1. In our simulation Bruce Leeds tends to beat Serena Williams and Jean Claude Van Dime, and Jean Claude Van Dime tends to beat Serena Williams. We can easily determine this by analyzing the probabilities of each of the players making a particular hit and the probabilities of the receiving player returning the hit. For example, the probability of Bruce returning a hit from Serena is:

Calculated in this way, we obtain the following table of probabilities:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Return Probabilities | Hitting | | | |
| Returning |  | Serena | Bruce | Jean |
| Serena | X | .643 | .604 |
| Bruce | .665 | X | .7175 |
| Jean | .701 | .698 | X |

By comparing each pair of competitors chances of returning a ball from the other we can immediately tell which one of them is more likely to win by observing that the player that has a higher probability of returning a ball will also have a higher probability of winning the overall match.

At a more subtle level, if Bruce, Serena, and Jean Claude all play an equal number of games against each other, one of Jean Claude or Bruce will win the most games. Jean Claude sometimes wins the most overall wins despite the fact that Bruce is more likely to beat both him and Serena because even though he loses slightly more often than he wins against Bruce, he wins with high probability against Serena and thus makes up for lost games against Bruce in this way. Other times Bruce wins the most. The following table shows an example of the number of wins each player has when the simulation is run 10,000 times.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Wins | Player’s number of wins | | | |
| When playing against: |  | Serena | Bruce | Jean |
| Serena | X | 5872 | 7769 |
| Bruce | 4128 | X | 4043 |
| Jean | 2231 | 5957 | X |

1. In the table above, Bruce wins the most but the number is very close. I ran the trial for 100,000 trials (running many more trials than this was starting to become unfeasible) to try and put the matter to rest and came up with Bruce winning the most with 118,597 wins and Jean Claude in second with 117,837 wins. These numbers are within 1% of each other though and so even with this many trials I am not entirely confident with the result. To obtain a more satisfactory result I think it would be possible to solve this problem analytically but it would be fairly complicated.
2. To beat the existing players I made a player named “Natan” who hits a slice 95% of the time and an unreturnable hit 5% of the time. This is the best choice in terms of hits because all three of the players have the lowest probability of being able to return a slice. For my returns I calculated the overall probability of receiving each of the hits in any given game and then weighted my returns toward better returning shots from Serena Williamson because she has a higher probability of returning my slice than the others (but it is still her worst return). I ended up with a 60% chance of returning a flat hit, a 30% chance of returning a slice, and a 100% chance of returning a topspin (because topspin is Serena’s most common hit) . This gave me between 99%-100% of wins against Jean Claude and Serena, and a little over 95% of wins against Bruce.