Bayesian Inference II

Lab 4: Bayesian GLM

We will look at the data on infection following birth by Caesarian section.

a) Run the main effects model discussed in the lecture using the algorithms in the file "logistic.r".

   For each parameter β_j, compute samples from the posterior distribution and provide some interpretation in terms of how each of the explanatory variables is related to presence/absence of infection.

   Explain the interpretation of the β_j parameters in terms of log odds ratios and interpret your MCMC output in the light of this.

b) Extend the design matrix $\boldsymbol{X}$ to include an additional column, which is the interaction (ie. the *product*) of the variables `noplan` and `factor`. Use `R` to do a Maximum Likelihood Analysis of this model and comment on the results.

c) Now consider the extended model in Part (b) in a Bayesian context. Assign a Normal prior for $\boldsymbol{\beta}$ with mean zero and diagonal covariance matrix with all entries equal to 10. Compute posterior means and standard deviations for the parameter estimates. Compute the posterior correlation between the parameters and comment.

d) Finally repeat the analysis using a Probit regression model. The MCMC algorithm you need to run is in the file "probit.r". Now you need to consider the individuals *without* grouping them according to their covariate values.Thus, you need to consider a Bernoulli sampling model. First, construct the appropriate design matrix $\mathbf{X}$ and vector of responses $\mathbf{y}$. Then, expand this matrix with a new column, the interaction term, obtained by multiplying the 2 relevant columns of the matrix $\mathbf{X}$. Then proceed to running the MCMC algorithm given in "probit.r" using the appropriate design matrix and vector of responses.