# User Manual
## SYSC 3110 Milestone 4: Documentation

Group Members:
Dorothy Tran 101141902
Evan Smedley 101148695
Harsimran Kanwar 101143556
Shuvaethy Neill 101143478

This is a GUI-based version of Monopoly. The game can be booted up through your terminal and will display as a frame. User input during game play will be taken through button interactions (via mouse) and no text inputs will be accepted.

### Setup

1. Download the provided .jar file and store it in a directory on your computer.
2. Open your terminal.
3. Navigate to the directory in which the .jar file is located in
    a. You can use the *cd* command to do so
    For ex: “cd Downloads”
4. Run the .jar file
    a. Use the following command: “java -jar Monopoly.jar”

Setup complete! You should now see a pop-up message prompting you to select either new game or load game.

### Buttons

- **Help** : displays a list of descriptions of buttons a player can click
- **Start** : initiates the start of the game and the first player to begin is selected randomly
- **Roll Dice** : rolls the dice and moves the player on the board based on the rolled value
- **Buy**: purchases an available property that is for sale on the board
- **Pass** : ends the current player’s turn and passes it to the next player
- **Buy House/Hotel**: checks if the player has a set of properties for which they can buy a hotel, completes the transaction and adds a hotel to the board

### Menu Items

- **Save** : save the current game state in a file
- **Quit** : exits the game

### Objective of the Game

The objective of Monopoly is to become the wealthiest player through buying and renting property. Players roll a pair of dice to move around the board and have the opportunity to purchase any available property they land on. The winner of the game is the last player left who has not reached bankruptcy.

Note: In this version, we have excluded collecting money on free parking, players cannot collect double rent from owning all the properties of a colour group, players cannot mortgage or sell their properties, and chance/community chest card benefits have not been included.

## Welcome

You will first need to select if you want to play a new game or load a previously saved game. If you select *Load Previous Game*, you can continue playing the game of Monopoly where you last saved. If you select *New Game*, you will be prompted with a drop down menu to enter a version of the game. Currently, the version drop down menu only has two versions of the game: starwars and english. For ease of use we put the two options in a drop down menu. More versions can be made quite easily using our XML format. Once a version is chosen, you can select the number of players that will be playing. There can be a minimum of 2 human players and a maximum of 8 human players. After selecting a number of players, please click the "Ok" button to proceed. You will then be prompted to enter the names of each of the human players. If you enter more than 10 characters for a name then the game will automatically truncate it. After entering all the player names, you will be prompted to select the number of AI players that you will be playing with. The Monopoly Game can have a maximum of 8 players in total including human and AI players. After selecting the number of AI players, the game frame will display. Each player is represented by a coloured circle icon, begins on the "GO" space and is given $1500 in their account to start off with. Press the "Start" button to begin the game. The starting player will be chosen randomly and their turn will be first.

## Playing a Turn

Click the "Roll Dice" button to roll the pair of dice on your turn. The two values you roll will be randomly generated by the game .You will be moved the number of spaces indicated on your dice in a clockwise direction on the board. Depending on the space you have landed on, you may be entitled to buy a property, do nothing (free space), go straight to jail, or be obliged to pay rent or taxes. After you have completed your turn, it passes to the next player after you in a clockwise direction. You will remain on the space you have landed on and proceed from that point during your next turn. Two or more players may rest on the same space at the same time.

## Rolling Doubles

The term *rolling doubles* refers to when a player rolls and the result of the two dice are the same value. If you roll doubles, you move around the board as usual, and are subject to any privileges or penalties pertaining to the space on which you land. Now instead of your turn ending, you may roll the dice again and move as you did before. If you roll doubles three times in succession, you will not be allowed to roll for a fourth time and your turn will officially end. Should you choose to end your turn after rolling a double instead of rolling for a second time, you can click the "Pass" button to do so. If you roll a double but do not want to buy the property you landed on, simply roll again.

## Passing a Turn

You have the option to pass your turn by clicking the “Pass” button. You can pass your turn instead of rolling or if you want to decline purchasing an available property that you land on (given you haven’t rolled doubles).

