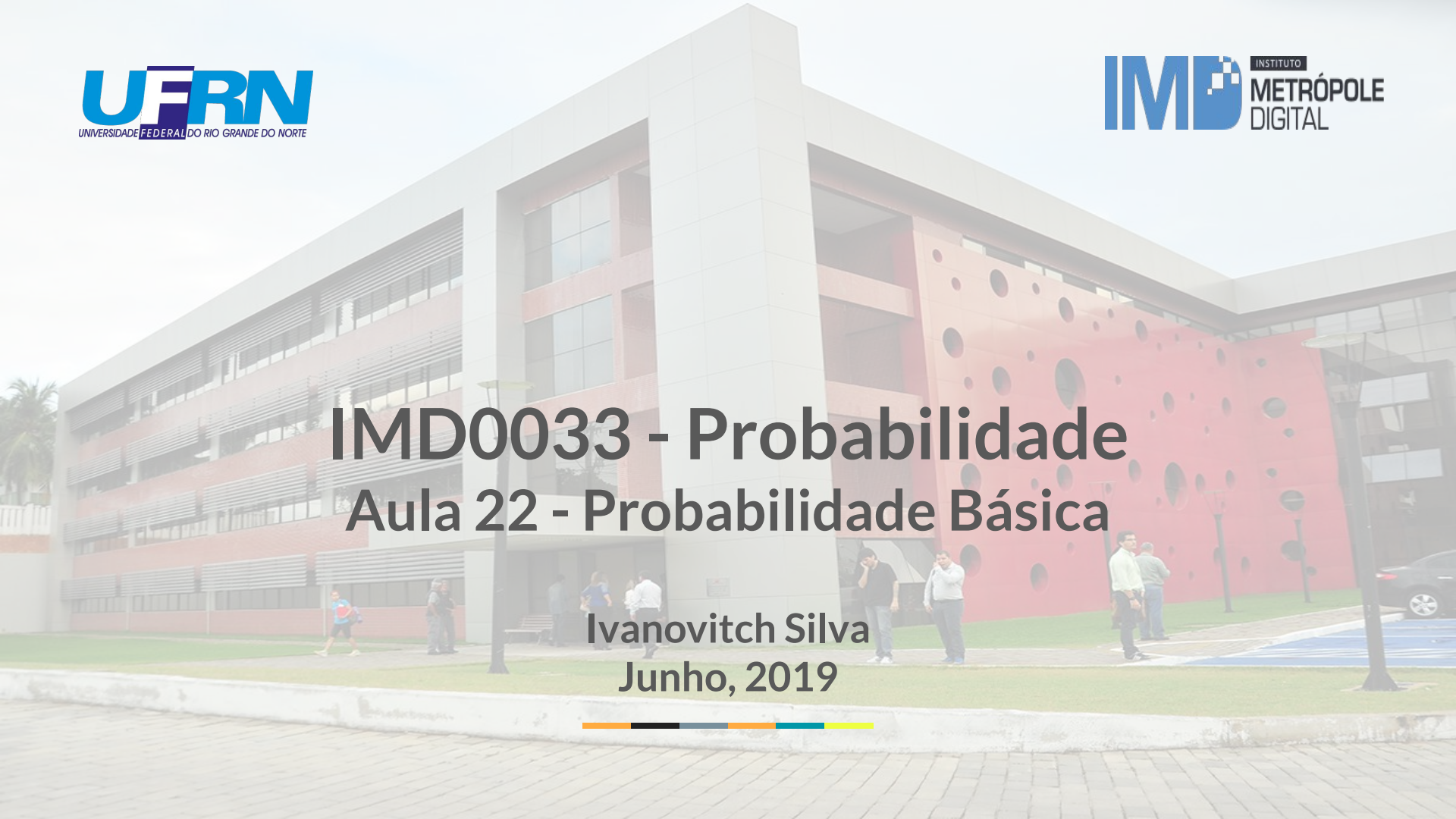


IMD0033 - Probabilidade

Aula 22 - Probabilidade Básica

Ivanovitch Silva

Junho, 2019

Agenda

- Estimando probabilidades
- Regras de probabilidade

