

# **Homework 4**

## **Software Quality**

### **Group 06**

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GitHub Link: <https://github.com/SkelpieX/Homework4-SoftwareQuality/>

You report on each of the steps above. You submit reports, Junit tests, Java code. You will test the following function/method:

NextDate is a function of three variables: day, month, and year. The three variables constitute a date between the years,  $1812 \leq \text{year} \leq 2212$ . The function returns the date of the next day as output. This function can be used, for example, in a calendar app.

1. Follow our algorithm to design test cases and group them in a test case table (chapter 6 of the book). Highlight characteristics, domains, blocks, values. Use the pairwise coverage criteria.

Test Case	Day	Month	Year	Expected Output	Additional Info
TC1	28	2	1900	1-3-1900	Non-leap year February end
TC2	29	2	2000	1-3-2000	Leap year February end
TC3	30	4	2021	1-5-2021	April end
TC4	31	7	2021	1-8-2021	July end
TC5	31	12	2212	1-1-2213	Year boundary
TC6	15	1	1812	16-1-1812	Normal day
TC7	29	2	1900	Invalid	Non-leap year February
TC8	32	1	2020	Invalid	Invalid day
TC9	31	4	2021	Invalid	Invalid April end
TC10	1	13	2021	Invalid	Invalid month

### **Characteristics and Domains:**

- **Day = 1-31**
- **Month = 1-12**
- **Year = 1812-2212**

### **Domains and Blocks**

- **Days valid = 1-28** for all months, **29** (for all months except Feb on non-leap years), **30** (for April, June, September, and November), **31** (for January, March, May, July, August, October, and December)
- **Days invalid = 0**, and all numbers greater than **31**
- **Months valid = 1-12**
- **Months invalid = 0**, and all numbers greater than **12**
- **Year valid = 1812-2212**
- **Year invalid = less than 1812, greater than 2212**

### **Values for Testing**

- **Day:** 1, 15, 28, 29, 30, 31
- **Month:** 1, 2, 4, 7, 12
- **Year:** 1812, 1900, 2000, 2212

### **Pairwise Coverage**

- **Pair 1:** Pairs the day and months together to ensure the testing of non-leap years (28 Feb), leap years (29 Feb), as well as the testing of 30 or 31 days in a month (30 April and 31 July)
- **Pair 2:** Pairs the months and years together to test for Feb. in leap years and non-leap years (Feb 1900 and Feb 2000)
- **Pair 3:** Pairs the days and years together for boundary testing (31 Dec 2212)

2. Write a Junit test script (This is a chance to experiment with different Junit annotations to organize your test cases)

```
package com.ontariotechu.sofe3980U;
import static org.junit.jupiter.api.Assertions.*;

import org.junit.jupiter.api.DisplayName;
import org.junit.jupiter.params.ParameterizedTest;
import org.junit.jupiter.params.provider.CsvSource;

/**
 * Provides unit tests for the NextDate class to verify correct behavior across a variety of dates.
 * This includes handling of leap years, end-of-month scenarios, and validation of date inputs.
 */
public class NextDateTest {
    tabnine: test | explain | document | ask
    /**
     * Executes a series of parameterized tests for the NextDate.nextDate method to ensure it correctly
     * calculates the next date given various input scenarios. These scenarios include leap years,
     * end-of-month transitions, year-end transitions, and invalid date checks.
     *
     * Each test case provides a day, month, and year as input and expects a specific output date as a string,
     * along with a description for better understanding of the test context.
     *
     * @param day The input day for the test case.
     * @param month The input month for the test case.
     * @param year The input year for the test case.
     * @param expected The expected result of the nextDate calculation.
     * @param info A descriptive message explaining the specific scenario being tested.
     */
    @DisplayName("Next Date Test Cases")
    @ParameterizedTest(name = "{index} => {0}, {1}, {2} = {3} ({4})")
    @CsvSource({
        "28, 2, 1900, 1-3-1900, Non-leap year February end", // Tests non-leap year end of February.
        "29, 2, 2000, 1-3-2000, Leap year February end", // Tests leap year end of February.
        "30, 4, 2021, 1-5-2021, April end", // Tests end of April, which has 30 days.
        "31, 7, 2021, 1-8-2021, July end", // Tests end of July, transitioning to August.
        "31, 12, 2212, 1-1-2213, Year boundary", // Tests transition from end of year to new year.
        "15, 1, 1812, 16-1-1812, Normal day", // Tests a normal day, verifying increment.
        "29, 2, 1900, Invalid, Non-leap year February", // Tests an invalid leap year date.
        "32, 1, 2020, Invalid, Invalid day", // Tests an invalid day number.
        "31, 4, 2021, Invalid, Invalid April end", // Tests invalid date at April end.
        "1, 13, 2021, Invalid, Invalid month" // Tests an invalid month number.
    })
    public void nextDateTest(int day, int month, int year, String expected, String info) {
        // Execute the method with the provided inputs and compare the result to the expected outcome.
        String result = NextDate.nextDate(day, month, year);
        // Assert that the calculated next date matches the expected output for the given test scenario.
        assertEquals(expected, result, info + " failed");
        // Optional: Print a success message for passed tests (useful for debugging or verbose test output).
        System.out.println(info + " passed");
    }
}
```

