EEB 133 - Elements of Theoretical and
Computational Biology
Spring 2005 Homework 1

Note: All calculations must be done with MatLab (or Mathematica). No exceptions. You should explain what you are doing using a text editor (I suggest MS Word) with the appropriate segments of MatLab input and output pasted in. (In Mathematica, you can do this more simply by using notebooks, see CT for instruction if you wish to do so).

1. Get into MatLab and work through part of the tutorial. Under Demos, work through the sections “What is MatLab”, “Matrices and Arrays” and part or all of “Graphics”.

2. Provide answers to the following:
   a) \( a + b \) where \( a = 6 \) and \( b = 8 \);
   b) \( 11,000 \times 0.03 \times 50 \);
   c) \( \sin 2 \);
   d) \((1,2,3,4) + (5,6,7,8)\);
   e) \( \begin{pmatrix} a+b & a-b \\ 3 & 2 \end{pmatrix} + \begin{pmatrix} a-b & a+b \\ 2 & 3 \end{pmatrix} \)

2. Consult the online CIA World Factbook to get the birth and death rates and size of the US population.
   a) what are the values for \( b, d \) and \( r \) (and \( R \))?
   b) What is the size of the US population in 2005?
   c) Assuming exponential growth of the US population, what do you predict will be the population size of the US in 2020? 2100?
   d) Plot the expected US population population from 2005 to 2100.
   e) Using this rate for exponential growth, estimate the population size of the US in 1964.
   f) (optional) How would migration affect these calculations? Can you modify the equation for population growth to accommodate this, e.g., assume a constant influx \( m \) of individuals coming in per year.

3. Understand and work through yourself and understand the program for the traveling bumblebee on page 53 of the text. How high must \( e_b \) and \( t_b \) be in order to raise the departure position to 5?