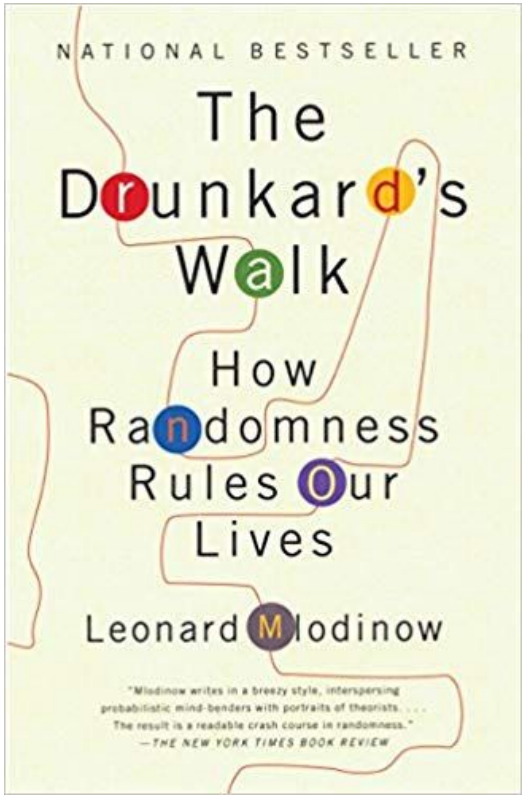
Atualizar o repositório

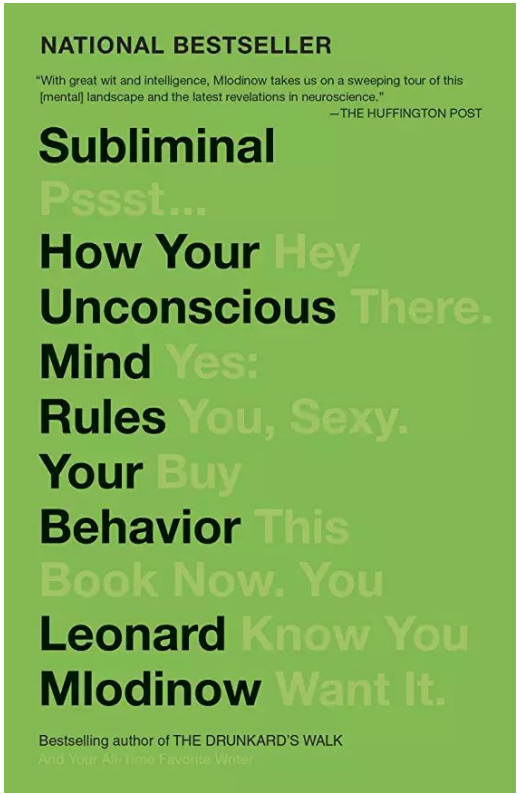
```
git clone https://github.com/ivanovitchm/imd0033_2019_1.git
```

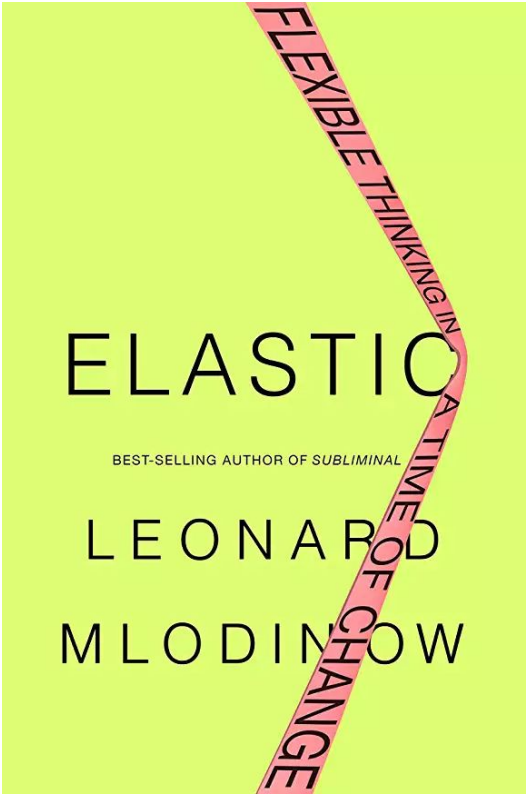
Ou ....

