Applied Statistics

Assignment #3 and Term paper

Due August 10, 2018

# Submit at a box located on the 5th floor (Economic Research Building) by 5pm on August 10 (Friday).

1. Assignment #3. Consider the model and the dataset of Exercise 4 in Chapter 5 (Section 5.13). Use WinBUGS to answer the following questions.
   (1) Estimate posterior means, standard deviations and 95% credible intervals of $\beta_0$ and $\beta_1$.
   (2) Plot the estimated marginal posterior densities of $\beta_0$ and $\beta_1$.
   (3) Show your “MCMC output analysis”.
      • Show trace plots, and sample autocorrelation functions of $\beta_0$ and $\beta_1$.
      • Is the sampling algorithm efficient?
      • Does your Markov chain converge?

2. Empirical study using Markov chain Monte Carlo method
   (1) Use real data (do not use simulated data). Where do you get the dataset?
   (2) Describe your statistical model. What are model parameters?
   (3) Specify your prior distributions and write the likelihood.
   (4) Show your “MCMC output analysis”
      • Sample paths (trace plots) of parameters of interest
        ➢ Explain how you determine the burn-in period
        ➢ Does your Markov chain converge?
      • Sample autocorrelation functions of parameters of interest
        ➢ Is your sampling algorithm efficient?
      • Summary statistics of parameters of interest
        ➢ Posterior means, posterior standard deviations, and 95% credible intervals
        ➢ Plot of the marginal posterior densities
        ➢ Interpret your MCMC estimation results
   (5) Sensitivity analysis
      • Check the prior sensitivity. What if you change your prior distributions?
   (6) Attach your R or WinBUGS code to the empirical paper.