

What is Probability?

“The **probability** of an **outcome** is the proportion of times the outcome would occur if we observed the **random process** an infinite number of times.”

What is Probability?

What about outcomes that can't happen more than once?

- the probability that Mark Zuckerberg becomes president in 2021
- the probability that I am telling the truth right now

An alternative way to define probability is as a *degree of belief*

- Harder to define, more controversial

Why Probability?

Probability allows us to reason about data even when it is uncertain!

We can predict what will happen in the future and make decisions accordingly

- If you are 95% certain it will rain tomorrow, go ahead cancel your plans
- If you are 55% certain it will rain, you should wait and see what happens

Why Probability?

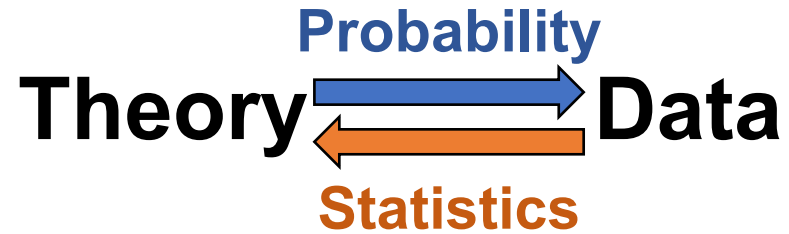
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We can estimate long-term tendencies to determine risk

- If you invest in a stock that has a 0.53 probability of increasing in value on any day, then you have a near-equal chance of gaining or losing money on a given day
- But long term, you can expect to gain more than you lose

Probability vs Statistics

- Both important for information science
- Often used together, so what's the difference?
- This class covers **probability**, not as much statistics



- **Probability:** A coin has a 50/50 chance of landing heads vs tails. You therefore conclude that if you flip many coins, about half of them will be heads.
- **Statistics:** You flip many coins and about half of them land heads. You therefore conclude that there is a 50/50 chance of heads vs tails.