Economics and Computation

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Rensselaer

This Course

- Economics: decision making by multiple actors, each with individual preferences, capabilities, and information, and motivated to act in regard to these preferences.
- Computer science: study of representation and processing of information for the purpose of specific calculation tasks.
- Breadth over depth

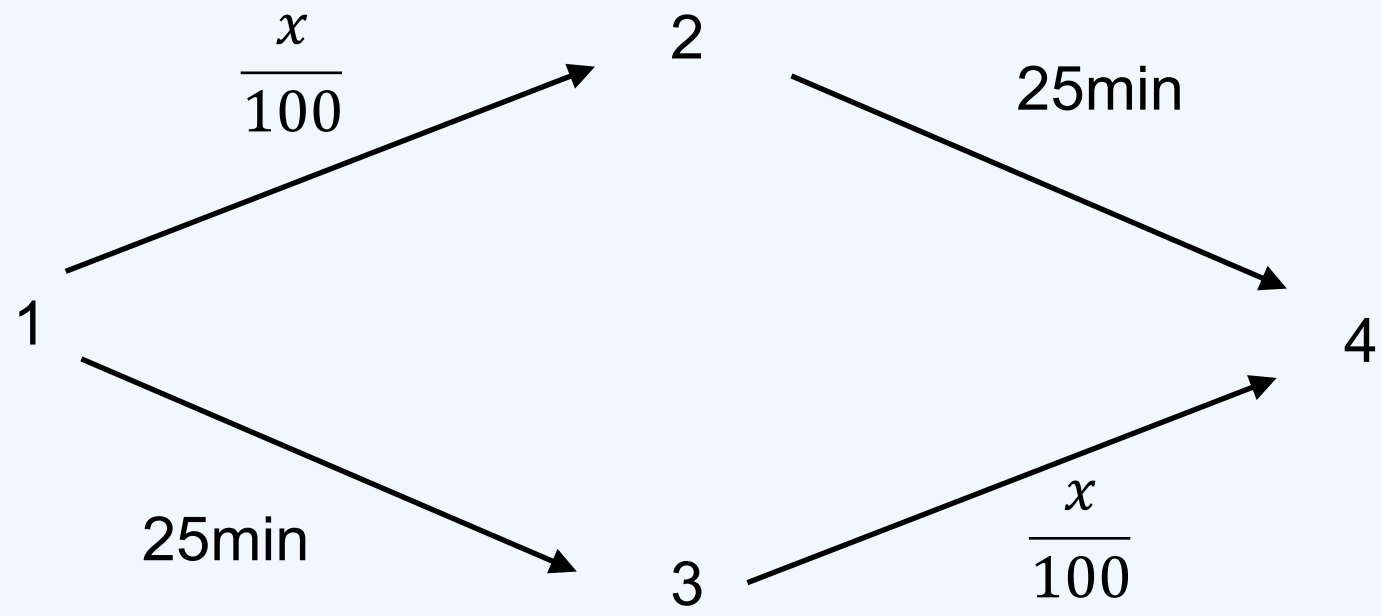
Mostly a math course

Rules and Suggestions

- "Theater rule": no electronics in class
  - Unless explicitly told
  - You may printout slides (useful in exams anyway)
  - If you insist on using electronic, please sit in the back row
- Take notes if possible
- Questions are very welcome
  - If you don't ask me, I may ask you (random quiz)

Tragedy of the commons: Braess' Paradox

- 2000 travelers from 1 to 4



- Centralized goal: minimize max delay
  - 1000 1→ 2→4; 1000 1→ 3→4;
  - minimax delay: 35min
- No one wants to deviate

