



## Week 12 Coding Assignment

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### Instructions :

1. Follow the **Coding Steps** below to complete this assignment.

- In Eclipse, or an IDE of your choice, write the code that accomplishes the objectives listed below. Ensure that the code compiles and runs as directed.
- Create a new repository on GitHub for this week's assignment and push your completed code to this dedicated repo.
- Create a video showcasing your work:
  - In this video: record and present your project verbally while showing the results of the working project.
  - Easy way to Create a video: Start a meeting in Zoom, share your screen, open Eclipse with the code and your Console window, start recording & record yourself describing and running the program showing the results.
  - Your video should be a maximum of 5-minutes.
  - Upload your video with a public link.
  - Easy way to Create a Public Video Link: Upload your video recording to YouTube with a public link.

2. In addition, please include the following in your Project Submission Quiz

- The URL for this week's GitHub repository.
  - The URL of the public link of your video.
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## Overview

In this assignment, you will create a **JUnit Test Case**, step by step!

### 1. Example Unit Test - Code This

**Follow Steps 1-1 to 1-4.** This Assignment builds a new **Maven Project** (*TestDemo.java*) with a **JUnit Test Case** (*TestDemoJUnitTest.java*).

This part will give you the opportunity to write a **@ParameterizedTest**.

### 2. Write a New JUnit Test

This section will give you the opportunity to write a **@Test** for **addPositive()**. Do not use parameters.

### 3. Create Your Own Method & JUnit Test

Try this on your own by doing the following:

(a) Creating a new method in *TestDemo.java*

(b) Write a test for your new method in *TestDemoJUnitTest.java*

### 4. Mocking a Class - TestDemo -- *more advanced!*

**Follow Steps 4-1 & 4-2.** Using the same **Maven Project** (*TestDemo.java*) and **JUnit Test Case** (*TestDemoJUnitTest.java*), create another method and test, this time using Mockito to mock the *TestDemo* inside of *TestDemoJUnitTest.java*.

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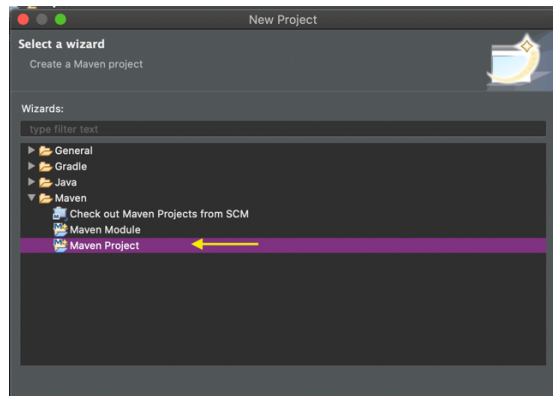
### Coding Steps:

#### 1. Example Unit Test - Code This

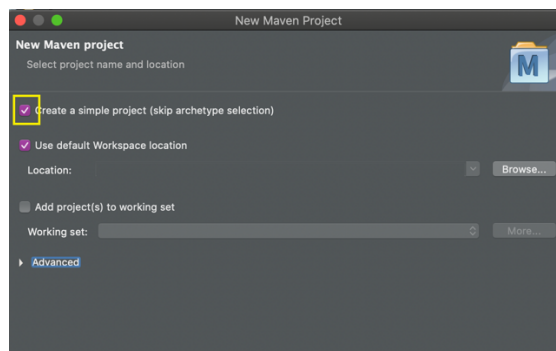
##### Step 1-1:

##### Create a new Maven project.

- a. In Eclipse, right-click in Project Explorer, select "New / Project". Expand "Maven". Select "Maven Project". Click "Next".



