

# Math 265: Time Series Theory and Methods, Fall 2009

**Instructor:** Prof. Steve Crunk, <http://www.math.sjsu.edu/faculty/crunk>, [crunk@math.sjsu.edu](mailto:crunk@math.sjsu.edu)  
**Course Time:** MW, 7:00 – 8:15 P.M.

**Who should take the class:** *Applied Mathematics* majors, to learn more about mathematical modeling. *Economics* and *Business* majors (where the study of time series data is virtually synonymous with empirical macroeconomics), as forecasting of time series data is a matter of great importance in finance, inventory control, transportation schedules. *Electrical engineering*, where similar material includes spectral analysis and is referred to as signal processing. *Epidemiologists*, in tracking populations (e.g., death rates, birth rates, disease rates, etc., through time). *Meteorologists* might track temperatures and rainfall through time. This is just a sampling of the many fields and topics that use time series analysis.

**Prerequisite:** Math 161A (or some familiarity with the basic concepts of hypothesis testing and confidence intervals) and math 129 (or some familiarity with working with matrices). Note, although this is a graduate level class, undergraduates are welcome provided they are willing to work hard.

**What we will study:** We will begin with a review of hypothesis testing, confidence intervals, and other elementary mathematical and statistical concepts that will be used throughout the course. This will be followed by an introduction to time series data and the properties of stationary processes, including autocovariance and autocorrelation. We will then build mathematical models (ARIMA, or Auto Regressive Integrated Moving Average models) to describe the data and predict future values of the process. Using spectral analysis we will discover periodicity in data. We will then study nonstationary and seasonal time series models. Time permitting, and depending upon the interests of the students, we may also study ARCH and GARCH models used to model volatility (e.g., in the stock market), transfer functions (e.g., filters used in signal processing... this is part of the math that makes your cell phone work), Multivariate time series, State-Space Models (e.g., The Kalman Filter, very important in the broader field of mathematics). *Note again that all of this is what is to be taught. You need not be familiar with any of this material before the beginning of the class.*

**Text:** Introduction to Time Series and Forecasting, second edition, 2002, Peter J. Brockwell and Richard A. Davis, Springer, ISBN: 978-0387953519.

**Software:** The statistical package “R” will be used extensively. The software is available for free. No previous knowledge of R is expected.

