Statistical Modeling, Winter 2025

Homework 7

Please submit your answers to these questions via Canvas prior to class next Tuesday.

I prefer a pdf, or a .Rmd / .Qmd / .R file. Please name the file with your last name and hw number (e.g., elahi_hw1).

Complete the following:

- read chapter 13 in *Statistical Rethinking* (McElreath 2020).
- watch Multilevel Adventures

Note for users that are knitting to pdf / html

Please use the following code in your `ulam` code chunks, as well as your code chunks that are loading libraries:

```
{r, warning=FALSE, message=FALSE, results='hide'}
```

https://rmarkdown.rstudio.com/lesson-3.html

Questions

From McElreath

1. Conduct a prior predictive simulation for the Reedfrog model. By this I mean to simulate the prior distribution of tank survival probabilities α_j. Start by using this prior:

$$\begin{aligned} \alpha_j &\sim \text{Normal}(\bar{\alpha}, \sigma) \\ \bar{\alpha} &\sim \text{Normal}(0, 1) \\ \sigma &\sim \text{Exponential}(1) \end{aligned}$$

   Be sure to transform the α_j values to the probability scale for plotting and summary. How does increasing the width of the prior on σ change the prior distribution of α_j? You might try Exponential(10) and Exponential(0.1) for example.

2. Revisit the Reedfrog survival data, `data(reedfrogs)`. Start with the varying effects model from the book and lecture. Then modify it to estimate the causal effects of the treatment variables `pred` and `size`, including how size might modify the effect of predation. One approach is to estimate an effect for each combination of `pred` and `size` (this means creating 4 separate categorical variables). The latter is only a suggestion, but regardless, you should justify your model with a DAG of this experiment.

Project

1. Consider your single predictor model from last week. Can you make it a hierarchical model, with varying intercepts? Use what you have learned from Chapter 13. If your dataset is not hierarchical, that is ok - you can add one more predictor to your model instead. Draw a DAG and interpret your model results.