

# TDD: JUnit Introduction

**“Code with Passion!”**



# Topics

- What is JUnit?
- JUnit 5 annotations
  - > @Test
  - > @BeforeEach, @AfterEach
  - > @BeforeAll, @AfterAll
  - > @Disabled, @DisplayName
- Assert statements (from JUnit 5)
- AssertThat (from AssertJ)
- Testing tools
- Exception handling
- Parameterization
- Best practices

# What is JUnit?

# What is JUnit?

- Unit testing framework for Java
- De-facto standard for unit testing
- Free and open-sourced

# JUnit 5 Annotations

`@Test`

`@BeforeEach, @AfterEach`

`@BeforeAll, @AfterAll`

`@Disabled, @DisplayName`

# How to write JUnit test?

- Create test class with test methods
- Each test method has to have the following method signature
  - > Annotate it with `@Test`
  - > `public`
  - > `void` return type
  - > No arguments
- Add fixtures
  - > `@BeforeEach` and `@AfterEach` to run before/after **each** test method
  - > `@BeforeAll` and `@AfterAll` to run once before/after **all** test methods
  - > `@Disabled` to temporarily ignore the testing
  - > `@DisplayName` to give more meaningful description of the test

# JUnit 5 Dependencies

```
<properties>
    <maven.compiler.source>17</maven.compiler.source>
    <maven.compiler.target>17</maven.compiler.target>
    <junit.version>5.9.2</junit.version>
</properties>

<dependencies>
    <dependency>
        <groupId>org.junit.jupiter</groupId>
        <artifactId>junit-jupiter-api</artifactId>
        <version>${junit.version}</version>
        <scope>test</scope>
    </dependency>
    <dependency>
        <groupId>org.junit.jupiter</groupId>
        <artifactId>junit-jupiter-engine</artifactId>
        <version>${junit.version}</version>
        <scope>test</scope>
    </dependency>
</dependencies>
```

# Example: Calculator Test Target

```
public class Calculator {  
  
    public int add(int x, int y) {  
        return x + y;  
    }  
  
    public int subtract(int x, int y) {  
        return x - y;  
    }  
}
```

# Example: Test class of Calculator Test Target

```
import org.assertj.core.api.Assertions;
import org.junit.jupiter.api.BeforeEach;
import org.junit.jupiter.api.Test;
import static org.junit.jupiter.api.Assertions.*;

public class CalculatorTest {
    private Calculator calculator;

    @BeforeEach
    void setup() {
        calculator = new Calculator();
    }

    @Test
    void add_should_return_added_value_when_two_numbers_are_given() {
        assertEquals(5, calculator.add(2, 3)); // using Junit 5 Jupiter Assertions package
        Assertions.assertThat(calculator.add(2, 3)).isEqualTo(5); // using AssertJ Assertions package
    }

    @Test
    void subtract_should_return_subtracted_value_when_two_numbers_are_given() {
        assertEquals(-1, calculator.subtract(2, 3)); // using Junit 5 Jupiter Assertions package
        Assertions.assertThat(calculator.subtract(2, 3)).isEqualTo(-1); // using AssertJ Assertions package
    }
}
```

# **Assert Statements (from Junit 5)**

# Assert Statements from JUnit 5 Jupiter

- JUnit Assertions are methods starting with `assert`
- Determines the success or failure of a test
- An assert is simply a comparison between an expected value and an actual value
- Two variants
  - > `assertXXX(<expected>, <actual>)`
  - > `assertXXX (<expected>, <actual>, String message)` - the message is displayed when the assertion fails
  - > `assertXXX (<expected>, <actual>, <Lambda-expression>)` – evaluate `<Lambda-expression>` when the assertion fails

# Assert Statements from Junit 5 Jupiter Package

- Asserts expected.equals(actual) behavior
  - > assertEquals(expected, actual)
  - > assertEquals(expected, actual, String message)
- Asserts expected == actual behavior
  - > assertSame(Object expected, Object actual)
  - > assertSame(Object expected, Object actual, String message, )
- Asserts that a condition is true
  - > assertTrue(boolean condition)
  - > assertTrue(boolean condition, String message)
- Asserts that a condition is false
  - > assertFalse(boolean condition)
  - > assertFalse(boolean condition, String message)

# Assert Statements from Junit 5 Jupiter Package

- Asserts object reference is null
  - > `assertNull(Object obj)`
  - > `assertNull(Object obj, String message)`
- Asserts object reference is not null
  - > `assertNotNull(Object obj)`
  - > `assertNotNull(Object obj, String message)`

