OODP– Session 4 - Tutorial

Session times

PT group 1 – Monday	18:00-21:00	room: Malet 403
PT group 2 – Thursday	18:00-21:00	room: Malet 407
FT - Tuesday	13:30-17:00	room: Malet 404

Email: oded@dcs.bbk.ac.uk

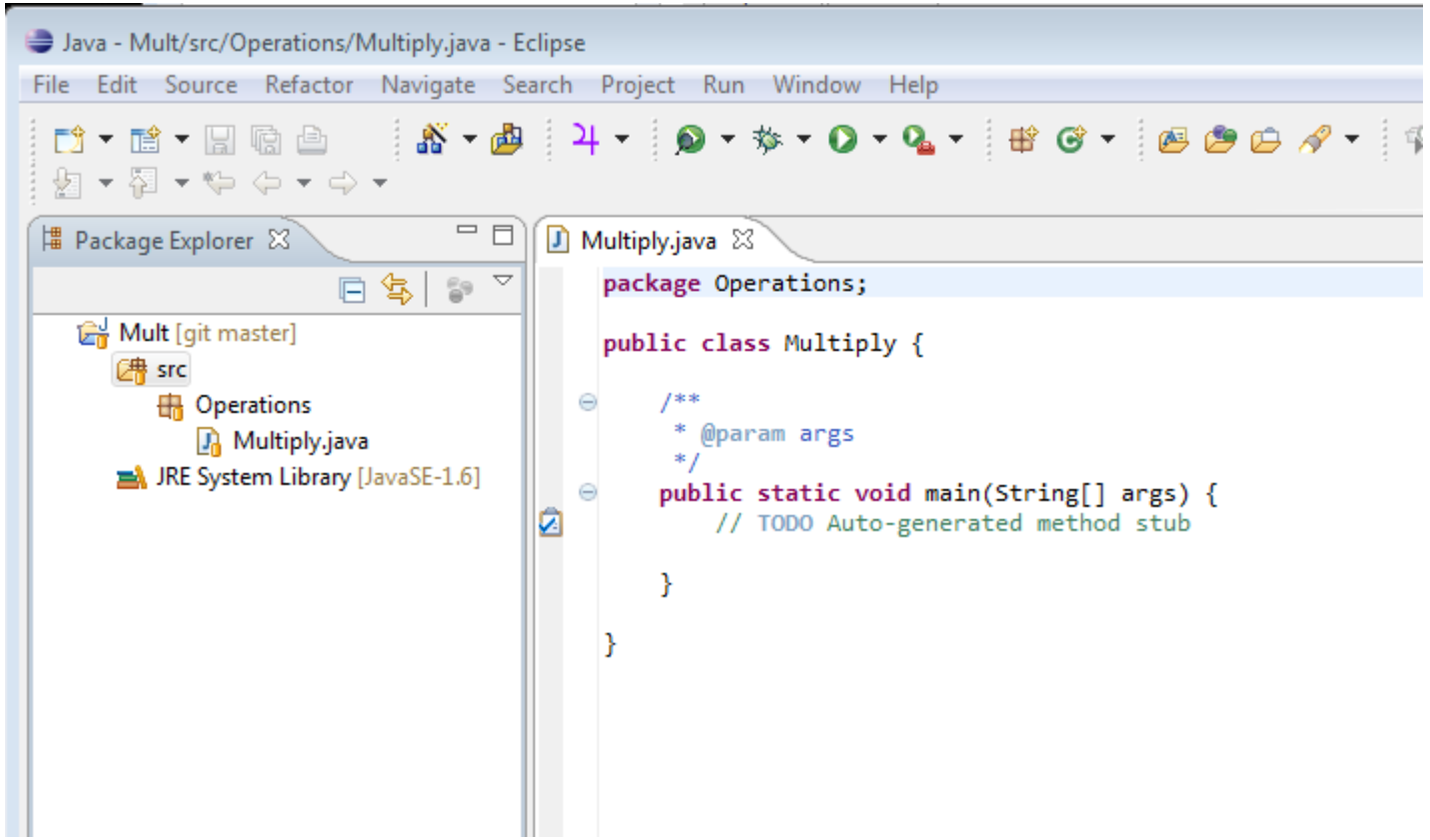
Web Page: http://www.dcs.bbk.ac.uk/~oded

Visiting Hours: Tuesday 17:00 to 19:00

Our First Test

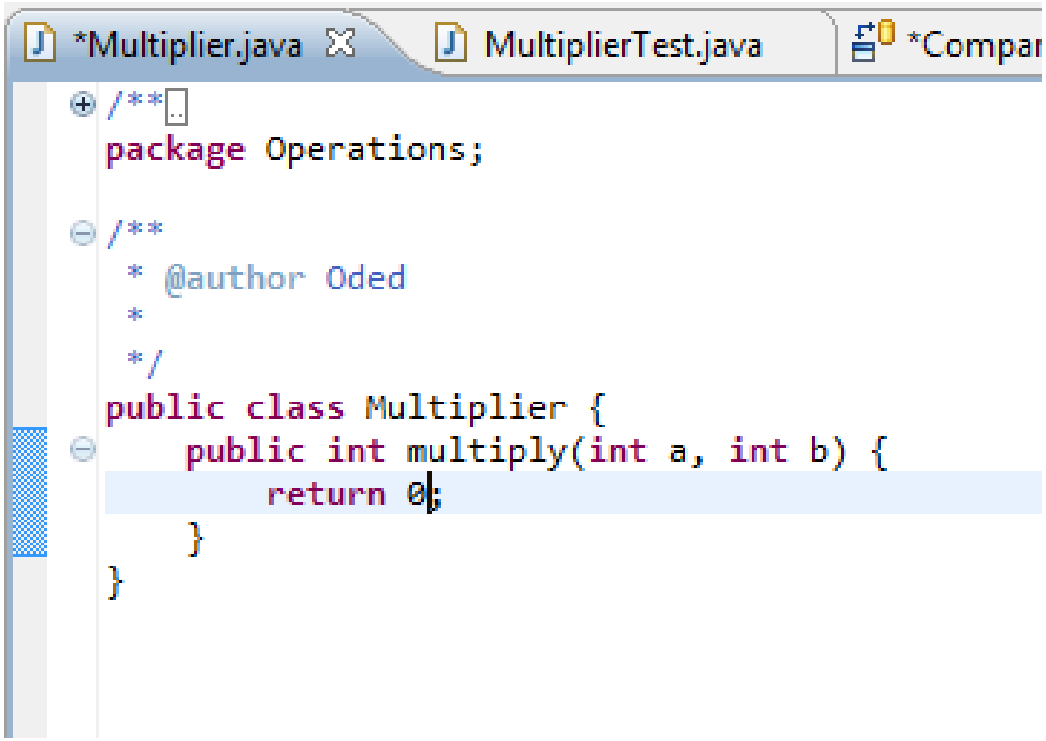
Write your own main

Don’t bother adding any coded



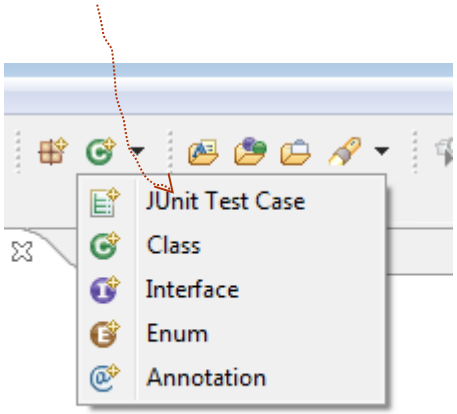
Add a class dedicated to a binary operation

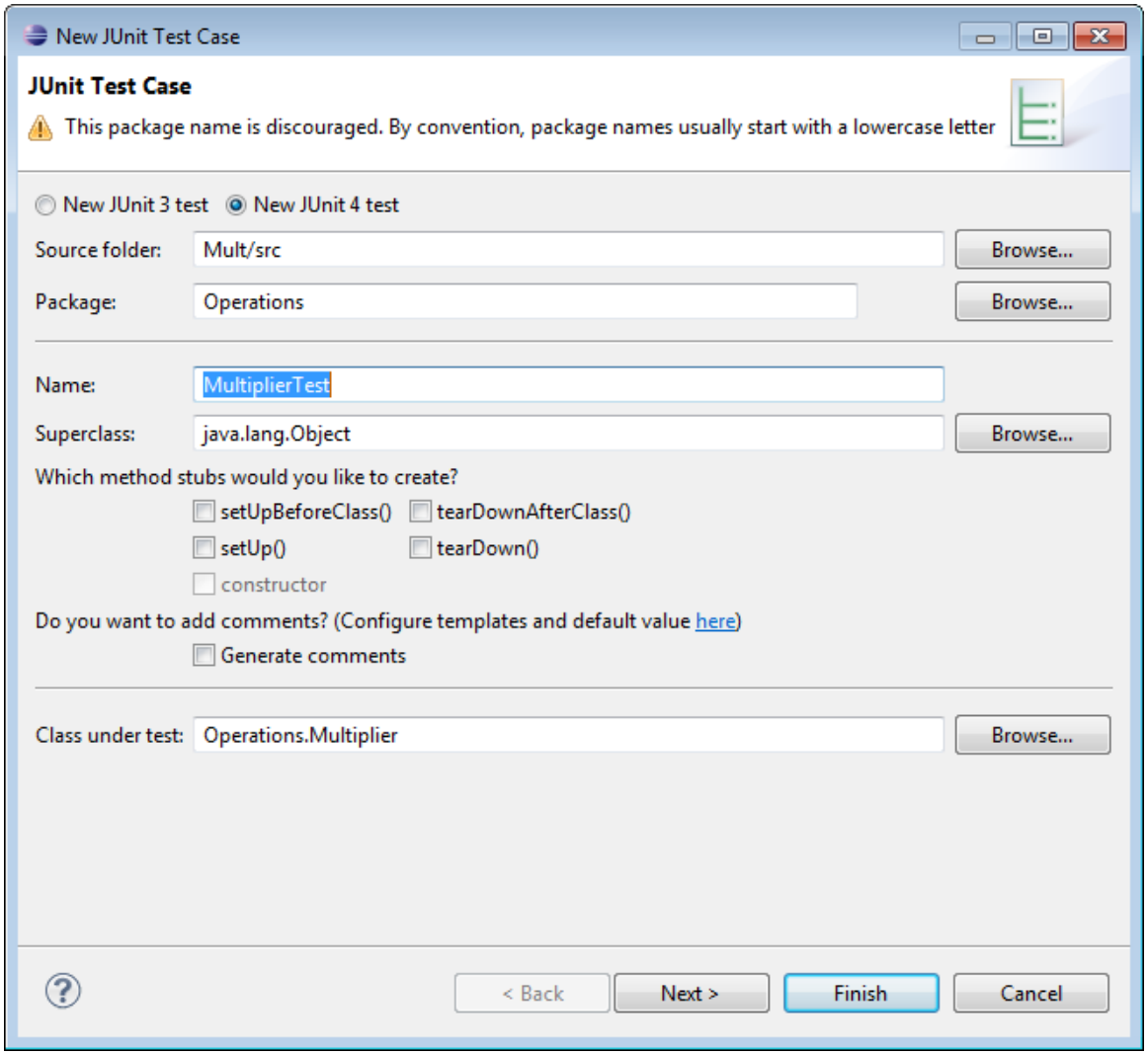
I chose to multiply (didn't bother with the code)



