Week #1

Syllabus

Welcome to CMSC398F!

Syllabus

- Syllabus is available on the ELMS page
- Lecture slides will be available on the github after every lecture: https://ter.ps/cmsc398F
- TA office hours for every week will be announced on piazza
- No textbooks from the syllabus are required
- Feedback form released every two weeks
- Piazza coming soon

Syllabus

Quick Rundown of topics:

- Introduction to Cryptocurrency
- Hash functions and attacks
- History of Bitcoin
- Blockchain Structure
- Proof-of-Work
- Mining, Faucets
- Wallets & Anonymity
- Crypto Markets, Market Caps, Investors
- Bitcoin as a Platform
- Introduction to Smart Contracts
- DAOs and ICOs
- Smart contract development
- Miscellaneous

Syllabus (Class Structure)

- Quizzes (30%)
  10 multiple choice questions based on the lecture
- Projects (30%)
  Simplified implementations of blockchain technology
- Midterm (20%)
  Concept-based exam. Consists of multiple choice and short answer questions
- Final (20%)
  Implementation of a smart contract
  More details later in the semester

Contact Us

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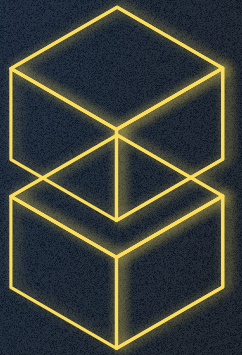
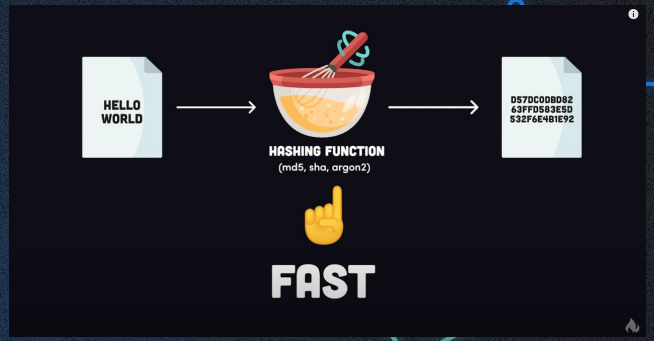
Cryptography and hash functions

- Cryptography is the study and practice of sending secure, encrypted messages or data between two or more parties.
- Cryptography allows transactions to be “trustless” – and makes secure transactions between strangers possible without a “trusted intermediary” like a bank or Venmo in the middle.
- Hash functions are mathematical functions that transform or "map" a given set of data into a bit string of fixed size, also known as the "hash value."
- Hash Function

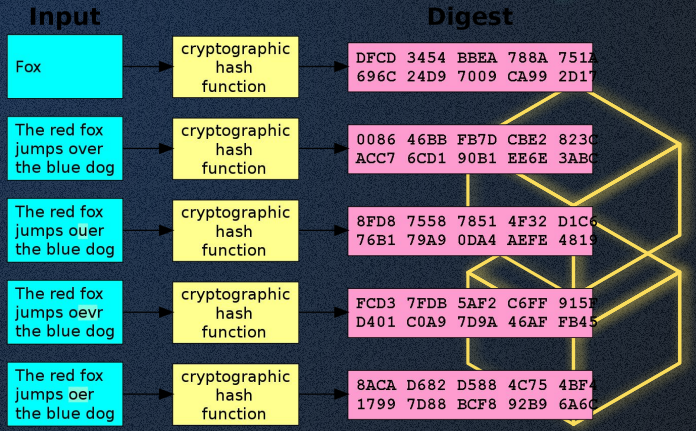


Hash Functions



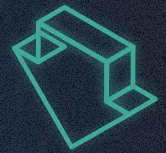
3 Properties of Hash Functions:

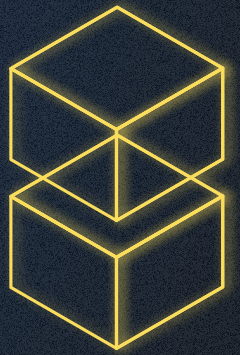
- **Collision-free**: no two inputs should map to the same output hash.
- **Irreversible:** You should not be able to guess the input value based on the output value.
- **Puzzle-friendly**: Should be difficult to select an input that provides a predefined output. Thus, the input should be selected from a distribution that's as wide as possible.



