Mechanism Design

Ezekiel Olugbami
Ifeoluwa Oladeji
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Abraham Musa
Femi Alayesanmi
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Past DSA Attendees

Tutorial author: Eric Sodomka
Based on lecture notes by Tim Roughgarden

Data Science Africa 2019 - Accra, Ghana

Inspired by, but unaffiliated with, MD4SG: www.md4sg.com

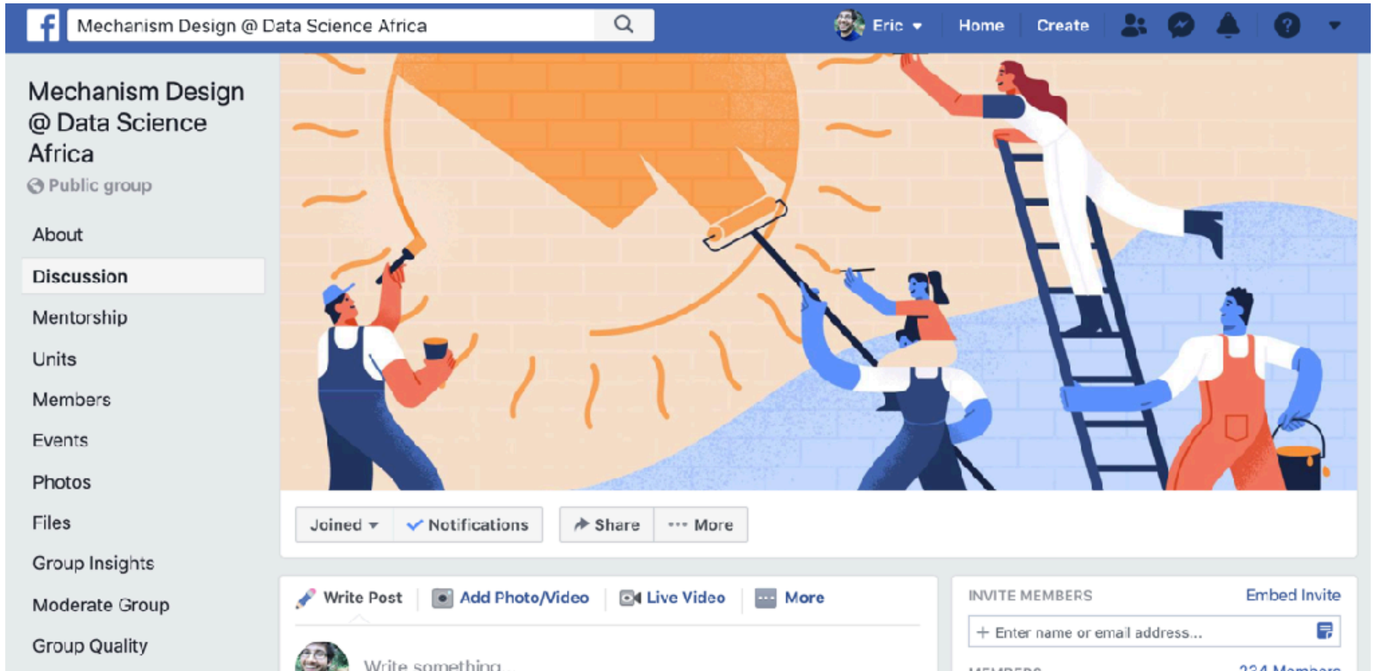
The winners are as follows:

- **Mechanisms for Crowdsourcing with Small-Holder Farmers.** *PI: Mutembesa Daniel (Makerere University). Collaborators: Boi Faltings (EPFL); Christopher Omongo (National Crops Resources and Research Institute); Humphrey Mutaasa (Uganda National Farmers Federation).*
- **Modern Social Choice: Mechanisms and Platforms for Large Scale Deliberation.** *Co-PIs: Ashish Goel (Stanford University); James S. Fishkin (Stanford University); Kamesh Munagala (Duke University).*
- **Promoting Diversity in Peer Production through Mechanism Design.** *Co-PIs: Zhiwei Steven Wu (University of Minnesota); Haiyi Zhu (University of Minnesota).*

Mechanisms for crowdsourcing with small-holder farmers

The problem: Farmers in the developing world rely on a healthy crop to provide for their families, but that crop is continually at risk of being destroyed. Diseases and pests can ruin a farmer's entire harvest, and outbreaks can affect the broader farming community. Such dangers are hard to detect in their early

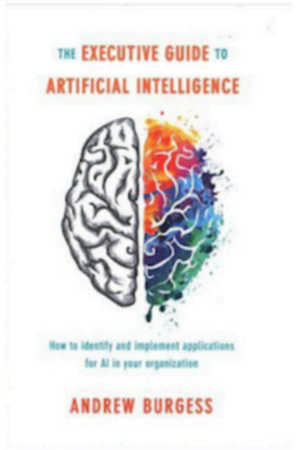
Join the group to be eligible for a book at end of this tutorial: tinyurl.com/dsa-fb-group

