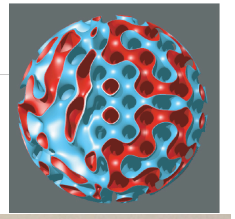
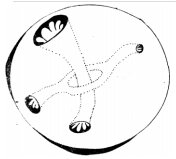
These slides, as well as all the information about the course, can be found at:
(shortcut: Google "Moira Chas")

http://www.math.stonybrook.edu/~moira/courses/mat364-fall2019/

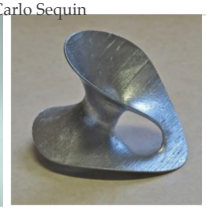
MAT 364 Topology and Geometry



Images by Carlo Sequin



8. Sphere with two holes bored through it, and one of the holes threaded through a hole in the other hole.



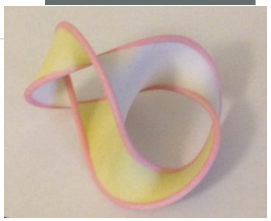


Image from "An Introduction to Topology" by E. C. Zeeman

Image by Mithra Muthukrishnan

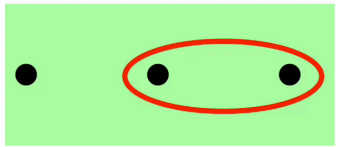
About your instructor and this course

Space, cyberspace and time coordinates of your instructor

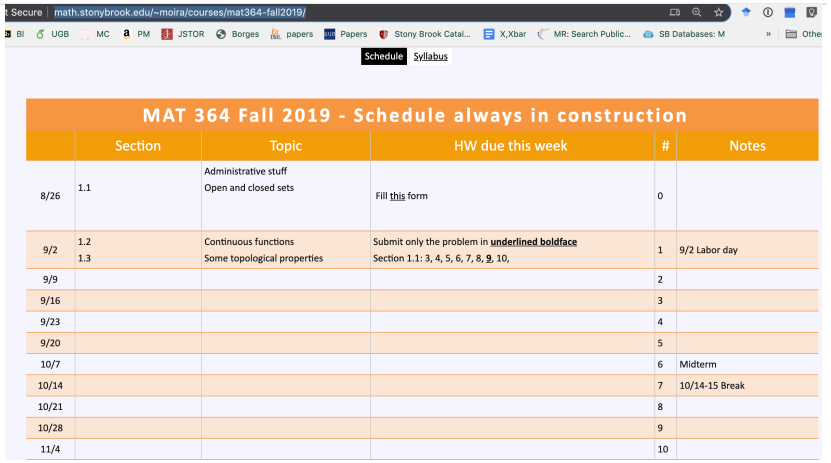
- Moira Chas, Associate professor
- Best way to contact me:
  - moira.chas at stonybrook.edu
- Website: http://www.math.sunysb.edu/~moira/
- Office: 3-119 Math Tower
- How to address me? Professor Chas is OK

I ♡ Math

- Office hours:
  - Mo 11am to 3:30spm in 3-119 Math Tower.
  - We 11am to 12pm in P-143 Math Tower,
  - and/or by appointment (email me!).



Online Syllabus



MAT 364 Fall 2019 - Schedule always in construction

	Section	Topic	HW due this week	#	Notes
8/26	1.1	Administrative stuff Open and closed sets	Fill this form	0	
9/2	1.2 1.3	Continuous functions Some topological properties	Submit only the problem in **underlined boldface** Section 1.1: 3, 4, 5, 6, 7, 8, 9, 10,	1	9/2 Labor day
9/9				2	
9/16				3	
9/23				4	
9/20				5	
10/7				6	Midterm
10/14				7	10/14-15 Break
10/21				8	
10/28				9	
11/4				10	

More about this course

The more times any of us practice remembering something we are trying to learn, the more firmly we lodge it in our memories for the long term. James Lang

- In the first the last few minutes of some classes, we may work on a summary of the what already learned and/or what we are about to learn.
- Make groups of 3, 4 students.
  - Exchange ways of communication (email, phone number, smoke signals, whatever you are confortable with).
  - Write down two or three sentences explaining what do you think a continuous transformation from a space to itself can and cannot do

1. Find all the classmates whose letter admits a continuous function with yours
2. Find all the classmates whose letter admits a homeomorphism with yours

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- Make groups of 3, 4 students.
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  - Write down two or three sentences explaining what do you think topology is

Inspired in an article by Ignacio Salduendo

Why math?

