Alternative Sets of Theoretical questions

Set 1

1 - Predictive distributions (explain and discuss)

2 - The main drawback of Jeffreys' priors (explain and discuss)

3 - The second order level distributions in the Hierarchical Bayes model (explain and discuss)

4 - Subjective probability (explain and discuss)

Set 2

1 - Bayesian hypothesis testing for simple and null alternative hypotheses (explain and discuss)

2 - The use of auxiliary variables in Hierarchical Bayes models (explain and discuss)

3 - Proposing indifference priors in Bayesian statistics (explain and discuss)

4 - Illustrate the probability distribution that is used when probability of events is considered. (explain and discuss)

Set 3

1 - Illustrate the meaning and the role of the highest level of priors in Bayesian hierarchical models.

2 - What is the proportionality factor that is so important in computing posterior distributions and why it is often considered not important?

3 - The simplest proposal of an indifference prior for a parameter that assumes only positive values.

4 - Subjective probability and Bayesian statistics.

Lab. Exercise

Load the data included in the csv file "Data_Ex_4.csv".

The dataset contains the observations from a survey about the vote expressed during the 2000 US Presidential elections. The response variable bush assumes value 1 if the subject voted for Bush, 0 otherwise. As auxiliary information, the gender (1=female, 0=male), the race (1=black, 0=other) and the state are included in the study.

A logistic regression model needs to be estimated. The default rstanarm priors are required. You are asked to consider two models:

a) Simple model with bush as response variable and race and gender as covariates,

b) Model with bush as response variable, race and gender as covariates and a random intercept to account for the correlation of respondents from the same state.

The default prior distributions provided by rstanarm are used. You are asked to:

1. Write (on the R script) the distributional assumptions of model b) reporting the likelihood and the priors
2. Fit both models using the functions included in the rstanarm package.
3. Properly assess the convergence of the MCMC algorithms.
4. Describe the basic concepts of the effective sample size indicator and explain how it can be useful in the previous step.
5. Select the best model according to the WAIC rule.
6. Generate samples from the posterior predictive distribution of the selected model and evaluate the model performance
7. Consider a female elector with race = 0 from state 49: compare the posterior distribution of the linear predictor (transformed to the original scale) for this subject under models a) and b).