# **AssertThat from AssertJ Package (Recommended)**

# What is and Why AssertJ?

- Open-source assertion package for Java
- Fluent and rich assertions in Java tests
- Much more readable than other assertions packages
- Default assertion package in “spring-boot-starter-test”

# Example: AssertJ Examples

- `assertThat(result).isEqualTo(5);`
- `assertThat(resultObject.getName()).startsWith("Yo").endsWith("Ya");`
- `assertThat(resultObject).isEqualTo(expectedObject);`
- `assertThat(resultBoolean).isTrue();`
- `assertThat(resultList).contains("John");`
- `assertThat(resultList).isNotEmpty();`
- `assertThat(resultList).isNotEmpty().contains("John").doesNotContain("Tom");`
- `assertThat(resultMap).isNotEmpty().containsKey(3);`

# AssertJ Dependency

```
<!-- https://mvnrepository.com/artifact/org.assertj/assertj-core -->
<dependency>
    <groupId>org.assertj</groupId>
    <artifactId>assertj-core</artifactId>
    <version>3.20.2</version>
    <scope>test</scope>
</dependency>
```

# Testing Tools

# Testing Tools

- Automatic testing tools
  - > Each time a change is made on the source code, tests are run
  - > Infinitest
- Test generating tools
  - > MoreUnit
- Code coverage tools
  - > Used to describe the degree to which the source code of a program is executed when a particular test suite runs
  - > EclEmma, JaCoco
- Source code version control
  - > Git
- Continuous Build tools
  - > Jenkins

# Lab:

**Exercise 2: Installation of Tools**  
**1651\_tdd\_junit.zip**



# Exception Handling

# Testing Exception (using Assertion Package from Junit 5)

```
@Test  
public void test_method() {  
  
    // Using Assertion package from JUnit 5  
    Assertions.assertThrows(Exception.class,  
        // Lambda expression  
        () -> {  
            // Call a method of a test target,  
            // which results in an exception  
        });  
  
}
```

# Testing Exception (using Assertion Package from AssertJ)

```
@Test  
public void test_method() {  
  
    // Using Assertion package from AssertJ  
    Assertions.assertThrows(Exception.class,  
        // Lambda expression  
        () -> {  
            // Call a method of a test target,  
            // which results in an exception  
        });  
  
}
```

# Testing Exception (using Assertion Package from AssertJ)

```
@Test  
public void test_method() {  
  
    // Using Assertion package from AssertJ  
    assertThatExceptionOfType(Exception.class)  
        .isThrownBy(() -> {  
            // Call a method of a test target,  
            // which results in an exception  
        });  
  
}
```

# Lab:

**Exercise 3: Exception Handling**  
**1651\_tdd\_junit.zip**



# Parameterization

# Parameterized Testing

- The Parameterized Test is used when we find ourselves writing identical tests where only data input values are different but the logic is the same
  - > Only one test method is needed which will have parameterized data supplied to it
- How to do parameterized testing
  - > Annotate the test method with `@ParameterizedTest`

# Example: Parameterized testing

Add the following dependency to the pom.xml

```
<dependency>
  <groupId>org.junit.jupiter</groupId>
  <artifactId>junit-jupiter-params</artifactId>
  <version>${junit.version}</version>
  <scope>test</scope>
</dependency>
```

# Example: Parameterized testing

```
public class CalculatorTest {  
  
    @DisplayName("parameterized test")  
    @ParameterizedTest(name = "{0} + {1} = {2}")  
    @CsvSource({  
        "0, 1, 1",  
        "1, 2, 3",  
        "49, 51, 100",  
        "1, 100, 101"  
    })  
    void add(int first, int second, int expectedResult) {  
        Calculator2 calculator = new Calculator2();  
        assertEquals(expectedResult, calculator.add(first, second),  
            () -> first + " + " + second + " should equal " + expectedResult);  
    }  
}
```

# Lab:

**Exercise 4: Parameterization**  
**1651\_tdd\_junit.zip**



# JUnit Best Practices

# Test Code vs Production Code

- Your test code becomes part of the codebase
- It is backed up and put into a source code repository along with the production code (test targets)
- Test code needs to be documented, although not as heavily as the production code
- Note that test code will most likely not deploy with the production code

# Be thorough

- Write tests for everything
  - > Except methods that are "too simple to fail"
  - > Only trivial getter/setter methods are too simple to fail
- Write multiple tests for each method
  - > "positive" testing
  - > "negative" testing
  - > boundary value testing (BVT)

# Code with Passion!

