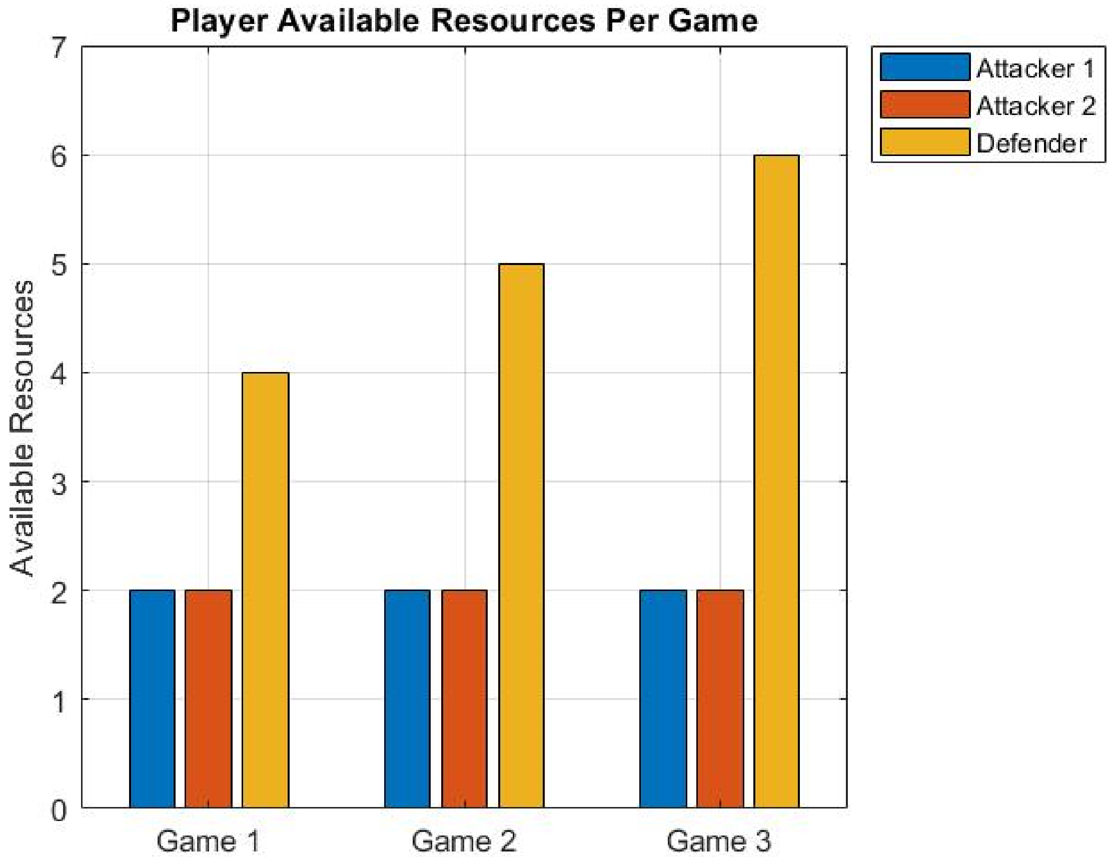
Brooke Albanese

Master's Project- Colonel Blotto Games

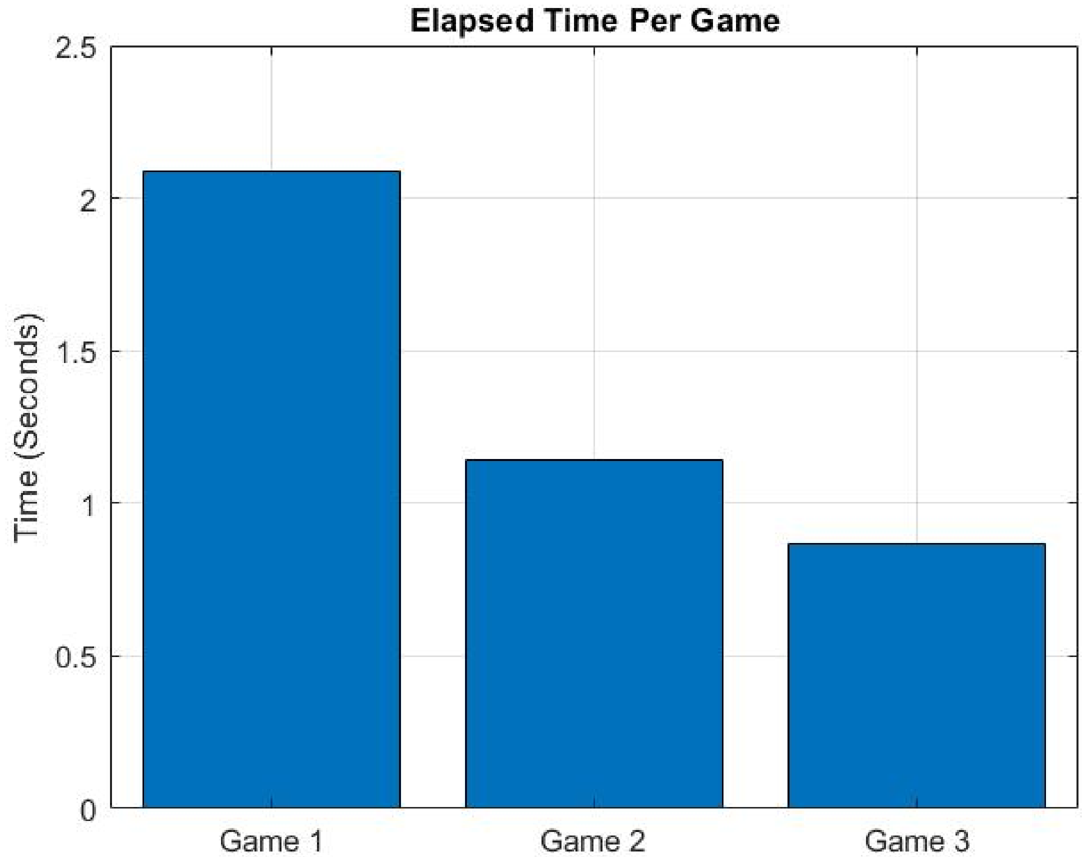
The goal of my project was to create a smaller *best response* matrix in order to decrease the computational time and keep the results as consistent as possible with previous years' results. To accomplish this, I created a new function that uses the provided connections and strategy sets for each player to repeatedly determine the defender's best response to both of the randomly selected attackers' strategies. By introducing randomness to this attempt, we are able to find an approximation of what the actual results are while significantly decreasing the computation time needed to find the nash equilibrium.

