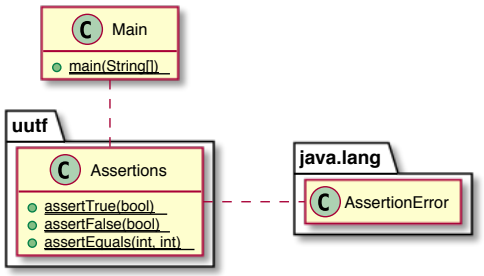
```
lucifer:inf5153-junit-demo mosser$ mvn -q clean package exec:java
# JUnit Demonstration
## Case 1: x+y == 2
PASSED
## Case 2: x-y == 1
FAILED
lucifer:inf5153-junit-demo mosser$
```

On avance pas à pas ...
Et on ajoute de la valeur.


```java
try {
    System.out.println("## Case 1: x+y == 2");
    int x = 1;
    int y = 1;
    assertEquals(2, x+y);
    System.out.println("PASSED");
} catch(AssertionError ae) {
    System.out.println("FAILED");
}
```

```java
public void testAdd() {
   assertEquals(2, x+y)
}
```

UQÀM Unit Test Framework



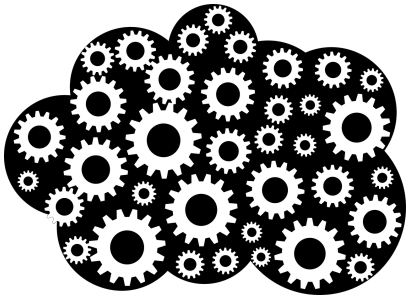
Version 1. 13 lines de Java.

Cas de Test 3

Problème : Responsabilisation du test ?

```
try {
    System.out.println("## Case 1: x+y == 2");
    int x = 1;
    int y = 1;
    assertEquals(2, x+y);
    System.out.println("PASSED");
} catch(AssertionError ae) {
     System.out.println("FAILED");
}
```

```
public abstract class TestCase {
```



Canevas Logiciel

```
}
```

```
public class AddTwoNumbers extends TestCase {

    protected void test() {
        int x = 1;
        int y = 1;
        assertEquals(2, x+y);
    }

}
```

Utilisateur

```
public abstract class TestCase {

    public void run() {
        try {
            System.out.print("## Case " + this.getClass().getCanonicalName() + " ");
            test();
            System.out.println("[X]");
        } catch (AssertionError ae) {
            System.out.println("[ ]");
        } catch (Exception e) {
            System.out.println("[!]");
        }
    }

    protected abstract void test();

}
```

Canevas Logiciel

```
public class AddTwoNumbers extends TestCase {

    @Override
    protected void test() {
        int x = 1;
        int y = 1;
        assertEquals(2, x+y);
    }

}
```

Utilisateur

```
public abstract class TestCase {

    public void run() {
        try {
            System.out.print("## Case " + this.getClass().getCanonicalName() + " ");
            test();
            System.out.println("[X]");
        } catch (AssertionError ae) {
            System.out.println("[ ]");
        } catch (Exception e) {
            System.out.println("[!]");
        }
    }

    protected abstract void test();

}
```

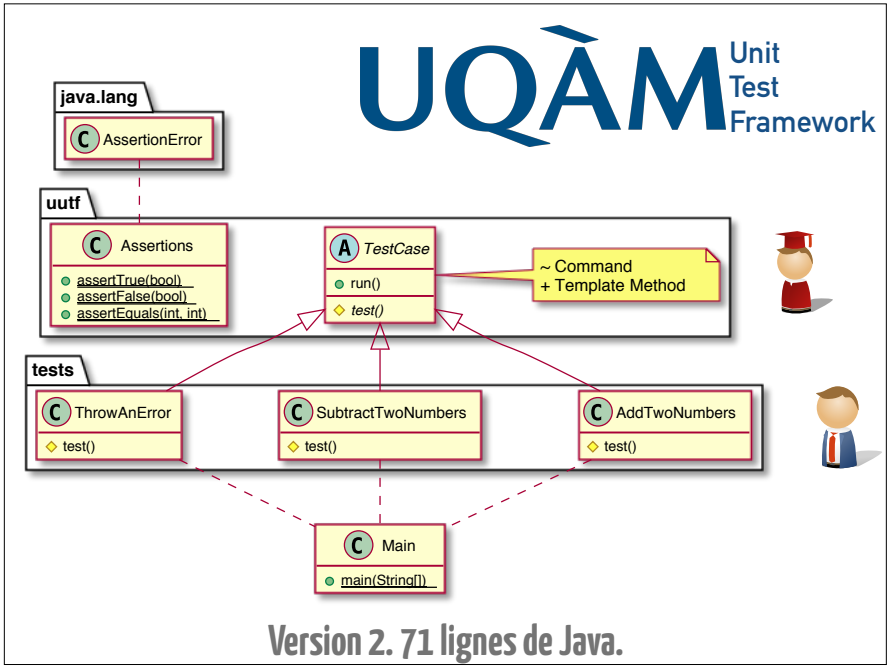
Template Method

```
public class AddTwoNumbers extends TestCase {

    @Override
    protected void test() {
        int x = 1;
        int y = 1;
        assertEquals(2, x+y);
    }

}
```

Extension par Héritage

```
inf5153-junit-demo — -bash — 85×6
lucifer:inf5153-junit-demo mosser$ mvn -q clean package exec:java
# JUnit Demonstration
## Case tests.AddTwoNumbers [X]
## Case tests.SubtractTwoNumbers [ ]
## Case tests.ThrowAnException [!]
lucifer:inf5153-junit-demo mosser$
```

```java
public static void main(String[] args) {
    System.out.println("# JUnit Demonstration");
    (new AddTwoNumbers()).run();
    (new SubtractTwoNumbers()).run();
    (new ThrowAnException()).run();
}
```