Lets start testing

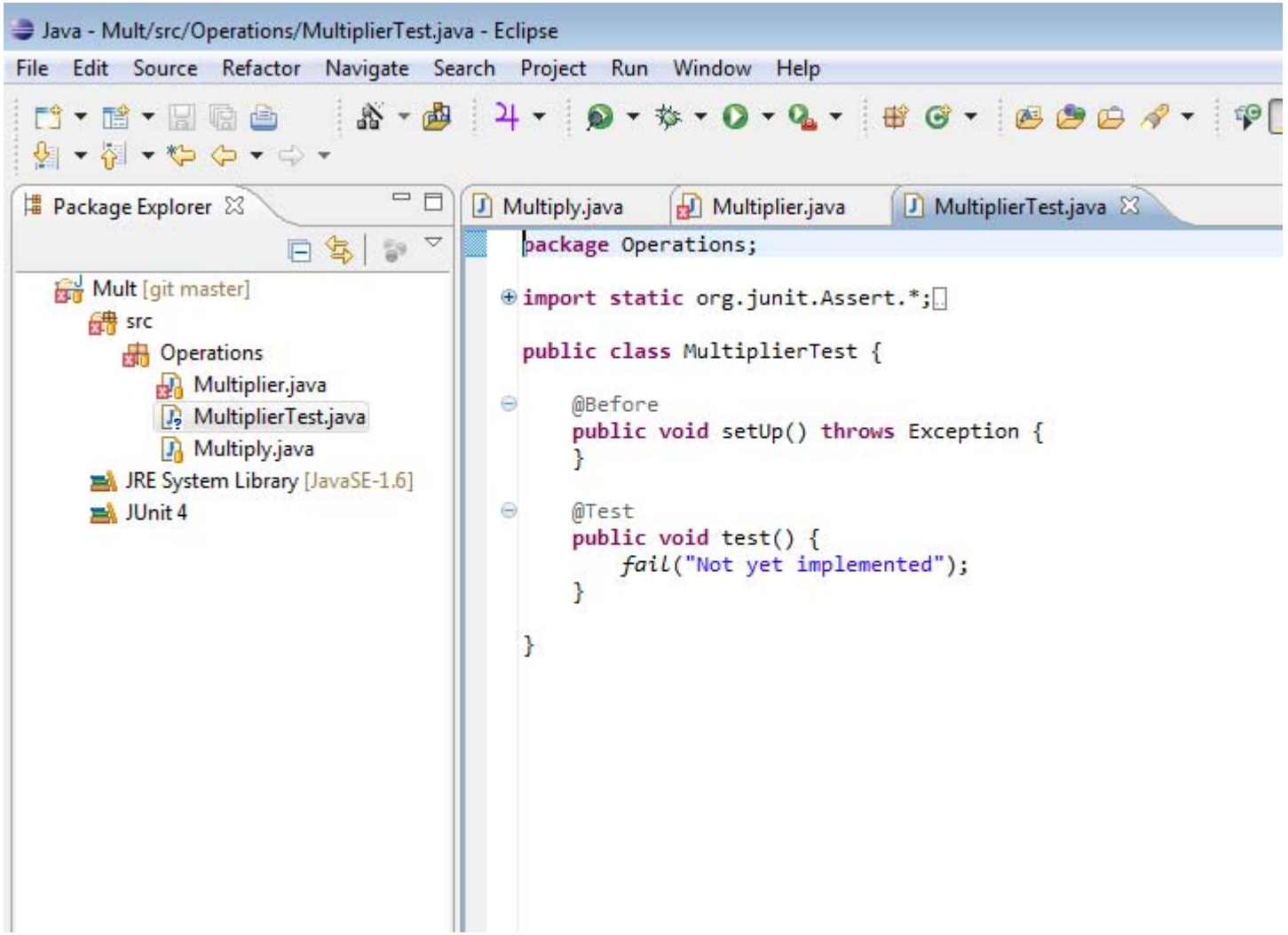
Pick this





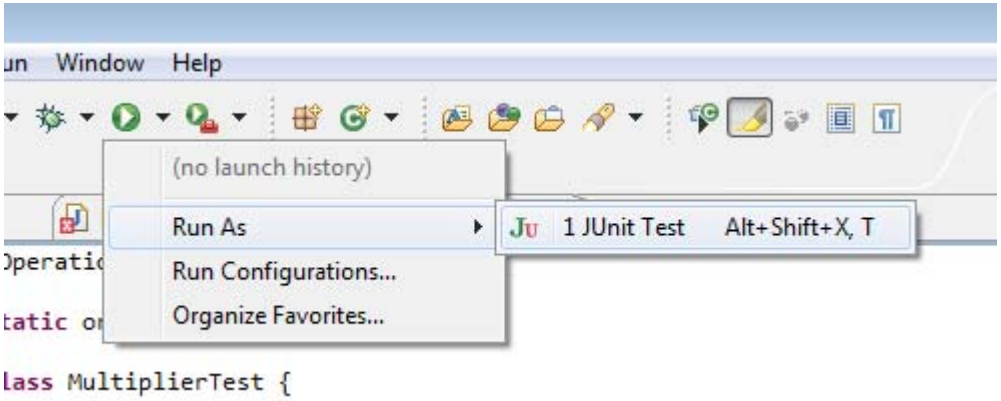
Our new test

Known also

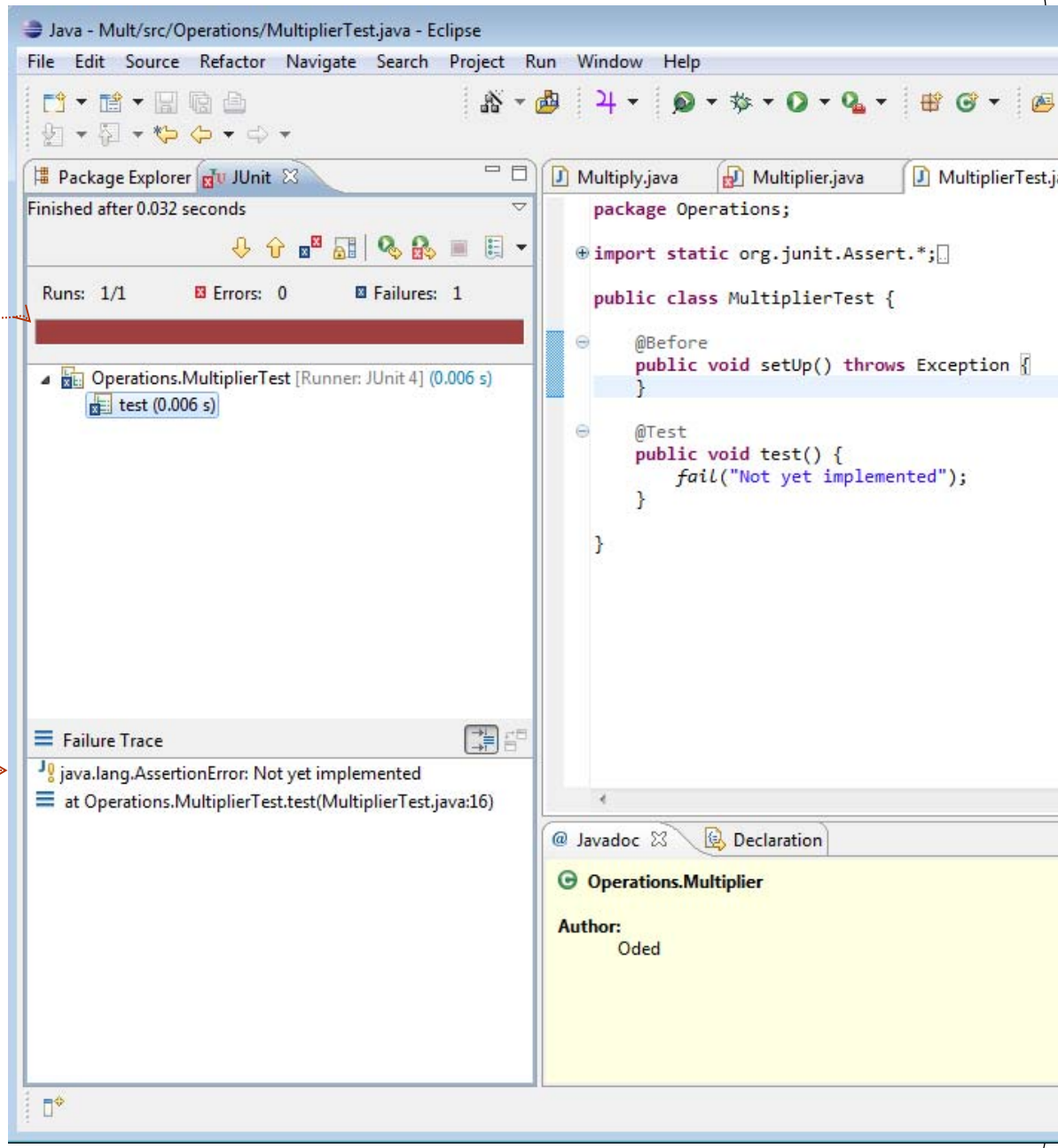


Running Our First Test

Known also



Test Failed


Java - Mult/src/Operations/MultiplierTest.java - Eclipse
File Edit Source Refactor Navigate Search Project Run Window Help
Package Explorer
JUnit
Finished after 0.032 seconds
Runs: 1/1
Errors: 0
Failures: 1
Operations.MultiplierTest [Runner: JUnit 4] (0.006 s)
test (0.006 s)
Failure Trace
java.lang.AssertionError: Not yet implemented
at Operations.MultiplierTest.test(MultiplierTest.java:16)
Multiply.java
Multiplier.java
MultiplierTest.j
package Operations;
import static org.junit.Assert.*;
public class MultiplierTest {
@Before
public void setUp() throws Exception {
}
@Test
public void test() {
fail("Not yet implemented");
}
}
Javadoc
Declaration
Operations.Multiplier
Author:
Oded

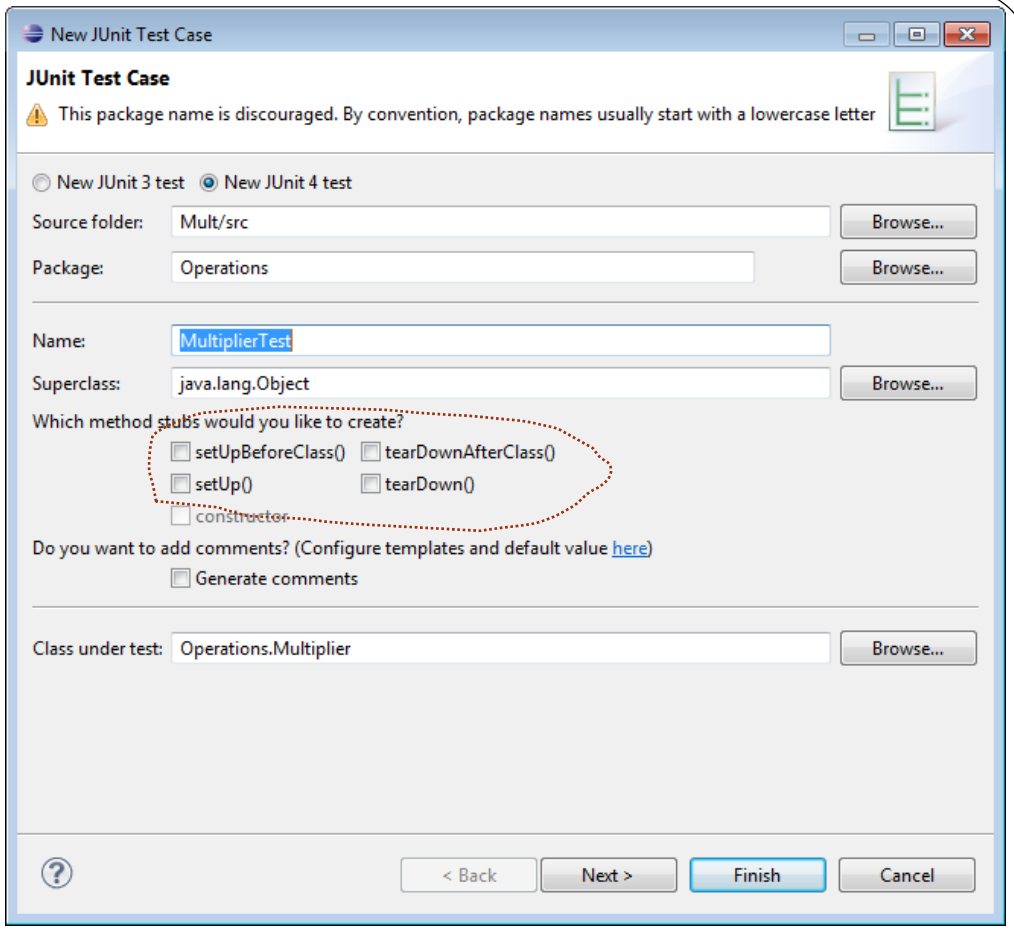
Stuff we Saw on the Way

(to our first test)

Method stubs

SetUpBeforeClass () – adds a method that is performed before all tests (we can run more than one test at a time) we might want to set up a database etc.

SetUp() – adds a method that is performed before the test, used to set up the test environment



TearDownAfterClass() – adds a method that is performed after all tests

TearDown() – adds a method that is performed after the test

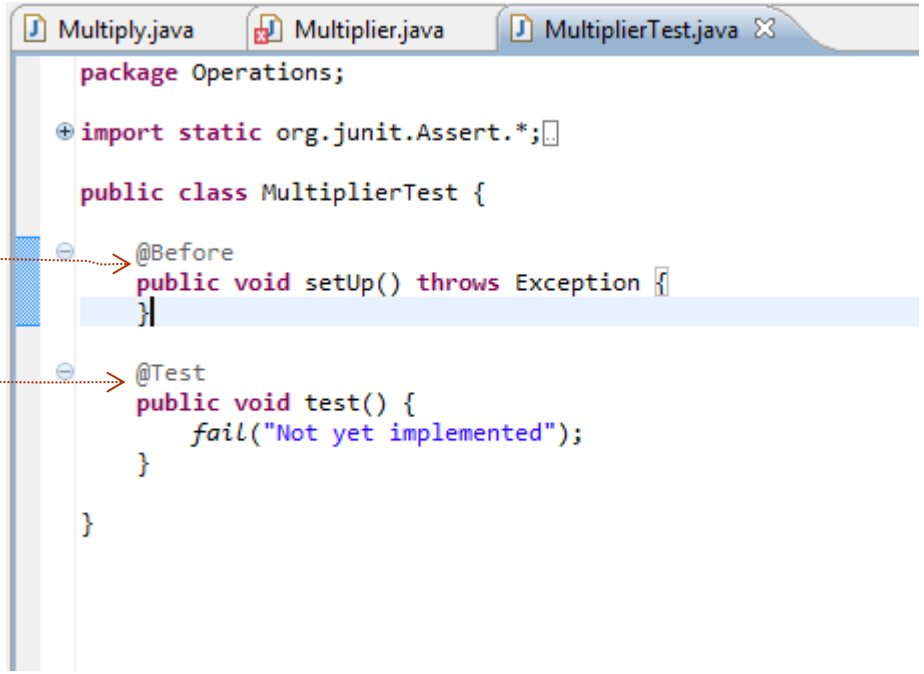
Method Stubs Manifestation - Annotations

Annotations – are data about the program that is not part of the program itself

Uses of annotations – instruction for compiler, runtime processing, Junit 4

Before method

Test method



But Our Test is Empty - Assertions

@Test - this is a test method

@Before - this is a before method

@After - this is teardown method

@BeforeClass - this a before class method

@AfterClass - this is teardown after class

@Ignore – ignore this method, when you don't want one of the above executed

@Test(expected=IllegalArgumentException.class) - does the method throw the named exception (Exception?)

@Test(timeout=10) fail after 10 millisecond – so the test does not run forever

(add timeout to your code)

