MATH 3012B: APPLIED COMBINATORICS
COURSE POLICIES AND EXPECTATIONS
FALL 2008

1. Course Information

Course	MATH 3012B: Applied Combinatorics (3.00 Credit Hours)
CRN	82030
Prerequisites	D or higher in MATH 1502 (or equivalent) or MATH 1711 Computer Science majors should take CS 1050 before MATH 3012
Lecture	Mitchel T. Keller (`keller@math.gatech.edu`)
Time/Location	TR 0805-0925 in Skiles 256
Office Hours	MWF 0930-1030 and by appointment
Office	Skiles 138A (404.894.6365)
Website	`http://www.math.gatech.edu/~keller/classes/091/math3012B.php`
Text	Trotter and Keller, *Applied Combinatorics*. Fall 2008 Edition. **On the course website. No physical text required!**

You are welcome to drop by my office any time to see if I am available to answer your questions. I do suggest you call my office to ensure that I'm there first. Office hours are *your time*, however, so I strongly encourage you to make use of them.

Course description. The catalog describes the content of MATH 3012 as "Elementary combinatorial techniques used in discrete problem solving: counting methods, solving linear recurrences, graph and network models, related algorithms, and combinatorial designs." In order to cover this content, we will focus on three main areas: discrete structures, enumeration, and algorithms and optimization. Discrete structures will include strings, sets, graphs, digraphs, and posets (the last being one of my favorite subjects). Enumeration will be a recurring theme throughout the course. We will focus on basic enumeration (counting) techniques and see how they can be applied to many discrete problems. These techniques are particularly important in the analysis of how efficient an algoritm is. We will also look at some slightly more sophisticated (but still fundamental!) enumeration techniques such as generating functions and recurrence relations. The end of the course will focus heavily on algorithms for graphs and posets.

Combinatorics is a subject area that you really must develop a gut-level feeling about. Often, we will avoid stating things as general principles in order to reinforce that you should be developing an intuition to carry with you, rather than memorizing a formula. **This course is likely different from every other mathematics course you have taken!** You will almost never hear talk of derivatives or limits in this course, for example. We will draw many pictures to illustrate our discussions, but they (generally) won't be graphs of functions like you would draw in calculus. I think combinatorics is the most beautiful area of mathematics, and I hope that by the end of the semester, I will have convinced you to share my view. It is also a very applicable area of mathematics, historically to computer science, but increasingly to areas such as biology as well.

Course goals. At the end of the semester, you should be able to:

- apply fundamental enumeration techniques and algorithms to discrete structures;
- analyze a discrete mathematical model to identify important structural or enumerative properties in order to solve problems related to the model; and
- evaluate unfamiliar problems to determine if a discrete structure provides an appropriate model and develop such a model.

2. Grading

Your grade in this course will be based on four categories of work: reading questions, homework/quizzes, tests, and the final exam. These categories and their approximate weighting are described below.

(1) Reading questions will be assigned prior to each lecture. You are responsible for reading the sections of the text designated in the reading assignment and then giving short (one- to three-sentence) responses to each question posed. The questions will generally check your understanding of what you've read so that I can tailor my lectures. Thus, reading question responses need to be submitted by 2200 the night before the lecture in order to count. Each reading assigment will be graded on a scale of 0, 1, or 2. A score of 2 will be assigned if you submit the assignment on time and your response reflects that you've read the material, even if you didn't understand it all. A score of 1 will be assigned if you submit the assignment but your response does not sufficiently reflect that you read the material. A score of 0 is assigned if and only if you do not submit the assignment on time.

The 26 reading assignments will be worth 5 percent of your grade. Your grade on reading assignments will be an integer between 0 and 5 determined using the following guidelines:

Score	Description
5	At least 24 reading assignments with scores of 2
4	At least 23 reading assignments submitted, at least 20 with scores of 2
3	At least 19 reading assignments submitted, at least 15 with scores of 2
2	At least 17 reading assignments submitted, at least 12 with scores of 2
1	At least 15 reading assignments submitted, at least 9 with scores of 2
0	None of the above apply

(2) Homework problems will be assigned for each chapter of the text. Due dates for each set of problems will be posted on the website and the homework will be collected in class on those dates. Homework is due at the posted time, so if you must miss class, submit in advance! (A *legible* scanned copy emailed to me is acceptable under extreme circumstances.) Late homework will not be accepted. A nonempty (usually proper) subset of the problems will be graded.