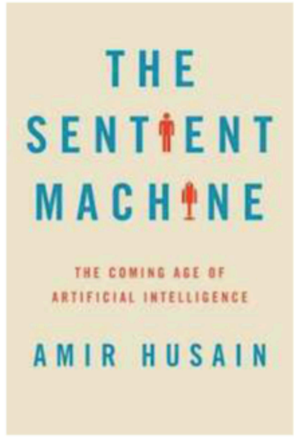


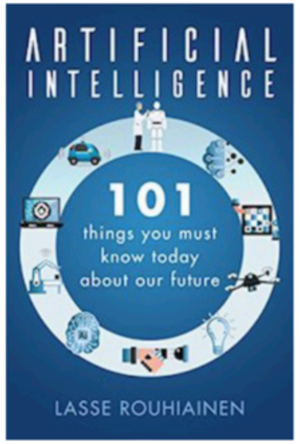
A motivating example

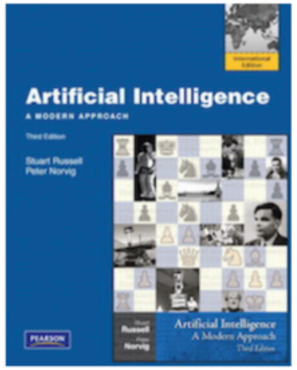
Ezekiel Olugbami

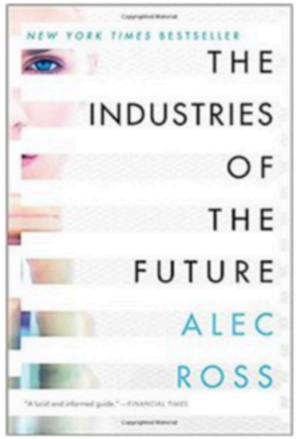
The Problem: Giving out Books

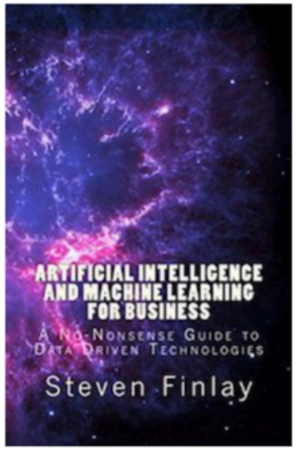


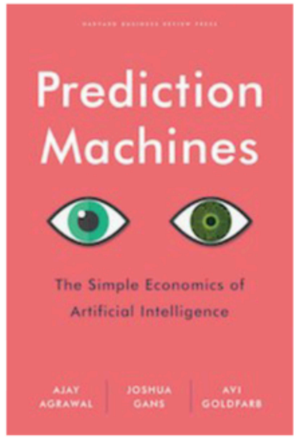


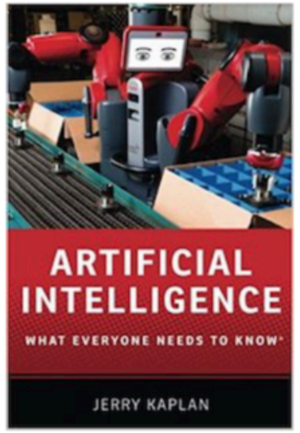


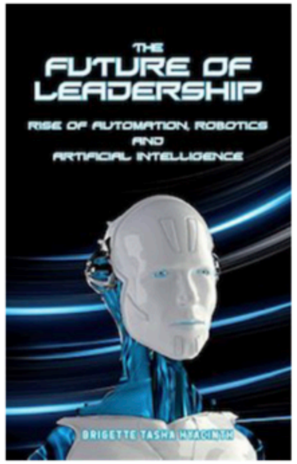


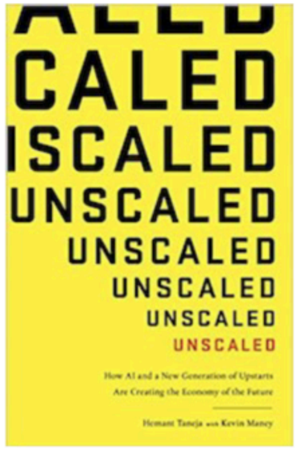












An Initial Proposal

Random Assignment

1. **Randomly order attendees**: assign each a unique number 1 through 200.

2. In that attendee order, give each attendee a **randomly chosen book** amongst those remaining.

Discuss with your Neighbor

- Do you have any complaints about Random Assignment?
- Can you come up with anything better?

Random Assignment

1. **Randomly order attendees**: assign each a unique number 1 through 200.
2. In that attendee order, give each attendee a **randomly chosen book** amongst those remaining.

Done? Join Facebook Group **Mechanism Design @ Data Science Africa** tinyurl.com/dsa-fb-group.
We'll draw winners from that group at the end of the talk to play the "book giveaway" game.

Complaints about Random Assignment?

Random Assignment

1. **Randomly order attendees**: assign each a unique number 1 through 200.

2. In that attendee order, give each attendee a **randomly chosen book** amongst those remaining.

Complaints about Random Assignment?

- “It doesn’t consider what I want.”
- “I have to trade with people afterwards to get something better.”
- Benefit: “It’s quick and easy.”

Random Assignment

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Did you come up with anything better?

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Random Assignment

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Alternative mechanisms

Ifeoluwa Oladeji

Did you come up with anything better?

Choose Your Favorite

1. **Randomly order attendees**: assign each a unique number 1 through 200.

2. In that attendee order, give each attendee **the choice of their favourite book** amongst those remaining.

Random Assignment

1. **Randomly order attendees**: assign each a unique number 1 through 200.

2. In that attendee order, give each attendee a **randomly chosen book** amongst those remaining.

Can Ifeoluwa allocate books on his own time?

Can Ifeoluwa allocate books on his own time?

Choose Your Favourite (by proxy)

1. Have each participant submit their **preferences over books**.
2. **Randomly order attendees**: assign each a unique number 1 through 200.
3. In that attendee order, give each attendee **their favourite book** amongst those remaining, **according to their reported preferences**.

Can Ifeoluwa allocate books on his own time?

Serial Dictatorship

1. Have each participant submit their **preferences over books**.
2. **Randomly order attendees**: assign each a unique number 1 through 200.
3. In that attendee order, give each attendee **their favourite book** amongst those remaining, **according to their reported preferences**.

Evaluating mechanisms: Pareto optimality

Akowe Israel

Evaluating Mechanisms

- How is **Serial Dictatorship** better than **Random Assignment**?
- What does it mean for a mechanism to be “good”?

One Notion of Goodness

- An outcome is **pareto optimal** if you can't make someone better off without making someone else worse off.

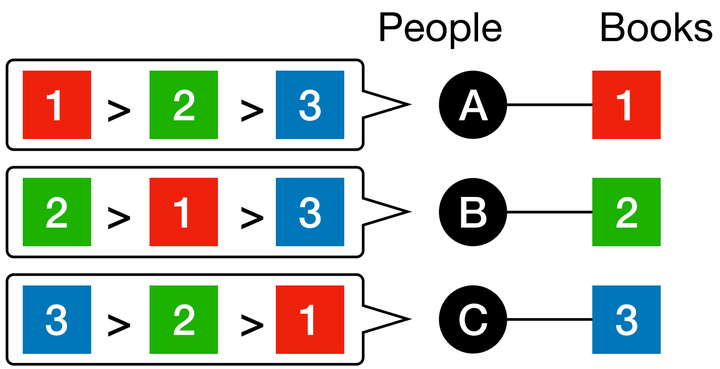
- An outcome is pareto optimal if there is no alternative outcome for which (1) everyone is at least as happy, and (2) someone is happier.

