Elementay Math Models

Group Project: Geometric Growth Models

In this project, you will use a geometric growth model to approximate real data published in the form of a graph or chart. Before meeting, each member of the group should individually find a graph in a magazine or newspaper that appears to have the characteristic shape of a geometric growth model: Curving upward on one side of the graph and leveling off along the horizontal axis on the other side. Avoid graphs for which one axis refers to some type of *categories*. For example, a graph showing medicare expenditures by state would not be acceptable, because one of the axes of the graph, the one showing states, is a category. You want to have a graph with numerical axes, so that it will make sense to extend the graph beyond the original data shown. A graph that has one axis for time and the other for some other numerical variable is ideal for this activity.

As a group, pick the graph that seems best suited for an geometric growth model. It should be the one that is closest in appearance to a geometric growth curve. For the graph that you pick, create a table of x and y values, either using data values given in the graph, or if necessary, estimating as accurately as possible from the data points on the graph. For this data set, formulate a geometric growth model. You will want to compute growth factors for your data, being sure that the x values increase by a fixed amount (for example, one data point each month, or each year). The geometric model you formulate will have a constant growth factor. Pick that constant so that is as close as possible to the growth factors you actually computed for your data.

Your definition of a model must include definitions for the variables, a difference equation, a graph of both the model data and the difference equation, and a functional equation.

You can test out how well different variations on your model fit the data points by using the demodel.mwt module. On the first screen, enter just the y values of your data, these correspond to sequence values a_0, a_1, a_2, etc. The second screen will allow you to enter your difference equation and functional equation and see them plotted in the same graph with the data points. Note that the computer screen will also show how far each data value deviates from the corresponding value produced by the difference equation. These numbers are referred to as the errors for the model. Try to make these errors as small as possible by modifying parameters of the difference equation: the growth factor r and the initial value a_0. For more details, see the help file for demodel.

Part of the project assignment is to write a report about your model. The report should discuss all of the things mentioned above, including the definitions of your variables, the difference and functional equations, and graphs of the original data and the model. You should also discuss how accurate the model is, in terms of the sizes of the errors you observed. In addition, use the model to make projections beyond the original data. For example, if your original graph showed data for several different years, you can use the model to predict what will happen for future years. Be sure to include a discussion of how reliable you think these predictions are.

You may create your report using the computer report module or any word processor if you choose. The snapshot feature on the computer module can be used to cut pictures from the screen, and these can then be pasted into a word processing document. However you create your report, please be sure to include a graph and a table for your data, as well as a xerox copy of the original source of the data.