The Logistic Map continued

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Introduction

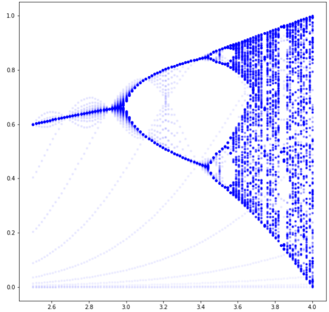
The logistic map is defined by the recursion $x_{n+1} = rx_n(1 - x_n)$. Where x_0 is the initial condition and r is the growth rate. This lab investigates the convergence of the logistic map in response to initial conditions by the usage of various analysis techniques.

Poincare Plot

The poincare plot examines a sequence of points $(x_i, x_{i+1}$ and plots them. This plot gives us an upside down parabola. This makes sense as the function we have is a negative quadratic. Then we examined a plot of random points and it is clear that the chaos of the logistic map is actually not chaos like the randoms points and is very deterministic and understood.

Bifurcation Diagram

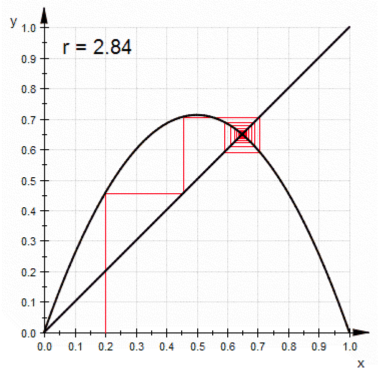
As we saw in previous labs, the function begins splitting around the value 3 and continues to become more and more chaotic as we get to 3.57 and then becomes very difficult to examine. Below is the figure.



Cobweb Plot

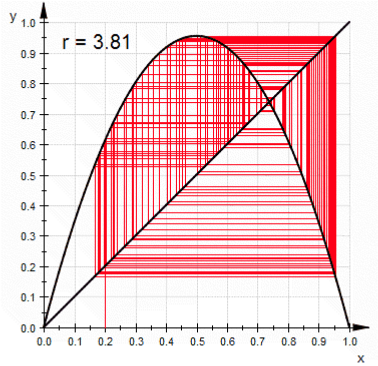
The cobweb plot is a function that helps examine the convergence of the function for differing values of r. Following an iterative process, the cobweb plot gives a better idea of how the function changes are r changes. Below is the cobweb plot for $r = 2.84$ and another for $r = 3.81$

Images



y
x
r = 2.84
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

Images



r = 3.81
y
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
x