# Assignment 3

36-462, Spring 2009

Due 10 February 2009

1. THE $r = 1$ LOGISTIC MAP AS IID COIN-TOSSING

   (a) Write a program to simulate the symbolic dynamics of the logistic map (under the generating partiton) at a given value of $r$.

   (b) For $r = 1$, tabulate the frequencies of sub-sequences of length $2L$. Test whether $X_t^{t+L-1}$ is independent of $X_{t-L}^{t-1}$. Explain how you decided how long the simulation should be, and what $L$ should be.

   *Hint:* Look up the `table` and `chisq.test` functions in R.

   (c) Repeat the previous part with $r = 0.966$. What happens?

2. TOPOLOGICAL ENTROPY RATE ESTIMATION

   (a) Write a program to calculate the topological entropy rate $h_0$ for the logistic map at any $r$. Check that it gives the right answers at $r = 1$ and at at least one $r$ where there is a periodic attractor.

   *Hint:* look at the handout on topological entropy rate.

   (b) How would you put a standard error on your estimate of $h_0$?

3. MARKOV CHAIN ESTIMATION Write a function `markov.mle.1` which takes as its input a time series from a Markov chain, in the form of a vector of discrete values, and returns the maximum likelihood estimate of the chain's transition matrix. (*To be continued.*)