### 3. Write the corresponding Java code

```
package com.ontariotechu.sofe3980U;

/**
 * The NextDate class provides a method to calculate the next date given a current date.
 * The method handles various edge cases such as leap years, end of the month, and end of the year scenarios.
 */
public class NextDate {

    tabnine: test | explain | document | ask
    /**
     * Calculates the next date given the current day, month, and year.
     * The method validates input dates and considers leap years, and month lengths to return the correct next date
     *
     * @param day The day of the month (1-31).
     * @param month The month of the year (1-12).
     * @param year The year (1812-2212, chosen limits for demonstration).
     * @return The next date in "day-month-year" format or "Invalid" if input date is not valid.
     */
    public static String nextDate(int day, int month, int year) {
        // Validate the input date ranges.
        if (
            (day < 1 || day > 31) ||
            (month < 1 || month > 12) ||
            (year < 1812 || year > 2212)
        ) {
            return "Invalid";
        }

        // Handle the end of the year case, moving to the next year.
        if (day == 31 && month == 12) {
            return "1-1-" + (year + 1);
        }

        // Handle the end of months with 30 days.
        if (day == 30 && (month == 4 || month == 6 || month == 9 || month == 11)) {
            return "1-" + (month + 1) + "-" + year;
        }

        // Leap year check for February 29.
        if (day == 29 && month == 2) {
            if (year % 4 == 0 && (year % 100 != 0 || year % 400 == 0)) {
                return "1-3-" + year; // Next day is March 1st if leap year.
            } else {
                return "Invalid"; // Invalid since it's not a leap year.
            }
        }

        // Handle February 28, moving to March 1st regardless of leap year.
        if (day == 28 && month == 2) {
            return "1-3-" + year;
        }

        // Handle the end of months with 31 days, except December (already handled).
        if (day == 31) {
            if ((month == 1 || month == 3 || month == 5 || month == 7 || month == 8 || month == 10)) {
                return "1-" + (month + 1) + "-" + year;
            } else {
                return "Invalid"; // Invalid since not all months have 31 days.
            }
        }
    }
}
```

