Math 220 - Discrete Mathematics

Course Information

Instructor and Course Meeting Information

Instructor: Lola Thompson
E-mail: lola.thompson@oberlin.edu
TuTh 3:00-4:15 PM
Location: King 237
Office: King 200
Office Hours:
Tu 1:30 - 2:30
W 11 - 12
Th 4:30 - 5:30
   *And by appointment.

Course Objectives

By the end of this course, you will be able to:

- Read and understand mathematical proofs
- Write your own mathematical proofs in a clear and precise fashion
- Orally communicate mathematical ideas to others
- Apply a variety of techniques from different disciplines within mathematics (logic, number theory, combinatorics, and graph theory).

Course Structure

This course will be taught using an Inquiry-Based Learning (IBL) model. The format will be very different from that of a typical math course. In particular, I will not spend much time giving lectures in classs. Rather than being presented with neatly-packaged theorems and proofs, in this course you will be asked to devise your own conjectures and then prove them for yourself!

Textbook

There is no required textbook for this course. We will discover the bulk of the material on our own, without the influence of a textbook! That said, for those who wish to consult a written resource, I have listed some recommended reading in the course schedule below. The reading comes from "How to Think Like a Mathematician" by Kevin Houston. You can find it at the Oberlin Bookstore, or you can order it online. There is also a copy on reserve at Mudd Library.

We will have some assigned readings from "The 5 Elements of Effective Thinking" by Edward Burger and Michael Starbird. These readings will be photocopies and posted on our course Blackboard site. If you are interested in reading the rest of the book, you can purchase it at your favorite bookstore (e.g., Amazon, Barnes and Noble, etc.).

Grades

The grades in this course will be calculated as follows:

	Weight
Class Participation	10%
Homework	25%
Quizzes	20%
Midterm Exam	20%
Final Exam	25%

Class participation

Class participation is essential in a course of this nature. When you miss class, you are not only affecting your own progress in the course but you are also causing your working group to be short one member. Your class participation grade (worth 10% of your course grade) will be calculated using a peer-assessment survey and a self-assessment survey, which will be handed out at the end of the semester.

Attendance: Each student is granted three "unexcused" absences. After that, absences will adversely affect your Class Participation grade. There is no need to e-mail me to explain an unexcused absence. If you have a legitimate academic reason for missing a class (or a documented illness), please e-mail me as soon as possible. All "excused" absences must be cleared with me before the start of the missed class period.

Group Work: Working groups will be assigned. They will normally consist of 3-4 students. Groups will be shuffled (approximately) every two weeks.

Student presentations: Student presentations are an important component of this course. During most class periods, I will ask several groups to present their solutions to the worksheet problems at the board. Audience questions are strongly encouraged! That said, all questions MUST be posed in a respectful and encouraging manner. You are welcome to take notes and revise your own work based on what you learn from the in-class presentations. However, you may not copy directly from another group. If you borrow ideas from your classmates' presentations, you need to explain them in your own words.

Homework Assignments

Problem sets will be due at the beginning of (nearly) every class period. This will normally consist of writing up a selection of problems from the worksheet from the previous class period. You are welcome (and encouraged!) to work closely with your group members on solving any of the problems, provided that each student writes up their own set of solutions in their own words. **Late homework will not be accepted unless you have cleared it with me in advance.** I will drop your two lowest scores at the end of the semester.

Exams

There will be one take-home midterm exam. There will also be two in-class quizzes. The in-class quizzes will test your ability to solve routine problems and write some basic proofs. The take-home midterm will involve a few more-sophisticated proofs.

Blackboard

Copies of the worksheets and other course materials can be found on the course Blackboard site. Go to `http://blackboard.oberlin.edu` to access these materials.

LaTeX

Beginning in the second week of classes, all students will be required to type up their homework using LaTeX. I will offer a LaTeX tutorial early in the second week to help you get up to speed. If you do not wish to deal with the hassle of installing LaTeX on your computer, you can use it (for free!) on the web: `https://www.sharelatex.com`

Course Policies

Academic Honesty

Homework

Each day, your homework assignment will be to finish and carefully write up solutions to some of the in-class problems. You are welcome to consult with your class notes, your classmates and the instructor. However, you *may not* consult any books (other than our course textbook) or internet resources – otherwise, you run the risk of ruining the surprise of discovering the course content for yourself. Your experience in Math 220 will be much richer (and your intuition for the subject far greater) if you arrive at the solutions without the aid of a book.

