Version July 21, 2017

Syllabus for Math 454, Summer 2016, Section E1

General Information

Course: Math 454, Combinatorial Theory

Term: Summer 2017

Section: E1

Meetings: MTuWTh 12:20-2:20 pm in Hill Center (HLL), Room 525 (Busch Campus)

Textbook: Richard A. Brualdi, *Introductory Combinatorics*, Prentice Hall, 5th ed., 2010 (ISBN: 978-0136020400)
supplemented by
Mitchel T. Keller, William T. Trotter, *Applied Combinatorics*, 2016.1 ed., which is available free online in html form at http://www.rellek.net/book/app-comb.html and as a pdf at http://www.rellek.net/book/app-comb-2016.pdf under the Creative Commons License https://creativecommons.org/licenses/by-sa/4.0/.

Prerequisites: CALC2 and 01:640:250 (Linear Algebra).

Instructor Information

Name: Cole Franks

Email Address: wcf17@math.rutgers.edu

Office: Hill Center, Room 606 (Busch Campus)

Office Hours: (Hill 606)

- Monday, 11:00 am-12:00 pm
- Tuesday, 2:30 pm-3:30 pm
- Wednesday, 2:30 pm-3:30 pm
- Thursday, 11:00 am-12:00 pm
- Or by appointment at least one day in advance

Webpages

You will be added to the **Sakai** page which is the main website for this course. If you haven't been added or don't receive mail from me, please let me know on the first day of class. This syllabus and the accompanying schedule is subject to change, but any changes will be announced on Sakai.
The department webpage for the course is
http://math.rutgers.edu/academics/undergraduate/courses/986-01-640-454-combinatorics

Course Overview

By this point, you have hopefully realized that there is more to advanced math than just higher and higher levels of calculus. Modern mathematics curricula put a heavy emphasis on calculus both because it is incredibly useful and because it is a classical, well-studied, long-refined field. Combinatorics, while also quite useful, is usually pushed back to upper-level math because it is a much younger, still-developing field, and it is less coherent as a topic. Over the period of these six weeks, you may feel at times that this course feels like a grab bag of mathematical tools and results.

The term *combinatorics* itself means *counting*. Hence, the primary problems in combinatorics are of the form "How many ways are there to…" The goal is to come up with a clever way to count the number of ways. Over time, the term *combinatorics* has been extended from its basic definition to cover most problems in discrete mathematics. Rather than explicitly counting something, many combinatorial problems relate instead to answering questions about objects with a well-defined finitary structure. We will see both types of combinatorics this term. The first half of the course will focus on counting problems and related questions, so-called *enumerative combinatorics*. Then, we will spend some time studying objects like graphs and partially-ordered sets, so-called *non-enumerative combinatorics*.

Class Structure

Lectures for this course will take place on every Monday, Tuesday, Wednesday, and Thursday when there is no exam. On every week other than that of the midterm and final, there will be a quiz on Thursday. Typically there will be one "workshop" per week on a non-quiz day that will be solved in groups during at most half of the class. There will also be short, open-note "miniquizzes" dispersed throughout the course.

Course Components

Homework: Homework will be posted on Sakai after every non-handout lecture, and will typically be due two days later. The completed assignments must be submitted via the assignments tool on Sakai as a picture, LaTeX document (see below) or a scanned copy *before 12:00 pm on the day they are due. It is your responsibility to submit legible homework; if either the grader or I cannot read your assignment it will be docked points. The homework must be uploaded as a single file.*

Please show work for all homework problems that require more than a one-line solution. Solutions without work will not receive full credit and may receive zero credit.

LaTeX: LaTeX (pronounced "lah-teck" or "lay-teck") is the typesetting language that mathematicians use to create documents that include mathematics. (In fact, your instructor used it to create this syllabus!) You are not required to submit any typed assignments in this course, and you are not required to use LaTeX for typed assignments. But, you may be expected to use LaTeX in some future math courses, and you will be expected to know LaTeX as you go forward into higher mathematics. So, I recommend that you do take the time to learn this valuable skill. Any homework submission typeset in LaTeX that receives at least 60% credit will receive an extra credit point. I would be

happy to assist you with LaTeX during my office hours. *Do not use Microsoft Word or equivalent. I can tell, and it looks awful.* It is helpful if you also submit the .tex file.

