STAT 515: Stochastic Processes I, Spring 2012
Syllabus

All changes to the original syllabus will be typeset in red text and announced in class.

Time and Place: MWF 2:30-3:20 in 373 Willard

Instructor: David Hunter <dhunter@stat.psu.edu>
Office hours: Thursdays 2:00-4:00pm in 310 Thomas

Grader: Xiaotian Zhu <xxz131@psu.edu>
Office hours: Thursdays 9:00–11:00am in 419 Thomas

Audience: This graduate-level course is required for first-year statistics students, but historically about half of the students come from other departments. It is assumed that students have taken probability at the level of STAT 414 or STAT 513. In previous semesters, students without any probability background but with a strong mathematics background have often been able to keep pace with the course with additional work. However, students without strong background in either probability or mathematics background have tended to struggle. If you are not certain whether your background is sufficient, please don’t hesitate to talk with me.

Textbook: *Introduction to Probability Models* by Sheldon Ross. You may use either the ninth or the tenth edition. I own a copy of the ninth edition and I have compared it with the tenth edition. There are a few additional sections in the tenth, but either edition will work for this course. Not all of the material I would like you to master is found in the textbook; there will be supplemental handouts. Many of these have been prepared or compiled by Murali Haran, who has taught STAT 515 at Penn State in previous semesters.

Objectives: Here are some of the things I hope you will learn:

- *How to understand and apply various topics in stochastic processes:* This, unsurprisingly, is the main course objective. In brief, the “various topics” include conditioning and conditional probability, introductory theory of Markov chains (both discrete-time and continuous-time), Poisson and possibly other well-known stochastic processes, classical Monte Carlo simulation techniques such as rejection and importance sampling, and implementation of Markov chain Monte Carlo algorithms, especially Metropolis-Hastings algorithms and various special cases.

- *How to write computer code to implement various Monte Carlo techniques:* As you will have to do this in order to complete many of your homework assignments and your take-home final exam, this skill is essential for this course. Naturally, this skill will be useful outside the course as well. As part of this skill, you should learn to use a quality text editor that formats computer code. All statistics students should use R, but in general no particular environment will be required. I recommend using R even for non-statistics students.
How to produce attractively typeset mathematical writing using \TeX: On later assignments, you will be required to typeset your homework. I strongly recommend that you try to become proficient in \LaTeX{} (basically an elaborate add-on to \TeX). If you are a statistics student, this is required. If not, and if you feel that \LaTeX{} will not be useful to you in your academic career, please let me know and we can discuss alternative means to produce your homework.

**Grading:** Overall grades will be based on an in-class midterm exam (20%), a comprehensive in-class final exam (30%), a take-home final exam (10%), and weekly homework assignments (40%).

Homework will be **due at the beginning of class** on its due date. Unless you inform me at least 24 hours before homework is due about any extenuating circumstances, late homework will not be accepted. I reserve the right to allow every student to drop his or her lowest assignment grade, but do not assume that this option will exist. You are allowed, even encouraged, to work together on homework assignments, but nothing you turn in may ever be copied directly from anyone else.

**Computing:** Computing will be a major component of this course. As mentioned above, you will need at least a working proficiency with:

- An environment for numerical analysis. I recommend R, though non-statistics students are welcome to use a suitable language of their choice. This alternative should enable easy preparation of graphical displays.
- An editor for both writing computing code and for writing \LaTeX{} source. A quality editor is most important for the former task.
- \LaTeX{} (or \TeX{} if you prefer). You will have to typeset at least some of your assignments this semester, and it is a good idea to familiarize yourself with these useful tools.

**Supplements:** Murali Haran, who taught STAT 515 most recently, has prepared quite a few supplementary materials that should be helpful if you are trying to get started with topics such as learning how to program in R, choosing a text editor, or writing \LaTeX{}. This material is available on the web at [http://sites.stat.psu.edu/~mharan/515/515.html](http://sites.stat.psu.edu/~mharan/515/515.html).

**Website:** The main course website is [http://sites.stat.psu.edu/~dhunter/515/](http://sites.stat.psu.edu/~dhunter/515/)

**Integrity:** All Penn State and Eberly College of Science policies regarding academic integrity apply to this course. See [http://science.psu.edu/current-students/Integrity/Policy.html](http://science.psu.edu/current-students/Integrity/Policy.html) for details.

**Climate:** The Eberly College of Science Code of Mutual Respect and Cooperation ([science.psu.edu/climate/Code-of-Mutual-Respectfinal.pdf](http://science.psu.edu/climate/Code-of-Mutual-Respectfinal.pdf)) embodies the values that we hope our faculty, staff, and students possess and will endorse to make the Eberly College of Science a place where every individual feels respected and valued, as well as challenged and rewarded.