Tragedy of the commons: Braess' Paradox

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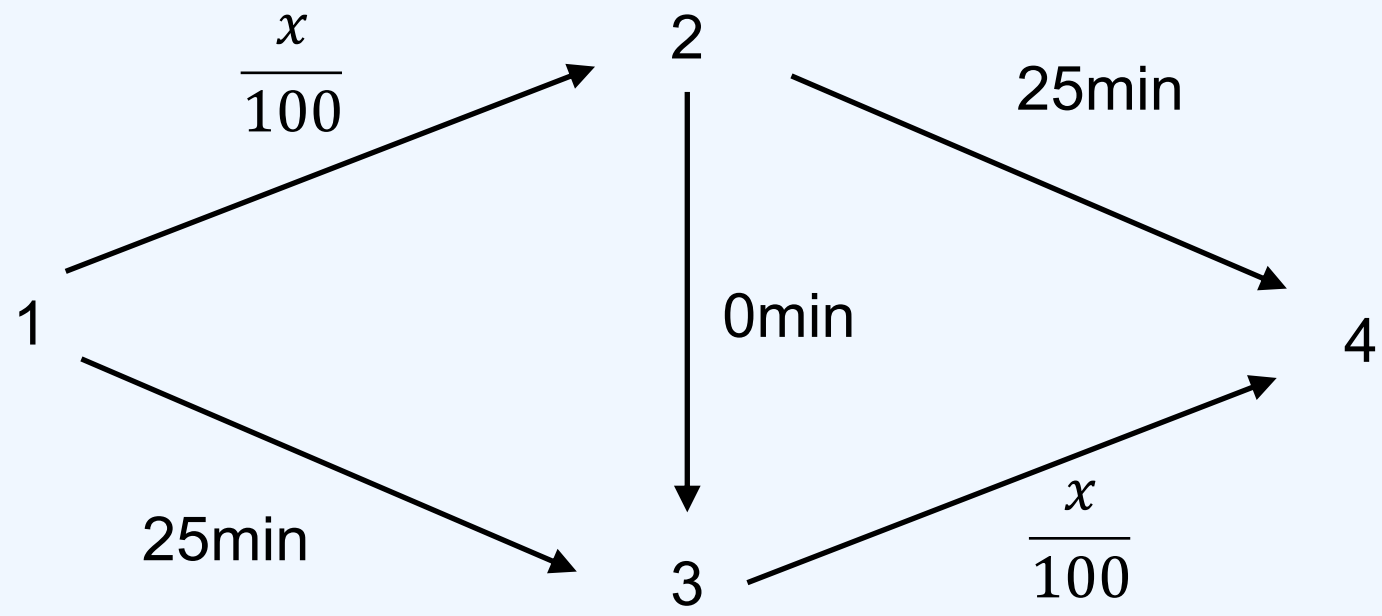

