Financial Information Systems
INFO-GB.3350
INFO-UB.6050
Fall 2024

Instructor	**Bernard S. Donefer** Adjunct Associate Professor Department of Technology, Operations Management & Statistics http://pages.stern.nyu.edu/~bdonefer/
Class Meetings	Thursday 6:00 – 9:00 pm Room KMC 4-120 (In person only, **not on Zoom**)
Email	bdonefer@stern.nyu.edu
Course Website	NYU Brightspace
Office Hours	Appointments before class *scheduled via email only* 4:30-5:30 in KMC 8-171 or after class without appointment

Our first class will be a discussion of AI technologies machine learning, deep learning, neural nets, large language models and their potential for hallucinations and AI's potential impact on the financial services industry. As we cover the subject matter of the course, we will consider AI's application in each context.

Understanding finance doesn't prepare you for the realities of how markets and their underlying infrastructure work today. Technology is a key driver of advances in the global markets. Virtually all US trading is done on electronic markets with exchange floors a relic of the past. Trading is done using algorithms, high frequency quant models and by automated market makers. We now have ~~11~~ 16 competing stock exchanges and over 40 Alternative Trading Systems (ATSs) providing *the mysterious dark liquidity which executes more than a third of our stock trades*. Are the markets rigged as suggested by Michael Lewis in his book *Flash Boys*? We examine the issues of market structure and technology interaction that underlie these claims and make our own objective assessment.

We study evolving payment systems, such as online transaction security using encryption, hashing, digital signatures, EMV, global mobile payment products, Bitcoin and crypto currencies including CBDCs and Decentralized Finance (DeFi). In examining post trade clearing and settlement, we consider how the blockchain may significantly improve these processes.

The financial services industry is being transformed by globalization, regulation, competition, consolidation and technology. These forces will be explored, focusing on how technology is both a driver of change as well as the vehicle for its implementation. Industry consolidation and convergence will be viewed in light of current events. The course objective is to bring both the business practitioner and technologist closer together. Topics will be covered through a combination of lectures, readings, news and case studies.

COURSE DESCRIPTION

The course consists of four primary topics, plus an AI background discussion, exploring its underlying technology and industry practices:

Artificial Intelligence Backgrounder – How it works and potential applications

1. Payment systems, institutional (Fedwire, CHIPS, ACH, SWIFT) and retail credit/debit cards and mobile payments (Zelle, Venmo, Paypal, mPesa, Alipay, etc.)
2. Internet transaction security, cryptography, digital signatures, TLS security layer
3. Blockchain, Cryptocurrency, Bitcoin, Ethereum smart contracts, new decentralized finance (DeFi) applications
4. Securities (equity) markets, electronic trading, algorithmic high frequency trading, post trade clearance and settlement

PREREQUISITES

None, however one course in investments, equities, fixed income, etc. or equivalent personal experience would be beneficial. Please contact me with any questions.

TEACHING MATERIALS

- NYU Brightspace website for this course will contain lecture materials, late breaking news and class announcements
- Readings will be posted on Brightspace at least a week early and should be read prior to each class. THERE IS NO TEXT BOOK for this course as most books are not sufficiently current.
- Students are encouraged to find current materials in the news or on the online for class discussion.
- **GRADING (Tentative)**

Item	Grade
First Quiz – Intro, AI and payment systems	30%
Second Quiz – Internet security, blockchain, crypto	30%
Third Quiz – Financial markets	30%
Assignments and class participation	10%

Quiz dates and study guides will be posted and dates will be announced in class. Quizzes will be given in class and the third and final quiz will be given on the last day of class.

YOUR E-MAIL ADDRESS

Be sure your email address in NYU Brightspace is correct. I will use it to communicate timely information about the course.

MY EXPECTED CLASSROOM BEHAVIOUR

Please follow covid protocols in force when the semester begins

Stern rules state that **you may not use cell phones, laptops, pads or other ELECTRONIC DEVICES OF ANY KIND during class meetings**. **You must silence cell phones BEFORE class.** If you are on-call for work or family, place your device on vibrate and leave the room before taking the call. If your phone rings, you will be asked to leave. Further I reserve the right to reduce your final grade by reducing points normally awarded for class participation. **Please see me if you have special circumstances, such as using your phone for medical monitoring, etc.**

Class will start on time. Arriving late interferes with other students' learning and is not acceptable. Subway delays and other problems are unavoidable on occasion, but it is each student's responsibility to plan carefully to arrive on time and well prepared. Repeated latecomers will be penalized. **Classes are recorded and will be available for students unable to attend a session.** Repeated absences will affect class participation grades.

As a mark of respect, **I ask all men to remove their caps or hats while in class**, unless worn for a religious reason.

Eating in class is limited to foods/drinks that can be eaten quietly and not so fragrant as to disturb other students in the class. There will be a short dinner break at about 7:30.