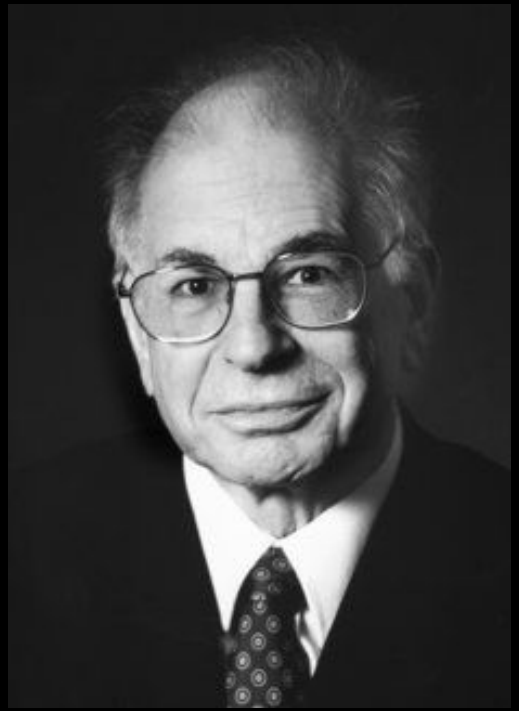
```
git pull
```

How Randomness Rules Our Lives



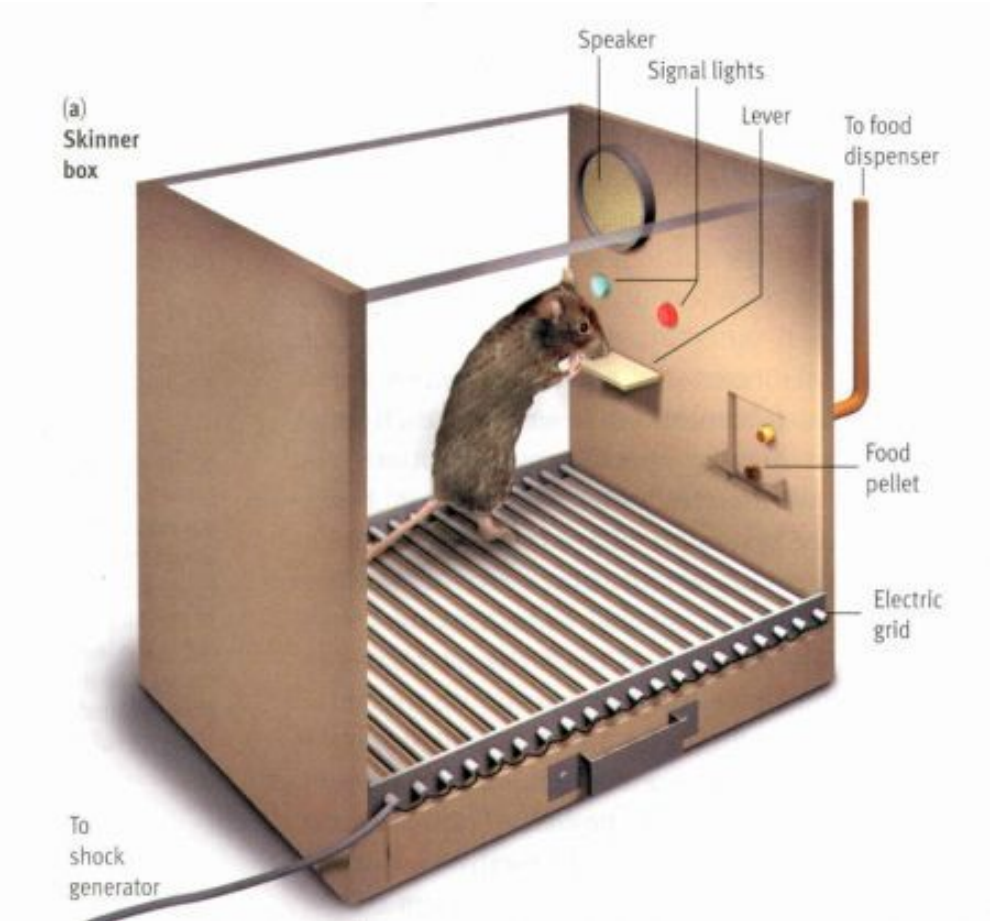






Daniel Kahneman
Nobel Memorial Prize in
Economic Sciences (2002)