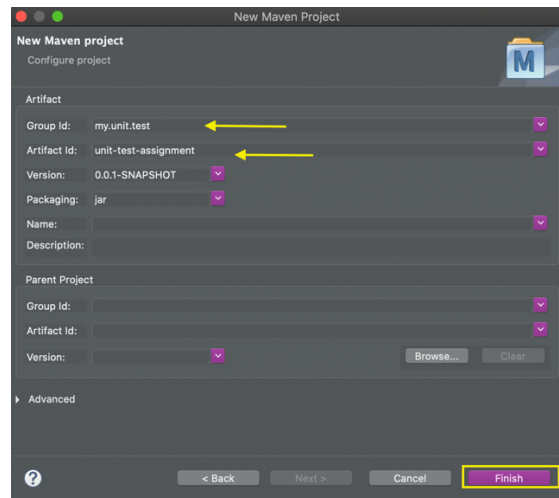
- b. Check "Create a simple project (skip archetype selection)". Click "Next".



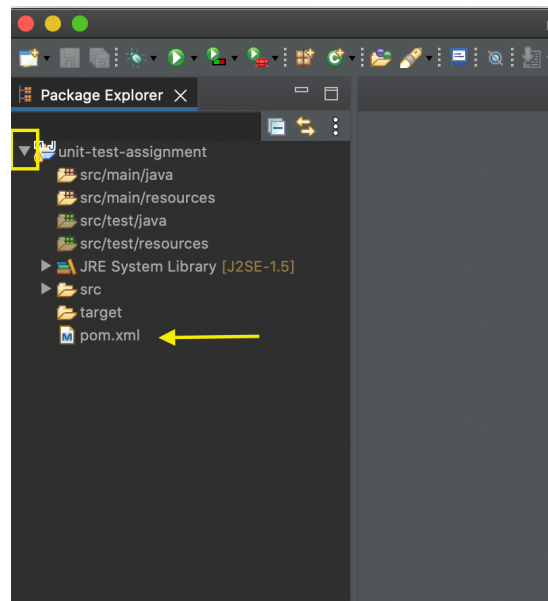
- c. Enter the Group Id: "my.unit.test". Enter the Artifact Id: "unit-test-assignment". Click "Finish".



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- d. The project "unit-test-assignment" should appear in the Package Explorer. Click the right arrow next to "unit-test-assignment" to expand it. Double-click on "pom.xml" to open it in the editor.



- e. Put a couple of blank lines between `<version>0.0.1-SNAPSHOT</version>` and `</project>`.



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- f. Copy and paste the following code (not the dotted lines) into the blank area you just created.

```
<properties>
  <java.version>17</java.version>
  <project.build.sourceEncoding>utf-8</project.build.sourceEncoding>
</properties>

<dependencies>
  <dependency>
    <groupId>com.google.guava</groupId>
    <artifactId>guava</artifactId>
    <version>30.1.1-jre</version>
  </dependency>

  <dependency>
    <groupId>org.junit.jupiter</groupId>
    <artifactId>junit-jupiter</artifactId>
    <version>5.7.2</version>
    <scope>test</scope>
  </dependency>
```



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```
<dependency>
  <groupId>org.assertj</groupId>
  <artifactId>assertj-core</artifactId>
  <version>3.20.2</version>
  <scope>test</scope>
</dependency>
```

```
<dependency>
  <groupId>org.mockito</groupId>
  <artifactId>mockito-junit-jupiter</artifactId>
  <version>3.11.2</version>
  <scope>test</scope>
</dependency>
</dependencies>
```

