This assignment **must** be type set (\LaTeX{} is preferred).

In this assignment you are to analyze the *spam data set* (obtained from the course website). These data consist of 4601 observations and 57 continuous covariates. The final column of this data set is the indicator of spam or not spam (1813 total spam). For this assignment, you are to fit the logistic regression model using MCMC and write a report on your findings.

This is a very open ended assignment, and you are to treat this as a mini research project. While you are free to analyze in various ways, you must

- use and discuss at minimum two different sets of priors for the parameters of interest. Discuss the impact of your choice and which prior(s) you prefer.
- analyze the convergence of the MCMC procedure.
- do some sort of prediction assessment of your results. You may simply do a cross validation study (based on MAP estimators or Posterior Means), or you may do the full blown Bayesian predictive probability inference.

Your report must have

- an introduction,
- an analysis section,
- a results section.

While the length of each report will vary, there is no minimum report size; however, there is a max size of 7 pages.
1 Extra Credit

Consider the “single change point” AR(1) model:

\[ x_t = \theta_t x_{t-1} + \epsilon_t, \]

where \( \epsilon_t \sim N(0, \sigma^2) \), and:

\[ \theta_t = \begin{cases} 
\theta_1, & \text{if } t < T_{cp} \\
\theta_2, & \text{otherwise}. \end{cases} \] (1)

For this problem, you are to (you do not need to do everything; do what you can):

- Design a simulation study for studying the effectiveness of the Bayesian approach for estimating \( \{\theta_1, \theta_2, T_{cp}\} \).

- Find a non Bayesian method for comparison.

- Generalize to an “N change point”, and study the problem through a simulation study.

- Perform a retrospective vs. prospective analysis.

- Write a report on your study which contains an: introduction, an analysis section, a results section.

Reports that are written and are of publishable quality will receive a full letter increase in their final grade. For example, if you were to receive a B, your grade will be elevated to an A. For reports of markedly lesser quality, letter grades will be increased based on the relative merits of the work.