BIOSTAT724 Project 3: Student Rubric

Total Points: 100

1. Background **(10 points)**
   1. Brief background on kinds of problems that the normal-normal model is appropriate for *(3 points)*
   2. Target of inference *(2 points)*
   3. Introduce example *(5 points)*
2. Normal PDF **(10 points)**
   1. Equation *(2 points)*
   2. Mean, Median, Mode, Variance *(4 points -- 1 point each)*
   3. Plain language description of what kinds of problems normal distributions are good for *(2 points)*
   4. Give example and how to interpret it in the context of our example *(2 points)*
3. Normal Prior **(10 points)** 
   1. Discuss how normal distribution can be used to describe information about the target parameter prior to study *(5 points)*
   2. Relate it to your example *(5 points)*
4. Normal Likelihood **(20 points)** 
   1. Explain what a likelihood function is generally *(3 points)*
   2. Show the equation for the normal likelihood *(2 points)*
   3. Explain each part of the equation in plain English *(3 points)*
   4. Show the likelihood for your example *(6 points -- 3 points each)*
      1. Include plot
      2. Interpret in plain English
   5. Show how the likelihood function is derived *(6 points)*
5. Normal-Normal Posterior **(20 points)** 
   1. Balance of prior and new data -- design a graphical illustration of how prior information and new data are weighted differently in the normal-normal model *(7 points)*
   2. Posterior distribution for the example *(13 points)*
      1. Show posterior for your example *(6 points -- 3 points each)*
         1. Use equations
         2. Use plots
      2. Report 95% equal-tailed CI *(2 points)*
      3. Report a posterior probability that is clinically relevant based on your example *(5 points)*
   3. Derivation of the Posterior Distribution **(EXTRA CREDIT: 10 points)**
6. MCMC Simulation **(30 points)**
   1. Use Rstan to simulate the posterior distribution *(15 points)* 
      1. Include code *(8 points)*
      2. Check 3 different diagnostics *(7 points)*
   2. Overlay plot of the actual posterior *(5 points)* 
      1. Include code
   3. Estimate the clinically relevant posterior probability with the MCMC posterior *(5 points)*
   4. Explain what is different about finding this posterior probability as compared to method based on conjugate family analysis *(5 points)*