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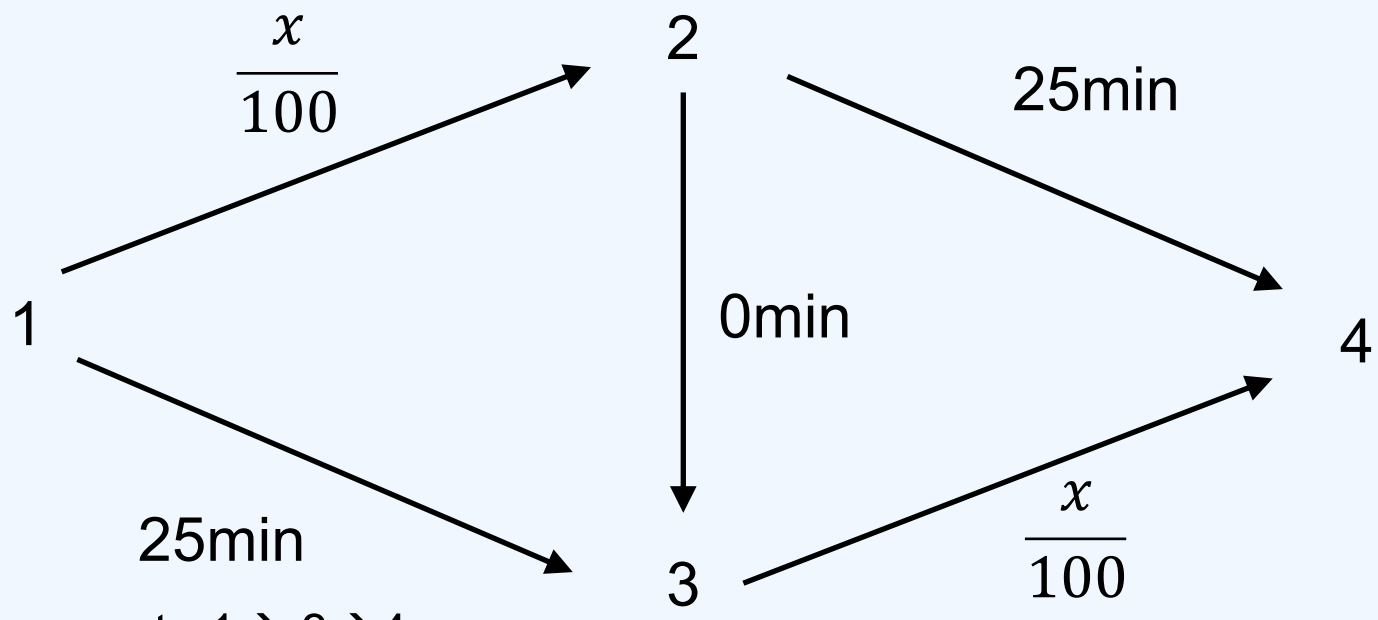