One Notion of Goodness

- An outcome is **pareto optimal** if you can't make someone better off without making someone else worse off.

- An outcome is pareto optimal if there is no alternative outcome for which (1) everyone is at least as happy, and (2) someone is happier.

Is this outcome pareto optimal?



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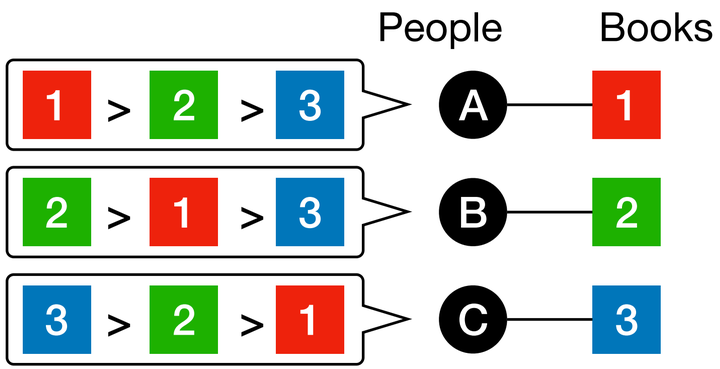

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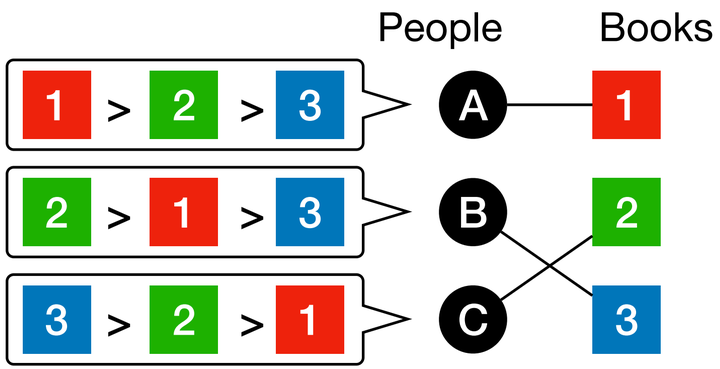

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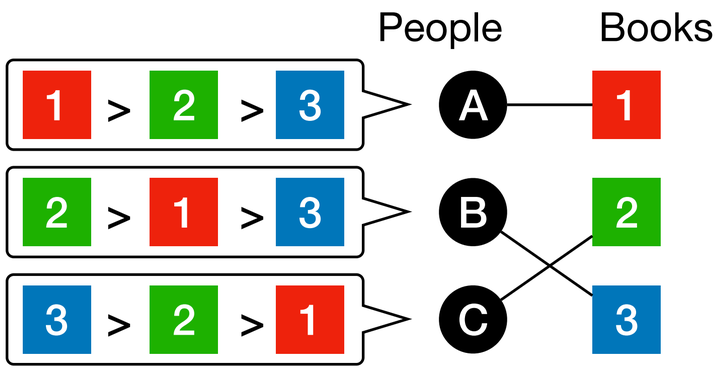

No

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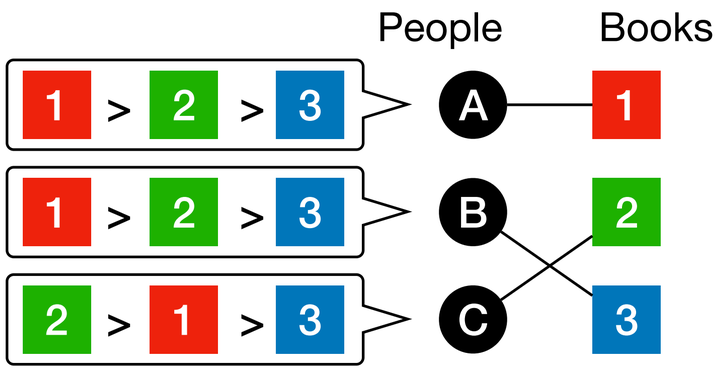

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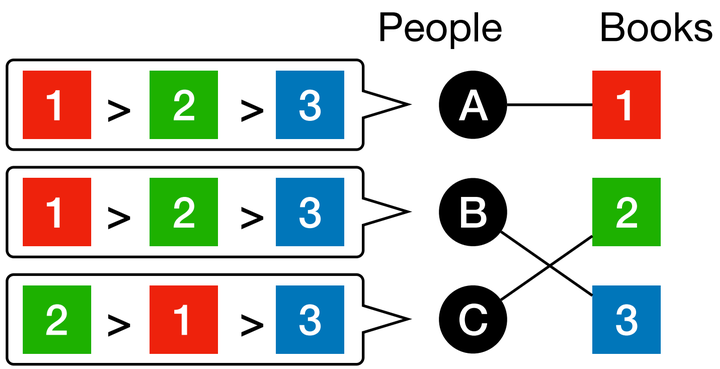


Yes

Evaluating mechanisms: Strategy proofness

Abraham Musa

Another Notion of Goodness

- A mechanism is **strategyproof** if honesty is the best policy.
- A mechanism is strategyproof if lying about your preferences can’t make you better off.

Is the Serial Dictatorship strategyproof?

- Your reported book preferences don’t affect your turn order.
- Your reported book preferences don’t affect what anyone before you gets.
- Thus, your reported book preferences don’t affect what books are available on your turn.
- Serial Dictatorship gives you the best available book on your turn (according to reported preferences).
- Thus, any misreport of preferences could only result in you getting a book you like less.