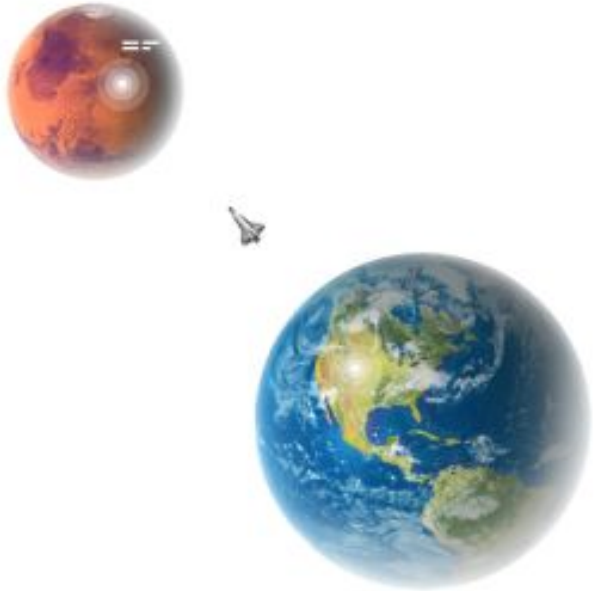
Although the **basic principles** of randomness arise from **everyday logic**, **many** of the **consequences** that follow from **those principles** prove **counterintuitive**.



Reward vs Punishment

"On many occasions I have praised flight cadets for clean execution of some aerobatic maneuver. The next time they try the same maneuver they usually do worse. On the other hand, I have often screamed into a cadet's earphone for bad execution, and in general he does better on his next try. So please don't tell us that reward works and punishment does not, because the opposite is the case."

Daniel Kahneman realized that the phenomenon mentioned by the instructors lies in the problem of **regression to the average**, which is based on the thesis that in any series of random events, there is a high probability that an extraordinary event is followed by a common event.



Predict where and when

We'll learn in this lesson that we're able to at least estimate the probability (the chances)