4. Run the tests and debug if need be.
5. Repeat until the quality of the code is assured

```
[INFO] Scanning for projects...
[INFO] -----< com.ontariotechu.sofe3980U:NextDate >-----
[INFO] Building NextDate 1.0.0
[INFO] from pom.xml
[INFO] -----[ jar ]-----
[INFO] --- clean:3.1.0:clean (default-clean) @ NextDate ---
[INFO] Deleting /mnt/c/Users/school/OneDrive - Ontario Tech University/Year 3/Software Quality/hw4/target
[INFO] --- resources:3.0.2:resources (default-resources) @ NextDate ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /mnt/c/Users/school/OneDrive - Ontario Tech University/Year 3/Software Quality/hw4/src/main/resources
[INFO] --- compiler:3.8.0:compile (default-compile) @ NextDate ---
[INFO] Changes detected - recompiling the module!
[INFO] Compiling 2 source files to /mnt/c/Users/school/OneDrive - Ontario Tech University/Year 3/Software Quality/hw4/target/classes
[INFO] --- resources:3.0.2:testResources (default-testResources) @ NextDate ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /mnt/c/Users/school/OneDrive - Ontario Tech University/Year 3/Software Quality/hw4/src/test/resources
[INFO] --- compiler:3.8.0:testCompile (default-testCompile) @ NextDate ---
[INFO] Changes detected - recompiling the module!
[INFO] Compiling 2 source files to /mnt/c/Users/school/OneDrive - Ontario Tech University/Year 3/Software Quality/hw4/target/test-classes
[INFO] --- surefire:3.2.1:test (default-test) @ NextDate ---
[INFO] Using auto detected provider org.apache.maven.surefire.junitplatform.JUnitPlatformProvider
[INFO] -----
[INFO] T E S T S
[INFO] -----
[INFO] Running com.ontariotechu.sofe3980U.AppTest
[INFO] Tests run: 1, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.156 s -- in com.ontariotechu.sofe3980U.AppTest
[INFO] Running com.ontariotechu.sofe3980U.NextDateTest
Non-leap year February end passed
Leap year February end passed
April end passed
July end passed
Year boundary passed
Normal day passed
Non-leap year February passed
Invalid day passed
Invalid April end passed
Invalid month passed
[INFO] Tests run: 10, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.392 s -- in com.ontariotechu.sofe3980U.NextDateTest
[INFO] Results:
[INFO] Tests run: 11, Failures: 0, Errors: 0, Skipped: 0
[INFO] --- resources:3.0.2:resources (default-resources) @ NextDate ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /mnt/c/Users/school/OneDrive - Ontario Tech University/Year 3/Software Quality/hw4/src/main/resources
[INFO] --- compiler:3.8.0:compile (default-compile) @ NextDate ---
[INFO] Nothing to compile - all classes are up to date
[INFO] --- resources:3.0.2:testResources (default-testResources) @ NextDate ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /mnt/c/Users/school/OneDrive - Ontario Tech University/Year 3/Software Quality/hw4/src/test/resources
[INFO] --- compiler:3.8.0:testCompile (default-testCompile) @ NextDate ---
[INFO] Nothing to compile - all classes are up to date
[INFO] --- surefire:3.2.1:test (default-test) @ NextDate ---
[INFO] Skipping execution of surefire because it has already been run for this configuration
[INFO] --- jar:3.0.2:jar (default-jar) @ NextDate ---
[INFO] Building jar: /mnt/c/Users/school/OneDrive - Ontario Tech University/Year 3/Software Quality/hw4/target/NextDate-1.0.0.jar
[INFO] --- site:3.7.1:site (default-site) @ NextDate ---
[INFO] configuring report plugin org.apache.maven.plugins:maven-javadoc-plugin:3.4.1
[INFO] preparing maven-javadoc-plugin:javadoc report requires 'generate-sources' forked phase execution
[INFO] >>> javadoc:3.4.1:javadoc > generate-sources @ NextDate >>>
```

```

[INFO] <<< javadoc:3.4.1:javadoc < generate-sources @ NextDate <<<
[INFO]
[INFO] 'generate-sources' forked phase execution for maven-javadoc-plugin:javadoc report preparation done
[INFO] preparing maven-javadoc-plugin:test-javadoc report requires 'generate-test-sources' forked phase execution
[INFO]
[INFO] >>> javadoc:3.4.1:test-javadoc > generate-test-sources @ NextDate >>>
[INFO]
[INFO] --- resources:3.0.2:resources (default-resources) @ NextDate ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /mnt/c/Users/school/OneDrive - Ontario Tech University/Year 3/Software Quality/hw4/src/main/resources
[INFO]
[INFO] --- compiler:3.8.0:compile (default-compile) @ NextDate ---
[INFO] Nothing to compile - all classes are up to date
[INFO]
[INFO] <<< javadoc:3.4.1:test-javadoc < generate-test-sources @ NextDate <<<
