COURSE INFORMATION

Introduction to Combinatorics
MATH 475 001 (3 Credits)
2020 Summer (1206) [1206]

Description

Prerequisite(s)
(MATH 320, 340, 341, or 375) or graduate/professional standing or member of the Pre-Masters Mathematics (Visiting International) Program

Breadths
N - Natural Science

Instruction Mode
Online Only

Section Level Com B
False

Department: Mathematics
College: Letters and Science

Canvas Course URL
https://canvas.wisc.edu/

2020 Summer (1206) [1206]
Term Start Date: Monday, 18-May-2020  Term End Date: Tuesday, 1-Sep-2020

Location and Schedule: ONLINE MTWR 11:45 AM-1:00 PM
CRN: 600011675

How the Credit Hours are Met
The credit standard for this course is met by an expectation of a total of 135 hours of student engagement with the courses learning activities (45 hours per credit), which include regularly scheduled instructor: student meeting times M-Th from 11:45 am to 1:00 pm, reading, writing, problem sets, and other student work as described in the syllabus.

INSTRUCTORS AND TEACHING ASSISTANTS

Instructors
Yida Ding
YDING54@WISC.EDU

ALEXANDER HANHART
HANHART@MATH.WISC.EDU

Instructor Availability
Alex Hanhart is available by email at hanhart@math.wisc.edu
Office hours will be held regularly in the BBCollaborate Ultra Course room Tuesday from 1-2pm and Friday from 12-1pm.
The class will also have a piazza page

TA Office Hours
Yida Ding will be available via BBCollaboate Ultra Course Room on
Sunday 2-3pm and Tuesday 2-3pm.
Understand basic counting strategies, such as staged thought-experiments, inclusion/exclusion, generating functions, and recurrence relations, and apply these strategies to solve a wide variety of counting problems.

Recall basic objects that are used in combinatorics, such as permutations and combinations of sets and multisets, binomial and multinomial coefficients, the Catalan numbers, the Stirling numbers, and the partition numbers.

Analyze a given combinatorial problem using the standard theorems of combinatorics, such as the pigeonhole principle, the Newton binomial theorem, the multinomial theorem, the Ramsey theorem, the Dilworth theorem, the Burnside theorem, and the Polya counting theorem.

Construct mathematical arguments related to combinatorial problems using the above definitions, properties, theorems, and counting strategies; including the construction of examples and counterexamples.

Convey his or her arguments in oral and written form in English, using appropriate mathematical terminology, notation, and grammar.

Grading
The course average will use:
1) the 10 best of 12 HW assignments at 5% each.
2) Three midterm exams at 10% each.
3) One final exam at 20%.

The distribution of course averages will be used to construct gradelines which reflect the standard interpretation of each letter (i.e., A - Excellent, B - Good, and so on). That being said, students who achieve at least the following averages will be guaranteed the given letter grade:

- 91 - A
- 89 - AB
- 81 - B
- 79 - BC
- 70 - C
- 60 - D

Discussion Sessions
No content has been entered for this form item. You may edit this form to provide content for this form item. If content is not provided, this item will not be displayed on the final version of the form.

Required Textbook, Software, & Other Course Materials
We will be using Introductory Combinatorics, fifth edition, by Richard Brualdi. It is published by Prentice Hall.

EXAMS, QUIZZES, PAPERS & OTHER MAJOR GRADED WORK

Exams, Quizzes, Papers & Other Major Graded Work
There will be three midterm exams and one final. They will be held biweekly on Thursdays: June 25, July 9, July 23, and August 6.

The exams will be open book and open notes, but you may not use any other sources (electronic devices, the internet, other people). Exams will begin promptly at the beginning of the class at 11:45 am and will be collected at 1:45 pm (for the midterms) or 2:45 pm (for the Final).

Late submissions of exams may not be graded. There are no make up exams. If you are not able to take an exam for any reason, then we will use the final exam to replace that score. If you are not able to take two exams for any reason, then you should reconsider if the load/pace of a summer course is appropriate for you.

Homework & Other Assignments
We will have a total of 12 HW assignments over the course of the term. Assignments posted on Mondays will be collected on Wednesdays and assignments posted on Wednesdays will be collected the following Monday. There will not be any HW assignments on the Wednesdays preceding exams.

While working on HW you are welcome to make use of any and all sources at your disposal. There is an expectation that you will CITE sources and give EVIDENCE of your understanding. In particular, you must give a full and reasoned explanation for your results and conclusions.

HW will be collected via canvas. Your solutions MUST be saved/scanned/etc as black and white PDF files. Color pdf will be accepted only if the use of color is important to your exposition. After you submit an assignment you MUST double check that it has uploaded and displays correctly!

