STAT 600 Statistical Computing

HW 5: MCMC

Spring 2024, **Due April 1st**

Homework format: Homework should be submitted as a pdf generated by LaTeX or Rmarkdown. All functions should be coded in `Rcpp`/`RcppArmadillo`. Please provide explanations of your solutions and appropriate graphics (labeled well).

Do problem 7.6 on page 233. The data are available on the book website:
`http://www.stat.colostate.edu/computationalstatistics/datasets/coal.dat`

For part (b), you can either program the diagnostics yourself with a few lines of code or you could use the `coda` package in `R` (or something similar).

In addition to parts (a)-(d) in the book, answer these questions:

e. Use the likelihood from (7.28) but change the prior for λ_1 and λ_2 to a half-normal distribution $\propto N(0, \sigma^2)1_{[\lambda > 0]}$ where σ^2 is known. Derive the appropriate algorithm (MH or Gibbs) to carry out inference on the posterior distribution of λ_1 and λ_2.

f. Implement your MCMC algorithm from part (e). Try several values of σ^2 based on your understanding of the problem. (What is a reasonable variance for λ based on what you know about the problem?).

g. Provide a few key results to compare the inferences that you'd make based on the two models. Which model do you prefer and why?

h. Run both models in Nimble (or some other (modern) probabilistic programming language). Compare the results and speed from your code and Nimble's (or other's). Briefly discuss.