[INFO]
[INFO] 'generate-test-sources' forked phase execution for maven-javadoc-plugin:test-javadoc report preparation done
[INFO] 6 reports detected for maven-javadoc-plugin:3.4.1: aggregate-no-fork, javadoc, javadoc-no-fork, test-aggregate-no-fork, test-javadoc, test-javadoc-no-fork
[INFO] configuring report plugin org.apache.maven.plugins:maven-surefire-report-plugin:3.0.0-M0
[INFO] preparing maven-surefire-report-plugin:report requires '[surefire]test' forked phase execution
[INFO]
[INFO] >>> surefire-report:3.0.0-M0/report > [surefire]test @ NextDate >>>
[INFO]
[INFO] --- resources:3.0.2:resources (default-resources) @ NextDate ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /mnt/c/Users/school/OneDrive - Ontario Tech University/Year 3/Software Quality/hw4/src/main/resources
[INFO]
[INFO] --- compiler:3.8.0:compile (default-compile) @ NextDate ---
[INFO] Nothing to compile - all classes are up to date
[INFO]
[INFO] --- resources:3.0.2:testResources (default-testResources) @ NextDate ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /mnt/c/Users/school/OneDrive - Ontario Tech University/Year 3/Software Quality/hw4/src/test/resources
[INFO]
[INFO] --- compiler:3.8.0:testCompile (default-testCompile) @ NextDate ---
[INFO] Nothing to compile - all classes are up to date
[INFO]
[INFO] --- surefire:3.2.1:test (default-test) @ NextDate ---
[INFO] Skipping execution of surefire because it has already been run for this configuration
[INFO]
[INFO] <<< surefire-report:3.0.0-M0/report < [surefire]test @ NextDate <<<
[INFO]
[INFO] '[surefire]test' forked phase execution for maven-surefire-report-plugin:report report preparation done
[INFO] 3 reports detected for maven-surefire-report-plugin:3.0.0-M0: failsafe-report-only, report, report-only
[INFO] configuring report plugin org.apache.maven.plugins:maven-project-info-reports-plugin:3.0.0
[INFO] 15 reports detected for maven-project-info-reports-plugin:3.0.0: ci-management, dependencies, dependency-info, dependency-management, distribution-management, index, issue-management, licenses, mailing-lists, modules, plugin-management, plugins, scm, summary, team
[INFO] Rendering site with default locale English (en)
[INFO] Relativizing decoration links with respect to localized project URL: http://www.example.com
[INFO] Rendering content with org.apache.maven.skins:maven-default-skin-jar:1.2 skin.
[INFO] Skipped 'javadoc' report (maven-javadoc-plugin:3.4.1:javadoc), file "apidocs/index.html" already exists.
[INFO] Skipped 'javadoc' report (maven-javadoc-plugin:3.4.1:javadoc-no-fork), file "apidocs/index.html" already exists.
[INFO] Skipped 'Test Javadoc' report (maven-javadoc-plugin:3.4.1:test-javadoc), file "testapidocs/index.html" already exists.
[INFO] Skipped 'Test Javadoc' report (maven-javadoc-plugin:3.4.1:test-javadoc-no-fork), file "testapidocs/index.html" already exists.
[INFO] Skipped 'Surefire Report' report (maven-surefire-report-plugin:3.0.0-M0/report-only), file "surefire-report.html" already exists.
[INFO] Generating 'Javadoc' report --- maven-javadoc-plugin:3.4.1:aggregate-no-fork
[INFO] No previous run data found, generating javadoc.
[INFO] Generating 'Test Javadoc' report --- maven-javadoc-plugin:3.4.1:test-aggregate-no-fork
[INFO] Configuration changed, re-generating javadoc.
[INFO] Generating 'Surefire Report' report --- maven-surefire-report-plugin:3.0.0-M0/report
[WARNING] Unable to locate Test Source XRef to link to - DISABLED
[INFO] Generating 'Dependencies' report --- maven-project-info-reports-plugin:3.0.0:dependencies
[INFO] Generating 'Dependency Information' report --- maven-project-info-reports-plugin:3.0.0:dependency-info
[INFO] Generating 'Dependency Management' report --- maven-project-info-reports-plugin:3.0.0:dependency-management
[INFO] Generating 'About' report --- maven-project-info-reports-plugin:3.0.0:index
[INFO] Generating 'Plugin Management' report --- maven-project-info-reports-plugin:3.0.0:plugin-management
[INFO] Generating 'Plugins' report --- maven-project-info-reports-plugin:3.0.0:plugins
[INFO] Generating 'Summary' report --- maven-project-info-reports-plugin:3.0.0:summary
[INFO]
[INFO] --- assembly:3.6.0:single (default-cli) @ NextDate ---
[INFO] Building jar: /mnt/c/Users/school/OneDrive - Ontario Tech University/Year 3/Software Quality/hw4/target/NextDate-1.0.0-jar-with-dependencies.jar
[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----

```