Probability: Random Isn't So Random

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Welcome!

- About me
- About you
- About this class
  - For beginners
  - Basic concepts in probability
  - Format: lecture, activity, class problems
- Ask questions!

Why study probability?

- To model the uncertain
- To make decisions under uncertainty
- To understand statistical studies
- To make intelligent guesses

Why study probability?

- What's the weather like tomorrow?
- What are the chances of a drug working?
- What kind of customer will buy my product?
- Should I buy a lottery ticket? Two?
- Is it a boy or girl?

So…what *is* probability?

- Frequency probability
  - How often a result comes up if an experiment is repeated again and again
- Bayesian probability
  - Measure of belief in some unknown event given the evidence

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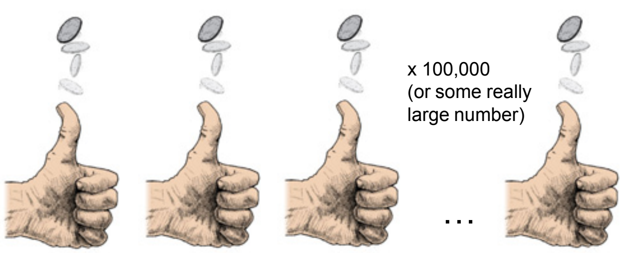

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What's the chance of flipping heads?

- Experiment:
  - Flip a coin a large number of times
  - Observe the percent of heads after each time
- Questions
  - What happens initially?
  - What happens after a while?

Basic Set Theory

- Set: collection of objects
  - Example: all the outcomes of a die
  - S = {1, 2, 3, 4, 5, 6}
- Element: object in a set
  - 1 is an element of S
  - Unique

Basic Set Theory

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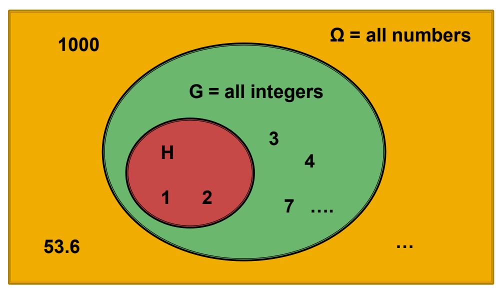
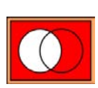
- Universal set Ω: contains all elements

Basic Set Theory

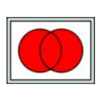


Set Operations

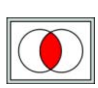
- Complement of S
  - all elements in Ω not in S
  - S^C



- Union of sets S, T
  - All elements in S or T (or both)
  - $S \cup T$



- Intersection of sets S,T
  - All elements in both S and T
  - $S \cap T$



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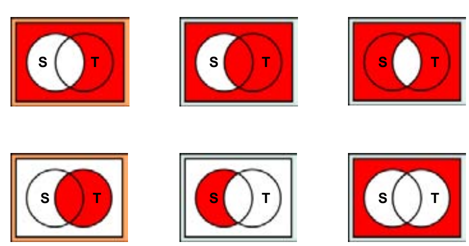
Exercises



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Probability Models

- Sample space: what are all the possible outcomes?
  - Cannot overlap
  - Must be exhaustive
- Events: subsets of sample space
- Probabilities: how likely events are

Model rolling a die

- Sample space?
- Events?
- Probabilities?

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- Sample space?
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What about two dice?

How do we represent sample space?

- Outcomes of rolling two dice

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Summary

- Why we study probability
- Two definitions of probability
- Basic set theory
- Probability models

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