Problem Description

No one will play Clue with me.

The object of the game is to use deductive reasoning to discover who committed the murder using what weapon in what room. There are six different characters (Colonel Mustard, Miss Scarlet, Professor Plum, Mr. Green, Mis. White, and Mrs. Peacock), six different weapons (Rope, Lead Pipe, Knife, Wrench, Candlestick, Pistol), and nine different rooms (Kitchen, Dining Room, Lounge, Ballroom, Hall, Conservatory, Billiard Room, Library, Study).

The game also contains a deck of cards. There is exactly one card for every Character, every Weapon, and every Room. One of each kind of card is taken from the deck and separated from the rest of the game. They represent the murderer, weapon, and room. The rest of the cards are distributed among the players as evenly as possible. To figure out which three cards were removed from the game, players must learn and deduce what the other players do or do not have. Each player picks a character to play as and the game begins with Miss Scarlet.

A player begins their turn by making selecting a character, weapon, and room and accusing them of being responsible for the crime. Then, in turn order, other players look at their cards to see if they can disprove the accusation. If they can, they pick a disproving card and show it to the accuser. If they can't disprove them, the next player tries to disprove the suggestion until either the suggestion is disproved or it gets back to the accusing player. A player is allowed to take notes throughout the game to help narrow down the solution.

When a player feels they know who the murderer, weapon and room are, they can make a final accusation. The player does this by announcing which cards they think have been taken out of the game, and taking a look at those 3 cards. If they are correct, the game ends and that player wins! If they are wrong, they can no longer accuse and can only act to disprove another players' suggestions.

Details

- Suggesting
    - You cannot make a suggestion in the same room on two consecutive turns
    - Every character (including yourself) could be the murderer.
    - You are allowed to suggest cards in your hand.

Solution Description

I made a game of clue that Supports at least one player to play against at least one other AI Player.

Game Play:

The game opens up with an options screen where the user can select if each of the six players will be playing and if they'll be human or computer. After making the selections, the user presses start and the game begins. At this point, the game collects player info, creates a deck, sets aside 3 cards, and deals out the rest to the players. The turn order is Miss Scarlet, Mrs. Peacock, Mrs. White, Prof. Plum, Col. Mustard, and Mr. Green regardless of who is playing and their status as human or computer. In order to help prevent one human player from looking at

another human player's cards, there is something of a warning screen before each opportunity to see a player's details.

Therefore, after the game starts, the first screen seen is always a notification of whose turn it is (unless a computer goes first). After pressing indicating that the player is ready, the player is shown their notecard. On the notecard are many buttons set up in a grid with players being the x-axis and cards being the y-axis. Those buttons can toggle between marks to make (-,X,?,!) or between colors and name abbreviations. The user can use these buttons however they like, but the buttons indicating which cards they have are not changeable. The User can also see all the accusations made before their turn, who made them, and who disproved them. (the maximum number of accusations the player can see at any time is 6).

To the left of the notecard are three sets of radio buttons used to select a Suspect, Weapon, and Room. If the user presses the "Accuse" button after selecting those items the Accusation sequence starts. If the user presses the "Final Accusation" button after selecting the items the Final Accusation sequence starts.

Accusation Sequence:

The game starts the accusation sequence by going through the players in turn order and comparing their cards against the accusation. Upon discovering that a player can answer, if that player is human, a screen pops up to tell them they can disprove the Accusation and they are allowed to pick a card from their disproving cards to show the accuser. Then a screen tells the accuser what card was shown to them. Afterwards the accuser is sent back to ther take-turn screen to take notes and end their turn. If the Accuser is a computer, the Screen that would normally show the player the evidence is skipped and instead the information is sent to the player. If the Disprover is a computer, the screen that would introduce the player and their cards is skipped and a card to present as evidence is randomly picked from their disproving cards.

Final Accusation Sequence:

Whether the player is human or computer, after the accusation is determined to be a final one, the game compares the accusation to the cards the game set aside. If the sets match, the player is told they win and is allowed to go back to the options screen to play again! If the sets don't match, the player is told they lost, given the actual solution, and allowed another opportunity to look at their notecard before pushing "End Turn" for the last time. Their name will still come up in the Accusation Sequence if a card in their hand will disprove an accusation.

Computer Players:

It should be noted that the game is propelled through its game states by user clicks which a computer player could not make. This made implementing a computer player turn a little messy. It was accomplished by intervening any time the game changed state. In other words, if the game was changing state and it was a computers turn, computer player functions were called and the game was made to move on to the next appropriate state.

The Computer player can be two different difficulties: Easy, when the player only makes deductions from accusations made by itself, and Hard, when the player makes deductions based on all of the players' accusations. There are a couple of things to be said

about the logic behind finding the card that no one has. First if no one owns a card, then no one owns it. Second, if all but one of a set (suspects/weapons/rooms) of cards is owned then no one owns that card. Third, if one person owns a card, no one else owns that card. Fourth, if someone does not move to disprove an accusation after being allowed to do so, they do not own that card. Fifth and finally, there are 18 cards in the collective players' hands and the cards are as evenly distributed in turn order as possible. If you know all the cards in a player's hand, the player owns no more cards. Both levels of difficulty use all of these things to deduce the answer, but because the hard computer player can use other players' accusations, they find more occasions to use the fourth rule.

Further Work

UI changes:

- The User interface could be given a larger text size and more written instructions and rules to help reduce any confusion involving buttons and functionality as well as the object of the game.
- Make it easier for the user to note that a card is THE card. Possibly by making the first column editable. The issue is the first column is used to mark the players cards. They cannot be allowed to "lose-track" of which card was theirs (this wouldn't affect the game itself, but it could easily make the game less enjoyable to the player)

Computer Player Changes:

- There was a detail in clue logic that i didn't mention in the Solution Description. When a player disproves an accusation, they have at least one of those cards. This can be a very powerful thing to know, because it allows you to learn other players' cards without making your own accusations. Giving this kind of reasoning to the computer would bring up the difficulty of the hard player significantly. Right now, the hard player is only marginally better than the easy player.

Technical Overview

The program was written in C++ within Visual Studio. GLUT was used to make all the graphics.

A computer keeps a vector of vectors to organize the data it comes by. Every time an accusation is made, the accusation, accuser, and disprover are sent to the computer players who make appropriate changes to their vector of vectors. The computers also keep three vectors titled "possibleSuspects", "possibleWeapons", and "possibleRooms". Any time a computer finds out that another player has a card, that card is removed from one of the three vectors. Any time the computer figures out one of the 3 cards that make up the solution, the name of that card is noted, but not removed from the lists of possibilities. At the beginning of the computer player's turn, they scan their notecard to see if they can make any more deductions before they randomly pick from their possible cards. Afterwards, an extensive if else chain ensures that the computer will always have something to learn after each accusation. If they do know the entire solution, the computer signals that this accusation will be the last and

accuses the 3 cards that make up the solution. The computer will always be right when they make the final accusation because the computer takes no risks. If the computer is wrong, something is wrong with the implementation.

The class structure is quite extensive, but every class is owned in one way or another by the Game class. Most of the game logic takes place here. Besides here, information is generally kept in the HumanPlayer and ComputerPlayer classes.