

Homework 6 – Due Tuesday, Apr. 11
STAT-GB.2302, STAT-UB.0018: Forecasting Time Series Data

The data sets chaos1 and chaos2 (available on the course website) were generated with $n = 50$ by iterating the “tent map”,

$$f(x) = \begin{cases} x/0.6 & \text{if } 0 \leq x \leq 0.6, \\ (1-x)/0.4 & \text{if } 0.6 < x \leq 1. \end{cases}$$

We used $x_0 = 0.500$ for chaos1 and $x_0 = 0.501$ for chaos2.

Problem 1

Check that $x_1 = f(x_0)$, where $\{x_t\}$ is the series of observations on chaos1, and f is the function defined above.

Problem 2

Plot chaos1 and chaos2 in separate plots. Do the series look random? Are they in fact random? Do the series look stationary?

Problem 3

Plot the ACF and PACF for chaos1. Based on these, suggest an ARMA model. Would this model provide the best possible forecasts?

Problem 4

Plot both chaos1 and chaos2 on the same plot. Do the paths look similar? Should they look similar when t is close to 1? What should happen if chaos1 and chaos2 happen to get very close together at some later time? Use the plot to help justify your answer.

Problem 5

Plot x_2, \dots, x_{50} versus x_1, \dots, x_{49} , where $\{x_t\}$ is the series of observations on chaos1. Does this plot reveal the map (in other words, the function f) which generated the data? Do you see why this f is called the tent map? Does this plot help us to see that $\{x_t\}$ is not an AR(1) series? How?