Day 22

Task 1: Write a set of JUnit tests for a given class with simple mathematical operations (add, subtract, multiply, divide) using the basic @Test annotation.

Program:

Step 1: Create a new Class called Calculator

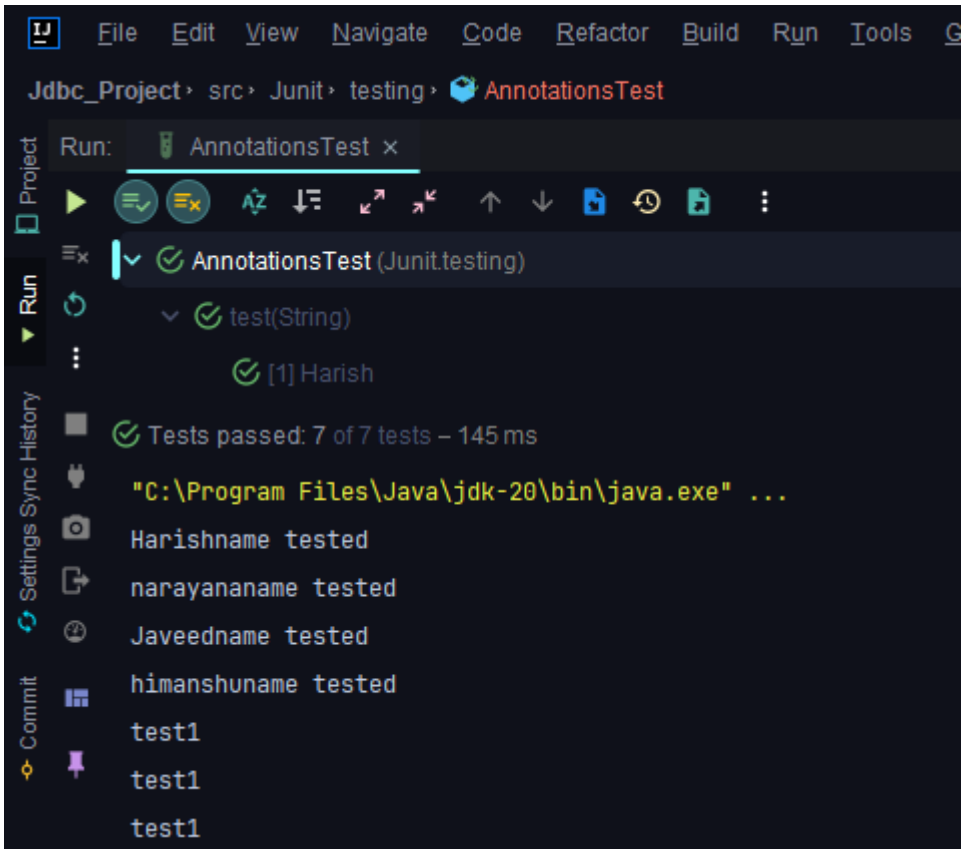
```
package Junit.calsi;

public class Calculator {

    public int add(int a, int b) {

        return a + b;

    }

    public int sub(int a, int b) {

        return a - b;

    }

    public int mul(int a, int b) {

        return a * b;

    }

}
```

Step 2: Create a CalculatorTest class for Junit testing

```
package Junit.testing;

import static org.junit.jupiter.api.Assertions.*;

import org.junit.jupiter.api.AfterAll;
import org.junit.jupiter.api.AfterEach;
import org.junit.jupiter.api.BeforeAll;
import org.junit.jupiter.api.BeforeEach;
import org.junit.jupiter.api.RepeatedTest;
import org.junit.jupiter.params.ParameterizedTest;
import org.junit.jupiter.params.provider.ValueSource;

class CalculatorTest {

    @BeforeAll
    static void setUpBeforeClass() throws Exception {
    }

    @AfterAll
```

```
    static void tearDownAfterClass() throws Exception {
    }

    @BeforeEach
    void setUp() throws Exception {
    }

    @AfterEach
    void tearDown() throws Exception {
    }

    @ParameterizedTest
    @ValueSource(strings = { "Harish", "narayana", "Javeed", "himanshu" })

    void test(String name) {

       System.out.println(name + "name tested");
       assertTrue(name.length() > 5);

    }

    @RepeatedTest(3)

    void test1() {

       System.out.println("test1");

       assertTrue(true);
    }

}
```

