Mathematical Models in the Life Sciences

Assignment 1

Due: 10:00 AM January 25, 2008

You are free to use any books or notes as you work on these problems. You are encouraged to work with other members of the class, but not to the point where you simply copy another's work. Also feel free to ask me any questions about these problems. Your work should be neatly and carefully written, and be sure to show all of your work. Solutions to the collected problems will be available following the due date.

- COURSE WEBPAGE: http://math.bu.edu/people/mak/MA565
- READING: Edelstein-Keshet — 1.0, 1.1.
- PROBLEMS:

1. Throughout this course, you will find computing numerical solutions useful (or essential) to solving particular problems. In this first assignment, I ask that you show some familiarity with the software package MATLAB. Please see the course website for links to MATLAB availability (for free on ACS or for purchase). You may use any software you like (such as *Mathematica* or XPPAUT — see course webpage for links to these) in completing your assignments. But throughout the semester you will be asked to execute examples provided in MATLAB. Please see me if you would like more assistance learning to use MATLAB. Note: if this assignment takes you more than 1 hour to complete, please come see me!

   In MATLAB:

   (a) Plot the function $y = x^2 - 1$ for $-10 < x < 10$. Label the horizontal and vertical axes x and y, respectively. Print out this plot and hand it in.

   (b) Download *blackbox.m* from the course webpage. Save this code to a folder on your computer. Direct MATLAB to this folder, execute the function *blackbox*, and plot the results in MATLAB as follows:

   ```
   >>  y = blackbox(100, 0.75);
   >>  plot(y);
   ```

The function *blackbox* requires two input arguments. In the example above, these are: 100 and 0.75. The first argument (100) is the number of simulation points for y. The second argument (0.75) is a parameter. Keep the first argument fixed at 100, and plot y for parameter values of 0.75, 1.0, and 1.01. Hand in these three plots.

(c) Open the file *blackbox.m* with the MATLAB editor or any other text editor and examine the code. Explain each line of the algorithm as best you can. Do you understand what the *blackbox* is doing?