8.2) The Monty Hall Problem

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Reference

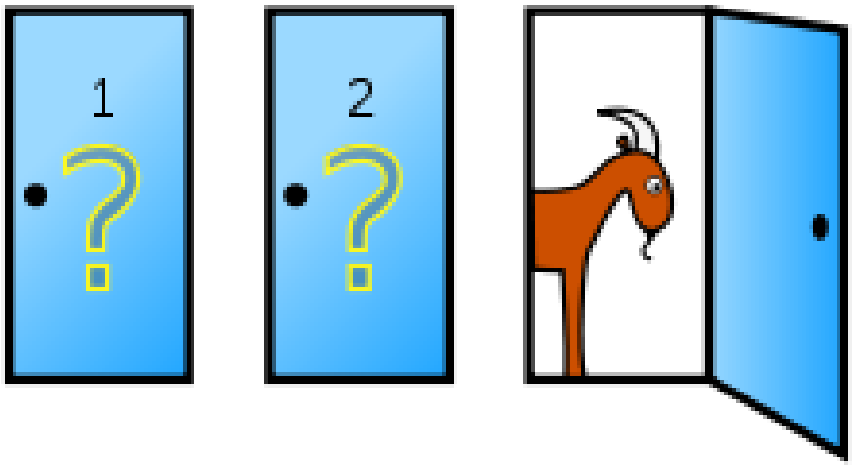
Tables, Graphics, and Figures from

Computational and Inferential Thinking: The Foundations of Data Science

Adhikari & DeNero (2019): Ch 9.4 The Monty Hall Problem

https://www.inferentialthinking.com/

The Monty Hall Problem



The chance that the car is behind the originally chosen door is 1/3

$\therefore$ the chance that the car is behind the door that remains is 2/3

Setting up the Goats

```
import numpy as np
from datascience import *
```

```
goats = make_array('first goat', 'second goat')
```

```
array(['first goat', 'second goat'], dtype='<U11')
```

```
def other_goat(x):
    if x == 'first goat':
        return 'second goat'
    elif x == 'second goat':
        return 'first goat'
```

```
hidden_behind_doors = make_array('car', 'first goat', 'second goat')
```

```
array(['car', 'first goat', 'second goat'], dtype='<U11')
```

Simulating One Play

```
def monty_hall_game():
    """Return [contestant's guess, what Monty reveals,
    what remains behind the other door]"""

    contestant_guess = np.random.choice(hidden_behind_doors)

    if contestant_guess == 'first goat':
        return [contestant_guess, 'second goat', 'car']

    if contestant_guess == 'second goat':
        return [contestant_guess, 'first goat', 'car']

    if contestant_guess == 'car':
        revealed = np.random.choice(goats)
        return [contestant_guess, revealed, other_goat(revealed)]
```

```
monty_hall_game()
```

```
['car', 'second goat', 'first goat']
```

Play the Game 10,000 times

```
games = Table(['Guess', 'Revealed', 'Remaining'])
# Play the game 10000 times and
# record the results in the table games
for i in np.arange(10000):
    games.append(monty_hall_game())
```

```
original_choice = games.group('Guess')
```

```
remaining_door = games.group('Remaining')
```

Guess	count
car	3339
first goat	3343
second goat	3318

Remaining	count
car	6661
first goat	1660
second goat	1679

Join the Two Tables

```
joined = original_choice.join('Guess', remaining_door, 'Remaining')
combined = joined.relabeled(0, 'Item').relabeled(1,
                'Original Door').relabeled(2, 'Remaining Door')
```

Item	Original Door	Remaining Door
car	3339	6661
first goat	3343	1660
second goat	3318	1679

Twice as likely to Win if Switches the Door

```
%matplotlib inline
import matplotlib.pyplot as plots
plots.style.use('fivethirtyeight')
combined.barh(0)
```