DEPARTMENT OF MATHEMATICAL AND COMPUTATIONAL SCIENCES
UNIVERSITY OF TORONTO MISSISSAUGA

MAT102H5F LEC0101
Introduction to Mathematical Proofs
Course Outline - Fall 2019

Class Location & Time	Tue, 09:00 AM - 10:00 AM CC 1140 Thu, 11:00 AM - 12:00 PM IB 345 Thu, 07:00 PM - 08:00 PM ZZ TBA Fri, 11:00 AM - 12:00 PM CC 1140
Instructor	Marina Tvalavadze
Office Location	DH3044
Office Hours	See course website
E-mail Address	marina.tvalavadze@utoronto.ca
Course Web Site	https://q.utoronto.ca
Co-Instructor	Nadya Askaripour
Office Location	DH3097A
Office Hours	See course website
E-mail Address	nadya.askaripour@utoronto.ca
Co-Instructor	Andrijana Burazin
Office Location	DH3058
Office Hours	See course website
E-mail Address	a.burazin@utoronto.ca
Co-Instructor	Shay Fuchs
Office Location	DH3046
Office Hours	See course website
E-mail Address	s.fuchs@utoronto.ca
Co-Instructor	Micheal Pawliuk
Office Location	DH3086
Office Hours	See course website
E-mail Address	m.pawliuk@utoronto.ca
Co-Instructor	Xinli Wang
Office Location	DH3060
Office Hours	See course website
E-mail Address	xinliw.wang@utoronto.ca
Teaching Assistant	Mark Lee
E-mail Address	markkw.lee@mail.utoronto.ca
Teaching Assistant	See course website

Course Description

Understanding, using and developing precise expressions of mathematical ideas, including definitions and theorems. Set theory, logical statements and proofs, induction, topics chosen from combinatorics, elementary number theory, Euclidean geometry. [41L, 12T]

Prerequisite: Minimum 70% in Grade 12 Advanced Functions (MHF4U)
Exclusion: MAT138H1,MAT246H1,CSC165H1,CSCA67H3
Recommended: Minimum 70% in Grade 12 Calculus and Vectors (MCV4U) (SCI)
Distribution Requirement: SCI

Students who lack a pre/co-requisite can be removed at any time unless they have received an explicit waiver from the department. The waiver form can be downloaded from here.

Learning Outcomes

There are two primary, complementary learning objectives in this course. By the end of this course, students should be able to:

1. **Communicate mathematically**.
    1. Communicate mathematical ideas/arguments/proofs, using the language of mathematics, including terminology and notation, in an accurate, precise and coherent way.
    2. Parse a mathematical sentence about fundamental notions and objects (such as sets, functions, divisibility, relations), as well as their properties.
2. **Think mathematically**.
    1. Identify and implement methods of proof (e.g., contradiction, induction) that can be used to prove a given mathematical statement.
    2. Detect flaws and gaps in a mathematical argument, and identify ways to fix them.
    3. Adapt ideas and techniques in given proofs to solve *new* problems.

Textbooks and Other Materials

The course notes (by Shay Fuchs) will be the main resource for this class and contains all required materials. These notes will be available on the course website. Hard copies of the course notes will also be available in the bookstore.

NOTE: Calculators are **not** needed for this course, and will **not** be allowed during quizzes, tests and exam.

Assessment and Deadlines

Type	Description	Due Date	Weight
Assignment	Best 4 (out of 5) hand-in assignments.	On-going	10%
Quiz	Best 3 (out of 4) in-class quizzes.	On-going	30%
Term Test		2019-10-31	20%
Final Exam	TBA	TBA	40%
		Total	100%

More Details for Assessment and Deadlines

Problem Sets

You are expected to work on the questions assigned, and if you cannot solve a problem, you should ask your TA and/or the instructor for help. You will submit the **Problem Sets 1,2,3,4 and 5** on Quercus for grading.

You are encouraged to work with your fellow students while working on questions from the problem sets.**However, the writing of your assignment must be done without any assistance whatsoever.** Your problem set mark will be determined by taking the average of the best **four** problem sets.

Note: To submit a problem set for grading, submitone copy of your work **on Quercus** by 5pm on the day it is due.

Due dates and coverage

1. PS 1 - Material from Blocks 1,2 - Due Friday Sept 20, 2019 at 5pm.
2. PS 2 - Material from Blocks 3,4 - Due Friday Oct 4, 2019 at 5pm.
3. PS 3 - Material from Blocks 5,6 - Due Friday Oct 25, 2019 at 5pm.
4. PS 4 - Material from Blocks 7,8 - Due Friday Nov 8, 2019 at 5pm.
5. PS 5 - Material from Blocks 9,10,11 - Due Friday Nov 29, 2019 at 5pm.

Quizzes and Term Test

There will be **four quizzes** and **one term test**. See the course schedule below for dates, times, location and material for each quiz/term test. More details about the term test and the quizzes will be given later. You **must** bring your student card to **the term test** and to **each quiz**. Your quiz mark will be determined by taking the average of the best**three** quizzes.

1. Quiz 1 - Material from Block 1 - Sept 19, 2019. 7:00pm-7:45pm.

2. Quiz 2 - Material from Blocks 2,3,4 - Oct 10, 2019. 7:00pm-7:45pm.
3. Term Test - Material from Blocks 1,2,3,4,5,6 - Oct 31, 2019. 7:00pm-8:00pm.
4. Quiz 3 - Material from Blocks 7,8 - Nov 14, 2019. 7:00pm-7:45pm.
5. Quiz 4 - Material from Blocks 7,8,9 - Nov 21, 2019. 7:00pm-7:45pm.

