

DATA 5695/6695: Predictive Methods for Fin-Tech

Class Details

- Instructor: Tyler J. Brough
- Days: T/Th
- Time: 1:30 – 2:45 PM
- Room: HH130 (TBA)

Course Description

This semester this course will cover the material typically covered in DATA 5690/6690 Computational Methods in FinTech. Here is the standard description for that course:

Computational finance is an interdisciplinary pillar of modern FinTech, at the intersection of data science, computer science, and economics. In this course students apply tools from computational science and statistics to identify and exploit arbitrage opportunities for entrepreneurial financial innovation. We will view the core concepts of the course through the perspectives of history, philosophy, and economic theory.

Course Material

We will be working from several sources, but primarily from the following:

- Derivatives Markets 3rd Edition by Robert McDonald
- Numerical Methods in Finance and Economics by Paolo Brandimarte

Assessment

Participation (50%)

In a seminar style course it is essential that you come prepared having completed readings and with burning questions to discuss. We will rely on the Socratic method for our discussions.

Computational Projects (50%)

- Project 0: Price vanilla call/put options via binomial model (Black-Scholes-Merton)
- Project 1: Price an exotic option via Monte Carlo with variance reduction
- Project 2: Figlewski replication
- Project 3: Price an American put option via the Longstaff-Schwartz Least Squares (LSLS) Monte Carlo method

Schedule

Module 1: Risk-Neutral Pricing

Week 1: An Primer on Option Basics

- Jan. 7: Welcome & discuss Figlewski case study
- Jan. 9: Options primer (Tyler)
- Readings:
 - Stephen Ross – Finance, pp. 1–34
 - Figlewski JF 1989
 - Brandimarte Chapter 2 Section 2.6 – Derivatives Pricing
 - McDonald Chapter 9 – Parity and Other Option Relationships
- If any of the concepts in McDonald Chapter 9 seem pretty foreign, you might want to take a look at the introduction in Chapter 2:
 - McDonald Chapter 2 – An Introduction to Forwards and Options
 - McDonald Appendix A – The Greek Alphabet
 - McDonald Appendix B – Continuous Compounding

Week 2: Binomial Option Pricing

- Week 1 homework assignment. Due by 01/21/2025.
- Jan. 14: Binomial option pricing – Part 1 (Tyler)
- Jan. 16: Binomial option pricing – Part 2 (Tyler)
- Readings:
 - McDonald Chapter 10 – Binomial Option Pricing: Basic Concepts
 - McDonald Chapter 11 – Binomial Option Pricing: Selected Topics

Week 3: Black-Scholes-Merton

- Jan. 21: Black-Scholes-Merton (Tyler)
- Jan. 23: Delta-Hedging (Tyler)
- Readings:
 - McDonald Chapter 12 – The Black-Scholes Formula
 - McDonald Chapter 13 – Market-Making and Delta-Hedging

Week 4: Pseudorandom Number Generation and Monte Carlo Integration

- Jan. 28: PRNGs and Monte Carlo Integration (Tyler)
- Jan. 30: Exotic and path-dependent options (Tyler)
- Readings:
 - Brandimarte Chapter 4.2 – 4.4
 - Brandimarte Chapter 2.7
 - McDonald Chapter 14 – Exotic Options: I

Week 5: Risk-Neutral Option Pricing

- Feb. 4: Risk-neutral Monte Carlo option pricing (Tyler)
- Feb. 6: Variance reduction techniques (Tyler)
- Readings:
 - Brandimarte Chapter 8 – Option Pricing by Monte Carlo Methods
 - McDonald Chapter 19 – Monte Carlo Valuation

Week 6: Longstaff-Schwartz (LSM) for American Options

- Feb. 11: Dynamic programming, search, optimal stopping
- Feb. 13: LSM
- Readings:
 - Brandimarte Chapter 10 – Dynamic Programming

Week 7

- Feb. 18:
- Feb. 20:

Week 8

- 15 02.25.2025.TUE
- 16 02.27.2025.THU

Week 9

- 17 03.04.2025.TUE
- 18 03.06.2025.THU

Week 10

- 19 03.18.2025.TUE
- 20 03.20.2025.THU

Week 11

- 21 03.25.2025.TUE
- 22 03.27.2025.THU

Week 12

- 23 04.01.2025.TUE
- 24 04.03.2025.THU

Week 13

- 25 04.08.2025.TUE
- 26 04.10.2025.THU

Week 14

- 27 04.15.2025.TUE
- 28 04.17.2025.THU

Week 15

- 29 04.22.2025.TUE

Calendar of Events

Academic Event	Day(s) of the Week	Date
First Day of Classes	Monday	Jan 06
First 7-week Session	34 instruction days, 1 test day	Jan 06 - Feb 25
Martin Luther King, Jr. Day - no class	Monday	Jan 20
Presidents' Day - no class	Monday	Feb 17
Second 7-week Session	34 instruction days, 1 test day	Feb 26 - Apr 22
Spring Break	Monday - Friday	Mar 10 - 14
No-Test Week No-Test Days Policy	Wednesday - Tuesday	Apr 16 - 22
Last Day of Classes	Tuesday	Apr 22
Final Examinations	Wednesday - Tuesday	Apr 23 - 29
Commencement	Wednesday - Friday	Apr 30 - May 02