- No one wants 1→ 3→4
  - 1→ 2→3→4 is always better
- No one wants 1→ 2→4
  - 1→ 2→3→4 is always better
- Everyone goes 1→ 2→3→4, delay is 40min each
- Paradox: worse than the system without 2→3
- More in the "game theory" class

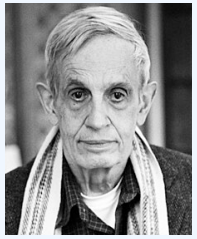
Goal of the course

- How to analyze the outcome?
  - Social choice, game theory
- How to incentivize people?
  - Mechanism design
- Economics + Computation
  - Incentives + computational thinking

Brief schedule

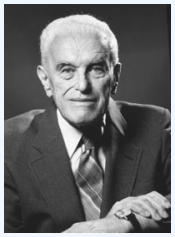
- (Algorithmic) Game theory
  - 3 days
- Auctions
  - 1 day
- Mechanism design
  - 1 day
- (Computational) Social choice
  - 2 days
- Wisdom of the crowd
  - 1 day
- Preference modeling
  - 1 day
- Bitcoin and blockchain
  - 1 day


Von Neumann


Nash

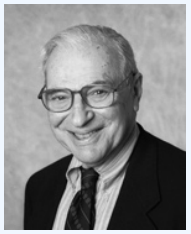

Selten


Aumann


Harsanyi


Myerson

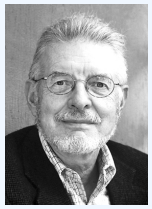

Vickrey


Arrow


Roth

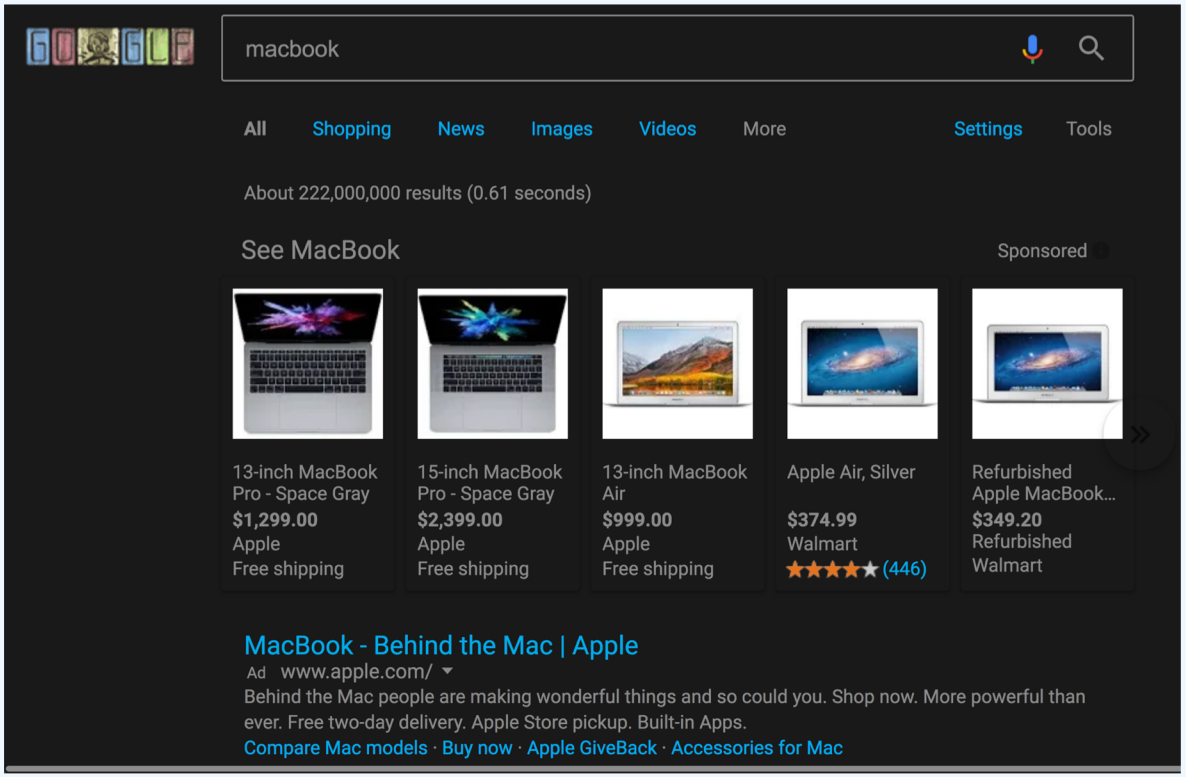

Shapley


Kahneman


McFadden

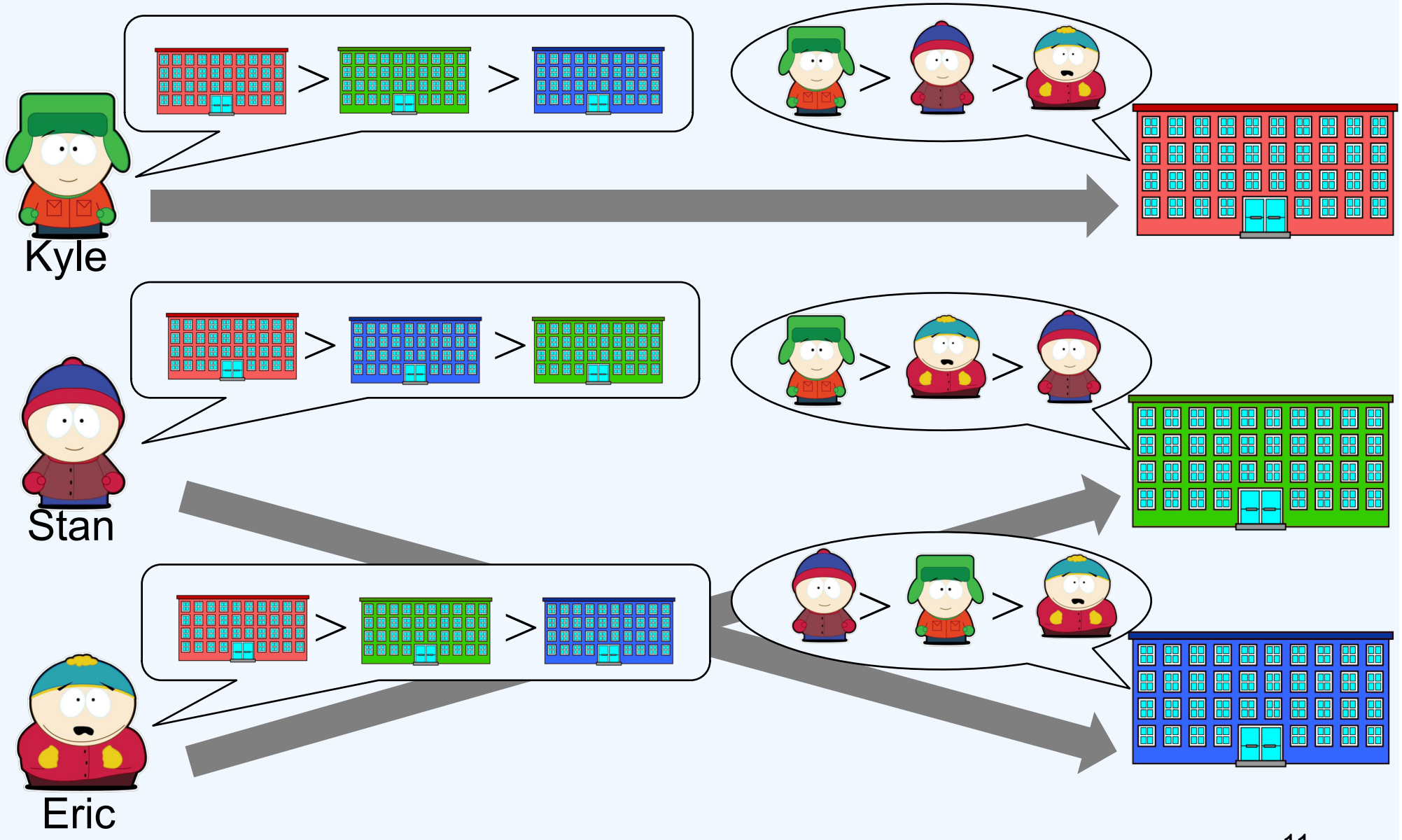

Hansen

Example: Auctions

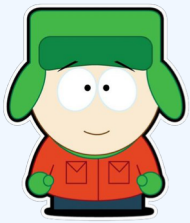


- 2nd price auction
  - highest bid wins
  - charged the 2nd highest price
  - more in the “auctions” and “mechanism design” class

