Course Syllabus - MAT 327: Introduction to Topology, Summer 2014

Course Instructor: Micheal Pawliuk
Email: m.pawliuk@mail.utoronto.ca
Office: 1027 Huron Building
Office Hours: M 2:00 - 3:00 pm, Thurs 2:00 - 3:00 pm
Course Title: MAT 327H1 Y: Intro to Topology, L101
Course Time: M 4:00 - 6:00 pm, W 4:00 - 5:00 pm
Course Location: SS 2127
TAs: Nikita Nikolaev, Jonguk Yang
Email: nikolaev@math.toronto.edu; jonguk.yang@mail.utoronto.ca
Tutorial Tut 0101: M 3:00 pm - 4:00 pm, SS1074
Tutorial Tut 0102: M 3:00 pm - 4:00 pm, LM 123
Tutorial Tut 5101: W 5:00 pm - 6:00 pm, SS1088
Course Website: http://wp.me/P3uYlF-ih

TOPICS TO BE COVERED

This is the planned list of topics to be covered (subject to time constraints).

First Half:

- **§1** - Topological Spaces
- **§2** - Basis
- **§3** - Closed Sets and Closures
- **§4** - Countability Review
- **§5** - Convergence and First Countable spaces
- **§6** - Continuous Functions and Homeomorphisms
- **§7** - Subspaces
- **§8** - Finite Products
- **§9** - Separation Axioms
- **§10** - Partial Orders, Linear Orders and Well Orders, ω_1

Second Half:

- **§11** - The Axiom of Choice
- **§12** - Metrizable Spaces
- **§13** - Urysohn's Lemma and the Tietze Extension Theorem

§14 - Arbitrary Products

§15 - Compactness

§16 - Tychonoff's Theorem

§17 - Connectedness

§18 - Compactifications

TEXTBOOK

Required textbook - None. I will post notes on the course website which contain all of the relevant material and many practice problems.
Optional Texts:

1. "Counterexamples in Topology" by Steen and Seebach. (This is only $12 and contains all the definitions and examples you'll need, but does not contain proofs.)
2. "Topology" by James Munkres, 2nd Edition. (Highly readable, standard undergraduate textbook for point-set topology. Unfortunately this text is $170.)

I will cover all relevant material in class, so it is not necessary to have a personal copy of Munkres' Topology, although you might find it useful.

GRADING SCHEME

8 Homework Assignments (each weighted equally) - 30%

Tutorial participation (see below) - 10%

Term Test - 20%

Final Exam - 40%

HOMEWORK ASSIGNMENTS

There are 8 assignments and they will be worth 30% of your final grade, each weighted equally.

Each assignment will be broken into three parts- "Comprehension", "Application" and "New Ideas".

"**Comprehension**"- These questions are designed to test your understanding of the basic definitions and theorems we have stated in class. You are expected to complete this section on your own while consulting your notes and, for this section, please do not consult other students or resources that are not your notes (e.g. the internet).

Example: Prove or disprove that the rational numbers are a closed subset of $\mathbb{R}$.

"**Application**"- These questions are designed to test your understanding of the main methods and examples presented in class. You may consult other students and texts for questions in this section, but please avoid consulting the internet. Most of the questions from this section will be standard questions whose solutions are easily available online. These questions will require little more than understanding the material covered in class, so looking up solutions for these questions defeats the purpose of these exercises. As always please cite which work is yours and which work is not. (See the section on Academic Integrity.)

Example: Give an example of a theorem that applies to $\mathbb{R}$ but does not apply to $\mathbb{R}^2$. Support your assertions.

"**New Ideas**"- These questions are designed to challenge you mathematically and will often go beyond the usual course material. These questions will each require a novel idea, an new insight or a clever application that is more than just unwinding definitions. You are encouraged to use every means available to you to produce partial or complete solutions. For these questions you may consult other students, other textbooks, other TAs, other professors or even the internet, but please vigilantly cite your sources. I am mainly looking to see if you understand why the question is difficult, and to see if you can say anything intelligent or insightful about the question. These questions might have solutions available online, but even just understanding those solutions might be challenging! I will be looking for evidence that you fully understand whatever solution you present.

