1 Me

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Course website: Blackboard. The following is not a live link but it is the right URL: `http://courseweb.library.upenn.edu` .

2 Course

Stat 530-531 / Math 546-547 – graduate level introduction to probability theory. Graduate level means "with proofs, based on theory of Lebesgue mesaure and integration". It does not mean "without intuition" nor "purely formal". Compare to Stat 510. There they use Ross. He does not even prove our first result (Strong Law of Large Numbers) except in finite variance case. Furthermore, even if you don't care about proofs, he does not even state many (most!) critical results on which classical statistical tests are based, e.g., LIL, large deviations, any theorem or criterion for Poisson approximation to be valid, etc.

Students sometimes need some help deciding whether this is the right course for them. I've addressed that to some degree on the course website. What it says there is to have a look at the textual materials and the first homework (already posted) and see whether you can envision being comfortable with that material within a few weeks. To the advice there, I would add: facility with writing mathematical proofs at the level of math 360-361 is going to be much more important than any specific mathematical or statistical knowledge. If you've had measure theory you'll be glad of it, but the majority of the students have not; most have had undergraduate probability but those who have not usually do fine; students who have not taken real analysis (Penn 360-361) at any level usually struggle mightily.

I've taken care to design the course so that (1) you don't need any prior knowledge of measure theory to take the course and (2) we won't need to spend all that much time doing measure theory in the course. In particular, the level of measure-theoretic technicalities we

will have to deal with will be consistent with the level that enhances intuition and is necessary for learning. As you will see, in the first semester this means the word "measurable" pretty much doesn't have to appear at all, though we do cover all the basics in order to forestall any confusion. In the second semester, we will need to go back and take care of some more of the measure theory.

The course is cross-listed between Math, Applied Math and Statistics, and there are usually students as well from Engineering, Wharton and SAS. I will try to cover the needs of this broad audience! There may be too many proofs for the engineers and non-Statistics Wharton folks, too few for the math folks, too many statistical applications for the SAS folks and too great a scope for the Statistics folks. As I get to know who you are, I'll try to fine-tune things to address your needs.

3 Book

The only required text is my lecture notes, which you can download for each of the ten topic units from BlackBoard. There are, however, several recommended texts. The one which I follow the most closely is Durrett's "Probability: Theory and Examples", third edition. It is strongly recommended, but it is a hard book and is not always popular with students. If you get through the course, you will be glad to have this book on your shelf as a reference, and will find it is the most modern and complete of the recommended texts. Other recommended texts include Billingsley's "Probability and Measure", Rosenthal's "A First Look at Rigorous Probability Theory" (highly recommended by the T.A.) and Folland's "Real Analysis".

4 Work

There will be eleven homework sets and a final exam. The grading scale for the course is: everyone who is not lost should get a B+ or better. Grades below that are used mostly to signal to varying degrees that you didn't really learn the material. Verbal descriptions of the grades are: A = Mastery of material; A- = Mastery of some of it, adequate knowledge of most of it; B+ = Can understand most of the material line by line but has trouble putting it together to solve harder problems; B = Superficial understanding; C = Clueless; F = stopped doing any work.

Working with other students on the homework is permitted, though care should be taken not to collaborate until you have given significant thought to a problem. In any case, each student must write their own solution: either submit it in your own handwriting, or type it into a word processor yourself. The use of worked solutions written up by someone outside of this year's class is not permitted, even to look at, though of course you can look at these *after* you hand in your homework.

The homeworks will be graded by the grader, who is always a Math or Stat graduate student. This year it is Sneha Subramanian, whose contact info is given above. The homework is divided into weekly problem sets of 4 problems each. These are all already posted on the website. We will try to publish solutions immediately after the assignment is due. Feedback from prior years tells us that students very much appreciate seeing the solutions while the problems are fresh in their minds. Consequently, we cannot accept any late homework (but you are welcome to do it early – it is all there on the web).

New this year: In order to serve a broad audience, we have developed a two-track system for the weekly homeworks. In addition to the four homework problems, one or two exercises are given that are somewhat simpler. They are designed mostly to ensure that you are keeping up with the curriculum and do not involve as significant a problem-solving or synthesis component. Grad students from departments other than Math, AMCS or Stat or undergraduate students are welcome to do the two exercises (numbered in Roman numerals) instead of the correspondingly numbered problems on each homework set, if they so choose. This allows such students to demonstrate mastery of the material at the level of an outside user. Please do not do this if you may be asking me for a letter of recommendation. Recommendation letters require that I compare you to students who have done the more difficult homework problems, and I cannot fairly compare if you have done the easier homework track.