Universität Zürich[UZH]

UZH Blockchain Center

PROF. DR CLAUDIO J. TESSONE

Blockchain Programming

03SMBINFS162 / 03SMMINFS562

SYLLABUS

AUTUMN SEMESTER 2021

Blockchain and Distributed Ledger Technologies
Department of Informatics (IfI)
University of Zurich, Switzerland

PREAMBLE

Welcome

This course takes place every Autumn Semester. You will find all necessary information concerning the course within this Syllabus. From time to time, updates will be communicated on the OLAT Platform and on the Blockchain and Distributed Ledger Technologies Group's webpage at IfI (http://www.ifi.uzh.ch/bdlt). Please, check regularly both.

We are very happy to welcome you to our lecture.

Prof. Dr Claudio J. Tessone
Blockchain and Distributed Ledger Technologies Group
Department of Informatics
Faculty of Business, Economics, and Informatics
University of Zurich

Quick Overview

Instructor

- Prof. Dr Claudio J. Tessone
  Office AND 4.42, Andreasstrasse 15
  CH-8050 Zürich
  Switzerland
  Meetings are online (MS Teams, or equivalent) after previous appointment

  Phone: +41 44 63 42 918
  E-mail: claudio.tessone@uzh.ch
  Webpage: https://www.ifi.uzh.ch/bdlt

Teaching Assistants

- Dr Matija Piškorec
  E-mail: **piskorec@ifi.uzh.ch**

Details

Type: Lecture
Target Audience: This course is acknowledged for
- MSc students and is assigned to the Core elective areas „Wahlpflichtbereich": Information Systems (INF1), Data Science (INF5), Artificial Intelligence (INF6)
- BSc students from Informatics

Frequency: Each Autumn Semester
AP (ECTS): 3
Language: English

Prerequisites

Solid programming skills in any of the popular general purpose programming languages (C++, Java, Python) are a necessary requirement (or the willingness to develop this knowledge **prior** to the lecture). No prior knowledge of blockchain programming is needded. Optional experience in Web technologies (HTML, CSS, JavaScript) for building Web applications.

Content:

Theoretical and practical introduction to programming decentralized applications on the most popular blockchain protocols.

Grading:

Oral exam (40%) and written project report (60%).

Further information:

https://www.ifi.uzh.ch/bdlt/teaching

Registration:

Through the registration tools at the University of Zurich.

1. Introduction and Objectives

The goal of this Seminar is to give students first-hand experience in programming decentralized applications on the most popular blockchain protocols, including, but not limited, Bitcoin, Ethereum and Polkadot. Students will be given theoretical and technical guidance as well as technical infrastructure - forks of several before mentioned blockchain protocols, so that they can start developing their own decentralized applications. Topics that are included in this Seminar (but are not limited to): blockchain protocols (Bitcoin, Ethereum, Polkadot), smart contracts, consensus mechanisms, transaction and smart contract languages (Script, Solidity), analysis of transaction networks, large scale preprocessing of blockchain data and extraction of relevant information (balances, addresses, entities).

Theoretical and technical concepts will be covered in sufficient detail so that students can start working on their own projects. However, prior programming knowledge and experience is recommended, not neccessarily in the field of blockchain technologies. Examples of possible projects include implementation of their own Uniswap protocol for decentralized finance using smart contract functionalities on either Ethereum or Polkadot blockchains.

During their project work students will be guided to critically assess all relevant technical aspects of their proposed application, to plan the development and deployment of their application, and to asses its usability in comparison to more traditional centralized solutions as well as in the wider context of existing decentralized blockchain applications.

2. Course Contents

LECTURE 1. Kickoff and introduction to blockchain and Bitcoin (CT)

. Blockchain and cryptocurrencies basics
. Industrial applications of blockchain
. Bitcoin basics
. Structure of a Bitcoin transaction
. Introduction to Script
. Practical demonstration

LECTURE 2. Ethereum and smart contracts (CT)

. Ethereum basics
. Smart contracts on Ethereum network
. Tokens and token standards on Ethereum network
. Programming smart contracts in Solidity
. Practical demonstration

LECTURE 3. Blockchain ecosystem (CT)

. Introduction to Polkadot, Tezos, Cardano, IOTA, Algorand
. Decentralized applications (dApps)
. Second layer solutions (Lightning network)
. RPC and APIs for data collection

3. Course Material

Material Offered

Students have access to OLAT and a Team specifically created on MS Teams to download the slides presented in class, re-hear the lecture, find relevant material, datasets and literature.
The following procedure is strongly recommended as preparation for the classes.

