NYU TANDON SCHOOL OF ENGINEERING

# Summer 2019 FRE Bootcamp Curriculum

Final Version
*Subject to minor changes
As of March 27, 2019
Professor David C. Shimko

## Required student preparation in advance of online course:

- Your personal laptop must be loaded with Excel. Include the **Data Analysis** and **Solver** add-ons.
- You may load your computer with free downloads of Python, Anaconda and Jupyter Notebook prior to class, and start writing simple programs.

## Required textbooks:

*Online portion, 5/28/19 – 7/11/19 (this PDF should be downloaded by students in advance)*

- **Guide to Financial Markets, The Economist,** 6th Edition (Free PDF avaialable at https://media.economist.com/sites/default/files/pdfs/Guide_to_Financial_Markets_6e.pdf)

*Bootcamp mornings, 8/5/19-8/16/19 (these books will be provided for students on arrival)*

- **A Practical Guide to Quantitative Finance Interviews**, Xinfeng Zhou, 2008.
- **Heard on the Street: Quantitative Questions from Wall Street Job Interviews**, 19th Edition, Timothy Crack, 2018.

*Bootcamp afternoons, 8/5/19-8/16/19 (students should arrange access to these free resources)*

- **Introduction to Python for Econometrics, Statistics and Data Analysis**, 3rd Edition, author Kevin Sheppard (PDF available for free download)
- **Python Data Science Handbook**, author Jake VanderPlas (available for free on Google Colabs and Github)
- **Introduction to Statistical Learning**, authors James, Witten, Hastie, and Tibshirani (PDF available for free download)
- *(Optional)* **Elements of Statistical Learning**, authors Hastie, Tibshirani and Friedman (PDF available for free download)

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## Online Portion (2 hour lectures except where indicated)

Instructor: Prof David Shimko
Guest instructor: Serge Feldman, Société Générale (to be confirmed)
Time and location: 8:00 a.m. – 10:00 a.m. New York (Eastern) time
Course code: FRE-GY.5010 and FRE-GY.5020

| # | Date | Instr | Topic: Subtopic |
|---|---|---|---|
| 1 | 5/28 | DS | Markets: Money & Foreign exchange (Ch 1-2) |
| 2 | 5/30 | DS | Markets: Fixed Income Markets (Ch 3-4) |
| 3 | 6/4 | DS | Markets: Corporations and Equity (Ch 7) |
| 4 | 6/6 | DS | Markets: Exchange-Traded Derivatives (Ch 8-9) |
| 5 | 6/11 | DS | Markets: Financial institutions (tbd) |
| 6 | 6/13 | SF | Python: Introduction |
| 7 | 6/18 | SF | Python: Collections (3 hours) |
| 8 | 6/20 | DS | Calculus: Differentiation and integration, Analytic and numerical |
| 9 | 6/25 | DS | Calculus: Constrained optimization, numerical methods |
| 10 | 6/27 | DS | Linear Algebra: Basics, Matrices, Matrix operations |
| 11 | 7/2 | DS | Linear Algebra: Regression and inference |
| 12 | 7/4 | DS | Differential Equations: Analytic solutions |
| 13 | 7/9 | DS | Simulation |
| 14 | 7/11 | DS | Final exam and Python Project due |

*Reminder:* Even if you only intend to attend selected lectures of the **online** boot camp, we highly recommend that you register. You will not be penalized for online lectures that you do not attend.

*Python note:* Google Colabs is an online environment where one can run Python code using a web browser without having Python installed on your machine. This might help those who have not downloaded Anaconda or who have had trouble with their Anaconda installations.

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## Onsite Boot Camp Mornings

Instructor: Prof Andrew Papanicolaou
Time and location: 9:00 a.m. - 12:00 p.m., Pfizer Auditorium
Course code: FRE-GY.5030

| # | Date | Instr | Topic |
|---|---|---|---|
| 1 | 8/5 | AP | Series summation, math inductions |
| 2 | 8/6 | AP | Basic probability |
| 3 | 8/7 | AP | Probability distributions, expected value, variance & covariance, order statistics |
| 4 | 8/8 | AP | Statistics and hypothesis testing |
| 5 | 8/9 | AP | Markov chains |
| 6 | 8/12 | AP | Martingales & Random walks |
| 7 | 8/13 | AP | Brownian motion and stochastic calculus |
| 8 | 8/14 | AP | Option pricing |
| 9 | 8/15 | AP | The Greeks, option portfolios and exotics |
| 10 | 8/16 | AP | Review and final quiz |

## Onsite Boot Camp Afternoons

Instructor: Prof Conall O'Sullivan
Guest instructor: Serge Feldman, Société Générale (to be confirmed)
Time and location: 1:00 p.m. – 4:00 p.m., Pfizer Auditorium
Course code: FRE-GY.5040

| # | Date | Instr | Topic: Subtopic |
|---|---|---|---|
| 1 | 8/5 | SF or COS | Python: Advanced |
| 2 | 8/6 | SF or COS | Python: PANDAS data management project |
| 3 | 8/7 | COS | Probability and Statistics Functions in Python |
| 4 | 8/8 | COS | Linear Regression with Python, Statistical Analysis with statsmodels (a Python library) |
| 5 | 8/9 | COS | Estimating Fama-French risk premia, estimating the parameters of a GARCH model |
| 6 | 8/12 | COS | Introduction to Machine Learning and Scikit-Learn |
| 7 | 8/13 | COS | Hyperparameters, Model Validation and Feature Engineering |
| 8 | 8/14 | COS | Naïve Bayes Classification and Support Vector Machines |
| 9 | 8/15 | COS | Decision Trees, Random Forests, PCA and other ML algorithms |
| 10 | 8/16 | COS | Final Python Machine Learning in-class project |