

Math 217 – Voting Theory – Course Policies

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TEXTS: *Chaotic Elections* by Don Saari and
Fair Representation by Michel Balinski and Peyton Young

Overview

Over the last two centuries, certain questions involving the design of political structures have arisen that at first glance, appear fairly straightforward to answer; however, they actually require some deceptively subtle, and sophisticated, mathematical analysis. These questions have contributed to the development of the academic discipline of Social Choice Theory, which has attracted attention from a variety of fields including economics, political science, mathematics, and psychology.

In this course, we will focus on three major questions:

- How can the ideal of “One-Person-One-Vote” be implemented? This leads to the study of measuring the power of a voter in a voting system, which becomes quite subtle when applied to voters who elect representatives who then vote in a representative body. We will use these measures of power to study the implications of the various proposals considered for voting in the Council of Ministers in the expanding European Union as well as measuring power in the United States Electoral College.
- Every ten years, a census is taken in the United States. How are the seats in the House of Representatives assigned to the states? This seems very straightforward, but the fundamental problem is that you cannot assign a fraction of a seat to any state. In addition to studying the very thorough and beautiful mathematical analysis of apportionment laid out by Balinski and Young, we will also examine the interesting, and sometimes entertaining, politics that have come into play.
- If there are more than two candidates in an election, how does a voter indicate her preferences, and what method is used to determine the winner? We will approach this through the very nice geometric framework that Don Saari has developed to understand why different voting methods give different outcomes, even if no voter changes her vote. One of our goals is to understand why different procedures behave as they do so that we can identify when we have inadvertently made a bad decision. This has applications not just in political elections but in any group decision process.

This course forms a connection with the Political Science course Pols 211 Congress and the Legislative Process, taught by Professor Marcus Allen. He will visit our class at various times during the semester, and you will complete a joint project with the students in Pols 211 that will explore the intricacies in re-drawing the boundaries of single-seat legislative districts following a new census.

This is going to be a really fun semester.

Evaluation

Your final grade will be determined by

Two Exams	30%
Comprehensive Final Exam	20%
Presentations and Projects	15%
Homework	35%

The Honor Code

Remember that we are operating under the Honor Code for all of your academic work while you are at Wheaton. I take this quite seriously. This carries freedoms and responsibilities for both you as students and me as the professor. The best approach is to avoid any situation where there is a temptation to violate the Honor Code. Or if you find yourself in such a position, you should remove yourself from it.

Remember that you should write out, and sign, the following statement on all course work:

“I have abided by the Wheaton College Honor Code in this work.”

Working with Other Students

Several of the assignments this term will be group assignments where you will work in groups of two (preferably) or three of your choosing. Each assignment will receive a grade, and the group will determine how the points are allocated to each member. For example, if a group of two receives an 85 on an assignment, then the group will have $2 \times 85 = 170$ points to distribute among them. I will be available to mediate this process, if necessary.

Exams

On each of the two exams, there will most likely be an inclass part and a more substantial takehome part. The Final Exam will be comprehensive and most probably be entirely takehome. I strongly suggest that you begin these early to leave time to ask me questions about the exam. See the syllabus on the course web page for the dates of the exams.

Presentations and Projects

We will only scratch the surface of many topics during class, but you will have the opportunity to explore one of these areas in more depth in a group project that will culminate in a paper and a presentation to the class in the last week of the classes. More details and deadlines will be forthcoming about this project and the joint project with Pols 211.

Homework

A major emphasis in this course is that you learn how to write precise and complete mathematical arguments. This can be a challenging endeavor and may be somewhat different than in your other math courses, but the process will not only aid your mathematical development but can also greatly improve your clarity of thought in other disciplines and areas as well. With this emphasis, your homework should be precise, comprehensible, completely justified, and written in complete sentences.

The homework assignments will alternate between Individual assignments and Group assignments. For the Group assignments, *each* student should attempt *all* of the homework problems, and the group should meet to complete the assignment. Each group will turn in one paper with one student designated as the primary author who writes-up the solutions for that assignment. **The role of primary author must rotate among the members of the group.**

You may discuss the Individual assignments with other students, but each person must turn in a separate paper that represents his/her own work. In addition, you should cite each student with whom you discussed the homework.

Most of the homework problems will be graded on a scale of 0–10 with the following guidelines:

- 10: Exceptional. All areas perfect.
- 8: Essentially complete. Needs minor improvements.
- 5: Needs substantial improvements
- 1: Needs improvement in all areas

If a problem is worth a different amount, the guidelines will be scaled appropriately.

Here are a few guidelines for the presentation of your homework. If you do not follow these, I reserve the right to return your homework ungraded!

- You *must* cite other students you work with on the assignment.
- Be sure to label the primary author on the group assignments.
- Your writing must be clear and legible.
- If you do work with someone else on an assignment, you should indicate that in a note on the top of your paper.
- Your homework should be well-written, using complete sentences to justify your results where necessary. *A list of answers without explanation is not acceptable.*
- Here is a good rule of thumb to follow when writing up your homework:

Write your solutions so that you could hand them to another student in the class and she could understand your explanation.

- If you write in pen, there should be no scratch-outs.
- Do not turn in paper torn from a spiral notebook with ragged edges. Scissors are a mature technology that you can use to solve this problem.
- Clearly label each problem.
- Remember to include the Honor Code pledge on every assignment.

The assignments can be time-consuming, so you should definitely plan to start early and to take advantage of my office hours. The homework is due in my office by 4:00 on Thursday. Be aware that

Late homework is not accepted!! No exceptions!!

Course Expectations

The class will be structured with some lectures to emphasize particular topics, but much of the time will be devoted to discussion or in-class work. You will have a reading assignment for nearly every class meeting, and it is **extremely** important that you complete the reading before the next class meeting. The class meetings are not intended to be a complete encapsulation of the course material, but instead will focus on the major concepts from the reading and clarifying the more subtle ideas in the course.

You should expect to put in at least 3 hours outside of class for each hour in class. In other words, expect to spend a minimum of 9 hours per week outside of class. There will be some weeks where you spend more time (e.g. working on projects or preparing for exams), and there may be some weeks where you devote less time.

Class Attendance

Although class attendance is not a specified percentage of your grade, I will keep a class roll to help me determine borderline grades at the end of the semester. If you do miss class, you are responsible for the material that was covered.

Getting Help

Please come see me during my office hours! If you have a conflict and cannot make my office hours, please call or email me and we can set up an appointment for another time.