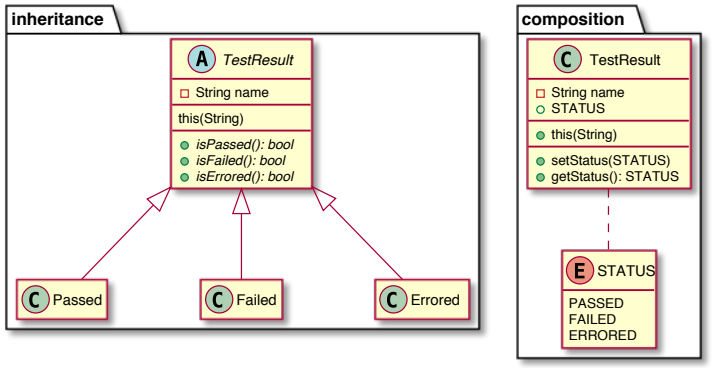


Version 2. 71 lignes de Java.

Succès & échecs 4

Comment traiter les résultats ?

```
# JUnit Demonstration
## [!] tests.ThrowAnException
## [X] tests.AddTwoNumbers
## [ ] tests.SubtractTwoNumbers
{[Passed]=1, [Failed]=1, [Errored]=1}
```



Héritage ou Composition ?

```java
public enum STATUS {
    PASSED('X'),
    FAILED(' '),
    ERRORED('!');

    private char symbol;

    STATUS(char symbol) {
        this.symbol = symbol;
    }

    @Override
    public String toString() {
        return "["+symbol+"]";
    }
}
```

```java
public class TestResult {

    private String name;
    private STATUS status;

    public TestResult(String name) {
        this.name = name;
    }

    public void setStatus(STATUS status) {
        this.status = status;
    }

    public STATUS getStatus() {
        return status;
    }

    @Override
    public String toString() {
        return "## " + status + " " + name;
    }
}
```

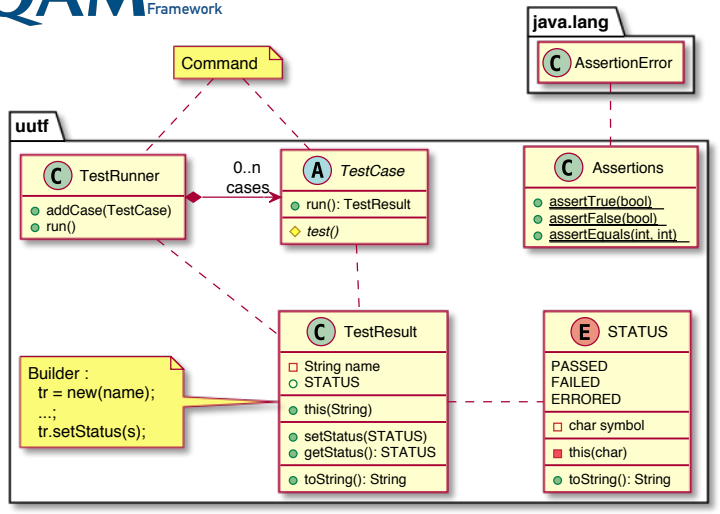
```java
public abstract class TestCase {

    public final TestResult run() {
        TestResult result = new TestResult(this.getClass().getCanonicalName());
        try {
            test();
            result.setStatus(STATUS.PASSED);
        } catch (AssertionError ae) {
            result.setStatus(STATUS.FAILED);
        } catch (Exception e) {
            result.setStatus(STATUS.ERRORED);
        }
        return result;
    }

    protected abstract void test();

}
```

```java
public class TestRunner {

    private Set<TestCase> cases = new HashSet<>();

    public void addCase(TestCase tc) {
        this.cases.add(tc);
    }

    public void run() {
        Map<STATUS, Integer> counters = new HashMap<>();
        Set<TestResult> results = new HashSet<>();
        for(TestCase tc: cases) {
            TestResult r = tc.run();
            counters.put(r.getStatus(), counters.getOrDefault(r.getStatus(),0)+1);
            results.add(r);
        }
        results.forEach(System.out::println);
        System.out.println(counters);
    }

}
```

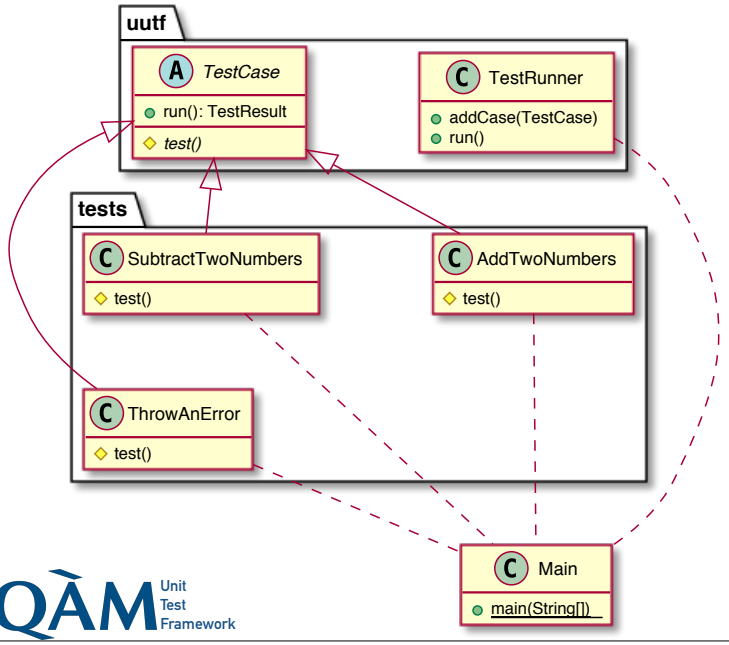
```java
public class Main {

    public static void main(String[] args) {
        System.out.println("# JUnit Demonstration");

        TestRunner runner = new TestRunner();
        runner.addCase(new AddTwoNumbers());
        runner.addCase(new SubtractTwoNumbers());
        runner.addCase(new ThrowAnException());
        runner.run();
    }

}
```

```
inf5153-junit-demo — -bash — 80×7
azrael:inf5153-junit-demo mosser$ mvn -q exec:java
# JUnit Demonstration
## [ ] tests.SubtractTwoNumbers
## [X] tests.AddTwoNumbers
## [!] tests.ThrowAnException
{[X]=1, [!]=1, [ ]=1}
azrael:inf5153-junit-demo mosser$
```

