

Stat/Math 360 - Probability - Syllabus
Fall 2017 - Section 01

Meetings: MW 2-3:50 PM, SM 206

Professor: Amy Wagaman

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Office Hours: MW 4-5:30, T 3-4:30, or by appt.

Course Description:

This course explores the nature of probability and its use in modeling real world phenomena. There are two explicit complementary goals: to explore probability theory and its use in applied settings, and to learn parallel analytic and empirical problem solving skills. The course begins with the development of an intuitive feel for probabilistic thinking, based on the simple yet subtle idea of counting. It then evolves toward the rigorous study of discrete and continuous probability spaces, independence, conditional probability, expectation, and variance. We will cover a variety of distributions and other selected topics.

Pre-requisites and necessary background: Mathematics 121 or instructor consent. You need to be comfortable with calculus – derivation, integration, and infinite sums.

Textbook: Dobrow, Robert. *Probability with Applications and R*. Wiley 2014. The textbook is available via e-reserves on Moodle. The textbook errata .pdf is posted on Moodle.

Grading Policy:

Assignments: 30% (Homework 20%; Writing Assignments 10%)

Class Participation: 5%

Course Project: 15%

Exams: 50% (Midterms 15% each; Final 20%)

Final grades may be curved depending on the grade distribution. The curve will **never** lower your grade.

Inclusion and Accessibility

I strive to make this course welcoming to all students. If you would like to discuss your learning needs with me, please schedule a meeting. I look forward to working with you to understand and support your academic success.

In particular, if you have a documented disability that requires accommodations, you will need to register with Accessibility Services for coordination of your academic accommodations. You can reach them via email at accessibility@amherst.edu, or via phone at 413-542-2337. Once you have your accommodations in place, I will be glad to meet with you privately during my office hours or at another agreed upon time to discuss the best implementation of your accommodations.

Schedule: This is a tentative and APPROXIMATE schedule, subject to change.

Week of	Sections	Topics and Important Notes
Sept. 4	1.1-1.4	Overview, Axioms and Properties, Introduction to R/RStudio
Sept. 11	1.5-1.11, 3.4, 2.1-2.3	Counting Methods and Problem-Solving Techniques, Conditional Probability
Sept. 18	2.4-2.6, 3.1-3.3, 3.5	Bayes Rule, Independence, Bernoulli and Binomial Distributions
Sept. 25	3.6-3.9, 4.1-4.5	Poisson Distribution, Expectation, Functions of Random Variables including Joint Distributions
Oct. 2	4.6-4.11, 5.1-5.3	Variance, Covariance, Conditional Distributions, Geometric, Negative Binomial, and Hypergeometric Distributions
Oct. 11	5.4-5.6	Fall Break - No Class Monday Multinomial Distributions, Benford's Law, Review
Oct. 16	6.1-6.4	First Midterm; Continuous Probability Distributions, Uniform Distribution
Oct. 23	6.5-6.12, 10.2	Exponential Distribution, More on Continuous Distributions, Functions of Random Variables
Oct. 30	6.6, 6.10-6.12, 10.2, 7.1-7.2	More on Functions of Random Variables, Normal and Gamma Distributions
Nov. 6	7.3-7.6, 8.1-8.4	Beta and Pareto Distributions, Poisson Processes, Conditional Expectation
Nov. 13	8.5-8.6, 9.1-9.2	Conditional Variance, Weak and Strong Law of Large Numbers
Nov. 20	-	Thanksgiving Break - No Classes
Nov. 27	9.3-9.4	Second Midterm; Central Limit Theorem
Dec. 4	9.5-9.6, 10.1	Moment-Generating Functions, Proof of CLT, Bivariate Normal Distribution
Dec. 11	10.6	Markov Chain Monte Carlo (MCMC), Review

On the Statement of Intellectual Responsibility:

- **For exams** – your work must be entirely your own. No talking, passing notes, etc. You will have access to your calculators and a single-sided page of notes as specified below. The primary purpose for that is to remove “formula” anxiety.
- **For homework** – the work you turn in must be your own. If you work with fellow students, you cannot copy a solution from another student. Instead, they may explain the problem to you or show you part of their work, but you need to write your own solution to turn in. And you need to list who you received assistance from (see homework section for details).
- **For the writing assignments** – the work you turn in must be your own. You may brainstorm ideas with other students in the class, proofread and offer comments to each other, and use the Writing Center for assistance as needed. A classmate cannot completely re-write your submission for you, though they may suggest you perform a

major revision. Your final submission must be your own work, acknowledging classmate assistance if provided. (see below for details)

- **For the course project** - your work must be entirely your own. You may ask me for assistance, particularly in regards to help with the computing software for the project, but the project is individual work. This includes the writing component of the project.

