

MTH/BIO 415 - Fall 2013

Homework Assignment #2a: ANOTHER Nonlinear Difference Equation

Due: Monday, September 24

1. A frequently encountered difference equation model for a single population is based on an the *logistic* growth observed in continuous models.

$$N_{n+1} = N_n e^{r(1-N_n/K)} .$$

- (a) The idea here is that the environment has a *Carrying Capacity* given by the value of K . Analyze the model to find the steady states, then explain, in words, what K is and why it is called the *Carrying Capacity*. Be clear enough that a mathematician can understand!
- (b) Rewrite the equation to look like:

$$N_{n+1} = R(N_n)N_n$$

where $R(N)$ is the population dependent growth rate. Use MatLab to sketch a graph of the population dependent growth rate as a function of population. What is the maximum value of R ? For what values of the population does the population grow? Determine how this graph changes with changes to r and K .

- (c) Do some analysis: Determine the conditions for each steady state to be stable.
- (d) Write a matlab script like `logmap.m` to simulate the Equation. Demonstrate the results determined above with Matlab. (In other words, use the program to show that the steady state is stable or unstable for different values of r and K .)