Problem:

I am investigating which squash scoring system, Point-a-rally or English scoring, is better. To determine the better system, I will take factors such as player advantage and skill into account.

Personally, I am expecting the initial server in an English game to have a higher chance of winning a game for a particular value of ra/rb compared to the same value using PARS. This is because the opponent has to initially win 2 rallies in a row to get one point, whereas the player must only win one. With the pars system, only the players individual skill effects their chances of gaining a point.

Method

Each player has a skill level (1 - 100) which can be used to calculate the chance of them winning a point. This chance is represented as ra/rb.

In order to show how these systems, differ, I will perform 2 main simulations. Firstly, a simulation which takes a large range of ra/rb (100 values) and compares the probability that player a wins for each value. Rb shall remain constant (at 50) and ra shall range from 1 to 100. The probability will be calculated by running many games for each ra/rb value and getting the average chance of victory. Then, the probability will be plotted against ra/rb on a graph using matplotlib.pyplot as a line plot. This will be repeated for both scoring systems and plotted on the same graph, hopefully showing any disparity in the win probabilities for each ra/rb.

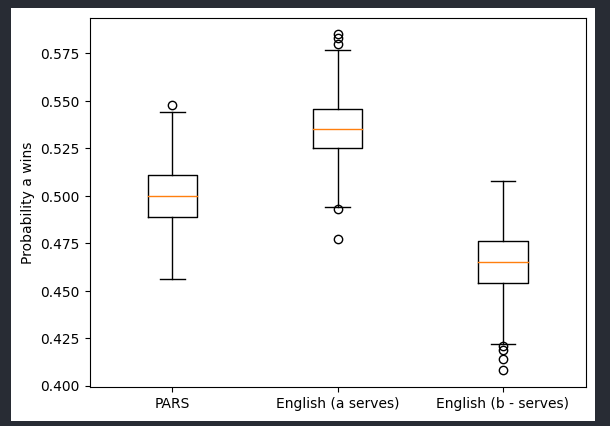
To implement this, I will have to create an English squash game function, as well as a function that will run it a given number of times and return the average win rate for a. Ra and rb will be given as parameters along with the number of requested simulations. I will also add an optional server parameter so if need be, player b can start as the server.

Secondly, I am going to do another similar simulation except that this time ra/rb remains constant. This is to compare whether a particular player has a win advantage even if skill levels are equal. The same functions will be used, but now it will be plotted using a box plot. This will show us the spread of what we can except from a single value.

Assumptions

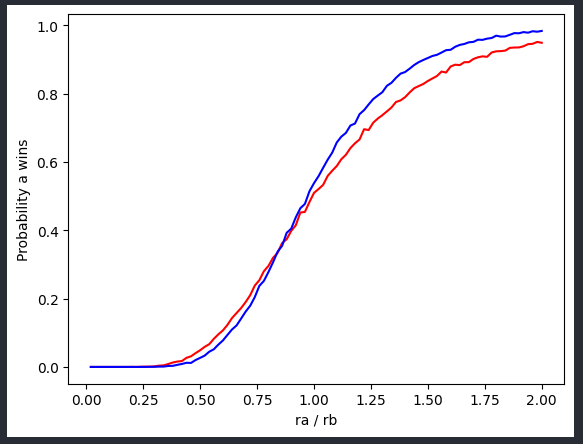
During these simulations, we are assuming that a player does not get tired during a game, thus their skill or ability to successfully win a rally stays constant throughout a match. We are also assuming that no external/environmental factors effect a player’s skill. For example, pressure of winning could distract a player from the game, and therefore increase their likelihood of making a misplay.

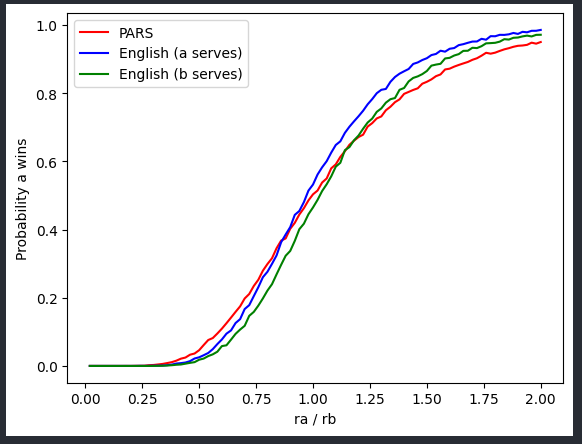
Results



From this graph we can determine a few things. Firstly, PARS produces an almost perfectly equal distribution around 0.5 (50%). This implies that each player, with equal skill has an equal chance of winning the game.

In the second plot we can see that even with an equal skill level, a has a higher chance of winning a game than b. The third plot further supports this theory as a has a lower chance of winning when b is the server. Therefore, we can deduce that the initial server has a slightly higher chance of winning a game.



This graph further supports the theory as a clearly has a higher chance of winning than b for the majority of ra/rb when serving. However, it also shows that for low values of ra/rb being the initial server has a lower chance of winning than in PARS. This is most likely due to the fact that once the opponent becomes the server, their skill level outweighs the impact of initially serving and they have a higher chance of continuing than the opponent winning twice in a row. This is even more noticeable when b serves as it takes a much higher level of ra/rb for the probability of a winning to exceed the pars game.

Conclusion

In conclusion, I believe that PARS is the better squash scoring system. This is because in English scoring, the initial server has an increase in their chances of winning at an equal or higher skill level. And at a lower skill level their chances of winning are reduced regardless, but more noticeably when they are not the server. In my opinion a player should not have an advantage based on initial starting conditions and should only have an advantage based on their own skill.