UQÀM Unit Test Framework



Version 3. 84 lignes de Java.



UQÀM Unit Test Framework

Suite de tests

5

Problème :
C'est le Runner qui compose !

```
public class TestRunner {
    // …
    public void run() {
        Map<STATUS, Integer> counters = new HashMap<>();
        Set<TestResult> results = new HashSet<>();
        for(TestCase tc: cases) {
            TestResult r = tc.run();
            counters.put(r.getStatus(), counters.getOrDefault(r.getStatus(),0)+1);
            results.add(r);
        }
        results.forEach(System.out::println);
        System.out.println(counters);
    }
}
```

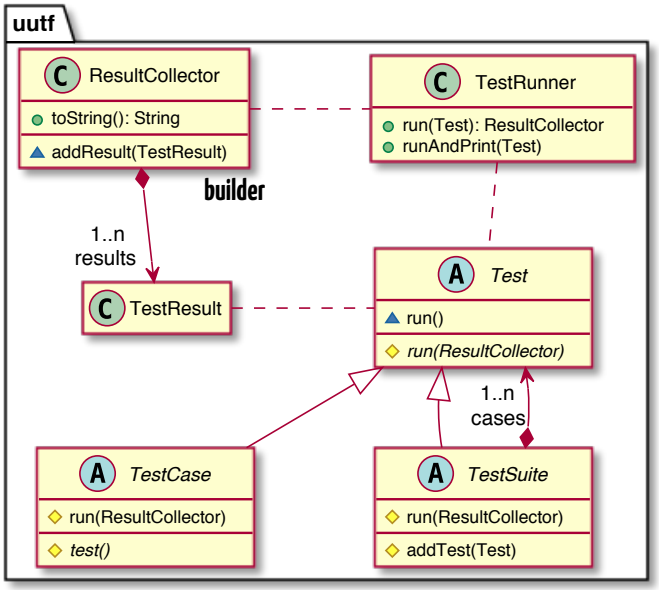
Responsabilité unique …

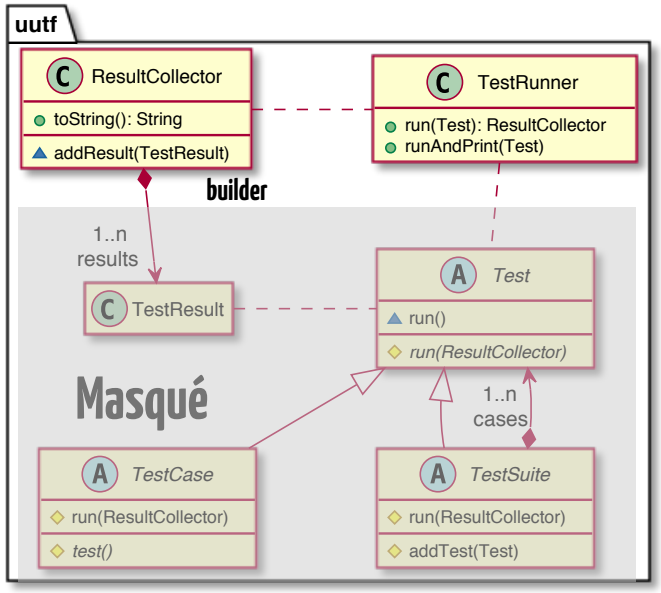
Proposition de conception

- Un **`Test`** peut être :
  - Un **`TestCase`** atomique (AddTwoNumbers, …)
  - Une **`TestSuite`**, qui est composée de **`Test`**s(patron Composite)
- Un **`Test`** porte la responsabilité de s'exécuter
- Le **`TestRunner`** lance UN SEUL **`Test`** et affiche son résultat

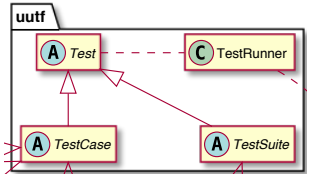
Proposition de conception

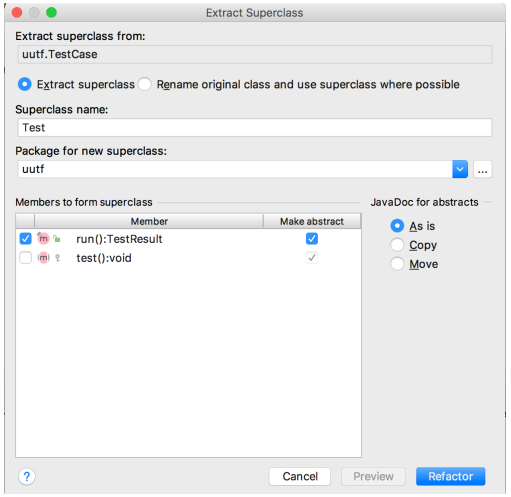
- Un **`Test`** peut être :
  - Un **`TestCase`** atomique (AddTwoNumbers, …)
  - Une **`TestSuite`**, qui est composée de **`Test`**s(patron Composite)
- Un **`Test`** porte la responsabilité de s'exécuter
- Le **`TestRunner`** lance UN SEUL **`Test`** et affiche son résultat
- Problèmes :
  - Comment composer les résultats des tests ?
  - Comment ré-usiner le code pour en faire le moins possible ?





