CS 4646: Machine Learning for Trading

Joao Matheus Nascimento Francolin

Project 1: Martingale

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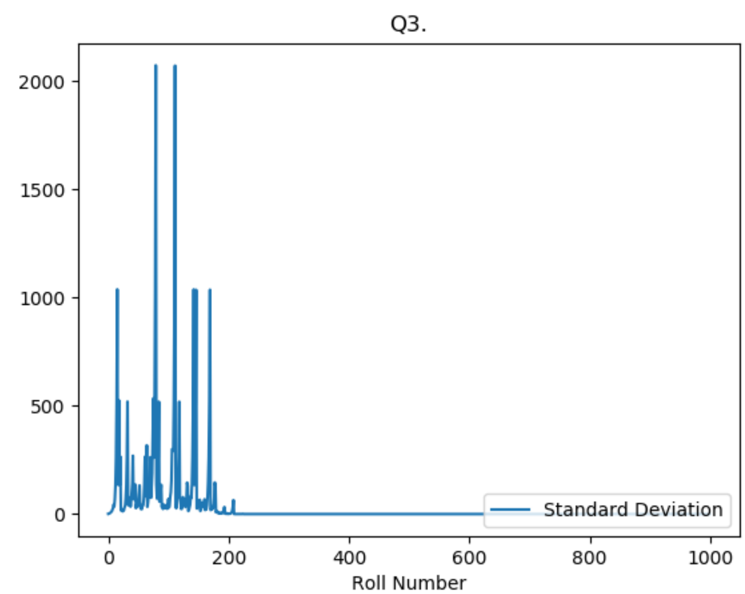
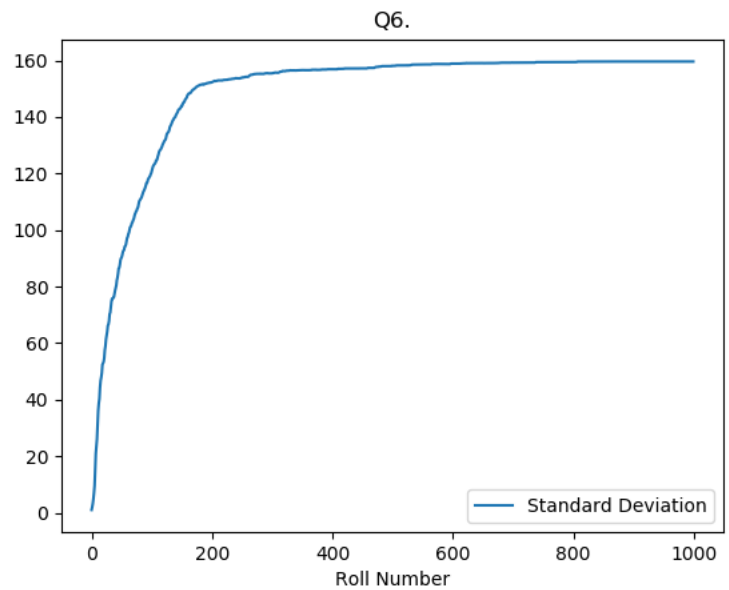
1. We can empirically estimate the probability of winning $80 within 1000 sequential bets by running a simulation of such scenario and counting the number of times the cumulative sum of winnings was equal to $80. Given that in Experiment 1 eventually all trials converged to a cumulative sum of $80, the estimated probability is in fact equal to 1.
2. We can empirically estimate the expected value of our winnings after 1000 sequential bets by running a simulation of such scenario, summing the final winnings of each trial, and dividing it by the number of trials performed. Given that in Experiment 1 eventually all trials converged to a cumulative sum of $80, the expected value of our winnings is in fact $80.
3. As we can see on the graph bellow, in Experiment 1, the standard deviation does not converge to finite value. In this scenario, neither there was no cap on the possible losses of the player, nor there was limits on the next his bet. Hence, we observed a behavior of a system with variance that would not converge to any finite value, and instead terminated when (inevitably) a positive winning of $80 was achieved.



4. We can empirically estimate the probability of winning $80 within 1000 sequential bets by running a simulation of such scenario and counting the number of times the cumulative sum of winnings was equal to $80. Out of the 1000 trials performed in Experiment 2, 656 yield on a cumulative sum of $80. Therefore, such probability is approximately 0.656.
5. We can empirically estimate the expected value of our winnings after 1000 sequential bets by running a simulation of such scenario, summing the final winnings of each trial, and dividing it by the number of trials performed. Out of the 1000 trials performed in Experiment 2, 656 trials yield on a positive cumulative sum of

$80, and 344 trials yield on a negative cumulative sum of $(-256). Therefore, we would expect the value of our winnings after 1000 sequential to be $(-35.584).

6. As we can see on the graph bellow, in Experiment 2, the standard deviation does converge to finite value. In this scenario, there was a cap on the possible losses of the player. This condition prevents the betting pattern from oscillating from positive infinite to negative infinite (and vice-versa) until a terminating condition could be met. Therefore, by (indirectly) setting betting limits, we have managed to stabilize the system. Hence, the system's expect value and variance now behaves more continually, until it eventually converges.



