Sta 601/360: Lab 5

Suppose you fit a Bayesian model to a set of data and your posterior includes three variables X, Y, and Z whose joint posterior is Multivariate Normal with mean $(0, 0, 0)$ and covariance matrix

$$\begin{pmatrix} 1 & 0.9 & 0.1 \\ 0.9 & 1 & 0.1 \\ 0.1 & 0.1 & 1 \end{pmatrix},$$

One of the problems with Gibbs sampling is that it moves very slowly when posterior variables are highly correlated. This lab explores this issue.

1. What are the posterior complete conditionals for X, Y, and Z?

2. Write a Gibbs sampler that alternates updating each of the variables. Provide a trace plot of 1,000 draws for either X or Y. Comment on the trace plot.

3. One option for dealing with this high correlation is doing *block updates*, where multiple variables are updated at once. Give the complete conditionals for $(X, Y)|Z$ and $Z|(X, Y)$, and code a Gibbs sampler where X and Y are updated together (using a random from from a Multivariate Normal), alternating with Z being updated. Provide a trace plot of 1,000 draws for either X or Y and comment on the plot.

4. Comment on the difference between the performance of the two Gibbs samplers. Why is the second more efficient?