# Assignment 3

CSSE1001/7030
Semester 1, 2017

Version 1.1.1
20 marks / 25 marks

Due Saturday 3 June, 2017, 21:30

## Introduction

This assignment will use concepts taught throughout the course to extend the functionality of the provided tile based game. This assignment will ask you to extend the game with basic, intermediate and advanced features. For CSSE7030 students there will also be an open-ended component.

The assignment will focus on the concept of Graphical User Interfaces (GUIs). You will be requested to implement extra functionality to the base game including extending the GUI for a better game experience.

## Assignment Tasks

### Task Breakdown

CSSE1001 students will be marked out of 20 and CSSE7030 students will be marked out of 25 based on the following breakdown.

| | Sub-Task | Marks |
|---|---|---|
| **Task 1** *Basic Features* | | **10 marks** |
| | App Class | 2.5 marks |
| | Status Bar | 1 mark |
| | Logo | 2 marks |

| | Sub-Task | Marks |
|---|---|---|
| | Popup Dialogs | 1 mark |
| | File Menu | 1 mark |
| | Lightning Button | 1.5 marks |
| | Keyboard Shortcuts | 1 marks |
| | | **6 marks** |
| **Task 2** *Intermediate Features* | Auto-Playing Game | 3 marks |
| | Loading Screen | 1 mark |
| | High Score Window | 2 marks |
| | | **4 marks** |
| **Task 3** *Advanced Features* | Multiple Game Modes | 2 mark |
| | Objective Game Mode | 2 marks |
| **Open-Ended** *CSSE7030 only* | *Sophisticated, additional functionality.* | **5 marks for CSSE7030; 0 marks for CSSE1001** |

## Mark Breakdown

For each task, marks will be awarded proportionately according to the following breakdown.

| | Description | Marks |
|---|---|---|
| **Code Quality** | | 10% |

| | Description | Marks |
|---|---|---|
| | Code is readable. Appropriate and meaningful identifier names have been used. Simple and clear code structure. Repeated code has been avoided. Code has been simplified where appropriate and is not overly convoluted. | 10% |
| **Documentation** | Documented clearly and concisely, without excessive or extraneous comments. | 10% |
| **Functionality** | Components are functional, without major bugs or unhandled exceptions. | 70% |

## Download the Files

Before beginning work on the assignment you must download `a3_files.zip` provided from the course website.

Inside `a3_files.zip`, there should be a file called `a3.py`. This is the file where you will write your assignment. The other files are support files. These **must not** be edited. Their purpose is explained below.

# Support Code

You have been supplied with a large amount of support code to help you complete this assignment. To begin the assignment, you do not need to understand much of this code. As you progress through the tasks, the degree to which you should understand this code will increase.

| File | Description | Understanding |
|---|---|---|
| **a3.py** | Main assignment file. | Task 1 |
| **play_game.py** | Plays a game of Lolo. | Task 1 |
| **game_*.py** | | |

| File | Description | Understanding |
|---|---|---|
| | Concrete modelling & app classes for each game mode. | Task 1: Simple<br>Task 3: Solid |
| **colours.py** | Mappings of colour names to codes. | Task 1 |
| **high scores.py** | High score management. | Task 2 |
| **view.py** | GridView widget. | Task 2 |
| **model.py** | Abstract modelling classes. | Task 3 |
| **tile_generators.py** | Concrete tile generator classes. | Task 3 |
| **modules/** | Third-party libraries. | Task 3 |

*__Note:__ Ideally, each game type would be in a subdirectory called `game`, without the `game_` prefix. However, this would add complixity for managing this, so the prefix was chosen instead for simplicity.

## Event Listeners

> **Note:** In this section, the word function is used to mean anything that is able to be called like a function, such as a method, a lambda, etc.

The *Game classes (`AbstractGame` and its subclasses) and the `GridView` class follow a pattern which allows you to attach a function to be called when an event is triggered. This can be referred to as binding to or listening for an event.

