Normative Economics and System Performance

Ariel Procaccia

Disclaimer

- "Wild and crazy ideas"

- = "ideas so vague that it would be wild/crazy to present them"

- All statements appearing in this presentation are vague. Any resemblance to real research, published or unpublished, is purely coincidental
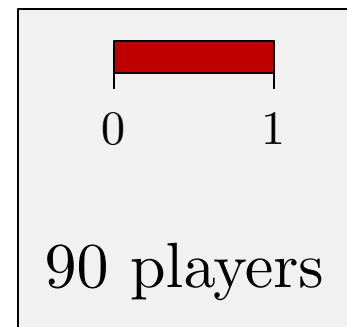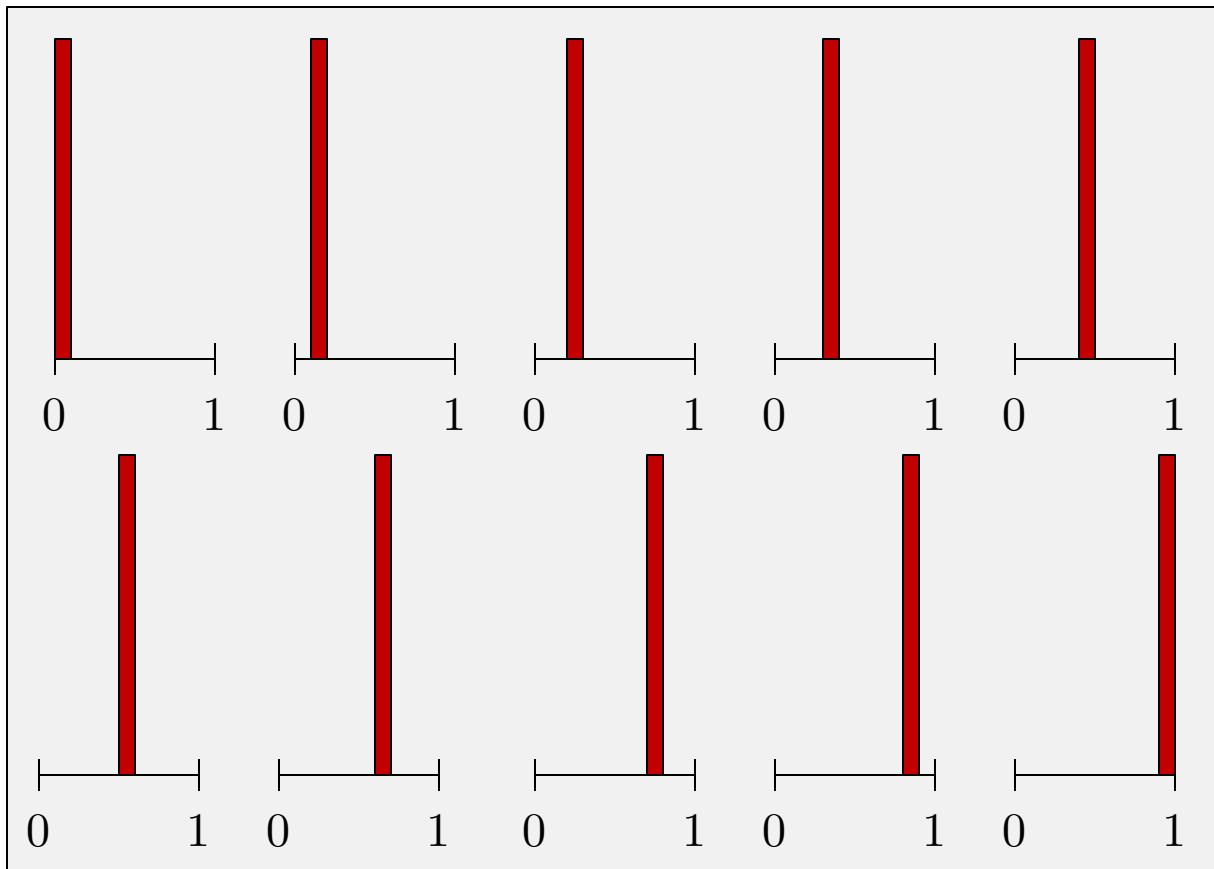
Fair division

- Example: cake cutting
- Cake is the interval [0,1]
- Players have heterogeneous, additive valuations; $\forall i, V_i([0,1])=1$
- Proportional allocation: $\forall i, V_i(A_i) \geq 1/n$
- Envy free allocation: $\forall i,j, V_i(A_i) \geq V_i(A_j)$

Price of fairness
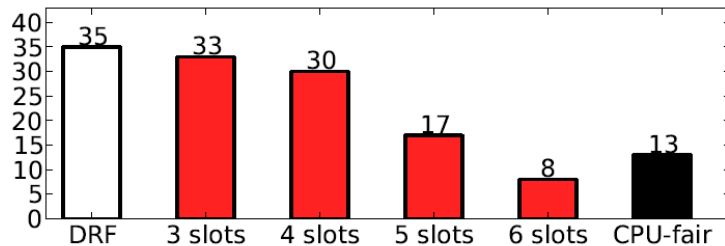

90 players

Nevertheless...