Overview of classes

On the webpage an overview of all classes given by our team can be found. Develop an idea of the classes and how they best fit into your personal agenda.

Syllabus

For each course, a detailed syllabus exists with all details concerning that specific course. This is your guideline for the class and a MUST read. You'll find everything in here concerning the grading of the course, the agenda, the planned topics and much more…
The main materials used in this course are Bibliography and the Slides.

The Slides

The slides presented and discussed in class are available in a digital format. You can download the slides to each class. The slides do not completely cover the entire Syllabus; therefore, it is necessary to participate in the class. All slides will be distributed after each module. All our slides follow our detailed standardised slide format. All presentations in the classroom also have to follow this format.

All course slide and recordings of the lectures will be given on a dedicated Team on MS Teams communicated to all students.

4. Reading

Bibliography

Basic bibliography:

- "Mastering Ethereum" by Antonopoulos A.M., Wood G. (O'Reilly Media)
- "Mastering Bitcoin" by Antonopoulos A.M. (O'Reilly Media)

Recommended readings:

- "Blockchain By Example" by Bellaj Badr, Richard Horrocks, Xun Wu (Packt Publishing)

Useful links

- *"Ethereum book" https://github.com/ethereumbook/ethereumbook*
- *"Solidity documentation" https://solidity.readthedocs.io/*
- *"Solidity by example" https://solidity-by-example.org/*

- *"Bitcoin whitepaper" https://bitcoin.org/en/bitcoin-paper*
- *"Ethereum whitepaper" https://ethereum.org/en/whitepaper/*
- *"Polkadot whitepaper" https://polkadot.network/PolkaDotPaper.pdf*
- *"Cardano whitepaper" https://whitepaper.io/document/581/cardano-whitepaper*
- *"Tezos whitepaper" https://tezos.com/whitepaper.pdf*

5. Application Procedure

Please enrol to the course using the usual UZH planning tools. In case of doubts, contact the instructor of the booking service of the Faculty

E-Mail: modulbuchung@oec.uzh.ch

6. Evaluation

There is no final written exam on the subjects taught during the course. However there is an oral exam as well as written project report through which students will demonstrate first-hand knowledge of the course topic.

6.1 Oral exam

Oral exam will be performed at the end of the semester and it will mainly involve the topic of the student's chosen project. Oral exam will carry 40% of the grade.

6.2 Final project

Students will form groups and select a topic of their interest. Then they will develop a project in the area of the course. Written report is expected as an output of the project and will carry 60% of the grade.

7. Academic Fraud

The Code of Honour of the University of Zurich applies to all work in this course and will be strictly enforced. The intent of the Honour Code in this course is to ensure that each student claims and receives credits for his/her own efforts. Violations to this are considered academic fraud.

Definition

Academic fraud is an act by a student, which may result in a false academic evaluation of that student or of another student. Plagiarism is understood as the use or imitation of another people's work, either wholly or partially, without acknowledging the source and the author. In principle, plagiarism is an infringement of copyright law. Short passages from another author may be quoted.

All documents you will hand-in are going to be checked by software and manually for plagiarism. Documents with a score above 10% are going to be intensively validated and in suspicious cases we hand-out penalties for fraud behaviour.

8. Administrative Comments

8.1 Course format

Lectures. All lectures will be live on Zoom (link made available to the students before the course begins). Attendance is non mandatory but highly recommended. All lectures will be recorded for future consultation by the students. Lectures are - in general - one hour long. We would be grateful if you can keep your cameras on, as visual feedback with you is of help to us when lecturing.

Q&A Sessions. On a weekly basis, Q&A sessions will take place on MS Teams on a Meeting in the General Channel. These are non-mandatory (you only need to join the meeting). *They will not be recorded.*

8.2 Getting in contact with us

- The first option for you is to contact us on the General Channel on MS Teams (and eventually other channels when appropriate). This channel is there for you to post questions, and we will strive to have a rapid answering time
- We will strive to provide you with speedy answers to the questions posted on MS Teams.
- You can reach us either bilaterally (if it is a matter that concerns only you), or through the appropriate, common channels (in case your question may be of help to others).
- *We do not guarantee answering e-mail communication*

8.3 Students with disabilities

Any student with a documented disability needing academic adjustment or accommodation is requested to speak with the instructors during the first two days of class. All discussion will remain confidential. Students with disabilities will need to also contact the directors of the Faculty.

8.4 Laptops

Laptops or equivalent computing devices are needed in for the sole purpose of supporting the individual learning process.