

Math 40a: Introduction to Applied Mathematics

Fall 2023

Instructor: Yangyang Wang (yangyangwang@brandeis.edu)

Time: Tuesday and Friday, 12:45-2:05 pm

Class Location: Abelson-Bass 131

Student Hours: Friday 9:00-11:00 am, Goldsmith 302

Office location: Goldsmith 302

Introduction

This course is organized around seminal papers of applied mathematics drawn from public health, finance, sports, game theory, neuroscience, and other areas. The broad range of topics illustrates the many opportunities for using mathematics to understand the world.

The course is organized around 6 topics. Within each topic, class sessions will include explanations of the key mathematical concepts, interactive Python programming exercises, and student presentations. Students will carry out final projects in which they explore a mathematical model and develop video presentations. Learning oral communications skills focused on how to effectively communicate mathematical concepts will be emphasized throughout the course.

Prerequisites

MATH 15a or 22a and MATH 20a or 22b. Students should have familiarity with single variable calculus, multi-variable calculus, and linear algebra.

Objectives

1. Effective oral communication of the main ideas and results presented in mathematical papers
2. Construction and critique of simple mathematical models
3. Basic familiarity with Python and its numerical capabilities

Course Topics

The course will cover different topics in applied math: Sports analytics, Information theory, Imaging process, Epidemiology, Random Walks, Game Theory and Linear Programming. No textbook will be required for this course. Course materials including associated papers will be provided in Latte

Course Work and Grading

- Participation: 15% of total grade.
 - Students are expected to be active participants during class. Class sessions will include interactive groupwork and peer reviews that will count toward the participation portion of the grade. In-person class attendance is expected (unless accommodations have been cleared with me beforehand).
- Homework & lab problems (weekly): 35% of total grade.
 - Homeworks and lab problems are due weekly. The lowest two scores are dropped. Late assignments will only be accepted under exceptional circumstances (e.g. medical emergency).
- In-class paper presentation (once during the course): 20% of total grade.
 - During the course, each student will be required to present a paper on one of the topics covered in class.
- Final project and video presentation (Last day of class): 30% of total grade.
 - The video project will serve as the final assessment. Students will make short (3–6 minute) YouTube videos further exploring one of the papers discussed in the course.

Learning Expectations and Resources

This course will be conducted in-person. However, in the event of campus closures such as snow days or other disruptions, it may transition to remote instruction through Zoom. In-person attendance is expected (unless accommodations have been cleared with me beforehand)—there will be in-class labs and other mandatory activities during class sessions.

In this course, the minimal set of hardware, software and course supplies needed to be successful in this course are a computer with Python. Instructions on how to set up Python will be provided in the first few class sessions. Students facing any difficulties participating because of issues with technology, etc. should contact me.

Success in this 4 credit-hour 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, labs, preparation for projects, etc.).

Undergraduate students from SAS with financial need should contact Student Financial Services to discuss options available to purchase equipment and other technology and supply needs. GSAS students should contact Monique Howell in GSAS.

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) (781-736-3470, access@brandeis.edu). 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.

Important Policies and Resources

Academic Integrity

Every member of the University community is expected to maintain the highest standards of academic integrity. A student shall not submit work that is falsified or

is not the result of the student's own effort. Infringement of academic integrity by a student subjects that student to serious penalties, which may include failure on the assignment, failure in the course, suspension from the University or other sanctions. Please consult [Brandeis University Rights and Responsibilities](#) for all policies and procedures related to academic integrity. Students may be required to submit work via TurnItIn.com or similar software to verify originality. A student who is in doubt regarding standards of academic integrity as they apply to a specific course or assignment should consult the faculty member responsible for that course or assignment before submitting the work. Allegations of alleged academic dishonesty will be forwarded to the Department of Student Rights and Community Standards. Citation and research assistance can be found at [Brandeis Library Guides - Citing Sources](#).

Breaks

Class meetings of 90 minutes include a 10-minute break, while class meetings of 180 minutes include two breaks, at the instructor's discretion.

Classroom Health and Safety

- Register for the [Brandeis Emergency Notification System](#). Students who receive an emergency notification while attending class should notify their instructor immediately. In the case of a life-threatening emergency, call 911. As a precaution, review [this active shooter information sheet](#).
- Brandeis provides [this shuttle service](#) for traveling across campus or to downtown Waltham, Cambridge and Boston.
- On the Brandeis campus, all students, faculty, staff and guests are required to observe the university's policies on physical distancing and mask-wearing to support the health and safety of all classroom participants. Review up to date [COVID-related health and safety policies](#) regularly.

Course Materials/Books/Apps/Equipment

If you are having difficulty purchasing course materials, please make an appointment with your Student Financial Services or Academic Services advisor to discuss possible funding options, including vouchers for purchases made at the Brandeis Bookstore.

LATTE

[LATTE](#) is the Brandeis learning management system. Login using your UNET ID and password. For LATTE help, contact Library@brandeis.edu.

Library

[The Brandeis Library](#) collections and staff offer resources and services to support Brandeis students, faculty and staff. Librarians and Specialists from Research & Instructional Services, Public Services, Archives & Special Collections, Sound & Image Media Studios, MakerLab, AutomationLab, and Digital Scholarship Lab are available to help you through consultations and workshops.

Privacy

To protect your privacy in any case where this course involves online student work outside of Brandeis password-protected spaces, you may choose to use a pseudonym/alias. You must share the pseudonym/ alias with me and any teaching assistants as needed. Alternatively, with prior consultation, you may submit such work directly to me.

Student Support

Brandeis University is committed to supporting all our students so they can thrive. If a student, faculty, or staff member wants to learn more about support resources, the [Support at Brandeis](#) webpage offers a comprehensive list that includes these staff colleagues you can consult, along with other support resources:

- The [Care Team](#)
- [Academic Services](#) (undergraduate)
- [Graduate Student Affairs](#)
- Directors of Graduate Studies in each department, School of Arts & Sciences
- Program Administrators for the Heller School and International Business School
- [University Ombuds](#)
- [Office of Equal Opportunity](#).