Assertions

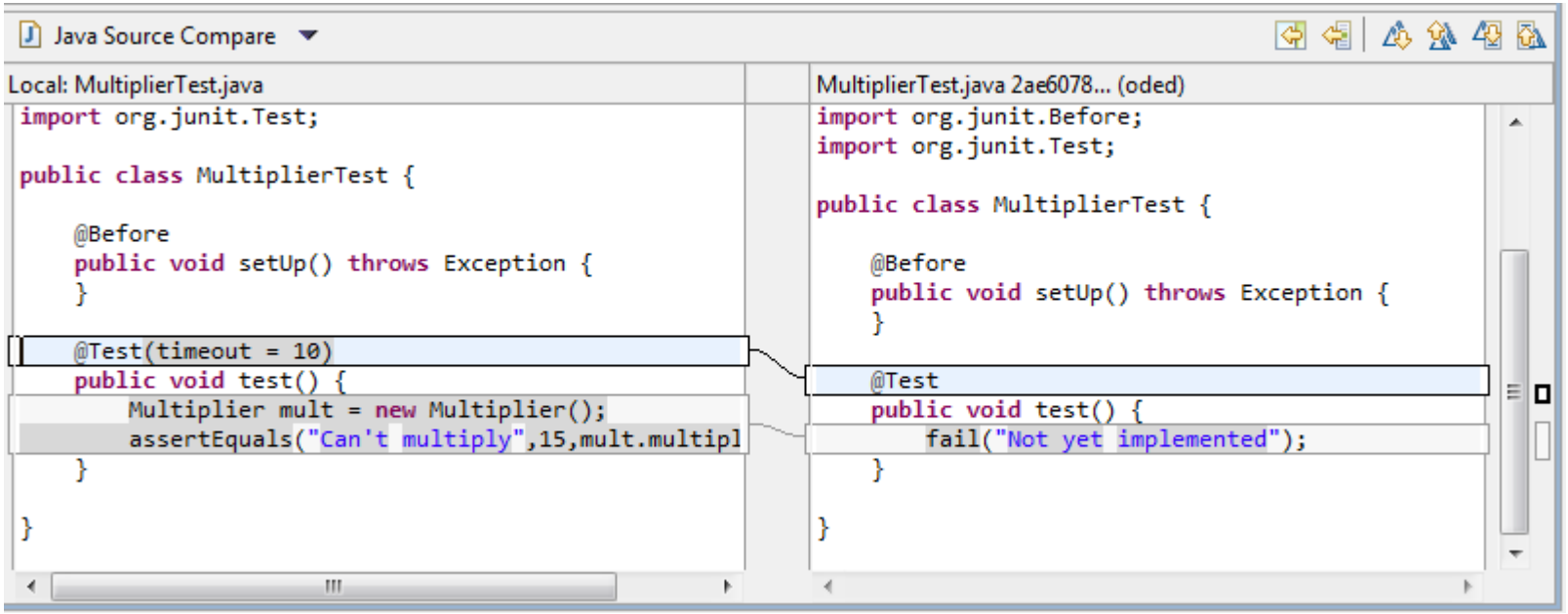
- fail([String])- test failed
- AssertTrue(true)- test passed
- assertEquals([String], expected, actual)- Check if values of expected and actual are the same.
- assertNull([String], object) – Check reference null
- assertNotNull([String], object) – Check if reference not null
- assertSame([String], expected, actual) – Check if reference to the same object
- assertNotSame([String], expected, actual) - Check if reference to different objects
- assertTrue([String], boolean condition) – Check if Boolean condition is true

Our First TDD Iteration

Real Test

- The new code is on the left

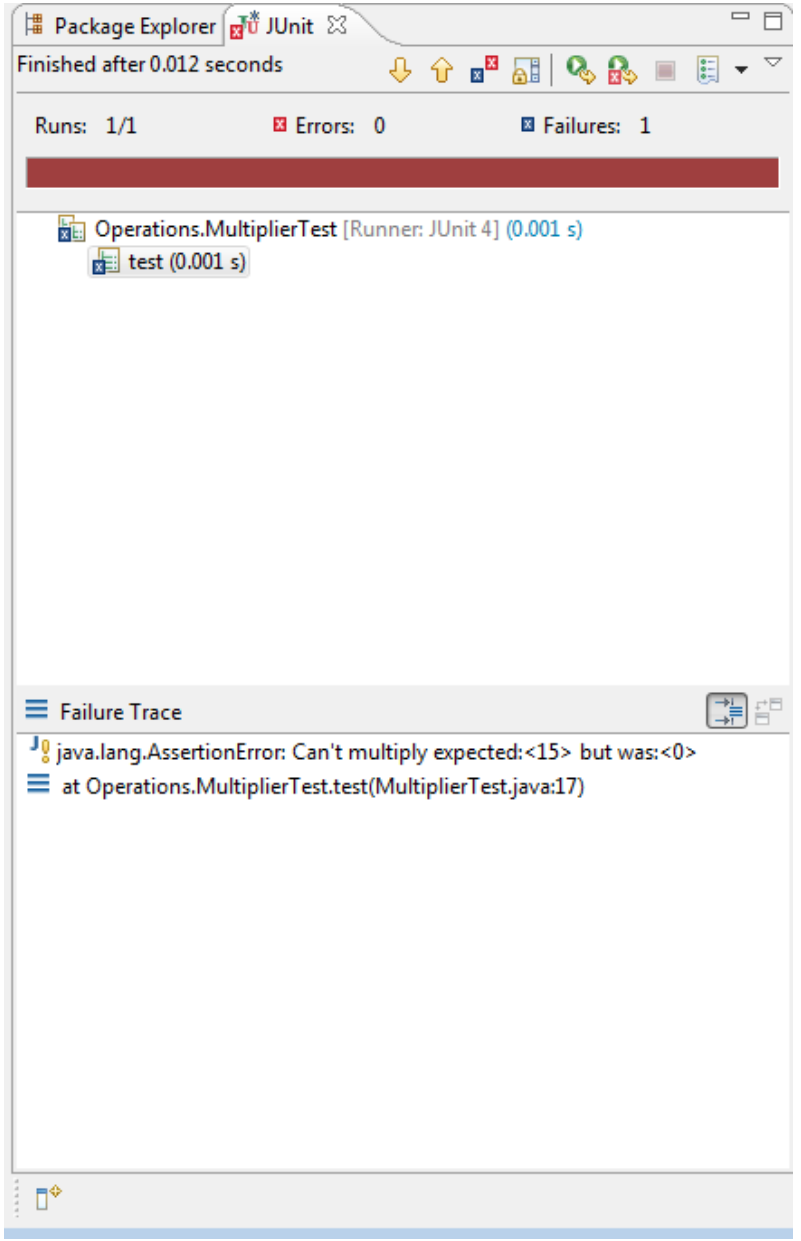
(result of comparing to HEAD)



Real Test result

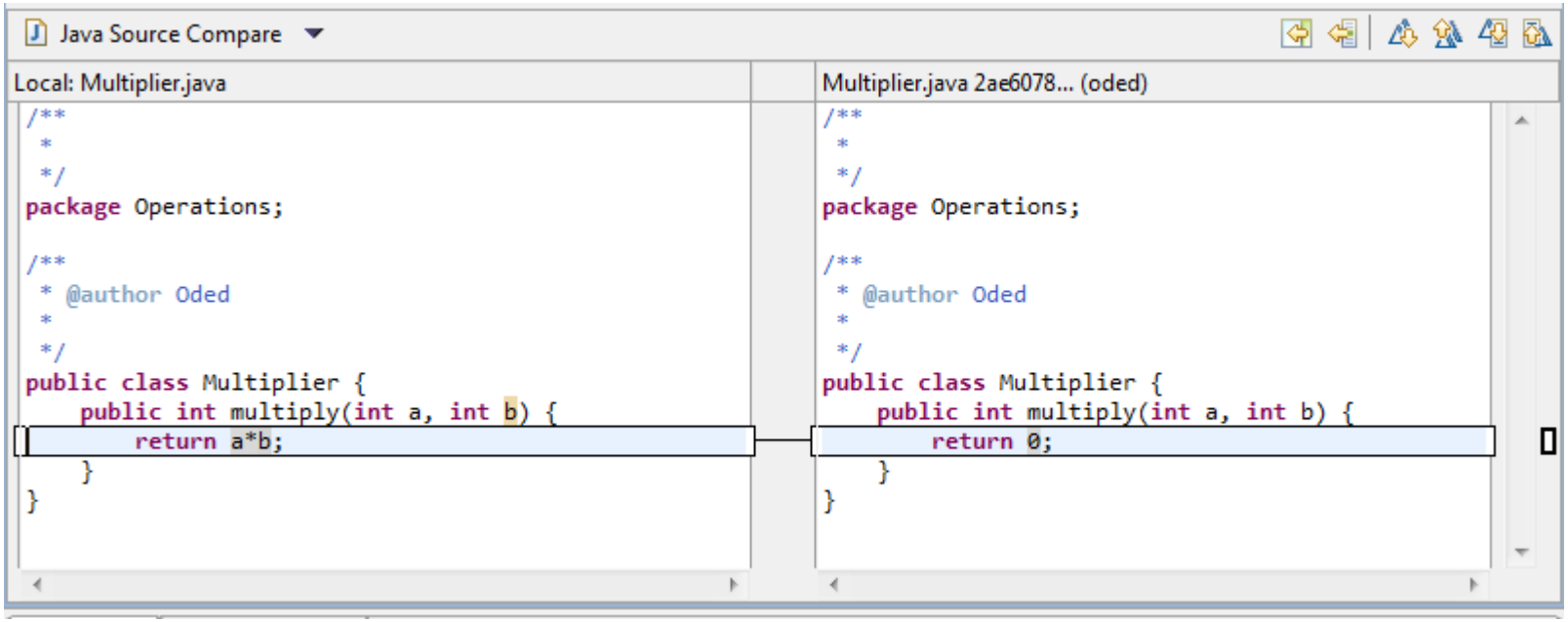
- It failed

TDD says it should – cause we haven't written the implementation!



