General functionality

The project is divided into two different programs.

User Interface

The functionality of the user interface can be explained with the help of 5 scenes:

1. Logo animation, 2. home scene, 3. sudoku scene, 4. scores scene, and 5. rules scene.

When starting the program, one first encounters the first scene: a short logo animation (1).

Thereafter, the home scene (2) is displayed with the date, our logo, and the option of pressing three buttons and thereby navigation to the remaining three scenes:

- play button(3): navigates to the daily sudoku under the condition it has not already been completed. We have implemented the sudoku such that it will either be displayed traditionally with numbers or with images.

- scores button(4): navigates either to a message that directs the user to play the sudoku today or under the condition it was already played, displays the top ten players with name and time (in seconds) and a graph with the minimum, maximum, average and player times (in seconds).

- rules button(5): here we have provided a short run down of the general sudoku rules and our concept.

If a user starts playing, the app downloads the sudoku for today from the server which is uniquely identified by today's date. Thereby, the sudoku can have different game modes (classic or diagonal) and different difficulties (easy, medium, hard). Game mode and difficulty are randomly chosen when the sudoku is uploaded to the server.

When the user solves the sudoku and enters his name, the needed time and the name are uploaded to the server and stored together with the current date.

Sudoku Uploader

The second program generates sudokus and uploads them to the server. Therefore, an admin passes a number n and a starting date to the program. The number n determines how many sudokus should be uploaded and the starting date defines from which date on the sudokus will be created. For instance, n=5 in combination with January 1st 2023 would create sudokus from January 1st to January 5th 2023.

Generating a sudoku itself works like the following. First, the most left column and the middle row of an empty sudoku grid are filled with random numbers according to the game mode rules. This method guarantees that the prefilled sudoku actually has a solution. After that, the prefilled sudoku is solved using a backtracking algorithm. Finally, an amount of numbers is deleted from the solution according to the difficulty (easy: 37, medium: 45, hard: 53). The amount of deleted numbers for hard sudokus was chosen by trial and error so that the program will not run into infinite loops in the

following steps. The procedure of deleting numbers works like the following. First, a random cell is chosen, and the corresponding number is deleted, Now the program checks if the resulting sudoku has more than one solution. This is done via a modification of the backtracking algorithm that does not stop after the first solution but rather if two solutions are found. Furthermore, the program checks if not more than one type of integer (from 1 to 9) has zero occurrences. Otherwise, this would also lead to an insolvability of the sudoku. If the resulting sudoku cannot be solved clearly, the selected number will not be deleted, and a different cell is chosen.

Server (general information)

The server that we use is a graph related database namely Neo4j. Therefore, each player result and each sudoku are stored as a node in this database. All entries are stored with their corresponding dates which allows for unique filtering.

Note: As the central idea of our program is to have one identical sudoku for all users every day, we have incorporated a dynamic date variable in our code. We have prepared four example days to be viewed. If the program is not run on the 19.06.2023, 20.06.2023, 21.06.2023, 22.06.2023 or it you wish to try out the different days, please change this.todayDate to either “20230619”, “20230620”, “20230621” or “20230622” right after this.todayDate = date.format(formatter); (after line 691).

Furthermore, we will have created Sudokus for the whole year starting from June 19th 2023. So, there is no need to run the Sudoku Uploader before playing the game this year. Of course, the program can be run anyway to test it. Besides, we created fake player results for the listed dates above. Therefore, the score page will display several results to demonstrate the full functionality.