MAT-511 Syllabus

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TL; DR

- **Goal**: Independent thinking by formulating mathematical arguments.
- **Expectation**: Read, write, engage, discuss, revise, improve, learn, and share.
- **Takeaways**: Abilities to think independently, to think mathematically, to spot flaws in arguments, and to appreciate higher literature in related fields. Knowledge of a slight flavor of logic, number theory, set theory, a concept of infinity, topology, and a brief history of mathematics.
- **Mindset**: All students are expected to make lots of mistakes, including you! Focus on your improvement but not on how many correct answers you give.
- **Location**: Zoom, synchronous online.

Course Description

Course Goal

The main focus of this course is to teach you how to formulate careful (mathematical) arguments, which is a crucial step towards appreciating the profound beauty of mathematics.

By formulating a rigorous mathematical argument, you will update what you think rigor is. Being able to spot the potential flaws in arguments equips you the ability of **independent thinking**, and offers a new perspective of many things. It is arguably essential in modern life, where too much information is available.

1. Writing proofs

- **Logic**, the meta language of arguments.
- **Induction**, and its use in computer science.
- **Number theory**, as an example and application.

2. What is infinity?

- **Set theory**, the basis of modern mathematics.
- **Cardinality**, a new perspective of measurement.
- **Infinity**, and its different layers.

3. What are numbers that are real?

- **Real numbers**, and their construction.
- **Continuum hypothesis**, as an example of an exotic axiomatic system.

4. What are spaces?

- **Extra structures**, things we care but miss paying attention to.
- **Topology**, a primitive yet important attribute of spaces.

Textbook

The required textbook is *An Introduction to Proof via Inquiry-Based Learning*, by Dana C. Ernst, Ph.D. It is open-source and can be found online.

`http://danaernst.com/IBL-IntroToProof/`

As far as I know, it has no printed version yet. However, because it is licensed under a Creative Commons Attribution-ShareAlike 4.0 license, you are free to print if needed.

Have a copy with you. I pick it among all other textbooks because it is concise and well-written. You are required to read and give hard thoughts on it a lot. You should attempt to do the problems, as much as possible.

Assignments

Homework assignments consist of 50% of your final grade. There will be five problem sets, one per week, each counted 10%. You should turn them in on Blackboard, by the deadline.

I will read through them carefully, give comments, send you notes, and will discuss parts to be improved in the lectures. As I review them in the class, I will not reveal who made the error, so don't worry. I will, however, send you a note before the lecture about where you should pay more attention to. You are required to read the comments and notes, pay attention to the correction in class, **revise your homework accordingly**, and turn in the revised version.

As it is so crutial in your study, **no late homework will ever be excused without an official documentation**. Please take care of yourself as the course move on, since it will be tough to catch up once you miss any lecture.

Grades

Your grade will be calculated in the following way:

- Homework assignments: $5 \times 10\%$
- Midterms: $2 \times 10\%$
- Final Exam: 10%
- Participation: 10%
- Attitude: 10%

For details, a homework assignment will be given each week. There will be five of them in total, adding up to 50%. Two midterms and a final will be given, adding up to 30%. For participation, with the maximum being 10%, you will receive 1% each time you come to the lecture fully – that means you show up and leave on time. Finally, it is trickier as for attitude. Thinking actively, discussing engagingly, and doing homework assignments carefully bring you 10%. Lacking any of the above results in a warning and points will be taken away accordingly if no improvement is made.

Mindset

Making mistakes

All students, including you, are expected to make lots of mistakes. It's ok to make mistakes. In fact, I would worry if there is none. Discover your mistakes and fix them. In this course, we will focus mainly on how much you improve, but not how many correct answers you make.

Don't give up

If you find this course too challenging, it's ok. Take a deep breath, be brave, and face the problem again. Discuss with me where you are and where the difficulties lie. In the end, however, it's still you who stand up for yourself.

If you are "forced" to be here..

I get you. As a student, too, I found myself stranded in courses I do not want to take. So if this is the case, I will not judge you, but you should talk to me openly as early as possible. I am more than willing to help.

I cannot, however, pass you right away, as it is an illegal practice. I am required to examine if students have fulfilled certain goals before passing them. Play no victim, realize that there **is no** short escape, either take it or drop it, and be responsible for your decision.

Contact

Office hour will be delivered on Zoom.

E-mail is the best form of communication besides lectures and office hours. My address is

`jin-cheng.guu@stonybrook.edu`

DSS NOTICE

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Disability Support Services at (631) 632-6748 or at

`http://studentaffairs.stonybrook.edu/dss/`

They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential. Students who require assistance during emergency evacuation are encouraged to discuss their

needs with their professors and Disability Support Services. For procedures and information go to the following website:

https://www.stonybrook.edu/

Academic Integrity

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty are required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology and Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at

http://www.stonybrook.edu/uaa/academicjudiciary/

Critical Incident Management Statement

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific prodecures.