

Mathematics is indeed discussable



Jephian C.-H. Lin

<https://hackmd.io/@jephianlin/mathematics-is-indeed-discussable>

Mathematics is ~~disgusting~~ discussable!

About me





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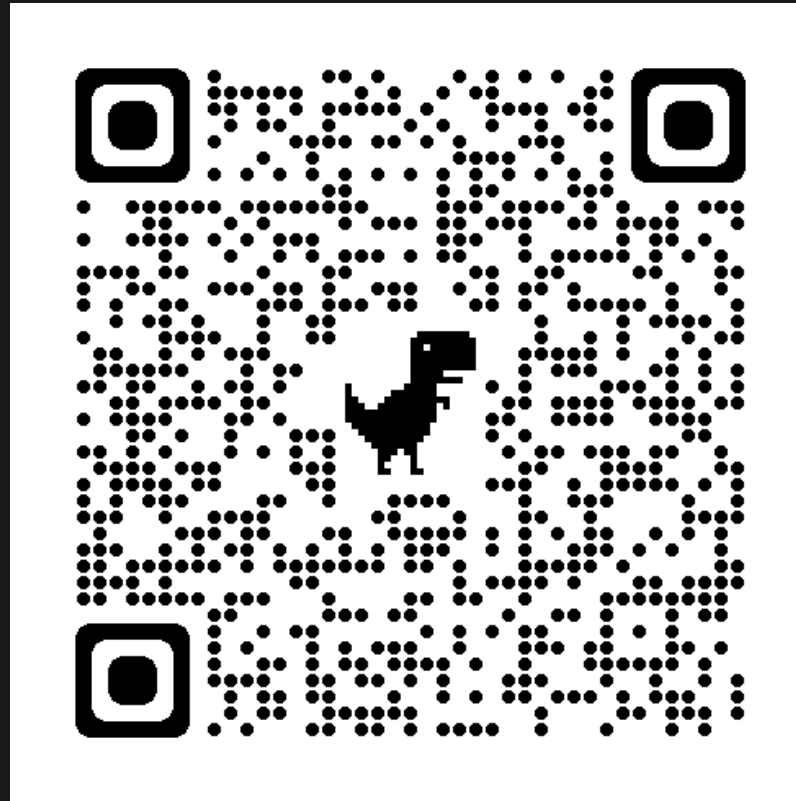
Experiences

- Overseas: Calculus, ...
- EMI in Taiwan : Machine Learning, Linear Algebra, ...
- Superior Teaching Award (NSYSU, 2021)
- EMI Faculty Institute (ASU, 2023)
- Promoting EML in the University EML Environment (British Council, 2020)
- Flipped Learning 3.0 Certification (Official 2020)

Outline

- Challenges: competency? interest?
- Active Learning:  teach →  learn
- How: rapport + clear instruction

**Are you happy with the
current outcome?**



Why Mathematics?

- Math is useful ?
- Math trains your mind ?

Why Mathematics?

- Math is useful ?
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believe vs



feel

Essense of learning — real story

A function $f(x)$ is **continuous** at a point c if ...

Textbook version:

*for any $\epsilon > 0$, there is $\delta > 0$
such that
any x with $|x - c| < \delta$ also
satisfies $|f(x) - f(c)| < \epsilon$*

Student version :

$$\epsilon > 0, \delta > 0, |x - c| < \delta, \\ |f(x) - f(c)| < \epsilon$$

Student version :

$$\epsilon > 0, \delta > 0, |x - c| < \delta, \\ |f(x) - f(c)| < \epsilon$$



delivery vs



learning outcome

How to make the content fun?

fun ? programming ? applications ?