Partial solutions to very difficult questions are encouraged and will be graded generously.

Example: We all know how to describe the (Euclidean) distance between two real numbers, namely $d(x, y) = |x - y|$. It is easy to see that a sequence of irrationals can converge to a rational number using this distance. Describe a new distance function on the irrational numbers so that no sequence of irrationals converge to a rational number. (Your distance function should be defined on all pairs of irrational numbers and satisfy the usual definitions of a distance function. See: http://en.wikipedia.org/wiki/Metric_%28mathematics%29#Definition). Now, do the same, but make sure that if a sequence of irrationals converge to an irrational with the Euclidean distance, then they still converge to that same irrational with your distance function.

Please submit assignments that are readable both in terms of your mathematical clarity, and in terms of your physical writing. If you choose to write up your solutions in a word processor, please use Tex (pronounced 'Tek'). Yes, Tex is more challenging to use than Microsoft word, but it is far more elegant and you will need to know Tex if you want to pursue a career in the sciences.

SUBMITTING ASSIGNMENTS & PENALTIES FOR LATE SUBMISSIONS

Assignments must be handed in by 4:10 PM on Mondays when assignments are due. You may hand in your assignment in person (in-class) or you may hand in your assignment to me in my office during my office hours on the Monday that the assignment is due.

Late assignments will not be accepted.

Sometimes you will be unable to attend class on the day an assignment is due. In this case, please make every attempt to hand in your assignment in advance. In exceptional circumstances (i.e. no more than twice this term) you may submit your assignment electronically by emailing a (readable) copy of the assignment to me by 4:10 PM on the Monday that the assignment is due, and is subject to the same lateness penalties below as usual. Please use common sense when sending your assignment electronically - notably, do not send an attachment to me of size > 2 mb.

TUTORIALS

You will be assigned to one of the three weekly tutorial sections for this course. Every tutorial 5-8 students will individually present, at the chalkboard, a solution to a problem they have previously prepared. You may choose any problem from the list of tutorial problems available on the course website, and you will sign up for them in tutorial. The first Wednesday tutorial is on May 14 (which will be used for organization) and the first Monday tutorial is on May 26 (but an organizational meeting will happen on May 14th at 5:00pm after class).

The tutorials are designed to improve your skill in reading, writing and presenting solutions to topology problems.

As a presenter your goals are to: clearly state the problem, establish the overarching idea, draw a picture (if needed), point out difficulties, establish the context of the problem (Why do we care about this problem?), present a solution in a logical, understandable way, answer any questions and fix any problems that arise.

As an audience member your goals are to: be skeptical (don't accept false proofs), follow the solution if possible, tell the presenter when you are lost (make them work!), ask questions, request clarification, point out logical errors (and fixes if possible!), suggest alternatives and ask about generalizations.

Your 10% tutorial grade will be established based on those criteria.

TERM TEST

There will be one term test on Wednesday July 2, 2014. It will be written in class from 4:10-6:00. It is worth 20% of your final grade. There will be no tutorial that day. The room will be announced later.

FINAL EXAM

The room, date and time are TBA. It is worth 40% of your final grade.

MISSED TERM TEST

A student who misses the term test without providing valid documentation by Monday July 7, 2014 at the beginning of class will receive a mark of 0 on the term test. If a student misses the term test for a valid reason, there will be a make-up test (written or oral, at the instructor's discretion).

