Token Engineering Academy

Reputation-based Weighted Voting: A New Primitive for DAO Governance

With

Octopus / Angela Kreitenweis
Eight Arms Nine Brains / TE Academy

Today

We are recording & streaming!!

1. Introduction & Course Structure
2. Voting Mechanisms & Challenges
3. Requirements & Timelines for RWV
4. Coding Standards

Prior Readings

Prepare yourself

Before We Start on May 1st: Learning List on Voting and Social Choice

Videos

General Voting Theory

Which Voting System Is The Best?

The Mathematical Danger of Democratic Voting

Arrow's Impossibility Theorem

The Flaw in Every Voting System

Readings

Nice Introductory Overview of Voting System Challenges

Mathematical Overview of Social Choice

Try These Things On Your Computer

Install an IDE. VSCode is a good choice, especially for beginners. Here is a walkthrough on how to get it set up. If you already have an opinion on vim/emacs war, you're well ahead of what we will be discussing.

Introduction

General Introduction

In this session we will introduce

1. Ourselves
2. Course structure
3. Course topics

Instructor Introduction

Octopus (or andrew octopus)

- Cyberspace, 1992
- Crypto-anarchism, alternative currencies, and DAOs: 2004
- First introduced to cryptocurrencies.
  - Theory: 2007
  - Practice: 2014.
- Token Engineering: January 2021.

