MATH 36a: Probability
Summer 2020 (Session I)

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Office Hours: TBD
Email Address: ehanson4@brandeis.edu

“The greatest advantage in gambling lies in not playing at all.”
- Gerolamo Cardano, ca.1560

Course Meeting Time: This course meets Monday, Tuesday, Wednesday, and Thursday via Zoom each week. There is a required synchronous component to this class. There will be two separate 1-hour meeting times and you will have the choice to attend one or the other (the expectation is that you attend the same time slot every day). Every effort will be made to accommodate students in different timezones. Please email me if you have any concerns about this - a survey about which times you are available will be sent out the week before classes begin.

Technology Access: Please contact me as soon as possible if you have any concerns about technology access for this class. In particular:

- Our Zoom meetings will consist almost entirely of team problem solving. This works most effectively when we can all see one another. If you do not have access to a webcam and a high-speed internet connection, please let me know as soon as possible so that we can work out a solution that works for you.

- This course will have written assignments and problem sets. It is preferred that problem sets are typed, but clear and legible scans will also be accepted. Written assignments are required to be typed. Please let me know as soon as possible if you do not have access to a way to type or scan your work so that we can work out a solution that works for you.

- All course materials will be made available on LATTE. This is also where all assignments will be submitted. If you are having difficulty accessing LATTE, please let me know as soon as possible so we can connect you with the technology help team.

Course Description:
Philosophers such as Aristotle, Cicero, and Boethius first wrote about probability over two thousand years ago. Even the mathematical approach to probability is not new - having started with the gambler Gerolamo Cardano studying games of chance in the 16th century. This has led to a rich mathematical theory which allows us to assign precise numerical values to the uncertainty of events.

In this course, students will learn the language and techniques behind both discrete and continuous probability. Some examples of the questions this will let us answer are:

- Should a flush beat a straight in poker?
- How long should I expect my laptop to work before it crashes?

• Can appearing in an anonymized dataset violate my privacy?

**Learning Goals for Math 36a:** Students will

• Become familiar with the language of probability and its key theorems.

• Hone computational skills applicable to future courses in mathematics and related fields.

• Practice communicating their understanding of solutions through written presentation and oral discussion.

• Learn to look critically at how probability is presented in the media.

**Text:** *A First Course in Probability*, Sheldon Ross, 10th edition (Pearson) - Available as an ebook (recommended) or physical textbook. 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 and/or textbook alternatives.

**Prerequisites:** Math 20a or 22b, or equivalent (multivariable calculus). This class will use quite a bit of single-variable integration (including improper integration) and some multiple integration.

**Course Layout:**

The best way to learn mathematics is by doing mathematics. As such, this class will be “half flipped”. Our synchronous meeting time will almost exclusively be time for team problem solving and discussion. Outside of our meeting time, students will be exposed to new material through readings and videos. Students will also prepare solutions to problems to turn in. A more detailed day-to-day layout can be found below.

1. Before Meeting Time: Complete assigned reading, watch recorded videos, complete reading quiz.

2. Meeting Time: Work in teams on problems designed to deepen understanding.

3. After Meeting Time: Finish any unsolved problems from meeting time, work on homework problems, and complete any other assignments.

**Assessment:**

Final grades will be determined by the following criteria.

<table>
<thead>
<tr>
<th>Grade Item</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Reading Quizzes</td>
<td>15%</td>
</tr>
<tr>
<td>Attendance and Participation</td>
<td>5%</td>
</tr>
<tr>
<td>Problem Sets</td>
<td>30%</td>
</tr>
<tr>
<td>Probability in the News Assignments</td>
<td>25%</td>
</tr>
<tr>
<td>Final Project</td>
<td>25%</td>
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</table>
1. **Reading Quizzes:** Almost every day, there will be a reading quiz to complete on LATTE. You will be able to attempt each quiz twice, and your grade will be the average of your attempts. Reading quizzes are due at the start time of your class meeting. **No late reading quizzes are accepted**, but your 3 lowest scores will be dropped.

2. **Attendance and Participation:** The expectation is that you are coming to our meetings prepared and ready to work with your peers on problems. In order to maintain a sense of community, daily attendance is expected. If you need to miss a session for some reason, please email me at least 24 hours **before** the missed class. You can earn full credit in this category by attending class, being on time, and making a clear effort to work in collaboration with your peers.

