Math 5110: Homework Assignment 6
Due Oct 3, 2017

1. Consider the fisheries model we studied in class.

$$F_{t+1} = rF_t(1 - F_t) - hF_t.$$

   Recall that we found two different values of h, the MSY (let's call that h_M) and the competitive or "bionomic" equilibrium (let's say h_B).

   a. Write a payoff matrix showing how fisherpeople who choose between a cooperative strategy of $h_M/2$ and the competitive strategy h_B do against each other.

   b. Does this have the structure of a Prisoner's Dilemma?

2. Complete the analysis of the alternative harvesting fisheries model

$$F_{t+1} = r(1 - h)F_t(1 - F_t)$$

   where h is the fraction of fish harvested each year.

   a. Find the MSY (maximum sustained yield), the value of h that maximizes the equilibrium harvest.

   b. Find the competitive equilibrium where the harvests h_1 and h_2 are the best replies to each when there are two competing harvesters.

   c. Do the results match those of the model from class? Is this still an example of the tragedy of the commons?

3. We looked at the Wright-Fisher model for population genetics with very small populations of $n = 2$ and $n = 3$.

   a. Find the matrix with $n = 4$.

   b. By hook or crook, find the largest eigenvalue that is less than 1. Explain what you did.

   Extra Credit: Find a clever way to compute this largest eigenvalue for any value of n.