THE MONTY HALL PROBLEM

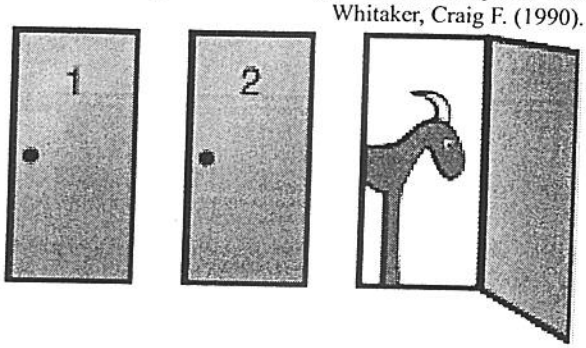
22/25

The Monty Hall problem is a puzzle involving probability loosely based on the American game show *Let's Make a Deal*. The name comes from the show's host, Monty Hall. A widely known statement of the problem is from Craig F. Whitaker of Columbia, Maryland in a letter to Marilyn vos Savant's September 9, 1990, column in *Parade Magazine*.

The Problem

Suppose you're on a game show, and you're given the choice of three doors: Behind one door is a car; behind the others, goats. You pick a door, say No. 1, and the host, who knows what's behind the doors, opens another door, say No. 3, which has a goat. He then says to you, "Do you want to pick door No. 2?" Is it to your advantage to switch your choice?

Whitaker, Craig F. (1990). [Letter]. "Ask Marilyn" column, *Parade Magazine* p. 16 (9 September 1990).



1. When you are given the choice of the three doors, what is the probability you choose the door with the car? Explain how you determined this.

There is a 33.3% chance of getting the car. There are 3 choices to choose from. +1/1

2. After the game show host opens one of the doors with a goat behind it, what is the probability the door you have chosen has the car behind it? Explain how you determined this.

There is a 50% chance of getting the car. There are two choices to choose from. +1/1

3. Should you switch doors or stay with the one you have already chosen? What does your intuition say? +1/1

My intuition tells me to stay with the door I have already chosen.

4. Create a simulation of the Monty Hall Problem. Describe your simulation in detail. Make sure your simulation is random – you do not want a pattern of any kind.

put two white chips and one blue chip with one under each cup and mix them up and have someone try to pick the blue chip. +2/5

More details...
Is this random?

5. Perform the simulation with a partner. Each person should run the simulation 30 times.

Trial Number	Switch? (Yes or No)	Won the Car? (Won or Lost)
1	No	Won
2	Yes	Won
3	No	Lost
4	Yes	Won
5	No	Lost
6	Yes	Won
7	Yes	Won
8	No	Lost
9	No	Won
10	No	Won
11	Yes	Won
12	Yes	Won
13	No	Won
14	Yes	Lost
15	No	Won
16	No	Lost
17	Yes	Won
18	No	Won
19	Yes	Won
20	No	Won
21	Yes	Lost
22	No	Won
23	No	Lost
24	No	Lost
25	Yes	Won
26	No	Won
27	Yes	Lost
28	No	Lost
29	No	Won
30	Yes	Won

+5/5

Record your **own** results in the table.

# of times switched
13

# of times no switch
17

# of times won after stayin
10

# of times won after switching
10

After 30 trials, switch rolls and repeat the simulation 30 more trials for your partner.

6. Use your results from the table to complete the information below.

a. **Probability of winning the car after switching doors** = $\frac{10}{13}$ = 76.9% +2/2

b. **Probability of winning the car after not switching doors** = $\frac{10}{17}$ = 58.8% +2/2

Record your results on the board to obtain class data.

7. Using the class data.

a. **Probability of winning the car after switching doors** = $\frac{170}{239}$ = 71.1% +2/2

b. **Probability of winning the car after not switching doors** = $\frac{84}{240}$ = 35% +2/2

8. After performing the simulation….after the game show hose opens one of the doors with a goat behid it, what is the probability the door you have chosen has the car behind it? How does the compare to what you had said in question #2?

There is about a 35% chance that the door you chose has the car. There is a lower chance than #2. +2/2

9. Is it to your advantage to switch doors after you have been shown the goat? Explain your reasoning.

Yes because in our data there is a 71.1% chance of winning after switching doors which is better than a 35% chance of winning and not switching doors. +1/1

10. In questions #6-9, you used relative frequency probability to determine the probability of winning the car if you switch doors or choose not to switch. Use a different method to determine the probability of winning the car if you switch doors or choose not to switch doors. Show your work.

Goat ~~Goat~~ Car
Goat Car ~~Goat~~
Car Goat ~~Goat~~

There is 2/3 chance of getting a goat and odds are you choose a goat. There is a 71.1% chance of winning after switching doors. +5/5