FIN-413

Financial applications of blockchains and distributed ledgers

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Cursus	Sem.	Type
Financial engineering minor	E	Opt.
Financial engineering	MA2, MA4	Opt.
Managmt, tech et entr.	MA2, MA4	Opt.

Language of teaching	English
Credits	3
Withdrawal	Unauthorized
Session	Summer
Semester	Spring
Exam	During the semester
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	2 weekly
Project	1 weekly
Number of positions	

It is not allowed to withdraw from this subject after the registration deadline.

Summary

This course provides an introduction to Distributed Ledger Technology (DLT), blockchains and cryptocurrencies, and their applications in finance and banking and draws the analogies between Traditional Finance (TradFi) and crypto and the ways investors/traders can transact in those worlds.

Content

- History and evolution of money, the double spending problem
- Introduction to blockchain, layers (L1, L2), application layer
- Crypto sutody and infrastructure : self-sustody, custodial wallets, multisignature wallets
- TradFi: financial services, products and landscape
- Crypto: Centralized crypto exchanges (CEXs) vs. Decentralized blockchain-based venues (DEXs)
    - Limit order book vs. Automated Market Makers (AMM)

- DeFi landscape, composability and money-legos
- CBDCs, tokenized deposits, stablecoins
- On-chain credit: borrow/lending, interest rate benchmarks and interest rate setting mechanism
- Counterparty credit risk and mitigation mechanisms in TradFi vs. DeFi
- Derivatives trading in TradFi vs. DeFi
- Applications/Use cases:
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        - Settlement mechanics and involved parties
        - Collateral considerations to manage counterparty credit risk
        - Annual Percentage Yield (APY) and key risks under both product wrappers
        - Looping BUIDL token

- Securitization and tokenizing TradFi financial instruments:

- TradFi products for DeFi yield, and
- TradFi collateral for accessing DeFi funding
- Securitization and credit tranching for on-chain financial products

- Cross margining, concentration risk, capital efficiency and Lombard lending under DeFi
- Tokenomics, market-making, decentralized governance
- Prediction markets

Keywords

Cryptocurrencies, Distributed Ledger Technology, Blockchain, Bitcoin, Ethereum, Smart Contracts, Decentralized Finance

Learning Prerequisites

Recommended courses

Introduction to Finance, Derivatives

Important concepts to start the course

Databases, Interest rates, Counterparty credit risk, Derivatives

Learning Outcomes

By the end of the course, the student must be able to:

- Use basic cryptographic concepts including private/public keys, signatures, hash functions, Merkle trees
- Distinguish between different types of blockchain (private vs public, permissioned vs non-permissioned, etc.) and cryptocurrencies (utility tokens, security tokens, stablecoins etc.)
- Recall historical examples of electronic money
- Formulate alternative approaches to Byzantine fault-tolerant consensus including proof of work, proof of stake, etc.
- Sketch the basic setup of Bitcoin, Ethereum, XRP Ledger and EOSIO
- Conduct wallet installation, inter-wallet transactions and cryptocurrency trading
- Critique misuse of blockchains
- Investigate fraudulent activities in the crypto-market
- Present existing examples of DeFi (Decentralized Finance)
- Explore potential financial applications of DLT (Distributed Ledger Technology)
- Propose business strategies for blockchain start-ups
- Explain the concepts of smart contracts, Layer 1 and 2, and CEXs vs DEXs
- Reconstruct the various AMMs implementations
- Present existing examples of DeFi (Decentralized Finance) in areas such as borrow/lending and derivatives businesses
- Compare financial products offered in TradFi vs. DeFi under various formats and analyze implications on credit counterparty risk and capital efficiency
- Present various examples of two-way bridges between TradFi and DeFi

Transversal skills

- Access and evaluate appropriate sources of information.
- Communicate effectively with professionals from other disciplines.
- Demonstrate the capacity for critical thinking

Teaching methods

Lectures, group project

Assessment methods

- 100% Group project

Supervision

Office hours	Yes
Assistant.e.s	No
Forum	No

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

- DeFi and the Future of Finance, by C. R. Harvey , A. Ramachandran, et al.
- Blockchain And Distributed Ledgers: Mathematics, Technology, And Economics, by A. Lipton and A. Treccani
- Cryptocurrencies: Money, Trust and Regulation by O. McDonald

Ressources en bibliothèque

- Find the references at the Library

Moodle Link

- https://go.epfl.ch/FIN-413