Full Stack

Caltech | Center for Technology & Management Education

# Post Graduate Program in Full Stack Web Development



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Full Stack

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# Implement Frameworks the DevOps Way



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# JUnit 5 Testing

# A Day in the Life of a Full Stack Developer

All the desired results were achieved in the last sprint and the sprint was marked as completed. Joe has been appreciated for the last project.

He is now assigned a new project which he needs to complete in a week. As a part of developing an ecommerce web application, a test-suite has to be created to do unit testing of all backend components in the web application. This project will test the user authentication class. This project will be a standalone Java application. Joe has to test only the classes that have the business logic.

In this lesson, we will learn how to solve this real-world scenario to help Joe complete his task effectively and quickly.

# Learning Objectives

By the end of this lesson, you will be able to:

- Outline the steps involved in migrating from JUnit 4 to JUnit 5
- Describe JUnit 5 architecture
- Demonstrate how assertions work
- Define nested and repeated tests and dynamic tests
- Use a dependency injection

# Moving from JUnit 4 to JUnit 5

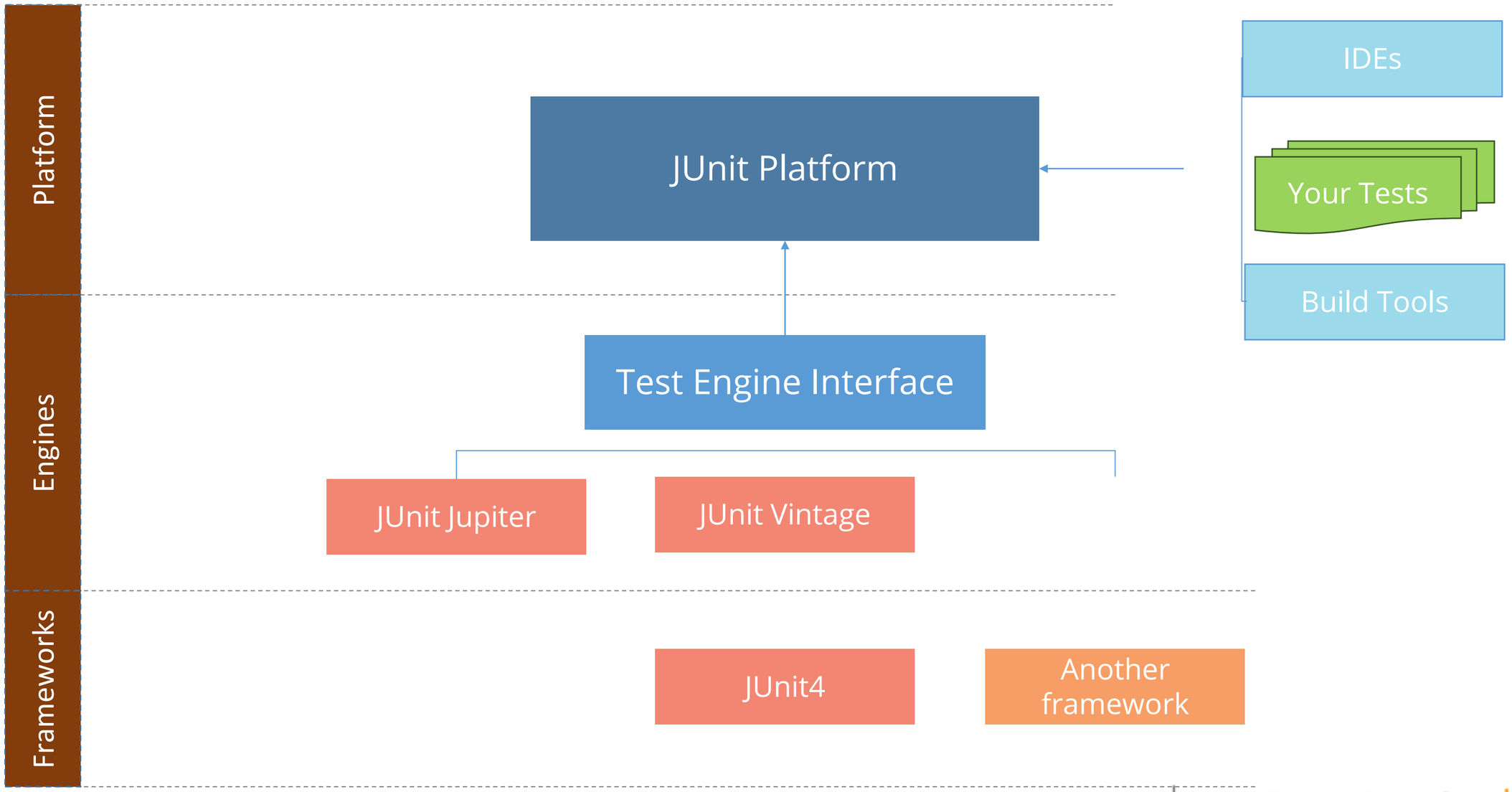
# Moving from JUnit 4 to JUnit 5

JUnit 5 provides a gentle migration path via the JUnit Vintage test engine, which allows for execution of legacy test cases on top of the JUnit platform.

| Feature | JUnit 4 | JUnit 5 |
|---|---|---|
| Annotation package | org.JUnit | org.JUnit.Jupiter.api |
| Declaring a test | @Test | @Test |
| Setup for all tests | @BeforeClass | @BeforeAll |
| Setup per test | @Before | @BeforeEach |
| Tear down for all tests | @AfterClass | @AfterAll |
| Tear down per test | @After | @AfterEach |
| Tagging and filtering | @Category | @Tag |
| Disabling a test method or a class | @Ignore | @Disabled |
| Nested tests | NA | @Nested |
| Repeated tests | Using custom rule | @Repeated |
| Dynamic tests | NA | @TestFactory |
| Test templates | NA | @TestTemplate |

# JUnit 5 Architecture

# JUnit 5 Architecture

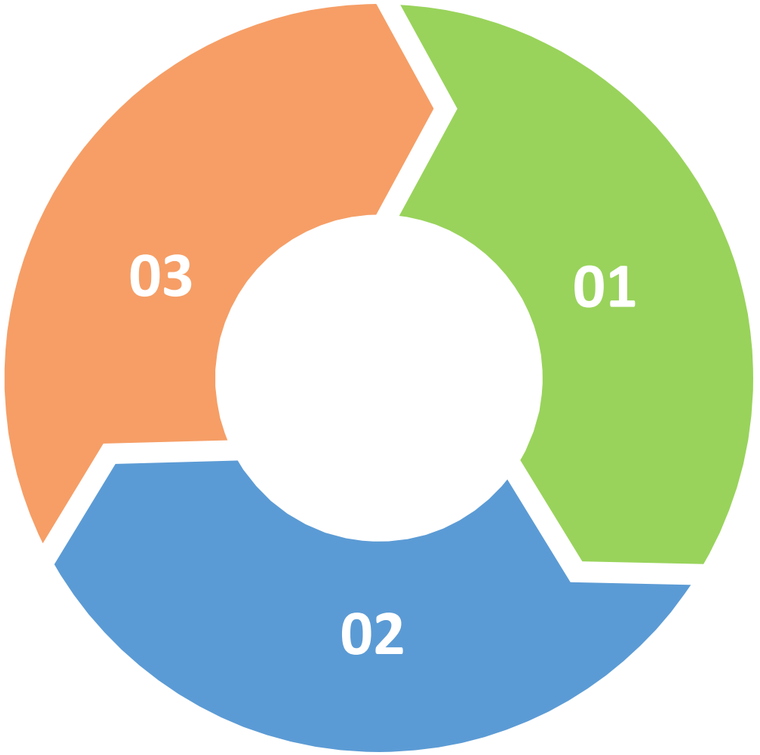


# JUnit 5 Architecture

JUnit 5 is split into three different subprojects.