ACADEMIC INTEGRITY

We take pride in our well-rounded education and approach our academics with honesty and integrity. Indeed, integrity is critical to all that we do here at NYU Stern. As members of our community, all students agree to abide by the **NYU Academic Integrity Policies** as well as the NYU Stern Student Code of Conduct, which includes a commitment to:

- Exercise integrity in all aspects of one's academic work including, but not limited to, the preparation and completion of exams, papers and all other course requirements by not engaging in any method or means that provides an unfair advantage.
- Clearly acknowledge the work and efforts of others when submitting written work as one's own. Ideas, data, direct quotations (which should be designated with quotation marks), paraphrasing, creative expression, or any other incorporation of the work of others should be fully referenced.
- Refrain from behaving in ways that knowingly support, assist, or in any way attempt to enable another person to engage in any violation of the Code of Conduct. Our support also includes reporting any observed violations of this Code of Conduct or other School and University policies that are deemed to adversely affect the NYU Stern community.

STERN CODE OF CONDUCT

The Stern Code of Conduct and Judiciary Process applies to all students enrolled in Stern courses.

For graduate students, information can be found here: https://www.stern.nyu.edu/uc/codeofconduct.

For undergraduates, information can be found here: https://www.stern.nyu.edu/portal-partners/current-students/undergraduate/community/community-expectations

To help ensure the integrity of our learning community, prose assignments you submit to NYU Brightspace will be submitted to Turnitin. Turnitin will compare your submission to a database of prior submissions to Turnitin, current and archived Web pages, periodicals, journals, and publications. Additionally, your document will become part of the Turnitin database.

GENERAL CONDUCT & BEHAVIOR

Students are also expected to maintain and abide by the highest standards of professional conduct and behavior. Please familiarize yourself with Stern's Policy in Regard to In-Class Behavior & Expectations for Graduate and Undergraduate students. (https://www.stern.nyu.edu/portal-partners/registrar/policies-procedures/general-policies/code-conduct) (http://www.stern.nyu.edu/portal-partners/current-students/undergraduate/resources-policies/academic-policies/index.htm) and the NYU Student Conduct Policy (https://www.nyu.edu/about/policies-guidelines-compliance/policies-and-guidelines/university-student-conduct-policy.html).

GRADING INFORMATION FOR STERN ELECTIVE COURSES

At NYU Stern, we strive to create courses that challenge students intellectually and that meet the Stern standards of academic excellence. To ensure fairness and clarity of grading, the Stern faculty have agreed that for elective courses the individual instructor or department is responsible for determining reasonable grading guidelines.

STUDENT ACCESSIBILITY

If you will require academic accommodation of any kind during this course, you must notify me at the beginning of the course and provide a letter from the Moses Center for Student Accessibility (212-998-4980, mosescsa@nyu.edu) verifying your registration and outlining the accommodations they recommend. If you will need to take an exam at the Moses Center for Student Accessibility, you must submit a completed Exam Accommodations Form to them at least one week prior to the scheduled exam time to be guaranteed accommodation. For more information, visit the CSA website: https://www.nyu.edu/students/communities-and-groups/student-accessibility.html

STUDENT WELLNESS

Our aim is for students to be as successful academically as they can, and to help them overcome any impediments to that. Bookmark the NYU Stern Well-being Resource Hub (https://www.stern.nyu.edu/wellbeing) for existing services at NYU and Stern covering a wide variety of topics including financial well-being, relationship well-being, mental well-being, and more. Any student who may be struggling and believes this may affect their performance in this course is urged to contact the Moses Center for Student Accessibility (see also the Student Accessibility section of this syllabus) at 212-998-4980 to discuss academic accommodations. If mental health assistance is needed, call the NYU's 24/7 Wellness Exchange hotline 212-443-9999. Furthermore, please approach me if you feel comfortable doing so. This will enable me to provide relevant resources or referrals. There are also drop-in hours and appointments. Find out more at http://www.nyu.edu/students/health-and-wellness/counseling-services.html
Graduate students can also reach out to the Academic Advising team at academicaffairs@stern.nyu.edu if you would like to receive more information or further support.

NAME PRONUNCIATION AND PRONOUNS

NYU Stern students now have the ability to include their pronouns and name pronunciation in Albert. I encourage you to share your name pronunciation and preferred pronouns this way. Please utilize this link for additional information: Pronouns & Name Pronunciation

RELIGIOUS OBSERVANCES AND OTHER ABSENCES

NYU's Calendar Policy on Religious Holidays states that members of any religious group may, without penalty, absent themselves from classes when required in compliance with their religious obligations. You must notify me in advance of religious holidays or observances that might coincide with exams, assignments, or class times to schedule mutually acceptable alternatives. Students may also contact religiousaccommodations@nyu.edu for assistance.

