

SDS 385: Exercises 1 – Preliminaries

August 23 2016

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Problem 1

Suppose we are only given random drawings $\theta^{(0)}, \dots, \theta^{(n)}$ from the $\text{Ga}(\hat{a}, \hat{b})$ distribution. Then we can look at the 2.5% quantile and 97.5% quantile of these random drawings (in R we use the `quantile` command) in order to estimate θ_L and θ_U .

Problem 2

Now we suppose that $a = b = 1$, and $\sum y_i = 325, n = 250$, so our posterior distribution is $\text{Ga}(326, 251)$.

- (a) If we use the inverse CDF function (`qgamma` in R), then we can calculate the 95% credible interval. In this case, our credible interval is (1.161627, 1.443528).
- (b) If we are only allowed to use random samples from the gamma distribution (`rgamma` in R), then we simply find the quantiles of these samples. If we draw 250 random samples, we have a 95% credible interval of (1.168850, 1.451595).
- (c) Our MLE estimate is $\sum y_i / n = 1.3$. This is contained within both credible intervals we created. Also, the intervals from parts (a) and (b) are approximately equal.

R code is shown on the following page.

```
#####  
##### Created by Spencer Woody on 20 Aug 2016 #####  
#####  
5  a <- 1  
   b <- 1  
  
   sumofy <- 325  
   n <- 250  
10  
   ahat <- 1 + 325  
   bhat <- 1 + n  
  
   # Part a  
15  lower1 = qgamma(0.025, ahat, bhat)  
   upper1 = qgamma(0.975, ahat, bhat)  
   sprintf('Our 95%% credible interval is (%f, %f)', lower1, upper1)  
  
   # Part b  
20  samples = rgamma(250, ahat, bhat)  
   lower2 = quantile(samples, 0.025)  
   upper2 = quantile(samples, 0.975)  
   sprintf('Our 95%% credible interval is (%f, %f)', lower2, upper2)  
  
25  # Part c  
   MLE = sumofy / n  
   print(MLE)  
  
   # END
```