Example: School choice

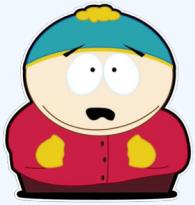


Example: Resource allocation



1 > 2 > 3 > 4 > 5 > 6

1 > 6 > 2 > 3 > 5 > 4

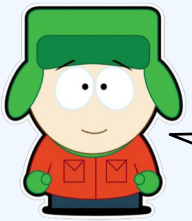


6 > 5 > 4 > 3 > 2 > 1

Sequential allocation

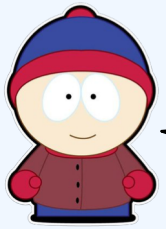
o

Kyle



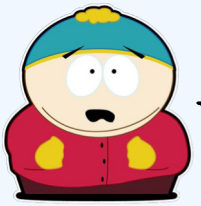
1 > 2 > 3 > 4 > 5 > 6

Stan

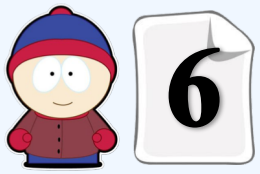


1 > 6 > 2 > 3 > 5 > 4

Eric



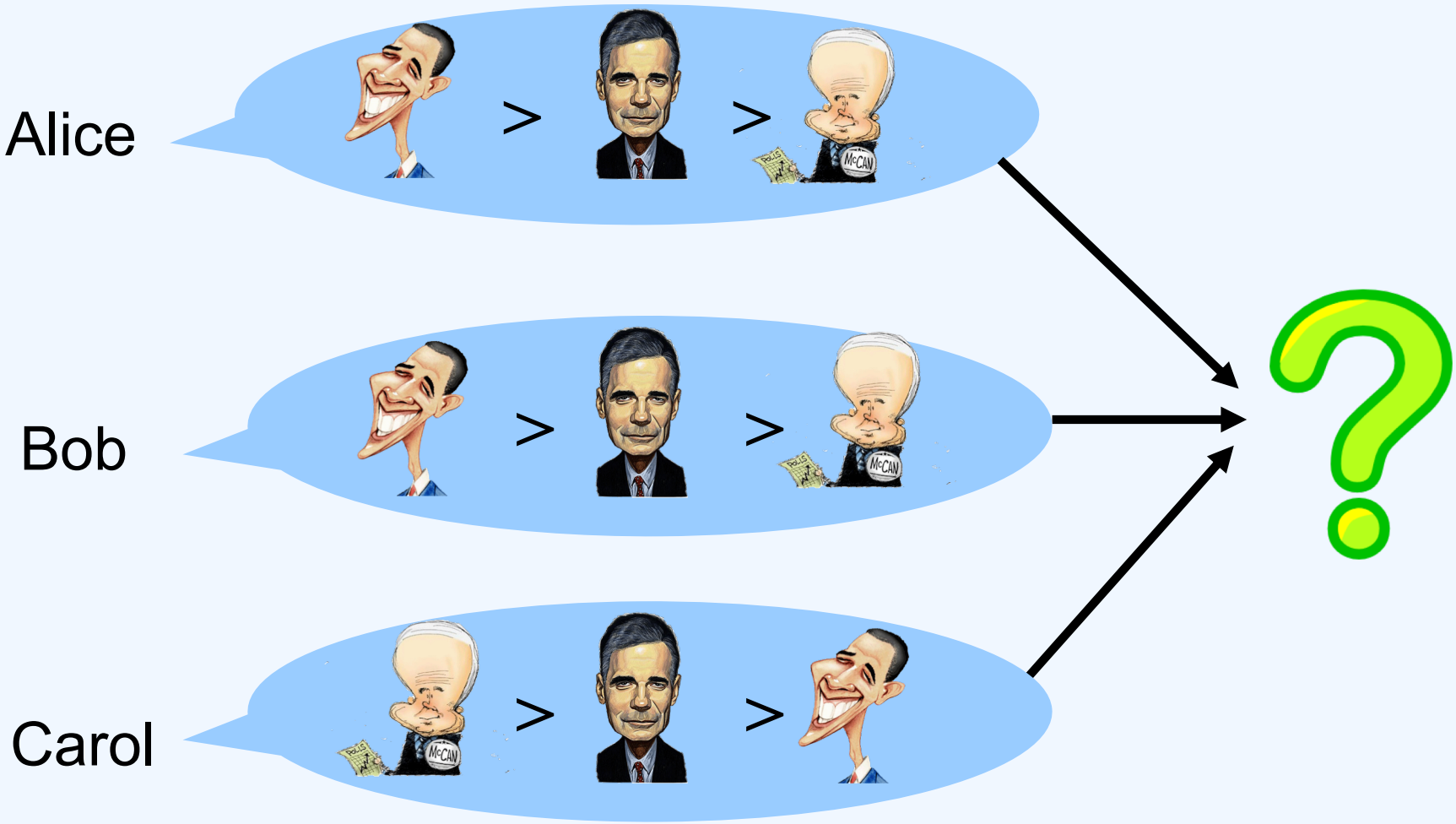
6 > 5 > 4 > 3 > 2 > 1

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6
					

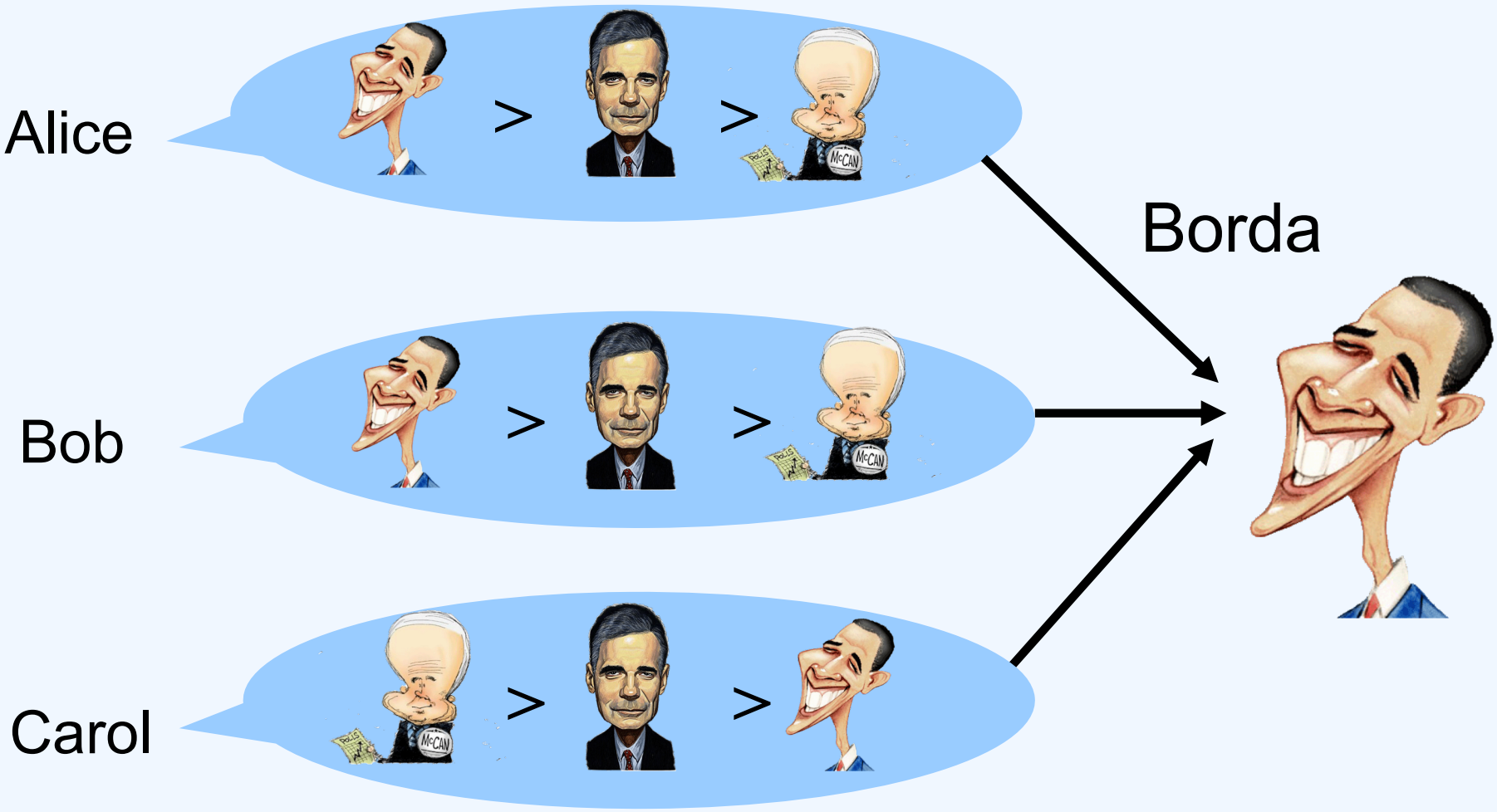
Is it a good mechanism?

- Sounds good
  - Efficient: if we have different preferences, then we will all (almost) get what we want
  - Fair: (1^{st} pick, last pick), (2^{nd} pick, 2^{nd} to last pick)…
- How can we formalize these ideas?
  - more in “matching and resource alloation”

