

STAT 532: Midterm Exam

Name:

With Halloween just around the corner, you are interested in learning the probability of getting a chocolate candy when trick-or-treating. Assume that this is stored as a binary response, a success would be a something with chocolate and a failure would be things like smarties and tootsie rolls.

1. Sampling Model (8 points)

a. (4 points)

What is a sampling model and why is it necessary in Bayesian statistics? Is there an assumed sampling model in most classical statistical procedures?

b. (4 points)

Write out the sampling model for this problem. You can assume you receive N total pieces of candy and have y pieces of chocolate candy.

2. Priors (8 points)

a. (4 points)

State and defend a prior distribution(s) for the parameters in your sampling model detailed in part 1b. Make sure to use notation that clearly defines all parameters and values in your model.

b. (4 points)

In a few sentences, discuss your philosophy for choosing prior distributions.

3. Posterior (19 points)

a. (4 points)

It turns out that your trick-or-treating adventure only results in 15 pieces of candy, of which 9 pieces are chocolate. Given your prior distribution, what is the posterior distribution for getting chocolate candy when trick-or-treating?

b. (3 points)

Given this posterior distribution in part 3a, what is the posterior mean for the probability of getting chocolate candy? You do not need to simplify this expression.

c. (4 points)

Assume that your posterior HDI is $(.50, .70)$. Explain to my 6-year old what this means in the context of getting chocolate candy when trick-or-treating.

d. (4 points)

After hearing your explanation, your roommate remembers her Intro to Stat course and asks “So this posterior HDI is just a confidence interval, right?” Respond to your roommate’s question with a yes or no and an explanation of your answer.

e. (4 points)

Describe how you would test your model and prior combination to see if it is useful.