1. The probability of winning $80 within 1000 sequential betsSo, if we reach 80 won spins in the first 1000 rolls, then we are done (since we will have won $80). Then the problem reduces to using the binomial distribution (or in this case you could also approximate it with the normal distribution) with p=0.474, n=1000 and solving for P(X>=80). This will be an incredibly high probability essentially 1. So the chance of not getting to $80 is essentially 0 as you already realized. The betting strategy in experiment 1 generates $1 for every win and effectively does not create a loss for an incorrect bet. That means we have to lose 921 times to win less than $80. The odds for that are (20/38)^921, or one could also say non-existent.
2. Based on the previous answer's reasoning, we have an expected value of $1 times 18/38 or $0.47 per bet. That means the expected value is $470 for 1000 consecutive bets. Since the limit is $80, all graphs end at that value. If we increase the limit to $1000 and change the graph's dimensions, we can see that $470 is the area where the winnings graphs end.

3. The more sequential bets reach their final value of $80, the more the standard deviation stabilizes and eventually goes to zero. The more bets are ongoing, the higher the chances that one of them goes on a losing streak, which results in a significant standard deviation. Therefore, the maximum standard deviation is likely to occur between the first couple of bets (so that a losing streak can build up), but before many bets reach $80.
4. We start at $256. After losing eight times (nine times if we have already built some bankroll), we go bankrupt. Consequently, we are at 0.59% ((20 / 38) ** 8) risk to lose everything for each dollar we want to earn. Therefore, the probability of winning $80 is 0.9941^80 or 62.34%.
5. According to the previous question's answer, we have a 62.34% chance to win $80, which leaves us with 27.66% to lose $256. Accordingly, the expected value is 0.6234 * $80 - 0.3766 * $256 = -$46.53. This result seems to match our experiment. After 300 bets, we are on average at -$40, and when we extend the timescale to 1000 bets, the graph converges towards $45.
6. The standard deviation reaches a maximum value and stabilizes once all runs have either bankrupted or reached the $80 goal.

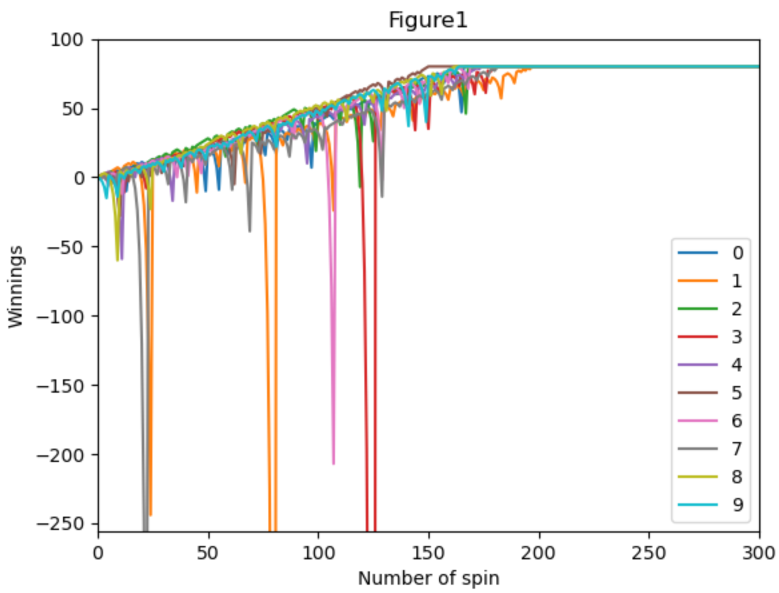


Figure1
Winnings
Number of spin
0
1
2
3
4
5
6
7
8
9
100
50
0
−50
−100
−150
−200
−250
0
50
100
150
200
250
300

7.

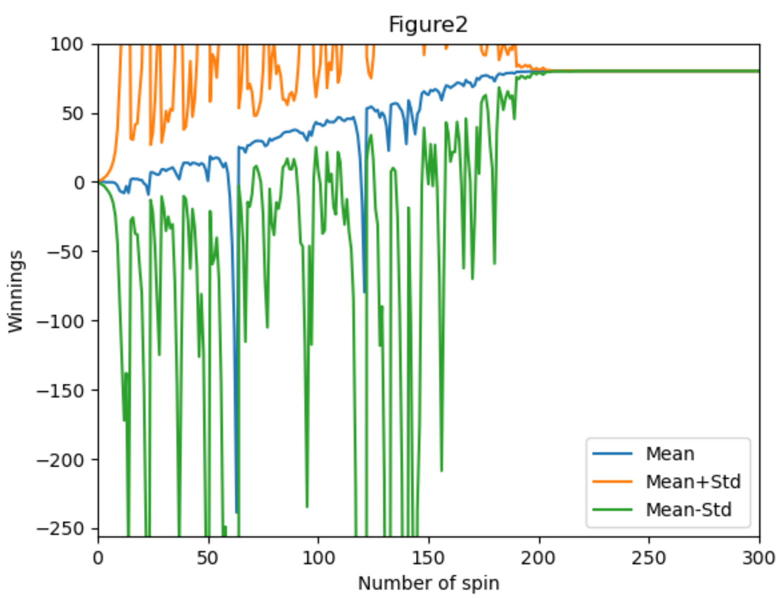


Figure2
Winnings
Number of spin
Mean
Mean+Std
Mean-Std
100
50
0
−50
−100
−150
−200
−250
0
50
100
150
200
250
300