Theory —————> Applications

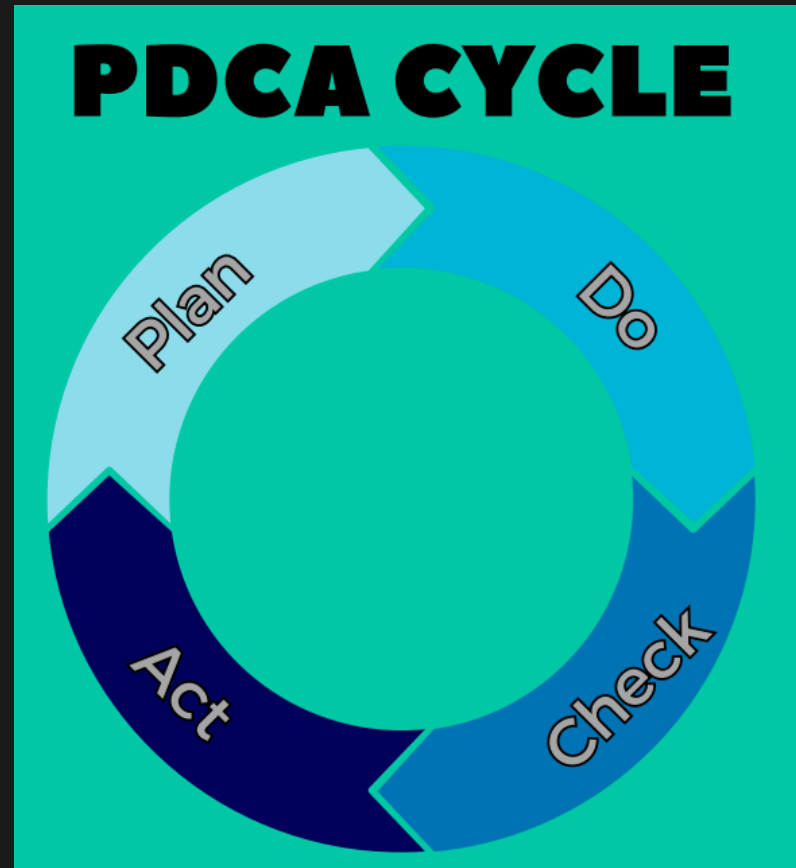
How to make the content fun?

fun ? programming ? applications ?

