Recitation 1

1. Recall the shark-tuna (predator-prey) population graph shown in lecture:

populations of sharks and tuna
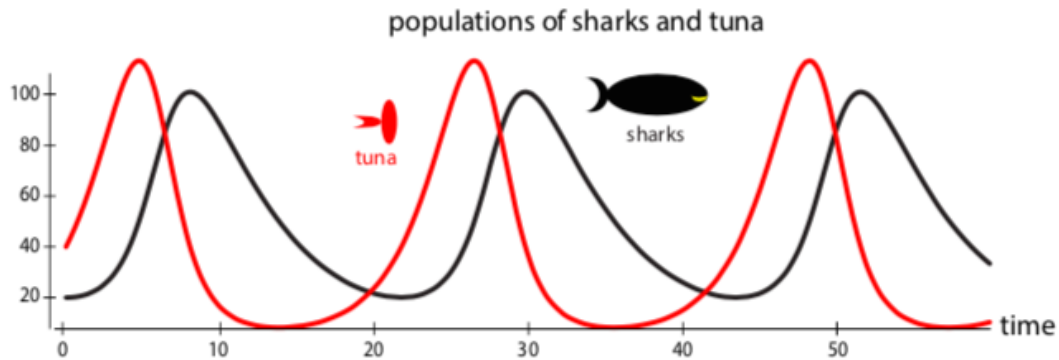
(a) Discuss with your group **how the system works**. Some things to mention are:

   1. What is happening to the population of shark and tuna as time passes?

   2. What effect does the population of shark have on the population of tuna and vice-versa? How do the two populations influence each other?

   3. How do you think the graph would continue? In other words, what will happen to these populations as time continues to pass?

Developed by Matthew Eichhorn, based on materials from prior MATH 1106 iterations.   1/4

(b) When creating a model, it is impossible to account for every factor present in real life, otherwise the model would be so hard to study that it would become ineffective. What are the **limitations of this model? In other words, what are some factors that are not considered here and that might also affect these populations?**

(c) Use your answer in part 1.a.ii to explain how this system gives an example of a negative feedback loop. In other words, explain how "a positive value of a variable leads to a decrease in that variable, and a negative value of a variable leads to an increase in that variable".

2. Imagine that we place a flat map of the world on top of a sheet of graphing paper, for example with Ithaca at the point $(0,0)$. On that graphing paper, we draw the velocity of the wind at each point of the surface, represented as a arrow.

(a) What would the direction of the arrow indicate? And its length?

(b) For each of the following wind charts, choose any point and imagine that you stand precisely at that point on the surface of the Earth and throw a feather up in the air. Draw as best as you can the trajectory that the feather would follow, and describe it with your own words (What is the general shape of the trajectory? Is the trajectory a closed loop? If it is not closed, where does start and where does it end?). Do the same with another point.
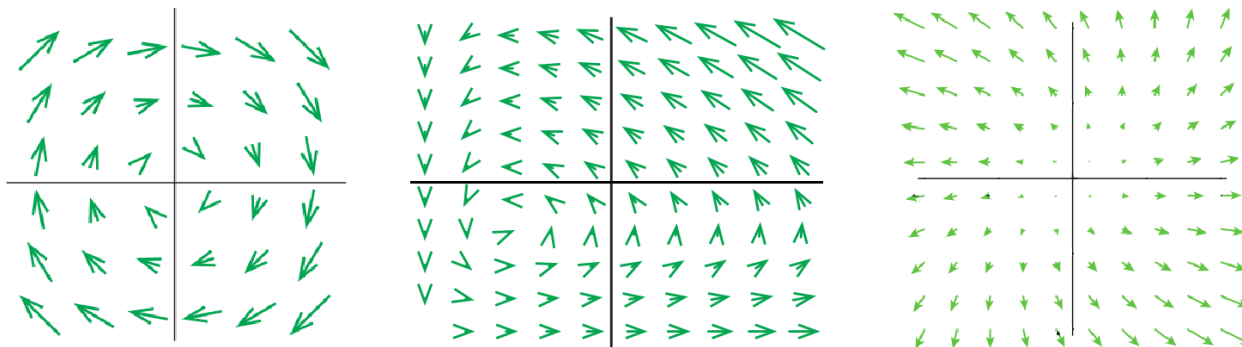
In a few weeks we will study the evolution of biological systems by studying their trajectories given by such "vector fields".

3. Without using the textbook, write down 2 examples of positive feedback loops, and 2 examples of negative feedback loops other than the predator-prey system.