A small number of unannounced quizzes will be given in lecture, usually leading up to tests as a way of giving you an opportunity to practice test-like problems that you must solve on your own.

Each homework set and quiz will be counted equally in computing your homework/quiz grade, which will be 10 percent of your final grade.

(3) Tests will be given in class on the following dates: 18 September 2008, 23 October 2008, and 25 November 2008. The tests will each last the full 80 minutes of the class period. These test dates are firmly set. The course schedule gives an estimate of the material each test will cover, but that is subject to change as the term progresses. Each test will count 17 percent of your final grade, making your tests worth 51 percent of your grade.

(4) The final exam will be held (tentatively) on Monday, 8 December 2008, from 1450 to 1740 in Skiles 256. It will be comprehensive and will count for 34 percent of your final grade.

(5) There is also an opportunity for extra credit, which will be used to determine grades in borderline cases. If you catch any typos or mathematical errors in the text (and possibly also anything that's just not as clear as it should be) and are the first one to post about it on T-Square, I'll make a record of it. Your total accumulated number of such contributions can help you out if you're on the borderline between two grades at the end of the semester.

All exercises on the homework and exams will be graded based on the following holistic five-point scale:

5 Excellent work communicated through a well-written solution/proof ($\sim$A+)
4 Good work with minor errors or small gaps in explanation ($\sim$A)
3 Good work with more serious errors or insufficiently clear explanation ($\sim$B)
2 Significant, but incomplete, explanation that could clearly lead to a correct answer/proof ($\sim$C)
1 Some ideas that might lead to a complete solution/proof are presented ($\sim$D)
0 No progress, no relevant information, or illegible

Note that grades of 0 and 1 are considered unacceptable.

Your score on a multi-problem homework, quiz, test, or exam will be the average of the scores on the individual problems, and should be interpreted according to the above scale. Your final grade in the course will be determined using the weighting described above based on this five-point scale. Do not interpret these scores as percentages! For example, if we have a test with five problems on it, and you receive scores of 2, 3, 5, 4, and 3, your average score on the test is 3.4, which is a B based on our scale, rather than being a 68%.

Reiterating, grades in this course will be determined using the following components, weighted roughly as indicated below:

Reading questions	5%
Homework	10%
Test I (18 Sept 08)	17%
Test II (23 Oct 08)	17%
Test III (25 Nov 08)	17%
Final Exam (8 Dec 08)	34%

Final grades in this course, however, will be determined by the judgment of the instructor. In particular, **you must pass the final exam in order to pass the class.**

Make-up tests. I discourage make-ups, and generally will not approve them. Any student with a valid reason for missing a test **must obtain permission from me well before the test date**. Please note that our final exam is on Monday of finals week. No student will be allowed to take the final exam outside the scheduled time except as established by Georgia Tech policy on conflicting exams. I encourage you to look over your final exam schedule now and ask me if you have any questions about conflicts.

3. Homework

Homework will be assigned for each chapter of the text and due dates will be posted on the course web page. A nonempty (usually proper) subset of the homework problems will be graded, and the graded homework will be returned to you. I do not plan to post solutions for homework problems, but will try to post comments about common problems students encountered in order to help you prepare for the tests. Even if I do not assign all of the problems from a chapter, I encourage you to work them all, as practice will help you improve your combinatorial intutition. Mathematics is not a spectator sport! The only way to learn mathematics is by getting your hands dirty, and you will only accomplish that in this course by solving homework problems. If you get stuck, you're more than welcome to send me an email, post a question on the T-Square forum, or vist with me in my office.

