BLOCKCHAIN AND CRYPTOCURRENCY

IE University
Professor: **GAEL SANCHEZ SMITH**
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Academic year: 23-24
Degree course: THIRD
Semester: 1º
Category: COMPULSORY
Number of credits: 3.0
Language: English

PREREQUISITES

Class is opened to every student even those who do not have prior exposure to blockchain technology or cryptocurrencies. However, in order to participate into practical sessions, every student will be invited to purchase 50EUR – Fifty Euros – of Bitcoin at the beginning of the class. The purchase of Bitcoin should be considered as a learning material and not as an investment.

It is recomended that students read through the books outlined in the bibliography. Students that wish to delve further into the material covered during the course are invited to listen to the What Bitcoin Did Pocast and the Bankless Podcast.

SUBJECT DESCRIPTION

Many technologies we now take for granted were at some point obscure and only understood by a few enlightened experts. Blockchain and its most famous ambassador, the Bitcoin, belong to this category of inventions. Since its inception by Satoshi Nakamoto in 2009, blockchain applications have evolved from the niche world of cryptography researchers and coders to the spotlights of skyrocketing cryptocurrencies valuations.

Note that the class is not intended to teach students about trading or financial advisory as an asset class or profession.

OBJECTIVES AND SKILLS

- Understand the origin and innovative aspects of Bitcoin.
- Develop a better understanding of the underlying technologies enabling blockchain.
- Get an insight on current applications for startups and corporate
- Be able to design business models and value proposition where blockchain technology brings value.
- Develop a critical mindset about the potential for Bitcoin and other blockchain applications.

METHODOLOGY

Through this elective course, we want to give students the opportunity to understand blockchain from different angles. The class follows a top-down approach that will take the audience from general concepts to specific business models enabled by the technology. Finance was one of the first industries to see the potential impact of blockchain on their business models, but we will demonstrate that many industries are being challenged by the disrupting power of blockchain. We will discuss the possibilities offered by blockchain to rethink our daily life through P2P transactions in a more decentralized and secure way.

We believe that the best way to grasp the full potential of a technology is by experiencing it from a practical point of view. Very early, we will give students the opportunity to install and use some of the tools used by the blockchain community starting from the wallet creation. We will then pursue our journey toward the exciting world of cryptocurrency and trading platforms.

Teaching methodology	Weighting	Estimated time a student should dedicate to prepare for and participate in
Lectures	33.33 %	25 hours
Discussions	13.33 %	10 hours
Exercises	20.0 %	15 hours
Group work	13.33 %	10 hours
Other individual studying	20.0 %	15 hours
TOTAL	100.0 %	75 hours

PROGRAM

SESSION 1 (LIVE IN-PERSON)

Introduction

Lecture: Welcome, instructor presentation, course overview, grading policy. We will study money and its functions, the different types of money used thru history, fiat money and the advent of digital currencies.

Study questions

What is money?
Why is money important for a functioning society?
What are the issues with the current monetary system?

Article: From silkroad to ATMs: The history of bitcoin (The Guardian, Thu 14 Sep 2017)

SESSION 2 (LIVE IN-PERSON)

The creation of Bitcoin

Lecture: In this lecture we will study the creation of Bitcoin; the context in which it was created and what problems did its creator intend to solve.

Study questions

In what context was Bitcoin created?
Why was Bitcoin created?
Does Bitcoin fulfil the functions of money (medium of exchange, store of value, & unit of account)? Can it do so in the future?

Other / Complementary Documentation: Bitcoin open source implementation of P2P currency

Article: From Silk Road to ATMs (The Guardian, Thu 14 Sep 2017)

Book Chapters: 'Bitcoin and Cryptocurrency Technologies, Preface — The Long Road to Bitcoin' Clark (pages 3 – 21) (ced)

SESSION 3 (LIVE IN-PERSON)

The world of cypherpunks

In Session 3 we will analyze the different ideologies that gave birth to Bitcoin and identify who were Bitcoin ?s early adopters. Who are cypherpunks? Where do they come from? Students are requested to watch the series of videos and answer a set of questions:

Study Questions

•Where do Bitcoin and Blockchain come from?

