# Lesson 11

Back to Week 4

**5/5** points earned (100%)

Quiz passed!



1 / 1 points

1.
Suppose we flip a coin five times to estimate $\theta$, the probability of obtaining heads. We use a Bernoulli likelihood for the data and a non-informative (and improper) Beta(0,0) prior for $\theta$. We observe the following sequence: (H, H, H, T, H).

Because we observed at least one H and at least one T, the posterior is proper. What is the posterior distribution for $\theta$?

- Beta(4,1)

**Correct Response**

We observed four "successes" and one "failure," and these counts are the parameters of the posterior beta distribution.

- Beta(1.5, 4.5)
- Beta(2,5)
- Beta(4.5, 1.5)
- Beta(5,2)
- Beta(1,4)

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1 / 1 points

2. Continuing the previous question, what is the posterior mean for $\theta$? Round your answer to one decimal place.

0.8

**Correct Response**

This is the same as the MLE, $\bar{y}$.

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1 / 1 points

3.

Consider again the thermometer calibration problem from Lesson 10.

Assume a normal likelihood with unknown mean $\theta$ and known variance $\sigma^2 = 0.25$. Now use the non-informative (and improper) flat prior for $\theta$ across all real numbers. This is equivalent to a conjugate normal prior with variance equal to $\infty$.

- You collect the following $n = 5$ measurements: (94.6, 95.4, 96.2, 94.9, 95.9). What is the posterior distribution for $\theta$?

○ $\mathrm{N}(95.4, 0.25)$

○ $\mathrm{N}(95.4, 0.05)$

**Correct Response**

This is $\mathrm{N}(\bar{y}, \frac{\sigma^2}{n})$.

○ $\mathrm{N}(96.0, 0.25^2)$

○ $\mathrm{N}(96.0, 0.05^2)$

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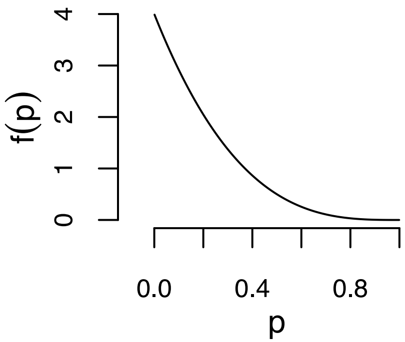
1 / 1
points

4.

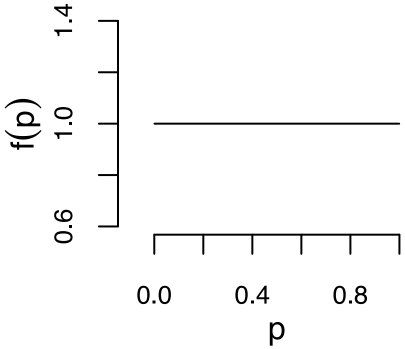
Which of the following graphs shows the Jeffreys prior for a Bernoulli/binomial success probability $p$?

Hint: The Jeffreys prior in this case is Beta(1/2, 1/2).

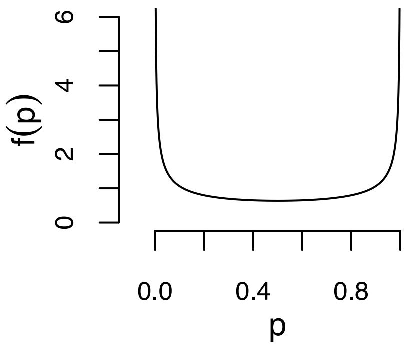
○



f(p)
0
1
2
3
4
0.0
0.4
0.8
p

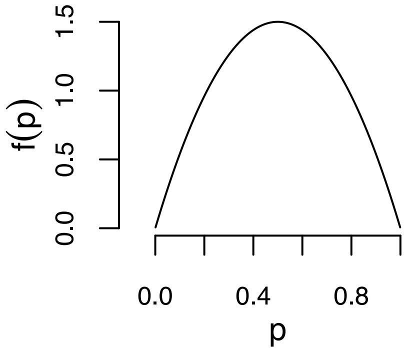



f(p)
0.6
1.0
1.4
0.0
0.4
0.8
p




**Correct Response**

Beta distributions with parameters between 0 and 1 have a distinct "U" shape.




1 / 1
points

points

5.
Scientist A studies the probability of a certain outcome of an experiment and calls it $\theta$. To be non-informative, he assumes a Uniform(0,1) prior for $\theta$.

Scientist B studies the same outcome of the same experiment using the same data, but wishes to model the odds $\phi = \frac{\theta}{1-\theta}$. Scientiest B places a uniform distribution on $\phi$. If she reports her inferences in terms of the probability $\theta$, will they be equivalent to the inferences made by Scientist A?

- Yes, they both used uniform priors.
- Yes, they used the Jeffreys prior.
- No, they are using different parameterizations.
- No, they did not use the Jeffreys prior.

**Correct Response**
The uniform prior on $\theta$ implies the following prior PDF for $\phi$: $f(\phi) = \frac{1}{(1+\phi)^2} I_{\{\phi \geq 0\}}$, which clearly is not the uniform prior used by Scientist B.

They would obtain equivalent inferences if they both use the Jeffreys prior.