Instructor Introduction

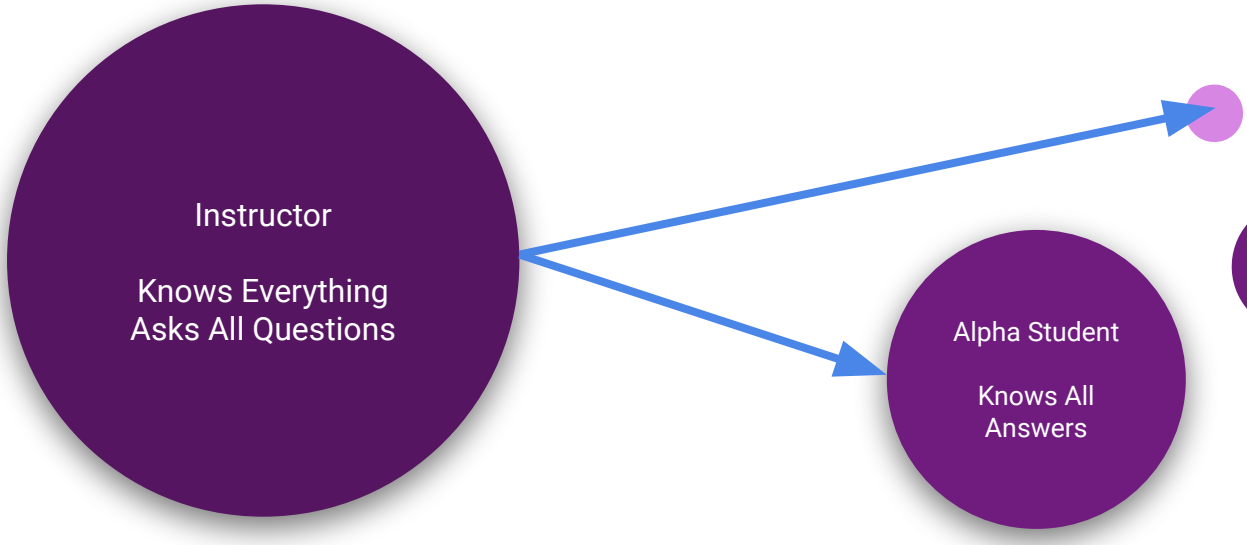
Octopus

Government name: Andrew Penland

Math Professor, 2015 - 2022

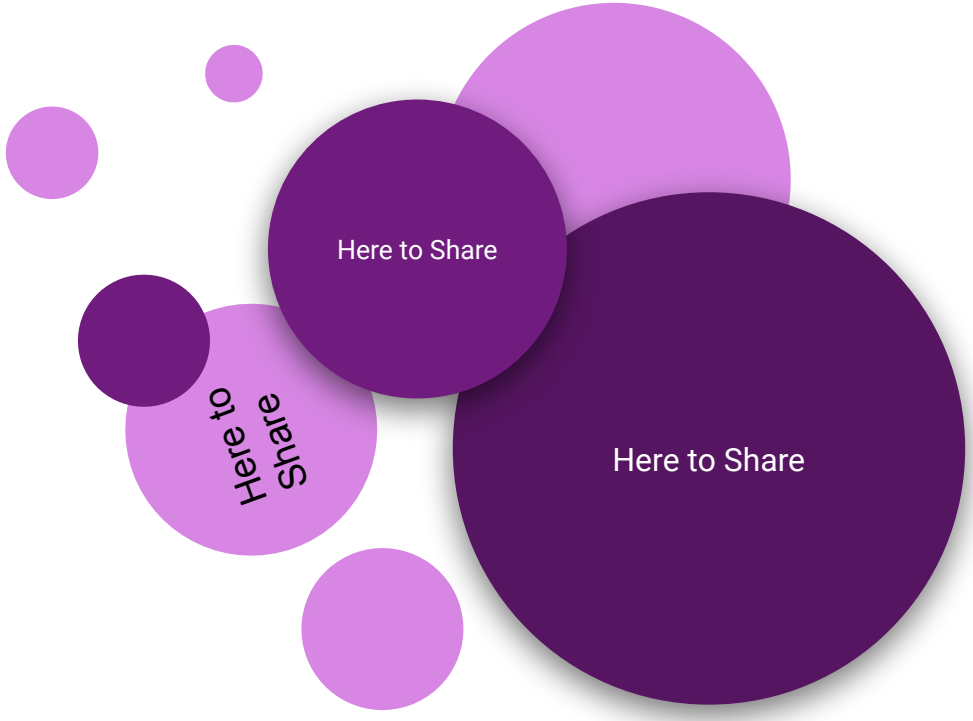
- Published peer-reviewed research articles in group theory, theoretical computer science, dynamical systems, graph theory, hypergraph theory, and probability.
- Awarded national-level teaching award from Mathematical Association of America
- Developed undergraduate research focus.

Different Teaching Models



Centralized knowledge networks have the same risks as centralized networks in general.

Different Teaching Models



In my experience, this learning process works best if we are all here to share our knowledge.
Note: “Knowledge” here can include questions, memes, perspectives, etc.!

Instructor Introduction

Angela

- Founded TE Academy in 2020
- Launched the first bachelor-level program TE Fundamentals in 2022, since then 4000+ students enrolled
- Established TE community, 5K+ newsletter, token engineering @EthCC
- Background in Web2 early stage startups and seed investments, both on the investors' and startups' side
- Active in Web3 since 2016

Your Turn!

Your Turn!

Introduce yourself

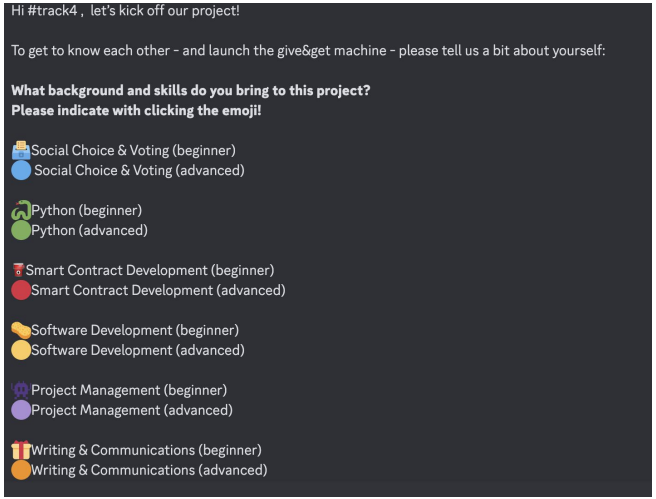
What time is it?

What's the weather like at your place?

Your Turn!

We'll need a number of different skills in this project!

1. Python
2. Social Choice & Voting
3. Project Management
4. Writing
5. …



Go to Discord and indicate your skills!

We are recording & streaming!!

