Problem Set 2

Econometric Theory

Due on 09/03/2016

1. [Julia] Write a code for evaluating the following two sums

   (a) $y = \sum_{i=0}^{1000} 0.5^i$ for i even .

   (b) $z = \sum_{i=1}^{1001} 0.5^i$ for i odd.

2. [Julia] Code the following Algorithm in `Julia`

   (a) Set $j = 1$

   (b) For each $i \leq N$ draw $x_i^{(j)} \sim F(\cdot)$ (where $F(\cdot)$ is a distribution)

   (c) Calculate $\bar{x}^{(j)} = \sum_{i=1}^{N} x_i/N$

   (d) If $j < M$, set $j = j + 1$ and go to step 2, else go to step 5

   (e) Plot the sample distribution of $\bar{x}^{(j)}$

   Run the algorithm assuming that F is the distribution of (i) a $N(0, 1)$; (ii) a χ_2^2; (iii) a Cauchy; (iv) Pareto with $\alpha = 1$; (v) Pareto with $\alpha = 3$; (vi) Binomial with $p = 0.49$.

3. [Julia] Code the following Algorithm in `Julia`

Step 1 Set $j = 1$.

Step 2 For each $i \leq N$, draw $u_i \sim (\chi_2^2 - 2)/2$, $x_i = z_i^2$ where $z_i \sim N(5, 1)$, and set

$$y_i = \beta_1 + \beta_2 x_i + u_i$$

where $\beta_0 = 0.1$ and $\beta_1 = 0.4$.

Step 3 Calculate $\hat{\beta}_1^{(j)}$ and $\hat{\beta}_2^{(j)}$ and an estimate of their asymptotic variance covariance matrix, $\hat{V}^{(j)}$.

Step 4 If $j < M$, set $j = j + 1$ and go to step 2, else go to step 5

Step 5 Plot the sample distribution of $\sqrt{N}\hat{\beta}_1^{(j)}/\sqrt{\hat{V}_{11}}$ and $\sqrt{N}\hat{\beta}_2^{(j)}\sqrt{\hat{V}_{22}}$.

Run the algorithm for $M = 100000$ and $N = 20$, $N = 50$ and $N = 200$.

Note

In Julia plotting can be done using the `Plots.jl` package. In JuliaBox is already installed. Running the code below should clarify how to use `Plots.jl`.

```
using Plots  ## Load the package
x = randn(1000); ## generate 1000 draws from a standard normal
Plots.histogram(x) ## Produce the histogram of x
Plots.histogram(x, bins = 30) ## use 30 bins
Plots.histogram(x, bins = 30, normalize = true) ## use 30 bins and normalized to integra
y = 0.1 + 0.2*x + randn(1000) ## produice fake regression data
## Scatterplot
Plots.plot(x,y)
```

A Jupyter notebook that illustrates these commands can be downloaded here.