•What do cypherpunks stand for?

•Who were the early adopters of the technology?

•Who is Satoshi Nakamoto?

Video: Before the Web: The 1980s Dream of a Free and Borderless Virtual World (Youtube)

Video: Cryptography vs. Big Brother: How Math Became a Weapon Against Tyranny (Youtube)

Video: When Encryption Was a Crime: The 1990s Battle for Free Speech in Software (Youtube) (Youtube)

SESSION 4 (LIVE IN-PERSON)

The Engineering of Bitcoin

During this session we will study the set of challenges that Satoshi needed to surmount in order to create the first decentralised, digital monetary system. We will focus on how Satoshi used existing technologies to engineer the socio-economic incentives that underpin Bitcoin.

Study questions

What were the main challenges for the development of a decentralised digital currency?
What is the double-spending problem and how does the Bitcoin protocol prevent it?
What are cryptographic hash functions, asymmetric cryptography and the law of large numbers and how are they relevant to Bitcoin?

Article: Bitcoin Whitepaper: "A Peer-to-Peer Electronic Cash System"

Article: Reid Hoffman: Why the blockchain matters (Wired, 15.05.2015)

Article: Gael Sánchez Smith: The Engineering of Bitcoin (gaelgss.medium.com)

SESSION 5 (LIVE IN-PERSON)

Technical concepts (simulation)

In session 5, students will simulate the role of a miner and understand their role in the ecosystem. We will see what is a hash, a transaction, a block and how those blocks are linked together.

Study questions:

•Mining blocks. How a miner works and what is his role?

Video: How Bitcoin works under the Hood (Youtube)

Video: Blockchain 101 - A Visual Demo (Youtube)

SESSION 6 (LIVE IN-PERSON)

Mining Industry

The miner’s role is crucial in securing transactions happening on the blockchain. By providing their CPU time, miners are rewarded in cryptocurrencies (bitcoin, ether,...) but overtime, mining activity has become very competitive and often unprofitable for individuals. We will study the different types of mining, their evolution and economical aspects associated with this activity.

Study questions
•How to calculate the profitability of mining activities?
•What is the payback period?
•Are miners centralized or decentralized?

Article: Proof-of-Stake and Stablecoins: A Blockchain Centralization Dilemma; Section 1: Proof-of-Stake vs Proof-of-Work (Lyn Alden, November 2021)

Podcast: Why Proof of Stake is Flawed with Lane Rettig- First 28 minutes (Youtube)

SESSION 7 (LIVE IN-PERSON)

Austrian economics and Bitcoin

This session will be the opportunity to introduce the different forms of monetary systems used over time and compare "The gold standard" with current fiat money systems. In a context of free market encouraging economic freedom for individuals, we will explore how Bitcoin can become a global reserve currency.

Study questions:

- Is fractional reserve banking viable under a Bitcoin Standard?

- Is Bitcoin's fixed monetary rule an economic problem?

- Austrian Epistemology: The empiricist vs Rationalist approach to Economics and its relevance to the study of Bitcoin quantitative models such as Stock2Flow

SESSION 8 (LIVE IN-PERSON)

Introduction to Blockchain

Lecture: In this session we will study the link between bitcoin and blockchains, the different types and use cases and the compromise that they are willing to make.

Study questions

Why were other blockchains invented beyond Bitcoin?
What are smart contracts and decentralised applications?
How do blockchains differ from Bitcoin architecture? Use the analytical framework introduced in Session 4.
What other consensus protocols are there? What are some of the tradeoffs of alternative consensus algorithms?

Article: A NEXT GENERATION SMART CONTRACT & DECENTRALIZED APPLICATION PLATFORM (ethereum.org)

Article: Blockchain Technology (gaelgss.medium.com)

SESSION 9 (LIVE IN-PERSON)

Tokenization: From ICOs to NFTs

We will dive into the fast-changing world of tokens and Initial Coin Offering (ICO). We will cover the case study of FileCoin ?s ICO and see how tokens are being traded on dedicated platforms.