Strategy-proofness and the *Abridged* Serial Dictatorship

Femi Alayesanmi

The Abridged Serial Dictatorship

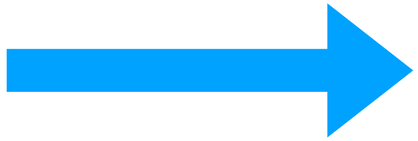
Abridged Serial Dictatorship

1. Have each participant submit their preferences over their **top K** books.

2. Randomly order attendees.

3. In that order, give each attendee their favorite book amongst those remaining, according to their reported preferences. **If all their favorite books are gone, give them nothing.**

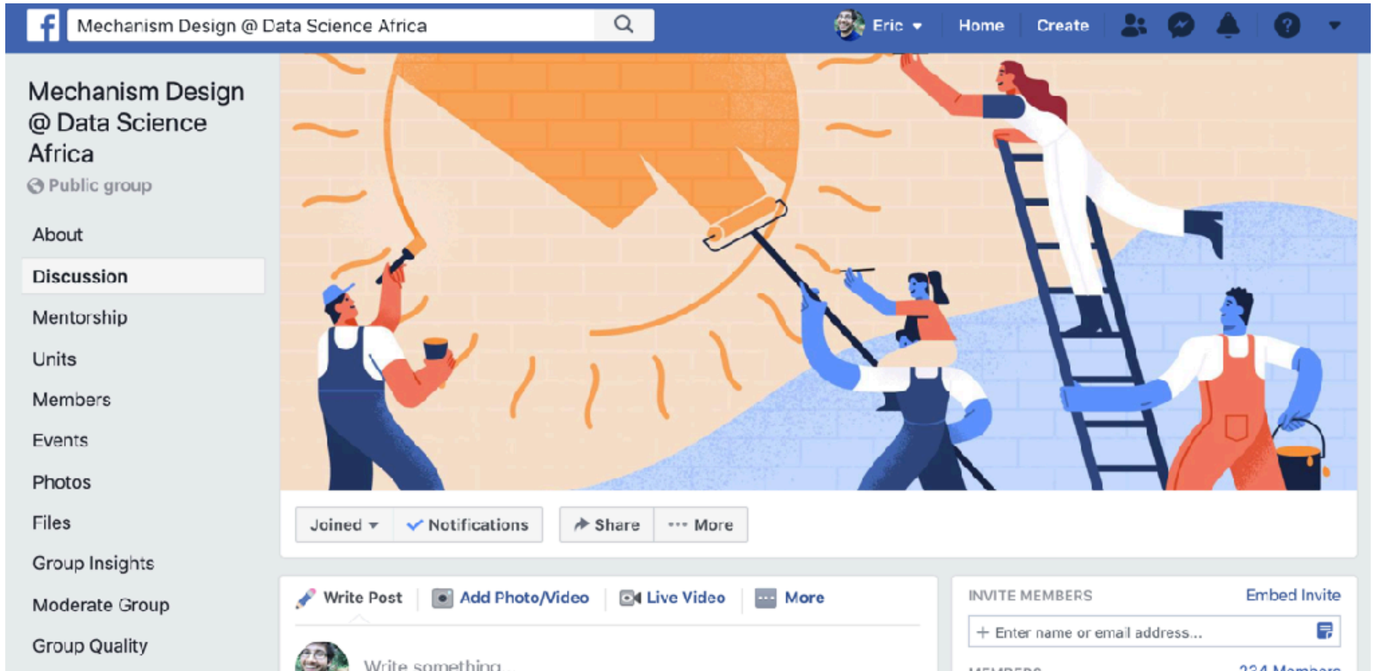
Serial dictatorship: full list



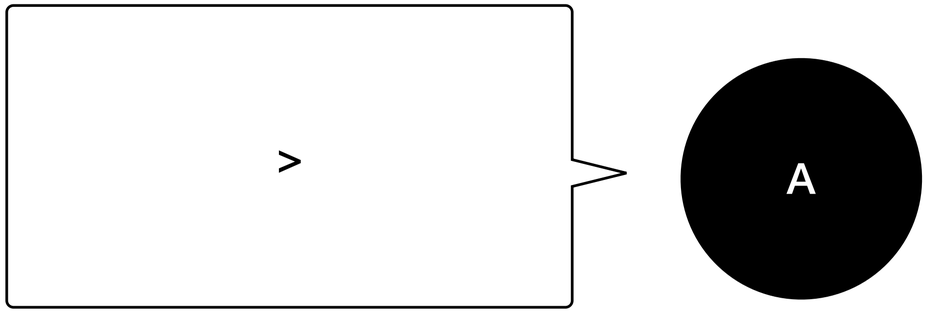
Abridged Serial dictatorship: truncated list

Is the Abridged Serial Dictatorship strategyproof? (examples)

Last chance to join the group to be eligible for contest: tinyurl.com/dsa-fb-group



Example 1: Serial Dictatorship



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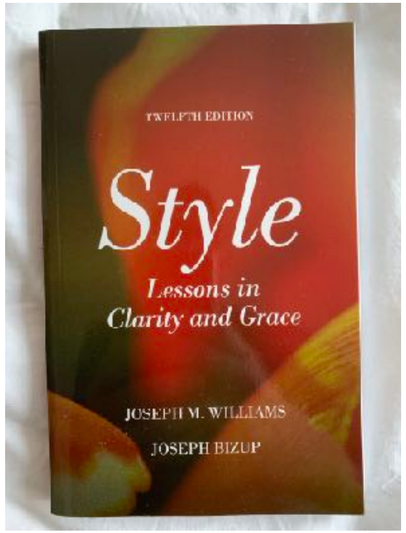

