

Course Syllabus
Math 3710---Fall 2011

Instructor: Dr. Neal Smith

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Office Hours: How about 10:00-12:00 TR, and by appointment. Stop by if you're really stuck on a problem, or for any other reason.

Prerequisite: Calculus II or permission of instructor. A basic working knowledge of series will be needed.

Text: Proofs that Really Count: The Art of Combinatorial Proof, by Benjamin and Quinn. For parts of the course, we will use the text, but much of the course material will come from outside the text.

Grading: Your grade will be determined by your performance on 2 'mid-term' exams, homework, and a final exam; each mid-term will count for 30% of your grade, the final 30%, and homework will count for the remaining 10%.

| If your final percentage is in the interval... | Your course grade is... |
|---|--------------------------------|
| [80%, 100%] | A |
| [70%, 80%) | B |
| [60%, 70%) | C |
| [40%, 60%) | D |
| [0%, 40%) | F |

Other Policies:

Attendance: I'm not the attendance police, but you need to be here every day. Now that you're in the world of upper-division courses, frivolous absence is a bad thing. You never know if you might want someone to write you a recommendation letter someday. If you know you will be absent on a given day for a legitimate purpose, it is expected that you will notify me beforehand.

Make-ups: I do not like to do make-ups. If you know you're going to be gone at some point (for a non-frivolous reason) when exam-time nears, let me know well in advance, so I can schedule the exam appropriately.

Grading philosophy: A large component of this course deals with how to put together a coherent mathematical argument. Homework and exams will be graded with this in mind; thus you should make things as clear, neat, and organized as possible to ensure that you receive the proper credit for your work.

Grading philosophy, specifics: On homework and exams, problems will typically be evaluated with the following rubric in mind.

4-The problem is completely correct, beyond any reproach.

3-The problem is 'basically correct', but there may be some problems with a minor detail, the proof may be not as well written as it should be, etc.

2-The problem is almost complete. The key idea is there, but there may be some errors. Or, the problem is correct but the solution is poorly written.

1-Shows some awareness of correct methods, but little to no progress towards an actual solution is present.

0-Speaks for itself. What is written down is of no value with regards to a solution to the problem.

Honor Statement: Each student is responsible for maintaining academic honesty as specified in the ASU catalog. You are free to work with others on homework assignments, but homework handed in should be your own and not simply a 'bad photocopy' of someone else's work. On any assignment which is designated as a 'take-home exam' or portion thereof, there shall be **no collaboration of any kind** between students.

Etiquette: Please be punctual and make sure your cell phone is turned off before coming to class.

Advice: You will probably find that we will not be able to spend as much time in class answering questions as anyone (myself included) would like. Please take advantage of my office hours. Get to know your classmates; the semester will probably be more productive (and more fun) if you get to know some people that you can work with. When the exam rolls around, see if you can explain stuff to the people in your study group!

Course Outline:

*---denotes topics where the textbook will be referred to often.

I. Preliminaries

- a. What is Combinatorics?
- b. Sets, functions, and bijections
- c. Mathematical induction

II. Basic counting techniques

- a. The addition and multiplication principles
- b. Permutations of a set
- c. Combinations of a set
- *d. The Combinatorial proof
- *e. The Binomial Coefficients
- *f. Binomial Coefficient Identities
- *g. Combinatorial Interpretations of the Binomial Coefficients
- h. The Binomial Theorem
- i. Multisets, the Multinomial coefficients, and the Multinomial Theorem
- j. The Inclusion-Exclusion Principle

Exam 1 should happen around here

III. More advanced counting techniques: Recurrences and Generating Functions

- a. Examples of recurrences
- *b. The Fibonacci sequence
- *c. Combinatorial interpretations of Fibonacci numbers
- d. Difference equations: homogeneous and inhomogeneous
- e. Techniques for solving difference equations
- f. Derangements of a set
- g. Review of Calc II: power series
- h. Generating functions: ordinary and exponential

Exam 2 should happen around here

IV. Some sort of advanced stuff

- *a. Stirling numbers of the second kind.
- b. The Difference Operator Δ , a 'discrete derivative'
- c. Properties of Δ , difference tables, and the "Fundamental Theorem of Finite Differences".
- d. Polya's counting theorem.

Student survey

Take two minutes of your life and fill this out.

Which of the following courses have you taken/will you take eventually?

| | Already taken | Will take eventually |
|---|---------------|----------------------|
| Math 2030 (Logic and Set Theory) OR CSCI 3030 | | |
| Math 3020 (Differential Equations) | | |
| Math 4211 (Abstract Algebra) | | |
| Math 4251 (Probability and Statistics) | | |

What is your post-graduation goal?

Job (non-teaching) _____

Teaching job _____

Graduate school in Mathematics _____

Graduate school (not Mathematics) _____

Other _____