Curriculum

This course applies a signal processing formalism to the study of financial time series. Through signal processing, investment horizons longer than the update frequency of the underlying data can be addressed. In doing so we seek to *manage detail*. How causal smoothing functions are constructed and applied, both for offline and online applications, is covered by this class.

Signal processing relies heavily on Fourier, Laplace and z-transforms; and on pole-zero diagrams drawn in the complex plane. By the end of the course you will know three ways to express the same smoothing function: as a series in time, as a filter, and as a pole-zero diagram. Each representation adds richness to the understanding of how filters operate on financial data.

This course is theoretically rigorous. If you are uncomfortable with Fourier and complex analysis at a modest level then this course may not be for you.

Topics by Week:

1. The kdb vector database and the q language – an introduction.
2. Course overview. Superposition and convolution, *chapters 1 and 2*.
3. Fourier transforms, spectral analysis and filters, *chapter 3*.
4. Sampling, replication and z-transforms, *chapter 4*.
5. Finite-difference equations with constant coefficients, *chapter 5*.
6. Finite-difference equations, convolution revisited, *chapter 5*.
7. Summary: the entire course in one lecture.

Reading Material

This year I introduce the first five chapters of my manuscript *Signal Processing for Quantitative Finance* for the class. The department will give all registered students a copy. *Copies will be available the week of Feb 8th.*

Administrative Details

- **Lecturer:** Jay Damask, jay.damask@baruch.cuny.edu
- **TAs:** We are fortunate to have two excellent TAs this year. They are:
  - Eileen Hu, rong.hu@baruchmail.cuny.edu
  - Ethan Cui, email tbd
- **Class Room and Time:** 6:00pm - 8:30pm, Room 9-140
- **Class Dates:**
  - **Thursdays** Feb 4th, Feb 11th, Feb 18th, Feb 25th;
  - **Thursdays** Mar 3rd, Mar 10th, Mar 17th
- **Final Exam Date:** Sat Mar 26th, time 10am-12:30pm
- **Final Exam Notes:** The final exam is closed book and will run two and one-half hours. A cheat sheet will be provided. The final will count as **28%** of your final grade.
- **Homeworks:** Homework is due at the beginning of class, and should be emailed to your assigned TA.
  - Our policy is no late homeworks unless there is medical need.
  - Solutions will be posted after class.
  - There will be six homeworks, one due each week except for the first class. Each homework counts for **12%** of your final grade. The work is cumulative so it's important to keep pace.
  - The homeworks are to be done in **teams of two**. Please let our TAs know how you make up your teams. Teams will be assigned after the first homework if not already formed.
  - Scripts are to be written in Matlab. All scripts must run. Data will be provided for you.
  - Poor or incorrect form can penalize you. Make sure all of your axes are labeled, that your graphs are clearly marked, and your scripts commented. Simply put: follow good scientific practice and you will be fine.
  - Many of the homeworks are substantial so I recommend that you begin them early.
  - The homeworks are the practical component of the course. The lectures offer the theoretic part.
- **Reading Material:** The principal source material are my lecture notes, *Signal Processing for Quantitative Finance.* Registered students will receive a bound copy from the department.