Elementay Math Models

Worksheet: Logistic Growth

This worksheet discusses 5 sample models that will give you some practice working with the ideas of logistic growth.

The basic framework for each model is the same. A laboratory is developing a procedure to grow a certain kind of mold that will be used to make a new antibiotic. The mold is grown in a vat with a nutrient solution made up of sugars, water, and other ingredients. For each different nutrient solution, the laboratory makes two tests by introducing a known amount of the mold and observing how the mold grows over a 24 hour period. For each of the two test amounts, the growth factor for the 24 hour period is recorded. The results of these tests are shown in the table below.

Test	First Test		Second Test	
Solution	Population	Growth Factor	Population	Growth Factor
A	100	0.8	500	0.6
B	100	0.9	400	0.3
C	100	2.0	500	1.2
D	100	3.0	600	1.5
E	100	4.0	600	1.5

For each Test Solution (A - E), your job is to develop and analyze a logistic growth model. A special worksheet has been provided for this purpose. Use a separate worksheet for each model, and follow the outline below.

1. Develop a linear equation that relates the growth factor to the population size. There is room on the work sheet to graph the line and work out the equation.

2. Formulate a difference equation in the form $p_{n+1} = m(L - p_n)p_n$. What are the constants m and L for this model?

3. Make a graph using p_n as the x value and p_{n+1} as the y value. Find the highest point on the graph. Use this to decide whether the model will always produce values of p_{n+1} that are between 0 and L for your L. Relate your conclusion to the condition $mL < 4$.

4. Is there a value of the population that results in a growth factor equal to 1? What does that tell you about the future population growth for this model? Relate your conclusion to the value of $L - 1/m$.

5. Verify your conclusions by computing and graphing the first several values of population model for some starting population.