

## ST495/590 – Assignment 7 – Due 3/23

In this assignment you will perform Bayesian linear regression for the microbiome data are the course website. Let  $Y_i$  be the precipitation for observation  $i$  and  $X_{ij}$  equal one if OTU  $j$  is present in sample  $i$ . First, extract the 50 OTU with the largest absolute correlation between  $X_{ij}$  and  $Y_i$ . Then fit a Bayesian linear regression model precipitation as the response and with these 50 covariates (and an intercept term) using three priors:

- (1) Uninformative normal priors:  $\beta_j \sim \text{Normal}(0, 100^2)$
- (2) Hierarchical normal priors:  $\beta_j | \tau^2 \sim \text{Normal}(0, \tau^2)$  where  $\tau^2 \sim \text{InvGamma}(0.01, 0.01)$
- (3) Bayesian LASSO:  $\beta_j | \tau^2 \sim \text{DE}(0, \tau^2)$  where  $\tau^2 \sim \text{InvGamma}(0.01, 0.01)$

Compare convergence and the posterior distribution of the regression coefficients under these three priors. In particular, are the same OTU's significant in all three fits?

You should turn in your responses to these questions in 3-4 pages (i.e., two pieces of paper with text on both sides). You should also turn in a separate file with carefully commented code. Only output in the 3-4 page document will be graded. Please staple both documents together!