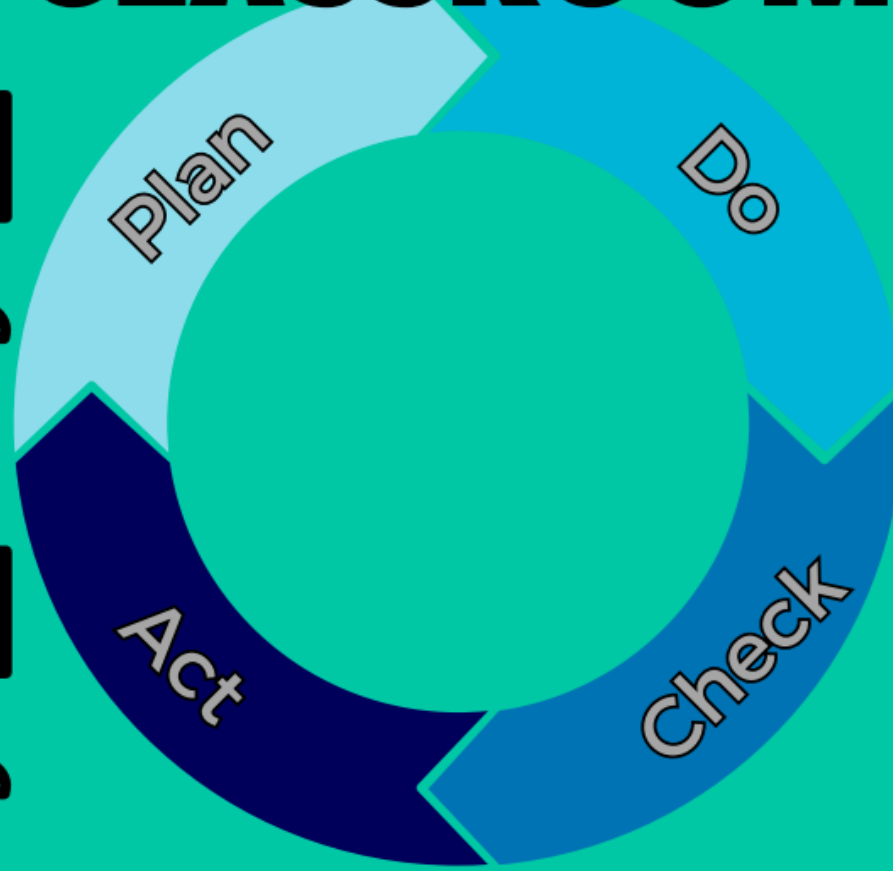
Theory —————> Applications

Fun =  learned something

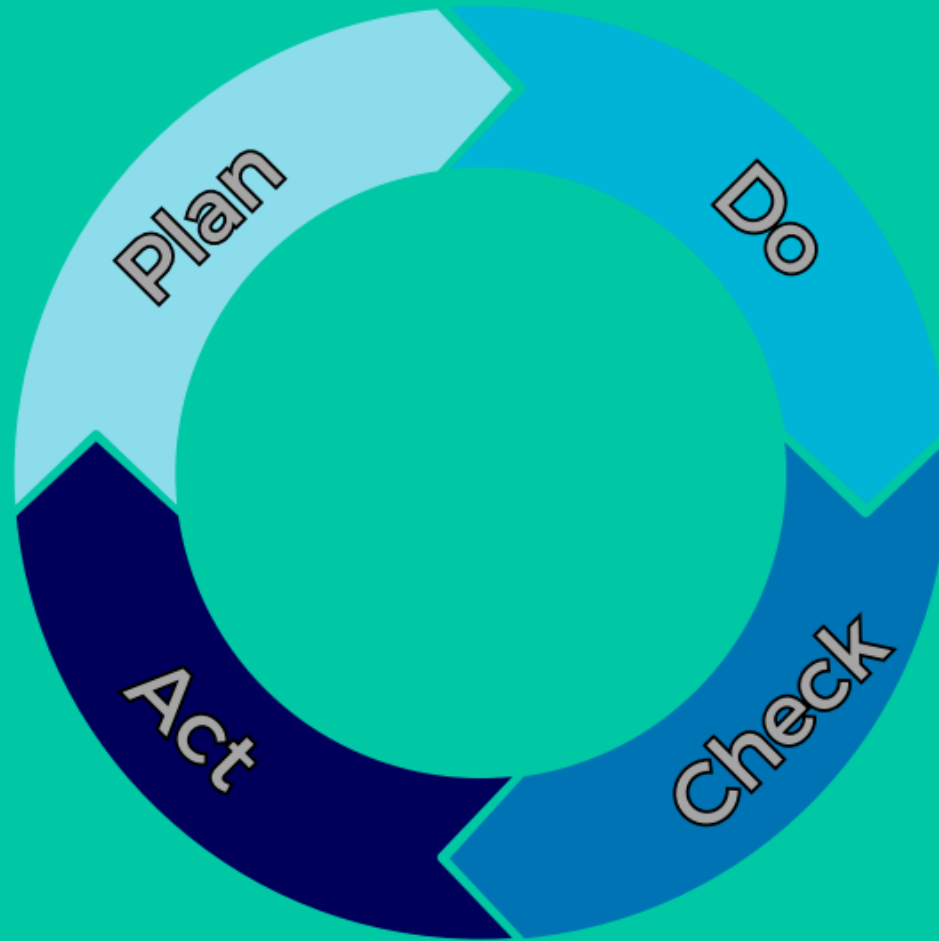
Active learning \neq self learning



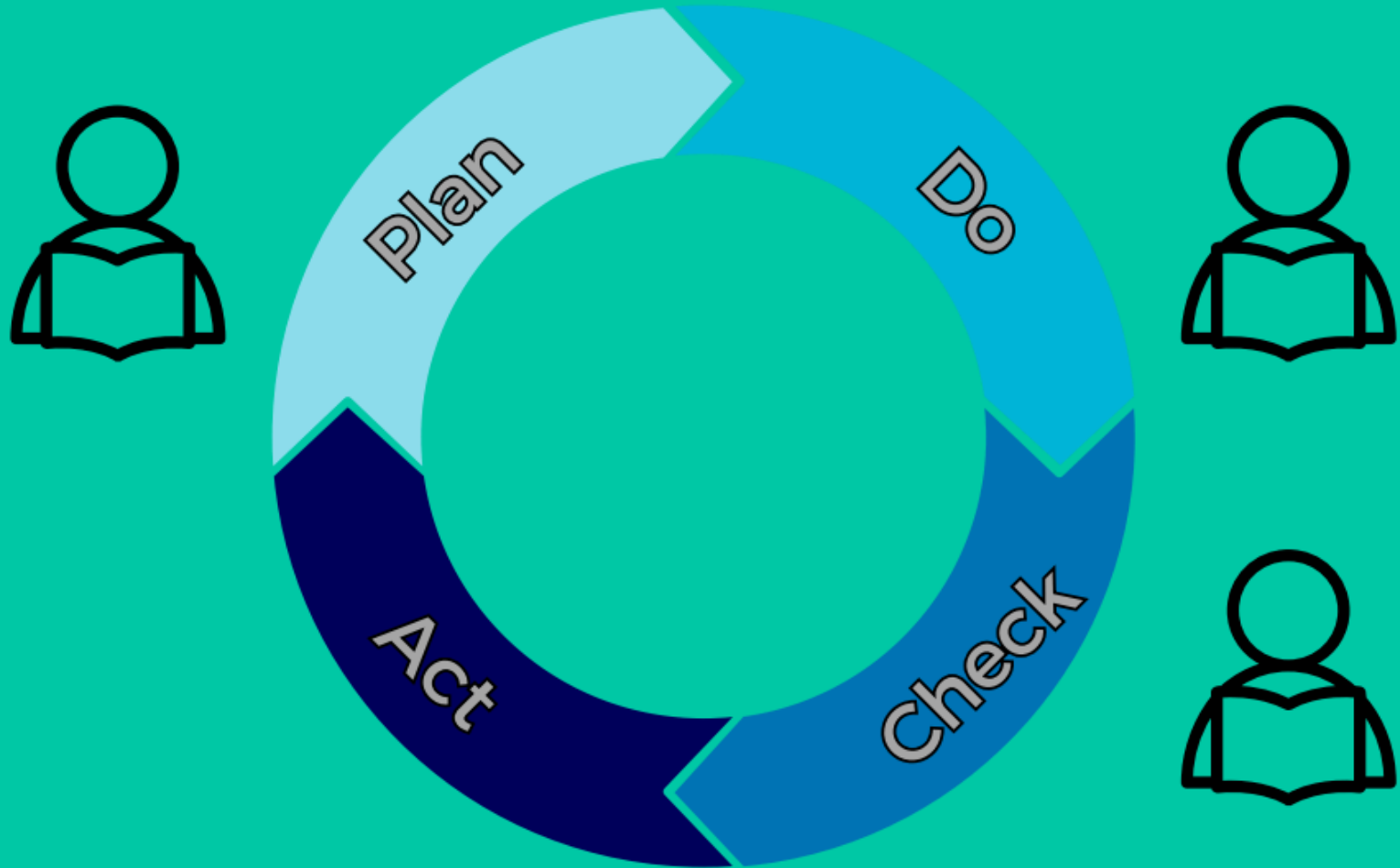
TRADITIONAL CLASSROOM



SELF LEARNING



ACTIVE LEARNING



augmented matrix 增廣矩陣

$$[A | b] = \left[\begin{array}{ccccc|c} 1 & 1 & 1 & 1 & 1 & 3 \\ 1 & 2 & 2 & 2 & 2 & 4 \\ 1 & 3 & 3 & 4 & 4 & 5 \end{array} \right]$$

eq

$$\left[\begin{array}{ccccc|c} 1 & 1 & 1 & 1 & 1 & 3 \\ 0 & 1 & 1 & 1 & 1 & 4 \\ 0 & 2 & 2 & 3 & 3 & 5 \end{array} \right]$$

no solution

$$\left[\begin{array}{ccccc|c} 1 & 1 & 1 & 1 & 1 & 3 \\ 0 & 1 & 1 & 1 & 1 & 4 \\ 0 & 0 & 0 & 1 & 1 & 5 \end{array} \right]$$