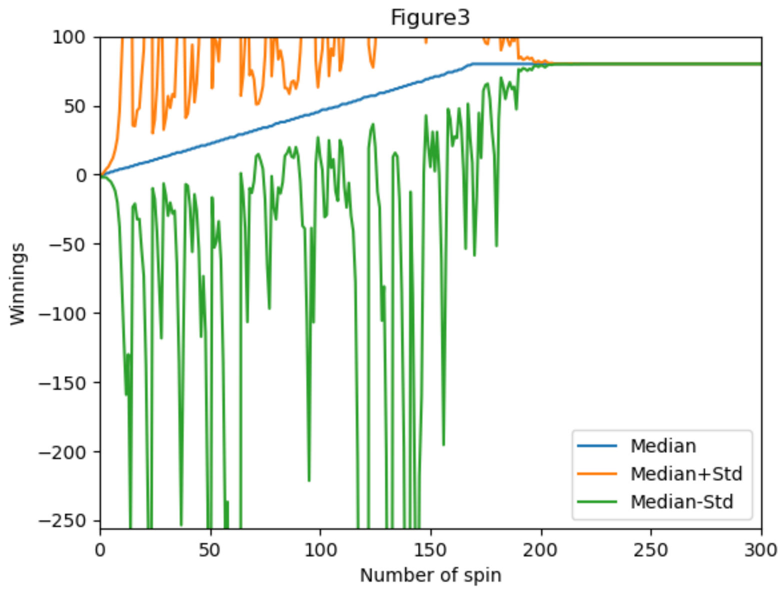


Figure3
Winnings
Number of spin
Median
Median+Std
Median-Std
100
50
0
−50
−100
−150
−200
−250
0
50
100
150
200
250
300

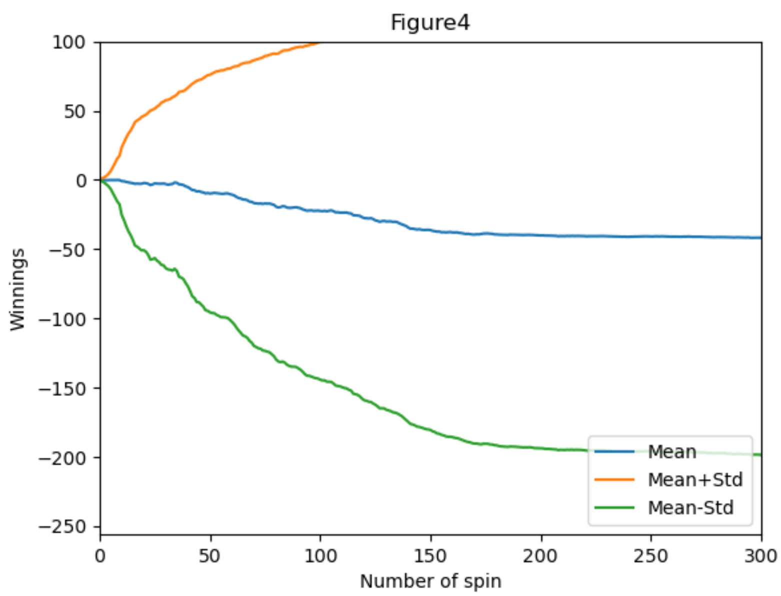
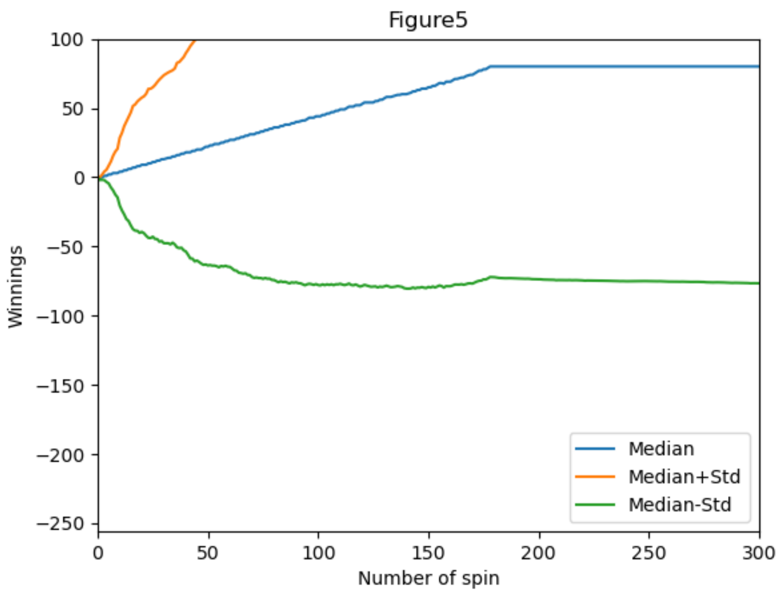


Figure4
Winnings
Number of spin
Mean
Mean+Std
Mean-Std
100
50
0
−50
−100
−150
−200
−250
0
50
100
150
200
250
300



8. I learned a lot about coding in python, statistical analysis, as well as betting odds. I have not done anything like this before, and this was a really cool project to work on. I have always been interested in financial analysis and its intersection with coding, so this project and class in general are very interesting to me. I am surprised at the odds of certain things, such as the answers provided above.