

# BC COMS 1016: Intro to Comp Thinking & Data Science

## Lecture 9 –

## Monty Hall & Probability

# Announcements



- HW03 - Functions, Histograms, and Groups
  - Due Tonight (Thursday 11/12)
- Lab 04 - Lab 4 – Simulations
  - Due Friday (11/13)
- HW04 - Applying Functions and Iteration
  - Due Monday (11/16)
- Checkpoint/Project 1:
  - Paired assignment that covers the previous section of the course material
  - Due Wednesday (11/18)
  - Recommended to complete first 8 questions by beginning of next week



# Control Statements

# Control Statements



These statements *control* the sequence of computations that are performed

- The keywords **if** and **for** begin control statements
- The purpose of **if** is to define functions that choose different behavior based on their arguments
- The purpose of **for** is to perform a computation for every element in a list or array

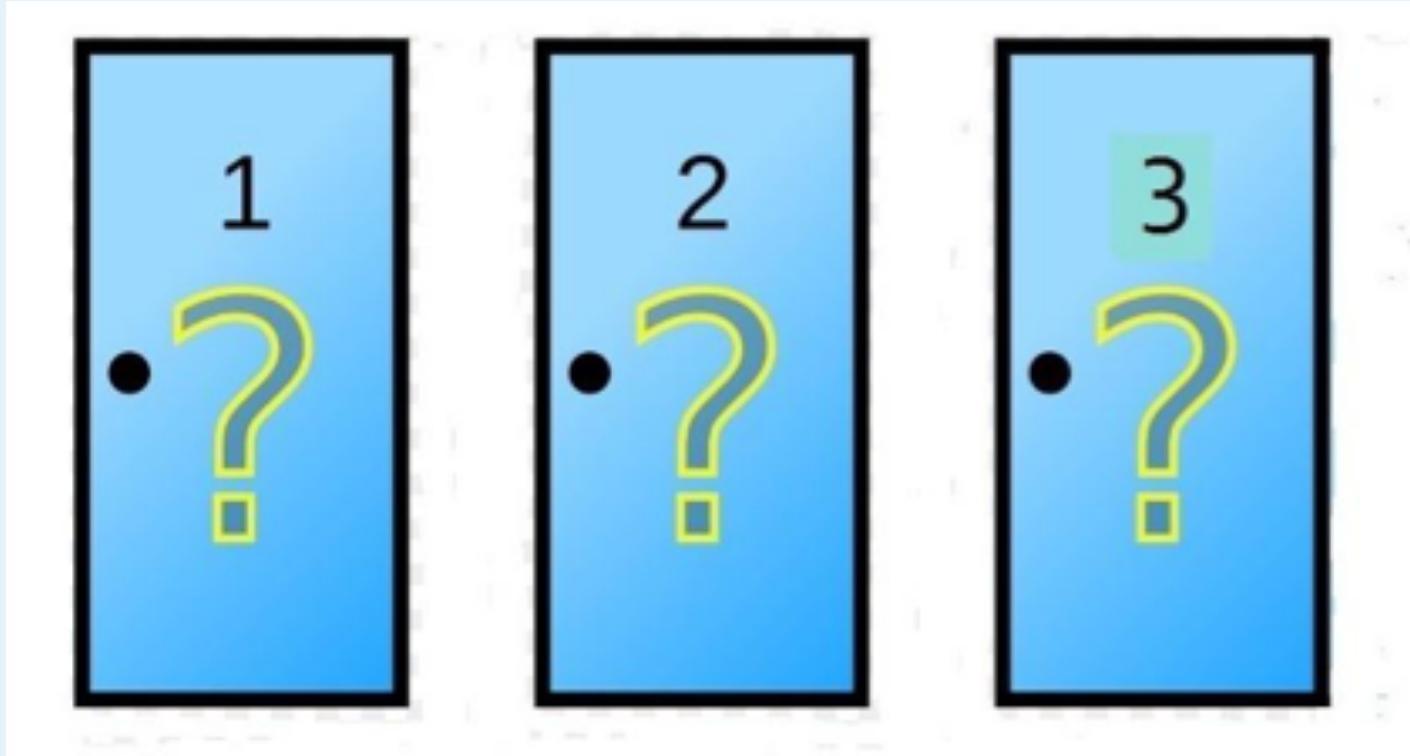


# Monty Hall Problem





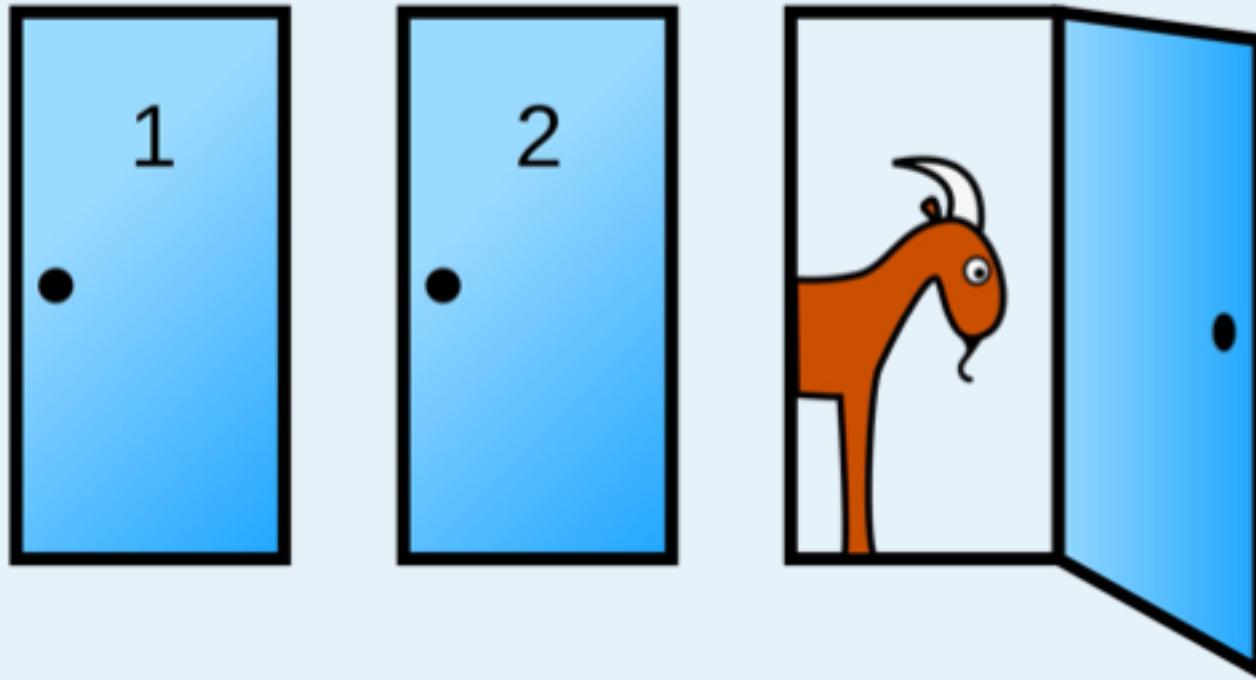