Collaboration on homework. You are permitted to work in groups of at most four students when solving homework problems. You must, however, write up your solutions for the problems on your own. The process of explaining your solution in writing (using complete sentences whenever possible!) will help you better understand the material. Each member of a group that worked together on a homework set must write at the top of their homework submission "I collaborated on this assignment with _____." where the other group members' names are used to fill in the blank.

4. Policies

(1) Timeliness is expected. Class starts at 0805 and ends at 0925. Late arrivals and early departures are disruptive to the class and are to be avoided except in emergency situations. If you must depart class early, please find a seat near the door in order to minimize disruptions.
(2) Students are encouraged to sit near the front of the classroom in order to best see, hear, and *participate* in class. Plus, students who sit in the front row tend to have higher final grades in college courses.
(3) Audible noises from cellular telephones and pagers will not be tolerated. This includes the noise made by some models when set to vibrate. Please turn your phone/pager off or set it on silent before class begins.
(4) For all problems submitted for grading (homework, quizzes, tests, exams, etc.), your answer should be written using **complete sentences to explain how you reached your answer**. Your explanations are important not just to receive partial credit in cases where your answer is not correct but

also to support your answer and receive full credit when correct. **Correct answers that are not fully supported by explanations using complete sentences will generally not receive full credit.**

(5) You are free to use any calculator or computer algebra system (*Mathematica*, MATLAB, *Maple*, etc.) on homework. (An explanation of the form "This is the answer because *Mathematica* said so" is not acceptable unless I approve it in advance, which I may do if it's a computation that's not part of our course material.) Unless specified otherwise *in writing*, you may not use a calculator, computer, cellular telephone, personal digital assistant, or any other electronic or manual calculating device during a quiz, test, or exam.

(6) If you have questions about the grading of homework, a quiz, or a test, you must return it directly to **me** within **one week** of the date it was handed back. Please attach a separate piece of paper indicating the problem(s) you want regraded and the reasons you feel a regrade is appropriate. **Do not write anything on the test itself.** I reserve the right to retain photocopies of any and all graded work prior to returning them to prevent regrade abuse.

(7) You should retain all graded materials returned to you until after final grades have been posted. You will need these documents to support any claim that your grade was inaccurately computed.

(8) You are encouraged to form study groups to work problems and enhance your understanding of the material. See the information above regarding collaboration on homework for details on how you may work together on problems to be graded. For quizzes, tests, and exams, unless otherwise specified *in writing*, you are to work completely alone without the aid of texts or notes.

5. Academic Integrity

As I hope you are aware by now, Georgia Tech takes academic integrity very seriously. I ask that you review the Honor Code at `http://www.honor.gatech.edu/`. For this course, I encourage you to make use of any old exams, quizzes, and homework from previous incarnations of this course. The more problems you work, the more successful you will be in this course. Be aware that the exams you will see in this course will not be identical to exams given by other instructors in previous semesters. In addition to making use of old exams, I will post some form of practice problems for each test prior to the test date. I will also be sure to clearly communicate the list of topics that will be covered on each test as it approaches.

Cheating via any means is unethical and unacceptable. Unless specified *in writing*, you are to work completely alone without the aid of notes or texts on quizzes, tests, and exams.

Behavior contrary to the above expectations will not be tolerated and will be handled via the appropriate channels. If you have questions regarding academic integrity policies in this course, talk to me. If you have other general academic integrity questions, you should consult with a member of the Honor Advisory Council, either during drop-in office hours (posted online at the address above) or by making an appointment through the Council's chair via email at `honor@gatech.edu`. Note that I am a member of the Council and hold weekly office hours as part of my HAC responsibilities. If you would feel more comfortable speaking with another Honor Advisor, you can determine which office hour is mine by consulting my online schedule.

At all times, in all things you do in this course, please keep the Georgia Tech Honor Challenge in mind:

I commit to uphold the ideals of honor and integrity by refusing to betray the trust bestowed upon me as a member of the Georgia Tech community.

6. Special needs

Any students with disabilities who need special accommodations in this course are invited to share their concerns or requests with the instructor as soon as possible. Students with disabilities are also referred to the ADAPTS office in the Office of the Dean of Students, located in Suite 210 of the Smithgall Student Services Building ("Flag Building").