Assignment 4

The data in *PedersenEtAl2017/data.csv* come from a group of adult patients with attention-deficit hyper- activity disorder (ADHD). They completed a reward learning task two times. Once on their medication and once off their medication. Pedersen and colleagues compare a series of different drift diffusion model (DDM) specifications to see which one fits the data better. Their implicit assumption is that a DDM will yield more precise estimates of the learning rate parameters than the softmax choice rule (i.e., logistic regression) typically used in studies of reward learning. Your assignment is to explicitly test this assumption.

Part 1

The R code and JAGS model that Pedersen et al., used to fit their data is included in this assignment. Modify this JAGS model code to include a logistic regression for optimal vs suboptimal choice outcomes (i.e., a binary indicator variable) instead of the DDM.

- In the R code, you will need to change the RT variable in the data.csv into a binary (1, 0) variable for choice outcomes and give that variable to your JAGS model. Note that optimal choices have positive RTs and suboptimal choices have negative RTs.
- In the JAGS model, you can use the drift rate parameter as the input to a softmax or ilogit function. You should also add an "intercept" term that measures the tendency to make optimal choices regardless of which options are shown. For example, ilogit(beta[g,s] + v[trial]). Remember that you will need to add priors to your model for this intercept beta parameter too.
- Burn in your logit model for 40,000 samples and then sample 2000 times with a thinning rate equal to 5. Use three chains.
- Monitor the group and subject-level parameters because you will need the subject-level parameters for Part 2.

Details of what to do/turn in:

1. A summary table of the logistic regression model fits (40%).
2. A histogram or density plot of the four group-level learning rate parameters (ON-positive, ON-negative, OFF-positive, OFF-negative). This parameter is labeled eta in Pedersen et al's code (5%).
3. Create the parallels of Fig. 5e and 5f by plotting the difference between the group-level positive and negative learning rates ON and OFF medication (5%). Include the 95% HDIs for each difference in your plots or in the text of a caption below the plots.
4. Interpret the differences in these parameters based on the Figures in the paper and your fits with a logistic regression instead of a DDM. (10%)
5. All R code and the JAGS models used to estimate the models and generate the summaries and plots.

Part 2

Test the accuracy of parameter recovery from your reward learning + logit model. Simulate choices for each trial that each of the 17 participants made on and off medication using the means of the posterior chains for each of their individual parameters estimated in Part 1. This will give you a choice set of 7204 observations

just like the original empirical data. Then fit these choices with the same JAGS code you used for Part 1.

Details of what to do/turn in:

1. A summary table of the logistic regression model fits for the simulated data (20 %).
2. A plot similar to Fig. 6 in Pedersen et al. showing the posterior chains for 4 group-level learning rates (ON-positive, ON-negative, OFF-positive, OFF-negative) as well as the mean group-level parameters from Part 1. The group means from Part 1 should approximately match the means from the fits to simulated data if the parameter recovery is good. Do they? (20%).
3. All R code and the JAGS models used to estimate the models and generate the summaries and plots.