In a tv show you’re given the choice of three doors: behind one door is a car; behind the others, goats. Let’s say you pick door No. 1. 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?
Monty Hall game

- Based on the American television game show *Let’s Make a Deal*
- One car behind one of three doors, the other two have a goat behind them.
- Player selects one, say Door No. 1.
- Before opening this door, the host (who knows what is behind each door), opens one of the other two doors, say door No. 3, and shows a goat.
- Host now offers to change selection.
- Issue: Is there any point in changing?
- Vote:
  A. the car is equally likely to be behind door No. 1 and door No. 2
  B. the car is more likely to be behind door No. 2
Very popular problem

• It got popular as a question from a reader’s letter in a magazine in 1990 (see pp. 213-215 in the textbook)

• Explained by Kevin Spacey (actually one of his students) in the movie 21
  http://www.youtube.com/watch?v=Zr_xWfThjJ0

• A (pretty boring!) game online
  http://math.ucsd.edu/~crypto/Monty/monty.html

• Known also under other variants: e.g. the problem of the three prisoners (see p. 216 in the textbook)

• Paul Erdos, one of the most famous and active mathematicians in history, got convinced about the solution only after seeing a Monte Carlo simulation.
Monty Hall game

- Let’s say that you choose door 1
- What is random?
  - which door has the car
  - which door the host opens

<table>
<thead>
<tr>
<th>given car behind door</th>
<th>Pr Host opens door</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

where we implicitly introduced the notion of conditional probability

- Which door to choose is a policy, so not random (switch vs don’t switch)
- We first run a simulation, and then use probability arguments
Monte Carlo simulation

Check the syntax by downloading `Monty_Hall.xlsx` from the course webpage.