3. **Problem Sets:** Most days, you will be given a short problem set after our meeting time ends. Typically, these will be due (submitted directly to LATTE) at the start time of your class meeting two days after being assigned. **No late problem sets are accepted**, but your 2 lowest scores will be dropped. Detailed expectations and grading criteria for problem problem sets will be available on LATTE, but note in particular:
   - You are encouraged to work together on problems, but **your final solution to each problem must be written by you and you alone**.
   - Your solutions should include explanations in addition to equations. Examples of an appropriate level of explanation are available on LATTE.
   - You are encouraged to use LaTeX or an equation editor, but **clear and legible scanned handwritten solutions will be accepted**.

4. **Probability in the News Assignments:** We will have 3 projects about examining how probability is portrayed by the news media. These will involve reading news articles and writing a short essay. These are individual assignments, meaning **your writing, ideas, and opinions must be your own**. These assignments are due at the start time of your class meeting. Late essays will be accepted with a grade penalty up to 48 hours after the deadline. Detailed expectations and grading criteria are available on LATTE.

5. **Final Project:** In place of a final exam, you will be asked to prepare a (live or recorded) presentation on an advanced topic in probability. There will be some suggestions for topics, or you can pick one of your own with instructor approval. Detailed expectations, grading criteria, and a timeline will be provided in LATTE well in advance.

**Topics Covered:**
We will cover parts of chapters 1-8 in the text. The plan will be to move quickly at the start so that we have more time when we reach more difficult and technical material near the end of the semester. A more detailed course plan is shown below. A day-by-day schedule for the course is available on LATTE.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Textbook Reference</th>
<th>Class Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counting</td>
<td>Sections 1.2-1.5</td>
<td>1</td>
</tr>
<tr>
<td>Axioms of Probability</td>
<td>Sections 2.2-2.5</td>
<td>1</td>
</tr>
<tr>
<td>Conditional Probability</td>
<td>Sections 3.2-3.5</td>
<td>2</td>
</tr>
<tr>
<td>Discrete Random Variables</td>
<td>Chapter 4</td>
<td>3.5</td>
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<tr>
<td>Continuous Random Variables</td>
<td>Sections 5.1-5.5</td>
<td>2</td>
</tr>
<tr>
<td>Joint Distributions</td>
<td>Sections 6.1-6.2, 6.4-6.5</td>
<td>1.5</td>
</tr>
<tr>
<td>The Central Limit Theorem</td>
<td>Section 8.3</td>
<td>1</td>
</tr>
<tr>
<td>Correlation and Conditioning</td>
<td>Sections 7.2, 7.4-7.5</td>
<td>3</td>
</tr>
<tr>
<td>The Law of Large Numbers</td>
<td>Sections 8.2, 8.4</td>
<td>1</td>
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This leaves two days to work on final projects and one day to present final projects.

**Four-Credit Course:**

As per the Department of Education Standard, success in a five-week, four-credit course is based on the expectation that students will spend 180 hours preparing for and attending class (readings, papers, discussion sections, preparation for exams, etc.).

**Diversity Statement:** I aim to create a learning environment where all students are treated with respect. I welcome individuals of all backgrounds, beliefs, ethnicities, gender identities, religious affiliations, sexual orientations, abilities, and other visible and nonvisible differences. If you have a preferred name and/or pronouns you would like me to use, or there is anything you would like me to know about you, please let me know by email or in person.

**Students with Disabilities:**

Brandeis seeks to welcome and include all students. If you are a student who needs accommodations as outlined in an accommodations letter, please talk with me and present your letter of accommodation as soon as you can. I want to support you.

In order to provide test accommodations, I need the letter more than 48 hours in advance. I want to provide your accommodations, but cannot do so retroactively. If you have questions about documenting a disability or requesting accommodations, please contact Student Accessibility Support (SAS) at 781.736.3470 or access@brandeis.edu.

**Academic Integrity:**

You are expected to follow the University’s policy on academic integrity, which is distributed annually as section 4 of the Rights and Responsibilities Handbook (see [https://www.brandeis.edu/studentlife/srcs/rightsresponsibilities/index.html](https://www.brandeis.edu/studentlife/srcs/rightsresponsibilities/index.html)). Instances of alleged dishonesty will be forwarded to the Department of Student Development and Conduct for possible referral to the Student Judicial System. Potential sanctions include failure in the course and suspension from the University. If you have any questions about how these policies apply to your conduct in this course, please ask.

**Disclaimer:** Elements of this syllabus are subject to change at the instructor’s discretion.

Now email me with your favorite joke to show that you have read the syllabus!