**VIETNAM NATIONAL UNIVERSITY**

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A picture containing text, room, gambling house

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**DATA STRUCTURES AND ALGORITHMS PROJECT REPORT**

***Project: Minesweeper***

***Language: Java***

***Course: DSA – Semester 2 (2021-2022)***

***Link:*** [DuyVu285/DSAProject: The DSA project- Minesweeper Game (github.com)](https://github.com/DuyVu285/DSAProject)

***Group:***

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1. ***Introduction:***
2. ***What is Minesweeper***

Minesweeper is a single-player puzzle video game. The objective of the game is to clear a rectangular board containing hidden "mines" or bombs without detonating any of them, with help from clues about the number of neighboring mines in each field.

1. ***Difficulty in creating Minesweeper***

The program is designed from scratch with the help of libraries in python. Thus, learning what libraries can do in the progress of designing is time-consuming but rewarding.

1. ***Scope***

This report represents the overall result of our group with the Minesweeper project. It illustrates how Minesweeper is made such as user interface, algorithms, data structures and features.

1. ***Classes:***

**The classes:**

**cell.py**: The design of cells with. their functions(cell constructor, show cell, click actions,..)

**main.py**: Where the frames are designed(grid, labels, losing, winning,...).

**settings**.**py**: The settings of the game.

**utils**.**py**: Simple width/length function for ease of usage.

1. ***Usage of Learned Lectures***
2. ***How to play Minesweeper***

- Understand the principles behind Minesweeper. Each Minesweeper game starts out with a grid of unmarked squares. After clicking one of these squares, some of the squares will disappear, some will remain blank, and some will have numbers on them. It's your job to use the numbers to figure out which of the blank squares have mines and which are safe to click.

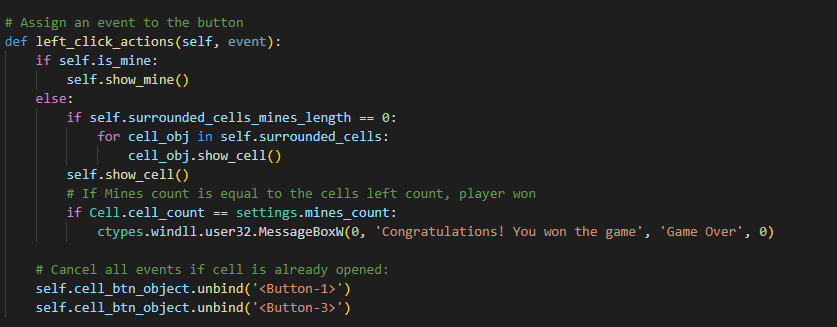
- Use the mouse's left and right buttons. The mouse is the only tool that you'll need to play Minesweeper. The left mouse button is used to click squares to show whether it is a mine or a safe square, while the right mouse button is used to flag squares that contain mines.

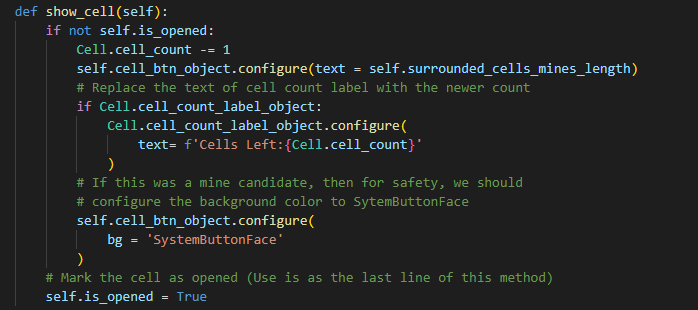
- Know what the numbers mean. A number on a square refers to the number of mines that are currently touching that square. For example, if there are two squares touching each other and one of the squares has "1" on it, you know that the square next to it has a mine beneath it.

