

Homework 4. For r varying between 0 and 4, find out the possible “limit cycles”[§] of the iterative map:

$$x_{n+1} = rx_n(1 - x), \quad x_0 = 0.5 \text{ (or anything else that is not 0 nor 1)} \quad (14)$$

This converges to a single value for some values of r but for others results in an “orbit”, which can be very long. For every $0 < r < 4$, “find” this orbit and plot the orbits together.

Use the “matrix-at-a-time” notation we learned in the last iteration example:

- Start with a vector of r -values, and a vector of x -values (both row vectors and the same size).
- Perform many (how many?) iterations on the whole vector of x -values, so that each place in the vector is updated according to its appropriate r .
- Plot the resulting x -values vs. the r values.
- Continue the iteration and plot several more iterations (how many?).
- Observe the nice pattern that arises, and explore its self-similarity properties.

[§]a limit cycle is an orbit of an iterative map that the dynamics of the problem converges too, regardless of the initial condition

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