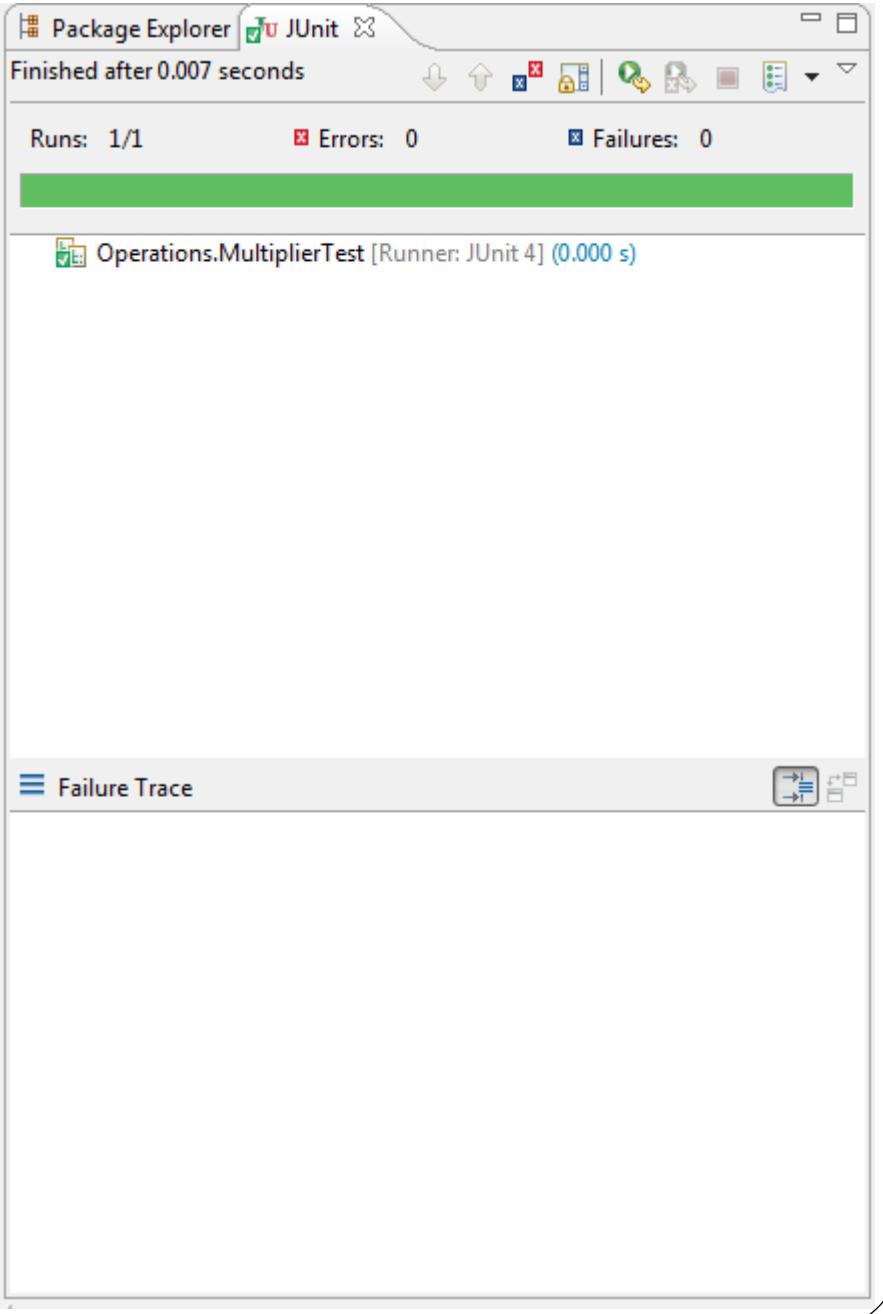
The implementation

- Implementation on the left



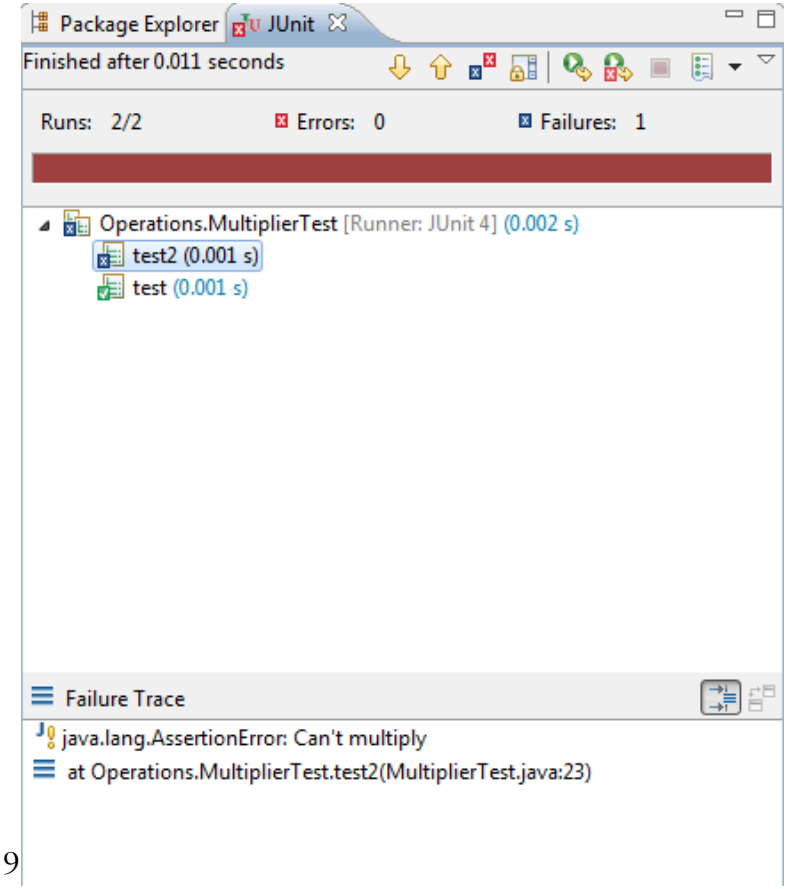
Running our test again

- Now it passed
  (surprise)



Another Test

- One passed One Failed

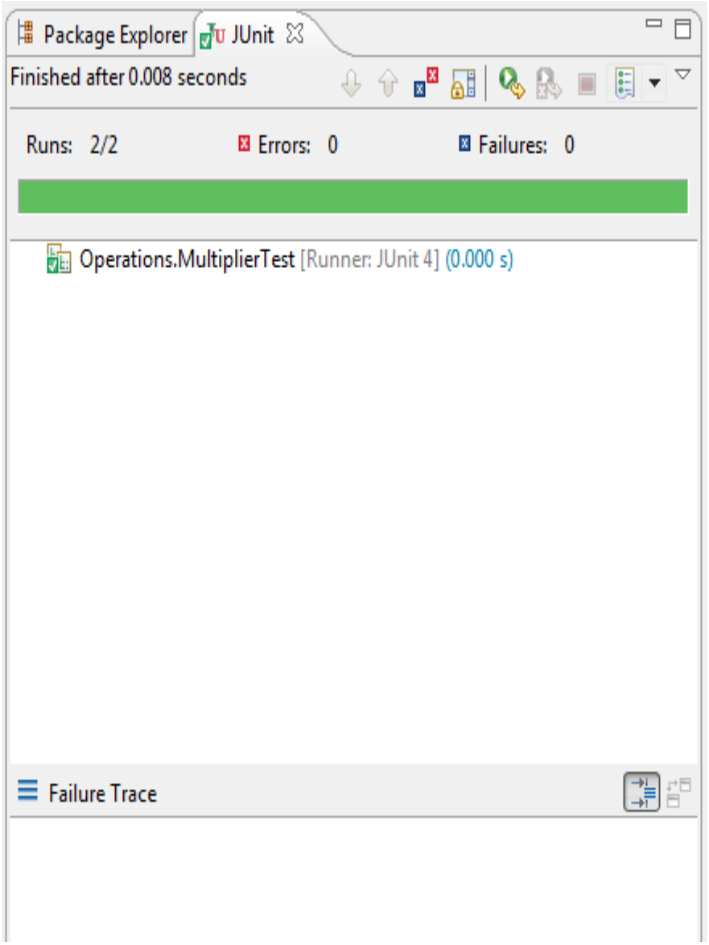


Multiply.java | Multiplier.java | MultiplierTest.java

```
package Operations;

import static org.junit.Assert.*;

public class MultiplierTest {

    @Before
    public void setUp() throws Exception {
    }

    @Test(timeout = 10)
    public void test() {
        Multiplier mult = new Multiplier();
        assertEquals("Can't multiply",15,mult.multiply(3,5));
    }

    @Test(timeout = 10)
    public void test2() {
        Multiplier mult = new Multiplier();
        assertTrue("Can't multiply",(mult.multiply(3,6) != 18));
    }

}
```

After Fixing

- One passed One Failed



Multiply.java | Multiplier.java | MultiplierTest.java

```
package Operations;

import static org.junit.Assert.*;

public class MultiplierTest {

    @Before
    public void setUp() throws Exception {
    }

    @Test(timeout = 10)
    public void test() {
        Multiplier mult = new Multiplier();
        assertEquals("Can't multiply",15,mult.multiply(3,5));
    }

    @Test(timeout = 10)
    public void test2() {
        Multiplier mult = new Multiplier();
        assertTrue("Can't multiply",(mult.multiply(3,6) != 15));
    }

}
```

Note

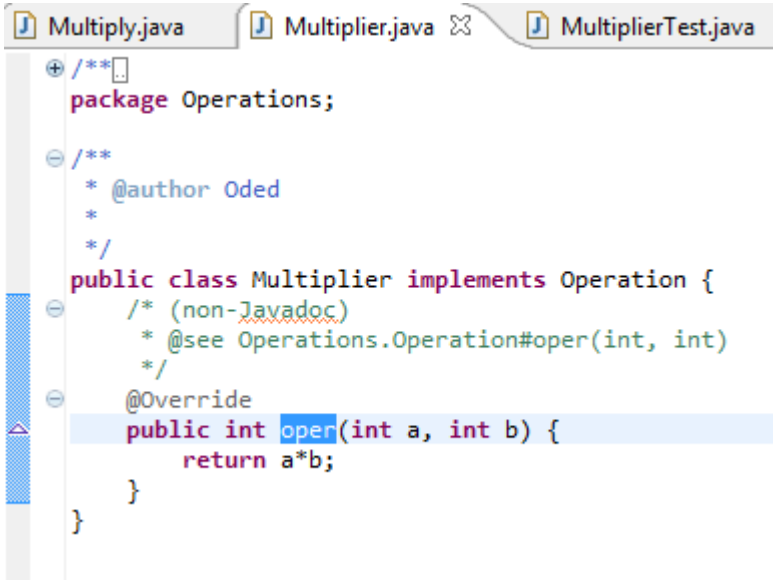
Here we wrote one of the tests after we implemented the code.

