

# Design Proposal

## A. Project Proposal

### a. Project Description:

- i. This project is called "Millennial Scrabble" (because slang words are allowed).
- ii. This project will be a game of fairly traditional Scrabble, which can be played by a person against a computer which will be playing using artificial intelligence. Potentially, there will also be other elements of the game which include tiles which change color to change point values, tiles which change if the person takes too long to decide their word, or a computer player which starts out easy and progressively gets more difficult.

### b. Competitive Analysis:

- i. There are a lot of similar projects online, especially because the game of Scrabble is a popular and commonly existing one. It would be very difficult to ensure that my project be fully different from these, simply because of the nature of the game. The ways in which my project will be different will be through the AI algorithm, which I will develop to be my own, and the additional elements of gameplay that I will add to enrich the user experience and make the game more interesting than traditional Scrabble.

### c. Structural Plan:

- i. The final product will be contained in several different files, with each file likely containing 1-2 classes. These classes will include the main game page, the board, the human player, the computer player, a mechanism to check rules for both the computer and human player, the bag to store the letters, a general file to keep track of any data collected, and any other classes that may come up afterward.

### d. Algorithmic Plan:

- i. The trickiest part of this project is AI portion, which is the computer player.
- ii. The algorithm for this will use a minimax technique, involving backtracking, assuming 2 players in the game, one of whom is trying to get the highest score and one of whom is trying to get the lowest score possible. The computer always wants to be the maximizing player.

1. For scrabble: first create an index of words you could attempt to create, and then a dictionary of these words indexed by length, and then build separate dictionaries based on letter position and specific letters used.
2. Then, you would generate a tree of possible moves based on this, and use backtracking to go through each of these so that you can go back if you get stuck, until you reach the highest possible score you can have.
3. The important piece of this is creating a large enough pool of words for the computer to choose from, and for counting the scores indicated by the squares in each direction of the board, and considering both board and individual letter scores.

e. Timeline Plan:

- i. By this week, the majority of the basic gameplay is done which would allow 1 person to play the game alone (this is except for a few small features which need to be debugged or added still, including a display of letter scores on the tiles, and drag and drop for the tiles). By next week (the week of November 25), I intend to complete or nearly complete the AI portion of the project, meaning a person and computer should be able to play. I intend to complete this to the fullest extent I can, but if not I will continue to make the AI better afterwards. By Monday, December 2, I plan to be done with the 1-2 additional features that I will add to the game, which will be decided based on the time that needs to be spent on the AI. Between December 2 and December 5 I plan to solely do debugging, user testing, and other final components.

f. Version Control Plan:

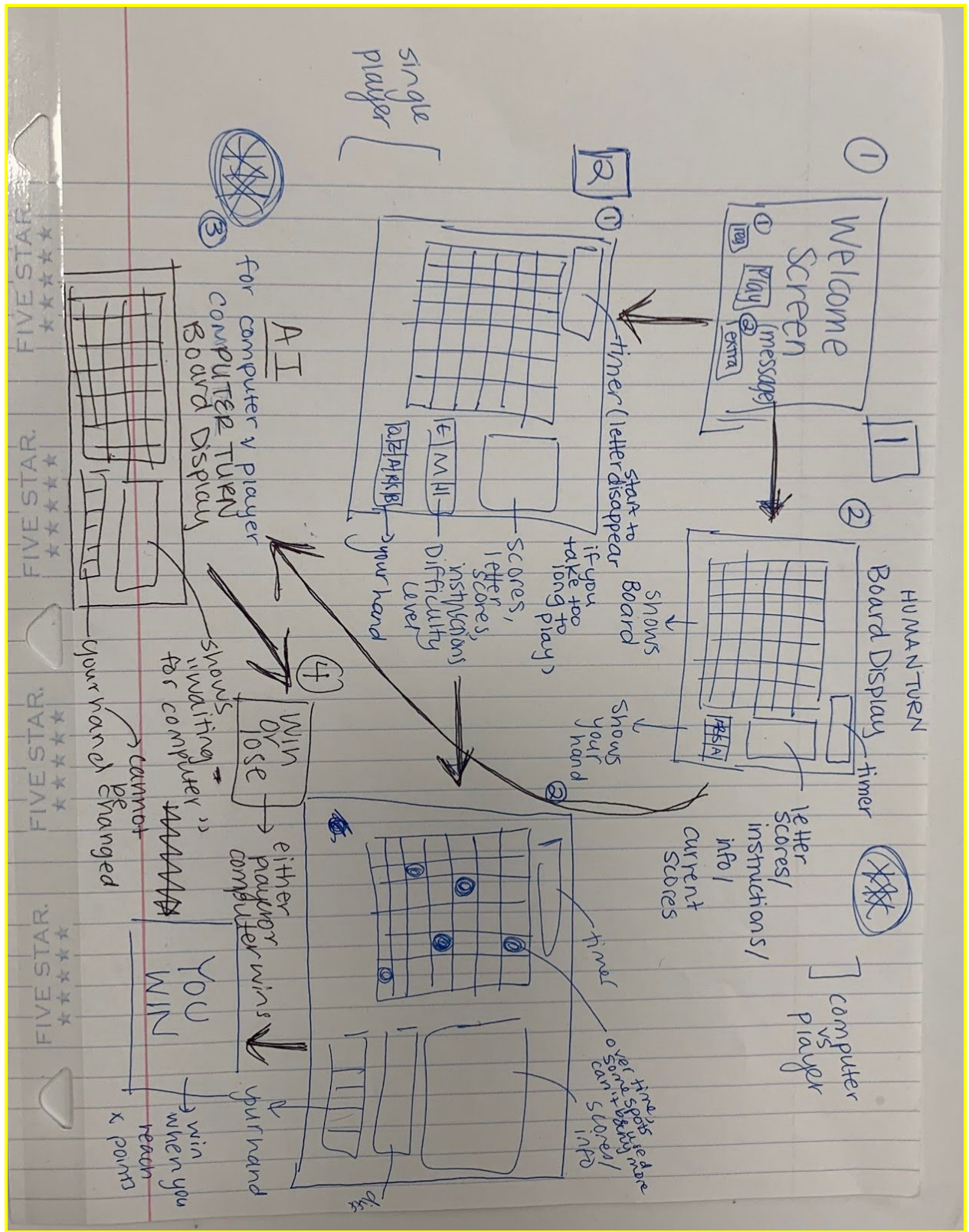
- i. All the code that I work on gets backed up to the cloud from my laptop daily, I have also put it on Google Drive, and I backup my desktop to a hard drive every week.

g. Module List:

- i. I will not be using any modules before my MVP. Afterwards, I may potentially look into some, but only if time permits.

## **B. Storyboard**

- a. Image on next page



TP2 UPDATE:

The major design change that has been made is the structure of how the board is displayed on the page: there will be a board in the center, with the score, the player's hand, and information about the letter values and board colors on the side. There will also be a popup message box that will appear any time an invalid move is made to let the player know what to fix.

### **TP3 Update:**

The major design modifications that have been made are the modes. There is now a welcome screen with buttons to go to the help screen and the game screen, and there is now a second game mode which is a difficult version of the game.

I also incorporated several user suggestions into the design (the highlighted suggestions on the following list).

Here is a full list of all user suggestions:

- add another mode that's different from regular Scrabble
- Help feature for user to go through every possible word
- telling user where the points are coming from
- make score more obvious to see than the play buttons
- change tile color when clicked
- put a different color in center so we know where to start