Output:



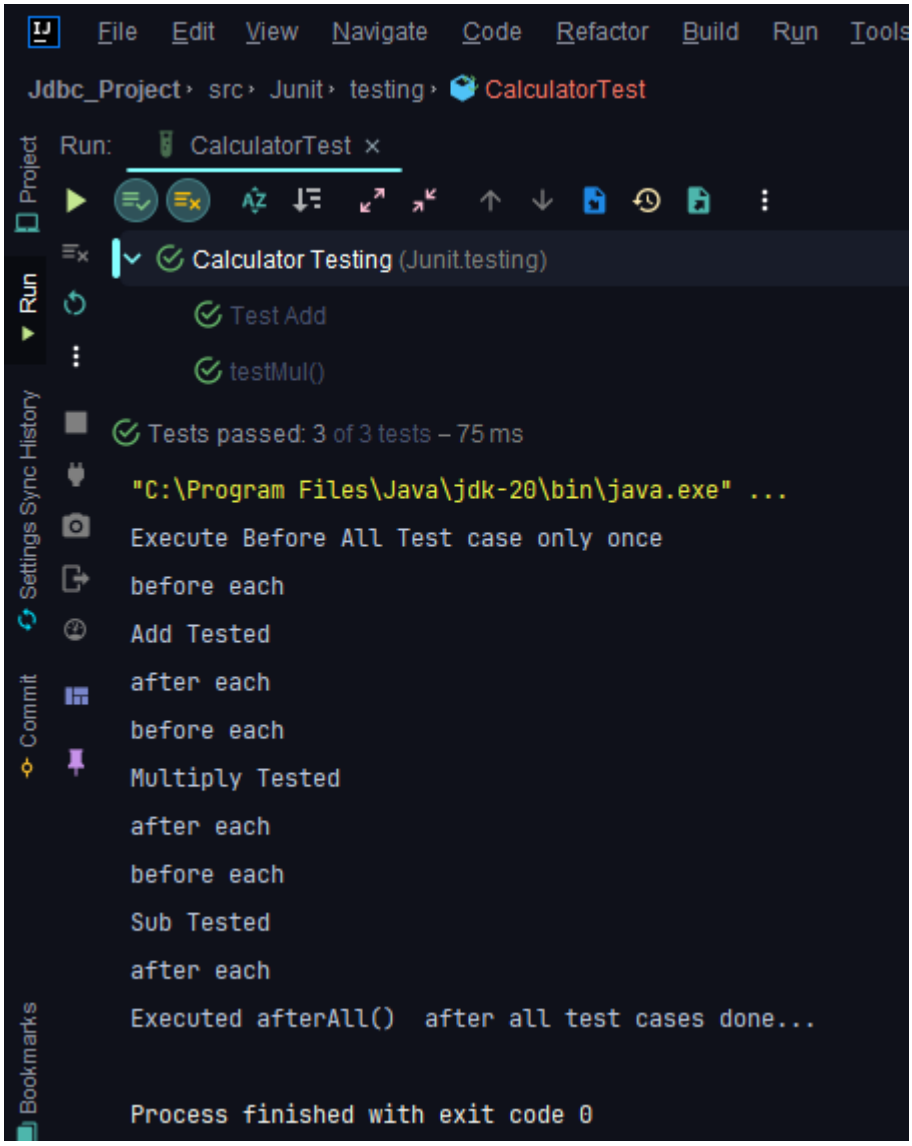
Task 2: Extend the above JUnit tests to use @Before, @After, @BeforeClass, and @AfterClass annotations to manage test setup and teardown.

