

Computer Science 691 – Topics in Computer Science
(Computational Finance)
Spring 2007

Instructor: Steven Skiena

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Office Hours: 11:15AM-12:45PM Tuesday-Thursday, and by appointment.

Course Time: 9:50-11:10AM Tuesday-Thursday **Place:** SBS N117

Textbook: There is no single textbook for this course. Most of the material we will cover in the first half of the course appears in the following books:

- Hull, *Options, Futures, and Other Derivatives*, Prentice Hall, 2006 (Sixth Edition).
- Tsay, *Analysis of Financial Time Series*, Wiley, 2001.

Overview: The financial industry is a tremendous consumer of advanced computing technologies and mathematical modeling techniques, and a primary employer of computer science graduates in the New York metropolitan area. In this course, we will present the principles of computational finance and financial data analysis, focusing on research problems of algorithmic interest.

The first half of the course will serve as an introduction to how financial markets work (about 3.5 weeks), and standard mathematical approaches for working with financial data (about 4 weeks).

The second half of the course will build on this foundation to discuss special topics of research interest, including online algorithms, short-term trading strategies, technical analysis, and text/data mining. Several research papers will be covered in the second half of the course; links to these appear on the course website. Hopefully we will have occasional guest lecturers from the financial services industry.

Students will be required to do a significant semester research project, and participate actively in class. This means presenting regular project progress reports as well as making a substantial class presentation.

- **Grading:** Grades will be assigned based on the following formula, with cut-offs determined by my opinion of students on the boundary.

Class Participation / Presentations = 30%

Semester Project - 70%

This partition has been designed so I can award grades below B on the strength of either inadequate project or participation.

- **Research Project:** This is your opportunity to study some aspect of computational finance in depth. Students will be required to give a class presentation on their project and/or other technical material, along with regular oral project progress reports, where I hope there will be an active exchange of ideas. A list of possible topics will be distributed a few weeks into the semester, although you are encouraged to devise your own.

A written proposal of what you intend to do, with a progress report will be due approximately mid-semester. Both will be graded, to provide further motivation not to leave the project to the last week of the semester. Each student will be required to produce a webpage reporting the complete results of their project.

Tentative Lecture Schedule:

Introduction to Markets (two lectures)
Introduction to Derivatives (one lecture)
Pricing Futures (one lecture)
The Capital Assets Pricing Model (one lecture)
Properties of Stock Options (one lecture)
Financial Time Series Data (one lecture)
Linear Time Series Analysis (two lectures)
Random Walk Models (one lecture)

Student Project Presentations (four lectures)

Money Management/Kelly Criteria (one lecture)
Competitive Analysis (two lectures)
Binomial Trees (one lecture)
Technical Analysis (one lecture)

Student Project Presentations (three lectures)

Fractal Analysis (one lecture)
Spectral Analysis (one lecture)
Cluster Analysis (one lecture)

Final Thoughts (one lecture)

Rules of the Game:

1. This course is intended for advanced MS/Ph.D. students and reflects a bias toward the algorithmic aspects of computational finance. CS students must have had the equivalent of CSE 548.
2. I taught a previous version of this course in Spring 2004. This version will be quite similar to it. Lecture notes and audio from the previous edition are available on the course webpage.

3. I anticipate that the course will have more interest than I can handle. Ph.D. students who have not passed at least one section of the qual are discouraged from taking it. I will admit only selected M.S. students who have demonstrated successful analytical and project experience. If necessary I will deregister students who do not fit my specifications.
4. I encourage interest from students who have a business/finance background. Talk to me about your particular situation.
5. The WWW page for the course is <http://www.cs.sunysb.edu/~skiena/691/>. All course handouts and notes are available there, along with the latest announcements. Please check it out.
6. Because a primary goal of the course is to teach professionalism, any academic dishonesty will be viewed as evidence that this goal has not been achieved, and will be grounded for receiving a grade of F. (See CEAS Procedures and Guideline Governing Academic Dishonesty, 1/81.)
7. If you have a physical, psychological, medical or learning disability that may impact on your ability to carry out assigned course work, I would urge that you contact the staff in the Disabled Student Services office (DSS), ECC Building, 632-6748/TDD. DSS will review your concerns and determine, with you, what accommodations are necessary and appropriate. All information and documentation of disability is confidential.