```
<build>
  <plugins>
    <plugin>
      <groupId>org.apache.maven.plugins</groupId>
      <artifactId>maven-compiler-plugin</artifactId>
      <version>3.8.1</version>
      <configuration>
        <source>${java.version}</source>
        <target>${java.version}</target>
      </configuration>
    </plugin>
  </plugins>
</build>
```

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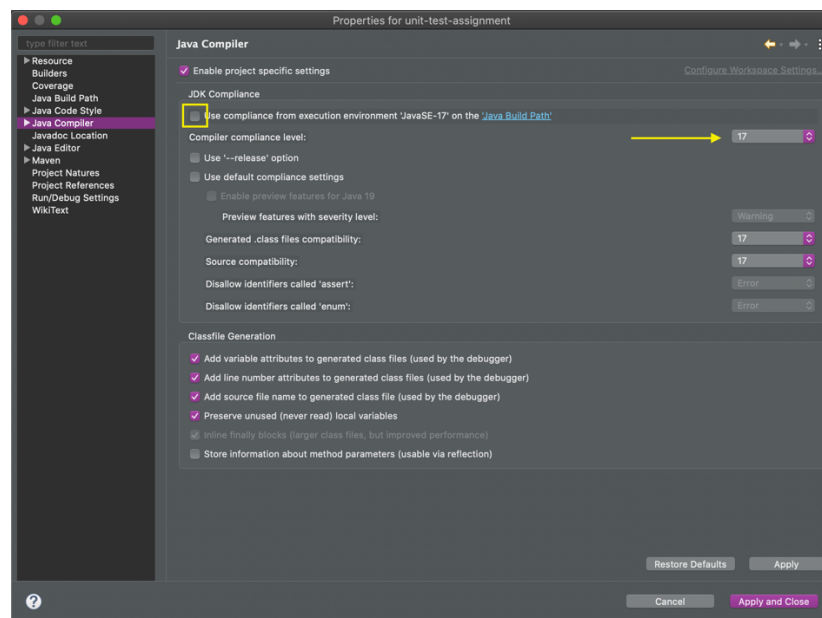


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- g. Save the modified **pom.xml** file.

**Suggested: Execute a Maven Update Project**

- h. **For Eclipse only:** right-click on "unit-test-assignment" in the Project Explorer. Click on "Properties". Click "Java Compiler". Make sure "Enable project specific settings" is checked. Uncheck "Use compliance from execution environment 'J2SE-1.5' on the 'Java Build Path'". Set "Compiler compliance level" to 17. Click "Apply and Close".



- i. If asked to rebuild the project, click "Yes".

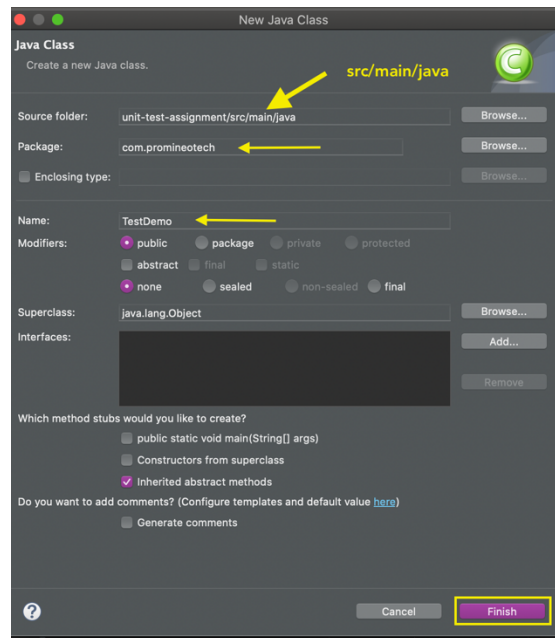
### Step 1-2:

Create a class named "TestDemo" under src/main/java in the com.promineotech package. (In Package Explorer, expand "unit-test-assignment". Right-click on "src/main/java" and select "New / Class". Enter "TestDemo" in the "Name" field, "com.promineotech" in the Package field, and click "Finish".)



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- a. Create an instance method (not static) named `addPositive`. It should take two `int` parameters and return an `int`.

