ECON 7920
Econometrics II
Philip Shaw
Problem Set 4
Due Date: March 10, 2022

Problem 1

Recall that the iterative procedure for the Newton-Raphson method is given by:

$$\theta^{\{g+1\}} = \theta^{\{g\}} - \Big[\sum_{i=1}^{N} H_i(\theta^{\{g\}})\Big]^{-1}\Big[\sum_{i=1}^{N} s_i(\theta^{\{g\}})\Big] \tag{1}$$

a. Generate a random draw of data ($N = 100$) using the population model $y = exp(1 + 0x) + u$ where x is generated first, u is generated second followed by y. Before generating the data, set the seed to one as done in class.

b. Starting with a guess of $\theta^{\{g\}} = [.5, 0]'$, compute the next value implied by the N-R formula given by equation (1).

c. Now update $\theta^{\{g\}} = \theta^{\{g+1\}}$ and repeat the process 10 times with the help of a for loop. Over the loop, store the difference between each interations as $d = max(|\theta^{\{g\}} - \theta^{\{g+1\}}|)$. Plot the difference once the loop is complete. Do the parameter values converge?

d. Now estimate the model using the *nls* command. How do estimates compare to the values you got above?

e. Building off the steps above, write a R-script file that conducts the Newton-Raphson method which you should call *nrmethod.R* . The code should take as inputs y, x, and $\theta^{\{g\}}$ where $\theta^{\{g\}}$ is the initial guess for the $P \times 1$ parameter vector. Using a while command, your stopping criteria should be $d < \epsilon$ where you can set $\epsilon = 10^{-10}$. Now verify your code works for the guess $\theta^{\{g\}} = [.5, 0]'$. Does it work for the initial values $\theta^{\{g\}} = [-2, 0]'$?