SciencesPo Computational Economics
Spring 2017

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April 15, 2019

0.1 Problems

You can try to solve those problems either in a julia REPL (your terminal), in Juno, or by adding new cells in this notebook.

Problem 1a Use Julia's array and control flow syntax in order to define the NxN Strang matrix:

$$\begin{bmatrix} -2 & 1 & & & \\ 1 & -2 & 1 & & \\ & \ddots & \ddots & \ddots & \\ & & \ddots & \ddots & 1 \\ & & & 1 & -2 \end{bmatrix}$$

Problem 1b Write an expression that computes

$$y = \sum_{i=1}^{25} \sum_{j=1}^{i} j^{-1}$$

Problem 2

```
#### Prepare Data

X = rand(1000, 3)               # feature matrix
a0 = rand(3)                    # ground truths
y = X * a0 + 0.1 * randn(1000);  # generate response
```

Given an Nx3 array of data (`randn(N,3)`) and a Nx1 array of outcomes, produce the data matrix `X` which appends a column of 1's to the data matrix, and solve for the 4x1 array via `X = b` using `qrfact` or `\`. (Note: This is linear regression)

Problem 3 Compare your results to that of using `fit` from `GLM.jl` (note: you need to go find the documentation to find out how to use this!)

Problem 4 The logistic difference equation is defined by the recursion

$$b_{n+1} = r * b_n(1 - b_n)$$

where b_n is the number of bunnies at time n. Starting with $b_0 = .25$, by around 400 iterations this will reach a steady state. This steady state (or steady periodic state) is dependent on r. Write a function which solves for the steady state(s) for each given r, and plot "every state" in the steady attractor for each r (x-axis is r, y=value seen in the attractor) using Plots.jl. Take $r \in (2.9, 4)$