Predict heads or tails

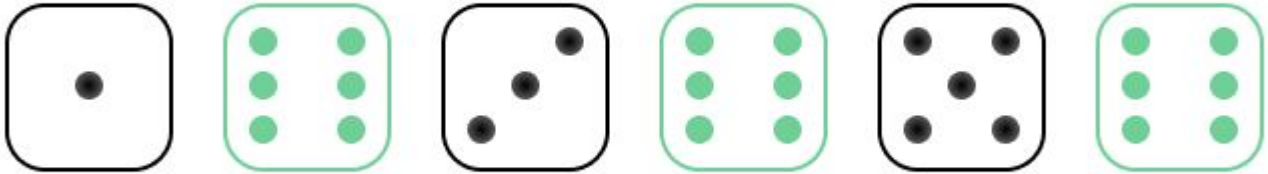
Empirical Probability

#random_experiment

$$probability = \frac{56\ heads}{100\ tosses} = 0.56$$

Empirical Probability

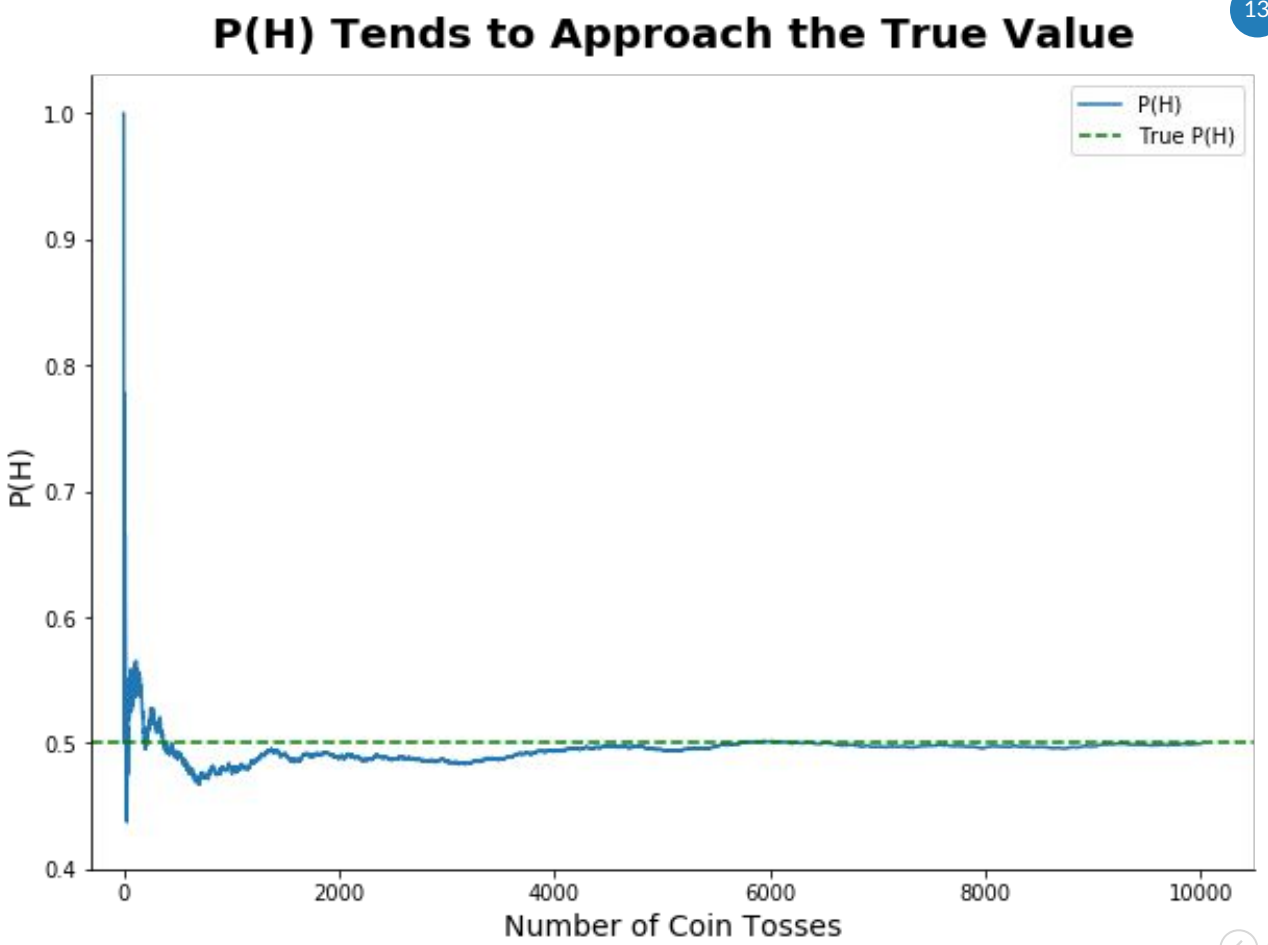
$$P(E) = \frac{number\ of\ times\ event\ E\ happened}{number\ of\ times\ we\ repeated\ the\ experiment}$$



$$P(E) = \frac{number\ of\ successful\ outcomes}{number\ of\ possible\ outcomes}$$

$$P(6) = \frac{number\ of\ successful\ outcomes}{number\ of\ possible\ outcomes} = \frac{3}{6} = 0.5 = 50\%$$

Repeating an experiment: the true **Probability Value**



Main definitions

Random experiment

It is an experiment that can be repeated several times considering the same initial conditions.

Shaker

Aging

Thermal Shock

Salt-Spray

Main definitions

Single outcome

It is the result of a specific random experiment (also called an event)

Thermal Shock

After a thermal shock of $\Delta = 80\ ^\circ$ the component suffered a defect?