Figure 9: Number of large jobs completed for each allocation scheme in our comparison of DRF against slot-based fair sharing and CPU-only fair sharing.
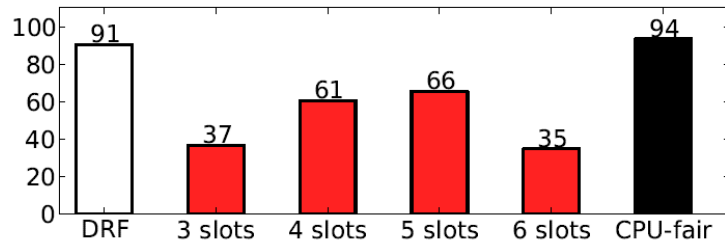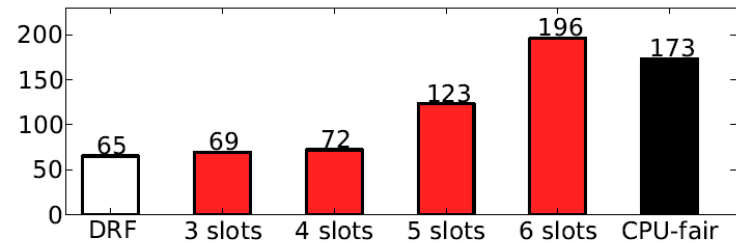
Figure 11: Average response time (in seconds) of large jobs for each allocation scheme in our comparison of DRF against slot-based fair sharing and CPU-only fair sharing.

Figure 10: Number of small jobs completed for each allocation scheme in our comparison of DRF against slot-based fair sharing and CPU-only fair sharing.
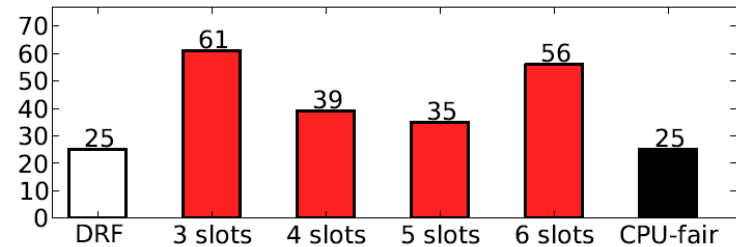
Figure 12: Average response time (in seconds) of small jobs for each allocation scheme in our comparison of DRF against slot-based fair sharing and CPU-only fair sharing.

From: Ghodsi et al. Dominant resource fairness: Fair allocation of multiple resource types. NSDI 2011.
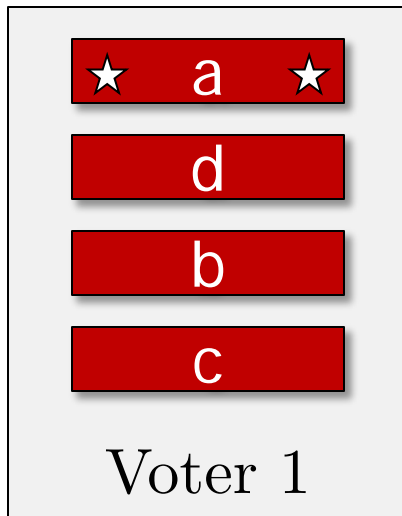
Social choice

- Set of voters and set of alternatives
- Each voter ranks the alternatives
- Voting rule maps rankings to winning alternative
- Axioms used to compare voting rules
- Axioms designed to guarantee "socially desirable" outcomes
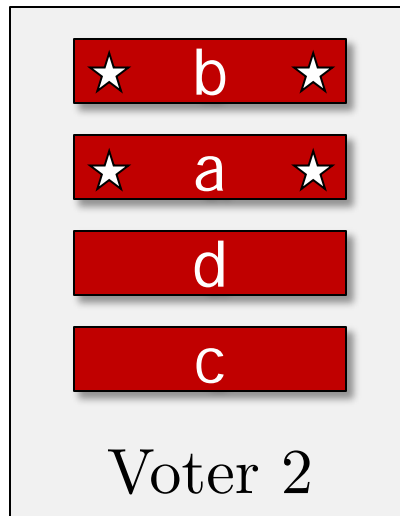
Monotonicity

Voter 1	Voter 2	Voter 3
★ a ★	★ b ★	c
d	★ a ★	★ d ★
b	d	★ a ★
c	c	b

Discussion

- Can we quantify the benefit of axiomatic properties to system performance?

- The AI perspective:
  - Do axioms like monotonicity or envy-freeness have any meaning in a multi-agent system?
  - Example metric: robustness to random failures
  - Super vague connection: monotonic boolean functions guarantee some level of noise sensitivity

- A good answer could be important