Course Expectations and Policy:

Attendance, Readings, and Class Participation:

- Our class meets twice a week. The usual class structure will be a warm-up problem, lecture or other activity, and then more practice problems. We will usually take a break around 3 pm (or whenever is a good time for swapping tasks). Especially because of this class structure, you are expected to come to class prepared to engage with the material, and to do your best while learning new topics.
- Reading the material is important. You are expected to have read the assigned sections before class. Daily reading assignments will be posted on Moodle while you can see the tentative weekly schedule above. The book presents many examples that may help you solve the homework problems in addition to the examples we will cover in class.
- You are also expected to read/review the R Supplements provided that accompany the assigned sections. These supplements are designed to help you work with the R code in the textbook.
- In class, we will often work on problems for practice. (Computer use is discussed below). You are expected to be engaged with the material during this time.
- Reading quizzes may be used. Quiz completion (not correctness) may impact participation points. These may be run through Moodle.
- Please let me know if you are unable to come to class due to a serious conflict. This helps me get material to you, and can facilitate a meeting to be sure you are working through the missed material and examples.
- Repeated unexcused absences or lack of engagement with the material during class (i.e. doing work for another class or non-academic work, etc.) is grounds for loss of all class participation points.

Exams: There will be two midterm exams and a cumulative final exam. The midterms will be held in class on **Monday, October 16th** and **Wednesday, November 29th** (tentatively). The final exam will be scheduled later by the Registrar. Students are expected to plan travel for finals AFTER the schedule is released by the Registrar. Calculators and a single (one-sided) page of notes are permitted for exams as well as whatever writing utensils you prefer. I may allow a double-sided page for the final, and will announce that later in the semester. There are NO excuses for missing an exam apart from serious illness, religious conflict, or the like. If you know you will be missing an exam for a serious reason, you need to arrange a makeup **in advance**, with reasonable notice.

Special Note for Examinations:

All cell phones and mobile devices must be turned off and put away in your backpacks/bags. They cannot be used as calculators or as clocks. A clock is available in the classroom, and I have spare calculators available at request (in advance of the examination date). Use of a cell phone or mobile device during an examination (unless it is a serious emergency) is grounds for immediate expulsion from the examination with no option for completion.

Homework (Problem Sets):

- Homework is *due to me* at the *beginning of class* on the due date. Due to our schedule, homework will often (but not always) be due on **Wednesdays**. I strongly encourage you to start it early.
- Homework turned in after class but within 24 hours will be marked down 30%. Homework not turned in within 24 hours of the due date will be recorded as a 0.
- Please turn in your homework **stapled** and with your name on each page if multiple pages are needed. Homework must be complete, **legible**, and include supporting work. You do NOT need to rewrite the problems on your homework solutions.
- Pay attention to the **R PROBLEM** on each homework assignment that should be submitted electronically.
- You are encouraged to work with your fellow students on homework and in studying. **If you receive help from someone on a problem, you need to make a note of it on the top page of your homework.** However, there is a fine line between working together, getting help, and “copying”, so please read above on the statement of intellectual responsibility.
- Under exceptional circumstances, I may grant a homework extension with a minimum of 24 hours prior notice (email, preferably).

Writing Assignments:

The course includes a few short writing assignments. Three assignments involve writing a paragraph (or two) and occur relatively early in the semester, and the other three “writing” assignments involve you writing a probability question and solution to demonstrate concept mastery. More details will be provided as these are assigned. Those assignments form the 10% writing assignment part of your grade. Under exceptional circumstances, I may grant an extension on these assignments with a minimum of 24 hours prior notice (email, preferably).

These writing submissions must be your own, but you can discuss ideas with classmates, proofread for one another, etc. In short, your classmates cannot write your submissions for you, but you can give each other feedback. You must acknowledge assistance on your submissions. It’s only fair to give credit where credit is due.

There may also be short writing components on the R problems for homework that are folded into the homework grade. Homework expectations apply to those components. Finally, the project also includes a short writing component folded into the project grade, which is a non-collaborative individual assignment.

Classroom Activity or "Lab" Sessions:

Class will often have activity or problem-solving components, where you may be working in groups. This "lab" time will enable us to use software (see below) and do hands-on activities, as well as provide an avenue for practice problem sessions. For most activities, you may work alone or in small groups, though we may have some class activities as well. Participation in class is largely based on your participation in these sessions. If you are not engaged with the material, not working with your group, or don't come to class, do not expect a high participation score. As above, repeatedly missing class (without an excuse), or repeatedly working on non-course related material in class is grounds for losing all participation points.

