

Testing Methodology

Assignment 2

Unit testing using JUnit

COSC 565/475: Software Engineering I

Fall Semester 2017
Deadline: 28th of November

What is JUnit?

JUnit is a framework for testing parts, or units of your code. In general, these units are considered to be the methods of each class. JUnit can help you to make sure that each of your classes work as expected. In unit testing you will usually write one test class for each of the classes that you want to test. Your test class will often include a test method for each method implemented by the class being tested. But keep in mind that this is not always feasible, or necessary. A test case will, and should often touch on more than a single method. These tests should be written to make it likely that when all the tests pass, the code is functioning as required.

JUnit with Eclipse

- Run Eclipse IDE. We will create a new workplace project
 - ◆ so click File -> New -> Project,
 - ◆ then choose Java and click Next.
 - ◆ Type in a project name -- for example, ProjectWithJUnit. Click Finish.
 - ◆ The new project will be generated in your IDE. Let's configure our Eclipse IDE, so it will add the JUnit library to the build path.
 - ◆ Click on Project -> Properties, select Java Build Path, Libraries, click Add External JARs and browse to directory where your JUnit is stored. Pick *junit.jar* and click Open.
 - ◆ You will see that JUnit will appear on your screen in the list of libraries. By clicking Okay you will force Eclipse to rebuild all build paths.
 - ◆ To create such a test, right-click on the ProjectWithJUnit title,
 - ◆ select **New -> Other**, expand the "Java" selection, and choose **JUnit**.
 - ◆ On the right column of the dialog, choose **Test Case**, then click **Next**.

Example

```
public class HelloWorld {  
    public String say() {    return("Hello World!");    }  
}
```

```
import junit.framework.TestCase;  
public class TestThatWeGetHelloWorldPrompt extends TestCase {  
    public TestThatWeGetHelloWorldPrompt(  

```

```

    String name) {
        super(name);
    }
    public void testSay() {
        HelloWorld hi = new HelloWorld();
        assertEquals("Hello World!", hi.say());
    }
    public static void main(String[] args) {
        junit.textui.TestRunner.run(
            TestThatWeGetHelloWorldPrompt.class);
    }
}

```

Basic Information

Before you begin, we would like to call your attention to the following conventions:

- A Test Case Class is named [classname]Test.java, where classname is the name of the class that is tested.
- A Test Case Method is a method of the Test Case Class which is used to test one or more of the methods of the target class. Test Case Methods are annotated with `@Test` to indicate them to JUnit. Cases without `@Test` will not be noticed by JUnit.

JUnit assertions are used to assert that a condition must be true at some point in the test method. JUnit has many types of assertions. The following is a selection of the most commonly used assertions:

`assertEquals(expected, actual)`: Assert that expected value is equal to the actual value. The expected and actual value can be of any type, for example integer, double, byte, string, char or any Java object. If the expected and actual values are of type double or oat, you should add a third parameter indicating the delta. It represents the maximum difference between expected and actual value for which both numbers are still considered equal.

`assertTrue(condition)`: Asserts that the Boolean condition is True.

`assertFalse(condition)`: Asserts that the Boolean condition is False.

`assertNull(object)`: Asserts that an object is null.

`assertNotNull(object)`: Asserts that an object is not null.

`assertSame(expected object, actual object)`: Asserts that two variables refer to the same object.

`assertNotSame(expected object, actual object)`: Asserts that two variables do not refer to the same object.

Whenever an assertion fails, an `AssertionError` is thrown, which is caught by the JUnit framework and presented as a red bar, indicating test failure. Assert statements accept an extra message parameter before the other parameters.

Loading the Project

Download the file `bowling.rar` from blackboard

In Eclipse, choose File -> New -> Java Project. Give it a name ("Lab1", for instance) and click Finish.

Running the Test Cases

When you run a test class, JUnit will run each method annotated with `@Test` separately and show a green bar if all of them pass, and a red bar if any of them fail. It is important that anything happening in a test method is independent from the other test methods, otherwise you risk getting weird results.

Assignment Tasks

- You have been given a template for the *bowling class*, *game class* and *frame class*. You have to write minimum **60 test cases** for the 3 classes.
- First, write test cases for the methods of each class, and then fill in the methods with code that will make your test cases pass.
- Create `GameTest.java`
- Create `FrameTest.java`
- Create `BowlingTest.java`
- If you run your test cases for `GameTest.java`, `BowlingTest.java`, and `FrameTest.java` at this point, they should be all pass.
- Write the following test cases for `Frame` class
 - `testOneThrow()`
 - `testNeverKnockDownAllThePins()`
 - `testStrike()`
 - `testFrameScore()`
- Write the following test cases for `GameTest` class
 - `testEmptyGame()`
 - `testOneThrow1()`
 - `testThreeThrows()`
 - `testThreeThrowsStrike()`
 - `testPerfectGame()`
 - `testAllOnesGame()`
- At least 20 test case should often touch on more than a single method.
- Archive your project folder in zip format and name it `FirstName1.LastName1-FirstName2.LastName2.zip` where the first name and last name refers to your name and your partner's name participating in the assignment.
- Comment your code and comment all the test cases
- Uses **5 different assert statements**. The most common assert statement is `assertEquals()` which takes at least two arguments. Each JUnit test case (method)

should have at least one of the assert statements listed below, otherwise the test passes, which can be misleading if you never actually check the value of any data.

- Examine the [API for JUnit](#) and add a few additional methods and test cases that use other [Assert class](#) methods, such as assertEquals, assertTrue, assertFalse, assertNull and fail.

Working independently. Your answers to the questions on this assignment will be individually marked, and must be your own work. You will be assigned 0 marks for this entire assignment, if any of your answers to individual questions bears a close resemblance to another student's submission, or to something previously published on the internet or elsewhere

Reference

Lab session1: <http://www.vogella.com/tutorials/JUnit/article.html>

Lab session2: <https://courses.cs.washington.edu/courses/cse143/11wi/eclipse-tutorial/junit.shtml>

Rubric

Rubric for Assignment 2

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Criteria	Ratings					Pts
Test Coverage	Tests cover all edge cases. 40 pts	Tests cover most edge cases. 30 pts	A test suite exists and runs in JUnit, but doesn't actually test anything. 20 pts	Tests do not run in JUnit. 10 pts	No Tests. 0 pts	40 pts
Code Correctness	The program works and meets all of the specifications. 40 pts	The program works and produces the correct results and displays them correctly. It also meets most of the other specifications. 30 pts	The program produces correct results but does not display them correctly. 20 pts	The code does not produce correct results. 10 pts	No Code. 0 pts	40 pts
Code Readability	The code is very well organized and very easy to follow. 20pts	The code is readable only by someone who knows what it is supposed to be doing. 10pts		The code is poorly organized and very difficult to read. 0 pts		20pts

Total Points: 100