Logistic Explorations!

Chaos and Fractals

College of the Atlantic

Do these before your discussion section on Tuesday, Jan 11, 2022

General Instructions

- Do this with others if you like. It might be more fun that way.
- We'll go over this in discussion section. There's nothing to hand in, but take some notes (words and/or pictures) as you explore.
- Don't spend more than 15-20 minutes on these exploration (unless you want to).
- Use this web page for iterating: http://hornacek.coa.edu/dave/Chaos/time_series.html.

You will investigate iterating the logistic equation, $f(x) = rx(1-x)$, for different values of the initial condition x_0. For each of the r values listed below:

- Determine the long-term behavior of the itinerary. Does it approach a fixed point? Does it enter in to a cycle? If so, what is the period of the cycle?
- Try a few initial conditions for each r value. Your initial condition should be between 0 and 1. Don't choose simple fractions like 0.5 or 0.25.
- For each value, make a rough sketch of the time series plot.

Here are the r values to try:

1. $r = 0.5$. approaches fixed point = 0, here the initial condition does not affect the outcome, attraction to the fixed point happens in few time steps
2. $r = 1.5$. approaches fixed point = 0.3, here the initial condition does not affect the outcome, attraction to the fixed point happens in few time steps
3. $r = 2.9$ (we did this at the end of class) approaches fixed point = 0.65, here the initial condition does not affect the outcome, attraction to the fixed point happens in few, but a few more time steps examples above
4. $r = 3.3$. does not approach fixed point, attracts to oscillation of period = 2 around fixed point, fixed point seems to be repelling
5. $r = 3.5$. does not approach fixed point, attracts to oscillation of period = 4 around fixed point, fixed point seems to be repelling
6. $r = 3.56$. does not approach fixed point, attracts to oscillation of period = 8 around fixed point, fixed point seems to be repelling
7. $r = 3.835$. does not approach fixed point, attracts to oscillation of period = 3 around fixed point, fixed point seems to be repelling
8. $r = 4.0$. does not approach fixed point, attracts chaotically around fixed point, fixed point seems to be repelling, itinerary is aperiodic