Study questions

•What is a token and how does it differ from a coin?

•Why were blockchain tokens invented?

•What types of tokens exist?

•What is an ICO?

•What are the risks and benefits, and the implications for the global capital market?

Practical Case: Filecoin's Initial Coin Offering: Using Blockchain to Decentralise Storage (HBS NTU182-PDF-ENG)

Article: Tokens, Cryptocurrencies & other Cryptoassets (Block Chain Hub, 2020)

SESSION 10 (LIVE IN-PERSON)

Decentralized Finance

In this session we will explore some of the new tools being built on top of decentralised networks. The very vibrant world of Decentralized Finance - or DeFi - opens the door to new possibilities to enable a P2P economy. Students will be given the opportunity to place orders with the tokens in their possession on a decentralised exchange platform and put their token at use

Study questions:

What's the difference between decentralised finance and centralised finance? What are some examples of each service?

Readings:

Article: DeFi is eating finance, Bankless.

Article: DeFi: The Ultimate Beginner's Guide to Decentralized Finance

SESSION 11 (LIVE IN-PERSON)

Other Blockchain Trends: DAOs, Metaverse and Gamefi.

In this session we will explore some of the most prevalent trends that have recently emerged in the blockchain space.

Readings:

Article: Article: Why DAOs are the new firms Corporate firms have been decentralising for decades. DAOs are the next evolution. Ryan Sean Adams (Bankless, Mar 16)

Article: GameFi: How to Earn Crypto Playing Games Online, By Annika Feign, Ollie Leech. (Coin Desk, Mar 9, 2022)

Article: The Metaverse Emerges (Bankless, Sep 1, 2021)

SESSION 12 (LIVE IN-PERSON)

Blockchain Corporate Case Study; Visa & The Lighting Network (Guest Speaker)

Banks and financial institutions have stayed away from bitcoin due to its toxic reputation.

This session is an opportunity to understand how businesses and payment service providers make investment decisions related to existing vs. potential technology. Analyse when and how a company should self-disrupt. Critically analyse the role of start-ups in innovation introduced by large firms.

Study questions:

What are the differences between permissioned and permissionless blockchains?
How should a company assess Bitcoin and blockchain opportunities?
What would self-disruption mean in the context of Visa?
What is Lightning Network? Why does it matter?

Practical Case: Visa Inc.: Threat from Cryptocurrency? (HBS W20161-PDF-ENG)

SESSION 13 (LIVE IN-PERSON)

Risks and Critiques of Bitcoin and Blockchain

In the final session we look at some of the strongest arguments against the promises of Bitcoin and Blockchain innovations.

Study Questions

Can Bitcoin's volatility come down enough for it to act as money?

How robust is the Bitcoin network and what are the risks associated with the concentration of mining?

Could CBDC's replace current cryptocurrencies?

Most blockchains are migrating to proof of stake, what are the risks with this consensus mechanism? Are proof of stake blockchains sufficiently decentralised to fulfil their promises?

Can decentralised applications really scale to serve the world?

SESSION 14 (LIVE IN-PERSON)

During the last 2 sessions, students will be invited to form groups of 4-5 people. Each group will choose an existing blockchain protocol and will analyse using the knowledge acquired throughout the course:

1-Why was this protocol built? What benefits does it bring?

2-How is it engineered, is the security model sound?

3-Is blockchain the best tool for this service?

The instructor will challenge the teams to apply some of the models that have been discussed in class.

During the second session, each team will pitch their solution to the rest of the class for 5mn and answer questions for 4 minutes

SESSION 15 (LIVE IN-PERSON)

During the last 2 sessions, students will be invited to form groups of 4-5 people. Each group will choose an existing blockchain protocol and will analyse using the knowledge acquired throughout the course:

1-Why was this protocol built? What benefits does it bring?

2-How is it engineered, is the security model sound?

3-Is blockchain the best tool for this service?

The instructor will challenge the teams to apply some of the models that have been discussed in class.

