Bio 285:
HW 3

Problem 1

Suppose a study is conducted in which patients' blood pressure is monitored over time, and patients belong to one of 15 different study centers. Interest focuses on predicting blood pressure from age, smoking, and other variables.

1. Describe a **parametric** hierarchical model for these data.

2. Modify this model to allow the distribution of the varying parameters to be unknown to allow uncertainty in variability (heterogeneity) among patients as well as patients within study centers.

3. Outline the steps of a Gibbs sampler for the parametric model and how the steps are modified for the semiparametric model (don't code anything).

Problem 2

1. Simulate data from the following mixture of normals:

$$p\left(y_i\right) \sim 0.1\ \text{N}\left(y \mid -1, 0.2^2\right) + 0.5\ \text{N}\left(y \mid 0, 1^2\right) + 0.4\ \text{N}\left(y \mid 1, 0.4^2\right), i = 1, \ldots, 100$$

2. Use the density () function in R to obtain a non-Bayesian estimate of the density and plot this estimate versus the true density.

3. Apply a blocked Gibbs sampler for $k = 20$ (number of mixture components) $\alpha = 1, \mu_0 = 0$, and $\kappa = \alpha_\tau = b_\tau = \alpha = 1$

4. Run the predictive Polya Urn sampler or a Slice Sampler for the same hyperparameter specification.

5. Compare the resulting density estimates.