Program:

```
package Junit.testing;

import static org.junit.jupiter.api.Assertions.assertEquals;
import static org.junit.jupiter.api.Assertions.assertNotEquals;
import static org.junit.jupiter.api.Assertions.assertNotNull;
import static org.junit.jupiter.api.Assertions.assertTrue;

import Junit.calsi.Calculator;
import org.junit.jupiter.api.AfterAll;
import org.junit.jupiter.api.AfterEach;
import org.junit.jupiter.api.BeforeAll;
import org.junit.jupiter.api.BeforeEach;
import org.junit.jupiter.api.DisplayName;
import org.junit.jupiter.api.Tag;
import org.junit.jupiter.api.Test;


@DisplayName("Calculator Testing")
class AnnotationTest {

    static Calculator cal = null;

    @BeforeAll
    public static void beforeAll() {

       System.out.println("Execute Before All Test case only once");

       cal = new Calculator();

    }


    @BeforeEach
    public  void  before() {

       System.out.println("before each");

    }

    @AfterEach
    public void after() {

       System.out.println("after each");


    }



    @Tag("G1")
    @DisplayName("Test Add")
    @Test
    void testAdd() {

       assertNotNull(cal);

       int actual = cal.add(5,4);
```

```
        assertEquals(9, actual);

        System.out.println("Add Tested");

    }

    //@Disabled
    @Tag("G1")
    @Test
    void testSub() {

        int actual = cal.sub(10, 4);

        assertEquals(6, actual);

        assertNotEquals(0, actual);

        System.out.println("Sub Tested");

    }

    @Test
    void testMul() {

        int actual = cal.mul(5, 4);

        assertTrue(actual > 0);

        System.out.println("Multiply Tested");

    }

    @AfterAll
    public static void afterAll() {

        System.out.println("Executed afterAll()  after all test cases done...");

    }

}
```

Output:



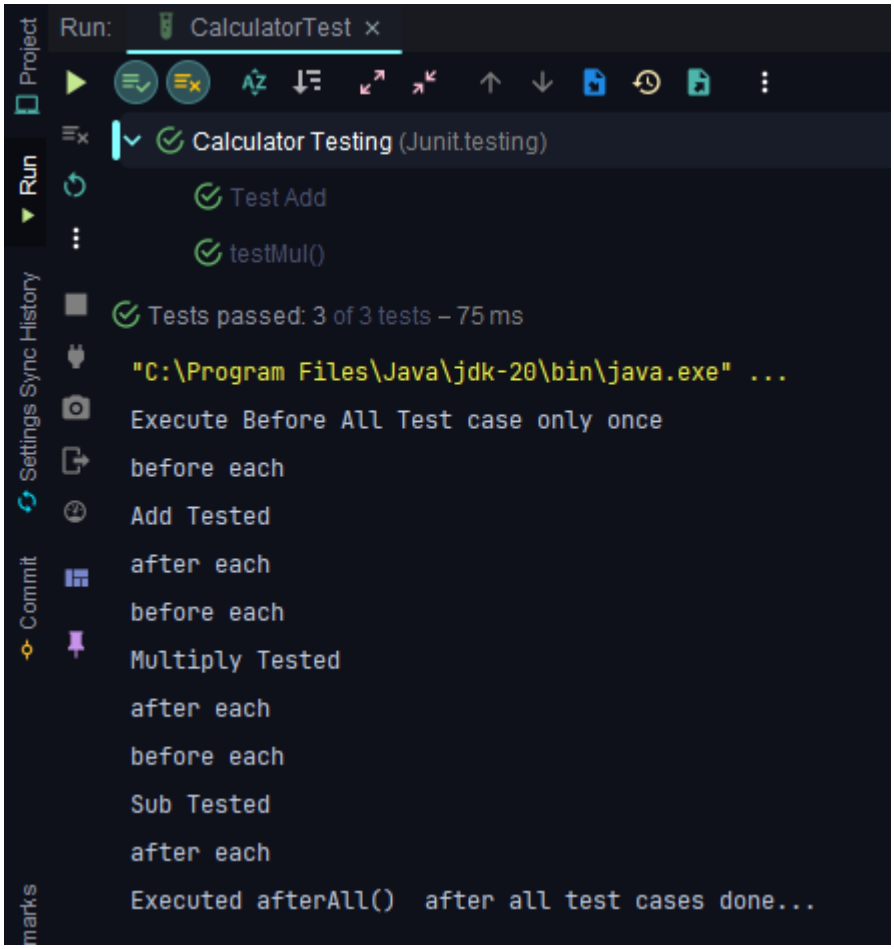
Task 3: Create test cases with assertEquals, assertTrue, and assertFalse to validate the correctness of a custom String utility class**.**

