Considered the next big thing after the Internet, Blockchain enables a digital decentralized society where people can contribute, collaborate, and transact without having to second-guess trust and transparency. Consequently, Blockchain will revolutionize the way applications are built to serve people. It is the technology behind the success of Bitcoin, Ethereum, and many exciting applications and platforms that emerge everyday, with impact in many sectors, including finance, education, health care, environment, transportation, technology, to name a few. Put it simply, if you have a startup idea doing something, think about blockchain FIRST! This course covers a basic set of essential concepts, algorithms, and tools suitable for aspiring students who want to be technologically ready for a blockchain venture. Topics touch various issues in decentralized computing and networking. Students will learn Solidity and Javascript sufficiently for developing a blockchain project from scratch.

Prerequisites

- CS310 or PERMISSION of the instructor

Textbook

- Slides from Prof. Tran and other sources.

Topics and Schedule

Technical and algorithmic aspects of blockchain and Ethereum-based project building:

- Week 1:
  - Intro to Blockchain: data structure, network architecture, characteristics, consensus, taxonomy
- Week 2:
  - Intro to Bitcoin: cryptocurrency, protocol, consensus, optimization
- Week 3:
  - Intro to Ethereum: smart contracts, protocol, consensus, standards
- Week 4:
  - Blockchain Applications: Use Cases
  - Group assignments for project, idea brainstorming for project
- Week 5, 6, 7
  - Hands-on programming with Ethereum (Solidity, Javascript, Web3)
- Week 8:
  - P2P Networking (Distributed Hash Tables)
- Week 9:
Consensus algorithms: Byzantine, Proof of Work, Proof of Stake, Delegated Proof of Stake, etc.

- Week 10
  - Internet Planetary File System (IPFS): Understanding and working with a P2P storage network

- Week 11:
  - New blockchain network architectures
  - Game Theory and Network Attacks

- Week 12
  - Challenges, recent advances, and future directions in blockchain development

- Week 13, 14
  - Presentation of projects

- Week 15
  - Class review for final exam
  - Brainstorming on continuation of projects and future ventures

Grading

- **Homework** (20%): Individual, about programming and use cases of Blockchain.
- **Attendance** (20%): We will take attendance at the beginning of every class. An absence must be justified with supporting documents.
- **Project** (40%): Students will be divided into teams, each developing a blockchain project from scratch, based on the idea brainstormed by the team. Expected output includes: (1) 20%: final software product, including a front-end application for end-users, and (2) 20%: a white paper summarizing the project.
- **Final Exam** (20%): This is a writing exam testing your comprehensive knowledge of blockchain technologies.

Late Submission and Makeup Policy

Submission deadline can extend for 24 hours, holiday included; 10% grade penalty.

Accommodations

Section 504 of the Rehabilitation Act of 1973 offers guidelines for curriculum modifications and adaptations for students with documented disabilities. If you have a disability and feel you will need accommodations in order to complete course requirements, please contact the Ross Center for Disability Services (Campus Center, Upper Level, Room 211) at 617.287.7430. Each eligible student must present and discuss these recommendations with each professor within the first two weeks of class, preferably by the end of the Drop/Add period. If you need special accommodations, please let the professor know your situation within the first two weeks of class.

Code of Conduct and Academic Integrity

The University presupposes that any submission of work for academic credit indicates that the work is the student’s own and is in compliance with University policies, including its policies on appropriate citation and plagiarism. These policies are spelled out in the Code of Student Conduct. Students are required to adhere to the Code of Student Conduct, including requirements for academic honesty, as delineated in UMass Boston Graduate Studies Catalogue and relevant program student handbook(s).