- Math is useful: without math we wouldn't have GPS, subway, medicines…
- Math is beautiful and interesting (says me, the mathematician)
- Logical structure: It is developed from few initial concepts and clear arguments.
- Math keeps us honest.
- Math teaches us patience and grit
- "Education is what remains after one has forgotten what one has learned in school.." Einstein

Why math?

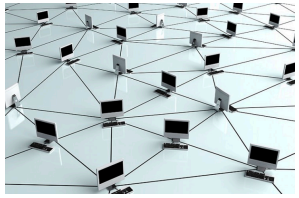
411,296 views | Nov 12, 2014, 11:43am

The 10 Skills Employers Most Want In 2015 Graduates

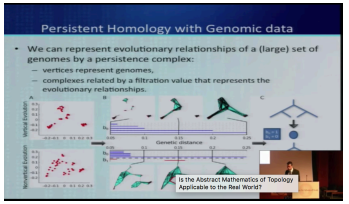
Susan Adams Forbes Staff
I'm a senior editor in charge of Forbes' education coverage.

1. Ability to work in a team structure
2. Ability to make decisions and solve problems
3. Ability to communicate verbally with people inside and outside an organization
4. Ability to plan, organize and prioritize work
5. Ability to obtain and process information
6. Ability to analyze quantitative data
7. Technical knowledge related to the job
8. Proficiency with computer software programs
9. Ability to create and/or edit written reports
10. Ability to sell and influence others

Why topology?



Besides many applications to different areas of mathematics, top is applied in many models of the real world.



Tips to succeed in this course

Dedicate around 6-8 hours/wk to this course (outside the classroom). During these hours, your goal should be to **understand** the material. To do so,

- Work on written **HOMEWORK**
- **READ** the assigned sections of the textbook beforehand **(with paper and pencil handy).**

Every topic will be covered in class but some details will not be explained. You must must must READ the book

Tips to succeed in this course

- Do not leave the homework for the last minutes before the deadline.
- Attend the lectures, and when you do, *be completely* in the class. (This implies no use of electronics. Note: cell-phone is electronic)
- Come ready to work in class
- Get help if you need it, as soon as you need it (office hours, MLC)

Tips to succeed in this course

- Office hours: you do not need a concrete question, any confusion or uncertainty is a good reason to make them.
- Get out of your comfort zone (in a productive way). Remember that most of us have been there: where not understanding a topic almost hurts… But if you work hard this changes.
- Ask questions (for instance What do you mean by a "blah"?)
- Answer questions
- The process of learning involves making mistakes. In other words, expect to make mistakes and do not judge yourself or others for them.

Constructive feedback is welcome by me, your instructor.

Administrative stuff

Homework Assignments

- HW 0: It is required!!
- You cannot learn math without working on problems.
- Expect to spend a few hours a week working on homework.
- Each graded problem is worth 5 points.
- **Grader:** Frederik Benirschke frederik.benirschke at stonybrook.edu

Written Homework must contain

- The statement of the problem
- An answer that is emphasized, if appropriate.
- In most problems if there is no work shown, there is no credit. In other words, an answer with no justification is not admissible (even if it is the correct answer!)

Homework should by legible and written in complete English sentences.

Is it allowed to work in teams?

- You may discuss the assignments in this course with classmates, before working in the write-up.
- Each student's submission must be his or her own work.
- It is not allowed to browse the Internet for solutions.

ACADEMIC DISHONESTY

- **All work you submit for homework, final, or exams MUST be your own work.**
- **If you cheat or aid someone in cheating, you will automatically fail this course and be brought up on charges of academic dishonesty without warning.**
- **Cheat includes: presenting work of other as your own, copying other student work, facilitate that other student copies your work, use of notes, calculators and/or electronic devices during examinations.**

Online Resources

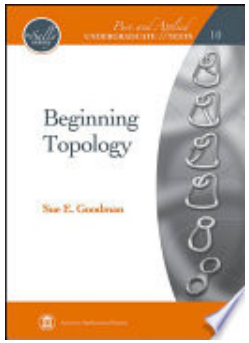
- Course Website:
  - http://www.math.stonybrook.edu/~moira/courses/mat364-fall2019/
    - Syllabus, homework schedule, exams dates, announcements.
  - http://www.math.stonybrook.edu/~moira/courses/mat364-fall2019/material/
    - Slides, and other materials (including the one you are reading)
- Blackboard:
  - Grades