Workshops: Once a week, students will work in small groups to solve several problems of the instructor's choosing about the material from a recent (usually that day's) lecture. The students will then write up the workshop by the due date, and *handed in at the beginning of class.*

Challenge Problems: A few extra credit problems will be assigned each week. They are to be submitted in person at the beginning of class on the due date. You can submit them online also.

Quizzes: Every Thursday when there is no exam there will be a 20-minute quiz on that week's material. There may be quiz questions on that same day's material, but such questions will be easier. I intend to give these quizzes at the end of class, but I reserve the right to give them at any time during the class without advance warning. (I will only do this if there is a tardiness epidemic.)

There will be several smaller "miniquizzes," which will not be announced in advance, scattered throughout the course. Miniquizzes will be open-note. Both quizzes and miniquizzes will be graded, but miniquizzes will have lower weight.

Midterms: There will be one in-class midterm exam on Thursday, July 13. It will take the entire 110 minute class period.

Final: The final exam for the course will take place on Thursday, August 3, in Hill 005. The final will be cumulative. The final will run for three hours: from 12:20 to 3:20 pm. *Please make sure that your schedule is clear for the extended meeting that day, and please note the room change!*

Course Policies

Calculators: Calculators may not be used during quizzes and examinations.

Late Work: Late work (homework, workshop write-ups) will not be accepted under any circumstances.

Missed Exams: Generally speaking, missing any exam, midterm or final, is utterly unacceptable and will result in a grade of zero for the exam. The only exceptions to this rule are for truly grave, DOCUMENTED circumstances on the level of hospitalization the day of the exam or a death in the immediate family. Even if you do have such a documented circumstance for the midterm exam, you may not make up the exam. Instead, the portion of your grade for that exam will be reallocated to the final.

Missed Quizzes: Similar to a missed exam, a missed quiz will be recorded as a zero without a documented reason akin to the acceptable exam excuses. Even if you do have such a documented circumstance, you may not make up the quiz. Instead, the portion of your grade for that quiz will be reallocated to the midterm or final, whichever is next.

Attendance: You are expected to attend every class. This is a summer course, so we will move at a blistering pace. As such, it will be very easy to fall behind, even from missing a single class. Attendance will not be taken explicitly, but there is an assessment or something due every class.

Grading: The breakdown of the overall grade in the course is as follows:

Final: 35% overall

Midterm: 25% overall

Quizzes: 15% overall

Homework: 15% overall

Workshops: 10% overall

The cutoffs for various grades will be no higher than (and may be substantially lower than): 90% for A, 85% for B+, 80% for B, 75% for C+, 70% for C, 65% for D

Challenge Problems: There will be at most 5 points which can be gained from turning in challenge problems. These function like extra credit. After I calculate cutoffs for letter grades, I will add the number of points you have earned from challenge problems.

I will try to grade workshops in time for the next class, and I will try to ensure that the homework grader returns the homework in a timely manner.

Important dates

Jun 23, 2017: Last day to drop with a full refund and no W.

Jul 5, 2017: Last day to drop with a W and a 50% refund.

Jul 28, 2017: Last day to drop with a W and no refund.

Important dates site: These dates are not comprehensive, and you should know the dates at this link: http://www.summersession.rutgers.edu/important-dates

Academic Integrity

The University's Academic Integrity Policy can be found at the URL

`https://slwordpress.rutgers.edu/academicintegrity/wp-content/uploads/sites/41/2014/11/AI_Policy_2013.pdf`

Violations of the policy include: cheating, fabrication, plagiarism, denying others access to information or material, and facilitating violations of academic integrity. Violations of the policy will not be taken lightly: consequences could range anywhere from a zero on the affected assignment to failing the course to being expelled from Rutgers.

Disabilities

Information for students with disabilities at Rutgers is available at https://ods.rutgers.edu. To request special accomodations regarding a disability, please see https://ods.rutgers.edu/students/applying-for-services.