## Buying Property

If you land on a property that is available for purchase you have two options:

- Click the “Buy” button to purchase and own the property given the listed price
- Click the “Pass” button to decline and pass your turn to the next player

You will not be allowed to buy a property that is already owned. Instead, you will have to pay rent to the player who owns it. If you pass up an opportunity to purchase the property you are currently on from your last turn, you will not be allowed to purchase it at the start of your next turn.

## Paying Rent

When you land on a property owned by another player, you must pay the rent to the owner. The game automatically takes the pre-calculated rent out of your account and directs it to the owner’s account. The rent of a coloured property with no houses or hotels is calculated to be the rounded integer result of: (*buying price of property*)$^3$ (0.000001) + (*buying price of property*)$^2$ (-0.0007) + price (0.2014) - 7.5593. It is even more advantageous to have houses or hotels on properties because rents are much higher than for unimproved properties. The rent of a coloured property with any number of houses or a hotel is calculated using a formula similar to that for the regular rent of the property, based on the buying price of property. These formulas were generated using excel by graphing the relationship between the original price of the property and what the rent for the property should be, and generating a quartic line of best fit for the graph. These graphs are shown in figures 1 through 5. If you land on a property that you own, you do not need to pay rent (considered a free space).

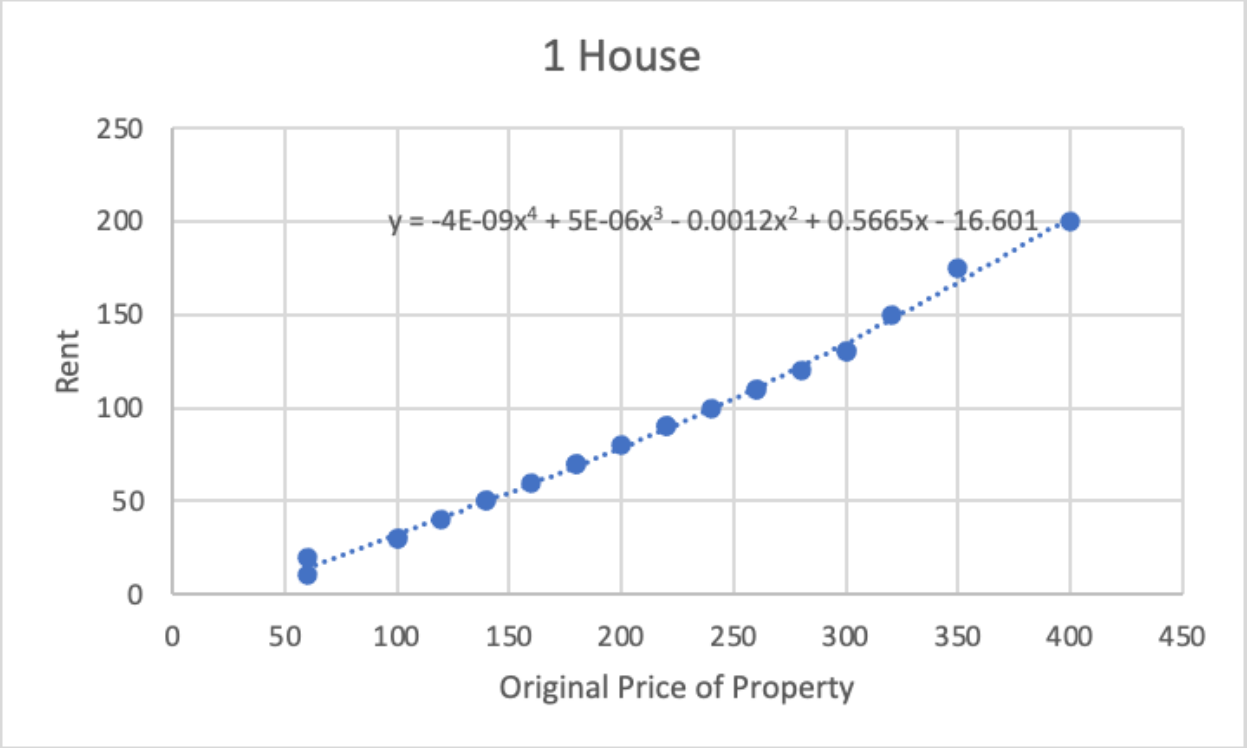


Figure 1: The rent equation for a property with one house

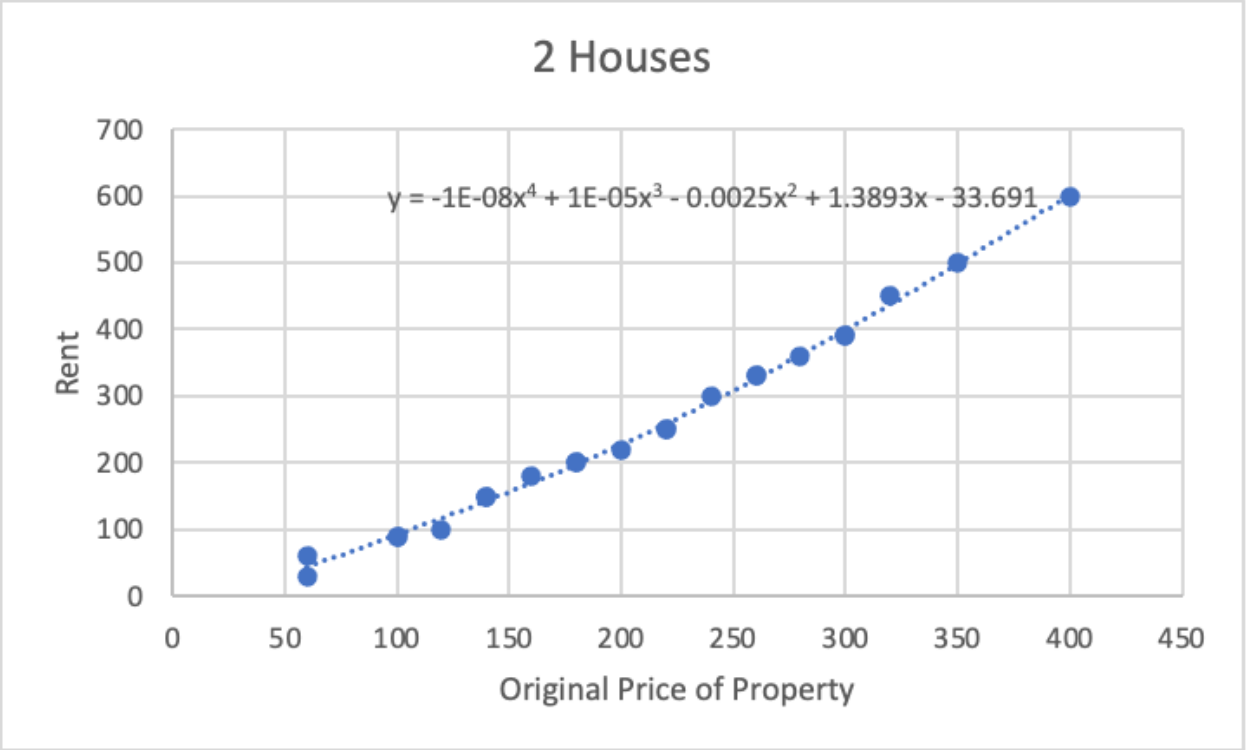


Figure 2: The rent equation for a property with two houses

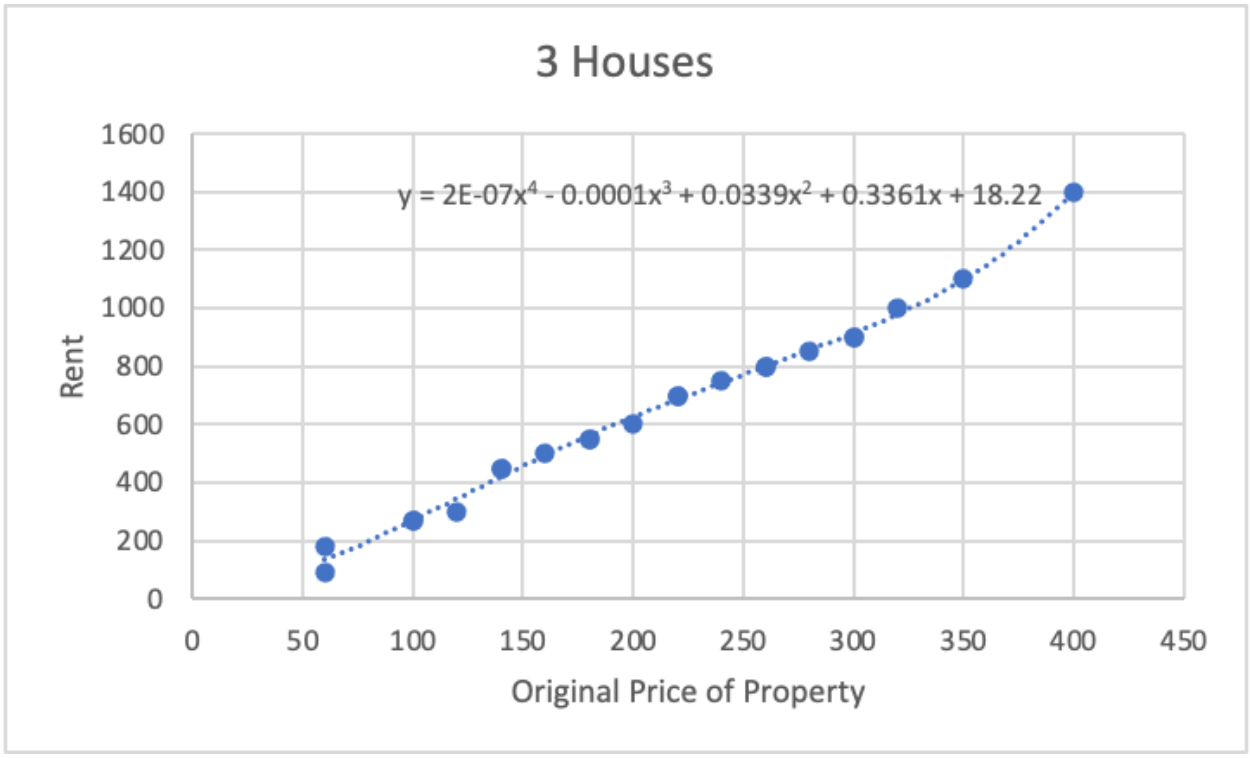


Figure 3: The rent equation for a property with three houses

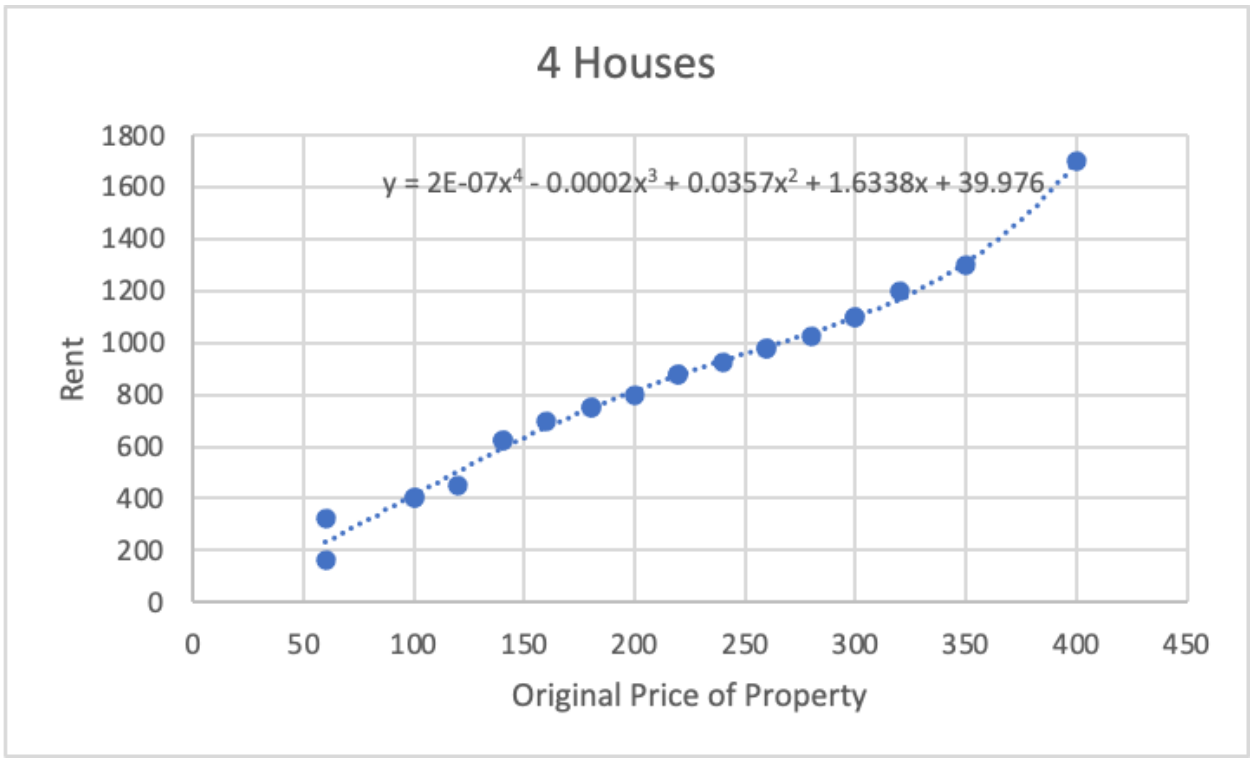


Figure 4: The rent equation for a property with four houses


Figure 5: The rent equation for a property with 5 houses

**Houses and Hotels**

When you own all the properties in a color group, you can click the "Build Houses/Hotels" button to buy houses and build them on those properties. The house will automatically be placed on one of the properties in the color group. The next house you buy will also automatically be built on another property in the color group. You can only build houses at the start of your turn before you roll. The price you must pay for each house will be shown to you with a dialog box during the house building process. You are allowed to buy and build as many houses as you financially can at a time.

