MATH 39A   INTRODUCTION TO COMBINATORICS

SYLLABUS FOR SUMMER 2024

INSTRUCTOR

Lecturer: Theo Douvropoulos (feel free to call me "Theo")
Lecture mode/time: Virtual, Mondays, Tuesdays and Thursdays 11:10am-1:40pm.
Zoom: https://brandeis.zoom.us/j/91727587567?pwd=bNGC3PjHH8XE60aHbeEpWfFN6p7bSf.1
Jamboard: https://jamboard.google.com/d/1o68GsQWraiveWcvs_OP4tEXmVhklRNL2wgBCoP9qAvc
e-mail: tdouvropoulos@brandeis.edu (please include the header "Math 39A" in the subject line)
Theo's Office Hours: TBD

INVITATION TO LEARNING

Class Content: MATH 39A (Introduction to Combinatorics) is a course designed for math and computer science majors, but which is also relevant to other sciences and economics majors. Combinatorics is a central branch of mathematics concerned with the description and analysis of discrete data structures such as graphs and trees, spanning trees and matchings, lattice paths, permutations of objects, etc. The goal is to find hidden patterns in such structures, in order to answer various kinds of questions:

- When do such objects exist? what happens if we impose further conditions (i.e. planarity of graphs)?
- How many such objects exist? (in particular, is there a "nice" formula for this number?)
- How do extra conditions (numerical restrictions, or given symmetries, or assumed properties) affect these structures and their numerology?
- Are there explicit algorithms that produce these structures or help us count them?

We will explore various problem-solving methods including the pigeonhole principle, induction and recursion, generating functions, and direct bijection proofs.

Class Style: This will be a partially flipped class: Before every class meeting students are expected to have studied the upcoming material and written a few paragraphs on it. About a third of the lecture time will be spent lecturing, reviewing, and covering questions, while the rest will be spent working on problems.

During the in-class problem sessions, the students will practice along with their problem-solving skills also ways to improve mathematical collaboration and clear communication of ideas. In particular, each one of us will make a conscious effort to focus away from the personal goal (as in "minimize time it took me to solve the problem") and work towards a group goal ("maximize how well the whole class understands the problem and its solution").

Credits: 4

RECOURCES

Webpage: Latte.

Textbook: Combinatorics and Graph Theory, John M. Harris, Jeffry L. Hirst, Michael J. Mossinghoff (second edition). The first chapter of the textbook (which will last us for the first two weeks at least) is available at the moodle page of the course. *Moreover, if you have difficulty purchasing course materials, please make an appointment with your Student Financial Services or Academic Services advisor (or click here) to discuss possible funding options and alternative solutions.*

WEIGHTS OF ASSESSMENTS

The final score will be computed using the following weights:

Homework Assignments: 45%
Midterm Exam: 20%
Final Exam: 20%
Participation: 15%

GRADING SCALE

The tentative grading scale for the course is as follows. There might only be a curve in case of unusual distribution, and that would only be in the students' favor (i.e. if everyone achieves a total score of more than 90% in the class, then everyone gets an A).

A : 93 - 100%
A-: 90 - 92%
B+: 86 - 89%
B : 82 - 85%
B-: 78 - 81%
C+: 74 - 77%
C : 70 - 73%
C -: 65 - 69%
D+: 60 - 64%
D : 55 - 60%
F : 0 - 54%

HOMEWORK AND PARTICIPATION

We will have weekly Homework that will be posted on the Latte site of the class and done through GradeScope; it will be due one week after it is posted. Before each class meeting I will be asking you to read part of the next sections in the textbook and to complete a Latte-assignment: give a summary in a few paragraphs of what you read focusing on what you would like to see addressed in class time. The 15% participation grade will depend on these assignments graded P/F.

EXAMS

Midterm: The midterm exam is tentatively scheduled for Wednesday June 19th. The topics for the first midterm will include the first chapter of the textbook.

Final: The final exam will be cumulative but with a focus on the second half of the class (second chapter). It will take place tentatively on Wednesday, July 3rd.

FEDERICO ARDILA'S AXIOMS

Axiom 1: Mathematical potential is distributed equally among different groups, irrespective of geographic, demographic, and economic boundaries.

Axiom 2: Everyone can have joyful, meaningful, and empowering mathematical experiences.

Axiom 3: Mathematics is a powerful, malleable tool that can be shaped and used differently by various communities to serve their needs.

Axiom 4: Every student deserves to be treated with dignity and respect.

ACADEMIC HONESTY

You are expected to be familiar with, and to follow, the University's policies on academic integrity. You are expected to be honest in all of your academic work. Please consult Brandeis University Rights and Responsibilities for all policies and procedures related to academic integrity. Allegations of alleged academic dishonesty will be forwarded to Student Rights and Community Standards. Sanctions for academic dishonesty can include failing grades and/or suspension from the university. Citation and research assistance can be found on the university library website.

If you have any questions, please contact Alex Rosett (arossett@brandeis.edu), Assistant Dean, Student Rights and Community Standards.

ACCOMMODATIONS

Brandeis seeks to create a learning environment that is welcoming and inclusive of all students, and I want to support you in your learning. If you think you may require disability accommodations, you will need to work with Student Accessibility Support (SAS). You can contact them at 781-736-3470, email them at access@brandeis.edu, or visit the Student Accessibility Support home page. You can find helpful student FAQs and other resources on the SAS website, including guidance on how to know whether you might be eligible for support from SAS.

If you already have an accommodation letter from SAS, please provide me with a copy as soon as you can so that I can ensure effective implementation of accommodations for this class. In order to coordinate exam accommodations, ideally you should provide the accommodation letter at least 48 hours before an exam.

EXPECTATIONS FOR OUT-OF-CLASS WORK FOR 4-CREDIT COURSES

Success in this four-credit course is based on the expectation that students will spend a minimum of 9 hours of study time per week in preparation for class (readings, homework, preparation for exams and quizzes, etc.).

MAKE-UP QUIZZES AND EXAMS

There will be no make up exams. If you must miss the midterm for an unavoidable, significant, well-documented reason, please inform me as soon as possible.

RELIGIOUS OBSERVANCE POLICY

It is the policy of the university that instructors strive to support students' observance of their traditions by allowing absence from classes for such purposes; by endeavoring to ensure that examinations, written reports, oral reports or other mandatory class assignments are not scheduled for or due on holy days; and that instructors provide ample opportunities for students to make up work missed on such occasions, without penalty. Should a student need to miss class for religious reasons, the absence will be excused. Classes missed for travel plans are not considered excused absences. Only the dates of the holidays themselves are considered excused absences.

ACADEMIC GUIDELINES FOR STUDENT-ATHLETES

Student athletes who anticipate a need for accommodation should present me, at the beginning of the semester, with a letter from the athletic director verifying their participation in a varsity sport and containing the schedule for the team. Students should not expect accommodation for practices; coaches should accept the responsibility to schedule practices to minimize conflict with classes and accommodate missed practices if necessary for class attendance. We may then work out a plan for compensating for classes or other assignments that will be missed. The goal should be that athletes satisfy approximately the same overall obligations and enjoy approximately the same overall learning opportunities as non-athletes.

STATEMENT ON RESPECTFUL ENVIRONMENT

Brandeis University is committed to providing its students, faculty and staff with an environment conducive to learning and working, where all people are treated with respect and dignity. Please refrain from any behavior toward members of our Brandeis community, including students, faculty, staff, and guests, that intimidates, threatens, harasses, or bullies. Please consult Brandeis University Rights and Responsibilities for all policies and practices related to respectful environment.