DATA 8

Spring 2022

Lecture 14

Chance

Announcements

Iteration

`for` Statements

- `for` is a keyword that begins a multiline `for` statement.
- Executing a `for` statement performs a computation for every element in a list or array.
- A common special case is to perform a computation a fixed number of times.

(Demo)

Anatomy of a for loop

Example:

variable name

array of values

```
for item in some_array:
    print(item)
```

indent

code to evaluate in each iteration of for loop

Finding Chances

Basics

- **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:

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

A Question

- I have three 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* happens) x P(*B* happens given that *A* 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 three 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 is a 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 6

(Demo)

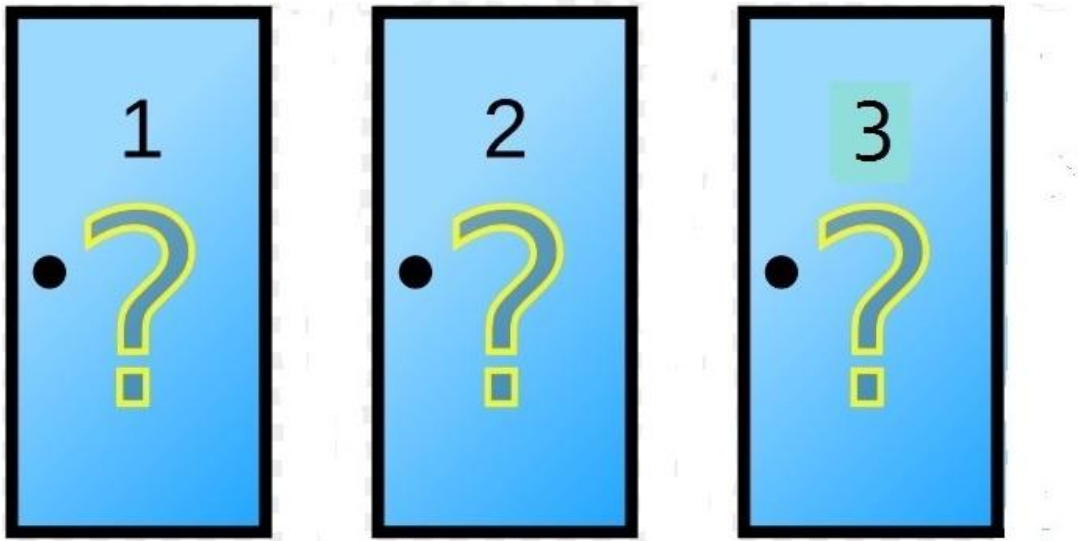
Problem-Solving Method

Here's a method that works widely.

- Ask yourself what the first trial has to be. If there's a clear answer (e.g. "not a six") whose probability you know, almost certainly you can continue the process with the multiplication rule.
- If there's no clear answer (e.g. "could be K, could be Q, but then the next one would have to be Q, or K …"), list all the distinct ways your event could occur and add up their chances.
- If the list above is long and complicated, look at the complement. If the complement is simpler (e.g. the complement of "at least one" is "none"), you can find its chance and subtract that from 1.