During the second session, each team will pitch their solution to the rest of the class for 5mn and answer questions for 4 minutes

BIBLIOGRAPHY

Recommended

- Saifedean Ammous. *The Bitcoin Standard: The Decentralized Alternative to Central Banking.* John Wiley & Sons Inc. ISBN 1119473861 (Digital)

- Nik Bhatia. *Layered Money: From Gold and Dollars to Bitcoin and Central Bank Digital Currencies.* ISBN 1736110519 (Digital)

- David Graeber. *Debt. The First 5,000 Years.* ISBN 9781612194196 (Digital)

- Yan Pritzker. *Inventing Bitcoin: The Technology Behind The First Truly Scarce and Decentralized Money Explained.* Yan Pritzker. ISBN 9781794326316 (Digital)

EVALUATION CRITERIA

Criteria	Percentage	Comments
Class Participation	15 %	Participation and attendance.
Individual Work	45 %	Practical exercises and pop-up quiz.
Final Exam	40 %	Workshop.

Class participation

Students are requested to read the case studies, documents and watch the videos before each session and be prepared to discuss them actively during class. Course grade will be determined by value-added participation (ie quality, not quantity of comments).

Individual work

Individual work is composed of practical exercises given in class and a quiz. For the quiz, the student will respond to a set of questions related to the topics that have been covered during the course. Date not communicated.

Final Exam: Workshop

Students will form teams of 2-3 people to prepare and deliver a 5-minute pitch in class on the last day followed by 5mn of Q&A.

Students will be graded based on the following list of criteria:
•Capacity to apply learnings acquired during class,
•Accuracy of argumentation,
•Ability to define clearly a real-life problem,
•Creativity and originality of solution,
•Clarity of presentation materials.

PROFESSOR BIO

Professor: **GAEL SANCHEZ SMITH**

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GAEL SANCHEZ SMITH

Gael Sánchez Smith has more than 5 years of experience in the world of Bitcoin and cryptocurrencies, including consultancy work and presenting at conferences on the economic and societal implications of Bitcoin and other cryptocurrencies and has published the reference book "Bitcoin lo Cambia Todo" with the Spanish publishing house Anaya. He has worked in the I.T. industry as and has more than 10 years of experience as an investor in a wide range of financial markets including Equities, Commodities, Bonds and Cryptocurrencies.

OTHER INFORMATION

RE-SIT / RE-TAKE POLICY

Each student has four (4) chances to pass any given course distributed over two (2) consecutive academic years. Each academic year consists of two calls: one (1) ordinary call (during the semester when the course is taking place); and one (1) extraordinary call (or "re-sit") in June/July.

Students who do not comply with the 70% attendance requirement in each subject during the semester will automatically fail both calls (ordinary and extraordinary) for that Academic Year and have to re-take the course (i.e., re-enroll) during the next Academic Year.

Regarding to the newly implemented ´liquid learning´ model, all students must still abide by the same IEU attendance policy, including those students who are connecting remotely to class sessions and not physically in the classroom because they are unable to be physically in Spain, on campus. During the sessions, students connecting remotely are required to fully connect their camera and microphone at all times, and must actively participate during the sessions (using all necessary audiovisual equipment), just as their fellow peers who are physically present in the classroom on campus.

The Extraordinary Call Evaluation criteria will be subject to the following rules:

- Students failing the course in the ordinary call (during the semester) will have to re-sit evaluation for the course in June / July (except those students who do not comply with the attendance rule, and therefore will not have that opportunity, since they will fail both calls and must directly re-enroll in the course during the next Academic Year).
  It is not permitted to change the format nor the date of the extraordinary call exams or deadlines under any circumstance. All extraordinary call evaluation dates will be announced in advance and must be taken into consideration before planning the summer (e.g. internships, trips, holidays, etc.)
- The June/July re-sit will consist of a comprehensive evaluation of the course. Your final grade for the course will depend on the performance in this exam or evaluation only. I.e., continuous evaluation over the semester (e.g. participation, quizzes, projects and/or other grade components over the semester) will not be taken into consideration on the extraordinary call. Students will have to achieve the minimum passing grade of 5 and the maximum grade will be capped at 8.0 (out of 10.0) – i.e., "notable" in the extraordinary call.
- Re-takers: Students who failed the subject on a previous Academic Year and are now re-enrolled as re-takers in a course will need to check the syllabus of the assigned professor, as well as contact the professor individually, regarding the specific evaluation criteria for them as

re-takers in the course during that semester (ordinary call of that Academic Year). The maximum grade that may be obtained as a retaker during the ordinary call (i.e., the 3rd call) is 10.0 (out of 10.0).

