Homework 5

STAT 697STA Spring 2023

Due March 22, 2023, 9:40am on Gradescope

1 Reading

- Read sections 2.12, 3.1, and 3.2 of HRW.

2 Questions

1. HRW 2.9
2. HRW 2.10 *start this one in class - it is a more complicated Bayesian model
   - Do parts a,b,c as in the book
   - Read part d, but as it is in the book, it doesn't require output. Instead, for part (d), please explore diagnostics for your fit for the parameters σ_ϵ, σ_u, σ_v, $\hat{f}(median(date))$, and $\sqrt{\hat{g}(median(date))}$

   Hints:

   - You do want to do transformations, but think carefully about how to back-transform. After it runs, you probably want to back-transform fits for both f and $\sqrt{g}$.
   - Go through the example code and add code for $\gamma, v, \sigma_v, and\ z^g$ in parallel to the existing code for $\beta, u, \sigma_u, and z^f$ (I called z^g w to make it easier to keep track). Note that the $x/date$ values should be the same for both f and g functions, but the spline bases, and numbers of basis functions are different.
   - There are some tricky coding pieces. Here are 2 tricks I found helpful:
     - There are some tricky transformations in this model. I found it helpful to add a 'transformed parameters' section to my model specification that looks like this:

```
transformed parameters {
   vector[n] deltay;  // change in r
   vector[n] f; // f function
   vector[n] g; // g function
   deltay[1] = 0;
   for (t in 2:n)
     deltay[t] =(y[t]-y[t-1]);
   f = X*beta + Z*u;
   g = exp(X*gamma + W*v);
}
```

     Note that this also shows how to introduce a lagged function.
     - You can model a variable variance like this:

```
deltay[t] ~ normal(f[t-1], sqrt(g[t-1])*sigmaeps);
```