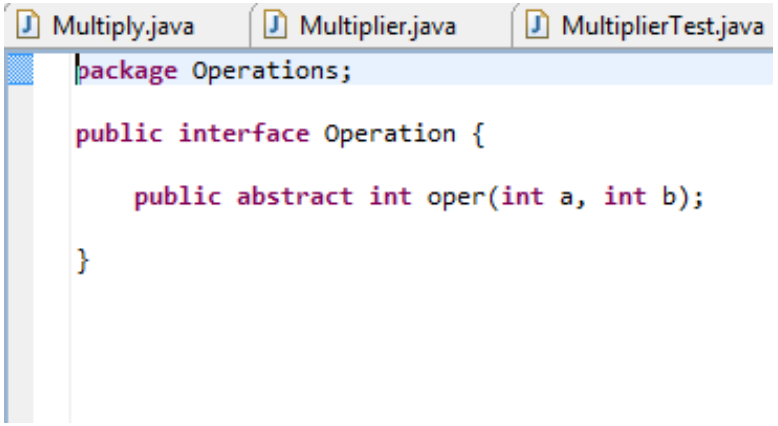
According to TDD we should have tried to avoid this.

Our Second TDD Iteration Refactoring

Extract Interface

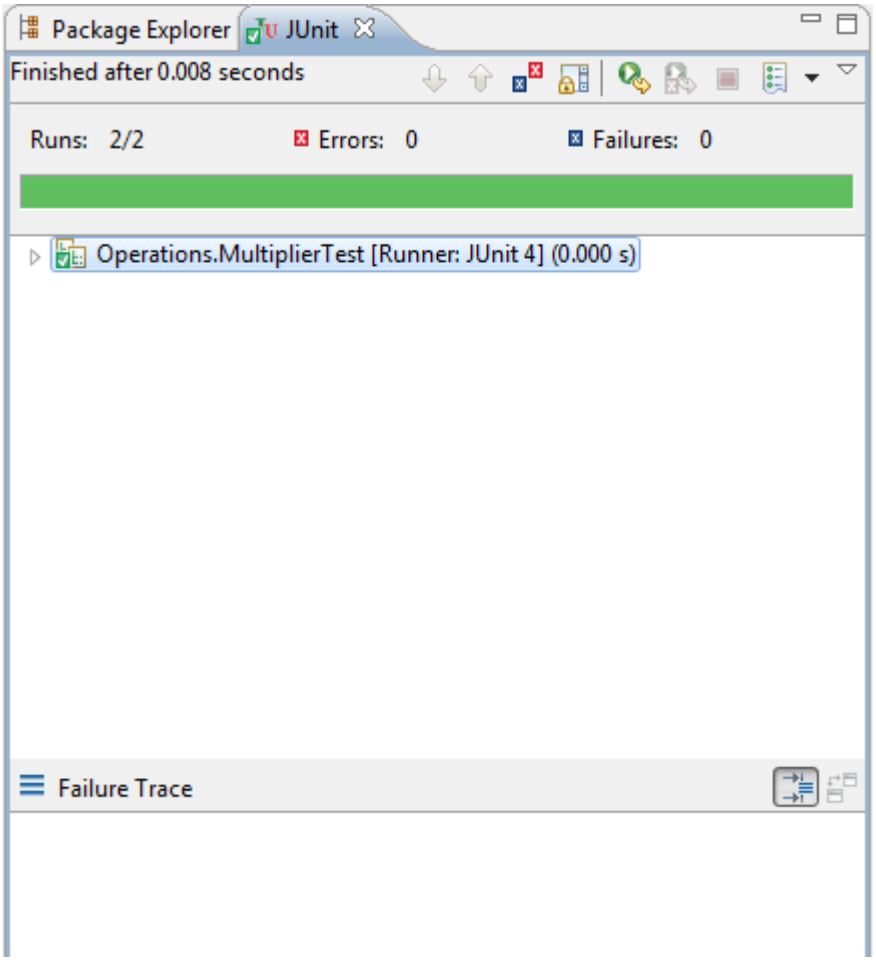
1. Rename “multiply” to “oper”
2. Extract interface





