

Stat238: Lab 6

October 7

- This lab explores MCMC-based computations using the NIMBLE package in R. The code in the Unit 6 demo that we saw in class on Wednesday (*unit6-comp.R*) can serve as a template.
- If you get stuck with any of the NIMBLE coding or error messages, let me know.

Problems

1. Install NIMBLE from CRAN. You'll need *Rtools.exe* on Windows and *Xcode* on Mac, so please see Section 4.3 of our User Manual <http://r-nimble.org/manuals/NimbleUserManual.pdf> if you don't already have the compiler tools installed on your machine.
2. Write the BUGS code for the following statistical model for the data from Gelfand et al. (1990, JASA 85:972) (in the file *ratsy.dat*). The data are weights of rats measured over time at five time points: 8, 15, 22, 29, and 36 days. Consider the random effects linear growth curve model:

$$\begin{aligned}Y_{ij} &\sim N(\alpha_i + \beta_i(t_j - \bar{t}), \sigma_y^2) \\ \alpha_i &\sim N(\mu_\alpha, \sigma_\alpha^2) \\ \beta_i &\sim N(\mu_\beta, \sigma_\beta^2) \\ \sigma_y &\sim U(0, c) \\ \sigma_\alpha &\sim U(0, c) \\ \sigma_\beta &\sim U(0, c) \\ p(\mu_\alpha, \mu_\beta) &\propto 1\end{aligned}$$

3. Think about starting values for the MCMC. How could you get some very rough starting values without putting too much effort in?
4. Set up and run a default sampler in NIMBLE. What samplers are being used?
5. Consider the performance of the MCMC based on the traceplots of the hyperparameters and a few of the process values (the α s and β s) (we'll consider more formal quantitative metrics next week in class).
6. Try putting in starting values that you know are wildly unreasonable. Do the MCMC still converge to the posterior fairly quickly?
7. (We'll consider this in Lab 7 as I didn't get to the relevant material in class yet, but will on Monday.) Finally consider using different samplers:
 - (a) Try using Metropolis-Hastings for some or all of the parameters. Does that help or hurt the mixing?
 - (b) How about blocking together parameters for which the posterior dependence is strong (as seen in the output from the default samplers)