Logistic Map

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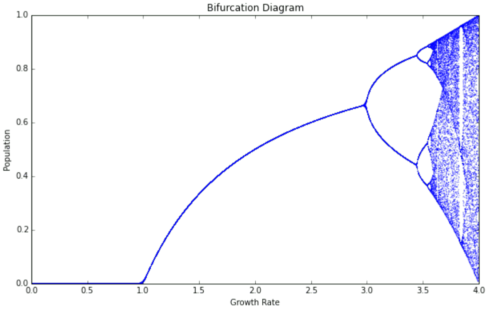
Basis of Logistic Map

The logistic map function, modeled by the map below, recursively maps an input, scaled by an initial condition, to an output that will be again used iteratively. The initial population input, denoted by x, does not determine the behavior of the function, but the growth rate, denoted by r determines the shape and where possible bifurcations might happen.

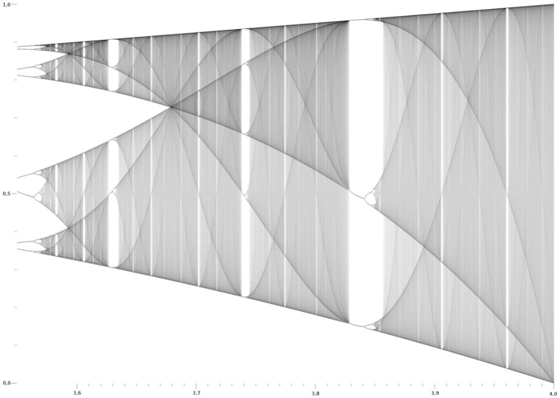
$$x_{n+1} = r \cdot x_n \cdot (1 - x_n)$$

Bifurcation Diagram



Graphing the equation with certain initial conditions, we observe the above behavior. We can observe a series of bifurcations that lead to a chaotic behavior.

Chaos of the Logistic Map



While the first few bifurcations can be clearly pinpointed, the behavior rapidly becomes unpredictable. We can zoom into the Feigenbaum constant, at around 3.6, where the unpredictable behavior begins to happen. Depending on initial conditions, this map will look vastly different, hence why this map is considered chaotic.