When a player has four houses on each property of a complete colour group, they may buy a hotel and build it on any property of that colour group. Upon doing so, the four houses will be removed so that the hotel can replace them. You can only have one hotel per property. The price of a hotel will be shown to you in the same dialog box as the price of a house. The method for buying a hotel is exactly the same as that for buying a house.

Note: AI cannot build houses and hotels (you have an advantage!)

**Tax**

There are two spaces on the board that require a player to pay tax. If a player lands on "INCOME TAX", $200 will be extracted from their account. If a player lands on "LUXURY TAX", $100 will be extracted from their account. Tax spaces are not available for purchase and are solely on the board for players to pay tax.

**Free Parking, Just Visiting Jail, Community Chest & Chance**

A player who lands on this space does not receive any money or property. This is just a free space.

### GO
During the first round, players do not receive $200 for starting the game off on the GO space. However, everytime a player fully rotates through the board and passes or lands on GO they will receive $200.

### Go to Jail
A player who lands on the Go to Jail board space will be sent directly to the Jail boardspace and their turn will end. You are not entitled to collect money for passing GO when you are sent to jail.

There are two ways you can be freed from jail:

1. Throwing doubles on any of your next three turns
    a. If you succeed, you will be freed but cannot move on the board until your next turn.
2. Paying a fine of $50 before you try to roll the dice for doubles on either or you next three turns

If you do not throw doubles by your third turn, the $50 fine will be automatically taken from your account and you will be freed. However, your turn will be over and you will only be able to begin moving on the board again during your next turn. If you are not sent to jail but instead are “Just Visiting Jail", that space is considered to be a free space and you will not receive any penalty.

### Railroads
The rent for railroads depends on how many railroads the owner owns. If they own one, the rent is $25. If they own two, the rent is $50 rent from anyone landing on either of them. If they own three then they get $100, and if they own all four railroads then the rent is $200. You cannot build houses or hotels on railroads.

### Utility
There are two utility properties in the game: Electric Company or Water Works. Utilities are the only properties without fixed rents since the rent depends on the player’s dice roll that landed them on the utility. If the owner of the utility only owns that one utility property, then the rent is calculated to be: dice roll value x 4. If the owner of the utility owns both utility properties, then the rent is calculated to be: dice roll value x 10.

