COSC150: Laboratory 3 (7 March 2023)

Collaborative, Guided Discovery

What makes a "wildfire" wild?

Emphasizing the EXPECTATION, OBSERVATION, REFLECTION cycle of scientific investigations, we will work together to divide a very large amount of work among all of us, but only after generating evidence that we can trust each other enough for each to do their share of the work. We will revisit the concepts of AVERAGE, VARIANCE, STANDARD DEVIATION, and STANDARD ERROR in the process. We will also compare multiple representations (tabular, graphical, and functional).

To understand basic forest fires, the experts at Clemson tell us there are two simple rules:

1. Fires spread in the simplest models to NEAREST NEIGHBORS only.
2. As the burning probability increases, the percent of the forest burned should also increase.

These are the relevant links:

http://www.shodor.org/interactivate/activities/fire1 (the simplest fire model)

http://www.shodor.org/interactivate/activities/SimplePlot (a simple, comparative graphing tool)

http://www.shodor.org/interactivate/activities/MultiFunctionDataFly (data and functions tool)

http://webs.wofford.edu/panoffrm/COSC150/Labs/Lab3.pdf (electronic version of this file)

http://www.tinyurl.com/COSC150SharedFire (google Sheet file to collect class data)

Your individual write up of today's explorations should be more complete, using the Expectation, Observation, Reflection cycle as your guide, and compare the Lab model to the class Excel model.

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Wildfires and Predictions (From Directed to Guided Discovery)

We will be using the "Fire!" activity to understand what makes a "simple" wildfire "wild". We will use fractions and decimals and percents and averages to measure and report to each other in the form of a graph the results of an exploration of fires.

1. Go to the Fire! Activity. Simple Linear Model:
   http://www.shodor.org/interactivate/activities/fire1

   - Set the "probability of burning" to 0.
     - Click anywhere in the forest. Watch what happens.
     - What percent of the trees were burned?
     - Regrow the forest and start a new fire.
     - Does the same thing happen? Why or why not?
     - Repeat this several times. See if you can detect a pattern.
     - How does the number of iterations (steps) change with fire starting point?

   - Set the "probability of burning" to 1.
     - Click anywhere in the forest. Watch what happens.
     - What percent of the trees were burned?
     - Regrow the forest and start a new fire.
     - Does the same thing happen? Why or why not?
     - Repeat this several times. See if you can detect a pattern.
     - How does the number of iterations (steps) change with fire starting point?

For the remaining explorations, record your results in:

http://tinyurl.com/COSC150SharedFire

- Successive Approximation: add a middle point. Set the "probability of burning" in the Fire! App to 3/6 or 1/2 or 0.5 (hit enter)
  - As a CONTROL, always start the fire at the center tree. Watch what happens.
  - What percent of the trees were burned?
  - Regrow the forest and start a new fire. Does the same thing happen? Why or why not? ***Repeat this three times and enter each value in the shared sheet***. See if you can detect a pattern.

2. Now repeat the burning simulation 20 times with the probability set to 0.5, (ALWAYS REGROWING and STARTING WITH THE CENTER TREE) and record your individual burn results in the shared google sheet IN YOUR OWN TAB.

   Then calculate (and record on the SHARED tab):

   - What is your AVERAGE percentage of trees burned?
   - What is your AVERAGE number of iterations (steps) the fire burned?
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   - What is the VARIANCE in the percentage of trees burned?
   - What is the VARIANCE in the number of iterations (steps) the fire burned?

   - What is the STANDARD DEVIATION in the AVERAGE PERCENTAGE of the trees burned?

   - What is the STANDARD ERROR in the AVERAGE PERCENTAGE of the trees burned?

   - How does the graph in "Graphit" change? From "1" to "2"?

3. Successive Approximation: We will add several interpolation points. Now repeat the burning simulation 20 times with the probability set to YOUR CUSTOM VALUES (=YOUR INDEX/21), (ALWAYS REGROWING and STARTING WITH THE CENTER TREE) and record your individual burn results in the shared google sheet (be sure to share YOUR PROBABILITY) IN YOUR OWN TAB. Then calculate (and record on the CONTROL CENTER tab):

   - What is your AVERAGE percentage of trees burned?
   - What is your AVERAGE number of iterations (steps) the fire burned?

   - What is the VARIANCE in the percentage of trees burned?

- What is the STANDARD DEVIATION in the AVERAGE PERCENTAGE of the trees burned?

- What is the STANDARD ERROR in the AVERAGE PERCENTAGE of the trees burned?

- How does the graph in Graphit Change from “2” to “3”?

4. Randomize your index sheets. Now repeat the burning simulations 20 times with the probability set to YOUR CUSTOM VALUES (=YOUR INDEX/21), (ALWAYS REGROWING and STARTING WITH A **CORNER** TREE) and record your individual burn results in the shared google sheet (be sure to share YOUR PROBABILITY) IN YOUR OWN TAB. Then calculate (and record on the CONTROL CORNER tab):

- What is your AVERAGE percentage of trees burned?
- What is your AVERAGE number of iterations (steps) the fire burned?

- What is the VARIANCE in the percentage of trees burned?

- What is the STANDARD DEVIATION in the AVERAGE PERCENTAGE of the trees burned?

- What is the STANDARD ERROR in the AVERAGE PERCENTAGE of the trees burned?

5. What do you observe about the pattern in the CONTROL CENTER shared data? Is there any difference compared to the CONTROL CORNER?