

Some information about Finite Mathematics, MATH 279, for Fall 2009

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Graduate assistant: Wes Fussner
- David’s office hours: Permanent hours will be announced. *Please feel free* to ask for an appointment if my office hours are not convenient.
- Text: *Discrete Mathematics with Applications, Third Edition*, by Susanna Epp, and other handouts.

Thank you for your input to help design the course. I will incorporate many of the things you have already expressed, and maintain flexibility for us to take advantage of needs and opportunities as they arise. My goal is for you to be very actively involved in learning some topics in finite/discrete mathematics, in the context of learning various fundamentals of modern mathematics, logic, and methods of proof. With this course you should gain competence with the basic practice of mathematics, consisting of the progression Experiment \rightarrow Conjecture \rightarrow Proof \rightarrow Generalization, and back to Experiment. This will be a challenging course, and you should expect to spend a lot of time and effort on it; the ultimate responsibility for what you learn is your own. I hope you will find that mathematics is broad, rich, interesting, and useful, and that you can personally be mathematically creative and have a real feeling of accomplishment from it. We should also have fun and stretch our brains at the same time, which is what I think doing mathematics is all about.

Topics:

- Some of the topics in *discrete mathematics* I will select from are:
 - algorithms (division algorithm, Euclidean algorithm, leading to the Fundamental Theorem of Arithmetic);
 - discrete summation (sums of powers in the works of Archimedes, Fermat, Pascal, Bernoulli, Euler, and connections to continuous mathematics via integration);
 - elementary number theory (Fermat’s Theorem, leading to the RSA cryptosystem used for internet encryption security today);
 - the combinatorics of counting and discrete probability, involving combination numbers in the works of Fermat and Pascal, the binomial theorem, and the Catalan numbers, leading to generating functions;
 - other modern discrete structures such as graphs and their topology (the Königsberg bridge problem, Euler circuits, Hamiltonian circuits).
- Intimately integrated with these topics will be an introduction to various *foundational structural concepts* for modern mathematics, such as sets, functions, and relations, including facility with absolute values and inequalities.
- All our work will also be integrated with first studying the basics of *logic* (with direct applications in Boolean algebra and digital circuits) needed to do mathematics, and with the nature and practice of *proof techniques* in mathematics. We will specifically study and learn methods of direct proof and proof by counterexample, indirect proof by contradiction and contrapositive, and the method of mathematical induction.

This material is all roughly in Chapters 1–7 and 10,11 of our text.

Course design: I am designing the course to help you succeed in learning and have a productive experience, and to be well prepared for future study. Your work will have several components. A variety of types of work will allow you to shine in ways which best match your strengths. I expect that some people will excel with certain types of assignments, and others with different ones. Your course grade will be based on a holistic evaluation of all these components. If you are not actively participating in class and keeping up with passing quality written work, including advance preparation for class, I will initiate an instructor withdrawal for you. The major components and their approximate importance in the overall holistic evaluation are:

- **Textbook and Project homework, including in-class participation and work (65%):** This is the critical day-to-day fundament of our course.

Each homework will consist of three equally important parts, encompassing all together: advance preparation with reading, writing responses to reading questions, creating some of your own questions, reflection; then warm-up exercises and in-class work with others and the whole class; and then completion of main exercises. The details are explained on a separate handout.

I expect everyone to attend and participate actively in class, in particular to speak up during class discussion with questions and ideas, and to work well with others. A substantial part of your work for the course is this active participation in class. Please always be on time and prepared for class, so that we can make the best use of our precious time together.

I expect and encourage you to work collaboratively on homework, but then to write up your own final homework paper all by yourself based on what you have learned. Thus your homework papers should not read like anyone else's. I always expect to receive your homework when due, unless there are extenuating circumstances you discuss with me; speak with me if your homework must be late for a special reason. You should always hand in your homework when due even if it is incomplete. Late homework will receive only partial or no credit. On-time homework may sometimes, at my suggestion, be re-worked after I critique it, to bring it to perfection, due at the next class period after being returned by me. My goal is to help you perfect your work to your and my satisfaction.

Some of your regular work will be with projects based on primary historical source material on major topics in finite/discrete mathematics, which you will work on both in and out of class. This is intended to enrich your understanding and appreciation of the subject, and provide a more in-depth, holistic, and comprehensive experience than homework from the textbook; I will explain more about this later. As with textbook homework, I will encourage collaborative work, to be followed by writing up your work all by yourself.

- **Personal Dictionary (5%):** I expect you to make an excellent personal dictionary for the course, of new concepts and definitions, with your own ideas and views on them. Also include helpful examples and connections. I will collect and mark this periodically.
- **Midterm and final exams (30%):** I will announce the format of these later. You must plan to be here at the University's scheduled time for our final exam during final exam week.
Caveat: I will expect you, irrespective of other work, to earn a grade of C on both the midterm and final exams to earn a C in the course.

Regarding what I write on your papers: My goal is to help you learn. If I write a note asking you a question, write back and bring my attention to it, or talk to me! If I circle something

and put a question mark, I could not decipher or understand it. If I circle something with no comment, I am alerting you to check on a question of spelling, grammar, or meaning which needs correcting. If something needs further work, I will often expect you to redo it to perfect it, and give credit when it is corrected.

Joint expectations: We should each expect time, energy, enthusiasm, hard work, fun, confidence, good will, and fairness from each other. I expect your personal participation: attend and be active in class, and do all assigned work on time in advance, so that we can all benefit most from class time. Be willing to explore new ideas, and bring your suggestions, ideas, and needs to class. You can expect me to make class interesting by selecting good topics for us to explore, to tie topics together and to applications, to provide expert guidance, help, and encouragement in your learning both in and out of class, to help you build your self-confidence, ability, understanding, and appreciation of mathematics, and to design the course best for you to learn, to show what you have learned, and to meet your individual needs. I will provide flexibility to encourage innovation, allowing us to take advantage of opportunities as they arise. I will serve as a model for you in the practice of mathematics.

Help: Here are places to go for help.

1. Your friends and other classmates, relatives, and any dog, cat, or other pet should all be considered useful sources of inspiration. I strongly encourage group work on homework, with individual writeups. The only **rule** is that if you are to hand in your own individual assignment, then after you've talked all you want with sources of help, go home and write up your own assignment, *by yourself*, to hand in. Your paper should never read like anyone else's, since it should always be your own thoughts in your own words.
2. Also, I'm available, and want to help. I should be your primary source of help after those above. Try to prepare specific questions about things you are having trouble with. "I can't do this problem" is not very helpful to you or me, whereas "I started to do this, and then this happened, and I got stuck" gives us much more to work with. I can help you a lot in class, and am also available during my office hours, or by appointment.
3. The NMSU Student Success Center, in Hardman Hall 210, provides help with study habits and skills, though not for content of specific courses. The Center offers specific help on learning mathematics. The Center serves anyone who is interested in improving the quality of his or her academic life. In particular, the Center administers and interprets a "learning style inventory," which can help you understand your learning preferences and cope with different types of courses.
4. The Writing Center (<http://www.nmsu.edu/~english/wc/writingcenter.html>) is available to help with all aspects of your writing skills, including grammar. Written expression is extremely important in mathematics, increasingly so at the level we will be working.