



Northeastern University

College of Engineering

INFO 7510 Decentralized Finance

Course Information

Course Title: Decentralized Finance

Course Number: INFO 7510

Term and Year: Spring 2022

Credit Hour: 4

Course Format: On-Ground

Instructor Information

Full Name: Suhabe Bugrara

Email Address:

Course Prerequisites

Graduate level INFO 7500 Minimum Grade of B-

Course Description

DeFi or decentralized finance is a movement that aims at making a new financial system that is open to everyone and doesn't require trusting intermediaries like banks. To achieve this, DeFi relies heavily on cryptography, decentralized networks, and smart contracts. The DeFi ecosystem has recently exploded in activity and now consists of thousands of projects and has more than \$80 billion committed to it.

Instructor

Dr. Suhabe Bugrara received a Ph.D. in computer science from Stanford University and B.Sc. from MIT. He has published in top academic conferences in operating systems, computer security, and software engineering. He wrote his Ph.D. dissertation on state space reduction techniques for program analysis and verification. He is currently a security researcher at ConsenSys focusing on smart contract security. Previously, he was founder of Wise OR, a software startup in Silicon Valley focusing on optimizing the profitability of surgical cases at world-class hospitals. Contact: sbugrara@northeastern.edu.

Standard Learning Outcomes

The goal of the course is to enable you to 1) build new applications on top of DeFi protocols, 2) extend and compose existing DeFi protocols with new functionality, and 3) secure your applications against novel DeFi attacks, and 4) devise and execute profitable trading strategies.

The only prerequisite for the course is strong programming skills and some experience with the blockchain space. The coursework will consist of programming projects that involve:

1. Reading, coding, and deploying smart contracts,

2. Studying and replicating the results of DeFi technical research papers
3. Data mining of DeFi transaction history

Topics

- Introduction
 - CeFi vs DeFi
 - DeFi primitives: smart contracts, tokens, transaction execution, keepers, oracles, governance
 - DeFi protocol composability
- On-chain Asset Exchanges
 - Analysis of Uniswap markets
 - Automated market maker protocols
 - StableSwap
 - Theory of automated market makers in DeFi
 - Concentrated liquidity in Uniswap v3
- Loanable funds markets for on-chain assets
 - Liquidations
 - Flash loans
 - Protocols for loanable funds
- Stablecoins
 - Exogenous vs endogenous, instability in crypto assets, economic attacks
- Crypto portfolio management
 - Automatic rebalancing of token portfolios, yield aggregation strategies
- Crypto derivatives:
 - Synthetic assets, futures, perpetual swaps, options
- Oracles:
 - Authenticated data feeds, Chainlink
- Technical Security
 - Wash trading, flash loans, sandwich attacks, governance attacks, transaction ordering, displacement attacks
- Economic Security:
 - rationality, incentive compatibility, overcollateralization as security, threats from Miner Extractable Value: governance risks and governance extractable value, market and oracle manipulation
- High frequency trading
 - profit generating transactions, abstractable value

End-of-Course Evaluation Surveys

Your feedback regarding your educational experience in this class is very important to the College of Professional Studies. Your comments will make a difference in the future planning and presentation of our curriculum.

At the end of this course, please take the time to complete the evaluation survey at <https://neu.evaluationkit.com>. Your survey responses are **completely anonymous and confidential**. For courses 6 weeks in length or shorter, surveys will be open one week prior to the end of the courses; for courses greater than 6 weeks in length, surveys will be open for two weeks. An email will be sent to your HuskyMail account notifying you when surveys are available.

Academic Integrity

A commitment to the principles of academic integrity is essential to the mission of Northeastern University. The promotion of independent and original scholarship ensures that students derive the most from their educational experience and their pursuit of knowledge. Academic dishonesty violates the most fundamental values of an intellectual community and undermines the achievements of the entire University.

As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, examinations of whatever kind, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Students are responsible for learning the conventions of documentation and acknowledgment of sources in their fields. Northeastern University expects students to complete all examinations, tests, papers, creative projects, and assignments of any kind according to the highest ethical standards, as set forth either explicitly or implicitly in this Code or by the direction of instructors.

Go to <http://www.northeastern.edu/osccr/academic-integrity-policy/> to access the full academic integrity policy.

Student Accommodations

Northeastern University and the Disability Resource Center (DRC) are committed to providing disability services that enable students who qualify under Section 504 of the Rehabilitation Act and the Americans with Disabilities Act Amendments Act (ADAAA) to participate fully in the activities of the university. To receive accommodations through the DRC, students must provide appropriate documentation that demonstrates a current substantially limiting disability.

For more information, visit <http://www.northeastern.edu/drc/getting-started-with-the-drc/>.

Library Services

The Northeastern University Library is at the hub of campus intellectual life. Resources include over 900,000 print volumes, 206,500 e-books, and 70,225 electronic journals.

For more information and for Education specific resources, visit <http://subjectguides.lib.neu.edu/edresearch>.

24/7 Blackboard Technical Help

For immediate technical support for Blackboard, call 617-373-4357 or email help@northeastern.edu

Within Blackboard, open a support case via the red support button on the right side of the screen, click Create Case

myNortheastern, e-mail, and basic technical support

Visit the [Information Technology Services \(ITS\) Support Portal](#)

Email: help@northeastern.edu
ITS Customer Service Desk: 617-373-4357

Diversity and Inclusion

Northeastern University is committed to equal opportunity, affirmative action, diversity and social justice while building a climate of inclusion on and beyond campus. In the classroom, member of the University community work to cultivate an inclusive environment that denounces discrimination through innovation, collaboration and an awareness of global perspectives on social justice.

Please visit <http://www.northeastern.edu/oidi/> for complete information on Diversity and Inclusion

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In case of an emergency, please call 911.

Please visit www.northeastern.edu/titleix for a complete list of reporting options and resources both on- and off-campus.