SYLLABUS FOR MATH 590
INTRODUCTION TO TOPOLOGY
Fall 2007

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Office hours: official office hours are M,W the hour after class, F the hour before class. I am happy to accomodate extra/alternative times by appoint-
ment.

TEXTBOOK: Topology, P.Schick, Wiley

LOGISTICS: The class will meet MWF 10:00 - 11:00am in EH 2866.

INITIAL DISCLAIMER: This syllabus is not necessarily what exactly is
going to happen in this class. I feel that in this case the journey is equally
(if not more!) important than the destination itself, and so some flexibility
should be essential in targeting the material to YOUR taste, pace, and in-
terests. I strongly (STRONGLY!) encourage continuous feedback and input
on the course (in any form...I have also set-up an anonymous electronic com-
ment form that you can use if you are shy or need to insult me really bad -
there is a link from the course webpage); I promise to always listen carefully
and ponder any feedback, even though I reserve the right of making the final
decisions.

As far as class and grading policies go, for the sake of simplicity, fairness, and
intellectual honesty, they are decided once and for all, and will be followed
exactly as stated here.

COURSE OUTLINE: I like to think that modern geometry is born in 1872,
when Felix Klein wrote the Erlangen Programme, a mathematical manifesto
that addresses a philosophical question: what is geometry?

The answer Klein proposes is the following: a geometry is the study of
properties of shapes and spaces - properties that are invariant under a group
of transformations. What this means is that, before we make any statement,
we must decide two things:

1. what kind of objects we consider “shapes and spaces”.
2. what is the group of transformations, i.e. what is our notion of “being
equal”.

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This also means that there is not a unique geometry, and so yes, it is correct to say that two parallel lines never meet if you are doing euclidean geometry, but it is not if you are doing projective geometry. And if you are working projectively over the complex numbers, then lines are really spheres, but two of them still meet transversally at one point (huh?).

As you see, geometry is escaping the boundaries of our "common sense intuition", and it will more and more. So it is our job of mathematicians to try and really understand what is going on - i.e. to abstract our intuitive geometric notions to a more general context.

Topology is a fun branch of geometry to study in order to accomplish such a goal. In fact, in topology, Klein’s group of transformations is simply huge! Two geometric shapes are considered equal if there is a bijective, (open), continuous function between them. Some people like to call topology “rubber geometry”, in the sense that is the stdy of objects that are made of an extremely stretchable and bendable rubber. This means, for example, that a triangle, a square and a circle are all the same. So even searching for properties to study is a chore to begin with! (lengths, areas, angles, number of sides...all goes topsy turvey if a triangle is the same as a circle). Properties that remain the same under such a huge flexibility are called topological invariants.

We will spend the first part of the semester going through foundational material. Roughly, this means chapters 2,3 and 4 from the book. Then we will certainly spend a good amount of time on the fundamental group (chapter 5), which I consider both cool and important. From there, we will go on and choose some cool stuff (and possibly also useful) to take us to the end of the semester. Possible topics could include knots, surface theory, homology and or cohomology of many many types, covering theory... it will certainly make more sense to make that call after I’ve gotten to know you guys a little bit.

PRE-REQUISITES: I can’t really think of any formal prerequisite to this course, besides a solid intuition of the notion of continuity. However, the degree of abstraction in this class will be pretty high, so it will certainly be useful if you have seen a fair amount of “modern” mathematics.

OFFICE HOURS: I strongly encourage you to come to my office with problems, questions, things you are confused about, or just for a cup of tea.

HOMEWORK: It is a fact that doing problems is THE way to learn math. It’s only when you get our hands dirty that you really end up grasping the concepts. So, in an ideal world, I should not be assigning homework, but only reccommending exercises, and you guys should be responsible enough
to work through them and come talk about any sort of problems you have with your problems. Alas, the daily news remind us constantly that we live in a world that in many ways is far from ideal, so we will be having weekly graded homework deadlines, on Fridays.

You are encouraged to work on the homeworks together, but I do insist that everybody writes up their own solutions in their own words and demonstrate understanding of what they have done. Write effectively, with due attention to organization and logical progression of the ideas. Each solution should be complete and appropriately supported - by relevant observations, argumentation, drawings (I like drawings - a picture often time can represent an excellent explanation in topology), etc.

QUIZZES: As far as quizzes go, I want to do away with the traditional quiz format, and introduce the concept of a micro-quiz: a micro-quiz will consist of one or two simple short questions, typically of qualitative nature. You will have only a few minutes to answer them, and then we will immediately discuss the answers. Micro-quizzes will happen irregularly, but very often (we may even have weeks where we have micro-quizzes every day). The idea is to give you guys an instrument to constantly monitor your grasp of the fundamental ideas. The idea is also to NOT stress you guys out, so let me say that micro-quizzes will be handed in, but typically NOT graded. In fact, I will only look at them in case at the end of the semester your grade is “in between” grades, as then they will give me a tool to decide on what to do. So, bottom line is, micro-quizzes should be mostly a tool for YOU, not for ME.

EXAMS: We’ll have two intermediate exams, that at this point are tentatively scheduled for the following dates:

- Oct. 12
- Nov. 19

FINAL EXAM: the final exam may be a regular exam, or a take home, or a project...I don’t know yet. We will decide as the course progresses on what sounds like the best idea. I’ll let you know details plenty in advance.

COURSE GRADES. Here is the chart of how grades will be decided:

- 30% - $\varepsilon$ for the final exam.
- 25% - $\varepsilon$ for each of the two intermediate exams.
- 15% - $\varepsilon$ for homework.
- 5% - $\varepsilon$ for class attendance and participation.
- 4$\varepsilon$ for micro-quizzes.
MISCELLANEOUS: Make up quizzes and exams can be arranged, but please, please, please do notify me beforehand. I reserve the right to refuse to offer a makeup if I am asked after the event itself.

In case of special needs I am willing to make special arrangements about homework, attendance policy etc etc but again I require that you discuss such arrangements “before the fact”.

I consider class participation extremely important. I encourage you to make questions, remarks, comments. I will often ask you guys to come up to the blackboard to solve exercises. And yes, questions. Ask lots of questions, don’t be afraid...as usual, if you are confused, most likely other people are, and everybody is just being shy. Worse case scenario, if I feel I can’t afford the time to answer your question during class time, we will discuss it after class.
Remember: NO QUESTION WILL EVER BE HELD AGAINST YOU!

ADA STATEMENT: the American with Disabilities Act requires that reasonable accomodations be provided for students with physical, cognitive, systemic, learning and psychiatric disabilities. Please contact me at the beginning of the course to discuss any such accomodations you may require for the course.