

# LogisticProject

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## 1 Logistic Map Bifurcation Diagram

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 PyPlot. Take  $r \in (2.9, 4)$

Optimize this function.

### 1.1 Old Solution

Please try solving this yourself first! Use this one as a hint if you get stuck.

```
In [ ]: ## Produces the logistic plot
        # Requires PyPlot

function logisticPlot()
    tic()
    r = 2.9:.00005:4; numAttract = 100;
    steady = ones(length(r),1)*.25;
    for i=1:400 ## Get to steady state
        @devec steady = r.*steady.*(1-steady);
    end
    x = zeros(length(steady),numAttract);
    x[:,1] = steady;
    @simd for i=2:numAttract ## Grab values at the attractor
        @inbounds @fastmath x[:,i] = r.*x[:,i-1].*(1-x[:,i-1]);
    end
    toc()
    fig = figure(figsize=(20,10));
    plot(collect(r),x,"b.",markersize=.06)
    savefig("plot.png",dpi=300);
end
using PyPlot
@time logisticPlot()
```