THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Department of Mathematics

Mathematics of Social Choice

Course Number and Title:
MA 108-2C
Mathematics of Social Choice

Credit: 3 credit hours

Class Meeting Times:
Tuesday/Thursday @ 11:00 am
UH 2009

Prerequisite: There is no specific mathematical prerequisite. Students should have a high school degree meeting the mathematics requirements of the Alabama curriculum.

Resources
Materials and assignments for this course will be located on the Canvas Learning Management system. Mathematics of Social Choice by Christoph Borgers is an optional resource that you may want to purchase.

Instructor Info
Lauren Wickman, PhD
Office: UH 4037
Email: lwickman@uab.edu
Office hours:
M 10:00-11:00,
T 12:30-1:30
W 1:00- 2:00
R 12:30-1:30
Forrest Hilton, **GTA**
Office: Math Learning Lab
Email: fmhilton@uab.edu
Office hours: Tu/Th 3-4 PM, MLL (HHB 202)

Course Description and Objectives:

You make decisions daily. Most are insignificant such as what to eat or where to study while others are of more consequence such as how much insurance is enough. Groups make decisions as well. Who will be mayor and how will they be selected? Should a company allow employees to work from home? How can an inheritance be divided fairly? The organizing principle of the course is that mathematics underlies many of our social choices and can assist in deciding what to do and determining what is fair. For most people, the value of mathematics lies in applications. While our society depends upon a great deal of technical mathematics that is mastered by a minority of the population, this course takes the view that there are many useful applications of mathematics that require only an understanding and computational familiarity with elementary mathematics. In this course, you will construct models of problem situations, translate verbal descriptions into mathematical form, use quantitative evidence as a basis for reasoning, argument, and drawing conclusions, and communicate your results to an audience appropriately.

Learning Outcomes:

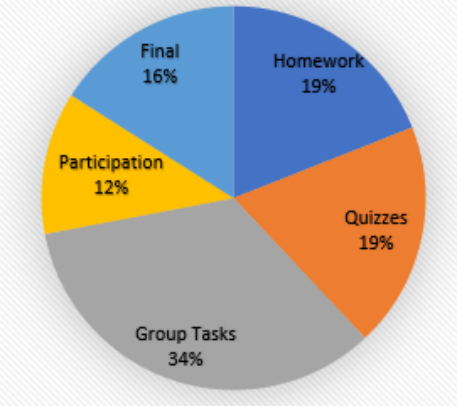
Upon successful completion of this course, students will be able to articulate an understanding of, solve problems related to, and make informed decisions regarding:

1. principles of fair division, including both equal and unequal entitlements (QL1);
2. methods of dividing both divisible and indivisible resources fairly (QL 2);
3. apportionment methods, the principles of fairness that one might want an apportionment method to satisfy, and the paradoxes of trying to satisfy all the desirable principles. Interestingly, one paradox is known as the "Alabama Paradox." (QL 2);
4. voting methods, the principles of fairness that one might want a voting method to satisfy, and the paradoxes of trying to satisfy all the desirable principles (QL 1);
5. the evaluation of data, as well as commonly seen misleading displays of data (QL 3).
6. cost-sharing rules and the mathematically articulable value of different game positions (QL 2);

Course Requirements:

You earn your grade in the course as shown in the tables below. Each grade component is described in the paragraphs that follow. Points accumulated will be recorded in Canvas within one week of the completion of the assignment or activity. Due dates will be listed in the Canvas calendar.

Grade Element	Points
Canvas Homework	112
Canvas Quizzes	112
Participation	70
Group Assignments	206
Final Exam*	100
Total	**600**



Canvas/ALEKS Homework (19% of grade)

Homework is due each **Friday** for the entire semester. Each assignment is worth 8 points. You are strongly encouraged to begin homework before the due date as some of the information available on homework assignments will be useful in class assignments. You have access to textbook resources through the ALEKS platform. Homework assignments typically include videos which may be especially beneficial to in-class assignments. Homework assignments may be submitted after the due date for partial credit.

Canvas/ALEKS Quizzes (19% of grade): Quizzes are due on **Fridays** of the assigned week. Typically, quizzes are brief. The purpose of this quiz is to solidify work from homework and in class. Each quiz counts 8 points. Quizzes may be submitted late for partial credit, please note that they are no longer available after the close date.

Group Tasks (34% of grade): This is an inquiry-based course. Therefore, nearly all group assignments will begin in class with you working with other students in a randomly assigned group. Although you work in groups to complete in-class assignments, each person turns in their own written work to be graded. You are responsible for learning the material, and you will be expected to perform on your own, particularly on quizzes and the final exam. Assignments are due on a weekly basis and will be submitted in Canvas. You will also have the opportunity to present your work or that of your group in class as part of participation in processing. Group work for this course is designed to engage you in interesting tasks related to the math of social choices in ways that develop the essential learning objectives of this course.

