The Monty Hall problem in Excel: demo notes

Download the exercise file: monty-hall.xlsx

This thought experiment comes from the television show *Let's Make a Deal!*

- Behind three doors randomly lie two goats and a car, respectively.
- You pick a door.
- Monty opens another door: it has a goat.
- Do you stick to your door, or switch doors? *Does it matter?*

Let's simulate 1,000 rounds of the Monty Hall problem and see whether one strategy works better.

We will use emojis inside conditional formatting to make our simulations come to life. 🎉

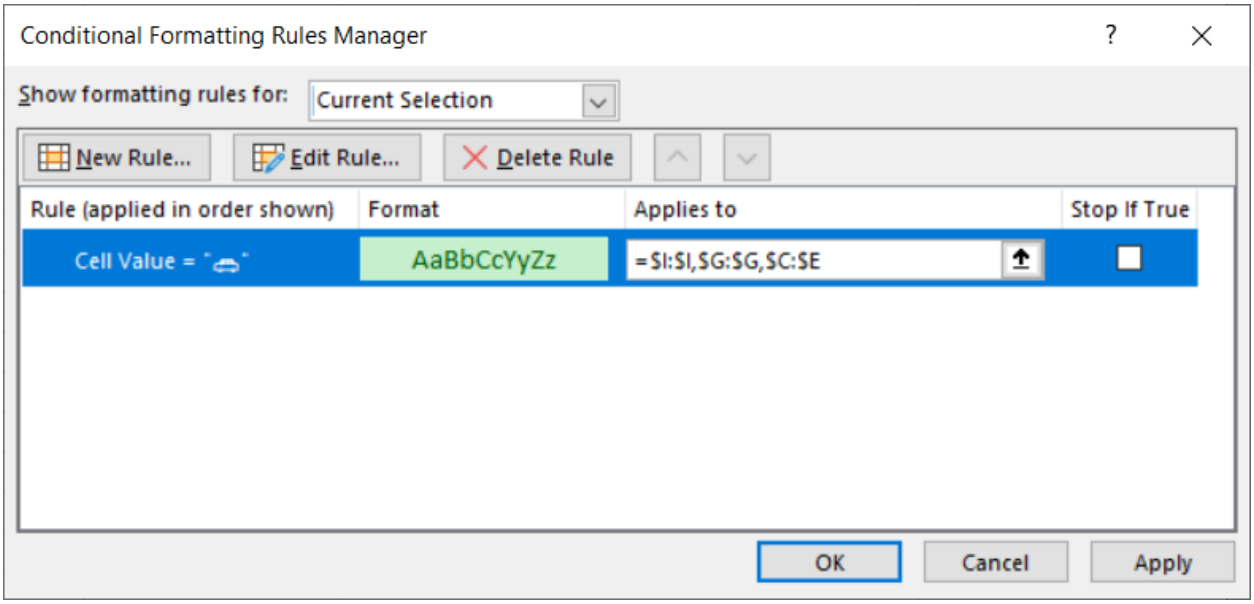
You can insert emojis on Windows with the keyboard shortcut `Ctrl + ;`. For Mac, it's `Ctrl + Cmd + Space`.

1. Enter the following formulas into the table:

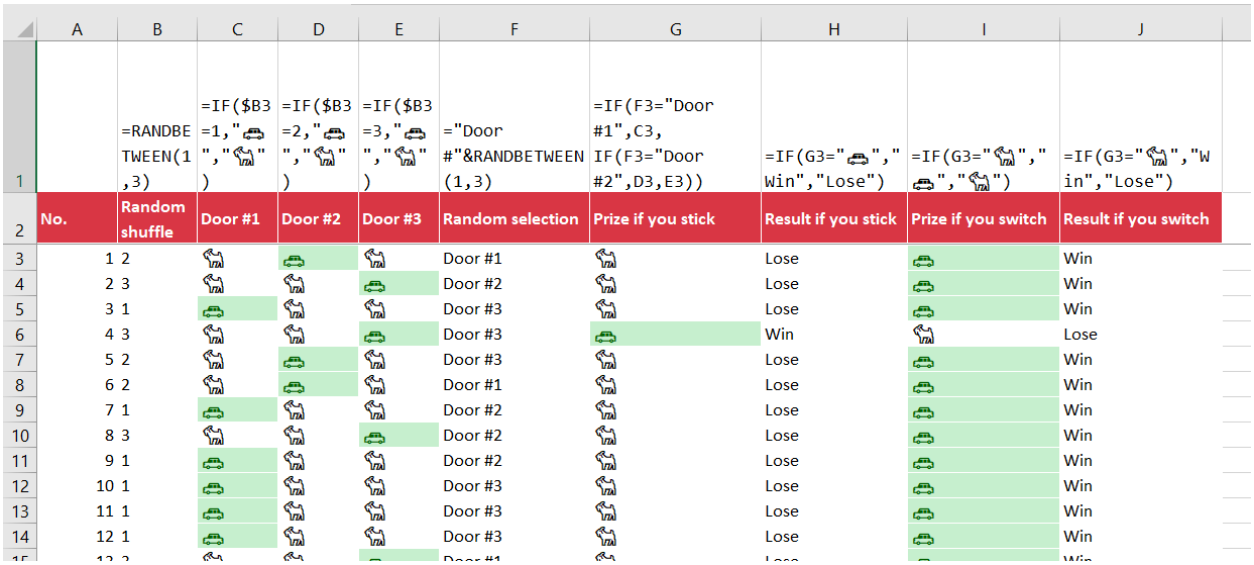
Column reference	**Column label**	**Formula used**	**Description**
B	Random shuffle	`=RANDBETWEEN(1,3)`	This is used to randomly shuffle our prizes behind the doors.
C	Door #1	`=IF($B3=1,"🚗","🐐")`	Assign a car or goat to this door.
D	Door #2	`=IF($B3=2,"🚗","🐐")`	Assign a car or goat to this door.
E	Door #3	`=IF($B3=3,"🚗","🐐")`	Assign a car or goat to this door.

