Lecture 2: Simple Applications

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Outline

Overview and details

NFTs

Voting

Outline

Recap

- We covered a simple model of a blockchain
- An interface for the blockchain
- The simplest possible (useful) application

This lecture

- More ‘interesting’ applications: (soulbound?) NFTs, voting
- Some real-world phenomena
- An on-chain voting game

Survey responses

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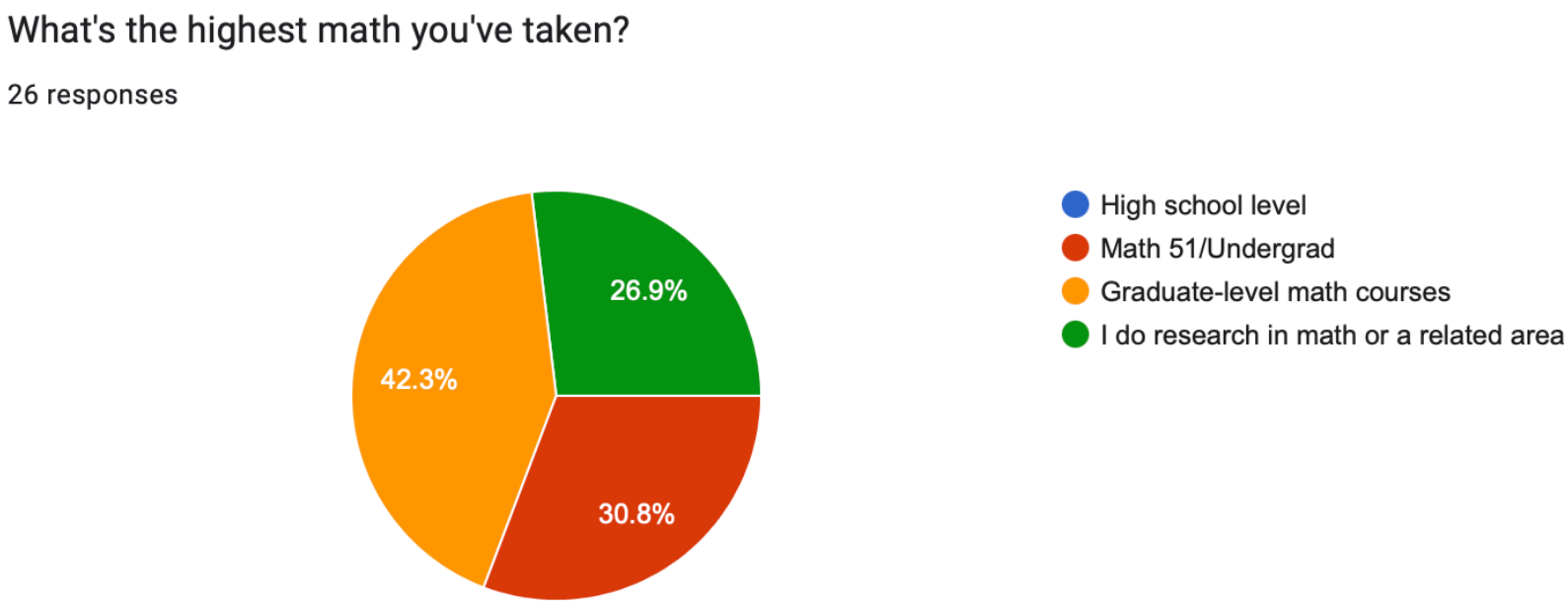
Wide range of backgrounds (as expected):