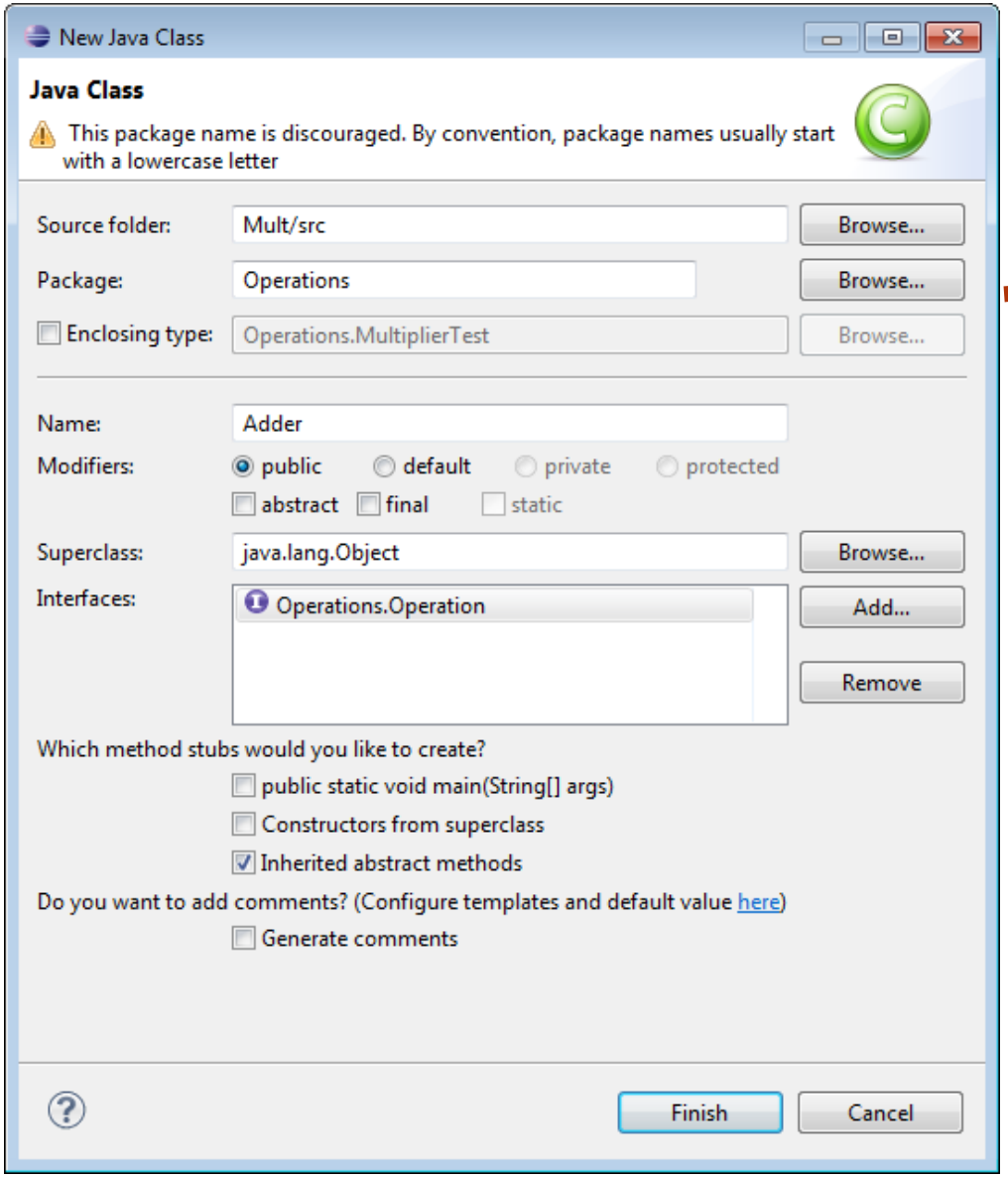
Run Test

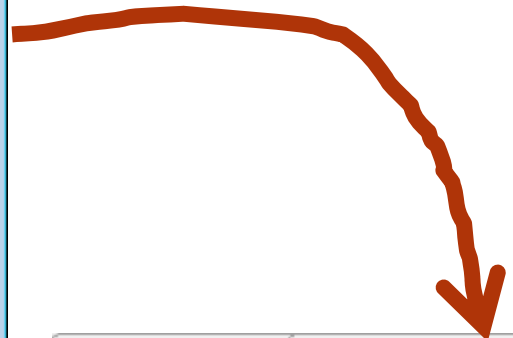
Surprise it passed

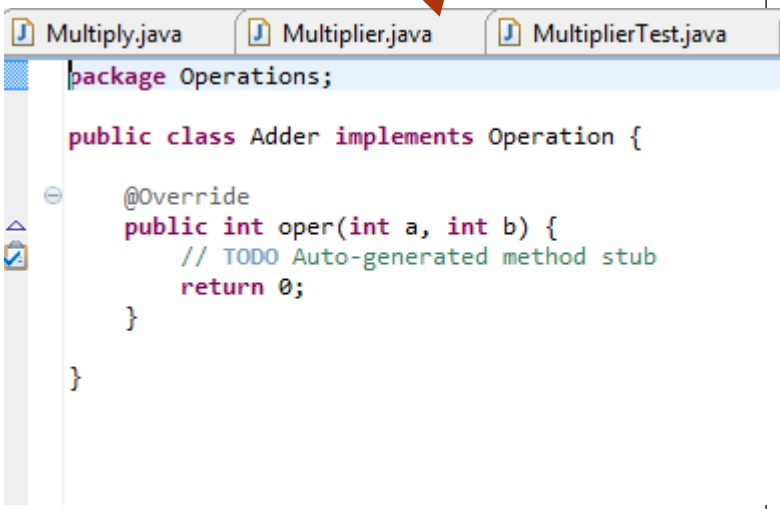


Our Third TDD Iteration
Adding a Class

New Object Adder



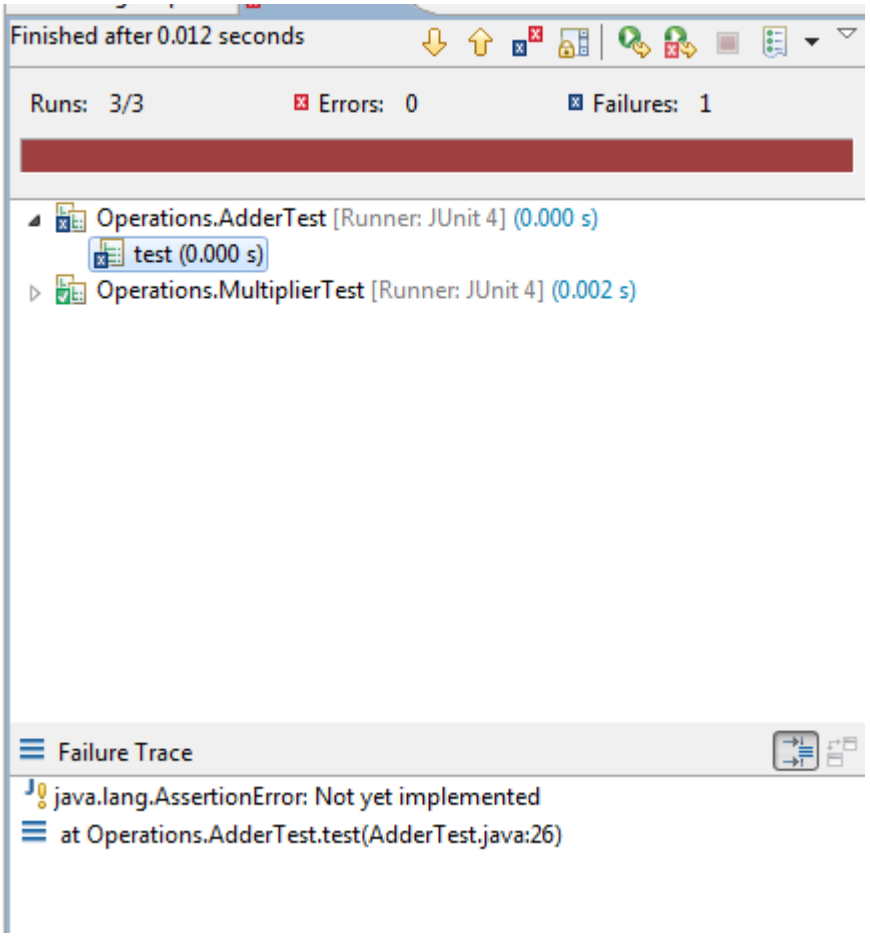




New Test,

Multiply.java | Multiplier.java | MultiplierTest.java

```
/**
package Operations;

import static org.junit.Assert.*;

/**
 * @author Oded
 *
 */
public class AdderTest {

    /**
     * @throws java.lang.Exception
     */
    @Before
    public void setUp() throws Exception {
    }

    @Test
    public void test() {
        fail("Not yet implemented");
    }

}
```



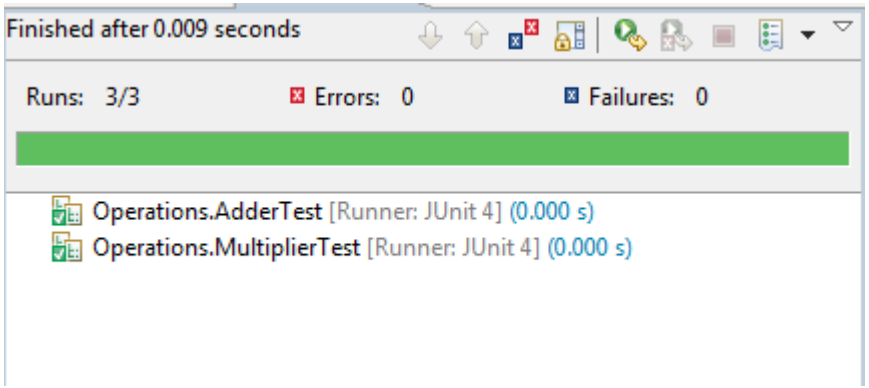
After fixing test and then writing code

Multiply.java | Multiplier.java | MultiplierTest.java

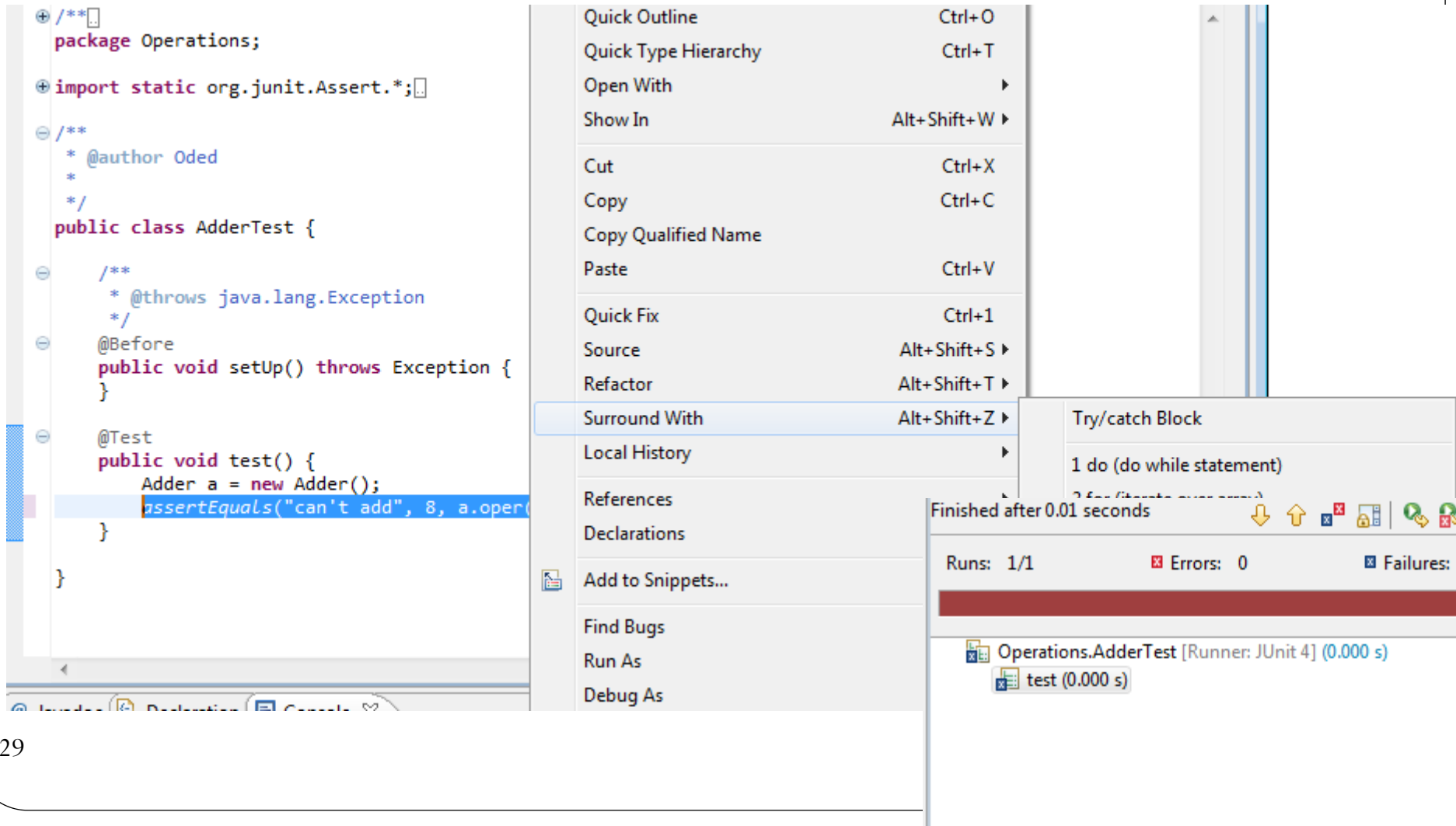
```
/**
package Operations;

import static org.junit.Assert.*;

/**
 * @author Oded
 *
 */
public class AdderTest {

    /**
     * @throws java.lang.Exception
     */
    @Before
    public void setUp() throws Exception {
    }

    @Test
    public void test() {
        Adder a = new Adder();
        assertEquals("can't add",8,a.oper(3,5));
    }

}
```

Multiply.java | Multiplier.java | MultiplierTest.java

```
package Operations;

public class Adder implements Operation {

    @Override
    public int oper(int a, int b) {
        // TODO Auto-generated method stub
        return a+b;
    }

}
```



Lets make the test a bit more interesting



Lets make the test a bit more interesting

Multiplier.java | MultiplierTest.java | Adder.java | *AdderTest.java | AllTests.ja