Extraction automatique de la super-classe Test





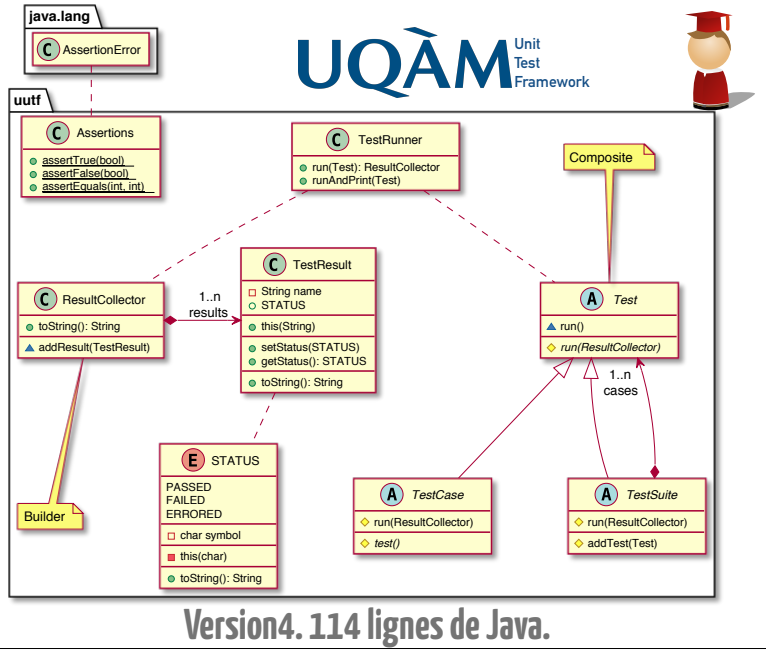

```java
public abstract class Test {

    final void run() {
        ResultCollector rc = new ResultCollector();
        this.run(rc);
        System.out.println(rc);
    }

    protected abstract void run(ResultCollector rc);

}


public class ResultCollector {

    private Set<TestResult> results = new HashSet<>();

    public void addResult(TestResult tr) { this.results.add(tr); }

    @Override
    public String toString() {
        StringBuilder builder = new StringBuilder();
        Map<STATUS, Integer> counters = new HashMap<>();
        for(TestResult tr: results) {
            counters.put(tr.getStatus(), counters.getOrDefault(tr.getStatus(),0)+1);
            builder.append(tr).append("\n");
        }
        builder.append(counters);
        return builder.toString();
    }
}
```

```java
public abstract class TestCase extends Test {

    @Override
    protected final void run(ResultCollector rc) {
        TestResult result = new TestResult(this.getClass().getCanonicalName());
        try {
            test();
            result.setStatus(STATUS.PASSED);
        } catch (AssertionError ae) {
            result.setStatus(STATUS.FAILED);
        } catch (Exception e) {
            result.setStatus(STATUS.ERRORED);
        }
        rc.addResult(result);
    }

    protected abstract void test();

}

public class TestSuite extends Test {

    private Set<Test> cases = new HashSet<>();

    protected void addTest(Test t) { this.cases.add(t); }

    @Override
    protected void run(ResultCollector rc) {
        for(Test t: this.cases)
            t.run(rc);
    }

}
```

```java
public class Main {

    public static void main(String[] args) {
        System.out.println("# JUnit Demonstration");

        TestRunner runner = new TestRunner();
        runner.runAndPrint(new IntegerTests());
    }
}
```

```java
public class TestRunner {

    public void runAndPrint(Test t) {
        System.out.println(this.run(t));
    }

    public ResultCollector run(Test t) {
        ResultCollector rc = new ResultCollector();
        t.run(new ResultCollector());
        return rc;
    }

}
```

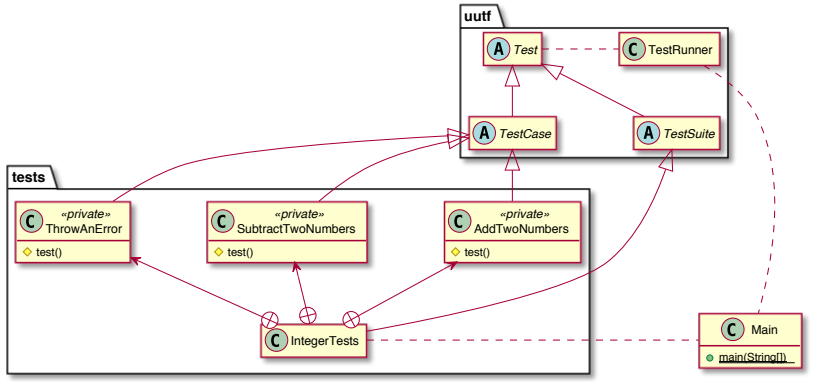
```java
public class IntegerTests extends TestSuite {

    public IntegerTests() {
        addTest(new SubtractTwoNumbers());
        addTest(new ThrowAnException());
        addTest(new AddTwoNumbers());
    }

}
```



Version4. 114 lignes de Java.

```java
public class IntegerTests extends TestSuite {

    public IntegerTests() {
        addTest(new SubtractTwoNumbers());
    }

    private class AddTwoNumbers extends TestCase {

        private int x, y = 0;

        @Override protected void setUp() {
            x = 1; y = 1;
        }

        @Override
        protected void test() {
            assertEquals(2, x+y);
        }

    }

}
```