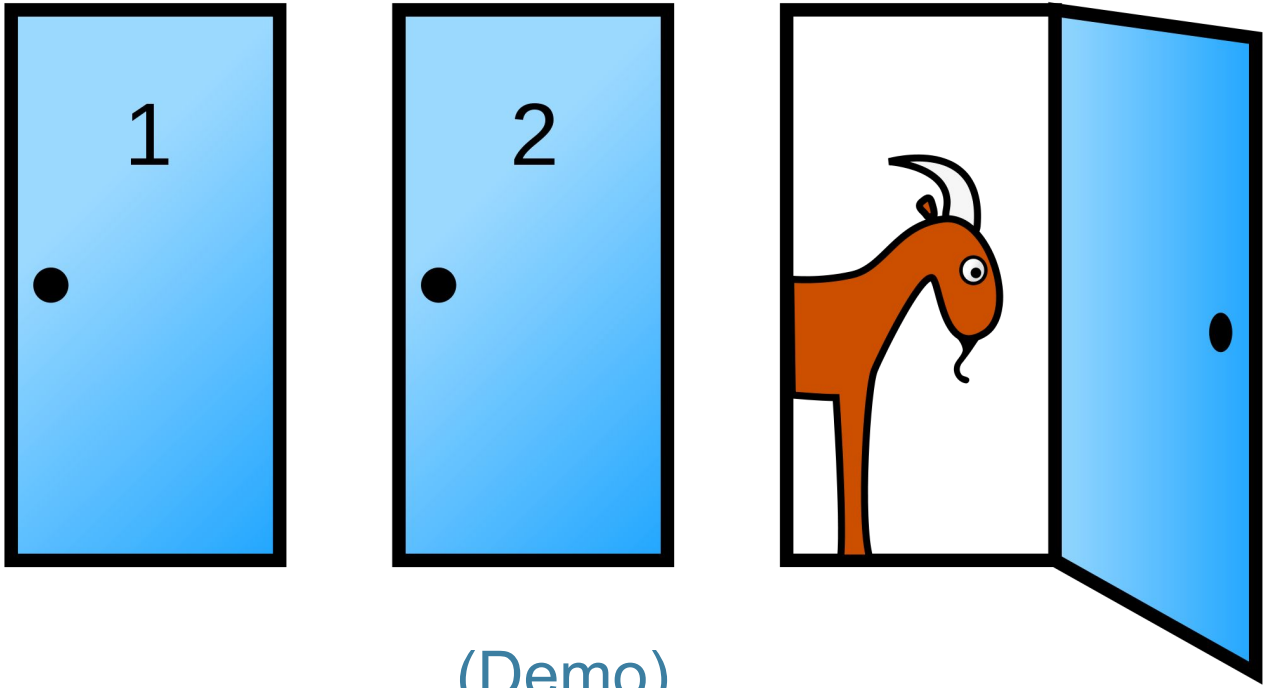
The Monty Hall Problem

Monty Hall Problem



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

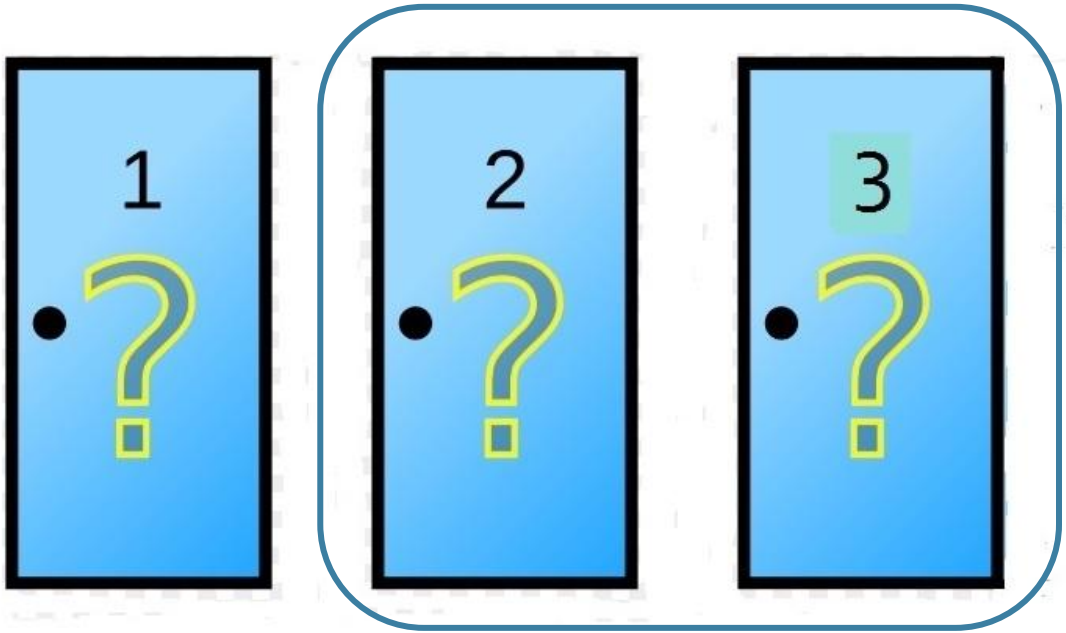
The Final Choice



https://en.wikipedia.org/wiki/Monty_Hall_problem

(Demo)

Stay or Switch?



(Demo)

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