Note: **There are no makeup quizzes!** If you miss **one quiz** due to illness, you **DO NOT** need to submit a medical note, since only the best three quizzes will count. If you miss more than one quiz, you will have to provide proper documentation to the assisstant course coordinator (Mark Lee) and your marking scheme will be adjusted (see the section Missing a Quiz below).

Penalties for Lateness

Missing a Problem Set

Late Problem Sets will not be accepted for marking.

Procedures and Rules

Missed Term Work

Missing a Quiz

There are no makeup quizzes! If you miss one quiz due to illness, you **do not** need to submit a medical note, since only the best three quizzes will count. If you miss more than one quiz, you will have to provide proper documentation to the assisstant course coordinator (Mark Lee) and the weight of the quiz (quizzes) will be shifted towards the final exam.

Missing the Term Test

If you cannot show up for the test because of illness or any other special reason, you should declare your absence on ACORN and submit your documentation to the assisstant course coordinator (Mark Lee) no later than **one week** after the day of the test (for medical notes, you must use the **Official Verification of Student Illness or Injury form**, which can be downloaded from the course website).
There will be no make-up tests. If valid documentation is provided, the weight of the test will be shifted towards the final exam.

Missed Final Exam

Students who cannot write a final examination due to illness or other serious causes must file an online petition **within 72 hours of the missed examination**. Original supporting documentation must also be submitted to the Office of the Registrar **within 72 hours of the missed exam**. Late petitions will **NOT** be considered. If illness is cited as the reason for a deferred exam request, a U of T Verification of Student Illness or Injury Form must show that you were **examined and diagnosed at the time of illness and on the date of the exam, or by the day after at the latest**. Students must also record their absence on ACORN on the day of the missed exam or by the day after at the latest. Upon approval of a deferred exam request, a non-refundable fee of $70 is required for each examination approved.

Academic Integrity

Honesty and fairness are fundamental to the University of Toronto's mission. Plagiarism is a form of academic fraud and is treated very seriously. The work that you submit must be your own and cannot contain anyone elses work or ideas without proper attribution. You are expected to read the handout How not to plagiarize (http://www.writing.utoronto.ca/advice/using-sources/how-not-to-plagiarize) and to be familiar with the Code of behaviour on academic matters, which is linked from the UTM calendar under the link Codes and policies.

Final Exam Information

Duration:	3 hours
Aids Permitted:	None

Additional Information

Tutorials

There are several tutorial groups in the course. Each student must be registered in one of the tutorials (on ROSI), and attend it regularly every week. Details regarding the day, time and location of your tutorial are available online, at https://registrar.utm.utoronto.ca/student/timetable/.

In tutorials, you will have the opportunity to work on problems and get help and guidance from your TA. Occasionally, the TA will review some of the material discussed in the lectures, and will present solutions to homework problems.

Tutorials will begin on the week of **September 9, 2019.**

Note: Students can register for any of the tutorials, regardless of the lecture section in which they are registered.

E-mail Policy
E-mails must originate from a utoronto.ca address and contain the course code MAT102 in the subject line. You **must include** your **full name** and **student number** in your e-mail.

All questions about course content should be made on Piazza (not by email).

Course Content (Tentative)

A "Block" is a week starting on Thursday and ending on Wednesday.

Block 1

Introductions [0.5 hours]
1.1 The Quadratic Formula [0.5 hours]
1.4 Types of Numbers [1 hour]
Definitions/Axioms/Theorems [1 hour]

Block 2

3.1 Mathematical Statements and their building blocks [0.5 hours]
3.2 The Logic Symbols [0.5 hours]
3.3 Truth and Falsity [1 hour]
3.4 Truth Tables and Logical Equivalences [1 hour]

Block 3

3.5 Negation [1 hour]
3.6 Proof Strategies [2 hours]

Block 4

2.1 Sets [2 hours]
2.2 Functions (OMIT range calculations involving inequalities) [1 hour]

Block 5

7.1 The Definition of a Relation [1 hour]
7.2 Equivalence Relations [1 hour]
7.3 Equivalence Classes [1 hour]

Block 6

7.4 Congruence mod n [1 hour]
1.2 Inequalities and AGM [1 hour]
1.3 The Triangle Inequality [1 hour]

Block 7

2.2 Functions (range calculations involving inequalities) [1 hour]
4.2 Summation and Product Notation [1 hour]
4.1 The Principle of Mathematical induction [1 hour]

Block 8

4.1 The Principle of Mathematical induction [2 hours for 4.1, 4.3 and 4.4]
4.3 Variations (on induction)

4.4 Additional Examples
4.5 Strong Induction [1 hour]

Block 9

5.1 Injections, Surjections and Bijections [2 hours]
5.2 Compositions [1 hour]

Block 10

5.3 Cardinality [2 hours]
5.4 Cardinality Theorems [1 hour]

Block 11

Power set [1 hour]
5.5 More Cardinality [1 hour for Cantor's thm]
6.1 Divisibility and the Division Algorithm [1 hour]

Block 12

6.2 GCDs and the Euclidean Algorithm [2 hours]
6.3 The Fundamental Theorem of Arithmetic [1 hour]

Last Date to drop course from Academic Record and GPA is November 7, 2019.