BIOSTAT724 Project 4: Student Rubric

Total Points: 100

1. Write Bayesian Logistic Regression Model **(10 points)** 
   1. Write data model -- mathematical notation *(1 point)* and English description *(1 point)*
   2. Write model for prior *(8 points)* 
      1. Prior for Beta0 -- explain/show work *(2 points)*
      2. Prior for Beta1 -- explain/show work
         1. Prior *(2 points)*
         2. Interpretation of the mean (log odds and odds scales) *(2 points -- one for each)*
         3. 95% CI (log odds and odds scale) (*2 points -- one for each)*
2. Simulation of Priors **(15 points)** 
   1. Show code for simulations *(3 points)*
   2. Plot theoretical priors and MCMC simulated priors *(4 points)*
   3. State mean, median, 95% CI for priors and write interpretations *(3 points)*
   4. Simulate 100 models that represent prior belief about effect of prior history of fracture on risk at 1 year *(5 points)*
      1. Show code *(1 point)*
      2. Plot *(2 points)*
      3. Describe *(2 points)*
3. Update prior belief using OSTEO data (include code for all steps) **(15 points)** 
   1. Plot posterior distribution for changes in log odds of fracture at 1 year associated with prior history *(2 points)*
   2. Interpret median and 95% HPD CI *(2 points)*
   3. Repeat (a) and (b) on odds ratio scale *(2 points -- 1 each)*
   4. What is the posterior probability that OR > 1? What does this imply? *(3 points)*
   5. What is the posterior probability that OR > 2? *(2 points)*
   6. What is the value of the OR at which the posterior probability exceeds 80%? *(2 points)*
   7. Summary sentence *(2 points)*
4. Including Age in Model **(13 points)** 
   1. Writing data model -- follow format from 1a. *(2 points)*
   2. Prior distributions for regression parameters *(5 points)* 
      1. Create MCMC simulation of weakly informative priors -- include code *(2 points)*
      2. Write priors that rstanarm has identified *(3 points)*
   3. Posterior *(6 points)* 
      1. Plot posterior for prior history of fracture (Beta1) *(2 points)*
      2. State median and 95% HPD CI on odds ratio scale *(2 points)*
      3. What happened to posterior for Beta1 now that age is included? *(2 points)*
5. Evaluating Interaction between Age and Prior History of Fracture **(17 points)** 
   1. Write data model -- follow format from 1a. *(2 points)*
   2. Prior distributions for regression parameters -- follow format from 4b. *(5 points)*
   3. Posterior *(10 points)* 
      1. Plot posterior for the interaction term *(2 points)*
      2. Interpret median and 95% HPD CI *(2 points)*
      3. What impact does older age have on relationship between fracture risk in those with and without prior history? *(2 points)*
      4. What is the posterior probability that the interaction is < 0? *(2 points)*
      5. Summary sentence *(2 points)*
6. Predicting Fracture Risk based on Prior History and Age **(10 points)** 
   1. Make a plot that shows the posterior predicted probability of fracture at 1 year post-diagnosis with osteoporosis by age at diagnosis 55-80 in increments of 5, and prior history of fracture -- show code
7. Posterior Predictive Check **(10 points)**
   1. Perform check using 100 datasets *(5 points)*
   2. Explain how posterior predictive check works and what you conclude from results *(5 points)*
8. Identifying Women at High Risk of Fracture **(10 points)**
   1. Use cutoff for predicting woman is at high risk to evaluate the model based on the data available. State and interpret the following *(5 points)* 
      1. sensitivity
      2. Specificity
      3. Overall accuracy
      4. Positive predictive value
   2. Use cross validation to evaluate the future performance of the model. State and interpret the same values as part a. *(5 points)*