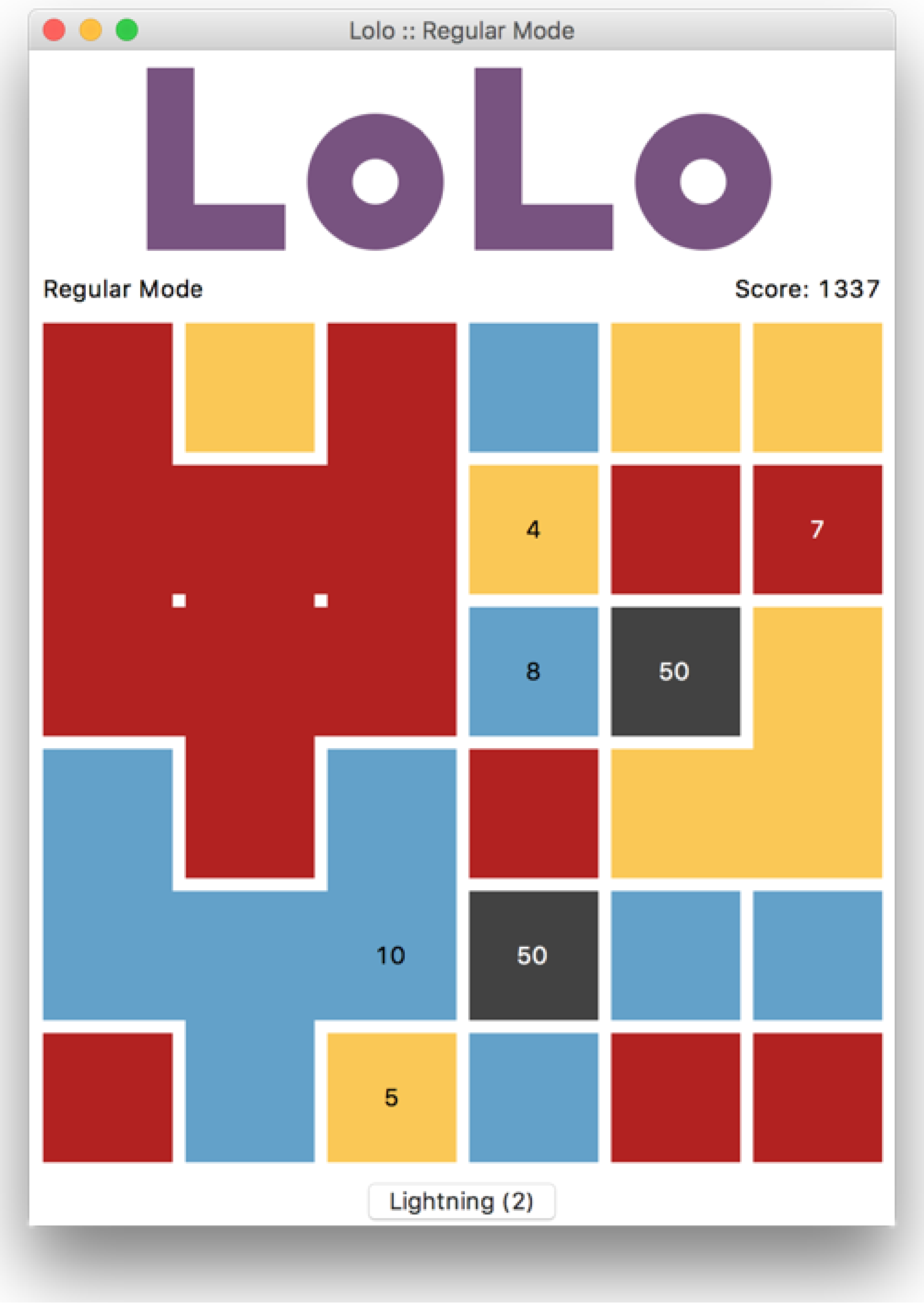
This pattern is called the Event Emitter pattern, and is an implementation of the Observer pattern (the Publisher/Subscriber pattern is similar).