HW will be marked out of a total of ten points each. Two problems will be selected, each worth 4 points. The remaining two points will be devoted to presentation and completeness. The basic grading rubric for a problem is as follows:

4 - A correct result with complete and detailed argument. This student has demonstrated an excellent understanding.
3 - An otherwise correct result, but lacking in some small details or exposition. Note: it is possible to give a "right" answer but not receive full credit.
2 - A correct result, but with sufficient details missing, or an incorrect result which still demonstrates some understanding (for example, the correct theorem is used, but not correctly).
1 - Significant errors or logical gaps
0 - No submission.

OTHER COURSE INFORMATION

Other Course Information
The following is our tentative schedule for the summer term. This schedule may be updated as the summer progresses, so check out the main canvas site for up-to-date info!

<table>
<thead>
<tr>
<th>Week</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 15 - 18</td>
<td>Basic counting principles, Combinations, Permutations</td>
<td>Work Day</td>
<td>Multisets, Probability HW 1 Due</td>
<td>Work Day</td>
</tr>
<tr>
<td>June 22 - 25</td>
<td>Pigeonhole Principle, Ramsey's Theorem HW 2 Due</td>
<td>Work Day</td>
<td>Generating Permutations and Combinations HW 3 Due</td>
<td>Exam 1</td>
</tr>
<tr>
<td>June 29 - July 2</td>
<td>Partial Orders, Equivalence Relations</td>
<td>Work Day</td>
<td>Binomials HW 4 Due</td>
<td>Work Day</td>
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<tr>
<td>July 6 - 9</td>
<td>Multinomial Theorem, Posets HW 5 Due</td>
<td>Work Day</td>
<td>Inclusion-Exclusion HW 6 Due</td>
<td>Exam 2</td>
</tr>
<tr>
<td>July 13 - 16</td>
<td>Mobius Inversion</td>
<td>Work Day</td>
<td>Generating Functions HW 7 Due</td>
<td>Work Day</td>
</tr>
<tr>
<td>July 20 - 23</td>
<td>Homogeneous and Nonhomogeneous Recurrence HW 8 Due</td>
<td>Work Day</td>
<td>Catalan and Stirling Numbers HW 9 Due</td>
<td>Exam 3</td>
</tr>
<tr>
<td>July 27 - 30</td>
<td>Schroder Numbers</td>
<td>Work Day</td>
<td>Burnside's Theorem HW 10 Due</td>
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<tr>
<td>Aug 3 - 6</td>
<td>Polya Counting HW 11 Due</td>
<td>Work Day</td>
<td>Work Day HW 12 due</td>
<td>Final</td>
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</tbody>
</table>

LaTeX: Though not required, it might be a good idea to spend some time learning how to use the standard (free) typsetting system known as LaTeX. If you find that you do a lot of technical writing, plan on doing a thesis or paper in the future, give a technical talk, make a poster for a conference, go to graduate school, then it would be wise to begin using it now! Here are two easy ways to get started:

Overleaf is a free online editor which produces pdf files: [https://www.overleaf.com/](https://www.overleaf.com/)

NYU has a nice page which can get you started if you would prefer to work offline: [https://guides.nyu.edu/LaTeX](https://guides.nyu.edu/LaTeX)

ACADEMIC POLICIES
OTHER IN-PERSON INSTRUCTIONAL REQUIREMENTS

Practice physical distancing (staying at least six feet apart from others), in both indoor and outdoor spaces, including when entering and exiting building and instructional spaces.

- Monitor symptoms using the COVID-19 Symptom Tracker daily and, if symptoms exist, stay home and immediately get tested. Free testing is available to the entire campus community including students. Find more information on testing including on-campus testing locations, getting test results and what to do if you test positive for COVID-19.
- Follow specific guidance on classroom seating and furniture use. “Sit Here Signs” will be placed in classrooms to indicate where students should sit, as well as floor decals to indicate where furniture should be placed and remain.
- Limit the sharing of materials (papers, books, writing utensils, calculators, etc.) with others in class. Any materials brought to class must be taken with you when leaving the classroom.
- Food and beverages are not allowed in instructional spaces. For students who may need access to food or beverages during class (e.g., medical condition, other accommodation or circumstance) may do so while wearing face coverings. If this will be a recurring situation, students should discuss their ongoing need with their instructor.
- Carefully observe and follow health and safety signs posted inside and outside the classroom.
- Course start and stop times are not staggered. At their discretion, instructors may start or end class a few minutes off schedule to avoid congestion in the halls.

