SYLLABUS FOR F335 SECURITY TRADING AND MARKET MAKING – SPRING 2020

Professor:	Craig W. Holden
Office:	HH 6157
Office Hours:	Mon-Wed, 1:00-3:00 pm or feel free to drop by any time!
Office Phone:	812-855-3383
E-Mail:	cholden@indiana.edu

COURSE GOAL AND DESCRIPTION

The overall goal of this course is for you to learn the theory and practice of security trading on exchanges around the world. The formal name for this field of study is **market microstructure**. This course differs from other finance courses, which typically assume away trading frictions in order to focus other matters. This course puts the spotlight on real-world trading frictions, such as the bid-ask spread, price impact, brokerage commissions, execution failures, time delays, etc. Security trading is complex and constantly changing subject, but the fundamental concepts that we will cover hold up over time.

COURSE LEARNING OUTCOMES AND KELLEY STUDENT LEARNING OUTCOMES (SLOs)

By the end of the course, students will be able to:

1. Explain what orders supply liquidity, what orders demand liquidity, in what asset classes, on what electronic or floor-based exchanges around the world, and for what purposes. (SLO 7.1)
2. Compute quantitative models of trading using Excel, including the National Best Bid and Offer, limit order book and call market trading models, transaction cost measures, implementation shortfall components, and the probability of informed trading. (SLO 5.1, 5.2, 5.4)
3. Construct an optimal trading algorithm to buy a requested quantity of shares within a specified timeframe while minimizing both transaction cost and risk. (SLO 3.2, 3.3)
4. Create an optimal dealer algorithm to simultaneously maximize market marker profits and minimize inventory risk. (SLO 3.2, 3.3)
5. Describe and analyze a wide variety of concerns about security trading, including flash crashes, the impact of high-frequency trading, broker conflicts-of-interest, arbitrage trading, insider trading, market manipulation, behavioral biases, etc. (SLO 2.2, 2.3, 7.1)
6. Demonstrate presentation skills through an in-class group presentation. (SLO 4.1)
7. Show writing and small group communication skills through two group projects. (SLO 4.2, 6.1, 6.2)

TEACHING STYLE

My approach to teaching involves four key features:

1. **Assignment Preparation.** I use the "case method," except that the "case" is a set of assigned readings. Students are expected to read those assigned readings in advance and come to class ready to discuss them.

2. **Class Participation.** Students are expected to play a primary role in explaining the assigned readings, expressing their opinions, asking questions, and contributing to the class discussion. This "active learning" approach is student-centered, as opposed to professor-centered (where the professor simply lectures). I will frequently ask for voluntary contributions. I will frequently cold call on students to ensure that everyone participates. Each time that I call on you, either as a volunteer or as a cold call, and you have a reasonable response that will count towards your class participation score. Attendance does *not* count.

3. **Top Hat Participation.** I will frequently ask Top Hat questions to the entire class. *All* students are asked to respond to these questions using the Top Hat app on any device (laptop, smartphone, or tablet) with

Bluetooth and location services enabled. Two points will be given for a correct response and one point for an incorrect response provided that you are physically in the classroom as verified by the Top Hat Secure Attend feature. Total Top Hat points will be scaled to fit the grading scale listed in the grading section. No allowance will be made for forgetting to bring a device, technology failures, or for interviews or other events that might lead you to miss class. Top Hat responses are individual. You are not allowed to consult or coordinate with others. You are not allowed to submit Top Hat responses for others or submit Top Hat responses when you are not physically-present in class. Top Hat Support is available via email (support@tophat.com), the in-app support button, or by calling 1-888-663-5491.

4. **Learn By Doing.** The best way to learn how to trade is to actually do (simulated) trades. The best way to learn how to present your ideas to others is to actually present your ideas to others. Therefore, you are expected to participate in two trading simulation projects and to do a group presentation of your trading ideas to the class.

