Assignment 7—Introduction to Statistics Using R

Paul Gribble
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* Due Friday Apr 14

Bayesian Approaches: Is my coin fair?

I give you a coin, and you flip it 10 times. The result is:

H T H H H T H T H H

Answer the following questions about this result. For questions 1-4, use an uninformative prior on p. Hint: remember how we saw in class that the Beta distribution is a conjugate prior for the Binomial likelihood distribution.

Let p be the probability of obtaining H on a single flip of the coin.

1. Plot the prior distribution for p — that is, for all possible values of p, plot $\text{prob}(p)$.
2. Plot the likelihood distribution for p — that is, for all possible values of p, plot $\text{prob}(D|p)$, where D are the data given above for the 10 flips of the coin.
3. Plot the posterior distribution for p — that is, for all possible values of p, plot $\text{prob}(p|D)$.
4. Based on the data from the 10 flips above, what is the most likely value of p?
5. What is the 95% credible interval for p?
6. What is the probability that $p > 0.5$?

Update the model

You decide that you want more data, so you flip the same coin another 10 times. Here is the result:

T T H T H H T H H H

Incorporate these new data into your model of p to answer the following questions:

7. Plot the new prior distribution for p (hint: it was the posterior computed above from the previous 10 flips).
8. Plot the likelihood function for p, given the new data.
9. Plot the new posterior distribution for p.
10. What is the most likely value of p?
11. What is the 95% credible interval for p?
12. What is the probability that $p > 0.5$?