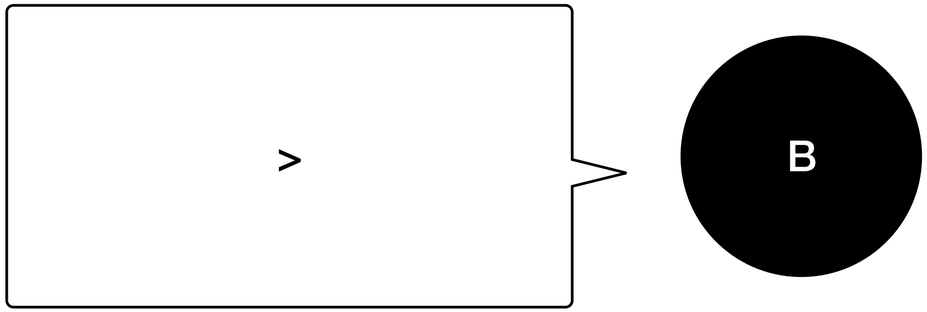

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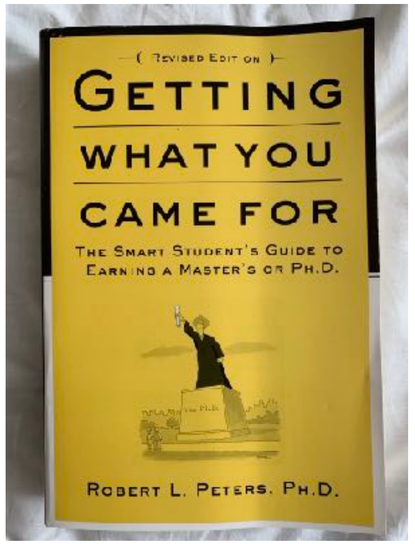
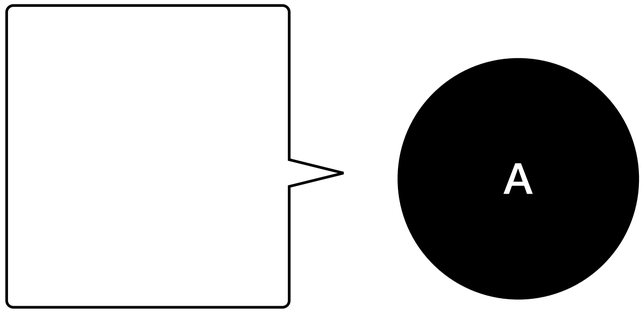
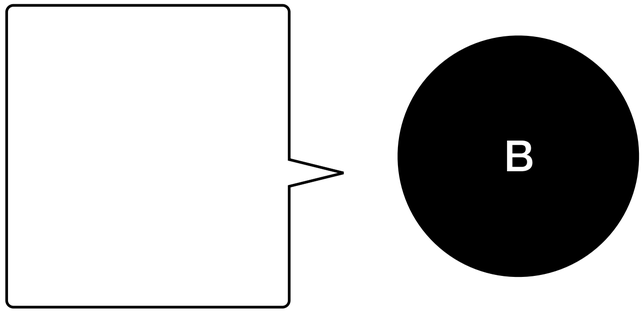


Example 2: Abridged Serial Dictatorship





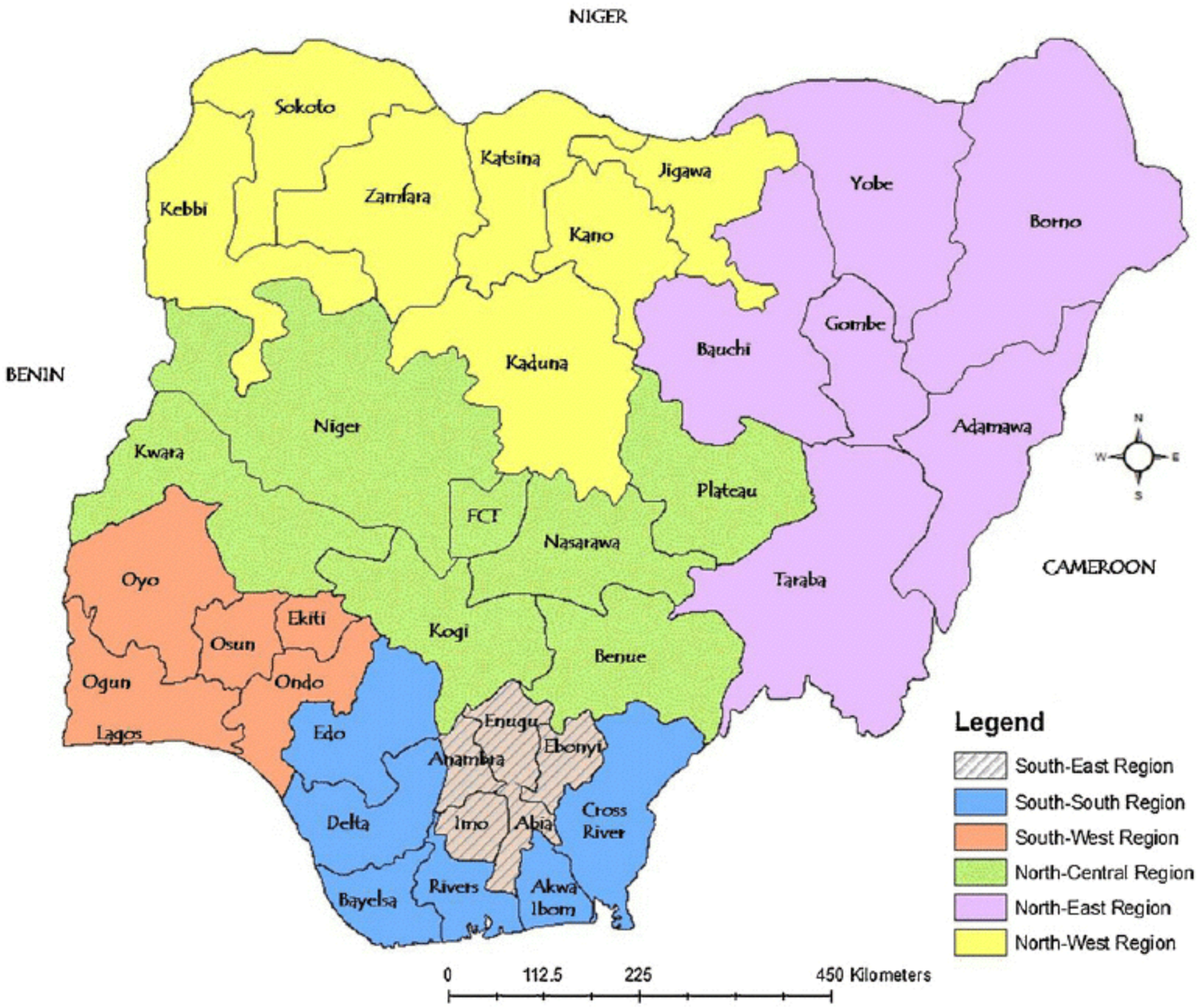
Things to remember

- The rules of the game matter
- Small changes to the rules can make a big difference

