CS 346U: Exploring Complexity in Science and Technology

Week 2 Assignment

Due Monday, October 14

1. Watch videos for Unit 2 on http://complexityexplorer.org **(due Wednesday by class time)**

2. Reading:

- Textbook, Chapter 2 **(due Wednesday by class time)**
- Optional: L. Kadanoff, Chaos: A view of complexity in the physical sciences (from Course Materials page on complexityexplorer.org)

3. Exercises:

- Quiz in Unit 2.2
- Exercises 1-3 in Unit 2.3
- Quiz in Unit 2.4
- Exercise in Unit 2.5
- Prove algebraically that $x_{t+1} = 2\,(x_t - x_t^2)$ has fixed point 0.5.

4. **Unit 2 test** (complete and submit online)

5. NetLogo Assignment 1

Download SimplePopulationGrowth.nlogo from the Course Materials page. Do the following modifications of the code.

- Change the shape of the reproducing individuals from bunnies to another shape. (To see the list of possible shapes, go to the "observer >" box below the Command Center window, and type "show shapes", followed by a carriage return, or see the list of "default shapes" at http://ccl.northwestern.edu/netlogo/docs/index2.html (and click on "Shapes Editor" under "Features" on the left sidebar).

- Change the color of the patches, using "set pcolor green" or whatever color you

prefer. The list of color names you can use includes: black, gray, white, red, orange, brown, yellow, green, lime, turquoise, cyan, sky, blue, violet, magenta, pink.   You can see all the color codes by going to the Tools menu and clicking on "Color Swatches".

- Add a "Monitor" box to the interface, similar to the "count bunnies" box, but call it "cumulative bunnies", and have the program use it to count how many total bunnies have been born so far in a given run.

- Save your new model under the name Week2Netlogo1.nlogo

6. Netlogo Assignment 2

- Download and modify SensitiveDependence.nlogo (available on the Course Materials page) as follows: Add a third initial condition, x_0'', that can be set by a slider and that is updated and plotted by the program in the same way that x_0' is updated and plotted, but with a color different from red or blue.

- Further modify SensitiveDependence.nlogo to color the background green, and have each of the three dots show a label with its coordinates (x_t, x_{t+1}). (Hint: use the "set label" command in an "ask turtles" section.)

- Save your new model under the name Week2Netlogo2.nlogo

7. Netlogo Assignment 3

Our LogisticModel.nlogo updates the population using the Logistic Model equation. This assignment is to build an agent-based (rather than equation-based) model of logistic population growth.

Build a model that has the following features:

- A slider to set the initial population.
- Turtles that reproduce (no mating necessary) with a reproduction rate set by a slider on the interface.
- Some aspect of the environment (food, space, etc.) that either limits reproduction or increases the death-rate.
- A plot that shows the population as it changes over time.
- Save your new model under the name Week2Netlogo3.nlogo

Does your model show population growth dynamics that are qualitatively similar to the

Logistic Model, or are the dynamics different? If different, why are they different?
Write a paragraph or two describing your observations.

What to turn in: Complete and submit the Unit 2 test online.   Email your three
completed Netlogo Models, along with your paragraph(s) on model 3, to
mm@cs.pdx.edu.   (You don't need to submit answers to the Exercises/Quizzes.)