Project:
Topic in Probability Theory

Important reminder This project is in lieu of a test, and as such you are not allowed to work with anyone, including other students. Any questions that you have about it should be directed to me only.

Assignment

Choose a subject in probability theory not covered in class and write an article on that subject as if for an undergraduate mathematics journal. Also present your research on the subject to the class.

Purpose

In order of priority, the goals of this assignment are:

1. To learn how to teach yourself mathematics without the guidance of class lectures.
2. To learn how to write a mathematical journal article.
3. To learn how to present mathematics in person to an audience.
4. To learn about a subject in probability theory that we have not covered in class.

While learning the actual subject matter is a goal, it is not the most important one.

Due dates

This project has various due dates:

- Wednesday, November 8 topic due
- Wednesday, November 15 outline due
- TBA (Monday, November 27 to Wednesday, December 6) in-class presentation
- Wednesday, December 6 paper due

I will not collect the topics in written form, but will ask for students to state them in class instead. The outline is important to ensure that you are thinking about the overall structure of the paper early. It should also include a bibliography to make sure that you have found enough sources for your project. If you submit a section of your paper to me prior to the paper deadline, I will make comments on it as soon as I can (which should be within a couple of days), so that you can revise and improve both it and other sections accordingly.
Grading

Of all the above items, only the paper is graded; the others are merely to facilitate writing the paper. The in-class presentation is not graded but is an important part of the learning goals.

I will grade your papers separately in two broad areas: content and writing. Content refers to the mathematical aspects of the paper and how well you have shown that you understand them. Writing refers to clarity of exposition, which includes structure, grammar, spelling, typos, layout, and so forth.

There is a trade-off between your topic’s level of sophistication and the depth of understanding that I expect. If you choose a simple topic, you will have to explain it extremely well and demonstrate that you have a solid understanding of it in order to earn a high grade. If you choose a more advanced topic, your explanation and understanding of the material still need to be good, but I will not hold them to quite so high a standard as with a simpler topic.

Assignment details

There is no required length for your paper. It should be long enough to clearly explain what you are trying to explain, and no longer. I am guessing that this will make most students’ papers about 10-12 pages long (double-spaced), but you should not deliberately strive for this range.

Your in-class presentation should be 12-15 minutes, and it should be both interesting and informative to your fellow classmates. You shouldn’t necessarily present everything that is in your paper, since people can follow highly technical arguments in a paper much better than they can absorb them in a talk. A short talk such as this calls for especially careful consideration of which details to include and, more importantly, which to leave out.

Also, I offer the following two suggestions to help your presentation go smoothly:

1. Rehearse your presentation, preferably in front of at least one other person. Rehearsing the presentation is the best (if not the only) way to get the timing right. Rehearsing also helps catch typos, errors, stumbling points, and other subtleties that can detract from or even derail a presentation.

2. Check the technology. If you are going to use any technology in your presentation, try it out on the equipment that you will be using. If you will use the classroom computer, check that your files display correctly on it. If you will hook your laptop into the classroom projector, make sure beforehand that you can indeed connect it and that when you do, your files display correctly.

Following these suggestions won’t necessarily eliminate all the errors and foibles from your talk, but it will at least help to minimize them.
Topics

Here are some general areas from which you might narrow down a project topic. Your topic does not have to be derived from this list though; the list is only to help you generate some ideas.

- hidden Markov models
- martingales
- Poisson processes
- entropy
- geometric probability
- simulating random variables on a computer
- Monte Carlo integration
- queueing theory
- Brownian motion
- probability in [insert a discipline here]

Keep in mind that, whatever topic you choose, the focus of the paper must be on the mathematics.