An introduction to probabilistic programming with PyMC3

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Introduction

Bayesian statistics

Markov Chains

Road map

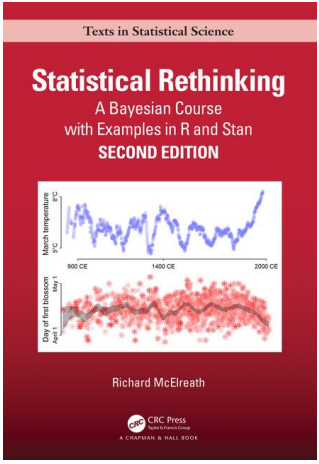
- Theory
  - The basics of Bayesianism
  - Markov chain Monte Carlo methods (MCMC)
- Practice
  - Probabilistic programming with PyMC3

What is Bayesian data analysis?

"A Bayesian is one who, vaguely expecting a horse, and catching a glimpse of a donkey, strongly believes he has seen a mule."

What is Bayesian data analysis?

- Richard McElreath: “Bayesian inference is just counting.”
- Count all the ways observed data could have arisen according to assumptions
- Assumptions that can arise in more ways are more consistent with the data, and therefore more plausible



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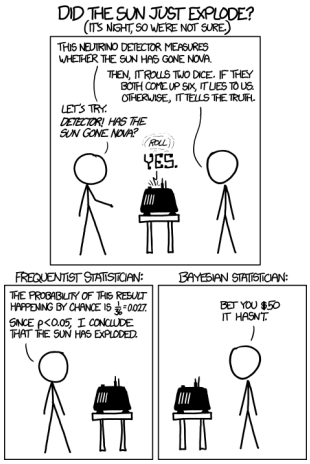
The Frequentist vs. Bayesian debacle

- Frequentist statistics
  - Probability defined as the limiting frequency at which events occur
  - Uncertainty arises from sampling variation
- Bayesian statistics
  - Frequency and probability are different things
  - Uncertainty arises from our ignorance of the true state of the world



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A slide with a theorem and a proof.

Theorem (Integral)

$$\int_a^b f(x)\,dx = F(b) - F(a)$$

Bevis.

Here's the proof. □

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A slide using pause

- Represent Abelian groups on the computer

A slide using pause

- Represent Abelian groups on the computer
- Compute on Abelian groups

A slide using pause

- Represent Abelian groups on the computer
- Compute on Abelian groups
- Solve equations, factor group homomorphisms