ST440/540 – Mid-term exam – Due 4/15

Nike recently released a new running shoe called the Vaporfly that has made a huge slash in the marathon running community. Several studies have reported dramatic speed improvements for runners wearing these shoes. The objective of this study is to determine the magnitude of the improvement and whether the improvement varies across (1) gender, (2) runner and/or (3) course. The data on the course website are from the recent paper

https://www.researchers.one/article/2020-02-14

The .csv files have the marathon times by runner, course, gender and whether they were wearing the Vaporfly shoes. You can use the random effects model in the paper above as a starting point, but use a Bayesian approach and extend the analysis to perform the three tests above.

Summarize your analysis in a 2-4 page report (double spaced, 11pt, one-inch margins). Papers longer than four pages will be penalized. To avoid penalty, your report MUST have the follow sections and contents:

1. Introduction: Briefly describe the problem and your objectives

2. Methods: Describe the Bayesian model(s) you propose and other relevant details

3. Computation: Give the details of the algorithms you use and the verify the algorithms were successful

4. Model comparisons: Fit 3-5 models to the data, select a best fitting model

5. Results: Present your final estimates of improvements due to wearing these shoes, and tests whether the improvement varies by gender, runner or course

Your paper should be written as a professional document will full paragraphs, clearly labeled and numbered figures and/or tables, and few spelling/grammar errors. You should include enough detail that another student in class could reproduce your results. You do not need to turn in all of your code, but please include commented JAGS code for your final model (this does not count towards the four pages limit).

Email your completed exam to the instructor (bjreich@ncsu.edu) by midnight on the 15th.

Have fun!