



Ljubljana Summer School
“Take the Best from East & West”
4 – 22 July 2022

Blockchain Economics

Bachelor course (ECTS: 6)

09.30 – 12.00

MIHAJLOV Martin

Jozef Stefan Institute, Slovenia

Course objectives and learning outcomes:

Blockchain is a new technology that has the potential to disrupt business processes in entire industries. From banking and supply chain management to a host of other industries, blockchain applications are making novel changes in how business is executed. Considering that potential, there is a lot of hype that follows. Hence, the main aim of the course is to help students grasp both the technological aspects of blockchain as well as its economic properties and implications.

While the course has been specially designed for student of economics, due to the nature of topic it would also be interesting to students from other areas of study. Every economic and IT topic has been carefully broken down to its necessary fundamentals, explaining only the useful aspects through relatable analogies and metaphors. It assumes no knowledge of technology and even re-introduces economic concepts from a different perspective. Other aspects of the course include examining how specific features of blockchain solve existing problems and studying various use cases of blockchain to see how different industries are applying the technology.

At the completion of this course the student will be able to:

- Identify the core components of blockchain technology.
- Understand the technological components of a blockchain.
- Understand the fundamentals of money/currency and its evolution from pre-cryptocurrency to digital/cryptoassets.
- Understand the variations and differences of existing major blockchain platforms.
- Understand the limitations and outstanding issues of existing blockchain technology.
- Learn how many large corporations are already implementing blockchain technology.
- Learn how to think of innovative application models, leveraging the blockchain technology

Prerequisites for attending the course:

None.



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Course syllabus/Daily topics:

PROGRAMME DAY	ACTIVITY/TOPIC/SESSION
Monday, 4 July	LSS Welcome session (no lectures)
Tuesday, 5 July	The world of money
Wednesday, 6 July	Blockchain Fundamentals
Thursday, 7 July	Cryptography
Friday, 8 July	Mining
Monday, 11 July	Creating value on the blockchain
Tuesday, 12 July	Cryptoassets
Wednesday, 13 July	Smart contracts and decentralized apps
Thursday, 14 July	Blockchain investing and cryptomarkets
Monday, 18 July	Blockchain in other industries
Tuesday, 19 July	Blockchain: Present and Future
Wednesday, 20 July	No lectures (preparation for final examination)
Thursday, 21 July	Final examination
Friday, 22 July	Meeting hours with students & LSS Farewell session

DAY 1 - The World of Money

The course begins with an introductory lecture in money. To begin understanding the economics of blockchain it is first necessary to understand how money has evolved through the years, as blockchain has brought back money to its roots.

We will go back in time to the age of bartering and move through the world of Amazon cocoa money and Kublai Khans paper money implementation. Then we refocus on the rise and fall of the gold standard before finally settling on the current state of money, fiat. In the second half of the day we will discuss the current financial system and the silent worldwide move from paper to electronic money. We will lay the foundation for the first manifestation of blockchain technology, cryptocurrencies.

- Class Activity: Discussion
- Optional Home Activity: Watch the Big Short

DAY 2 - Blockchain

To understand the potential and limits of blockchain technology it is necessary to know how blockchain works and how this solution addresses previously unsolvable problems. Hence, in this and the following two lectures the focus will be on explaining the technical aspects of blockchain in the least technical way.

We will learn about the fundamental blockchain properties and how they apply to real case scenarios. We will expound on the concept of hashing, explain blockchains' distributive properties and finally, discover how a blockchain network works through the existence of "volunteer" nodes that perform different functionalities.

- Class Activity: Discussion
- Optional Home Activity: Watch the Imitation Game



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DAY 3 - Cryptography

Although cryptography is nothing more than "secretive writing" it represents the backbone of security in any ICT technology. On this day, we will learn how to create secret messages (encryption) using special codes (encryption keys) and how to make these codes difficult to break (asymmetrical encryption). Following, we will then see how this can be applied to create unique digital identities via digital signatures.

After the general cryptography introduction, we will apply this (and previous) knowledge to blockchain technology to explain how digital accounts are created and how digital identities can remain (partially) hidden in a public network. We will then move on to transactions and wallets before concluding the day with a brief mention of cryptocurrency exchanges.

- Class Activity #1: Creating cryptocurrency wallets
- Class Activity #2: Exploring the Bitcoin blockchain

DAY 4 - Mining

From Byzantine generals to Game of Thrones, the issue of trust has always been difficult to resolve, especially in an ICT setting. Satoshi's trustless protocol is what binds the previously explained blockchain properties into a successful trustful solution.

These lectures complete the technical description of blockchain. Students find out how a blockchain ledger is managed and how multiple originals can co-exist at the same time. They will then learn about the intricacies of the system like processing transactions, transactions fees and getting rewarded for solving puzzles that protect the system. We will also discuss forking and mining pools briefly, sufficiently enough to set up the next phase of the course.

- Class Activity: Case study of Bitcoin
- Optional Home Activity: Watch War Games

DAY 5 - Creating value on the blockchain

After three days of technology it is time to go back to the more economical aspects of the blockchain.