**JUnit Vintage**

Allows running of JUnit 4 tests with JUnit 5




**JUnit Platform**

Provides build plugins and an API for writing test engines

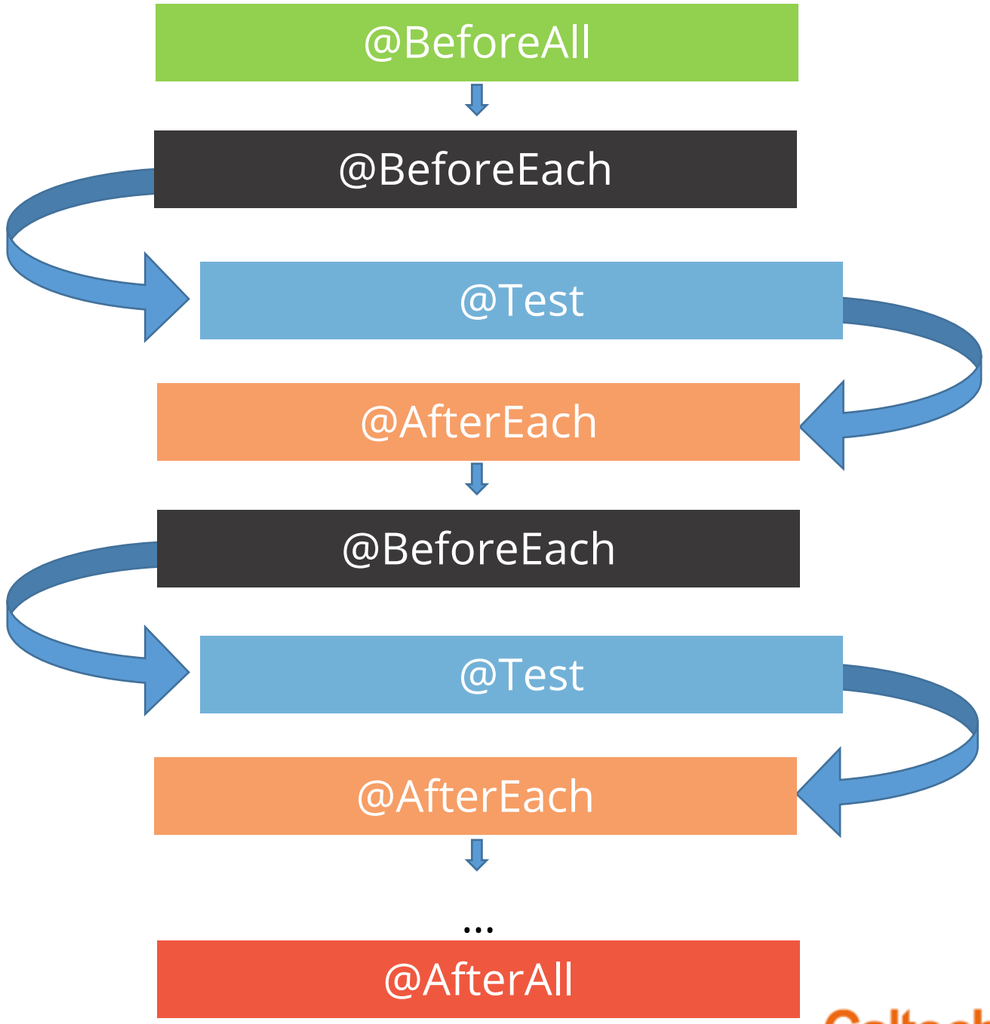
**JUnit Jupiter**

Provides new API for writing tests and extensions in JUnit 5

# Standard Tests

# Standard Tests

In JUnit 5, the @Test annotation represents a test. Any public method can be annotated with @Test to make it a test method.



# Annotations

The following annotations are used for configuring tests in JUnit5:

| Annotation | Description |
|---|---|
| @Test | Denotes a test method |
| @DisplayName | Declares a custom display name for the test class or test method |
| @BeforeEach | Denotes that the annotated method should be executed before each test method |
| @AfterEach | Denotes that the annotated method should be executed after each test method |
| @BeforeAll | Denotes that the annotated method should be executed before all test methods |
| @AfterAll | Denotes that the annotated method should be executed after all test methods |
| @Disable | Used to disable a test class or test method |
| @Nested | Denotes that the annotated class is a nested and non-static test class |
| @Tag | Declares tags for filtering tests |
| @ExtendWith | Registers custom extensions |

# Assisted Practice

Assisted Practice: JUnit5: Standard Tests

**Duration: 10 min.**

**Problem Statement:**

Write a program to demonstrate standard tests.

# Assisted Practice: Guidelines

Steps to demonstrate standard tests:

1. Create a Java project in your IDE
2. Write a program in Java to demonstrate standard tests
3. Initialize the .git file
4. Add and commit the program files
5. Push the code to your GitHub repositories

# Assertions

# Assertions

Every test method is evaluated using assertions so that the test can be executed. JUnit Jupiter assertions are found in the **org.JUnit.jupiter.api.Assertions class.**

| Assertion | Description |
|---|---|
| assertEquals(expected, actual) | Fails when expected does not equal actual |
| assertFalse(expression) | Fails when expression is not false |
| assertNull(actual) | Fails when actual is not null |
| assertNotNull(actual) | Fails when actual is null |
| assertAll() | Groups many assertions; every assertion is executed even if one or more of them fail |
| assertTrue(expression) | Fails if expression is not true |
| assertThrows() | Class to be tested is expected to throw an exception |

# Assisted Practice

Assisted Practice: Assertions

**Duration: 10 min.**

**Problem Statement:**

Write a program to demonstrate assertions.