Structure

Structure of Course

Sync Meetings
Zoom

Wednesdays,
May 5 - June 1
1230 - 2 PM UTC

Async Discussion
Discord

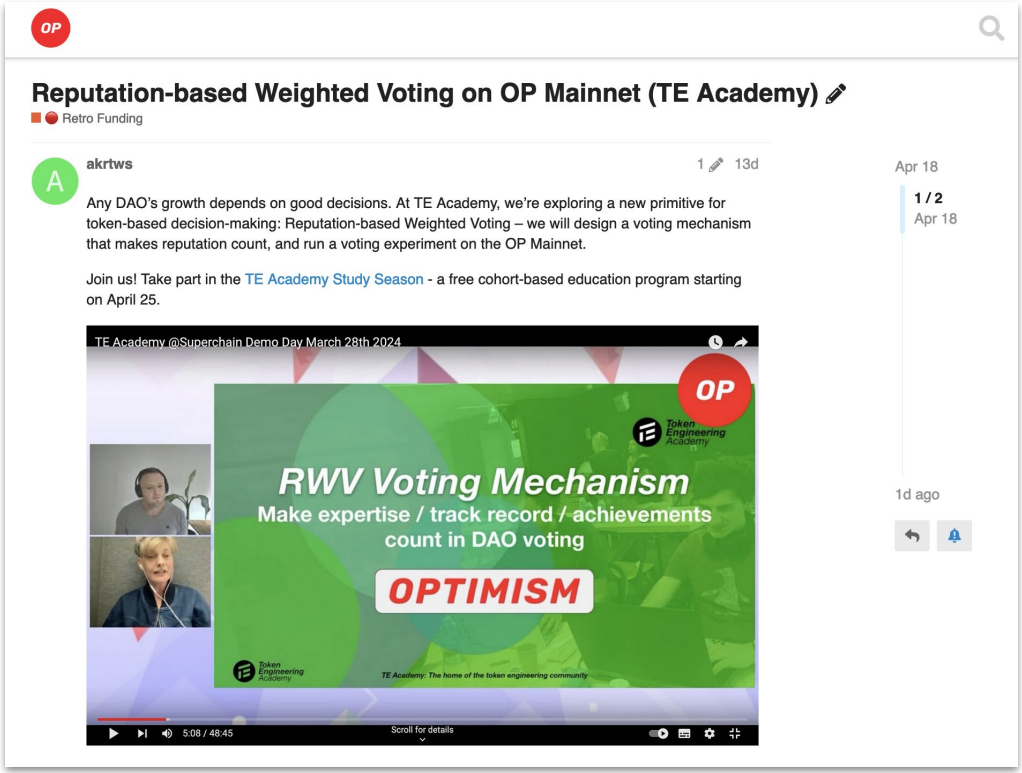
Open schedule,
work in teams,

organize yourself,
be reasonable.

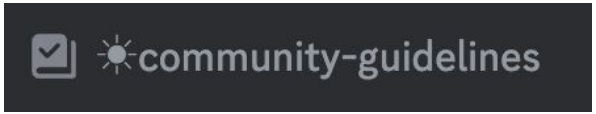
Assignments + Challenges
GitHub

Hands-on practice and evidence of mastery.

