Course: 21-301 Combinatorial Analysis, MWF 12:30–1:20PM, MM A14
Instructor: Clifford Smyth, csmth@andrew.cmu.edu, 268 5583, Wean 6214, office hours M 2:30-3:30PM, F 10-11AM (these may change)
Prerequisites: 21-112 (power series), 21-127 (proof and induction)
Note: Although the blackboard system is new to me, I hope to put this course on there shortly. Failing that, I’ll have a course page.

What is combinatorics?
Combinatorics is among the fastest growing and most exciting areas of mathematics and is contributing ever more deeply and fundamentally to theoretical computer science. Combinatorics is still a young field, and so the distance between the beginning student and the research frontier is very near. I will try to introduce you to many problems that are easily understood yet very much open (unsolved). One often finds surprising connections between combinatorial problems and other fields like analysis, algebra, number theory, probability, and geometry.

Combinatorics is the study of discrete (and usually finite) structures such as: graphs, designs, planes, general set systems, codes, and arrangements of natural numbers such as Latin squares and graph colorings. (You’ll learn what many of these terms mean during the course.) The usual game in combinatorics is to pick some type of discrete structure, impose some constraints, and then try to answer questions like: “Does such a structure exist?”, “How many are there?”, “Can you classify them into types?”, “Can you efficiently find one/list them all?”, or “How big (or how small) can such a structure be (in some sense)?”.

What will we do?
We’ll lay the groundwork of combinatorics by focusing on the enumerative questions (“How many are there?”) and the techniques used to answer them: the sum and product principles, inclusion-exclusion, the twelve-fold way, recurrences and generating functions, and Pólya enumeration (Chapters 1-3, 8). Depending on time and class input we’ll also cover graph theory, codes and designs, and/or partial orders.

Grades
Homeworks: 10%, 9-10 assignments typically given and due on Wednesdays, one dropped and the rest averaged
Exams: 30% each, in class 9/23, 10/28, and 11/25
Final: 30%
I’ll drop the lowest exam.
I’ll also periodically give out extra credit problems that will hopefully be fun and challenging. Any one of them will be worth one HW assignment (or more if no one else gets that one...)

Remarks:

- The Statement on Academic Integrity as outlined in the Student Handbook will be enforced. You are encouraged to study with other students but any assignment submitted should be your own work.

- Show all of your work. If a sufficient explanation of your reasoning does not exist, you may not ANY get credit for an otherwise correct problem.

- No calculators, computers or other electronic device on any exam.

- Please provide me with documentation if you have a valid reason for missing an exam. Valid reasons include serious illness (with doctor’s note), religious observance (notify me before the date) or University-sponsored event.