# Assisted Practice: Guidelines

Steps to demonstrate assertions:

1. Create a Java project in your IDE
2. Write a program in Java to demonstrate assertions
3. Initialize the .git file
4. Add and commit the program files
5. Push the code to your GitHub repositories

# Conditional Test Execution

# Conditional Test Execution

JUnit 5 extension model is used to establish custom conditions for test execution. The **ExecutionCondition** is used for this purpose.

| Conditional Annotation Type | Annotation List |
|---|---|
| Operating system conditions | @EnabledOnOs, @DisabledOnOs |
| Java runtime environment conditions | @EnabledOnJre, @DisabledOnJre |
| System property conditions | @EnabledIfSystemProperty, @DisabledIfSystemProperty |
| Environment variable conditions | @EnabledIfEnvironmentVariable, @DisabledIfEnvironmentVariable |
| Script-based conditions | @EnabledIf, @DisabledIf |

# Assisted Practice

Assisted Practice: Conditional Test Execution

**Duration: 10 min.**

**Problem Statement:**

Write a program to demonstrate conditional test executions.

# Assisted Practice: Guidelines

Steps to demonstrate conditional test execution:

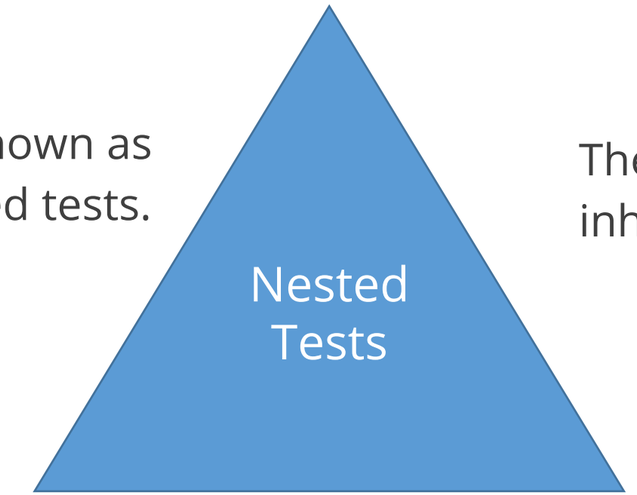
1. Create a Java project in your IDE
2. Write a program in Java to demonstrate conditional test execution
3. Initialize the .git file
4. Add and commit the program files
5. Push the code to your GitHub repositories

# Nested and Repeated Tests

# Nested Tests

@Nested annotation is used to mark a nested class to be included in the test cases.

Only non-static nested classes, also known as inner classes, can serve as @Nested tests.