You are encouraged to work with your group members outside of class. You are also welcome to form study groups with other students in the course. In any collaborative efforts (outside of working with your group members), you must abide by the following guideline: you may discuss the general problem-solving techniques for homework problems with other students, but you must write up your solutions independently.

Exams

You are not allowed to use any electronic device or consult any source other than the instructor during an in-class quiz or exam. In particular, this means *no calculators, smartphones, regular cellphones, iPods, eReaders, laptops, notes, textbooks, etc.* For the take-home midterm, you may only use your class notes, problem sets, and your professor as resources (i.e., all other resources, including fellow humans, are off limits). You are on your honor not to talk to another student about an exam until both students have turned them in.

Note: Information about the Honor System at Oberlin can be found at the following website: http://www.oberlin.edu/students/links-life/honorcode.html. Please familiarize yourself with its content.

Disabilities

Students in this course with disabilities, including "invisible" disabilities such as chronic diseases and learning disabilities, and who may need disability-related classroom accommodations, are encouraged to make an appointment to see their instructor as soon as possible.

Make-up Policy

Typically, I will not accept late homework, and a missed midterm exam cannot be made up. That said, I understand that some circumstances are beyond your control. Should you contract a serious illness or find yourself in an emergency situation, please contact me *immediately*. I will be happy to make arrangements with you under these types of extreme circumstances.

Religious Observances

Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me before the end of the second week of the semester to discuss appropriate accommodations.

Important Dates

Add/Drop Deadline	February 10th (Wednesday)
Spring Break!	March 19th (Saturday) - March 27th (Sunday)
Withdraw and P/NP Deadline	April 4th (Monday)
Classes End	May 6th (Friday)
Reading Period	May 7th (Saturday) - December 10th (Tuesday)
Final Exam	May 13th (Friday) from 7 - 9 PM

Course Schedule

The following is an estimated schedule for the course. Please note that the quiz and exam dates are tentative.

Lectures	Brief Description	Recommended Reading
2/2	Thinking Mathematically	Chap. $1-4$
2/4	Logic: Truth Tables	Chap. 6
2/9	Logic: Implications	Chap. $7-9$
2/11	Interlude: Intro to Number Theory	
2/16	Logic: Quantifiers; More Fun with Quantifiers!	Chap. $10-11$
2/18	Proof-writing Skills: Proof Techniques	Chap. $20-23$
2/23	Proof-writing Skills: Induction	Chap. 24
2/25	Number Theory: Modular Arithmetic & gcds; **Quiz**	Chap. 27
3/1	Number Theory: Euclid's Algorithm, Diophantine Equations	Chap. 28
3/3	Number Theory: Multiplicative Orders	
3/8	Number Theory: Unique Factorization	
3/10	Number Theory: Gems of Number Theory	
3/15	Counting: Sets in Mathematics	
3/17	Counting: Functions in Mathematics; **Midterm Exam due**	
3/19 - 3/27	**Spring Break (No Class!)**	
3/29	Counting: Binomial Coefficients and Pascal's Triangle	
3/31	Counting: Binomial Theorem	
4/5	Counting: More Fun with Counting Techniques!	
4/7	Graph Theory: Intro to Graph Theory	
4/12	Graph Theory: Walks, Cycles, Paths, and Trees	
4/14	Graph Theory: Diameters and Subgraphs	
4/19	Graph Theory: Chromatic Number; **Quiz**	
4/21	Graph Theory: Hamiltonian Paths and Cycles	
4/26	Graph Theory: Planar Graphs	
4/28	Special Topic: Sizes of Infinity	
5/3	Special Topic: The Triangle Game and Ramsey Theory	
5/5	Special Topic: Cryptography and Digital Security	
5/10	**Optional: Class Party/Exam Review** 3 - 5 PM	
5/13	**Final Exam** 7 - 9 PM	