

# Analysis of Old Maid

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## Introduction

Old Maid is a card game where anywhere from two to thirteen players receive a hand of an evenly distributed deck of cards and one card that is “The Old Maid”. On a player’s turn they look through their hand and look to see if they have a four of a kind. This can be four aces, twos, threes, etc. If the player has one or more four of a kinds, they can place them in front of them. Regardless if four of a kinds are found, they offer their hand to the player to their right and they blindly select a card from their hand. The next player repeats the same actions until all four of a kinds are found and the player with “The Old Maid” is the losing player.

## Hypothesis

This game can be seen as a very, very inefficient sorting method for a deck of cards. When playing originally, I thought it may be something along the lines of a log base 13 (amount of 4 of a kinds) or 52 (size of a deck) of the player count, which will be referred to as  $n$ . Upon plugging some of these values into a calculator, I realized that this didn’t really make much sense at all. From this, I started to think of an experiment on how to find the asymptotics of this “sort”

## Experiment

For this experiment I want to create a simulation of Old Maid where cards are randomly passed around the players, following the games rules. After each player selects from the previous and the first player’s turn is up again, this will be known as a “round”. Once the simulation is set up, The game will be run for all sizes of players two to thirteen. Each player size will be run 50 times. After each player size has completed, points will be plotted on a graph. The X-axis will be the rounds and the Y-axis will be the four of a kinds discovered. From the 50 simulations and the points plotted, a line of best fit will be created as the average for those players. Once all line of best fits are created, one final line of best fit will be created, leading to the average length of a game, equivalent to the asymptote of the “sort”.