Mechanism Design in the Wild

Emmanuel Adeiza Ozi-yusuf


NYSC



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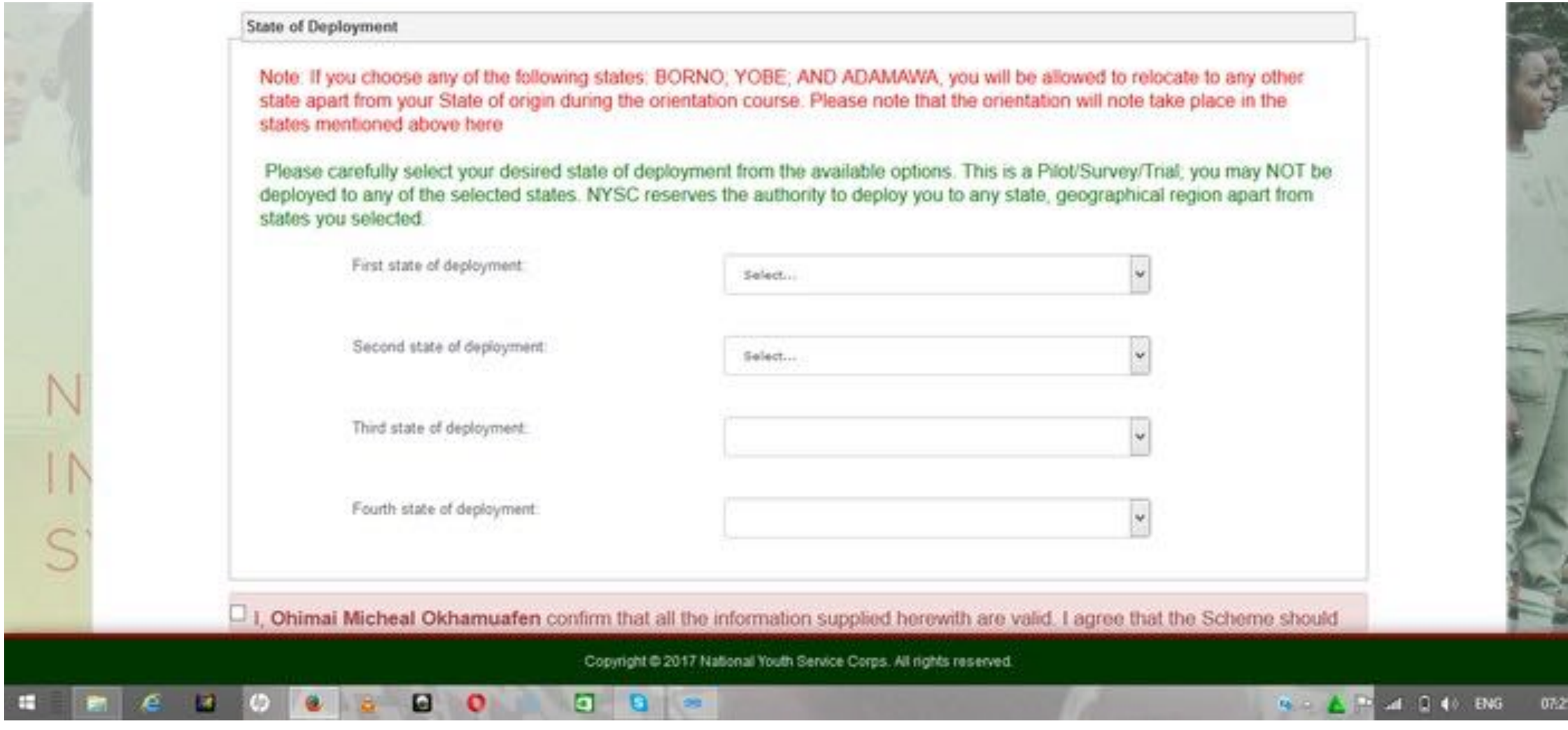
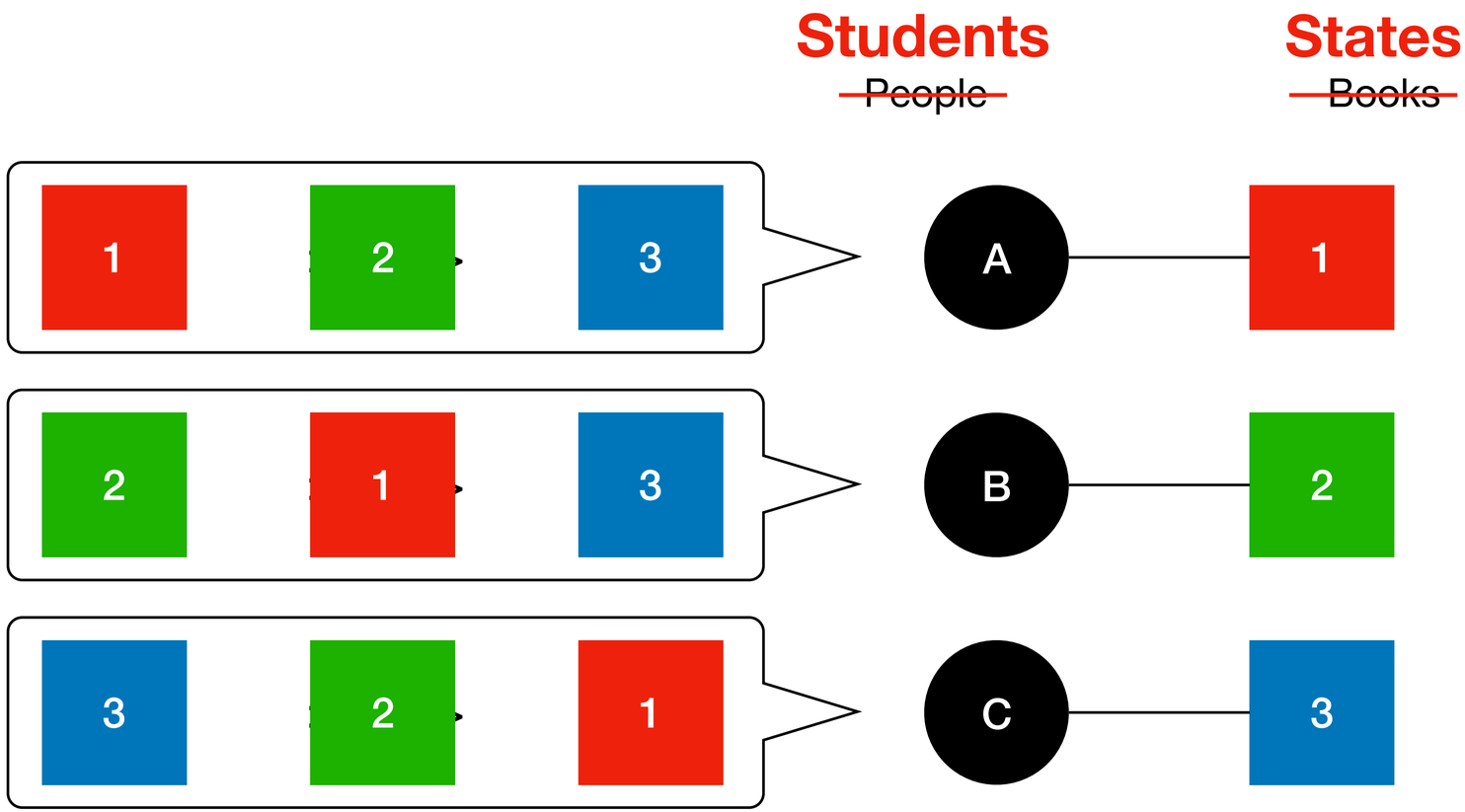
Sokoto	North West	North	Nigeria
Zamfara			
Katsina			
Kebbi			
Jigawa			
Kaduna			
Kano			
Benue	North Central		
FCT			
Kogi			
Kwara			
Nasarawa			
Plateau			
Niger			
Adamawa	North East		
Bauchi			
Borno			
Gombe			
Taraba			
Yobe			
Ekiti	South West	South	
Lagos			
Ondo			
Ogun			
Osun			
Oyo			
Akwa Ibom	South South		
Bayelsa			
Cross River			
Edo			
Delta			
Rivers			
Abia	South East		
Ebonyi			
Enugu			
Anambra			
Imo			

