**Problem Set 4**

PSCI 107

7 April 2021

21249856

**Question 1:**

**a.** In my simulation, Sara won 3 out of the 5 games, so she became the Ultimate Cribbage Champion.

**b.** After using a for loop and simulating a 5-game cribbage championship 10,000 times, I found the proportions of the championships where Sara wins 0-5 games. According to this simulation, Sara would win 3 or more games about 68.29% of the time, which would be her odds of becoming Ultimate Cribbage Champion.

**c.** To determine the proportion of times Sara wins a series of cribbage from 5 games to 151 games, I used a double for loop and simulated the cribbage championship 10,000 times for each championship length. I graphed the championship length on the axis and the proportion of time Sara wins the series on the y-axis and noted the proportion of 0.95. At about 65 games in the championship, Sara would win 95% of the 10,000 simulated championships:

Chart

Description automatically generated

**d.** If Sara has the same ability as Ivan at playing cribbage (the null hypothesis), then the odds of her winning a 5-game championship about 68% of the time would not be too unlikely. However, when increasing the number of games in a championship, the odds of her winning a championship increase, becoming even *more* unlikely if she had the same ability as Ivan. For instance, the odds of her winning a 65-game championship about 95% of the time would be *very* unlikely if she had the same ability as Ivan. Since we know that Sara is the better player, it makes sense to reject the null hypothesis and conclude that she does *not* have the same ability as Ivan at playing cribbage. Also, it is better to use more than 5 games to determine the Ultimate Cribbage Champion.

**Question 2:**

**Bonus:** I wanted to investigate whether drug sales increased as the months progressed. My assumption was that as the months got warmer, there would be more drug sales and presumably more arrests for drug sales\*. Here is a plot of the mean daily arrests for drug sales per district for the months of January, February, and March 2021, with error bars:

Chart

Description automatically generated

Here is another plot of only districts 24 and 25, which had the larger daily drug sale arrests:

Chart, box and whisker chart

Description automatically generated

According to these plots, there is not a significant increase in daily arrests for drug sales from January to March. Districts 24 and 25, which are both North Philadelphia districts had significantly higher arrests than the other districts, but within each district, the mean number of daily drug sales stayed about the same from January to March.

\*It should be noted that daily *arrests* for drug sales does not necessarily equate to daily drug sales.