MATH 579: Combinatorics

Spring 2007 (TR 11-12:15pm, BA 340)

Overview:
Combinatorics is concerned with the sizes of finite sets. For example, consider the set of all possible different necklaces made with m beads, chosen from a tub of n different beads. A variety of tools have been developed to find the size of such a set exactly, or perhaps to find an estimate or bound.

Learning Objectives:
There are three distinct phases to solving a combinatorial problem. Generally, the first phase is the most difficult to learn, and the last phase is the easiest. Students will learn all three in this course. First, the problem must be categorized as to which combinatorial tool would be appropriate. Second, a model must be created that translates the abstract formulation of the problem into the symbols required for the combinatorial tools to work. Third, the combinatorial tools must be applied to the symbols.

Students will, on exams, mimic solutions to specific problems; this allows students to demonstrate mastery of the third phase even if they are still learning the earlier phases.

Students will, at home, produce solutions to problems of specific types; this allows students to achieve mastery of the second phase even if they are still learning the first phase. Their mastery of this phase will be demonstrated on exams, when they mimic solutions they themselves produced earlier.

Students will, on exams, find solutions to problems of unknown types; this allows students to demonstrate mastery of all three phases.

Textbook:
A Walk Through Combinatorics, by Miklós Bóna, 1st OR 2nd edition. This course will cover chapters 1-8.

Students are expected to read the text; it is quite brief and easy to understand, although the 1st edition does have a few errors. It contains many exercises, some with brief solutions and some without.

Portfolio:
Students are expected to keep a portfolio in a three-ring binder or something similar, containing a detailed and complete solution to every exercise in the text (those marked + or ++ are optional). These portfolios will not be collected or checked, except upon a student's request; however, they will be an invaluable resource during exams. The exams are structured so that there is just enough time to mimic a solution from a portfolio but not enough time to create it fresh.

Students are NOT required to personally solve every exercise appearing in their portfolios; they are strongly encouraged to collaborate with classmates. However, before accepting a classmate's solution into their portfolio, students are expected to carefully check it for completeness and correctness.

Attendance:
Students are expected to attend every class; otherwise, they are personally responsible for copying notes from a classmate. Makeup exams are not given; the lowest exam grade is dropped, to account for the unexpected.

Course Mechanics:
Each chapter from the text (counting Chapter 8 as two chapters) will be taught for two class periods. The third class period will be an exam, after which the next chapter begins (1.5 week cycle). Half of the exams will be on Tuesdays, half on Thursdays.

EXAM SCHEDULE:

Jan. 30	Chapter 1	Mar. 1	Chapter 4	Apr. 12	Chapter 7
Feb. 8	Chapter 2	Mar. 13	Chapter 5	Apr. 24	Chapter 8.1
Feb. 20	Chapter 3	Mar. 22	Chapter 6	May 3	Chapter 8.2

FINAL EXAM: May 10 10:30-12:30

Exams:
Exams will consist of two parts. Part I, worth 30 points, will last 40 minutes; then, a five-minute break; then, Part II, worth 20 points, will last 30 minutes. The use of calculators is required on both parts; students must have at minimum a basic calculator for this course (a scientific calculator is better).

Part I will be open book, open notes. It is designed to verify mastery of specific problems, and to ensure compliance with the portfolio policy; the questions will be very similar to questions in the textbook from the immediately previous chapter. Students will pick three questions from a list of five. One of the questions will be similar to an exercise solved in the text; students will receive between 5 and 8 points, depending on the quality and completeness of their solutions. (NOTE: the solutions in the text are sometimes incomplete, and would not earn the full 8 points). Three of the questions will be similar to exercises given in the text without solutions; students will receive between 5 and 10 points. The last question will be one of the more difficult exercises in the text; students will receive between 5 and 12 points. Depending on the choice of questions, it is possible to earn over 100%, and it is also possible to have a perfect paper but only earn 96%. The maximum value of each question will be clearly indicated on the exam.

Part II will be closed book, closed notes. It is designed to test assimilation of combinatorial tools into the students' skillset, by challenging students with a problem unlike any previously encountered. It will consist of a single question, which will not be similar to any in the text. The tools required to solve it might not be from the immediately previous chapter. Students will receive between 10 and 20 points.

Grading:
The 8 exams (dropping the lowest score of nine) will be worth 8% of the course grade each. Class participation will be worth 6% of the course grade. The final exam will be worth 30% of the course grade. The grading policy is as follows: A 92-100, B 82-87, C 72-77, D 62-67, ± as obvious

Extra Credit:
On the next class day after an exam (before the exam is returned), students may submit extra credit to improve their grades. This consists of revised solutions to incorrectly solved exam problems, *as well as solutions to the problems not chosen initially.* The revised exam score will be calculated with the three *lowest* (from five) problem scores on part I, added to the problem score on part II. This revised score will be averaged with the original exam score, but only if it increases the exam grade. Example:

Original:	(1) N/A	(2) +10	(3) +8	(4) +6	(5) N/A	(6) +15	10+8+6+15=39/50 (C+)
Revised:	(1) +8	(2) blank	(3) +9	(4) +9	(5) +11	(6) +18	8+9+9+18=44/50

(39+44)/2=41.5 +3 extra credit awarded; revised grade is 42/50 (B)

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Office hours: Tuesdays and Thursdays 9-10:45am, and by appointment

Classmate Contact Info