Structure of Course



Our Culture & Values

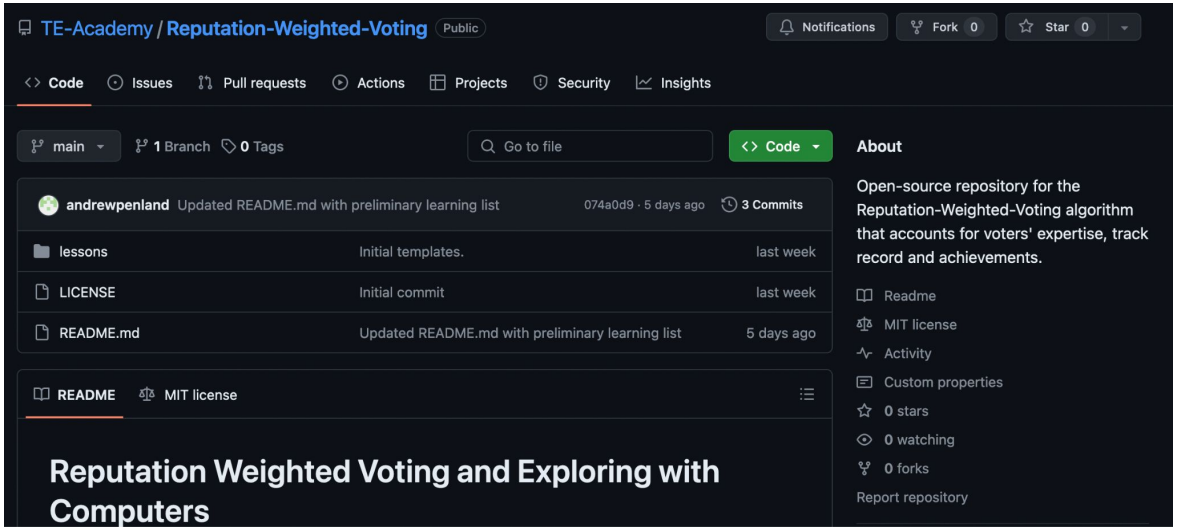


Be pro-active!
To solve issues, reach out to fellow students #give&get

Feel free to schedule additional learning sessions in your time zone with fellow students

There are no stupid questions!
Be mindful when asking for support, praise those who supported you and give back!

Where we collaborate



https://github.com/TE-Academy/Reputation-Weighted-Voting

Earning NFTs

TE Academy Study Season 2024

Token Engineering Academy

Earning NFT

Share Knowledge and Skills

Demonstrate Overall Proficiency

Final NFT for Course Completion / Proof-of-Knowledge!

Earning NFT

Share Knowledge and Skills

Each week, there will be opportunities to earn **points** by completing specific tasks related to the course.

Keep track of your own records and points, using template.

At end of course, 30 points are needed to be eligible for NFT.

Earning NFT

Share Knowledge and Skills

Each week, there will be opportunities to earn **points** by completing specific tasks related to the course.

Keep track of your own records and points, using a provided template.

At end of course, 30 points are needed to qualify for NFT. (Far more than 30 points will be possible - this allows you to choose tasks that suit you.)

Earning NFT

Demonstrate Overall Proficiency

At the end of the course, students can complete a structured final project that demonstrates achievement of the learning objectives.

The project can be completed in teams of max 2, and will combine coding and analysis.

Details coming next week.

Voting Mechanisms

Background on Voting Mechanisms

Discussion: What were your main learnings from the videos and readings?

What do you already know, or want to know, about voting?

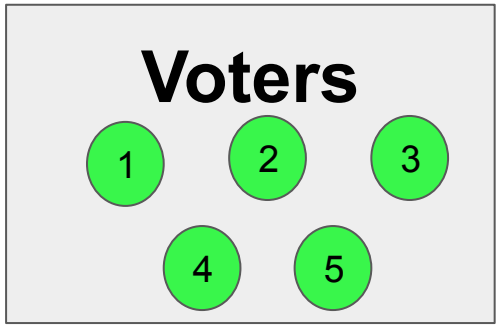
Source: https://plato.stanford.edu/archivES/FALL2017/entries/arrows-theorem/#ArrFra

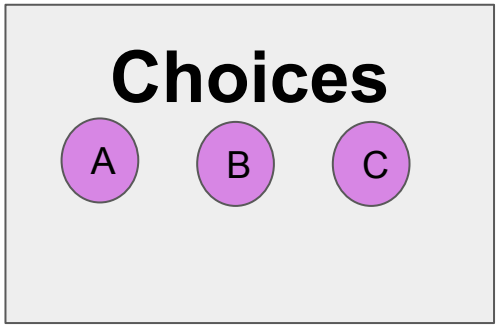
Voting Mechanism

Voters have ***identity information*** and ***preference information.***

The ***voting mechanism*** combines this information and produces a ***final decision.***

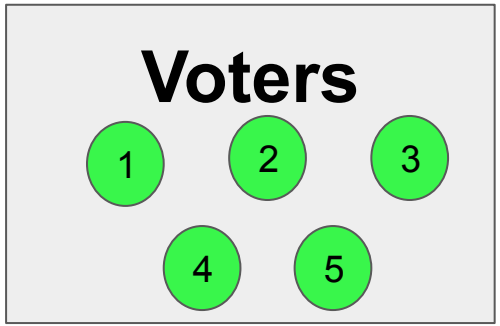
Example: Simple Plurality (1)

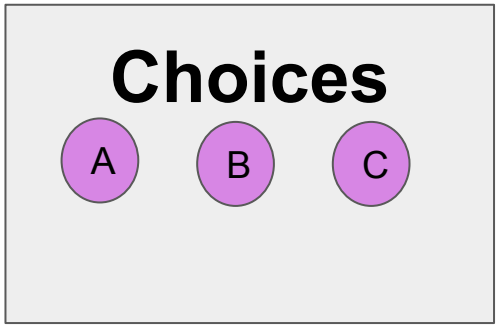




- Each voter has one vote.
- The vote must be allocated to at most one choice.
- One choice is selected as the winner.
- The choice with the most votes wins.

