Pranshav Thakkar

pthakkar7

pthakkar7@gatech.edu

Martingale Report

1. In Experiment 1, the probability of winning $80 within 1000 sequential bets is 100%. This is because in Experiment 1, we have an unlimited amount of money to work with, and so no matter how much debt we get in, we can always win the next bet and get closer to being positive. Also, we are betting black, which has a 18/38 chance of winning, and so it is very close to being 50/50 on winning and losing. Thus, it is VERY unlikely that we will keep losing for a long amount of time, and eventually we will win $80. The martingale strategy is based on the fact that we will always have $1 profit after we win a bet. Figure 1 shows that the winnings of each of the 10 simulations stabilizes at $80 and Figure 2 shows that the mean of each of the 1000 simulations stabilizes at $80, which means that we definitely end up with $80.
2. In Experiment 1, the expected value of our winnings within 1000 sequential bets is $80. I got this value from Figure 2, as the average mean of each of the 1000 simulations ends up being $80 after around 200 bets. As discussed in #1, since we have a 100% chance of winning $80 within 1000 sequential bets, we can safely state that the expected value within 1000 sequential bets is 80.
3. In Experiment 1, the standard deviation doesn't reach a maximum value and converge or stabilize. Instead, it is all over the place and then ends up going to 0 as the mean of the winnings stabilizes at $80. This makes sense as all of the winnings end up being $80, and so there is no variance between the winnings. This leads to the standard deviation being 0 as the mean winnings of Experiment 1 stabilize.
4. In Experiment 2, I believe that the probability of winning $80 within 1000 sequential bets is around 66%. This is because from Figure 4, I can see that the average mean of the winnings (or the expected value) is around -40, and I assume that most of the time we either hit $80 in winnings and stay there or lose 256 dollars(all of our money) and stay there. There is a very little chance of us ending up with winnings in between that, so I disregard that possibility. Based on that, I can say that 80x + (-256)y = -40, and x + y = 1, with x and y being the probability that I end up with 80 and -256 respectively. Solving those equations, I ended up with x = approx. 2/3 and y = approx. 1/3. Thus, the probability of winning $80 is 66%.
5. Similar to #2, I look at the graph of the average means, which for Experiment 2, is Figure 4. Figure 4 shows that the average mean stabilizes around -40 for the experiment, and so we can say that our expected value for Experiment 2 is -40.
6. In Experiment 2, the standard deviation definitely reaches a maximum and then stabilizes at the maximum as the number of sequential bets increases. This is because the winnings also stabilize as being either $80 or $-256. As most of the winnings fall into one of these two categories, the standard deviation stabilizes as the variance between these two categories. There is no more fluctuation.

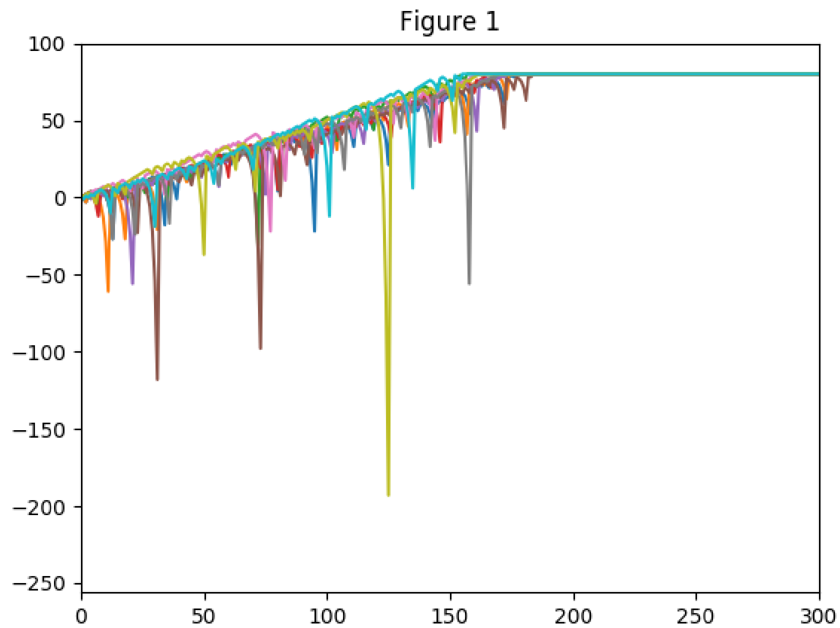
Figure 1
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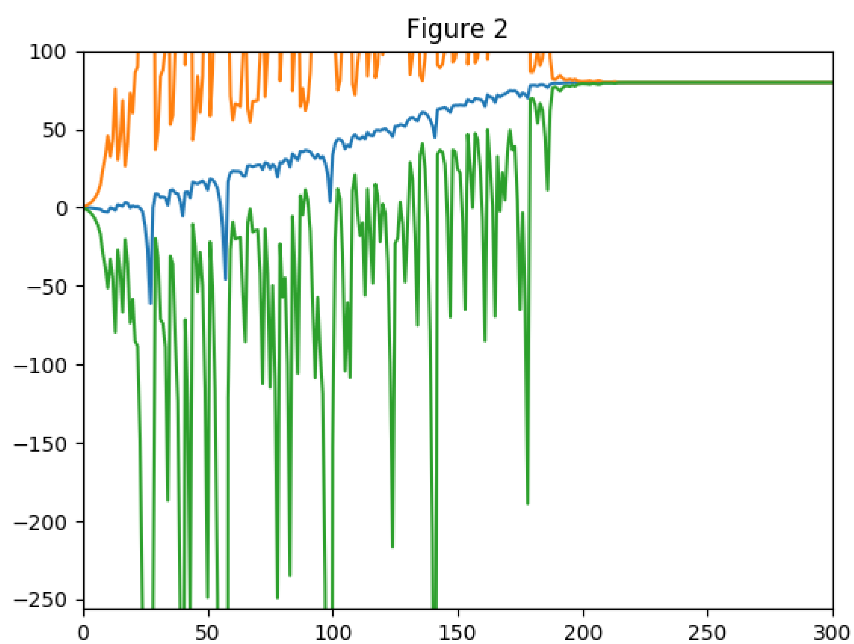
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Figure 3