Main definitions

Sample space

It is the set of all samples from a specific random experiment

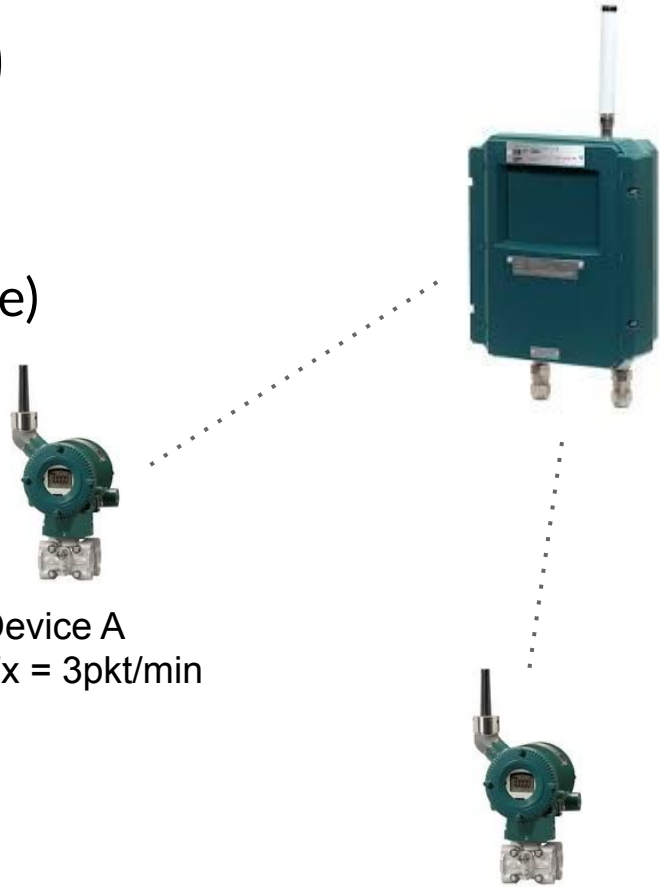
Thermal Shock

Δ = 80º - Was there a defect?

Ω = {yes, no, no, yes}

Example (sample space)

Assume a random variable P (number of packets arriving at the gateway every minute)



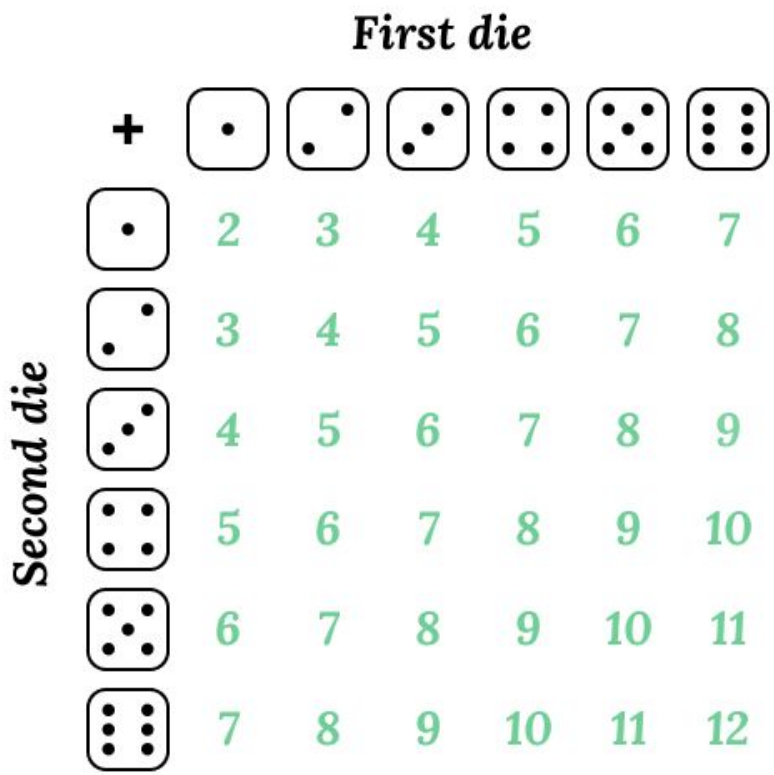
Sample Space

$\Omega = \{(\overset{A}{0},\overset{B}{0}),(1,0),(2,0),(3,0),(0,1),(1,1),$

$(2,1),(3,1),(0,2),(1,2),(2,2),(3,2)\}$

Probability of events

- The sum of the two rolls is 6?
- The sum of the two rolls is lower than 15?
- The sum of the two rolls is greater than 13?