3 4t t 5

$$\left[\begin{array}{ccccc|c} 1 & 1 & 1 & 1 & 1 & 3 \\ 0 & 1 & 1 & 1 & 1 & 4 \\ 0 & 0 & 0 & 1 & 1 & 5 \end{array} \right]$$

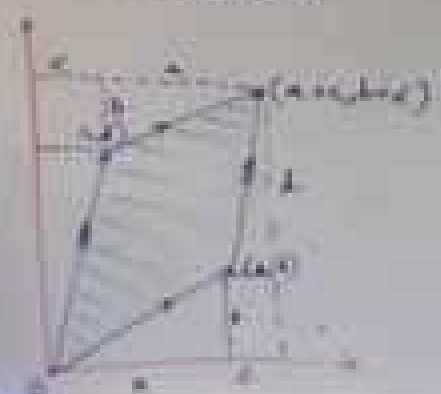
<https://www.youtube.com/watch?v=ZQ12ESNoy5k>

DETERMINANTS


12/6/11

Matrices in terms of vectors
(= VECTORS)

\vec{a} \vec{b} \vec{c}



Area



Sinus

DISCUSS

COMPARE

CLASS

DESCRIBE





OUTLINE

IDENTIFY



https://www.youtube.com/watch?v=_L8roj-8HfM

- Video 1 by Jephian Lin: teaching only
- Video 2 by [Eddie Woo](#): teaching + learning

Any questions?

-  no questions
-  don't understand, don't want to ask
-   I don't know where I don't understand.

Group discussion

- groups of 2 → 
- groups of 4 → 
- unexpected answers
- free-rider

What happens?



- Charisma ?
- Fluent English ?
- Logical delivery ?

rapport + clear instruction

=

Mathematics is discussable!

Clear instruction

-  to get to NSYSU, there are three routes, the one on the left takes longer but has beautiful views, the one in the middle is the easiest and the shortest, the one on the right is winding, bumpy, and not recommended, you may make a choice on your own
-  go straight

ICQs

Instruction Checking Questions

Where are we going at the next intersection?

CCQs

Concept Checking Questions

If you would like to enjoy the beautiful views,
which route would you choose?

Rapport

The first clas is **IMPORTANT!**

Not your fault...

- clear instruction
- rapport
- students
- classroom
- course content

Not your fault...

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But there are rooms for improvement → PDCA

Sharing my experiences

First class: Build the mindset

- **M**istakes make you smarter.
- **A**sk questions.
- **T**hink carefully.
- **H**elp each other.