```
/**
package Operations;

import static org.junit.Assert.*;

/**
 * @author Oded
 *
 */
public class AdderTest {

    /**
     * @throws java.lang.Exception
     */
    @Before
    public void setUp() throws Exception {
    }

    @Test
    public void test() {
        Adder a = new Adder();
        while (condition) {
            assertEquals("can't add", 8, a.oper(3, 5));
        }
    }

}
```

Lets make the test a bit more interesting

Multiplier.java | MultiplierTest.java | Adder.java

```
package Operations;

public class Adder implements Operation {

    @Override
    public int oper(int a, int b) {
        if (b !=7) {
            // TODO Auto-generated method stub
            return a + b;
        } else {
            return 0;
        }
    }

}
```

Finished after 0.01 seconds

Runs: 1/1 Errors: 0 Failures: 1

Operations.AdderTest [Runner: JUnit 4] (0.000 s)

test (0.000 s)

Failure Trace

java.lang.AssertionError: can't add expected:<10> but was:<0>

at Operations.AdderTest.test(AdderTest.java:30)

Multiplier.java | MultiplierTest.java | Adder.java | AdderTest.java

```
/**
package Operations;

import static org.junit.Assert.*;

/**
 * @author Oded
 *
 */
public class AdderTest {

    /**
     * @throws java.lang.Exception
     */
    @Before
    public void setUp() throws Exception {
    }

    @Test
    public void test() {
        Adder a = new Adder();
        int i = 1;
        while (i < 100) {
            ++i;
            assertEquals("can't add", 3+i, a.oper(3, i));
        }
    }

}
```

Don’t like these changes?