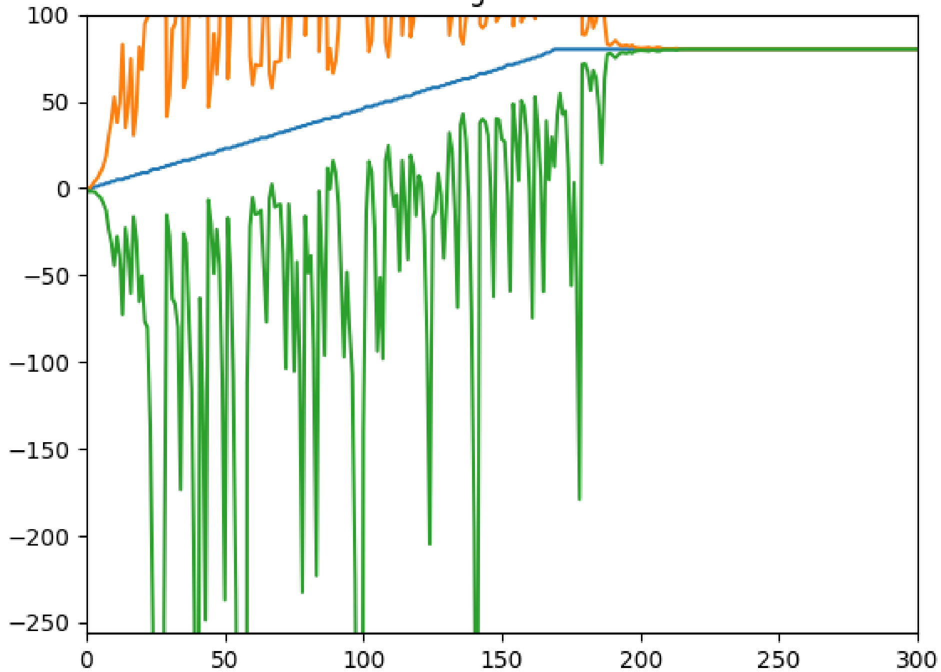
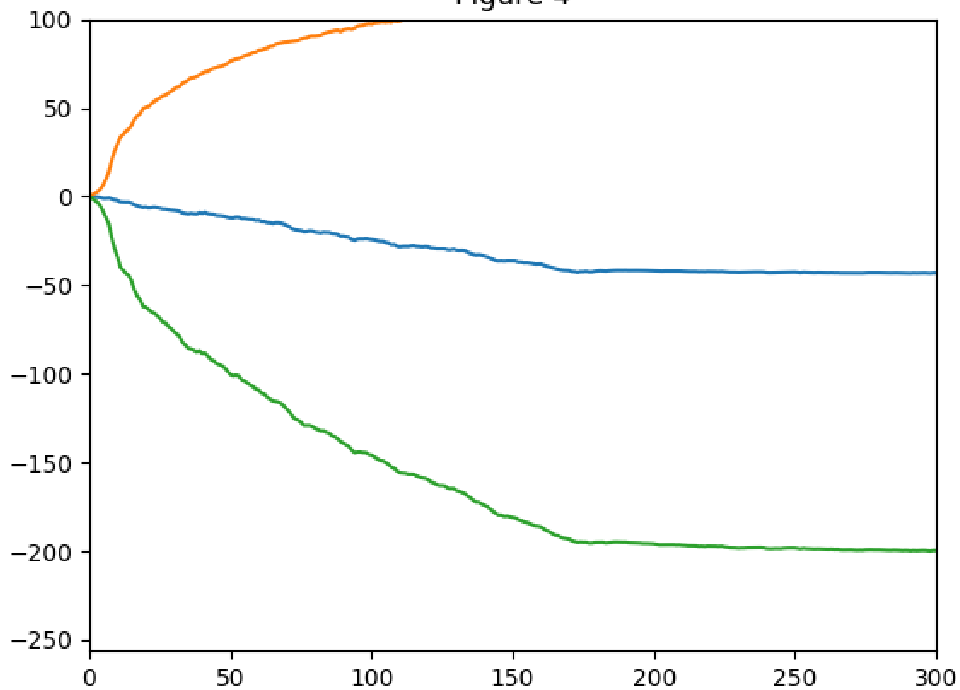


