

## Combinatorics and Graph Theory: Math 415/515; (3 credits)

**Text:** Introductory Combinatorics (5<sup>th</sup> edition) by Richard Brualdi

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**Office Hours:** MTuW 3:25-4:30, lots more by appointment!

**Course Objective:** Combinatorics is what it says on the tin: the study of combining. We start with the simplest building blocks: sets, numbers, shapes—and see what we can make. First we ask how to count the structures we build, then we ask how to relate them to each other. In this class we will learn the basics of enumerative combinatorics, including generating functions, recurrence relations, inclusion-exclusion, and other topics. We will also see some of the basics of the theory of graphs. All of these topics have many applications to computer science, biology, and many other fields.

**Important Note:** All relevant course information will be posted on the course webpage: [https://sforcey.github.io/sf34/class\\_home/comb/comb23.htm](https://sforcey.github.io/sf34/class_home/comb/comb23.htm) (linked from Brightspace).

Be sure to check this page frequently for announcements, including homework assignments and exam dates.

### **GRADING POLICY:**

- The quiz/homework average will be calculated by dropping a total of 15 raw points which means that I'll calculate your percentage by first adding up to 15 points back on to your raw score, limited by the maximum number of hw/quiz points possible.
- No test may be taken early or late. The final total test score will use the 2 highest of 3 percentages: 2 percentage test grades and the final exam percentage grade. This will have the effect of allowing one missed test to be replaced by the final exam.
- 1000 points possible. For each of four categories the fraction of points you receive is the same fraction that you earn out of the total possible raw score. So if you get a 49 out of 50 on Test 1 then you earn  $(49/50) \cdot 200 = 196$  points.

200 pts: Quizzes (20%)

400 pts: 2 Tests at 200 pts each. (40%)

300 pts: Final Exam (30%)

100 pts: poster/paper/project (10%)

900 pts. guarantees an A

800 pts. guarantees a B

700 pts. guarantees a C

600 pts. guarantees a D

(+,- at my discretion)

### **Course Outline:**

- Aug. 29: Day one.
- Sep. 4: No class on Labor day.
- Chapter 2: Counting
- Chapter 5: Pascal's Triangle
- Sep. 10: Last day to drop.
- Chapter 6 : Inclusion Exclusion
- Oct. 15: Last day to w/draw.
- TEST 1. October 19
- Chapter 7: Recurrence and Generating Functions
- Chapter 11: Graphs
- TEST 2. Tues Nov. 21
- Nov. 23,24: Thanksgiving.
- Dec. 7: Last day.
- Final Exam TBA

**No notes, formula sheets or books may be used on the any test or the final exam.**

Homework may not be copied, but collaboration and research are allowed. All other work is individual. Any incidence of academic dishonesty carries a minimum penalty of a non-removable zero for that work. No active cellular phones, pagers, media players, computers or other electronic communication devices are permitted during the test.

## **Learning Outcomes for 3450:415/515 Combinatorics and Graph Theory**

Students are expected to be able to

- Understand and apply the basic concepts of graph theory, including Eulerian trails, Hamiltonian cycles, bipartite graphs, planar graphs, and Euler characteristics.
- Use permutations and combinations to solve counting problems with sets and multisets
- Compute a generating function and apply them to combinatorial problems
- Set up and solve a linear recurrence relation
- Apply the inclusion/exclusion principle