Sample - Do Not Remove

Lab 6- Where's the Goat?

The goal of this lab was to decide the best strategy for the "Where's the Goat?" game in order to become 'rich and famous'.

1. My initial guess for the probabilities of staying vs. switching choices was that switching would give you a 2 in 3 chance of winning and staying would give you a 1 in 3 chance of winning. why these prob?
2. In looking at Figure 1, we can see that the frequency values begin to level out after more and more test runs are done. This helps to show what the probability of each strategy is. The probability of an outcome is the proportion of times that the outcomes would occur in a very long series of repetitions. One can see that after a long simulation of tests, the relative frequency values for each strategy becomes pretty stable, thus the probability of each of those strategies are probably very close to the last relative frequency value.

Table 1- Multiple Simulation Results

	Switch	Stay	Total
Games	250	250	500
Wins	151	81	232
% Wins	60%	32%	

3. Based on the simulation results for performing the test for a very long period of time, I came to the conclusion that the optimal strategy for winning was to switch curtains when given the option.
4. The probabilities of winning became a more regular number as I took more observations. The probability of the switch strategy tended to stay around 60% and the probability of the stay strategy tended to stay around 30%, and having an end value of 32%.
5. I ran the observation for long enough to get a stable (nonfluctuating) probability value for at least one of the strategies. I also wanted to get to a nice even amount of simulations as well, so at 500, which was 250 for each of the strategies, I stopped. The % Wins for the switch column had also been stable for a number of simulations, so this made me feel comfortable with stopping.
6. Based on the simulation results and the data in Table 1, we can see that the probability of winning a car if you switch is about 60%, or p=0.6, or 6 out of 10 times. The probability of winning a car if you stay is about 32%, or p=.32, or 3.2 out of 10 times. careful The basic probability rules state that when finding a probability, the values calculated must be between 0 and 1 and all of the probabilities must add up to one, which they do in the calculation of the probabilities. These rules along with the multiplication rule were used in the tree diagram (see Figure 2) calculations to find out the probability of winning the car. The multiplication rule was used in determining the probability of the strategies because for the 1st choice, you have three options, which would

give every one of the options a 1/3 chance of being the winner. After you pick the curtain, the host will show you a curtain that has a goat behind it. In each of the multiply spaces, that is the chance that the host will show you what is behind that curtain. These chances are based on the assumption that the car is behind curtain A. Since the car is behind curtain A, there is no chance that the host will show you that curtain, thus the zero. Next, you determine if the person will win or lose based on the strategy and write that in the spaces below each strategy. You then multiply the chance that resulted from the 1st selection (1/3) by the chance that the host will show you that curtain and write it by each win that was written. Then the addition rule for probabilities allows you to add the sum of the probabilities for wins because the ways that one can win cannot happen simultaneously. These sums give us the probability that we will win depending on what strategy we choose. good description ✓

Figure 2- Tree Diagram for Finding the Probability

1st curtain choice	host shows...	multiply	results if stay (win or lose)	results if switch (win or lose)
1/3 A	B	1/2	win 1/6	lose
	C	1/2	win 1/6	lose
1/3 B	A	0	lose	—
	C	1	lose	win 1/3
1/3 C	A	0	lose	—
	B	1	lose	win 1/3
Sum of Probabilities for wins:			2/6 = 1/3	2/3

good ✓

7. In calculating the probabilities of each of the strategies using the tree branch technique (see Figure 2), I came to the conclusion that a person had a better chance of winning the car if they switched curtains. With the switch curtain strategy, a person has a 2/3 chance of winning, while a person who chooses to stay with the curtain that they originally chose has only a 1/3 chance of winning. good ✓
8. The curtain that the person starts with does not really matter when the game show is being played and a person has only one chance to pick their strategy. In doing the simulations however, it is important that we only choose one curtain so that there will be no chance for biased error. By doing the experiment over and over in the exact same way, we will have much more accurate results than if we varied the curtains that were chosen first as well. That could be a whole other test in itself. −1/2 - no b/c each game independent of one another
9. The probability calculations agreed with the computer simulations. The computer simulation for the probability of staying was about p=.32 and the probability calculations showed that p=.33. The computer simulation showed that the probability for switching was about p=.6 and the probability

calculations showed that p=.66. They were very close to each other in value and they might have gotten even closer if the simulation on the computer had been run longer. √

10. The simulation calculations and the calculated values for the probabilities of each of the strategies are expected to be very close if not the same. Since the probability is the proportion of times that the outcomes would occur in a very long series of repetitions and the likelihood of it occurring, it can be calculated and simulated/tested. The results from both of these methods should be the same however. The computer simulation was the proportion of times that outcomes would occur in a long series of repetitions. The calculations using the tree branching method tells us the likelihood if it occurring. The reasons that these answers should be similar is because they are measuring the same thing. If they were very different, then we would know that there was a mistake in the calculations or a bias in the tests that were run. In a sense, this is a way that we can double check our results and make sure that there is a not a big mistake somewhere in our calculations or data. Small differences between the results could mean that there were not enough tests run to reach the stable probability.
11. If asked, I would tell someone that it is better to switch than to stay with the first choice when playing the car game. If they could picture a pie chart with colored sections of red with 2/3 colored in and blue with 1/3 colored in, and standing on a ladder in the air and dropping a coin onto the pie chart. The coin will most likely land on the color that has the most area. The same concept applies to the curtains. Since there are more curtains that have goats behind them then there are cars, it is most likely that the curtain that you initially choose will be one that has a goat behind it. When the host shows you the curtain that has the other goat behind it, and you take into account the assumption that the first curtain choice that you had was probably a goat too, your best choice would be to switch to the one that is left.

perhaps not same scenario

−1/2 better to switch over the long run

very thorough answers +10

+25/25