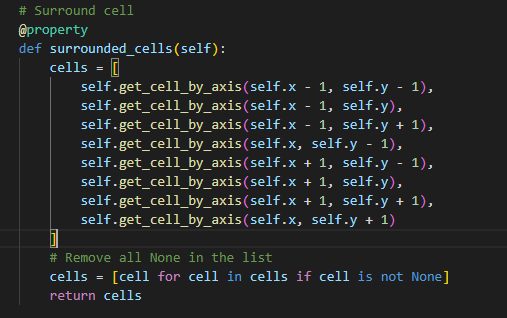
- **Win condition**: you have clicked all the safe squares without triggering any mines.

1. ***Algorithms and Data structures***

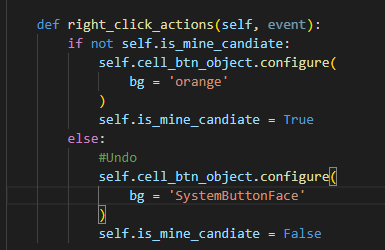
- **Clear unnecessary cells:** When the left click event occurs, the open property is set to true, and the surrounding mines value is also checked. If the value is 0, then use recursion to open the surrounding cells. The recursion will stop when that value is not 0. This is how when we click on an empty cell, a bunch of unimportant cells will open.







- **Flagging mines**: If you are not sure of a specific cell, you can flag with right click to avoid it until later. We can undo it by click it once again to make it becomes normal cell.



**- Undo features:** For undo features, we will take use of the properties of Stack, which takes advantage of the “last in first out” property to undo the user’s most recent step by “popping” it out of the Stack. When the user left clicks a number or an empty cell, use the "push" method to add steps to the Stack, and right clicks to flag/unflag a cell, which reflects the user's most recent move. The user may undo an unlimited number of movements for any sort of move, including clicking on marked cells, empty cells, and neighbor cells, however the Undo feature is disabled for bomb cells (to guarantee the game ends when a bomb is clicked) by "clearing" the Stack.

In progress

1. ***User interface***

Chart, scatter chart

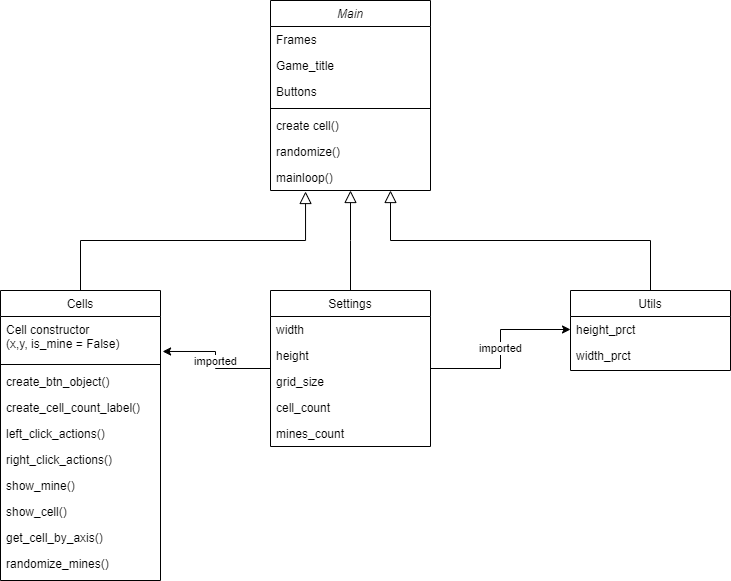
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1. ***Further implementation***

My team is still trying to improve the code, algorithms and will try to finish the game before the set deadline

Compared to the traditional Minesweeper, my team will have an improved UI for the game, add new levels and develop more kinds of gameplay.

1. ***Class Diagram:***

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**Link:** [Minesweeper - diagrams.net](https://app.diagrams.net/#G1jl7mJRS7xQHuWyKMz0ZI9Vb-TQ84ti-T)

1. ***References***

***Wikipedia.com:*** https://en.wikipedia.org/wiki/Minesweeper\_(video\_game)

***Wikihow.com:*** <https://www.wikihow.com/Play-Minesweeper>