

# Modified Condition/Decision Coverage (MC/DC)

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In this recitation class, we are going to explore 'Modified Condition/Decision Coverage (MC/DC)', *a white-box testing technique*, in the `jpacman` project.

Please make sure your machine is configured properly, i.e.:

- [Java](#) installed on your machine and available through the command line. Disclaimer: this tutorial has been validated under Java-11. It may or may not work on other versions of Java. Let us know whether it does not work under Java-X, where X is a version higher than 11.
- [Apache Maven](#) to be installed on your machine and available through the command line. In case Maven is not installed, please follow the following steps:
  - Download [apache-maven-3.9.4-bin.zip](#)
  - Extract `apache-maven-3.9.4-bin.zip`
  - On Windows, augment your environment variables with the full path to the `<extracted directory>/bin`. On Linux/MacOS, run `export PATH="<extracted directory>/bin:$PATH". (You might have to run the export everytime you restart the computer. For a more permanent solution, please consider adding that command to your bash profile.)`

## 1. Perform 'Modified Condition/Decision Coverage (MC/DC)'

Given the source code of the `jpacman` project, which you could find in [here](#), we expect you to perform 'Modified Condition/Decision Coverage (MC/DC)' on the following two functions.

In a nutshell, apply Modified Condition/Decision Coverage (MC/DC) to all **decisions** in each function and then implement the derived tests.

### 1.1 `withinBorders` function in the `n1.tudelft.jpacman.board.Board` class

```
Java
/**
```

```

    * Determines whether the given <code>x,y</code> position is on
    this board.
    *
    * @param x
    *         The <code>x</code> position (row) to test.
    * @param y
    *         The <code>y</code> position (column) to test.
    * @return <code>true</code> iff the position is on this board.
    */
    public boolean withinBorders(int x, int y) {
        return x >= 0 && x < getWidth() && y >= 0 && y < getHeight();
    }

```

## 1.2 start function in the `nl.tudelft.jpacman.game.Game` class

```

Java
/**
 * Starts or resumes the game.
 */
public void start() {
    synchronized (progressLock) {
        if (isInProgress()) {
            return;
        }
        if (getLevel().isAnyPlayerAlive() &&
getLevel().remainingPellets() > 0) {
            inProgress = true;
            getLevel().addObserver(this);
            getLevel().start();
        }
    }
}

```

## 2. Exercise: write unit tests

Write unit test cases using the [JUnit framework](#) to every single test you found in section 1 of this tutorial. Note: in maven projects, tests must be developed under `src/test/java`.

## 3. What should you submit/deliver?

Zip the project's directory and submit it [here](#) (M.EIC's moodle) or [here](#) (MESW's moodle).

Deadline: ~~End of the recitation class~~ November 8, 2023, 11:59:00 pm.

Grades: available on November 15, 2023.

## Miscellaneous

- [Guide to Configuring Maven Plug-ins](#)
- [JUnit framework](#)
- [Learn how to write unit tests](#)
- [JUnit 5 User Guide](#)
- [Parameterized Tests](#) and [JUnit 5 Tutorial: Writing Parameterized Tests](#)