

## MATH 119, CHAPTER 3: PROBABILITY

### THE MONTY HALL PROBLEM: WHEN INTUITION FAILS!

Marilyn vos Savant, who has a record-breaking IQ, writes a column called “Ask Marilyn” for *Parade* magazine. One of her columns caused an uproar that led statistics PhDs to write in letters saying that she was wrong. She was correct! The uproar was over her analysis of a game show ....

Monty Hall was the host of the game show “Let’s Make a Deal.” At the end of the show, a contestant would be shown three doors. The grand prize, usually a new car, was behind one of the doors. Gag prizes, such as a goat, were behind the other two doors. The contestant would pick a door. Monty Hall would then show what was behind one of the other doors, and there would always be a goat. The contestant could then either stick with the door s/he chose, or s/he could switch to the other door that Monty hadn’t opened yet.

Question: What is the probability that the contestant will win if s/he switches, as opposed to sticking with his/her first choice? Is it 0.5?

We will form teams of two people. One person **with clean hands** will play Monty Hall. The other person will play the Contestant. I will give Monty three cards. Exactly one of the three cards will be a Jack, a Queen, a King, or an Ace; this card will represent the car. The other two cards will be numbered cards (2-10); they will represent goats. Monty will secretly shuffle the three cards and place them face down in front of the Contestant; Monty must remember which card is the car. The Contestant picks a card, but Monty does not turn it over.

- If the Contestant has picked a goat, then Monty must turn over the **other** card that is a goat.
- If the Contestant has picked the car, then Monty can turn over **either** of the other two cards; they’re both goats.

In our experiment, the Contestant **must switch** to the other unturned card. Monty then turns over this card. If it is the car, then put a check under “Won when switched.” If it is a goat, then put a check under “Lost when switched.”

Repeat until 18 rounds are completed. Count the numbers of “Wins” and “Losses.”

#### Example 1

Card A is the car. Cards B and C are goats.  
The Contestant picks card B. Monty must then turn over card C (the other goat).  
The Contestant must switch to card A. Monty then reveals that the Contestant has won the car! Check “Won when switched.”

#### Example 2

Card A is the car. Cards B and C are goats.  
The Contestant picks card A. Monty can turn over either card B or card C. Let’s say Monty turns over card B. The Contestant must switch to card C. Monty then reveals that the Contestant has won a goat. Check “Lost when switched.”  
(I don’t care if you like goats....)

**Won when switched**

**Lost when switched**

Round 1

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Round 2

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Round 3

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Round 4

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Round 5

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Round 6

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Round 7

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Round 8

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Round 9

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Round 10

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Round 11

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Round 12

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Round 13

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Round 14

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Round 15

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Round 16

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Round 17

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Round 18

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**Total #**

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