Example 3: Political elections



Example of Borda

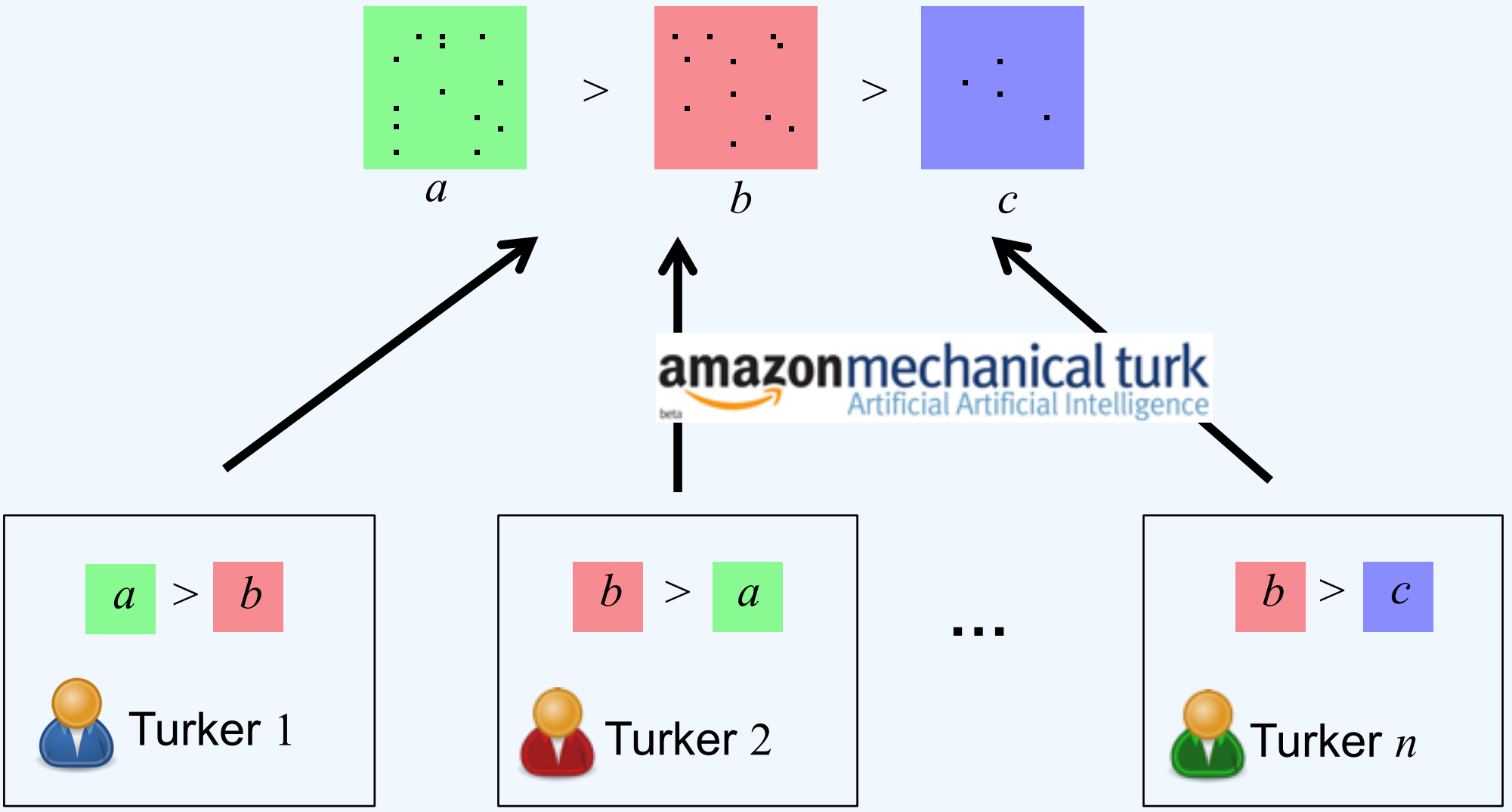


Total scores : 2+2+0=4 : 1+1+1=3 : 0+0+2=2

Other voting rules?

- Many other voting rules beyond Borda will be discussed in the social choice class
- Which one is the best?
  - Hard to compare.
  - Criteria will be discussed in the social choice class

Example: Crowdsourcing



Optimal way to make a decision

- How can we make an optimal decision by aggregating noisy answers from strategic agents?
  - more in “Wisdom of the crowd”

Grading, let's vote

- Final grades:
  - Option1: Participation 10%; Exam 30%
  - Option2: Participation 20%; Exam 20%
  - Option3: Participation 30%; Exam 10%
  - Option4: Participation 0%; Exam 40%
  - Option5: Participation 40%; Exam 0%
  - https://campusopra.cs.rpi.edu/polls/1072/

Before tomorrow

- Sign up on piazza
- Sign up on OPRA and vote
- Print the slides if you want
- Remember to bring computer/smart phone for in-class voting (but don't use it in class otherwise)