Email communications

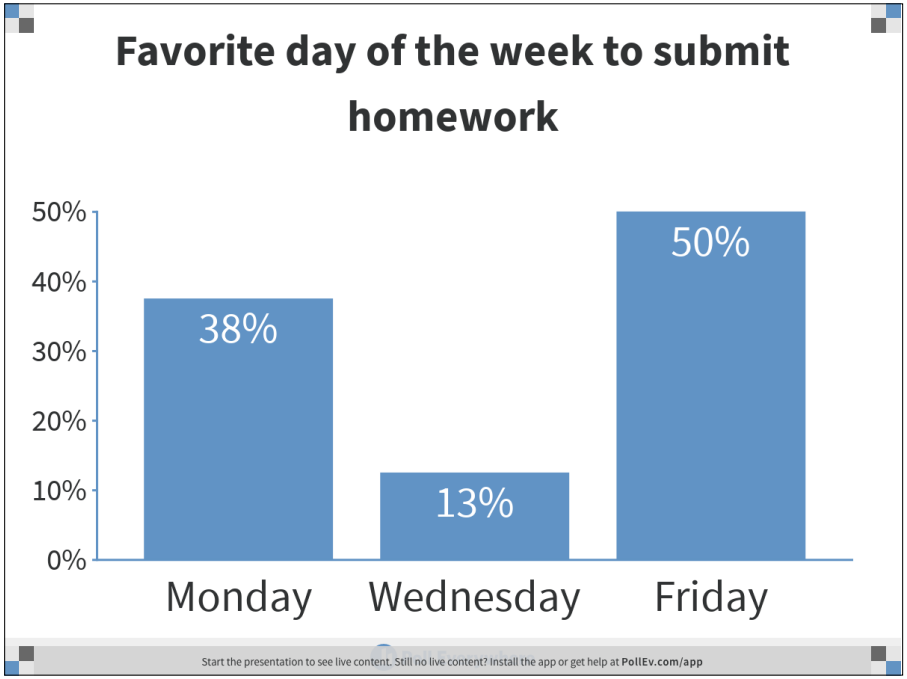
- During the semester, I will send a few emails. Please make sure that you check the Stony Brook email account regularly.
- Messages should be written in complete English sentences.
- I check my email about once a day, so expect my answer accordingly. I cannot answer complicated math questions by email, but I'll be happy to discuss those during my office hours or if you make an appointment.

Book

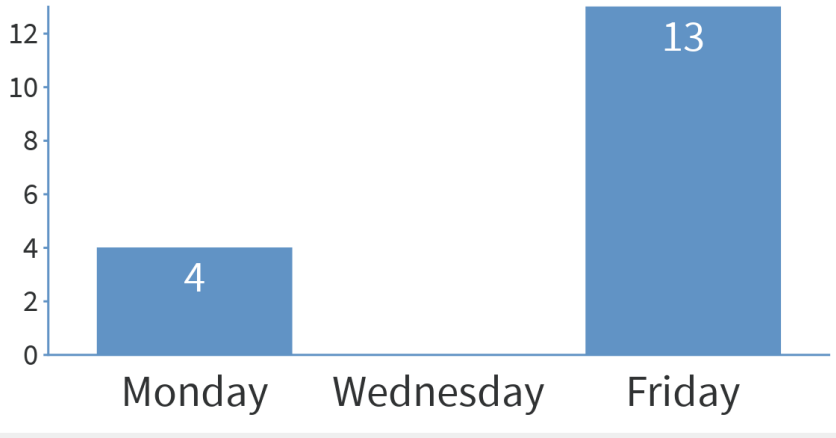
Textbook: :Beginning Topology by Sue Goodman



