Solidity and Smart Contract Development

—

Overview & Syllabus

Syllabus

Lecture 1 - Blockchain Basics and Open Source Principles
Lecture 2 - Solidity Fundamentals
Lecture 3 - Contracts and Complex Data Structures
Lecture 4 - ERC20 Tokens and Tokenomics
Lecture 5 - Intro to DeFi
Lecture 6 - Further DeFi Applications
Lecture 7 - NFTs
Lecture 8 - Use Case: Blockchain in Space
Lecture 9 - DAOs and Governance
Lecture 10 - Contract vulnerabilities and testing
Lecture 11 - Assembly and Gas Optimization
Lecture 12 - ZK and Rollups

Grading

- **Homework - 45%**
  - Weekly homework. Released on Sunday for the week. Submission deadline is next Sunday
  - Submission on Github account
- **Final oral exam - 30%**
  - Final project (70%)
  - Oral exam on concepts covered in class (30%)
- **In class presentation - 20 %**
  - Weekly on Monday
  - Graded by professor (70%) and a class DAO (30%)
- **Participation - 5%**
  - Github comments
  - In class participation, punctuality
  - Discord Activity

This class is heavily use-case based! Homework takes priority.

Presentation Topics

- 27 January : Open Source Community Management : Linux vs OnlyDust
  - Research the success metrics and management ideologies of Linux Foundation vs OnlyDust.
  - How is Web3 OS different from Web2? Effectiveness?
  - No code.
- 3 February: Advanced Ethereum data structure: Tries
  - Introduction to tries and types of Ethereum Tries - State, Transaction, Receipts.
  - Walkthrough existing code snippet
- 10 February: Stability mechanisms of stablecoins
  - Collateral, Seigniorage, etc., and the pros and cons of each.
  - No code. Finance focused literature review.
- 17 February: Decentralized NFT storage: IPFS
  - Introduction to IPFS and different commercial NFT storage offerings
  - Focus on data and security challenges, and current innovations
- 5 March: Smart Contract security
  - Present a case of Smart Contract attack and the aftermath / remediation steps of the affected.
  - Code demonstration required.

In Class Presentations

- 15 min presentation + 3 min questions
- Every team member must speak during presentation
- These are not topics covered in class. They are an extension to the previous week's discussion.
- Grading
  - 70% graded by professor
    - Check grading rubric on github
  - 30% voted on by your fellow classmates through a class DAO
    - It is your responsibility to make sure the vote is setup and there are votes. No votes means a zero for this part.
    - To avoid problems of collusion and manipulation encountered by small DAOs, professor reserves the right to veto the class vote

Presentation Groups

Group 1		Open Source Communities
Group 2		Ethereum Tries
Group 3		Stability Mechanisms
Group 4		NFT Storage
Group 5		Smart Contract Attacks

Final Exam - Project + Technical knowledge

- Choose a Topic from next slide and begin working on it as soon as possible.
- Deliverables - due date TBD
  - Oral Presentation - 70% - 30min
  - Technical Concepts - 30% - 20min

Oral Presentation (20 - 25min + 5min questions)	Technical Concepts
❖ 5min startup pitch style ➢ What is the value / problem addressed by your project? ❖ 10min project walkthrough ❖ 10min Solidity code considerations ➢ How did you structure your project and why? ➢ What considerations did you make while coding (eg. gas optimization)	❖ Questions from any class material in the slides or demos done in class. ❖ Answer individually or as a team.

Final Project - Topic List

All projects must be deployed to testnet !!

1. Marketplace - what good or service to trade?
2. Web3 game
3. IPFS storage dApp
4. New voting mechanic dApp
5. Crypto payments through QR codes
6. Time-Lock Wallet
7. Real Estate fractional NFTs
8. Propose your own - but must be sufficiently complex

Final Project - Groups

Group 1	Group 2	Group 3
Arina Brian Josephine Joakim Duy Tung	Jinane Cesar Kathleen Sami	Jean-Baptiste Grace Anmool Jahad Xuanzheng

Final remarks - web3 is about networking!

As a young industry, it's all about who you know and your reputation.

Some opportunities during our course:

1. NFT Paris Conference: 13 - 14 February (extra credit)
2. Hackathons or CTF opportunities
3. Feel free to ask me for internship recommendations

Have a great semester and enjoy!