COURSE OUTLINE
UNIT I: AN OVERVIEW OF TRADING AND MARKETS

(1.) Jan 13, Introduction
- Hasbrouck, Pages 4-9
- Live Exercise: National Best Bid and Offer (NBBO)
- Resources: F335 Class 01 Introduction.ppt, F335 Exercise 1 National Best Bid and Offer.xlsx

(2.) Jan 15, Overview
- Johnson, Sections 1.1-1.3, 1.6-1.8
- Resources: F335 Class 02 Overview.ppt

Jan 20, MLK Holiday

(3.) Jan 22, Market Microstructure
- Johnson, Pages 27-40
- Resources: F335 Class 03 Market Microstructure.ppt

(4.) Jan 27, World Markets in the computer lab CG 3075
- Live Exercise: Hasbrouck 7EX Trading Simulation
- Johnson, Sections 2.5 and 3.1-3.4 and Page 475
- Resources: F335 Class 04 World Markets.ppt, Hasbrouck 7EX Trading Simulation.xlsm

UNIT II: ALGORITHMIC TRADING AND DMA STRATEGIES

(5.) Jan 29, TAQ Project Explanation and Orders
- TAQ Project Instructions
- Johnson, Sections 4.1-4.4
- Resources: F335 TAQ Project Instructions.pdf, F335 Class 05 Orders.ppt, Six alternative TAQ data files for: Alphabet, Apple, Cummins, Lilly, SPDR S&P 500 ETF, Vanguard Total World Stock ETF

(6.) Feb 3, TAQ Project Discussion and LOB and Call Markets
- TAQ Project Discussion
- Live Exercise: LOB and Call Markets
- Resources: F335 Class 06 LOB and Call Markets.ppt, F335 Exercise 2 LOB and Call Markets.xlsx

(7.) Feb 5, Algorithm Overview
- Johnson, Sections 5.1-5.2, 5.4-5.6
- Resources: F335 Class 07 Algorithm Overview.ppt

(8.) Feb 10, Kickoff of the Algorithmic Trading Simulation in the computer lab CG 3075
- Live Exercise: Algorithmic Trader Simulation
- Group organization
- Resources: F335 Class 08 Kickoff of the Algorithmic Trader Simulation.ppt, F335 2018 Algorithmic Trader Simulation.xlsm, F335 2018 Algorithmic Trader Results.xlsx, F335 2018 Algorithmic Trader Simulation Teams.pdf

(9.) Feb 12, Transaction Costs
- Johnson, Pages 161-175
- Live Exercise: Transaction Cost Measures
- Resources: F335 Class 09 Transaction Costs.ppt, F335 Exercise 3 Transaction Cost Measures.xlsx

UNIT III: IMPLEMENTING TRADING STRATEGIES

(10.) Feb 17, Optimal Trading Strategies
- Live Exercise: Implementation Shortfall Components
- Johnson, Sections 7.1-7.5
- Resources: F335 Class 10 Optimal Trading Strategies.ppt, F335 Exercise 4 Implementation Shortfall Components.xlsx

(11.) Feb 19, Order Placement
- Johnson, Sections 8.1-8.4
- Resources: F335 Class 11 Order Placement.ppt

(12.) Feb 24, Algorithmic Trader Competition in the computer lab CG 3075
- Competition

(13.) Feb 26, Algorithmic Trader Presentations by Teams 1-5 (9:30 class) and 11-15 (11:15 class)
- Presentations
- Peer evaluations
- Written reports are due

(14.) March 2, Execution Tactics
- Debate Instructions and Teams
- Johnson, Pages 257-271
- Debate Team Organization
- Resources: F335 Class 14 Execution Tactics.ppt, F335 2018 Debate Instructions and Teams.pdf

(15.) March 4
- Midterm

UNIT IV: CONCERNS ABOUT SECURITY TRADING

(16.) March 9, Probability of INformed Trading (PIN)
- Easley, Kiefer, O'Hara and Paperman, Probability of INformed Trading (PIN), pages 1405-1410, 1418, 1421
- Live Exercise: Probability of INformed Trading (PIN), PIN Model Dynamics
- PIN Sampler (Vega, Long-term Estimates of PIN; Agudelo, Do Local or Foreign Traders Know More?; Easley, Engle, O'Hara, and Wu, Time-Varying Arrival Rates)
- Debate: "The government should require employers to set a default choice (if you don't make another choice) of putting retirement savings contributions into a passive index fund in order to nudge investors to avoid excess trading."
- Resources: F335 Class 16 Probability of INformed Trading (PIN).ppt, F335 Exercise 5 Probability of INformed Trading (PIN).xlsx, F335 PIN Model Dynamics.xlsx, F335 2017 Debate Teams.pdf

