Lab 09
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Question 1

1. Take a look at heights.log in Tracer. Do the estimates of mu and sigma seem right? Did they converge?

   mu: There are two peaks in the Marginal Prob Distribution, which means there are two possible values, and thus it does not converge. In the Trace tab, the trace does not form a typical caterpillar form.

   sigma: There are two and a half peaks in the Marginal Prob Distribution, which means there are two or three possible values, and thus it does not converge. In the Trace tab, the trace does not form a typical caterpillar form.

   The ESS values of mu and sigma are both way lower than 200. To sum up, the estimates of mu and sigma do not seem right.

2. What does the delta argument in the mvSlide function do?

   The slide move proposes new values for the variable by “sliding” its value within a small window determined by the delta argument.

3. Set delta=1.0 for each of the moves, and rerun the analysis. How do the estimates look now? Did they converge? What are your ESS values for mu and sigma?

   mu: There is one peak in the Marginal Prob Distribution, which means the possible values converge to one peak value. The ESS values of mu is 699, which is high enough for us to accept the results.

   sigma: There is one peak in the Marginal Prob Distribution, which means the possible values converge to one peak value. The ESS values of sigma is 655, which is high enough for us to accept the results.

Question 2

In the model above we used highly uninformative uniform priors on mu and sigma. The average height in the United States is 5.4 feet and the SD is about 0.23. Modify the code above to use a more informative prior for mu. Don’t just set it to be constant, use a different prior distribution that is more informative than the uniform prior.

1. Rerun the analysis using the informative prior. Show me the line of code you used to set an informative prior for mu.

   mu ~ dnNormal(5.4, 0.23)

2. Did this affect the final estimates of mu and sigma? Which estimate is closer to the actual mean? What does this tell you about using informative priors?

   mu: In the Marginal Prob Distribution, the informative prior make the estimate results of mu closer to 5.4 and has a higher and thinner peak. This means the possible values are condense to smaller a range and the estimation would be more accurate. In addition, the ESS value of mu is higher now (765).

sigma: The informative prior of mu does not make the Marginal Prob Distribution of sigma change that much. However, the ESS value of sigma is higher now (779).

I believe the informative prior make the estimate closer to the actual mean because the probability of being around 5.4 is higher than other regions in the model. Using informative priors helps us to get an accurate results according to the priors. Nevertheless, if the informative priors are not correct, it would alternatively guild us to a worse results.

Question 3

1. In a text editor, modify the code above to use the GTR model instead of Jukes-Cantor. I describe how to set up the GTR model below. Save the script in a file called primates GTR.Rev. Send me a copy of your working script.
2. Run your script by calling source("primates GTR.Rev") in RevBayes. Open the final MAP tree and properly reroot it. Do the posterior probabilities, topology, and/or branch lengths differ from the Jukes-Cantor tree?

    Posterior probabilities: The posterior probabilities are a bit different in JC and GTR tree. The posterior probabilities in GTR tree are averagely higher than JC tree. It may be due to the fact that the GTR model gives the program more flexibility and thus can get a better fit for the tree.

    Topology: In the figures below, I highlight the parts that congruent to each other in JC and GTR model. We can see that most of the topology is the same in both JC and GTR tree.

    Branch lengths: The branch lengths in the two trees are very similar. However, the branch lengths in GTR tree are overall shorter.

3. Send me both of your MAP tree files. **Left: JC. Right: GTR.**