Statistics 956 **Financial Time Series and Computational Statistics**
Professor J. Michael Steele

Audience: This course course is intended for graduate students in statistics, economics, and finance who are interested in statistical models and algorithms for estimation, model selection, and forecasting. Much of our effort will be directed toward models for asset returns, but along the way we will see models and data from many different subject areas.

Prerequisites: Students who have had one or more graduate level courses in statistics or econometrics should be well-prepared. The full range of linear algebra tools will be fair game. Similarly, students will be expected to know about maximum likelihood and Bayes's theorem. It will be useful to have had exposure to asymptotic methods of statistics, including the multivariate central limit theorem. It is not expected that students have a background in numerical analysis, but a health curiosity about numerical methods will help. Although prior experience with the statistical program R (or S-Plus) is not required, students are expected to have enough experience with computing to be able to pick up these tools quickly. Much of our effort will be directed toward algorithms and their implementation in R, but we will also engage projects that use financial data from WRDS, the *Wharton Research Data Source.*

Course Plan: The first part of Stat 956 will cover material in the undergraduate financial time series course 434, but we will cover this material of 434 very quickly and with more much commitment to the underlying mathematics. ARIMA and GARCH (together with the GARCH ZOO (TGARCH, EGARCH, PGARCH, etc.) will set the baseline, but we will also take long looks at Kalman filtering, hidden Markov models, and new Monte Carlo estimation algorithms like the particle filter. Along the way we will spend considerable effort working with optimization code and algorithms that are used in S-plus and R. The **Stat 956 Home Page** provides further details of the topics to be covered.

Text: The text *Time Series Analysis and Its Applications (with R Examples)* by Shumway and Stoffer, Second Edition (Springer 2006) is recommended, but not required. We will look at many original research papers and we will use many web resources.

Deliverables: Grades will be based on Homework (10%), Two Mini-projects (20% each) and a Final Project (50%).

Auditors: Auditors are welcome.

Office Hours: Please see my home page or the course home page for current office hours and contact information.