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Emory University
Math for Sustainability- Economic, Environmental, & Social

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Introduction: This course is one I have wanted to work on for a long time. Doing the Piedmont project helped me put some time and thought into this course. There is still a lot of work to be done, but the Piedmont project helped me see how this course that I had been planning could take and incorporate aspects of the community we are in at Emory in two different ways:

- I would love to have some of the speakers during our workshop as guest speakers in the class.
- Emory functions on an ethos of sustainability that I had been unaware of. It would be a missed opportunity to not incorporate this aspect into a class on sustainability.

It was eye-opening to learn about Emory's water hub and the other green initiatives at Emory. The Hahn woods were also delightful. I could imagine myself taking students on "Field trips" on campus that helped connect what appears to be abstract mathematics to something tangible and real that happens to also be a part of the world the inhabit.

Course synopsis: This is an intro course that satisfies the Quantitative Reasoning Explorations Course requirement.
We view doing math as a "sense-making" activity that gives us the tools to make sense of the world we live in. How long can a system – a collection of different organisms living and interacting together, like the animals and plants in a rainforest or the people and companies in an economy – remain diverse, active and productive? This is the sustainability question, and asking and answering this question with regard to the systems of human society will be an increasingly urgent concern for the 21st century. We will focus our lens on sustainability where we will find that almost any issue has underlying quantitative aspects that help us see not just what the situation is, but also why it is the way it is. We will build the mathematical tools needed to understand and critique issues such as living wages, access to clean water and air, who grows our food and where, where does waste go and who bears that burden, who gets flagged at traffic signals, and who gets out on bail, marriage equality and taxation. While building on the mathematical skills, you will also work on your technical communication and technical writing skills. Techniques and concepts will be selected from probability theory, hypothesis testing, statistical inference, graph theory, combinatorics, calculus, and mathematical modeling.

Textbook: We will use and refer to many different books and articles. To begin with:

- Weapons of Math Destruction, Cathy O'Neil
- Mathematics for Sustainability, John Roe, Russ deForest, Sara Jamshidi

This list will be regularly updated.

Prerequisites: There are no prerequisites for this class.

Belonging: In 2016, the *Notices of the American Mathematical Society*, published an article[1] by Federico Ardila (SFSU) on cultivating diversity in mathematics. There, Prof. Ardila listed a set of "Axioms" in mathematical pedagogy. Like him, we firmly believe in these axioms, and use them as guiding principles in this course's design. We encourage you to read and think about each:

Axiom 1 Mathematical talent is distributed equally among different groups, irrespective of geographic, demographic, and economic boundaries.

Axiom 2 Everyone can have joyful, meaningful, and empowering mathematical experiences.

Axiom 3 Mathematics is a powerful, malleable tool that can be shaped and used differently by various communities to serve their needs.

Axiom 4 Every student deserves to be treated with dignity and respect.

Weekly Pre-class Reflection: You will be writing short pre-class reflections. The goals of this reflection are to prepare you for a class discussion. We will also use your reflection to incorporate in class your questions and what you find most interesting.

Weekly News Awareness Canvas Discussion: One of the goals for this class is to help you to critically interpret numbers and mathematics in the news media. Each week, you'll be asked to report on numbers or mathematics contained in an article you've read related to an issue of sustainability. You'll also be asked to respond to someone else's report. These assignments will be completed on canvas discussions.

Participation: Actively and enthusiastically engage in any and all in-class group/active work. Your participation in class will facilitate your learning as well as that of your classmates. Please be respectful of your classmates and me by being punctual and staying on task. **Avoid the use of electronic devices in class unless you have discussed it with me.** If you miss a session of in-class work, you can make up for this by attending (and actively participating in) one of the office hours (see schedule at top of page).

Midterm Exam: There will be one in-class exam.

Final Paper: You will write a 5-6 page expository article on a topic of your choice falling within mathematics and sustainability. The default audience will be any Emory student who has taken an intro mathematics or statistics class. Your final paper submission will be scaffolded as follows:

1. You will submit a 1 page proposal, including selected references
2. You will submit a first draft of your paper. You will also receive an anonymized paper to give feedback to based on a detailed rubric.
3. You will submit a 1-2 page referee report that summarizes and highlights the strengths and weaknesses of your assigned paper
4. After an in-class workshop between author-referee pairs, revise your original paper and resubmit along with a short summary of changes made.

[1] Ardila-Mantilla F. Todos Cuentan: Cultivating Diversity in Combinatorics. Not Am Math Soc. 2016;63(10):1164-1170.

Grading: Your final grade in this course will be comprised of the following:

	Percentages
Weekly Pre-Class Reflections	15%
Weekly News Awareness Discussions	15%
Participation	10%
Midterm Exam	30%
Final Paper	30%
TOTAL:	100%

Course averages will be converted to letter grades on a standard ten point scale.

A	93-100%	C+	77-80%
A–	90-93%	C	73-77%
B+	87-90%	C–	70-73%
B	83-87%	D+	67-70%
B–	80-83%	D	60-67%

If necessary, course grades will be curved so that the median letter grade is *at least* a B–.

Late Work: Late work is not accepted, except in the case of extended illness. In-class activities and quizzes will not be accepted, if you are not present in that class meeting. The scores dropped from your average are intended to cushion your grade, in the case you need (or want) to miss a class.

Academic Integrity: Emory is stressful, and taking a math class can also add to that stress. I would love to create an environment where you feel empowered, and confident. I really want all of you to take the assessments in the class while only relying on yourself and the allowed resources. It's not okay for me if you are not able to do that. Please do not put yourself in a situation that leads to regrets or guilt. *Nothing is worth that.*

You are encouraged to collaborate or use outside sources in solving your homework assignments, **but the work you submit must be expressed in your own words**. You are **not authorized to view or use the work of another student during quizzes or exams. Specifically, it is not okay to email or share your written work with other students.**

Again, I really hope that you will all be able to take the assessments with your heads held high. Please reach out if you are struggling. You should familiarize yourself with the Emory College honor code.

catalog.college.emory.edu/academic/policies-regulations/honor-code.html

Harassment: From the Emory University policies, available at policies.emory.edu/1.3 :
Discriminatory harassment of any kind, whether it is sexual harassment or harassment on the basis of race, color, religion, ethnic or national origin, gender, genetic information, age, disability, sexual orientation, gender identity, gender expression, veteran's status, or any factor that is a prohibited consideration under applicable law, by any member of the faculty, staff, administration, student body, a vendor, a contractor, guest or patron on campus, is prohibited at Emory.

Accessibility: The Department of Mathematics at Emory supports equal access for students with disabilities. Any students needing special accommodations due to a disability should speak with someone in the Department of Accessibility Services as soon as possible. Please see details here accessibility.emory.edu/index.html . Accommodations cannot be granted without a letter from the office. They also cannot be granted retroactively.