1. Do Problem 4.4 in the Chapter 4 Exercises of the *Bayes Rules!* text.

2. **(Graduate students only; extra credit for undergrads)**: Do Problem 4.10 in the Chapter 4 Exercises of the *Bayes Rules!* text.

3. Do Problem 4.16 in the Chapter 4 Exercises of the *Bayes Rules!* text.

4. Do Problem 4.19 in the Chapter 4 Exercises of the *Bayes Rules!* text. Hint: The code

   ```
   bechdel %>% filter(year==1980)
   ```

   is one way (not the only way) to pick out the movies in the data set from the year 1980. And the code

   ```
   bechdel %>% filter(year==1980) %>% tabyl(binary)
   ```

   will give a table of the FAIL/PASS results.

5. The eBay selling prices for auctioned Palm M515 PDAs are assumed to follow a normal distribution with μ and σ^2 unknown. We wish to perform inference on the mean selling price μ.

   (a) Suppose we assume an $IG(1100, 250000)$ prior for σ^2 and let the prior for $\mu|\sigma^2$ be

   $$p(\mu|\sigma^2) \propto (\sigma^2)^{-1/2}e^{-\frac{1}{2\sigma^2/s_0}(\mu-\delta)^2},$$

   with $s_0 = 1$ and $\delta = 220$. If our sample data are: (212, 249, 250, 240, 210, 234, 195, 199, 222, 213, 233, 251), then find a point estimate and 95% credible interval for μ.

   (b) Now suppose (perhaps unrealistically) that we had known the true population variance was $\sigma^2 = 228$. Assuming a conjugate prior for μ with $\delta = 220$ and $\tau^2 = 25$, find a point estimate and 95% credible interval for the single unknown parameter μ.

   (c) How (if at all) does the inference in part (b) differ from the inferences in part (a)? Explain your answer intuitively.

6. Do Problem 5.5 in the Chapter 5 Exercises of the *Bayes Rules!* text.

7. Do Problem 5.6 in the Chapter 5 Exercises of the *Bayes Rules!* text.

8. Do Problem 5.12 in the Chapter 5 Exercises of the *Bayes Rules!* text. [Hint: For part (a), use

   ```
   control_subjects <- football %>% filter(group == "control")
   ```

   to pick out the "control" subjects.]

9. Do Problem 5.19 in the Chapter 5 Exercises of the *Bayes Rules!* text.

10. A researcher is trying to estimate the mean number of accidents per month within 100 feet of the Gervais Street/Assembly Street intersection in Columbia. She assumes a Poisson(λ) model for the number of accidents Y per month, so that the density function for Y given λ is

$$p(y|\lambda) = \frac{\lambda^y e^{-\lambda}}{y!}, \quad y = 0, 1, 2, \ldots, \quad \lambda \geq 0.$$

(a) She uses a standard exponential prior distribution for λ (i.e., an exponential with mean 1, which is the same as a gamma distribution with shape 1 and rate 1). Derive the general form of her posterior distribution for λ given a random sample $y_1, \ldots, y_n$ from n weeks. Your answer for part (a) should be in terms of the y_i's and n.

(b) If she gathers the following accident counts from 15 randomly selected months

1 0 4 1 4 2 5 3 0 3 1 2 2 4 1

find the posterior mean and a 95% credible interval (get both a quantile-based interval and a HPD interval) for λ using the standard exponential prior, along with these data.

2