First class: Build the mindset

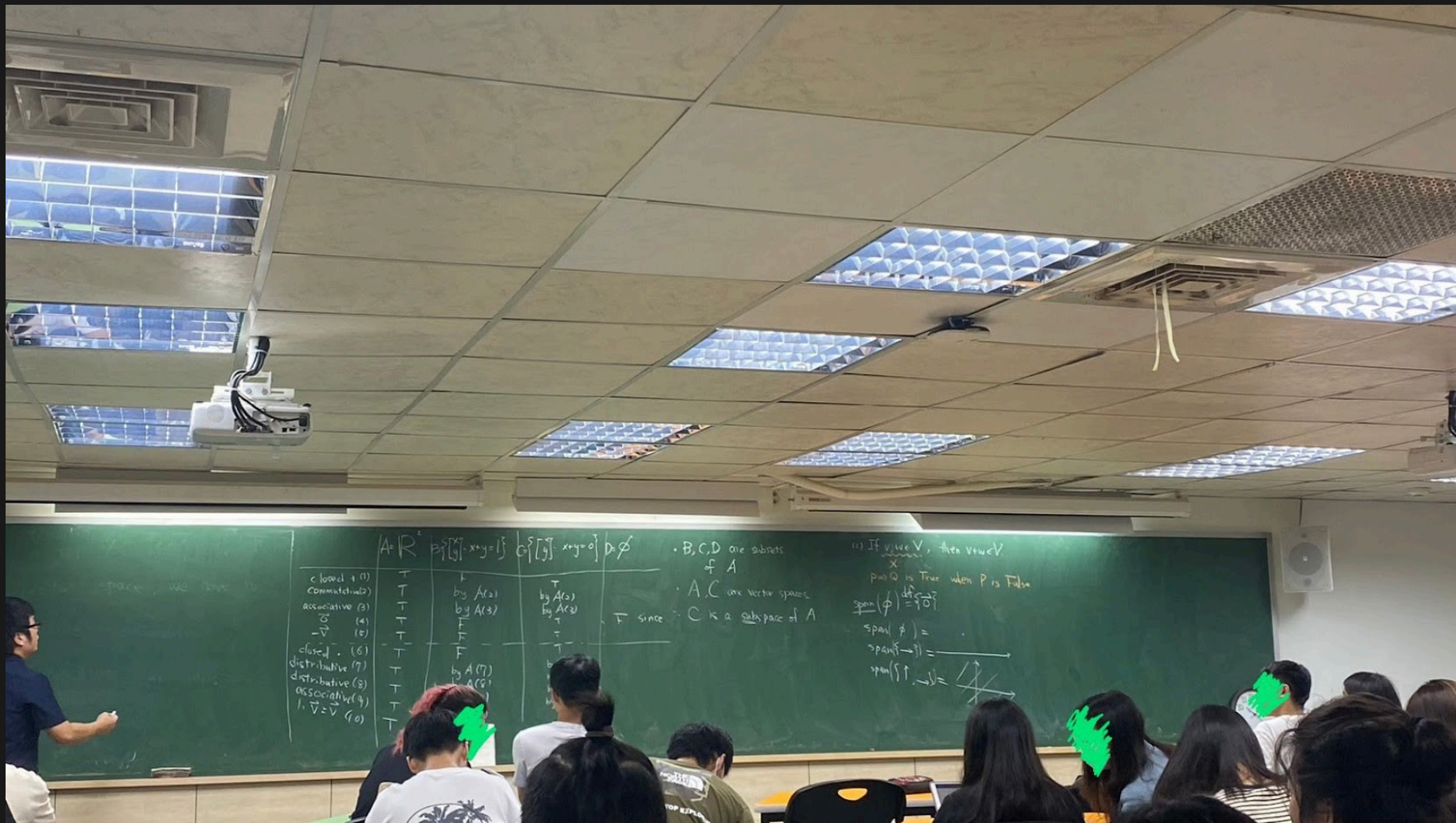
- **M**istakes make you smarter.
- **A**sk questions.
- **T**hink carefully.
- **H**elp each other.

We are bound to **learn together.**

First class: Scaffolded self introduction

- How are you?
- My name is .
- My major is .
- **Assign** the group.
- ChatGPT: Please tell me some applications of linear algebra in .

Activities: Run the definition




Activities: Collaborative computation

- Each group get a different exercise.
- The final answer depends on each group's result.

$$\mathbf{u}_1 = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}, \mathbf{u}_2 = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$$

