

Voting and Democracy

Math Final Guidelines

The math portion of the final will represent 25% of your grade. You will be allowed to bring in one sheet of paper with notes to use on the final. The sheet must be handwritten and in your own handwriting and must be prepared by you.

We will cover two broad topics in the math portion. They are:

Social Choice Functions and Welfare Functions

Things to know:

- The definitions (and difference between the definitions) of a social choice function and social welfare functions.
- The social choice and welfare functions we covered (eg. Plurality, Borda Count, Hare, etc.)
- The desirable properties for social choice and welfare functions that we covered (eg. always-a-winner, Condorcet winner criterion, Pareto condition, monotonicity, independence of irrelevant alternatives)
- Statements of May's Theorem and Arrow's Impossibility Theorem

Things you will need to be able to do:

- Show that a given voting system does or doesn't satisfy a desirable property.

Things you will not be tested on:

- Approval Voting
- The proofs of May's Theorem and Arrow's Impossibility Theorem
- Black's Theorem and Single Peakedness

Simple Voting Games (aka: Yes/No Systems)

Things to know:

- The definition of Simple Games (known as Yes-No systems)
- The US Federal System
- Definition of Swap Robust
- Definition of Banzhaf and Shapely-Shubik power indices
- What binomial coefficients are and how to use them
- The method is used to compute the power of the president
- The definition of saying one player is more desirable than another in a simple voting game
- The definition of a hierarchy for simple games
- Which hierarchies are possible

Things you will need to be able to do:

- Determine if a given simple voting game is swap robust
- Calculate the Banzhaf and Shapely Shubik indices for a player in a (small) simple voting game (possibly using binomial coefficients).
- Determine the hierarchy of a simple voting game
- For a given hierarchy, determine if it is possible and if so construct a weighted voting game that satisfies the hierarchy.

Things you will not be tested on:

- All other examples of simple voting games (procedure to amend the Canadian Constitution etc.) if you need them they will be given to you.
- Trade Robustness
- The details (actual numbers) in the computation of the power of the president
- Proofs of the impossibility theorems for the hierarchies

Dr. Parker's Office Hours Finals Week: Monday and Tuesday: 1:30 – 3:00 PM
Math Review Session (Location TBA): Thursday 1:30-3:00 PM