

Exercise 2.2 Univariate Conjugates

Instructions: You may discuss this assignment with other students in the class, but you must submit your own answers to the questions below. Include an honor pledge with your submission. Submit online and in PDF. This exercise is ungraded.

1. Suppose you are a data scientist for a health systems company. The CEO asks you give her a method to predict if her software engineers will deliver their systems according to schedule. You look at the data for 5 system deliveries by the software engineers and find that only one of them did not meet their scheduled delivery time. Give a prediction with a 95% confidence interval using a $Be(5, 5)$ prior (mode = $1/2$, variance = $.023$).
2. You work as a data scientist for a small software-as-a-service (SAS) company. Your CEO asks you to estimate the average time, X , it will take to complete an addition to your main product. To do this, you assume $X \sim N(M, \frac{1}{\tau W})$ with $E[M] = 3$ months based on the equivalent of 3 observations. Also, you assume $Pr[M > 9] = 0.01$.
 - (a) Find the prior hyperparameters.
 - (b) Using data from 14 past projects you obtain the following: $\bar{x} = 4.25$ months, $\sum_{i=1}^{14} (x_i - \bar{x})^2 = 8.46$. Find the posterior hyperparameters and the 95% credible interval for your estimate of project length.
 - (c) Before completing your report another part of the company gives you data from 10 more projects with $\bar{x} = 4.48$, $\sum_{i=1}^{10} (x_i - \bar{x})^2 = 5.82$. Assume the new observations are independent of and identically distributed with the first set of observations. Use the posterior from the previous observations in part (2b) as the prior to obtain new hyperparameter estimates, as well as, a revised 95% credible interval for the posterior of M .