```
public int addPositive(int a, int b) {}
```

- b. If both parameters are positive (greater than zero) return the sum of the parameters. If either parameter is zero or negative, throw an `IllegalArgumentException` with the message "Both parameters must be positive!". `IllegalArgumentException` is in the `java.lang` package so you won't need an import statement.
- c. Save the file.

### Step 1-3:

Create a JUnit Test Case named "TestDemoJUnitTest" under `src/test/java` in `com.promineotech` package.

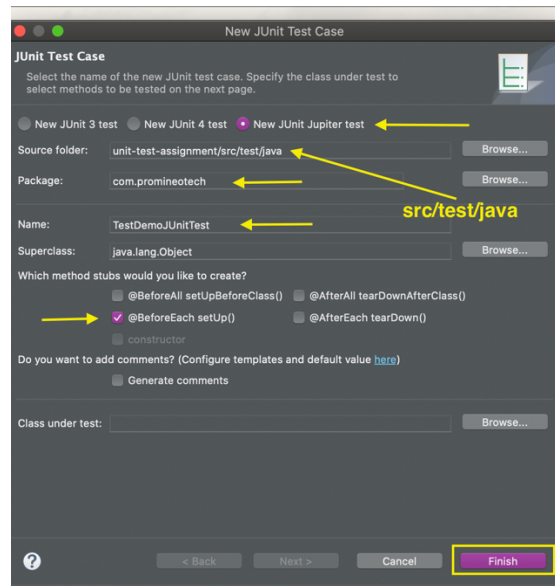
In Package Explorer, find "`src/test/java`" and right-click on it. Select "New / JUnit Test Case". In the "Name" field, enter "TestDemoJUnitTest". In the "Package"





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field, enter **com.promineotech**. Make sure that "New JUnit Jupiter test" is selected. Make sure that "@BeforeEach setUp()" is checked. Click "Finish".



### Step 1-4:

In *TestDemoJUnitTest.java*, add a **private instance variable** of type *TestDemo* named *testDemo*. Remember that **instance** variables are *non-static variables* which are defined **in a class**, but **outside** of any method, constructor or a block.

- In the *setUp* method, create the *TestDemo* object. This will ensure that a new *TestDemo* object is created before each test.

```
class TestDemoJUnitTest {  
    private TestDemo testDemo; // Instance Variable Creation  
    @BeforeEach  
    void setUp() throws Exception {  
        testDemo = new TestDemo(); // Step 4a  
    }  
}
```

- Change `@Test` to `@ParameterizedTest`. Add the import statement for `org.junit.jupiter.params.ParameterizedTest`
- Change the name of method "test" to "assertThatTwoPositiveNumbersAreAddedCorrectly"
- Add four parameters to `assertThatTwoPositiveNumbersAreAddedCorrectly` as shown:



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Type	Name
int	a
int	b
int	expected
boolean	expectException

e. **Write the test.**

- Remove the "fail" line.
- Test the value of expectException. If it is false, assert that when TestDemo.addPositive is called with values a and b, that the result is the same as the parameter expected.
- The assertion should look like this:

```
If (!expectException) {  
    assertThat(testDemo.addPositive(a, b)).isEqualTo(expected);  
}
```

f. Add the test for the thrown exception in an else clause. Use assertThatThrownBy for this. Add the static import:

```
org.assertj.core.api.Assertions.assertThatThrownBy;
```

- g. As a parameter to assertThatThrownBy, add a Lambda expression with no parameters. The Lambda body should be the method call to testDemo.addPositive.
- h. Use the assertion `assertInstanceOf(IllegalArgumentException.class)` to ensure that the correct exception is thrown.
- i. If this is too confusing, you can "cheat" and copy this:

```
assertThatThrownBy(() ->  
    testDemo.addPositive(a, b))
```



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*.isInstanceOf(IllegalArgumentException.class);*

j. Add the parameter source method.

- Create a static method named `argumentsForAddPositive`. It should not have any parameters and it should return a `Stream` of `Arguments`. The imports are:

```
java.util.stream.Stream  
org.junit.jupiter.params.provider.Arguments
```

- The method should return a `Stream` as in `Stream.of()`;
- Each parameter set should be wrapped in an `arguments()` method call. Add the static import for `arguments`:

```
org.junit.jupiter.params.provider.Arguments.arguments
```

- So, if you are adding 2 and 4 to get the value of 6 and are not expecting an exception, you need to do:

