Data

Annual marriage counts per $1,000$ of the population in Italy from 1936 to 1961 (from Columbo 1952). The dataset "ItalyMarriageRates.csv" can be found on Canvas.

Task

Carry out a Bayesian analysis that attempts to answer the following question: Are marriage rates before, during, and after World War II the same? Note that WWII took place from 1939-1945. Your case study should be completed in R Markdown. I have provided a template for you in Canvas; feel free to use it!

This analysis is rather open-ended, but you will have to implement everything by hand using a Gibbs sampler. Therefore, you should select/create a model that can actually be coded up! This may require some trial and error, going back to the drawing board, playing around with prior choice, etc. The first step is to consider the sampling model of your data; i.e. what *type* of data do you have, and what would be an appropriate distribution to represent them?

Some questions to consider

1. What are your Bayesian methods? What is your model? What assumptions are you making? Are the assumptions justified?
2. What are the parameter(s) in your model(s)? What prior distribution(s) do you use?
3. What is your computation scheme? What are you full conditional distribution(s)?
4. What are your posterior summaries of your parameter(s)? (Don't forget MCMC diagnostics to make sure your chain has converged.)
5. What is your conclusion? Are there any limitations/unreasonable assumptions you made?

Requirements/General rubric

- Clearly state your model (address questions 1 and 2 above). (5 pts)
- Clearly state how you will implement your model (address question 3 above). You should provide enough detail such that someone else could implement your analysis. (5 pts)
- Code that correctly implements your Gibbs sampler. (5 pts)
- Provide results *with interpretation* (address question 4 above). This should include plots and/or posterior summaries. (7 pts)
- Give a conclusion that answers the research question (address question 5 above). (3 pts)
- Your code should be clean. That means only code necessary for implementing your sampler and obtaining your results should be included in your final document. Your code should also be as reproducible as possible. (5 pts)
- Your report should be well-written. This means correct spelling, complete sentences, a nice flow to the report, etc. You should only provide plots/results that you actually intend to discuss in words. Think about this as a *professional* report. I estimate that the final document to be somewhere between 3-5 pages, depending on figure sizes and length of code, but feel free to write more/less if you think that is what the report needs. (5pts)