Math 68
Algebraic Combinatorics
Fall 1999

Instructors: Kenneth Bogart, Michael Orrison

In this course we will develop the main algebraic methods of enumeration: generating functions, inclusion and exclusion and Möbius Inversion, and enumeration under the action of a group. In addition to the goal of covering some fundamental algebraic topics in Combinatorics, the course is intended to give students an opportunity to work as mathematicians do. Rather than use a textbook, students will work from problems which are designed to lead the class to develop and prove its own theorems. Some of the problems will be worked in class as the basis for discussion and some will be out of class. Class attendance will thus be essential. Students are encouraged to work together. There may be readings from books and papers which will either be on reserve in the math library or passed out to the class. Students are welcome to use library resources, but must give credit to any sources they use. Students will present their work in class, sometimes informally and extemporaneously, and sometimes in a formal presentation.

Class participation will count towards 20% of the grade. Helping other students in significant ways also counts as class participation. Other components will be a homework notebook (50%), a midterm exam primarily to give students a sense of how they are doing (10%) and a final oral exam (20%). The application of the honor principle to the exams will be explained at the time of the exam; however in essence it is expected that students will neither give nor receive help from other students or sources on exams. This precludes discussing the content of an oral exam with another student who has not yet taken the exam.

The homework notebook will contain the student's writeup of problems done in class and/or assigned for out-of-class work. The notebooks will be collected regularly; they will be graded (both for accuracy and mathematical presentation) and returned; if there are difficulties with a writeup, the student will be expected to rewrite the problem. Extra credit will be given for multiple solutions to problems and to interesting ideas (problems, insights, theorems, etc.) the student adds to the problem sets. The first entirely correct solution to a problem will receive one point. A solution that receives a grade of @ is to be done again. A second complete solution which is different from the first will also receive one point. Additional complete and distinct solutions will receive two points each. Students who present a solution as an additional solution are expected to explain why it is different from previous ones, and the instructors will be the final judges of what is and is not different! There will also

be one point for each significant generalization of a problem [e.g. formulating and solving (or perhaps getting the class to help solve) an interesting problem suggested by the original one, or stating and proving a theorem suggested by a problem]. Partial credit of .5 is available on problems that are about half-way done if the instructors choose to give the student the option of accepting half credit and forgetting about the problem, and credit of .9 is available on solutions that, while not entirely satisfactory, are sufficiently well-done to allow the student to base future work on them. The instructors expect to give no other partial credit, and do not intend to give partial credit for extra solutions, or to keep partial credit for one solution if a second solution earns full credit. Students are expected to continue working on problems they have not yet solved unless they and the instructors agree that their background makes this fruitless (continuing to work on problems with .5 credit or .9 credit is optional).

The reason for keeping the solutions in a notebook (other than permanence!) is so that an instructor can compare a rewrite to the original version and the original comments on it. Thus each notebook should begin with several pages reserved for a table of contents which will provide for each problem the page number and date for the first solution, a place to record the grade and places to indicate dates of resubmission, pages and grades of any additional attempts. Beyond this expectation, students may organize the notebook as they choose, so long as this organization makes it possible for an instructor to immediately find new work and conveniently compare it to old work. Students are encouraged to learn TEXand use it to print solutions on three-hole punched paper, but pen or pencil notebooks are welcome. Instructors will provide assistance in using TEXand the drawing facility of Claris Works. Experience suggests that in the long run, having electronic files of solutions is less work than repeatedly copying correct portions of old solutions!

Students are encouraged to cooperate on developing solutions to problems, but students are on their honor to present only their own understanding of a solution to a problem in their notebooks. Students are welcome to critique other students notebooks or have theirs critiqued by other students; it is simply what a student writes in the notebook that must be his or her own understanding.

Grades will not be based on student success relative to each other, but on success relative to what a student knows at the beginning of the term. Students will be expected to attempt new problems at the pace set by the instructors; the problems will be structured so that there are many points of beginning throughout the course. Students will also want to continue to work on old problems whose solution has eluded them. Students should **not**, however, expect large amounts of homework that is **not** turned in at this pace to be graded. While the instructors expect few, if any, students to do all problems, they expect all students to do most problems. Students who are concerned that they may not be attempting enough problems should discuss such concerns with an instructor as soon as they arise.

Students that need disability-related accommodations are encouraged to discuss this with the instructors as soon as possible.

Office Hours as posted. You may use e-mail to arrange to come at other times for questions.