MATH 8820

Homework Assignment 4

Problem 1: In this problem you will explore a Metropolis-Hastings algorithm which can be used to fit Generalized linear models. In particular, the proposal that you will investigate was proposed by Dani Gamerman (1997) in a work entitled "Sampling from the posterior distribution in generalized linear mixed models." Your investigation will be centered around the use of this technique with respect to fitting a logistic regression model.

1. Concisely and generally describe the approach outlined in this article. Your discussion should summarize how this approach is used to fit generalized linear models in general.

2. Outline all of the necessary details required to implement the approach under logistic regression, be very specific.

3. Write R code which will implement the approach under logistic regression.

4. Use your code and my MH code to analyze the diabetes data that we considered in class. Comment on similarities and differences that you see; e.g., effective sample size, autocorrelation of the chains, acceptance rates, etc. etc.

Problem 2: In this problem you will investigate a new approach to specifying prior distributions. In particular, the proposal that you will investigate was proposed by Bedrick, Christensen, and Johnson (1996) in a work entitled "A new perspective on priors for generalized linear models." Again your investigation will be centered around the use of this technique with respect to fitting a logistic regression model.

1. Concisely and generally describe what is meant by a CMP prior. Your discussion should summarize how this approach is used to develop a CMP prior for all generalized linear models.

2. Outline all of the necessary details required to develop the CMP prior for a logistic regression model.

3. Develop a strategy for drawing posterior samples under a CMP prior using the Metropolis-Hastings algorithm considered in Problem 1.

Problem 3: For the CAR model described in Problem 2 of Homework 3, develop a Metropolis-Hastings algorithm that can be used to sample ρ.