Example: Simple Plurality (2)

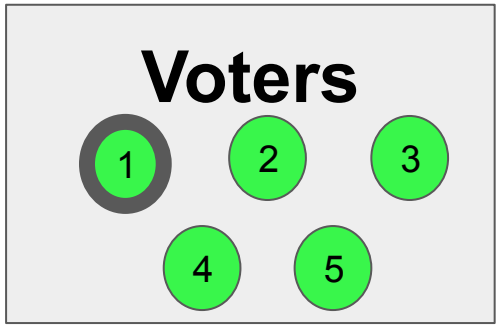


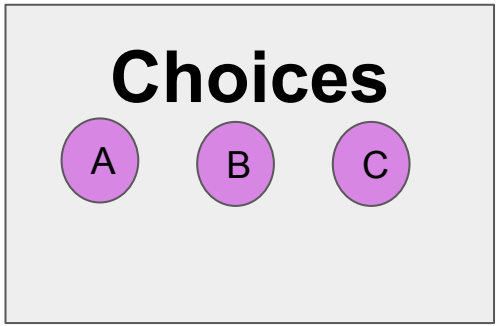


- Each voter has one vote.
- The vote must be allocated to at most one choice.
- One choice is selected as the winner.
- The choice with the most votes wins.

What could go wrong here?

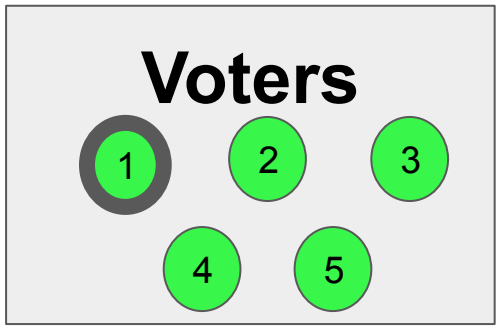
Example: Dictatorship

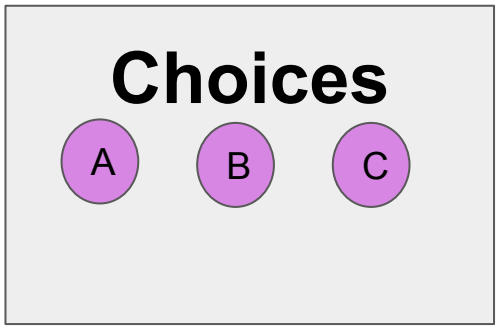




- Only one voter (the dictator) gets to vote.
- The vote must be allocated to at most one choice.
- One choice is selected as the winner.
- The choice with the most votes wins.

Example: Martian Dictatorship





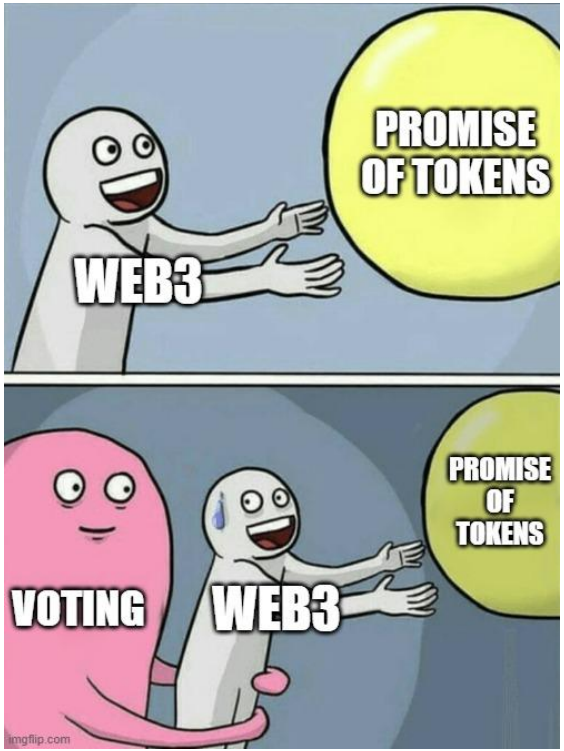
- There are N voters. (N = 5 in image)
- The vote of one special voter (The Martian Dictator), whose vote counts as (N-2) “ordinary” votes.
- All other voters have 1 “ordinary” vote.
- Each vote must be allocated to at most one choice.
- One choice is selected as the winner.
- The choice with the most votes wins.