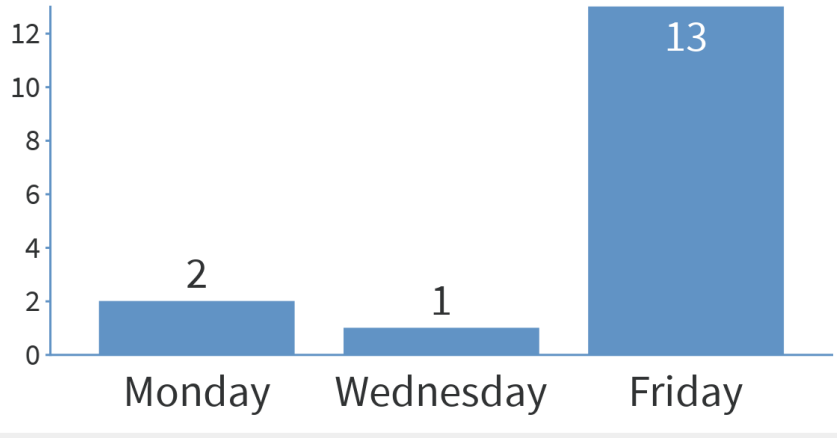
Course Policies



Favorite day of the week of the midterm 1 (on the week that starts on Oct 7th)



Favorite day of the week of the midterm 2 (on the week that starts Nov 18th)



There are no dumb questions

What to do with cellphones

A quotation (sometimes attributed to Mark Twain)

"Lecturing is that mysterious process by means of which the contents of the note-book of the professor are transferred to the note-book of the student without passing through the mind of either."

Table by Eric Mazur

Let's make brain waves in this lecture.

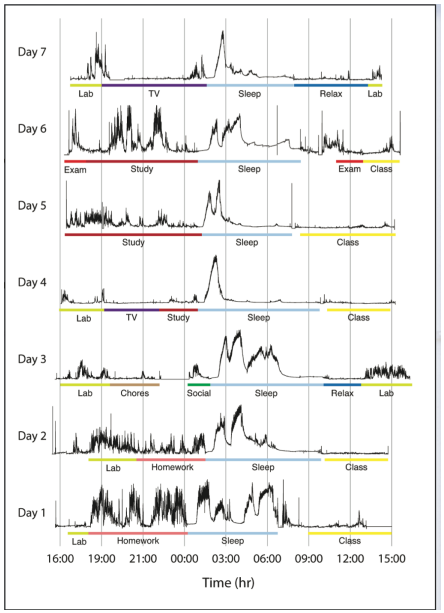


TABLE 1

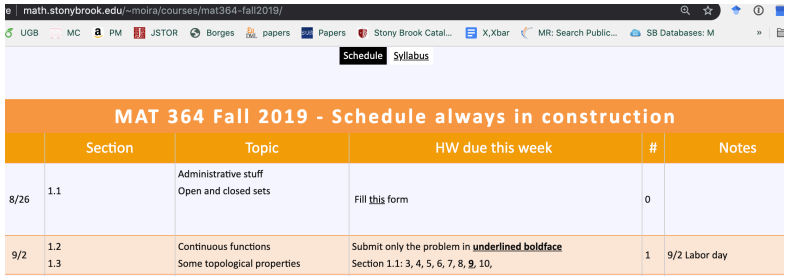
Fixed mindset

Growth mindset

Instead of thinking	Try thinking
I am not good at this	What am I missing?
I am awesome at this	I am on the right track
I give up	This might take longer than I expected
This is too hard	I'll try to use some of the strategies we learned
I can't make it any better	I can improve if I keep trying
I am not a math person	I can train my brain to do math.
I am upset because I made a mistake	Mistakes help me learn better
The problem is that X is smarter than me	I'll try to learn how X does it.
It is good enough	How can I improve this?
My strategy didn't work.	What other strategy I can try?
This is too easy for me	Can I understand this more deeply?

Unknown source

Online Resources



Grades and Exams

Exam	*When and where*		*% of Final Grade*
Midterm 1	Friday Oct 11th	In class	15%
Midterm 2	Friday Nov 22nd	In class	15%
Final Exam	Wed, Dec 18, 2:15pm-5:00pm	To be announced.	40%
Homework	Every Friday		20%
Class participation			10%

What is topology about?

"Doughnuts and coffee cups" "shape" "Shapes not shes" "C"

"Shes and how they can be morphed and still stay the "same"" "Open sets" "Surfaces"

"Shape" "Transformations" "Top" "geomatic" "C" "space" "Maps"

"deformations"

What does a continuous map do?

