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 \( K \).)