While it is also quite a similar approach to how Tkinter handles commands for button presses, the Event Emitter pattern is far more flexible in general.

The events that games and grid views emit are useful in completing the assignment. For task 1 you should consider listening for the select event to appropriately update the score. Postgraduate students are encouraged to consider emitting their own events.

## Task 1 — Basic GUI

The purpose of this task is to create the basic graphical user interface (GUI) for the Lolo game. You may choose any **one** of the supplied games (Regular, Make 13, Lucky 7, Unlimited). There are several sub-tasks that need to be completed for this task. You will be working towards creating the user interface demonstrated below.



# Basic GUI Example

## Basic GUI

The very first part of this task is to implement a class for the basic GUI. This class should be named `LoloApp` and should inherit from `BaseLoloApp`. The `BaseLoloApp` class provides some support code to simplify the complex process of animating.

The title of the window should be set to something appropriate (i.e. `Lolo :: {game_mode_name} Game`). This also applies to any window in subsequent tasks.

As the basic GUI is improved in subsequent tasks, **the LoloApp class will need to be modified accordingly**.

## Status Bar

Define a class named `StatusBar`, which inherits from `tk.Frame`. This class must display two labels, with the following text and alignment:

- `{game_mode_name} Game` *(Left)*
  The name of whichever game mode the player is currently playing. See `AbstractGame.get_name`.
- `Score: {score}` *(Right)*
  Must be updated whenever the player's score changes.

**Note:** For convenience, you should have two methods, one for each of the relevant labels: `set_game(game_mode)` & `set_score(score)`.

## Logo

Define a class named `LoloLogo`, which inherits from `tk.Canvas`. This class must draw a simple logo, similar to the one seen in examples, made out of canvas shapes. It does not need to be resizable.

You are encouraged to extend on the complexity of the design but no extra marks will be awarded.

## File Menu

Implement a menu bar, with a `File` menu. The File menu should have the following entries:

- `New Game`: Restarts the game.
- `Exit`: Exits the application.

**Note:** On Mac OS X, this should appear in the global menu bar (top of the screen).

## Lightning Button

When the lightning ability is active and the user selects a tile, instead of being joined with the surrounding tiles, it should be deleted from the game grid. Doing so uses one lightning.

Place the lightning button below the `GridView`. When pressed, this button should toggle the lightning ability if the user has any lightning available. Otherwise, this button should be disabled. When the lightning ability is active, the button's text should indicate this to the user. It should also include the number of lightning the user has remaining.

At the beginning of a game, the user should receive one lightning. Every so often, the user should gain one lightning. This could be implemented in a variety of ways, some more interesting than others, such as:

- Fixed number of turns (i.e. every 20 turns)
- Randomly (i.e. there is a 5% chance of the user gaining a lightning each turn)
- Increasing number of turns (i.e. 5, 10, 20, 40, etc. - $5 \times 2^i$ )
- *etc.*

> `BaseLoloApp.remove` facilitates the proper removal of tiles at arbitrary position(s), similar to `BaseLoloApp.activate`.

## Dialog

Implement the following dialog boxes:

- Invalid Activation: If the user attempts to activate a tile that cannot be activated, show an error dialog with an appropriate message.
- Game Over: When the game ends, show a dialog informing the user of their score.

### Keyboard Shortcuts

Implement the following keyboard shortcuts:

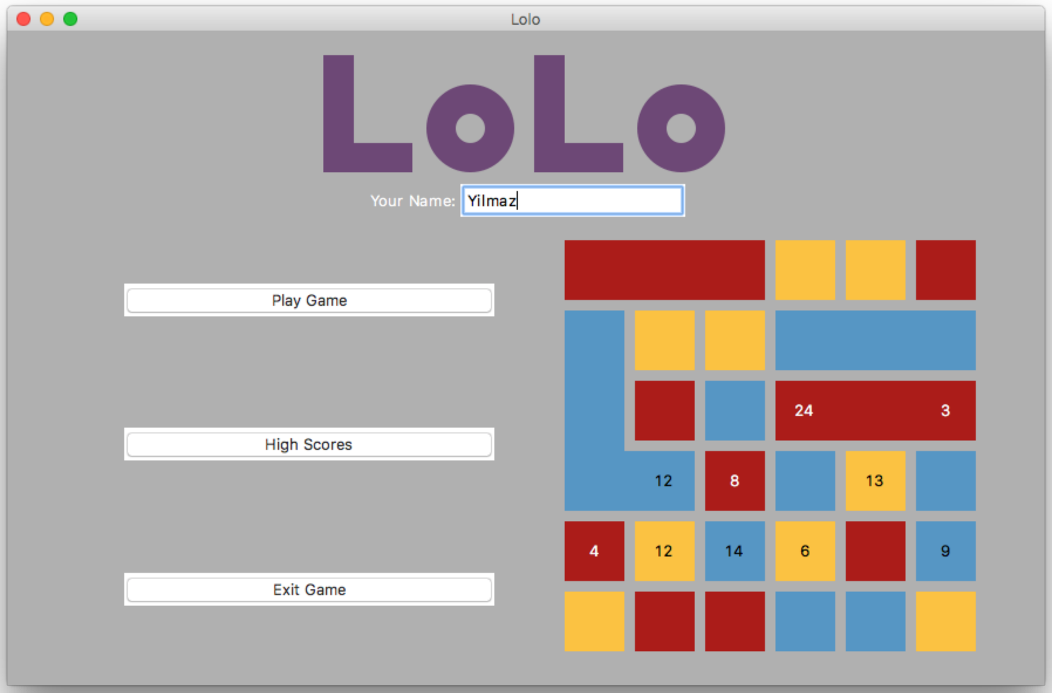
- `ctrl + n`: Start new game.
- `ctrl + l`: Performs the lightning action.

**Note:** Ideally, `cmd` would be used on Mac instead of `ctrl`. It is permitted to also bind to `cmd` on Mac, however `ctrl` must also be implemented.