Choosing state of preference



NYSC Matching



Discussion

- Can you think of other systems that you regularly participate in that are clearly not strategyproof, or that do not produce Pareto optimal outcomes?
- What are some problems that feel similar to“book giving” problems? What’s the general version of the problem?
- (Discuss for 2-5 minutes)

Next Steps

Eric Sodomka

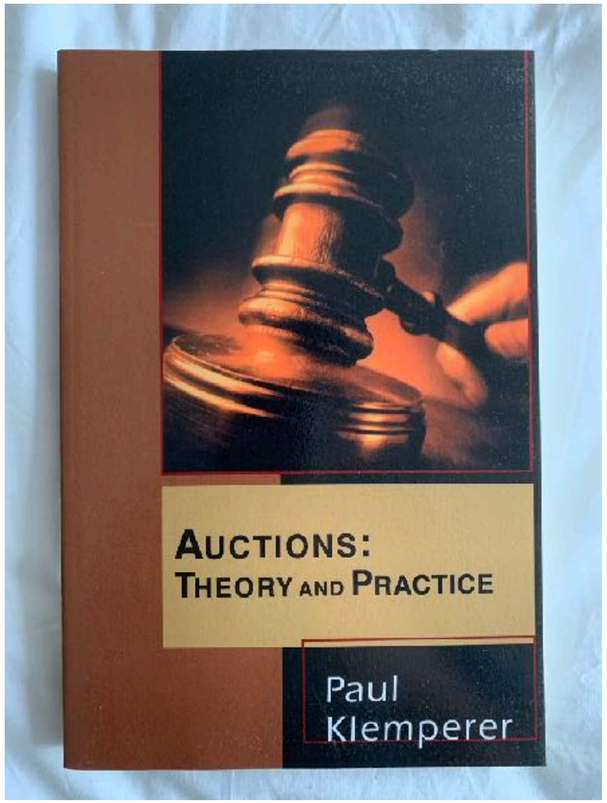
What did you learn?

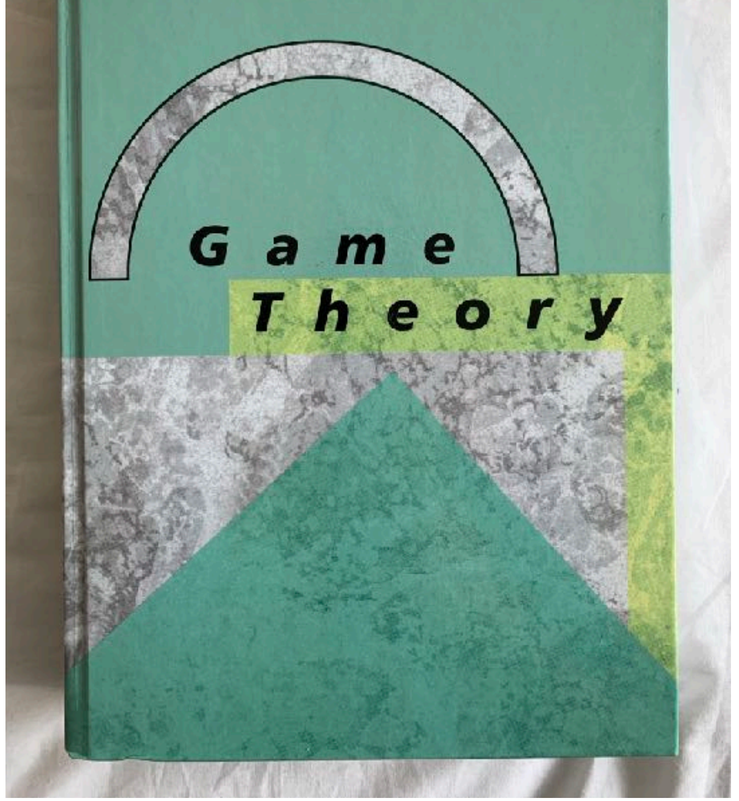
What did you learn?

