

CS 346U: Exploring Complexity in Science and Technology

Week 5 Assignment

Due Monday November 4

I. Watch videos for Unit 5 on <http://complexityexplorer.org>

II. Reading: Textbook, Chapters 5 and 9

III. Exercises (Ungraded and not turned in):

- All quizzes in Unit 5. Do these **before** you do the Unit 5 test.

IV. Unit 5 test (complete and submit online).

V. Assignments to turn in

1. In a paragraph or so, describe two major differences between Lamarck's account of how biological evolution occurred and the account due to the modern interpretation of Darwin's theory summarized on p. 78-79 of *Complexity: A Guided Tour*.
2. Describe in a few sentences one disagreement between the early Darwinists and the early Mendelians, and how this disagreement was resolved under the Modern Synthesis.
3. Stephen Jay Gould and other evolutionary theorists have argued for the notion of "group selection", in which natural selection works at the level of groups of individuals. A possible piece of evidence for this would be the common appearance of "group-level" traits that are adaptive at the group level but maladaptive at the level of an individual organism. In a paragraph or so, discuss an example of such a trait in some biological group—that is, a trait that helps groups of individuals survive and give rise to "offspring" groups, but that is maladaptive for individuals.

Explain why you think your example has these properties.

4. Open the Netlogo Models Library program "Bug Hunt Speeds" (under Biology/Evolution). Using "Save As" under the File menu, save this model to another name: BugHuntShapes.nlogo

(a) Experiment with the model, evolving bugs for speed.

(b) Modify the model you saved so that it uses shapes in the place of speeds. That is, the bugs should all move at the same speed, but start with different shapes. The population should evolve in the direction of successful shapes rather than speeds. The plots should display population statistics as a function of shapes rather than speeds. The buttons and sliders, etc. in the interface that originally have "speed" in their descriptions should now have "shape".

(c) Do the same thing as (a), but this time use **size** in place of shapes. That is, all bugs have the same shape and speed, but different sizes.

(d) Write a paragraph comparing the results you get (and any observations you want to make) in evolving bugs under the original model (i.e., speed) as compared to part (b) (i.e., shapes) and part (c) (i.e., size).

5. (a) As described in *Complexity: A Guided Tour*, Chapter 9, Robby the Robot's strategies are represented as strings of 243 numbers (each between 0 and 6), where each number corresponds to the action Robby would take in the corresponding situation. Explain where the number 243 comes from.

(b) Give examples of two situations that are counted in the 243 situations, but that Robby would never actually encounter in the 10x10 world.

6. Start thinking about ideas for your class project. This could include extending an existing model, or creating a new model.

What to turn in: Complete and submit the Unit 5 test online. Email a pdf document with your typed answers to Assignments 1-5 to mm@cs.pdx.edu. You don't need to turn in any NetLogo models this week. Also, you don't need to turn in anything for Question 6—just start thinking about a possible project you might want to do. We will discuss this further in class next week.