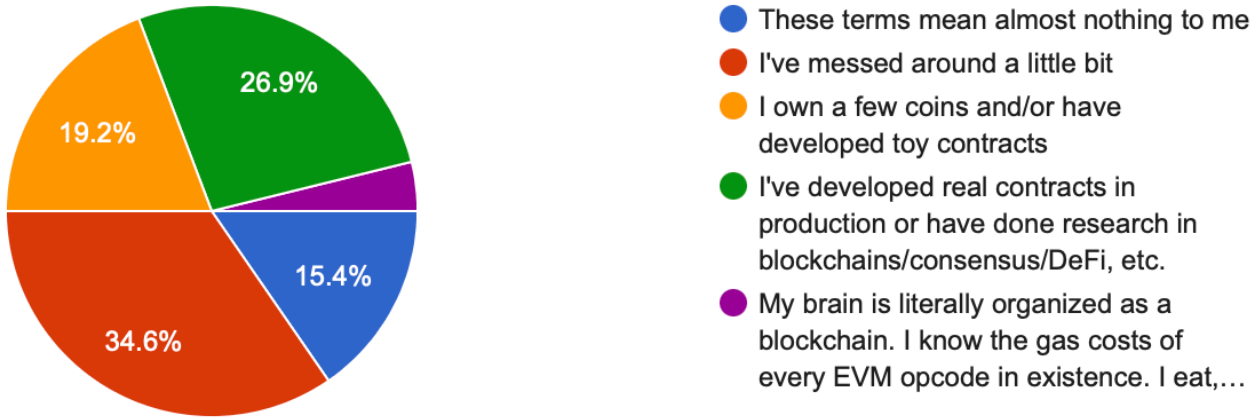


Survey responses (cont.)

Hmm...

How much experience do you have with crypto/blockchain/etc

26 responses



Survey responses (cont.)

- Many responses for the final lecture
  - Optimization and blockchains
  - Zero-knowledge, homomorphic encrypion, privacy
  - Attacks and failures of protocols
  - *etc.*
- Mostly to gauge interest...
- I will send out a later form closer to then

Outline

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- JPEGs? Weird random collections?
- Stands for *Non-Fungible Token*
- On-chain existence means it's possible to verify ownership

Interface

Interface

- An NFT is usually specified by an easily-computable unique identifier
- (Hash, unique combination of properties, *etc.*)
- The easier it is to verify, the better

Interface (cont.)

- Implements:

```
mint(id, acc)

ownerOf(id)
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  - `mint(id, acc)`: mint NFT `id` with `acc` as owner
  - `ownerOf(id)`: returns the account owning `id`

Interface (cont.)

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- Here, we have:
  - `mint(id, acc)`: mint NFT `id` with `acc` as owner
  - `ownerOf(id)`: returns the account owning `id`
- Usually `mint` is permissioned!

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- Including no way to transfer the NFT?

Non-transferrable NFTs

- Very bare bones...
- Including no way to transfer the NFT?
- These are (sometimes) called *soul-bound tokens*
- (After the World of Warcraft property)

Non-transferrable NFTs (cont.)

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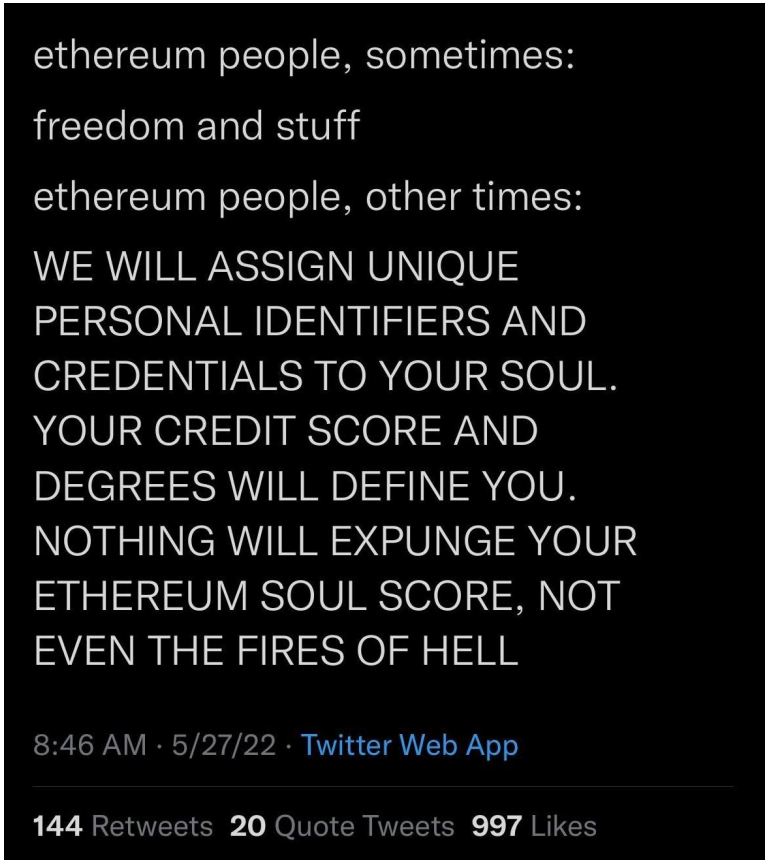

‘Normal’ NFTs

- ‘Normal’ NFTs have the additional ability to transfer NFTs

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transfer(id, acc)
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- In this case we recover the ‘usual’ NFTs

NFTs continued

- In many ways, NFTs act as cryptographically-verifiable collectibles
- There are a number of obvious uses (art)
- A number of less-obvious uses, too: awards, tickets, *etc.*

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- In many ways, NFTs act as cryptographically-verifiable collectibles
- There are a number of obvious uses (art)
- A number of less-obvious uses, too: awards, tickets, *etc.*
- Simple to implement, difficult to reason about!

Outline

On-chain voting

- Another simple on-chain application is *voting*
- Useful in many contexts:
  - Decentralized automous organizations (DAOs)
  - Voting for protocol specification
  - Among many others...

Interface

- The interface is