$$\Omega = \{(1,1),(1,2),(1,3),\ldots,(3,1),(3,2),\ldots,(6,5),(6,6)\}$$

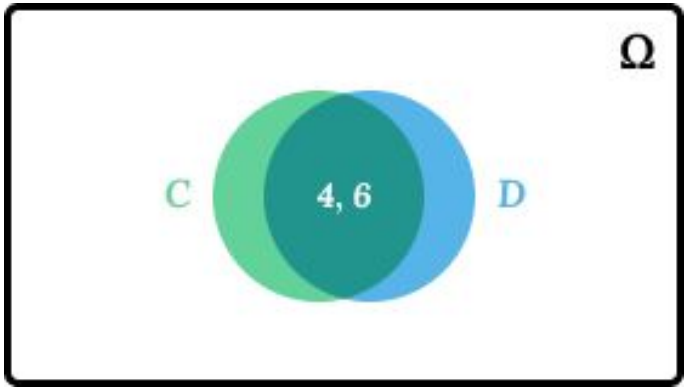
Addition Rule

Consider rolling a fair six-sided die

$P(C \text{ or } D)$?

C = {2,4,6}— getting an even number

D = {4,5,6}— getting a number greater than 3



$$P(C \text{ or } D) = P(C) + P(D) = \frac{3}{6} + \frac{3}{6}$$

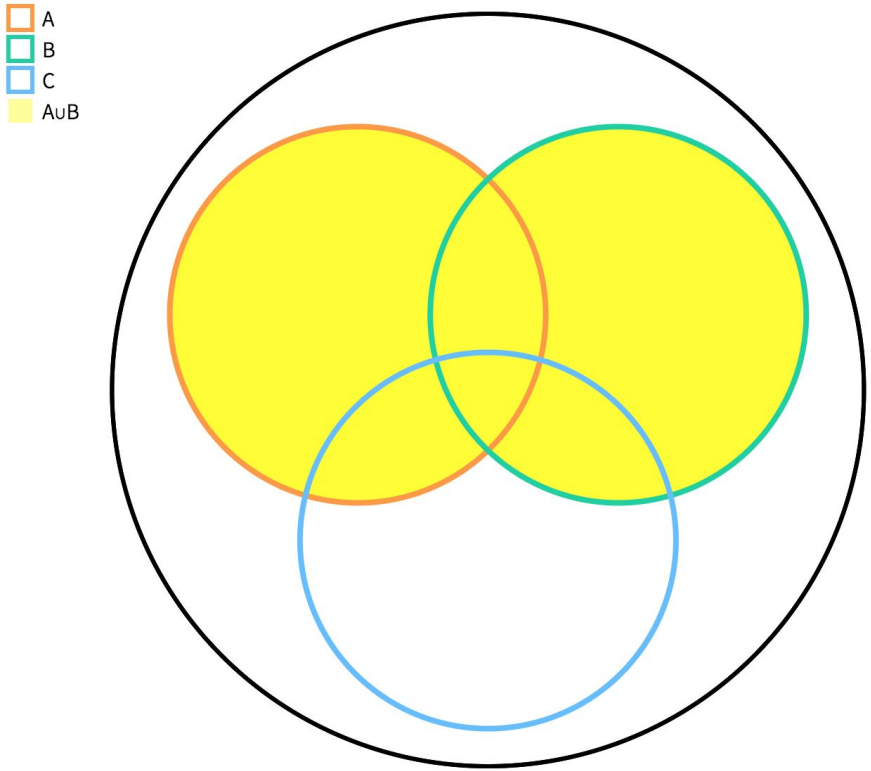
???