For medical excuses you will be required to fill out a University of Toronto Verification of Student Illness or Injury Form, available at http://www.illnessverification.utoronto.ca/

YOUR EXPECTATIONS FOR ME

Above all, you can expect I will be professional and respectful in every aspect of the course. You can expect that I will provide you with clear goals, clear assignments and provide you with the tools to succeed in the course. You can expect that the term test and final exam will accurately reflect material, techniques and ideas covered in class and on the assignments. Assignments and tests will be marked fairly and will be returned within a week, barring exceptional circumstances. I will be receptive to your questions, comments and concerns and I will be accessible, both in my office hours and by email. You can expect that most emails will be responded to in a day or less.

MY EXPECTATIONS FOR YOU

Above all, I expect you to engage the course material personally, intimately, honestly and thoughtfully. I expect you to develop an understanding of the basic notions, definitions and ideas in topology through extensive problem solving, engaging in the lectures, and by asking a lot of questions. By the end of the course you should know all of the standard ideas in topology, know some of the history of the area, and strongly develop your problem solvingband proof writing abilities. For the assignments I expect that you will submit work that is your own, that you understand, and that you are proud of.

ACADEMIC INTEGRITY

"Honesty and fairness are considered fundamental values shared by students, staff and faculty at the University of Toronto. The University's policies and procedures that deal with cases of cheating, plagiarism (representing someone else's work as your own), and other forms of academic misconduct are designed to maintain a community where competition is fair." (Taken from: http://www.artsci.utoronto.ca/newstudents/transition/academic/plagiarism)

For your submitted assignments, unless otherwise stated (for example by citing sources) you are claiming all of the work submitted is completely your own. Mathematics is a very collaborative discipline, and you are encouraged to work with other students on the "Application" and "New Ideas" sections of each assignment, however you must submit your own work. If you choose to work with someone else you must write up your solutions independently; copied solutions will not be accepted, and will be treated as academic misconduct.

For the "New Ideas" section of each assignment you will be given a lot of room to consult other sources. You may discuss the problem with other students, TAs or professors, and you may even attempt doing a search of the available literature. **If you submit a solution with an idea, technique or notation that you did not discover on your own you must cite your source**. For this section of questions, with proper citation, it is acceptable to submit a solution whose main idea is not your own, but it must be clear that you completely understand your presented solution. As always though you must write up your own solution, independently.

Familiarize yourself with the University of Torontos Code of Behaviour on Academic Matters (http://www.governingcouncil.utoronto.ca/policies/behaveac.htm). It is the rule book for academic behaviour at the U of T, and you are expected to know the rules.

The University of Toronto treats cases of academic misconduct very seriously. All suspected cases of academic dishonesty will be investigated following the procedures outlined in the Code. The consequences for academic misconduct can be severe, including a failure in the course and a notation on your transcript. If you have any questions about what is or is not permitted in this course, please do not hesitate to contact me. If you have questions about appropriate research and citation methods, seek out additional information from me, or from other available campus resources like the U of T Writing Website. If you are experiencing personal challenges that are having an impact on your academic work, please speak to me or seek the advice of your college registrar.

For more information, please see: www.artsci.utoronto.ca/osai/students

ACCESSIBILITY

Accessibility Services provides academic accommodations in collaboration with students, staff and faculty to support students with documented disabilities in equal opportunities to achieve academic and co-curricular success. Services include but are not limited to:

- Test and Exam accommodations
- Support in determining and negotiating effective accommodations
- Expertise in learning strategies and adaptive technology
- Access to funding for disability related supports and services for qualified students

If this pertains to you, you are encouraged to register with Accessibility Services so that every reasonable accommodation may be made.

For more information please see: http://www.accessibility.utoronto.ca/Home.htm

IMPORTANT DATES

- Monday May 12: First day of class.
- Wednesday May 14: First Wednesday tutorial.
- Monday May 19: Victoria Day. **NO CLASS**
- Monday May 26: First Monday Tutorial.
- Monday June 23 - Friday June 27: Summer Reading Break. **NO CLASS**
- Monday July 1: Canada Day. **University closed**
- Sunday July 20: Last day to drop this course.
- Monday August 4: Civic Holiday. **NO CLASS**
- Monday August 11: Last day of class.