Voting is a Hard Problem (1)

Arrow's Theorem (paraphrased): As soon as there are at least three voters and at least three choices, any voting mechanism has issues.

(See also No Free Lunch Theorem.)

Voting is a Hard Problem (2)



Introducing tokens and web3 infrastructure to the voting problem introduces even more challenges.

Discussion: web3 Voting Challenges.

What are some challenges with using tokens to vote in web3?

Voting Systems and Parameters

The *parameters* of voting are aspects that can be modified *before* the system's operation, but are typically kept stable during its use.

Examples:

- Vote-counting mechanism
- Vote format (how many choices, ranked ,etc.)
- Decision to start voting window
- How long voting window lasts
- Voter eligibility
- Vote transference
- Vote amount by voter property

1 Token, 1 Vote

- “1 Token, 1 Vote” was used by some early DAOs.
- Centralizes power to largest token holders.

Beanstalk Farms · April 19th, 2022

Beanstalk Governance Exploit

Beanstalk was attacked on April 17, resulting in a theft of ~$77M in non-Beanstalk user assets.

- Technical Breakdown
- Path Forward
- A Farmer's Guide to the Barn Raise
- Anticipated Replant Timeline

Beanstalk, a decentralized credit based stablecoin protocol, was attacked at roughly 12:24pm UTC on April 17, resulting in a theft of ~$77M in non-Beanstalk user assets. The perpetrator used a flash loan to exploit the protocol’s governance mechanism and send the funds to a wallet they controlled. Beanstalk Farms, the decentralized development team working on Beanstalk, is preparing a strategy to safely re-launch a more secure Beanstalk with a path forward.

With flash loans, anyone can be a whale for 15 seconds.

Sybil Attacks (Pseudospoofing)

- “Anti-whale” mechanisms (1 account 1 vote, Quadratic Voting, etc.) face *Sybil Attacks* (use of multiple accounts to manipulate system).

Image of Voltaire, Public Domain

- Even in meatspace, democracy can turn into mob rule.

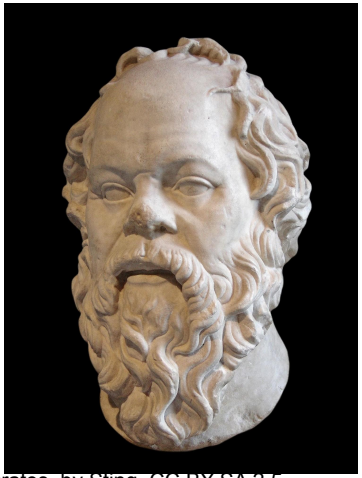


Image of Socrates, by Sting, CC BY-SA 2.5, https://commons.wikimedia.org/w/index.php?curid=96296061

Many Voting Mechanisms!

Discuss in Discord:

Give an example of a voting mechanism that has not yet been listed.
Describe it in detail and/or give understandable references.

- Where is it used?
- What do you like about it?
- What potential weaknesses or challenges do you see?

Example Discussion
https://forum.tecommons.org/t/strengths-and-weaknesses-of-conviction-voting-and-other-mechanisms/1278

Requirements Engineering

Requirements Discussion Activity

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1) **Don’t be afraid to talk/ask questions.**

2) **Cover 360°/100%: collect ALL relevant information for your system design.**

3) **Create a documentation as a reference for the design process. Find proper formats (text, lists, diagrams…)**

Step 1 (30 mins)

Observe & take notes!
+ ask questions!

Octopus

Token Engineer

Angela

Client

Step 2 (until next week)

Step 3 (until next week)

Writing Volunteer

Please write a short summary of what we've discussed in this first session, and collect all ressources/links

Coding Standards

A Challenge Worth Tackling

We have a very ambitious challenge in front of us:

1. **Technical:** Design and *validate* a voting mechanism that will be used in the process of selecting the final TE Fellowship winner.
    a. Needs to meet client's technical and non-technical requirements.
    b. Carefully consider potential risks and limitations.
    c. Be sure we have considered a variety of relevant mechanisms.

