SYLLABUS

Mathematics 220 will meet Tuesdays and Thursdays in King 227.
Section 01: 9:30–10:45 a.m., Section 02: 11:00 a.m.–12:15 p.m.

TAUGHT BY: Elizabeth Wilmer
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OFFICE HOURS: Tuesday, 2:00–3:00 p.m.
Wednesday 10:00–11:30 a.m.
Wednesday, 2:00–3:00 p.m.
Thursday, 3:00-4:00 p.m.

GOALS OF THE COURSE: An introduction to the tools and methods of higher mathematics via logic, number theory, combinatorics, and graph theory. You will learn how to turn an intuitive justification of a mathematical statement into a *proof*. You will also learn to write up your proofs in standard mathematical style.

TEXTBOOK: *Discrete Mathematics,* second edition (Norman L. Biggs, Oxford, 2003, ISBN 978-0198507178), available at the Oberlin Bookstore. We will cover most of Chapters 1 through 10 and parts of chapters 11 through 13.

RECOMMENDED BOOK: *How to Think Like a Mathematician: A Companion to Undergraduate Mathematics* (Kevin Houston, Cambridge, 2009, ISBN 978-0521719780).

OWL: Jesse Banks will be leading Workshop and Learning Sessions for Math 220; these are tentatively scheduled for Sunday, Tuesday and Thursday, 8:00 to 9:00 p.m., in King 243.

COURSE MECHANICS

EVALUATION: Each of the two in-class exams is worth 100 points. The final is worth 200 points. The project is worth 100 points. Homework is worth 200 points.

EXAMS: There will be two in-class exams: **THURSDAY, MARCH 6** and **THURSDAY, APRIL 17**.

- Final exam, Section 01: **THURSDAY, MAY 15, FROM 9:00 TO 11:00 A.M.**
- Final exam, Section 02: **WEDNESDAY, MAY 14, FROM 2:00 TO 4:00 P.M.**

Books, notes, and calculators will not be allowed at any of the exams.

ASSIGNMENTS: Homework is the intellectual heart of this course. *You should take it very seriously.*

The problems assigned will be challenging. You should expect to spend quite a bit of time working on them. You should also expect that sometimes your first, or second, or third attempt to solve a problem might not work out. Keep going! Keep trying! Come talk to me about what you've tried, how far you've gotten, and what you suspect might work. You learn something about a problem every time you think about it, and seeing why one argument doesn't work may point the way towards one that does.

In Mathematics 220, the words you write will be at least as important as the numbers or equations they surround. Learning how to express abstract reasoning clearly and in appropriate words and symbols is a central goal of this course. There will be handouts with advice on writing proofs, and

Huston's book gives lots of good advice. The graders and I will comment on both the mathematical content and the clarity of your writing.

- There will be one assignment per week, generally due at the beginning of class on Thursday.

- Late assignments will not be accepted (medical emergencies excepted), although your two lowest assignment scores will be dropped.

- Each assignment will include problems labeled "warmup" and problems labeled "to turn in." Only the "to turn in" problems will be graded.

- Ordinary problem sets will be graded on a √+/√/√- scale. An even mix of √+'s of √'s will be scaled to at least a B+ as final grades are prepared.

- Full solution sets will be posted to Blackboard shortly after assignments are due.

GRAPH THEORY PROJECT: At the end of the course, there will be a group project on graph theory requiring independent exploration and construction of proofs. It will be handed out on Tuesday, April 22 and due at the last class meeting on **THURSDAY, MAY 8**. You will work on this project with two or three other students.

IF YOU HAVE QUESTIONS–ASK! Stop by during office hours, or make an appointment for another time. Go to an OWL session. Send e-mail any time (although I usually can't reply between 10:00 pm and 8:30 a.m.) Call.

THE HONOR CODE AND MATHEMATICS 220

Since your grade for Mathematics 220 depends on the results of your exams, your problem sets, and your group projects, you must uphold the Honor Code while completing all three types of work. You are expected to write and sign the Honor Pledge,

"I affirm that I have adhered to the Honor Code in this assignment,"

at the end of each problem set and each exam. At the end of the graph theory project, *every* member of the group should write and sign the Honor Pledge. The meaning of adhering to the Honor Code differs, however, for the three types of assignments.

THE HONOR CODE AND PROBLEM SETS: Talking about mathematics is an excellent way to improve your understanding of the subject. I encourage you to discuss homework problems with other students. Unless otherwise specified, however, *you must write up the problems on your own*. Some quick examples:

> **OKAY:** "I wonder if we can use De Morgan's Laws to simplify this. Pat, do you think that will work, or is something different going on?"
> **NOT OKAY:** "Pat, I hate it when you write so small! Is that a *2* or an *a* in front of the *y*? I'm never going to get this copied by the time class starts!"
>
> **OKAY:** "I'm not sure I understand this. Maybe we should try to find another example, except with the graph not bipartite."
> **NOT OKAY:** "Huh. You have this letter *m* in your write-up. Maybe I can call it *k* instead, to make it look different. "

You may feel free, when working on problem sets, to consult other written resources (such as other books or web sites on discrete mathematics)–as long as (a) the sources you consult do not directly address assigned problems, or close variants of assigned problems, and (b) you cite your sources in your writeup.

THE HONOR CODE AND THE GRAPH THEORY PROJECT: You should consult only other members of your group when working on the group project. There will be sharp restrictions on what written and/or electronic materials may be consulted. Details will be provided on the project sheet.

THE HONOR CODE AND EXAMS: You will be expected to work *entirely on your own* during the exams. No books, notes, or calculators may be used during an exam.

STUDENTS WITH DISABILITIES

Any student eligible for and needing academic accommodations because of a disability should consult with the Office of Disability Services and Prof. Wilmer at least one week before the accommodations will be needed.

SCHEDULE (APPROXIMATE)

Week	Dates	
1–2	February 4–13	Sets: notation, operations, identities. Formal logic: propositional notation, logical equivalence, quantifiers.
3	February 18–20	Natural numbers: axioms and properties. Induction: weak.
4	February 25–27	Induction: strong, principle of least element. Recursion.
5	March 4–6	Induction and its consequences, continued. Fundamental Theorem of Arithmetic, part I. **EXAM I**
6	March 11–13	Functions. Sizes of sets; pigeonhole principle, finiteness. Equivalence relations.
7	March 18–20	Building **Z** (the set of integers) from **N** (the set of natural numbers) Rational and irrational numbers. Countable and uncountable infinite sets.
	March 25–27	**SPRING BREAK**
8	April 1–3	Proving things about integers. Quotient-remainder theorem.
9	April 8–10	Greatest common divisors, Euclidean algorithm. Fundamental Theorem of Arithmetic, part II.
10	April 15–17	Modular arithmetic. Starting enumeration: addition principle, multiplication principle. **EXAM 2**
11	April 22–24	Enumeration, continued: binomial coefficients, Pascal's triangle, identities. Combinatorial proofs; **Graph Theory project handed out**
12–13	April 29 –May 8	Graph theory
	May 14/15	**FINAL EXAM** (date depends on section)