"It is a bijective mapping from one set to another." "preserves holes"

"Continuous map from space A to Space B maintain the topological structure of the range set to the image set"

"stretch" "Fold"

"A continuous map should be any map that where the resulting shaping is homomorphic the original"

"scale" "The preimage of a continuous function is open set"

"continuous mapping is a kind of transformation that makes function F into function G and the process is bijective"

"Maps connected in dom. sets to connected sets in codom." "Twist" "Scale" "Mapping"

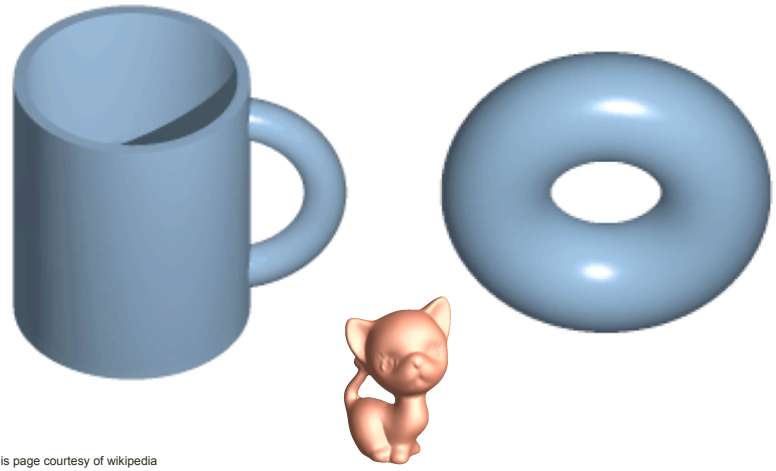
"translate"

Homework

- Written homework assignments are due every Friday.
- These assignments will be updated according to the progress of the class.
- Each Friday before 5pm, the assignments will be posted for the following Friday.

Respect, Speed, etc

Topology jest: A topologist can't distinguish a coffee mug from a doughnut



Animation on this page courtesy of wikipedia

In each of the following cases, for each letter # find

1. All the letters * such that there is a continuous function from # to *.
2. All the letters * such that there is a homeomorphism from from # to * (a homeomorphism is a continuous bijective function with continuous inverse)
3. All the letters * that can be deformed into # .
4. All the letters * that can be isotoped into # .

X is a **set of points** - a space - think of a subset of R^n

Open sets: A list of special subsets of X, with certain properties.

Topology on a set X: A list of open sets on X.
A structure that organizes the points of X by glueing them. A topology gives "texture" to X.

Continuous function between topological spaces: A function that "respects" some features of the topology on X. Does not break or tear X.

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Connected set: A set that cannot be broken into pieces respecting the topology.

Closed sets: Complement of open sets on X

Compact set: A "small", controlable set

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Relative topology: A way of giving a topology of a subset Y of X, determined by a topology on X.

Product space: Given two topological spaces X and X, a topology in X x Y, depending on the topologies of X and Y.

Quotient space: Partition X into subsets, and think of all the points in one of those subsets as a new point of a new space. The new points of a new space have a topology coming fro the topology on X

X is a **set of points** - a space - think of a subset of R^n

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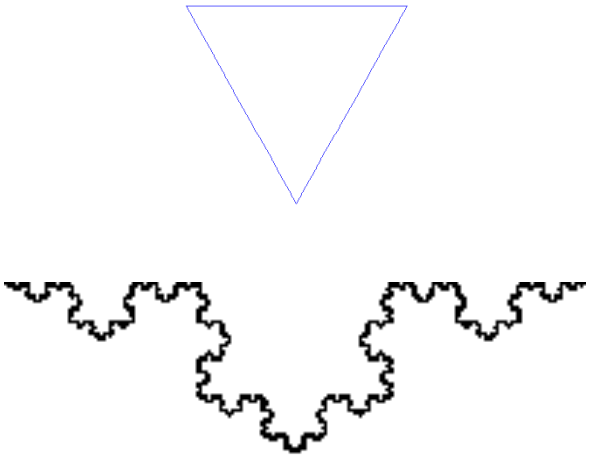
Cell complexes: A special type of topological space made of balls of R^n, glued in a particular way.

Particular cell complexes:
- Surfaces
- Trees
- Graphs

Euler characteristic: An integer associated to a cell complex (related to how the balls made the cell complex are glued by the topology)



Koch snowflake - Animations from Wikipedia