Notes on the book Statistical Rethinking

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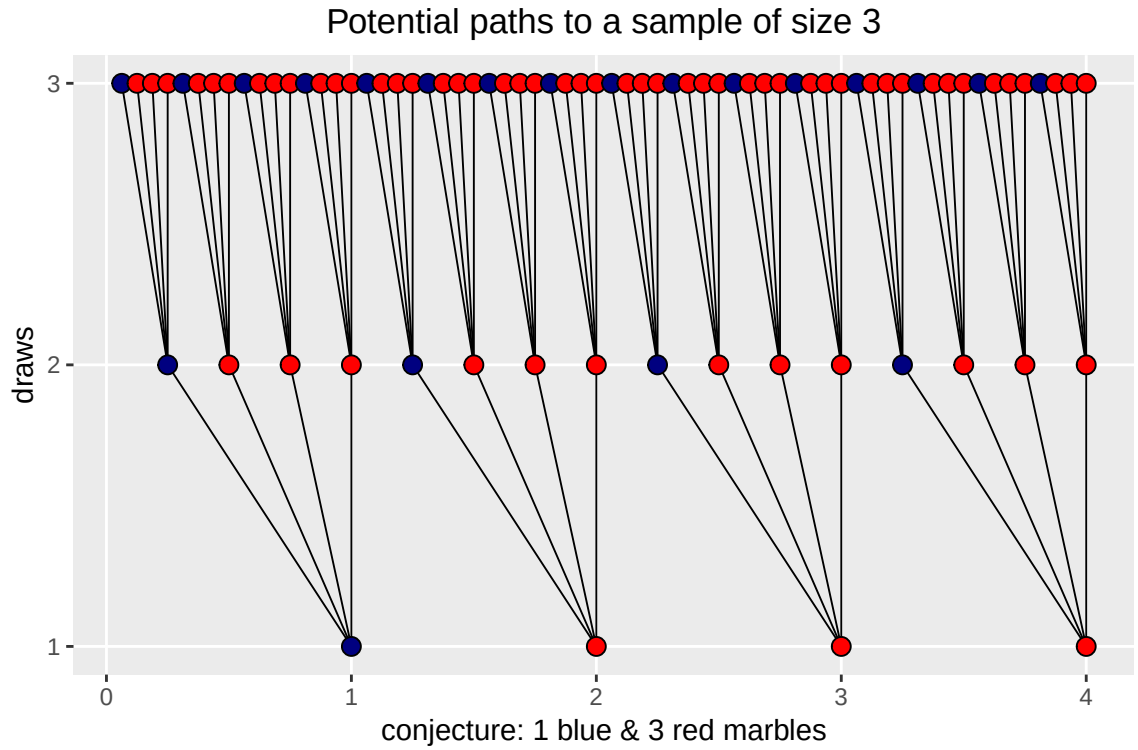
Chapter 1: The Golem of Prague

- Limitations of *deductive falsification*
  1. "Hypotheses are not models. The relations among hypotheses and different kinds of models are complex. Many models correspond to the same hypothesis, and many hypotheses correspond to a single model. This makes strict falsification impossible." (p. 4)
  2. "Measurement matters. Even when we think the data falsify a model, another ob- server will debate our methods and measures. They don't trust the data. Sometimes they are right." (p.4)
- Main topics covered in this book...
  1. Bayesian data analysis
  2. Multilevel models
  3. Model comparison using information criteria

Chapter 2: Small Worlds and Large Worlds

Useful Example. Suppose there is a bag containing marbles. We *know* there are four marbles in the bag and that each marble may be either red or blue. Next, suppose we observe some data in the form of ● ● ● in that exact order (*so sequence matters*). We can think of the likelihood as a way to count all of the possible ways of producing this sample **given** a conjecture of what the bag looks like (i.e., a paramter for our model).

- Consider one possible conjecture: ● ● ● ● . How likely is the observed sample ● ● ● given the conjecture? To answer this question, we count the possible ways our conjecture can generate the sample. Then we will compare the total number of ways across different conjectures as a way to evaluate which conjecture is the most likely candidate for generating ● ● ● . The following plot shows all of the possible samples that (the conjecture) ● ● ● ● can produce:



From this figure we see that there are 3 possible ways to generate the observed data. The following table lists all of the ways that the 5 possible conjectures could generate the sample ● ● ● :

Conjecture	**# of ways to produce ● ● ●**
● ● ● ●	$1 \times 3 \times 1 = 3$
● ● ● ●	$2 \times 2 \times 2 = 8$
● ● ● ●	$3 \times 1 \times 3 = 9$
● ● ● ●	$4 \times 0 \times 4 = 0$
● ● ● ●	$0 \times 4 \times 0 = 0$

- Prior belief.
- Bayesian updating & posterior distribution.

Chapter 3

Chapter 4