7. Include figures 1 through 5

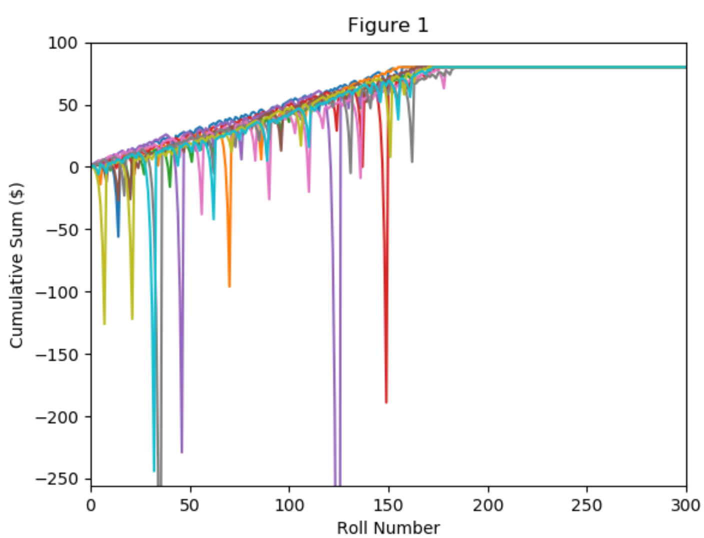


Figure 2

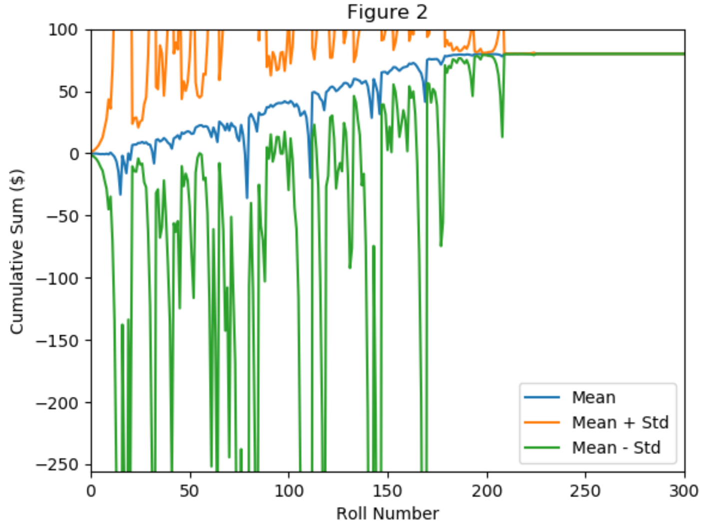


Figure 3

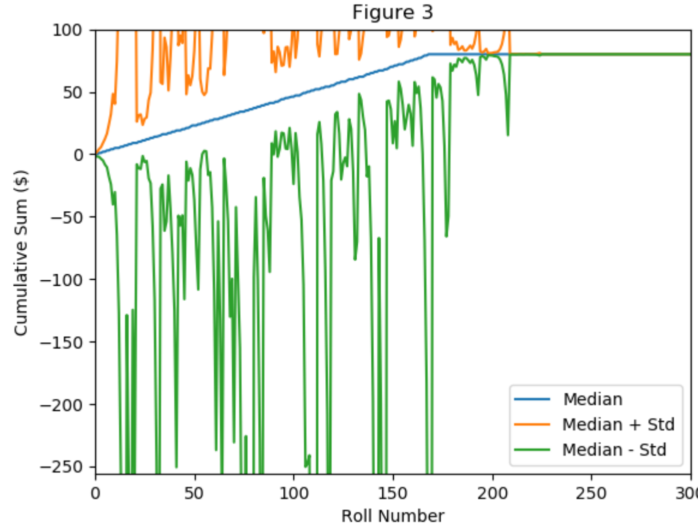


Figure 4

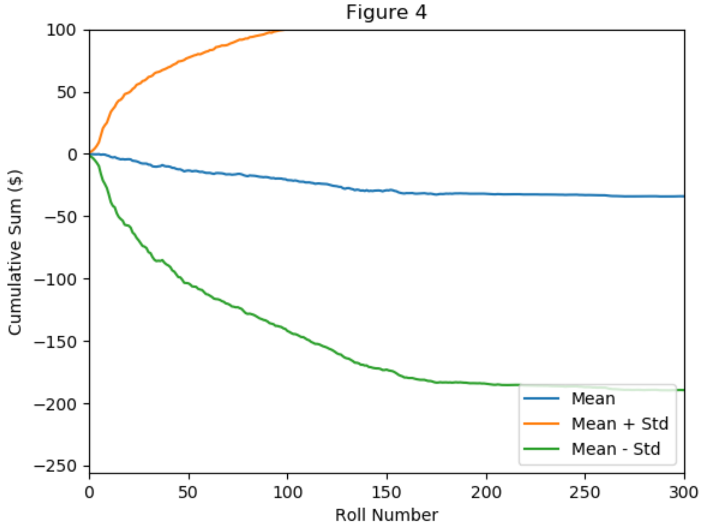


Figure 5