Math 342 – The Mathematics of Social Choice (Fall 2023)

Instructor: Kevin Woods. Call me Kevin! (he/him)

Contacting me: Kevin.Woods@oberlin.edu or 443-695-1681 (mobile). Email is better for involved or less important questions; texting is better for quick, time-sensitive questions.

Class: TuTh 9:30-10:45am, King 323.

Google Drive: I will post assignments and other material in the course Google Drive folder. I recommend bookmarking this link (it is available from blackboard, if you need).

Problem sessions: Fridays 3:30-5pm, Math Library (King 203). Come individually, come in groups, come with questions, come to get started on the homework with other students around. Your choice! Showing up to this is a great way to find other students to collaborate with.

Other office hours:
- Mondays 10:30-11:30am and 2-3pm, my office (King 220B).
- Tuesdays 12-1pm, my office (King 220B).
- Thursdays 12-1pm, my office (King 220B).
- Fridays 12-1:30pm, Math Library (King 203; these are the problem sessions for my other class, so I will give them priority, but you are still welcome to come).
- If these times don't work, you can make an appointment via email.

Textbook: None. I will give you handouts of what I talk about in class.

Prerequisites:
- MATH 220 (Discrete Mathematics). The only important thing from Discrete is comfort with mathematical proofs and readiness for a 300-level math class. Even though the subject matter is very approachable, **this is a 300-level math class**: there will be challenging proofs, and things will sometimes get abstract.
- An implicit prerequisite is Calc I (a prerequisite for Discrete). In the last third of the class, we will need optimization using derivatives, simple integration, and an intuitive understanding of Riemann sums.

Learning Goals: At the end of this course, students will:
- Have knowledge of a number of different areas within the mathematics of social choice, including voting, auctions, matching markets, fair distribution, and game theory.
- Have experience thinking axiomatically, algorithmically, and strategically about these problems.
- Have confidence proving statements and mathematically manipulating examples in this field.
- Gain confidence and proficiency in their mathematical writing.
- Have experience working with other students on mathematics (this one is up to you to work on).

Assignments and Grades:
- Your focus should be on **growth**, but grades are a fact of college life. **If I can see that you are working hard and seeking support, you will pass this class.** If you find yourself preoccupied with grades, consider taking it P/NP.
- Your grade will be based on **weekly problem sets** and a small amount of **peer grading**. For the most part, you can and should work on the weekly problem sets in groups, but (in lieu of take

home exams) there will be a problem or two on each problem set that I expect you to work alone on.

- The best way to learn the concepts in this course is to get your hands dirty! I hope you will work in groups on these, though your written solutions must be in your own words. This is also an opportunity to work on writing careful, clear proofs and explanations. Good mathematics is articulate mathematics! Explain things carefully and in complete sentences. Imagine that another student in the class who hasn't done this problem yet will read your solution: they should be able to understand it without having to ask you questions.
- Problem sets will be due approximately every Tuesday, **in class, on paper.** I will drop the two lowest problem sets. Life happens: you get busy, you get sick, you self-isolate, you oversleep, you struggle in the class but slowly improve, and I want to acknowledge that. There will be a final problem set due at the end of the scheduled final exam time (Tuesday, December 19, 11am) that will count as one or two problem sets.
- Late Work: If you ask in advance, I'll generally give you about 24 hours extra. After that, late work is generally not accepted, because we have a complicated system of peer grading, and it is logistically difficult to deal with late work. I drop two problem sets because I know that everyone has bad days or weeks, so it is perfectly ok to simply skip that week.
- **Honor Code:** I encourage you to work together on the problem sets. Your solutions must be in your own words, however. Work on the problem together, and then go back home and write up your solution. You should never go looking for the solution to a specific problem (e.g., don't read someone else's solution, search the internet or a book, or ask reddit/AI/etc. online). And there will generally be a clearly marked problem or two that you have to work alone on; treat these like take-home exam problems in typical classes.
- About three times in the semester, you will be responsible for meeting in small groups to grade other students' homework. This is a valuable opportunity to grow as a mathematical writer, because you will see how other students construct arguments, use mathematical language, and what you find confusing vs clear. Your grade will be determined by completing this task and sending me a follow-up reflection; all together, these will count as one problem set that cannot be dropped. More details to follow.

Support:
- You belong at Oberlin and you belong in this class. People arrive here with different experiences and backgrounds in mathematics. Put in the work, seek out support, and focus on self-improvement, and I promise you that **your mathematical skills will grow**. The rest of us are here to help, including:
- Me! Come by office hours, any time.
- Your peers! Working with other students helps everyone improve.
- **Yourself!** Your skills will improve best if you come at this with a growth mindset: embrace the challenge of this class, persist through difficulty, be inspired (not threatened) by the success of others, seek out support.
- If you have a disability of any sort that may affect your performance in this class, please consult with me and with the [Office for Disability and Access](). I am committed to meeting the needs of all students in my class.
- **I want you to succeed, and I want to help you succeed.** Please let me know how I can help!