Math 455 Introduction to Discrete Structures

Instructor:	Tom Braden	**TA:**	Cristian Rodriguez
Office and phone:	LGRT 1240, 5-1732		LGRT 1323B
email:	braden at math dot umass dot edu		rodriguez at math dot umass dot edu
Office Hours:	M 10:30-1:30, Fri 2:30-3:30, and by appointment		Fri 11-noon

Web page: blogs.umass.edu/math455-braden

Course meets: MW 2:30-3:45, LGRT 219

Text: Harris, Hirst, and Mossinghoff, Combinatorics and Graph Theory, 2nd edition. It is available to download for free as a pdf from the UMass library (follow the link above, then click "view e-book"). You can also order a low-cost softcover from the same page.

Description: This course gives a rigorous introduction to some topics in mathematics that underlie areas in computer science and computer engineering, including graphs and trees, spanning trees, colorings and matchings; the pigeonhole principle, induction and recursion, and generating functions. The course integrates learning mathematical theories with applications to concrete problems from other disciplines using discrete modeling techniques. Student groups will be formed to investigate a modeling problem and each group will report its findings to the class in a final presentation. This course satisfies the university's Integrative Experience (IE) requirement for math majors.

Prerequisites: Calculus (MATH 131, 132, 233), Linear Algebra (MATH 235), and Math 300 or CS 250, or equivalent experience reading and writing proofs.

Grading: Your course grade will be based on

- Two exams:
  a midterm, in class Wednesday October 16, worth 20%
  a final exam Friday December 13, 3:30-5:30pm, worth 30%
- Homework assignments 30%
- A group project and self-reflective essay 20%

The final exam will be cover the entire course, but it will be more strongly weighted on material from after the midterm.

Homework Rules and Guidelines:
I encourage students to discuss the homework problems with each other and to work in groups, but if you do so, you **must** list the names of all people you worked with**,** and you **MUST** write up your solutions completely independently.

More generally, I expect all students to follow the standards set out in the University's academic honesty policy.

Homework will be due at the start of lecture, generally on Mondays. Late homework will not be accepted without a valid reason (illness, etc.), but I will drop the lowest homework grade.

Group project and self-reflective essay:
As part of the designation of Math 455 as an IE course, each of you will be participating in a group project. Around the time of the midterm I will divide the class into groups of 4-5 students each, based roughly on your interests and backgrounds as provided in a questionnaire I will distribute. Each group

will decide on a topic to investigate -- I will give you a list of suggestions for topics, or you can come up with your own, subject to my approval. Topics can involve applications of discrete mathematics to real-world problems, or more theoretical results. Some projects may involve some computer programming, others can be investigated using pencil and paper. At the end of the semester, the groups will give short presentations (~25 minutes) about what they have learned. Each student will also

As another part of the IE designation of the course, you will write a short self-reflective essay, about your goals and your experiences in the class, in the major, and at the university. This will be done at the end of the term, and it will be graded as part of the final project component of your grade. Details will come later.

About the book:
The book we are using is well-written, but it is not all on the surface. In a lot of places there are statements or examples which do not contain all the details. It is your job to unpack them. This can mean providing a short proof, doing a calculation, coming up with some examples, or relating a concept to something that you read earlier. In short, you need to be an **active** reader.

Here are some specific pieces of advice:

- The book has a lot of definitions. You should learn them! At a minimum that means you should be able to reproduce them on an exam (hint, hint). But it's also helpful to be able to produce some examples and non-examples, and to understand how the definition relates to other definitions.
- When you read longer or more complicated proofs, you will probably want to take several passes. Sometimes a good first step is to see check that the statement is true in some examples, before reading any of the proof. Then the first time through the proof you may just read line-by-line, checking that each statement is true and follows from the previous statements. Then on a second pass you can look for the bigger structure, identifying what are the most important ideas and steps in the proof. Ideally when you are done you should be able to close the book and reproduce the whole proof, or at least most of it, in your own words.
- When you hit a statement that you don't understand, don't just keep going. Stop! Spend a minute (or more) trying to see what is going on. You can try examples, try rephrasing it in your own words, or look at how it relates to other things in the section, for instance. If something still isn't clear, make a note of it so you can come back later.
- If you're really stuck, don't be afraid to **ask for help**! It can be from another student, our TA, or me. Both the TA and I have office hours, which are there for you to use. I'm also happy to answer questions in class.
- In order for this to be effective, it's important that you make at least a first pass through the assigned reading **before** you come to class. Then we can spend the time concentrating on the most interesting/difficult parts.

Note that I will not be discussing every concept or example from every section that we cover. You are still responsible for knowing them, unless I specifically say that you are not responsible for something.

Disability statement: The University of Massachusetts Amherst is committed to making reasonable, effective and appropriate accommodations to meet the needs of students with disabilities and help create a barrier-free campus. If you have a disability and require accommodations, please register with Disability Services (161 Whitmore Administration building; phone 413-545-0892) to have an accommodation letter sent to your faculty. Information on services and materials for registering are also available on their website www.umass.edu/disability.