NYU Stern is committed to ensuring an equitable educational experience for all students regardless of identity or circumstances and strives to recognize the obligations its students have outside of Stern. Please review all class dates at the start of the semester and review all course requirements to identify any foreseeable conflicts with exams, course assignments, projects, or other items required for participation and attendance. If you are aware of a potential conflict, please contact me as soon as possible to discuss any potential conflicts to determine whether/how they can be accommodated.

LAPTOPS, CELL PHONES & OTHER ELECTRONIC DEVICES

Due to the nature of this class and the potential disruptions caused by student use of electronic devices, students are not permitted to use any such devices during class without explicit permission from the instructor.

INCLUSION STATEMENT

This course strives to support and cultivate diversity of thought, perspectives, and experiences. The intent is to present materials and activities that will challenge your current perspectives with a goal of understanding how others might see situations differently. By participating in this course, it is the expectation that everyone commits to making this an inclusive learning environment for all.

Topic Schedule

Classes Thursdays September 19 - December 12, 2024 (Ex Nov 28)

All topics are subject to revision

Topic numbers do not equate to class meetings

Changes will be posted on NYU Brightspace

	Topics	**Questions**
Introduction	Welcome to FIS Course Logistics	What's this course about? Review syllabus How are the teaching materials organized? What is the grading policy? How should we communicate? Questions.
Backgrounder	Artificial Intelligence	Methods of machine learning, deep learning, neural nets, large language models and possible hallucinations Potential impact of AI in financial services
Topic 1	Introduction to Money and Banking	How is the financial services industry organized? Money, and banking history and functions Federal Reserve Bank
Topic 2	Payment Systems I Retail	What is the history and economics of various payment methods? Cash, checking, debit cards, credit, prepaid cards How are payments processed in the US? Smart chip cards, NFC communication What has the experience been with emerging payment systems, Paypal, EMV, Square, EZpass, MetroCard, Zelle, Venmo, Alipay, mPesa, etc. PCI DSS Standards
Topic 3	Payment Systems II Institutional	Institutional high value payments via ACH, Fedwire, CHIPS and SWIFT. CLS for ForEx Clearance and Settlement Bangladesh Central Bank Hack -- Fedwire ISO 20022 standards
Topic 4	Encryption, hashing, digital signatures Internet Transaction Security	Secret key and public key, symmetric and asymmetric encryption, RSA ECC How to secure internet payments. SSL/TLS Encryption Use of public key infrastructure Hashing – securing passwords on a server Digital signatures Impact of quantum computing on encryption
Topic 5	Blockchain and Bitcoin	Distributed ledgers, peer to peer computing, hash pointers How the Blockchain works, transactions, wallets Cryptocurrency - Bitcoin Mining consensus Proof of Work Building an exchange on a blockchain
Topic 6	Smart Contracts and Blockchain Use Cases Cryptocurrencies	Smart contracts Ethereum EMV Proof of Stake Initial coin offerings (ICOs) and other cryptocurrencies Decentralized Financed (DeFi) Exchanges, staking, NFTs Proof of concept blockchain use cases Central Bank Digital Currency
Topic 7	Introduction to Financial Services Industry- Securities Industry	What are the functions of securities, insurance, markets? Differences between broker and dealer, buy side and sell side Mutual funds, ETFs, Hedge Funds Equities How firms raise capital, The IPO process and Google's Dutch auction, SPACs How to research a firm and Homework Assignment

Topic 8	Introduction to Markets	Markets and Price Discovery Primary and secondary, Listed and OTC Market Structures Order types and order books
Topic 9	US Equity Market Structure	16 US Equity Exchanges How does an order book work? Hidden iceberg orders Maker taker model NYSE DMMs and SLPs NASDAQ price time order book, open close/auctions Wholesalers, PFOF Dark Pool ATSs, Posit, Liquidnet, Luminex, BIDS OTC Markets Microcap and Pinksheets Market data, SIP, CTS, CQS Index construction and weighting
Topic 10	Institutional Trading and Algo Trading	The institutional search for liquidity Transaction Cost Accounting (TCA) Benchmarks, VWAP, implementation shortfall etc. and post trade analytics Algorithmic trading by institutions, VWAP, TWAP, etc. Smart order routers
Topic 11	Low Latency and High Frequency (HFT) Trading Are US Equity Markets Rigged?	SEC definition of High Frequency Trading Automated Market Making, Payment for Order Flow Quant Trading (Stat Arb, Pairs, etc.) Trading Strategies Possible use of AI trading Wholesalers (Internalizers), Payment for Order Flow HFT, Colocation, Latency Arbitrage, Front Running Market Structure, Fragmentation, Spreads, Volatility *Flash Boys* – Are Markets Rigged
Topic 12	After the Trade	What is clearance and settlement What are CUSIPs, LEI What is T+1 What are the functions of a prime broker and custodian ISO 20022