```
arguments(2, 4, 6, false)
```

- Add as many `arguments` lines as needed to test the `addPositive` method thoroughly. Make sure to add some zero or negative arguments.

k. Just below the `@ParameterizedTest` annotation, add the annotation `@MethodSource`. Pass a single parameter to `@MethodSource`. It must be the fully-qualified (includes package) class name of the test followed by a `#` sign followed by the name of the method that supplies the parameters. Remember that the test is in the **com.promineotech** package. So, the package name needs to be in the following annotation:

```
@MethodSource("com.promineotech.TestDemoJUnitTest#argumentsForAddPositive")
```

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### 2. Write a New JUnit Test for addPositive

#### Review

*At this point in the assignment, we have done the following:*

- Created a method in **TestDemo** named **addPositive** that takes two int parameters.
- Created a Junit Test in **TestDemoJUnitTest** named **assertThatTwoPositiveNumbersAreAddedCorrectly** that uses **@ParameterizedTest**

**NOW:** *Let's write a test that uses **@Test** for the same method!*

#### Step 2-1

**In TestDemoJUnitTest.java, write a test for addPositive.**

- Create a method annotated with **@Test** named **assertThatPairsOfPositiveNumbersAreAddedCorrectly**. The method must have package visibility (not public!) or JUnit won't find it. The annotation **@Test** is in the **org.junit.jupiter.api** package.
- Use **assertThat** to test that the value returned from **addPositive** is equal to the correct value.

```
assertThat(testDemo.addPositive(4,5)).isEqualTo(9);
```

```
assertThat(testDemo.addPositive(40,50)).isEqualTo(90);
```

- Add as many calls like the ones above as you wish.
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### 3. Create Your Own Method & JUnit Test:

NOW it's time to write a new method and a test (parameterized or not) that tests your method. This can be a very simple method. Try to replicate the process.

- Create your own method in **TestDemo**
  - Create your own Junit Test in **TestDemoJUnitTest** that uses either **@ParameterizedTest** or **@Test**
  - Document the code in both places to explain the method, and to explain the test.
- 

### 4. Mocking a Class – TestDemo

#### Step 4-1:

In **TestDemo.java**, add another method named **randomNumberSquared**. This method obtains a random int between 1 and 10 and then returns the square of the number.

- **randomNumberSquared** should return an int and not take any parameters.
- It should call another method in the same class named **getRandomInt**. This method takes no parameters and must be package visibility so that the test can see it. **getRandomInt** should look like this:

```
int getRandomInt() {  
    Random random = new Random();  
    return random.nextInt(10) + 1;  
}
```

The **Random** class is in the **java.util** package.

- **randomNumberSquared** should return the value obtained from **getRandomInt** multiplied by itself.



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### Step 4-2:

Write a test for `randomNumberSquared` in `TestDemoJUnitTest.java`. Since you don't know what `getRandomInt` will return (that's the point of random, after all), you will need to mock it out and supply a known value.

- a. Create a method annotated with `@Test` named `assertThatNumberSquaredIsCorrect`. The method must have package visibility (not public!) or JUnit won't find it. The annotation `@Test` is in the `org.junit.jupiter.api` package.

- b. To mock the `TestDemo` class, use `Mockito.spy`. The `spy` method can be imported with a static import of `org.mockito.Mockito.spy`.

```
TestDemo mockDemo = spy(testDemo);
```

- c. Program the mocked `TestDemo` object to return 5 when the `getRandomInt` method is called. Remember to use the form: `doReturn(aValue).when(mockedObject).methodCall()`. You can use a static import for `doReturn`: `import static org.mockito.Mockito.doReturn`;

```
doReturn(5).when(mockDemo).getRandomInt();
```

- d. Call the method `randomNumberSquared` on the mocked `TestDemo` object. This will call the stubbed out (mocked) method `getRandomInt`, which now should return the value 5.

```
int fiveSquared = mockDemo.randomNumberSquared();
```

- e. Use `assertThat` to test that the value returned from `randomNumberSquared` is equal to 5 squared.

```
assertThat(fiveSquared).isEqualTo(25);
```

- f. You don't need to verify the mocked method call – you know it was called since the return value is correct.

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