

Software Construction (L+E) HS 2022

Instructor: Prof. Dr. Alberto Bacchelli

Assignment 3

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Week 12

To correctly complete this assignment you **must**:

- Carry out the assignment with your team only (unless otherwise stated). You are allowed to discuss solutions with other teams, but each team should come up its own personal solution. A strict plagiarism policy is going to be applied to all the artifacts submitted for evaluation.
 - Prepare the solutions to the exercises by strictly following this structure:
 - A root folder named: `Group[id on OLAT]-a[AssignmentNumber]`¹
 - One subfolder per each exercise named using the double digit number of the exercise.²
 - Inside each subfolder:
 - * an `answer.pdf` file that answers the exercise's questions, directly and/or by explaining the decision taken in the source code, depending on the exercise's requirements;
 - * only for questions requiring code: a `src` subfolder with the source code of your solution.
 - Package your root folder into a single ZIP file named:
`Group[id on OLAT]-a[AssignmentNumber].zip`³
 - Upload the solution to the right OLAT task by the deadline (i.e., **Jan 02, 2023 @ 18:00**)
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Exercise 1 - A Two-Player version of Conway's Game of Life - Design

Referring to the game requirements in Appendix A and to the rules you find in Appendix B, use what you have learned in the lecture about Responsibility Driven Design to do the following tasks:

1. Following the Responsibility Driven Design, start from the game's requirements and rules and derive classes, responsibilities, and collaborations (use CRC cards). Describe each step you make and store the final cards in your answer.
2. Following the Responsibility Driven Design, describe the *main* classes you designed to be your project in terms of responsibilities and collaborations; also draw their class diagram.

Exercise 2 - A Two-Player version of Conway's Game of Life - Implementation

Implement in Java the game design that you designed in the previous exercise.⁴ Make sure to put into practice what you have learned in all the sessions in the course (Dec 13 included) and explain how you did so in the accompanying `answer.pdf` file.

Exercise 3 - A Two-Player version of Conway's Game of Life - Testing

Test your implementation of the game. Make sure to use JUnit version 5.9+ and to reach at least 70% branch coverage. If, for some reasons, it is not possible to reach this branch coverage, clearly explain the reasons in the accompanying `answer.pdf` file.

¹e.g., a correct name would be: `Group1-a1`.

²e.g., the subfolder `01` contains the answer to exercise 1.

³e.g., a correct name would be: `Group1-a3.zip`.

⁴For the assignment to be valid, it should also be possible to play the entire game on the terminal.

Appendix A: Requirements for a Two-Player Conway's Game of Life

In this implementation of the game, two players can play the game. This implementation can either use a graphical user interface (GUI), which is the preferred solution, or a terminal-based user interface. In case of the former, the group can freely decide which GUI framework to use.

The computer takes care of the logistics of the game (turns, allowing only legal actions, determining if someone has won, etc.), but the players have to take their strategic decision at each turn. When the game starts, the program asks for the names of the two players. The computer also asks for which symbol/color should be used for each player. The players then take turns following an alphabetical order based on their names. At the end of each turn, the computer updates statistics on the game, including how many alive cells each player has at this generation as well as the number of generations that have taken place so far. At the end of every turn, a new generation takes place. With the new generation, the computer checks whether a user is left with no alive cells; in this case, the other user is declared as the winner. Otherwise, the turn passes to the next player in alphabetical order.

Appendix B: Rules for a Two-Player Conway's Game of Life

You can find the rules of a Two-Player version of Conway's Game of Life in this webpage. We report the details about the two-player mode here for your convenience, please note that we only consider the two-player mode and do not allow for more than two players.

"The live cells come in two colors [or symbols] (one associated with each player). When a new cell comes to life, the cell takes on the color of the majority of its neighbors. (Since there must be three neighbors in order for a cell to come to life, there cannot be a tie. There must be a majority). Players alternate turns. On a player's turn, he or she must kill one enemy cell and must change one empty cell to a cell of their own color [or symbols]. They are allowed to create a new cell at the location in which they killed an enemy cell. After a player's turn, the Life cells go through one generation, and the play moves to the next player. There is always exactly one generation of evolution between separate players' actions. The initial board configuration should be decided beforehand and be symmetric. A player is eliminated when they have no cells remaining of their color."