# Industry-Academia Tour

Joseph Chuang-Chieh Lin

Economics and Computation Lab,
Department of Computer Science & Engineering,
National Taiwan Ocean University

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# Outline

## https://josephcclin.github.io

# Joseph Chuang-Chieh Lin

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*Me @ University of Tokyo, January 2024.*

EC LAB Welcome to our lab:
Economics and Computation Laboratory

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| Background | Research | Curriculum Vitae | Running |
| Mathematics Genealogy | Teaching | Publications | Interest |

# Education

- BS.: Mathematics, National Cheng Kung University
- MS.: CSIE, National Chi Nan University
    - Supervisor: R. C. T. Lee
      Algorithms
- Ph.D.: CSIE (2011), National Chung Cheng University
    - Supervisors: Maw-Shang Chang & Peter Rossmanith
      FPT + Randomized Algorithms

# Work Experience

- Postdoc in Academia Sinica (2011–2018).
- *Quantitative Analyst* (intern) @ Point72/Cubist Systematic Strategies (2018–2020).
- *Quantitative Analyst* @ Seth Technologies Inc. (2020–2021).
- Assistant Professor @ Dept. CSIE, Tamkang University (2021–2024).

# Research Interests

- **Algorithmic Game Theory**
  - Equilibrium Computation, Computational Social Choice, Mechanism Design, etc.
- **Machine Learning Theory**
  - Online Learning with No-Regret, Bandit Problems, etc.
- **Design of TCS Algorithms**
  - Randomized Algorithms, Fixed-Parameter Algorithms, Approximation Algorithms, Online Algorithms.

# Ongoing Projects

- *Algorithmic Game Theory with Machine-Learned Predictions.*
  - Taiwan (NSTC) $\leftrightarrow$ Netherlands (NWO)
  - Period: July 2025–June 2025).
- *Parameterized Online Learning for Min-Max Envy Resource Allocation and Team Formation.*
  - Taiwan (NSTC) $\leftrightarrow$ France (BFT)
  - Period: January 2024–December 2025.
- *A Study on Group Competition Game of Real-Policy Making Based on Equilibria Existence and Gradient Algorithms.*
  - Independent NSTC Project
  - Period: August 2023–July 2026.

# Outline

# Teaching Courses

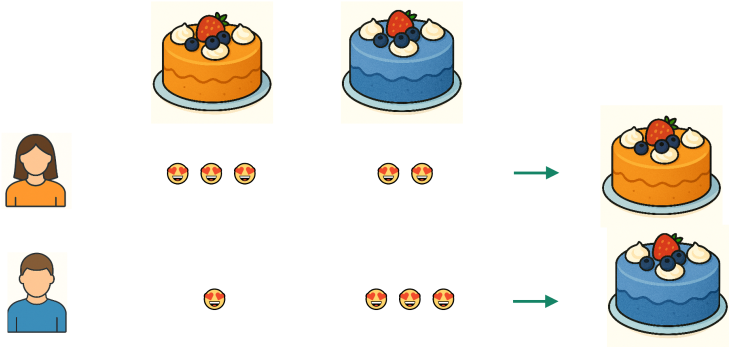
- Undergraduates:
    - Introduction to Programming (II) [EMI]
    - **Data Structures**
- Graduates:
    - Economics and Computation [EMI]
    - Randomized Algorithms [EMI]
    - **Mathematics for Machine Learning** [EMI]

# Outline

1. Self Introduction
2. Teaching Courses
3. Focus of The Junior Project

# Some fairness concepts

# Some fairness concepts



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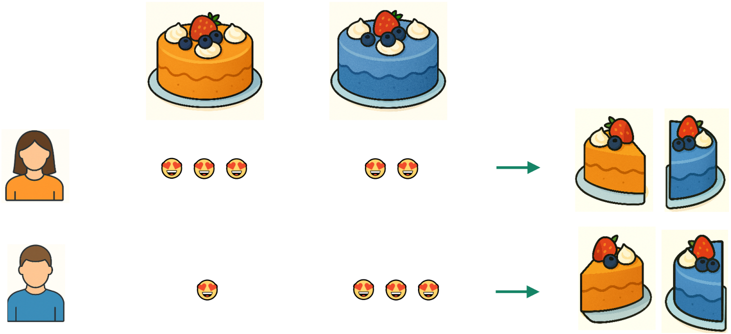

# Envy-freeness for allocating indivisible goods

**Two-Partition Problem**

Given a multiset $S$ of positive integers, determine if it is possible to partition $S$ into two disjoint subsets, say $S_1$ and $S_2$, such that the sum of the integers in $S_1$ is equal to the sum of the integers in $S_2$.

- $S = \{1, 5, 11, 5\}$

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- $S = \{3, 5, 8, 10, 11, 14, 17, 19, 21, 22, 25, 33\}$.
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# Envy-freeness for allocating indivisible goods

NP-complete

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# Envy-free up to any good (EFX)

## EFX

$\mathcal{A} = (A_1, \ldots, A_n)$ is an EFX allocation of a set $M$ of indivisible goods to a set $N$ of agents if for every pair of agents $i, j \in N$ it holds that

$$v_i(A_i) \;\geq\; v_i\big(A_j \setminus \{g\}\big) \;\text{ for every good } g \in A_j,$$

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## Example

Agents $N = \{1, 2, 3\}$; goods $M = \{a, b, c, d, e\}$. All agents share the same additive valuation $v$ with $v(a) = v(b) = v(c) = v(d) = v(e) = 1$,
Then $A_1 = \{a, b\},\ A_2 = \{c, d\},\ A_3 = \{e\}$ is an EFX allocation.

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- **OPEN PROBLEM:** Does there always exists an EFX allocation for $m$ indivisible goods to $n \geq 4$ agents?

# Thank you!

Questions?