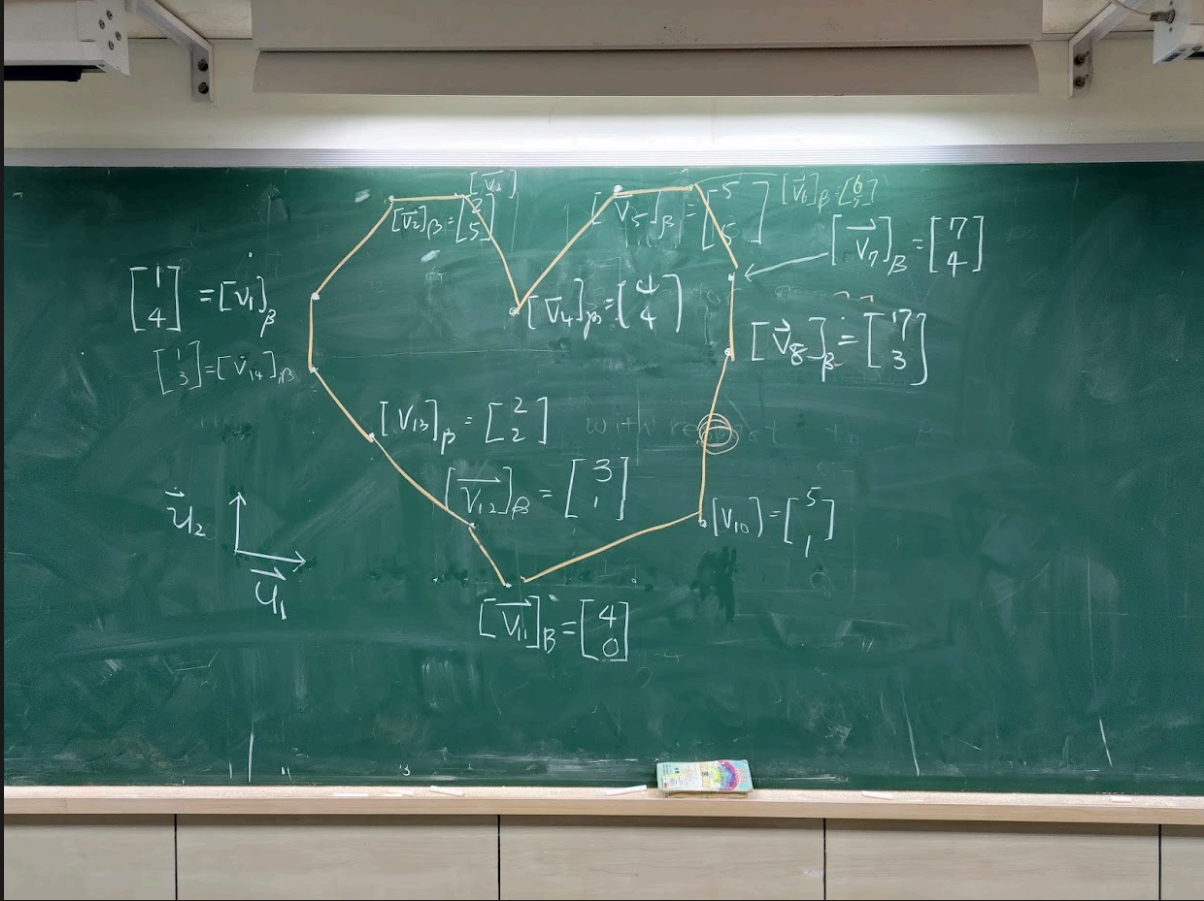
$$\mathbf{v}_1 = \begin{bmatrix} 5 \\ 9 \\ 13 \\ 17 \end{bmatrix} = c_1 \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix} + c_2 \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$$

Where is \vec{v}_1 ?

$$\begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix} = \vec{u}_2$$


$$\vec{u}_1 = \begin{bmatrix} | \\ | \\ | \\ | \end{bmatrix}$$


$$\vec{v}_1 = \begin{bmatrix} 5 \\ 9 \\ 13 \\ 17 \end{bmatrix} = 1 \begin{bmatrix} | \\ | \\ | \\ | \end{bmatrix} + 4 \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$$



Activities: Yes-No jigsaw

- Is this set linear independent? Case of yes
- Is this set linear independent? Case of no

Why we need so many teachers?

- ★ Push students to work hard
- ★ ★ Motivate students to learn more
- ★ ★ ★ Offer customized advice based on the needs

Be a student again

If you got a chance to learn the subject again, how would you learn it...?