For example, let’s consider a player who has a dice roll sum of 7 and lands on Electric Company. If the player who owns Electric Company only owns that one utility, then the rent is calculated to be 7 x 4 = $28. However, if the player who owns Electric Company also owns Water Works, then the rent is calculated to be 7 x 10 = $70.

### Bankruptcy
A player is declared bankrupt if they have an account balance of $0, the price of an available property they landed on is greater than their account balance, or they do not have enough money to pay rent to another player. Once a player is deemed bankrupt, they will be removed from the game (including their player state panel on the right). The last player left in the game wins.

## Player State

The state of all the players can be seen on the right side of the game. You can navigate through the different player states by clicking the various tabs that display the player names. Each tab displays the player's position, account balance, and list of owned properties.

## Saving the Game

You can save the game at any time during gameplay by clicking the Menu button at the top left corner of the game and then clicking Save. By doing so, the entire state of the game and its components will be saved so that when you run the game again you can load the game to begin playing exactly where you left off! After the game has been saved, it will close and exit the game.

## Ending the Game

There are two ways in which the game can end:

- A player can end the game by clicking the Menu button at the top left corner of the game and then clicking Quit to exit out of the program
- A player can end the game by clicking the Menu button at the top left corner of the game and then clicking Save to save the game and exit out of the program
- Win by being the last player left who hasn't reached bankruptcy

# Design Choices

## MonopolyModel Class

- Added the following new private helper methods to clean up the roll method
    - checkIfAI method to check if the current player is an instance of AI. Instead of having the same if statement nested in the if statements already placed in roll, it is much simpler and cleaner to have a one line method call to do so
    - handleNonDoubleTurnRoll method to handle the case where the player's roll was not a double and they are an AI. Similar to the reason listed for the new method above, this was previously a repetitive if statement nested in the if statements already placed in roll. Thus to clean up the code, it was extracted into a helper function so that it could be a single method call
    - payRent method to handle all instances where a player lands on an owned property and rent payment is owed. We saw this as a sub-functionality and extracted it to be a helper function so that it can be called in roll method instead
- Moved house and hotel logic from MonopolyFrame class to MonopolyModel class
    - New "BUILDING" state and "BUILD" constant used in play method to comply with new "Build Houses/Hotel" button
    - Created new helper method updatePropertyLists that keeps track of the colouredProperties a player has and if they own any full colour sets
    - Created a new method buildHouseHotel that is called when the "Build Houses/Hotel" button is pressed. It will check if a user is eligible to start building (checks if they own any full colour sets) and will notify the frame to proceed with the property colour set selection
- Implemented saveSerialize and importSerialize methods to save/load game data
    - saveSerialize saves the data stored in the model, specifically the players, their positions, the board pieces and the current player's turn. The data is saved as a text file under the name MonopolyGame.txt.
    - importSerialize imports previously stored game data and updates the current model. This method calls the previously stored MonopolyGame.txt file. In the case, there is no previously stored data, the program will inform the user the file does not exist, print the stacktrace, and then exit.

## Player Class

- Implemented two new list attributes that are used in the house and hotel building logic
    - Implemented new HashMap attribute to keep tracks of the coloured properties a player owns (similar idea to the property cards in a physical game)
    - Implemented new Arraylist attribute to keep track of the complete property colour sets a player owns
- Implemented boolean canBuild attribute to determine the action of clicking the "Build Houses/Hotel" button is valid for the current player

**MonopolyAIPlayer Class**

- Moved hardcoded AI strategy logic into the MonopolyAIPlayer class and created method getRollDecision to handle that

**MonopolyModelTest Class**

- Implemented setUp method to eliminate repetitive instantiations in each test methods
- Added test cases to test the save\load and international features.

**MonopolyFrame Class**

- Created new menu items for “Save Game” and “Quit” and grouped them together under JMenu “Menu”
- Replaced old “Quit” button with “Build Houses/Hotel” to keep all game play command buttons in the same area

**MonopolyController Class**

- Added XML importing functionality using SAX Parser in this class
- This class now extends DefaultHandler (for responding to XML parser events)
- This class now has another dialog box that will get the user input for which version to use (which XML file to parse)