Revert back to previous

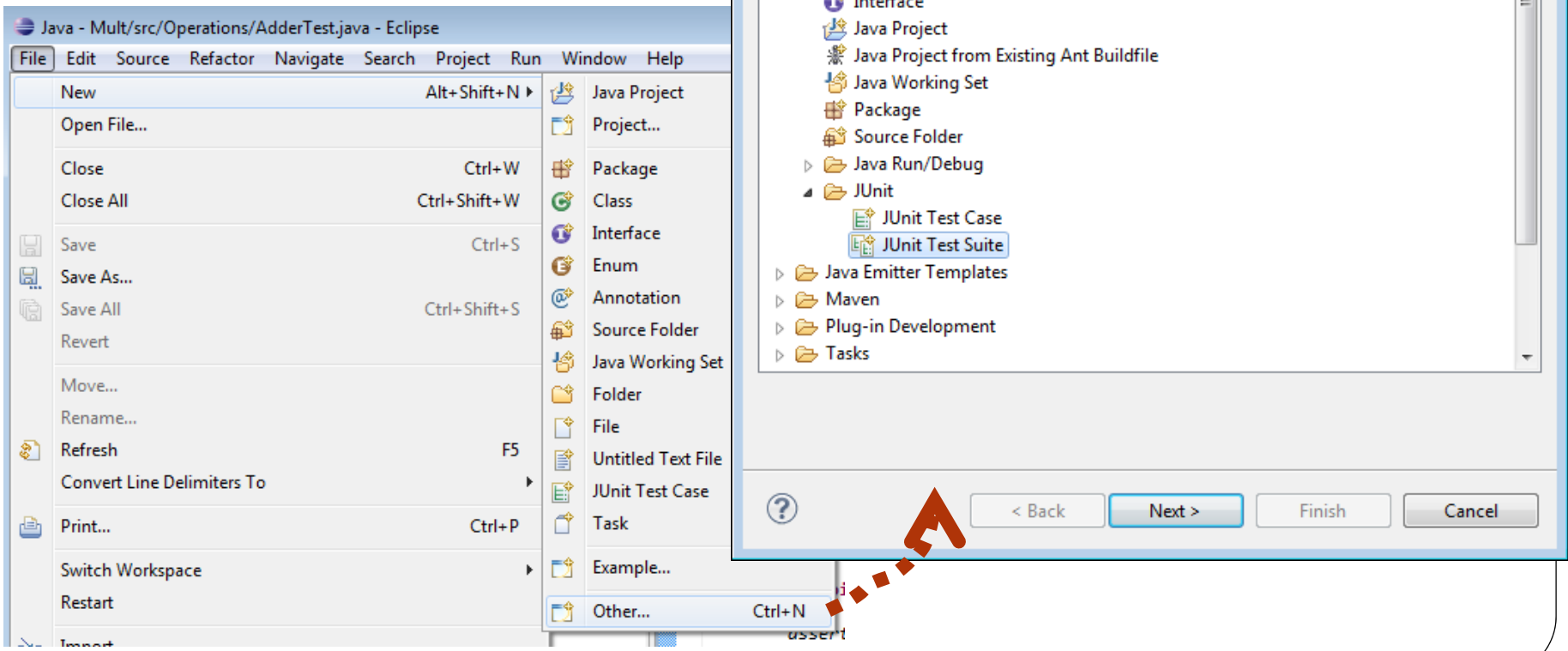
More than One Test.

Test Suite

Test suite

If one has more than one test
they can be combined
into a test suite.

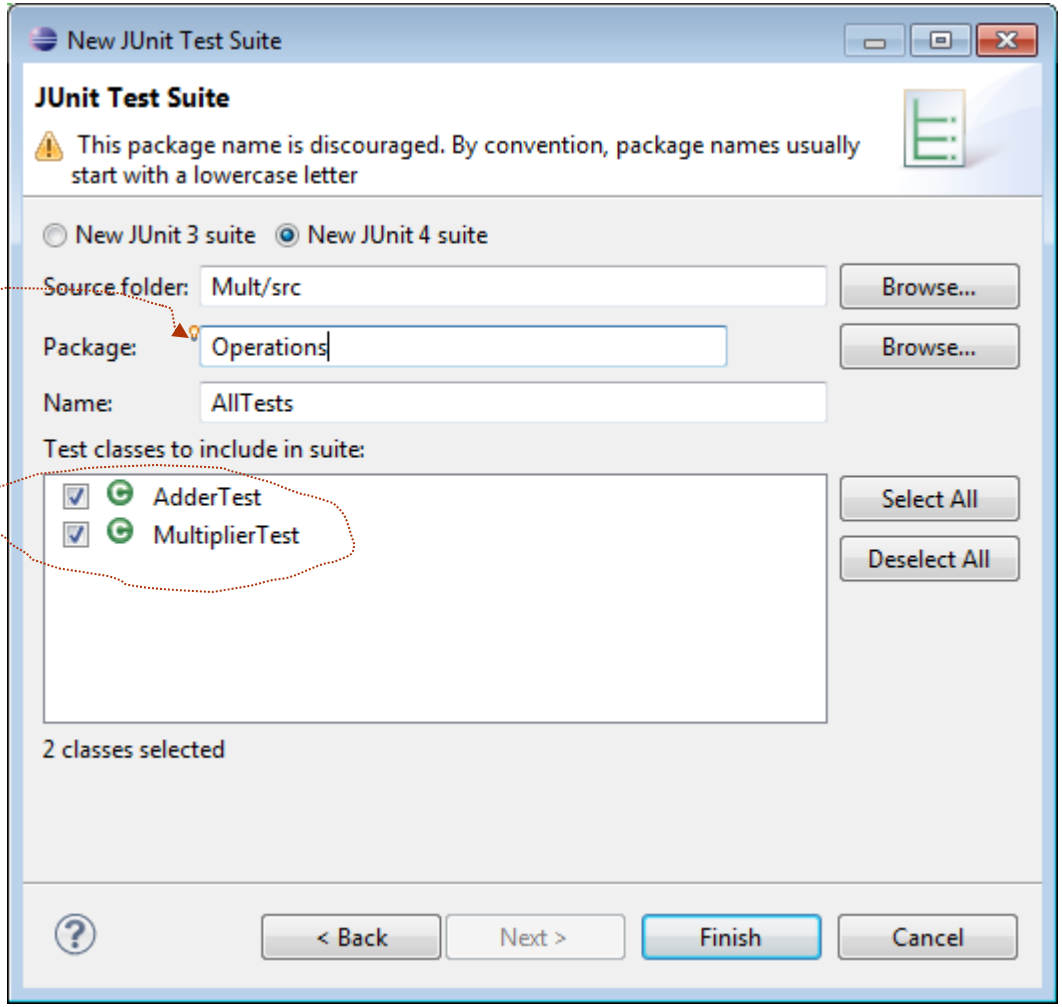
Test suite generated automatically



Test Suite

Fill in Package

Choose tests



Test Suite Code

Multiplier.java | MultiplierTest.java | Adder.java | AdderTest.java

```
package Operations;

import org.junit.runner.RunWith;

@RunWith(Suite.class)
@SuiteClasses({ AdderTest.class, MultiplierTest.class })
public class AllTests {

}
```

Note that it is possible to run all the test without the test suite.

Things to Notice

We are writing classes

We did not bother with the main method

We do not have any of these annoying print

More About Java

Types

Java programming language is statically-typed

All variables must first be declared before they can be used. (anyone know a language that is not)

Java's types

- PrimitiveType
- ReferenceType
- null Type

PrimitiveType

- Predefined
- Their names are reserved keywords

Primitive data types supported by Java:

- **byte** - 8-bit signed two's complement integer. It has a minimum value of -128 and a maximum value of 127 (inclusive)
- **short** - 16-bit signed two's complement integer. It has a minimum value of -32,768 and a maximum value of 32,767 (inclusive)
- **int** - 32-bit signed two's complement integer. It has a minimum value of -2,147,483,648 and a maximum value of 2,147,483,647 (inclusive)
- **long** - The long data type is a 64-bit signed two's complement integer. It has a minimum value of -9,223,372,036,854,775,808 and a maximum value of 9,223,372,036,854,775,807 (inclusive)
- **float** - single-precision 32-bit IEEE 754 floating point
- **double** - double-precision 64-bit IEEE 754 floating point
- **boolean** - only two possible values: true and false
- **char** - is a single 16-bit Unicode character

ReferenceType

```
public class Adder { …
}

Adder a = new Adder();
```

"a" is not an object of type Adder,
It is a reference to type Adder

Other types that are ReferenceType: interface and array

Parameter Passing

- In Java parameters are always passed to a method by value.
- Objects are not passed to methods
- So what is passed on instead of the object?
- Instead of the object a reference is passed on to the method.

What does this mean?

Lets let Eclipse and JUnit help us understand.