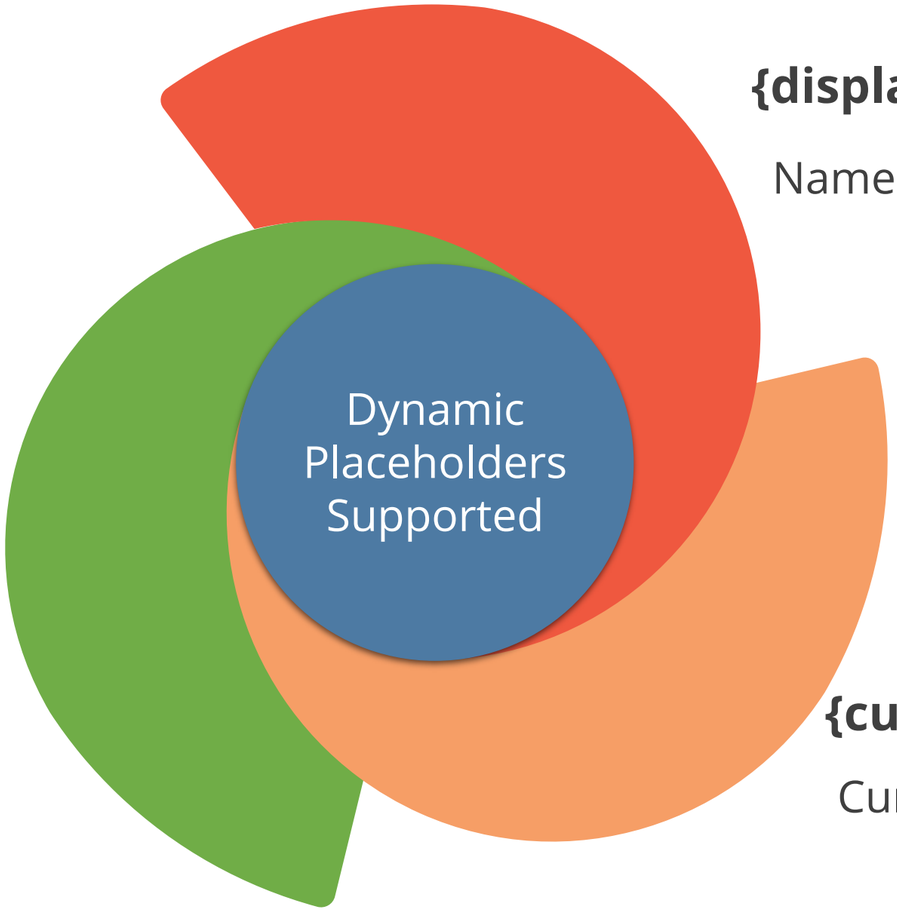



The setup and tear down for each test are inherited in the nested tests.

@TestInstance(Lifecycle.PER_CLASS) is used to override the restriction that Java does not allow static members in inner classes.

# Repeated Tests

A test can be repeated a fixed number of times by annotating a method with @RepeatedTest, specifying the total number of repetitions desired.




**{displayName}**

Name of the @RepeatedTest method

**{totalRepetitions}**

total number of repetitions

**{currentRepetition}**

Current repetition count

# Assisted Practice

Assisted Practice: Nested and Repeated Tests

**Duration: 10 min.**

**Problem Statement:**

Write a program to demonstrate nested and repeated tests.

# Assisted Practice: Guidelines

Steps to demonstrate nested and repeated tests:

1. Create a Java project in your IDE
2. Write a program in Java to demonstrate nested and repeated tests
3. Initialize the .git file
4. Add and commit the program files
5. Push the code to your GitHub repositories

# Dynamic Tests

# Dynamic Tests

JUnit 5 allows to generate tests at runtime by a factory method that is annotated with @TestFactory.

Properties of Dynamic Tests:

Must return a Stream, Collection, Iterable, or Iterator of DynamicNode instances

Stream returned properly closed by calling stream.close(),

# Assisted Practice

Assisted Practice: Dynamic Tests

**Duration: 10 min.**

**Problem Statement:**

Write a program to demonstrate dynamic tests.

# Assisted Practice: Guidelines

Steps to demonstrate dynamic tests:

1. Create a Java project in your IDE
2. Write a program in Java to demonstrate dynamic tests
3. Initialize the .git file
4. Add and commit the program files
5. Push the code to your GitHub repositories

# Dependency Injection

# Dependency Injection

JUnit5 allows both test constructors and methods to include parameters.

**TestInfoParameterResolver**

Supplies an instance of TestInfo corresponding to the current container

**RepetitionInfoParameter Resolver**

Supplies an instance of RepetitionInfo

**TestReporterParameter Resolver**

Supplies an instance of TestReporter

# Assisted Practice

Assisted Practice: Dependency Injection

**Duration: 10 min.**

**Problem Statement:**

Write a program to demonstrate a dependency injection.

# Assisted Practice: Guidelines

Steps to demonstrate dependency injection:

1. Create a Java project in your IDE
2. Write a program in Java to demonstrate a dependency injection
3. Initialize the .git file
4. Add and commit the program files
5. Push the code to your GitHub repositories

# Key Takeaways

- JUnit is a unit testing framework for Java programming language, and it follows the TDD approach
- JUnit 5 allows multiple runners to work simultaneously
- Dependency injection is a technique in which one object supplies dependencies to the other
- Assertions are validation rules used to test results that check your target service platform

# Lesson-End Project

**Duration: 30 min.**

## Handling User Authentication

**Problem Statement**:
Set up a standalone project to do unit testing of the user authentication class which is used in the main web application. The objective is to create a JUnit class that will test all aspects of the authentication class.