> **Late Assignment Policy**: Assignments no more than one class meeting late will be subject to a 10% grade penalty. Assignments more than one class meeting late are subject to greater penalty at the discretion of the instructor.

Participation (12% of grade): You are expected to participate actively, particularly in small group work, in-class group activities, and class discussions. **Mere presence does not constitute ACTIVE participation.** Participation points are awarded as in the following table. Note that it is possible to earn MORE than 70 points total for the semester since we will have about 14 weeks of class. Points earned beyond 70 are extra credit. Students who participate fully generally enjoy the class more and increase their learning.

Level of Participation	Points
Be present in class	1
Make minimal contribution to class discussion or group task	2
Contribute significantly to group task	3
Contribute significantly to class discussion	4
Make substantially correct presentation to the class	5
Make correct presentation to the class	6

Final Exam (16% of grade): The final examination will consist of several problems like the major problems and applications of the course, but not repeating problems from the course. You select a small number of problems to complete from a longer list. (*However, a bit later in the term, we will have a class vote on periodic tests instead of a final exam. See Learning Outcome 4.)

Make-Up Policy. There are no make-up quizzes or presentations for absences resulting in decreased participation or quiz credit. If you miss a class for a verifiable emergency, illness, necessary medical appointment, medical isolation, or on UAB official business, the instructor will work with you to find a reasonable accommodation

Final Grades are assigned as follows:

Points Earned	Course Grade
540 points or more	A
480-539 points	B
420-479 points	C
360-419 points	D
Below 360 points	F

There are many resources available to you both through the math department and through other UAB resources designed to ensure your success. You can reach me through email or office hours. The Math Learning Lab (MLL) is open Monday – Friday for student assistance. You can simply show up and ask for help.

Below is a link to additional UAB academic resources. Please ask me if you have questions about whom to contact. Also see Module, UAB Policies and Resources, in our Canvas course.

https://www.uab.edu/students/academics

Course Materials:

ALEKS. Our textual material, videos, quizzes, and homework are available through ALEKS in our Canvas course. You must set up your ALEKS account in the first week of class to take the Initial Knowledge Check and to do any of the quizzes (after Quiz 1) and homework. There is no additional charge for ALEKS – it is included in your course fees as part of the First Day program (see the First Day link for options to Opt-out). ALEKS is a resource link in our Canvas course menu.

Course Expectations:

What I can expect from you:	What you can expect from me:
It is important for your academic success that you **attend each class and arrive on time**. Life events sometimes prevent class attendance, but if you must miss more than 3 classes, you may want to consider withdrawing from the course.	I will be prepared for class and arrive at least 10 minutes before class. I will make any changes regarding class meetings well in advance except in the event of an emergency.
Participate fully when you are in class. You will learn more and the content will be more interesting to you if you do.	I will actively support and encourage your learning. I will be engaged with students throughout class either in whole class discussions or group tasks.
Have a **positive and productive disposition** toward yourself, your classmates, and learning mathematics. Because we work in groups on a regular basis, it is essential that you be respectful of others during interactions regardless of whether the interactions are in class or online.	I will respect your views even when they are different than mine. I will respond in a positive manner to your genuine effort regardless of whether you are correct mathematically.
Assignments are carefully designed to help you learn the big ideas from this course. Obviously, missing multiple assignments will impact what you take from this course as well as likely have a negative impact on your grade.	I will grade assignments and assessments in a fair, transparent, and timely manner.
Seek help if needed and before you get too far behind or feel lost.	You can contact me through email and I will respond within 24 hours except perhaps on weekend. You may also see me during office hours.

Adapted from https://digitallearning.ucsd.edu/_files/learner-centered-syllabus-guide.pdf

Rules for Group Work

1. Each member takes responsibility for his/her own learning.
2. Each member of the group is willing to help every other group member who asks for help.
3. Groups may ask the instructor/GTA for help only when all group members have the same question.
4. There is always a further challenge.

These rules apply during all small group discussions. Whole group discussions require adherence to the standard rule of classroom engagement: Speak and listen respectfully.

Scoring Rubric (10 points)

	Conceptual Understanding: *Interpreting the concepts of the task and translating them into mathematics* *(Identifying the "core" of the problem)*	**Evidence Of Problem Solving:** *The use of task-appropriate tools and problem-solving strategies.*	**Explanation:** *Using verbal reasoning and appropriate constructions to best convey the solution.* *(The explanation flows smoothly.)*	**Accuracy:** *Providing a wholly justified solution for the task at hand.*
3			Explanation is coherent, and the ideas involved follow logically from previously stated ones.	The solution is completely justified, with no gaps in the argument.
2	Student's work has demonstrated that he/she has fully identified the major concepts of the task.	The student's work has demonstrated the strategic use of all task-appropriate tools and problem-solving methods.	Explanation is not sufficiently rigorous, or something may not immediately follow from what is written.	The solution has one or two minor gaps in justification.
1	Some, but not all, of the major concepts needed were evident.	Not all tools needed for the task are used or the tools are not used in a manner appropriate for solving the problem.	Explanation has multiple gaps or multiple steps need to be inferred.	The solution has major gaps in the justification.
0	Does not achieve minimal requirements for 1 point	Does not achieve minimal requirements for 1 point	Does not achieve minimal requirements for 1 point	Does not achieve minimal requirements for 1 point

There is also a 14-point rubric for Group Tasks.