2. **Educational:**
    a. Lead a learning community with diverse interests and backgrounds.
    b. Share through meaningful discussion and experiences
    c. Learn about software best practices, and how to teach them effectively.

3. **Personal:**
    a. Have fun
    b. Enjoy life.
    c. Be patient.

Let's Double Down!

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My goal is not just to create and validate specific mechanisms, but also to create a reusable software tool **domain-specific language** for exploring voting mechanisms in general.

A Thought

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“...the best way to learn a subject is by teaching it…an even better way to learn a new subject is by teaching it to a computer.”

- Doron Zeilberger

Interview from MAA Focus, May/June 2007

Writing Code

“Any fool can write code that a computer can understand. Good programmers write code that humans can understand. ”

- Martin Fowler

“Write code so that *someone else* can follow it. That *someone else* could be you in a month.”

- Me (and many others)

Hacking, Coding, and Software Engineering

Hacking - making a system do what you want it to do, often in an extreme manner, i.e. extremely fast.

Coding - writing in a programming language to achieve a specific result

Software Engineering - a professional discipline that uses clear tools and processes in the design, validation, and deployment of software systems.

https://ethics.acm.org/code-of-ethics/software-engineering-code/

Overall Instructional Objectives

Skills Through Experiential Project-Based Learning. By going through the process of building a piece of software, we will be able to learn and practice specific software skills that are used in industry.

Real Knowledge Gained Through Experiment. By carefully following a process, we will be able to compare the drawbacks and advantages of different approaches to software design and development.

Pedagogical Metacognition. (Thinking about thinking how we learn.) We will reflect on how various knowledge acquisition strategies (e.g. Discord chat, AI, etc.) served us in different contexts.

Complete before next Wednesday:

1) **2 Volunteers:**
   A - Set up the requirements list as a Google spreadsheet. Submit a link by tomorrow in the Discord (8 points!)
   B - Write a summary of this session and collect all link to ressources we've discussed. Submit a link (8 points!)
2) **Everyone: Let's create a 100% requirements list together! Submit your requirement to this spreadsheet by next Wednesday (2 points).**

Complete before next Wednesday:

3) **Everyone:**
Complete the Github and editor setup tasks introduced today by next Tuesday, May 7.

Remaining time today - collaborative head start.

End recording/streaming.

Let's get started!

Stop recording & streaming!!

1. **Overview of basic task.**
2. **If you have experience and would be willing to be help others, please raise your hand.**
3. **If you have a specific non-basic task you would like to attempt, please type it in the chat.**

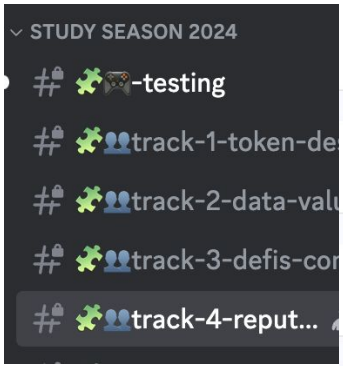
End recording/streaming.

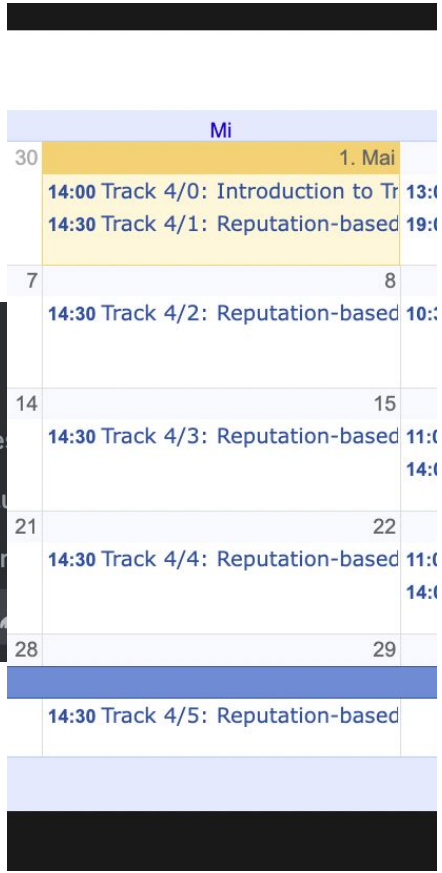
Questions?

See you!

TOMORROW: 11am UTC

Tech requirements session with Vitor/Software Dev TE Academy





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