

2805ICT, Milestone 2: Progress Report

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Contents

1	Progress Report	2
1.1	Requirements	2
	List of completed requirements	2
	Prioritized list of on-going requirements	3
1.2	Product Use Cases	3
	Completed	3
	Pending	6
1.3	Software Architecture	7
1.4	Software Design	8
	Design Goals	8
	Dynamic Modelling	8
	Structural Modelling	9
	Software Patterns	10
1.5	Testing	10
	Version Control History / Log	11

1 Progress Report

1.1 Requirements

The current version of minesweeper successfully meets the requirements of the traditional minesweeper game however it is still yet to implement the hexagon and colour-based minesweeper modes successfully.

List of completed requirements

Functionality associated with icons — The program is able to meet this requirements by accomplishing the following actions:

- The program shows whether a cell is covered or uncovered by clearly displaying the state of the buttons. The buttons possess a 3D-like image when unclicked, the colour of the buttons change once it is sunken (or clicked) into a darker contrast of the same colour.
- When a cell with no adjacent mines is clicked, all adjacent cells alike are uncovered until it reaches a cell with adjacent mines. This task was done in a while loop, not recursively (as there was no need) as previously stated.
- The state of the board, once the buttons are pressed, are represented by a 'backing grid' which assigns all cells with a number or mine, according to the randomly generated mines and its coordinates.
- The program displays whether a cell has a mine or not by representing it with an image of a mine when pressed and also displaying a message that the game is over.

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Displaying icons —

- The program uses the tkinter module and its button component. This makes responding to left mouse click for icon display possible. The left click implementation for the flag is yet to be implemented.

Losing a game —

- When the user clicks on a button which reveals a mine, a message is displayed in the window "Game Over!" and the state of the game is disabled.

Options —

- The user is able to start the game by selecting a difficulty and not a game mode, the program will default to the basic minesweeper game.
- Selecting the cross at the top right of the window will exit the program and window.

Flagging —

- The user is able to flag a cell that they believe is a mine.
- If all mines are flagged, the game is won.

Prioritized list of on-going requirements

Game Mode —

- The hexagon and colour-based minesweeper.

Difficulty —

- The user has the ability to select a difficulty: beginner, intermediate or advanced. When a difficulty is selected, it resets the board to that chosen difficulty and board dimension associated.

1.2 Product Use Cases

Completed

Game Over Use Case	Description
Use case name	Game over
Brief description	The game ends when a mine is uncovered. When the game ends, all ability to interact with the current state of the game will be lost. All the existing mines will uncover, the timer will stop and the score will be set.
Actors	Player.
Entry condition	Player must click on a button that uncovers a mine.
Exit condition	The current game will stop, there will be no further interaction with the current board and the timer will stop.
Flow of activities	<ol style="list-style-type: none">1. The player uncovers a tile with a hidden mine.2. The system reveals the tile is a mine.3. The system reveals all existing mines on the board.4. The system disables the board state and timer.5. The system displays a message notifying the player "Game over".
Exception conditions	The tile is flagged and cannot be uncovered.

Cascading Reveal Use Case	Description
Use case name	Cascading Reveal.
Brief description	The player uncovers an empty tile and continues to uncover empty adjacent tiles while the loop condition is satisfied.
Actors	Player
Entry condition	Player must click on an empty cell with empty adjacent cells.
Exit condition	A portion of the board is revealed with empty cells until a number greater than 0 is reached.
Flow of activities	<ol style="list-style-type: none"> 1. Player reveals empty cell. 2. System uncovers grid of empty mines until a number is reached. 3. System reveals the first set of adjacent numbers for the empty tiles.
Exception conditions	If an empty cell does not have any empty neighbouring cells, this will not occur.

	Description
Use case name	Player flags a tile
Brief description	The player flags a tile if it is believed that the tile will uncover a mine.
Actors	Player.
Entry condition	Player flags an unrevealed tile (right click).
Exit condition	The button is no longer clickable until the player unflags it (right click).
Flow of activities	<ol style="list-style-type: none"> 1. Player right clicks a tile to flag it 2. The system represents the tile with a flag. 3. The system stops the left click activation for that tile and deems the tile to be disabled.
Exception conditions	If the tile is already uncovered, it cannot be flagged.