```
vote(option, voteShare)

delegate(acc, voteShare)

totalVotes(option)
```

Some notes

- `vote` should fail after a certain time (*block height*)
- Note that any votes and delegations are public at voting time
- From transaction history, we can view who voted for what

Some “interesting” votes

- Context: Juno is a chain
- ‘Airdropped’ a number of tokens to holders
- A user (‘whale’) gamed the airdrop, controlled a huge stake
- On chain vote proposed to remove whale’s tokens

Some “interesting” votes

- Context: Juno is a chain
- ‘Airdropped’ a number of tokens to holders
- A user (‘whale’) gamed the airdrop, controlled a huge stake
- On chain vote proposed to remove whale’s tokens
- Hilarity ensues

Initial account

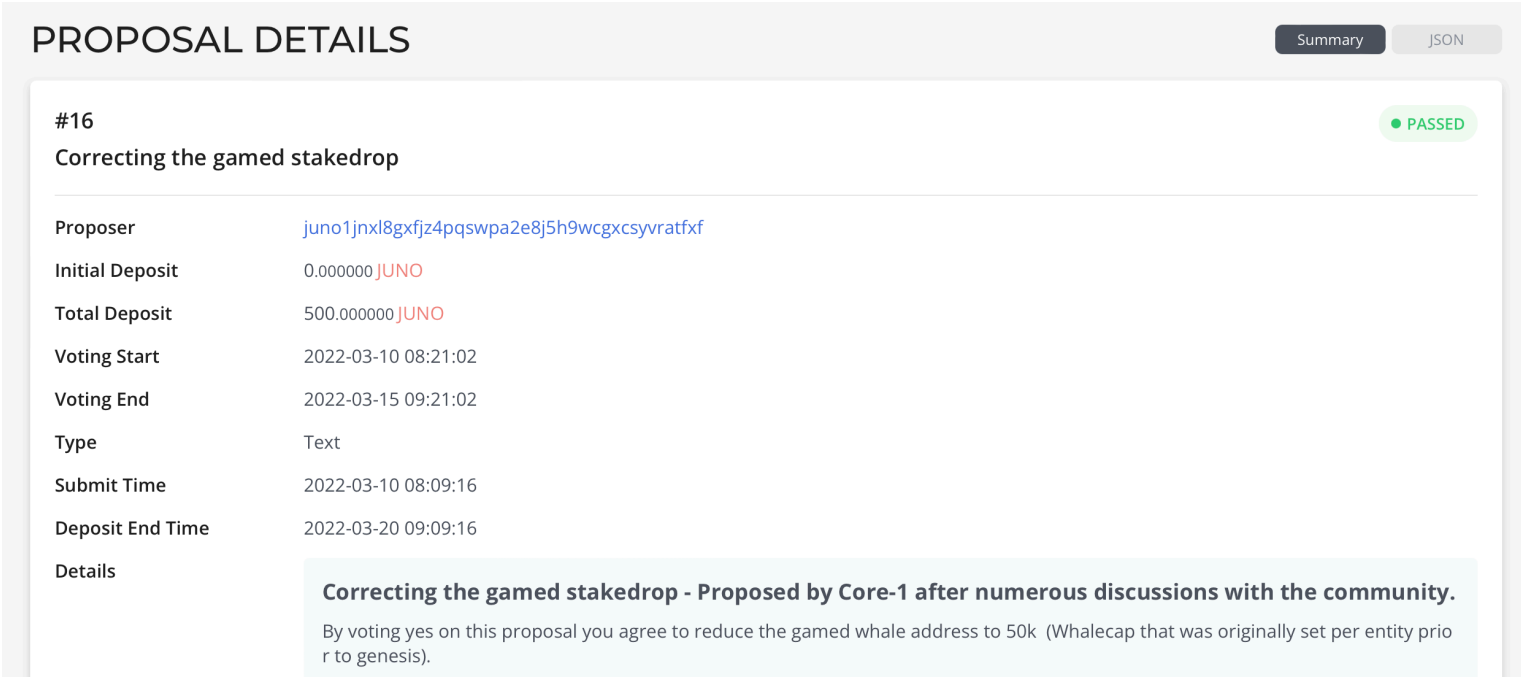
- Whale account transfers very large amount of JUNO tokens to one account
- Address:

  `juno1aeh8gqu9wr4u8ev6edlgfq03rcy6v5twfn0ja8`

  for future reference

Holders notice

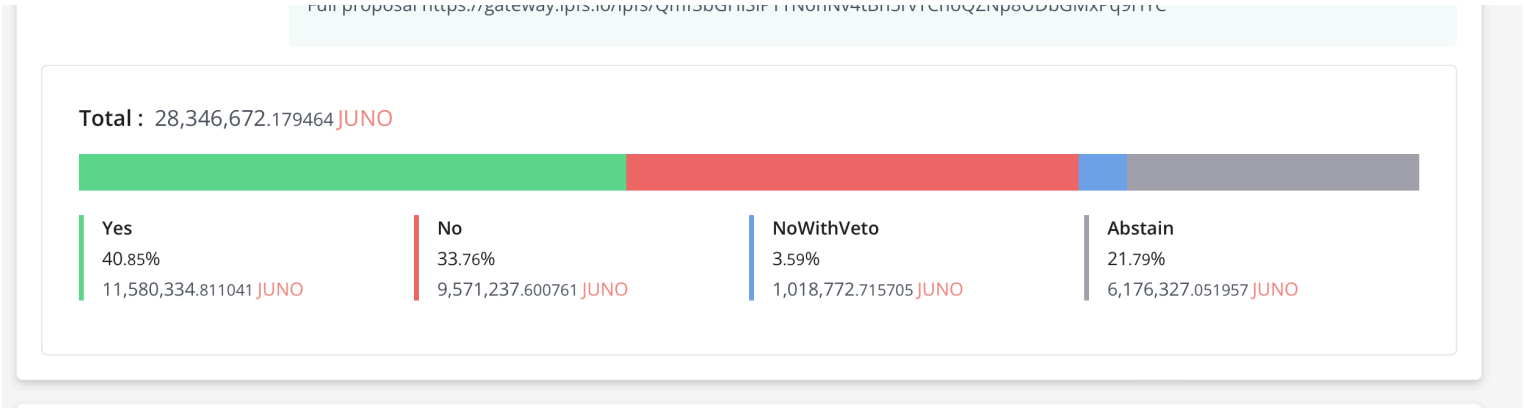
- JUNO holders notice and create a vote(!)



- The vote, if passed, removes all but 50k JUNO ($\sim 125,000$ USD, right now)

Holders vote

- The vote passes (!!)



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News Analysis

Typo Moves $36M in Seized JUNO Tokens to Wrong Wallet

Validators, developers and token holders grapple with who is to blame for the copy-paste error that moved the tokens to an address no one can access.

Sam Kessler

May 5, 2022 at 11:57 a.m. PDT Updated May 6, 2022 at 5:10 a.m. PDT

- Wait *what*???

The end

- If there's a lesson here, it is, perhaps:
- Voting is not always a good replacement for good mechanisms
- But it can be very useful

Implementing voting mechanisms

- In some cases even the voting *mechanism* can be dangerous

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Beanstalk DeFi project robbed of $182 million in flash loan attack

Reserves were drained after the attacker awarded themselves voting rights.

Written by **Charlie Osborne, Contributor** on **April 21, 2022**

Decentralized finance (DeFi) project Beanstalk has lost $182 million in a flash loan attack.

Non-public voting

- In some cases, we might not want votes to be public until after vote has ended

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- Achieve this via *commit-reveal schemes*

Commit-reveal schemes

- A commitment of m is a value s and function f such that
  a. $f(m, s) = \texttt{true}$
  b. Given only s it is 'hard' to compute m' such that $f(m', s) = \texttt{true}$

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- After voting period ends, reveal m
- (Why does this work?)

A game

- Called ‘A vs. B’
- Run on chain, contract address:

  `0xa51594Ba644ef4Da9830F62EB9dC505EB4fC0394`
- Rules
  - Two options, A and B
  - Non-publicly vote for one, in ETH
  - After voting period ends, votes are revealed
  - Option with least votes takes complete pool

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- Proof? See homework! (To be posted soon...)

Next lecture(s)

- We will start talking about AMMs/CFMMs
- Get to quantitative results!
- Building blocks to "real" DeFi
- Such as trading, oracles, stablecoins, *etc.*