

# Understanding Trends In A Probabilistic Gambling Challenge

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In March of 2021, the American Statistical Association hosted a March Randomness competition for statistics students around the country. My brother and I participated and came in last place. The goal of this project is to analyze trends in this competition to see how our team could have done better.

The organizers posted each team's bets and wagers at the end of the competition in a Google Sheet, found at [https://docs.google.com/spreadsheets/u/1/d/e/2PACX-1vTwkB\\_zRc1yCzyMS8QMKo6mBPOsLQGycnhKRLK7w7\\_duWrwSv65UNKwNcB-YduYWsL8QRysv59cZnIQ/pubhtml?gid=1169843611&single=false#](https://docs.google.com/spreadsheets/u/1/d/e/2PACX-1vTwkB_zRc1yCzyMS8QMKo6mBPOsLQGycnhKRLK7w7_duWrwSv65UNKwNcB-YduYWsL8QRysv59cZnIQ/pubhtml?gid=1169843611&single=false#). The data set includes 214 rows, one for each team including those that were eliminated for failing to submit a bet each day. The columns include information on how each team bet in each challenge, as well as how much they wagered, and also includes demographic information on if the team was a group or an individual and if the team was composed of college or pre-college students.

I began my analysis from a reflective perspective. I knew we had come in last place, but I wanted to know how our team, the "10% Trimmed Mean Muggers," compared to the other teams throughout the competition, particularly when broken down by demographics.

**Figure 1** displays this analysis, comparing the average scores of teams with similar demographics to the average scores of all teams. Throughout the competition, Pre-College Individuals and College Teams outperformed the all-teams average (they were about 527 and 314 StatCoins, on average, above the mean respectively). Pre-College Teams and College Individuals underperformed the all-teams average (by about 208 and 310 StatCoins on average, respectively). Meanwhile, the 10% Trimmed Mean Muggers underperformed the average by about 1253 Statcoins, with our bad streak beginning at the halfway point (after challenge 7 we were above College Individuals by about 25; after challenge 8 we were below them by about 5 and we never recovered).

Next I was curious about the relationship between the final StatCoin amounts and the average bet amounts by each team. Since teams could not control the outcome of the challenge, but could control how much they bet, I was curious if betting more or less on average had an effect on the final outcome. **Figure 2** shows my K-means analysis of this question. After assessing inertia for a variety of cluster amounts, I saw few gains after 5 clusters, so did my analysis using this amount. The figure shows how the clusters formed based on a range of outcomes, not based on a range of bet amounts, indicating that average bet amount does have some impact on outcome. Indeed, the centroid for the highest final StatCoin amount cluster is about 85 StatCoins above the centroid for the lowest amount cluster.

Finally, I conducted a linear regression comparing final StatCoin outcome to average wager amount and controlling for demographics. When fitting different polynomial regressions, a cubic fit ended up being the most interesting and intuitive, as wagering extremely high or extremely low would have a more dramatic effect on outcome than just middling bets when considering that the wager amount is either lost or won on each bet. **Figure 3** shows how this is the case: a cubic model predicts middle to high average wagerers to outperform low wagerers, but there's a slight dip for middle-high wagerers as lost bets start to subtract from their points. The 10% Trimmed Mean Muggers fell into this category of middle-high wagerers: my model predicts we should come out with about 4934 StatCoins. Of course we came out much lower than that at 600 StatCoins: the  $r^2$  score for the model is only about 0.10 due to the heteroskedasticity of the data.

In conclusion, my analysis shows that the 10% Trimmed Mean Muggers would have been better off wagering either slightly less or slightly more than we did, in order to minimize losses and maximize gains. While our strategy seemed to work for the first half of the competition, we did not do as well as other teams in thinking critically about our wagers. This of course does not take into account our luck in the competition: this is left for future analysis.

# Figures

