Problem Set 1

Due via email by Thursday, October 6, 2011.

For this course, it will be necessary to use a general or scientific programming language such as Matlab (Octave), Python/SciPy, or Gauss. The goal of this exercise is to learn the basics of such tools by simulating and estimating a simple discrete choice model via maximum likelihood. The overall framework of this exercise and the discrete choice component, will be useful preparation for later problem sets.

Consider a simple binary choice model where $U$ has a standard type I extreme value distribution with cdf

$$F(u) = \exp(-\exp(-u))$$

and where there are two covariates

$$X_1 \sim N(0,1) \text{ and } X_2 \sim \chi^2_1.$$ 

Suppose that $\beta_1 = 1.0$ and $\beta_2 = -0.5$.

1. Write a procedure to simulate a dataset of size $N$ from the model for a given set of parameter values $\beta$. Hint: to generate draws from the type I extreme value distribution, draw a number of $U(0,1)$ draws and use the inverse of the cdf.

2. Code the log likelihood function as a function of the parameters $\beta$.

3. Generate $R = 101$ samples of size $N = 400$. Estimate the model for each sample and report the mean and standard deviation of the parameter estimates across the samples along with the mean bias and mean square error.

   Use an optimization algorithm provided by your language of choice (BFGS, Nelder-Mead, etc.) to maximize the log likelihood function for each sample. Specify which optimization routine you used, the starting values, and the values of any tuning parameters you had to choose.

Turn in your code and a short write-up which includes the results and algorithms used.