Encryption vs. Hashing

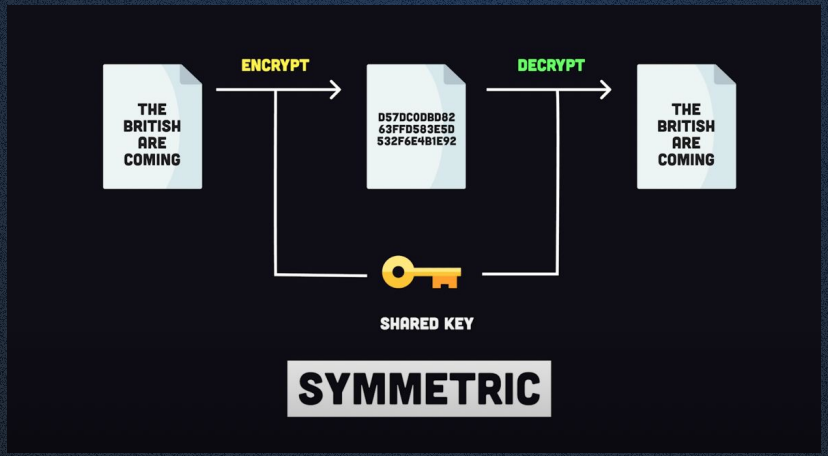
- **Encryption** is a two way function that includes encryption and decryption, and is used to send data securely.
  - It is the process of converting plaintext to cipher-text, which can be converted back to plain text.
- Hashing and encryption are **NOT** the same
- Hashing is a one way function that turns plain text into a unique digest that is irreversible. It is used to validate the integrity of messages, compare large data, and in hash tables





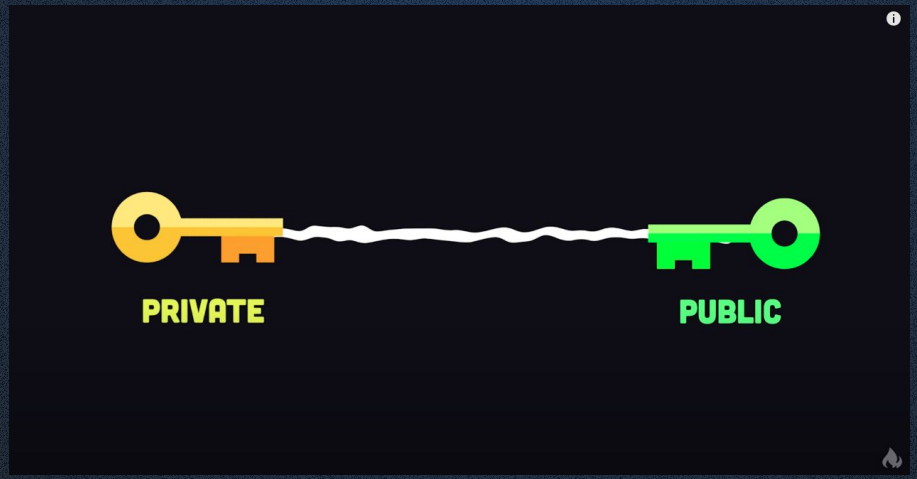
Symmetric Encryption

- What if we want to send a message to someone securely, and we want them to be able to read the message?
- In symmetric encryption, we use a hash function to scramble up a message (into cipher-text), but also provide a ‘secret key’ to decrypt the message
- The secret key must be shared between the sender and receiver to decrypt the message
- Key size is small, which means less storage space and faster transmission, so it is good for bulk encryption.



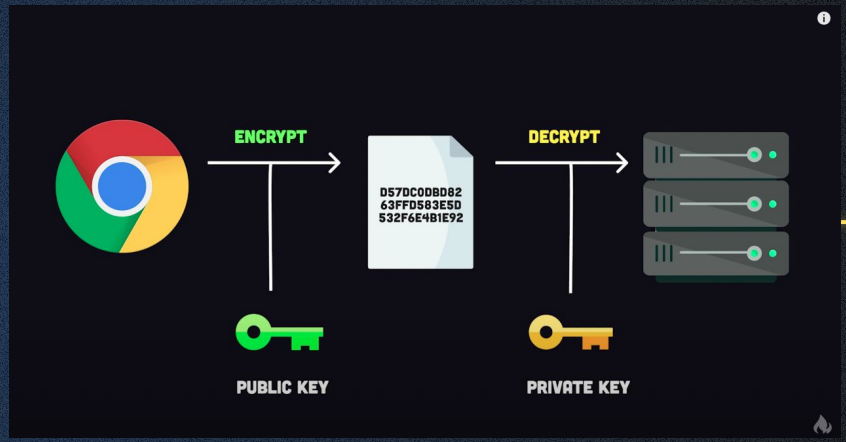
Key-pairs

- There is a limitation when it comes to symmetric encryption: both parties must share a private key.
- Instead, we can use two keys: a public key and private key, which are mathematically linked.



Asymmetric Encryption

- Asymmetric encryption uses public and private keys to share information.
- We use this all the time when we visit websites with https.
- Asymmetric and symmetric encryption are often used together
- Public-private key encryption consists of mathematically complex hash functions
  - SHA-256
  - SCRYPT
  - RSA



Summary

- Hash functions and introduction to encryption functions
- First Quiz posted!