Game Timer Use Case	Description
Use case name	Game timer
Brief description	The game timer is the scoring system for the minesweeper game. The shorter the time, the better the score. It begins as soon as the difficulty and game mode is selected for the game.
Actors	Player.
Entry condition	Game difficulty and game mode is selected.
Exit condition	Timer stops when a game is either won or lost.
Flow of activities	<ol style="list-style-type: none"> 1. Player starts new game by selecting mode and difficulty 2. System starts timer 3. System stops timer if: game is won or game is lost.
Exception conditions	Player exits game and the time is lost.

Reset Game Use Case	Description
Use case name	Player resets game.
Brief description	The player may reset the game when desired otherwise the player is prompt to restart the game once completed. A completed game can either be won or lost.
Actors	Player.
Entry condition	The game can be reset any time the board has been configured. The only entry condition would be starting the game once.
Exit condition	The game is reset.
Flow of activities	<ol style="list-style-type: none"> 1. Player starts new game by selecting mode and difficulty 2. System starts timer 3. System stops timer when game ends.
Exception conditions	When a game ends, a window will appear asking the user if they want to play again.

Pending

Choosing Difficulty Use Case	Description
Use case name	Player chooses game difficulty.
Brief description	The player has three difficulty levels to choose from before starting a new game.
Actors	Player.
Entry condition	The program must be executed.
Exit condition	The dimension of the board is set according to the difficulty chosen and the game is playable.
Flow of activities	<ol style="list-style-type: none"> 1. Player runs program. 2. Player chooses difficulty from three given.
Exception conditions	No exceptions, game will not start without choosing a difficulty.

1.3 Software Architecture

The minesweeper program is designed based on a high level system best described as Model View Controller(MVC). By having an MVC architecture, the program can be split up into three different components which handle different parts of the program. The model component divides the behaviour and data from the view, and can only be changed according to the controller. The GameModel includes the position of where the mines are on the board, and assigns each tile its number along with the current state of the game. The view component manages the Graphical User Interface (GUI) of the system. It displays the board according to the updates of the model and information provided by the controller, the controller facilitates actions/data between Model and View. There will be three views, each for the type of game mode. The first view is referred to as GameView, this uses a grid layout manager in Tkinter and its button components whereas the HexagonView will need to use the Canvas tool as the buttons cannot be hexagon shaped. The controller component is what the player/user uses to interact with the game. There is one controller component: GameController. The GameController handles the actions and configurations of the buttons in the game, and in future, the canvas as well.

The MVC architecture supports the separation of concerns design patterns and keeps the code for each concern separate by dividing it into three components. By allowing less overlap in functionality, the software maintains its low coupling. MVC also allows developers to write unit testable code. For smaller programs such as minesweeper, both model classes can be unit tested sufficiently to ensure there are no underlying issues. The main programming language used was Python. It is a cross-platform language, being able to run on Windows and Linux. This was one of the main reasons it was chosen.

1.4 Software Design

Design Goals

The goal of the project is to not only produce the requirements of the software but also design the software in a way that will ensure the code is reusable. Each class is a blueprint of the object it creates, this infers that the software should have high cohesion, it should only have methods relating to the intention of the class. The program is split into MVC, it is intentionally done this way to make each class purposeful and independent of another. Another way to refer to this is coupling. The goal of good software design is to lower coupling so that when a part of software needs to be changed, it does not effect the other. If the layout of the game needs to be modified, it doesn't affect the action of the buttons and certainly not the data stored behind them.