(17.) March 11, News Trading and Insider Trading
- Chordia, Green, and Kottimukkalur, News Trading, pages 0-6, 35, 37-38, 41, 45
- Harris, Chapter 29 Insider Trading, pages 584-597
- Bhattacharya, Daouk, Jorgenson, and Kehr, Insider Trading in Mexico, pages 69-70,73-74, 82-83, 93
- Bhattacharya and Daouk, Insider Trading in the World, pages 75, 80-84, 89, 92-93
- Debate: "Insider trading should be legalized."
- Resources: F335 Class 17 News Trading and Insider Trading.ppt

  Spring Break

(18.) March 23, Kickoff of the Algorithmic Dealer Simulation in the computer lab CG 3075
- Live Exercise: Algorithmic Dealer Simulation
- Debate: "The United States should adopt a tax of 0.1 percent on all U.S. stock, bond, and derivative trades (i.e., a 'Tobin tax' on all U.S. securities trades)."
- Group organization
- Resources: F335 Class 18 Kickoff of the Algorithmic Dealer Simulation and a Tobin Tax.ppt, F335 2018 Algorithmic Dealer Simulation.xlsm, F335 2018 Algorithmic Dealer Results.xlsm, F335 2018 Algorithmic Dealer Simulation Teams.pdf

(19.) March 25, Bid-Ask Spreads and Brokers
- Harris, Bid-Ask Spreads pages 297-303
- Harris, Chapter 7 Brokers, pages 139-142, 151-152, 159-167
- Harris, Hillary Clinton's Futures Trading Profits
- Clinton, Living History, pages 86-87
- Battalio, Corwin, and Jennings, Take Fees and Make Rebates, pages 2193-2197, table I, figures 1-2
- Debate: "The SEC should require that brokers pass all take fees and make rebates through to their clients and require that exchanges incorporate these fees and rebates into their trade and quote prices by using four decimal places."
- Resources: F335 Class 19 Bid-Ask Spreads and Brokers.ppt

(20.) March 30, Ghost Exchange
- Video Clips: *Ghost Exchange*
- Discussion of *Ghost Exchange*
- Debate: "The SEC should create a regulatory board that certifies any algorithm before it is allowed to interact with the market."
- Resources: F335 Class 20 Ghost Exchange.ppt

(21.) April 1, Arbitrage and Legal Informed Trading
- Harris, Lecture 13 Arbitrage, pages 1-5
- Gagnon and Karolyi, Arbitrage in Cross-Listed Stocks, page 60
- Bowen, Hutchinson, and Sullivan, Pairs Trading, pages 31-35
- Harris, Styles of Legal Informed Trading, pages 226-229, 235
- Debate: "Co-location should be outlawed."
- Resources: F335 Class 21 Arbitrage.ppt

(22.) April 6, High-frequency Trading
- Hasbrouck and Saar, pages; 646-649, 653, 655
- Video Clip: *Flash Boys*
- Discussion of *Flash Boys*
- Holden, Jacobsen, and Subrahmanyam, High-frequency Trader Impacts, pages 308-318
- Debate: "High frequency traders improve market quality."
- Resources: F335 Class 22 High-frequency Trading.ppt

(23.) April 8, Behavioral Biases
- Barber and Odean, Attention Effects, pages 785-788, 797, 800, 802, 804
- Bhattacharya, Holden, and Jacobsen, Round Number Effects, pages 413-415, 418-421, 426-427
- Bhattacharya, Kao, Lin, and Zhao, Do Superstitious Traders Lose Money?, pages 1, 7
- Grinblatt and Keloharju, Sensation Seeking and Overconfidence Effects, pages 549-556, 569, 574
- Debate: "The US equity tick size should be reduced to one-tenth of a penny ($.001)."
- Resources: F335 Class 23 Behavioral Biases.ppt

(24.) April 13, Algorithmic Dealer Competition in the computer lab CG 3075
- Competition

(25.) April 15 Algorithmic Dealer Presentations by Teams 6-10 (9:30 class) and 16-20 (11:15 class)
- Presentations
- Peer evaluations
- Written reports are due