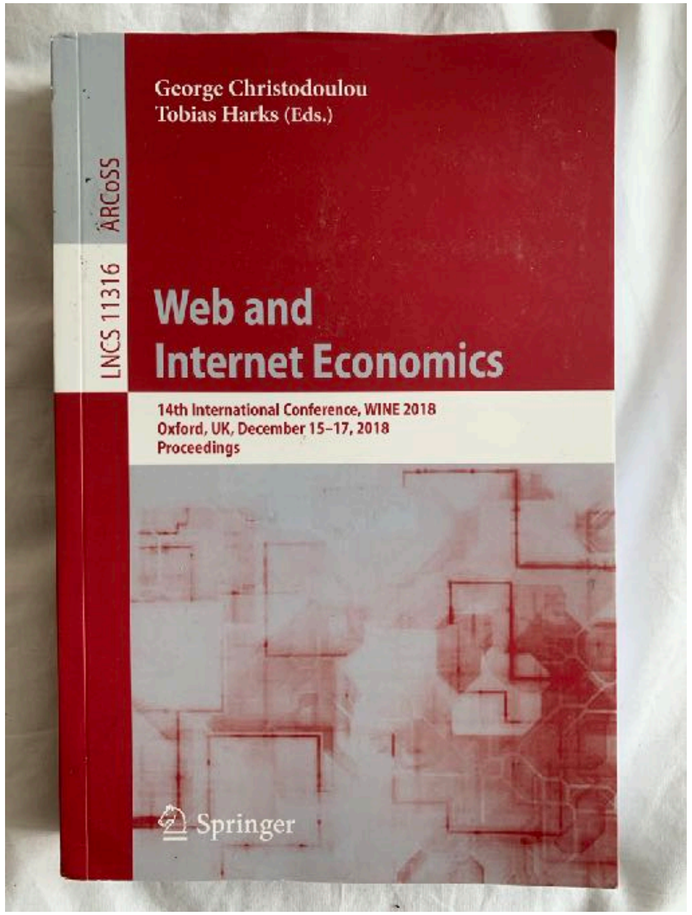
- Mechanism design
- Serial dictatorship
- Pareto optimal
- Strategy proof
- “Abridged serial dictatorship”

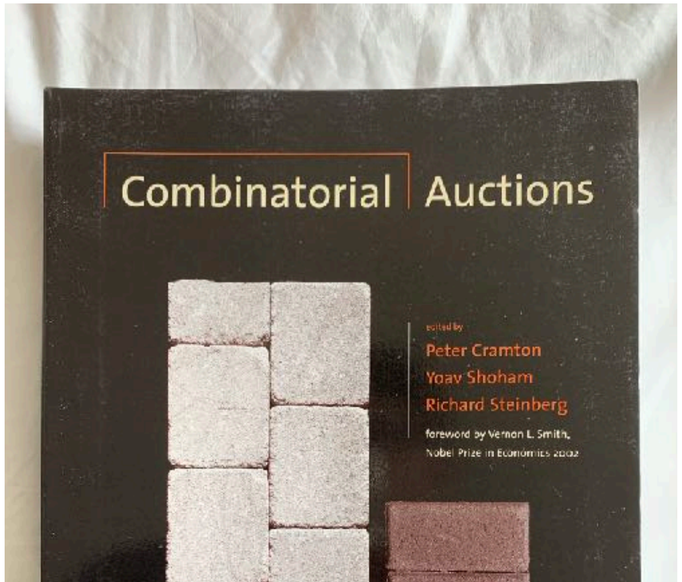
Contest: Local Challenges in Mechanism Design

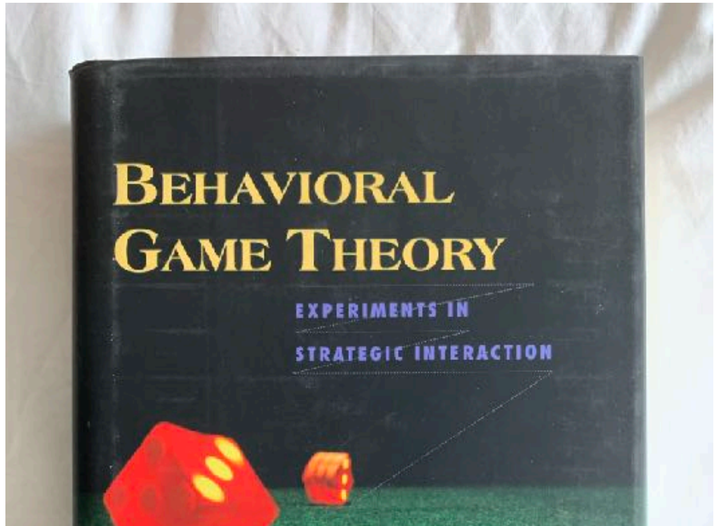
- **Identify a real-world problem in your region that could benefit from the tools of mechanism design.**
- Prize: (1) Mechanism design book of your choice; (2) If exceptional submission: Funding to attend mechanism design conference.
- Submission deadline: Thursday 9:00 AM
- Submit early for feedback. You can edit your submission.
- Winner(s) announced at DSA talk on Thursday


AUCTIONS:
THEORY AND PRACTICE
Paul
Klemperer


Game
Theory


George Christodoulou
Tobias Harks (Eds.)
LNCS 11316
ARCoSS
Web and
Internet Economics
14th International Conference, WINE 2018
Oxford, UK, December 15–17, 2018
Proceedings
Springer


Combinatorial Auctions
edited by
Peter Cramton
Yoav Shoham
Richard Steinberg
foreword by Vernon L. Smith,
Nobel Prize in Economics 2002


BEHAVIORAL
GAME THEORY
EXPERIMENTS IN
STRATEGIC INTERACTION

Contest: Local Challenges in Mechanism Design

- Brainstorming form: tinyurl.com/dsa-accra-brainstorm
- Submission form: tinyurl.com/dsa-accra-contest
- Facebook group: tinyurl.com/dsa-fb-group

Next Step: Join Facebook Group

Mechanism Design @ Data Science Africa tinyurl.com/dsa-fb-group

- This talk based on first lecture of course by Tim Roughgarden: *Incentives in Computer Science.* Available online!
- Resources for learning more about mechanism design
- Resources for getting involved in the mechanism design community
- Contest announcements

What I want…

- Winners of upcoming Mechanism Design **research grants** are attendees of Data Science Africa (DSA) 2019 Accra.
- **Top-tier publications** between mechanism design researchers and DSA attendees.
- Top **academic and industry positions** for DSA attendees in mechanism design.

Contest: Local Challenges in Mechanism Design

- Brainstorming form: tinyurl.com/dsa-accra-brainstorm
- Submission form: tinyurl.com/dsa-accra-contest
- Facebook group: tinyurl.com/dsa-fb-group