Dynamic Modelling

```
1 def end_game(self, win):
2     if win:
3         title = "You won! Hooray!"
4         msg = "Good job! Play again?"
5     else:
6         title = "You lost..."
7         msg = "Play again?"
8     ans = tkmsg.askyesno(title, msg)
9     if ans:
10        self.start_new_game(self.backing_grid, self.board)
11    else:
12        sys.exit()
```

Figure 1:

Structural Modelling

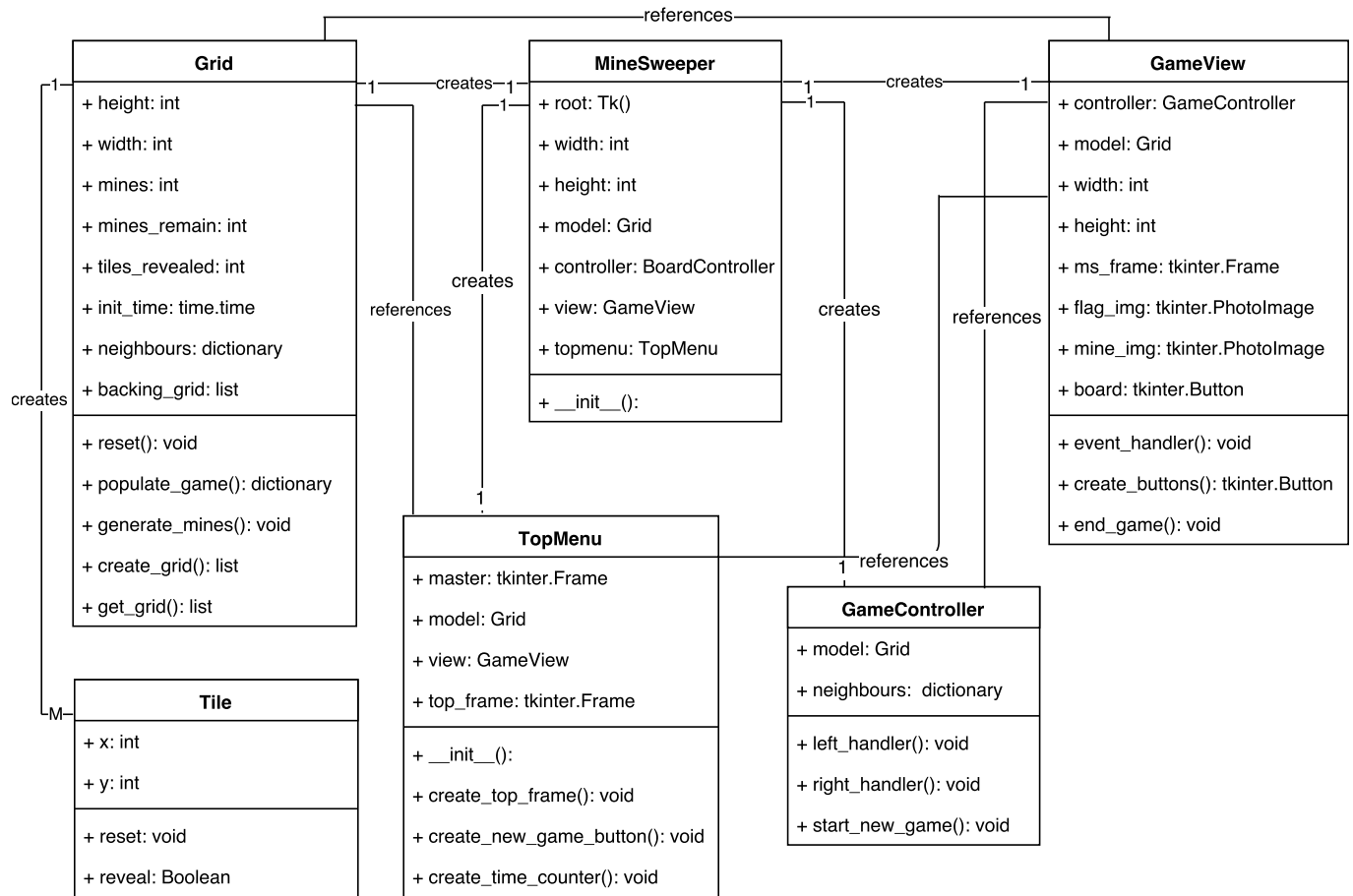


Figure 2: UML diagram for the Python implementation of Minesweeper

Software Patterns

1.5 Testing

A software fault is a common occurrence, a programmer makes an error, which results in a defect in the source code. Without testing with the intent for finding such bugs, the program will produce the wrong outcome or results and cause it to fail. As soon as the program was executable, testing was conducted. The testing of Mine Sweeper took an agile approach as programming and testing needed to be done concurrently. The unittest module was imported in to the test file and unit tests were written to test separate functions of the program and as expected, some tests failed initially. Firstly, the populating of the game was tested - whether the information stored in the dictionary of neighbours was relative to the position of the mines. As the development of the program progressed, the written code passed incrementally larger portions of the test suites. The test suites are updated as new problems are found with the program. The unit tests are maintained along with the source code for Mine Sweeper. The goal of concurrently performing tests and writing the program ensures continuous integration. This also helps to meet the specified requirements of the software, makes sure the program responds accordingly to all kinds of user interaction and is sufficiently usable. This white-box style of software testing ensures that specific functions work as expected, especially for small pieces of software. Unit testing does not guarantee the functionality of the software alone however, it does ensure the building blocks of the software work independently from each other.

Version Control History / Log

User	Activity
ZaymonFC	Finished testfile
ZaymonFC	Merge branch 'master' of github.com/ZaymonFC/2810ICT_Assignment
ZaymonFC	Added diagrams and function description
Natnicha	Added modifications to full system tests.
Natnicha	Added more unit tests.
ZaymonFC	Added system tests and put the main method contents of word ladder into a run function
