BIOE 148B Quantitative Methods in Ecology and Evolution

This class aims to give students quantitative skills they can use in a wide range of careers from biology to tech to engineering. It involves building mathematical models and using theory and data in combination to answer questions in ecology and evolution. It also includes learning to write computer code to simulate models and analyze data (using R, though this is NOT a course in statistics). The biological topics we will model and analyze include population dynamics, and evolutionary dynamics, life history theory and behavior, but the focus is on developing and using quantitative skills. In addition to the prerequisites (BIOE 107 and BIOE109), it is very helpful if students are comfortable with or excited about mathematics and statistics, and eager to learn to program, which is initially very frustrating, but eventually very powerful. Please fill out these questions using just the knowledge in your head (not using the web or books) so we can determine whether this class is a good fit for you! Depending on your answers, we may ask some follow-up questions. And if we think the course is a good fit for you, we will then give you a permission code so you can enroll.

1. A background in ecology and evolution are necessary for this course. Have you taken a course in Ecology (e.g. BIOE107) and Evolution (e.g. BIOE109)? If so what courses and where (i.e. at UCSC?)

2. Please list the mathematics, statistics, and computer programming courses you’ve taken or experience you have outside of class.

3. \[ \frac{dN}{dt} = bN - dN \]
   Can you solve this differential equation (which gives the rate of change in a population of size N) to get a function describing the population size, N, at any time t in the future? (b is the birth rate and d is the death rate, which you can assume are constant).

   Even if you can’t solve the equation does doing so seem like fun?
4. Draw a histogram or probability distribution function for a normal or Gaussian distribution. What information can one get from this graph?

5. Given the following function $F(x)$ where $x$ is the variable and $a$ and $c$ are constant; how would you find the maxima or minima of this function? What would the graph of this function look like ($x$ on the horizontal axis, $F(x)$ on the vertical axis)

$$F(x) = ax(1-cx)$$

6. Given the following two equations with two unknowns ($x$ and $y$), find the values for $x$ and $y$ that make both equations true.

$$2x + y = 1$$
$$-3x + 2y = 0$$

7. Solve the following for $x$.

$$y = 2x^3$$

$$y = 10\exp[-x]$$

$$y = 6 + 2x + x^2$$

8. Would you describe these problems as: a) fun; b) painful but useful; c) I have no idea how to even start these problems?

9. Why are you interested in taking this class (so we know a little bit more about you and your interests)?