UAB Policies

Add/Drop and Course Withdrawal

- Drop/Add: Deadlines for adding, dropping, or withdrawing from a course and for paying tuition are published in the Academic Calendar available online. Review the Institutional Refund Policy for information on refunds for dropped courses.
- Withdrawal: To avoid academic penalty, a student must withdraw from a course by the withdrawal deadline shown in the academic calendar and receive a grade of W (withdrawn). Failure to attend class does not constitute a formal drop or withdrawal.

Academic Misconduct

The University of Alabama at Birmingham expects all members of its academic community to function according to the highest ethical and professional standards.

Academic dishonesty and misconduct include, but are not limited to, acts of abetting, cheating, plagiarism, copying homework, fabrication, and misrepresentation. Students are expected to honor the UAB Academic Integrity Code.

DSS Accessibility Statement
UAB is committed to providing an accessible learning experience for all students. If you are a student with a disability that qualifies under Americans with Disabilities Act (ADA) and Section 504 of the Rehabilitation Act, and you require accommodations, please contact Disability Support Services for information on accommodations, registration and procedures. Requests for reasonable accommodations involve an interactive process and consist of a collaborative effort among the student, DSS, faculty and staff. If you are registered with Disability Support Services, please contact DSS to discuss accommodations that may be necessary in this course. If you have a disability but have not contacted Disability Support Services, please call (205) **934-4205**, visit the DSS website, or their office located in Hill Student Center Suite 409.

Non-harassment, hostile work/class environment
The UAB College of Arts and Sciences expects students to treat fellow students, their Course Instructors, other UAB faculty, and staff as adults and with respect. No form of hostile environment or harassment will be tolerated by any student or employee. In this class, we will only use constructive criticism and will work to build a community of life-long learners.

Title IX Statement
UAB is committed to providing an environment that is free from sexual misconduct, which includes gender-based assault, harassment, exploitation, dating and domestic violence, stalking, as well as discrimination based on sex, sexual orientation, gender identity, and gender expression. If you have experienced any of the aforementioned conduct we encourage you to report the incident. For more information about Title IX, policy, reporting, protections, resources and supports, please visit http://www.uab.edu/titleix for UAB's Title IX Policy, UAB's Equal Opportunity, Anti-Harassment Policy and Duty to Report and Non-Retaliation Policy.

Links to additional UAB policies are available in our Canvas course.

Blazer Core – Quantitative Literacy

Courses in quantitative literacy provide students with central conceptual knowledge of numbers, formulas, data, and probabilities, and encourage students to apply this knowledge to address real-world problems.

(QL 1) Identify and utilize tools of quantitative reasoning to solve problems that impact academic understanding and public life.

(QL 2) Critically analyze and evaluate how quantitative information, including statistical information, is derived, reported, and applied.

(QL 3) Analyze and evaluate how information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words) is used to describe, predict, or model natural or social processes.

Sample Course Calendar

	Tuesday	Thursday
Week 1	Fair Division & Apportionment	**Group Task 1** **HW due on Friday.**
Week 2		**Group Task 2 Due** **HW 2 and Quiz 2 due on Friday.**
Week 3		**Group Task 3 Due** **HW 3 and Quiz 3 due on Friday.**
Week 4		**Group Task 4 Due** **HW 4 and Quiz 4 due on Friday.**
Week 5	Voting Methods	**Group Task 5 Due** **HW 5 and Quiz 5 due on Friday.**
Week 6		**Group Task 6 Due** **HW 6 and Quiz 6 due on Friday.**
Week 7		**Group Task 7 Due** **HW 7 and Quiz 7 due on Friday.**
Week 8	Displaying Data	**Group Task 8 Due** **HW 8 and Quiz 8 due on Friday.**
Week 9		**Group Task 9 Due** **HW 9 and Quiz 9 due on Friday.**
Week 10		**Group Task 10 Due** **HW 10 and Quiz 10 due on Friday.**
Week 11		**Group Task 11 Due** **HW 11 and Quiz 11 due on Friday.**
Week 12	Game Theory	**Group Task 12 Due** **HW 12 and Quiz 12 due on Friday.**
Week 13		**Group Task 13 Due** **HW 13 and Quiz 13 due on Friday.**
Week 14		**Group Task 14 Due** **HW 14 and Quiz 14 due on Friday.**
Final	You will choose 4 problems from a list of 8 to submit. You may use any **personal** notes that you have created for this class (i.e. not the instructor's notes and not someone else's notes).	