# Monty Hall Problem



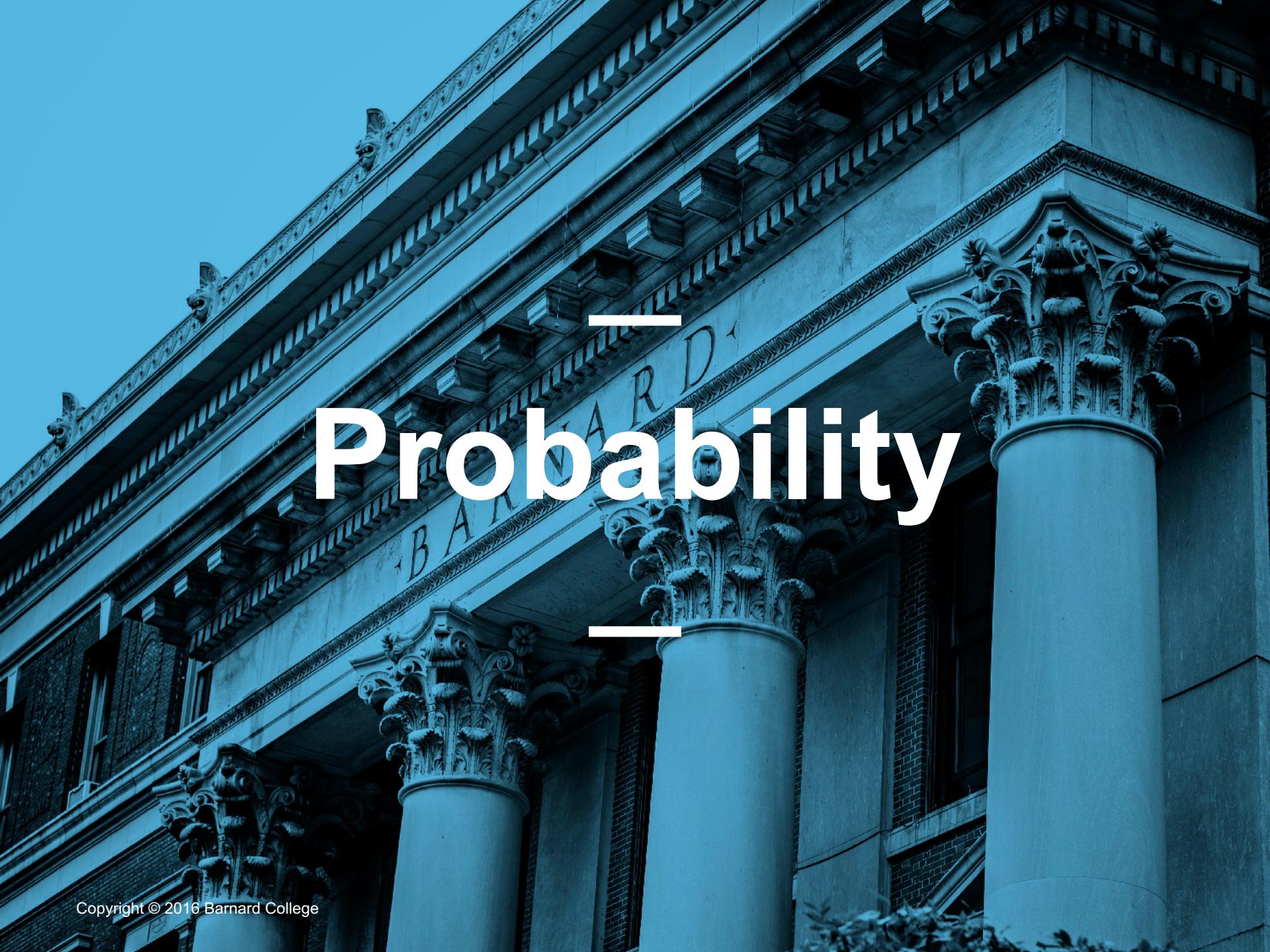
<https://probabilityandstats.files.wordpress.com/2017/05/monty-hall-pic-1.jpg>



# Monty Hall Problem



[https://en.wikipedia.org/wiki/Monty\\_Hall\\_problem](https://en.wikipedia.org/wiki/Monty_Hall_problem)



# Probability



- **Lowest value:** 0
  - Chance of event that is impossible
- **Highest value:** 1 (or 100%)
  - Chance of event that is certain
- **Complement:** If an event has chance 70%, then the chance that it doesn't happen is:
  - $100\% - 70\% = 30\%$
  - $1 - 0.7 = 0.3$

# Equally Likely Outcomes



**Assuming** all outcomes are equally likely, the chance of an event A is:

$$P(A) = \frac{\text{number of outcomes that make } A \text{ happen}}{\text{total number of outcomes}}$$



# A Question

- I have 3 cards: **ace of hearts**, **king of diamonds**, and **queen of spades**
- I shuffle them and draw two cards at *random without replacement*.
- What is the chance that I get the Queen followed by the King?

# Multiplication Rule



Chance that two events  $A$  and  $B$  both happen

=  $P(A \text{ happens}) \times P(B \text{ happens given that } A \text{ has happened})$

- The answer is *less than or equal* to each of the two chances being multiplied
- The more conditions you have to satisfy, the less likely you are to satisfy them all

# Another Question



- I have 3 cards: **ace of hearts**, **king of diamonds**, and **queen of spades**
- I shuffle them and draw two cards at *random without replacement*.
- What is the chance that one of the cards I draw is King and the other is Queen?

# Addition Rule



If event  $A$  can happen in *exactly one* of two ways, then

$$P(A) = P(\text{first way}) + P(\text{second way})$$

- The answer is *greater than or equal* to the chance of each individual way



# Complement: At Least One Head

- In 3 tosses:
  - Any outcome except TTT (tails, tails, tails)
  - $P(TTT) = (1/2) \times (1/2) \times (1/2) = 1/8$
  - $P(\text{at least one head}) = 1 - P(\text{TTT}) = 1 - (1/8) = 87.5\%$
  
- In 10 tosses:
  - $1 - (1/2)^{10} \cong 99.9\%$