(26.) April 20, Flash Crashes
- Wall Street Journal, A News Crash, "Stocks Plunge As Rescue Plan Fails To Gain House Approval"
- Joint Preliminary Report on the Flash Crash, pages 11-15, 35, 46, 51, 54
- Joint Final Report on the Flash Crash, pages 1-8, 21, 30, 33, 88
- "Navinder Sarao sent millions of trade messages ahead of flash crash, prosecutors say," MarketWatch.com
- "Why Nav Sarao Had To Be Destroyed," Tyler Durden
- Kirilenko, Kyle, Samadi, and Tuzun, HFT Role in the Flash Crash, pages 967-972, 979, figures 4, 5, 6, 7, 9, 12
- Gao and Mizrach, Market Quality Breakdowns and Breakups, 1-4, 6-8, 21
- Debate: "The SEC should replace millisecond (and faster) trading systems with frequent call auctions at one-second intervals."
- Resources: F335 Class 26 Flash Crashes.ppt

(27.) April 22, Day Trading
- Video Clip: *Risky Business: The Day Traders*
- Discussion of *Risky Business: The Day Traders*
- NASAA Report, Analysis of Customer Day Trader Accounts, pages i, 1, 44-45
- Wall Street Journal, The Sad Story of Mark Barton, "Gambling Man,"
- Barber and Odean, Trading is Hazardous to Your Wealth, pages 773-776
- Debate: "Training people to be day traders is a sleazy (i.e., unethical/illegitimate) business."
- Resources: F335 Class 27 Day Trading.ppt

(28.) April 27, Deception, Uninformed Traders, and Transparency
- Hanke and Hauser, Stock Spam E-mails, pages 57-66, 76, 81-82
- Bloomfield, O'Hara, and Saar, Uninformed Traders, pages 2275-2283, 2286, 2288, 2293, 2295
- Bessembinder, Maxwell, and Venkataraman, Transparency Impacts, pages 251-254, 268-269
- Edwards, Harris, and Piwowar, More on Transparency Impacts, pages 1421-1423, 1437, 1441
- Debate: "Dark pools disadvantage retail investors."
- Resources: F335 Class 28 Deception, Uninformed Trading, and Transparency.ppt

(29.) April 29, Regulatory Issues
- Video Clip: Market Manipulation segment in *Next: The Future Just Happened*
- Discussion of Market Manipulation in *Next: The Future Just Happened*, including Lebed posting
- Beber and Pagano, Global Impact of Short Selling Bans during the Financial Crisis, pages 343-345, 352-354, 356, 358-359, 371
- Barber, Lee, Liu, and Odean, Individual Trading Losses, pages 609-611, 614-615, 619, 621
- Battalio, Hatch, and Jennings, Impact of Option Exchange Linkage on Market Quality, pages 933-936, 944-945, 948-949, 952-953, 955
- Debate: "The SEC should eliminate the current fragmented system of trading and replace it with a single Centralized Limit Order Book (CLOB)."
- Debate team peer evaluations
- Resources: F335 Class 29 Regulatory Issues.ppt

(30.) Final Exam
- 9:30 class: Friday, May 8, 8:00 a.m.-10:00 a.m., HH 1034
- 11:15 class: Monday, May 4, 10:15 a.m.-12:15 p.m., HH 1034

READINGS
- *Algorithmic Trading & DMA*: *An Introduction to Direct Access Trading Strategies*, by Barry Johnson, published by 4Myeloma Press, only available at Amazon.com

- A readings collection PDF file that can be downloaded from the **Files** link in **Canvas**

GRADING

Grading is done on a relative (not absolute) basis. Following standard finance department policy, the average GPA will fall in the range from 2.70 to 3.10. A detailed break-down of points earned-to-date will be posted on the **View'em** link in **Canvas** on two occasions: (1) when the midterm is returned (including a indicative grade for the first half of the course) and (2) shortly after the last class session, which will be prior to finals week. The course grade is based on:

Item	Points	Percent	Kick Off	Due Date
Class participation				
• Verbal participation in first half	25 points	6.25%	----	----
• Verbal participation in second half	25 points	6.25%		
Top Hat Participation				
• Top Hat participation in first half	25 points	6.25%	----	----
• Top Hat participation in second half	25 points	6.25%		
Algorithmic Trader Simulation				
• Algo. Trader Sim. Competition	15 points	3.75%	Feb 10	Feb 24
• Algo. Trader Sim. Written Report	20 points	5%	Feb 10	Feb 26
Algorithmic Dealer Simulation				
• Algo. Dealer Sim. Competition	15 points	3.75%	March 23	April 13
• Algo. Dealer Sim. Written Report	20 points	5%	March 23	April 15
Group Presentation	10 points	2.5%	----	Feb 26 or April 15
Debate Performance	20 points	5%		----
Midterm	100 points	25%	----	March 4
Final Exam	100 points	25%	----	May 4 or 8
Total Points	400 points	100%	----	----

POLICIES

1. In the first two class sessions we will be evolving towards permanent seats with due consideration for the usual course adds and drops. In class 3, I will ask you to sign-up for a permanent seat for the rest of the semester. Permanent seats assist me in associating faces and names.

2. At the end of each team project and team debates, I will ask for confidential peer evaluations of individual contributions to the team output. Individuals who have contributed significantly less than their teammates will be penalized. The purpose of the peer evaluations is to provide direct incentives for individual contributions to the team output.

3. Students are expected to be ready for class at the scheduled time. Classes will start class on time and late arrivals will be frowned on.

4. The final exam is *not* cumulative. It is based on the second half of the course. The content and discussion of videos presented in class is fair game on the exams (i.e., the midterm and final exam).

5. Video cameras may be used to monitor the room during student assessment activities, including but not limited to, exams, tests, and quizzes. Video recordings may be used to investigate or support disciplinary action. All access to and use of video equipment and recordings will follow applicable IU policies. During exams, baseball caps must be removed or worn backwards.

GROUP PROJECTS

ALGORITHMIC TRADER SIMULATION

Students will be organized into teams and each team will download Algorithmic Trader Simulation, which is based on Excel. Teams can analyze a variety of security trading problems. Each problem requests that a certain number of shares be purchased within a particular timeframe. In implementing this request, the general goal is to minimize the utility cost of trading = total cost of trading on shares purchased + (penalty coefficient) * (shares not purchased within the timeframe). Teams will use their own intuition to search for an *optimal* algorithmic order submission strategy (order type, size, and price, dynamic response to market conditions, etc.) for each problem. Security trading problems can vary based on requested buy %, deadline, underfill penalty, portfolio manager information, portfolio manager risk aversion, and benchmark. Each team's order submission strategies will be put to the test in a live, head-to-head, security trading competition and each team will summarize their security trader strategies in a written report. Half of the teams will present their strategies in class.

ALGORITHMIC DEALER SIMULATION

Students will be organized into teams and each team will download the Algorithmic Dealer Simulation, which is based on Excel. Teams can analyze a variety of dealer problems in a pure dealer market. Teams will manage the strategy of one dealer in competition with other dealers. The overall goal is to maximize profits and control inventory risk. Teams will search for an *optimal* algorithmic dealer strategy (quote prices and depths, execute large orders in full or partial, adjust to updated market conditions, and manage inventory) for each problem. Dealer problems can vary based on adverse selection, risk aversion, daytime volatility, overnight volatility, and order processing cost. Each team's dealer strategies will be put to the test in a live, head-to-head, dealer competition and each team will summarize their dealer strategies in a written report. The remaining half of teams will present their strategies in class.

DEBATES

In the second half of the course, students will be organized into teams to debate important concerns and public policy issues about security trading. Each team will debate twice – once on the affirmative side of a proposition and once on the opposed side. Each audience member (not including teams that just debated) will vote on which team did better in the debate. For the audience members, these votes will be part of their second-half Top Hat participation.

APPENDIX
Bloomington Undergraduate Program Learning Goals and Student Learning Outcomes (SLOs)

1. An Integrative Point of View
Evaluate and make business decisions taking into account the interdependent relationships among competitive and environmental conditions, organizational resources, and the major functional areas of business.
- **SLO 1.1**: Identify the relationships between two or more business functions; explain how actions in one functional area affect other functional areas.
- **SLO 1.2**: Describe how the relationships among the functional areas relate to the goals of the organization.
- **SLO 1.3**: Use integrative techniques, structures, or frameworks to make business decisions.

