

THE MONTY HALL PROBLEM

Picture the following scenario:

You are at the final stage of a game show. In front of you stands three doors. For ease of reference, they are labelled as A, B, and C in order of left to right. Behind one door lies the prize you have been competing for (a brand-new car, for example). The other two doors hold goats. Pick the wrong door, and you get nothing.

The game show host requests that you choose a door. Let us say the chosen door is B. Then the game show host, who knows what is behind each door, goes over and opens C. Revealed behind it is a goat. Now, the host asks you if you would like to switch your choice to A.

At this point, most assume the probability of winning to be 50%. It is natural to do so, since we consider only two options A and B. However, the solution to the Monty Hall Problem says that there is a higher probability of winning if you switch.

Let us consider the case where you picked B as the door and refused to switch.

1. Now if the car was behind A, the host would open C, and you would obviously lose.
2. If the car was behind C, the host would open A, and you would lose in this scenario as well.
3. Finally, if the car was behind B the entire time, you would win.

Thus, if you do not switch, there is a $\frac{1}{3}$ chance of winning the car (ie. a 66.6% chance of losing).

Now, say you chose B and decided to switch every time

1. If the car was behind A, the host would open C, you would switch to A and win the car
2. If the car was behind C, the host would open A, you would switch to C and win.
3. Finally, if the car was behind B the entire time, you would lose.

Thus, by switching every time, your chances of winning go from $1/3$ to $2/3$, (ie. from 33.3% to 66.6%)

The Monty Hall Problem originated from a 1975 letter written by Steve Stelvin to *The American Statistician* titled “A Problem In Probability” and was named after Monty Hall, the host of the television game show ‘*Let’s Make A Deal*’, which inspired the scenario of choosing three doors to win a prize. Marilyn vos Savant went on to popularise, describe, and solve the problem in 1990, in her “*Ask Marilyn*” column in the *Parade* magazine.