I chose to introduce randomness into picking the attackers' strategies that are used to determine the defender's best response for each repetition. For a given number of randomly selected attacker strategies, I found the defender's best response to one or both of the selected attackers' strategies. Assembling the random attacker strategies and the first found best response strategies for the defender into a new matrix allows a smaller matrix to be passed into the nash solver. This smaller matrix decreases the computational time significantly. The randomness helps to better model the actual results. However, the results aren't the same for each run because of this. The trends are generally consistent with the original results, with an occasional outlier showing up.

Here are the resources used, per game:

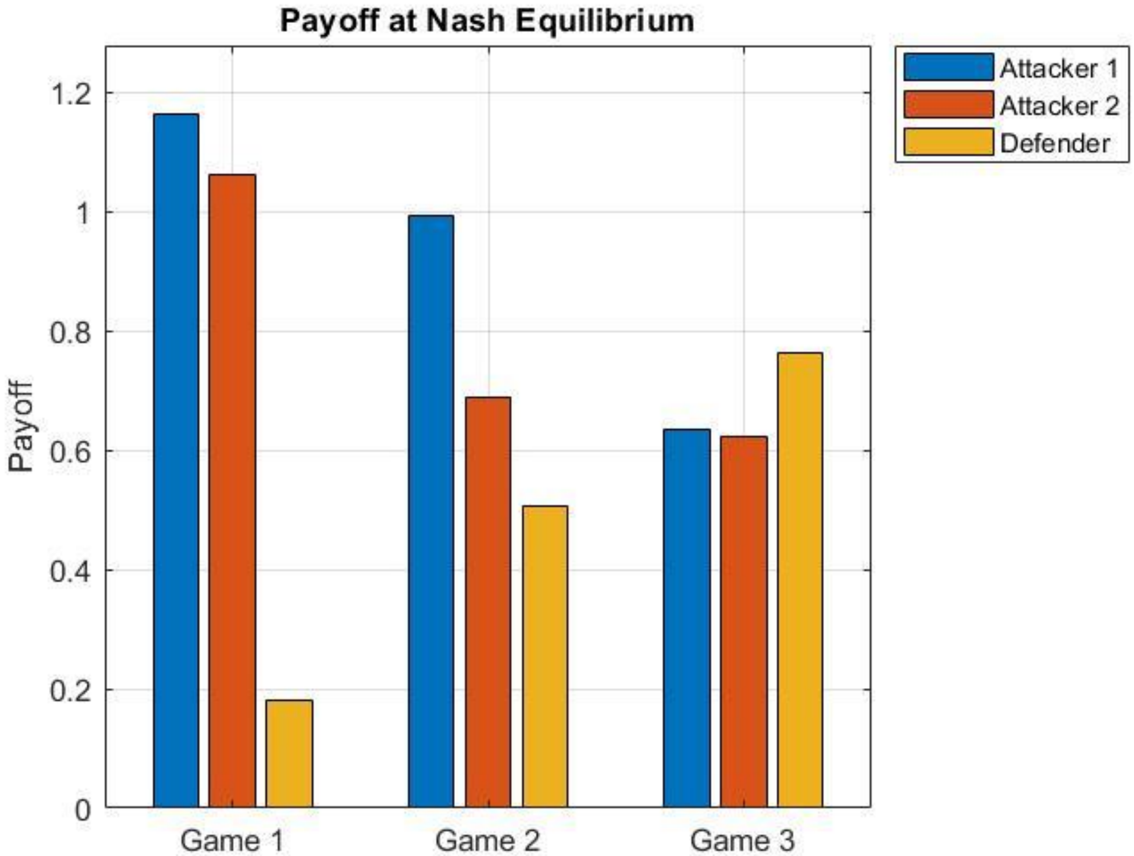


The original project results took up to 140 seconds per game; this attempt takes the following for a given run:



These numbers vary due to the randomness that is introduced when determining the best response strategies but generally remain less than 10 seconds per game.

This attempt has the following payoffs, which aren't exactly the same as previous results due to the randomness that was introduced, but show the same trends as past results:



The previous results show the attackers' payoffs being equal to each other, as you can see that is one significant change that occurred with this attempt. Another significant change, is that based on what strategies are selected for all players, we may see an outcome where the defender's payoff ends up being more than the attackers' payoffs for games one and two and less for game three. This result, while less common, is an interesting side effect of the introduction of randomness into choosing smaller strategy sets.