2. Ethical Reasoning
Recognize ethical issues, describe various frameworks for ethical reasoning, and discern the tradeoffs and implications of applying various ethical frameworks when making business decisions.

- **SLO 2.1**: Identify the ethical dimension(s) of a business decision.
- **SLO 2.2**: Recognize the tradeoffs created by application of competing ethical theories and perspectives.
- **SLO 2.3**: Formulate and defend a well-supported recommendation for the resolution of an ethical issue.

3. Critical Thinking and Decision Making in Business
Identify and critically evaluate implications of business decisions for organizational stakeholders and the natural environment.
- **SLO 3.1**: Recognize the implications of a proposed decision from a variety of diverse stakeholder perspectives.
- **SLO 3.2**: Evaluate the integrity of the supporting evidence and data for a given decision.
- **SLO 3.3**: Analyze a given decision using critical techniques, structures, or frameworks.

Goal 4: Communication and Leadership
Communicate effectively in a wide variety of business settings employing multiple media of communications.
- **SLO 4.1**: Deliver clear, concise, and audience-centered individual and team presentations.
- **SLO 4.2**: Write clear, concise, and audience-centered business documents.
- **SLO 4.3**: Effectively participate in informational and employment interviews.
- **SLO 4.4**: Articulate one's unique value proposition to a given audience.

Goal 5: Quantitative Analysis and Modeling
Systematically apply tools of quantitative analysis and modeling to make recommendations and business decisions.
- **SLO 5.1**: Use appropriate technology to solve a given business problem.
- **SLO 5.2**:Analyze business problems using appropriate mathematical theories and techniques.
- **SLO 5.3**: Explain the role of technologies in business decision making analysis, or modeling.
- **SLO 5.4**: Structure logic and frame quantitative analysis to solve business problems.

Goal 6: Team Membership & Inclusiveness
Collaborate productively with others, functioning effectively as both members and leaders of teams.
- **SLO 6.1**: Facilitate team meetings and collaborate effectively in both face-to-face and virtual interactions.
- **SLO 6.2**: Identify and employ best team practices.
- **SLO 6.3**: Assess and offer feedback on one's own effectiveness as well as one's team members' effectiveness with respect to productivity and relationship-building in both oral and written formats.
- **SLO 6.4**: Articulate and analyze the value of inclusivity in a variety of business settings.

Goal 7: Cultural awareness and global effectiveness
Become conversant with major economic, social, political, and technological trends and conditions that influence the development of the global economy and demonstrate competence in the cultural, interpersonal and analytical dimensions of international business.
- **SLO 7.1**: Identify the risks and opportunities associated with determining and implementing optimal global business strategies.
- **SLO 7.2**: Integrate international, regional, and local non-market forces into strategic decisions of multinational corporations.
- **SLO 7.3**: Analyze obstacles resulting from cultural differences and recommend leadership approaches that leverage diversity to enhance business performance.
- **SLO 7.4**: Identify the personal and contrasting attitudes, values, and beliefs that shape business relationships.

Title IX

As your instructor, one of my responsibilities is to create a positive learning environment for all students. Title IX and IU's Sexual Misconduct Policy prohibit sexual misconduct in any form, including sexual harassment, sexual assault, stalking, and dating and domestic violence. If you have experienced sexual misconduct, or know someone who has, the University can help.

If you are seeking help and would like to speak to someone confidentially, you can make an appointment with:

> The Sexual Assault Crisis Services (SACS) at (812) 855-8900 (counseling services)
> Confidential Victim Advocates (CVA) at (812) 856-2469 (advocacy and advice services)
> IU Health Center at (812) 855-4011 (health and medical services)

It is also important that you know that Title IX and University policy require me to share any information brought to my attention about potential sexual misconduct, with the campus Deputy Title IX Coordinator or IU's Title IX Coordinator. In that event, those individuals will work to ensure that appropriate measures are taken and resources are made available.   Protecting student privacy is of utmost concern, and information will only be shared with those that need to know to ensure the University can respond and assist.

I encourage you to visit **stopsexualviolence.iu.edu** to learn more.