

Math 217 – Voting Theory – Course Policies

PROFESSOR: Tommy Ratliff, Science Center 101, x3968
EMAIL: tratliff@wheatoncollege.edu
HOME PAGE: <http://acunix.wheatoncollege.edu/tratliff/>
TENTATIVE Monday 3:30–4:30
OFFICE HOURS: Wednesday 3:30–4:30
Thursday 2:00–3:00
Friday 10:30–11:15
And by appointment (Really!)
TEXT: *Chaotic Elections!* by Don Saari

Overview

The mathematical study of voting theory began in the late 18th century, but it did not gain prominence until Kenneth Arrow's celebrated Impossibility Theorem in 1951. Most disconcerting to students new to the area are the results that there is no completely "fair" voting system and that every voting system can be manipulated through strategic voting.

Although these results are bothersome, we will see that they should not come as a surprise. One of the goals of voting theory is to understand why different procedures behave as they do so that we can identify when we have inadvertently made a bad decision. In addition to the expected applications to political elections, we will frame our discussions in terms of any group decision process. There are also some very interesting applications of voting theory to computational biology and computer science, and we will see how the problem of apportioning legislative districts easily generalizes to the much broader field of fair division.

This is going to be a really fun semester.

Evaluation

Your final grade will be determined by

Homework	30%
Two Exams	30%
Comprehensive Takehome Final Exam	15%
Presentations and Projects	25%

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 require several iterations, 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.

An important aspect of your mathematical development is that you learn to discuss mathematics with others and collaborate on problems. The homework assignments will alternate between Individual assignments and Group assignments. On the group homework assignments, you will work in groups of two and turn in one paper. It is extremely important that both of you understand every solution that your group produces. On each assignment, one student will be designated as the primary author who writes-up the solutions, and the role of primary author must alternate between 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.

Exams

The two exams during the semester will have a closed-book, inclass component, which will count for 20-25% of the total grade. The remaining part of the exam will be open-book and takehome. You will have at least five days to complete each takehome exam and at least one week to complete the final exam. I would strongly suggest that you begin these early to leave time to ask me questions about the exam.

A Few Notes on Your Homework and Exams

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

- Your writing must be clear and legible.
- Your solutions 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 work:

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

- Do not turn in your first draft of the assignment. You should expect to *neatly* recopy and organize your work.
- If you write in pen, there should be no scratch-outs.
- Do not turn in paper torn from a spiral notebook with ragged edges.
- **Homework is usually due at 2:00 on Friday afternoons.**

I strongly recommend that you turn in all assignments on time. For each 24 hour period that an assignment is late, you will lose 25%.

Presentations and Projects

Toward the end of the semester, you will give a group presentation on a topic of your choosing that we have not discussed during class.

You will also write a book review on a mathematical book written for a popular audience. There are many possibilities, including *Fermat's Enigma*, *A Mathematician's Apology*, *Flatterland*, *The Code Book*, *The Man Who Knew Infinity* (a biography of Srinivasa Ramanujan), and *The Man Who Loved Only Numbers* (an account of Paul Erdos). I can help you find a book for this. More information will be forthcoming during the semester.

The Honor Code

Remember that we are operating under the Honor Code for all of your academic work while you are at Wheaton, and 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 great temptation to violate the Honor Code, or if you find yourself in this position, remove yourself from it.

At the Faculty Meeting on March 7, the Wheaton faculty approved a resolution that all students should write out, and sign, the following statement on all course work:

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

Grading of Group Assignments

Each group assignment will receive a single 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 a presentation, then the group will have $2 \times 85 = 170$ points to distribute between them. I will be available to mediate this process, if necessary.

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.

MONDAY	WEDNESDAY
	9/3 Welcome to Math 217 & Course overview
9/8 Three Candidate Elections & The Representation Triangle	9/10 The Procedure Line & Approval voting region
9/15 A Fundamental Decomposition of \mathbb{R}^6	9/17 More on the Decomposition <i>Group HW Due 9/19</i>
9/22 Creating paradoxes <i>Title for Book Review Due</i>	9/24 Four Candidate Elections <i>Indiv HW Due 9/26</i>
9/29 A Fundamental Decomposition of \mathbb{R}^{24}	10/1 The No-Show Paradox Exam 1 In-Class <i>Group HW Due</i>
10/6 Arrow's Impossibility Theorem	10/8 Independence of Irrelevant Alternatives Exam 1 Due
10/13 Fall Break	10/15 Understanding Arrow's Theorem <i>Progress Report on Book Due</i>
10/20 "Overcoming" Arrow's Result	10/22 Should Lincoln have won the 1860 Presidential election? <i>Indiv HW Due 10/24</i>
10/27 Yes/No Voting Systems	10/29 Measuring Influence: Power Indices Book Review Due <i>Group HW Due 10/31</i>
11/3 Power Indices	11/5 Generalizing Power Indices Exam 2 In-Class <i>Indiv HW Due</i>
11/10 Proportional Representation	11/12 Apportionment Exam 2 Due
11/17 Fair Division <i>Topic for Group Presentation Due</i>	11/19 Fair Division
11/24 More Fair Division <i>Abstract for Presentation Due</i>	11/26 Thanksgiving Break
12/1 The Gibbard-Satterthwaite Theorem	12/3 The Gibbard-Satterthwaite Theorem
12/8 Group Presentations	12/10 Group Presentations

Final Exam due Saturday December 20, 11:00 am