UQÀM Unit Test Framework



Mise en contexte 6

Problème : Contexte melangé au test !

```java
public class AddTwoNumbers extends TestCase {

    @Override
    protected void test() {
        int x = 1;
        int y = 1;
        assertEquals(2, x+y);
    }

}
```

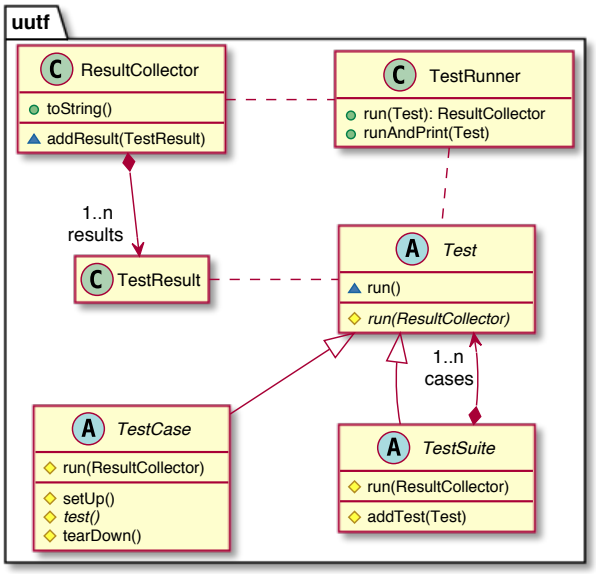
Responsabilité unique ...

```java
public class IntegerTest extends TestCase {

    private int x = 0;
    private int y = 0;

    public void setUp() throws Exception {
        x = 1;
        y = 1;
    }

    public void testAdd() {
        assertEquals(2, x+y)
    }

    public void testSub() {
        assertEquals(0, x-y)
    }

}
```

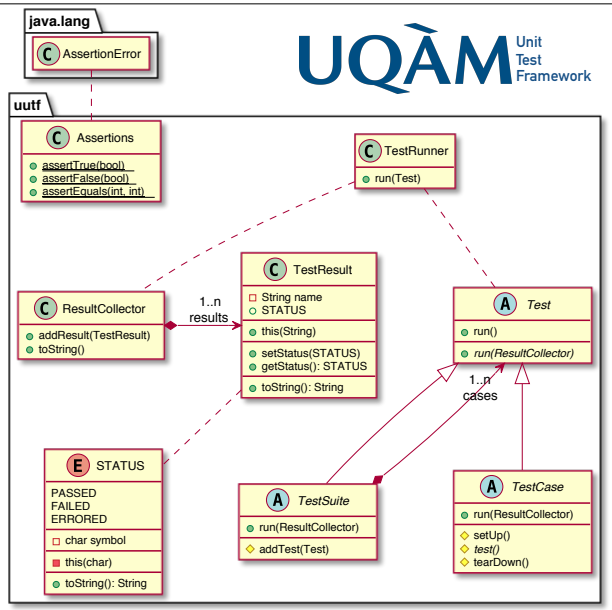
Junit 3.x utilise des méthodes prédéfinies

setUp()

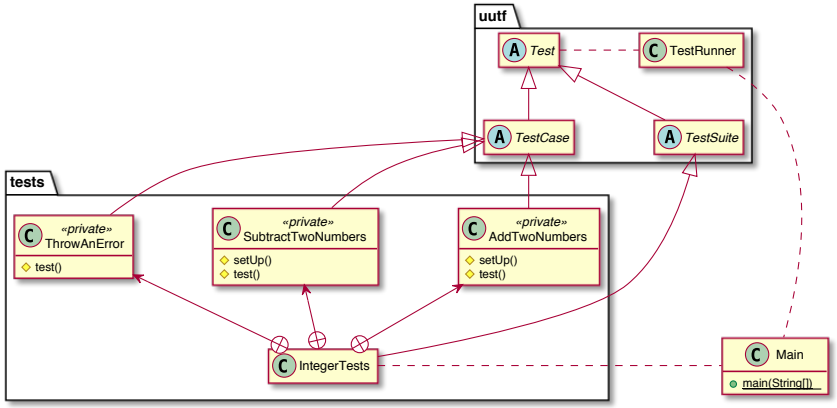
tearDown()



```java
public abstract class TestCase extends Test {

    @Override
    protected final void run(ResultCollector rc) {
        TestResult result = new TestResult(this.getClass().getCanonicalName());
        try {
            setUp();
            test();
            result.setStatus(STATUS.PASSED);
        } catch (AssertionError ae) {
            result.setStatus(STATUS.FAILED);
        } catch (Exception e) {
            result.setStatus(STATUS.ERRORED);
        } finally {
            tearDown();
        }
        rc.addResult(result);
    }

    protected void setUp() { }
    protected abstract void test();
    protected void tearDown() { }

}
```



Version 5. 119 lignes de Java.




```java
public class IntegerTests extends TestSuite {

    public IntegerTests() {
        addTest(new SubtractTwoNumbers());
    }

    private class AddTwoNumbers extends TestCase {

        private int x, y = 0;

        @Override protected void setUp() {
            x = 1; y = 1;
        }

        @Override
        protected void test() {
            assertEquals(2, x+y);
        }

    }

}
```

On y est presque ...