Additionally, students should:

- Clean desks and seats before and after class with the provided classroom supplies and wipe off hands with disinfectant wipes. The provided cleaning supplies will be safe for skin contact; gloves are not needed. See guidance for cleaning classrooms.
- Exit the classroom as quickly as possible to allow the next section to transition in safely.
- Be aware of and sensitive to others around you, particularly those who may be struggling or having difficulties.

HOW TO SUCCEED IN THIS COURSE

Provide information on how students can best succeed in the course. For instance, instructors might include suggestions about completing assignments or studying for exams. Instructors might also include resource links to other campus services such as:

- University Health Services
- Undergraduate Academic Advising and Career Services
- Office of the Registrar
- Office of Student Financial Aid
- Dean of Students Office

STUDENTS’ RULES, RIGHTS & RESPONSIBILITIES

During the global COVID-19 pandemic, we must prioritize our collective health and safety to keep ourselves, our campus, and our community safe. As a university community, we must work together to prevent the spread of the virus and to promote the collective health and welfare of our campus and surrounding community. Rights & Responsibilities

UW-MADISON BADGER PLEDGE

Badger Pledge

UW-MADISON FACE COVERING GUIDELINES

UW-Madison face covering guidelines. While on campus all employees and students are required to wear appropriate and properly fitting face coverings while present in any campus building unless working alone in a laboratory or office space.

Face Coverings During In-person Instruction Statement (COVID-19)

Individuals are expected to wear a face covering while inside any university building. Face coverings must be worn correctly (i.e., covering both your mouth and nose) in the building if you are attending class in person. If any student is unable to wear a face-covering, an accommodation may be provided due to disability, medical condition, or other legitimate reason.

Students with disabilities or medical conditions who are unable to wear a face covering should contact the McBurney Disability Resource Center or their Access Consultant if they are already affiliated. Students requesting an accommodation unrelated to disability or medical condition, should contact the Dean of Students Office.

Students who choose not to wear a face covering may not attend in-person classes, unless they are approved for an accommodation or exemption. All other students not wearing a face covering will be asked to put one on or leave the classroom. Students who refuse to wear face coverings appropriately or adhere to other stated requirements will be reported to the Office of Student Conduct and Community Standards and will not be allowed to return to the classroom until they agree to comply with the face covering policy. An instructor may cancel or suspend a course in-person meeting if a person is in the classroom without an approved face covering in position over their nose and mouth and refuses to immediately comply.

QUARANTINE OR ISOLATION DUE TO COVID-19

Student should continually monitor themselves for COVID-19 symptoms and get tested for the virus if they have symptoms or have been in close contact with someone with COVID-19. Student should reach out to instructors as soon as possible if they become ill or need to isolate or quarantine, in order to make alternate plans for how to proceed with the course. Students are strongly encouraged to communicate with their instructor concerning their illness and the anticipated extent of their absence from the course (either in-person or remote). The instructor will work with the student to provide alternative ways to complete the course work.
COURSE EVALUATIONS

Indicate how students can evaluate the course. For example:

Students will be provided with an opportunity to evaluate this course and your learning experience. Student participation is an integral component of this course, and your feedback is important to me. I strongly encourage you to participate in the course evaluation.

Digital Course Evaluation (AEFIS)

For instructors using the campus digital course evaluation survey tool, AEFIS.

UW-Madison now uses an online course evaluation survey tool, AEFIS. In most instances, you will receive an official email two weeks prior to the end of the semester when your course evaluation is available. You will receive a link to log into the course evaluation with your NetID where you can complete the evaluation and submit it, anonymously. Your participation is an integral component of this course, and your feedback is important to me. I strongly encourage you to participate in the course evaluation.

ACADEMIC CALENDAR & RELIGIOUS OBSERVANCES

• See: https://secfac.wisc.edu/academic-calendar/#religious-observances

ACADEMIC INTEGRITY STATEMENT

Instructors should discuss academic integrity with students early and often. For suggested ways to engage students in these discussions, see the College of Letters and Science Remote Teaching Toolkit.

By virtue of enrollment, each student agrees to uphold the high academic standards of the University of Wisconsin-Madison; academic misconduct is behavior that negatively impacts the integrity of the institution. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these previously listed acts are examples of misconduct which may result in disciplinary action. Examples of disciplinary action include, but is not limited to, failure on the assignment/course, written reprimand, disciplinary probation, suspension, or expulsion.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES STATEMENT

The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student’s educational record, is confidential and protected under FERPA. (See: McBurney Disability Resource Center)

DIVERSITY & INCLUSION STATEMENT

https://diversity.wisc.edu/is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world.