Computationally Feasible VCG Mechanisms
Recap Terms

Mechanism Design- Field of study dedicated to protocol design for non-cooperative environments.

Incentive Compatible/Truthful- when all participants receive their personally prefered outcome only through truthful interaction with the mechanism.

VCG- Only general truthful mechanism construction algorithm.

IC Example: Second price auction model
Why do we need a non-optimal IC mechanism?

- Vanilla VCG is infeasible for complex problems.
  - Optimal outcome calculations for complex problems are NP-complete
  - VCG requires optimal outcomes to find a truthful mechanism.
- These complex problems are highly applicable to many fields.
  - pg. 20, 2nd paragraph lists the various fields that would benefit from a new algorithm.
Terms To Know

Reasonable-If only one participant desires an item, that participant will receive that item.

Combinatorial Auctions: Similar to a standard auction except it allows participants to place a bid for any subset of (or entire set of) the auctioned items.
Can we modify VCG to use suboptimal outcomes?

- Yes, VCG-based suboptimal mechanisms are possible, but
  - the mechanisms are not **truthful** (Lehmann, O’Callaghan, & Shoham, 2002; Nisan & Ronen, 2001)...
  - or **reasonable** (Theorem 3.8)...
  - and some results are **degenerate** (Corollary 3.14)...
- Without these properties, the mechanisms are not usable in a practical setting.
Maximal in its Range
Section 3.1 Theorems for Truthfulness
Theorem for Reasonableness

Mechanism R

Mechanism B
Second Chance Mechanism

- Uses the VCG-based algorithm, but takes an additional input in the form of an appeal function.
- The SC mechanism takes the appeal function and the default VCG function and picks the one that maximizes general welfare for agent types.
- In the case where a participant’s appeal function is accepted, they have strong incentive to report truthfully as their valuations would be centered around their own truthful reporting.
Second Chance Mechanism’s Flaws

- The paper does not explain a method for collecting these appeal functions.
- No thorough proofs to demonstrate effectiveness in the paper.
- Only guarantees that manipulating the system will most likely be too difficult for a human to deduct.
- No empirical research into using this algorithm.
Conclusions and Questions

- VCG Mechanisms are not computationally feasible for complex problems.
- VCG-based mechanisms are not very useful.
- Second Chance has potential pending future experimentation.

Question 1: Considering the lack of empirical testing data for the second chance mechanism, do you think the mechanism could be useful for solving these complex problems?

Question 2: The paper mentions tools for gathering appeal functions, but is vague on how these tools would work or what form they would take. How would you envision these tools? Do you think they would be practical in an application?