Assignment 6

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1) Do the two groups (i.e. adults and kids) have different log(reaction times) and if so what is the effect? (provide posterior point and interval estimates (mean, hdi, etc.))

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The log reaction time for adults is shown by mu and the log reaction time for kids is shown by mu+phi. As can be seen from the above figures, the two groups have different log reaction times.

2) Posterior of tau is different compared to the previous case of using no indicator for kids and adults (i.e. Assignment 5).

* 1. Provide plots and estimates (mean, hdi, etc.) of tau in both cases (i.e. Assignment 5 and 6)
  2. Why are they different?
  3. What does this mean in terms of shrinkage?

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The results are different because is assignment 5, we only have reaction time for one group, while for the assignment 6, we have two different groups (adults and kids) which have two different reactions times. Hence, the distribution for assignment 5 is slightly fatter than assignment 6. It means the results given by assignment 6 are more accurate.

3) Plot the two prior distributions for the expected log(reaction time), one for kids and one for adults (i.e. prior for theta in Gelman’s approach and prior for (theta+phi\*child) in Kruschke’s approach when child = 0,1). Compare against a single prior of theta in Assignment 5. When plotting the prior you may plot it using the mean value of its dependent parameters.

1. Explain what you see and can you give an explanation to why the curves look like they do?

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As can be seen in the figure, the prior of adults are less than mean prior for kids. Also, the prior of assignment 5 is somewhere between prior of kids and adults which is due to the fact that the data for assignment 5 is a combination of both kids and adults.

4) Provide posterior predictive distribution with knowledge of if the individual is a child and one without knowledge of if it is a child.

* 1. If you do not have time to do this numerically, it is enough to explain how to do this.
  2. To provide the latter distribution we need to make assumptions on the fraction of adults and kids in our material.
     + Given number of children and the total number of participants in our study, you may use posterior predictive draws from a bernoulli distribution (i.e coin flip examples we have worked with in previous assignments). To simulate this you may
       - Pick a posterior sample of a theta (representing the probability of children) given the fraction of children and adults in our data set.
       - Draw a new participant given this theta.
       - If the new participant is a child use child=1 otherwise use child=0.
       - …. your code to generate samples from the posterior predictive distribution of the reaction time given knowledge of child ….
     + Another alternative is to pick a fixed fraction given knowledge of it from the entire population. However, in our case the participants in our study is not representative of any population what I know of.

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For this question, I did the following steps in Matlab (I need to mention that I took a look at the Jaya’s code to write the code)

I generated a random numbers to randomly select from data

Then,

Posterior distribution for a child:

Theta = rand(0,1)\*tau+mu+phi

Y\_predict\_child = rand(0,1)\*sigma+Theta

Posterior distribution for an adult:

Theta = rand(0,1)\*tau+mu

Y\_predict\_adult = rand(0,1)\*sigma+Theta

Posterior predictive distribution without knowing about being a child or adult:

We compute the fraction of child which is

Then, we generate a random number between 0 and 1,

If the generated number is less than that of fraction of child, then:

Theta = rand(0,1)\*tau+mu+phi

Y\_predict\_child = rand(0,1)\*sigma+Theta

Else

Theta = rand(0,1)\*tau+mu

Y\_predict\_adult = rand(0,1)\*sigma+Theta