Addition Rule

C = {2,4,6}— getting an even number

D = {4,5,6}— getting a number greater than 3

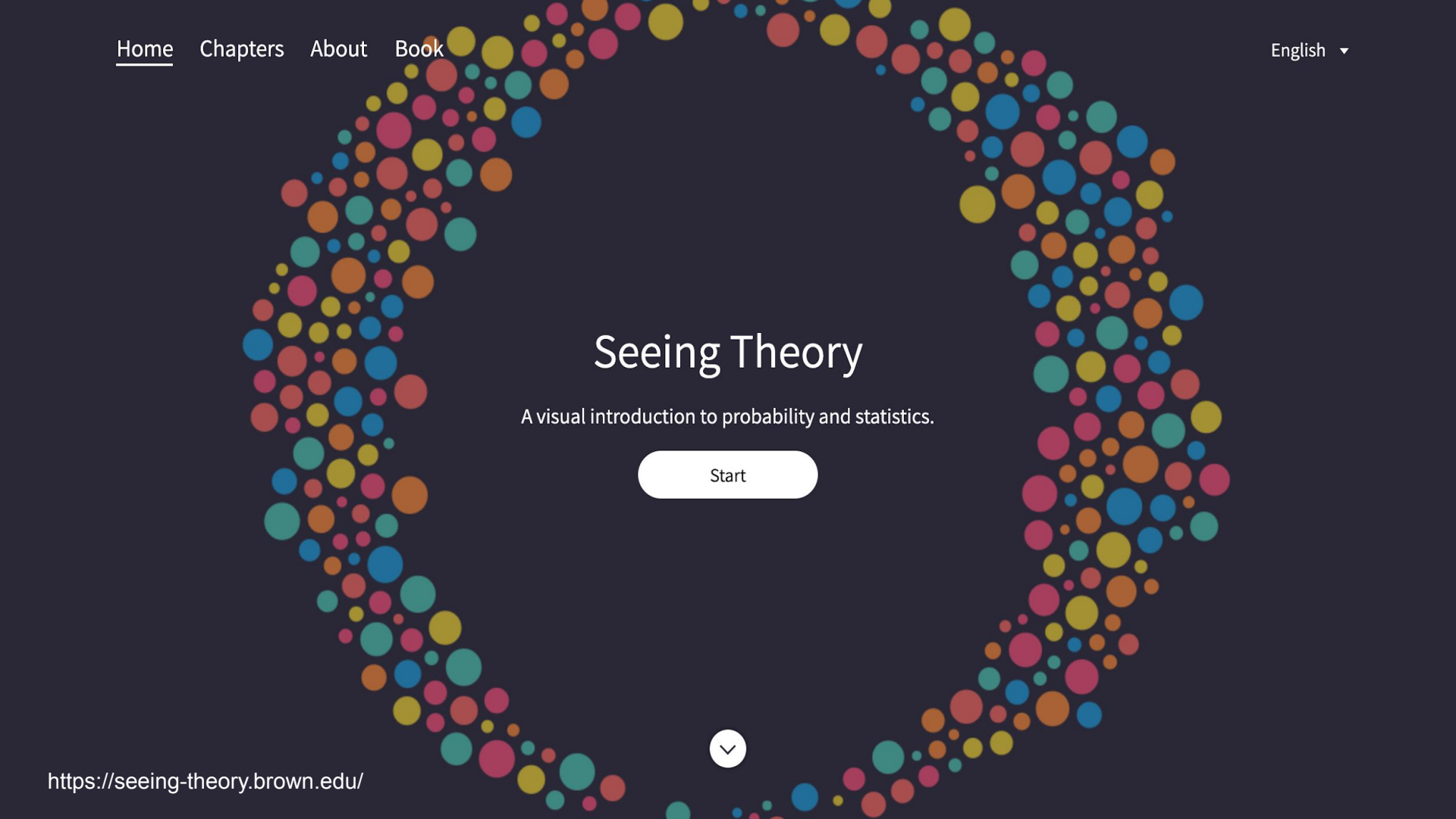
Addition Rule



$$Pr(A \cup B) = Pr(A) + Pr(B) - Pr(A \cap B)$$

if A and B are mutually exclusive:

$$Pr(A \cup B) = Pr(A) + Pr(B)$$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