F	Random selection	="Door #"&RANDBETWEEN(1,3)	Let's pick a door at random.
G	Prize if you stick	=IF(F3="Door #1",C3, IF(F3="Door #2",D3,E3))	Here's what we win if we stick with that door.
H	Result if you stick	=IF(G3="🚗","Win","Lose")	Did we win or lose by sticking?
I	Prize if you switch	=IF(G3="🐐","🚗","🐐")	Here's what we win if we switch doors.
J	Result if you switch	=IF(G3="🐐","Win","Lose")	Did we win or lose by switching?

2. Conditional formatting is set to turn the cells with a car emoji green in columns C, D, E, G and I.



Our resulting simulation looks like this:



	A	B	C	D	E	F	G	H	I	J
1		=RANDBETWEEN(1,3)	=IF($B3=1,"🚗","🐐")	=IF($B3=2,"🚗","🐐")	=IF($B3=3,"🚗","🐐")	="Door #"&RANDBETWEEN(1,3)	=IF(F3="Door #1",C3,IF(F3="Door #2",D3,E3))	=IF(G3="🚗","Win","Lose")	=IF(G3="🐐","🚗","🐐")	=IF(G3="🐐","Win","Lose")
2	No.	Random shuffle	Door #1	Door #2	Door #3	Random selection	Prize if you stick	Result if you stick	Prize if you switch	Result if you switch
3	1	2	🐐	🚗	🐐	Door #1	🐐	Lose	🚗	Win
4	2	3	🐐	🐐	🚗	Door #2	🐐	Lose	🚗	Win
5	3	1	🚗	🐐	🐐	Door #3	🐐	Lose	🚗	Win
6	4	3	🐐	🐐	🚗	Door #3	🚗	Win	🐐	Lose
7	5	2	🐐	🚗	🐐	Door #3	🐐	Lose	🚗	Win
8	6	2	🐐	🚗	🐐	Door #1	🐐	Lose	🚗	Win
9	7	1	🚗	🐐	🐐	Door #2	🐐	Lose	🚗	Win
10	8	3	🐐	🐐	🚗	Door #2	🐐	Lose	🚗	Win
11	9	1	🚗	🐐	🐐	Door #2	🐐	Lose	🚗	Win
12	10	1	🚗	🐐	🐐	Door #3	🐐	Lose	🚗	Win
13	11	1	🚗	🐐	🐐	Door #3	🐐	Lose	🚗	Win
14	12	1	🚗	🐐	🐐	Door #3	🐐	Lose	🚗	Win

3. We can now count the number of times we win by sticking versus switching:
   a. `=COUNTIF($H$3:$H$1002,"Win")`
   b. `=COUNTIF($J$3:$J$1002,"Win")`

It turns out that we win about two-thirds of the time when we switch. Why?

Interpretation

A contestant gains to benefit from switching in the Monty Hall problem because Monty reveals more information about the placement of the car after opening a door to one of the goats:

- When you pick the first door, you have a 33% chance of picking the car.
- That leaves 66% of the doors “unanswered.”
- Monty opens another door: it has a goat. You *know* this door doesn’t have a car.
    - You are now twice as likely to find the car in that second door than the first door, because the 66% likelihood has been “pushed into” one door.

Credits

My workbook demonstration is heavily borrowed from the post “Monty Hall Problem Simulation in Excel.”

Special thank-you to Numberphile's Monty Hall Problem video and Statistics by Jim's Monty Hall Problem blog post for further understanding of the problem.