After exams and other assessments are graded by the professor (on either the ordinary or extraordinary call), students will have a possibility to attend a review session (whether it be a final exam, a final project, or the final overall grade in a given course). Please be available to attend the session in order to clarify any concerns you might have regarding your grade. Your professor will inform you about the time and place of the review session.

- Students failing more than 18 ECTS credits after the June/July re-sits will be asked to leave the Program. Please, make sure to prepare yourself well for the exams in order to pass your failed subjects.
- In case you decide to skip the opportunity to re-sit for an exam or evaluation during the June/July extraordinary call, you will need to enroll in that course again for the next Academic Year as a re-taker, and pay the corresponding tuition fees. As you know, students have a total of four (4) allowed calls to pass a given subject or course, in order to remain in the program.

ATTENDANCE

Attendance is mandatory at IE University, as it is an essential factor of IE´s learning methodology. While we do closely monitor attendance in each course, we also consider our students responsible for their own agenda and commitments, as adult university students. With that in mind, each student may miss up to 30% of the sessions within a given course and still maintain the possibility of passing that given course. This 30% “buffer” is to be used for any absences, such as: illnesses, personal emergencies, commitments, official/governmental matters, business and/or medical appointments, family situations, etc. Students should manage their various needs, and situations that may arise, within that 30% buffer. If a student is absent to more than the allowed 30% of the sessions (regardless of the reason), s/he will obtain a 0.0 grade for that course in both the ordinary and extraordinary calls of the current academic year, and s/he will have to retake the course during the following academic year.

Please pay close attention to your attendance. The program strongly encourages attending 100% of the sessions as it will improve your learning outcomes, it will increase the class performance and it will benefit your participation grade. Noncompliance with deadlines for Non-Classroom Learning activities or assignments will result in an absence for the session.

Extreme cases involving emergencies such as: extended hospitalizations, accidents, serious illnesses and other cases of force majeure, are to be consulted with the Program Management (bir.madridoffice@ie.edu) for assessment of the situation and corresponding documentation, in order to support and guide each student optimally.

PLAGIARISM / ACADEMIC HONESTY

Plagiarism is the dishonest act of presenting another person’s ideas, texts or words as your own. This includes in order of seriousness of the offense:

- providing faulty sources;
- copy-pasting material from your own past assignments (self-plagiarism) withoutthe instructor’s permission;
- copy-pasting material from external sources even while citing them;
- using verbatim translations from sources in other languages without citing them;
- copy-pasting material from external sources without citing them;
- and buying or commissioning essays from other parties.

IEU students must contact the professor if they don’t know whether the use of a document constitutes plagiarism. For help with your academic writing, contact the Writing Center (writingcenter@faculty.ie.edu). The professor will also advise the student on how to present said material. All written assignments must be submitted through Turn-it-in, which produces a similarity report and detects cases of plagiarism. Professors are required to check each student's academic work in order to guarantee its originality. If the originality of the academic work is not clear, the professor will contact the student in order to clarify any doubts. Students using external tutorial support should report it to the professor and the BIR Program from the moment they began receiving this support. In the event that the meeting with the student fails to clarify the originality of the academic work, the professor will inform the Director of the Bachelor Program about the case, who will then decide whether to bring the case forward to the BIR Academic Review Panel. Very high similarity scores will be automatically flagged and forwarded to the Academic Review Panel. Plagiarism constitutes a very serious offense and may carry penalties ranging from getting a zero for the assignment to expulsion from the university depending on the severity of the case and the number of times the student has committed plagiarism in the past.