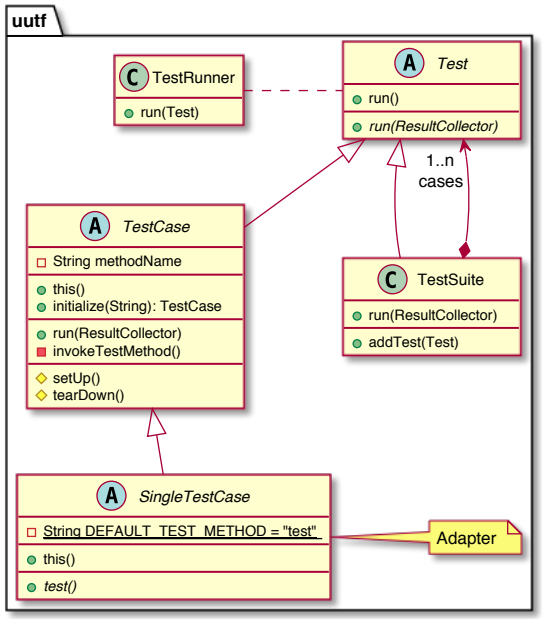
```java
public class IntegerTest extends TestCase {

   private int x = 0;
   private int y = 0;

   public void setUp() throws Exception {
      x = 1;
      y = 1;
   }

   public void testAdd() {
      assertEquals(2, x+y)
   }
}
```

Intégration Java 7

Comment dégager les classes internes ?

```
private class AddTwoNumbers extends TestCase {

    private int x, y = 0;

    @Override protected void setUp() {
        x = 1; y = 1;
    }

    @Override
    protected void test() {
        assertEquals(2, x+y);
    }

}
```

```
public class IntegerTest extends TestCase {

    private int x = 0;
    private int y = 0;

    public void setUp() throws Exception {
        x = 1;
        y = 1;
    }

    public void testAdd() {
        assertEquals(2, x+y)
    }
}
```



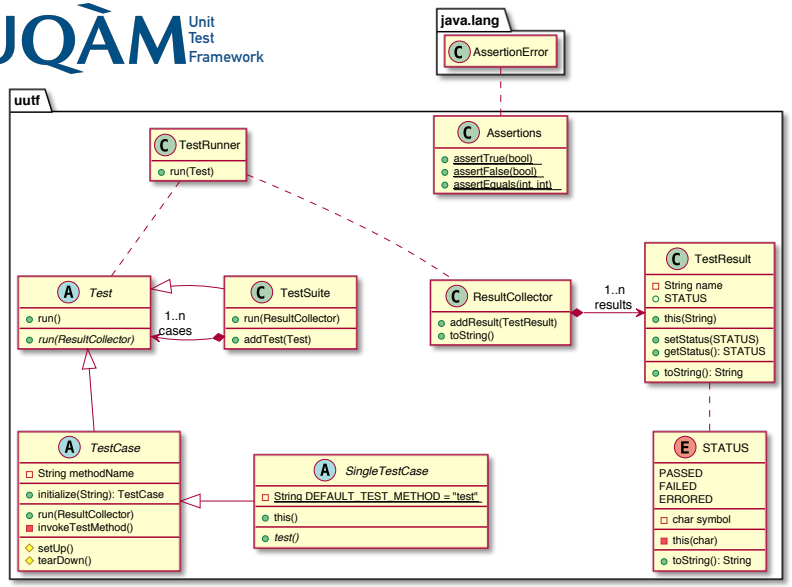

```
public abstract class TestCase extends Test {

    private String testMethodName;

    public TestCase initialize(String testMethodName) {
        this.testMethodName = testMethodName;
        return this;
    }

    @Override
    protected void run(ResultCollector rc) {
        TestResult result =
                new TestResult(this.getClass().getCanonicalName()+"::"+testMethodName);
        try {
            setUp();
            invokeTestMethod();
            result.setStatus(STATUS.PASSED);
        } catch (InvocationTargetException ite) {
            if (ite.getTargetException() instanceof AssertionError)
                result.setStatus(STATUS.FAILED);
            else
                result.setStatus(STATUS.ERRORED);
        } catch (Exception e) {
            result.setStatus(STATUS.ERRORED);
        } finally {
            tearDown();
        }
        rc.addResult(result);
    }

    private void invokeTestMethod() throws Exception {
        Method tm = this.getClass().getMethod(testMethodName);
        tm.invoke(this);
    }

    public void setUp() { }
    public void tearDown() { }

}
```

```java
public abstract class SingleTestCase extends TestCase {

    private static final String DEFAULT_TEST_METHOD = "test";

    public SingleTestCase() { initialize(DEFAULT_TEST_METHOD); }

    public abstract void test();

}
```

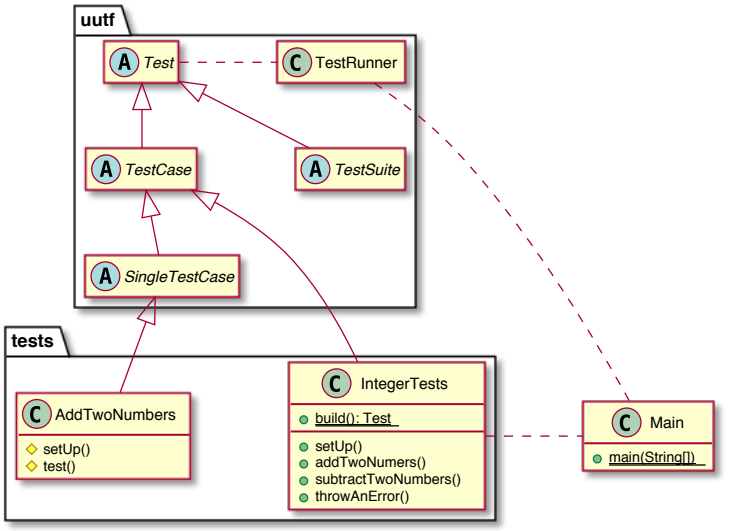
```java
public class TestSuite extends Test {

    private Set<Test> cases = new HashSet<>();

    public void addTest(Test t) { this.cases.add(t); }

    @Override
    protected void run(ResultCollector rc) {
        for(Test t: this.cases)
            t.run(rc);
    }

}
```

```java
public class IntegerTests extends TestCase {

    public static Test build() {
        TestSuite suite = new TestSuite();
        suite.addTest(new IntegerTests().initialize("addTwoNumbers"));
        suite.addTest(new IntegerTests().initialize("subtractTwoNumbers"));
        suite.addTest(new IntegerTests().initialize("throwAnException"));
        return suite;
    }

    private int x, y = 0;

    @Override public void setUp() { x = 1; y = 1; }
    public void addTwoNumbers() { assertEquals(2, x+y); }
    public void subtractTwoNumbers() { assertEquals(1, x-y); }
    public void throwAnException() { throw new RuntimeException(); }

}
```