Program:

```
package Junit.testing;

import static org.junit.jupiter.api.Assertions.*;

import org.junit.jupiter.api.AfterAll;
import org.junit.jupiter.api.AfterEach;
import org.junit.jupiter.api.BeforeAll;
import org.junit.jupiter.api.BeforeEach;
import org.junit.jupiter.api.RepeatedTest;
import org.junit.jupiter.params.ParameterizedTest;
import org.junit.jupiter.params.provider.ValueSource;

class AnnotationsTest {

    @BeforeAll
    static void setUpBeforeClass() throws Exception {
    }
```

```
    @AfterAll
    static void tearDownAfterClass() throws Exception {
    }

    @BeforeEach
    void setUp() throws Exception {
    }

    @AfterEach
    void tearDown() throws Exception {
    }

    @ParameterizedTest
    @ValueSource(strings = { "Harish", "narayana", "Javeed", "himanshu" })

    void test(String name) {

       System.out.println(name + "name tested");
       assertTrue(name.length() > 5);

    }

    @RepeatedTest(3)

    void test1() {

       System.out.println("test1");

       assertTrue(true);
    }

}
```

Output:



Task 4: Research and present a comparison of different garbage collection algorithms (Serial, Parallel, CMS, G1, ZGC) in Java.

Answer:

GC algorithms:

1. **Serial Garbage Collector:**
    - Type: Single-threaded, stop-the-world collector.
    - Use Case: Suitable for small applications or single-threaded environments.
    - Pros: Simple, low overhead.
    - Cons: High pause times during major collections.
    - Command Line Option: -XX:+UseSerialGC.
2. **Parallel Garbage Collector (Parallel GC):**

- Type: Multi-threaded, stop-the-world collector.
- Use Case: General-purpose applications with multi-core CPUs.
- Pros: Better throughput than Serial GC.
- Cons: Longer pause times than G1 or ZGC.
- Command Line Option: -XX:+UseParallelGC.

3. **Concurrent Mark-Sweep (CMS) Garbage Collector:**
   - Type: Concurrent collector (low pause times).
   - Use Case: Applications requiring low-latency response times.
   - Pros: Low pause times, good for interactive applications.
   - Cons: Fragmentation, may cause CPU overhead.
   - Command Line Option: -XX:+UseConcMarkSweepGC.
4. **G1 Garbage Collector:**
   - Type: Region-based, parallel collector.
   - Use Case: Large heaps, balanced throughput and low-latency requirements.
   - Pros: Predictable pause times, adaptive.
   - Cons: Higher CPU usage than CMS.
   - Command Line Option: -XX:+UseG1GC.
5. **Z Garbage Collector (ZGC):**
   - Type: Low-latency, region-based collector.
   - Use Case: Applications requiring ultra-low pause times.
   - Pros: Extremely short pause times, suitable for large heaps.
   - Cons: May have slightly lower throughput.
   - Command Line Option: -XX:+UseZGC.