Game theory is the main topic in the first part of the day. As in economics, game theory is essentially concerned with what happens when people interact strategically with each other, it is the perfect prism to view blockchain mechanics. By playing actual games, we will explain how a widely distributed blockchain system reaches a stable equilibrium that treats fraud as a lose scenario. We will then explore the theories of value to see how virtual coins created out of thin air can have factual utility and worth. Both objective and subjective aspects of generating value will be observe, and we will use Bitcoin valuation as an example of how blockchain asset pricing works.

- Class Activity: Playing games
- Optional Homework: Watch A Beautiful Mind



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DAY 6 – Cryptoassets

The digitalization of value through blockchain has brought almost 2000 cryptocurrencies on the digital market. While it is not possible to discuss the whole spectrum, we can explain how blockchain has created a new type of asset class.

We will explain how the underlying properties of a blockchain-based cryptocurrency can take the shape and form of any asset like currency, commodity, security, etc. We will first look at traditional assets and compare properties with blockchain solutions to find the appropriate crypto alternatives.

- Class Activity: Case study of different cryptocurrencies

DAY 7 – Smart contracts and decentralized apps

Once the technical and economic principles of the blockchain are understood it is easy to move on from the world of finance to the world of information.

As we take blockchain programability to the next level, we will get introduced to smart contracts, the completely inalterable agreements executed on the blockchain. We will see how every phase of contracting can be facilitated, verified and enforced in a completely digital environment. We will also learn how smart contracts can be utilized not only for the exchange of money, but also anything of value in a transparent way without the need for a third party. As we exchange financial transactions with informational transactions we enter the realm of distributed decentralized apps. During this segment of the lecture we will introduce a novel way to use and execute apps via a peer-to-peer network.

- Class Activity: Case study of Ethereum
- Class Activity: Case study of IBM Blockchain World Wire

DAY 8 – Blockchain investing and cryptomarkets

Cryptomarkets are not that different from regular markets, mostly because human behavior plays a central role in both cases. Hence, during this class we will explain the similarities between traditional and crypto investing, with the main difference being lack of regulation. By observing past and present market trends we will evaluate the fallacies of inappropriate investment strategies placing emphasis on expert delusion and emotional bias

Following we will discuss the emergence of a new type of funding, initial coin offering (ICO). We will present the innovative concept of offering company issued tokens instead of shares and the different utilities these tokens can assume. We will also explain the differences between ICO and its older funding sibling IPO.

- Class Activity: Analyzing ICO failures
- Home Activity: Blockchain research #1



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DAY 9 – Applying Blockchain in Other Industries

With the continued development of blockchain technology and infrastructure, the concepts and ideas behind blockchain have the potential to disrupt other industries beyond the financial sector.

In this partially flipped class we will explore the effect blockchain has or will have on non-banking industries. Topics of discussion will include, but will not be limited to supply-chain management, real estate, healthcare, etc.

- Class Activity: Case study of Tradelens
- Home Activity: Blockchain research #2

DAY 10 – Blockchain: Present and Future

As blockchain is slowly transforming from a top trending buzzword to a potential reality we will completely flip the final class and shift to the learners instead of the instructor. Considering that student have already been introduced to a wide variety of blockchain topics, we will explore blockchain in greater depths by letting students share findings from their open-topic research. We will also engage in creative problem solving by tackling emerging problems to construct knowledge in a peer-to-peer environment

Course materials/List of readings:

The materials used in the course will be slides from lectures, and short case studies. Optionally, course participants can also use the following books to further improve the acquired knowledge:

- Antony Lewis - The Basics of Bitcoin and Blockchains
- William Mougayar and Vitalik Buterin - The Business Blockchain: Promise, Practice, and Application of the Next Internet Technology
- Chris Burniske - Cryptoassets: The Innovative Investor's Guide to Bitcoin and Beyond
- Daniel Drescher - Blockchain Basics: A Non-Technical Introduction in 25 Steps

Teaching Methods:

This course will consist of a combination of teaching methods. They include visually interactive lectures, case studies, in-class discussions and blended learning for some of classes.



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Examination methods and evaluation criteria (weighted categories):

- **In-class participation (10%)**
Based on active involvement during all lessons.
- **Quizzes (40%)**
Classes on days 2 to 9 will have quizzes on content from the previous day. Each quiz will contribute 5% towards the final grade.
- **Group project (50%)**
Participants will work in groups of 2-4 people to perform an in-depth analysis of a specific blockchain solution.

Grading scale:

DEFINITION	%	LOCAL SCALE	ECTS SCALE	Grade (USA)
exceptional knowledge without or with negligible faults	92-100	10	A	A+, A, A-
very good knowledge with some minor faults	85-91	9	B	B+, B
good knowledge with certain faults	77-84	8	C	B
solid knowledge but with several faults	68-76	7	D	C+, C, C-
knowledge only meets minimal criteria	60-67	6	E	D+, D
knowledge does not meet minimal criteria	<60	5	F	

Short course leader(s) biography:

Martin Mihajlov is an associate professor of Information Technologies at the Ss. Cyril and Methodius University, Faculty of Economics in Skopje, Macedonia. At the present he is actively employed by the Jozef Stefan Institute in Ljubljana, Slovenia as an academic researcher. His main area of academic and research interest is the effects new technologies have on modern societies. Hence, for the past several years he has been focused on the economics aspect of blockchain.