UQÀM Unit Test Framework



Version 6. 139 lignes de Java.



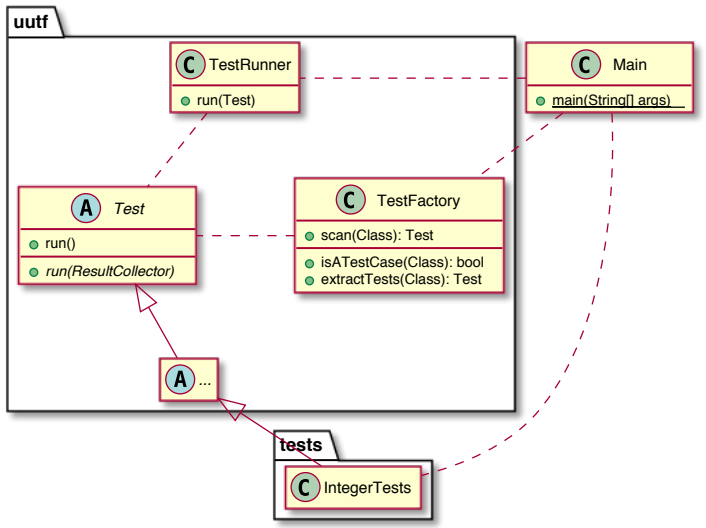
Intégration Java

Le retour

Comment dégager la fonction de build ?

```
public static Test build() {
    TestSuite suite = new TestSuite();
    suite.addTest(new IntegerTests("addTwoNumbers"));
    suite.addTest(new IntegerTests("subtractTwoNumbers"));
    suite.addTest(new IntegerTests("throwAnException"));
    return suite;
}
```

Un peu comme si on voulait FABRIQUER des objets ...




```
public class TestFactory {

    private static final String TEST_METHOD_PREFIX = "test_";

    public Test scan(Class klass) {
        if (! isATestCase(klass))
            return new TestSuite();
        try {
            return extractTests(klass);
        } catch (Exception e) {
            return new TestSuite();
        }
    }

    private Test extractTests(Class klass) throws Exception {









    }

    private void buildTestCase(Class klass, TestSuite suite, Method m)
            throws Exception {



    }

    private boolean isATestCase(Class klass) {

    }
}
```

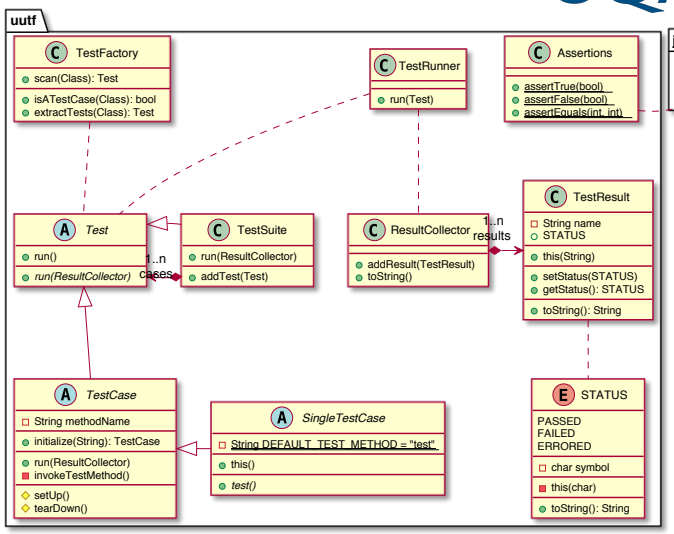
```
public class TestFactory {

    private static final String TEST_METHOD_PREFIX = "test_";

    public Test scan(Class klass) {
        if (! isATestCase(klass))
            return new TestSuite();
        try {
            return extractTests(klass);
        } catch (Exception e) {
            return new TestSuite();
        }
    }

    private Test extractTests(Class klass) throws Exception {









    }

    private void buildTestCase(Class klass, TestSuite suite, Method m)
            throws Exception {



    }

    private boolean isATestCase(Class klass) {
        return TestCase.class.isAssignableFrom(klass);
    }

}
```

```
public class TestFactory {

    private static final String TEST_METHOD_PREFIX = "test_";

    public Test scan(Class klass) {
        if (! isATestCase(klass))
            return new TestSuite();
        try {
            return extractTests(klass);
        } catch (Exception e) {
            return new TestSuite();
        }
    }

    private Test extractTests(Class klass) throws Exception {
        TestSuite suite = new TestSuite();
        for(Method m: klass.getMethods()) {
            if (m.getName().startsWith(TEST_METHOD_PREFIX)) {
                buildTestCase(klass, suite, m);
            }
        }
        return suite;
    }

    private void buildTestCase(Class klass, TestSuite suite, Method m)
            throws Exception {



    }

    private boolean isATestCase(Class klass) {
        return TestCase.class.isAssignableFrom(klass);
    }

}
```

```
public class TestFactory {

    private static final String TEST_METHOD_PREFIX = "test_";

    public Test scan(Class klass) {
        if (! isATestCase(klass))
            return new TestSuite();
        try {
            return extractTests(klass);
        } catch (Exception e) {
            return new TestSuite();
        }
    }

    private Test extractTests(Class klass) throws Exception {
        TestSuite suite = new TestSuite();
        for(Method m: klass.getMethods()) {
            if (m.getName().startsWith(TEST_METHOD_PREFIX)) {
                buildTestCase(klass, suite, m);
            }
        }
        return suite;
    }

    private void buildTestCase(Class klass, TestSuite suite, Method m)
            throws Exception {
        TestCase tc =
                (TestCase) klass.getDeclaredConstructor().newInstance();
        suite.addTest(tc.initialize(m.getName()));
    }

    private boolean isATestCase(Class klass) {
        return TestCase.class.isAssignableFrom(klass);
    }

}
```

```
        public class Main {
            public static void main(String[] args) {
                System.out.println("# JUnit Demonstration");

                TestFactory scanner = new TestFactory();
                TestRunner runner = new TestRunner();
                runner.runAndPrint(scanner.scan(IntegerTests.class));
            }
        }









    public class IntegerTests extends TestCase {

        private int x, y = 0;

        @Override public void setUp() { x = 1; y = 1; }
        public void test_addTwoNumbers() { assertEquals(2, x+y); }
        public void test_subtractTwoNumbers() { assertEquals(1, x-y); }
        public void test_throwAnException() { throw new RuntimeException(); }

    }
```

