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Report on fairness of sailing scoring

Problem
I am investigating the problem whether consistent or inconsistent sailors would benefit more from the current scoring system. In order to fully understand the problem, I also need to analyse how the results change if I modify the number of discarded races variable in the scoring formula.

My hypothesis is that over a small number of races the consistent sailors would perform better than the inconsistent ones. However, I believe as the number of races starts increasing the inconsistent sailors would overtake the consistent sailors, but the difference between them over an extremely large number of races would be very small.

I also expect the consistent sailors to be even more ahead of the inconsistent ones when the number of discarded races is increased.

Method
To investigate the problem, I created the following sailor profiles. I made sure to include multiple sailors with the same mean skill value but different standard deviation values to analyse the relationship between consistency and mean performance score.

Name	Mean skill value	Standard Deviation
Alice	100	0
Bob	100	5
Clare	100	10
Dennis	90	0
Eva	90	5

As the table shows, we have three sailors with the same skill value of 100 but Alice is completely consistent while Clare is capable of producing a much higher or lower performance score than Alice or Bob.

To investigate how consistency affects race performance, I am going to calculate their mean performance score for each set of races. The table below lists the number of races in each simulation.

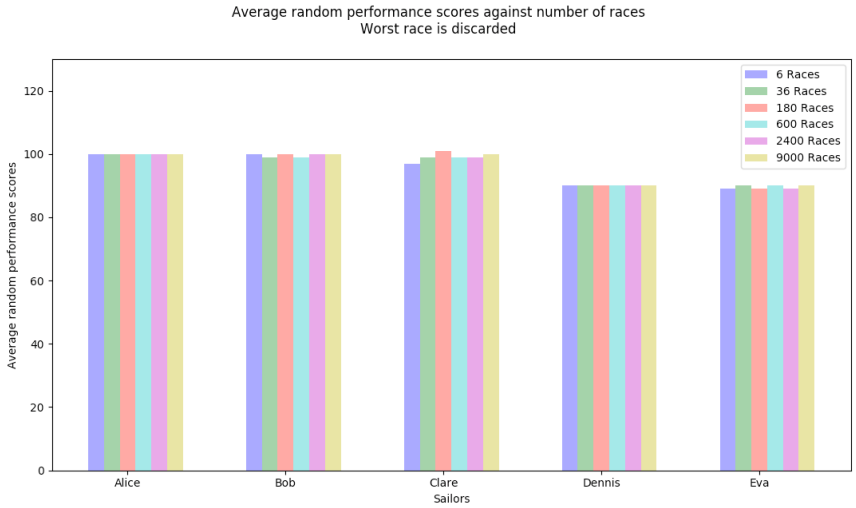
Simulation #1	Simulation #2	Simulation #3	Simulation #4	Simulation #5	Simulation #6
6 races	36 races	180 races	600 races	2400 races	9000 races

For each race, each sailor will get a random performance score based on their mean skill value and standard deviation. After each simulation, I am going to calculate each sailor's mean performance score by dividing the sum of their performance scores by the number of races in each simulation.

Assumptions
I made a few assumptions that can affect the results. For example, I assumed that the sailor's mean skill value stays the same for each simulation. In a real world scenario, a sailor's mean skill value could change after a certain number of races. It is also highly unlikely to have a sailor with 100% consistency for over 1000 races. I also assumed that each sailor will finish every single race.

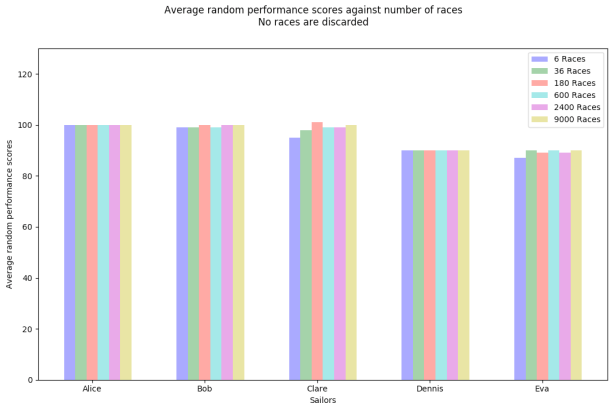
Results

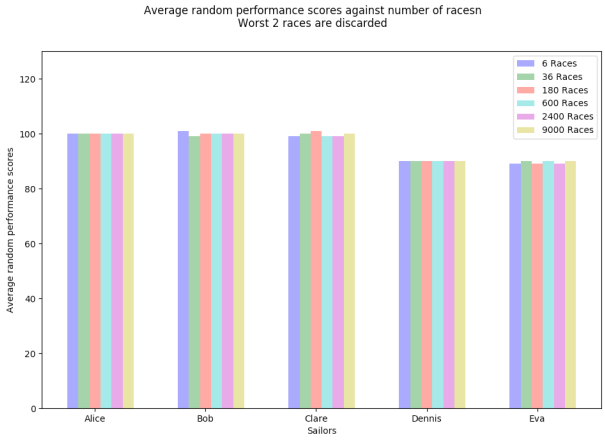
The following three bar charts compare the average random performance score of each sailor against a number of races. The first diagram below discards the worst score from each set of races.



The bar chart clearly shows that consistent sailors such as Alice and Denis perform equally or better than inconsistent sailors when we run the simulation over a small number of races like 6. As soon as we start testing with a larger number of races, the inconsistent sailors seem to overtake the consistent ones with a noticeable difference. Clare, who is the most inconsistent sailor with a standard deviation of 10 has the highest mean performance score over a set of 180 races. However, the sailors seem to even out when the number of races is extremely huge like 9000.

The diagram on the left uses the exact same random generated data as the diagram above but I performed operations on the results to not exclude any worst race scores and the diagram on the right discards the worst two race results for each sailor over each set of races.





By comparing the two diagrams side by side, we can conclude that the average performance score of each sailor doesn't change much regardless how small or big the number of races is when the scoring system discards the worst two scores from each set of races.

Conclusions

In conclusion, I believe that the scoring system is relatively fair, the difference between the sailors' mean performance score is usually not significant but changing the number of discarded races can noticeably affect the outcome of the simulations. However, the simulations are not entirely realistic, in a real world scenario, luck often plays an important factor in any competition and therefore I recommend introducing a random luck factor for each sailor in addition to the mean skill value and standard deviation to further manipulate the results.