Figure 4



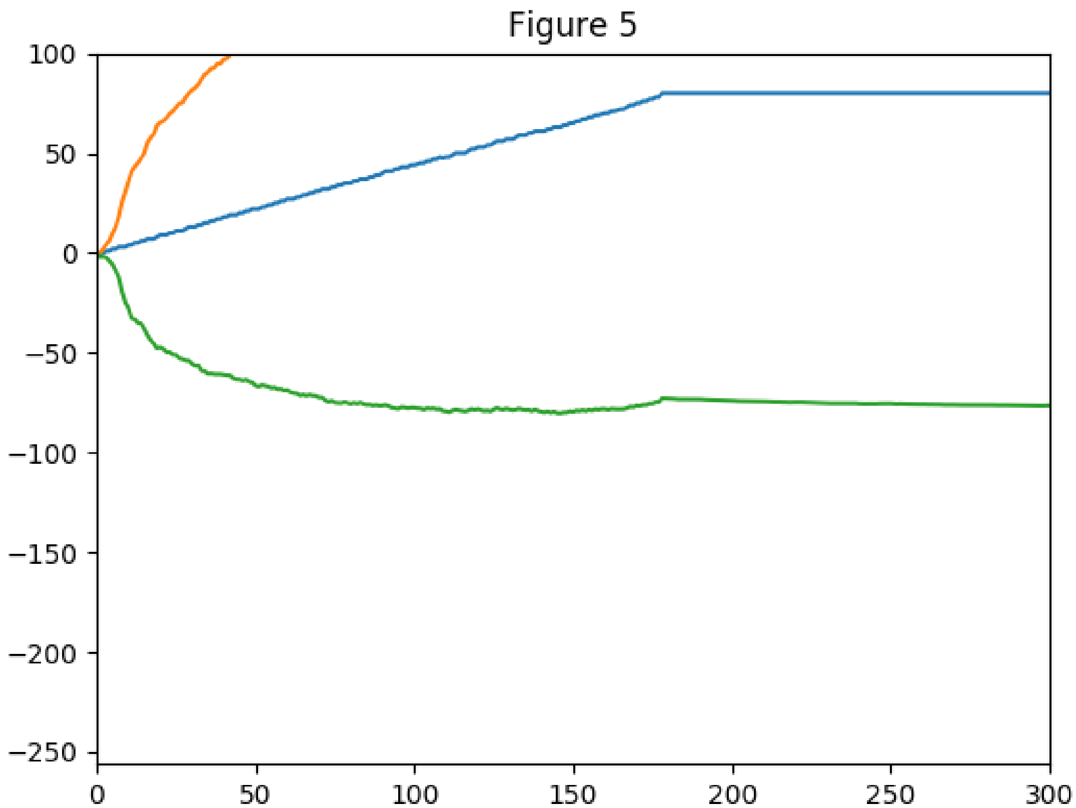


Figure 5
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