UQÀM Unit Test Framework



Version 6bis. 171 lignes de Java.

Conclusion 8

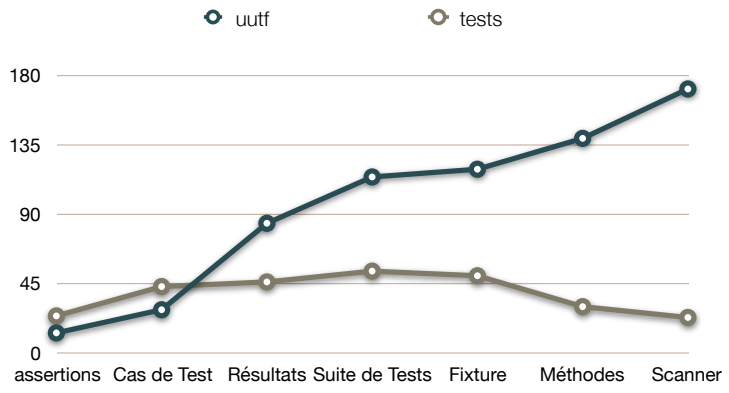
```
public class IntegerTest extends TestCase {

   private int x, y = 0;

   public void setUp() throws Exception {
      x = 1; y = 1;
   }

   public void testAdd() {
      assertEquals(2, x+y)
   }

}
```

JUnit

UQÀM Unit Test Framework

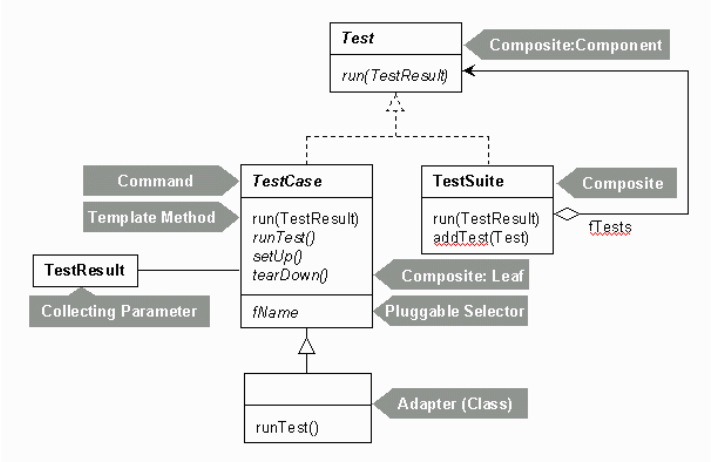
```
public class IntegerTests extends TestCase {

    private int x, y = 0;

    public void setUp() {
      x = 1; y = 1;
    }

    public void test_addTwoNumbers() {
      assertEquals(2, x+y);
    }
}
```

Taille et Livraison de valeur



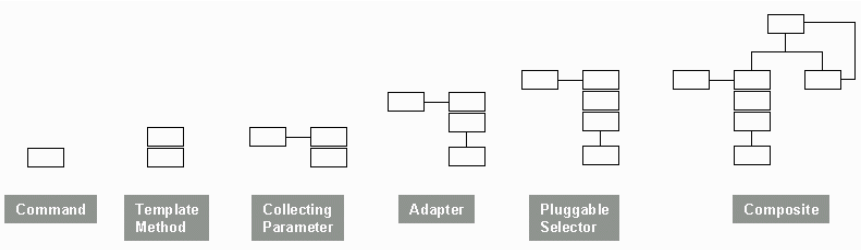
Portée		Objectif: Création	Objectif: Structure	Objectif: Comportement
	classe	**Factory**	**Adapter**	Interpreter **Template Method**
	objet	Abstract Factory **Builder** Prototype Singleton	Adapter Bridge **Composite** Decorator Facade Flyweight Proxy	Chain of Responsibility **Command** Iterator Mediator Memento Observer State Strategy Visitor

On a un peu triché (mais pas tant que ça en fait)



http://junit.sourceforge.net/doc/cookstour/cookstour.htm

Conception Itérative ("vrai histoire", pour JUnit 3.8.x)



http://junit.sourceforge.net/doc/cookstour/cookstour.htm