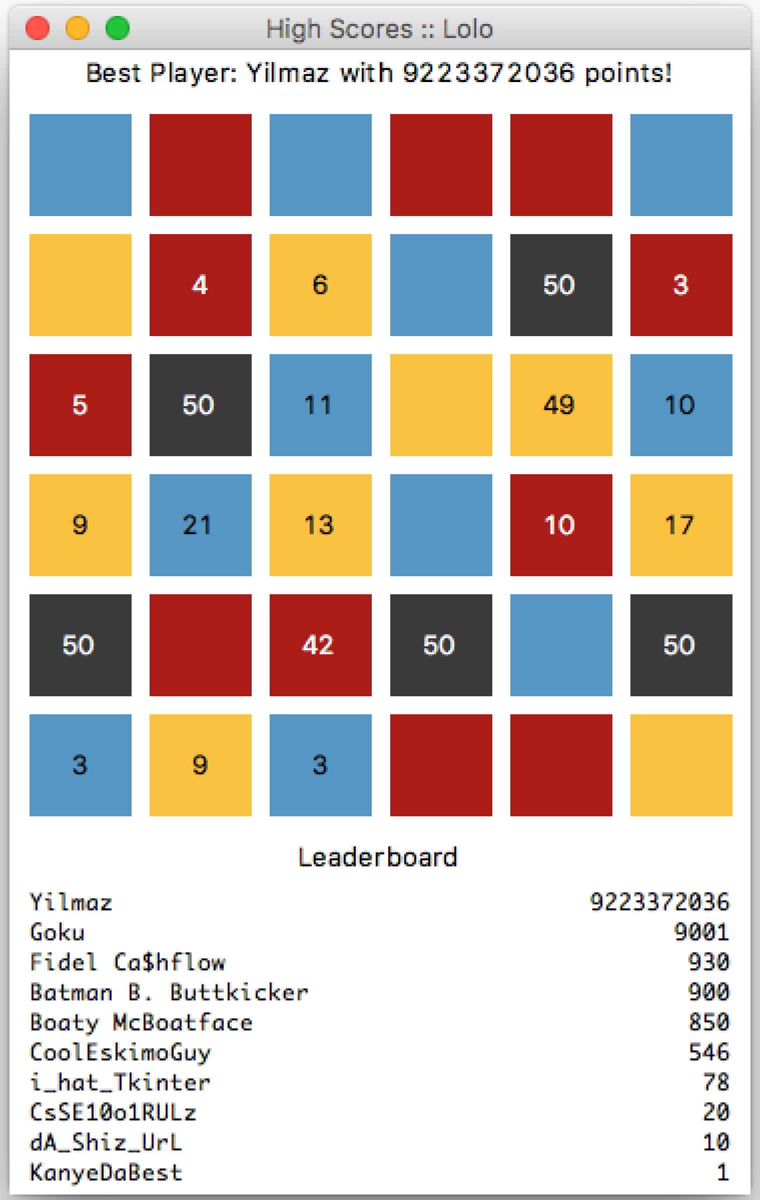
## Task 2 — Intermediate Features

The purpose of this task is to extend the functionality of the basic GUI by adding a loading screen and high score window.

Instead of the basic GUI, the loading screen should be displayed upon launching the game.



Loading Screen Example



Best Player: Yilmaz with 9223372036 points!

Leaderboard

```
Yilmaz                    9223372036
Goku                            9001
Fidel Ca$hflow                   930
Batman B. Buttkicker             900
Boaty McBoatface                 850
CoolEskimoGuy                    546
i_hat_Tkinter                     78
CsSE10o1RULz                      20
dA_Shiz_UrL                       10
KanyeDaBest                        1
```

High Scores Window Example

## Auto-Playing Game

Implement a class, `AutoPlayingGame`, which inherits from `BaseLoloApp`. This class must be able to display either a static or automatically played game.

> **Hint:** this can be achieved by initially displaying a static representation of the game, and implementing a method that begins the game playing.

The player should not be able to interact with this class. For automatically played games, a random valid tile should be chosen each move, and the game should restart after the game ends.

## Loading Screen

The loading screen must be the first thing the player sees when they start the game. It must contain all of the components from the example above. You may lay them out however you wish, provided it is reasonable.

Required components:

- **Logo:** Should be reused from task 1 (see 4.3 Logo).
- **Buttons:** Play Game, Exit Game, High Scores (performing the appropriate action). Others may be added during Task 3 and Open-Ended Task.
- **Name Entry:** For recording high scoring player's name.
- **Auto Playing Game:** Randomly playing a game (see auto-playing game above).

## High Score Window

The high score window should be displayed in a separate window to the main application. It can be accessed through the button on the loading screen, or through the file menu (a new entry must be added).

The high score window contains all of the components from the example above, laid out as shown.

Required components:

- **Best Player:** Display the name, score, and a static visual representation of how their game ended (see Auto-Playing Game above).
- **Text Leaderboard:** display a row of text with the player's name and score for each player on the leaderboard. Name and score should be left-aligned and right-aligned respectively

# Task 3 — Advanced Features

## Multiple Game Modes

On the loading screen, add a `Game Mode` button underneath `New Game`. When pressed, this should open a window that allows the user to choose the game mode. If the user hasn't entered their name yet, they should be prompted with a dialog box.

The window must have a series of `Radiobuttons`, one for each available game mode, with the current game mode pre-selected. It must also contain a visual example and the name of the currently selected game mode. The visual example must update whenever a `Radiobutton` is selected. For the visual example, `AutoPlayingGame` can be reused here.

Modify `New Game` so that it starts a game of the currently selected mode.

Initially, your application must include all of the provided game types (Regular, Make 13, Lucky 7, Unlimited). Any additional game types added must also be included (see objective game mode and open-ended task below).