ZaymonFC	Added build test
ZaymonFC	Merge conflict resolved
ZaymonFC	Finished adding data structures and list of functions.
Natnicha	Edited acceptance test and unit test in document.
Natnicha	Merge branch 'master' of github.com/ZaymonFC/2810ICT_Assignment
Natnicha	Added unit tests to report.
ZaymonFC	Added tests and added the banned words implementation to the word ladder
ZaymonFC	Removed TestCase
ZaymonFC	Added comments for some test cases in testfile.py
ZaymonFC	Added multiple unit tests for different functions in word_ladder
ZaymonFC	Added tests for user input in testfile.py
ZaymonFC	Logged work
ZaymonFC	Fixed BFS and implemented a queue data type
ZaymonFC	Added breadth first search for shortest path
Natnicha	Resolved merge conflict
Natnicha	Modified unit test section.
ZaymonFC	Resolved merge conflict
ZaymonFC	Added test skeleton for input validation
Natnicha	Fixed spelling and name errors

Natnicha	Merge branch 'master' of github.com/ZaymonFC/2810ICT_Assignment
Natnicha	Added requirement acceptance test & user instructions.
ZaymonFC	Added section describing all functions in the program
ZaymonFC	Created UML and logical block diagrams, added to report
ZaymonFC	Merge branch 'master' of github.com/ZaymonFC/2810ICT_Assignment
ZaymonFC	Modified test file and fixed formatting in report
Natnicha	Merge branch 'master' of github.com/ZaymonFC/2810ICT_Assignment
Natnicha	Modified test table
ZaymonFC	Fixed algorithm to find short paths by limiting reverse progress
ZaymonFC	Merge branch 'master' of github.com/ZaymonFC/2810ICT_Assignment
ZaymonFC	Improved performance by reversing sorting direction of fitness function
Natnicha	Added version control section & Unit test tables
Natnicha	Merge branch 'master' of github.com/ZaymonFC/2810ICT_Assignment
Natnicha	Added unittest cases
ZaymonFC	Refactored word_ladder.py to validate user input
Natnicha	Modified listing for user requirements
ZaymonFC	Added unittest file and added test ideas to README.md
ZaymonFC	Added .gitignore file and removed postcompile latex objects
ZaymonFC	Merge branch 'master' of github.com/ZaymonFC/2810ICT_Assignment
ZaymonFC	Modified report preamble to remove redundant packages
Natnicha	Added headings and user requirements
ZaymonFC	Added LaTeX template for assignment documentation
ZaymonFC	Added program files and created project directory structure
ZaymonFC	Initial Commit

Note: Repository is private to prevent plagiarism. | This log was created by using the command

```
1 git log --pretty=format:'%h;%an;%s' > ./log.csv
```