Course Project: There are many topics in probability that we will not get a chance to take a look at. The course project is your opportunity to explore a probability-related topic that we would not otherwise see in depth. More details will be provided in mid-October once we have covered necessary background material. Your work on this course project is expected to be **INDIVIDUAL**. It is **NOT** a group project. Part of the project will likely be due before Thanksgiving break, to ensure that all students are making progress on the foundational material.

Laptops\Software:

We will be using R via RStudio with RMarkdown for computational activities. We will be learning how to use these programs in class, and I will help with commands whenever asked. You will need to know how to read code and output from the program for exams, and will likely need to run commands for the course project (where you can ask me for help). Amherst has an RStudio webserver, which means you can access the software from any machine connected to the internet, provided you log in. The web server is at: <https://r.amherst.edu/>. Due to this use of software in class, and our large class size, we will need to have laptops available. Thus, ***I expect students to bring their laptops to class***, when use of a computer is denoted on the Moodle page, as there will be regular use of computing technology during class. This usually occurs at least once each week. Please contact me in case of any questions or problems.

Datacamp:

This semester, I am working to integrate some free Datacamp materials into the course. These are online courses designed to help you learn the statistical software. We will be working to complete one course (Intro to R), and three chapters of a second course (Intermediate R) that should build computational skills useful for our class. All that I am receiving from Datacamp is notification that you have completed the assigned work (completion-based). Completion of these activities will be part of your participation score for the course.

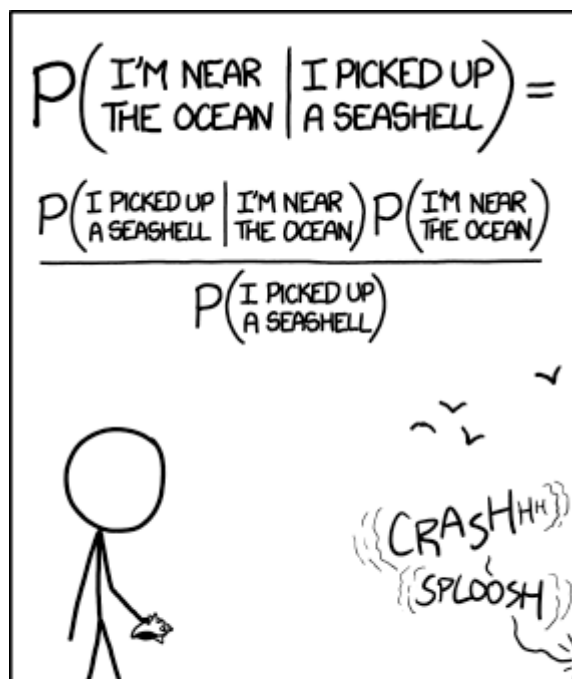
Email Expectations

I respond fairly quickly to email. If you email me with a question before 8 pm, you can most likely expect a reply that evening. Later emails will likely receive replies the following morning. Emailing late at night with a question on the homework due the next day is not a good strategy. Start your assignments early, and be sure to make use of my

office hours and your TAs office hours! You should NOT email your TA homework questions.

Helpful Hints for the semester:

- **Attend class.** This will help you see examples and tackle problems out of textbook context, showing you probability applications, use of the software, and hopefully helping you figure out how to tackle problems in exams.
- **Turn in your assignments.** If you don't turn in assignments, both you and I get basically no feedback as to how you are doing in the course until exams.
- **Practice, practice, practice.** Do as many problems as you can throughout the semester (there are lots that aren't assigned for homework in the book).
- **Don't wait until the last minute to start your assignments, course project, or study for exams** (important for your mental sanity). I'm here to help but won't appreciate being asked how to do the entire homework assignment the day before it's due or what chapters 1 through 4 were talking about the night before an exam. If you wait until the last minute to do your work, you will be swamped, confused, sleep-deprived, and you will hate probability.
- **Ask for help as soon as you are having problems.** I would be happy to help clarify problems early on rather than trying to help clarify everything right before the final exam.
- **Calculus issues.** If you find you need some help with the calculus, like with the possibly new concept of double integrals towards the middle or end of the semester (or refreshers on integration by parts, etc.), please just ask me for help! The "math" is a tool to help us, not something that should trip you up.



STATISTICALLY SPEAKING, IF YOU PICK UP A SEASHELL AND DON'T HOLD IT TO YOUR EAR, YOU CAN PROBABLY HEAR THE OCEAN.