## Objective Game Mode

An objective game mode is an extension of the regular game mode, in which the player has a number of tiles as objectives. The player's goal is to join tiles to eliminate each objective tile. For each objective tile, the player must form a tile with the same type and with at least the value of the objective. Once this happens, the objective tile is eliminated, and tile that was joined should be removed from the game grid.

The player may eliminate objective tiles in any order. The game is won only if they eliminate all objectives before the move limit is reached.

Objective game modes should be able to be loaded from a `JSON` file in the following format:

```
{
    "mode": "objective",
    "min_group": 3, // the minimum number of tiles to
form a group
    "types": 4, // the number of tile types
    "size": [6, 6], // the number of [rows, columns]
    "starting_grid": ..., // optionally defines the
starting grid
    "objectives": [...], // a representation of the
objective tiles
    "limit": 90, // the number of moves the user can
make
}
```

The game grid should be randomly generated unless the `starting_grid` key is present. For `starting_grid` & `objectives`, it may be useful to use a similar representation as `HighScoreManager` does (see `highscores.json`).

## Open-Ended — CSSE7030 Only

This task is only required for CSSE7030 students. CSSE1001 students are permitted to attempt this task, but will be not be awarded marks for it.

This task is open ended. It is up to you to decide what to do for this task. Marks will be awarded based on the sophistication of the features you choose to implement. Ensure that you consult with course staff before you commence this task to ensure that the features are sufficiently sophisticated.

You are encouraged to utilize extra Python modules to help you implement your desired functionality.

You must also submit a brief PDF describing the features you have implemented for this task, named `description.pdf`. **This file must be in PDF format; marks will be deducted if you submit another format** (such as .txt or .docx, for example). This file should also contain an outline of any third party Python modules you have used, and instructions on how to install them. For example if you have used Pillow module, then the following would be sufficient:

> Install the Pillow module with pip using the command:
> `pip install Pillow`

### Suggestions

- Saving and loading a game

- Background music/event sounds
- Additional custom game modes
- Various animations (e.g. row completion animation, picking up and placing tiles, failed tile placement)
- Multiplayer (local or network)

## Assignment Submission

Your assignment must be submitted via the assignment three submission link on Blackboard. You must submit a zip file, `a3.zip`, containing `a3.py` and all the files required to run your application (excluding the support code). **You should not have made modifications to any of the support files**. If you are a CSSE7030 student, this zip file must also contain your `description.pdf` file.

Late submission of the assignment will **not** be accepted. In the event of exceptional circumstances, you may submit a request for an extension.

All requests for extension must be submitted on the UQ Application for Extension of Progressive Assessment form: http://www.uq.edu.au/myadvisor/forms/exams/progressive-assessment-extension.pdf **at least 48 hours prior** to the submission deadline. The application and supporting documentation must be submitted to the ITEE Coursework Studies office (78-425) or by email to enquiries@itee.uq.edu.au.

## Change Log

Version 1.0.1 - May 12

- Status Bar: Fixed typo to indicate that only the two indicated labels are required.
- High Score Window: Fixed typo that repeated the required components from loading screen.

Version 1.1.0 - May 18

- Basic GUI: Mandated window title.
- Lightning button
  - Expanded requirements for lightning button.

    - Added `BaseLoloApp.remove` to aid in implementing lightning button.
    - Updated screenshot of Basic GUI Example to include lightning button.
- Replaced error dialog logic in `BaseLoloApp.activate` with raising of `IndexError` (error dialog logic must be implemented by students in `LoloApp.activate`).
- Decreased the default tile size of `GridView` to accommodate smaller screen sizes.
- Added the `get_name` method to `AbstractGame` and its subclasses to simplify retrieval of the name of a game (see status bar).
- Replaced `increase_score` method of `AbstractGame` with `set_score` method.

Version 1.1.1 - May 20

- Fixed missing internal links.

> **Note:** No further modifications will be made to the support code after 1.1.0 (except for bug fixes).